



TAPPING | THREADING

WIDIA™ Means Complete Quality

As an innovator for more than 80 years, the WIDIA Products Group has been designing and manufacturing metalcutting products that make customer machining processes more efficient and effective.

With thousands of products in our portfolio, the WIDIA Products Group offers competitive advantages that will enhance your productivity and bolster your profitability.

To learn more, contact your local Authorized WIDIA Distributor or visit **www.widia.com**.

TAPPING | THREADING

Tapping | Threading

Introduction	.ii-vii
Holemaking – Tapping	.A1-A275
Services and Support	.B1-B13
Index by Order Number	.C2-C15
Index by Catalog Number	.C16-C29
Global Contacts	.C30-C31

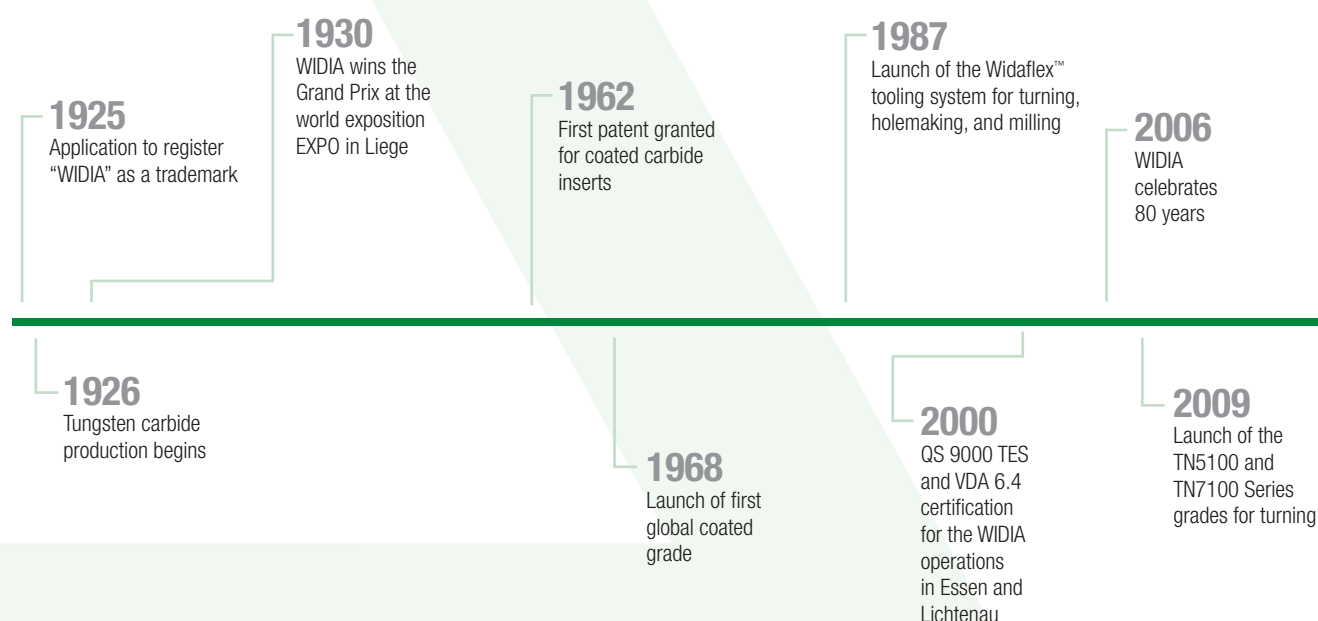


WIDIA™ means complete quality

When you buy products from the WIDIA family of brands, you're not just buying speed, power, and precision — you're buying complete quality.

The WIDIA Products Group brands offer the most complete portfolio of precision-engineered products and custom solution services available today. With more than 14,000 turning, milling, and holmaking products in our portfolio and a skilled network of Authorized Distributor partners, you'll find everything you need from one single source.

80+ Years of Quality



Technical expertise you can count on



WIDIA™ brand cutting tools are available exclusively through a specialized network of Authorized Distributor partners whom you can count on to deliver much more than products.

They will show you how to:

- Achieve measurable productivity improvements.
- Significantly reduce cycle time.
- Improve machine tool utilization.
- Take advantage of proven supply chain solutions.
- Access local inventory and best-in-class technical support.
- Request onsite demonstrations of the latest tooling technology.

The most powerful family of brands in the industry

The WIDIA family of brands is well served by a global network of the finest Authorized Distributors in the industry, selected for their specialized expertise in the areas of:

Turning, Holemaking, Indexable Milling, and Tooling Systems

WIDIA

WIDIA
MANCHESTER

WIDIA
CLAPPDICO

WIDIA
CIRCLE

Solid Carbide End Milling and Solid Carbide Drilling and Reaming

WIDIA
HANITA

WIDIA
RÜBIG

Tapping Operations

WIDIA
GTD



Easy to order

Finding the right WIDIA™ products for your machining applications has never been easier. Our engineers and Authorized Distributor partners are experts in high-performance machining. They will work with you to determine the correct product for your application, then order, ship, and deliver the product with the attention to customer service you would expect from a world-leading brand.

Supply chain services

Whether your manufacturing enterprise involves batch processes or mass production, or your metalcutting machines are organized in lines, cells, or as standalone units, our supply chain services program will eliminate unnecessary overhead, ensure tooling availability, shorten setup times, and minimize costs by 30–90%.

In fact, our solutions often quickly pay for themselves by delivering savings that well exceed your annual spending on cutting tools and supplies.



Global manufacturing

WIDIA products are developed and manufactured at our Centers of Manufacturing Excellence in

- Essen, Germany
- Lichtenau, Germany
- Nabburg, Germany
- Johnson City, Tennessee, USA
- New Market, Virginia, USA
- Orwell, Ohio, USA
- Solon, Ohio, USA
- Bangalore, India
- Shlomi, Israel



Robust training programs

As a WIDIA™ customer, you can gain access to our exclusive online training program, where you'll find dozens of training courses on our newest products and services.

On the web

Visit our website to read up-to-the-minute information about new products, download electronic copies of product literature, and see a list of industry events in which we are participating. Visit www.widia.com and use the Distributor Finder to locate the Authorized Distributor nearest you.



When you think
speed, power, and precision,
think complete quality —
think WIDIA.

To find the Authorized WIDIA Distributor nearest you,
use the Distributor Finder at www.widia.com.



Solutions for Holemaking, Milling, Turning, and Tooling Systems



We are dedicated to designing and developing holemaking, milling, turning, and tooling systems solutions for demanding operations and focused manufacturing. Our factory engineers, production experts, and field application engineers are available to work with you to design solutions to provide maximum productivity and throughput.

Unique advantages, such as in-house PVD high-quality coating facilities (TiN, TiCN, TiAlN, AlTiN, Z-coat), a wide range of raw materials (HSS, HSS-E, HSS-Powder; Solid Carbide, Brazed Carbide), and capabilities for a wide range of diameters 0,25–75mm, position WIDIA™ as the preferred brand for high-quality, application-specific tools.

We specialize in designing and manufacturing blueprint specials in the following tool styles:

- Complex geometries
- Toolholders and boring bars
- Form tools
- Modified standards
- Superabrasives (PCD and CBN)
- Tooling and inserts for:
 - Bar peeling
 - Heavy-duty turning
 - Railway wheel machining



Environmental responsibility

We are deeply committed to offering environmentally responsible products that deliver high performance and proven value. With decades of experience in tooling and manufacturing, combined with the synergy of superior engineering, we offer customers some of the most effective opportunities for sustainable manufacturing in the industry.

Sustainable engineering

Leading the way with innovation, engineering, and service in standard and custom tooling.
A proven methodology and partnership.

Successful project engineering requires planning, teamwork, and disciplined execution. Through our extensive experience in developing and implementing new project engineering strategies, we have pioneered a proven methodology to help you manufacture new products and bring them to market quickly. Service deliverables are carefully outlined and jointly agreed to before the project begins. We formally evaluate progress and results with you throughout the project through our stage-gate management systems.

With our best-in-class process, you'll experience accelerated time to market, lower overall costs, and reduced risks to implement new technologies.

Vendor of choice

We serve every major industrial market throughout the world and are a brand of choice in the most demanding industries, including aerospace, die and mold, automotive, heavy equipment, medical, and general engineering. Throughout our more than 80-year history, we have achieved a reputation for providing our customers with a constant flow of new and unique products and services, specially designed for maximum efficiency and performance. We have enabled customers to become more competitive and more profitable in their own industries, producing parts in less time, with fewer tool changes and longer tool life.

We are committed to providing you with tools and services that deliver the ultimate in customer satisfaction, and we are pleased to feature some of our latest breakthroughs in this catalog. For more information about how these products can impact your bottom line, please contact your local Authorized WIDIA™ Distributor today.



Greenfield Tap & Die

The brand name you've trusted since 1872 is now...

Greenfield Tap & Die, now WIDIA-GTD™, has been supplying the highest quality taps, dies, and gages to the industry for more than 139 years. From premium raw materials, put through a stringent ISO-certified production process, to carefully inspected, packaged, and shipped tools, WIDIA-GTD has consistently delivered quality products and services to you, our customer. Always committed to innovation, WIDIA-GTD continues to focus on developing products that enable you to achieve better production at lower costs.

139+ Years of Reliable Quality



A PRODUCT OF KENNAMETAL INC.

1872

Wiley & Russell started to produce taps

1915

GTD GUN™ tap patented

1991

Greenfield acquires VTD and Lyndonville plant

1912

Greenfield Tap & Die (GTD) is formed

1982

Launched first PVD TiN coated taps (VTD)

WIDIA-GTD™



2005

Launched new generation HP carbide tap line (GX series)

2011

WIDIA-GTD launches the new GT series of HP HSS-E-PM taps

1993

EM series tap launched

2010

GTD brand becomes part of WIDIA™ Products Group

WIDIA
GTD™



Holemaking – Tapping

High-Performance Taps	A4–A140
Solid Carbide Taps • GX Series	A6–A29
HSS-E-PM Taps • GT Series.....	A30–A85
HSS-E Taps • EM Series	A86–A140
Production Taps	A142–A196
Maintenance Tools	A198–A213
Maintenance Taps	A198–A204
Dies.....	A205–A209
Accessories.....	A210–A211
Maintenance Sets.....	A212–A213
High-Performance Thread Mills • GTM Series	A214–A238
Solid and Indexable Thread Mills	A239–A245
Technical Information	A248–A274



New Products

Our latest metalcutting advances are designed to deliver higher productivity, longer tool life, and increased application versatility compared with your current tooling.



VICTORY Victory™ GX Series Taps

- Our best-performing, high-precision solid carbide taps.
- Run up to 4x faster and last up to 4x longer than conventional high-speed steel taps.
- Precision design delivers more accurately tapped holes.
- Cutting taps can be factory reconditioned to original patented specifications and tolerances.

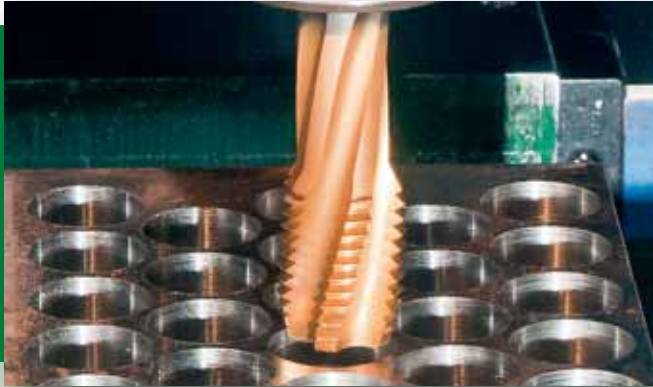


VICTORY Victory GT Series Taps

- New generation of high-performance, high-speed steel powdered-metal taps for material-specific tapping applications.
- Optimum combination of grades, geometries, and coatings to deliver higher quality threads and longer tool life.
- Boost your productivity with our unique, highly wear-resistant powder-metal substrate, modified with a higher than standard cobalt content for greater heat resistance.



For more information about the latest products and services from WIDIA, please contact your WIDIA Representative or Authorized WIDIA Distributor, or visit www.widia.com.



VICTORY Victory™ GT Series Wind Taps

- New high-performance, large-sized HSS-E-PM taps.
- Developed for manufacturing important wind turbine components like hubs, rings, and gearbox housing.
- For both conventional non-rigid and CNC-synchronous tapping machines.
- Can be used with precision round- or square-drive toolholders.
- An extra-long version is also available.



VICTORY Victory GTM Series Thread Mills

- The new high-performance solid thread mills program is designed for maximum performance and reliability.
- Internal or external thread on 3-axis CNC machining.
- Produce thread on broad range of materials up to 63 HRC.
- GTM31 and GTM41 can drill the hole, countersink the hole, and cut the thread all at the same time, resulting in shorter cycle time and fewer tool changes.
- Short chips enable better evacuation and secure performance.



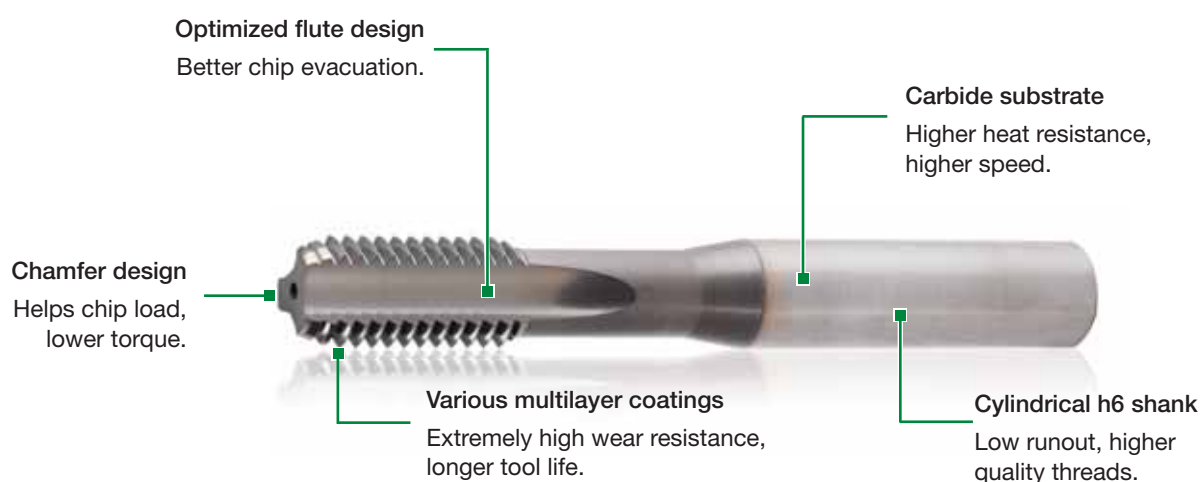
High-Performance Solid Carbide Taps

Solid carbide taps for high productivity and outstanding performance in a wide range of workpiece materials.

WIDIA-GTD™



- High performance to surpass competitive taps.
- More production from a single tool.
- Available in various specifications.



Advanced WIDIA™ Technology

- Manufactured with fine-grain micrograin carbide for exceptional wear life.
- Ideal for long production runs where fewer tool changes mean greater productivity.
- Designed for outstanding tool life in steel, cast iron, aluminum, and hardened materials.

Features

- Runs 5x faster and lasts 4x longer than conventional taps.
- Enhanced tap precision and design.
- Tap runout less than 10 microns (.0004").
- PVD nanolayer TiAlN/TiN coated carbide grade.
- Custom solutions available upon request.

Benefits

- Superior accuracy of product thread.
- Excellent thread quality and tap performance.
- High edge strength and wear resistance.
- Maximum chip control and free cutting in through holes.
- Can be factory reconditioned to original specifications and tolerances.



Application Information

- For use on CNC machines with synchronous or rigid tapping control and precision toolholders.
- Straight-flute taps for sizes M16 and larger for ductile or cast iron.
- Use with machining centers equipped with precise and rigid hydraulic, shrink fit, or precision collet toolholders.

Victory™ GX Series HP Solid Carbide Taps and Solid Carbide Forming Taps • Metric

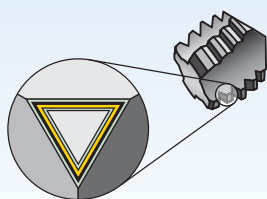
★ Good ★★ Better ★★★ Best							
GX Series High-Performance Solid Carbide Taps	series	size range (inch and metric)	hole	chamfer form	coolant	grade	shank
		size min - max					
	GX32	M6 - M16				GP4535	6535 HA
	GX33	M6 - M16				GP4535	6535 HA
	GX34	M4 - M20				GP4535	6535 HA
	GX35	M4 - M16				GP4535	6535 HA
	GX46	M6 - M16				GN1515	6535 HA
	GX47	M6 - M16				GN1515	6535 HA
	GX10	M3 - M16				WH16PG	DIN371,374,376
GX Series High-Performance Solid Carbide Forming Taps							
	GX38	M4 - M10				GP4535	6535 HA
	GX48	M4 - M12				GN1515	6535 HA
	GX39	M4 - M10				GP4535	6535 HA
	GX49	M4 - M12				GN1515	6535 HA

Victory GX Series HP Solid Carbide Taps and Solid Carbide Forming Taps • Inch

★ Good ★★ Better ★★★ Best							
GX Series High-Performance Solid Carbide Taps	series	size range (inch and metric)	hole	chamfer form	coolant	grade	shank
		size min - max					
	GX32	1/4" - 5/8"				GP4535	6535 HA
	GX33	1/4" - 5/8"				GP4535	6535 HA
	GX34	#6 - 3/4"				GP4535	6535 HA
	GX35	#6 - 3/4"				GP4535	6535 HA
	GX46	1/4" - 5/8"				GN1515	6535 HA
	GX47	1/4" - 5/8"				GN1515	6535 HA
GX Series High-Performance Solid Carbide Forming Taps							
	GX38	#6 - 3/8"				GP4535	6535 HA
	GX48	#6 - 1/2"				GN1515	6535 HA
	GX39	#6 - 3/8"				GP4535	6535 HA
	GX49	#6 - 1/2"				GN1515	6535 HA

P				M	K		N			S				H			
1, 2, 3, 4, 6, 7	5, 9, 10, 11	12, 13.1	13.2	14.1, 14.2, 14.3, 14.4	15, 16, 17, 18, 19	20	21	22, 23, 24, 25	26, 27, 28	31, 32	33, 34, 35	36	37	38.1, 38.2, 40.1, 40.2, 41.1	39.1, 41.2		
Steel <35 HRC	Steel 36–48 HRC	PH & Ferritic Stainless Steel <35 HRC	PH & Ferritic Stainless Steel >35 HRC	Stainless Steel	Cast Iron		Wrought Aluminum	Cast Aluminum	Copper, Copper Alloys	Iron Based	Cobalt Based	Nickel Based	Titanium & Alloys	Hardened Steel 49–55 HRC	Hardened Steel 56–68 HRC	Page	Recommended Cutting Parameters
★★★					★	★										A12	A23
★★★					★	★										A13	A23
					★★★	★★★										A14	A23
					★★★	★★★										A15	A23
								★★★								A18	A23
								★★★								A19	A23
														★★★		A22	A23
★★★																A16	A23
							★★★	★★								A20	A23
★★★																A17	A23
							★★★	★★								A21	A23

P				M	K		N			S				H			
1, 2, 3, 4, 6, 7	5, 9, 10, 11	12, 13.1	13.2	14.1, 14.2, 14.3, 14.4	15, 16, 17, 18, 19	20	21	22, 23, 24, 25	26, 27, 28	31, 32	33, 34, 35	36	37	38.1, 38.2, 40.1, 40.2, 41.1	39.1, 41.2		
Steel <35 HRC	Steel 36–48 HRC	PH & Ferritic Stainless Steel <35 HRC	PH & Ferritic Stainless Steel >35 HRC	Stainless Steel	Cast Iron		Wrought Aluminum	Cast Aluminum	Copper, Copper Alloys	Iron Based	Cobalt Based	Nickel Based	Titanium & Alloys	Hardened Steel 49–55 HRC	Hardened Steel 56–68 HRC	Page	Recommended Cutting Parameters
★★★					★	★										A12	A23
★★★					★	★										A13	A23
					★★★	★★★										A14	A23
					★★★	★★★										A15	A23
								★★★								A18	A23
								★★★								A19	A23
★★★																A16	A23
							★★★	★★								A20	A23
★★★																A17	A23
							★★★	★★								A21	A23



Coatings are designed for optimized tapping performance in specific materials.

P	Steel
M	Stainless Steel
K	Cast Iron
N	Non-Ferrous Materials
S	High-Temp Alloys
H	Hardened Materials

wear resistance ← → toughness

Coating	Grade Description	05	10	15	20	25	30	35	40	45
GP4535	Coated carbide, PVD multilayer coating with TiAlN and TiN over a high-strength carbide substrate specifically designed for tap application. Use in steel up to 32 HRC and cast iron at four times faster speeds than HSS-E-PM taps.	P								
GN1515	Coated carbide, PVD two-layer coating over fine-grain carbide. Coating consists of low-friction CrC/C over wear-resistant TiN. CrC/C resists galling of non-ferrous materials to the tap. Provides superior performance for tapping cast aluminum and other non-ferrous materials.	K								
WH16PG	Coated carbide, PVD two-layer coating with heat-resistant TiAlN base layer and low-friction MoS ₂ top layer over carbide substrate. Use in hardened steel 55–63 HRC.									
GP6520	Coated HSS-E-PM, PVD heat- and wear-resistant high-vanadium cobalt powder metal HSS substrate coated with wear-resistant TiCN base layer. Use in steel, cast iron, and cast aluminum with silicon.									
WP31MG	Coated HSS-E-PM, PVD powder metal HSS-E substrate with TiN coating. Use for tapping steel 32–44 HRC and for forming threads in steel to 32 HRC.	P								
WH36MG	Coated HSS-E-PM, PVD powder metal HSS-E substrate coated with TiN base layer and low-friction MoS ₂ top layer. Use in deep blind steel holes, 32–44 HRC.	P								
GM6515	Coated HSS-E-PM, PVD heat- and wear-resistant high-vanadium cobalt powder metal HSS substrate. Coating consists of low-friction CrC/C over wear-resistant TiN base layer. Use for tapping stainless steel and non-ferrous materials.	M								
WN38MG	Coated HSS-E-PM, PVD powder metal HSS-E substrate with DLC coating. Use for form tapping aluminum. Not recommended for steel.	N								
WN48EG	Coated HSS-E, PVD lower vanadium HSS-E substrate with DLC coating. Use for tapping non-ferrous materials with low cutting temperatures like wrought aluminum. Not recommended for steel.	N								
WN35MG	Coated HSS-E-PM, PVD powder metal HSS-E substrate with two-layer coating. TiN base layer and DLC top layer that resists galling of non-ferrous materials to the tap. Use for tapping titanium. Not recommended for steel.	S								
WS32MG	Coated HSS-E-PM, PVD heat- and wear-resistant high-vanadium cobalt powder metal HSS substrate with high-hardness TiCN coating. Use when tapping heat-treated steel 44–55 HRC and cobalt- or nickel-based heat-resistant alloys.	S								

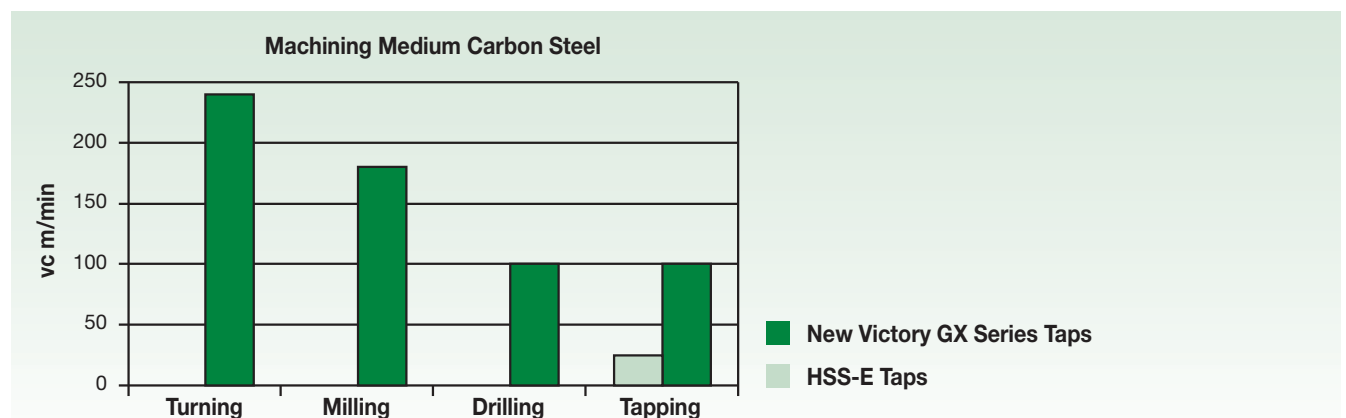
WIN WITH WIDIA™



Victory™ GX HP Solid Carbide for the Ultimate High-Performance Tapping Line

Run up to 4x faster and last up to 4x longer than conventional high-speed steel taps.

- Enhanced precision design delivers more accurately tapped holes.
- A full range of styles and grades for blind hole and through hole applications in ferrous and non-ferrous materials.
- After use, cutting taps can be factory reconditioned to original patented specifications and tolerances.



To learn more about our innovations, contact your local Authorized Distributor or visit www.widia.com.

WIDIA 

High-Performance Taps

Victory™ Solid Carbide Left-Hand Spiral-Flute Taps • Through Holes

WIDIA
GTD™

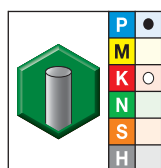
- GP4535 TiAlN + TiN for steel.



VICTORY

- first choice
- alternate choice

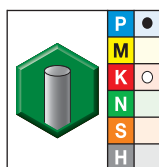
■ GX32 • Form D Plug Chamfer • Inch



							Shank Tolerance	
							D	Tolerance h6
							.250-.375	+0, -.0004
							.438-.625	+0, -.0004
GP4535	D1 size	L	L3	L2	LS	D	number of flutes	class of fit
12200	1/4 - 20	2.76	.59	.91	1.67	.2500	3	3BX
12201	1/4 - 28	2.76	.59	.91	1.67	.2500	3	3BX
12202	5/16 - 18	3.15	.67	1.10	1.85	.3125	3	3BX
12203	5/16 - 24	3.15	.67	1.10	1.85	.3125	3	3BX
12204	3/8 - 16	3.54	.75	1.30	2.01	.3750	4	3BX
12205	3/8 - 24	3.54	.75	1.30	2.01	.3750	4	3BX
12206	7/16 - 14	3.94	.87	1.42	2.26	.4375	4	3BX
12207	1/2 - 13	3.94	.94	1.58	2.08	.5000	4	3BX
12208	1/2 - 20	3.94	.94	1.58	2.08	.5000	4	3BX
12209	9/16 - 12	4.33	1.02	1.85	2.35	.5000	4	3BX
12210	5/8 - 11	4.33	1.10	2.09	2.09	.5625	5	3BX



■ GX32 • Form D Plug Chamfer • Metric

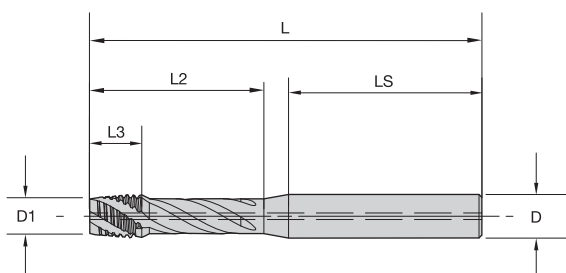


							Shank Tolerance	
							D	Tolerance h6
							6	+0, -0,008
							8-10	+0, -0,009
							12-16	+0, -0,011
GP4535	D1 size	L	L3	L2	LS	D	number of flutes	class of fit
12225	M6 X 1	70	12	23	43	6,0	3	6HX
12226	M8 X 1,25	80	15	28	47	8,0	3	6HX
12227	M10 X 1,5	90	18	33	51	10,0	4	6HX
12228	M12 X 1,75	100	21	40	54	12,0	4	6HX
12229	M14 X 2	110	24	47	61	12,0	4	6HX
12230	M16 X 2	110	24	53	55	14,0	4	6HX

Proprietary technology.

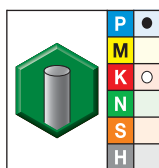
WIDIA
GTD™

- GP4535 TiAlN + TiN for steel.


VICTORY

- first choice
- alternate choice

■ GX33 • Form C Semi-Bottoming Chamfer • Through Coolant • Inch

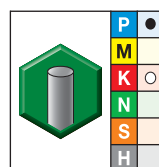


Shank Tolerance	
D	Tolerance h6
0.250-0.375	+0, -0.0004
0.438-0.625	+0, -0.0004

GP4535	D1 size	L	L3	L2	LS	D	number of flutes	class of fit
12761	1/4 - 20	2.76	.39	.94	1.63	.2500	3	3BX
12762	1/4 - 28	2.76	.39	.94	1.63	.2500	3	3BX
12763	5/16 - 18	3.15	.47	1.26	1.69	.3125	3	3BX
12764	3/8 - 16	3.54	.51	1.57	1.74	.3750	4	3BX
12765	7/16 - 14	3.94	.59	1.73	1.94	.4375	4	3BX
12766	1/2 - 13	3.94	.63	1.89	1.76	.5000	4	3BX
12767	9/16 - 12	4.33	.67	2.20	2.00	.5000	4	3BX
12768	5/8 - 11	4.33	.75	2.52	1.66	.5625	4	3BX



■ GX33 • Form C Semi-Bottoming Chamfer • Through Coolant • Metric



Shank Tolerance	
D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-16	+0, -0,011

GP4535	D1 size	L	L3	L2	LS	D	number of flutes	class of fit
12781	M6 X 1	70	8	24	42	6,0	3	6HX
12782	M8 X 1,25	80	10	32	43	8,0	3	6HX
12783	M10 X 1,5	90	12	40	44	10,0	4	6HX
12784	M10 X 1	90	12	40	44	10,0	4	6HX
12786	M12 X 1,5	100	14	48	46	12,0	4	6HX
12785	M12 X 1,75	100	14	48	46	12,0	4	6HX
12788	M14 X 1,5	110	16	56	52	12,0	4	6HX
12787	M14 X 2	110	16	56	52	12,0	4	6HX
12789	M16 X 2	110	16	64	44	14,0	4	6HX

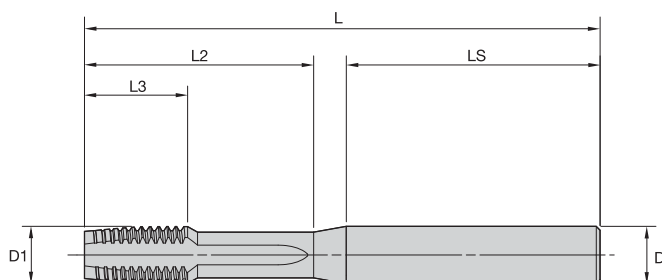
Proprietary technology.

High-Performance Taps

Victory™ Solid Carbide Straight-Flute Taps • Through Holes

WIDIA
GTD™

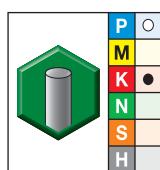
- GP4535 TiAlN + TiN for cast iron.



VICTORY

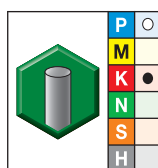
- first choice
- alternate choice

■ GX34 • Form D Plug Chamfer • Inch



GP4535	D1 size	L	L3	L2	LS	D	Shank Tolerance	
							D	Tolerance h6
12713	6 - 32	2.36	.28	.55	1.37	.2500	0.250-0.375	+0, -0.0004
12714	8 - 32	2.36	.28	.63	1.37	.2500	0.438-0.625	+0, -0.0004
12715	10 - 24	2.36	.35	.79	1.25	.2500		
12716	10 - 32	2.36	.35	.79	1.25	.2500		
12717	1/4 - 20	2.76	.59	.91	1.67	.2500		
12718	1/4 - 28	2.76	.59	.91	1.67	.2500		
12719	5/16 - 18	3.15	.67	1.10	1.85	.3125		
12404	3/8 - 16	3.54	.75	1.30	2.01	.3750		
12405	3/8 - 24	3.54	.75	1.30	2.01	.3750		
12406	7/16 - 14	3.94	.87	1.42	2.26	.4375		
12407	1/2 - 13	3.94	.94	1.58	2.08	.5000		
12408	1/2 - 20	3.94	.94	1.58	2.08	.5000		
12409	9/16 - 12	4.33	1.02	1.85	2.35	.5000		
12410	5/8 - 11	4.33	1.10	2.09	2.09	.5625		
12411	3/4 - 10	4.92	1.22	2.48	2.42	.6250		

■ GX34 • Form D Plug Chamfer • Metric

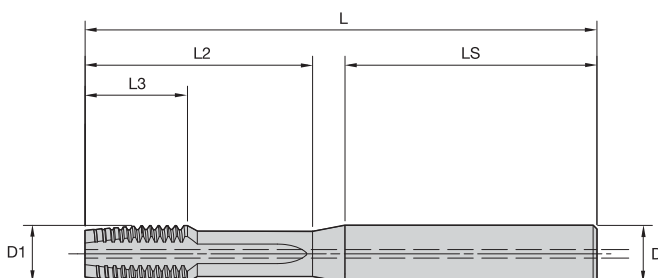


GP4535	D1 size	L	L3	L2	LS	D	Shank Tolerance	
							D	Tolerance h6
12742	M4 X 0,7	60	6	16	36	6,0	6	+0, -0,008
12743	M5 X 0,8	60	7	20	34	6,0	8-10	+0, -0,009
12744	M6 X 1	70	12	23	43	6,0	12-16	+0, -0,011
12745	M8 X 1,25	80	15	28	47	8,0		
12427	M10 X 1,5	90	18	33	51	10,0		
12746	M10 X 1	90	18	33	51	10,0		
12747	M12 X 1,5	100	21	40	54	12,0		
12428	M12 X 1,75	100	21	40	54	12,0		
12429	M14 X 2	110	24	47	61	12,0		
12748	M14 X 1,5	110	24	47	61	12,0		
12430	M16 X 2	110	24	53	55	14,0		
12431	M18 X 2,5	125	30	59	62	16,0		
12432	M20 X 2,5	140	30	66	—	18,0		

Proprietary technology.

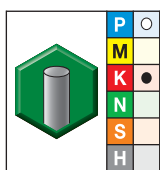
WIDIA
GTD™

- GP4535 TiAlN + TiN for tapping cast iron.


VICTORY

- first choice
- alternate choice

■ GX35 • Form E Bottoming Chamfer • Through Coolant 1/4" and Larger • Inch

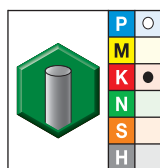


Shank Tolerance	
D	Tolerance h6
.250-.375	+0, -.0004
.438-.625	+0, -.0004

GP4535	D1 size	L	L3	L2	LS	D	number of flutes	class of fit
12700	6 - 32	2.36	.28	.55	1.37	.2500	3	3BX
12701	8 - 32	2.36	.28	.63	1.37	.2500	3	3BX
12702	10 - 24	2.36	.35	.79	1.25	.2500	3	3BX
12703	10 - 32	2.36	.35	.79	1.25	.2500	3	3BX
12704	1/4 - 20	2.76	.59	.91	1.67	.2500	4	3BX
12705	1/4 - 28	2.76	.59	.91	1.67	.2500	4	3BX
12706	5/16 - 18	3.15	.67	1.10	1.85	.3125	4	3BX
12707	3/8 - 16	3.54	.75	1.30	2.01	.3750	4	3BX
12708	7/16 - 14	3.94	.87	1.42	2.26	.4375	4	3BX
12709	1/2 - 13	3.94	.94	1.57	2.08	.5000	4	3BX
12710	9/16 - 12	4.33	1.02	1.85	2.35	.5000	4	3BX
12711	5/8 - 11	4.33	1.10	2.09	2.09	.5625	5	3BX
12712	3/4 - 10	4.92	1.22	2.48	2.42	.6250	5	3BX



■ GX35 • Form E Bottoming Chamfer • Through Coolant M6 and Larger • Metric

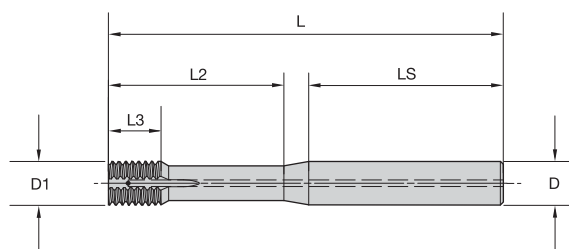


Shank Tolerance	
D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-16	+0, -0,011

GP4535	D1 size	L	L3	L2	LS	D	number of flutes	class of fit
12731	M4 X 0,7	60	6	16	36	6,0	3	6HX
12732	M5 X 0,8	60	7	20	34	6,0	3	6HX
12733	M6 X 1	70	12	23	43	6,0	4	6HX
12734	M8 X 1,25	80	15	28	47	8,0	4	6HX
12736	M10 X 1	90	18	33	51	10,0	4	6HX
12735	M10 X 1,5	90	18	33	51	10,0	4	6HX
12738	M12 X 1,5	100	21	40	54	12,0	4	6HX
12737	M12 X 1,75	100	21	40	54	12,0	4	6HX
12740	M14 X 1,5	110	24	47	61	12,0	4	6HX
12739	M14 X 2	110	24	47	61	12,0	4	6HX
12741	M16 X 2	110	24	53	55	14,0	4	6HX

Proprietary technology.

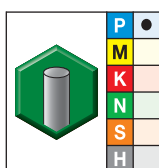
- GP4535 TiAlN + TiN for tapping steel.



VICTORY

- first choice
- alternate choice

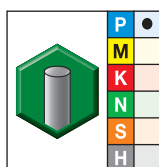
- GX38 • Form D Plug Entry Taper • Through Coolant 1/4" and Larger • Inch



							Shank Tolerance	
							D	Tolerance h6
							.250-.375	+0, -.0004
							.438-.625	+0, -.0004
GP4535	D1 size	L	L3	L2	LS	D	number of lube grooves	class of fit
12809	6 - 32	2.36	.28	.55	1.37	.2500	2	3BX
12810	8 - 32	2.36	.28	.63	1.37	.2500	2	3BX
12811	10 - 24	2.36	.35	.79	1.25	.2500	2	3BX
12812	10 - 32	2.36	.35	.79	1.25	.2500	2	3BX
12813	1/4 - 20	2.76	.39	.95	1.63	.2500	2	3BX
12814	1/4 - 28	2.76	.39	.95	1.63	.2500	2	3BX
12815	5/16 - 18	3.15	.47	1.26	1.69	.3125	2	3BX
12816	3/8 - 16	3.54	.51	1.58	1.74	.3750	3	3BX



- GX38 • Form D Plug Entry Taper • Coolant M6 and Larger • Metric

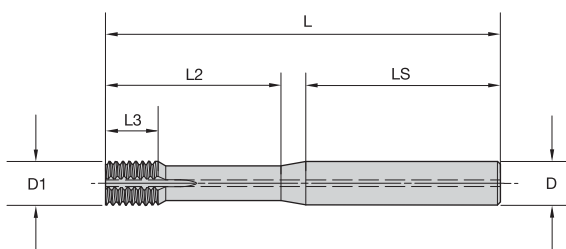


							Shank Tolerance	
							D	Tolerance h6
							6	+0, -0,008
							8-10	+0, -0,009
							12-16	+0, -0,011
GP4535	D1 size	L	L3	L2	LS	D	number of lube grooves	class of fit
12831	M4 X 0,7	60	6	16	36	6,0	2	6HX
12832	M5 X 0,8	60	7	20	34	6,0	2	6HX
12833	M6 X 1	70	8	24	42	6,0	2	6HX
12834	M8 X 1,25	80	10	32	43	8,0	2	6HX
12835	M10 X 1,5	90	12	40	44	10,0	3	6HX

Proprietary technology.

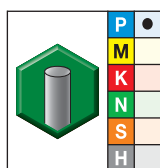
Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

- GP4535 TiAlN + TiN for tapping steel.


VICTORY

- first choice
- alternate choice

■ GX39 • Form E Bottoming Entry Taper • Through Coolant 1/4" and Larger • Inch

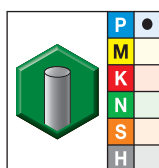


Shank Tolerance	
D	Tolerance h6
.250-.375	+0, -.0004
.438-.625	+0, -.0004

GP4535	D1 size	L	L3	L2	LS	D	number of lube grooves	class of fit
12801	6 - 32	2.36	.28	.55	1.37	.2500	2	3BX
12802	8 - 32	2.36	.28	.63	1.37	.2500	2	3BX
12803	10 - 24	2.36	.35	.79	1.25	.2500	2	3BX
12804	10 - 32	2.36	.35	.79	1.25	.2500	2	3BX
12805	1/4 - 20	2.76	.39	.95	1.63	.2500	2	3BX
12806	1/4 - 28	2.76	.39	.95	1.63	.2500	2	3BX
12807	5/16 - 18	3.15	.47	1.26	1.69	.3125	2	3BX
12808	3/8 - 16	3.54	.51	1.58	1.74	.3750	3	3BX



■ GX39 • Form E Bottoming Entry Taper • Through Coolant M6 and Larger • Metric



Shank Tolerance	
D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-16	+0, -0,011

GP4535	D1 size	L	L3	L2	LS	D	number of lube grooves	class of fit
12826	M4 X 0,7	60	6	16	36	6,0	2	6HX
12827	M5 X 0,8	60	7	20	34	6,0	2	6HX
12828	M6 X 1	70	8	24	42	6,0	2	6HX
12829	M8 X 1,25	80	10	32	43	8,0	2	6HX
12830	M10 X 1,5	90	12	40	44	10,0	3	6HX

Proprietary technology.

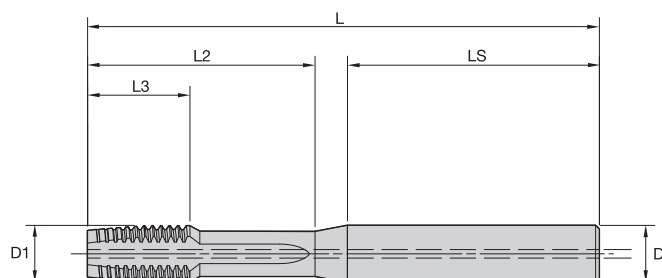
Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

High-Performance Taps

Victory™ Solid Carbide Straight-Flute Taps • Through Holes

WIDIA
GTD™

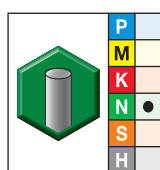
- GN1515 TiN + CrC/C for aluminum.



VICTORY

- first choice
- alternate choice

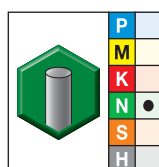
■ GX46 • Form D Plug Chamfer • Through Coolant 1/4" and Larger • Inch



							Shank Tolerance	
							D	Tolerance h6
							.250-.375	+0, -.0004
							.438-.625	+0, -.0004
GN1515	D1 size	L	L3	L2	LS	D	number of flutes	class of fit
12836	1/4 - 20	2.76	.59	.94	1.63	.2500	3	3BX
12838	1/4 - 28	2.76	.59	.94	1.63	.2500	3	3BX
12839	5/16 - 18	3.15	.67	1.26	1.69	.3125	3	3BX
12840	3/8 - 16	3.54	.75	1.57	1.74	.3750	3	3BX
12841	7/16 - 14	3.94	.87	1.73	1.94	.4375	3	3BX
12843	1/2 - 13	3.94	.94	1.89	1.76	.5000	3	3BX
12844	9/16 - 12	4.33	1.02	2.20	2.00	.5000	4	3BX
12845	5/8 - 11	4.33	1.10	2.52	1.66	.5625	4	3BX



■ GX46 • Form D Plug Chamfer • Through Coolant M6 and Larger • Metric

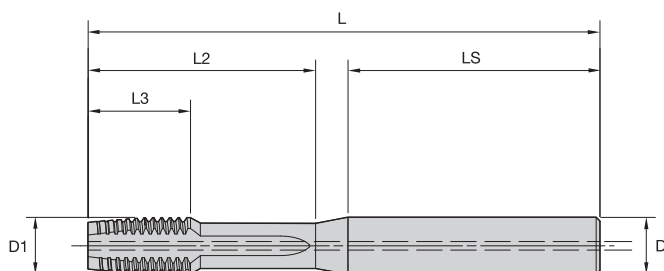


							Shank Tolerance	
							D	Tolerance h6
							6	+0, -0,008
							8-10	+0, -0,009
							12-16	+0, -0,011
GN1515	D1 size	L	L3	L2	LS	D	number of flutes	class of fit
12846	M6 X 1	70	12	24	42	6,0	3	6HX
12847	M8 X 1,25	80	15	32	43	8,0	3	6HX
12848	M10 X 1,5	90	18	40	44	10,0	3	6HX
12850	M10 X 1	90	18	40	44	10,0	3	6HX
12852	M12 X 1,5	100	21	48	46	12,0	3	6HX
12851	M12 X 1,75	100	21	48	46	12,0	3	6HX
12854	M14 X 1,5	110	24	56	52	12,0	4	6HX
12853	M14 X 2	110	24	56	52	12,0	4	6HX
12856	M16 X 1,5	110	24	64	44	14,0	4	6HX
12855	M16 X 2	110	24	64	44	14,0	4	6HX

Proprietary technology.

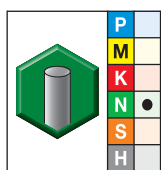
WIDIA
GTD™

- GN1515 TiN + CrC/C for aluminum.


VICTORY

- first choice
- alternate choice

■ GX47 • Form E Bottoming Chamfer • Through Coolant • Inch

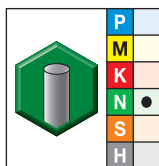


Shank Tolerance	
D	Tolerance h6
.250-.375	+0, -.0004
.438-.625	+0, -.0004

GN1515	D1 size	L	L3	L2	LS	D	number of flutes	class of fit
12858	1/4 - 20	2.76	.59	.94	1.63	.2500	3	3BX
12859	1/4 - 28	2.76	.59	.94	1.63	.2500	3	3BX
12860	5/16 - 18	3.15	.67	1.26	1.69	.3125	3	3BX
12861	3/8 - 16	3.54	.75	1.57	1.74	.3750	3	3BX
12862	7/16 - 14	3.94	.87	1.73	1.94	.4375	3	3BX
12863	1/2 - 13	3.94	.94	1.89	1.76	.5000	3	3BX
12864	9/16 - 12	4.33	1.02	2.20	2.00	.5000	4	3BX
12865	5/8 - 11	4.33	1.10	2.52	1.66	.5625	4	3BX



■ GX47 • Form E Bottoming Chamfer • Through Coolant • Metric



Shank Tolerance	
D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-16	+0, -0,011

GN1515	D1 size	L	L3	L2	LS	D	number of flutes	class of fit
12866	M6 X 1	70	12	24	42	6,0	3	6HX
12867	M8 X 1,25	80	15	32	43	8,0	3	6HX
12868	M10 X 1,5	90	18	40	44	10,0	3	6HX
12869	M10 X 1	90	18	40	44	10,0	3	6HX
12872	M12 X 1,5	100	21	48	46	12,0	3	6HX
12870	M12 X 1,75	100	21	48	46	12,0	3	6HX
12874	M14 X 1,5	110	24	56	52	12,0	4	6HX
12873	M14 X 2	110	24	56	52	12,0	4	6HX
12876	M16 X 1,5	110	24	64	44	14,0	4	6HX
12875	M16 X 2	110	24	64	44	14,0	4	6HX

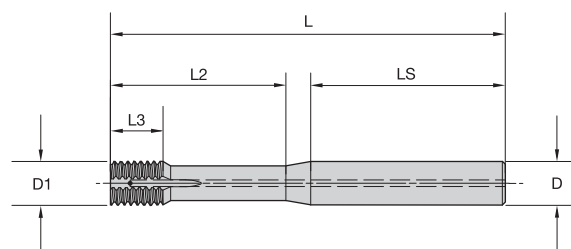
Proprietary technology.

High-Performance Taps

Victory™ Solid Carbide Forming Taps • Through Holes

WIDIA
GTD™

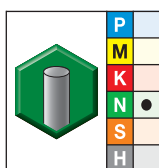
- GN1515 TiN + CrC/C for aluminum.



VICTORY

- first choice
- alternate choice

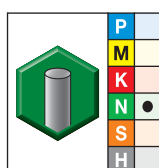
■ GX48 • Form D Plug Entry Taper • Through Coolant 1/4" and Larger • Inch



GN1515	D1 size	L	L3	L2	LS	D	Shank Tolerance	
							D	Tolerance h6
12877	6 - 32	2.36	.28	.55	1.37	.2500	.250-.375	+0, -.0004
12878	8 - 32	2.36	.28	.63	1.37	.2500	.438-.625	+0, -.0004
12879	10 - 24	2.36	.35	.79	1.25	.2500		
12880	10 - 32	2.36	.35	.79	1.25	.2500		
12881	1/4 - 20	2.76	.39	.94	1.63	.2500		
12882	1/4 - 28	2.76	.39	.94	1.63	.2500		
12883	5/16 - 18	3.15	.47	1.26	1.69	.3125		
12884	3/8 - 16	3.54	.51	1.57	1.74	.3750		
12885	7/16 - 14	3.94	.59	1.73	1.94	.4375		
12886	1/2 - 13	3.94	.63	1.89	1.76	.5000		

D	Tolerance h6
.250-.375	+0, -.0004
.438-.625	+0, -.0004

■ GX48 • Form D Plug Entry Taper • Coolant M6 and Larger • Metric



GN1515	D1 size	L	L3	L2	LS	D	Shank Tolerance	
							D	Tolerance h6
12887	M4 X 0,7	60	6	16	36	6,0	6	+0, -0,008
12888	M5 X 0,8	60	7	20	34	6,0	8-10	+0, -0,009
12889	M6 X 1	70	8	24	42	6,0	12-16	+0, -0,011
12890	M8 X 1,25	80	10	32	43	8,0		
12891	M10 X 1,5	90	12	40	44	10,0		
12892	M10 X 1	90	12	40	44	10,0		
12894	M12 X 1,5	100	14	48	46	12,0		
12893	M12 X 1,75	100	14	48	46	12,0		

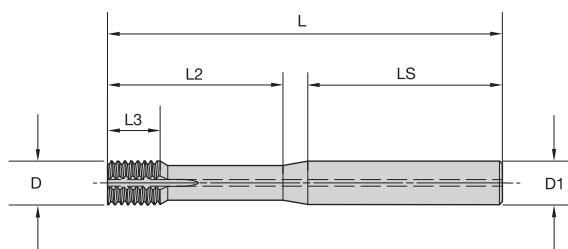
D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-16	+0, -0,011

Proprietary technology.

Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

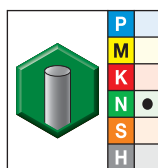
WIDIA
GTD™

- GN1515 TiN + CrC/C for aluminum.


VICTORY

- first choice
- alternate choice

■ GX49 • Form E Bottoming Entry Taper • Through Coolant 1/4" and Larger • Inch

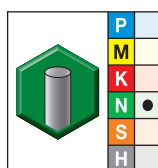


Shank Tolerance	
D	Tolerance h6
.250-.375	+0, -.0004
.438-.625	+0, -.0004

GN1515	D1 size	L	L3	L2	LS	D	number of lube grooves	class of fit
12895	6 - 32	2.36	.28	.55	1.37	.2500	2	3BX
12896	8 - 32	2.36	.28	.63	1.37	.2500	2	3BX
12897	10 - 24	2.36	.35	.79	1.25	.2500	2	3BX
12898	10 - 32	2.36	.35	.79	1.25	.2500	2	3BX
12899	1/4 - 20	2.76	.39	.94	1.63	.2500	2	3BX
12901	1/4 - 28	2.76	.39	.94	1.63	.2500	2	3BX
12902	5/16 - 18	3.15	.47	1.26	1.69	.3125	2	3BX
12903	3/8 - 16	3.54	.51	1.57	1.74	.3750	3	3BX
12904	7/16 - 14	3.94	.59	1.73	1.94	.4375	3	3BX
12905	1/2 - 13	3.94	.63	1.89	1.76	.5000	3	3BX



■ GX49 • Form E Bottoming Entry Taper • Through Coolant M6 and Larger • Metric



Shank Tolerance	
D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-16	+0, -0,011

GN1515	D1 size	L	L3	L2	LS	D	number of lube grooves	class of fit
12906	M4 X 0,7	60	6	16	36	6,0	2	6HX
12907	M5 X 0,8	60	7	20	34	6,0	2	6HX
12908	M6 X 1	70	8	24	42	6,0	2	6HX
12909	M8 X 1,25	80	10	32	43	8,0	2	6HX
12911	M10 X 1,5	90	12	40	44	10,0	3	6HX
12912	M10 X 1	90	12	40	44	10,0	3	6HX
12915	M12 X 1,5	100	14	48	46	12,0	3	6HX
12914	M12 X 1,75	100	14	48	46	12,0	3	6HX

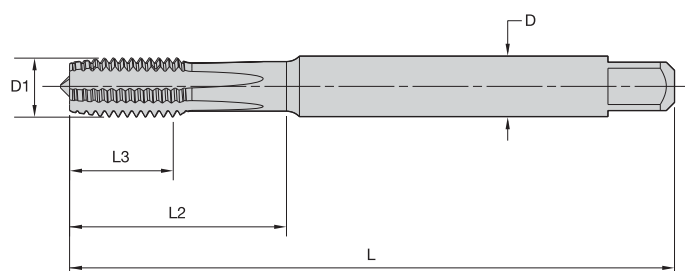
Proprietary technology.

Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

High-Performance Taps

Victory™ Straight-Flute Carbide Taps • Blind and Through Holes

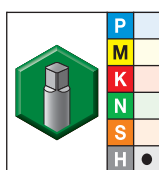
- WH16PG TiAlN/MoS₂ for steel 55–63 HRC.



VICTORY

- first choice
- alternate choice

■ GX10 • Form C Semi-Bottoming Chamfer • Metric DIN 371, 374, and 376



Shank Tolerance	
D	Tolerance h9
1–3	+0, -0,025
3,5–6	+0, -0,030
7–10	+0, -0,036
11–18	+0, -0,043

WH16PG	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GX105001	M3 X 0,5	63	6	18	4,5	4	DIN 371	6HX
GX105002	M4 X 0,7	63	8	20	4,5	4	DIN 371	6HX
GX105003	M5 X 0,8	70	10	26	6,0	4	DIN 371	6HX
GX105004	M6 X 1	80	12	28	6,0	4	DIN 371	6HX
GX105009	M8 X 1	90	15	35	8,0	5	DIN 374	6HX
GX105005	M8 X 1,25	90	15	35	8,0	5	DIN 371	6HX
GX105010	M10 X 1	100	18	38	10,0	5	DIN 374	6HX
GX105006	M10 X 1,5	100	18	38	10,0	5	DIN 371	6HX
GX105011	M12 X 1,5	110	21	41	12,0	5	DIN 374	6HX
GX105007	M12 X 1,75	110	21	41	12,0	5	DIN 376	6HX
GX105012	M14 X 1,5	110	24	44	14,0	5	DIN 374	6HX
GX105008	M14 X 2	110	24	44	14,0	6	DIN 376	6HX
GX105013	M16 X 1,5	110	24	44	16,0	5	DIN 374	6HX

	Group	 Through Holes				 Blind Holes					
		Tap Style	Grade	Range — m/min			Tap Style	Grade	Range — m/min		
				min	Starting Value	max			min	Starting Value	max
P	1	GX32, GX38	GP4535	80	100	130	GX33, GX39	GP4535	50	70	90
	2	GX32, GX38	GP4535	70	90	120	GX33, GX39	GP4535	50	60	80
	3, 4, 6, 7	GX32, GX38	GP4535	60	80	100	GX33, GX39	GP4535	50	60	80
K	15, 16	GX34	GP4535	80	105	140	GX35	GP4535	50	70	90
	17, 18, 19	GX34	GP4535	80	100	130	GX35	GP4535	50	70	90
	20	GX34	GP4535	70	90	120	GX35	GP4535	50	60	80
N	21	GX46, GX48	GN1515	90	120	160	GX47, GX49	GN1515	60	80	100
	22, 23, 24	GX46, GX48	GN1515	80	100	130	GX47, GX49	GN1515	50	70	90
	25	GX46, GX48	GN1515	70	85	110	GX47, GX49	GN1515	50	60	80
H	39.1, 41.2	GX10	WH16PG	1,2	1,5	2,0	GX10	WH16PG	0,8	1,1	1,4
	39.1	GX10	WH16PG	0,6	0,8	1,0	GX10	WH16PG	0,4	0,5	0,7

	 Through Holes					 Blind Holes					
			Range — SFM					Range — SFM			
	Group	Tap Style	Grade	min	Starting Value	max	Tap Style	Grade	min	Starting Value	max
P	1	GX32, GX38	GP4535	260	330	430	GX33, GX39	GP4535	160	230	300
	2	GX32, GX38	GP4535	230	300	390	GX33, GX39	GP4535	160	200	260
	3, 4, 6, 7	GX32, GX38	GP4535	200	260	330	GX33, GX39	GP4535	160	200	260
K	15, 16	GX34	GP4535	260	340	460	GX34	GP4535	160	230	300
	17, 18, 19	GX34	GP4535	260	330	430	GX34	GP4535	160	230	300
	20	GX34	GP4535	230	300	390	GX34	GP4535	160	200	260
N	21	GX46, GX48	GN1515	300	390	520	GX47, GX49	GN1515	200	260	330
	22, 23, 24	GX46, GX48	GN1515	260	330	430	GX47, GX49	GN1515	160	230	300
	25	GX46, GX48	GN1515	230	280	360	GX47, GX49	GN1515	160	200	260
H	39.1, 41.2	GX10	WH16PG	4	5	6	GX10	WH16PG	3	3	4
	39.1	GX10	WH16PG	2	2	3	GX10	WH16PG	1	2	2

Steel

								P		
typical thread sizes				required tap drill diameter				Solid Carbide Taps		Solid Carbide Taps
cutting taps		forming taps						 blind hole with coolant GX33_GP4535		 through hole GX32_GP4535
metric	inch	metric	inch	mm	inch	fraction	wire			 forming blind hole with coolant GX39_GP4535
—	—	—	6-32	3,175	.1250	1/8	—	—	—	12801
M4,5 x 0,75	—	M4 x 0,70	—	3,700	.1457	—	—	—	—	12826
—	—	—	8-32	3,797	.1495	—	25	—	—	12802
—	—	—	10-24	4,366	.1719	11/64	—	—	—	12803
—	12-24	—	10-32	4,496	.1770	—	16	—	—	12804
—	—	M5 x 0,80	—	4,700	.1850	—	13	—	—	12827
M6 x 1,00	—	—	—	5,000	.1969	—	—	12781	12225	—
—	1/4-20	—	12-28	5,106	.2010	—	7	12761	12200	—
—	1/4-28	—	—	5,410	.2130	—	3	12762	12201	—
—	—	M6 x 1,00	—	5,600	.2205	—	—	—	—	12828
—	—	—	1/4-20	5,791	.2280	—	1	—	—	12805
—	—	—	1/4-28	5,944	.2340	—	A	—	—	12806
—	5/16-18	—	—	6,528	.2570	—	F	12763	12202	—
M8 x 1,25	—	—	—	6,700	.2638	—	—	12782	12226	—
—	5/16-24	—	—	6,909	.2720	—	I	—	12203	—
—	—	—	5/16-18	7,366	.2900	—	L	—	—	12807
—	—	M8 x 1,25	—	7,400	.2913	—	—	—	—	12829
—	3/8-16	—	—	7,938	.3125	5/16	—	12764	12204	—
—	3/8-24	—	—	8,433	.3320	—	Q	—	12205	—
M10 x 1,50	—	—	—	8,500	.3346	—	—	12783	12227	—
M10 x 1,00	—	—	—	9,000	.3543	—	—	12784	—	—
—	—	—	3/8-16	8,839	.3480	—	S	—	—	12808
—	7/16-14	—	3/8-24	9,093	.3580	—	T	12765	12206	—
—	—	M10 x 1,50	—	9,400	.3701	—	—	—	—	12830
M12 x 1,75	—	—	—	10,200	.4016	—	—	12785	12228	—
M12 x 1,50	—	—	—	10,500	.4134	—	—	12786	—	—
—	1/2-13	—	—	10,716	.4219	27/64	—	12766	12207	—
—	1/2-20	—	—	11,509	.4531	29/64	—	—	12208	—
M14 x 2,00	—	—	—	12,000	.4724	—	—	12787	12229	—
—	9/16-12	—	—	12,304	.4844	31/64	—	12767	12209	—
M14 x 1,50	—	—	—	12,500	.4921	—	—	12788	—	—
—	5/8-11	—	9/16-12	13,495	.5313	17/32	—	12768	12210	—
M16 x 2,00	—	—	—	14,000	.5512	—	—	12789	12230	—

P	P		All Materials	
Solid Carbide Taps	Recommended SC Drill		Alternate Tap Drill	
				
forming through hole with coolant GX38_GP4535	approximately 5 x D with coolant TDS402 WP20PD	approximately 5 x D non-coolant TDS202 WP20PD	approximately 5 x D with coolant VDS402A WU25PD	approximately 5 x D non-coolant VDS202A WU25PD
12809	TDS402A03175	TDS202A03175	VDS402A03175	VDS202A03175
12831	TDS402A03700	TDS202A03700	VDS402A03700	VDS202A03700
12810	TDS402A03797	TDS202A03797	VDS402A03797	VDS202A03797
12811	TDS402A04219	TDS202A04219	VDS402A04219	VDS202A04219
12812	TDS402A04496	TDS202A04496	VDS402A04496	VDS202A04496
12832	TDS402A04700	TDS202A04700	VDS402A04700	VDS202A04700
—	TDS402A05000	TDS202A05000	VDS402A05000	VDS202A05000
—	TDS402A05106	TDS202A05106	VDS402A05106	VDS202A05106
—	TDS402A05410	TDS202A05410	VDS402A05410	VDS202A05410
12833	TDS402A05600	TDS202A05600	VDS402A05600	VDS202A05600
12813	TDS402A05791	TDS202A05791	VDS402A05791	VDS202A05791
12814	TDS402A05944	TDS202A05944	VDS402A05944	VDS202A05944
—	TDS402A06528	TDS202A06528	VDS402A06528	VDS202A06528
—	TDS402A06700	TDS202A06700	VDS412A06700	VDS212A06700
—	TDS402A06906	TDS202A06906	VDS412A06906	VDS212A06906
12815	TDS402A07366	TDS202A07366	VDS412A07366	VDS212A07366
12834	TDS402A07400	TDS202A07400	VDS412A07400	VDS212A07400
—	TDS402A07938	TDS202A07938	VDS412A07938	VDS212A07938
—	TDS402A08433	TDS202A08433	VDS412A08433	VDS212A08433
—	TDS402A08500	TDS202A08500	VDS412A08500	VDS212A08500
—	TDS402A09000	TDS202A09000	VDS412A09000	VDS212A09000
12816	TDS402A08839	TDS202A08839	VDS412A08839	VDS212A08839
—	TDS402A09093	TDS202A09093	VDS412A09093	VDS212A09093
12835	TDS402A09400	TDS202A09400	VDS412A09400	VDS212A09400
—	TDS402A10200	TDS202A10200	VDS412A10200	VDS212A10200
—	TDS402A10500	TDS202A10500	VDS412A10500	VDS212A10500
—	TDS402A10716	TDS202A10716	VDS412A10716	VDS212A10716
—	TDS402A11509	TDS202A11509	VDS412A11509	VDS212A11509
—	TDS402A12000	TDS202A12000	VDS412A12000	VDS212A12000
—	TDS402A12304	TDS202A12304	VDS412A12304	VDS212A12304
—	TDS402A12500	TDS202A12500	VDS412A12500	VDS212A12500
—	TDS402A13495	TDS202A13495	VDS412A13495	VDS212A13495
—	TDS402A14000	TDS202A14000	VDS412A14000	VDS212A14000

Cast Iron

typical thread sizes		required tap drill diameter				Solid Carbide Taps		Recommended SC Drill
						blind hole with coolant GX35 GP4535	through hole GX34 GP4535	approximately 3 x D with coolant TDS411 WK15PD
cutting taps								
metric	inch	mm	inch	fraction	wire			
—	6-32	2,705	.1065	—	36	12700	12713	TDS401A02705
M4 x 0,70	—	3,300	.1299	—	—	12731	12742	TDS401A03300
—	8-32 / 8-36	3,454	.1360	—	29	12701	12714	TDS401A03454
—	10-24	3,734	.1470	—	26	12702	12715	TDS401A03734
—	10-32	4,039	.1590	—	21	12703	12716	TDS401A04039
M5 x 0,80	—	4,200	.1654	—	—	12732	12743	TDS401A04200
M6 x 1,00	—	5,000	.1969	—	—	12733	12744	TDS401A05000
—	1/4-20	5,106	.2010	—	7	12704	12717	TDS401A05106
—	1/4-28	5,410	.2130	—	3	12705	12718	TDS401A05410
—	5/16-18	6,528	.2570	—	F	12706	12719	TDS401A06528
M8 x 1,25	—	6,700	.2638	—	—	12734	12745	TDS411A06700
—	3/8-16	7,938	.3125	5/16	—	12707	12404	TDS411A07938
—	3/8-24	8,433	.3320	—	Q	—	12405	TDS411A08433
M10 x 1,50	—	8,500	.3346	—	—	12735	12427	TDS411A08500
M10 x 1,00	—	9,000	.3543	—	—	12736	12746	TDS411A09000
—	7/16-14	9,093	.3580	—	T	12708	12406	TDS411A09093
M12 x 1,75	—	10,200	.4016	—	—	12737	12428	TDS411A10200
M12 x 1,50	—	10,500	.4134	—	—	12738	12747	TDS411A10500
—	1/2-13	10,716	.4219	27/64	—	12709	12407	TDS411A10716
—	1/2-20	11,509	.4531	29/64	—	—	12408	TDS411A11509
M14 x 2,00	—	12,000	.4724	—	—	12739	12429	TDS411A12000
—	9/16-12	12,304	.4844	31/64	—	12710	12409	TDS411A12304
M14 x 1,50	—	12,500	.4921	—	—	12740	12748	TDS411A12500
—	5/8-11	13,495	.5313	17/32	—	12711	12410	TDS411A13495
M16 x 2,00	—	14,000	.5512	—	—	12741	12430	TDS411A14000
M18 x 2,50	—	15,500	.6102	—	—	—	12431	TDS411A15500
—	3/4-10	16,670	.6563	21/32	—	12712	12411	TDS411A16670
M20 x 2,50	—	17,500	.6890	—	—	—	12432	TDS411A17500

K		All Materials	
Recommended SC Drill		Alternate Tap Drill	
			
approximately 5 x D with coolant TDS412 WK15PD	approximately 5 x D non-coolant TDS212 WK15PD	approximately 5 x D with coolant VDS402A WU25PD	approximately 5 x D non-coolant VDS202A WU25PD
TDS402A02705	TDS212A02705	VDS402A02705	VDS202A02705
TDS402A03300	TDS212A03300	VDS402A03300	VDS202A03300
TDS402A03454	TDS212A03454	VDS402A03454	VDS202A03454
TDS402A03734	TDS212A03734	VDS402A03734	VDS202A03734
TDS402A04039	TDS212A04039	VDS402A04039	VDS202A04039
TDS402A04200	TDS212A04200	VDS402A04200	VDS202A04200
TDS402A05000	TDS212A05000	VDS402A05000	VDS202A05000
TDS402A05106	TDS212A05106	VDS402A05106	VDS202A05106
TDS402A05410	TDS212A05410	VDS402A05410	VDS202A05410
TDS402A06528	TDS212A06528	VDS402A06528	VDS202A06528
TDS412A06700	TDS212A06700	VDS412A06700	VDS212A06700
TDS412A07938	TDS212A07938	VDS412A07938	VDS212A07938
TDS412A08433	TDS212A08433	VDS412A08433	VDS212A08433
TDS412A08500	TDS212A08500	VDS412A08500	VDS212A08500
TDS412A09000	TDS212A09000	VDS412A09000	VDS212A09000
TDS412A09093	TDS212A09093	VDS412A09093	VDS212A09093
TDS412A10200	TDS212A10200	VDS412A10200	VDS212A10200
TDS412A10500	TDS212A10500	VDS412A10500	VDS212A10500
TDS412A10716	TDS212A10716	VDS412A10716	VDS212A10716
TDS412A11509	TDS212A11509	VDS412A11509	VDS212A11509
TDS412A12000	TDS212A12000	VDS412A12000	VDS212A12000
TDS412A12304	TDS212A12304	VDS412A12304	VDS212A12304
TDS412A12500	TDS212A12500	VDS412A12500	VDS212A12500
TDS412A13495	TDS212A13495	VDS412A13495	VDS212A13495
TDS412A14000	TDS212A14000	VDS412A14000	VDS212A14000
TDS412A15500	TDS212A15500	VDS412A15500	VDS212A15500
TDS412A16670	TDS212A16670	VDS412A16670	VDS212A16670
TDS412A17500	TDS212A17500	VDS412A17500	VDS212A17500

Aluminum

typical thread sizes		required tap drill diameter				N		
						Solid Carbide Taps		Solid Carbide Taps
cutting taps	metric inch	forming taps		mm	inch	fraction	wire	blind hole with coolant GX47_GN1515
		metric	inch					
—	—	—	6-32	3,175	.1250	1/8	—	—
M4,5 x 0,75	—	M4 x 0,70	—	3,700	.1457	—	—	—
—	—	—	8-32	3,797	.1495	—	25	—
—	—	—	10-24	4,366	.1719	11/64	—	—
12-24	—	—	10-32	4,496	.1770	—	16	—
—	—	M5 x 0,80	—	4,700	.1850	—	13	—
M6 x 1,00	—	—	—	5,000	.1969	—	—	12866
—	1/4-20	—	12-28	5,106	.2010	—	7	12858
—	1/4-28	—	—	5,410	.2130	—	3	12859
—	—	M6 x 1,00	—	5,600	.2205	—	—	—
—	—	—	1/4-20	5,791	.2280	—	1	—
—	—	—	1/4-28	5,944	.2340	—	A	—
—	5/16-18	—	—	6,528	.2570	—	F	12860
M8 x 1,25	—	—	—	6,700	.2638	—	—	12867
—	—	—	5/16-18	7,366	.2900	—	L	—
—	—	M8 x 1,25	—	7,400	.2913	—	—	—
—	3/8-16	—	—	7,938	.3125	5/16	—	12861
M10 x 1,50	—	—	—	8,500	.3346	—	—	12868
M10 x 1,00	—	—	—	9,000	.3543	—	—	12869
—	—	—	3/8-16	8,839	.3480	—	S	—
7/16-14	—	—	3/8-24	9,093	.3580	—	T	12862
—	—	M10 x 1,50	—	9,400	.3701	—	—	—
M12 x 1,75	—	—	—	10,200	.4016	—	—	12870
M12 x 1,50	—	—	—	10,500	.4134	—	—	12872
—	1/2-13	—	—	10,716	.4219	27/64	—	12863
M14 x 2,00	—	—	—	12,000	.4724	—	—	12873
—	9/16-12	—	—	12,304	.4844	31/64	—	12864
M14 x 1,50	—	—	—	12,500	.4921	—	—	12874
—	5/8-11	—	9/16-12	13,495	.5313	17/32	—	12865
M16 x 2,00	—	—	—	14,000	.5512	—	—	12875
M16 x 1,50	—	—	—	14,500	.5709	—	—	12876

Solid Carbide Taps	N		All Materials	
	Recommended SC Drill		Alternate Tap Drill	
 forming through hole with coolant GX48_GN1515	 approximately 3 x D with coolant WD 412522	 approximately 5 x D with coolant WD 412527	 approximately 5 x D with coolant VDS402A_WU25PD	 approximately 5 x D non-coolant VDS202A_WU25PD
12877	TCM65903000	012535—00318	VDS402A03175	VDS202A03175
12887	TCM25903700	—	VDS402A03700	VDS202A03700
12878	—	—	VDS402A03797	VDS202A03797
12879	—	—	VDS402A04219	VDS202A04219
12880	—	—	VDS402A04496	VDS202A04496
12888	TCM25904700	—	VDS402A04700	VDS202A04700
—	TCM25909500	012535—00500	VDS402A05000	VDS202A05000
—	—	—	VDS402A05106	VDS202A05106
—	—	—	VDS402A05410	VDS202A05410
12889	TCM25905600	—	VDS402A05600	VDS202A05600
12881	—	—	VDS402A05791	VDS202A05791
12882	—	—	VDS402A05944	VDS202A05944
—	—	—	VDS402A06528	VDS202A06528
—	TCM25906700	—	VDS412A06700	VDS212A06700
12883	—	—	VDS412A07366	VDS212A07366
12890	TCM25907400	—	VDS412A07400	VDS212A07400
—	TCM65908000	012535—00793	VDS412A07938	VDS212A07938
—	TCM25908500	012535—00850	VDS412A08500	VDS212A08500
—	TCM25909000	012535—00900	VDS412A09000	VDS212A09000
12884	—	—	VDS412A08839	VDS212A08839
—	—	—	VDS412A09093	VDS212A09093
12891	TCM25909400	—	VDS412A09400	VDS212A09400
—	TCM25910200	012535—01020	VDS412A10200	VDS212A10200
—	TCM25910500	012535—01050	VDS412A10500	VDS212A10500
—	—	012535—01072	VDS412A10716	VDS212A10716
—	TCM25912000	012535—01200	VDS412A12000	VDS212A12000
—	TCM65912100	—	VDS412A12304	VDS212A12304
—	TCM25912500	012535—01250	VDS412A12500	VDS212A12500
—	—	—	VDS412A13495	VDS212A13495
—	TCM25914000	012535—01400	VDS412A14000	VDS212A14000
—	TCM25914500	012535—01450	VDS412A14500	VDS212A14500

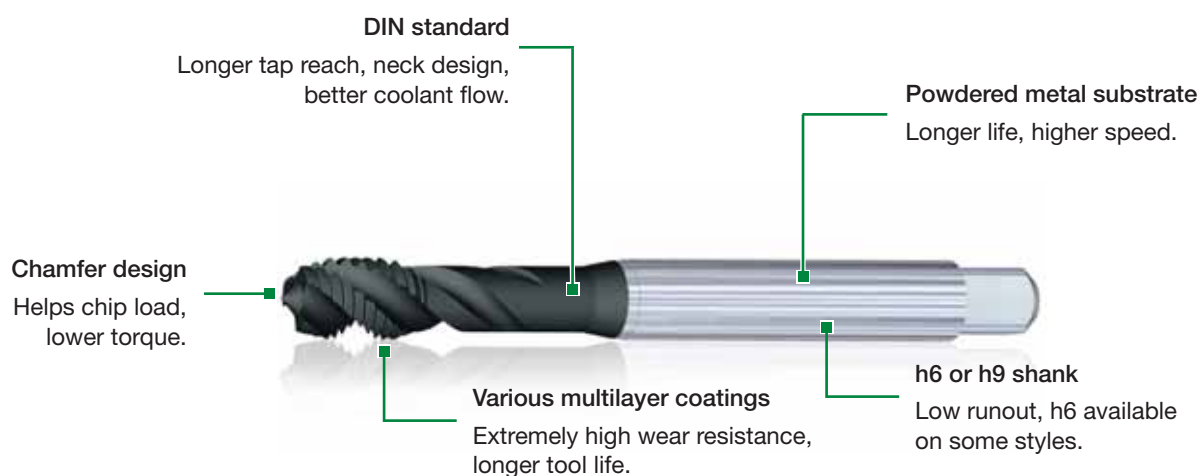
High-Performance HSS-E-PM Taps

Our powdered metal taps deliver highly reliable threads and superior performance in blind and through hole applications. The HP HSS-E-PM is the optimum choice for customers looking for high productivity and long tool life in material-specific applications.



WIDIA-GTD™

- Enhanced design for reliable thread on different materials.
- More resistant to edge chipping than carbide.
- Better performance at high speeds.



Powdered Metal Taps

- Manufactured from high-speed steel and powder coated for thread forming and thread cutting in various applications.
- Offer performance advantages over other regular high-speed taps.
- Unmatched by competitive products.

Tap Functions

- High wear resistance and hot hardness without sacrificing edge strength.
- PVD multilayer coatings offer outstanding thermal stability, hot hardness, oxidation resistance, and low frictional coefficient.
- Spiral point feature pushes chips ahead in through holes.
- Chips stored in flutes or flushed out with straight flutes.
- Taps can be used in collet and hydraulic holders.
- Low runout of thread and chamfer.

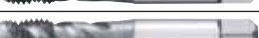
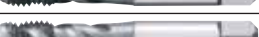
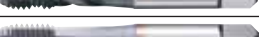
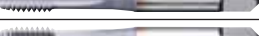
Benefits

- Long tap life at up to 50% higher tapping speed.
- Excellent chip control.
- Greater thread strength.
- Exceptional thread quality and long life.



Victory™ GT Series HSS-E-PM Taps • ANSI Inch and Metric

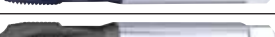
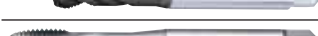
- ★ Good
★★ Better
★★★ Best

GT Series High-Performance HSS-E-PM Taps	series	size range (inch and metric)	hole	chamfer form	coolant	grade	tap dimension
		size min - max					
	GT20	#2 - 3/4"				GP6520	ANSI 302A
	GT20	#2 - 3/4"				GM6515	ANSI 302A
	GT20	M3 - M12				GP6520	ANSI 302A
	GT20	M3 - M12				GM6515	ANSI 302A
	GT30	#2 - 1"				GP6520	ANSI 302A
	GT30	#2 - 1"				GM6515	ANSI 302A
	GT30	#4 - 3/4"				GP6505	ANSI 302A
	GT40	#10 - 3/4"				GP6520	ANSI 302A
	GT40	M3 - M16				GP6520	ANSI 302A

P				M	K			N			S				H			
1, 2, 3, 4, 6, 7	5, 9, 10, 11	12, 13.1	13.2	14.1, 14.2, 14.3, 14.4	15, 16, 17, 18, 19	20		21	22, 23, 24, 25	26, 27, 28	31, 32	33, 34, 35	36	37	38.1, 38.2, 40.1, 40.2, 41.1	39.1, 41.2		
Steel <35 HRC	Steel 36-48 HRC	PH & Ferritic Stainless Steel <35 HRC	PH & Ferritic Stainless Steel >35 HRC	Stainless Steel	Cast Iron			Wrought Aluminum	Cast Aluminum	Copper, Copper Alloys	Iron Based	Cobalt Based	Nickel Based	Titanium & Alloys	Hardened Steel 49-55 HRC	Hardened Steel 56-68 HRC	Page	Recommended Cutting Parameters
★★★		★★★									★★★						A36	A70-A71
				★★★				★	★					★			A36	A70-A71
★★★		★★★									★★★						A37	A70-A71
				★★★				★	★					★			A37	A70-A71
★★★		★★★									★★★						A44	A70-A71
				★★★				★	★					★			A44	A70-A71
★★		★		★														
					★★★	★★★											A56	A70-A71
					★★★	★★★											A57	A70-A71

Victory™ GT Series HP HSS-E-PM Taps • DIN Metric

★ Good
★★ Better
★★★ Best

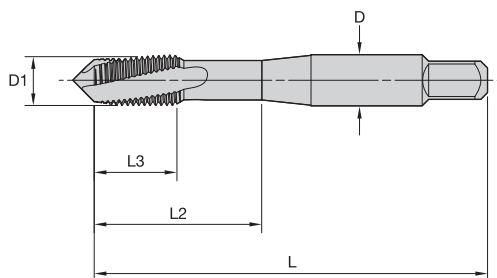
GT Series High-Performance HSS-E-PM Taps	series	size range (metric) size min - max	hole	chamfer form	coolant	grade	tap dimension
	GT00	M3 - M20				WP31MG	DIN 371,374,376
	GT02	M3 - M20				WP31MG	DIN 371,374,376
	GT04	M3 - M20				WH36MG	DIN 371,374,376
	GT06	M6 - M16				WS32MG	DIN 371,374,376
	GT10	M3 - M20				WS32MG	DIN 371,374,376
	GT12	M3 - M20				WS32MG	DIN 371,374,376
	GT14	M3 - M12				WN35MG	DIN 371,376
	GT16	M3 - M12				WN35MG	DIN 371
	GT20	M3 - M42				GP6520	DIN 371,374,376,XL
	GT20	M3 - M20				GM6515	DIN 371,374,376
	GT21	M5 - M14				GP6520	DIN 371,376
	GT21	M5 - M14				GM6515	DIN 371,376
	GT22	M3 - M16				WP31MG	DIN 371,374,376
	GT22	M3 - M16				WN38MG	DIN 371,374,376
	GT23	M5 - M16				WP31MG	DIN 371,374,376
	GT23	M5 - M16				WN38MG	DIN 371,374,376
	GT30	M3 - M42				GP6520	DIN 371,374,376,XL
	GT30	M3 - M24				GM6515	DIN 371,374,376
	GT30	M3 - M16				GP6505	DIN 371,376
	GT31	M5 - M42				GP6520	DIN 371,376,XL
	GT31	M5 - M16				GM6515	DIN 371,376
	GT32	M5 - M16				GP6520	DIN 371,374,376
	GT33	M5 - M16				GP6520	DIN 371,374,376
	GT40	M4 - M22				GP6520	DIN 371,376
	GT41	M4 - M20				GP6520	DIN 371,376
	GT42	M5 - M16				GP6520	DIN 371,374,376
	GT43	M5 - M16				GP6520	DIN 371,374,376
	GT50	M24 - M42				GP6520	DIN 376,XL
	GT51	M24 - M42				GP6520	DIN 376,XL
	GT70	M3 - M16				WN48EG	DIN 371,376
	GT80	M3 - M20				WN48EG	DIN 371,376

P				M	K			N			S				H			
1, 2, 3, 4, 6, 7	5, 9, 10, 11	12, 13.1	13.2	14.1, 14.2, 14.3, 14.4	15, 16, 17, 18, 19	20		21	22, 23, 24, 25	26, 27, 28	31, 32	33, 34, 35	36	37	38.1, 38.2, 40.1, 40.2, 41.1	39.1, 41.2		
Steel <35 HRC	Steel 36–48 HRC	PH & Ferritic Stainless Steel <35 HRC	PH & Ferritic Stainless Steel >35 HRC	Stainless Steel	Cast Iron			Wrought Aluminum	Cast Aluminum	Copper, Copper Alloys	Iron Based	Cobalt Based	Nickel Based	Titanium & Alloys	Hardened Steel 49–55 HRC	Hardened Steel 56–68 HRC	Page(s)	Recommended Cutting Parameters
	★★★		★★★★	★	★	★						★					A40	A70–A71
	★★★		★★★★		★	★						★					A50	A70–A71
	★★★		★★★★		★★★★	★★★★					★★	★★	★★				A52	A70–A71
					★★★★	★★★★									★★★★		A53	A70–A71
												★★★★	★★★★				A42	A70–A71
												★★★★	★★★★				A54	A70–A71
										★				★★★★			A43	A70–A71
										★				★★★★			A55	A70–A71
★★★★		★★★★									★★★★						A38, A65	A70–A71
				★★★★				★	★					★			A38	A70–A71
★★★★		★★★★									★★★★						A39	A70–A71
				★★★★				★	★					★			A39	A70–A71
																	A62	A70–A71
★★★★								★★★★	★								A62	A70–A71
		★★★★															A63	A70–A71
								★★★★	★								A63	A70–A71
★★★★		★★★★									★★★★						A46, A66	A70–A71
				★★★★				★						★			A46	A70–A71
★★																	A46	A70–A71
★★★★		★★★★									★★★★						A47, A67	A70–A71
				★★★★				★						★			A47	A70–A71
★★★★		★★★★									★★★★						A48	A70–A71
★★★★		★★★★															A49	A70–A71
					★★★★	★★★★		★★★★	★★								A58	A70–A71
					★★★★	★★★★		★★★★	★★								A59	A70–A71
					★★★★	★★★★		★★★★	★★								A60	A70–A71
					★★★★	★★★★		★★★★	★★								A61	A70–A71
★★★★		★★		★													A68	A70–A71
★★★★		★★		★													A69	A70–A71
								★★★★	★	★							A41	A70–A71
								★★★★									A51	A70–A71

High-Performance Taps

Victory™ Left-Hand Spiral-Flute HSS-E-PM Taps • Through Holes

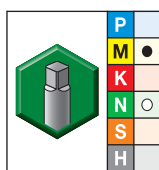
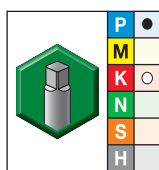
- GM6515 TiN + CrC/C for stainless steel.
- GP6520 TiCN for steel.



VICTORY

- first choice
- alternate choice

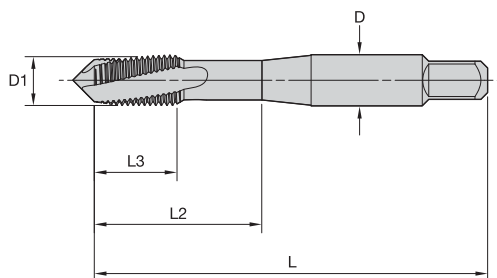
■ GT20 • Machine Screw and Fractional • Form D Plug Chamfer



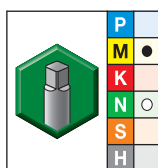
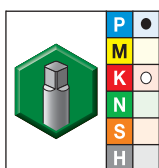
Shank Tolerance	
D Fractional	D Inch
.250-.375	+0, -.0004
.438-.625	+0, -.0004

GP6520	GM6515	D1 size	L	L3	L2	D	number of flutes	class of fit
GT205031	GT205001	2 - 56	1.75	.44	.50	.141	2	2BX
GT205032	GT205002	2 - 56	1.75	.44	.50	.141	2	3BX
GT205033	GT205003	4 - 40	1.88	.56	.69	.141	2	2BX
GT205034	GT205004	4 - 40	1.88	.56	.69	.141	2	3BX
GT205035	GT205005	5 - 40	1.94	.63	.75	.141	2	3BX
GT205036	GT205006	6 - 32	2.00	.36	.71	.141	2	2BX
GT205037	GT205007	6 - 32	2.00	.36	.71	.141	2	3BX
GT205038	GT205008	8 - 32	2.13	.31	.76	.168	2	2BX
GT205039	GT205009	8 - 32	2.13	.31	.76	.168	2	3BX
GT205052	GT205022	8 - 36	2.13	.31	.76	.168	3	3BX
GT205040	GT205010	10 - 24	2.38	.47	.91	.194	3	3BX
GT205053	GT205023	10 - 32	2.38	.47	.91	.194	3	2BX
GT205054	GT205024	10 - 32	2.38	.47	.91	.194	3	3BX
GT205041	GT205011	12 - 24	2.38	.42	.96	.220	3	3BX
GT205042	GT205012	1/4 - 20	2.50	.44	1.00	.255	3	2BX
GT205043	GT205013	1/4 - 20	2.50	.44	1.00	.255	3	3BX
GT205055	GT205025	1/4 - 28	2.50	.44	1.00	.255	3	2BX
GT205056	GT205026	1/4 - 28	2.50	.44	1.00	.255	3	3BX
GT205044	GT205014	5/16 - 18	2.72	.49	1.13	.318	3	2BX
GT205045	GT205015	5/16 - 18	2.72	.49	1.13	.318	3	3BX
GT205057	GT205027	5/16 - 24	2.72	.49	1.13	.318	3	3BX
GT205046	GT205016	3/8 - 16	2.94	.60	1.27	.381	3	2BX
GT205047	GT205017	3/8 - 16	2.94	.60	1.27	.381	3	3BX
GT205058	GT205028	3/8 - 24	2.94	.60	1.27	.381	3	3BX
GT205048	GT205018	7/16 - 14	3.16	.71	1.49	.323	3	3BX
GT205059	GT205029	7/16 - 20	3.16	.71	1.49	.323	3	3BX
GT205049	GT205019	1/2 - 13	3.38	.77	1.74	.367	3	3BX
GT205060	GT205030	1/2 - 20	3.38	.77	1.74	.367	3	3BX
GT205050	GT205020	5/8 - 11	3.81	.91	1.89	.480	3	3BX
GT205051	GT205021	3/4 - 10	4.25	1.00	2.08	.590	3	3BX

- GM6515 TiN + CrC/C for stainless steel.
- GP6520 TiCN for steel.



■ GT20 • Form D Plug Chamfer • Metric ANSI



								Shank Tolerance	
								D Fractional	D Inch
								.250-.375	+0, -.0004
								.438-.625	+0, -.0004
		D1 size	L	L3	L2	D	number of flutes	class of fit	
GP6520									
GT205069		GT205061	M3 X 0,5	1.94	.63	.75	.141	2	6HX
GT205070		GT205062	M4 X 0,7	2.13	.32	.76	.168	2	6HX
GT205071		GT205063	M5 X 0,8	2.38	.47	.91	.194	2	6HX
GT205072		GT205064	M6 X 1	2.50	.46	1.01	.255	3	6HX
GT205074		GT205066	M8 X 1,25	2.72	.48	1.12	.318	3	6HX
GT205075		GT205067	M10 X 1,5	2.94	.53	1.26	.381	3	6HX
GT205076		GT205068	M12 X 1,75	3.38	.77	1.74	.367	3	6HX



VICTORY

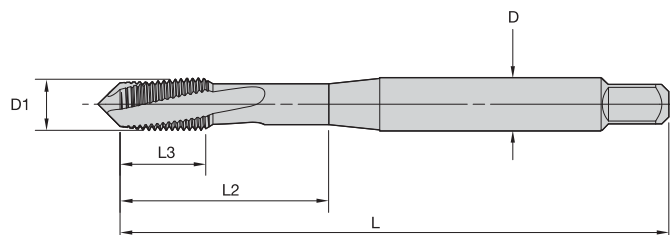
- first choice
- alternate choice

High-Performance Taps

Victory™ Left-Hand Spiral-Flute HSS-E-PM Taps • Through Holes

WIDIA
GTD™

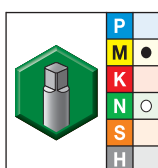
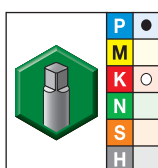
- GM6515 TiN + CrC/C for stainless steel.
- GP6520 TiCN for steel.



- first choice
- alternate choice

VICTORY

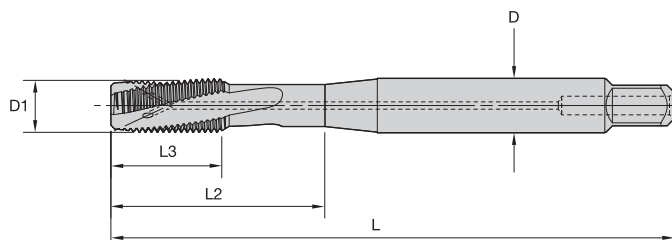
■ GT20 • Form D Plug Chamfer • Metric DIN 371, 374, and 376



						number of flutes	dimension standard	class of fit
GP6520	GM6515	D1 size	L	L3	L2			
GT205094	GT205077	M3 X 0,5	56	8	18	2	DIN 371	6HX
GT205095	GT205078	M4 X 0,7	63	10	21	2	DIN 371	6HX
GT205096	GT205079	M5 X 0,8	70	10	25	2	DIN 371	6HX
GT205097	GT205080	M6 X 1	80	10	30	3	DIN 371	6HX
GT205104	GT205087	M8 X 1	90	13	35	4	DIN 374	6HX
GT205098	GT205081	M8 X 1,25	90	13	35	3	DIN 371	6HX
GT205105	GT205088	M10 X 1	90	10	35	4	DIN 374	6HX
GT205106	GT205089	M10 X 1,25	100	15	39	4	DIN 374	6HX
GT205099	GT205082	M10 X 1,5	100	15	39	3	DIN 371	6HX
GT205107	GT205090	M12 X 1,5	100	15	39	4	DIN 374	6HX
GT205100	GT205083	M12 X 1,75	110	18	44	3	DIN 376	6HX
GT205108	GT205091	M14 X 1,5	100	15	47	4	DIN 374	6HX
GT205101	GT205084	M14 X 2	110	20	52	4	DIN 376	6HX
GT205109	GT205092	M16 X 1,5	100	15	46	4	DIN 374	6HX
GT205102	GT205085	M16 X 2	110	20	51	4	DIN 376	6HX
GT205110	GT205093	M18 X 1,5	110	15	50	4	DIN 374	6HX
GT205103	GT205086	M20 X 2,5	140	25	64	4	DIN 376	6HX

Shank Tolerance	
D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-16	+0, -0,011

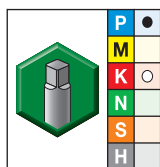
- GM6515 TiN+CrC/C for stainless steel.
- GP6520 TiCN for steel.



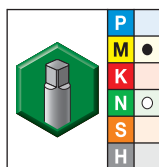
VICTORY

- first choice
- alternate choice

■ GT21 • Form D Plug Chamfer • Through Coolant • Metric DIN 371 and 376



GP6520



GM6515

Shank Tolerance	
D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-16	+0, -0,011

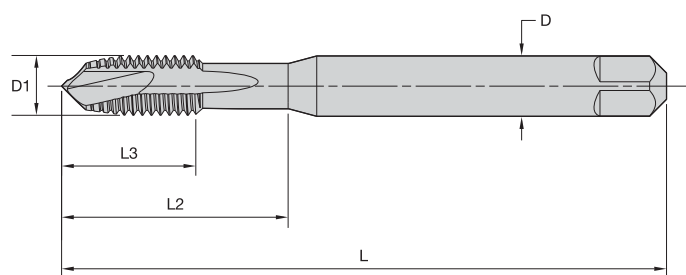
		D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT215007	GT215001	M5 X 0,8	70	10	25	6,0	2	DIN 371	6HX
GT215008	GT215002	M6 X 1	80	10	30	6,0	3	DIN 371	6HX
GT215009	GT215003	M8 X 1,25	90	13	35	8,0	3	DIN 371	6HX
GT215010	GT215004	M10 X 1,5	100	15	39	10,0	3	DIN 371	6HX
GT215011	GT215005	M12 X 1,75	110	18	44	9,0	3	DIN 376	6HX
GT215012	GT215006	M14 X 2	110	20	52	11,0	4	DIN 376	6HX

High-Performance Taps

Victory™ Spiral-Point Plug HSS-E-PM Taps • Through Holes

WIDIA
GTD™

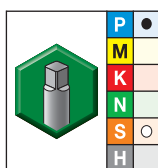
- WP31MG TiN for steel 32–44 HRC.



- first choice
- alternate choice

VICTORY

- GT00 • Form B Plug Chamfer • Metric DIN 371, 374, and 376

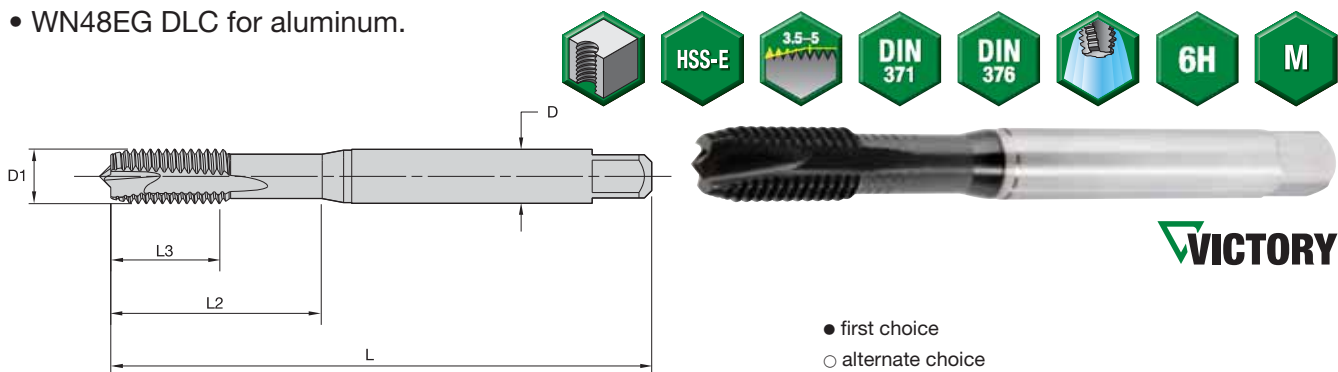


Shank Tolerance	
D	Tolerance h9
1–3	+0, -0,025
3,5–6	+0, -0,030
7–10	+0, -0,036
11–18	+0, -0,043

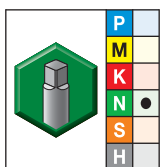
WP31MG	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT005001	M3 X 0,5	56	11	18	3,5	2	DIN 371	6HX
GT005002	M4 X 0,7	63	13	21	4,5	2	DIN 371	6HX
GT005003	M5 X 0,8	70	15	25	6,0	2	DIN 371	6HX
GT005004	M6 X 1	80	17	30	6,0	3	DIN 371	6HX
GT005012	M8 X 1	90	17	—	6,0	3	DIN 374	6HX
GT005005	M8 X 1,25	90	20	35	8,0	3	DIN 371	6HX
GT005013	M10 X 1	90	18	—	7,0	3	DIN 374	6HX
GT005014	M10 X 1,25	100	22	—	7,0	3	DIN 374	6HX
GT005006	M10 X 1,5	100	22	39	10,0	3	DIN 371	6HX
GT005015	M12 X 1,25	100	22	—	9,0	3	DIN 374	6HX
GT005016	M12 X 1,5	100	22	—	9,0	3	DIN 374	6HX
GT005007	M12 X 1,75	110	24	—	9,0	3	DIN 376	6HX
GT005017	M14 X 1,5	100	22	—	11,0	3	DIN 374	6HX
GT005008	M14 X 2	110	26	—	11,0	3	DIN 376	6HX
GT005018	M16 X 1,5	100	22	—	12,0	4	DIN 374	6HX
GT005009	M16 X 2	110	27	—	12,0	4	DIN 376	6HX
GT005010	M18 X 2	125	30	—	14,0	4	DIN 376	6HX
GT005011	M20 X 2,5	140	32	—	16,0	4	DIN 376	6HX

WIDIA
GTD™

- WN48EG DLC for aluminum.



■ GT70 • Form B Plug Chamfer • Metric DIN 371 and 376



Shank Tolerance	
D	Tolerance h9
1-3	+0, -0,025
3,5-6	+0, -0,030
7-10	+0, -0,036
11-18	+0, -0,043

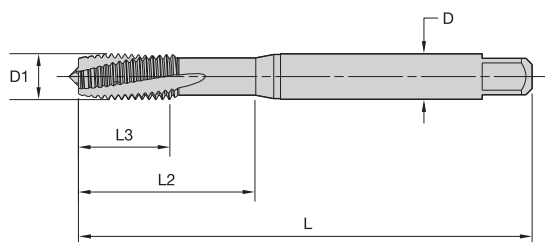
WN48EG	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT705001	M3 X 0,5	56	11	18	3,5	2	DIN 371	6H
GT705002	M4 X 0,7	63	13	21	4,5	2	DIN 371	6H
GT705003	M5 X 0,8	70	15	25	6,0	2	DIN 371	6H
GT705004	M6 X 1	80	17	30	6,0	2	DIN 371	6H
GT705005	M8 X 1,25	90	20	35	8,0	2	DIN 371	6H
GT705006	M10 X 1,5	100	22	39	10,0	2	DIN 371	6H
GT705007	M12 X 1,75	110	24	—	9,0	3	DIN 376	6H
GT705008	M16 X 2	110	27	—	12,0	3	DIN 376	6H

High-Performance Taps

Victory™ Left-Hand Spiral-Flute HSS-E-PM Taps • Through Holes

WIDIA
GTD™

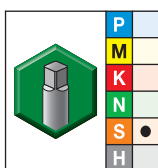
- WS32MG TiCN for nickel and nickel alloys.



VICTORY

- first choice
- alternate choice

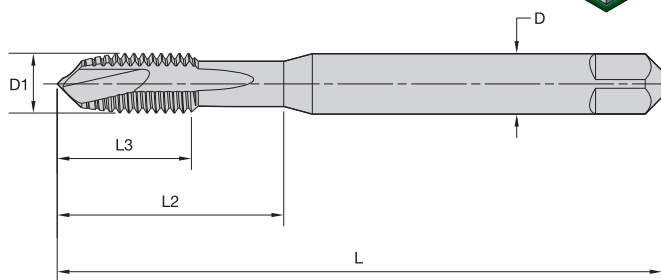
■ GT10 • Form D Plug Chamfer • Metric DIN 371 and 376



Shank Tolerance	
D	Tolerance h9
1-3	+0, -0,025
3,5-6	+0, -0,030
7-10	+0, -0,036
11-18	+0, -0,043

WS32MG	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT105001	M3 X 0,5	56	11	18	3,5	2	DIN 371	6HX
GT105002	M4 X 0,7	63	13	21	4,5	3	DIN 371	6HX
GT105003	M5 X 0,8	70	15	25	6,0	3	DIN 371	6HX
GT105004	M6 X 1	80	17	30	6,0	3	DIN 371	6HX
GT105005	M8 X 1,25	90	20	35	8,0	3	DIN 371	6HX
GT105006	M10 X 1,5	100	22	39	10,0	3	DIN 371	6HX
GT105007	M12 X 1,75	110	24	—	9,0	3	DIN 376	6HX
GT105008	M14 X 2	110	26	—	11,0	3	DIN 376	6HX
GT105009	M16 X 2	110	27	—	12,0	3	DIN 376	6HX
GT105010	M20 X 2,5	140	32	—	16,0	3	DIN 376	6HX

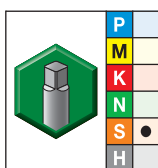
- WN35MG TiN/DLC for titanium and titanium alloys.



VICTORY

- first choice
- alternate choice

■ GT14 • Form B Plug Chamfer • Metric DIN 371 and 376



Shank Tolerance	
D	Tolerance h9
1-3	+0, -0,025
3,5-6	+0, -0,030
7-10	+0, -0,036
11-18	+0, -0,043

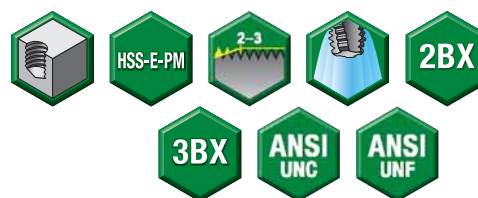
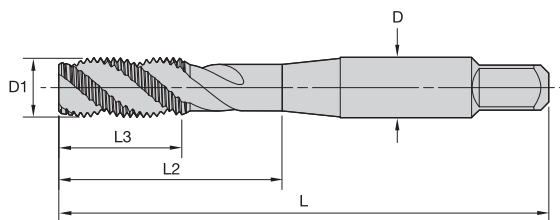
WN35MG	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT145001	M3 X 0,5	56	11	18	3,5	3	DIN 371	6HX
GT145002	M4 X 0,7	63	13	21	4,5	3	DIN 371	6HX
GT145003	M5 X 0,8	70	15	25	6,0	3	DIN 371	6HX
GT145004	M6 X 1	80	17	30	6,0	3	DIN 371	6HX
GT145005	M8 X 1,25	90	20	35	8,0	3	DIN 371	6HX
GT145006	M10 X 1,5	100	22	39	10,0	3	DIN 371	6HX
GT145007	M12 X 1,75	110	24	—	9,0	3	DIN 376	6HX

High-Performance Taps

Victory™ Spiral-Flute HSS-E-PM Taps • Blind Holes

WIDIA
GTD™

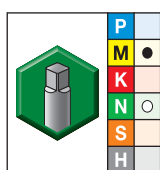
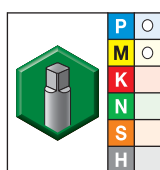
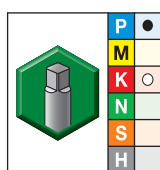
- GM6515 TiN + CrC/C for stainless steel.
- GP6520 TiCN for steel.
- GP6505 Oxide for steel.



- first choice
- alternate choice

VICTORY

GT30 • Machine Screw and Fractional • Form C Semi-Bottoming Chamfer



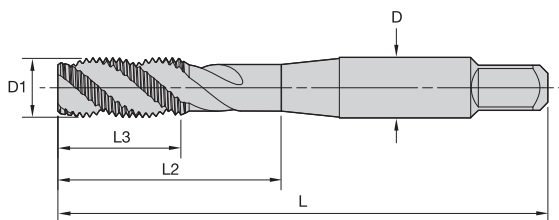
Shank Tolerance

D Fractional	D Inch
.250-.375	+0, -.0004
.438-.625	+0, -.0004

	GP6520	GP6505	GM6515	D1 size	L	L3	L2	D	number of flutes	class of fit
GT305031	—	—	GT305001	2 - 56	1.75	.44	.49	.141	2	3BX
GT305032	—	—	GT305002	4 - 40	1.88	.56	.68	.141	2	2BX
GT305033	GT305125	—	GT305003	4 - 40	1.88	.56	.68	.141	2	3BX
GT305034	—	—	GT305004	6 - 32	1.99	.36	.71	.141	3	2BX
GT305035	GT305126	—	GT305005	6 - 32	1.99	.36	.71	.141	3	3BX
GT305036	GT305127	—	GT305006	8 - 32	2.12	.31	.76	.168	3	3BX
GT305037	GT305128	—	GT305007	10 - 24	2.37	.47	.91	.194	3	3BX
GT305052	—	—	GT305022	10 - 32	2.36	.47	.91	.194	3	2BX
GT305053	GT305140	—	GT305023	10 - 32	2.36	.47	.91	.194	3	3BX
GT305038	GT305129	—	GT305008	1/4 - 20	2.50	.44	1.01	.255	3	2BX
GT305039	GT305130	—	GT305009	1/4 - 20	2.50	.44	1.01	.255	3	3BX
GT305054	GT305141	—	GT305024	1/4 - 28	2.49	.43	1.00	.255	3	2BX
GT305055	GT305142	—	GT305025	1/4 - 28	2.49	.43	1.00	.255	3	3BX
GT305040	GT305131	—	GT305010	5/16 - 18	2.72	.49	1.13	.318	3	2BX
GT305041	GT305132	—	GT305011	5/16 - 18	2.72	.49	1.13	.318	3	3BX
GT305056	GT305143	—	GT305026	5/16 - 24	2.71	.48	1.13	.318	3	2BX
GT305057	—	—	GT305027	5/16 - 24	2.71	.48	1.13	.318	3	3BX
GT305042	GT305133	—	GT305012	3/8 - 16	2.94	.60	1.27	.381	3	2BX
GT305043	GT305134	—	GT305013	3/8 - 16	2.94	.60	1.27	.381	3	3BX
GT305058	—	—	GT305028	3/8 - 24	2.92	.58	1.25	.381	3	3BX
GT305044	GT305135	—	GT305014	7/16 - 14	3.16	.71	1.49	.323	4	3BX
GT305059	GT305145	—	GT305029	7/16 - 20	3.16	.71	1.49	.323	4	3BX
GT305045	GT305136	—	GT305015	1/2 - 13	3.38	.77	1.74	.367	4	2BX
GT305046	GT305137	—	GT305016	1/2 - 13	3.38	.77	1.74	.367	4	3BX
GT305060	GT305147	—	GT305030	1/2 - 20	3.38	.77	1.74	.367	4	3BX
GT305047	—	—	GT305017	5/8 - 11	3.81	.91	1.89	.480	4	2BX
GT305048	GT305138	—	GT305018	5/8 - 11	3.81	.91	1.89	.480	4	3BX
GT305049	—	—	GT305019	3/4 - 10	4.25	1.00	2.08	.590	4	2BX
GT305050	GT305139	—	GT305020	3/4 - 10	4.25	1.00	2.08	.590	4	3BX
GT305051	—	—	GT305021	1 - 8	5.13	1.25	2.58	.800	4	3BX

WIDIA
GTD™

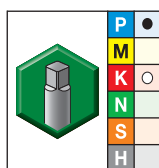
- GM6515 TiN + CrC/C for stainless steel.
- GP6520 TiCN for steel.



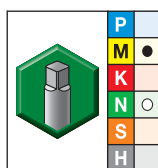
VICTORY

- first choice
- alternate choice

■ GT30 • Form C Semi-Bottoming Chamfer • Metric ANSI



GP6520



GM6515

Shank Tolerance	
D Fractional	D Inch
.250-.375	+0, -.0004
.438-.625	+0, -.0004

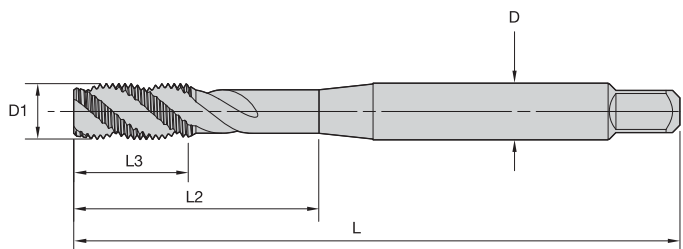
		D1 size	L	L3	L2	D	number of flutes	class of fit
GT305070	GT305061	M3 X 0,5	1.94	.63	.75	.141	3	6HX
GT305071	GT305062	M4 X 0,7	2.13	.32	.76	.168	3	6HX
GT305072	GT305063	M5 X 0,8	2.38	.47	.91	.194	3	6HX
GT305073	GT305064	M6 X 1	2.50	.46	1.01	.255	3	6HX
GT305074	GT305065	M8 X 1,25	2.72	.48	1.12	.318	3	6HX
GT305075	GT305066	M10 X 1,5	2.94	.53	1.26	.381	3	6HX
GT305076	GT305067	M12 X 1,75	3.38	.77	1.74	.367	4	6HX
GT305077	GT305068	M14 X 2	3.59	.83	1.74	.429	4	6HX
GT305078	GT305069	M16 X 2	3.81	.91	1.89	.480	4	6HX

High-Performance Taps

Victory™ Spiral-Flute HSS-E-PM Taps • Blind Holes

WIDIA
GTD™

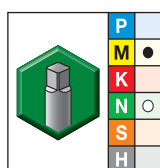
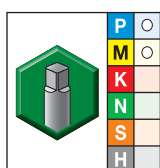
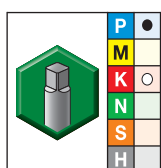
- GM6515 TiN + CrC/C for stainless steel.
- GP6520 TiCN for steel.
- GP6505 oxide for steel.



- first choice
- alternate choice

VICTORY

■ GT30 • Form C Semi-Bottoming Chamfer • Metric DIN 371, 374, and 376

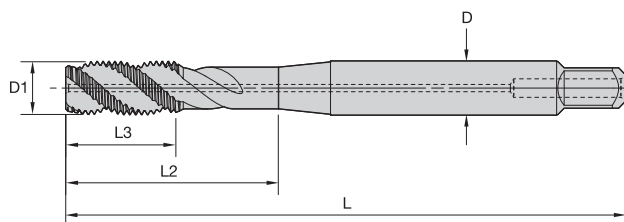


Shank Tolerance	
D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-16	+0, -0,011

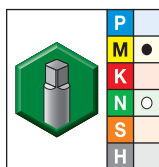
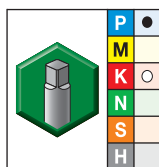
GP6520	GP6505	GM6515	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT305097	GT305116	GT305148	M3 X 0,5	56	8	18	3,5	3	DIN 371	6HX
GT305098	GT305117	GT305079	M4 X 0,7	63	10	21	4,5	3	DIN 371	6HX
GT305099	GT305118	GT305080	M5 X 0,8	70	10	25	6,0	3	DIN 371	6HX
GT305100	GT305119	GT305081	M6 X 1	80	10	30	6,0	3	DIN 371	6HX
GT305109	—	GT305090	M8 X 1	90	13	35	6,0	4	DIN 374	6HX
GT305101	GT305120	GT305082	M8 X 1,25	90	13	35	8,0	3	DIN 371	6HX
GT305110	—	GT305091	M10 X 1	90	10	35	7,0	4	DIN 374	6HX
GT305111	—	GT305092	M10 X 1,25	100	15	39	7,0	4	DIN 374	6HX
GT305102	GT305121	GT305083	M10 X 1,5	100	15	39	10,0	3	DIN 371	6HX
GT305112	—	GT305093	M12 X 1,5	100	15	39	9,0	4	DIN 374	6HX
GT305103	GT305122	GT305084	M12 X 1,75	110	18	44	9,0	4	DIN 376	6HX
GT305113	—	GT305094	M14 X 1,5	100	15	47	11,0	4	DIN 374	6HX
GT305104	GT305123	GT305085	M14 X 2	110	20	52	11,0	4	DIN 376	6HX
GT305114	—	GT305095	M16 X 1,5	100	15	46	12,0	4	DIN 374	6HX
GT305105	GT305124	GT305086	M16 X 2	110	20	51	12,0	4	DIN 376	6HX
GT305115	—	GT305096	M18 X 1,5	110	15	50	14,0	4	DIN 374	6HX
GT305106	—	GT305087	M18 X 2,5	125	25	58	14,0	4	DIN 376	6HX
GT305107	—	GT305088	M22 X 2,5	140	25	70	18,0	4	DIN 376	6HX
GT305108	—	GT305089	M24 X 3	160	30	77	18,0	4	DIN 376	6HX
GT305161	—	—	M24 X 3	160	30	77	18,0	5	DIN 376	6HX
GT305163	—	—	M30 X 3,5	180	35	91	22,0	5	DIN 376	6HX
GT305164	—	—	M33 X 3,5	180	35	100	25,0	5	DIN 376	6HX
GT305166	—	—	M36 X 4	200	40	110	28,0	5	DIN 376	6HX
GT305168	—	—	M42 X 4,5	200	45	120	32,0	5	DIN 376	6HX

WIDIA
GTD™

- GM6515 TiN + CrC/C for stainless steel.
- GP6520 TiCN for steel.


VICTORY

- first choice
- alternate choice

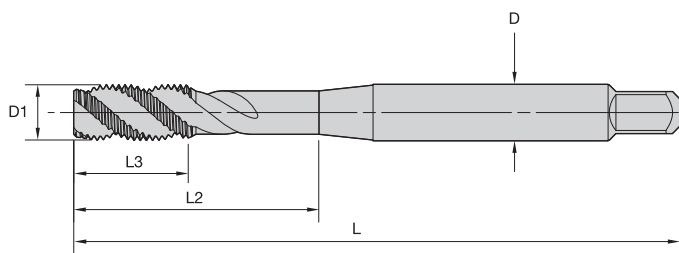
GT31 • Form C Semi-Bottoming Chamfer • Through Coolant • Metric DIN 371 and 376


Shank Tolerance	
D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-16	+0, -0,011

GP6520	GM6515	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT315007	GT315001	M5 X 0,8	70	10	25	6,0	3	DIN 371	6HX
GT315008	GT315002	M6 X 1	80	10	30	6,0	3	DIN 371	6HX
GT315009	GT315003	M8 X 1,25	90	13	35	8,0	3	DIN 371	6HX
GT315010	GT315004	M10 X 1,5	100	15	39	10,0	3	DIN 371	6HX
GT315011	GT315005	M12 X 1,75	110	18	44	9,0	4	DIN 376	6HX
GT315012	GT315006	M14 X 2	110	20	52	11,0	4	DIN 376	6HX
GT315025	—	M24 X 3	160	30	77	18,0	5	DIN 376	6HX
GT315027	—	M30 X 3,5	180	35	91	22,0	5	DIN 376	6HX
GT315028	—	M33 X 3,5	180	35	100	25,0	5	DIN 376	6HX
GT315030	—	M36 X 4	200	40	110	28,0	5	DIN 376	6HX
GT315032	—	M42 X 4,5	200	45	120	32,0	5	DIN 376	6HX

High-Performance Taps

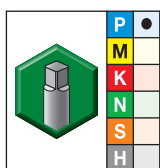
Victory™ Spiral-Flute HSS-E-PM Taps • Threading Close to the Bottom in a Blind Hole



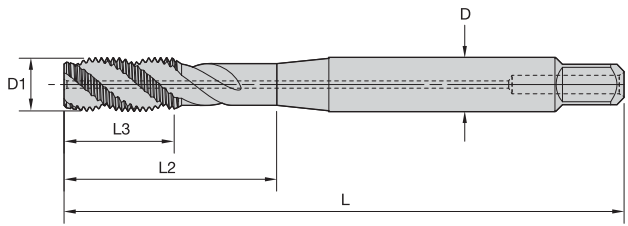
- first choice
- alternate choice

VICTORY

■ GT32 • Form E Bottoming Chamfer • Metric DIN 371, 374, and 376



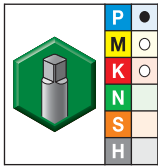
						Shank Tolerance		
						D	Tolerance h6	
						6	+0, -0,008	
						8-10	+0, -0,009	
						12-16	+0, -0,011	
GP6520	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT325001	M5 X 0,8	70	10	25	6,0	3	DIN 371	6HX
GT325002	M6 X 1	80	10	30	6,0	3	DIN 371	6HX
GT325003	M8 X 1,25	90	13	35	8,0	3	DIN 371	6HX
GT325004	M10 X 1,5	100	15	39	10,0	3	DIN 371	6HX
GT325007	M12 X 1,5	100	15	39	9,0	4	DIN 374	6HX
GT325005	M12 X 1,75	110	18	44	9,0	4	DIN 376	6HX
GT325008	M14 X 1,5	100	15	47	11,0	4	DIN 374	6HX
GT325006	M14 X 2	110	20	52	11,0	4	DIN 376	6HX
GT325009	M16 X 1,5	100	15	46	12,0	4	DIN 374	6HX



- first choice
- alternate choice

VICTORY

■ GT33 • Form E Bottoming Chamfer • Through Coolant • Metric DIN 371, 374, and 376



Shank Tolerance	
D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-16	+0, -0,011

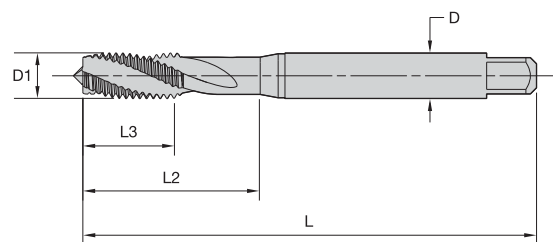
GP6520	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT335001	M5 X 0,8	70	10	25	6,0	3	DIN 371	6HX
GT335002	M6 X 1	80	10	30	6,0	3	DIN 371	6HX
GT335003	M8 X 1,25	90	13	35	8,0	3	DIN 371	6HX
GT335004	M10 X 1,5	100	15	39	10,0	3	DIN 371	6HX
GT335007	M12 X 1,5	100	15	39	9,0	4	DIN 374	6HX
GT335005	M12 X 1,75	110	18	44	9,0	4	DIN 376	6HX
GT335008	M14 X 1,5	100	15	47	11,0	4	DIN 374	6HX
GT335006	M14 X 2	110	20	52	11,0	4	DIN 376	6HX
GT335009	M16 X 1,5	100	15	46	12,0	4	DIN 374	6HX

High-Performance Taps

Victory™ Spiral-Flute HSS-E-PM Taps • Blind Holes

WIDIA
GTD™

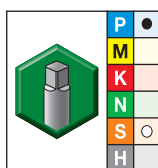
- WP31MG TiN for steel 32–44 HRC.



- first choice
- alternate choice

VICTORY

- GT02 • Form C Semi-Bottoming Chamfer • Metric DIN 371, 374, and 376

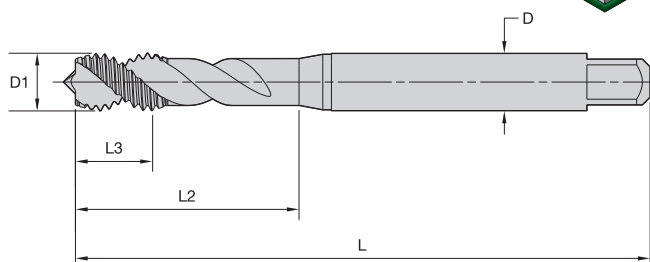


Shank Tolerance	
D	Tolerance h9
1-3	+0, -0,025
3,5-6	+0, -0,030
7-10	+0, -0,036
11-18	+0, -0,043

WP31MG	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT025001	M3 X 0,5	56	11	18	3,5	3	DIN 371	6H
GT025002	M4 X 0,7	63	13	21	4,5	3	DIN 371	6H
GT025003	M5 X 0,8	70	15	25	6,0	3	DIN 371	6H
GT025004	M6 X 1	80	17	30	6,0	3	DIN 371	6H
GT025012	M8 X 1	90	17	—	6,0	3	DIN 374	6H
GT025005	M8 X 1,25	90	20	35	8,0	3	DIN 371	6H
GT025013	M10 X 1	90	18	—	7,0	3	DIN 374	6H
GT025014	M10 X 1,25	100	22	—	7,0	3	DIN 374	6H
GT025006	M10 X 1,5	100	22	39	10,0	3	DIN 371	6H
GT025015	M12 X 1,25	100	22	—	9,0	3	DIN 374	6H
GT025016	M12 X 1,5	100	22	—	9,0	3	DIN 374	6H
GT025007	M12 X 1,75	110	24	44	12,0	3	DIN 376	6H
GT025017	M14 X 1,5	100	22	—	11,0	3	DIN 374	6H
GT025008	M14 X 2	110	26	52	11,0	3	DIN 376	6H
GT025018	M16 X 1,5	100	22	—	12,0	3	DIN 374	6H
GT025009	M16 X 2	110	27	—	12,0	3	DIN 376	6H
GT025010	M18 X 2	125	30	—	14,0	4	DIN 376	6H
GT025011	M20 X 2,5	140	32	—	16,0	4	DIN 376	6H

WIDIA
GTD™

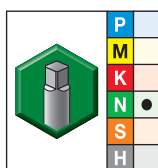
- WN48EG DLC for aluminum.



VICTORY

- first choice
- alternate choice

■ GT80 • Form C Semi-Bottoming Chamfer • Metric DIN 371 and 376



Shank Tolerance	
D	Tolerance h9
1-3	+0, -0,025
3,5-6	+0, -0,030
7-10	+0, -0,036
11-18	+0, -0,043

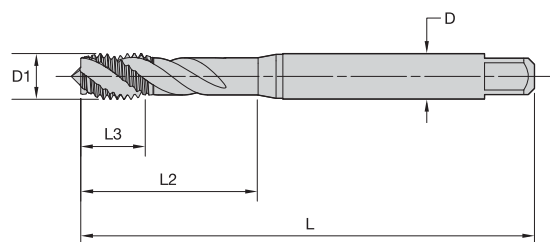
WN48EG	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT805001	M3 X 0,5	56	6	18	3,5	2	DIN 371	6H
GT805002	M4 X 0,7	63	7	21	4,5	2	DIN 371	6H
GT805003	M5 X 0,8	70	8	25	6,0	2	DIN 371	6H
GT805004	M6 X 1	80	10	30	6,0	2	DIN 371	6H
GT805005	M8 X 1,25	90	14	35	8,0	2	DIN 371	6H
GT805006	M10 X 1,5	100	16	39	10,0	2	DIN 371	6H
GT805007	M12 X 1,75	110	18	—	9,0	3	DIN 376	6H
GT805008	M16 X 2	110	22	—	12,0	3	DIN 376	6H
GT805009	M20 X 2,5	140	25	—	16,0	3	DIN 376	6H

High-Performance Taps

Victory™ Spiral-Flute HSS-E-PM Taps • Blind Hole 3 x D

WIDIA
GTD™

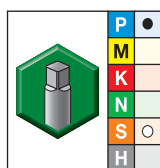
- WH36MG TiAlN/MoS₂ for steel
32–44 HRC (3 x D).



- first choice
- alternate choice

VICTORY

■ GT04 • Form C Semi-Bottoming Chamfer • Metric DIN 371, 374, and 376

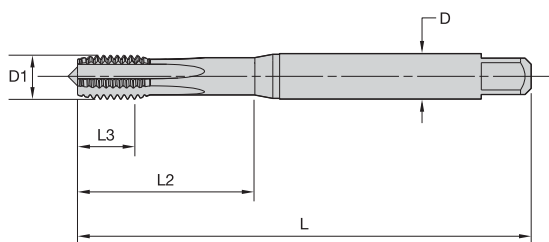


Shank Tolerance	
D	Tolerance h9
1–3	+0, -0,025
3,5–6	+0, -0,030
7–10	+0, -0,036
11–18	+0, -0,043

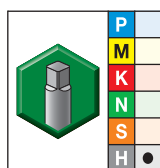
WH36MG	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT045001	M3 X 0,5	56	6	18	3,5	3	DIN 371	6H
GT045002	M4 X 0,7	63	7	21	4,5	3	DIN 371	6H
GT045003	M5 X 0,8	70	8	25	6,0	3	DIN 371	6H
GT045004	M6 X 1	80	10	30	6,0	3	DIN 371	6H
GT045012	M8 X 1	90	10	—	6,0	3	DIN 374	6H
GT045005	M8 X 1,25	90	14	35	8,0	3	DIN 371	6H
GT045013	M10 X 1	90	10	—	7,0	3	DIN 374	6H
GT045014	M10 X 1,25	100	16	—	7,0	3	DIN 374	6H
GT045006	M10 X 1,5	100	16	39	10,0	3	DIN 371	6H
GT045015	M12 X 1,25	100	15	—	9,0	4	DIN 374	6H
GT045016	M12 X 1,5	100	15	—	9,0	4	DIN 374	6H
GT045007	M12 X 1,75	110	18	—	9,0	4	DIN 376	6H
GT045017	M14 X 1,5	100	15	—	11,0	4	DIN 374	6H
GT045008	M14 X 2	110	20	—	11,0	4	DIN 376	6H
GT045018	M16 X 1,5	100	15	—	12,0	4	DIN 374	6H
GT045009	M16 X 2	110	22	—	12,0	4	DIN 376	6H
GT045010	M18 X 2	125	25	—	14,0	4	DIN 376	6H
GT045011	M20 X 2,5	140	25	—	16,0	4	DIN 376	6H

WIDIA
GTD™

- WS32MG TiCN for steel 44–55 HRC.



- first choice
- alternate choice

VICTORY
GT06 • Form C Semi-Bottoming Chamfer • Metric DIN 371, 374, and 376


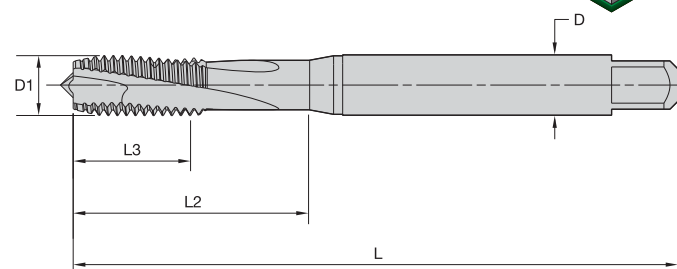
Shank Tolerance	
D	Tolerance h9
1–3	+0, -0,025
3,5–6	+0, -0,030
7–10	+0, -0,036
11–18	+0, -0,043

WS32MG	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT065003	M6 X 1	80	10	30	6,0	4	DIN 371	6HX
GT065006	M8 X 1	90	10	35	8,0	5	DIN 374	6HX
GT065001	M8 X 1,25	90	14	35	8,0	5	DIN 371	6HX
GT065008	M12 X 1,5	100	15	—	9,0	5	DIN 374	6HX
GT065004	M12 X 1,75	110	18	—	9,0	5	DIN 376	6HX
GT065007	M10 X 1	90	10	35	10,0	5	DIN 374	6HX
GT065002	M10 X 1,5	100	16	39	10,0	5	DIN 371	6HX
GT065009	M14 X 1,5	100	15	—	11,0	6	DIN 374	6HX
GT065010	M16 X 1,5	100	15	—	12,0	6	DIN 374	6HX
GT065005	M16 X 2	110	22	—	12,0	6	DIN 376	6HX

High-Performance Taps

Victory™ Spiral-Flute HSS-E-PM Taps • Blind Holess

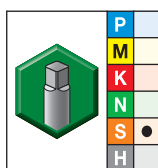
- WS32MG TiCN for nickel and nickel alloys.



VICTORY

- first choice
- alternate choice

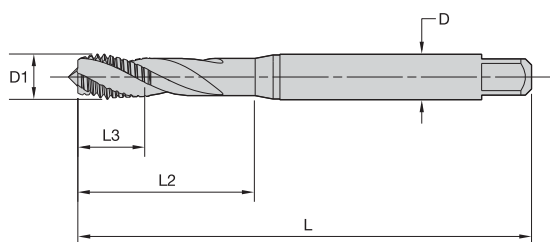
■ GT12 • Form C Semi-Bottoming Chamfer • Metric DIN 371 and 376



Shank Tolerance	
D	Tolerance h9
1-3	+0, -0,025
3,5-6	+0, -0,030
7-10	+0, -0,036
11-18	+0, -0,043

WS32MG	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT125001	M3 X 0,5	56	11	18	3,5	2	DIN 371	6HX
GT125002	M4 X 0,7	63	13	21	4,5	3	DIN 371	6HX
GT125003	M5 X 0,8	70	15	25	6,0	3	DIN 371	6HX
GT125004	M6 X 1	80	17	30	6,0	3	DIN 371	6HX
GT125005	M8 X 1,25	90	20	35	8,0	3	DIN 371	6HX
GT125006	M10 X 1,5	100	22	39	10,0	3	DIN 371	6HX
GT125007	M12 X 1,75	110	24	—	9,0	3	DIN 376	6HX
GT125008	M14 X 2	110	26	—	11,0	3	DIN 376	6HX
GT125009	M16 X 2	110	27	—	12,0	3	DIN 376	6HX
GT125010	M20 X 2,5	140	32	—	16,0	3	DIN 376	6HX

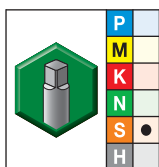
- WN35MG TiN/DLC for titanium and titanium alloys.



VICTORY

- first choice
- alternate choice

■ GT16 • Form C Semi-Bottoming Chamfer • Metric DIN 371



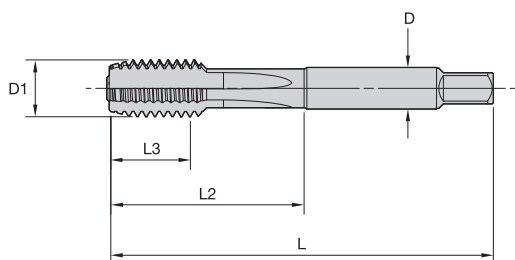
Shank Tolerance	
D	Tolerance h9
1-3	+0, -0,025
3,5-6	+0, -0,030
7-10	+0, -0,036
11-18	+0, -0,043

WN35MG	D1 size	L	L3	L2	D	number of flutes	class of fit
GT165001	M3 X 0,5	56	6	18	3,5	3	6HX
GT165002	M4 X 0,7	63	7	21	4,5	3	6HX
GT165003	M5 X 0,8	70	8	25	6,0	3	6HX
GT165004	M6 X 1	80	10	30	6,0	3	6HX
GT165005	M8 X 1,25	90	14	35	8,0	3	6HX
GT165006	M10 X 1,5	100	16	39	10,0	3	6HX
GT165007	M12 X 1,75	110	18	44	12,0	3	6HX

High-Performance Taps

Victory™ Straight-Flute HSS-E-PM Taps • Through and Blind Holes

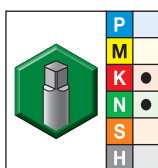
- GP6520 TiCN for cast iron and cast aluminum.



- first choice
- alternate choice

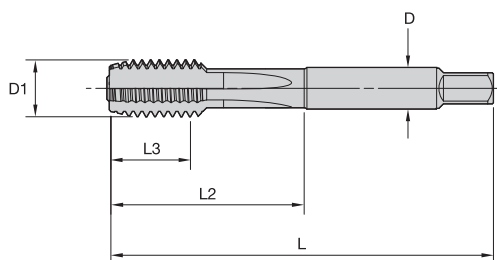
VICTORY

■ GT40 • Machine Screw and Fractional • Form C Semi-Bottoming Chamfer



GP6520	D1 size	L	L3	L2	D	Shank Tolerance	
						D Fractional	D Inch
GT405012	10 - 24	2.37	.47	.91	.194	.250-.375	+0, -.0004
GT405013	10 - 32	2.36	.47	.91	.194	.438-.625	+0, -.0004
GT405014	1/4 - 20	2.50	.44	1.01	.255		
GT405015	1/4 - 20	2.50	.44	1.01	.255		
GT405016	1/4 - 28	2.49	.43	1.00	.255		
GT405017	1/4 - 28	2.49	.43	1.00	.255		
GT405018	5/16 - 18	2.72	.49	1.13	.318		
GT405019	5/16 - 18	2.72	.49	1.13	.318		
GT405020	5/16 - 24	2.71	.48	1.13	.318		
GT405021	3/8 - 16	2.94	.60	1.27	.381		
GT405022	3/8 - 16	2.94	.60	1.27	.381		
GT405023	3/8 - 24	2.92	.58	1.25	.381		
GT405024	7/16 - 14	3.16	.71	1.49	.323		
GT405025	7/16 - 20	3.16	.71	1.49	.323		
GT405026	1/2 - 13	3.38	.77	1.74	.367		
GT405027	1/2 - 20	3.38	.77	1.74	.367		
GT405028	5/8 - 11	3.81	.91	1.89	.480		
GT405029	3/4 - 10	4.25	1.00	2.08	.590		

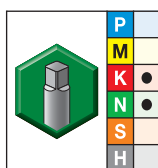
- GP6520 TiCN for cast iron and cast aluminum.



VICTORY

- first choice
- alternate choice

■ GT40 • Form C Semi-Bottoming Chamfer • Metric ANSI



Shank Tolerance	
D Fractional	D Inch
.250-.375	+0, -.0004
.438-.625	+0, -.0004

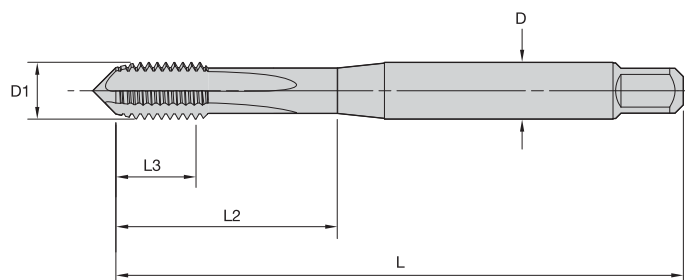
GP6520	D1 size	L	L3	L2	D	number of flutes	class of fit
GT405030	M3 X 0,5	1.94	.63	.75	.140	4	6HX
GT405031	M4 X 0,7	2.12	.32	.76	.168	4	6HX
GT405032	M5 X 0,8	2.37	.47	.91	.194	4	6HX
GT405033	M6 X 1	2.50	.46	1.01	.255	4	6HX
GT405034	M8 X 1,25	2.71	.48	1.13	.318	4	6HX
GT405035	M10 X 1,5	2.92	.53	1.26	.381	4	6HX
GT405036	M12 X 1,75	3.38	.77	1.74	.367	4	6HX
GT405037	M14 X 2	3.59	.83	1.74	.429	4	6HX
GT405038	M16 X 2	3.81	.91	1.89	.480	4	6HX

High-Performance Taps

Victory™ Straight-Flute HSS-E-PM Taps • Through and Blind Holes

WIDIA
GTD™

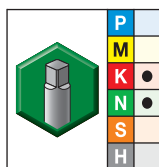
- GP6520 TiCN for cast iron and cast aluminum.



- first choice
- alternate choice

VICTORY

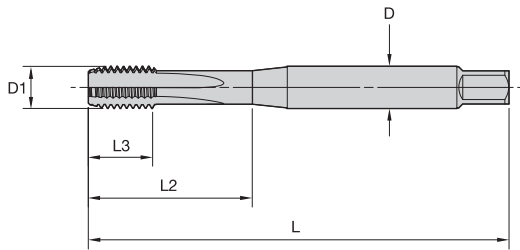
- GT40 • Form C Semi-Bottoming Chamfer • Metric DIN 371 and 376



									Shank Tolerance	
									D	Tolerance h6
									6	+0, -0,008
									8-10	+0, -0,009
									12-16	+0, -0,011
GP6520	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit		
GT405001	M4 X 0,7	63	10	21	4,5	3	DIN 371	6HX		
GT405002	M5 X 0,8	70	10	25	6,0	3	DIN 371	6HX		
GT405003	M6 X 1	80	10	30	6,0	4	DIN 371	6HX		
GT405004	M8 X 1,25	90	13	35	8,0	4	DIN 371	6HX		
GT405005	M10 X 1,5	100	15	39	10,0	4	DIN 371	6HX		
GT405006	M12 X 1,75	110	18	44	9,0	4	DIN 376	6HX		
GT405007	M14 X 2	110	20	52	11,0	4	DIN 376	6HX		
GT405008	M16 X 2	110	20	51	12,0	4	DIN 376	6HX		
GT405009	M18 X 2,5	125	25	58	14,0	4	DIN 376	6HX		
GT405010	M20 X 2,5	140	25	64	16,0	4	DIN 376	6HX		
GT405011	M22 X 2,5	140	25	70	18,0	4	DIN 376	6HX		

WIDIA
GTD™

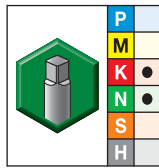
- GP6520 TiCN for cast iron and cast aluminum.



- first choice
- alternate choice

VICTORY

■ GT41 • Form C Semi-Bottoming Chamfer • Through Coolant • Metric DIN 371 and 376



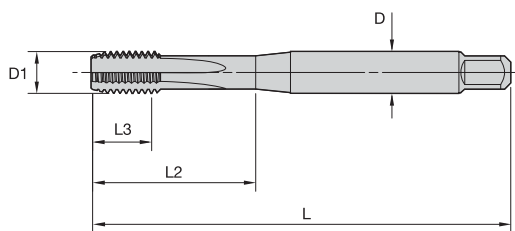
Shank Tolerance	
D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-16	+0, -0,011

GP6520	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT415001	M4 X 0,7	63	10	21	4,5	3	DIN 371	6HX
GT415002	M5 X 0,8	70	10	25	6,0	3	DIN 371	6HX
GT415003	M6 X 1	80	10	30	6,0	4	DIN 371	6HX
GT415004	M8 X 1,25	90	13	35	8,0	4	DIN 371	6HX
GT415005	M10 X 1,5	100	15	39	10,0	4	DIN 371	6HX
GT415006	M12 X 1,75	110	18	44	9,0	4	DIN 376	6HX
GT415007	M14 X 2	110	20	52	11,0	4	DIN 376	6HX
GT415008	M16 X 2	110	20	51	12,0	4	DIN 376	6HX
GT415009	M18 X 2,5	125	25	58	14,0	4	DIN 376	6HX
GT415010	M20 X 2,5	140	25	64	16,0	4	DIN 376	6HX

High-Performance Taps

Victory™ Straight-Flute HSS-E-PM Taps • Threading Close to the Bottom in a Blind Hole

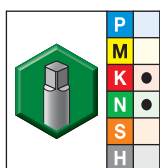
- GP6520 TiCN for cast iron and cast aluminum.



- first choice
- alternate choice

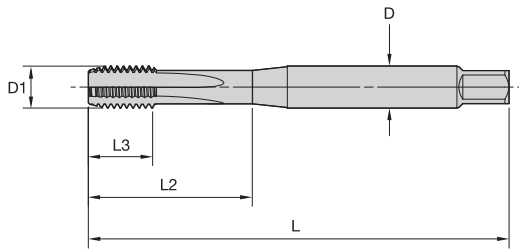
VICTORY

- GT42 • Form E Bottoming Chamfer • Metric DIN 371, 374, and 376



						Shank Tolerance		
						D	Tolerance h6	
						6	+0, -0,008	
						8-10	+0, -0,009	
						12-16	+0, -0,011	
GP6520	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT425001	M5 X 0,8	70	10	25	6,0	3	DIN 371	6HX
GT425002	M6 X 1	80	10	30	6,0	4	DIN 371	6HX
GT425003	M8 X 1,25	90	13	35	8,0	4	DIN 371	6HX
GT425004	M10 X 1,5	100	15	39	10,0	4	DIN 371	6HX
GT425007	M12 X 1,5	100	15	39	9,0	4	DIN 374	6HX
GT425005	M12 X 1,75	110	18	44	9,0	4	DIN 376	6HX
GT425008	M14 X 1,5	100	15	47	11,0	4	DIN 374	6HX
GT425006	M14 X 2	110	20	52	11,0	4	DIN 376	6HX
GT425009	M16 X 1,5	100	15	46	12,0	4	DIN 374	6HX

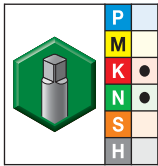
- GP6520 TiCN for cast iron and cast aluminum.



- first choice
- alternate choice

VICTORY

- GT43 • Form E Bottoming Chamfer • Through Coolant • Metric DIN 371, 374, and 376



Shank Tolerance	
D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-16	+0, -0,011

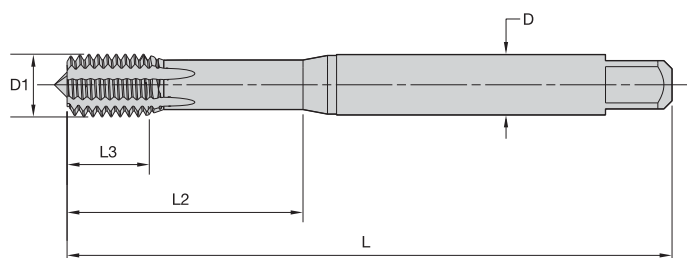
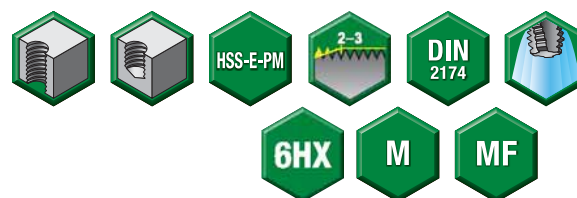
GP6520	D1 size	L	L3	L2	D	number of flutes	dimension standard	class of fit
GT435001	M5 X 0,8	70	10	25	6,0	3	DIN 371	6HX
GT435002	M6 X 1	80	10	30	6,0	4	DIN 371	6HX
GT435003	M8 X 1,25	90	13	35	8,0	4	DIN 371	6HX
GT435004	M10 X 1,5	100	15	39	10,0	4	DIN 371	6HX
GT435007	M12 X 1,5	100	15	39	9,0	4	DIN 374	6HX
GT435005	M12 X 1,75	110	18	44	9,0	4	DIN 376	6HX
GT435008	M14 X 1,5	100	15	47	11,0	4	DIN 374	6HX
GT435006	M14 X 2	110	20	52	11,0	4	DIN 376	6HX
GT435009	M16 X 1,5	100	15	46	12,0	4	DIN 374	6HX

High-Performance Taps

Victory™ Forming Tap HSS-E-PM • Blind and Through Holes

WIDIA
GTD™

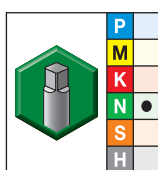
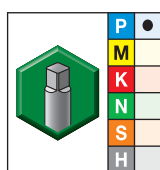
- WP31MG TiN for steel.
- WN38MG DLC for aluminum.



- first choice
- alternate choice

VICTORY

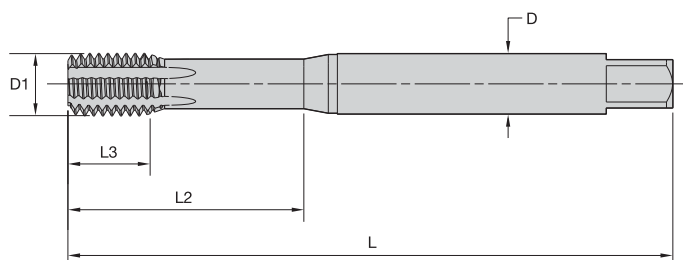
GT22 • Form C Semi-Bottoming Entry Taper • Metric DIN 2174



							Shank Tolerance	
							D	Tolerance h9
							1-3	+0, -0,025
							3,5-6	+0, -0,030
							7-10	+0, -0,036
							11-18	+0, -0,043
							number of lube grooves	class of fit
WP31MG	WN38MG	D1 size	L	L3	L2	D		
GT225016	GT225001	M3 X 0,5	56	6	18	3,5	4	6HX
GT225017	GT225002	M4 X 0,7	63	7	21	4,5	4	6HX
GT225018	GT225003	M5 X 0,8	70	8	25	6,0	4	6HX
GT225019	GT225004	M6 X 1	80	10	30	6,0	5	6HX
GT225024	GT225009	M8 X 1	90	10	35	8,0	5	6HX
GT225020	GT225005	M8 X 1,25	90	14	35	8,0	5	6HX
GT225025	GT225010	M10 X 1	90	10	35	10,0	5	6HX
GT225026	GT225011	M10 X 1,25	100	16	39	10,0	5	6HX
GT225021	GT225006	M10 X 1,5	100	16	39	10,0	5	6HX
GT225027	GT225012	M12 X 1,25	100	15	—	9,0	6	6HX
GT225028	GT225013	M12 X 1,5	100	15	—	9,0	6	6HX
GT225022	GT225007	M12 X 1,75	110	18	—	9,0	6	6HX
GT225029	GT225014	M14 X 1,5	100	15	—	11,0	6	6HX
GT225030	GT225015	M16 X 1,5	100	15	—	12,0	6	6HX
GT225023	GT225008	M16 X 2	110	22	—	12,0	6	6HX

WIDIA
GTD™

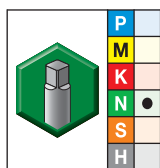
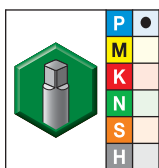
- WP31MG TiN for steel.
- WN38MG DLC for aluminum.



- first choice
- alternate choice

VICTORY

■ GT23 • Form C Semi-Bottoming Entry Taper • Through Coolant • Metric DIN 2174



Shank Tolerance	
D	Tolerance h9
1-3	+0, -0,025
3,5-6	+0, -0,030
7-10	+0, -0,036
11-18	+0, -0,043

WP31MG	WN38MG	D1 size	L	L3	L2	D	number of lube grooves	class of fit
GT235012	GT235001	M5 X 0,8	70	8	25	6,0	4	6HX
GT235013	GT235002	M6 X 1	80	10	30	6,0	5	6HX
GT235018	GT235007	M8 X 1	90	10	35	8,0	5	6HX
GT235014	GT235003	M8 X 1,25	90	14	35	8,0	5	6HX
GT235019	GT235008	M10 X 1	90	10	35	10,0	5	6HX
GT235015	GT235004	M10 X 1,5	100	16	39	10,0	5	6HX
GT235020	GT235009	M12 X 1,5	100	15	—	9,0	6	6HX
GT235016	GT235005	M12 X 1,75	110	18	—	9,0	6	6HX
GT235021	GT235010	M14 X 1,5	100	15	—	11,0	6	6HX
GT235022	GT235011	M16 X 1,5	100	15	—	12,0	6	6HX
GT235017	GT235006	M16 X 2	110	22	—	12,0	6	6HX

WIN WITH WIDIATM

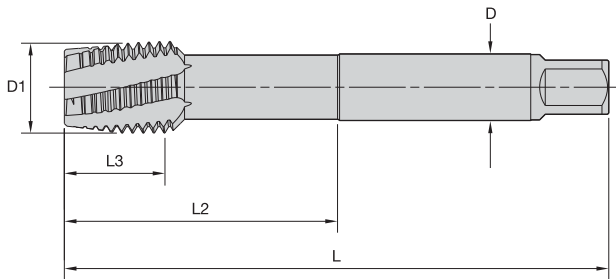


VictoryTM GT HP HSS-E-PM Wind Taps

Boost productivity on large-sized components.

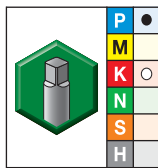
- Made with highly alloyed powdered metal HSS-E substrate that combines wear and heat resistance with toughness.
- GP6520TM Grade provides long tap life at high tapping speeds.
- Precision h6 shank results in exceptional thread quality and tool life due a very low runout.
- GT20 through holes.
- GT30 and GT31 for blind holes on vertical tapping.
- GT50 and GT51 for blind holes on horizontal tapping.
- All GTTM Series Wind Taps are available according to DIN 376 and extra-long lengths as standard.

- GP6520 TiCN for steel and cast iron.

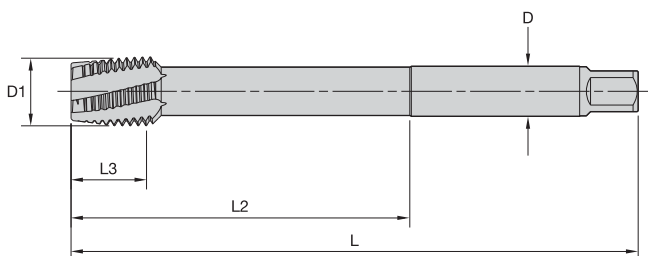

VICTORY

- first choice
- alternate choice

■ GT20 • Form D Plug Chamfer • Larger Sizes • Metric DIN 376

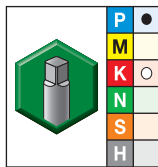


GP6520	D1 size	L	L3	L2	D	Shank Tolerance	
						D	Tolerance h6
GT205111	M24 X 3	160	30	77	18,0	12-18	+0, -0,011
GT205113	M30 X 3,5	180	35	91	22,0	20-30	+0, -0,013
GT205114	M33 X 3,5	180	35	100	25,0	32-36	+0, -0,016
GT205116	M36 X 4	200	40	110	28,0		
GT205118	M42 X 4,5	200	45	120	32,0		


VICTORY

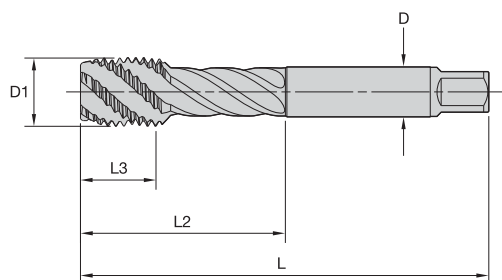
- first choice
- alternate choice

■ GT20 • Form D Plug Chamfer • Larger Sizes • Metric Extra Long



GP6520	D1 size	L	L3	L2	D	Shank Tolerance	
						D	Tolerance h6
GT205122	M24 X 3	200	30	120	18,0	12-18	+0, -0,011
GT205124	M30 X 3,5	250	35	150	22,0	20-30	+0, -0,013
GT205125	M33 X 3,5	250	35	150	25,0	32-36	+0, -0,016
GT205127	M36 X 4	250	40	150	28,0		
GT205129	M42 X 4,5	300	45	180	32,0		

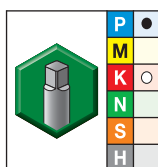
- GP6520 TiCN for steel and cast iron.



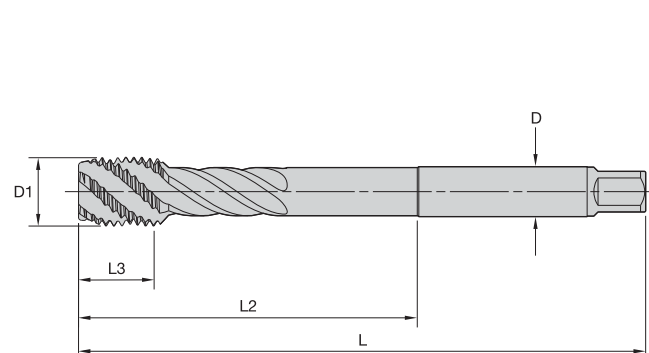
VICTORY

- first choice
- alternate choice

- GT30 • Form C Semi-Bottoming Chamfer • Larger Sizes • Metric DIN 376



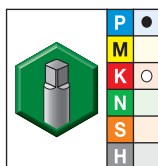
GP6520	D1 size	L	L3	L2	D	Shank Tolerance	
						D	Tolerance h6
GT305161	M24 X 3	160	30	77	18,0	12-18	+0, -0,011
GT305163	M30 X 3,5	180	35	91	22,0	20-30	+0, -0,013
GT305164	M33 X 3,5	180	35	100	25,0	32-36	+0, -0,016
GT305166	M36 X 4	200	40	110	28,0		
GT305168	M42 X 4,5	200	45	120	32,0		



VICTORY

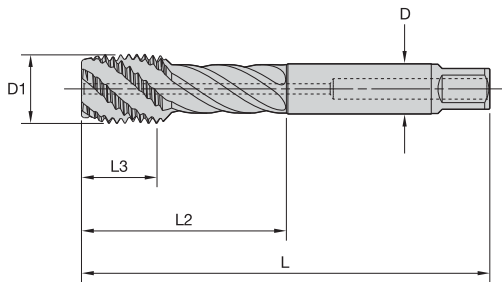
- first choice
- alternate choice

- GT30 • Form C Semi-Bottoming Chamfer • Larger Sizes • Metric Extra Long



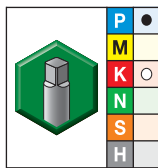
GP6520	D1 size	L	L3	L2	D	Shank Tolerance	
						D	Tolerance h6
GT305151	M24 X 3	200	30	120	18,0	12-18	+0, -0,011
GT305153	M30 X 3,5	250	35	150	22,0	20-30	+0, -0,013
GT305154	M33 X 3,5	250	35	150	25,0	32-36	+0, -0,016
GT305156	M36 X 4	250	40	150	28,0		
GT305158	M42 X 4,5	300	45	180	32,0		

- GP6520 TiCN for steel and cast iron.


VICTORY

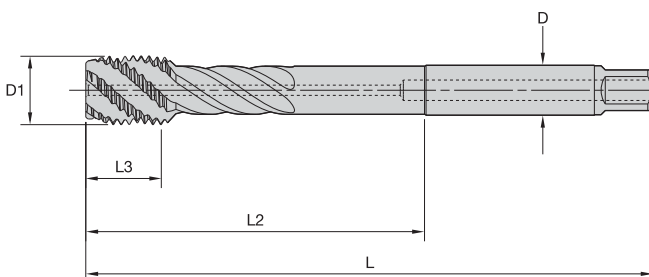
- first choice
- alternate choice

- GT31 • Form C Semi-Bottoming Chamfer • Through Coolant • Larger Sizes • Metric DIN 376



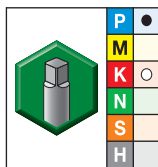
Shank Tolerance	
D	Tolerance h6
12-18	+0, -0,011
20-30	+0, -0,013
32-36	+0, -0,016

GP6520	D1 size	L	L3	L2	D	number of flutes	class of fit
GT315025	M24 X 3	160	30	77	18,0	5	6HX
GT315027	M30 X 3,5	180	35	91	22,0	5	6HX
GT315028	M33 X 3,5	180	35	100	25,0	5	6HX
GT315030	M36 X 4	200	40	110	28,0	5	6HX
GT315032	M42 X 4,5	200	45	120	32,0	5	6HX


VICTORY

- first choice
- alternate choice

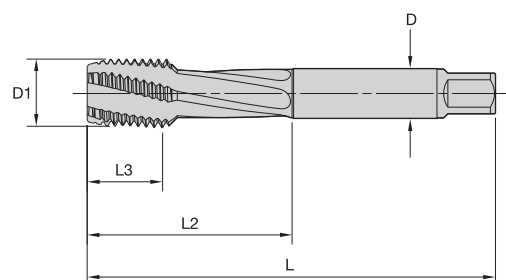
- GT31 • Form C Semi-Bottoming Chamfer • Through Coolant • Larger Sizes • Metric Extra Long



Shank Tolerance	
D	Tolerance h6
12-18	+0, -0,011
20-30	+0, -0,013
32-36	+0, -0,016

GP6520	D1 size	L	L3	L2	D	number of flutes	class of fit
GT315014	M24 X 3	200	30	120	18,0	5	6HX
GT315016	M30 X 3,5	250	35	150	22,0	5	6HX
GT315017	M33 X 3,5	250	35	150	25,0	5	6HX
GT315019	M36 X 4	250	40	150	28,0	5	6HX
GT315021	M42 X 4,5	300	45	180	32,0	5	6HX

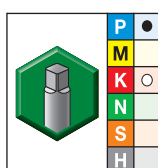
- GP6520 TiCN for steel and cast iron.



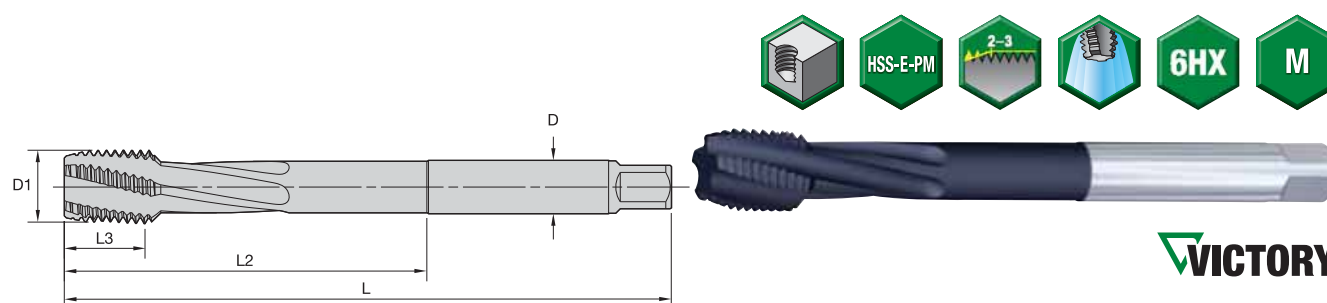
VICTORY

- first choice
- alternate choice

■ GT50 • Form C Semi-Bottoming Chamfer • Larger Sizes • Metric DIN 376



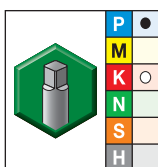
GP6520	D1 size	L	L3	L2	D	Shank Tolerance	
						D	Tolerance h6
GT505001	M24 X 3	160	30	77	18,0	12-18	+0, -0,011
GT505002	M30 X 3,5	180	35	91	22,0	20-30	+0, -0,013
GT505003	M33 X 3,5	180	35	100	25,0	32-36	+0, -0,016
GT505004	M36 X 4	200	40	110	28,0		
GT505005	M42 X 4,5	200	45	120	32,0		



VICTORY

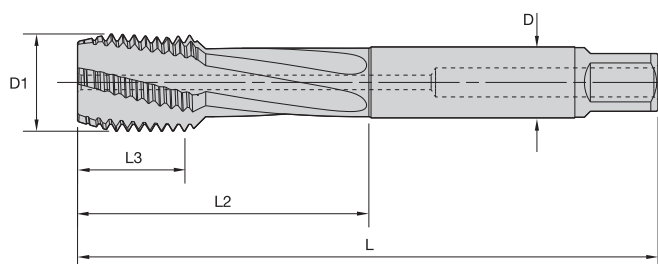
- first choice
- alternate choice

■ GT50 • Form C Semi-Bottoming Chamfer • Larger Sizes • Metric Extra Long



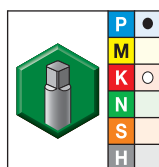
GP6520	D1 size	L	L3	L2	D	Shank Tolerance	
						D	Tolerance h6
GT505006	M24 X 3	200	30	120	18,0	12-18	+0, -0,011
GT505007	M30 X 3,5	250	35	150	22,0	20-30	+0, -0,013
GT505008	M33 X 3,5	250	35	150	25,0	32-36	+0, -0,016
GT505009	M36 X 4	250	40	150	28,0		
GT505010	M42 X 4,5	300	45	180	32,0		

- GP6520 TiCN for steel and cast iron.


VICTORY

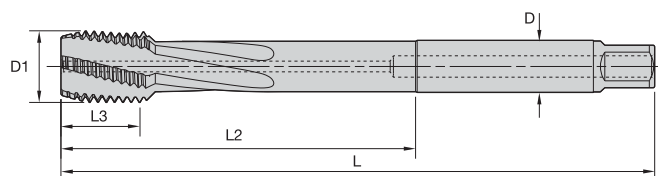
- first choice
- alternate choice

■ GT51 • Form C Semi-Bottoming Chamfer • Through Hole • Larger Sizes • Metric DIN 376



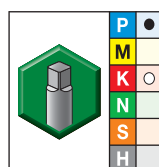
Shank Tolerance	
D	Tolerance h6
12-18	+0, -0,011
20-30	+0, -0,013
32-36	+0, -0,016

GP6520	D1 size	L	L3	L2	D	number of flutes	class of fit
GT515001	M24 X 3	160	30	77	18,0	4	6HX
GT515002	M30 X 3,5	180	35	91	22,0	5	6HX
GT515003	M33 X 3,5	180	35	100	25,0	5	6HX
GT515004	M36 X 4	200	40	110	28,0	5	6HX
GT515005	M42 X 4,5	200	45	120	32,0	6	6HX


VICTORY

- first choice
- alternate choice

■ GT51 • Form C Semi-Bottoming Chamfer • Through Coolant • Larger Sizes • Metric Extra Long



Shank Tolerance	
D	Tolerance h6
12-18	+0, -0,011
20-30	+0, -0,013
32-36	+0, -0,016

GP6520	D1 size	L	L3	L2	D	number of flutes	class of fit
GT515006	M24 X 3	200	30	120	18,0	4	6HX
GT515007	M30 X 3,5	250	35	150	22,0	5	6HX
GT515008	M33 X 3,5	250	35	150	25,0	5	6HX
GT515009	M36 X 4	250	40	150	28,0	5	6HX
GT515010	M42 X 4,5	300	45	180	32,0	6	6HX

Group		 Through Holes				 Blind Holes					
				Range — m/min					Range — m/min		
		Tap Style	Grade	min	Starting Value	max	Tap Style	Grade	min	Starting Value	max
P	1	GT20	GP6520	20	30	45	GT30, GT32, GT50	GP6520	14	21	32
		GT22	WP31MG	18	30	50	GT22	WP31MG	13	21	35
	2	GT20	GP6520	17	25	38	GT30, GT32, GT50	GP6520	12	18	26
		GT22	WP31MG	15	25	42	GT22	WP31MG	10	18	29
	2, 3, 4, 6, 7,	GT20	GP6520	12	15	20	GT30, GT32, GT50	GP6520	8	11	14
	5, 9, 10, 11	GT00	WP31MG	5	6	8	GT02, GT04	WP31MG	3	4	5
	12, 13.1	GT20	GP6520	12	15	20	GT30, GT32, GT50	GP6520	8	11	14
M	13.2	GT00	WP31MG	6	8	10	GT02, GT04	WP31MG	4	6	7
	14.1	GT20	GM6515	12	15	20	GT30, GT32, GT50	GM6515	8	11	14
	14.3	GT20	GM6515	9	12	16	GT30, GT32, GT50	GM6515	6	8	11
K	14.2, 14.4	GT20	GM6515	8	10	13	GT30, GT32, GT50	GM6515	5	7	9
	15, 16	GT40	GP6520	35	45	59	GT40, GT42	GP6520	24	32	41
	17, 18, 19	GT40	GP6520	31	40	52	GT40, GT42	GP6520	22	28	36
	20	GT40	GP6520	23	30	39	GT40, GT42	GP6520	16	21	27
N	21	GT40	GP6520	38	50	65	GT40, GT42	GP6520	27	35	46
		GT22	WN38MG	33	50	75	GT22	WN38MG	23	35	53
	22, 23, 24	GT70	WN48EG	42	55	72	GT80	WN48EG	30	39	50
		GT22	WN48EG	37	55	83	GT22	WN48EG	26	39	58
	26, 27, 28	GT40	GP6520	4	6	9	GT40, GT42	GP6520	3	4	5
S	31, 32	GT20	GP6520	8	12	18	GT30, GT32	GP6520	6	8	11
	33, 34, 35	GT10	WS32MG	3	5	8	GT12	WS32MG	3	4	5
	36	GT10	WS32MG	3	4	6	GT12	WS32MG	2	3	4
	37	GT14	WN35MG	3	4	6	GT16	WN35MG	2	3	4
H	38.1, 40.1, 40.2	GT06	WN35MG	1,3	2,0	3,0	GT06	WN35MG	1,1	1,4	1,8
	38.2, 41.1	GT06	WN35MG	1,0	1,5	2,3	GT06	WN35MG	0,8	1,1	1,4

NOTE: Increase speed by up to 25% when using coolant taps (GT21, GT23, GT31, GT33, GT41, GT43, and GT51).

Use grade GP6505™ in steels. Use 50% of the recommended speed listed for grade KP6525™.

		 Through Holes					 Blind Holes				
				Range — SFM					Range — SFM		
Group		Tap Style	Grade	min	Starting Value	max	Tap Style	Grade	min	Starting Value	max
P	1	GT20	GP6520	70	100	150	GT30, GT32, GT50	GP6520	50	70	100
		GT22	WP31MG	60	100	160	GT22	WP31MG	40	70	120
	2	GT20	GP6520	50	80	120	GT30, GT32, GT50	GP6520	40	60	90
		GT22	WP31MG	50	80	140	GT22	WP31MG	30	60	100
	2, 3, 4, 6, 7,	GT20	GP6520	40	50	60	GT30, GT32, GT50	GP6520	30	30	40
	5, 9, 10, 11	GT00	WP31MG	15	20	26	GT02, GT04	WP31MG	11	14	18
	12, 13.1	GT20	GP6520	40	50	60	GT30, GT32, GT50	GP6520	30	30	40
M	13.2	GT00	WP31MG	20	30	30	GT02, GT04	WP31MG	10	20	20
	14.1	GT20	GM6515	40	50	60	GT30, GT32, GT50	GM6515	30	30	40
	14.3	GT20	GM6515	30	40	50	GT30, GT32, GT50	GM6515	20	30	40
K	14.2, 14.4	GT20	GM6515	30	30	40	GT30, GT32, GT50	GM6515	20	20	30
	15, 16	GT40	GP6520	110	150	190	GT40, GT42	GP6520	80	100	130
	17, 18, 19	GT40	GP6520	100	130	170	GT40, GT42	GP6520	70	90	120
N	20	GT40	GP6520	80	100	130	GT40, GT42	GP6520	50	70	90
	21	GT40	GP6520	130	160	210	GT40, GT42	GP6520	90	110	150
		GT22	WN38MG	110	160	250	GT22	WN38MG	80	110	170
	22, 23, 24	GT70	WN48EG	140	180	230	GT80	WN48EG	100	130	160
		GT22	WN48EG	120	180	270	GT22	WN48EG	80	130	190
S	26, 27, 28	GT40	GP6520	13	20	30	GT40, GT42	GP6520	11	14	18
	31, 32	GT20	GP6520	30	40	60	GT30, GT32	GP6520	21	28	36
	33, 34, 35	GT10	WS32MG	11	16	25	GT12	WS32MG	9	11	15
	36	GT10	WS32MG	9	13	20	GT12	WS32MG	7	9	12
H	37	GT14	WN35MG	9	13	20	GT16	WN35MG	7	9	12
	38.1, 40.1, 40.2	GT06	WN35MG	4	7	10	GT06	WN35MG	4	5	6
	38.2, 41.1	GT06	WN35MG	3	5	7	GT06	WN35MG	3	3	4

NOTE: Increase speed by up to 25% when using coolant taps (GT21, GT23, GT31, GT33, GT41, GT43, and GT51).

Use grade GP6505™ in steels. Use 50% of the recommended speed listed for grade KP6525™.

Steel <32 HRC • Selector

Holemaking • High-Performance Taps

typical thread sizes		required tap drill diameter				P			
						HSS-E-PM Taps		HSS-E-PM Taps	
cutting taps						ANSI		DIN 371, 374, 376	
metric	inch	mm	inch	fraction	wire	blind hole GT30_GP6520	through hole GT20_GP6520	blind hole GT30_GP6520	through hole GT20_GP6520
M3 x 0,50	—	2,500	.0984	—	—	GT305070	GT205069	GT305097	GT205094
—	6-32	2,705	.1065	—	36	GT305035	GT205037	—	—
M4 x 0,70	—	3,300	.1299	—	—	GT305071	GT205070	GT305098	GT205095
—	8-32	3,454	.1360	—	29	GT305036	GT205039	—	—
—	8-36	3,454	.1360	—	29	—	GT205052	—	—
—	10-24	3,734	.1470	—	26	—	GT205040	—	—
—	10-32	4,039	.1590	—	21	GT305053	GT205054	—	—
M5 x 0,80	—	4,200	.1654	—	—	GT305072	GT205071	GT305099	GT205096
M6 x 1,00	—	5,000	.1969	—	—	GT305073	GT205072	GT305100	GT205097
—	1/4-20	5,106	.2010	—	7	GT305039	GT205043	—	—
—	1/4-28	5,410	.2130	—	3	GT305055	GT205056	—	—
—	5/16-18	6,528	.2570	—	F	GT305041	GT205045	—	—
M8 x 1,25	—	6,700	.2638	—	—	GT305074	GT205074	GT305101	GT205098
—	5/16-24	6,909	.2720	—	I	GT305057	GT205057	—	—
M8 x 1,00	—	7,000	.2756	—	—	—	—	GT305109	GT205104
—	3/8-16	7,938	.3125	5/16	—	GT305043	GT205047	—	—
—	3/8-24	8,433	.3320	—	Q	GT305058	GT205058	—	—
M10 x 1,50	—	8,500	.3346	—	—	GT305075	GT205075	GT305102	GT205099
M10 x 1,25	—	8,700	.3425	—	—	—	—	GT305111	GT205106
M10 x 1,00	—	9,000	.3543	—	—	—	—	GT305110	GT205105
—	7/16-14	9,093	.3580	—	T	GT305044	GT205048	—	—
—	7/16-20	9,921	.3906	25/64	—	GT305059	GT205059	—	—
M12 x 1,75	—	10,200	.4016	—	—	GT305076	GT205076	GT305103	GT205100
M12 x 1,50	—	10,500	.4134	—	—	—	—	GT305112	GT205107
—	1/2-13	10,716	.4219	27/64	—	GT305046	GT205049	—	—
—	1/2-20	11,509	.4531	29/64	—	GT305060	GT205060	—	—
M14 x 2,00	—	12,000	.4724	—	—	GT305077	—	GT305104	GT205101
M14 x 1,50	—	12,500	.4921	—	—	—	—	GT305113	GT205108
—	5/8-11	13,495	.5313	17/32	—	GT305048	GT205050	—	—
M16 x 2,00	—	14,000	.5512	—	—	GT305078	—	GT305105	GT205102
M16 x 1,50	—	14,500	.5709	—	—	—	—	GT305114	GT205109
M18 x 2,50	—	15,500	.6102	—	—	—	—	GT305106	—
M18 x 1,50	—	16,500	.6496	—	—	—	—	GT305115	GT205110
—	3/4-10	16,670	.6563	21/32	—	GT305050	GT2050551	—	—
M20 x 2,50	—	17,500	.6890	—	—	—	—	—	GT205103
M22 x 2,50	—	19,500	.7677	—	—	—	—	GT305107	—
M24 x 3,00	—	21,000	.8268	—	—	—	—	GT305161	GT205111
—	1-8	22,225	.8750	7/8	—	GT305051	—	—	—

P		P		All Materials	
HSS-E-PM Taps		Recommended Drill		Alternate Tap Drill	
 DIN 371, 374, 376 blind hole with coolant GT31_GP6520 through hole with coolant GT21_GP6520		 approximately 5 x D with coolant TDS402 WP20PD approximately 5 x D non-coolant TDS202 WP20PD		 approximately 5 x D with coolant VDS402A WU25PD approximately 5 x D non-coolant VDS202A WU25PD	
—	—	TDS402A02500	TDS202A02500	VDS402A02500	VDS202A02500
—	—	TDS402A02705	TDS202A02705	VDS402A02705	VDS202A02705
—	—	TDS402A03300	TDS202A03300	VDS402A03300	VDS202A03300
—	—	TDS402A03454	TDS202A03454	VDS402A03454	VDS202A03454
—	—	TDS402A03700	TDS202A03700	VDS402A03700	VDS202A03700
—	—	TDS402A03797	TDS202A03797	VDS402A03797	VDS202A03797
—	—	TDS402A04100	TDS202A04100	VDS402A04100	VDS202A04100
GT315007	GT215007	TDS402A04219	TDS202A04219	VDS402A04219	VDS202A04219
GT315008	GT215008	TDS402A05055	TDS202A05055	VDS402A05055	VDS202A05055
—	—	TDS402A05410	TDS202A05410	VDS402A05410	VDS202A05410
—	—	TDS402A05600	TDS202A05600	VDS402A05600	VDS202A05600
—	—	TDS402A06600	TDS202A06600	VDS412A06600	VDS212A06600
GT315009	GT215009	TDS402A06906	TDS202A06906	VDS412A06906	VDS212A06906
—	—	TDS402A07000	TDS202A07000	VDS412A07000	VDS212A07000
—	—	TDS402A07366	TDS202A07366	VDS412A07366	VDS212A07366
—	—	TDS402A08433	TDS202A08433	VDS412A08433	VDS212A08433
—	—	TDS402A08500	TDS202A08500	VDS412A08500	VDS212A08500
GT315010	GT215010	TDS402A08700	TDS202A08700	VDS412A08700	VDS212A08700
—	—	TDS402A09000	TDS202A09000	VDS412A09000	VDS212A09000
—	—	TDS402A08839	TDS202A08839	VDS412A08839	VDS212A08839
—	—	TDS402A09400	TDS202A09400	VDS412A09400	VDS212A09400
—	—	TDS402A10200	TDS202A10200	VDS412A10200	VDS212A10200
GT315011	GT215011	TDS402A10262	TDS202A10262	VDS412A10262	VDS212A10262
—	—	TDS402A10716	TDS202A10716	VDS412A10716	VDS212A10716
—	—	TDS402A10800	TDS202A10800	VDS412A10800	VDS212A10800
—	—	TDS402A11908	TDS202A11908	VDS412A11908	VDS212A11908
GT315012	GT215012	TDS402A12251	TDS202A12251	VDS412A12251	VDS212A12251
—	—	TDS402A12800	TDS202A12800	VDS412A12800	VDS212A12800
—	—	TDS402A13500	TDS202A13500	VDS412A13500	VDS212A13500
—	—	TDS402A14500	TDS202A14500	VDS412A14500	VDS212A14500
—	—	TDS402A14684	TDS202A14684	VDS412A14684	VDS212A14684
—	—	TDS402A16500	TDS202A16500	VDS412A16500	VDS212A16500
—	—	TDS402A16670	TDS202A16670	VDS412A16670	VDS212A16670
—	—	TDS402A17000	TDS202A17000	VDS412A17000	VDS212A17000
—	—	TDS402A17859	TDS202A17859	VDS412A17859	VDS212A17859
—	—	—	—	—	—
GT315025	—	TDM220R3SCF25M	TDM220R5SCF25M	—	—
—	—	TDM230R3SCF25M	TDM230R5SCF25M	—	—

Steel 32–44 HRC • Selector

typical thread sizes	required tap drill diameter	
cutting taps metric	mm	inch
M3 x 0,50	2,500	.0984
M4 x 0,70	3,300	.1299
M5 x 0,80	4,200	.1654
M6 x 1,00	5,000	.1969
M8 x 1,25	6,700	.2638
M8 x 1,00	7,000	.2756
M10 x 1,50	8,500	.3346
M10 x 1,25	8,700	.3425
M10 x 1,00	9,000	.3543
M12 x 1,75	10,200	.4016
M12 x 1,50	10,500	.4134
M12 x 1,25	10,800	.4252
M14 x 2,00	12,000	.4724
M14 x 1,50	12,500	.4921
M16 x 2,00	14,000	.5512
M16 x 1,50	14,500	.5709
M18 x 2,50	15,500	.6102
M18 x 1,50	16,500	.6496
M20 x 2,50	17,500	.6890

P HSS-E-PM Taps — Tapping Steel 32–44 HRC		
		
blind hole GT02_WP31MG	blind hole (3 x D) GT04_WH36MG	through hole GT00_WP31MG
GT025001	GT045001	GT005001
GT025002	GT045002	GT005002
GT025003	GT045003	GT005003
GT025004	GT045004	GT005004
GT025005	GT045005	GT005005
GT025012	GT045012	GT005012
GT025006	GT045006	GT005006
GT025014	GT045014	GT005014
GT025013	GT045013	GT005013
GT025007	GT045007	GT005007
GT025016	GT045016	GT005016
GT025015	GT045015	GT005015
GT025008	GT045008	GT005008
GT025017	GT045017	GT005017
GT025009	GT045009	GT005009
GT025018	GT045018	GT005018
GT025010	GT045010	GT005010
GT025010	GT045010	GT005010
GT025011	GT045011	GT005011

Steel • Selector

typical thread sizes	required tap drill diameter	
cutting taps metric	mm	inch
M3 x 0,50	2,800	.1102
M4 x 0,70	3,700	.1457
M5 x 0,80	4,700	.1850
M6 x 1,00	5,600	.2205
M8 x 1,25	7,400	.2913
M8 x 1,00	7,600	.2992
M10 x 1,50	9,400	.3701
M10 x 1,25	9,500	.3740
M10 x 1,00	9,500	.3740
M12 x 1,75	11,300	.4449
M12 x 1,50	11,300	.4449
M12 x 1,25	11,500	.4528
M14 x 1,50	13,400	.5276
M16 x 2,00	15,200	.5984
M16 x 1,50	15,400	.6063

P Steel <32 HRC — Forming Tap		
		
blind and through hole GT22_WP31MG	DIN 2174	blind and through hole with coolant GT23_WP31MG
GT225016		—
GT225017		—
GT225018		GT235012
GT225019		GT235013
GT225020		GT235014
GT225024		GT235018
GT225021		GT235015
GT225026		—
GT225025		GT235019
GT225022		GT235016
GT225028		GT235020
GT225027		—
GT225029		GT235021
GT225023		GT235017
GT225030		GT235022

P Recommended SC Drill		All Materials Alternate Tap Drill	
			
approximately 5 x D with coolant TDS402 WP20PD	approximately 5 x D without coolant TDS202 WP20PD	approximately 5 x D with coolant VDS402A WU25PD	approximately 5 x D non-coolant VDS202A WU25PD
TDS402A02500	TDS202A02500	VDS402A02500	VDS202A02500
TDS402A03300	TDS202A03300	VDS402A03300	VDS202A03300
TDS402A04219	TDS202A04219	VDS402A04219	VDS202A04219
TDS402A05055	TDS202A05055	VDS402A05055	VDS202A05055
TDS402A06906	TDS202A06906	VDS412A06906	VDS212A06906
TDS402A07366	TDS202A07366	VDS412A07366	VDS212A07366
TDS402A08700	TDS202A08700	VDS412A08700	VDS212A08700
TDS402A09000	TDS202A09000	VDS412A09000	VDS212A09000
TDS402A08839	TDS202A08839	VDS412A08839	VDS212A08839
TDS402A10262	TDS202A10262	VDS412A10262	VDS212A10262
TDS402A10716	TDS202A10716	VDS412A10716	VDS212A10716
TDS402A11300	TDS202A11300	VDS412A11300	VDS212A11300
TDS402A12251	TDS202A12251	VDS412A12251	VDS212A12251
TDS402A12800	TDS202A12800	VDS412A12800	VDS212A12800
TDS402A14500	TDS202A14500	VDS412A14500	VDS212A14500
TDS402A14684	TDS202A14684	VDS412A14684	VDS212A14684
TDS402A16500	TDS202A16500	VDS412A16500	VDS212A16500
TDS402A16670	TDS202A16670	VDS412A16670	VDS212A16670
TDS402A17859	TDS202A17859	VDS412A17859	VDS212A17859

P Recommended SC Drill		All Materials Alternate Tap Drill	
			
approximately 5 x D with coolant TDS402 WP20PD	approximately 5 x D without coolant TDS202 WP20PD	approximately 5 x D with coolant VDS402A WU25PD	approximately 5 x D non-coolant VDS202A WU25PD
TDS402A02800	TDS202A02800	VDS402A02800	VDS202A02800
TDS402A03734	TDS202A03734	VDS402A03734	VDS202A03734
TDS402A05000	TDS202A05000	VDS402A05000	VDS202A05000
TDS402A05791	TDS202A05791	VDS402A05791	VDS202A05791
TDS402A07493	TDS202A07493	VDS412A07493	VDS212A07493
TDS402A07938	TDS202A07938	VDS412A07938	VDS212A07938
TDS402A09500	TDS202A09500	VDS412A09500	VDS212A09500
TDS402A09500	TDS202A09500	VDS412A09500	VDS212A09500
TDS402A09921	TDS202A09921	VDS412A09921	VDS212A09921
TDS402A11300	TDS202A11300	VDS412A11300	VDS212A11300
TDS402A11500	TDS202A11500	VDS412A11500	VDS212A11500
TDS402A11509	TDS202A11509	VDS412A11509	VDS212A11509
TDS402A13400	TDS202A13400	VDS412A13400	VDS212A13400
TDS402A15250	TDS202A15250	VDS412A15250	VDS212A15250
TDS402A15500	TDS202A15500	VDS412A15500	VDS212A15500

Stainless Steel • Selector

							M			
							HSS-E-PM Taps		HSS-E-PM Taps	
typical thread sizes		required tap drill diameter								
cutting taps							ANSI		DIN 371, 374, 376	
metric	inch	mm	inch	fraction	wire	blind hole GT30_GM6515	through hole GT20_GM6515	blind hole GT30_GM6515	through hole GT20_GM6515	
M3 x 0,50	—	2,500	.0984	—	—	GT305061	GT205061	GT305148	GT205077	
—	6-32	2,705	.1065	—	36	GT305005	GT205007	—	—	
M4 x 0,70	—	3,300	.1299	—	—	GT305062	GT205062	GT305079	GT205078	
—	8-32	3,454	.1360	—	29	GT305006	GT205008	—	—	
—	8-36	3,454	.1360	—	29	—	GT205022	—	—	
—	10-24	3,734	.1470	—	26	GT305007	GT205010	—	—	
—	10-32	4,039	.1590	—	21	GT305023	GT205024	—	—	
M5 x 0,80	—	4,200	.1654	—	—	GT305063	GT205063	GT305080	GT205079	
—	12-24	4,496	.1770	—	16	—	GT205011	—	—	
M6 x 1,00	—	5,000	.1969	—	—	GT305064	GT205064	GT305081	GT205080	
—	1/4-20	5,106	.2010	—	7	GT305009	GT205013	—	—	
—	1/4-28	5,410	.2130	—	3	GT305025	GT205026	—	—	
—	5/16-18	6,528	.2570	—	F	GT305011	GT205015	—	—	
M8 x 1,25	—	6,700	.2638	—	—	GT305065	GT205066	GT305082	GT205081	
—	5/16-24	6,909	.2720	—	I	GT305027	GT205027	—	—	
M8 x 1,00	7.000	0,2756	—	—	—	—	GT305090	GT205087	—	
—	3/8-16	7,938	.3125	5/16	—	GT305013	GT205017	—	—	
—	3/8-24	8,433	.3320	—	Q	GT305028	GT205028	—	—	
M10 x 1,50	—	8,500	.3346	—	—	GT305066	GT205067	GT305083	GT205082	
M10 x 1,25	8.700	0,3425	—	—	—	—	GT305092	GT205089	—	
M10 x 1,00	9.000	0,3543	—	—	—	—	GT305091	GT205088	—	
—	7/16-14	9,093	.3580	—	T	GT305014	GT205018	—	—	
—	7/16-20	9,921	.3906	25/64	—	GT305029	GT205029	—	—	
M12 x 1,75	—	10,200	.4016	—	—	GT305067	GT205068	GT305084	GT205083	
M12 x 1,50	—	10,500	.4134	—	—	—	—	GT305093	GT205090	
—	1/2-13	10,716	.4219	27/64	—	GT305016	GT205019	—	—	
—	1/2-20	11,509	.4531	29/64	—	GT305030	GT205030	—	—	
M14 x 2,00	—	12,000	.4724	—	—	GT305068	—	GT305085	GT205084	
M14 x 1,50	—	12,500	.4921	—	—	—	—	GT305094	GT205091	
—	5/8-11	13,495	.5313	17/32	—	GT305018	GT205020	—	—	
M16 x 2,00	—	14,000	.5512	—	—	GT305069	—	GT305086	GT205085	
M16 x 1,50	—	14,500	.5709	—	—	—	—	GT305095	GT205092	
M18 x 2,50	—	15,500	.6102	—	—	—	—	GT305087	—	
M18 x 1,50	—	16,500	.6496	—	—	—	—	GT305096	GT205093	
—	3/4-10	16,670	.6563	21/32	—	GT305020	GT205021	—	—	
M20 x 2,50	—	17,500	.6890	—	—	—	—	—	GT205086	
M22 x 2,50	—	19,500	.7677	—	—	—	—	GT305088	—	
M24 x 3,00	—	21,000	.8268	—	—	—	—	GT305089	—	
—	1—8	22,225	.8750	7/8	—	GT305021	—	—	—	

HSS-E-PM Taps		M		All Materials	
DIN 371, 374, 376		Recommended SC Drill		Alternate Tap Drill	
blind hole with coolant GT31_GM6515	through hole with coolant GT21_GM6515	approximately 3 x D with coolant WD 412522	approximately 5 x D with coolant WD 412527	approximately 3 x D with coolant VDS401A WU25PD	approximately 5 x D with coolant VDS402A WU25PD
—	—	—	—	VDS401A02500	VDS402A02500
—	—	—	—	VDS401A02705	VDS402A02705
—	—	412522—00330	412527—00330	VDS401A03300	VDS402A03300
—	—	—	—	VDS401A03454	VDS402A03454
—	—	—	—	VDS401A03454	VDS402A03454
—	—	—	—	VDS401A03734	VDS402A03734
—	—	—	—	VDS401A04039	VDS402A04039
GT315001	GT215001	412522—00420	412527—00420	VDS401A04200	VDS402A04200
—	—	—	—	VDS401A04496	VDS402A04496
GT315002	GT215002	412522—00500	412527—00500	VDS401A05000	VDS402A05000
—	—	—	—	VDS401A05106	VDS402A05106
—	—	—	—	VDS401A05410	VDS402A05410
—	—	412522—00652	412527—00652	VDS401A06528	VDS402A06528
GT315003	GT215003	412522—00670	412527—00670	VDS411A06700	VDS412A06700
—	—	—	—	VDS411A06906	VDS412A06906
—	—	412522—00700	412527—00700	VDS411A07000	VDS412A07000
—	—	412522—00793	412527—00793	VDS411A07938	VDS412A07938
—	—	—	—	VDS411A08433	VDS412A08433
GT315004	GT215004	412522—00850	412527—00850	VDS411A08500	VDS412A08500
—	—	412522—00870	412527—00870	VDS411A08700	VDS412A08700
—	—	412522—00900	412527—00900	VDS411A09000	VDS412A09000
—	—	—	—	VDS411A09093	VDS412A09093
—	—	412522—00992	412527—00992	VDS411A09921	VDS412A09921
GT315005	GT215005	412522—01020	412527—01020	VDS411A10200	VDS412A10200
—	—	412522—01050	412527—01050	VDS411A10500	VDS412A10500
—	—	412522—01072	412527—01072	VDS411A10716	VDS412A10716
—	—	—	—	VDS411A11509	VDS412A11509
GT315006	GT215006	412522—01200	412527—01200	VDS411A12000	VDS412A12000
—	—	412522—01250	412527—01250	VDS411A12500	VDS412A12500
—	—	—	—	VDS411A13495	VDS412A13495
—	—	412522—01400	412527—01400	VDS411A14000	VDS412A14000
—	—	412522—01450	412527—01450	VDS411A14500	VDS412A14500
—	—	412522—01550	412527—01550	VDS411A15500	VDS412A15500
—	—	412522—01650	412527—01650	VDS411A16500	VDS412A16500
—	—	—	—	VDS411A16670	VDS412A16670
—	—	412522—01750	412527—01750	VDS411A17500	VDS412A17500
—	—	412522—01950	412527—01950	VDS411A19500	VDS412A19500
		Recommended Modular Drill			
		insert	tool body 3 x D		
—	—	TDM2100UPM	TDM210R3SCF25M	—	—
—	—	TDM2223UPM	TDM0886R3SS088	—	—

Cast Iron • Selector

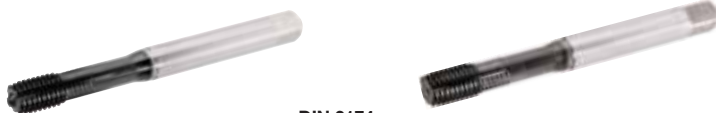
typical thread sizes		required tap drill diameter				K			K
						HSS-E-PM Taps			Recommended SC Drill
cutting taps						ANSI	DIN 371, 374, 376		
metric	inch	mm	inch	fraction	wire	blind and through hole GT40_GP6520	blind and through hole GT40_GP6520	blind and through hole with coolant GT41_GP6520	approximately 3 x D with coolant TDS411 WK15PD
M3 x 0,50	—	2,500	.0984	—	—	GT405030	—	—	TDS401A02500
M4 x 0,70	—	3,300	.1299	—	—	GT405031	GT405001	GT415001	TDS401A03300
—	10-24	3,734	.1470	—	26	GT405012	—	—	TDS401A03734
—	10-32	4,039	.1590	—	21	GT405013	—	—	TDS401A04039
M5 x 0,80	—	4,200	.1654	—	—	GT405032	GT405002	GT415002	TDS401A04200
M6 x 1,00	—	5,000	.1969	—	—	GT405033	GT405003	GT415003	TDS401A05000
—	1/4-20	5,106	.2010	—	7	GT405015	—	—	TDS401A05106
—	1/4-28	5,410	.2130	—	3	GT405017	—	—	TDS401A05410
—	5/16-18	6,528	.2570	—	F	GT405019	—	—	TDS401A06528
M8 x 1,25	—	6,700	.2638	—	—	GT405034	GT405004	GT415004	TDS411A06700
—	5/16-24	6,909	.2720	—	I	GT405020	—	—	TDS411A06906
—	3/8-16	7,938	.3125	5/16	—	GT405022	—	—	TDS411A07938
—	3/8-24	8,433	.3320	—	Q	GT405023	—	—	TDS411A08433
M10 x 1,50	—	8,500	.3346	—	—	GT405035	GT405005	GT415005	TDS411A08500
—	7/16-14	9,093	.3580	—	T	GT405024	—	—	TDS411A09093
—	7/16-20	9,921	.3906	25/64	—	GT405025	—	—	TDS411A09921
M12 x 1,75	—	10,200	.4016	—	—	GT405036	GT405006	GT415006	TDS411A10200
—	1/2-13	10,716	.4219	27/64	—	GT405026	—	—	TDS411A10716
—	1/2-20	11,509	.4531	29/64	—	GT405027	—	—	TDS411A11509
M14 x 2,00	—	12,000	.4724	—	—	GT405037	GT405007	GT415007	TDS411A12000
—	5/8-11	13,495	.5313	17/32	—	GT405028	—	—	TDS411A13495
M16 x 2,00	—	14,000	.5512	—	—	GT405038	GT405008	GT415008	TDS411A14000
M18 x 2,50	—	15,500	.6102	—	—	—	GT405009	GT415009	TDS411A15500
—	3/4-10	16,670	.6563	21/32	—	GT405029	—	—	TDS411A16670
M20 x 2,50	—	17,500	.6890	—	—	—	GT405010	GT415010	TDS411A17500
M22 x 2,50	—	19,500	.7677	—	—	—	GT405011	—	TDS411A19500

K		All Materials		
Recommended SC Drill		Alternate Tap Drill		
				
approximately 5 x D with coolant TDS412 WK15PD	approximately 5 x D non-coolant TDS212 WK15PD	approximately 3 x D with coolant VDS401A WU25PD	approximately 5 x D with coolant VDS402A WU25PD	approximately 5 x D non-coolant VDS202A WU25PD
TDS402A02500	TDS212A02500	VDS401A02500	VDS402A02500	VDS202A02500
TDS402A03300	TDS212A03300	VDS401A03300	VDS402A03300	VDS202A03300
TDS402A03734	TDS212A03734	VDS401A03734	VDS402A03734	VDS202A03734
TDS402A04039	TDS212A04039	VDS401A04039	VDS402A04039	VDS202A04039
TDS402A04200	TDS212A04200	VDS401A04200	VDS402A04200	VDS202A04200
TDS402A05000	TDS212A05000	VDS401A05000	VDS402A05000	VDS202A05000
TDS402A05106	TDS212A05106	VDS401A05106	VDS402A05106	VDS202A05106
TDS402A05410	TDS212A05410	VDS401A05410	VDS402A05410	VDS202A05410
TDS402A06528	TDS212A06528	VDS401A06528	VDS402A06528	VDS202A06528
TDS412A06700	TDS212A06700	VDS411A06700	VDS412A06700	VDS212A06700
TDS412A06906	TDS212A06906	VDS411A06906	VDS412A06906	VDS212A06906
TDS412A07938	TDS212A07938	VDS411A07938	VDS412A07938	VDS212A07938
TDS412A08433	TDS212A08433	VDS411A08433	VDS412A08433	VDS212A08433
TDS412A08500	TDS212A08500	VDS411A08500	VDS412A08500	VDS212A08500
TDS412A09093	TDS212A09093	VDS411A09093	VDS412A09093	VDS212A09093
TDS412A09921	TDS212A09921	VDS411A09921	VDS412A09921	VDS212A09921
TDS412A10200	TDS212A10200	VDS411A10200	VDS412A10200	VDS212A10200
TDS412A10716	TDS212A10716	VDS411A10716	VDS412A10716	VDS212A10716
TDS412A11509	TDS212A11509	VDS411A11509	VDS412A11509	VDS212A11509
TDS412A12000	TDS212A12000	VDS411A12000	VDS412A12000	VDS212A12000
TDS412A13495	TDS212A13495	VDS411A13495	VDS412A13495	VDS212A13495
TDS412A14000	TDS212A14000	VDS411A14000	VDS412A14000	VDS212A14000
TDS412A15500	TDS212A15500	VDS411A15500	VDS412A15500	VDS212A15500
TDS412A16670	TDS212A16670	VDS411A16670	VDS412A16670	VDS212A16670
TDS412A17500	TDS212A17500	VDS411A17500	VDS412A17500	VDS212A17500
TDS412A19500	TDS212A19500	VDS411A19500	VDS412A19500	VDS212A19500

Aluminum • Selector

							N		
							HSS-E-PM Taps (Wrought, low Si)		HSS-E-PM Taps (Cast <12%)
									
							DIN 371, 374, 376		ANSI
typical thread sizes		required tap drill diameter					blind hole	through hole	blind and through hole
cutting taps							GT80_WN48EG	GT70_WN48EG	GT40_GP6520
metric	inch	mm	inch	fraction	wire				
M3 x 0,50	—	2,500	.0984	—	—		GT805001	GT705001	GT405030
M4 x 0,70	—	3,300	.1299	—	—		GT805002	GT705002	GT405031
—	10-24	3,734	.1470	—	26		—	—	GT405012
—	10-32	4,039	.1590	—	21		—	—	GT405013
M5 x 0,80	—	4,200	.1654	—	—		GT805003	GT705003	GT405032
M6 x 1,00	—	5,000	.1969	—	—		GT805004	GT705004	GT405033
—	1/4-20	5,106	.2010	—	7		—	—	GT405015
—	1/4-28	5,410	.2130	—	3		—	—	GT405017
—	5/16-18	6,528	.2570	—	F		—	—	GT405019
M8 x 1,25	—	6,700	.2638	—	—		GT805005	GT705005	GT405034
—	5/16-24	6,909	.2720	—	I		—	—	GT405020
—	3/8-16	7,938	.3125	5/16	—		—	—	GT405022
—	3/8-24	8,433	.3320	—	Q		—	—	GT405023
M10 x 1,50	—	8,500	.3346	—	—		GT805006	GT705006	GT405035
—	7/16-14	9,093	.3580	—	T		—	—	GT405024
—	7/16-20	9,921	.3906	25/64	—		—	—	GT405025
M12 x 1,75	—	10,200	.4016	—	—		GT805007	GT705007	GT405036
—	1/2-13	10,716	.4219	27/64	—		—	—	GT405026
—	1/2-20	11,509	.4531	29/64	—		—	—	GT405027
M14 x 2,00	—	12,000	.4724	—	—		—	—	GT405037
—	5/8-11	13,495	.5313	17/32	—		—	—	GT405028
M16 x 2,00	—	14,000	.5512	—	—		GT805008	GT705008	GT405038
M18 x 2,50	—	15,500	.6102	—	—		—	—	—
—	3/4-10	16,670	.6563	21/32	—		—	—	GT405029
M20 x 2,50	—	17,500	.6890	—	—		GT805009	—	—
M22 x 2,50	—	19,500	.7677	—	—		—	—	—

Aluminum • Forming Taps • Selector

			N		
			Forming Taps		
					
			DIN 2174		
typical thread sizes		required tap drill diameter	blind and through hole	blind and through hole with coolant	
cutting taps			GT22_WN38MG	GT23_WN38MG	
metric		mm			
M3 x 0,50		2,800	.1102	GT225001	—
M4 x 0,70		3,734	.1470	GT225002	—
M5 x 0,80		4,700	.1850	GT225003	GT235001
M6 x 1,00		5,600	.2205	GT225004	GT235002
M8 x 1,25		7,400	.2913	GT225005	GT235003
M8 x 1,00		7,600	.2992	GT225009	GT235007
M10 x 1,50		9,400	.3701	GT225006	GT235004
M10 x 1,25		9,500	.3740	GT225011	—
M10 x 1,00		9,500	.3740	GT225010	GT235008
M12 x 1,75		11,300	.4449	GT225007	GT235005
M12 x 1,50		11,300	.4449	GT225013	GT235019
M12 x 1,25		11,500	.4528	GT225012	—
M14 x 1,50		13,400	.5276	GT225014	GT235010
M16 x 2,00		15,200	.5984	GT225008	GT235006
M16 x 1,50		15,400	.6063	GT225015	GT235011

N		Recommended SC Drill	All Materials	
HSS-E-PM Taps (Cast <12%)			Alternate Tap Drill	
 DIN 371, 374, 376 blind and through hole GT40_GP6520		 approximately 3 x D with coolant 259/659	 approximately 3 x D with coolant VDS401A WU25PD	
blind and through hole GT41_GP6520			approximately 5 x D with coolant VDS402A WU25PD	
GT405001	GT415001	TCM25903300	VDS401A02500	VDS402A02500
—	—	—	VDS401A03300	VDS402A03300
—	—	—	VDS401A03734	VDS402A03734
—	—	—	VDS401A04039	VDS402A04039
GT405002	GT415002	TCM25904200	VDS401A04200	VDS402A04200
GT405003	GT415003	TCM25905000	VDS401A05000	VDS402A05000
—	—	TCM25905100	VDS401A05106	VDS402A05106
—	—	TCM25905400	VDS401A05410	VDS402A05410
—	—	TCM25906500	VDS401A06528	VDS402A06528
GT405004	GT415004	TCM25906700	VDS411A06700	VDS412A06700
—	—	TCM25906900	VDS411A06906	VDS412A06906
—	—	TCM65908000	VDS411A07938	VDS412A07938
—	—	—	VDS411A08433	VDS412A08433
GT405005	GT415005	TCM25908500	VDS411A08500	VDS412A08500
—	—	TCM25909100	VDS411A09093	VDS412A09093
—	—	TCM25909900	VDS411A09921	VDS412A09921
GT405006	GT415006	TCM25910200	VDS411A10200	VDS412A10200
—	—	TCM65910500	VDS411A10716	VDS412A10716
—	—	TCM65911500	VDS411A11509	VDS412A11509
GT405007	GT415007	TCM25912000	VDS411A12000	VDS412A12000
—	—	TCM25913500	VDS411A13495	VDS412A13495
GT405008	GT415008	TCM25914000	VDS411A14000	VDS412A14000
GT405009	GT415009	TCM25915500	VDS411A15500	VDS412A15500
—	—	—	VDS411A16670	VDS412A16670
GT405010	GT415010	TCM25917500	VDS411A17500	VDS412A17500
GT405011	—	TCM25919500	VDS411A19500	VDS412A19500

N	All Materials
Recommended SC Drill	Alternate Tap Drill
 approximately 5 x D with coolant 259/659	 approximately 3 x D with coolant VDS401A WU25PD
—	VDS401A02800
—	VDS401A03734
TCM25904700	VDS401A04700
TCM25905600	VDS401A05600
TCM25907400	VDS411A07400
TCM25907600	VDS411A07600
TCM25909400	VDS411A09400
TCM25909500	VDS411A09500
TCM25909500	VDS411A09500
TCM25911300	VDS411A11300
TCM25911300	VDS411A11300
TCM25911500	VDS411A11500
—	VDS411A13400
—	VDS411A15200
—	VDS411A15400
	VDS402A02800
	VDS402A03734
	VDS402A04700
	VDS402A05600
	VDS412A07400
	VDS412A07600
	VDS412A09400
	VDS412A09500
	VDS412A09500
	VDS412A11300
	VDS412A11300
	VDS412A11500
	VDS412A13400
	VDS412A15200
	VDS412A15400

High-Temperature Alloys • Selector

			S		
			HSS-E-PM Taps — Titanium Alloys		HSS-E-PM Taps — Nickel and Cobalt Alloys
			 DIN 371, 374, 376		 DIN 371, 374, 376
typical thread sizes	required tap drill diameter		blind hole GT16_WN35MG	through hole GT14_WN35MG	blind hole GT12_WS32MG
metric	mm	inch			
M3 x 0,50	2,500	.0984	GT165001	GT145001	GT125001
M4 x 0,70	3,300	.1299	GT165002	GT145002	GT125002
M5 x 0,80	4,200	.1654	GT165003	GT145003	GT125003
M6 x 1,00	5,000	.1969	GT165004	GT145004	GT125004
M8 x 1,25	6,700	.2638	GT165005	GT145005	GT125005
M10 x 1,50	8,500	.3346	GT165006	GT145006	GT125006
M12 x 1,75	10,200	.4016	GT165007	GT145007	GT125007
M14 x 2,00	12,000	.4724	—	—	GT125008
M16 x 2,00	14,000	.5512	—	—	GT125009
M20 x 2,50	17,500	.6890	—	—	GT125010

Hard Material • Selector

			H	
			HSS-E-PM Taps — 44-55 HRC	HSS-E-PM Taps — 55-63 HRC
			 DIN 371, 374, 376	
typical thread sizes	required tap drill diameter		blind and through hole GT06_WS32MG	blind and through hole GX10_WH16PG
metric	mm	inch		
M3 x 0,50	2,500	.0984	—	GX105001
M4 x 0,70	3,300	.1299	—	GX105002
M5 x 0,80	4,200	.1654	—	GX105003
M6 x 1,00	5,000	.1969	GT065003	GX105004
M8 x 1,25	6,700	.2638	GT065001	GX105005
M8 x 1,00	7,000	.2756	GT065006	GX105009
M10 x 1,50	8,500	.3346	GT065002	GX105007
M10 x 1,00	9,000	.3543	GT065007	GX105010
M12 x 1,75	10,200	.4016	GT065004	GX105007
M12 x 1,50	10,500	.4134	GT065008	GX105011
M14 x 2,00	12,000	.4724	—	GX105008
M14 x 1,50	12,500	.4921	GT065009	GX105012
M16 x 2,00	14,000	.5512	GT065005	—
M16 x 1,50	14,500	.5709	GT065010	GX105013

HSS-E-PM Taps — Nickel and Cobalt Alloys	S Recommended SC Drill		All Materials Alternate Tap Drill	
 DIN 371, 374, 376 through hole GT10_WS32MG	 approximately 3 x D with coolant WD 412522	 approximately 5 x D with coolant WD 412527	 approximately 3 x D with coolant TDS+	 approximately 5 x D with coolant TDS+5
GT105001	—	—	VDS401A02500	VDS402A02500
GT105002	412522-000330	412527-000330	17050103300	17050203300
GT105003	412522-000420	412527-000420	17050104200	17050204200
GT105004	412522-000500	412527-000500	17050105000	17050205000
GT105005	412522-000670	412527-000670	17050106700	17050206700
GT105006	412522-000850	412527-000850	17050108500	17050208500
GT105007	412522-001020	412527-001020	17050110200	17050210200
GT105008	412522-001200	412527-001200	17050112000	17050212000
GT105009	412522-001400	412527-001400	17050114000	17050214000
GT105010	412522-001750	412527-001750	17050117500	17050217500

	H Recommended SC Drill		All Materials Alternative Tap Drill	
	 approximately 3 x D with coolant WIDIA-Hanita™ M155	 approximately 5 x D with coolant WIDIA-Hanita™ M155	 approximately 3 x D with coolant TDS+	 approximately 5 x D with coolant TDS+
			—	—
			—	—
			17050104200	17050204200
			17050105000	17050205000
			17050106700	17050206700
			17050107000	17050207000
			17050108500	17050208500
			17050109000	17050209000
			17050110200	17050210200
			17050110500	17050210500
			17050112000	17050212000
			17050112500	17050212500
			17050114000	17050214000
			17050114500	17050214500

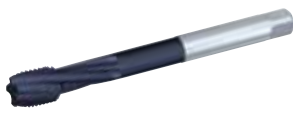
Steel • Selector

typical thread sizes	required tap drill diameter	
cutting taps metric	mm	inch
M24 x 3,00	21,000	.8268
M30 x 3,50	26,500	1.0433
M33 x 3,50	29,500	1.1614
M36 x 4,00	32,000	1.2598
M42 x 4,50	37,500	1.4764

P HSS-E-PM Taps		
		
blind hole GT30_GP6520	blind hole GT50_GP6520	through hole GT20_GP6520
GT305161	GT505001	GT505111
GT305163	GT505002	GT505113
GT305164	GT505003	GT505114
GT305166	GT505004	GT505116
GT305168	GT505005	GT505118

Steel • Extra Long • Selector

typical thread sizes	required tap drill diameter	
cutting taps metric	mm	inch
M24 x 3,00	21,000	.8268
M30 x 3,50	26,500	1.0433
M33 x 3,50	29,500	1.1614
M36 x 4,00	32,000	1.2598
M42 x 4,50	37,500	1.4764

P HSS-E-PM Taps		
		
blind hole GT30_GP6520	blind hole GT50_GP6520	through hole GT20_GP6520
GT305151	GT505006	GT205122
GT305153	GT505007	GT205124
GT305154	GT505008	GT205125
GT305156	GT505009	GT205127
GT305158	GT505010	GT205129

Cast Iron • Selector

typical thread sizes	required tap drill diameter	
cutting taps metric	mm	inch
M24 x 3,00	21,000	.8268
M30 x 3,50	26,500	1.0433
M33 x 3,50	29,500	1.1614
M36 x 4,00	32,000	1.2598
M42 x 4,50	37,500	1.4764

K HSS-E-PM Taps		
		
blind hole GT30_GP6520	blind hole GT50_GP6520	through hole GT20_GP6520
GT305161	GT505001	GT505111
GT305163	GT505002	GT505113
GT305164	GT505003	GT505114
GT305166	GT505004	GT505116
GT305168	GT505005	GT505118

Cast Iron • Extra Long • Selector

typical thread sizes	required tap drill diameter	
cutting taps metric	mm	inch
M24 x 3,00	21,000	.8268
M30 x 3,50	26,500	1.0433
M33 x 3,50	29,500	1.1614
M36 x 4,00	32,000	1.2598
M42 x 4,50	37,500	1.4764

K HSS-E-PM Taps		
		
blind hole GT30_GP6520	blind hole GT50_GP6520	through hole GT20_GP6520
GT305151	GT505006	GT205122
GT305153	GT505007	GT205124
GT305154	GT505008	GT205125
GT305156	GT505009	GT205127
GT305158	GT505010	GT205129

P HSS-E-PM Taps		P Recommended Modular Drill	
			
blind hole with coolant GT31_GP6520	blind hole with coolant GT51_GP6520	insert	tool body 3 x D
GT315025	GT515001	TDM2100UPM	TDM210R3SCF25M
GT315027	GT515002	Top Cut Plus™ TN7015/XOMT-34 or WIDIA-Metcut™ Spade Blade Program	
GT315028	GT515003		
GT315030	GT515004		
GT315032	GT515005		

P HSS-E-PM Taps		P Recommended Modular Drill	
			
blind hole with coolant GT31_GP6520	blind hole with coolant GT51_GP6520	insert	tool body 3 x D
GT315014	GT515006	TDM2100UPM	TDM210R3SCF25M
GT315016	GT515007	Top Cut Plus™ TN7015/XOMT-34 or WIDIA-Metcut™ Spade Blade Program	
GT315017	GT515008		
GT315019	GT515009		
GT315021	GT515010		

K HSS-E-PM Taps		K Recommended Modular Drill	
			
blind hole with coolant GT31_GP6520	blind hole with coolant GT51_GP6520	insert	tool body 3 x D
GT315025	GT515001	TDM2100UPM	TDM210R3SCF25M
GT315027	GT515002	Top Cut Plus™ TN5515/XOMT-35 or WIDIA-Metcut™ Spade Blade Program	
GT315028	GT515003		
GT315030	GT515004		
GT315032	GT515005		

K HSS-E-PM Taps		K Recommended Modular Drill	
			
blind hole with coolant GT31_GP6520	blind hole with coolant GT51_GP6520	insert	tool body 3 x D
GT315014	GT515006	TDM2100UPM	TDM210R3SCF25M
GT315016	GT515007	Top Cut Plus™ TN5515/XOMT-35 or WIDIA-Metcut™ Spade Blade Program	
GT315017	GT515008		
GT315019	GT515009		
GT315021	GT515010		

High-Performance HSS-E Taps

Our family of Exotic Material (EM) taps are specially designed to thread a broad assortment of materials for unrivaled high-performance tapping.



WIDIA-GTD™

- Enhanced tool geometry.
- Less tapping torque.
- Better chip removal.



Unmatched Performance

The WIDIA-GTD™ EM Series taps are designed and manufactured to successfully thread high- and low-volume applications in aluminum, stainless steel, nickel alloys, titanium alloys, mold steels, irons, brass, bronze, and plastics. The formulation of premium steel tap base material is unique for every application. The combination of a special geometry, tap surface treatment, and premium steep gives these taps the highest level of performance.

Premium Steels

EM Series taps use special HSS-E compositions containing chromium, tungsten, molybdenum, vanadium, and cobalt, depending on the application. The right combination improves tap performance resulting in improved product finish and pitch diameter size. These taps have excellent abrasion resistance and are designed for both high and low volume production. Each tap maintains the same quality from the first hole to the very last.

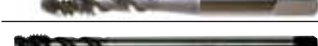
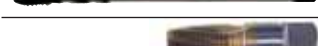
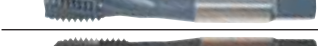
Broad Offering of Diameter Limits

Pitch diameters from H2–H7 and metric pitch diameters from D3–D7 are stocked as standards in many styles, at no premium in price. With rigid setups, higher pitch diameter limits can be used for longer tool life. The EM Series offers many size options to produce the class of thread desired.



EM Series HP HSS-E Taps • ANSI Inch and Metric

- ★ Good
★★ Better
★★★ Best

EM Series High-Performance HSS-E Taps	series	size range (inch and metric)	hole	chamfer form	coolant	coating	tap dimension
		size min - max					
	EM-SS™ GUN™ - 8301	#2 - 2 4 1/2"				TiCN, TiN, SH50 oxide, uncoated	ANSI 302A
	EM-SS™ GUN™ - 8351	M3 - M18				TiCN, TiN, SH50 oxide, uncoated	ANSI 302A
	EM-SS™ GUN™ 6" - 8701	#2 - 1/2"				SH50 oxide	extend 6"
	EM-SS™ SPIRAL - 8304	#2 - 2 4 1/2"				TiCN, TiN, SH50 oxide, uncoated	ANSI 302A
	EM-SS™ SPIRAL - 8304	#4 - 3/4"				SH50 oxide	ANSI 302A
	EM-SS™ SPIRAL - 8354	M3 - M18				TiCN, TiN, SH50 oxide, uncoated	ANSI 302A
	EM-SS™ SPIRAL - 8354	M3 - M18				SH50 oxide	ANSI 302A
	EM-SS™ SPIRAL 6" - 8314	#2 - 1/2"				SH50 oxide	extend 6"
	EM-SS™ PIPE - 8321	1/16" - 1 11 1/2"				TiN, SH50 oxide, uncoated	
	EM-AL GUN™ - 8201	#2 - 1/2"				maxi-nitrite	ANSI-DIN length
	EM-AL GUN™ - 8251	M3 - M12				maxi-nitrite	ANSI-DIN length
	EM-ALS 25° SPIRAL - 8204	#2 - 1/2"				maxi-nitrite	ANSI-DIN length
	EM-ALS 25° SPIRAL - 8254	M3 - M12				maxi-nitrite	ANSI-DIN length
	EM-AL 45° SPIRAL - 8214	#2 - 1/2"				maxi-nitrite	ANSI-DIN length
	EM-AL 45° SPIRAL - 8264	M3 - M12				maxi-nitrite	ANSI-DIN length
	EM-NI™ GUN™ - 8601	#2 - 3/4"				TiCN, SH47 oxide nitrite, uncoated	ANSI 302A
	EM-NI™ GUN™ - 8651	M2,5 - M12				TiCN, SH47 oxide nitrite	ANSI 302A
	EM-NI™ SPIRAL - 8604	#2 - 3/4"				TiCN, SH47 oxide nitrite	ANSI 302A
	EM-NI™ SPIRAL - 8604	#4 - 3/4"				SH47 oxide nitrite	ANSI 302A
	EM-NI™ SPIRAL - 8654	M2,5 - M12				TiCN, SH47 oxide nitrite	ANSI 302A
	EM-TI™ LHSF - 8901	#2 - 1/2"				maxi-nitrite	ANSI 302A
	EM-TI™ LHSF - 8951	M2,5 - M12				maxi-nitrite	ANSI 302A

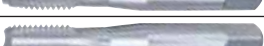
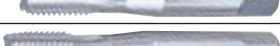
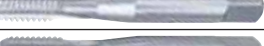
P				M	K			N			S				H			
1, 2, 3, 4, 6, 7	5, 9, 10, 11	12, 13.1	13.2	14.1, 14.2, 14.3, 14.4	15, 16, 17, 18, 19	20		21	22, 23, 24, 25	26, 27, 28	31, 32	33, 34, 35	36	37	38.1, 38.2, 40.1, 40.2, 41.1	39.1, 41.2		
Steel <35 HRC	Steel 36–48 HRC	PH & Ferritic Stainless Steel <35 HRC	PH & Ferritic Stainless Steel >35 HRC	Stainless Steel	Cast Iron			Wrought Aluminum	Cast Aluminum	Copper, Copper Alloys	Iron Based	Cobalt Based	Nickel Based	Titanium & Alloys	Hardened Steel 49–55 HRC	Hardened Steel 56–68 HRC	Page(s)	Recommended Cutting Parameters
★★★★		★		★★		★★		★★									A92– A94	A264–A265
★★★★		★		★★		★★		★★									A95	A264–A265
★★★★		★		★★		★★											A96	A264–A265
★★★★		★		★★		★★		★★									A97– A99	A264–A265
★★★★		★		★★		★★											A100– A101	A264–A265
★★★★		★		★★		★★		★★									A102	A264–A265
★★★★		★		★★		★★											A103	A264–A265
★★★★		★		★★		★★											A104	A264–A265
★★★★		★		★★		★★		★★		★★							A105	A264–A265
								★★★★	★★	★★							A106	A264–A265
								★★★★	★★	★★							A107	A264–A265
								★★	★★★★	★★							A108	A264–A265
								★★	★★★★	★★							A109	A264–A265
								★★★★	★★	★★							A110	A264–A265
								★★★★	★★	★★							A111	A264–A265
	★		★	★	★								★★★★				A112– A113	A264–A265
	★		★	★	★								★★★★				A114	A264–A265
	★		★	★	★								★★★★				A115– A116	A264–A265
	★		★	★	★								★★★★				A117– A118	A264–A265
	★		★	★	★								★★★★				A119	A264–A265
										★				★★★★			A120	A264–A265
										★				★★★★			A121	A264–A265

(continued)

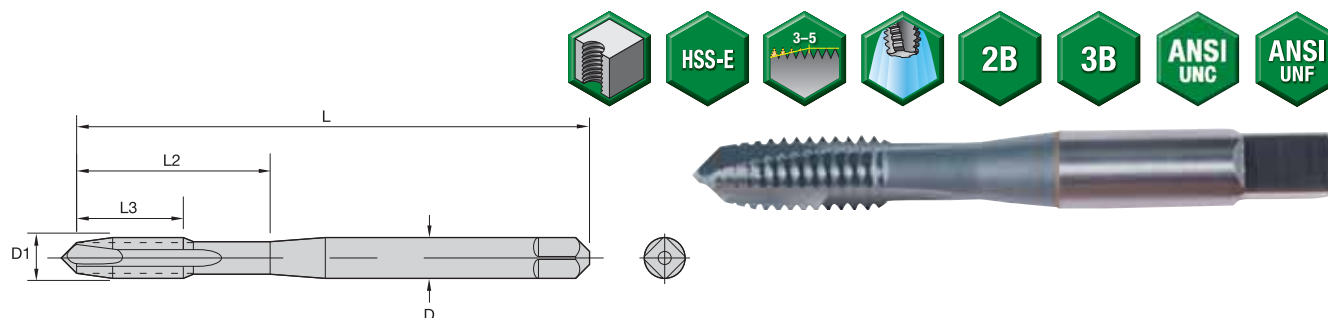
(continued)

EM Series HP HSS-E Taps • ANSI Inch and Metric

- ★ Good
★★ Better
★★★ Best

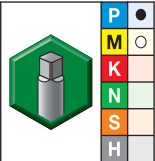
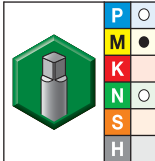
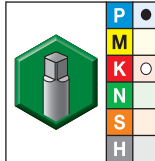
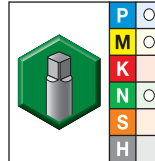
EM Series High-Performance HSS-E Taps	series	size range	hole	chamfer form	coolant	coating	tap dimension
		min - max					
	EM-TI™ SPIRAL - 8904	#2 - 1/2"				maxi-nitrite	ANSI 302A
	EM-TI™ SPIRAL - 8904	#4 - 1/2"				maxi-nitrite	ANSI 302A
	EM-TI™ SPIRAL - 8954	M2,5 - M12				maxi-nitrite	ANSI 302A
	EM-MS™ MOLD - 8330	#4 - 3/4"				uncoated	ANSI 302A
	EM-MS™ MOLD PIPE - 8320	1/8 - 3/4				uncoated	
	Solid Carbide - 8603	#10 - 5/8"				uncoated	ANSI 302A
	Solid Carbide - 8653	M3 - M16				uncoated	ANSI 302A
	Solid Carbide - 8603	#10 - 5/8"				uncoated	ANSI 302A
	Solid Carbide - 8653	M3 - M16				uncoated	ANSI 302A
	Solid Carbide - 8703	#5 - 1/2"				uncoated	ANSI 302A
	Solid Carbide - 8753	M3 - M12				uncoated	ANSI 302A
	Solid Carbide - 8703	#5 - 1/2"				uncoated	ANSI 302A
	Solid Carbide - 8753	M3 - M12				uncoated	ANSI 302A
EM Series High-Performance HSS-E Forming Taps							
	EM-TLD - 8580	#2 - 1/4"				TiCN	ANSI-DIN length
	EM-TLD - 8590	M3 - M6				TiCN	ANSI-DIN length
	EM-TL - 8502	#0 - 2/4"				TiCN	ANSI-DIN length
	EM-TL - 8512	M3 - M12				TiCN	ANSI-DIN length
	EM-TL - 8500	#6 - 1/2"				TiCN	ANSI-DIN length
	EM-TL - 8510	M3 - M12				TiCN	ANSI-DIN length

P				M	K			N			S				H			
1, 2, 3, 4, 6, 7	5, 9, 10, 11	12, 13.1	13.2	14.1, 14.2, 14.3, 14.4	15, 16, 17, 18, 19	20		21	22, 23, 24, 25	26, 27, 28	31, 32	33, 34, 35	36	37	38.1, 38.2, 40.1, 40.2, 41.1	39.1, 41.2		
Steel <35 HRC	Steel 36-48 HRC	PH & Ferritic Stainless Steel <35 HRC	PH & Ferritic Stainless Steel >35 HRC	Stainless Steel	Cast Iron			Wrought Aluminum	Cast Aluminum	Copper, Copper Alloys	Iron Based	Cobalt Based	Nickel Based	Titanium & Alloys	Hardened Steel 49-55 HRC	Hardened Steel 56-68 HRC	Page	Recommended Cutting Parameters
										★				★★★			A122	A264-A265
										★				★★★			A123	A264-A265
										★				★★★			A124	A264-A265
	★★				★★			★									A125	A264-A265
	★★				★★			★									A126	A264-A265
					★★★												A127	A264-A265
					★★★												A129	A264-A265
					★★★												A128	A264-A265
					★★★												A130	A264-A265
								★★★									A131	A264-A265
								★★★									A133	A264-A265
								★★★									A132	A264-A265
								★★★									A134	A264-A265
								★★★										
★★★				★				★	★								A135	A264-A265
★★★				★				★	★								A136	A264-A265
★★★				★				★	★								A137	A264-A265
★★★				★				★	★								A138	A264-A265
★★★				★				★	★								A139	A264-A265
★★★				★				★	★								A140	A264-A265



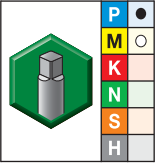
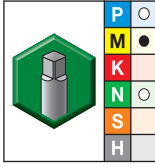
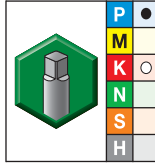
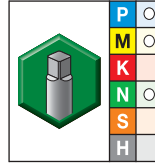
● first choice
○ alternate choice

■ Series 8301 • Machine Screw and Fractional • Plug Chamfer

												
	TiCN	TiN	oxide	uncoated	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit	
	—	—	82623	—	2 - 56	1.75	.26	.44	.141	2	H2	
	—	—	82624	—	2 - 56	1.75	.26	.44	.141	2	H3	
	—	—	82636	—	2 - 56	1.75	.26	.44	.141	2	H4	
	—	—	82600	—	3 - 48	1.81	.30	.50	.141	2	H2	
82301	82901	82601	82601B	82601B	4 - 40	1.88	.34	.56	.141	2	H2	
—	—	82602	—	—	4 - 40	1.88	.34	.56	.141	2	H3	
—	—	82612	—	—	4 - 40	1.88	.34	.56	.141	2	H4	
—	—	82634	82634B	—	4 - 40	1.88	.34	.56	.141	2	H5	
—	—	82638	—	—	4 - 40	1.88	.34	.56	.141	2	H6	
—	—	82683	—	—	4 - 48	1.88	.34	.56	.141	2	H2	
—	—	82641	—	—	4 - 48	1.88	.34	.56	.141	2	H4	
—	—	82603	—	—	5 - 40	1.94	.37	.63	.141	3	H2	
—	—	82604	—	—	6 - 32	2.00	.41	.69	.141	3	H2	
82305	82905	82605	82605B	—	6 - 32	2.00	.41	.69	.141	3	H3	
—	—	82608	—	—	6 - 32	2.00	.41	.69	.141	3	H4	
—	—	82635	82635B	—	6 - 32	2.00	.41	.69	.141	3	H5	
—	—	82659	—	—	6 - 32	2.00	.41	.69	.141	3	H6	
—	—	82665	82665B	—	6 - 32	2.00	.41	.69	.141	3	H7	
—	—	82684	—	—	6 - 40	2.00	.41	.69	.141	3	H2	
—	—	82642	—	—	6 - 40	2.00	.41	.69	.141	3	H3	
82307	82907	82606	—	—	8 - 32	2.13	.45	.75	.168	3	H2	
—	—	82607	82607B	—	8 - 32	2.13	.45	.75	.168	3	H3	
—	—	82629	—	—	8 - 32	2.13	.45	.75	.168	3	H4	
—	—	82637	82637B	—	8 - 32	2.13	.45	.75	.168	3	H5	
—	—	82660	—	—	8 - 32	2.13	.45	.75	.168	3	H6	
—	—	82667	—	—	8 - 32	2.13	.45	.75	.168	3	H7	
—	—	82686	—	—	8 - 36	2.13	.45	.75	.168	3	H2	
82309	82909	82609	82609B	—	10 - 24	2.38	.53	.88	.194	3	H3	
—	—	82657	—	—	10 - 24	2.38	.53	.88	.194	3	H4	
—	—	82639	82639B	—	10 - 24	2.38	.53	.88	.194	3	H5	
—	—	82690	—	—	10 - 24	2.38	.53	.88	.194	3	H6	
—	—	82669	—	—	10 - 24	2.38	.53	.88	.194	3	H7	
82310	82910	82611	—	—	10 - 32	2.38	.53	.88	.194	3	H2	
—	—	82610	82610B	—	10 - 32	2.38	.53	.88	.194	3	H3	
—	—	82630	—	—	10 - 32	2.38	.53	.88	.194	3	H4	
—	—	82640	82640B	—	10 - 32	2.38	.53	.88	.194	3	H5	
—	—	82661	—	—	10 - 32	2.38	.53	.88	.194	3	H6	
—	—	82670	—	—	10 - 32	2.38	.53	.88	.194	3	H7	

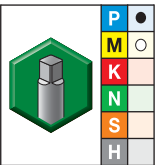
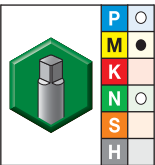
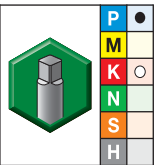
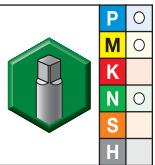
(continued)

(Series 8301 • Machine Screw and Fractional • Plug Chamfer continued)

				D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
TICN	TiN	oxide	uncoated							
—	—	82688	—	12 - 24	2.38	.57	.94	.220	3	H3
—	—	82689	—	12 - 28	2.38	.57	.94	.220	3	H3
—	—	82658	—	1/4 - 20	2.50	.59	1.00	.255	3	H2
82313	82913	82613	82613B	1/4 - 20	2.50	.59	1.00	.255	3	H3
—	—	82643	82643B	1/4 - 20	2.50	.59	1.00	.255	3	H5
—	—	82673	—	1/4 - 20	2.50	.59	1.00	.255	3	H7
—	—	82666	—	1/4 - 28	2.50	.59	1.00	.255	3	H2
82314	82914	82614	82614B	1/4 - 28	2.50	.59	1.00	.255	3	H3
—	—	82631	—	1/4 - 28	2.50	.59	1.00	.255	3	H4
—	—	82644	82644B	1/4 - 28	2.50	.59	1.00	.255	3	H5
—	—	82662	—	1/4 - 28	2.50	.59	1.00	.255	3	H6
—	—	82674	—	1/4 - 28	2.50	.59	1.00	.255	3	H7
82315	82915	82615	82615B	5/16 - 18	2.72	.67	1.13	.318	3	H3
—	—	82645	82645B	5/16 - 18	2.72	.67	1.13	.318	3	H5
—	—	82675	—	5/16 - 18	2.72	.67	1.13	.318	3	H7
82316	82916	82616	82616B	5/16 - 24	2.72	.67	1.13	.318	3	H3
—	—	82632	—	5/16 - 24	2.72	.67	1.13	.318	3	H4
—	—	82646	82646B	5/16 - 24	2.72	.67	1.13	.318	3	H5
—	—	82663	—	5/16 - 24	2.72	.67	1.13	.318	3	H6
—	—	82676	—	5/16 - 24	2.72	.67	1.13	.318	3	H7
82317	82917	82617	82617B	3/8 - 16	2.94	.75	1.25	.381	3	H3
—	—	82647	82647B	3/8 - 16	2.94	.75	1.25	.381	3	H5
—	—	82668	—	3/8 - 16	2.94	.75	1.25	.381	3	H7
82318	82918	82618	82618B	3/8 - 24	2.94	.75	1.25	.381	3	H3
—	—	82633	—	3/8 - 24	2.94	.75	1.25	.381	3	H4
—	—	82648	82648B	3/8 - 24	2.94	.75	1.25	.381	3	H5
—	—	82664	—	3/8 - 24	2.94	.75	1.25	.381	3	H6
—	—	82678	—	3/8 - 24	2.94	.75	1.25	.381	3	H7
82319	82919	82619	82619B	7/16 - 14	3.16	.89	—	.323	3	H3
—	—	82649	82649B	7/16 - 14	3.16	.89	—	.323	3	H5
—	—	82671	—	7/16 - 14	3.16	.89	—	.323	3	H7
82320	82920	82620	82620B	7/16 - 20	3.16	.89	—	.323	3	H3
—	—	82650	82650B	7/16 - 20	3.16	.89	—	.323	3	H5
—	—	82691	—	7/16 - 20	3.16	.89	—	.323	3	H6
—	—	82680	—	7/16 - 20	3.16	.89	—	.323	3	H7
82321	82921	82621	82621B	1/2 - 13	3.38	.98	—	.367	3	H3
—	—	82651	82651B	1/2 - 13	3.38	.98	—	.367	3	H5
—	—	82681	—	1/2 - 13	3.38	.98	—	.367	3	H7
82322	82922	82622	82622B	1/2 - 20	3.38	.98	—	.367	3	H3
—	—	82652	82652B	1/2 - 20	3.38	.98	—	.367	3	H5
—	—	82692	—	1/2 - 20	3.38	.98	—	.367	3	H6
—	—	82682	—	1/2 - 20	3.38	.98	—	.367	3	H7

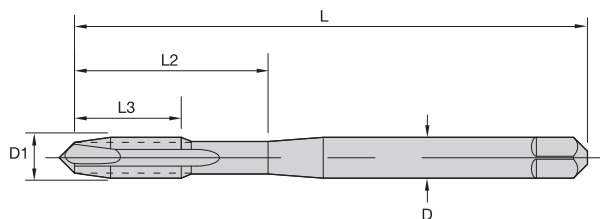
(continued)

(Series 8301 • Machine Screw and Fractional • Plug Chamfer continued)

				D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
TICN	TiN	oxide	uncoated							
82353	82953	82653	82653B	9/16 - 12	3.59	.98	—	.429	3	H3
82354	82954	82654	82654B	9/16 - 18	3.59	.98	—	.429	3	H3
82325	82925	82625	82625B	5/8 - 11	3.81	1.08	—	.480	3	H3
—	—	82655	82655B	5/8 - 11	3.81	1.08	—	.480	3	H5
—	—	82672	—	5/8 - 11	3.81	1.08	—	.480	3	H7
82326	82926	82626	82626B	5/8 - 18	3.81	1.08	—	.480	3	H3
—	—	82656	82656B	5/8 - 18	3.81	1.08	—	.480	3	H5
—	—	82694	—	5/8 - 18	3.81	1.08	—	.480	3	H6
—	—	82677	—	5/8 - 18	3.81	1.08	—	.480	3	H7
82327	82927	82627	82627B	3/4 - 10	4.25	1.20	—	.590	3	H3
—	—	81657	—	3/4 - 10	4.25	1.20	—	.590	3	H5
82328	82928	82628	82628B	3/4 - 16	4.25	1.20	—	.590	3	H3
82395	82995	82695	82695B	7/8 - 9	4.69	1.34	—	.697	3	H4
82396	82996	82696	82696B	7/8 - 14	4.69	1.34	—	.697	3	H4
82397	82997	82697	82697B	1 - 8	5.13	1.50	—	.800	3	H4
—	—	82679	—	1 - 12	5.13	1.50	—	.800	3	H4
—	—	—	82700	1 1/8 - 7	5.44	2.56	—	.896	4	H6
—	—	—	82701	1 1/8 - 12	5.44	2.56	—	.896	4	H5
—	—	—	82702	1 1/4 - 7	5.75	2.56	—	1.021	4	H6
—	—	—	82703	1 1/4 - 12	5.75	2.56	—	1.021	4	H5
—	—	—	82705	1 3/8 - 6	6.06	3.00	—	1.108	4	H6
—	—	—	82706	1 3/8 - 12	6.06	3.00	—	1.108	4	H5
—	—	—	82707	1 1/2 - 6	6.38	3.00	—	1.233	4	H6
—	—	—	82708	1 1/2 - 12	6.38	3.00	—	1.233	4	H5
—	—	—	82709	1 3/4 - 5	7.00	3.19	—	1.430	4	H7
—	—	—	82710	2 - 4 1/2	7.63	3.56	—	1.644	4	H7

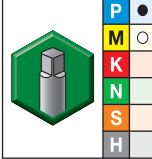
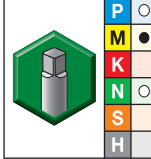
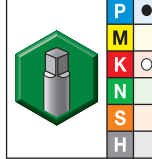
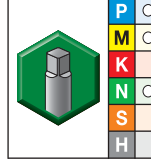
EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



- first choice
- alternate choice

Series 8351 • Plug Chamfer • Metric ANSI

				D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
TiCN	TiN	oxide	uncoated							
72815	72915	72615	72615B	M3 X 0,5	1.94	.31	.63	.141	3	D3
—	—	72616	72616B	M3,5 X 0,6	2.00	.38	.69	.141	3	D4
72817	72917	72617	72617B	M4 X 0,7	2.13	.38	.75	.168	3	D4
72819	72919	72619	72619B	M5 X 0,8	2.38	.50	.88	.194	3	D4
72820	72920	72620	72620B	M6 X 1	2.50	.63	1.00	.255	3	D5
—	—	72621	72621B	M7 X 1	2.72	.69	1.13	.318	3	D5
—	—	72622	72622B	M8 X 1	2.72	.69	1.13	.318	3	D5
72823	72923	72623	72623B	M8 X 1,25	2.72	.69	1.13	.318	3	D5
—	—	72624	72624B	M10 X 1,25	2.94	.75	1.25	.381	3	D5
72825	72925	72625	72625B	M10 X 1,5	2.94	.75	1.25	.381	3	D6
—	—	72626	72626B	M12 X 1,25	3.38	.94	—	.367	3	D5
72827	72927	72627	72627B	M12 X 1,75	3.38	.94	—	.367	3	D6
—	—	72628	72628B	M14 X 1,5	3.59	1.00	—	.429	3	D6
—	—	72629	72629B	M14 X 2	3.59	1.00	—	.429	3	D7
—	—	72630	72630B	M16 X 1,5	3.81	1.09	—	.480	3	D6
—	72930	—	—	M16 X 1,5	3.81	1.09	—	.480	—	D6
—	—	72631	—	M16 X 2	3.81	1.09	—	.480	3	D7
72831	72931	—	—	M16 X 2	3.81	1.09	—	.480	3	D7
—	—	—	72631B	M16 X 2	3.81	1.09	—	.480	3	D7
—	—	72632	—	M18 X 1,5	4.03	1.09	—	.542	3	D6
—	—	—	72632B	M18 X 1,5	4.03	1.08	—	.542	4	D6
—	—	1072633	—	M18 X 2,5	4.03	1.08	—	.542	3	D7
—	—	—	72633B	M18 X 2,5	4.03	1.08	—	.542	4	D7

Metric taps for 6H class of fit are suitable for MJ aerospace internal threading applications.

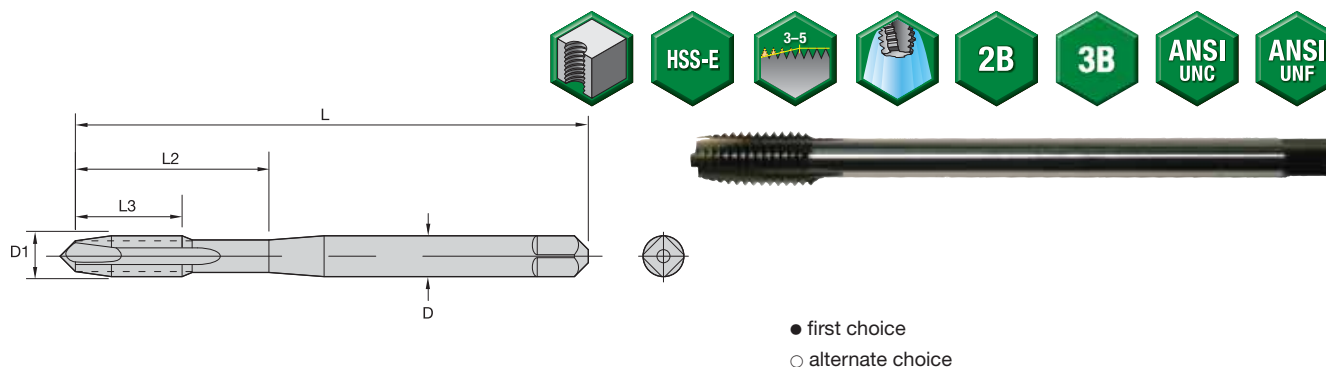
Metric taps are manufactured to USCTI specifications and dimensions.

Metric tap blank dimensions are equivalent to inch taps.

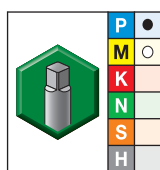
Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.

High-Performance Taps

EM-SS Extended Shank GUN™ Taps • Through Holes • 6" Length



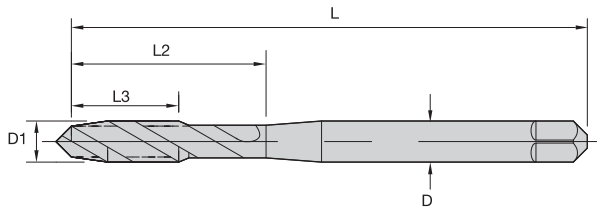
■ Series 8701 • Machine Screw and Fractional • Plug Chamfer



oxide	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
82523	2 - 56	6.00	.44	—	.141	2	H2
82500	3 - 48	6.00	.50	—	.141	2	H2
82501	4 - 40	6.00	.31	.56	.141	2	H2
82505	6 - 32	6.00	.38	.69	.141	3	H3
82507	8 - 32	6.00	.38	.75	.168	3	H3
82509	10 - 24	6.00	.50	.88	.194	3	H3
82510	10 - 32	6.00	.50	.88	.194	3	H3
82513	1/4 - 20	6.00	.63	1.00	.255	3	H3
82514	1/4 - 28	6.00	.63	1.00	.255	3	H3
82515	5/16 - 18	6.00	.69	1.13	.318	3	H3
82516	5/16 - 24	6.00	.69	1.13	.318	3	H3
82517	3/8 - 16	6.00	.75	1.25	.381	3	H3
82518	3/8 - 24	6.00	.75	1.25	.381	3	H3
82519	7/16 - 14	6.00	.88	—	.323	3	H3
82520	7/16 - 20	6.00	.88	—	.323	3	H3
82521	1/2 - 13	6.00	.94	—	.367	3	H3
82522	1/2 - 20	6.00	.94	—	.367	3	H3

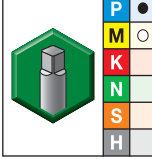
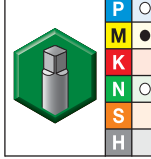
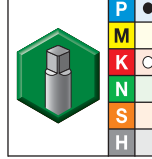
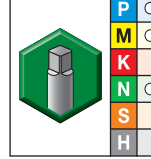
EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



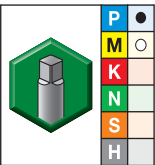
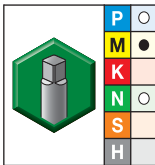
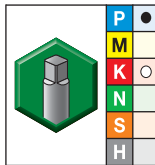
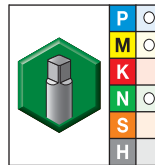
- first choice
- alternate choice

Series 8304 • Machine Screw and Fractional • Chamfer 2-1/2-3-1/2 Pitches

				D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
—	—	84671	84671B	2 - 56	1.75	.44	—	.141	2	H2
—	—	84672	—	3 - 48	1.81	.50	—	.141	2	H2
84301	84901	84601	84601B	4 - 40	1.88	.24	.56	.141	2	H2
—	—	84602	—	4 - 40	1.88	.24	.56	.141	2	H3
—	—	84629	—	4 - 40	1.88	.24	.56	.141	2	H4
—	—	84634	84634B	4 - 40	1.88	.24	.56	.141	2	H5
—	—	84612	—	4 - 40	1.88	.24	.56	.141	2	H6
—	—	84683	—	4 - 48	1.88	.24	.56	.141	2	H2
84303	84903	84603	84603B	5 - 40	1.94	.24	.63	.141	3	H2
—	—	84604	—	6 - 32	2.00	.28	.69	.141	3	H2
84305	84905	84605	84605B	6 - 32	2.00	.28	.69	.141	3	H3
—	—	84636	—	6 - 32	2.00	.28	.69	.141	3	H4
—	—	84635	84635B	6 - 32	2.00	.28	.69	.141	3	H5
—	—	84665	—	6 - 32	2.00	.28	.69	.141	3	H7
—	—	84684	—	6 - 40	2.00	.28	.69	.141	3	H2
—	—	84685	—	6 - 40	2.00	.28	.69	.141	3	H3
—	—	84606	—	8 - 32	2.13	.28	.75	.168	3	H2
84307	84907	84607	84607B	8 - 32	2.13	.28	.75	.168	3	H3
—	—	84638	—	8 - 32	2.13	.28	.75	.168	3	H4
—	—	84637	84637B	8 - 32	2.13	.28	.75	.168	3	H5
—	—	84660	—	8 - 32	2.13	.28	.75	.168	3	H6
—	—	84667	—	8 - 32	2.13	.28	.75	.168	3	H7
—	—	84687	—	8 - 36	2.13	.28	.75	.168	3	H3
—	—	84624	—	10 - 24	2.38	.35	.88	.194	3	H2
84309	84909	84609	84609B	10 - 24	2.38	.35	.88	.194	3	H3
—	—	84623	—	10 - 24	2.38	.35	.88	.194	3	H4
—	—	84639	84639B	10 - 24	2.38	.35	.88	.194	3	H5
—	—	84669	—	10 - 24	2.38	.35	.88	.194	3	H7
—	—	84611	—	10 - 32	2.38	.28	.88	.194	3	H2
84310	84910	84610	84610B	10 - 32	2.38	.28	.88	.194	3	H3
—	—	84630	—	10 - 32	2.38	.28	.88	.194	3	H4
—	—	84640	84640B	10 - 32	2.38	.28	.88	.194	3	H5
—	—	84662	—	10 - 32	2.38	.28	.88	.194	3	H6
—	—	84670	—	10 - 32	2.38	.28	.88	.194	3	H7

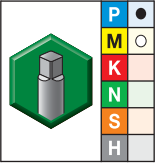
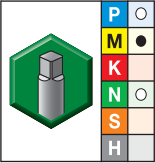
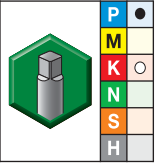
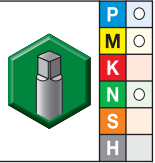
(continued)

(Series 8304 • Machine Screw and Fractional • Chamfer 2-1/2-3-1/2 Pitches continued)

				D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
TiCN	TiN	oxide	uncoated							
—	—	84688	—	12 - 24	2.38	.35	.94	.220	3	H3
—	—	84689	—	12 - 28	2.38	.28	.94	.220	3	H3
—	—	84641	—	1/4 - 20	2.50	.43	1.00	.255	3	H2
84313	84913	84613	84613B	1/4 - 20	2.50	.43	1.00	.255	3	H3
—	—	84643	84643B	1/4 - 20	2.50	.43	1.00	.255	3	H5
—	—	84673	—	1/4 - 20	2.50	.43	1.00	.255	3	H7
—	—	84642	—	1/4 - 28	2.50	.35	1.00	.255	3	H2
84314	84914	84614	84614B	1/4 - 28	2.50	.35	1.00	.255	3	H3
—	—	84631	—	1/4 - 28	2.50	.35	1.00	.255	3	H4
—	—	84644	84644B	1/4 - 28	2.50	.35	1.00	.255	3	H5
—	—	84664	—	1/4 - 28	2.50	.35	1.00	.255	3	H6
—	—	84674	—	1/4 - 28	2.50	.35	1.00	.255	3	H7
84315	84915	84615	84615B	5/16 - 18	2.72	.47	1.13	.318	3	H3
—	—	84645	84645B	5/16 - 18	2.72	.47	1.13	.318	3	H5
—	—	84675	—	5/16 - 18	2.72	.47	1.13	.318	3	H7
84316	84916	84616	84616B	5/16 - 24	2.72	.39	1.13	.318	3	H3
—	—	84646	84646B	5/16 - 24	2.72	.39	1.13	.318	3	H5
—	—	84657	—	5/16 - 24	2.72	.39	1.13	.318	3	H6
—	—	84676	—	5/16 - 24	2.72	.39	1.13	.318	3	H7
84317	84917	84617	84617B	3/8 - 16	2.94	.55	1.25	.381	3	H3
—	—	84647	84647B	3/8 - 16	2.94	.55	1.25	.381	3	H5
—	—	84677	—	3/8 - 16	2.94	.55	1.25	.381	3	H7
84318	84918	84618	84618B	3/8 - 24	2.94	.39	1.25	.381	3	H3
—	—	84633	—	3/8 - 24	2.94	.39	1.25	.381	3	H4
—	—	84648	84648B	3/8 - 24	2.94	.39	1.25	.381	3	H5
—	—	84658	—	3/8 - 24	2.94	.39	1.25	.381	3	H6
—	—	84678	—	3/8 - 24	2.94	.39	1.25	.381	3	H7
84319	84919	84619	84619B	7/16 - 14	3.16	.59	—	.323	3	H3
—	—	84649	84649B	7/16 - 14	3.16	.59	—	.323	3	H5
—	—	84679	—	7/16 - 14	3.16	.59	—	.323	3	H7
84320	84920	84620	84620B	7/16 - 20	3.16	.47	—	.323	3	H3
—	—	84650	84650B	7/16 - 20	3.16	.47	—	.323	3	H5
—	—	84691	—	7/16 - 20	3.16	.47	—	.323	3	H6
—	—	84680	—	7/16 - 20	3.16	.47	—	.323	3	H7
84321	84921	84621	84621B	1/2 - 13	3.38	.63	—	.367	3	H3
—	—	84651	84651B	1/2 - 13	3.38	.63	—	.367	3	H5
—	—	84681	—	1/2 - 13	3.38	.63	—	.367	3	H7
84322	84922	84622	84622B	1/2 - 20	3.38	.47	—	.367	3	H3
—	—	84652	84652B	1/2 - 20	3.38	.47	—	.367	3	H5
—	—	84692	—	1/2 - 20	3.38	.47	—	.367	3	H6
—	—	84682	—	1/2 - 20	3.38	.47	—	.367	3	H7
84353	84953	84653	84653B	9/16 - 12	3.59	.71	—	.429	3	H3

(continued)

(Series 8304 • Machine Screw and Fractional • Chamfer 2-1/2–3-1/2 Pitches continued)

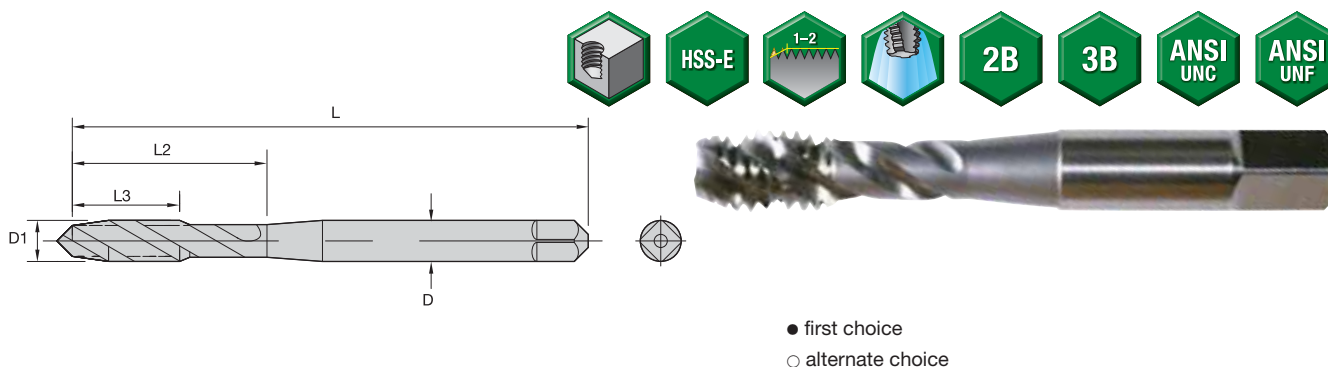
				D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
TiCN	TiN	oxide	uncoated							
—	—	84699	84699B	9/16 - 12	3.59	.71	—	.429	3	H5
84354	84954	84654	84654B	9/16 - 18	3.59	.51	—	.429	3	H3
—	—	84698	84698B	9/16 - 18	3.59	.51	—	.429	3	H5
84325	84925	84625	84625B	5/8 - 11	3.81	.75	—	.480	3	H3
—	—	84655	84655B	5/8 - 11	3.81	.75	—	.480	3	H5
—	—	84661	—	5/8 - 11	3.81	.75	—	.480	3	H7
84326	84926	84626	84626B	5/8 - 18	3.81	.51	—	.480	3	H3
—	—	84656	84656B	5/8 - 18	3.81	.51	—	.480	3	H5
—	—	84663	—	5/8 - 18	3.81	.51	—	.480	3	H6
—	—	84666	—	5/8 - 18	3.81	.51	—	.480	3	H7
84327	84927	84627	84627B	3/4 - 10	4.25	.83	—	.590	4	H3
—	—	84693	—	3/4 - 10	4.25	.83	—	.590	4	H5
84328	84928	84628	84628B	3/4 - 16	4.25	.59	—	.590	4	H3
—	—	84694	—	3/4 - 16	4.25	.59	—	.590	4	H5
—	—	84686	—	3/4 - 16	4.25	.59	—	.590	4	H7
84395	84995	84695	84695B	7/8 - 9	4.69	.83	—	.697	4	H4
84396	84996	84696	84696B	7/8 - 14	4.69	.71	—	.697	4	H4
84397	84997	84697	—	1 - 8	5.13	.98	—	.800	4	H4
—	—	84668	—	1 - 12	5.13	.71	—	.800	4	H4
—	—	—	84701B	1 1/8 - 7	5.44	2.56	—	.896	4	H6
—	—	—	84702	1 1/8 - 12	5.44	2.56	—	.896	4	H5
—	—	—	84703B	1 1/4 - 7	5.75	2.56	—	1.021	4	H6
—	—	—	84705	1 1/4 - 12	5.75	2.56	—	1.021	4	H5
—	—	—	84706	1 3/8 - 6	6.06	3.00	—	1.108	4	H6
—	—	—	84707	1 3/8 - 12	6.06	3.00	—	1.108	4	H5
—	—	—	84709	1 1/2 - 6	6.38	3.00	—	1.233	4	H6
—	—	—	84711	1 1/2 - 12	6.38	3.00	—	1.233	4	H5
—	—	—	84714	1 3/4 - 5	7.00	3.19	—	1.430	4	H7
—	—	—	84715B	2 - 4 1/2	7.63	3.56	—	1.644	4	H3
—	—	—	84697B	1 - 8	5.13	.98	—	.800	4	H4

EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

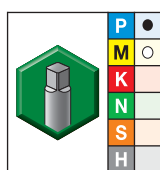
Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.

High-Performance Taps

EM-SS Spiral-Flute Taps • Threading Close to the Bottom in a Blind Hole



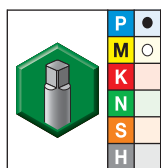
■ Series 8304 • Machine Screw and Fractional • Full Bottoming Chamfer



oxide	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
84001	4 - 40	1.88	.24	.56	.141	2	H2
84002	4 - 40	1.88	.24	.56	.141	2	H3
84034	4 - 40	1.88	.24	.56	.141	2	H5
84083	4 - 48	1.88	.24	.56	.141	2	H2
84003	5 - 40	1.94	.24	.63	.141	3	H2
84004	6 - 32	2.00	.28	.69	.141	3	H2
84005	6 - 32	2.00	.28	.69	.141	3	H3
84035	6 - 32	2.00	.28	.69	.141	3	H5
84084	6 - 40	2.00	.28	.69	.141	3	H2
84085	6 - 40	2.00	.28	.69	.141	3	H3
84006	8 - 32	2.13	.28	.75	.168	3	H2
84007	8 - 32	2.13	.28	.75	.168	3	H3
84037	8 - 32	2.13	.28	.75	.168	3	H5
84009	10 - 24	2.38	.35	.88	.194	3	H3
84039	10 - 24	2.38	.35	.88	.194	3	H5
84010	10 - 32	2.38	.28	.88	.194	3	H3
84040	10 - 32	2.38	.28	.88	.194	3	H5
84013	1/4 - 20	2.50	.43	1.00	.255	3	H3
84043	1/4 - 20	2.50	.43	1.00	.255	3	H5
84014	1/4 - 28	2.50	.35	1.00	.255	3	H3
84044	1/4 - 28	2.50	.35	1.00	.255	3	H5
84015	5/16 - 18	2.72	.47	1.13	.318	3	H3
84045	5/16 - 18	2.72	.47	1.13	.318	3	H5
84016	5/16 - 24	2.72	.39	1.13	.318	3	H3
84046	5/16 - 24	2.72	.39	1.13	.318	3	H5
84017	3/8 - 16	2.94	.55	1.25	.381	3	H3
84047	3/8 - 16	2.94	.55	1.25	.381	3	H5
84077	3/8 - 16	2.94	.55	1.25	.381	3	H7
84018	3/8 - 24	2.94	.39	1.25	.381	3	H3
84033	3/8 - 24	2.94	.39	1.25	.381	3	H4
84048	3/8 - 24	2.94	.39	1.25	.381	3	H5
84019	7/16 - 14	3.16	.59	—	.323	3	H3
84049	7/16 - 14	3.16	.59	—	.323	3	H5
84020	7/16 - 20	3.16	.47	—	.323	3	H3

(continued)

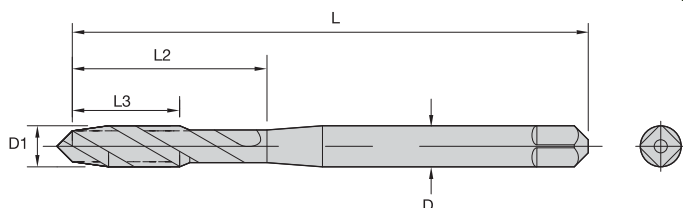
(Series 8304 • Machine Screw and Fractionl • Full Bottoming Chamfer continued)



oxide	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
84050	7/16 - 20	3.16	.47	—	.323	3	H5
84021	1/2 - 13	3.38	.63	—	.367	3	H3
84051	1/2 - 13	3.38	.63	—	.367	3	H5
84022	1/2 - 20	3.38	.47	—	.367	3	H3
84052	1/2 - 20	3.38	.47	—	.367	3	H5
84053	9/16 - 12	3.59	.71	—	.429	3	H3
84054	9/16 - 18	3.59	.51	—	.429	3	H3
84025	5/8 - 11	3.81	.75	—	.480	3	H3
84055	5/8 - 11	3.81	.75	—	.480	3	H5
84026	5/8 - 18	3.81	.51	—	.480	3	H3
84056	5/8 - 18	3.81	.51	—	.480	3	H5
84027	3/4 - 10	4.25	.83	—	.590	4	H3
84028	3/4 - 16	4.25	.59	—	.590	4	H3

EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



- first choice
- alternate choice

Series 8354 • Chamfer 2-1/2-3-1/2 Pitches • Metric ANSI

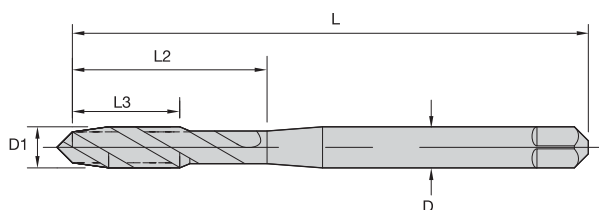
				D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
74815	74915	74615	74615B	M3 X 0,5	1.94	.31	.56	.141	3	D3
—	—	74616	74616B	M3,5 X 0,6	2.00	.38	.63	.141	3	D4
74817	74917	74617	74617B	M4 X 0,7	2.13	.38	.75	.168	3	D4
74819	74919	74619	74619B	M5 X 0,8	2.38	.50	.88	.194	3	D4
74820	74920	74620	74620B	M6 X 1	2.50	.63	1.00	.255	3	D5
—	—	74621	74621B	M7 X 1	2.72	.69	1.13	.318	3	D5
—	—	74622	74622B	M8 X 1	2.72	.69	1.13	.318	3	D5
74823	74923	74623	74623B	M8 X 1,25	2.72	.69	1.13	.318	3	D5
—	—	74624	74624B	M10 X 1,25	2.94	.75	1.25	.381	3	D5
74825	74925	74625	74625B	M10 X 1,5	2.94	.75	1.25	.381	3	D6
—	—	74626	74626B	M12 X 1,25	3.38	.94	—	.367	3	D5
74827	74927	74627	74627B	M12 X 1,75	3.38	.94	—	.367	3	D6
—	—	74628	74628B	M14 X 1,5	3.59	1.00	—	.429	3	D6
—	—	74629	74629B	M14 X 2	3.59	1.00	—	.429	3	D7
—	—	74630	74630B	M16 X 1,5	3.81	1.09	—	.480	3	D6
—	—	74631	74631B	M16 X 2	3.81	1.09	—	.480	3	D7
—	—	74632	—	M18 X 1,5	4.03	1.09	—	.542	3	D6
—	—	74633	—	M18 X 2,5	4.03	1.09	—	.542	3	D7
—	—	—	74632B	M18 X 1,5	4.03	1.09	—	.542	4	D6
—	—	—	74633B	M18 X 2,5	4.03	1.09	—	.542	4	D7

Metric taps for 6H class of fit are suitable for MJ aerospace internal threading applications.

Metric taps are manufactured to USCTI specifications and dimensions.

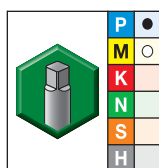
Metric tap blank dimensions are equivalent to inch taps.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.



- first choice
- alternate choice

Series 8354 • Full Bottoming Chamfer • Metric ANSI



oxide	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
74015	M3 X 0,5	1.94	.31	.56	.141	3	D3
74016	M3,5 X 0,6	2.00	.38	.63	.141	3	D4
74017	M4 X 0,7	2.13	.38	.75	.168	3	D4
74019	M5 X 0,8	2.38	.50	.88	.194	3	D4
74020	M6 X 1	2.50	.63	1.00	.255	3	D5
74021	M7 X 1	2.72	.69	1.13	.318	3	D5
74022	M8 X 1	2.72	.69	1.13	.318	3	D5
74023	M8 X 1,25	2.72	.69	1.13	.318	3	D5
74024	M10 X 1,25	2.94	.75	1.25	.381	3	D5
74025	M10 X 1,5	2.94	.75	1.25	.381	3	D6
74026	M12 X 1,25	3.38	.94	—	.367	3	D5
74027	M12 X 1,75	3.38	.94	—	.367	3	D6
74028	M14 X 1,5	3.59	1.00	—	.429	3	D6
74029	M14 X 2	3.59	1.00	—	.429	3	D7
74030	M16 X 1,5	3.81	1.09	—	.480	3	D6
74031	M16 X 2	3.81	1.09	—	.480	3	D7
74032	M18 X 1,5	4.03	1.09	—	.542	3	D6

Metric taps for 6H class of fit are suitable for MJ aerospace internal threading applications.

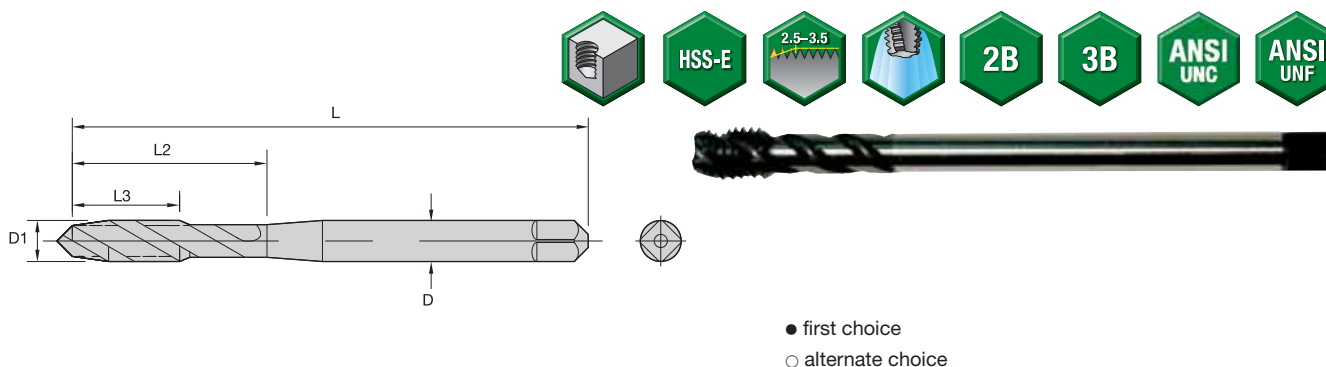
Metric taps are manufactured to USCTI specifications and dimensions.

Metric tap blank dimensions are equivalent to inch taps.

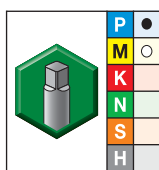
Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.

High-Performance Taps

EM-SS Extended Spiral-Flute Taps • Blind Holes • 6" Length



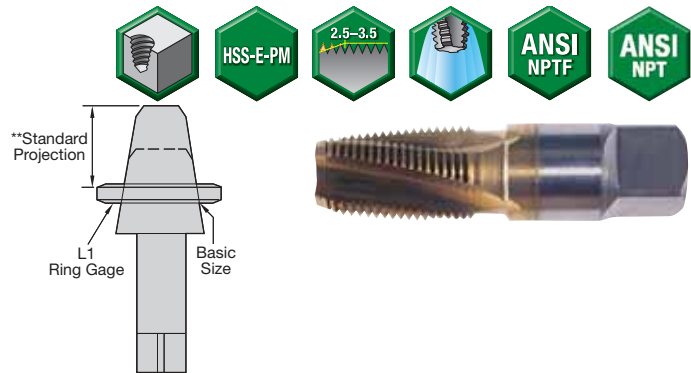
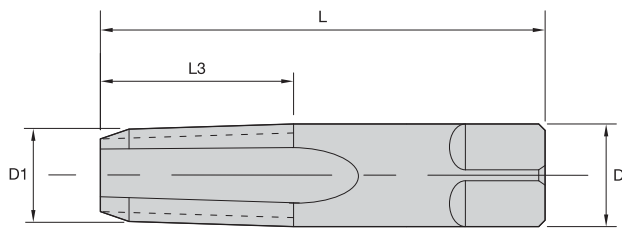
■ Series 8314 • Machine Screw and Fractional • Modified Bottoming Chamfer



Oxide	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
84523	2 - 56	6.00	.44	—	.141	2	H2
84500	3 - 48	6.00	.50	—	.141	2	H2
84501	4 - 40	6.00	.24	.56	.141	2	H2
84505	6 - 32	6.00	.28	.69	.141	3	H3
84507	8 - 32	6.00	.28	.75	.168	3	H3
84509	10 - 24	6.00	.35	.88	.194	3	H3
84510	10 - 32	6.00	.28	.88	.194	3	H3
84513	1/4 - 20	6.00	.43	1.00	.255	3	H3
84514	1/4 - 28	6.00	.35	1.00	.255	3	H3
84515	5/16 - 18	6.00	.47	1.13	.318	3	H3
84516	5/16 - 24	6.00	.39	1.13	.318	3	H3
84517	3/8 - 16	6.00	.55	1.25	.381	3	H3
84518	3/8 - 24	6.00	.39	1.25	.381	3	H3
84519	7/16 - 14	6.00	.59	—	.323	3	H3
84520	7/16 - 20	6.00	.47	—	.323	3	H3
84521	1/2 - 13	6.00	.63	—	.367	3	H3
84522	1/2 - 20	6.00	.47	—	.367	3	H3

EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

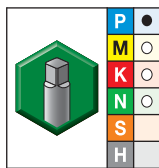
Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



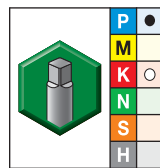
Features and Benefits:

- Ground thread pipe taps are standard in American Standard Pipe Thread (NPT) and American Standard Dryseal Pipe Thread (NPTF).
- NPT threads require the use of a sealer such as Teflon® tape or pipe compound.
- NPTF dryseal threads give a pressure-tight joint without the use of sealer.
- Standard projection.
- Unique slow spiral tap geometry for improved thread finish when tapping stainless steels.

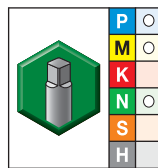
■ Series 8321 • Standard Chamfer



TiN



oxide



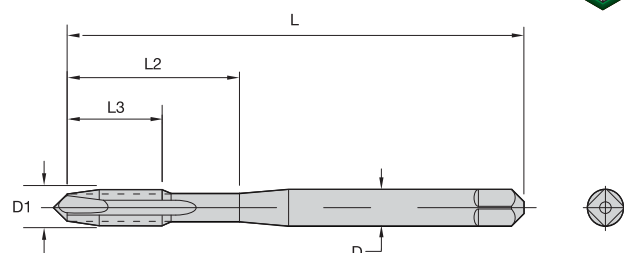
uncoated

- first choice
- alternate choice

			D1 size	L	L3	D	number of flutes	thread series
83940	83640	83640B	1/16 - 27	2.13	.69	.313	4	NPT
83960	83660	83660B	1/16 - 27	2.13	.69	.313	4	NPTF
83942	83642	83642B	1/8 - 27	2.13	.75	.313	4	NPT
83962	83662	83662B	1/8 - 27	2.13	.75	.313	4	NPTF
83941	83641	83641B	1/8 - 27	2.13	.75	.438	4	NPT
83961	83661	83661B	1/8 - 27	2.13	.75	.438	4	NPTF
83943	83643	83643B	1/4 - 18	2.44	1.06	.563	4	NPT
83963	83663	83663B	1/4 - 18	2.44	1.06	.563	4	NPTF
83944	83644	83644B	3/8 - 18	2.56	1.06	.703	4	NPT
83964	83664	83664B	3/8 - 18	2.56	1.06	.703	4	NPTF
83945	83645	83645B	1/2 - 14	3.13	1.38	.688	4	NPT
83965	83665	83665B	1/2 - 14	3.13	1.38	.688	4	NPTF
83946	83646	83646B	3/4 - 14	3.25	1.38	.906	4	NPT
83966	83666	83666B	3/4 - 14	3.25	1.38	.906	4	NPTF
83947	83647	83647B	1 - 11 1/2	3.75	1.75	1.125	4	NPT
83967	83667	83667B	1 - 11 1/2	3.75	1.75	1.125	4	NPTF

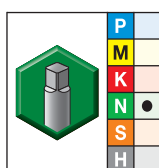
*Large shank available on D1=1/8 - 27.

**Pipe tap projection is the distance the small end of the tap projects through an American National Standard L1 Pipe Thread Ring Gage. For gage measurement projection, see technical page A253.



- first choice
- alternate choice

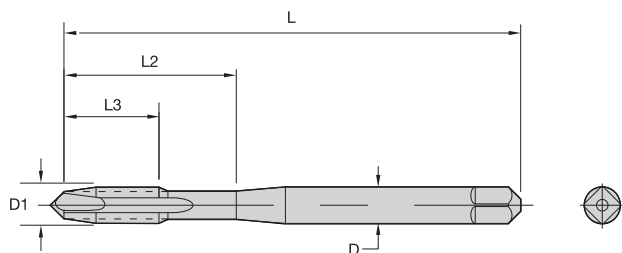
■ Series 8201 • Machine Screw and Fractional • Plug Chamfer • DIN Length



nitride	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
86200	2 - 56	1.77	.28	.47	.141	2	H2
86201	4 - 40	2.21	.43	.71	.141	2	H2
86202	5 - 40	2.21	.43	.71	.141	3	H2
86203	6 - 32	2.21	.51	.79	.141	3	H3
86204	8 - 32	2.48	.51	.83	.168	3	H3
86205	10 - 24	2.76	.63	.98	.194	3	H3
86206	10 - 32	2.76	.63	.98	.194	3	H3
86207	1/4 - 20	3.15	.75	1.18	.255	3	H3
86208	1/4 - 20	3.15	.75	1.18	.255	3	H5
86209	1/4 - 28	3.15	.75	1.18	.255	3	H3
86211	1/4 - 28	3.15	.75	1.18	.255	3	H4
86212	5/16 - 18	3.54	.87	1.38	.318	3	H3
86213	5/16 - 18	3.54	.87	1.38	.318	3	H5
86214	5/16 - 24	3.54	.87	1.38	.318	3	H3
86215	5/16 - 24	3.54	.87	1.38	.318	3	H4
86216	3/8 - 16	3.94	.95	1.54	.381	3	H3
86217	3/8 - 16	3.94	.95	1.54	.381	3	H5
86218	3/8 - 24	3.54	.79	1.54	.381	3	H3
86219	3/8 - 24	3.54	.79	1.54	.381	3	H4
86220	7/16 - 14	3.94	.95	1.65	.323	3	H3
86221	7/16 - 14	3.94	.95	1.65	.323	3	H5
86222	7/16 - 20	3.94	.95	1.65	.323	3	H3
86223	7/16 - 20	3.94	.95	1.65	.323	3	H5
86224	1/2 - 13	4.33	1.14	1.77	.367	3	H3
86225	1/2 - 13	4.33	1.14	1.77	.367	3	H5
86226	1/2 - 20	3.94	.87	1.77	.367	3	H3
86227	1/2 - 20	3.94	.87	1.77	.367	3	H5

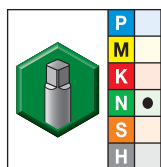
EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



- first choice
- alternate choice

■ Series 8251 • Plug Chamfer • DIN Length • Metric ANSI

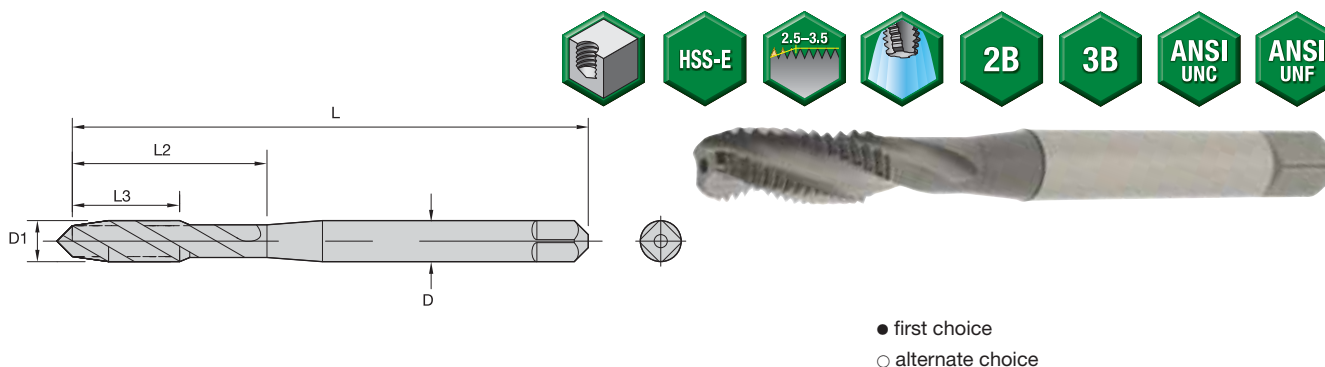


nitride	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
86228	M3 X 0,5	2.21	.43	.71	.141	3	D3
86229	M3,5 X 0,6	2.21	.51	.79	.141	3	D4
86230	M4 X 0,7	2.48	.51	.83	.168	3	D4
86231	M5 X 0,8	2.76	.63	.98	.194	3	D4
86232	M6 X 1	3.15	.75	1.18	.255	3	D5
86233	M7 X 1	3.15	.75	1.18	.318	3	D5
86234	M8 X 1	3.54	.87	1.38	.318	3	D5
86235	M8 X 1,25	3.54	.87	1.38	.318	3	D5
86236	M10 X 1,25	3.94	.95	1.54	.381	3	D5
86237	M10 X 1,5	3.94	.95	1.54	.381	3	D6
86238	M12 X 1,25	3.94	.87	1.77	.367	3	D5
86239	M12 X 1,5	3.94	.87	1.77	.367	3	D5
86240	M12 X 1,75	4.33	1.14	1.77	.367	3	D6

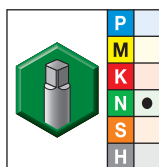
Metric taps for 6H class of fit are suitable for MJ aerospace internal threading applications.
Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.

High-Performance Taps

EM-ALS 25° Spiral-Flute Taps • Blind Holes



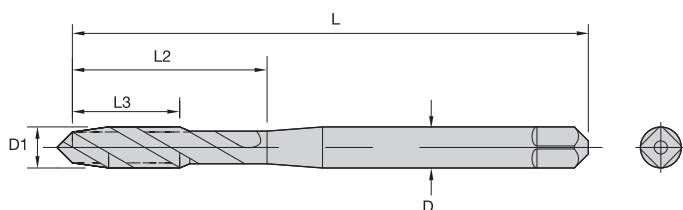
■ Series 8204 • Machine Screw and Fractional • Semi-Bottom Chamfer • DIN Length



nitride	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
86400	2 - 56	1.77	.28	.47	.141	3	H2
86401	4 - 40	2.21	.43	.71	.141	3	H2
86402	5 - 40	2.21	.43	.71	.141	3	H2
86403	6 - 32	2.25	.51	.79	.141	3	H3
86404	8 - 32	2.48	.51	.83	.168	3	H3
86405	10 - 24	2.76	.63	.98	.194	3	H3
86406	10 - 32	2.76	.63	.98	.194	3	H3
86407	1/4 - 20	3.15	.75	1.18	.255	3	H3
86408	1/4 - 20	3.15	.75	1.18	.255	3	H5
86409	1/4 - 28	3.15	.75	1.18	.255	3	H3
86411	1/4 - 28	3.15	.75	1.18	.255	3	H5
86412	5/16 - 18	3.54	.87	1.38	.318	3	H3
86413	5/16 - 18	3.54	.87	1.38	.318	3	H5
86414	5/16 - 24	3.54	.87	1.38	.318	3	H3
86415	5/16 - 24	3.54	.87	1.38	.318	3	H4
86416	3/8 - 16	3.54	.95	1.54	.381	3	H3
86417	3/8 - 16	3.54	.95	1.54	.381	3	H5
86418	3/8 - 24	3.54	.79	1.54	.381	3	H3
86419	3/8 - 24	3.54	.79	1.54	.381	3	H4
86420	7/16 - 14	3.94	.95	1.65	.323	3	H3
86421	7/16 - 14	3.94	.95	1.65	.323	3	H5
86422	7/16 - 20	3.94	.95	1.65	.323	3	H3
86423	7/16 - 20	3.94	.95	1.65	.323	3	H5
86424	1/2 - 13	4.33	1.14	1.77	.367	3	H3
86425	1/2 - 13	4.33	1.14	1.77	.367	3	H5
86426	1/2 - 20	3.94	.87	1.77	.367	3	H3
86427	1/2 - 20	3.94	.87	1.77	.367	3	H5

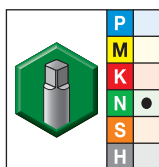
EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



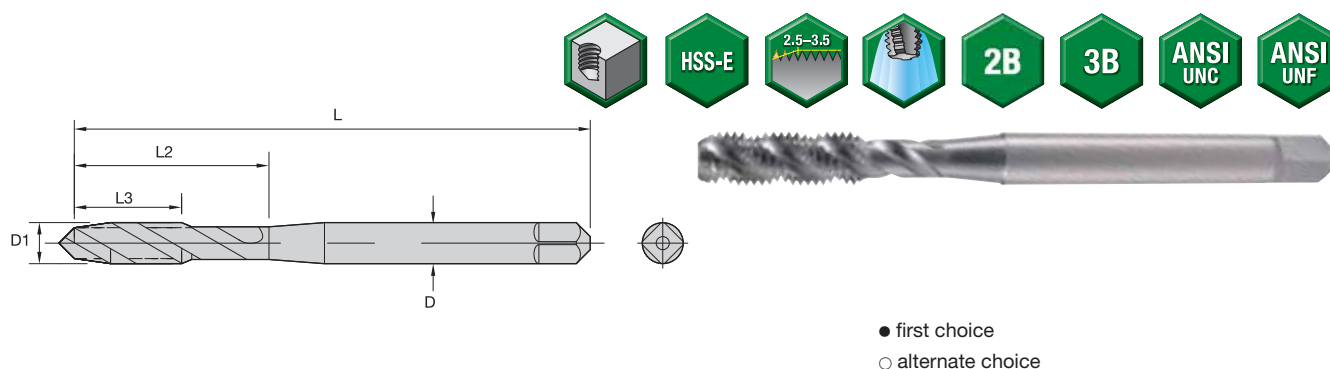
- first choice
- alternate choice

■ Series 8254 • Semi-Bottom Chamfer • DIN Length • Metric ANSI

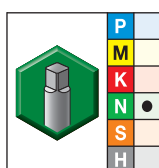


		L	L3	L2	D	number of flutes	pitch diameter limit
nitride							
86428	M3 X 0,5	2.21	.43	.71	.141	3	D3
86429	M3,5 X 0,6	2.21	.51	.79	.141	3	D4
86430	M4 X 0,7	2.48	.51	.83	.168	3	D4
86431	M5 X 0,8	2.76	.63	.98	.194	3	D4
86432	M6 X 1	3.15	.75	1.18	.255	3	D5
86433	M7 X 1	3.15	.75	1.18	.318	3	D5
86434	M8 X 1	3.54	.87	1.38	.318	3	D5
86435	M8 X 1,25	3.54	.87	1.38	.318	3	D5
86436	M10 X 1,25	3.94	.95	1.54	.381	3	D5
86437	M10 X 1,5	3.94	.95	1.54	.381	3	D6
86438	M12 X 1,25	3.94	.87	1.50	.367	3	D5
86439	M12 X 1,5	3.94	.87	1.50	.367	3	D5
86440	M12 X 1,75	4.33	1.14	2.05	.367	3	D6

Metric taps for 6H class of fit are suitable for MJ aerospace internal threading applications.
 Metric taps are manufactured to USCTI specifications and dimensions.
 Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.



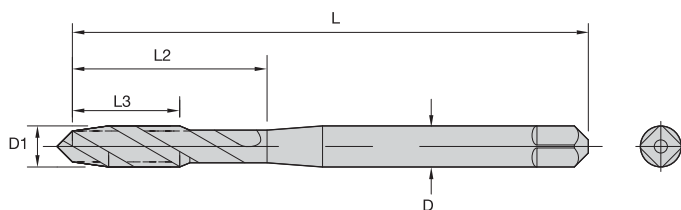
■ Series 8214 • Machine Screw and Fractional • Semi-Bottom Chamfer • DIN Length



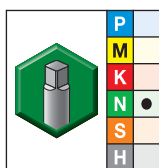
nitride	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
86500	2 - 56	1.77	.28	.47	.141	2	H2
86501	4 - 40	2.21	.43	.71	.141	2	H2
86502	5 - 40	2.21	.43	.71	.141	3	H2
86503	6 - 32	2.21	.51	.79	.141	3	H3
86504	8 - 32	2.48	.51	.83	.168	3	H3
86505	10 - 24	2.76	.63	.98	.194	3	H3
86506	10 - 32	2.76	.63	.98	.194	3	H3
86507	1/4 - 20	3.15	.75	1.18	.255	3	H3
86508	1/4 - 20	3.15	.75	1.18	.255	3	H5
86509	1/4 - 28	3.15	.75	1.18	.255	3	H3
86511	1/4 - 28	3.15	.75	1.18	.255	3	H4
86512	5/16 - 18	3.54	.87	1.38	.318	3	H3
86513	5/16 - 18	3.54	.87	1.38	.318	3	H5
86514	5/16 - 24	3.54	.87	1.38	.318	3	H3
86515	5/16 - 24	3.54	.87	1.38	.318	3	H4
86516	3/8 - 16	3.94	.95	1.54	.381	3	H3
86517	3/8 - 16	3.94	.95	1.54	.381	3	H5
86518	3/8 - 24	3.54	.79	1.54	.381	3	H3
86519	3/8 - 24	3.54	.79	1.54	.381	3	H4
86520	7/16 - 14	3.94	.95	1.65	.323	3	H3
86521	7/16 - 14	3.94	.95	1.65	.323	3	H5
86522	7/16 - 20	3.94	.95	1.65	.323	3	H3
86523	7/16 - 20	3.94	.95	1.65	.323	3	H5
86524	1/2 - 13	4.33	1.14	1.77	.367	3	H3
86525	1/2 - 13	4.33	1.14	1.77	.367	3	H5
86526	1/2 - 20	3.94	.87	1.77	.367	3	H3
86527	1/2 - 20	3.94	.87	1.77	.367	3	H5

EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.

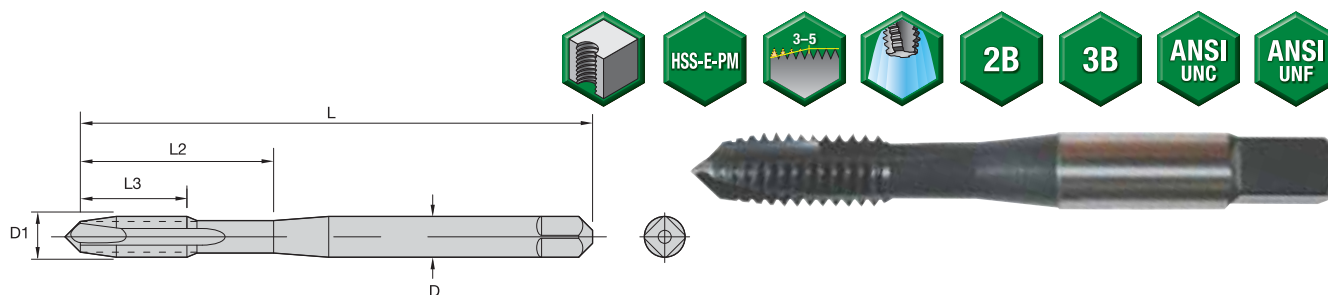


- first choice
- alternate choice

Series 8264 • Semi-Bottom Chamfer • DIN Length • Metric ANSI


nitride	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
86528	M3 X 0,5	2.21	.43	.79	.141	3	D3
86529	M3,5 X 0,6	2.21	.51	.71	.141	3	D4
86530	M4 X 0,7	2.48	.51	.83	.168	3	D4
86531	M5 X 0,8	2.76	.63	.98	.194	3	D4
86532	M6 X 1	3.15	.75	1.18	.255	3	D5
86533	M7 X 1	3.15	.75	1.18	.318	3	D5
86534	M8 X 1	3.54	.87	1.38	.318	3	D5
86535	M8 X 1,25	3.54	.87	1.38	.318	3	D5
86536	M10 X 1,25	3.94	.95	1.54	.381	3	D5
86537	M10 X 1,5	3.94	.95	1.54	.381	3	D6
86538	M12 X 1,25	3.94	.87	1.50	.367	3	D5
86539	M12 X 1,5	3.94	.87	1.50	.367	3	D5
86540	M12 X 1,75	4.33	1.14	2.05	.367	3	D6

Metric taps for 6H class of fit are suitable for MJ aerospace internal threading applications.
 Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.



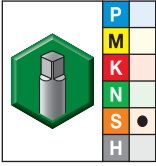
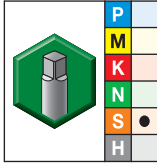
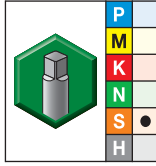
- first choice
- alternate choice

■ Series 8601 • Machine Screw and Fractional • Plug Chamfer

TiCN	oxide/nitride	uncoated	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit	
—	85523	—	2 - 56	1.75	.26	—	.141	2	H2	
85401	85501	85501B	4 - 40	1.88	.34	.56	.141	2	H2	
—	85502	—	4 - 40	1.88	.34	.56	.141	2	H3	
—	85504	—	4 - 40	1.88	.34	.56	.141	2	H4	
—	85506	—	4 - 48	1.88	.34	.56	.141	2	H2	
—	85503	—	5 - 40	1.94	.37	.62	.141	3	H2	
—	85508	—	6 - 32	2.00	.41	.69	.141	3	H2	
85405	85505	85505B	6 - 32	2.00	.41	.69	.141	3	H3	
—	85524	—	6 - 32	2.00	.41	.69	.141	3	H4	
—	85535	—	6 - 32	2.00	.41	.69	.141	3	H5	
—	85511	—	6 - 32	2.00	.41	.69	.141	3	H7	
—	85512	85512B	6 - 40	2.00	.41	.69	.141	3	H2	
—	85534	—	8 - 32	2.13	.45	.75	.168	3	H2	
85407	85507	85507B	8 - 32	2.13	.45	.75	.168	3	H3	
—	85529	—	8 - 32	2.13	.45	.75	.168	3	H4	
—	85537	—	8 - 32	2.13	.45	.75	.168	3	H5	
—	85560	—	8 - 32	2.13	.45	.75	.168	3	H6	
—	85567	—	8 - 32	2.13	.45	.75	.168	3	H7	
85409	85509	85509B	10 - 24	2.38	.53	.88	.194	3	H3	
—	85536	—	10 - 24	2.38	.53	.88	.194	3	H4	
—	85539	—	10 - 24	2.38	.53	.88	.194	3	H5	
—	85538	—	10 - 24	2.38	.53	.88	.194	3	H7	
—	85541	—	10 - 32	2.38	.53	.88	.194	3	H2	
85410	85510	85510B	10 - 32	2.38	.53	.88	.194	3	H3	
—	85530	—	10 - 32	2.38	.53	.88	.194	3	H4	
—	85540	—	10 - 32	2.38	.53	.88	.194	3	H5	
—	85561	—	10 - 32	2.38	.53	.88	.194	3	H6	
—	85570	—	10 - 32	2.38	.53	.88	.194	3	H7	
85413	85513	85513B	1/4 - 20	2.50	.59	1.00	.255	3	H3	
—	85543	—	1/4 - 20	2.50	.59	1.00	.255	3	H5	
—	85542	—	1/4 - 20	2.50	.59	1.00	.255	3	H7	
85414	85514	85514B	1/4 - 28	2.50	.59	1.00	.255	3	H3	
—	85531	—	1/4 - 28	2.50	.59	1.00	.255	3	H4	
—	85544	—	1/4 - 28	2.50	.59	1.00	.255	3	H5	
—	85562	—	1/4 - 28	2.50	.59	1.00	.255	3	H6	
—	85574	—	1/4 - 28	2.50	.59	1.00	.255	3	H7	
85415	85515	85515B	5/16 - 18	2.72	.67	1.13	.318	3	H3	
—	85545	—	5/16 - 18	2.72	.67	1.13	.318	3	H5	

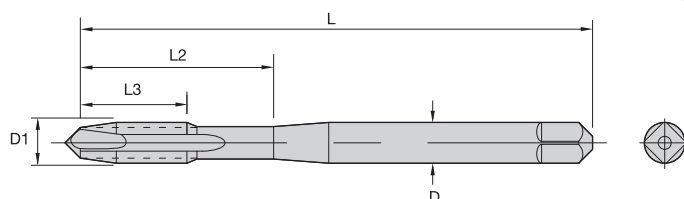
(continued)

(Series 8601 • Machine Screw and Fractional • Plug Chamfer continued)

								number of flutes	pitch diameter limit
TiCN	oxide/nitride	uncoated	D1 size	L	L3	L2	D		
—	85553	—	5/16 - 18	2.72	.67	1.13	.318	3	H7
85416	85516	85516B	5/16 - 24	2.72	.67	1.13	.318	3	H3
—	85532	—	5/16 - 24	2.72	.67	1.13	.318	3	H4
—	85546	—	5/16 - 24	2.72	.67	1.13	.318	3	H5
—	85563	—	5/16 - 24	2.72	.67	1.13	.318	3	H6
—	85576	—	5/16 - 24	2.72	.67	1.13	.318	3	H7
85417	85517	85517B	3/8 - 16	2.94	.75	1.25	.381	3	H3
—	85547	—	3/8 - 16	2.94	.75	1.25	.381	3	H5
—	85554	—	3/8 - 16	2.94	.75	1.25	.381	3	H7
85418	85518	85518B	3/8 - 24	2.94	.75	1.25	.381	3	H3
—	85533	—	3/8 - 24	2.94	.75	1.25	.381	3	H4
—	85548	—	3/8 - 24	2.94	.75	1.25	.381	3	H5
—	85564	—	3/8 - 24	2.94	.75	1.25	.381	3	H6
—	85578	—	3/8 - 24	2.94	.75	1.25	.381	3	H7
85419	85519	85519B	7/16 - 14	3.16	.87	—	.323	3	H3
—	85549	—	7/16 - 14	3.16	.87	—	.323	3	H5
85420	85520	85520B	7/16 - 20	3.16	.87	—	.323	3	H3
—	85550	—	7/16 - 20	3.16	.87	—	.323	3	H5
85421	85521	85521B	1/2 - 13	3.38	.96	—	.367	3	H3
—	85551	—	1/2 - 13	3.38	.96	—	.367	3	H5
—	85555	—	1/2 - 13	3.38	.96	—	.367	3	H7
85422	85522	85522B	1/2 - 20	3.38	.96	—	.367	3	H3
—	85552	—	1/2 - 20	3.38	.96	—	.367	3	H5
—	85556	—	1/2 - 20	3.38	.96	—	.367	3	H7
—	85525	—	5/8 - 11	3.81	1.08	—	.480	3	H3
—	85565	—	5/8 - 11	3.81	1.08	—	.480	3	H5
—	85526	—	5/8 - 18	3.81	1.08	—	.480	3	H3
—	85566	—	5/8 - 18	3.81	1.08	—	.480	3	H5
—	85527	—	3/4 - 10	4.25	1.20	—	.590	3	H3
—	85557	—	3/4 - 10	4.25	1.20	—	.590	3	H5
—	85528	—	3/4 - 16	4.25	1.20	—	.590	3	H3
—	85558	—	3/4 - 16	4.25	1.20	—	.590	3	H5

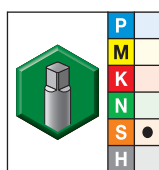
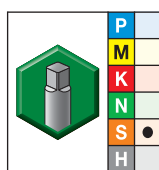
EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



- first choice
- alternate choice

■ Series 8651 • Plug Chamfer • Metric ANSI



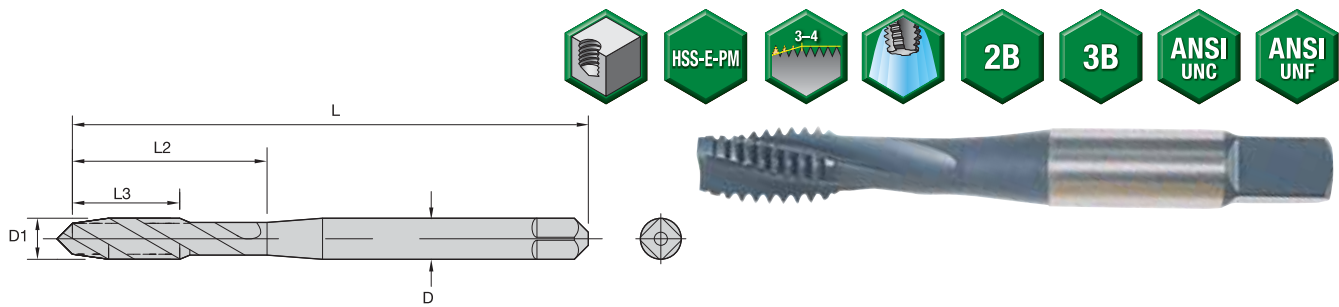
TiCN	oxide/nitride	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
—	87320	M2,5 X 0,45	1.81	.295	.500	.141	3	D3
87421	87321	M3 X 0,5	1.94	.374	.625	.141	3	D3
—	87322	M3,5 X 0,6	2.00	.413	.688	.141	3	D4
87423	87323	M4 X 0,7	2.13	.453	.750	.168	3	D4
87234	87324	M5 X 0,8	2.38	.531	.875	.194	3	D4
87235	87325	M6 X 1	2.50	.591	1.000	.255	3	D5
—	87326	M7 X 1	2.72	.669	1.125	.318	3	D5
—	87327	M8 X 1	2.72	.669	1.125	.318	3	D5
87238	87328	M8 X 1,25	2.72	.669	1.125	.318	3	D5
—	87329	M10 X 1,25	2.94	.748	1.250	.381	3	D5
87430	87330	M10 X 1,5	2.94	.748	1.250	.381	3	D6
—	87331	M12 X 1,25	3.38	.984	—	.367	3	D5
87432	87332	M12 X 1,75	3.38	.984	—	.367	3	D6

Metric taps for 6H class of fit are suitable for MJ aerospace internal threading applications.

Metric taps are manufactured to USCTI specifications and dimensions.

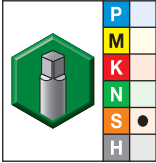
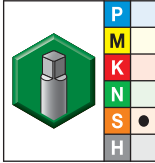
Metric tap blank dimensions are equivalent to inch taps.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.



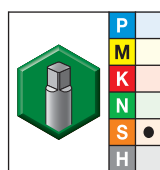
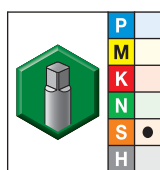
- first choice
- alternate choice

■ Series 8604 • Machine Screw and Fractional • 3–4 Pitches Chamfer

				D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
TiCN		oxide/nitride								
—	—	87523	—	2 - 56	1.75	.44	—	.141	3	H2
—	—	87571	—	3 - 48	1.81	.50	—	.141	3	H2
87301	—	87501	—	4 - 40	1.88	.31	.56	.141	3	H2
—	—	87502	—	4 - 40	1.88	.31	.56	.141	3	H3
—	—	87512	—	4 - 40	1.88	.31	.56	.141	3	H4
—	—	87572	—	4 - 40	1.88	.31	.56	.141	3	H5
—	—	87503	—	4 - 48	1.88	.31	.56	.141	3	H2
87304	—	87504	—	5 - 40	1.94	.31	.63	.141	3	H2
—	—	87506	—	6 - 32	2.00	.38	.69	.141	3	H2
87305	—	87505	—	6 - 32	2.00	.38	.69	.141	3	H3
—	—	87535	—	6 - 32	2.00	.38	.69	.141	3	H5
—	—	87566	—	6 - 32	2.00	.38	.69	.141	3	H7
—	—	87511	—	6 - 40	2.00	.38	.69	.141	3	H2
—	—	87524	—	8 - 32	2.13	.38	.75	.168	3	H2
87307	—	87507	—	8 - 32	2.13	.38	.75	.168	3	H3
—	—	87529	—	8 - 32	2.13	.38	.75	.168	3	H4
—	—	87537	—	8 - 32	2.13	.38	.75	.168	3	H5
—	—	87560	—	8 - 32	2.13	.38	.75	.168	3	H6
—	—	87567	—	8 - 32	2.13	.38	.75	.168	3	H7
87309	—	87509	—	10 - 24	2.38	.50	.88	.194	3	H3
—	—	87534	—	10 - 24	2.38	.50	.88	.194	3	H4
—	—	87539	—	10 - 24	2.38	.50	.88	.194	3	H5
—	—	87536	—	10 - 24	2.38	.50	.88	.194	3	H7
—	—	87538	—	10 - 32	2.38	.50	.88	.194	3	H2
87310	—	87510	—	10 - 32	2.38	.50	.88	.194	3	H3
—	—	87530	—	10 - 32	2.38	.50	.88	.194	3	H4
—	—	87540	—	10 - 32	2.38	.50	.88	.194	3	H5
—	—	87561	—	10 - 32	2.38	.50	.88	.194	3	H6
—	—	87570	—	10 - 32	2.38	.50	.88	.194	3	H7
87313	—	87513	—	1/4 - 20	2.50	.63	1.00	.255	3	H3
—	—	87543	—	1/4 - 20	2.50	.63	1.00	.255	3	H5
—	—	87541	—	1/4 - 20	2.50	.63	1.00	.255	3	H7
87314	—	87514	—	1/4 - 28	2.50	.63	1.00	.255	3	H3
—	—	87531	—	1/4 - 28	2.50	.63	1.00	.255	3	H4
—	—	87544	—	1/4 - 28	2.50	.63	1.00	.255	3	H5
—	—	87562	—	1/4 - 28	2.50	.63	1.00	.255	3	H6

(continued)

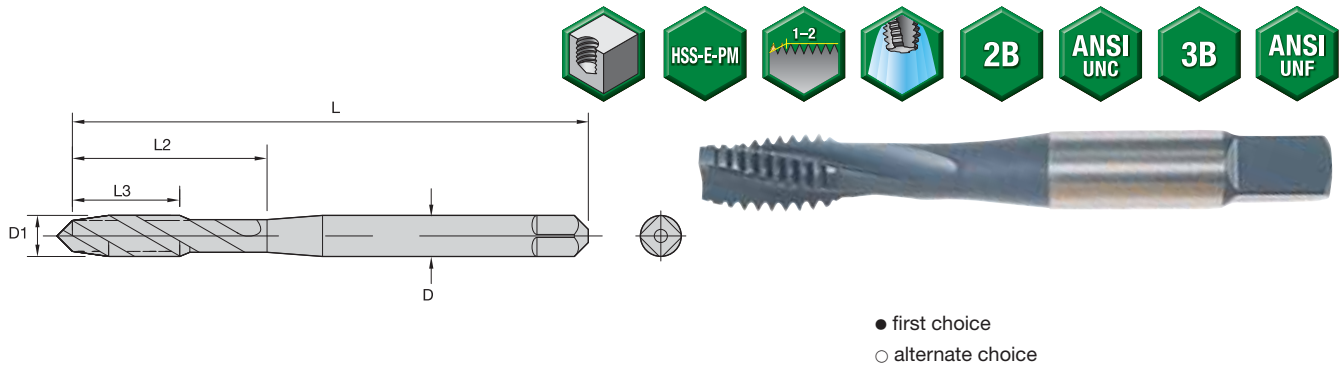
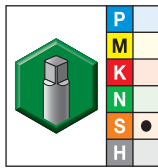
(Series 8604 • Machine Screw and Fractional • 3–4 Pitches Chamfer continued)



TiCN	oxide/nitride	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
—	87574	1/4 - 28	2.50	.63	1.00	.255	3	H7
87315	87515	5/16 - 18	2.72	.69	1.13	.318	3	H3
—	87545	5/16 - 18	2.72	.69	1.13	.318	3	H5
—	87542	5/16 - 18	2.72	.69	1.13	.318	3	H7
87316	87516	5/16 - 24	2.72	.69	1.13	.318	3	H3
—	87532	5/16 - 24	2.72	.69	1.13	.318	3	H4
—	87546	5/16 - 24	2.72	.69	1.13	.318	3	H5
—	87563	5/16 - 24	2.72	.69	1.13	.318	3	H6
—	87576	5/16 - 24	2.72	.69	1.13	.318	3	H7
87317	87517	3/8 - 16	2.94	.75	1.25	.381	3	H3
—	87547	3/8 - 16	2.94	.75	1.25	.381	3	H5
—	87553	3/8 - 16	2.94	.75	1.25	.381	3	H7
87318	87518	3/8 - 24	2.94	.75	1.25	.381	3	H3
—	87533	3/8 - 24	2.94	.75	1.25	.381	3	H4
—	87548	3/8 - 24	2.94	.75	1.25	.381	3	H5
—	87564	3/8 - 24	2.94	.75	1.25	.381	3	H6
—	87578	3/8 - 24	2.94	.75	1.25	.381	3	H7
87319	87519	7/16 - 14	3.16	.88	—	.323	3	H3
—	87549	7/16 - 14	3.16	.88	—	.323	3	H5
87220	87520	7/16 - 20	3.16	.88	—	.323	3	H3
—	87550	7/16 - 20	3.16	.88	—	.323	3	H5
87221	87521	1/2 - 13	3.38	.94	—	.367	3	H3
—	87551	1/2 - 13	3.38	.94	—	.367	3	H5
—	87554	1/2 - 13	3.38	.94	—	.367	3	H7
87222	87522	1/2 - 20	3.38	.94	—	.367	3	H3
—	87552	1/2 - 20	3.38	.94	—	.367	3	H5
—	87555	1/2 - 20	3.38	.94	—	.367	3	H7
—	87525	5/8 - 11	3.81	1.09	—	.480	4	H3
—	87526	5/8 - 18	3.81	1.09	—	.480	4	H3
—	87559	5/8 - 18	3.81	1.09	—	.480	4	H5
—	87586	5/8 - 18	3.81	1.09	—	.480	4	H7
—	87527	3/4 - 10	4.25	1.22	—	.590	4	H3
—	87557	3/4 - 10	4.25	1.22	—	.590	4	H5
—	87528	3/4 - 16	4.25	1.22	—	.590	4	H3
—	87558	3/4 - 16	4.25	1.22	—	.590	4	H5

EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

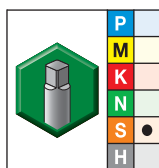
Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.


Series 8604 • Machine Screw and Fractional • Full Bottoming Chamfer


oxide/nitride	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
87582	4 - 40	1.88	.31	.56	.141	3	H2
87002	4 - 40	1.88	.31	.56	.141	3	H3
87072	4 - 40	1.88	.31	.56	.141	3	H5
87003	4 - 48	1.88	.31	.56	.141	3	H2
87581	5 - 40	1.94	.31	.63	.141	3	H2
87006	6 - 32	2.00	.38	.69	.141	3	H2
87005	6 - 32	2.00	.38	.69	.141	3	H3
87588	6 - 32	2.00	.38	.69	.141	3	H4
87035	6 - 32	2.00	.38	.69	.141	3	H5
87580	8 - 32	2.13	.38	.75	.168	3	H3
87037	8 - 32	2.13	.38	.75	.168	3	H5
87009	10 - 24	2.38	.50	.88	.194	3	H3
87039	10 - 24	2.38	.50	.88	.194	3	H5
87556	10 - 32	2.38	.50	.88	.194	3	H3
87040	10 - 32	2.38	.50	.88	.194	3	H5
87013	1/4 - 20	2.50	.63	1.00	.255	3	H3
87043	1/4 - 20	2.50	.63	1.00	.255	3	H5
87579	1/4 - 28	2.50	.63	1.00	.255	3	H3
87031	1/4 - 28	2.50	.63	1.00	.255	3	H4
87443	1/4 - 28	2.50	.63	1.00	.255	3	H5
87015	5/16 - 18	2.72	.69	1.13	.318	3	H3
87045	5/16 - 18	2.72	.69	1.13	.318	3	H5
87577	5/16 - 24	2.72	.69	1.13	.318	3	H3
87032	5/16 - 24	2.72	.69	1.13	.318	3	H4
87046	5/16 - 24	2.72	.69	1.13	.318	3	H5
87017	3/8 - 16	2.94	.75	1.25	.381	3	H3
87047	3/8 - 16	2.94	.75	1.25	.381	3	H5
87575	3/8 - 24	2.94	.75	1.25	.381	3	H3

(continued)

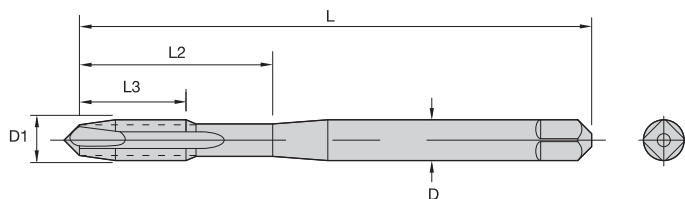
(Series 8604 • Machine Screw and Fractional • Full Bottoming Chamfer continued)



oxide/nitride	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
87033	3/8 - 24	2.94	.75	1.25	.381	3	H4
87048	3/8 - 24	2.94	.75	1.25	.381	3	H5
87019	7/16 - 14	3.16	.88	—	.323	3	H3
87049	7/16 - 14	3.16	.88	—	.323	3	H5
87573	7/16 - 20	3.16	.88	—	.323	3	H3
87050	7/16 - 20	3.16	.88	—	.323	3	H5
87500	1/2 - 13	3.38	.94	—	.367	3	H3
87051	1/2 - 13	3.38	.94	—	.367	3	H5
87022	1/2 - 20	3.38	.94	—	.367	3	H3
87052	1/2 - 20	3.38	.94	—	.367	3	H5
87025	5/8 - 11	3.81	1.09	—	.480	4	H3
87565	5/8 - 11	3.81	1.09	—	.480	4	H5
87585	5/8 - 11	3.81	1.09	—	.480	4	H7
87508	5/8 - 18	3.81	1.09	—	.480	4	H3
87027	3/4 - 10	4.25	1.22	—	.590	4	H3

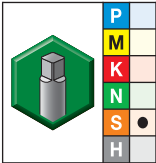
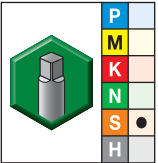
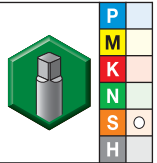
EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



- first choice
- alternate choice

■ Series 8654 • Modified Bottoming Chamfer • Metric ANSI

									
TiCN	oxide/nitride	uncoated	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
—	88320	—	M2,5 X 0,45	1.81	.50	—	.141	3	D3
88421	88321	88321B	M3 X 0,5	1.94	.31	.63	.141	3	D3
—	88322	—	M3,5 X 0,6	2.00	.38	.69	.141	3	D4
88423	88323	88323B	M4 X 0,7	2.13	.38	.75	.168	3	D4
88424	88324	88324B	M5 X 0,8	2.38	.50	.88	.194	3	D4
88425	88325	88325B	M6 X 1	2.50	.63	1.00	.255	3	D5
—	88326	—	M7 X 1	2.72	.69	1.13	.318	3	D5
—	88327	—	M8 X 1	2.72	.69	1.13	.318	3	D5
88428	88328	88328B	M8 X 1,25	2.72	.69	1.13	.318	3	D5
—	88329	—	M10 X 1,25	2.94	.75	1.25	.381	3	D5
88430	88330	88330B	M10 X 1,5	2.94	.75	1.25	.381	3	D6
—	88331	—	M12 X 1,25	3.38	.94	—	.367	3	D5
88432	88332	88332B	M12 X 1,75	3.38	.94	—	.367	3	D6

Metric taps for 6H class of fit are suitable for MJ aerospace internal threading applications.

Metric taps are manufactured to USCTI specifications and dimensions.

Metric tap blank dimensions are equivalent to inch taps.

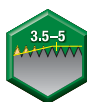
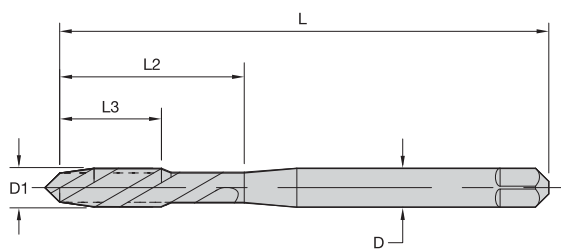
Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.

High-Performance Taps

EM-TI™ Left-Hand Spiral-Flute Taps • Through Holes

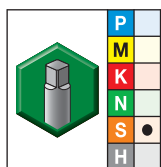
WIDIA
GTD™

Holemaking • High-Performance Taps



- first choice
- alternate choice

■ Series 8901 • Machine Screw and Fractional • Plug Chamfer

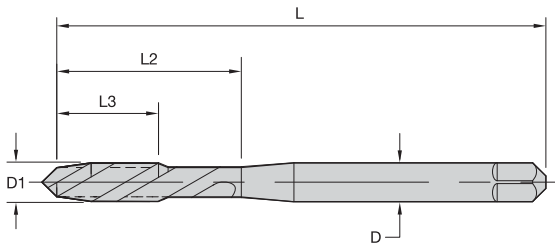


nitride	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
85623	2 - 56	1.75	.26	.44	.141	2	H2
85601	4 - 40	1.88	.34	.56	.141	3	H2
85603	5 - 40	1.94	.37	.63	.141	3	H2
85605	6 - 32	2.00	.41	.69	.141	3	H3
85635	6 - 32	2.00	.41	.69	.141	3	H5
85607	8 - 32	2.13	.45	.75	.168	3	H3
85637	8 - 32	2.13	.45	.75	.168	3	H5
85609	10 - 24	2.38	.53	.88	.194	3	H3
85639	10 - 24	2.38	.53	.88	.194	3	H5
85610	10 - 32	2.38	.53	.88	.194	3	H3
85640	10 - 32	2.38	.53	.88	.194	3	H5
85613	1/4 - 20	2.50	.59	1.00	.255	3	H3
85643	1/4 - 20	2.50	.59	1.00	.255	3	H5
85614	1/4 - 28	2.50	.59	1.00	.255	3	H3
85644	1/4 - 28	2.50	.59	1.00	.255	3	H5
85615	5/16 - 18	2.72	.67	1.13	.318	3	H3
85645	5/16 - 18	2.72	.67	1.13	.318	3	H5
85616	5/16 - 24	2.72	.67	1.13	.318	3	H3
85646	5/16 - 24	2.72	.67	1.13	.318	3	H5
85617	3/8 - 16	2.94	.75	1.25	.381	3	H3
85647	3/8 - 16	2.94	.75	1.25	.381	3	H5
85618	3/8 - 24	2.94	.75	1.25	.381	3	H3
85648	3/8 - 24	2.94	.75	1.25	.381	3	H5
85619	7/16 - 14	3.16	.87	—	.323	3	H3
85649	7/16 - 14	3.16	.87	—	.323	3	H5
85620	7/16 - 20	3.16	.87	—	.323	3	H3
85650	7/16 - 20	3.16	.87	—	.323	3	H5
85621	1/2 - 13	3.38	.98	—	.367	3	H3
85651	1/2 - 13	3.38	.98	—	.367	3	H5
85622	1/2 - 20	3.38	.98	—	.367	3	H3
85652	1/2 - 20	3.38	.98	—	.367	3	H5

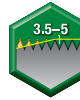
EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.

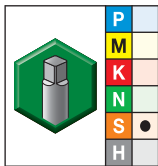
WIDIA
GTD™



- first choice
- alternate choice



■ Series 8951 • Plug Chamfer • Metric ANSI



nitride	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
85700	M2,5 X 0,45	1.81	.295	.500	.141	3	D3
85701	M3 X 0,5	1.94	.374	.625	.141	3	D3
85702	M3,5 X 0,6	2.00	.413	.688	.141	3	D4
85703	M4 X 0,7	2.13	.453	.750	.168	3	D4
85704	M5 X 0,8	2.38	.531	.875	.194	3	D4
85705	M6 X 1	2.50	.591	1.000	.255	3	D5
85706	M7 X 1	2.72	.669	1.125	.318	3	D5
85707	M8 X 1	2.72	.669	1.125	.318	3	D5
85708	M8 X 1,25	2.72	.669	1.125	.318	3	D5
85709	M10 X 1,25	2.94	.748	1.250	.381	3	D5
85710	M10 X 1,5	2.94	.748	1.250	.381	3	D6
85711	M12 X 1,25	3.38	.984	—	.367	3	D5
85712	M12 X 1,75	3.38	.984	—	.367	3	D6

Metric taps for 6H class of fit are suitable for MJ aerospace internal threading applications.

Metric taps are manufactured to USCTI specifications and dimensions.

Metric tap blank dimensions are equivalent to inch taps.

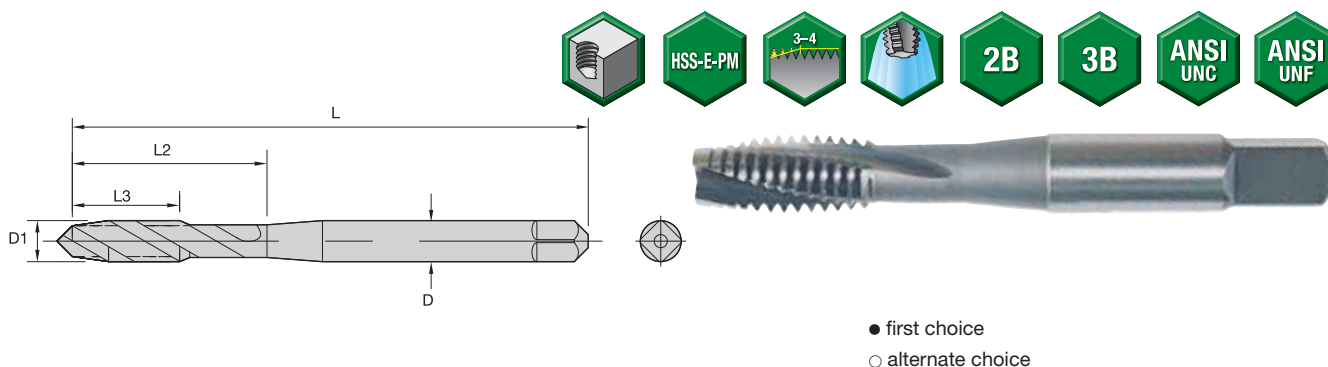
Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.

High-Performance Taps

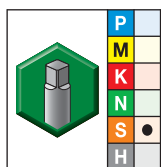
EM-TI™ High-Performance Spiral-Flute Taps • Blind Holes

WIDIA
GTD™

Holemaking • High-Performance Taps



■ Series 8904 • Machine Screw and Fractional • 3–4 Pitches Chamfer

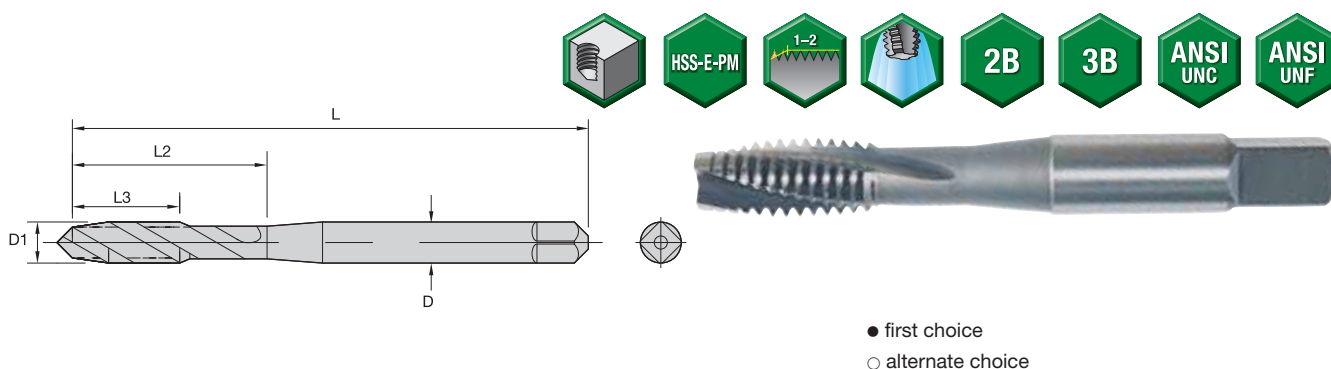
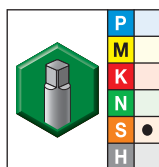


nitride	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
87638	2 - 56	1.75	.16	.44	.141	3	H2
87601	4 - 40	1.88	.24	.56	.141	3	H2
87612	4 - 40	1.88	.24	.56	.141	3	H4
87603	5 - 40	1.94	.24	.63	.141	3	H3
87605	6 - 32	2.00	.28	.69	.141	3	H3
87635	6 - 32	2.00	.28	.69	.141	3	H5
87607	8 - 32	2.13	.28	.75	.168	3	H3
87637	8 - 32	2.13	.28	.75	.168	3	H5
87609	10 - 24	2.38	.35	.88	.194	3	H3
87610	10 - 32	2.38	.28	.88	.194	3	H3
87640	10 - 32	2.38	.28	.88	.194	3	H5
87613	1/4 - 20	2.50	.43	1.00	.255	3	H3
87624	1/4 - 20	2.50	.43	1.00	.255	3	H5
87614	1/4 - 28	2.50	.35	1.00	.255	3	H3
87644	1/4 - 28	2.50	.35	1.00	.255	3	H5
87615	5/16 - 18	2.72	.47	1.13	.318	3	H3
87623	5/16 - 18	2.72	.47	1.13	.318	3	H5
87616	5/16 - 24	2.72	.39	1.13	.318	3	H3
87646	5/16 - 24	2.72	.39	1.13	.318	3	H5
87617	3/8 - 16	2.94	.55	1.25	.381	3	H3
87625	3/8 - 16	2.94	.55	1.25	.381	3	H5
87618	3/8 - 24	2.94	.39	1.25	.381	3	H3
87648	3/8 - 24	2.94	.39	1.25	.381	3	H5
87619	7/16 - 14	3.16	.59	—	.323	3	H3
87620	7/16 - 20	3.16	.47	—	.323	3	H3
87650	7/16 - 20	3.16	.47	—	.323	3	H5
87621	1/2 - 13	3.38	.63	—	.367	3	H3
87626	1/2 - 13	3.38	.63	—	.367	3	H5
87622	1/2 - 20	3.38	.47	—	.367	3	H3
87652	1/2 - 20	3.38	.47	—	.367	3	H5

EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.

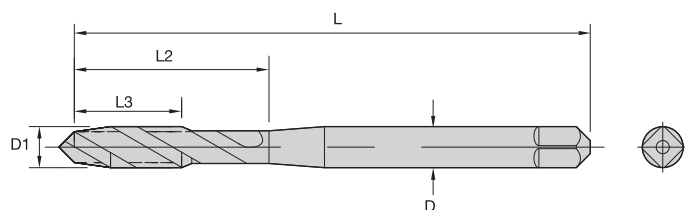
WIDIA
GTD™


Series 8904 • Machine Screw and Fractional • Full Bottoming Chamfer


nitride	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
87000	4 - 40	1.88	.24	.56	.141	3	H2
87001	4 - 40	1.88	.24	.56	.141	3	H4
87606	6 - 32	2.00	.28	.69	.141	3	H3
87007	8 - 32	2.13	.28	.75	.168	3	H3
87608	10 - 24	2.38	.35	.88	.194	3	H3
87010	10 - 32	2.38	.28	.88	.194	3	H3
87628	1/4 - 20	2.50	.43	1.00	.255	3	H3
87627	1/4 - 20	2.50	.43	1.00	.255	3	H5
87014	1/4 - 28	2.50	.35	1.00	.255	3	H3
87695	5/16 - 18	2.72	.47	1.13	.318	3	H3
87079	5/16 - 18	2.72	.47	1.13	.318	3	H5
87016	5/16 - 24	2.72	.39	1.13	.318	3	H3
87611	3/8 - 16	2.94	.55	1.25	.381	3	H3
87685	3/8 - 16	2.94	.55	1.25	.381	3	H5
87018	3/8 - 24	2.94	.39	1.25	.381	3	H3
87629	7/16 - 14	3.16	.59	—	.323	3	H3
87020	7/16 - 20	3.16	.47	—	.323	3	H3
87021	1/2 - 13	3.38	.63	—	.367	3	H3
87023	1/2 - 20	3.38	.47	—	.367	3	H3

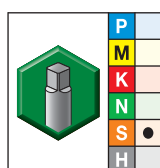
EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



- first choice
- alternate choice

■ Series 8954 • 3–4 Pitches Chamfer • Metric ANSI



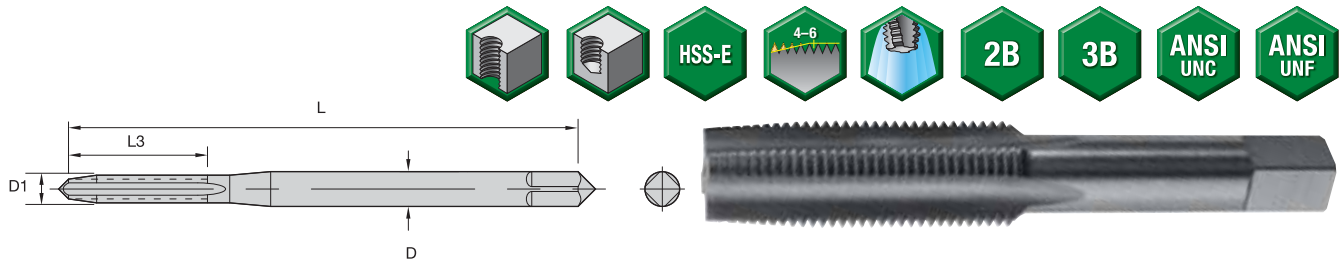
nitride	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
87700	M2,5 X 0,45	1.81	.295	.500	.141	3	D3
87701	M3 X 0,5	1.94	.197	.625	.141	3	D3
87702	M3,5 X 0,6	2.00	.276	.688	.141	3	D4
87703	M4 X 0,7	2.13	.276	.750	.168	3	D4
87704	M5 X 0,8	2.38	.354	.875	.194	3	D4
87705	M6 X 1	2.50	.433	1.000	.255	3	D5
87706	M7 X 1	2.72	.433	1.125	.318	3	D5
87708	M8 X 1,25	2.72	.472	1.125	.318	3	D5
87709	M10 X 1,25	2.94	.472	1.250	.381	3	D5
87710	M10 X 1,5	2.94	.512	1.250	.381	3	D6
87711	M12 X 1,25	3.38	.551	—	.367	3	D5
87712	M12 X 1,75	3.38	.591	—	.367	3	D6

Metric taps for 6H class of fit are suitable for MJ aerospace internal threading applications.

Metric taps are manufactured to USCTI specifications and dimensions.

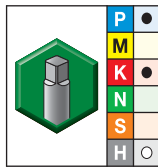
Metric tap blank dimensions are equivalent to inch taps.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.



- first choice
 ○ alternate choice

■ Series 8330 • Machine Screw and Fractional • Plug Chamfer



uncoated	D1 size	L	L3	D	number of flutes	pitch diameter limit
89599	4 - 40	1.88	.56	.141	3	H2
89601	5 - 40	1.94	.63	.141	3	H2
89602	6 - 32	2.00	.69	.141	3	H3
89604	8 - 32	2.13	.75	.168	3	H3
89606	10 - 24	2.38	.88	.194	3	H3
89607	10 - 32	2.38	.88	.194	3	H3
89613	1/4 - 20	2.50	1.00	.255	3	H3
89614	1/4 - 28	2.50	1.00	.255	3	H3
89615	5/16 - 18	2.72	1.13	.318	4	H3
89616	5/16 - 24	2.72	1.13	.318	4	H3
89617	3/8 - 16	2.94	1.25	.381	4	H3
89618	3/8 - 24	2.94	1.25	.381	4	H3
89619	7/16 - 14	3.16	1.44	.323	4	H3
89620	7/16 - 20	3.16	1.44	.323	4	H3
89621	1/2 - 13	3.38	1.66	.367	4	H3
89622	1/2 - 20	3.38	1.66	.367	4	H3
89625	5/8 - 11	3.81	1.81	.480	4	H3
89626	5/8 - 18	3.81	1.81	.480	4	H3
89627	3/4 - 10	4.25	2.00	.590	4	H3
89628	3/4 - 16	4.25	2.00	.590	4	H3

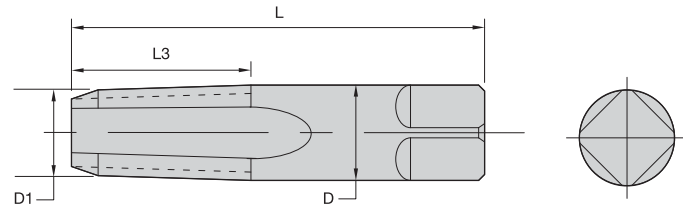
Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.

High-Performance Taps

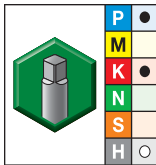
EM-MS™ NPT Straight-Flute Taper Pipe Taps



- first choice
- alternate choice

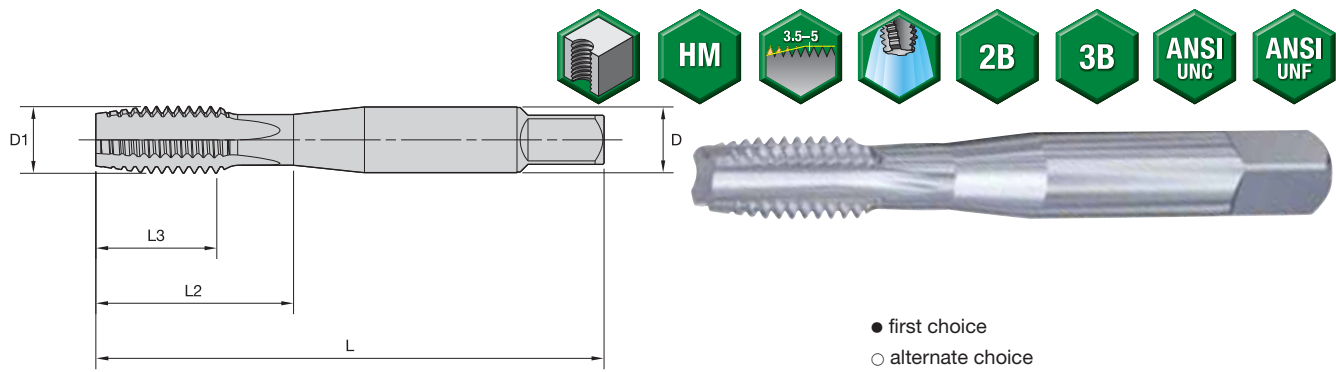


Series 8320 • NPT Pipe • Chamfer 2-1/2-3-1/2 Pitches

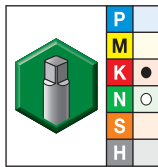


uncoated	D1 size	L	L3	D	number of flutes
89641	1/8 - 27	2.13	.750	.313	4
89643	1/4 - 18	2.44	1.063	.563	4
89644	3/8 - 18	2.56	1.063	.703	4
89645	1/2 - 14	3.13	1.375	.367	4
89646	3/4 - 14	3.25	1.375	.906	5

* Pipe tap projection is the distance the small end of the tap projects through an American National Standard L1 Pipe Thread Ring Gage.
For gage measurement projection, see technical page A253.

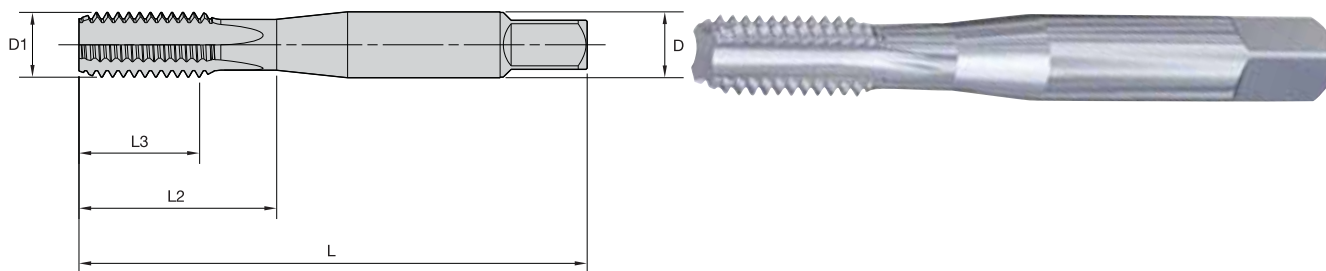


■ Series 8603 • Machine Screw and Fractional • Plug Chamfer



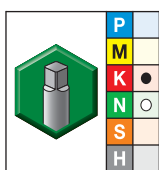
uncoated	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
83806	10 - 24	2.38	.50	.70	.194	4	H3
83808	10 - 32	2.38	.50	.70	.194	4	H3
83810	1/4 - 20	2.50	.56	.90	.255	4	H3
83812	1/4 - 28	2.50	.56	.90	.255	4	H3
83862	1/4 - 28	2.50	.56	.90	.255	4	H5
83814	5/16 - 18	2.72	.63	1.03	.318	4	H3
83816	5/16 - 24	2.72	.63	1.03	.318	4	H3
83818	3/8 - 16	2.94	.71	1.14	.381	4	H3
83868	3/8 - 16	2.94	.71	1.14	.381	4	H5
83820	3/8 - 24	2.94	.71	1.14	.381	4	H3
83870	3/8 - 24	2.94	.71	1.14	.381	4	H5
83824	7/16 - 20	3.16	.88	—	.323	4	H3
83874	7/16 - 20	3.16	.88	—	.323	4	H5
83826	1/2 - 13	3.38	.94	—	.367	4	H3
83828	1/2 - 20	3.38	.94	—	.367	4	H3
83878	1/2 - 20	3.38	.94	—	.367	4	H5
83836	5/8 - 18	3.81	1.09	—	.480	4	H3

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



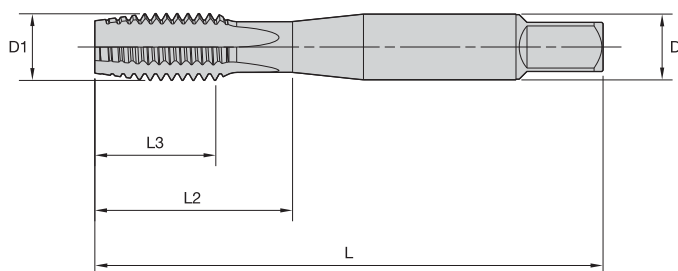
- first choice
- alternate choice

■ Series 8603 • Machine Screw and Fractional • Full Bottoming Chamfer



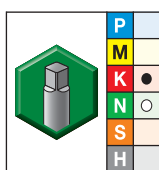
uncoated	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
83807	10 - 24	2.38	.50	.70	.194	4	H3
83809	10 - 32	2.38	.50	.70	.194	4	H3
83811	1/4 - 20	2.50	.56	.90	.255	4	H3
83861	1/4 - 20	2.50	.56	.90	.255	4	H5
83813	1/4 - 28	2.50	.56	.90	.255	4	H3
83863	1/4 - 28	2.50	.56	.90	.255	4	H5
83815	5/16 - 18	2.72	.63	1.03	.318	4	H3
83865	5/16 - 18	2.72	.63	1.03	.318	4	H5
83817	5/16 - 24	2.72	.63	1.03	.318	4	H3
83819	3/8 - 16	2.94	.71	1.14	.381	4	H3
83821	3/8 - 24	2.94	.71	1.14	.381	4	H3
83875	7/16 - 20	3.16	.88	—	.323	4	H5
83827	1/2 - 13	3.38	.94	—	.367	4	H3
83835	5/8 - 11	3.81	1.09	—	.480	4	H3

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



- first choice
- alternate choice

■ Series 8653 • Plug Chamfer • Metric ANSI



	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
uncoated							
70000	M3 X 0,5	1.94	.31	.52	.141	4	D3
70002	M4 X 0,7	2.13	.38	.64	.168	4	D4
70004	M5 X 0,8	2.38	.50	.70	.194	4	D4
70006	M6 X 1	2.50	.56	.90	.255	4	D5
70008	M8 X 1	2.72	.63	1.03	.318	4	D5
70010	M8 X 1,25	2.72	.63	1.03	.318	4	D5
70012	M10 X 1,25	2.94	.74	1.13	.381	4	D5
70014	M10 X 1,5	2.94	.74	1.13	.381	4	D6
70016	M12 X 1,25	3.38	.94	—	.367	4	D5
70018	M12 X 1,5	3.38	.94	—	.367	4	D6
70020	M12 X 1,75	3.38	.94	—	.367	4	D6
70024	M14 X 2	3.59	1.00	—	.429	4	D7
70026	M16 X 1,5	3.81	1.09	—	.480	4	D6

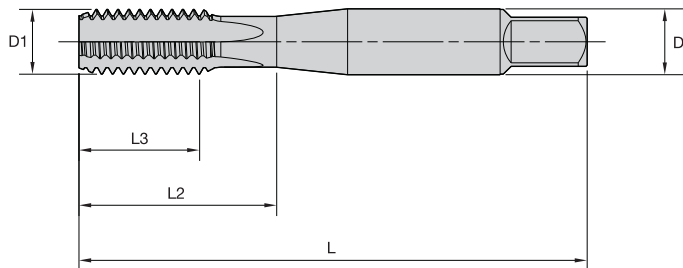
Metric taps are manufactured to USCTI specifications and dimensions.

Metric tap blank dimensions are equivalent to inch taps.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.

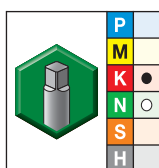
High-Performance Taps

Solid Carbide Straight-Flute Taps • Blind Holes



- first choice
- alternate choice

Series 8653 • Full Bottoming Chamfer • Metric ANSI

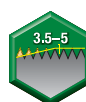
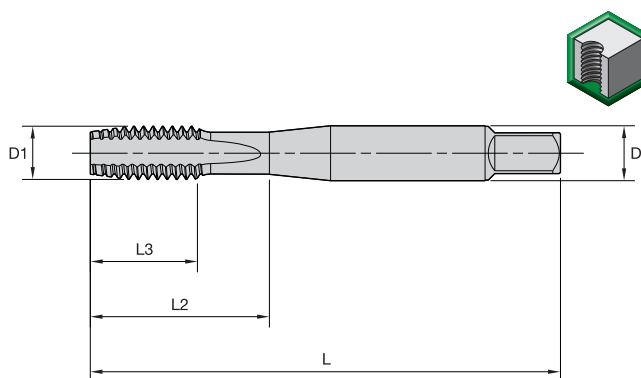


uncoated	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
70003	M4 X 0,7	2.13	.380	.64	.168	4	D4
70005	M5 X 0,8	2.38	.500	.70	.194	4	D4
70007	M6 X 1	2.50	.560	.90	.255	4	D5
70009	M8 X 1	2.72	.630	1.03	.318	4	D5
70011	M8 X 1,25	2.72	.630	1.03	.318	4	D5
70013	M10 X 1,25	2.94	.740	1.13	.381	4	D5
70015	M10 X 1,5	2.94	.740	1.13	.381	4	D6
70023	M14 X 1,5	3.59	1.000	—	.429	4	D6
70029	M16 X 2	3.81	1.090	—	.480	4	D7

Metric taps are manufactured to USCTI specifications and dimensions.

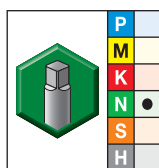
Metric tap blank dimensions are equivalent to inch taps.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.



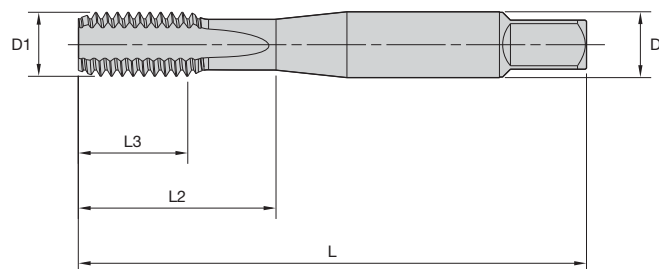
- first choice
- alternate choice

■ Series 8703 • Machine Screw and Fractional • Plug Chamfer



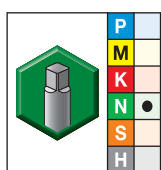
uncoated	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
84802	6 - 32	2.00	.38	.60	.141	3	H3
84804	8 - 32	2.13	.38	.64	.168	3	H3
84806	10 - 24	2.38	.50	.70	.194	3	H3
84808	10 - 32	2.38	.49	.70	.194	3	H3
84810	1/4 - 20	2.50	.56	.90	.255	3	H3
84860	1/4 - 20	2.50	.56	.90	.255	3	H5
84812	1/4 - 28	2.50	.56	.90	.255	3	H3
84862	1/4 - 28	2.50	.56	.90	.255	3	H5
84814	5/16 - 18	2.72	.63	1.03	.318	3	H3
84864	5/16 - 18	2.72	.63	1.03	.318	3	H5
84816	5/16 - 24	2.72	.63	1.03	.318	3	H3
84818	3/8 - 16	2.94	.71	1.14	.381	3	H3
84820	3/8 - 24	2.94	.71	1.14	.381	3	H3
84870	3/8 - 24	2.94	.71	1.14	.381	3	H5
84824	7/16 - 20	3.16	.88	—	.323	3	H3
84874	7/16 - 20	3.16	.88	—	.323	3	H5
84826	1/2 - 13	3.38	.94	—	.367	3	H3
84878	1/2 - 20	3.38	.94	—	.367	3	H5

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



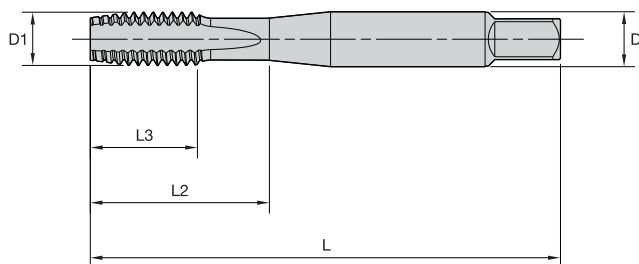
- first choice
- alternate choice

■ Series 8703 • Machine Screw and Fractional • Full Bottoming Chamfer



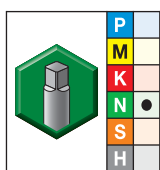
uncoated	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
84801	5 - 40	1.94	.31	.52	.141	3	H3
84803	6 - 32	2.00	.38	.60	.141	3	H3
84805	8 - 32	2.13	.38	.64	.168	3	H3
84807	10 - 24	2.38	.50	.70	.194	3	H3
84809	10 - 32	2.38	.50	.70	.194	3	H3
84811	1/4 - 20	2.50	.56	.90	.255	3	H3
84861	1/4 - 20	2.50	.56	.90	.255	3	H5
84813	1/4 - 28	2.50	.56	.90	.255	3	H3
84865	5/16 - 18	2.72	.63	1.03	.318	3	H5
84817	5/16 - 24	2.72	.63	1.02	.318	3	H3
84867	5/16 - 24	2.72	.63	1.03	.318	3	H5
84819	3/8 - 16	2.94	.71	1.25	.381	3	H3
84873	7/16 - 14	2.94	.88	1.14	.323	3	H5
84879	1/2 - 20	3.16	.94	—	.367	3	H5

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



- first choice
- alternate choice

■ Series 8753 • Plug Chamfer • Metric ANSI



uncoated	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
71000	M3 X 0,5	1.94	.31	.52	.141	3	D3
71002	M4 X 0,7	2.13	.38	.64	.168	3	D4
71004	M5 X 0,8	2.38	.50	.70	.194	3	D4
71006	M6 X 1	2.50	.56	.90	.255	3	D5
71008	M8 X 1	2.72	.63	1.03	.318	3	D5
71010	M8 X 1,25	2.72	.63	1.03	.318	3	D5
71014	M10 X 1,5	2.94	.71	1.13	.381	3	D6

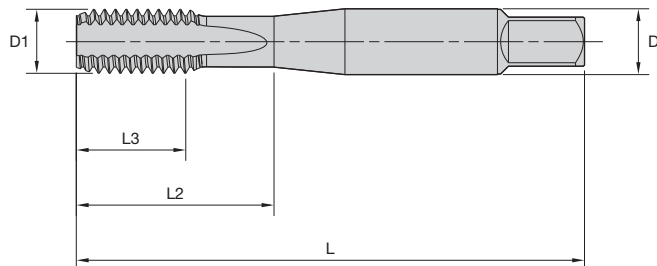
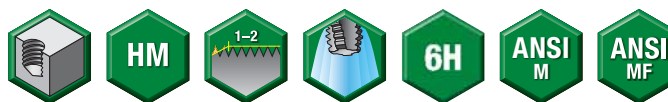
Metric taps are manufactured to USCTI specifications and dimensions.

Metric tap blank dimensions are equivalent to inch taps.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.

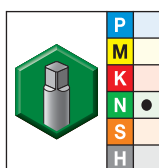
High-Performance Taps

Solid Carbide Straight-Flute Taps • Blind Holes



- first choice
- alternate choice

Series 8753 • Full Bottoming Chamfer • Metric ANSI

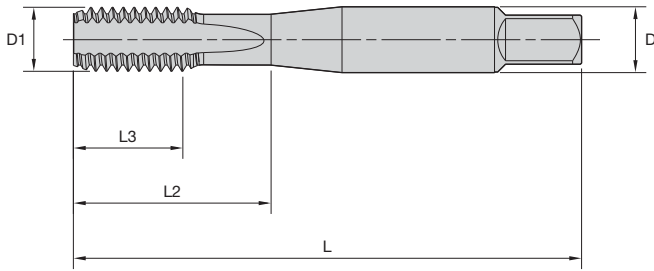


uncoated	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
71001	M3 X 0,5	1.94	.310	.520	.141	3	D3
71003	M4 X 0,7	2.13	.380	.640	.168	3	D4
71005	M5 X 0,8	2.38	.500	.700	.194	3	D4
71007	M6 X 1	2.50	.560	.900	.255	3	D5
71011	M8 X 1,25	2.72	.630	1.030	.318	3	D5
71013	M10 X 1,25	2.94	.710	1.130	.381	3	D5
71015	M10 X 1,5	2.94	.710	1.130	.381	3	D6
71017	M12 X 1,25	3.38	.940	—	.367	3	D5
71019	M12 X 1,5	3.38	.940	—	.367	3	D6

Metric taps are manufactured to USCTI specifications and dimensions.

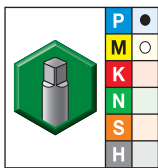
Metric tap blank dimensions are equivalent to inch taps.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.



- first choice
- alternate choice

■ Series 8580 • Machine Screw and Fractional • Entry Taper • DIN Length • Minimum Quantity Lubrication (MQL)

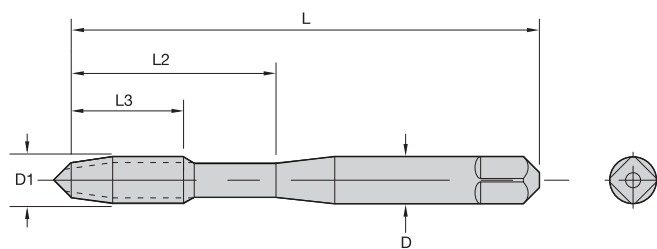


						number of lube grooves	pitch diameter limit
TiCN	D1 size	L	L3	L2	D		
86600	2 - 56	1.77	.354	.354	.141	—	H3
86601	4 - 40	2.21	.433	.709	.141	—	H5
86602	4 - 48	2.21	.433	.709	.141	—	H5
86603	5 - 40	2.21	.433	.709	.141	—	H5
86604	6 - 32	2.21	.512	.787	.141	—	H5
86605	8 - 32	2.48	.512	.827	.168	—	H5
86606	10 - 24	2.76	.630	.984	.194	—	H6
86607	10 - 32	2.76	.630	.984	.194	—	H6
86608	1/4 - 20	3.15	.748	1.181	.255	—	H6
86609	1/4 - 28	3.15	.748	1.181	.255	—	H6

EM-TLD form taps can be run 1.5–2 times faster than the tapping speeds recommended for thread cutting taps.

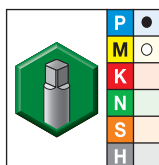
Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



- first choice
- alternate choice

■ Series 8590 • Entry Taper • Minimum Quantity Lubrication (MQL) • DIN Length • Metric ANSI



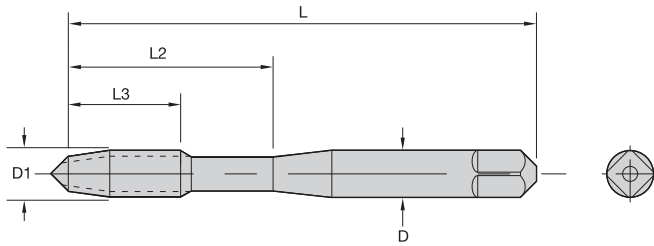
TiCN	D1 size	L	L3	L2	D	number of lube grooves	pitch diameter limit
86610	M3 X 0,5	2.21	.433	.709	.141	—	D5
86611	M3,5 X 0,6	2.21	.512	.787	.141	—	D6
86612	M4 X 0,7	2.48	.512	.827	.168	—	D7
86614	M5 X 0,8	2.76	.630	.984	.194	—	D7
86615	M6 X 1	3.15	.748	1.181	.255	—	D8

EM-TLD form taps can be run 1.5–2 times faster than the tapping speeds recommended for thread cutting taps.

Metric tap shank dimensions are equivalent to inch taps.

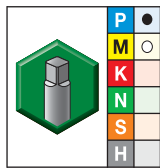
Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.



- first choice
 ○ alternate choice

■ Series 8502 • Machine Screw and Fractional • Bottom Entry Taper • DIN Length



TiCN	D1 size	L	L3	L2	D	number of lube grooves	pitch diameter limit
86800	0 - 80	1.58	.32	—	.141	—	H2
86801	2 - 56	1.77	.35	—	.141	—	H3
86802	3 - 48	1.97	.28	.49	.141	—	H3
86803	3 - 56	1.97	.28	.49	.141	—	H3
86804	4 - 40	2.21	.43	.71	.141	—	H3
86805	4 - 40	2.21	.43	.71	.141	—	H5
86806	4 - 48	2.21	.43	.71	.141	—	H3
86807	4 - 48	2.21	.43	.71	.141	—	H5
86799	5 - 40	2.21	.43	.71	.141	—	H5
86808	6 - 32	2.21	.51	.79	.141	2	H3
86809	6 - 32	2.21	.51	.79	.141	2	H5
86812	8 - 32	2.48	.51	.83	.168	2	H3
86813	8 - 32	2.48	.51	.83	.168	2	H5
86816	10 - 24	2.76	.63	.98	.194	2	H4
86817	10 - 24	2.76	.63	.98	.194	2	H6
86820	10 - 32	2.76	.63	.98	.194	2	H4
86821	10 - 32	2.76	.63	.98	.194	2	H6
86824	1/4 - 20	3.15	.75	1.18	.255	2	H4
86825	1/4 - 20	3.15	.75	1.18	.255	2	H6
86828	1/4 - 28	3.15	.75	1.18	.255	2	H4
86829	1/4 - 28	3.15	.75	1.18	.255	2	H6
86832	5/16 - 18	3.54	.87	1.38	.318	3	H5
86833	5/16 - 18	3.54	.87	1.38	.318	3	H7
86836	5/16 - 24	3.54	.87	1.38	.318	3	H5
86837	5/16 - 24	3.54	.87	1.38	.318	3	H7
86840	3/8 - 16	3.94	.95	1.54	.381	3	H5
86841	3/8 - 16	3.94	.95	1.54	.381	3	H7
86844	3/8 - 24	3.94	.79	1.54	.381	3	H5
86845	3/8 - 24	3.94	.79	1.54	.381	3	H7
86848	7/16 - 14	3.94	.95	—	.323	4	H5
86849	7/16 - 14	3.94	.95	—	.323	4	H7
86852	7/16 - 20	3.94	.95	—	.323	4	H5
86853	7/16 - 20	3.94	.95	—	.323	4	H7
86856	1/2 - 13	4.33	1.14	—	.367	4	H5
86857	1/2 - 13	4.33	1.14	—	.367	4	H7
86860	1/2 - 20	4.33	.87	—	.367	4	H5
86861	1/2 - 20	4.33	.87	—	.367	4	H7

EM-TL form taps can be run 1.5–2 times faster than the tapping speeds recommended for thread cutting taps.

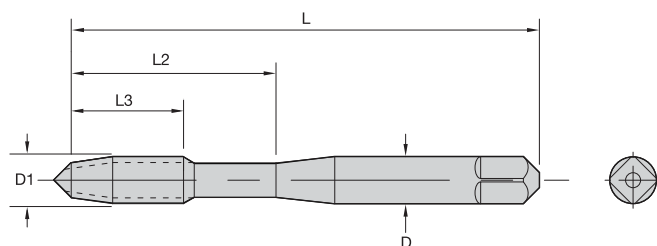
Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

Made to DIN tap lengths, ANSI shank dimensions.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.

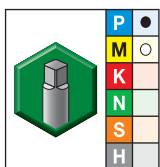
High-Performance Taps

EM-TL TRU-LEDE™ High-Performance Forming Taps • Blind Holes



- first choice
- alternate choice

Series 8512 • Bottom Entry Taper • DIN Length • Metric ANSI



TiCN	D1 size	L	L3	L2	D	number of lube grooves	pitch diameter limit
86864	M3 X 0,5	2.21	.433	.709	.141	2	D5
86865	M3,5 X 0,6	2.21	.512	.787	.141	2	D6
86866	M4 X 0,7	2.48	.512	.827	.168	2	D6
86867	M5 X 0,8	2.76	.630	.984	.194	2	D7
86868	M6 X 1	3.15	.748	1.181	.255	2	D8
86869	M7 X 1	3.15	.748	1.181	.318	2	D9
86871	M8 X 1	3.54	.866	1.378	.318	3	D9
86873	M8 X 1,25	3.54	.866	1.378	.318	3	D9
86875	M10 X 1,25	3.94	.945	1.535	.381	4	D9
86877	M10 X 1,5	3.94	.945	1.535	.381	4	D10
86879	M12 X 1,25	3.94	.866	—	.367	4	D9
86881	M12 X 1,5	3.94	.866	—	.367	4	D9
86883	M12 X 1,75	4.33	1.142	—	.367	4	D11

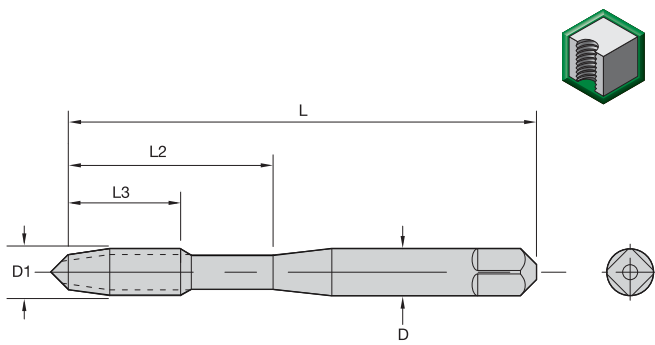
EM-TL form taps can be run 1.5–2 times faster than the tapping speeds recommended for thread cutting taps.

Metric tap shank dimensions are equivalent to inch taps.

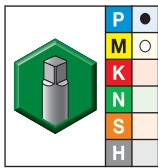
Made to DIN tap lengths, ANSI shank dimensions.

Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.



- first choice
- alternate choice

Series 8500 • Machine Screw and Fractional • Plug Entry Taper • DIN Length


	TiCN	D1 size	L	L3	L2	D	number of lube grooves	pitch diameter limit
	86800	0 - 80	1.58	.32	—	.141	—	H2
	86801	2 - 56	1.77	.35	—	.141	—	H3
	86802	3 - 48	1.97	.28	.49	.141	—	H3
	86803	3 - 56	1.97	.28	.49	.141	—	H3
	86804	4 - 40	2.21	.43	.71	.141	—	H3
	86805	4 - 40	2.21	.43	.71	.141	—	H5
	86806	4 - 48	2.21	.43	.71	.141	—	H3
	86807	4 - 48	2.21	.43	.71	.141	—	H5
	86799	5 - 40	2.21	.43	.71	.141	—	H5
	86808	6 - 32	2.21	.51	.79	.141	2	H3
	86809	6 - 32	2.21	.51	.79	.141	2	H5
	86812	8 - 32	2.48	.51	.83	.168	2	H3
	86813	8 - 32	2.48	.51	.83	.168	2	H5
	86816	10 - 24	2.76	.63	.98	.194	2	H4
	86817	10 - 24	2.76	.63	.98	.194	2	H6
	86820	10 - 32	2.76	.63	.98	.194	2	H4
	86821	10 - 32	2.76	.63	.98	.194	2	H6
	86824	1/4 - 20	3.15	.75	1.18	.255	2	H4
	86825	1/4 - 20	3.15	.75	1.18	.255	2	H6
	86828	1/4 - 28	3.15	.75	1.18	.255	2	H4
	86829	1/4 - 28	3.15	.75	1.18	.255	2	H6
	86832	5/16 - 18	3.54	.87	1.38	.318	3	H5
	86833	5/16 - 18	3.54	.87	1.38	.318	3	H7
	86836	5/16 - 24	3.54	.87	1.38	.318	3	H5
	86837	5/16 - 24	3.54	.87	1.38	.318	3	H7
	86840	3/8 - 16	3.94	.95	1.54	.381	3	H5
	86841	3/8 - 16	3.94	.95	1.54	.381	3	H7
	86844	3/8 - 24	3.94	.79	1.54	.381	3	H5
	86845	3/8 - 24	3.94	.79	1.54	.381	3	H7
	86848	7/16 - 14	3.94	.95	—	.323	4	H5
	86849	7/16 - 14	3.94	.95	—	.323	4	H7
	86852	7/16 - 20	3.94	.95	—	.323	4	H5
	86853	7/16 - 20	3.94	.95	—	.323	4	H7
	86856	1/2 - 13	4.33	1.14	—	.367	4	H5
	86857	1/2 - 13	4.33	1.14	—	.367	4	H7
	86860	1/2 - 20	4.33	.87	—	.367	4	H5
	86861	1/2 - 20	4.33	.87	—	.367	4	H7

EM-TL form taps can be run 1.5–2 times faster than the tapping speeds recommended for thread cutting taps.

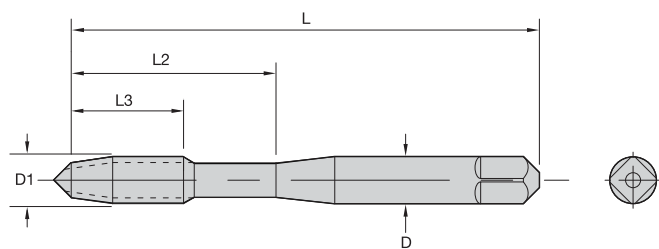
Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

Made to DIN tap lengths, ANSI shank dimensions.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.

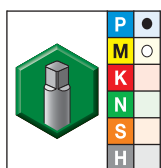
High-Performance Taps

EM-TL TRU-LEDE™ High-Performance Forming Taps • Through Holes



- first choice
- alternate choice

Series 8510 • Plug Entry Taper • DIN Length • Metric ANSI



TiCN	D1 size	L	L3	L2	D	number of lube grooves	pitch diameter limit
86885	M3 X 0,5	2.21	.43	.71	.141	2	D5
86886	M3,5 X 0,6	2.21	.51	.79	.141	2	D6
86887	M4 X 0,7	2.48	.51	.83	.168	2	D6
86888	M5 X 0,8	2.76	.63	.98	.194	2	D7
86889	M6 X 1	3.15	.75	1.18	.255	2	D8
86870	M7 X 1	3.15	.75	1.18	.318	2	D9
86872	M8 X 1	3.54	.87	1.38	.318	3	D9
86874	M8 X 1,25	3.54	.87	1.38	.318	3	D9
86876	M10 X 1,25	3.94	.95	1.54	.381	4	D9
86878	M10 X 1,5	3.94	.95	1.54	.381	4	D10
86880	M12 X 1,25	3.94	.87	—	.367	4	D9
86882	M12 X 1,5	3.94	.87	—	.367	4	D9
86884	M12 X 1,75	4.33	1.14	—	.367	4	D11

EM-TL form taps can be run 1.5–2 times faster than the tapping speeds recommended for thread cutting taps.

Metric tap shank dimensions are equivalent to inch taps.

Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.

On the Web



Fast, Free, and Easy Registration

You can easily register with www.widia.com to obtain full access to the features of the site.

Find a Local Authorized WIDIA™ Distributor in Your Area

The WIDIA Products Group offers world-class products and services globally. Our distributors know us, and more importantly, they know you. They know better than anyone in the industry how to put the global power of WIDIA to work for you — in your industry, in your region, and for your business.

Contact Us

Our customers are important to us. We want to provide you the best customer service in the industry. If you have a comment or question, please send it to us. We strive to respond to all inquiries within 24 hours.

WIDIA Products

Whether your operation is turning, milling, or holmaking, WIDIA brands are the high-performance tooling you need. We offer standard and custom solutions for the general engineering market.

Production Taps

WIDIA-GTD™ offers an extensive line of thread-cutting and thread-forming taps for any industrial application, manufactured using the highest quality materials and workmanship since 1872.



New GP+ GUN™ Taps

- The new WIDIA-GTD GP+ GUN taps have an optimized flute design for lower tapping torque and improved neck design for more efficient coolant flow.
- Higher quality thread and tool life.
- Enhanced performance with tool life at least 35% better than current GUN taps.
- Uncoated, TiCN, and TiN+CrC/C coatings available for tapping a broad range of materials.

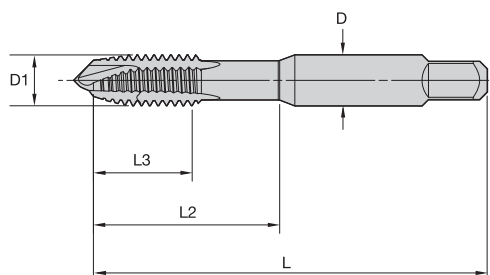
Alternate Coatings

WIDIA-GTD's in-house tool coating capabilities lead the industry! Choose from a wide range of sizes, tap limits, chamfers, and styles for through and blind holes.



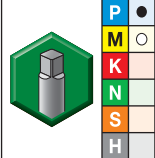
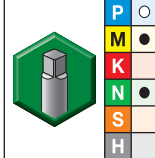
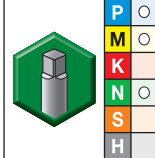
New TRU-LEDE™ Fe Taps

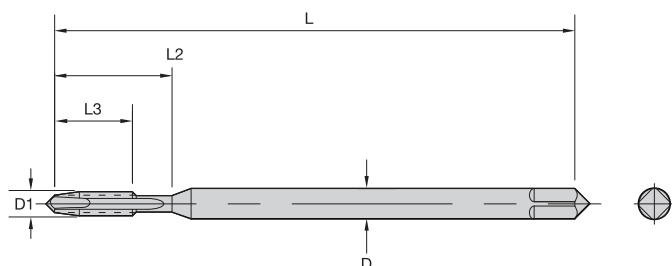
- The next generation of forming taps.
- Made from vanadium high-speed steel for extending wear life and better part finish.
- New tap lobe design improves roll threading in ductile steels and non-ferrous materials for better tool life.
- Necked design with short thread length for tapping at reduced torque levels.
- Plug and bottoming chamfers for form tapping without troublesome chips that clog and break taps.
- Performance-enhancing surface treatment available as stock standards with alternate coatings available as stocks modifications.



- first choice
- alternate choice

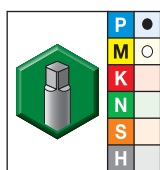
■ Series 2331 • Machine Screw and Fractional • Spiral-Point Plug Chamfer

									
TiCN	CrC/C	uncoated	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
17508	17708	17408	4 - 40	1.88	.56	.69	.141	2	H2
17510	17710	17410	5 - 40	1.94	.63	.75	.141	2	H2
17512	17712	17412	6 - 32	2.00	.39	.88	.141	2	H2
17513	17713	17413	6 - 32	2.00	.39	.88	.141	2	H3
17517	17717	17417	8 - 32	2.13	.39	.92	.168	2	H2
17518	17718	17418	8 - 32	2.13	.39	.92	.168	2	H3
17521	17721	17421	10 - 24	2.38	.51	1.07	.194	2	H2
17522	17722	17422	10 - 24	2.38	.51	1.07	.194	2	H3
17523	17723	17423	10 - 32	2.37	.51	1.04	.194	2	H2
17524	17724	17424	10 - 32	2.37	.51	1.04	.194	2	H3
17526	17726	17426	12 - 24	2.38	.51	1.05	.220	2	H3
17529	17729	17429	1/4 - 20	2.50	.61	1.16	.255	2	H3
17530	17730	17430	1/4 - 20	2.50	.61	1.16	.255	2	H5
17531	17731	17431	1/4 - 20	2.50	.61	1.16	.255	3	H3
17532	17732	17432	1/4 - 20	2.50	.61	1.16	.255	3	H5
17533	17733	17433	1/4 - 28	2.49	.61	1.15	.255	2	H2
17534	17734	17434	1/4 - 28	2.49	.61	1.15	.255	2	H3
17536	17736	17436	5/16 - 18	2.72	.68	1.32	.318	2	H3
17537	17737	17437	5/16 - 18	2.72	.68	1.32	.318	2	H5
17538	17738	17438	5/16 - 18	2.72	.68	1.32	.318	3	H3
17539	17739	17439	5/16 - 18	2.72	.68	1.32	.318	3	H5
17540	17740	17440	5/16 - 24	2.71	.67	1.31	.318	2	H3
17542	17742	17442	3/8 - 16	2.94	.76	1.39	.381	3	H3
17543	17743	17443	3/8 - 16	2.94	.76	1.39	.381	3	H5
17544	17744	17444	3/8 - 24	2.93	.76	1.41	.381	3	H3
17545	17745	17445	7/16 - 14	3.16	.88	1.42	.323	3	H3
17546	17746	17446	7/16 - 20	3.16	.88	1.42	.323	3	H3
17547	17747	17447	1/2 - 13	3.38	.97	1.61	.367	3	H3
17548	17748	17448	1/2 - 13	3.38	.97	1.61	.367	3	H5
17549	17749	17449	1/2 - 20	3.38	.97	1.61	.367	3	H3
17550	17750	17450	5/8 - 11	3.81	1.12	1.74	.480	3	H3
17551	17751	17451	5/8 - 18	3.81	1.12	1.74	.480	3	H3
17552	17752	17452	3/4 - 10	4.25	1.25	1.92	.590	3	H3



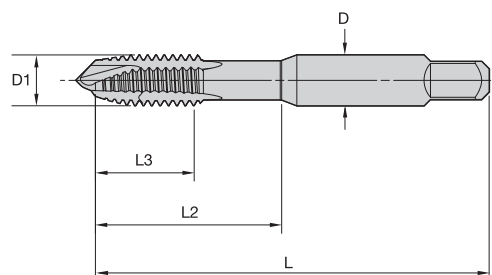
- first choice
- alternate choice

■ Series 2331 • Machine Screw and Fractional • Spiral-Point Plug Chamfer • DIN Length



TiCN	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
25830	4 - 40	2.09	.31	.71	.141	2	H2
25833	5 - 40	2.21	.43	.71	.141	2	H2
25836	6 - 32	2.21	.38	.79	.141	2	H3
25839	8 - 32	2.48	.38	.83	.168	3	H3
25842	10 - 24	2.76	.50	.98	.194	3	H3
25843	10 - 32	2.76	.50	.98	.194	3	H3
25848	1/4 - 20	3.15	.63	1.18	.255	3	H3
25850	1/4 - 28	3.15	.63	1.18	.255	3	H3
25852	5/16 - 18	3.54	.69	1.38	.318	3	H3
25854	5/16 - 24	3.54	.69	1.38	.318	3	H3
25856	3/8 - 16	3.94	.75	1.54	.381	3	H3
25864	1/2 - 13	4.33	.94	1.14	.367	3	H3

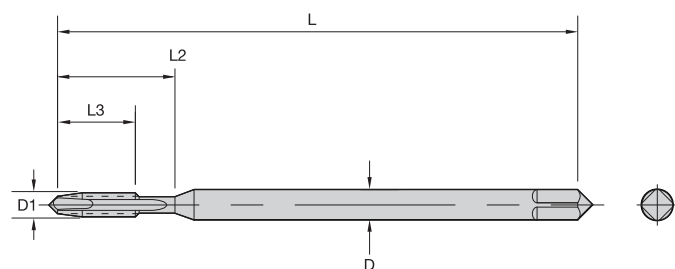
Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



- first choice
- alternate choice

■ Series 2361 • Spiral-Point Plug Chamfer • Metric ANSI

								number of flutes	pitch diameter limit
TiCN	CrC/C	uncoated	D1 size	L	L3	L2	D		
17563	17763	17463	M3 X 0,5	1.94	.63	.75	.141	2	D3
17564	17764	17464	M3,5 X 0,6	2.00	.38	.88	.141	2	D4
17565	17765	17465	M4 X 0,7	2.13	.39	.92	.168	2	D4
17568	17768	17468	M5 X 0,8	2.38	.51	1.07	.194	2	D4
17571	17771	17471	M6 X 1	2.49	.61	1.15	.255	2	D5
17569	17769	17469	M6 X 1	2.50	.61	1.16	.255	2	D5
17570	17770	17470	M6 X 1	2.50	.61	1.16	.255	3	D5
17573	17773	17473	M8 X 1,25	2.72	.67	1.31	.318	2	D5
17574	17774	17474	M8 X 1,25	2.72	.67	1.32	.318	3	D5
17575	17775	17475	M10 X 1,5	2.93	.76	1.41	.381	3	D6
17576	17776	17476	M12 X 1,75	3.38	.97	1.61	.367	3	D6
17577	17777	17477	M14 X 2	3.59	1.00	1.61	.429	3	D7
17578	17778	17478	M16 X 2	3.81	1.12	1.74	.480	3	D7

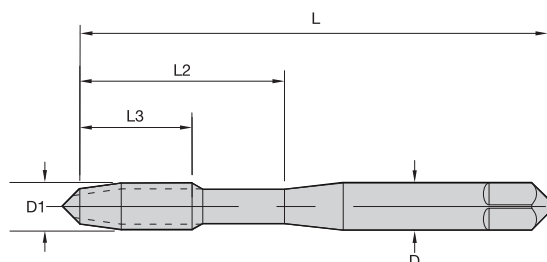
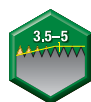


- first choice
- alternate choice

■ Series 2361 • Spiral-Point Plug Chamfer • DIN Length • Metric ANSI

								number of flutes	pitch diameter limit
TiCN	D1 size	L	L3	L2	D				
25867	M3 X 0,5	2.21	.38	.71	.141			2	D3
25868	M4 X 0,7	2.48	.38	.83	.168			3	D4
25869	M5 X 0,8	2.76	.50	.98	.194			3	D4
25870	M6 X 1	3.15	.63	1.18	.255			3	D5
25871	M8 X 1,25	3.54	.69	1.38	.318			3	D5
25872	M10 X 1,5	3.94	.75	1.54	.381			3	D6
25873	M12 X 1,75	4.33	.94	1.14	.367			3	D6

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.


HSS-E


3.5-5


2B

3B

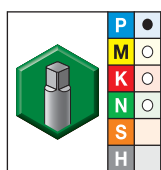
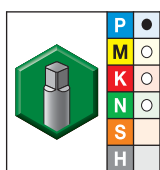
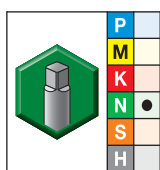
**ANSI
UNC**

**ANSI
UNF**


NOTE: Series 5900TC • TiCN Coated
 Series 5900TiN • TiN Coated
 Series 5900 • Uncoated

● first choice
 ○ alternate choice

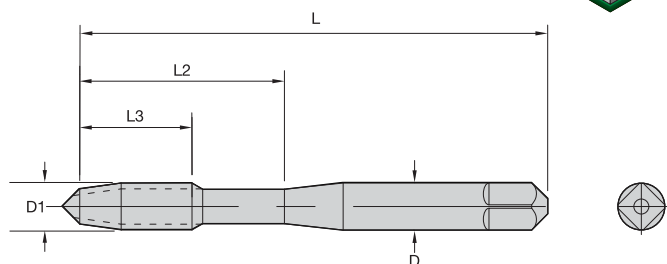
■ Series 5900 • Machine Screw and Fractional • Plug Entry Taper


TiCN

TiN

uncoated

			D1 size	L	L3	L2	D	number of lube grooves	pitch diameter limit
18703	18303	18203	6 - 32	2.00	.38	.69	.141	4	H3
18702	18302	18202	6 - 32	2.00	.38	.69	.141	4	H5
18706	18306	18206	6 - 40	2.00	.38	.69	.141	4	H3
18707	18307	18207	6 - 40	2.00	.38	.69	.141	4	H5
18711	18311	18211	8 - 32	2.13	.38	.75	.168	4	H3
18710	18310	18210	8 - 32	2.13	.38	.75	.168	4	H5
18717	18317	18217	10 - 24	2.38	.50	.88	.194	4	H4
18716	18316	18216	10 - 24	2.38	.50	.88	.194	4	H6
18721	18321	18221	10 - 32	2.38	.50	.88	.194	4	H4
18720	18320	18220	10 - 32	2.38	.50	.88	.194	4	H6
18724	18324	18224	12 - 24	2.38	.50	.94	.220	4	H4
18725	18325	18225	12 - 24	2.38	.50	.94	.220	4	H6
18729	18329	18229	1/4 - 20	2.50	.63	1.00	.255	4	H4
18728	18328	18228	1/4 - 20	2.50	.63	1.00	.255	4	H6
18733	18333	18233	1/4 - 28	2.50	.63	1.00	.255	4	H4
18732	18332	18232	1/4 - 28	2.50	.63	1.00	.255	4	H6
18737	18337	18237	5/16 - 18	2.72	.69	1.13	.318	4	H5
18736	18336	18236	5/16 - 18	2.72	.69	1.13	.318	4	H7
18741	18341	18241	5/16 - 24	2.72	.69	1.13	.318	4	H5
18740	18340	18240	5/16 - 24	2.72	.69	1.13	.318	4	H7
18745	18345	18245	3/8 - 16	2.94	.75	1.25	.381	4	H5
18744	18344	18244	3/8 - 16	2.94	.75	1.25	.381	4	H7
18748	18348	18248	3/8 - 24	2.94	.75	1.55	.381	4	H5
18752	18352	18252	1/2 - 13	3.38	.94	—	.367	4	H5
18751	18351	18251	1/2 - 13	3.38	.94	—	.367	4	H7
18754	18354	18254	1/2 - 20	3.38	.94	—	.367	4	H5

Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



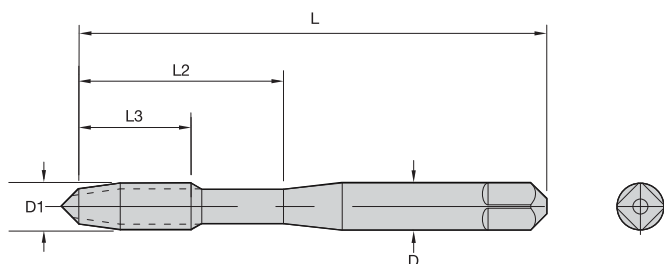
- first choice
- alternate choice

■ Series 5902 • Machine Screw and Fractional • Bottom Entry Taper

TiCN	TiN	uncoated	D1 size	L	L3	L2	D	number of lube grooves	pitch diameter limit	
18700	18300	18200	6 - 32	2.00	.38	.69	.141	4	H3	
18701	18301	18201	6 - 32	2.00	.38	.69	.141	4	H5	
18705	18305	18205	6 - 40	2.00	.38	.69	.141	4	H3	
18704	18304	18204	6 - 40	2.00	.38	.69	.141	4	H5	
18709	18309	18209	8 - 32	2.13	.38	.75	.168	4	H3	
18708	18308	18208	8 - 32	2.13	.38	.75	.168	4	H5	
18712	18312	18212	8 - 36	2.13	.38	.75	.168	4	H3	
18713	18313	18213	8 - 36	2.13	.38	.75	.168	4	H5	
18715	18315	18215	10 - 24	2.38	.50	.88	.194	4	H4	
18714	18314	18214	10 - 24	2.38	.50	.88	.194	4	H6	
18719	18319	18219	10 - 32	2.38	.50	.88	.194	4	H4	
18718	18318	18218	10 - 32	2.38	.50	.88	.194	4	H6	
18723	18323	18223	12 - 24	2.38	.50	.94	.220	4	H4	
18726	18326	18226	1/4 - 20	2.50	.63	1.00	.255	4	H4	
18727	18327	18227	1/4 - 20	2.50	.63	1.00	.255	4	H6	
18731	18331	18231	1/4 - 28	2.50	.63	1.00	.255	4	H4	
18730	18330	18230	1/4 - 28	2.50	.63	1.00	.255	4	H6	
18734	18334	18234	5/16 - 18	2.72	.69	1.13	.318	4	H5	
18735	18335	18235	5/16 - 18	2.72	.69	1.13	.318	4	H7	
18739	18339	18239	5/16 - 24	2.72	.69	1.13	.318	4	H5	
18738	18338	18238	5/16 - 24	2.72	.69	1.13	.318	4	H7	
18742	18342	18242	3/8 - 16	2.94	.75	1.25	.381	4	H5	
18743	18343	18243	3/8 - 16	2.94	.75	1.25	.381	4	H7	
18746	18346	18246	3/8 - 24	2.94	.75	1.25	.381	4	H5	
18747	18347	18247	3/8 - 24	2.94	.75	1.25	.381	4	H7	
18750	18350	18250	1/2 - 13	3.38	.94	—	.367	4	H5	
18749	18349	18249	1/2 - 13	3.38	.94	—	.367	4	H7	
18753	18353	18253	1/2 - 20	3.38	.94	—	.367	4	H5	

Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



NOTE: Series 5910TC • TiCN Coated
 Series 5910T • TiN Coated
 Series 5910 • Uncoated

● first choice
 ○ alternate choice

■ Series 5910 • Plug Entry Taper • Metric ANSI

TiCN	TiN	uncoated	D1 size	L	L3	L2	D	number of lube grooves	pitch diameter limit
18756	18356	18256	M4 X 0,7	2.13	.38	.75	.168	4	D6
18758	18358	18258	M5 X 0,8	2.38	.50	.88	.194	4	D7
18760	18360	18260	M6 X 1	2.50	.63	1.00	.255	4	D8
18762	18362	18262	M8 X 1,25	2.72	.69	1.13	.318	4	D9
18764	18364	18264	M10 X 1,5	2.94	.75	1.25	.381	4	D10
18766	18366	18266	M12 X 1,75	3.38	.94	—	.367	4	D11



NOTE: Series 5912TC • TiCN Coated
 Series 5912T • TiN Coated
 Series 5912 • Uncoated

● first choice
 ○ alternate choice

■ Series 5912 • Bottom Entry Taper • Metric ANSI

TiCN	TiN	uncoated	D1 size	L	L3	L2	D	number of lube grooves	pitch diameter limit
18755	18355	18255	M4 X 0,7	2.13	.38	.75	.168	4	D6
18757	18357	18257	M5 X 0,8	2.38	.50	.88	.194	4	D7
18759	18359	18259	M6 X 1	2.50	.63	1.00	.255	4	D8
18761	18361	18261	M8 X 1,25	2.72	.69	1.13	.318	4	D9
18763	18363	18263	M10 X 1,5	2.94	.75	1.25	.381	4	D10
18765	18365	18265	M12 X 1,75	3.38	.94	—	.367	4	D11

Metric taps are manufactured to USCTI specifications and dimensions.

Metric tap blank dimensions are equivalent to inch taps.

Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 6H class of fit.

Lightning™ Services



WIDIA-GTD™ Lightning Services

Rely on our Lightning Services program to deliver the special taps you need, when and where you need them. Within minutes, we can quote, process, and release your order to the factory.

- Non-standard tap sizes, pitches, PDs, coatings, etc.
- Special taps can be used for tapping steel, cast iron, aluminum or brass.
- Custom ordered taps can be designed to thread INCONEL®, titanium, and high-temp alloys.
- Always accurate thread pitch diameters and gage fits.

Let our Lightning Services program spark your production.
Contact your Authorized WIDIA Distributor.

Greenfield Lightning
Services Available

WIDIA 

Taps Custom-Order Worksheet

Use this Custom-Order Worksheet to modify an existing product to meet your specifications. If your custom requirements do not fall into these categories, simply contact your WIDIA™ Distributor.

Trust our experienced distributors and WIDIA engineering team to design the best solution for you.

1. Start with the standard product most similar to your specifications:

 catalog number

 grade/coating

2. Type of tap needed:

☐ solid carbide	☐ high performance HSS	☐ general purpose	☐ spiral point
☐ hand	☐ forming	☐ spiral flute	
pipe (and style)		other	

3. Direction of cut (circle one):

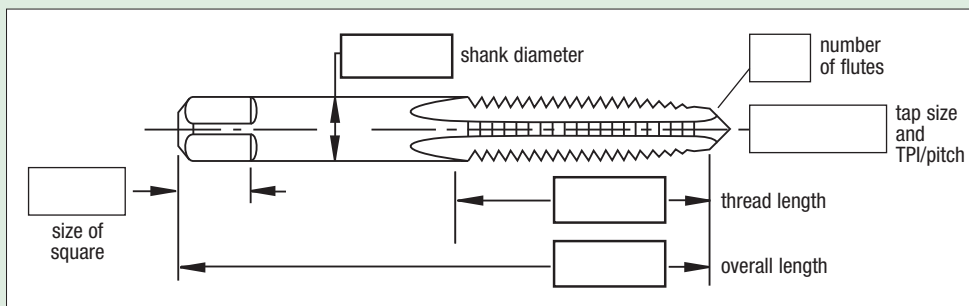
left hand

right hand

4. Material overview:

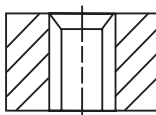
☐ ANSI	☐ DIN	☐ JIS	☐ other

5. Desired dimension:

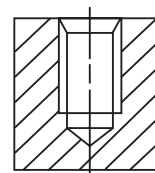


6. Choose one:

through hole:

 hole diameter
 hole depth


blind hole:

 hole diameter
 hole depth


7. Chamfer:

☐ taper: 7–10 pitch	☐ plug: 3–5 pitch	☐ semi-bottom: 2–3 pitch	☐ bottom: 1–2 pitch



8. Class of fit:

 H limit

 metric D limit

 diameter pitch limit

9. Workpiece material:

10. Hardness:

11. Number of taps required:

12. Price

Contact your Authorized WIDIA Distributor partners.

13. Other comments or special characteristics:

customer company name

date

address

phone number

city, state, zip

fax number

customer contact

customer email address

sales representative

WIDIA-GTD™ Hand Taps

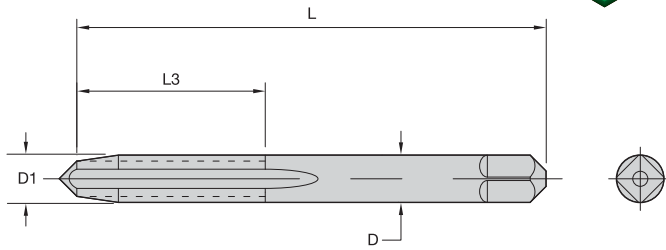
Features:

- Manufactured from high-speed steel.
- Straight-flute design.
- Versatile design.
- Can be used for through-hole or blind-hole tapping.
- Through-coolant holes available.

Benefits:

- Taps offer increased wear life.
- Can be used in general machinery or CNC tapping applications.
- Store chips in their flutes during threading, which protects the workpiece.





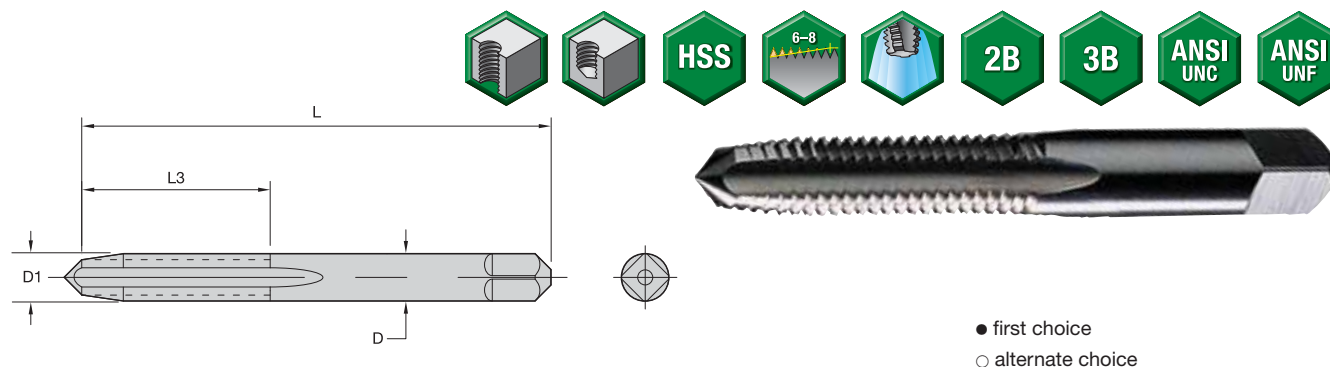
- first choice
- alternate choice

■ Series 5305 • Machine Screw Sizes • Taper Chamfer

oxide	uncoated	D1 size	L	L3	D	number of flutes	pitch diameter limit
—	15102	0 - 80	1.63	.31	.141	2	H1
—	15114	1 - 64	1.69	.38	.141	2	H1
—	15120	1 - 72	1.69	.38	.141	2	H1
—	15128	2 - 56	1.75	.44	.141	3	H1
—	15134	2 - 56	1.75	.44	.141	3	H2
—	15141	2 - 64	1.75	.44	.141	3	H1
—	15144	2 - 64	1.75	.44	.141	3	H2
—	15156	3 - 48	1.81	.50	.141	3	H2
19563	15166	3 - 56	1.81	.50	.141	3	H2
—	15184	4 - 40	1.88	.56	.141	3	H2
—	15196	4 - 48	1.88	.56	.141	3	H2
—	15209	5 - 40	1.94	.63	.141	3	H2
—	15220	5 - 44	1.94	.63	.141	3	H2
—	15225	6 - 32	2.00	.69	.141	3	H1
—	15231	6 - 32	2.00	.69	.141	3	H2
19573	15237	6 - 32	2.00	.69	.141	3	H3
—	15257	6 - 40	2.00	.69	.141	3	H2
—	15275	8 - 32	2.13	.75	.168	4	H2
19583	15283	8 - 32	2.13	.75	.168	4	H3
—	15301	8 - 36	2.13	.75	.168	4	H2
—	15320	10 - 24	2.38	.88	.194	4	H2
19597	15327	10 - 24	2.38	.88	.194	4	H3
—	15344	10 - 32	2.38	.88	.194	4	H1
—	15352	10 - 32	2.38	.88	.194	4	H2
19613	15360	10 - 32	2.38	.88	.194	4	H3
—	15383	12 - 24	2.38	.94	.220	4	H3
—	15390	12 - 28	2.38	.94	.220	4	H3

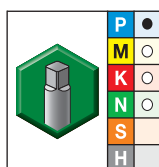
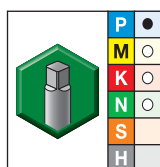
Hand taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



● first choice
○ alternate choice

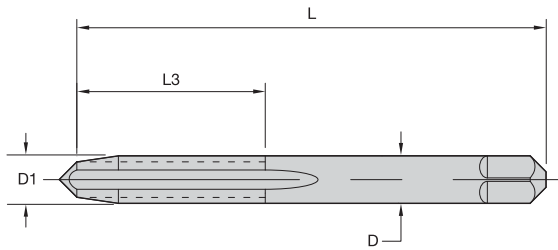
■ Series 5303 • Fractional Sizes • Taper Chamfer



oxide	uncoated	D1 size	L	L3	D	number of flutes	pitch diameter limit
—	14010	1/4 - 20	2.50	1.00	.255	4	H1
—	14015	1/4 - 20	2.50	1.00	.255	4	H2
19167	14022	1/4 - 20	2.50	1.00	.255	4	H3
19208	14055	1/4 - 28	2.50	1.00	.255	4	H3
19237	14092	5/16 - 18	2.72	1.13	.318	4	H3
19257	14122	5/16 - 24	2.72	1.13	.318	4	H3
19278	14157	3/8 - 16	2.94	1.25	.381	4	H3
19304	14190	3/8 - 24	2.94	1.25	.381	4	H3
—	14221	7/16 - 14	3.16	1.44	.323	4	H3
—	14246	7/16 - 20	3.16	1.44	.323	4	H3
19354	14281	1/2 - 13	3.38	1.66	.367	4	H3
19377	14308	1/2 - 20	3.38	1.66	.367	4	H3
—	14338	9/16 - 12	3.59	1.66	.429	4	H3
—	14356	9/16 - 18	3.59	1.66	.429	4	H3
19407	14379	5/8 - 11	3.81	1.81	.480	4	H3
—	14402	5/8 - 18	3.81	1.81	.480	4	H3
—	14423	11/16 - 11	4.03	1.06	.542	4	H3
—	14427	11/16 - 16	4.03	1.06	.542	4	H3
19443	14448	3/4 - 10	4.25	2.00	.590	4	H3
—	14471	3/4 - 16	4.25	2.00	.590	4	H3
—	14499	7/8 - 9	4.69	2.22	.697	4	H4
—	14516	7/8 - 14	4.69	2.22	.697	4	H4
—	14544	1 - 8	5.13	2.50	.800	4	H4
—	14557	1 - 12	5.13	2.50	.800	4	H4
—	14568	1 - 14	5.13	2.50	.800	4	H4
—	14594	1 1/8 - 7	5.44	2.56	.896	4	H4
—	14603	1 1/8 - 12	5.44	2.56	.896	4	H4
—	14612	1 1/4 - 7	5.75	2.56	1.021	4	H4
—	14620	1 1/4 - 12	5.75	2.56	1.021	6	H4
—	14632	1 3/8 - 6	6.06	3.00	1.108	4	H4
—	14640	1 3/8 - 12	6.06	3.00	1.108	6	H4
—	14645	1 1/2 - 6	6.38	3.00	1.233	4	H4
—	14653	1 1/2 - 12	6.38	3.00	1.233	6	H4

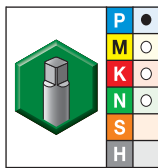
Hand taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



- first choice
- alternate choice

■ Series 5353 • Taper Chamfer • Metric ANSI



uncoated	D1 size	L	L3	D	number of flutes	pitch diameter limit
14725	M2 X 0,4	1.75	.44	.141	3	D3
14741	M3 X 0,5	1.94	.63	.141	3	D3
14757	M4 X 0,7	2.13	.75	.168	4	D4
14773	M5 X 0,8	2.38	.88	.194	4	D4
14797	M8 X 1,25	2.72	1.13	.318	4	D5
14813	M10 X 1,5	2.94	1.25	.381	4	D6
14829	M12 X 1,75	3.38	1.66	.367	4	D6
14845	M14 X 2	3.59	1.66	.429	4	D7
14861	M16 X 2	3.81	1.81	.480	4	D7
14877	M18 X 2,5	4.03	1.06	.542	4	D7
14893	M20 X 2,5	4.47	2.00	.652	4	D7
14909	M24 X 3	4.91	2.22	.760	4	D8
14925	M30 X 3,5	5.44	2.56	1.021	4	D9
14941	M36 X 4	6.06	3.00	1.233	4	D9

Metric taps for 6H class of fit are suitable for MJ aerospace internal threading applications.

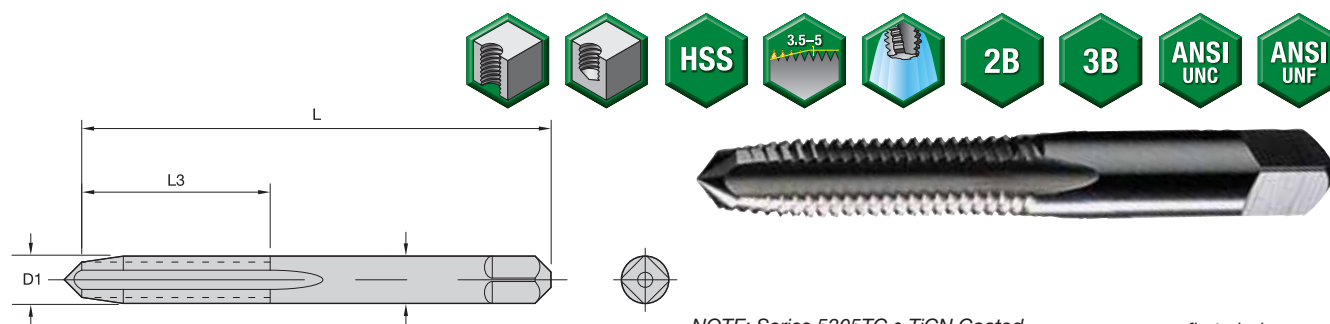
Metric taps are manufactured to USCTI specifications and dimensions.

Metric tap blank dimensions are equivalent to inch taps.

Refer to table on page A258 for the recommended pitch diameter limit for 6H class of fit.

Production Taps

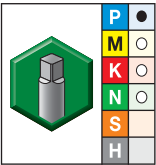
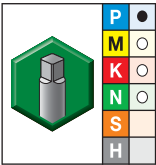
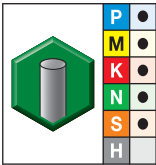
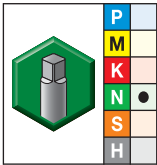
Hand Taps • Through or Blind Holes in General Machining Applications



NOTE: Series 5305TC • TiCN Coated
Series 2305 • TiN Coated
Series 5305S • SH50 Steam Oxide
Series 5305 • Uncoated

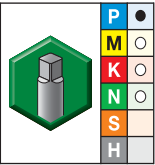
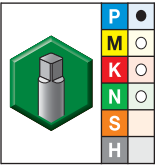
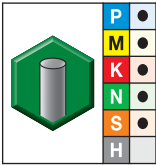
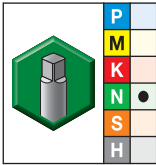
● first choice
○ alternate choice

■ Series 5305/2305 • Machine Screw Sizes • Plug Chamfer

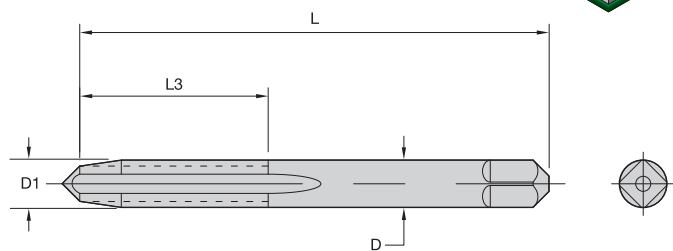
				D1 size	L	L3	D	number of flutes	pitch diameter limit
TiCN	TiN	oxide	uncoated						
—	—	—	15103	0 - 80	1.63	.31	.141	2	H1
19121	19202	—	15107	0 - 80	1.63	.31	.141	2	H2
—	—	—	15115	1 - 64	1.69	.38	.141	2	H1
—	—	—	15118	1 - 64	1.69	.38	.141	2	H2
—	—	—	15121	1 - 72	1.69	.38	.141	2	H1
—	—	—	15125	1 - 72	1.69	.38	.141	2	H2
—	—	—	15138	2 - 56	1.75	.44	.141	2	H2
—	—	—	15129	2 - 56	1.75	.44	.141	3	H1
19122	19207	—	15135	2 - 56	1.75	.44	.141	3	H2
—	—	—	15142	2 - 64	1.75	.44	.141	3	H1
—	—	—	15145	2 - 64	1.75	.44	.141	3	H2
—	15433	—	15160	3 - 48	1.81	.50	.141	2	H2
—	—	—	15157	3 - 48	1.81	.50	.141	3	H2
—	—	—	15167	3 - 56	1.81	.50	.141	3	H2
—	—	—	15182	4 - 40	1.88	.56	.141	2	H1
—	—	—	15189	4 - 40	1.88	.56	.141	2	H2
—	—	—	15179	4 - 40	1.88	.56	.141	3	H1
19123	19211	19565	15185	4 - 40	1.88	.56	.141	3	H2
—	—	—	15192	4 - 48	1.88	.56	.141	3	H1
—	—	—	15197	4 - 48	1.88	.56	.141	3	H2
—	15437	—	15214	5 - 40	1.94	.63	.141	2	H2
—	—	—	15204	5 - 40	1.94	.63	.141	3	H1
19124	19216	—	15210	5 - 40	1.94	.63	.141	3	H2
—	—	—	15221	5 - 44	1.94	.63	.141	3	H2
—	—	—	15235	6 - 32	2.00	.69	.141	2	H2
—	—	—	15245	6 - 32	2.00	.69	.141	2	H3
—	—	—	15226	6 - 32	2.00	.69	.141	3	H1
—	19221	—	15232	6 - 32	2.00	.69	.141	3	H2
15224	—	19575	15238	6 - 32	2.00	.69	.141	3	H3
—	—	—	15262	6 - 40	2.00	.69	.141	2	H2
—	—	—	15258	6 - 40	2.00	.69	.141	3	H2
—	—	—	15279	8 - 32	2.13	.75	.168	2	H2

(continued)

(Series 5305/2305 • Machine Screw Sizes • Plug Chamfer continued)

									
TiCN	TiN	oxide	uncoated	D1 size	L	L3	D	number of flutes	pitch diameter limit
—	—	—	15291	8 - 32	2.13	.75	.168	2	H3
—	—	—	15281	8 - 32	2.13	.75	.168	3	H2
—	15442	—	15293	8 - 32	2.13	.75	.168	3	H3
—	—	—	15268	8 - 32	2.13	.75	.168	4	H1
—	19226	—	15276	8 - 32	2.13	.75	.168	4	H2
—	—	19585	15284	8 - 32	2.13	.75	.168	4	H3
—	—	—	15295	8 - 32	2.13	.75	.168	4	H7
—	—	—	15300	8 - 36	2.13	.75	.168	4	H1
—	—	—	15302	8 - 36	2.13	.75	.168	4	H2
—	—	—	15324	10 - 24	2.38	.88	.194	2	H2
—	—	—	15335	10 - 24	2.38	.88	.194	2	H3
—	15444	—	15337	10 - 24	2.38	.88	.194	3	H3
—	—	—	15314	10 - 24	2.38	.88	.194	4	H1
—	—	—	15321	10 - 24	2.38	.88	.194	4	H2
19126	19231	19600	15328	10 - 24	2.38	.88	.194	4	H3
—	—	—	15356	10 - 32	2.38	.88	.194	2	H2
—	—	—	15368	10 - 32	2.38	.88	.194	2	H3
—	—	—	15358	10 - 32	2.38	.88	.194	3	H2
—	15450	—	15370	10 - 32	2.38	.88	.194	3	H3
—	—	—	15374	10 - 32	2.38	.88	.194	3	H7
—	—	—	15345	10 - 32	2.38	.88	.194	4	H1
—	—	—	15353	10 - 32	2.38	.88	.194	4	H2
15348	19236	19615	15361	10 - 32	2.38	.88	.194	4	H3
19127	19241	—	15384	12 - 24	2.38	.94	.220	4	H3
—	—	—	15391	12 - 28	2.38	.94	.220	4	H3

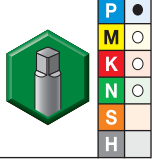
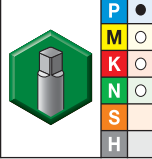
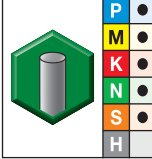
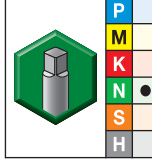
Hand taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.
 Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



● first choice

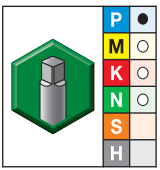
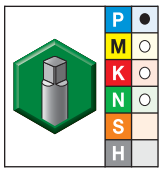
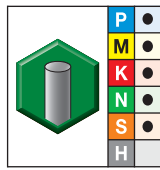
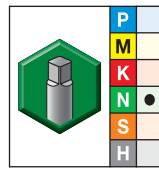
○ alternate choice

Series 5303/2303 • Fractional Sizes • Plug Chamfer

				D1 size	L	L3	D	number of flutes	pitch diameter limit
TiCN	TiN	oxide	uncoated						
—	15453	—	14030	1/4 - 20	2.50	1.00	.255	2	H3
—	—	—	14020	1/4 - 20	2.50	1.00	.255	3	H2
—	15454	—	14032	1/4 - 20	2.50	1.00	.255	3	H3
—	—	—	14039	1/4 - 20	2.50	1.00	.255	3	H5
—	—	—	14011	1/4 - 20	2.50	1.00	.255	4	H1
—	—	—	14016	1/4 - 20	2.50	1.00	.255	4	H2
14009	19247	19170	14023	1/4 - 20	2.50	1.00	.255	4	H3
—	—	—	14036	1/4 - 20	2.50	1.00	.255	4	H5
—	—	—	14041	1/4 - 20	2.50	1.00	.255	4	H11
—	—	—	14063	1/4 - 28	2.50	1.00	.255	2	H3
—	15456	—	14065	1/4 - 28	2.50	1.00	.255	3	H3
—	—	—	14048	1/4 - 28	2.50	1.00	.255	4	H1
—	—	—	14052	1/4 - 28	2.50	1.00	.255	4	H2
—	—	—	14053	1/4 - 28	2.50	1.00	.255	4	H2
19128	19253	19210	14056	1/4 - 28	2.50	1.00	.255	4	H3
—	—	—	14067	1/4 - 28	2.50	1.00	.255	4	H4
—	—	—	14100	5/16 - 18	2.72	1.13	.318	2	H3
—	—	—	14102	5/16 - 18	2.72	1.13	.318	3	H3
—	—	—	14082	5/16 - 18	2.72	1.13	.318	4	H1
—	—	—	14087	5/16 - 18	2.72	1.13	.318	4	H2
19129	19258	19240	14093	5/16 - 18	2.72	1.13	.318	4	H3
—	—	—	14104	5/16 - 18	2.72	1.13	.318	4	H5
—	—	—	14109	5/16 - 18	2.72	1.13	.318	4	H11
—	15462	—	14130	5/16 - 24	2.72	1.13	.318	3	H3
—	—	—	14113	5/16 - 24	2.72	1.13	.318	4	H1
—	—	—	14118	5/16 - 24	2.72	1.13	.318	4	H2
19131	19263	19260	14123	5/16 - 24	2.72	1.13	.318	4	H3
—	—	—	14133	5/16 - 24	2.72	1.13	.318	4	H4

(continued)

(Series 5303/2303 • Fractional Sizes • Plug Chamfer continued)

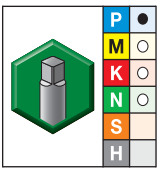
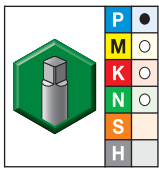
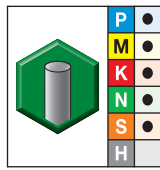
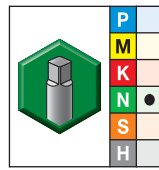
 TiCN	 TiN	 oxide	 uncoated	D1 size	L	L3	D	number of flutes	pitch diameter limit
—	15459	—	—	5/16 - 18	2.72	1.13	.318	2	H3
—	15460	—	—	5/16 - 18	2.72	1.13	.318	3	H3
—	15464	—	14165	3/8 - 16	2.94	1.25	.381	3	H3
—	—	—	14147	3/8 - 16	2.94	1.25	.381	4	H1
—	—	—	14152	3/8 - 16	2.94	1.25	.381	4	H2
19132	19268	19280	14158	3/8 - 16	2.94	1.25	.381	4	H3
—	—	—	14169	3/8 - 16	2.94	1.25	.381	4	H5
—	—	—	14174	3/8 - 16	2.94	1.25	.381	4	H11
—	15466	—	14198	3/8 - 24	2.94	1.25	.381	3	H3
—	—	—	14180	3/8 - 24	2.94	1.25	.381	4	H1
—	—	—	14185	3/8 - 24	2.94	1.25	.381	4	H2
19134	19273	19305	14191	3/8 - 24	2.94	1.25	.381	4	H3
—	—	—	14201	3/8 - 24	2.94	1.25	.381	4	H4
—	15467	—	14229	7/16 - 14	3.16	1.44	.323	3	H3
19135	19277	—	14222	7/16 - 14	3.16	1.44	.323	4	H3
—	—	—	14232	7/16 - 14	3.16	1.44	.323	4	H5
19136	19283	—	14247	7/16 - 20	3.16	1.44	.323	4	H3
—	—	—	14256	7/16 - 20	3.16	1.44	.323	4	H5
—	15469	—	14289	1/2 - 13	3.38	1.66	.367	3	H3
—	—	—	14274	1/2 - 13	3.38	1.66	.367	4	H1
19137	19291	19360	14282	1/2 - 13	3.38	1.66	.367	4	H3
—	—	—	14293	1/2 - 13	3.38	1.66	.367	4	H5
—	—	—	14297	1/2 - 13	3.38	1.66	.367	4	H11
—	15470	—	14316	1/2 - 20	3.38	1.66	.367	3	H3
—	—	—	14301	1/2 - 20	3.38	1.66	.367	4	H1
19138	19297	19375	14309	1/2 - 20	3.38	1.66	.367	4	H3
—	—	—	14319	1/2 - 20	3.38	1.66	.367	4	H5
—	—	—	14339	9/16 - 12	3.59	1.66	.429	4	H3
—	—	—	14346	9/16 - 12	3.59	1.66	.429	4	H5
—	—	—	14353	9/16 - 18	3.59	1.66	.429	4	H2
—	—	—	14357	9/16 - 18	3.59	1.66	.429	4	H3
—	—	—	14364	9/16 - 18	3.59	1.66	.429	4	H5

(continued)

Production Taps

Hand Taps • Through or Blind Holes in General Machining Applications

(Series 5303/2303 • Fractional Sizes • Plug Chamfer continued)

				D1 size	L	L3	D	number of flutes	pitch diameter limit
TiCN	TiN	oxide	uncoated						
—	—	—	14378	5/8 - 11	3.81	1.81	.480	4	H2
19139	19307	19410	14380	5/8 - 11	3.81	1.81	.480	4	H3
—	—	—	14388	5/8 - 11	3.81	1.81	.480	4	H5
—	—	—	14391	5/8 - 11	3.81	1.81	.480	4	H11
—	—	—	14400	5/8 - 18	3.81	1.81	.480	4	H2
19140	19317	—	14403	5/8 - 18	3.81	1.81	.480	4	H3
—	—	—	14411	5/8 - 18	3.81	1.81	.480	4	H5
—	—	—	14424	11/16 - 11	4.03	1.06	.542	4	H3
—	—	—	14428	11/16 - 16	4.03	1.06	.542	4	H3
19141	19327	19445	14449	3/4 - 10	4.25	2.00	.590	4	H3
—	—	—	14457	3/4 - 10	4.25	2.00	.590	4	H5
19142	19337	19455	14472	3/4 - 16	4.25	2.00	.590	4	H3
—	—	—	14479	3/4 - 16	4.25	2.00	.590	4	H4
—	—	—	14482	3/4 - 16	4.25	2.00	.590	4	H5
—	19347	19465	14500	7/8 - 9	4.69	2.22	.697	4	H4
—	—	—	14508	7/8 - 9	4.69	2.22	.697	4	H6
—	19357	—	14517	7/8 - 14	4.69	2.22	.697	4	H4
—	—	—	14524	7/8 - 14	4.69	2.22	.697	4	H6
—	19367	19475	14545	1 - 8	5.13	2.50	.800	4	H4
—	—	—	14553	1 - 8	5.13	2.50	.800	4	H6
—	—	—	14558	1 - 12	5.13	2.50	.800	4	H4
—	—	—	14567	1 - 14	5.13	2.50	.800	4	H2
—	—	—	14569	1 - 14	5.13	2.50	.800	4	H4
—	—	—	14595	1 1/8 - 7	5.44	2.56	.896	4	H4
—	—	—	14604	1 1/8 - 12	5.44	2.56	.896	4	H4
—	—	—	14613	1 1/4 - 7	5.75	2.56	1.021	4	H4
—	—	—	14621	1 1/4 - 12	5.75	2.56	1.021	6	H4
—	—	—	14633	1 3/8 - 6	6.06	3.00	1.108	4	H4
—	—	—	14641	1 3/8 - 12	6.06	3.00	1.108	6	H4
—	—	—	14646	1 1/2 - 6	6.38	3.00	1.233	4	H4
—	—	—	14654	1 1/2 - 12	6.38	3.00	1.233	6	H4

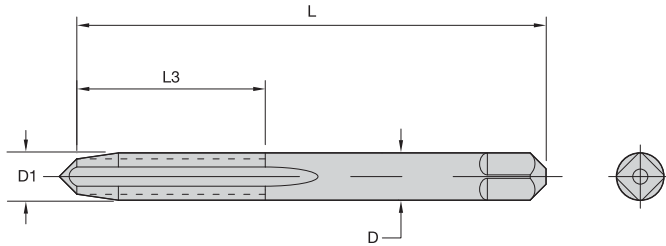
Hand taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.


HSS

2B

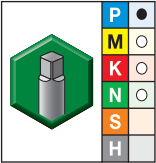
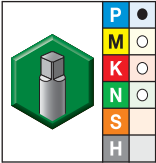
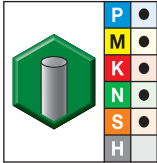
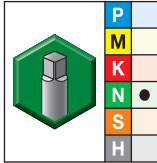
3B
**ANSI
UNC**

**ANSI
UNF**


NOTE: Series 5305Tc • TiCN Coated
 Series 2305 • TiN Coated
 Series 5305S • SH50 Steam Oxide
 Series 5305 • Uncoated

● first choice
 ○ alternate choice

■ Series 5305/2305 • Machine Screw Sizes • Bottoming Chamfer

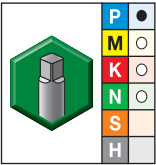
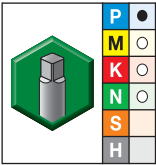
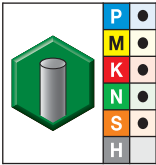
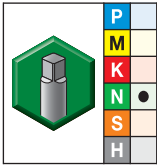
				D1 size	L	L3	D	number of flutes	pitch diameter limit
TiCN	TiN	oxide	uncoated						
—	—	—	15104	0 - 80	1.63	.31	.141	2	H1
19174	19204	—	15108	0 - 80	1.63	.31	.141	2	H2
—	—	—	15116	1 - 64	1.69	.38	.141	2	H1
—	—	—	15122	1 - 72	1.69	.38	.141	2	H1
—	—	—	15126	1 - 72	1.69	.38	.141	2	H2
—	—	—	15139	2 - 56	1.75	.44	.141	2	H2
—	—	—	15130	2 - 56	1.75	.44	.141	3	H1
19175	19209	—	15136	2 - 56	1.75	.44	.141	3	H2
—	—	—	15143	2 - 64	1.75	.44	.141	3	H1
—	—	—	15146	2 - 64	1.75	.44	.141	3	H2
—	15432	—	15161	3 - 48	1.81	.50	.141	2	H2
—	—	—	15158	3 - 48	1.81	.50	.141	3	H2
—	—	—	15168	3 - 56	1.81	.50	.141	3	H2
—	15434	—	15190	4 - 40	1.88	.56	.141	2	H2
19176	19213	19570	15186	4 - 40	1.88	.56	.141	3	H2
—	—	—	15198	4 - 48	1.88	.56	.141	3	H2
—	15436	—	15215	5 - 40	1.94	.63	.141	2	H2
19177	19218	—	15211	5 - 40	1.94	.63	.141	3	H2
—	—	—	15222	5 - 44	1.94	.63	.141	3	H2
—	—	—	15236	6 - 32	2.00	.69	.141	2	H2
—	15438	—	15246	6 - 32	2.00	.69	.141	2	H3
—	—	—	15227	6 - 32	2.00	.69	.141	3	H1
—	19223	—	15233	6 - 32	2.00	.69	.141	3	H2
19178	—	19580	15239	6 - 32	2.00	.69	.141	3	H3
—	—	—	15259	6 - 40	2.00	.69	.141	3	H2
—	—	—	15280	8 - 32	2.13	.75	.168	2	H2
—	—	—	15292	8 - 32	2.13	.75	.168	2	H3
—	—	—	15282	8 - 32	2.13	.75	.168	3	H2
—	—	—	15294	8 - 32	2.13	.75	.168	3	H3
—	—	—	15269	8 - 32	2.13	.75	.168	4	H1
—	19228	—	15277	8 - 32	2.13	.75	.168	4	H2
19179	—	—	15285	8 - 32	2.13	.75	.168	4	H3
15270	—	19590	—	8 - 32	2.13	.75	.168	4	H3
19860	—	—	—	8 - 32	2.13	.75	.168	4	H3
—	—	—	15303	8 - 36	2.13	.75	.168	4	H2
—	—	—	15336	10 - 24	2.38	.88	.194	2	H3

(continued)

Production Taps

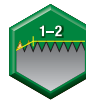
Hand Taps • Blind Holes in General Machining Applications

(Series 5305/2305 • Machine Screw Sizes • Bottoming Chamfer continued)

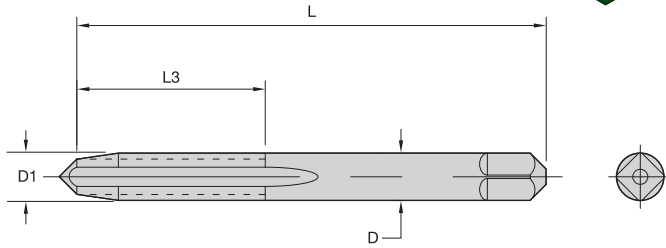
				D1 size	L	L3	D	number of flutes	pitch diameter limit
TiCN	TiN	oxide	uncoated						
—	15443	—	15338	10 - 24	2.38	.88	.194	3	H3
—	—	—	15322	10 - 24	2.38	.88	.194	4	H2
19181	19233	19605	15329	10 - 24	2.38	.88	.194	4	H3
—	—	—	15357	10 - 32	2.38	.88	.194	2	H2
—	15445	—	15369	10 - 32	2.38	.88	.194	2	H3
—	15446	—	15359	10 - 32	2.38	.88	.194	3	H2
—	15447	—	15371	10 - 32	2.38	.88	.194	3	H3
—	—	—	15346	10 - 32	2.38	.88	.194	4	H1
—	—	—	15354	10 - 32	2.38	.88	.194	4	H2
19182	19238	19620	15362	10 - 32	2.38	.88	.194	4	H3
19183	19243	—	15385	12 - 24	2.38	.94	.220	4	H3
—	—	—	15392	12 - 28	2.38	.94	.220	4	H3

Hand taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.

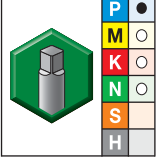
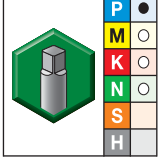
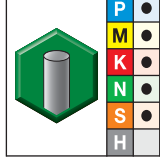
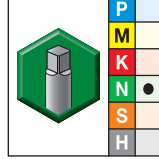

HSS

2B

**ANSI
UNC**

**ANSI
UNF**


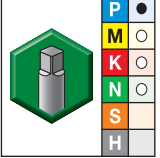
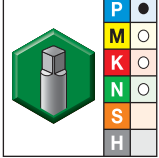
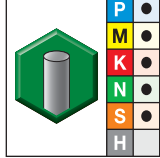
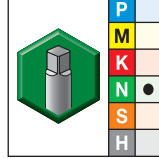
- first choice
- alternate choice

Series 5303/2303 • Fractional Sizes • Bottoming Chamfer

				D1 size	L	L3	D	number of flutes	pitch diameter limit
TiCN	TiN	oxide	uncoated						
—	—	—	14031	1/4 - 20	2.50	1.00	.255	2	H3
—	—	—	14033	1/4 - 20	2.50	1.00	.255	3	H3
—	—	—	14012	1/4 - 20	2.50	1.00	.255	4	H1
—	—	—	14017	1/4 - 20	2.50	1.00	.255	4	H2
19184	19251	19180	14024	1/4 - 20	2.50	1.00	.255	4	H3
—	—	—	14037	1/4 - 20	2.50	1.00	.255	4	H5
—	—	—	14064	1/4 - 28	2.50	1.00	.255	2	H3
—	15455	—	14066	1/4 - 28	2.50	1.00	.255	3	H3
19185	19256	19220	14057	1/4 - 28	2.50	1.00	.255	4	H3
—	—	—	14068	1/4 - 28	2.50	1.00	.255	4	H4
—	15457	—	14101	5/16 - 18	2.72	1.13	.318	2	H3
—	15458	—	14103	5/16 - 18	2.72	1.13	.318	3	H3
—	—	—	14083	5/16 - 18	2.72	1.13	.318	4	H1
—	—	—	14088	5/16 - 18	2.72	1.13	.318	4	H2
19186	19261	19245	14094	5/16 - 18	2.72	1.13	.318	4	H3
—	—	—	14105	5/16 - 18	2.72	1.13	.318	4	H5
—	15461	—	14131	5/16 - 24	2.72	1.13	.318	3	H3
—	—	—	14114	5/16 - 24	2.72	1.13	.318	4	H1
19187	19266	19265	14124	5/16 - 24	2.72	1.13	.318	4	H3
—	—	—	14134	5/16 - 24	2.72	1.13	.318	4	H4
—	15463	—	14166	3/8 - 16	2.94	1.25	.381	3	H3
—	—	—	14148	3/8 - 16	2.94	1.25	.381	4	H1
—	—	—	14153	3/8 - 16	2.94	1.25	.381	4	H2
19188	19271	19285	14159	3/8 - 16	2.94	1.25	.381	4	H3
—	—	—	14170	3/8 - 16	2.94	1.25	.381	4	H5
—	15465	—	14199	3/8 - 24	2.94	1.25	.381	3	H3
—	—	—	14181	3/8 - 24	2.94	1.25	.381	4	H1
19189	19275	19310	14192	3/8 - 24	2.94	1.25	.381	4	H3
—	—	—	14202	3/8 - 24	2.94	1.25	.381	4	H4
19191	19281	—	14223	7/16 - 14	3.16	1.44	.323	4	H3
—	—	—	14233	7/16 - 14	3.16	1.44	.323	4	H5
19192	19287	—	14248	7/16 - 20	3.16	1.44	.323	4	H3
—	—	—	14257	7/16 - 20	3.16	1.44	.323	4	H5
—	15468	—	14290	1/2 - 13	3.38	1.66	.367	3	H3
—	—	—	14275	1/2 - 13	3.38	1.66	.367	4	H1
19193	19293	19355	14283	1/2 - 13	3.38	1.66	.367	4	H3

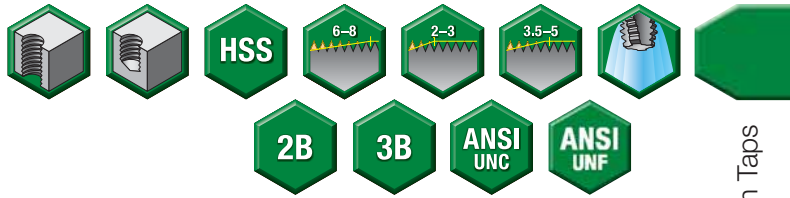
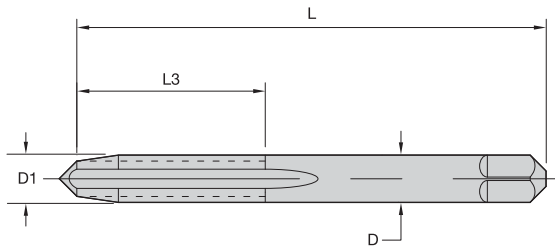
(continued)

(Series 5303/2303 • Fractional Sizes • Bottoming Chamfer continued)

				D1 size	L	L3	D	number of flutes	pitch diameter limit
TiCN	TiN	oxide	uncoated						
—	—	—	14294	1/2 - 13	3.38	1.66	.367	4	H5
19194	19303	19380	14310	1/2 - 20	3.38	1.66	.367	4	H3
—	—	—	14340	9/16 - 12	3.59	1.66	.429	4	H3
—	—	—	14358	9/16 - 18	3.59	1.66	.429	4	H3
19197	19313	19415	14381	5/8 - 11	3.81	1.81	.480	4	H3
—	—	—	14389	5/8 - 11	3.81	1.81	.480	4	H5
19198	19323	—	14404	5/8 - 18	3.81	1.81	.480	4	H3
—	—	—	14412	5/8 - 18	3.81	1.81	.480	4	H5
—	—	—	14425	11/16 - 11	4.03	1.06	.542	4	H3
—	—	—	14429	11/16 - 16	4.03	1.06	.542	4	H3
19199	19333	19450	14450	3/4 - 10	4.25	2.00	.590	4	H3
—	—	—	14458	3/4 - 10	4.25	2.00	.590	4	H5
—	19343	19460	14473	3/4 - 16	4.25	2.00	.590	4	H3
—	—	—	14483	3/4 - 16	4.25	2.00	.590	4	H5
—	19353	19470	14501	7/8 - 9	4.69	2.22	.697	4	H4
—	19363	—	14518	7/8 - 14	4.69	2.22	.697	4	H4
—	19373	19480	14546	1 - 8	5.13	2.50	.800	4	H4
—	—	—	14559	1 - 12	5.13	2.50	.800	4	H4
—	—	—	14570	1 - 14	5.13	2.50	.800	4	H4
—	—	—	14596	1 1/8 - 7	5.44	2.56	.896	4	H4
—	—	—	14605	1 1/8 - 12	5.44	2.56	.896	4	H4
—	—	—	14614	1 1/4 - 7	5.75	2.56	1.021	4	H4
—	—	—	14622	1 1/4 - 12	5.75	2.56	1.021	6	H4
—	—	—	14634	1 3/8 - 6	6.06	3.00	1.108	4	H4
—	—	—	14642	1 3/8 - 12	6.06	3.00	1.108	6	H4
—	—	—	14647	1 1/2 - 6	6.38	3.00	1.233	4	H4
—	—	—	14655	1 1/2 - 12	6.38	3.00	1.233	6	H4

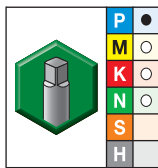
Hand taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



- first choice
- alternate choice

■ Series 5305 • Machine Screw Sizes • Sets of One Each Taper, Plug, and Bottoming Chamfer

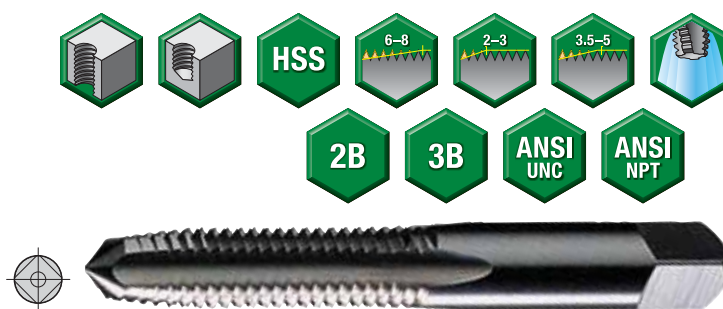
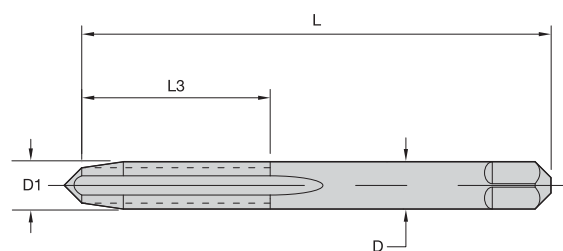


	uncoated	D1 size	L	L3	D	number of flutes	pitch diameter limit
	15105	0 - 80	1.63	.31	.141	2	H1
	15117	1 - 64	1.69	.38	.141	2	H1
	15123	1 - 72	1.69	.38	.141	2	H1
	15131	2 - 56	1.75	.44	.141	3	H1
	15137	2 - 56	1.75	.44	.141	3	H2
	15148	2 - 64	1.75	.44	.141	3	H1
	15147	2 - 64	1.75	.44	.141	3	H2
	15159	3 - 48	1.81	.50	.141	3	H2
	15169	3 - 56	1.81	.50	.141	3	H2
	15187	4 - 40	1.88	.56	.141	3	H2
	15199	4 - 48	1.88	.56	.141	3	H2
	15212	5 - 40	1.94	.63	.141	3	H2
	15223	5 - 44	1.94	.63	.141	3	H2
	15228	6 - 32	2.00	.69	.141	3	H1
	15234	6 - 32	2.00	.69	.141	3	H2
	15240	6 - 32	2.00	.69	.141	3	H3
	15260	6 - 40	2.00	.69	.141	3	H2
	15278	8 - 32	2.13	.75	.168	4	H2
	15286	8 - 32	2.13	.75	.168	4	H3
	15304	8 - 36	2.13	.75	.168	4	H2
	15323	10 - 24	2.38	.88	.194	4	H2
	15330	10 - 24	2.38	.88	.194	4	H3
	15347	10 - 32	2.38	.88	.194	4	H1
	15355	10 - 32	2.38	.88	.194	4	H2
	15363	10 - 32	2.38	.88	.194	4	H3
	15386	12 - 24	2.38	.94	.220	4	H3
	15393	12 - 28	2.38	.94	.220	4	H3

Hand taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

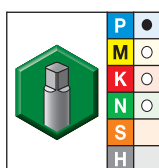
Tap sets — one of each taper, plug, and bottoming chamfers.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



● first choice
○ alternate choice

■ Series 5303 • Fractional Sizes • Taper, Plug, and Bottoming Chamfer

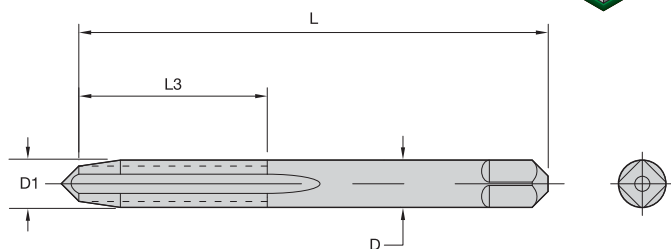


uncoated	D1 size	L	L3	D	number of flutes	pitch diameter limit
14013	1/4 - 20	2.50	1.00	.255	4	H1
14018	1/4 - 20	2.50	1.00	.255	4	H2
14025	1/4 - 20	2.50	1.00	.255	4	H3
14058	1/4 - 28	2.50	1.00	.255	4	H3
14095	5/16 - 18	2.72	1.13	.318	4	H3
14125	5/16 - 24	2.72	1.13	.318	4	H3
14160	3/8 - 16	2.94	1.25	.381	4	H3
14193	3/8 - 24	2.94	1.25	.381	4	H3
14224	7/16 - 14	3.16	1.44	.323	4	H3
14249	7/16 - 20	3.16	1.44	.323	4	H3
14284	1/2 - 13	3.38	1.66	.367	4	H3
14311	1/2 - 20	3.38	1.66	.367	4	H3
14341	9/16 - 12	3.59	1.66	.429	4	H3
14359	9/16 - 18	3.59	1.66	.429	4	H3
14382	5/8 - 11	3.81	1.81	.480	4	H3
14405	5/8 - 18	3.81	1.81	.480	4	H3
14426	11/16 - 11	4.03	1.06	.542	4	H3
14430	11/16 - 16	4.03	1.06	.542	4	H3
14451	3/4 - 10	4.25	2.00	.590	4	H3
14474	3/4 - 16	4.25	2.00	.590	4	H3
14502	7/8 - 9	4.69	2.22	.697	4	H4
14519	7/8 - 14	4.69	2.22	.697	4	H4
14547	1 - 8	5.13	2.50	.800	4	H4
14560	1 - 12	5.13	2.50	.800	4	H4
14571	1 - 14	5.13	2.50	.800	4	H4
14597	1 1/8 - 7	5.44	2.56	.896	4	H4
14606	1 1/8 - 12	5.44	2.56	.896	4	H4
14615	1 1/4 - 7	5.75	2.56	1.021	4	H4
14623	1 1/4 - 12	5.75	2.56	1.021	6	H4
14635	1 3/8 - 6	6.06	3.00	1.108	4	H4
14643	1 3/8 - 12	6.06	3.00	1.108	6	H4
14648	1 1/2 - 6	6.38	3.00	1.233	4	H4
14656	1 1/2 - 12	6.38	3.00	1.233	6	H4

Hand taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Tap sets — one of each taper, plug, and bottoming chamfers.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



- first choice
- alternate choice

Series 5353 • Plug Chamfer • Metric ANSI

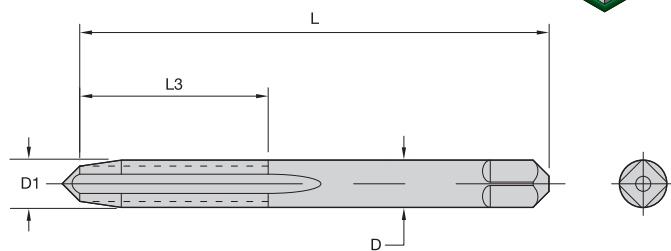
 TiCN	 TiN	 uncoated	D1 size	L	L3	D	number of flutes	pitch diameter limit
—	—	14718	M1,6 X 0,35	1.63	.31	.141	2	D3
—	—	14726	M2 X 0,4	1.75	.44	.141	3	D3
—	—	14734	M2,5 X 0,45	1.81	.50	.141	3	D3
19217	15471	14742	M3 X 0,5	1.94	.63	.141	3	D3
—	—	14750	M3,5 X 0,6	2.00	.69	.141	3	D4
19219	15473	14758	M4 X 0,7	2.13	.75	.168	4	D4
—	—	14766	M4,5 X 0,75	2.38	.88	.194	4	D4
19222	19906	14774	M5 X 0,8	2.38	.88	.194	4	D4
19224	—	14782	M6 X 1	2.50	1.00	.255	4	D5
—	—	14790	M7 X 1	2.72	1.13	.318	4	D5
19225	19912	14798	M8 X 1,25	2.72	1.13	.318	4	D5
19227	19915	14814	M10 X 1,5	2.94	1.25	.381	4	D6
19229	19955	14830	M12 X 1,75	3.38	1.66	.367	4	D6
—	—	14586	M14 X 1,25	3.59	1.66	.429	4	H4
—	—	14846	M14 X 2	3.59	1.66	.429	4	D7
—	—	14862	M16 X 2	3.81	1.81	.480	4	D7
—	—	14590	M18 X 1,5	4.03	1.81	.542	4	H4
—	—	14878	M18 X 2,5	4.03	1.06	.542	4	D7
—	—	14894	M20 X 2,5	4.47	2.00	.652	4	D7
—	—	14910	M24 X 3	4.91	2.22	.760	4	D8
—	—	14926	M30 X 3,5	5.44	2.56	1.021	4	D9
—	—	14942	M36 X 4	6.06	3.00	1.233	4	D9

Metric taps for 6H class of fit are suitable for MJ aerospace internal threading applications.

Metric taps are manufactured to USCTI specifications and dimensions.

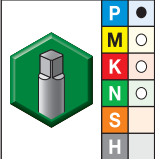
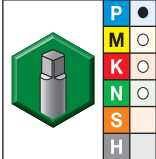
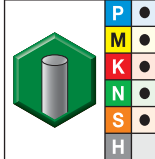
Metric tap blank dimensions are equivalent to inch taps.

Refer to table on page A258 for the recommended pitch diameter limit for 6H class of fit.

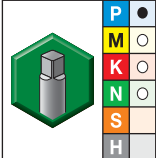


- first choice
- alternate choice

Series 5353 • Bottoming Chamfer • Metric ANSI

			D1 size	L	L3	D	number of flutes	pitch diameter limit
TiCN	TiN	uncoated						
19201	15472	14743	M3 X 0,5	1.94	.63	.141	3	D3
19203	15474	—	M4 X 0,7	2.13	.75	.168	4	D4
19205	19907	14775	M5 X 0,8	2.38	.88	.194	4	D4
19206	—	—	M6 X 1	2.50	1.00	.255	4	D5
19212	—	—	M8 X 1,25	2.72	1.13	.318	4	D5
19214	19916	—	M10 X 1,5	2.94	1.25	.381	4	D6
19215	—	—	M12 X 1,75	3.38	1.66	.367	4	D6
—	—	14847	M14 X 2	3.59	1.66	.429	4	D7
—	—	14863	M16 X 2	3.81	1.81	.480	4	D7
—	—	14895	M20 X 2,5	4.47	2.00	.652	4	D7
—	—	14911	M24 X 3	4.91	2.22	.760	4	D8
—	—	14927	M30 X 3,5	5.44	2.56	1.021	4	D9
—	—	14943	M36 X 4	6.06	3.00	1.233	4	D9

Series 5353 • Sets of One Each, Taper, Plug, Bottoming Chamfer • Metric ANSI

	D1 size	L	L3	D	number of flutes	pitch diameter limit
uncoated						
14744	M3 X 0,5	1.94	.63	.141	3	D3
14760	M4 X 0,7	2.13	.75	.168	4	D4
14777	M5 X 0,8	2.38	.88	.194	4	D4
14784	M6 X 1	2.50	1.00	.255	4	D5
14800	M8 X 1,25	2.72	1.13	.318	4	D5
14816	M10 X 1,5	2.94	1.25	.381	4	D6
14832	M12 X 1,75	3.38	1.66	.367	4	D6
14848	M14 X 2	3.59	1.66	.429	4	D7
14864	M16 X 2	3.81	1.81	.480	4	D7
14896	M20 X 2,5	4.47	2.00	.652	4	D7

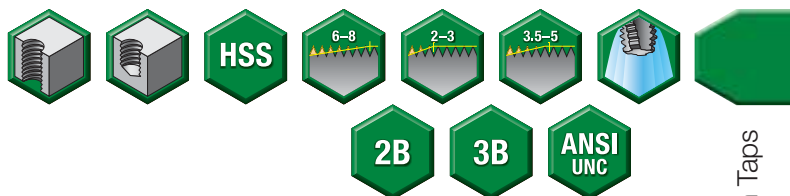
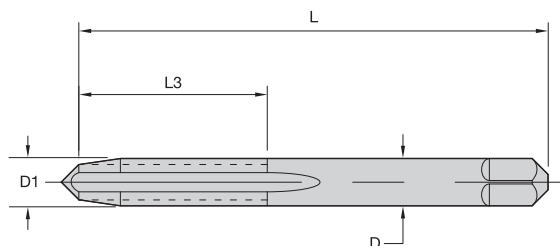
- first choice
- alternate choice

Metric taps for 6H class of fit are suitable for MJ aerospace internal threading applications.

Metric taps are manufactured to USCTI specifications and dimensions.

Metric tap blank dimensions are equivalent to inch taps.

Refer to table on page A258 for the recommended pitch diameter limit for 6H class of fit.



■ Series 5305L/5303L • Fractional Sizes • Taper, Plug, and Bottoming Chamfer and Sets

taper chamfer 7-10 pitch	plug chamfer 3-5 pitch	full bottom 1-2 pitch	taper & plug bottoming set	D1 size	L	L3	D	number of flutes	pitch diameter limit
14026	14027	14028	14029	1/4 - 20	2.50	1.00	.255	4	H3
—	14060	—	—	1/4 - 28	2.50	1.00	.255	4	H3
14096	14097	14098	14099	5/16 - 18	2.72	1.13	.318	4	H3
14126	14127	14128	14129	5/16 - 24	2.72	1.13	.318	4	H3
14161	14162	14163	14164	3/8 - 16	2.94	1.25	.381	4	H3
14194	14195	14196	14197	3/8 - 24	2.94	1.25	.381	4	H3
14225	14226	14227	14228	7/16 - 14	3.16	1.44	.323	4	H3
14250	14251	14252	14253	7/16 - 20	3.16	1.44	.323	4	H3
14285	14286	14287	14288	1/2 - 13	3.38	1.66	.367	4	H3
14312	14313	14314	14315	1/2 - 20	3.38	1.66	.367	4	H3
14342	14343	14344	14345	9/16 - 12	3.59	1.66	.429	4	H3
14360	14361	14362	14363	9/16 - 18	3.59	1.66	.429	4	H3
14383	14384	14385	14386	5/8 - 11	3.81	1.81	.480	4	H3
14406	14407	14408	14409	5/8 - 18	3.81	1.81	.480	4	H3
14452	14453	14454	14455	3/4 - 10	4.25	2.00	.590	4	H3
14475	14476	14477	14478	3/4 - 16	4.25	2.00	.590	4	H3

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.

WIDIA™ ToolBOSS™ Secure, high-capacity solutions.

Combined with our powerful WIDIA ToolBOSS Management Software, the 28 LEVEL cabinet provides a versatile, high-capacity solution to meet the unpredictable challenges of logistics and supply chain management.

- Cut tooling inventory.
- 24/7 stock availability.
- Unique reconfiguring.
- Decrease tooling spend.
- Reduce administrative costs.
- Accountability.
- Reduced cost per location.



Drawer Options

19 different drawer sizes available.

Compatibility

Fully compatible with existing ToolBOSS units.

Diagnostics

Built-in tray diagnostic port, facilitating improved remote system support, diagnosis, and repair.

Efficiency

Multiple drawers can be selected in one transaction, minimising the time required to manage large stock volumes.

Future-Port

USB interface, as well as a DCS expansion port, for use with RFID and other ancillary equipment.



High-Speed Access

Rapid search and selection of an item is enhanced with LED identification system, guiding users to the correct drawer.

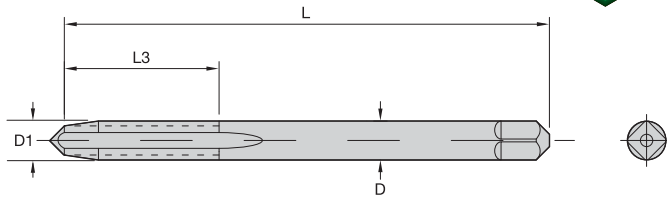
Traceability

Software provides a complete audit trail, tracking component usage details.

Expandability

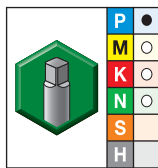
Expandable up to 10 units per system, providing up to 1,121 secure locations.

To learn more about ToolBOSS, contact your local Authorized Distributor or visit www.widia.com.



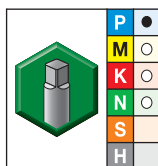
- first choice
- alternate choice

■ Series 5305L/5303L • Machine Screw and Fractional • Plug Chamfer



uncoated	D1 size	L	L3	D	number of flutes	pitch diameter limit
18827	6 - 32	6.00	.69	.141	3	H3
18891	8 - 32	6.00	.75	.168	4	H3
18833	10 - 24	6.00	.88	.194	4	H3
18836	10 - 32	6.00	.88	.194	4	H3
18839	1/4 - 20	6.00	1.00	.255	4	H3
18842	1/4 - 28	6.00	1.00	.255	4	H3
18845	5/16 - 18	6.00	.67	.318	4	H3
18848	5/16 - 24	6.00	.59	.318	4	H3
18851	3/8 - 16	6.00	1.25	.381	4	H3
18854	3/8 - 24	6.00	1.25	.381	4	H3

■ Series 5305L/3305L/5303L • Machine Screw and Fractional • Bottoming Chamfer



uncoated	D1 size	L	L3	D	number of flutes	pitch diameter limit
18828	6 - 32	6.00	.69	.141	3	H3
18892	8 - 32	6.00	.75	.168	4	H3
18834	10 - 24	6.00	.88	.194	4	H3
18837	10 - 32	6.00	.88	.194	4	H3
18840	1/4 - 20	6.00	1.00	.255	4	H3
18843	1/4 - 28	6.00	1.00	.255	4	H3
18846	5/16 - 18	6.00	.67	.318	4	H3
18849	5/16 - 24	6.00	.59	.318	4	H3
18852	3/8 - 16	6.00	1.25	.381	4	H3
18855	3/8 - 24	6.00	1.25	.381	4	H3

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.

WIDIA-GTD™ GUN™ Taps for Through Holes

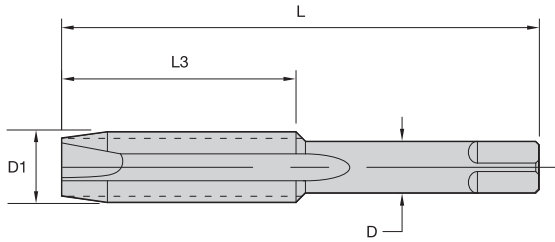
Features:

- GUN taps shoot chips ahead of the cutting action.
- Advanced steam oxide finish.
- High-performance TiN, TiN+CrC/C, and TiCN coatings.
- Alternate tap coatings available as stock modifications.

Benefits:

- The most efficient taps for through holes.
- Reduced overloading and clogging in flutes to protect the workpiece.
- Extended life in ferrous materials.
- Higher tapping speeds can be achieved to increase productivity.

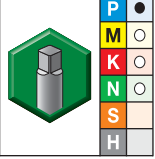
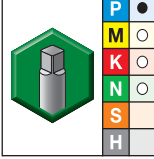
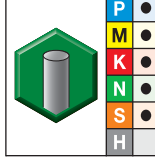
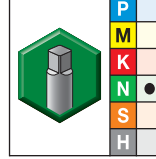




NOTE: Series 5301TC • TiCN Coated
 Series 2301 • TiN Coated
 Series 5301S • SH50 Steam Oxide
 Series 5301 • Uncoated

● first choice
 ○ alternate choice

■ Series 5301/2301 • Machine Screw and Fractional Sizes • Plug Chamfer

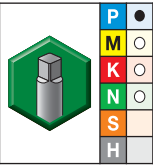
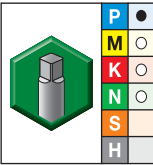
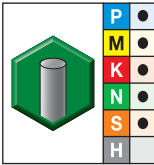
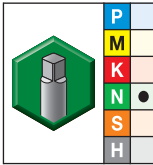
				D1 size	L	L3	D	number of flutes	pitch diameter limit
TiCN	TiN	oxide	uncoated						
19440	19370	—	13201	0 - 80	1.63	.31	.141	2	H1
19011	19001	13111	13202	0 - 80	1.63	.31	.141	2	H2
19441	19371	—	13203	1 - 64	1.69	.38	.141	2	H1
19442	—	—	13204	1 - 64	1.69	.38	.141	2	H2
19444	19372	—	13205	1 - 72	1.69	.38	.141	2	H1
19446	—	13115	13206	1 - 72	1.69	.38	.141	2	H2
19448	19374	—	13207	2 - 56	1.75	.44	.141	2	H1
19012	19006	13117	13208	2 - 56	1.75	.44	.141	2	H2
19449	—	—	13211	2 - 64	1.75	.44	.141	2	H2
19452	19007	13119	13213	3 - 48	1.81	.50	.141	2	H2
19454	19376	—	13214	3 - 56	1.81	.50	.141	2	H1
19459	—	13121	13215	3 - 56	1.81	.50	.141	2	H2
19461	19379	13126	13217	4 - 36	1.88	.56	.141	2	H2
19013	19016	13123	13219	4 - 40	1.88	.56	.141	2	H2
19462	—	—	13223	4 - 48	1.88	.56	.141	2	H2
19463	19381	—	13224	5 - 40	1.94	.63	.141	2	H1
19014	19021	13128	13225	5 - 40	1.94	.63	.141	2	H2
19464	—	—	13229	5 - 44	1.94	.63	.141	2	H2
19466	—	—	13230	6 - 32	2.00	.69	.141	2	H1
19467	19031	13131	13231	6 - 32	2.00	.69	.141	2	H2
19037	19038	13134	13237	6 - 40	2.00	.69	.141	2	H2
19469	19780	—	13240	8 - 32	2.13	.75	.168	2	H1
19471	19039	13136	13241	8 - 32	2.13	.75	.168	2	H2
19472	19046	13137	13242	8 - 32	2.13	.75	.168	2	H3
19473	—	13139	13246	8 - 36	2.13	.75	.168	2	H2
19474	—	—	13249	10 - 24	2.38	.88	.194	2	H1
19476	—	13141	13250	10 - 24	2.38	.88	.194	2	H2
19015	19056	13142	13251	10 - 24	2.38	.88	.194	2	H3

(continued)

Production Taps

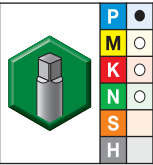
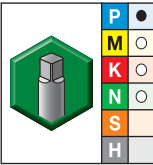
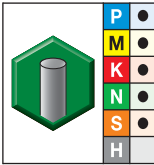
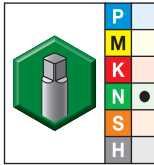
GUN™ Taps • Through Holes in General Machining Applications

(Series 5301/2301 • Machine Screw and Fractional Sizes • Plug Chamfer continued)

				D1 size	L	L3	D	number of flutes	pitch diameter limit
TiCN	TiN	oxide	uncoated						
19477	—	—	13252	10 - 24	2.38	.88	.194	2	H7
19478	—	—	13255	10 - 32	2.38	.88	.194	2	H1
19479	19069	13145	13256	10 - 32	2.38	.88	.194	2	H2
—	19071	13146	13257	10 - 32	2.38	.88	.194	2	H3
19481	—	—	13260	10 - 32	2.38	.88	.194	2	H7
19017	19076	13148	13262	12 - 24	2.38	.94	.220	2	H3
19482	—	13149	13264	12 - 28	2.38	.94	.220	2	H3
19484	—	—	13268	1/4 - 20	2.50	1.00	.255	2	H1
19483	—	—	—	1/4 - 20	2.50	1.00	.255	2	H1
—	19079	13151	13269	1/4 - 20	2.50	1.00	.255	2	H2
19485	19086	13152	13270	1/4 - 20	2.50	1.00	.255	2	H3
19486	19096	—	13273	1/4 - 20	2.50	1.00	.255	2	H5
—	19088	13154	13272	1/4 - 20	2.50	1.00	.255	3	H3
19487	19382	—	13274	1/4 - 20	2.50	1.00	.255	3	H5
19488	19383	—	13277	1/4 - 28	2.50	1.00	.255	2	H1
19489	—	13157	13278	1/4 - 28	2.50	1.00	.255	2	H2
19492	19101	13158	13280	1/4 - 28	2.50	1.00	.255	2	H3
—	—	—	13282	1/4 - 28	2.50	1.00	.255	2	H4
19018	—	—	—	1/4 - 28	2.50	1.00	.255	3	H2
19490	—	—	13279	1/4 - 28	2.50	1.00	.255	3	H2
19494	—	—	13283	1/4 - 28	2.50	1.00	.255	3	H4
19496	—	—	13289	5/16 - 18	2.72	1.13	.318	2	H1
19497	—	—	—	5/16 - 18	2.72	1.13	.318	2	H1
—	19102	—	13290	5/16 - 18	2.72	1.13	.318	2	H2
19498	19106	13164	13291	5/16 - 18	2.72	1.13	.318	2	H3
19499	—	—	13294	5/16 - 18	2.72	1.13	.318	2	H5
—	19103	—	—	5/16 - 18	2.72	1.13	.318	3	H2
19019	19384	13166	13293	5/16 - 18	2.72	1.13	.318	3	H3
19501	—	—	13295	5/16 - 18	2.72	1.13	.318	3	H5
19502	19385	—	13297	5/16 - 24	2.72	1.13	.318	2	H1

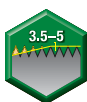
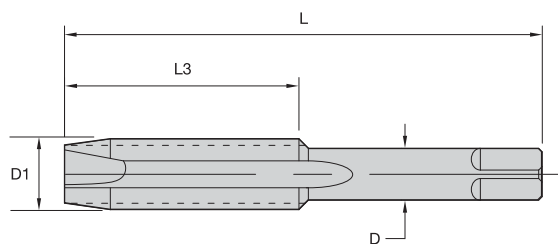
(continued)

(Series 5301/2301 • Machine Screw and Fractional Sizes • Plug Chamfer continued)

				D1 size	L	L3	D	number of flutes	pitch diameter limit
TiCN	TiN	oxide	uncoated						
—	—	13169	13298	5/16 - 24	2.72	1.13	.318	2	H2
19504	19108	13170	13300	5/16 - 24	2.72	1.13	.318	2	H3
19505	19386	—	13302	5/16 - 24	2.72	1.13	.318	2	H4
19020	19387	—	13303	5/16 - 24	2.72	1.13	.318	3	H4
19507	19388	—	13305	3/8 - 16	2.94	1.25	.381	3	H1
19508	—	—	13306	3/8 - 16	2.94	1.25	.381	3	H2
19022	19111	13176	13307	3/8 - 16	2.94	1.25	.381	3	H3
19509	—	—	13309	3/8 - 16	2.94	1.25	.381	3	H5
19510	19389	—	13311	3/8 - 24	2.94	1.25	.381	3	H1
19512	—	—	13312	3/8 - 24	2.94	1.25	.381	3	H2
19023	19112	13180	13313	3/8 - 24	2.94	1.25	.381	3	H3
19513	—	—	13315	3/8 - 24	2.94	1.25	.381	3	H4
19515	19391	—	13318	7/16 - 14	3.16	1.44	.323	3	H2
19024	19113	13183	13319	7/16 - 14	3.16	1.44	.323	3	H3
19516	—	—	13320	7/16 - 14	3.16	1.44	.323	3	H5
19025	19114	13185	13324	7/16 - 20	3.16	1.44	.323	3	H3
19517	—	—	13325	7/16 - 20	3.16	1.44	.323	3	H5
19519	—	—	13327	1/2 - 13	3.38	1.66	.367	3	H2
19026	19116	13189	13328	1/2 - 13	3.38	1.66	.367	3	H3
19520	—	—	13330	1/2 - 13	3.38	1.66	.367	3	H5
19521	19392	—	13332	1/2 - 20	3.38	1.66	.367	3	H1
19524	19393	—	13333	1/2 - 20	3.38	1.66	.367	3	H2
19027	19117	13193	13334	1/2 - 20	3.38	1.66	.367	3	H3
19525	—	—	13336	1/2 - 20	3.38	1.66	.367	3	H5
19028	19118	13195	13339	5/8 - 11	3.81	1.81	.480	3	H3
19526	19394	—	13340	5/8 - 11	3.81	1.81	.480	3	H5
19529	—	13199	13342	5/8 - 18	3.81	1.81	.480	3	H3
19029	19119	13197	13343	3/4 - 10	4.25	2.00	.590	3	H3
—	—	—	13344	3/4 - 10	4.25	2.00	.590	3	H5

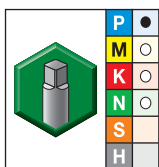
GUN taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



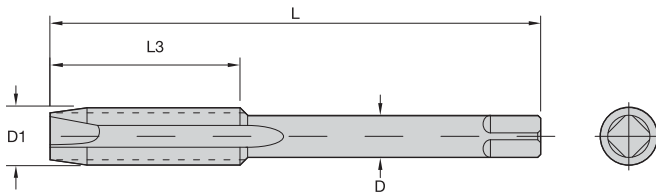
- first choice
- alternate choice

■ Series 5301F • Fractional Sizes • Spiral Point, Plug Chamfer



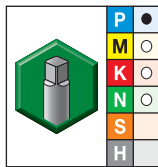
uncoated	D1 size	L	L3	D	number of flutes	pitch diameter limit
13275	1/4 - 20	2.50	1.00	.255	2	H11
13296	5/16 - 18	2.72	1.13	.318	2	H11
13331	1/2 - 13	3.38	1.66	.367	3	H11
13310	3/8 - 16	2.94	1.25	.381	3	H11
13341	5/8 - 11	3.81	1.81	.480	3	H11

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



- first choice
- alternate choice

■ Series 5301 • Fractional Sizes • Spiral Point, Plug Chamfer

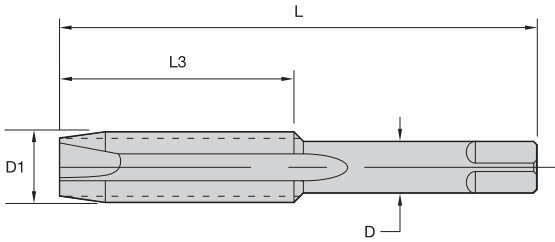


Uncoated	D1 size	L	L3	D	number of flutes	pitch diameter limit
18930	6 - 32	6.00	.69	.141	2	H3
18932	8 - 32	6.00	.75	.168	2	H3
18934	10 - 24	6.00	.88	.194	2	H3
18935	10 - 32	6.00	.88	.194	2	H3
18936	1/4 - 20	6.00	1.00	.255	2	H3
18937	1/4 - 28	6.00	1.00	.255	2	H3
18938	5/16 - 18	6.00	1.13	.318	2	H3
18939	5/16 - 24	6.00	1.13	.318	2	H3
18940	3/8 - 16	6.00	1.25	.381	3	H3
18941	3/8 - 24	6.00	1.25	.381	3	H3

Also available in Hand Tap Series 5305, 5303.

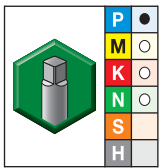
GUN taps for 3B class of fit are suitable for UNJ Aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



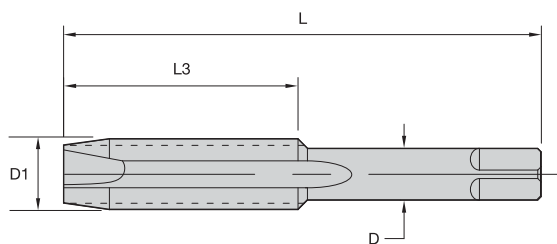
- first choice
- alternate choice

■ Series 5601 • Machine Screw and Fractional • Spiral Point, Plug Chamfer



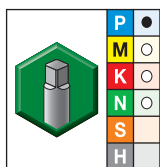
oxide/nitride	D1 size	L	L3	D	number of flutes	pitch diameter limit
16802	6 - 32	2.00	.69	.141	3	H3
16805	8 - 32	2.13	.75	.168	3	H3
16807	10 - 24	2.38	.88	.194	3	H3
16809	10 - 32	2.38	.88	.194	3	H3
16810	1/4 - 20	2.50	1.00	.255	3	H3
16812	1/4 - 28	2.50	1.00	.255	3	H3
16814	5/16 - 18	2.72	1.13	.318	3	H3
16818	3/8 - 16	2.94	1.25	.381	3	H3
16820	3/8 - 24	2.94	1.25	.381	3	H3
16826	1/2 - 13	3.38	1.66	.367	3	H3
16830	5/8 - 11	3.81	1.81	.480	3	H3
16832	3/4 - 10	4.25	2.00	.590	3	H3

GUN taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.
Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



- first choice
- alternate choice

■ Series 5302 • Machine Screw and Fractional • Spiral Point, Bottoming Chamfer

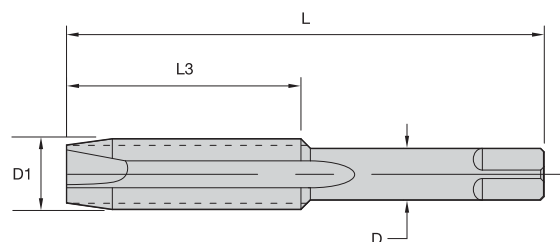


uncoated	D1 size	L	L3	D	number of flutes	pitch diameter limit
13602	0 - 80	1.63	.31	.141	2	H2
13606	2 - 56	1.75	.44	.141	2	H2
13609	3 - 48	1.81	.50	.141	2	H2
13614	4 - 40	1.88	.56	.141	2	H2
13617	5 - 40	1.94	.63	.141	2	H2
13619	6 - 32	2.00	.69	.141	2	H2
13620	6 - 32	2.00	.69	.141	2	H3
13623	6 - 40	2.00	.69	.141	2	H2
13625	8 - 32	2.13	.75	.168	2	H2
13626	8 - 32	2.13	.75	.168	2	H3
13629	10 - 24	2.38	.88	.194	2	H2
13630	10 - 24	2.38	.88	.194	2	H3
13633	10 - 32	2.38	.88	.194	2	H2
13634	10 - 32	2.38	.88	.194	2	H3
13636	12 - 24	2.38	.94	.220	2	H3
13638	1/4 - 20	2.50	1.00	.255	2	H3
13639	1/4 - 28	2.50	1.00	.255	2	H3
13641	5/16 - 18	2.72	1.13	.318	2	H3
13642	5/16 - 24	2.72	1.13	.318	2	H3

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.

Production Taps

GUN™ Taps • Through Holes in General Machining Applications



NOTE: Series 5351TC • TiCN Coated
Series 2351 • TiN Coated
Series 5351 • Uncoated

● first choice
○ alternate choice

Series 5351/2351 • Spiral Point, Plug Chamfer • Metric ANSI

							number of flutes	pitch diameter limit
TiCN	TiN	uncoated	D1 size	L	L3	D		
—	—	13367	M2 X 0,4	1.75	.44	.141	2	D3
—	—	13369	M2,5 X 0,45	1.81	.50	.141	2	D3
19002	19920	13371	M3 X 0,5	1.94	.63	.141	2	D3
—	—	13373	M3,5 X 0,6	2.00	.69	.141	2	D4
—	19921	13375	M4 X 0,7	2.13	.75	.168	2	D4
—	—	13377	M4,5 X 0,75	2.38	.88	.194	2	D4
19004	19922	13379	M5 X 0,8	2.38	.88	.194	2	D4
—	—	13381	M6 X 1	2.50	1.00	.255	2	D5
—	—	13382	M6,3 X 1	2.50	1.00	.255	2	D5
—	—	13383	M7 X 1	2.72	1.13	.318	2	D5
19008	—	13385	M8 X 1,25	2.72	1.13	.318	2	D5
19009	19925	13389	M10 X 1,5	2.94	1.25	.381	3	D6
19010	19926	—	M12 X 1,75	3.38	1.66	.367	3	D6
—	—	13405	M18 X 2,5	4.03	1.81	.542	3	D7

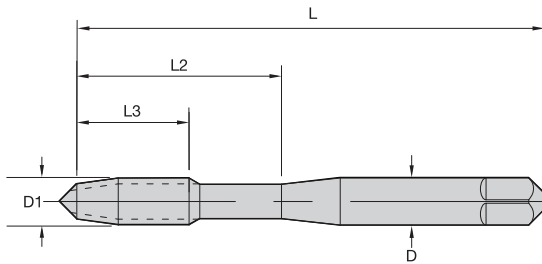
Metric taps for 6H class of fit are suitable for MJ aerospace internal threading applications.

Metric taps are manufactured to USCTI specifications and dimensions.

Metric tap blank dimensions are equivalent to inch taps.

Metric D limits suitable for ISO 6H tolerance class.

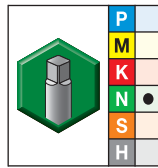
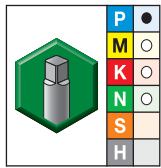
Refer to table on page A258 for the recommended pitch diameter limit for 6H class of fit.



NOTE: Series 2500TiN • TiN Coated
 Series 5500 • Uncoated

● first choice
 ○ alternate choice

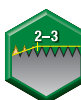
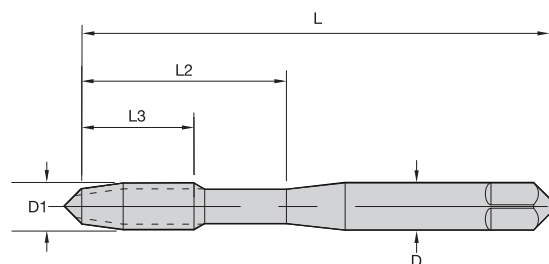
■ Series 2500/5500 • Machine Screw and Fractional • Plug Entry Taper



TiN	uncoated	D1 size	L	L3	L2	D	number of lube grooves	pitch diameter limit
19821	17000	4 - 40	1.88	.31	.56	.141	—	H3
—	17001	4 - 40	1.88	.31	.56	.141	—	H5
—	17002	4 - 48	1.88	.56	.56	.141	—	H3
—	17004	5 - 40	1.94	.31	.63	.141	4	H3
19822	17008	6 - 32	2.00	.38	.69	.141	4	H3
19823	17009	6 - 32	2.00	.38	.69	.141	4	H5
—	17011	6 - 40	2.00	.38	.69	.141	4	H3
—	17012	6 - 40	2.00	.38	.69	.141	4	H5
19824	17013	8 - 32	2.13	.38	.75	.168	4	H3
19826	17014	8 - 32	2.13	.38	.75	.168	4	H5
19827	17018	10 - 24	2.38	.50	.88	.194	4	H4
—	17019	10 - 24	2.38	.50	.88	.194	4	H6
19828	17020	10 - 32	2.38	.50	.88	.194	4	H4
—	17021	10 - 32	2.38	.50	.88	.194	4	H6
—	17023	12 - 24	2.38	.50	.94	.220	4	H4
—	17024	12 - 24	2.38	.50	.94	.220	4	H6
19841	17027	1/4 - 20	2.50	.63	1.00	.255	4	H4
—	17028	1/4 - 20	2.50	.63	1.00	.255	4	H6
19842	17030	1/4 - 28	2.50	.63	1.00	.255	4	H4
—	17031	1/4 - 28	2.50	.63	1.00	.255	4	H6
19846	—	5/16 - 18	2.72	.69	1.13	.318	4	H5
—	17034	5/16 - 18	2.72	.69	1.13	.318	4	H7
—	17037	5/16 - 24	2.72	.69	1.13	.318	4	H7
—	17033	5/16 - 18	2.72	.69	1.13	.318	4	H5
—	17036	5/16 - 24	2.72	.69	1.13	.318	4	H5
19847	17039	3/8 - 16	2.94	.75	1.25	.381	4	H5
—	17040	3/8 - 16	2.94	.75	1.25	.381	4	H7
—	17042	3/8 - 24	2.94	.75	—	.323	4	H8
—	17046	7/16 - 14	3.17	.88	—	.323	4	H8
—	17049	1/2 - 13	3.38	.94	—	.367	4	H5
—	17050	1/2 - 13	3.38	.94	—	.367	4	H8
—	17051	1/2 - 20	3.38	.94	—	.367	4	H5
—	17053	5/8 - 11	3.81	1.09	—	.480	4	H7
—	17055	5/8 - 18	3.81	1.09	—	.480	4	H7
—	17057	3/4 - 10	4.25	1.22	—	.590	4	H7
—	17059	3/4 - 16	4.25	1.22	—	.590	4	H7

Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



NOTE: Series 2502TiN • TiN Coated
Series 5502 • Uncoated
Series 5502TC • TiCN Coated

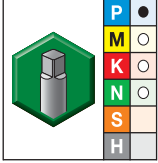
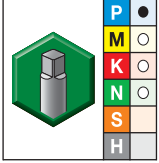
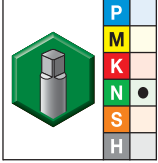
● first choice
○ alternate choice

Series 2502/5502 • Machine Screw and Fractional • Bottoming Chamfer

TiCN	TiN	uncoated	D1 size	L	L3	L2	D	number of lube grooves	pitch diameter limit
19500	19816	17200	0 - 80	1.63	.31	—	.141	—	H2
—	—	17201	0 - 80	1.63	.31	—	.141	—	H3
—	—	17202	1 - 64	1.69	.38	—	.141	—	H2
—	—	17204	1 - 72	1.69	.38	—	.141	—	H2
—	—	17205	1 - 72	1.69	.38	—	.141	—	H3
19506	19817	17206	2 - 56	1.75	.44	—	.141	—	H2
—	—	17207	2 - 56	1.75	.44	—	.141	—	H3
—	—	17208	2 - 64	1.75	.44	—	.141	—	H2
—	—	17209	2 - 64	1.75	.44	—	.141	—	H3
—	—	17210	3 - 48	1.81	.50	—	.141	—	H2
19511	19818	17211	3 - 48	1.81	.50	—	.141	—	H3
—	—	17213	3 - 48	1.81	.50	—	.141	—	H3
19514	19849	17214	4 - 40	1.88	.31	.56	.141	—	H3
—	—	17215	4 - 40	1.88	.31	.56	.141	—	H5
—	—	17216	4 - 48	1.88	.31	.56	.141	—	H3
—	—	17217	4 - 48	1.88	.31	.56	.141	—	H5
19518	19851	17218	5 - 40	1.94	.31	.63	.141	4	H3
—	—	17219	5 - 40	1.94	.31	.63	.141	4	H5
19522	19852	17222	6 - 32	2.00	.38	.69	.141	4	H3
19523	19856	17223	6 - 32	2.00	.38	.69	.141	4	H5
—	—	17225	6 - 40	2.00	.38	.69	.141	4	H3
—	—	17226	6 - 40	2.00	.38	.69	.141	4	H5
19527	19857	17227	8 - 32	2.13	.38	.75	.168	4	H3
19528	19861	17228	8 - 32	2.13	.38	.75	.168	4	H5
—	—	17230	8 - 36	2.13	.38	.75	.168	4	H3
—	—	17231	8 - 36	2.13	.38	.75	.168	4	H5
19532	19862	17232	10 - 24	2.38	.50	.88	.194	4	H4
—	—	17233	10 - 24	2.38	.50	.88	.194	4	H6
19535	19866	17235	10 - 32	2.38	.50	.88	.194	4	H4
—	—	17236	10 - 32	2.38	.50	.88	.194	4	H6
—	—	17238	12 - 24	2.38	.50	.94	.220	4	H4
—	—	17239	12 - 24	2.38	.50	.94	.220	4	H6
19542	19869	17242	1/4 - 20	2.50	.63	1.00	.255	4	H4
—	—	17243	1/4 - 20	2.50	.63	1.00	.255	4	H6
19545	19871	17245	1/4 - 28	2.50	.63	1.00	.255	4	H4
—	—	17246	1/4 - 28	2.50	.63	1.00	.255	4	H6

(continued)

(Series 2502/5502 • Machine Screw and Fractional • Bottoming Chamfer continued)

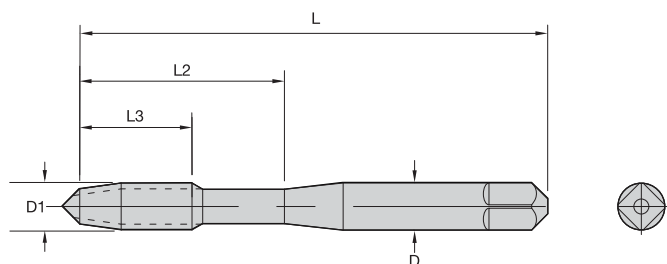
 TiCN	 TiN	 uncoated	D1 size	L	L3	L2	D	number of lube grooves	pitch diameter limit
—	19872	—	5/16 - 18	2.72	.69	1.13	.318	4	H5
19549	19848	17251	5/16 - 24	2.72	.69	1.13	.318	4	H5
—	—	17252	5/16 - 24	2.72	.69	1.13	.318	4	H7
19548	—	17248	5/16 - 18	2.72	.69	1.13	.318	4	H5
—	—	17249	5/16 - 18	2.72	.69	1.13	.318	4	H7
19554	19873	17254	3/8 - 16	2.94	.75	1.25	.381	4	H5
—	—	17255	3/8 - 16	2.94	.75	1.25	.381	4	H7
19555	19874	17257	3/8 - 24	2.94	.75	1.25	.381	4	H5
—	—	17258	3/8 - 24	2.94	.75	1.25	.381	4	H7
19556	19875	17264	1/2 - 13	3.38	.94	—	.367	4	H5
—	—	17265	1/2 - 13	3.38	.94	—	.367	4	H8
—	—	17266	1/2 - 20	3.38	.94	—	.367	4	H5
—	—	17280	5/8 - 11	3.81	1.09	—	.480	4	H7
—	—	17282	5/8 - 18	3.81	1.09	—	.480	4	H7
—	—	17284	3/4 - 10	4.25	1.22	—	.590	4	H7
—	—	17286	3/4 - 16	4.25	1.22	—	.590	4	H7

Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.

Production Taps

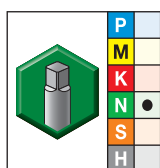
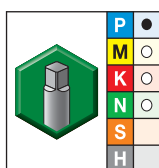
TRU-LEDE™ Forming Taps • Through Holes in General Machining Applications



NOTE: Series 2510 • TiN Coated
Series 5510 • Uncoated

● first choice
○ alternate choice

■ Series 2510/5510 • Plug Entry Taper • Metric ANSI



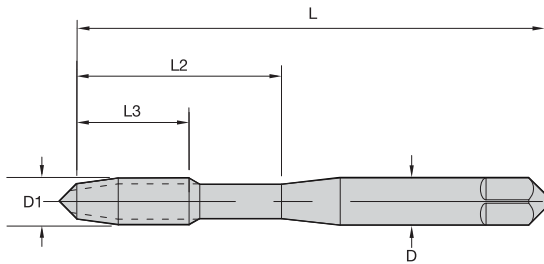
		D1 size	L	L3	L2	D	number of lube grooves	pitch diameter limit
TiN	Uncoated							
19941	17082	M3 X 0,5	1.94	.31	.63	.14	4	D5
—	17084	M4 X 0,7	2.13	.38	.75	.17	4	D6
19943	—	M5 X 0,8	2.38	.50	.88	.19	4	D7
—	17087	M6 X 1	2.50	.63	1.00	.26	4	D8
—	17090	M8 X 1,25	2.72	.69	1.13	.32	4	D9
—	17091	M10 X 1,5	2.94	.75	1.25	.38	4	D10

Metric taps are manufactured to USCTI specifications and dimensions.

Metric tap blank dimensions are equivalent to inch taps.

Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

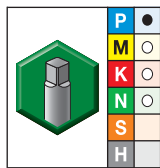
Refer to table on page A258 for the recommended pitch diameter limit for 6H class of fit.



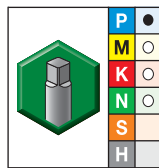
NOTE: Series 2512 • TiN Coated
Series 5512TC • TiCN Coated
Series 5512 • Uncoated

● first choice
○ alternate choice

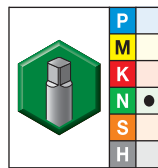
■ Series 2512/5512 • Bottom Entry Taper • Metric ANSI



TiCN



TiN



uncoated

			D1 size	L	L3	L2	D	number of lube grooves	pitch diameter limit
19567	19948	17267	M3 X 0,5	1.94	.31	.63	.141	4	D5
19569	19949	17269	M4 X 0,7	2.13	.38	.75	.168	4	D6
19571	19950	17271	M5 X 0,8	2.38	.50	.88	.194	4	D7
19572	19951	17272	M6 X 1	2.50	.63	1.00	.255	4	D8
19574	19952	17275	M8 X 1,25	2.72	.69	1.13	.318	4	D9
19576	19953	17276	M10 X 1,5	2.94	.75	1.25	.381	4	D10
—	19954	17277	M12 X 1,75	3.38	.94	—	.367	4	D11

Metric taps are manufactured to USCTI specifications and dimensions.

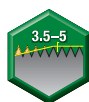
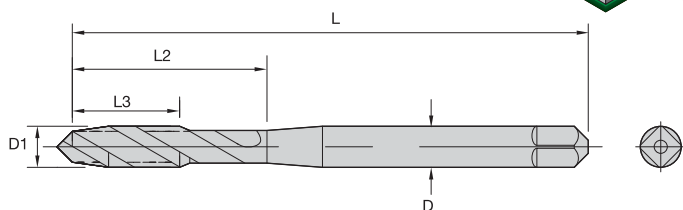
Metric tap blank dimensions are equivalent to inch taps.

Form taps require a larger drilled hole size prior to tapping than corresponding cutting taps.

Refer to table on page A258 for the recommended pitch diameter limit for 6H class of fit.

Production Taps

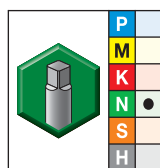
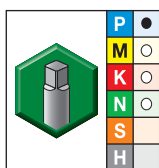
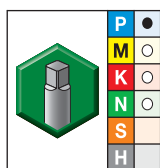
Spiral-Flute Taps • Blind Holes in General Machining Applications



NOTE: Series 5314TC • TiCN Coated
Series 2314 • TiN Coated
Series 5314 • Uncoated

● first choice
○ alternate choice

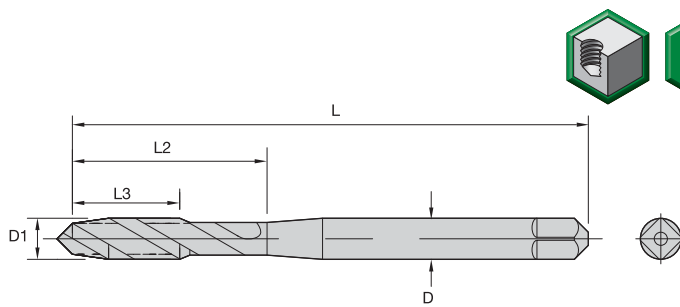
Series 2314/5314 • Machine Screw and Fractional • Plug Chamfer



TiCN	TiN	uncoated	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit
19144	19619	16003	4 - 40	1.88	.56	—	.141	2	H2
—	—	16005	5 - 40	1.94	.63	—	.141	2	H2
19146	19622	16007	6 - 32	2.00	.38	.69	.141	2	H3
19148	19626	16009	8 - 32	2.13	.38	.75	.168	3	H3
19151	19628	16011	10 - 24	2.38	.50	.88	.194	3	H3
19153	19624	16013	10 - 32	2.38	.50	.88	.194	3	H3
—	—	16015	12 - 24	2.38	.50	.94	.220	3	H3
19155	19632	16017	1/4 - 20	2.50	.63	1.00	.255	3	H3
19157	19634	16021	1/4 - 28	2.50	.63	1.00	.255	3	H3
19160	19636	16023	5/16 - 18	2.72	.69	1.12	.318	3	H3
19162	19638	16027	5/16 - 24	2.72	.69	1.12	.318	3	H3
19164	19641	16029	3/8 - 16	2.94	.75	1.25	.381	3	H3
19166	19643	16033	3/8 - 24	2.94	.75	1.25	.381	3	H3
19169	19646	16035	7/16 - 14	3.16	.88	—	.323	3	H3
—	—	16037	7/16 - 20	3.16	.88	—	.323	3	H3
19172	19648	16039	1/2 - 13	3.38	.94	—	.367	3	H3
—	—	16041	1/2 - 20	3.38	.94	—	.367	3	H3
—	—	16047	5/8 - 11	3.81	1.09	—	.480	4	H3
—	—	16051	3/4 - 10	4.25	1.22	—	.590	4	H3

EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



NOTE: Series 5314TC • TiCN Coated
 Series 2314 • TiN Coated
 Series 5314 • Uncoated

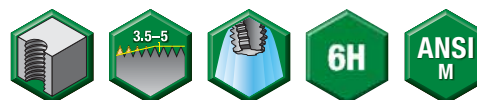
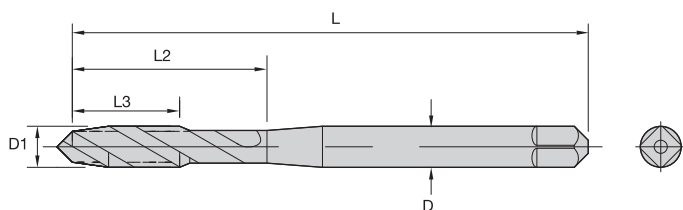
● first choice
 ○ alternate choice

■ Series 2314/5314 • Machine Screw and Fractional • Bottoming Chamfer

TiCN	TiN	uncoated	D1 size	L	L3	L2	D	number of flutes	pitch diameter limit	
19145	19621	16004	4 - 40	1.88	.56	—	.141	2	H2	
—	—	16006	5 - 40	1.94	.56	—	.141	2	H2	
19147	19623	16008	6 - 32	2.00	.38	.69	.141	2	H3	
19149	19627	16010	8 - 32	2.13	.38	.75	.168	3	H3	
19152	19629	16012	10 - 24	2.38	.50	.88	.194	3	H3	
19154	19631	16014	10 - 32	2.38	.50	.88	.194	3	H3	
—	—	16016	12 - 24	2.38	.50	.94	.220	3	H3	
19156	19633	16018	1/4 - 20	2.50	.63	1.00	.255	3	H3	
19158	19651	16022	1/4 - 28	2.50	.63	1.00	.255	3	H3	
19161	19637	16024	5/16 - 18	2.72	.69	1.12	.318	3	H3	
19163	19639	16028	5/16 - 24	2.72	.69	1.12	.318	3	H3	
19165	19642	16030	3/8 - 16	2.94	.75	1.25	.381	3	H3	
—	19644	16034	3/8 - 24	2.94	.75	1.25	.381	3	H3	
19168	—	—	3/8 - 24	2.94	.75	1.25	.381	3	H3	
19171	19647	16036	7/16 - 14	3.16	.88	—	.323	3	H3	
—	—	16038	7/16 - 20	3.16	.88	—	.323	3	H3	
19173	19649	16040	1/2 - 13	3.38	.94	—	.367	3	H3	
—	—	16042	1/2 - 20	3.38	.94	—	.367	3	H3	
—	—	16048	5/8 - 11	3.81	1.09	—	.480	4	H3	
—	—	16052	3/4 - 10	4.25	1.22	—	.590	4	H3	

EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

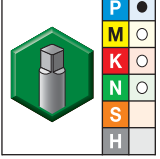
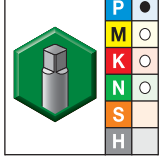
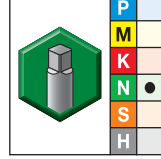
Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.



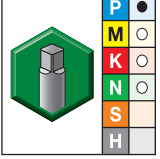
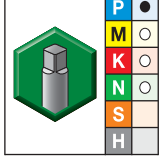
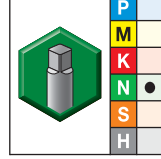
NOTE: Series 5364TC • TiCN Coated
Series 2364 • TiN Coated
Series 5364 • Uncoated

● first choice
○ alternate choice

Series 2364/5364 • Plug Chamfer • Metric ANSI

											
	TiCN	TiN	uncoated	D1 size	L	L2	L3	D	number of flutes	pitch diameter limit	
		19927	16053	M3 X 0,5	1.94	—	.31	.141	2	D3	
19047	—	—	—	M4 X 0,7	2.13	—	.38	.168	3	D4	
—	—	19929	16057	M4 X 0,7	2.13	.75	.38	.168	3	D4	
19049	—	—	—	M5 X 0,8	2.38	—	.50	.194	3	D4	
—	—	—	16061	M5 X 0,8	2.38	.88	.50	.194	3	D4	
—	—	19933	16063	M6 X 1	2.50	1.00	.63	.255	3	D5	
—	—	—	16069	M8 X 1,25	2.72	1.12	.69	.318	3	D5	
—	—	19935	19054	M8 X 1,25	2.72	1.12	.69	.318	3	D5	
—	—	19937	16071	M10 X 1,5	2.94	1.25	.75	.381	3	D6	
19061	—	—	—	M12 X 1,75	3.38	—	.94	.367	3	D6	
—	—	19939	16073	M12 X 1,75	3.38	—	.94	.367	3	D6	

Series 2364/5364 • Bottoming Chamfer • Metric ANSI

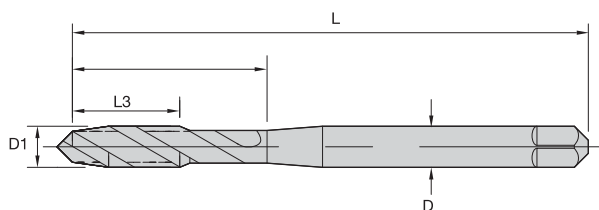
											
	TiCN	TiN	uncoated	D1 size	L	L2	L3	D	number of flutes	pitch diameter limit	
19044	—	—	—	M3 X 0,5	1.94	—	.31	.141	2	D3	
19045	—	—	19928	M3 X 0,5	1.94	—	.31	.141	2	D3	
—	—	—	16054	M3 X 0,5	1.94	—	.31	.141	2	D3	
—	—	19930	16058	M4 X 0,7	2.13	.75	.38	.168	3	D4	
—	—	—	19048	M4 X 0,7	2.13	.75	.38	.168	3	D4	
19051	—	19932	16062	M5 X 0,8	2.38	.88	.50	.194	3	D4	
—	—	—	16064	M6 X 1	2.50	.75	.38	.255	3	D5	
19052	—	—	—	M6 X 1	2.50	—	.38	.255	3	D5	
—	—	19934	19053	M6 X 1	2.50	.75	.38	.255	3	D5	
19057	—	19936	16070	M8 X 1,25	2.72	1.12	.69	.318	3	D5	
19058	—	—	—	M10 X 1,5	2.94	—	.75	.381	3	D6	
19059	—	19938	16072	M10 X 1,5	2.94	1.25	.75	.381	3	D6	
19062	—	—	16074	M12 X 1,75	3.38	—	.94	.367	3	D6	

Metric D limits are suitable for ISO 6H tolerance class.

Metric taps are manufactured to USCTI specifications and dimensions.

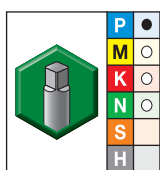
Metric tap blank dimensions are equivalent to inch taps.

Refer to table on page A258 for the recommended pitch diameter limit for 6H class of fit.

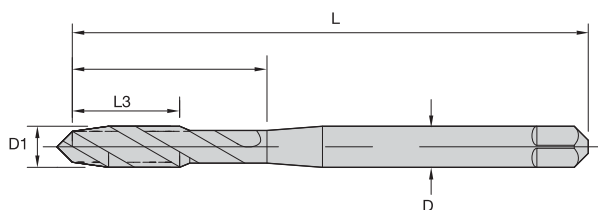


- first choice
- alternate choice

■ Series 5344 • Machine Screw and Fractional • Plug Chamfer

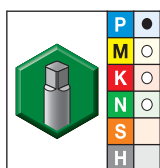


oxide	D1 size	L	L3	D	number of flutes	pitch diameter limit
16501	6 - 32	2.00	.38	.141	3	H3
16503	8 - 32	2.13	.38	.168	3	H3
16505	10 - 24	2.38	.50	.194	3	H3
16507	10 - 32	2.38	.50	.194	3	H3
16509	1/4 - 20	2.50	.63	.255	3	H3
16511	1/4 - 28	2.50	.63	.255	3	H3
16513	5/16 - 18	2.72	.69	.318	3	H3
16515	5/16 - 24	2.72	.69	.318	3	H3
16517	3/8 - 16	2.94	.75	.381	3	H3
16519	3/8 - 24	2.94	.75	.381	3	H3
16521	7/16 - 14	3.17	1.44	—	3	H3
16523	7/16 - 20	3.17	1.44	—	3	H3
16527	1/2 - 20	3.38	1.66	—	3	H3
16525	1/2 - 13	3.38	.94	.367	3	H3
16533	5/8 - 11	3.81	1.09	.480	4	H3
16537	3/4 - 10	4.25	1.22	.590	4	H3



- first choice
- alternate choice

■ Series 5344 • Machine Screw and Fractional • Bottoming Chamfer



oxide	D1 size	L	L3	D	number of flutes	pitch diameter limit
16502	6 - 32	2.00	.38	.141	3	H3
16504	8 - 32	2.13	.38	.168	3	H3
16506	10 - 24	2.38	.50	.194	3	H3
16508	10 - 32	2.38	.50	.194	3	H3
16510	1/4 - 20	2.50	.63	.255	3	H3
16512	1/4 - 28	2.50	.63	.255	3	H3
16514	5/16 - 18	2.72	.69	.318	3	H3
16516	5/16 - 24	2.72	.69	.318	3	H3
16518	3/8 - 16	2.94	.75	.381	3	H3
16520	3/8 - 24	2.94	.75	.381	3	H3
16522	7/16 - 14	3.16	.88	.323	3	H3
16524	7/16 - 20	3.17	1.44	—	3	H3
16528	1/2 - 20	3.38	1.66	—	3	H3
16526	1/2 - 13	3.38	.94	.367	3	H3
16534	5/8 - 11	3.81	1.09	.480	4	H3
16538	3/4 - 10	4.25	1.22	.590	4	H3

EM taps for 3B class of fit are suitable for UNJ aerospace internal threading applications.

Refer to table on pages A257–A258 for the recommended pitch diameter limit for 2B or 3B class of fit.

WIN WITH WIDIA™



WIDIA VariDrill™

WIDIA™ is pleased to announce the new VariDrill™ for a wide range of materials

The most extensive solid carbide drill line on the market today.

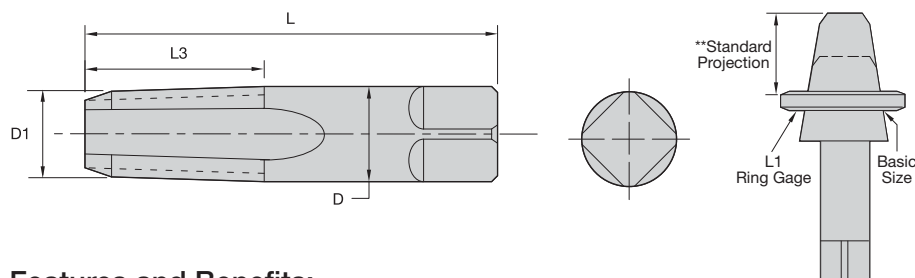
The VariDrill line is available as non-coolant drills in 3 x D and 5 x D, coolant drills in 3 x D, 5 x D, and 8 x D. "A" and "F" shanks available.

To learn more about our innovations, contact your local Authorized Distributor or visit www.widia.com.

WIDIA 

Production Taps

NPT/ANPT and NPTF Production Taper Pipe Taps



Features and Benefits:

- Manufactured from select high-speed steel.
- Ground thread pipe taps are standard in American Standard Pipe Form (NPT) and American Standard Dryseal Pipe Thread Form (NPTF).
- NPT threads require the use of a sealer, such as Teflon® tape or pipe compound.
- NPTF dryseal threads give a pressure-tight joint without the use of sealer.
- The nominal size of a pipe tap is that of the pipe fitting to be tapped, not the actual size of the tap; thread taper is 3/4" per foot.
- Alternate tap coatings are available as stock modifications.

NOTE: Series 2320 • TIN Coated
Series 5320S • SH50 Steam Oxide
Series 5320 • Uncoated

■ Series 2320/5320 • 2-1/2-3-1/2 Pitches

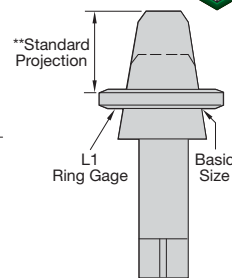
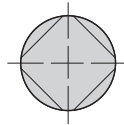
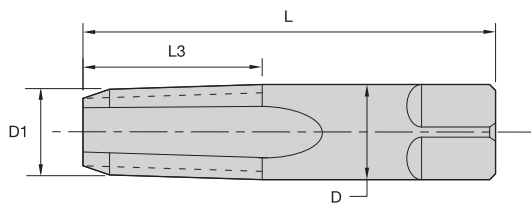
- first choice
- alternate choice

							number of flutes	thread series
oxide	TiN	uncoated	D1 size	L	L3	D		
19690	19698	16201	1/16 - 27	2.13	.69	.313	4	NPT/ANPT
—	19691	16203	1/16 - 27	2.13	.69	.313	4	NPTF
19695	19712	16204	1/8 - 27	2.13	.75	.313	4	NPT/ANPT
—	19707	—	1/8 - 27	2.13	.75	.313	4	NPT/ANPT
—	19701	16209	1/8 - 27	2.13	.75	.313	4	NPTF
—	19702	—	1/8 - 27	2.13	.75	.313	4	NPTF
—	—	16205	1/8 - 27	2.13	.75	.438	4	NPT/ANPT
—	—	16210	1/8 - 27	2.13	.75	.438	4	NPTF
19710	19728	16212	1/4 - 18	2.44	1.06	.563	4	NPT/ANPT
—	19721	16215	1/4 - 18	2.44	1.06	.563	4	NPTF
19730	19738	16217	3/8 - 18	2.56	1.06	.700	4	NPT/ANPT
—	—	16220	3/8 - 18	2.56	1.06	.700	4	NPTF
—	19736	—	3/8 - 18	2.56	1.25	.700	4	NPTF
19740	19748	16222	1/2 - 14	3.13	1.66	.687	4	NPT/ANPT
—	19746	16225	1/2 - 14	3.13	1.66	.687	4	NPTF
19760	19768	16227	3/4 - 14	3.25	1.38	.906	5	NPT/ANPT
—	19766	16230	3/4 - 14	3.25	1.38	.906	5	NPTF
—	19778	16232	1 - 11 1/2	3.75	1.75	1.125	5	NPT/ANPT
—	19776	16235	1 - 11 1/2	3.75	1.75	1.125	5	NPTF
—	—	16237	1 1/4 - 11 1/2	4.00	1.75	1.313	5	NPT/ANPT
—	—	16239	1 1/4 - 11 1/2	4.00	1.75	1.313	5	NPTF
—	—	16243	2 - 11 1/2	4.25	1.75	1.875	7	NPT/ANPT
—	—	16245	2 - 11 1/2	4.25	1.75	1.875	7	NPTF
—	—	16240	1 1/2 - 11 1/2	4.25	3.00	1.500	7	NPT/ANPT
—	—	16242	1 1/2 - 11 1/2	4.25	3.00	1.500	7	NPTF

**Pipe tap projection is the distance the small end of the tap projects through an American National Standard Pipe Tap Thread Ring Gage.

ANPT Taps marked NPT may be used for NPT and ANPT applications.

For gage measurement projection, see technical page A253.



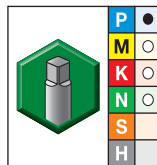
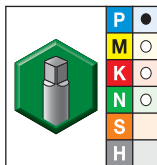
Features and Benefits:

- Manufactured from select high-speed steel.
- Interrupted threads to reduce drag while taper pipe threading.
- Use where chip disposal is a concern.
- Odd number of flutes standard.
- NPT threads require the use of a sealer, such as Teflon® tape or pipe compound.
- NPTF dryseal threads give a pressure-tight joint without the use of sealer.

NOTE: Series 5319S • SH50 Steam Oxide
 Series 5319 • Uncoated

■ Series 5319 • Standard Pipe Chamfer 2-1/2-3-1/2 Pitches

- first choice
 ○ alternate choice



oxide	uncoated	D1 size	L	L3	D	number of flutes	thread series
—	16103	1/8 - 27	2.13	.75	.313	5	NPTF
19650	16101	1/8 - 27	2.13	.75	.313	5	NPT/ANPT
—	16102	1/8 - 27	2.13	.75	.438	5	NPT/ANPT
—	16104	1/8 - 27	2.13	.75	.438	5	NPTF
19655	—	1/4 - 18	2.44	1.06	.563	5	NPT/ANPT
—	16106	1/4 - 18	2.44	1.06	.563	5	NPTF
—	16105	1/4 - 18	2.44	1.06	.563	5	NPT/ANPT
—	16109	1/2 - 14	3.13	1.66	.688	5	NPT/ANPT
—	16110	1/2 - 14	3.13	1.66	.688	5	NPTF
19665	—	1/2 - 14	3.13	1.66	.688	5	NPT/ANPT
—	16108	3/8 - 18	2.56	1.06	.700	5	NPTF
19656	16107	3/8 - 18	2.56	1.06	.700	5	NPT/ANPT
19675	—	3/4 - 14	3.25	1.38	.906	5	NPT/ANPT
—	16112	3/4 - 14	3.25	1.38	.906	5	NPTF
—	16111	3/4 - 14	3.25	1.38	.906	5	NPT/ANPT
—	16113	1 - 11 1/2	3.75	1.75	1.125	5	NPT/ANPT
—	16114	1 - 11 1/2	3.75	1.75	1.125	5	NPTF
—	16115	1 1/4 - 11 1/2	4.00	1.75	1.313	5	NPT/ANPT
—	16117	1 1/2 - 11 1/2	4.25	3.00	1.500	7	NPT/ANPT
—	16118	2 - 11 1/2	4.25	1.75	1.875	7	NPT/ANPT

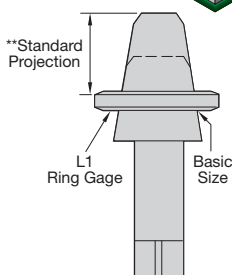
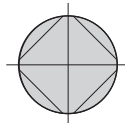
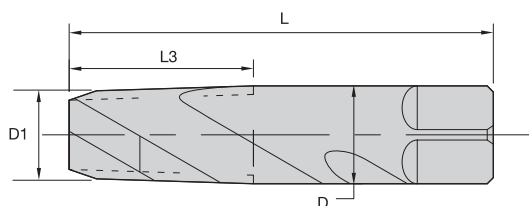
**Pipe tap projection is the distance the small end of the tap projects through an American National Standard Pipe Tap Thread Ring Gage.

NPT taps may be used for ANPT applications.

For gage measurement projection, see technical page A253.

Production Taps

NPT/ANPT and NPTF Spiral-Flute Production Taper Pipe Taps

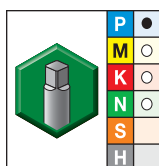


Features and Benefits:

- Manufactured from select tap high-speed steel.
- Ground threads standard in American Standard Pipe Form (NPT) and American Standard Dryseal Pipe Form (NPTF).
- NPT threads require the use of a sealer, such as Teflon® tape or pipe compound.
- NPTF dryseal threads give a pressure-tight joint without the use of sealer.
- Uncoated taps standard; coatings available as a stock modification.
- Spiral flutes lift chips out of the tapped hole reducing stop lines.
- Most effective in materials that produce long, stringy chips.

- first choice
- alternate choice

Series 5321 • Standard Pipe Chamfer

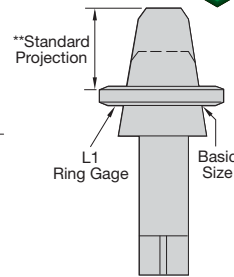
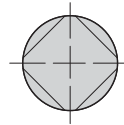
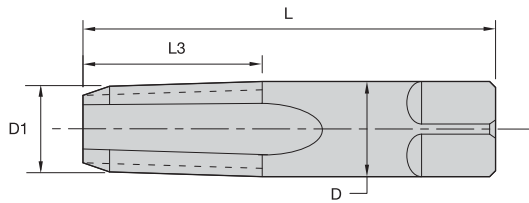


uncoated	D1 size	L	L3	D	number of flutes	thread series
16281	1/8 - 27	2.13	.75	.438	4	NPT/ANPT
16282	1/8 - 27	2.13	.75	.438	4	NPTF
16283	1/4 - 18	2.44	1.06	.563	4	NPT/ANPT
16284	1/4 - 18	2.44	1.06	.563	4	NPTF
16288	1/2 - 14	3.13	1.66	.688	4	NPTF
16287	1/2 - 14	3.13	1.66	.688	4	NPT/ANPT
16286	3/8 - 18	2.56	1.06	.700	4	NPTF
16285	3/8 - 18	2.56	1.06	.700	4	NPT/ANPT
16290	3/4 - 14	3.25	1.38	.906	5	NPTF
16289	3/4 - 14	3.25	1.38	.906	5	NPT/ANPT

**Pipe tap projection is the distance the small end of the tap projects through an American National Standard Pipe Tap Thread Ring Gage.

NPT taps may be used for ANPT applications.

For gage measurement projection, see technical page A253.

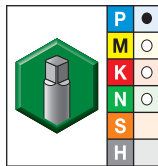


Features and Benefits:

- Manufactured from select high-speed steel.
- Ground thread pipe taps are standard in American Standard Pipe Form (NPT) and American Standard Dryseal Pipe Thread Form (NPTF).
- NPT threads require the use of a sealer, such as Teflon® tape or pipe compound.
- NPTF dryseal threads give a pressure-tight joint without the use of sealer.
- Uncoated taps standard; coatings available as specials.
- Hook designed for use in ductile materials that produce long, continuous chips.

- first choice
- alternate choice

■ Series 5820 • Standard Pipe Chamfer

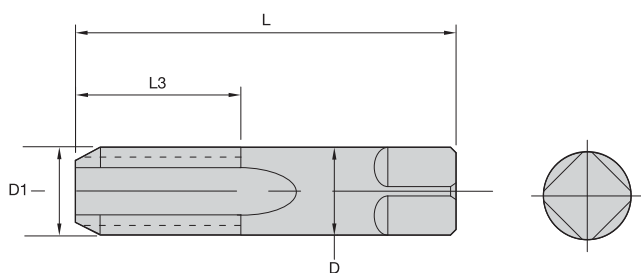


uncoated	D1 size	L	L3	D	number of flutes	thread series
16213	1/4 - 18	2.44	1.06	.563	4	NPT/ANPT
16223	1/2 - 14	3.13	1.66	.688	4	NPT/ANPT
16218	3/8 - 18	2.56	1.06	.700	4	NPT/ANPT
16228	3/4 - 14	3.25	1.38	.906	5	NPT/ANPT
16233	1 - 1 1/2	3.75	1.75	1.125	5	NPT/ANPT

**Pipe tap projection is the distance the small end of the tap projects through an American National Standard Pipe Tap Thread Ring Gage.

NPT taps may be used for ANPT applications.

For gage measurement projection, see technical page A253.

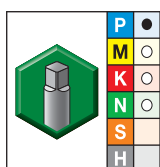


Features and Benefits:

- Manufactured from select tap high-speed steel.
- Ground thread pipe taps are standard in American National Standard Straight Pipe (NPS) thread form and American National Standard Dryseal Straight Pipe (NPSF) thread form.
- NPS threads are suitable for tapping holes or couplings for low-pressure work when used with a sealer; also suitable for NPSC and NPSM work.
- NPSF dryseal taps are intended for low-pressure work such as fuel and oil lines where a sealer is not used.
- Dryseal threads give a low-pressure, pressure-tight joint without the use of sealer.

- first choice
- alternate choice

■ Series 5323 • Modified Bottoming Chamfer



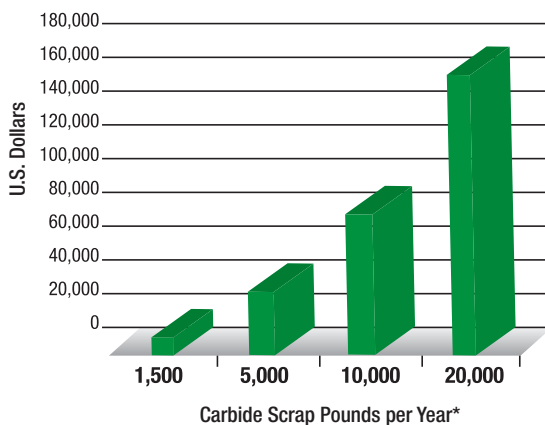
uncoated	D1 size	L	L3	D	number of flutes	thread series
16351	1/8 - 27	2.13	.75	.313	4	NPS
16353	1/8 - 27	2.13	.75	.313	4	NPSF
16354	1/8 - 27	2.13	.75	.438	4	NPSF
16352	1/8 - 27	2.13	.75	.438	4	NPS
16355	1/4 - 18	2.44	1.06	.563	4	NPS
16356	1/4 - 18	2.44	1.06	.563	4	NPSF
16360	1/2 - 14	3.13	1.66	.688	4	NPSF
16359	1/2 - 14	3.13	1.66	.688	4	NPS
16358	3/8 - 18	2.56	1.06	.700	4	NPSF
16357	3/8 - 18	2.56	1.06	.700	4	NPS
16362	3/4 - 14	3.25	1.38	.906	5	NPSF
16361	3/4 - 14	3.25	1.38	.906	5	NPS
16363	1 - 11 1/2	3.75	1.75	1.125	5	NPS

For gage measurement projection, see technical page A253.

Get Cash or Credit for Your Used Carbide



Your Potential Annual Returns*



*Actual returns may vary based on current market value for recycled carbide materials.

Why recycle?

It's the right thing to do!

It's easy for your company to be environmentally conscious with our Carbide Recycling Program.

By sending us your used carbide tools, you help preserve and protect the environment and ensure that these products are recycled responsibly.

It's profitable!

Not only does WIDIA™ make it easy for your company to be environmentally conscious, we offer an added incentive — it's profitable.

Through our Carbide Recycling Program, get the full value of your investment in metalcutting tools, improve profitability, and reduce your overall tooling spend. When you send us your used carbide, we will reward you with cash or credit. *(Credit offer valid in U.S.A. only.)*

It's EASY!

Our Carbide Recycling Program is available on the web and is easy to use. You can request a quote, arrange to send us your used carbide, and check the status of your shipment.

To find out more, please contact your Authorised Distributor.



Green Boxes for green companies

The Green Box™ program is a safe and efficient way for you to package and ship your spent carbide tools to an authorised recycling location.

Qualified used carbide includes mixed coated and uncoated metalcutting tools free of chips, oil, and steel contamination. Material must be free of braze.

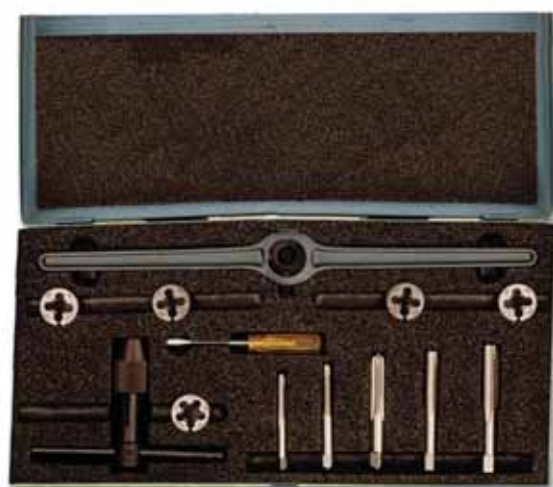
Maintenance Tools

A full line of taps and dies manufactured from high-speed steel with the strength and durability required for maintenance jobs.



WIDIA-GTD™

- Available in hand, GUN™, and taper pipe tap styles.
- Manufactured from select high-speed steel for blind- and through-hole tapping.
- Ground thread and straight-flute design for sharp cutting action.
- Maintenance taper pipe taps designed for very difficult maintenance applications.



Maintenance Tool Options

Hand Taps and GUN™ Taps

- Constructed from select high-speed steel.
- Ground thread and straight-flute design for sharp cutting action.
- Ideal for hand and power tapping for through or blind holes.
- Class 2B maintenance pitch diameter tolerances for longer life.
- Industrial quality taps at maintenance prices.

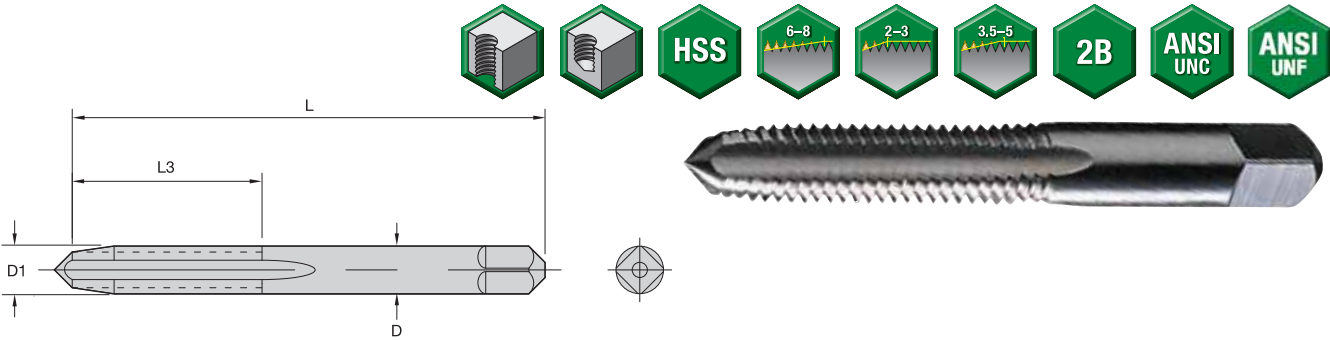
Taper Pipe Taps

- Made from select high-speed steel.
- American Standard Pipe Tap (NPT) thread form with a taper of 3/4" per foot.
- Made for the most difficult maintenance applications.
- Use for hand tapping or tapping under power.
- Furnished with 2-1/2–3-1/2 pitches chamfered.
- Standard projection.

Applications

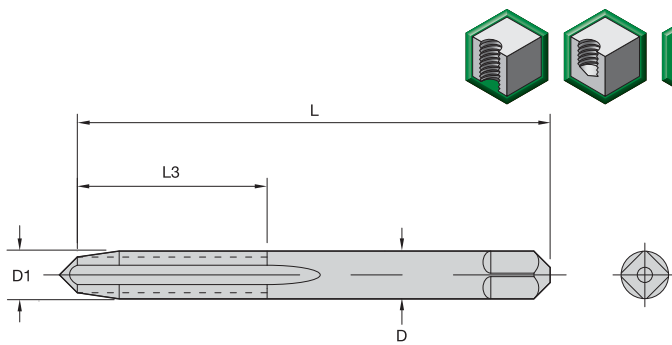
- Steel
- Stainless steel <30 Rc
- Non-ferrous materials
- Aluminum
- Cast iron



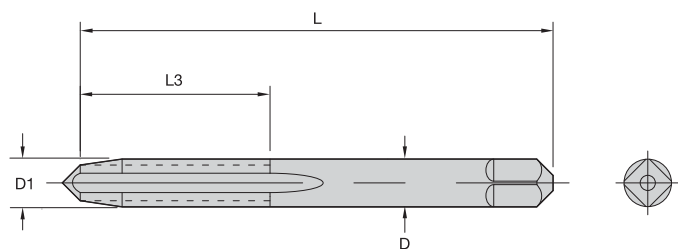


■ Series 7305 • Machine Screw • Taper, Plug, Bottoming Chamfer, and Sets

taper chamfer 7-10 pitch	plug chamfer 3-5 pitch	full bottom 1-2 pitch	taper and plug bottoming set	D1 size	L	L3	D	class of fit
—	11513	—	—	3 - 48	1.81	.500	.141	2B
11516	11517	11518	11519	4 - 40	1.88	.563	.141	2B
—	11521	—	—	4 - 48	1.88	.563	.141	2B
11524	11525	11526	11527	5 - 40	1.94	.625	.141	2B
11528	11529	11530	11531	6 - 32	2.00	.688	.141	2B
—	11537	—	—	6 - 40	2.00	.688	.141	2B
11540	11541	11542	11543	8 - 32	2.13	.750	.168	2B
—	11545	—	—	8 - 36	2.13	.750	.168	2B
11548	11549	11550	11551	10 - 24	2.38	.875	.194	2B
11552	11553	11554	11555	10 - 32	2.38	.875	.194	2B
11556	11557	11558	11559	12 - 24	2.38	.938	.220	2B
—	11561	—	—	12 - 28	2.38	.938	.220	2B


■ Series 7303 • Fractional • Taper, Plug, Bottoming Chamfer, and Sets

taper chamfer 7-10 pitch	plug chamfer 3-5 pitch	full bottom 1-2 pitch	taper and plug bottoming set	D1 size	L	L3	D	class of fit
11584	11585	11586	11587	3/16 - 24	2	.88	.194	2B
11596	11597	11598	11599	1/4 - 20	3	1.00	.255	2B
11600	11601	11602	11603	1/4 - 28	3	1.00	.255	2B
11604	11605	11606	11607	5/16 - 18	3	1.13	.318	2B
11608	11609	11610	11611	5/16 - 24	3	1.13	.318	2B
11612	11613	11614	11615	3/8 - 16	3	1.25	.381	2B
11648	11649	11650	—	5/8 - 18	3	1.25	.381	2B
11616	11617	11618	11619	3/8 - 24	3	1.25	.381	2B
11620	11621	11622	11623	7/16 - 14	3	1.44	.323	2B
11624	11625	11626	11627	7/16 - 20	3	1.44	.323	2B
11628	11629	11630	11631	1/2 - 13	3	1.66	.367	2B
11632	11633	11634	11635	1/2 - 20	3	1.66	.367	2B
11636	11637	11638	11639	9/16 - 12	4	1.66	.429	2B
11640	11641	11642	11643	9/16 - 18	4	1.66	.429	2B
11644	11645	11646	11647	5/8 - 11	4	1.81	.480	2B
—	—	—	11651	5/8 - 18	4	1.81	.480	2B
11652	11653	11654	11655	3/4 - 10	4	2.00	.590	2B
11656	11657	11658	11659	3/4 - 16	4	2.00	.590	2B
11660	11661	11662	11663	7/8 - 9	5	2.22	.697	2B
11664	11665	11666	11667	7/8 - 14	5	2.22	.697	2B
11668	11669	11670	11671	1 - 8	5	2.50	.800	2B
11672	11673	11674	11675	1 - 12	5	2.50	.800	2B
11676	11677	11678	11679	1 - 14	5	2.50	.800	2B
11680	11681	11682	11683	1 1/8 - 7	5	2.56	.896	2B
11684	11685	11686	11687	1 1/8 - 8	5	2.56	.896	2B
11688	11689	11690	11691	1 1/8 - 12	5	2.56	.896	2B
11692	11693	11694	11695	1 1/4 - 7	6	2.56	1.021	2B
11696	11697	11698	11699	1 1/4 - 8	6	2.56	1.021	2B
11700	11701	11702	11703	1 1/4 - 12	6	2.56	1.021	2B
11704	11705	11706	11707	1 3/8 - 6	6	3.00	1.108	2B
11708	11709	11710	11711	1 3/8 - 8	6	3.00	1.108	2B
11712	11713	11714	11715	1 3/8 - 12	6	3.00	1.108	2B
11716	11717	11718	11719	1 1/2 - 6	6	3.00	1.233	2B
11720	11721	11722	11723	1 1/2 - 8	6	3.00	1.233	2B
11724	11725	11726	11727	1 1/2 - 12	6	3.00	1.233	2B



Features and Benefits:

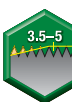
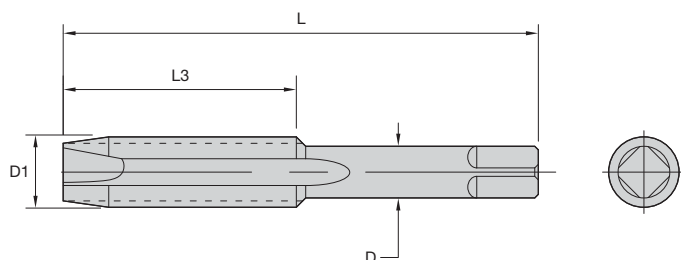
- Constructed from select high-speed steel.
- Ground thread straight flute design for sharp cutting action.
- Ideal for hand and power tapping for through or blind holes.
- Class 2B maintenance pitch diameter tolerances for longer life.
- Industrial quality taps at maintenance prices.

■ Series 7353 • Plug Chamfer • Metric ANSI

uncoated	D1 size	L	L3	D	class of fit
11900	M6 X 1	2.50	1.00	.255	6H
11901	M8 X 1,25	2.72	1.13	.318	6H
11902	M10 X 1,5	2.94	1.25	.381	6H
11903	M12 X 1,75	3.38	1.66	.367	6H
11904	M14 X 1,25	3.59	1.66	.429	6H
11905	M14 X 2	3.59	1.66	.429	6H
11906	M16 X 2	3.81	1.81	.480	6H
11907	M18 X 1,5	4.03	1.59	.542	6H
11908	M18 X 2,5	4.03	1.59	.542	6H
11909	M20 X 2,5	4.47	2.00	.652	6H
11910	M22 X 2,5	4.69	2.22	.697	6H
11911	M24 X 3	4.91	2.22	.760	6H

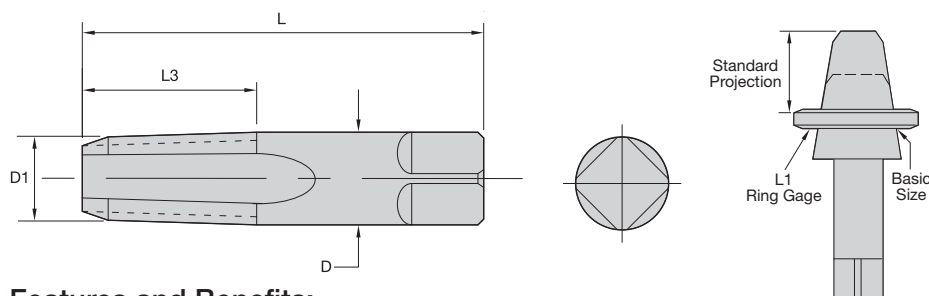
Metric taps are manufactured to USCTI specifications and dimensions.

Metric tap blank dimensions are equivalent to inch taps.



■ Series 7301 • Plug Chamfer

uncoated	D1 size	L	L3	D	class of fit
12027	4 - 40	1.88	.56	.141	2B
12030	5 - 40	1.94	.63	.141	2B
12031	5 - 44	1.94	.63	.141	2B
12032	6 - 32	2.00	.69	.141	2B
12033	6 - 40	2.00	.69	.141	2B
12034	8 - 32	2.15	.75	.168	2B
12035	8 - 36	2.15	.75	.168	2B
12036	10 - 24	2.38	.88	.194	2B
12037	10 - 32	2.38	.88	.194	2B
12038	12 - 24	2.38	.94	.220	2B
12039	12 - 28	2.38	.94	.220	2B
12040	1/4 - 20	2.50	1.00	.255	2B
12041	1/4 - 28	2.50	1.00	.255	2B
12042	5/16 - 18	2.72	1.13	.318	2B
12043	5/16 - 24	2.72	1.13	.318	2B
12044	3/8 - 16	2.94	1.25	.381	2B
12045	3/8 - 24	2.94	1.25	.381	2B
12046	7/16 - 14	3.16	1.44	.323	2B
12047	7/16 - 20	3.16	1.44	.323	2B
12048	1/2 - 13	3.38	1.66	.367	2B
12049	1/2 - 20	3.38	1.66	.367	2B
12050	5/8 - 11	3.81	1.81	.480	2B
12051	5/8 - 18	3.81	1.81	.480	2B
12052	3/4 - 10	4.25	1.81	.590	2B



Features and Benefits:

- Made from select high-speed steel.
- American Standard Pipe Tap (NPT) thread form with a taper of 3/4" per foot.
- Made for the most difficult maintenance applications.
- Use for hand tapping or tapping under power.
- Furnished with 2-1/2–3-1/2 pitches chamfered.
- Standard projection.

■ Series 7320 • Standard Chamfer 2-1/2–3-1/2 Pitches

uncoated	D1 size	L	L3	D	thread series
11800	1/8 - 27	2.13	.75	.313	NPT
11801	1/8 - 27	2.13	.75	.438	NPT
11802	1/4 - 18	2.44	1.06	.563	NPT
11803	3/8 - 18	2.56	1.06	.700	NPT
11804	1/2 - 14	3.13	1.38	.688	NPT
11805	3/4 - 14	3.25	1.38	.906	NPT
11806	1 - 11 1/2	3.75	1.75	1.125	NPT
11807	1 1/4 - 11 1/2	4.00	1.75	1.313	NPT
11808	1 1/2 - 11 1/2	4.25	1.75	1.500	NPT
11809	2 - 11 1/2	4.50	1.75	1.875	NPT



D1=cutting size

Features and Benefits:

- Carbon steel construction.
- Chamfered on both faces, 2–3 threads on one face and 1–2-1/2 threads on the other for threading close to the shoulder.
- Beveled slot to remove screw when die is used in a machine holder with its own adjusting screw.

Application Information:

- For use in hand-held die stocks or machine holders.
- For minor size adjustments, fine pitch screw adjusts edges of the die closer together or further apart; range of adjustment of round dies is slight.

Carbon Steel Round Adjustable Dies • Series 382
Machine Screw

D1	NC/UNF	NF/UNF	EDP number	
			13/16" die O.D. 1/4" thickness	1" die O.D. 3/8" thickness
0	—	80	23019	—
1	64	—	23021	—
1	—	72	23022	—
2	56	—	23023	—
2	—	64	23025	—
3	48	—	23026	—
3	—	56	23027	—
4	40	—	23029	—
4	—	48	23031	—
5	40	—	23032	—
5	—	44	23034	—
6	32	—	23035	23105
6	—	40	23038	—
8	32	—	23039	23107
8	—	36	23041	—
10	24	—	23043	23109
10	—	32	23045	23112
12	24	—	23048	23115
12	—	28	23049	—

NOTE: Sizes and/or dimensions not listed and left-hand dies are available as specials.
Fractional sizes are listed on the next page.

Carbon Steel Round Adjustable Dies • Series 382

■ Fractional

D1	NC/UNC	NF/UNF	EDP number					
			13/16" die O.D. 1/4" thickness	1" die O.D. 3/8" thickness	1-1/2" die O.D. 1/2" thickness	2" die O.D. 5/8" thickness	2-1/2" die O.D. 3/4" thickness	3" die O.D. 1" thickness
1/4	20	—	23051	23133	23204	23284	—	—
1/4	—	28	—	23138	23209	23287	—	—
5/16	18	—	—	23143	23211	23289	—	—
5/16	—	24	—	23147	23216	23293	—	—
3/8	16	—	—	23152	23220	23295	—	—
3/8	—	24	—	23157	23225	23300	—	—
7/16	14	—	—	23162	23230	23303	—	—
7/16	—	20	—	23166	23234	23306	—	—
1/2	13	—	—	23170	23241	23310	—	—
1/2	—	20	—	23171	23245	23313	—	—
9/16	12	—	—	—	23251	23316	—	—
9/16	—	18	—	—	23255	23319	—	—
5/8	11	—	—	—	23259	23321	23361	—
5/8	—	18	—	—	23263	23324	—	—
3/4	10	—	—	—	23268	23331	23363	—
3/4	—	16	—	—	23269	23336	23365	—
7/8	9	—	—	—	—	23340	23366	—
7/8	—	14	—	—	—	23343	23367	—
1	8	—	—	—	—	23347	23368	23376
1	—	12	—	—	—	23348	23372	23377
1	—	14	—	—	—	23349	—	—
1 1/8	7	—	—	—	—	—	—	23379
1 1/8	—	12	—	—	—	—	—	23380
1 1/4	7	—	—	—	—	—	—	23381
1 1/4	—	12	—	—	—	—	—	23384
1 3/8	6	—	—	—	—	—	—	23386
1 3/8	—	12	—	—	—	—	—	23388
1 1/2	6	—	—	—	—	—	—	23389
1 1/2	—	12	—	—	—	—	—	23390

NOTE: Sizes and/or dimensions not listed and left-hand dies are available as specials.

Carbon Steel Round Adjustable Dies • Series 382

■ NPT Taper Pipe

D1	TPI	1" die O.D. 3/8" thickness	EDP number	
			1-1/2" die O.D. 1/2" thickness	2" die O.D. 5/8" thickness
1/8	27	23118	23200	—
1/4	18	—	23202	23283
3/8	18	—	23223	23298
1/2	14	—	—	23312

NOTE: Sizes and/or dimensions not listed and left-hand dies are available as specials.



D1=cutting size

Features and Benefits:

- Made from high-speed steel for improved wear life.
- Chamfered on both faces, 2–3 threads on one face and 1–2-1/2 threads on the other for threading close to the shoulder.
- Beveled screw slot to remove screw when die is used in a machine holder; range of adjustment of round dies is slight.

Application Information:

- Ideal for maintenance in the shop or in the field.
- Use in round die stocks Series 1750 or Series 1790 (see page A208).
- For minor size adjustments, fine pitch screw adjusts edges of the die closer together or further apart.

High-Speed Steel Round Adjustable Dies • Series 6382
Machine Screw

D1	NC/UNC	NF/UNF	EDP number	
			13/16" die O.D. 1/4" thickness	1" die O.D. 3/8" thickness
5	40	—	23710	—
5	—	44	23712	—
6	32	—	23713	23730
6	—	40	23715	—
8	32	—	23716	23731
8	—	36	23718	—
10	24	—	23719	23732
10	—	32	23720	23733
12	24	—	23722	23735
12	—	28	23723	—

Fractional

D1	NC/UNC	NF/UNF	13/16" die O.D. 1/4" thickness	EDP number		
				1" die O.D. 3/8" thickness	1-1/2" die O.D. 1/2" thickness	2" die O.D. 5/8" thickness
1/4	20	—	23724	23739	23761	—
1/4	—	28	23725	23742	23764	—
5/16	18	—	23727	23746	23768	—
5/16	—	24	23728	23748	23770	—
3/8	16	—	—	23751	23773	—
3/8	—	24	—	23753	23776	—
7/16	14	—	—	23757	23779	—
7/16	—	20	—	23758	23781	—
1/2	13	—	—	—	23785	—
1/2	—	20	—	—	23787	—
9/16	12	—	—	—	23792	—
9/16	—	18	—	—	23793	—
5/8	11	—	—	—	23796	23811
5/8	—	18	—	—	23798	23813
3/4	10	—	—	—	—	23816
3/4	—	16	—	—	—	23818
7/8	9	—	—	—	—	23823
7/8	—	14	—	—	—	23824

NOTE: Sizes and/or dimensions not listed and left-hand dies are available as specials.

High-Speed Steel Round Adjustable Dies • Series 6385

■ Metric

size	13/16" die O.D. 1/4" thickness	EDP number	
		1" die O.D. 3/8" thickness	1-1/2" die O.D. 1/2" thickness
M2,5 x 0,45	23855	—	—
M3 x 0,5	23857	—	—
M3,5 x 0,6	23859	—	—
M4 x 0,7	23861	—	—
M4,5 x 0,75	23863	—	—
M5 x 0,8	23865	—	—
M6 x 1	23867	23869	—
M7 x 1	—	23871	—
M8 x 1,25	—	23873	—
M10 x 1,5	—	23877	—
M12 x 1,75	—	23881	—
M14 x 2	—	—	23885
M16 x 2	—	—	23889
M18 x 2,5	—	—	23893
M20 x 2,5	—	—	23897

NOTE: Sizes and/or dimensions not listed and left-hand dies are available as specials.

Die Stocks for Round Adjustable Dies

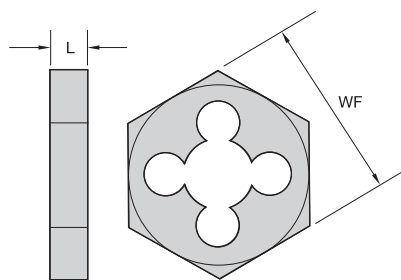
- Series 1750 die stocks hold round adjustable dies of any construction.
- These die stocks are specifically manufactured for holding dies with the open-type adjustment.
- Steel construction.



Series 1750 die stock

■ Die Stocks • Series 1750 Die Stocks with Three-Screw-Type Construction

stock number	length	die O.D.	EDP number
1751	6.25	13/16	01238
1752	9.00	1	01240
1753	14.00	1 1/2	01241
1757	23.00	2	01243
1758	29.00	2 1/2	01245
1759	40.00	3	01247


Features and Benefits:

- Made from carbon steel.
- Standard with right hand Unified and American National thread form.
- Available in metric and American National Taper Pipe (NPT) thread form.
- Cost-effective rethreading die.

Application Information:

- Use to dress over bruised or rusty threads.
- No special holder required; use standard wrench.
- Ideal for maintenance in the shop or in the field.

Hexagon Rethreading Bolt Dies • Series 377
Fractional

D1	NC/UNC	NF/UNF	WF width across flat	L	EDP number
1/4	20	—	19/32	1/4	24107
1/4	—	28	19/32	1/4	24110
5/16	18	—	11/16	5/16	24112
5/16	—	24	11/16	5/16	24115
3/8	16	—	25/32	3/8	24117
3/8	—	24	25/32	3/8	24121
7/16	14	—	7/8	7/16	24123
7/16	—	20	7/8	7/16	24126
1/2	13	—	1 1/16	1/2	24130
1/2	—	20	1 1/16	1/2	24133
9/16	12	—	1 1/16	1/2	24137
9/16	—	18	1 1/16	1/2	24139
5/8	11	—	1 1/4	5/8	24141
5/8	—	18	1 1/4	5/8	24144
11/16	11	—	1 7/16	3/4	24146
11/16	—	16	1 7/16	3/4	24148
3/4	10	—	1 7/16	3/4	24149
3/4	—	16	1 7/16	3/4	24153
7/8	9	—	1 5/8	7/8	24156
7/8	—	14	1 5/8	7/8	24159
1	8	—	1 13/16	1	24162
1	—	12	1 13/16	1	24166
1	—	14	1 13/16	1	24167
1 1/8	7	—	2	1	24170
1 1/8	—	12	2	1	24174
1 1/4	7	—	2 3/16	1	24176
1 1/4	—	12	2 3/16	1	24180
1 3/8	6	—	2 3/8	1	24182
1 3/8	—	12	2 3/8	1	24185
1 1/2	6	—	2 9/16	1	24187
1 1/2	—	12	2 9/16	1	24191

NOTE: D1 = thread size
WF = width across flat
L = thickness

Hexagon Rethreading Bolt Dies • Series 377
Metric

size	WF width across flat	L	EDP number
M5 x 0,8	19/32	1/4	24219
M6 x 1	19/32	1/4	24221
M8 x 1,25	11/16	5/16	24227
M10 x 1,5	7/8	7/16	24229
M12 x 1,75	1 1/16	1/2	24231
M14 x 2	1 1/16	1/2	24233
M16 x 2	1 1/4	5/8	24235
M20 x 2,5	1 5/8	7/8	24239

Hexagon Rethreading Bolt Dies • Series 377
NPT Pipe

D1	thread pitch NPT	WF width across flat	L	EDP number
1/8	27	1 1/16	3/8	24104
1/4	18	1 1/4	5/8	24106
3/8	18	1 7/16	5/8	24120
1/2	14	1 5/8	3/4	24132
3/4	14	2	13/16	24152
1	12	2 3/8	1	24165



Number 328 and 332
slip handle tap wrench



Number 338 and 339
ratchet and slip handle tap wrench



Number 336 and 337
long handle tap wrench

Features and Benefits:

- Made from carefully selected steel.
- High-quality tools designed for use in hand tapping.
- Can also be used with reamers, drills, screw extractors, and any other tools that can be turned by hand.

Numbers 328 and 332 Slip Handle Tap Wrench

- T-handle on this wrench may be slipped from side to side to enable complete turn in close quarters.

Numbers 329 and 333 Plain Handle Tap Wrench

- All-purpose wrench with fixed handle.
- Ideal for out-in-the-open tapping jobs.

Numbers 336 and 337 Long Shank Tap Wrench

- Long shank enables tapping in hard-to-reach places in machine and automobile repair work.
- Plain T-handle.

Numbers 338 and 339 Ratchet Handle Tap Wrench

- Combination of ratchet and slip handle makes this all-around wrench able to handle most hand tapping jobs.

■ T-Handle Tap Wrenches

wrench number	fractional taps	wrench capacity machine screw taps	metric taps	overall length	EDP number
328	1/16–1/4	0 - 14	M1.5 - M6.3	2 3/4	01350
332	7/32–1/2	12 - 14	M5.5 - M12.5	3 5/8	01355
329	1/16–1/4	0 - 14	M1.5 - M6.3	2 3/4	01352
333	7/32–1/2	12 - 14	M5.5 - M12.5	3 5/8	01358
336	1/16–1/4	0 - 14	M1.5 - M6.3	8 3/4	01362
337	7/32–1/2	12 - 14	M5.5 - M12.5	10 5/8	01364
338	1/16–1/4	0 - 14	M1.5 - M6.3	3 3/4	01366
339	7/32–1/2	12 - 14	M5.5 - M12.5	5	01377



Number 22 straight tap wrench

Features and Benefits:

- Made from rugged steel.
- Jaws are made of carefully hardened and tempered tool steel.
- High-quality tools designed for use in hand tapping.
- Straight-handle design provides greater leverage.
- Especially useful with larger diameter taps or reamers.

■ Straight Tap Wrenches

wrench number	wrench capacity			overall length	EDP number
	fractional taps	machine screw taps	pipe tap or reamers		
0	1/16 - 1/4	0 - 14	—	7	01287
14	1/16 - 3/8	0 - 14	—	9	01292
15	5/32 - 1/2	7 - 14	1/8	11 1/8	01299
13	5/32 - 3/4	7 - 14	1/8 - 1/4	14 7/8	01304
7	1/4 - 1 1/8	1/4 - 1 1/8	1/8 - 3/4	19	01311
8	3/4 - 1 5/8	3/4 - 1 5/8	3/8 - 1 1/4	40	01325
22	1 - 2 1/2	1 - 2 1/2	3/4 - 2	54	01338

OK Jr. Tap and Die Sets •
HSS Taps and Carbon Steel Round Adjustable Dies

■ **OK Jr. Tap and Die Sets**

set number	number of cutting sizes	7305/7303 tap				7320 taper pipe tap	7353 metric tap	tap wrench	die stock	set EDP number
		and 382 die sizes								
		NC	NF	NPT	metric					
B7	7	4-40 6-32 8-32 10-24 12-24 1/4-20	10-32	—	—		329	13	00517	
B8	8	2-56 3-48 4-40 6-32 8-32 10-24	0-80 1-72	—	—		329	13	00525	
B10	10	4-40 6-32 8-32 10-24 12-24	4-48 6-40 8-36 10-32 12-28	—	—		329	13	00526	
C5	5	1/4-20 5/16-18 3/8-16 7/16-14 1/2-13	—	—	—		333	14	00518	
407	9	1/4-20 5/16-18 3/8-16 7/16-14 1/2-13 5/8-11 3/4-10 7/8-9 1-8	—	—	—		15 7	14 15 16	00522	
3100	11	1/4-20 5/16-18 3/8-16 7/16-14 1/2-13	1/4-28 5/16-24 3/8-24 7/16-20 1/2-20	1/8-27	—		333	1	00528	
4132	21	1/4-20 5/16-18 3/8-16 7/16-14 1/2-13 9/16-12 5/8-11 3/4-10 7/8-9 1-8	1/4-28 5/16-24 3/8-24 7/16-20 1/2-20 9/16-18 5/8-18 3/4-16 7/8-14 1-14 NS	1/8-27	—		15 7	14 15 16	00532	
4700	28 taps 15 dies	4-40 6-32 8-32 10-24 12-24 1/4-20 5/16-18 3/8-16 7/16-14 1/2-13 9/16-12	10-32 1/4-28 5/16-24 3/8-24 7/16-20 1/2-20 9/16-18 5/8-18 3/4-16 7/8-14 1-14 NS	1/8-27 1/4-18 3/8-18 1/2-14	M14 x 1,25 M18 x 1,5		329 336 15 7	14 15 16	00533	



Set number C5

- Consist of:
 - Series 382 carbon steel round adjustable dies.
 - Series 7305, 7303, 7320, and 7353 HSS maintenance hand taps.
 - Series 1790 die stocks.
 - Tap wrenches.
- Dies and taps furnished with American National Form threads.
- Packaged in special case with moisture- and oil-resistant Ethafoam liner for tool protection.

Metric Tap, Die, and Drill Sets •
Industrial-Quality HSS Hand Taps with Hexagonal or Round Adjustable Dies


Tap, die, and drill set number 4800

■ Metric Tap, Die and Drill Sets

- Consist of:
 - Series 377 carbon steel hexagon rethreading dies or series 6385 HSS round adjustable dies.
 - Series 5353 industrial-quality metric hand taps.
 - Series 150 HSS jobber drill with black oxide surface treatment (except sets 48 and 49).
 - Series 1790 or 1750 die stocks.
 - Tap wrenches.
 - Screwdriver (except set 4800).
- Packaged in special case with moisture- and oil-resistant Ethafoam liner for tool protection.

set number	number of cutting sizes	7353 tap and 377 hexagon die sizes	150 HSS black oxide jobber drill size	tap wrench	die stock number	screwdriver number	set EDP number
4800	6	M5 x 0,8 M6 x 1 M8 x 1,25 M10 x 1,5 M12 x 1,75 M14 x 2	4,2 5,0 6,7 8,5 10,2 12,0	15	—	—	00606

set number	number of cutting sizes	7353 tap and 6385 HSS round adjustable die sizes	150 HSS black oxide jobber drill size	tap wrench	die stock number	screwdriver number	set EDP number
2001	13	M2,5 x 0,45 M3 x 0,5 M3,5 x 0,6 M4 x 0,7 M5 x 0,8 M6 x 1 M8 x 1,25 M10 x 1,5 M12 x 1,75 M14 x 2 M16 x 2 M18 x 2,5 M20 x 2,5	2,05 2,5 2,9 3,3 4,2 5,0 6,7 8,5 10,2 12,0 14,0 15,5 17,5	14 7	1851 1852 1853	300	00527
48	7	M2,5 x 0,45 M3 x 0,5 M3,5 x 0,6 M4 x 0,7 M4,5 x 0,75 M5 x 0,8 M6 x 1	—	329	1790	300	00448
48D	7	M2,5 x 0,45 M3 x 0,5 M3,5 x 0,6 M4 x 0,7 M4,5 x 0,75 M5 x 0,8 M6 x 1	2,05 2,5 2,9 3,3 3,7 4,2 5,0	329	1790	300	00448
49	5	M6 x 1 M7 x 1 M8 x 1,25 M10 x 1,5 M12 x 1,75	—	333	1790	300	00449
49D	5	M6 x 1 M7 x 1 M8 x 1,25 M10 x 1,5 M12 x 1,75	5,0 6,0 6,7 8,5 10,2	333	1790	300	00451

Thread Mills

Available for the first time, our solid thread mills are designed to be the highest quality thread milling solution.



WIDIA-GTD™

- Cut up to 63 HRC.
- Improved overall thread quality.

Optimized flute design
Better chip evacuation.

Carbide substrate
Higher heat resistance,
higher speed.



Various multilayer coatings
Extremely high wear resistance,
longer tool life.

Cylindrical h6 shank
Low runout, higher
quality threads.

Unmatched Capabilities

- Capable of easily cutting most difficult materials.
- Carbide grades make threading easier and machining times shorter.
- High-quality internal and external threading on 3-axis CNC machines.
- Thread mills make interrupted cuts and short chips.
- Design offers a range of benefits to improve overall thread quality.
- Short, easily evacuated chips generate less heat and friction, so there is a lower risk of damage to threading.

Choose WIDIA-GTD™ Thread Mills

- Greater versatility than competitive products.
- Optimum surface quality for an excellent end product.
- Designed to eliminate chipping issues.
- No need to reverse the spindle.
- Fewer machining problems means more production safety.



Victory™ GTM Series HP Solid Carbide Thread Mills • Metric

- ★ Good
★★ Better
★★★ Best

GTM Series Solid Thread Milling • Metric	series	size range min - max (inch and metric)	hole	operation	coolant	grade	shank
	GTM11	M3 - M20				WU13PV	6535 HA
	GTM21	M5 - M16				WU12PV	6535 HA
	GTM31	M4 - M16				WU12PV	6535 HA
	GTM41	M6 - M24				WU16PV	6535 HA
	GTM41LH	M6 - M12				WU16PV	6535 HA

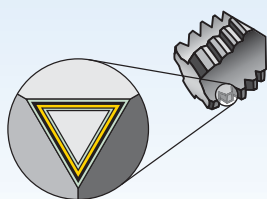
Victory GTM Series HP Solid Carbide Thread Mills • Inch

- ★ Good
★★ Better
★★★ Best

GTM Series Solid Thread Milling • Inch	series	size range min - max (inch and metric)	hole	operation	coolant	grade	shank
	GTM21	#10 - 5/8"				WU12PV	6535 HA
	GTM31	1/4" - 5/8"				WU12PV	6535 HA
	GTM41	1/4" - 3/4"				WU16PV	6535 HA

P				M	K		N			S				H			
1, 2, 3, 4, 6, 7	5, 9, 10, 11	12, 13.1	13.2	14.1, 14.2, 14.3, 14.4	15, 16, 17, 18, 19	20	21	22, 23, 24, 25	26, 27, 28	31, 32	33, 34, 35	36	37	38.1, 38.2, 40.1, 40.2, 41.1	39.1, 41.2		
Steel <35 HRC	Steel 36–48 HRC	PH & Ferritic Stainless Steel <35 HRC	PH & Ferritic Stainless Steel >35 HRC	Stainless Steel	Cast Iron		Wrought Aluminum	Cast Aluminum	Copper, Copper Alloys	Iron Based	Cobalt Based	Nickel Based	Titanium & Alloys	Hardened Steel 49–55 HRC	Hardened Steel 56–68 HRC	Page	Recommended Cutting Parameters
★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★	★	★	★			A220	A228–A233
★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★			A222	A228–A233
					★★★★	★★★★	★★★★	★★★★	★★★★							A224	A228–A233
★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★					★★★★	★★★★	A226	A228–A233
										★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	A227	A228–A233

P				M	K		N			S				H			
1, 2, 3, 4, 6, 7	5, 9, 10, 11	12, 13.1	13.2	14.1, 14.2, 14.3, 14.4	15, 16, 17, 18, 19	20	21	22, 23, 24, 25	26, 27, 28	31, 32	33, 34, 35	36	37	38.1, 38.2, 40.1, 40.2, 41.1	39.1, 41.2		
Steel <35 HRC	Steel 36–48 HRC	PH & Ferritic Stainless Steel <35 HRC	PH & Ferritic Stainless Steel >35 HRC	Stainless Steel	Cast Iron		Wrought Aluminum	Cast Aluminum	Copper, Copper Alloys	Iron Based	Cobalt Based	Nickel Based	Titanium & Alloys	Hardened Steel 49–55 HRC	Hardened Steel 56–68 HRC	Page	Recommended Cutting Parameters
★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★			A221	A228–A233
					★★★★	★★★★	★★★★	★★★★	★★★★							A223	A228–A233
★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★					★★★★	★★★★	A225	A228–A233



Coatings are designed for optimized tapping performance in specific materials.

P	Steel
M	Stainless Steel
K	Cast Iron
N	Non-Ferrous Materials
S	High-Temp Alloys
H	Hardened Materials

wear resistance ← → toughness

Coating		Grade Description	05 10 15 20 25 30 35 40 45								
NEW!	WU12PV	 Coated carbide. PVD fine-grain carbide substrate with high-hardness TiCN coating. Universal grade for thread milling most materials.	P								
			M								
			K								
			N								
			S								
NEW!	WU13PV	 Coated carbide. PVD carbide substrate with heat-resistant TiAlN coating. Universal grade for thread milling most materials.	P								
			M								
			K								
			N								
			S								
NEW!	WU16PV	 Coated carbide. PVD two-layer coating with heat-resistant TiAlN base layer and low-friction MoS ₂ top layer over carbide substrate. Use for thread milling most materials including high-hardness materials.	P								
			M								
			K								
			N								
			S								
			H								

WIN WITH WIDIA™



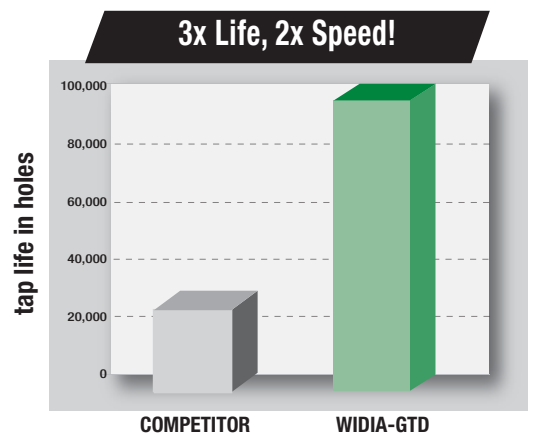
WIDIA-GTD™

High-Performance Solid Carbide Taps for Aluminum Tapping

The first solid carbide tap specifically engineered for tapping cast silicon aluminum, wrought aluminum, and other non-ferrous materials!

- Tap at 2x the speed of conventional HSS-E taps — with 3x the tap life!
- Proprietary GN1515™ grade is highly resistant to galling and wear.
- Fully cylindrical shanks with h6 tolerance — use with hydraulic holders, shrink-fit holders, and precision collet holders.
- Taps can be reconditioned by WIDIA for additional savings.

	COMPETITOR	WIDIA-GTD
tap:	HSS-E form tap	GX49 Bottom Forming
tap drill size:	9,5mm	9,5mm
speed:	47 m/min	94 m/min
coolant:	radial	radial
holder:	synchronous	Erickson™ Slim Line
tap life:	30,000 holes	100,000 holes

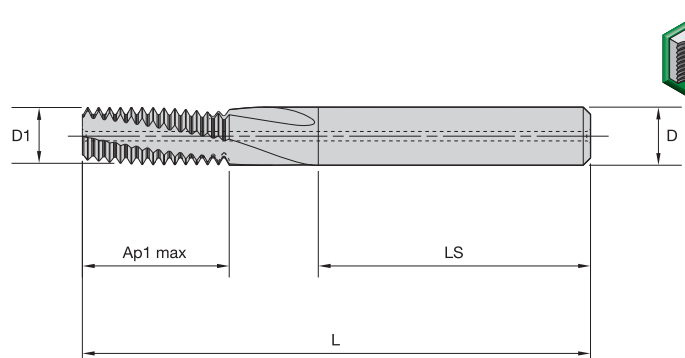


High-Performance Thread Mills

Victory™ Solid Carbide Thread Mills • Blind and Through Holes

WIDIA
GTD™

Holemaking • High-Performance Thread Mills



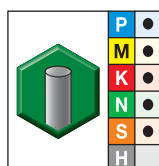
- first choice
- alternate choice

VICTORY

Shank Tolerance

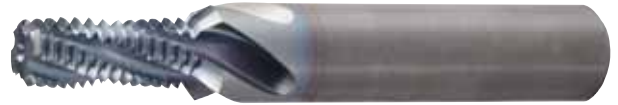
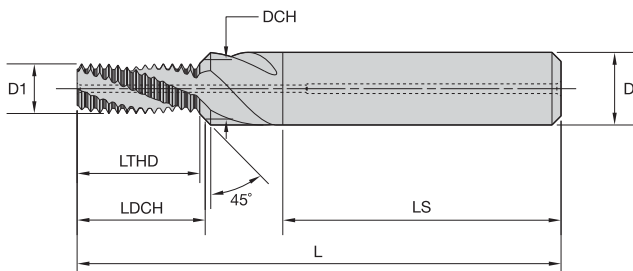
D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-18	+0, -0,011
20-30	+0, -0,013

■ GTM11 • Through Coolant • Metric and Metric Fine



	D1 size	D1	Ap1 max	L	LS	D	cutting edges
WU13PV							
GTM115001	M3 X 0.5	2,4	6	42	28	4,0	3
GTM115012	M4 X 0.5	3,4	8	55	36	6,0	3
GTM115002	M4 X 0.7	3,2	9	55	36	6,0	3
GTM115013	M5 X 0.5	4,3	10	55	36	6,0	3
GTM115003	M5 X 0.8	4,0	11	55	36	6,0	3
GTM115014	M6 X 0.75	5,0	12	55	36	6,0	3
GTM115004	M6 X 1	4,8	12	55	36	6,0	3
GTM115015	M8 X 0.75	5,9	17	63	36	6,0	3
GTM115016	M8 X 1	5,9	16	63	36	6,0	3
GTM115005	M8 X 1.25	5,9	17	63	36	6,0	3
GTM115017	M10 X 1	7,9	20	70	36	8,0	3
GTM115006	M10 X 1.5	7,9	20	70	36	8,0	3
GTM115018	M12 X 1	9,9	24	80	40	10,0	4
GTM115019	M12 X 1.5	9,9	25	80	40	10,0	4
GTM115007	M12 X 1.75	9,9	25	80	40	10,0	4
GTM115020	M14 X 1.5	9,9	29	80	40	10,0	4
GTM115008	M14 X 2	11,6	29	90	45	12,0	4
GTM115021	M16 X 1.5	11,9	32	90	45	12,0	4
GTM115009	M16 X 2	11,9	33	90	45	12,0	4
GTM115022	M18 X 1.5	13,9	37	90	45	14,0	4
GTM115010	M18 X 2.5	13,9	39	90	45	14,0	4
GTM115023	M20 X 1.5	13,9	41	90	45	14,0	4
GTM115011	M20 X 2.5	13,9	41	90	45	14,0	4

WIDIA
GTD™

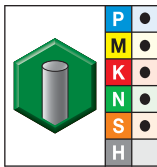


- first choice
- alternate choice

VICTORY

Shank Tolerance

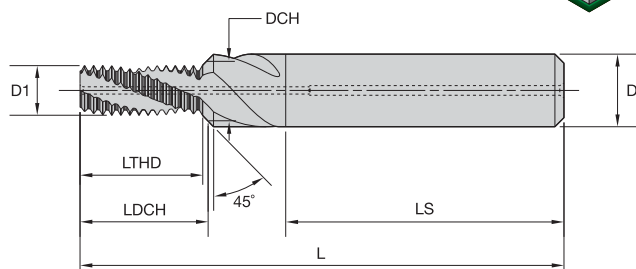
D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-18	+0, -0,011
20-30	+0, -0,013

■ GTM21 • Through Coolant • Inch UNC


	D1 size	D1	DCH	LTHD	LDCH	L	LS	D	cutting edges
WU12PV									
GTM215024	#10-32	3,8	5,13	9,95	10,53	55	36	6,0	3
GTM215017	1/4-20	4,7	6,65	13,36	14,23	62	36	8,0	3
GTM215025	1/4-28	5,2	6,65	13,19	13,84	62	36	8,0	3
GTM215018	5/16-18	6,2	8,25	16,26	17,19	74	40	10,0	3
GTM215026	5/16-24	6,6	8,25	16,44	17,15	74	40	10,0	3
GTM215019	3/8-16	7,7	9,83	19,89	20,85	80	45	12,0	3
GTM215027	3/8-24	8,2	9,83	19,62	20,31	80	45	12,0	3
GTM215020	7/16-14	9,0	11,43	22,72	23,79	80	45	12,0	3
GTM215028	7/16-20	9,6	11,43	22,28	23,08	80	45	12,0	3
GTM215021	1/2-13	10,4	13,00	26,43	27,60	90	45	14,0	4
GTM215029	1/2-20	11,1	13,00	26,10	26,89	90	45	14,0	4
GTM215022	9/16-12	11,8	14,61	30,75	31,99	100	48	16,0	4
GTM215030	9/16-18	12,5	14,61	28,99	29,88	100	48	16,0	4
GTM215023	5/8-11	13,1	16,18	33,54	34,89	102	48	18,0	4
GTM215031	5/8-18	14,1	16,18	33,24	34,09	102	48	18,0	4

High-Performance Thread Mills

Victory™ Solid Carbide Thread Mills • Blind and Through Holes



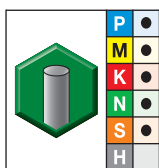
- first choice
- alternate choice

VICTORY

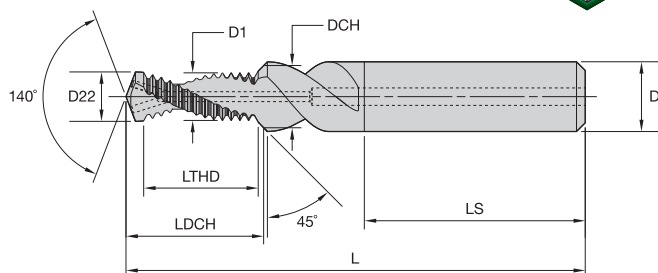
Shank Tolerance

D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-18	+0, -0,011
20-30	+0, -0,013

■ GTM21 • Through Coolant • Metric and Metric Fine



WU12PV	D1 size	D1	DCH	LTHD	LDCH	L	LS	D	cutting edges
GTM215001	M5 X 0.8	4,0	5,3	10,82	11,40	55	36	6,0	3
GTM215008	M6 X 0.75	5,0	6,3	12,40	12,97	62	36	8,0	3
GTM215002	M6 X 1	4,8	6,3	12,52	13,19	62	36	8,0	3
GTM215009	M8 X 1	6,7	8,3	16,53	17,23	74	40	10,0	3
GTM215003	M8 X 1.25	6,5	8,3	16,91	17,71	74	40	10,0	3
GTM215010	M10 X 1	8,7	10,3	20,55	21,23	80	45	12,0	3
GTM215011	M10 X 1.25	8,4	10,3	20,67	21,50	80	45	12,0	3
GTM215004	M10 X 1.5	8,2	10,3	20,29	21,22	80	45	12,0	3
GTM215012	M12 X 1	10,6	12,3	24,56	25,27	90	45	14,0	4
GTM215013	M12 X 1.25	10,4	12,3	24,43	25,24	90	45	14,0	4
GTM215014	M12 X 1.5	10,1	12,3	24,80	25,76	90	45	14,0	4
GTM215005	M12 X 1.75	9,9	12,3	25,42	26,48	90	45	14,0	4
GTM215015	M14 X 1.5	12,1	14,3	29,31	30,25	100	48	16,0	4
GTM215006	M14 X 2	11,6	14,3	29,05	30,24	100	48	16,0	4
GTM215016	M16 X 1.5	14,0	16,3	32,31	33,30	102	48	18,0	4
GTM215007	M16 X 2	13,6	16,3	33,05	34,24	102	48	18,0	4



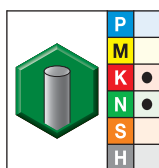
- first choice
- alternate choice

VICTORY

Shank Tolerance

D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-18	+0, -0,011
20-30	+0, -0,013

■ GTM31 • Through Coolant • Inch UNC

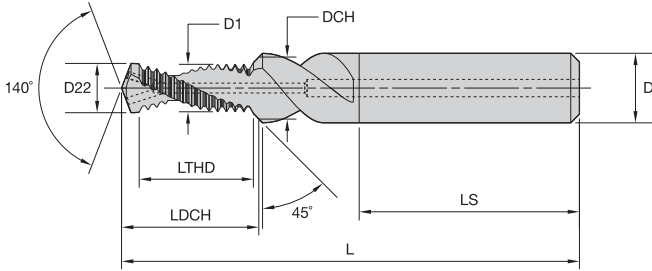


	D1 size	D22	D1	DCH	LTHD	LDCH	L	LS	D	cutting edges
WU12PV										
GTM315021	1/4-20	5,2	4,9	6,7	12,80	15,87	62	36	8,0	2
GTM315028	1/4-28	5,5	5,3	6,7	12,79	15,35	62	36	8,0	2
GTM315023	5/16-18	6,6	6,3	8,3	15,63	19,19	74	40	10,0	2
GTM315030	5/16-24	6,9	6,6	8,3	15,98	19,07	74	40	10,0	2
GTM315017	3/8-16	8,0	7,7	9,8	19,16	23,25	79	45	12,0	2
GTM315024	3/8-24	8,5	8,2	9,8	19,16	22,54	79	45	12,0	2
GTM315018	7/16-14	9,4	9,0	11,4	21,89	26,58	79	45	12,0	2
GTM315025	7/16-20	9,9	9,6	11,4	21,72	25,69	79	45	12,0	2
GTM315019	1/2-13	10,8	10,4	13,0	25,52	30,71	89	45	14,0	2
GTM315026	1/2-20	11,5	11,1	13,0	25,55	29,82	89	45	14,0	2
GTM315020	9/16-12	12,3	11,8	14,6	27,66	33,37	102	48	16,0	2
GTM315027	9/16-18	12,9	12,5	14,6	28,37	33,15	102	48	16,0	2
GTM315022	5/8-11	13,5	13,1	16,2	30,14	36,40	102	48	18,0	2
GTM315029	5/8-18	14,5	14,1	16,2	31,21	36,25	102	48	18,0	2

Holemaking • High-Performance Thread Mills

High-Performance Thread Mills

Victory™ Solid Carbide Thread Mills • Blind and Through Holes



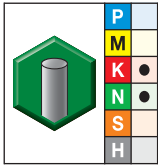
- first choice
- alternate choice

VICTORY

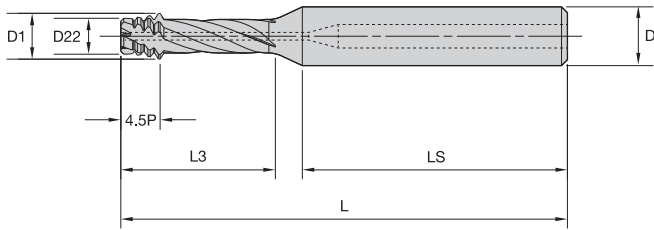
Shank Tolerance

D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-18	+0, -0,011
20-30	+0, -0,013

■ GTM31 • Through Coolant • Metric and Metric Fine



	D1 size	D22	D1	DCH	LTHD	LDCH	L	LS	D	cutting edges
WU12PV										
GTM315001	M4 X 0.7	3,3	3,2	4,3	7,74	9,6	49	36	6,0	2
GTM315002	M5 X 0.8	4,2	4,0	5,3	9,65	11,8	55	36	6,0	2
GTM315009	M6 X 0.75	5,3	5,1	6,3	12,07	14,4	62	36	8,0	2
GTM315003	M6 X 1	5,0	4,8	6,3	12,06	14,7	62	36	8,0	2
GTM315010	M8 X 1	7,0	6,8	8,3	16,09	19,1	74	40	10,0	2
GTM315004	M8 X 1.25	6,8	6,5	8,3	15,08	18,4	74	40	10,0	2
GTM315012	M10 X 1.25	8,8	8,4	10,3	20,11	23,9	79	45	12,0	2
GTM315005	M10 X 1.5	8,5	8,2	10,3	19,59	23,7	79	45	12,0	2
GTM315014	M12 X 1.5	10,5	10,2	12,3	24,12	28,6	89	45	14,0	2
GTM315006	M12 X 1.75	10,3	9,9	12,3	22,86	27,6	89	45	14,0	2
GTM315011	M10 X 1	9,0	8,7	10,3	20,11	23,5	79	45	12,0	2
GTM315013	M12 X 1.25	10,8	10,4	12,3	23,88	28,0	89	45	14,0	2
GTM315015	M14 X 1.5	12,5	12,1	14,3	27,14	32,0	102	48	16,0	2
GTM315007	M14 X 2	12,0	11,6	14,3	28,12	33,6	102	48	16,0	2
GTM315016	M16 X 1.5	14,5	14,1	16,3	31,65	36,9	102	48	18,0	2
GTM315008	M16 X 2	14,0	13,6	16,3	32,13	38,0	102	48	18,0	2



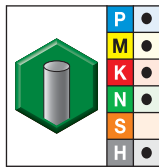
- first choice
- alternate choice

VICTORY

Shank Tolerance

D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-18	+0, -0,011
20-30	+0, -0,013

■ GTM41 • Through Coolant • Right Hand • Inch UNC and UNF

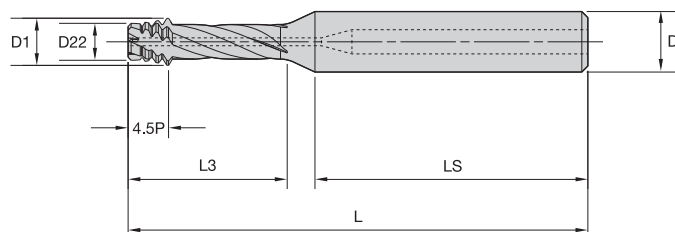


WU16PV	D1 size	D1	D22	L3	L	LS	D	cutting edges
GTM415025	1/4-20	4,64	3,34	17,0	60	36	8,0	3
GTM415033	1/4-28	4,66	3,62	17,0	60	36	8,0	3
GTM415026	5/16-18	5,64	4,12	21,9	76	40	10,0	4
GTM415034	5/16-24	5,64	4,48	21,9	76	40	10,0	4
GTM415035	3/8-24	7,14	6,00	26,3	76	40	10,0	4
GTM415027	3/8-16	7,16	5,42	26,3	76	40	10,0	4
GTM415037	1/2-20	8,45	7,06	33,0	86	45	12,0	4
GTM415036	7/16-20	8,45	7,06	33,0	86	45	12,0	4
GTM415028	7/16 - 24	8,47	6,49	31,0	86	45	12,0	4
GTM415029	1/2-13	10,08	7,95	33,4	86	45	12,0	4
GTM415038	9/16-18	11,27	9,72	41,0	98	48	16,0	4
GTM415030	9/16-12	11,28	8,98	41,0	98	48	16,0	4
GTM415039	5/8-18	12,38	10,83	42,0	98	48	16,0	4
GTM415031	5/8-11	12,89	10,40	42,0	98	48	16,0	4
GTM415040	3/4-16	15,38	13,65	51,3	111	50	20,0	5
GTM415032	3/4-10	15,50	12,77	51,3	111	50	20,0	5

High-Performance Thread Mills

Victory™ Solid Carbide Thread Mills • Blind and Through Holes

WIDIA
GTD™



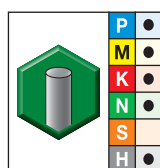
- first choice
- alternate choice

VICTORY

Shank Tolerance

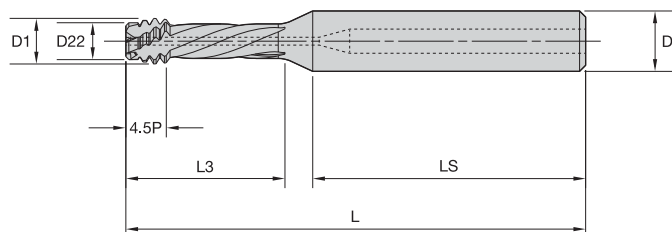
D	Tolerance h6
6	+0, -0,008
8-10	+0, -0,009
12-18	+0, -0,011
20-30	+0, -0,013

■ GTM41 • Through Coolant • Right Hand • Metric and Metric Fine



	D1 size	D1	D22	L3	L	LS	D	cutting edges
WU16PV								
GTM415001	M6 X 1	4,51	3,41	17	60	36	8,0	3
GTM415002	M7 X 1	4,51	3,41	17	60	36	8,0	3
GTM415013	M10 X 1.25	6,23	4,91	22	71	40	10,0	4
GTM415003	M8 X 1.25	6,23	4,91	22	71	40	10,0	4
GTM415004	M9 X 1.25	6,23	4,91	22	71	40	10,0	4
GTM415016	M10 X 1	6,23	5,13	22	71	40	10,0	4
GTM415014	M8 X 1	6,23	5,13	22	71	40	10,0	4
GTM415015	M9 X 1	6,23	5,13	22	71	40	10,0	4
GTM415005	M10 X 1.5	7,75	6,11	26	76	40	10,0	4
GTM415006	M11 X 1.5	7,75	6,11	26	76	40	10,0	4
GTM415007	M12 X 1.5	7,75	6,11	26	76	40	10,0	4
GTM415017	M12 X 1	9,15	8,06	30	86	45	12,0	4
GTM415018	M14 X 1	9,15	8,06	30	86	45	12,0	4
GTM415008	M12 X 1.75	9,16	7,21	32	86	45	12,0	4
GTM415019	M14 X 1.5	10,83	9,15	37	98	48	16,0	4
GTM415020	M16 X 1.5	10,83	9,15	37	98	48	16,0	4
GTM415009	M14 X 2	11,08	8,91	41	98	48	16,0	4
GTM415010	M16 X 2	11,08	8,91	41	98	48	16,0	4
GTM415011	M18 X 2.5	14,38	11,71	51	111	50	20,0	5
GTM415012	M20 X 2.5	14,38	11,71	51	111	50	20,0	5
GTM415021	M18 X 1.5	14,83	13,15	47	98	48	16,0	4
GTM415022	M20 X 1.5	14,83	13,15	47	98	48	16,0	4
GTM415023	M22 X 1.5	18,23	16,55	56	111	50	20,0	5
GTM415024	M24 X 1.5	18,23	16,55	56	111	50	20,0	5

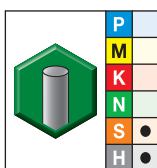
WIDIA
GTD™



VICTORY

- first choice
- alternate choice

■ GTM41 • Through Coolant • Left Hand • Metric and Metric Fine



WU16PV	D1 size	D1	D22	L3	L	LS	D	cutting edges
GTM415041	M6 X 1	4,51	3,41	17	60	36	8,0	3
GTM415042	M7 X 1	4,51	3,41	17	60	36	8,0	3
GTM415043	M8 X 1.25	6,23	4,91	22	71	40	10,0	4
GTM415044	M9 X 1.25	6,23	4,91	22	71	40	10,0	4
GTM415045	M10 X 1.5	7,75	6,11	26	76	40	10,0	4
GTM415046	M11 X 1.5	7,75	6,11	26	76	40	10,0	4
GTM415047	M12 X 1.5	9,17	7,21	32	86	45	12,0	4

Group		Thread Mill GTM11						Thread Mill • Chamfer GTM21					
		Cutting Speed — vc Range — SFM			Feed/Tooth by Diameter			Cutting Speed — vc Range — SFM			Feed/Tooth by Diameter		
		min	Starting Value	max		<0.375	>0.375	min	Starting Value	max		<0.375	>0.375
P	1	300	380	490	inch	0.002	0.003	460	610	790	inch	0.002	0.004
	2	300	380	490	inch	0.002	0.003	460	610	790	inch	0.002	0.004
	3	130	160	230	inch	0.001	0.001	230	300	390	inch	0.001	0.001
	4	—	—	—	—	—	—	230	300	390	inch	0.001	0.001
	5	200	260	330	inch	0.002	0.002	230	300	390	inch	0.002	0.003
	6	—	—	—	—	—	—	—	—	—	—	—	—
M	1	200	260	330	inch	0.002	0.002	230	300	390	inch	0.002	0.003
	2	200	260	330	inch	0.002	0.002	230	300	390	inch	0.002	0.003
	3	—	—	—	—	—	—	—	—	—	—	—	—
K	1	390	490	660	inch	0.002	0.004	430	560	720	inch	0.002	0.004
	2	390	490	660	inch	0.002	0.004	430	560	720	inch	0.002	0.004
	3	300	380	490	inch	0.002	0.003	360	460	590	inch	0.002	0.003
N	1	660	740	820	inch	0.002	0.002	890	980	1080	inch	0.003	0.006
	2	560	620	690	inch	0.002	0.002	520	570	620	inch	0.003	0.006
	3	820	900	980	inch	0.003	0.004	890	980	1080	inch	0.003	0.006
	4	820	900	980	inch	0.003	0.004	890	980	1080	inch	0.003	0.006
	5	890	980	1080	inch	0.005	0.005	820	900	980	inch	0.004	0.008
	6	560	620	690	inch	0.002	0.002	300	330	360	inch	0.004	0.008
S	1	200	260	330	inch	0.002	0.002	230	300	390	inch	0.002	0.003
	2	160	210	260	inch	0.001	0.002	160	200	260	inch	0.001	0.002
	3	160	210	260	inch	0.001	0.002	160	200	260	inch	0.001	0.002
	4	160	210	260	inch	0.001	0.002	160	200	260	inch	0.001	0.002

Group		Thread Mill GTM11						Thread Mill • Chamfer GTM21					
		Cutting Speed – vc Range – m/min			Feed/Tooth by Diameter			Cutting Speed – vc Range – m/min			Feed/Tooth by Diameter		
		min	Starting Value	max		<10mm	>10mm	min	Starting Value	max		<10mm	>10mm
					mm						mm		
P	1	90	115	150	mm	0,05	0,08	140	185	240	mm	0,06	0,10
	2	90	115	150	mm	0,05	0,08	140	185	240	mm	0,06	0,10
	3	40	50	70	mm	0,02	0,03	70	90	120	mm	0,03	0,04
	4	—	—	—	—	—	—	70	90	120	mm	0,03	0,04
	5	60	80	100	mm	0,04	0,06	70	90	120	mm	0,05	0,08
	6	—	—	—	—	—	—	—	—	—	—	—	—
M	1	60	80	100	mm	0,04	0,06	70	90	120	mm	0,05	0,08
	2	60	80	100	mm	0,04	0,06	70	90	120	mm	0,05	0,08
	3	—	—	—	—	—	—	—	—	—	—	—	—
K	1	120	150	200	mm	0,06	0,10	130	170	220	mm	0,06	0,11
	2	120	150	200	mm	0,06	0,10	130	170	220	mm	0,06	0,11
	3	90	115	150	mm	0,05	0,07	110	140	180	mm	0,05	0,07
N	1	200	225	250	mm	0,05	0,06	270	300	330	mm	0,08	0,16
	2	170	190	210	mm	0,04	0,05	160	175	190	mm	0,08	0,16
	3	250	275	300	mm	0,07	0,09	270	300	330	mm	0,08	0,16
	4	250	275	300	mm	0,07	0,09	270	300	330	mm	0,08	0,16
	5	270	300	330	mm	0,12	0,13	250	275	300	mm	0,11	0,20
	6	170	190	210	mm	0,05	0,06	90	100	110	mm	0,11	0,20
S	1	60	80	100	mm	0,04	0,06	70	90	120	mm	0,05	0,08
	2	50	65	80	mm	0,03	0,04	50	60	80	mm	0,03	0,05
	3	50	65	80	mm	0,03	0,04	50	60	80	mm	0,03	0,05
	4	50	65	80	mm	0,03	0,04	50	60	80	mm	0,03	0,05

												
Drill • Chamfer • Thread Mill GTM31												
Group	Cutting Speed — vc Range — SFM			Drilling Recommended Feed by Diameter				Milling Feed/Tooth by Diameter				
	min	Starting Value	max		<0.250	0.250–0.375	0.375–0.625		<0.250	0.250–0.375	0.375–0.625	
	K 1	430	570	750	IPR	0.004	0.006	0.012	inch	0.002	0.003	0.004
	N 1	890	980	1080	IPR	0.006	0.010	0.013	inch	0.002	0.003	0.005
N	2	460	490	560	IPR	0.006	0.010	0.013	inch	0.002	0.003	0.005
	4	890	980	1080	IPR	0.006	0.010	0.013	inch	0.002	0.003	0.005
	5	360	390	430	IPR	0.005	0.008	0.013	inch	0.002	0.003	0.005



Drill • Chamfer • Thread Mill GTM31

Group		Cutting Speed — vc Range — m/min			Drilling Recommended Feed by Diameter				Milling Feed/Tooth by Diameter			
		min	Starting Value	max		<6mm	6–10mm	10–16mm		<6mm	6–10mm	10–16mm
K	1	130	175	230	mm/r	0,10	0,16	0,30	mm	0,05	0,07	0,10
N	1	270	300	330	mm/r	0,15	0,25	0,34	mm	0,06	0,08	0,12
	2	140	150	170	mm/r	0,15	0,25	0,34	mm	0,06	0,08	0,12
	4	270	300	330	mm/r	0,15	0,25	0,34	mm	0,06	0,08	0,12
	5	110	120	130	mm/r	0,12	0,20	0,32	mm	0,06	0,08	0,12

High-Performance Thread Mills

Application Data • Universal Thread Mills • GTM41 • Inch

Group		 Mill • Chamfer • Thread Mill GTM41							
		Cutting Speed — vc				Feed/Tooth by Diameter			
		TM Style	Grade	min	Starting Value	max		<0.375	>0.375
P	1	GTM41 R	KCU36	560	740	950	inch	0.002	0.003
	2	GTM41 R	KCU36	560	740	950	inch	0.002	0.003
	3	GTM41 R	KCU36	390	490	660	inch	0.001	0.002
	4	GTM41 R	KCU36	330	410	520	inch	0.001	0.002
	5	GTM41 R	KCU36	390	490	660	inch	0.001	0.002
	6	GTM41 R	KCU36	200	260	330	inch	0.001	0.002
M	1	GTM41 R	KCU36	390	490	660	inch	0.001	0.002
	2	GTM41 R	KCU36	390	490	660	inch	0.001	0.002
	3	GTM41 R	KCU36	390	490	660	inch	0.001	0.002
K	1	GTM41 R	KCU36	620	820	1080	inch	0.002	0.004
	2	GTM41 R	KCU36	620	820	1080	inch	0.002	0.004
	3	GTM41 R	KCU36	460	610	790	inch	0.002	0.003
N	1	—	—	—	—	—	—	—	—
	2	GTM41 R	KCU36	590	750	980	inch	0.002	0.003
	3	—	—	—	—	—	—	—	—
	4	GTM41 R	KCU36	690	900	1180	inch	0.002	0.003
	5	—	—	—	—	—	—	—	—
	6	GTM41 R	KCU36	690	900	1180	inch	0.002	0.003
S	1	GTM41 L	KCU36	390	490	660	inch	0.001	0.002
	2	GTM41 L	KCU36	160	200	260	inch	0.001	0.001
	3	GTM41 L	KCU36	160	200	260	inch	0.001	0.001
	4	GTM41 L	KCU36	230	300	390	inch	0.001	0.001
H	1	GTM41	KCU36	260	330	430	inch	0.001	0.002
	2	GTM41	KCU36	260	330	430	inch	0.001	0.002
	3	GTM41	KCU36	160	210	260	inch	0.001	0.001
	4	GTM41	KCU36	160	210	260	inch	0.001	0.001

NOTE: For thread depths over 2 x D up to 3 x D, reduce speed by 25% and feed by 25%.



Mill • Chamfer • Thread Mill GTM41

Group		TM Style	Grade	Cutting Speed — vc Range — m/min			Feed/Tooth by Diameter		
				min	Starting Value	max		<10mm	>10mm
P	1	GTM41 R	KCU36	170	225	290	mm	0,05	0,08
	2	GTM41 R	KCU36	170	225	290	mm	0,05	0,08
	3	GTM41 R	KCU36	120	150	200	mm	0,03	0,05
	4	GTM41 R	KCU36	100	125	160	mm	0,03	0,05
	5	GTM41 R	KCU36	120	150	200	mm	0,03	0,04
	6	GTM41 R	KCU36	60	80	100	mm	0,03	0,04
M	1	GTM41 R	KCU36	120	150	200	mm	0,03	0,04
	2	GTM41 R	KCU36	120	150	200	mm	0,03	0,04
	3	GTM41 R	KCU36	120	150	200	mm	0,03	0,04
K	1	GTM41 R	KCU36	190	250	330	mm	0,06	0,10
	2	GTM41 R	KCU36	190	250	330	mm	0,06	0,10
	3	GTM41 R	KCU36	140	185	240	mm	0,04	0,07
N	1	—	—	—	—	—	—	—	—
	2	GTM41 R	KCU36	180	230	300	mm	0,06	0,07
	3	—	—	—	—	—	—	—	—
	4	GTM41 R	KCU36	210	275	360	mm	0,06	0,07
	5	—	—	—	—	—	—	—	—
	6	GTM41 R	KCU36	210	275	360	mm	0,06	0,07
S	1	GTM41 L	KCU36	120	150	200	mm	0,025	0,045
	2	GTM41 L	KCU36	50	60	80	mm	0,015	0,025
	3	GTM41 L	KCU36	50	60	80	mm	0,015	0,025
	4	GTM41 L	KCU36	70	90	120	mm	0,025	0,035
H	1	GTM41	KCU36	80	100	130	mm	0,030	0,050
	2	GTM41	KCU36	80	100	130	mm	0,030	0,050
	3	GTM41	KCU36	50	65	80	mm	0,020	0,030
	4	GTM41	KCU36	50	65	80	mm	0,020	0,030

NOTE: For thread depths over 2 x D up to 3 x D, reduce speed by 25% and feed by 25%.

Thread Milling Methods

Climb Milling

Properties:

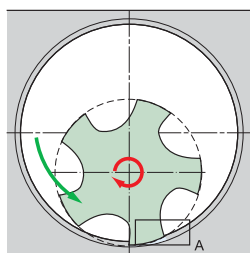
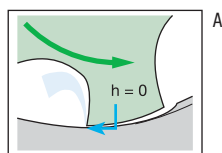
Tool rotation direction clockwise

Tool moves counterclockwise

Pitch upwards

Right-hand thread

Climb milling is always when the cutting edge goes out of the material with a chip thickness $h = 0$



Conventional Milling

Properties:

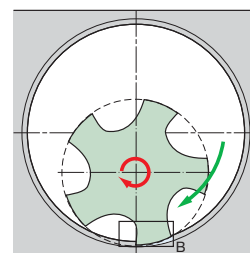
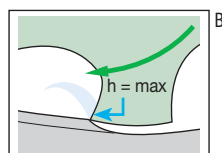
Tool rotation direction clockwise

Tool moves clockwise

Pitch downwards

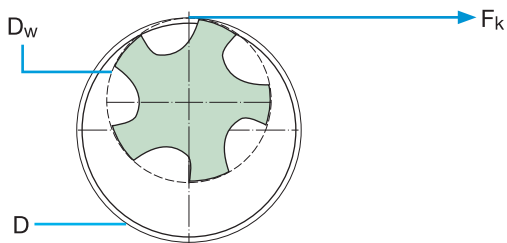
Right-hand thread

Conventional milling is always when the cutting edge goes out of the material with a chip thickness $h = \max$



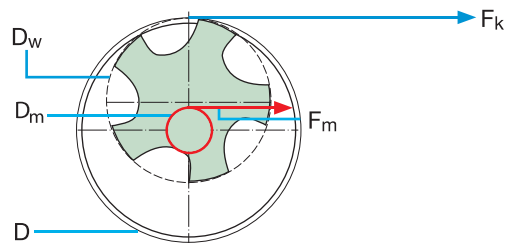
Counter Feed F_k

$$F_k = n \cdot f_z \cdot Z \text{ [mm/min]}$$



Center Point Feed F_m

$$F_m = \frac{F_k \cdot (D - D_w)}{D} \text{ [mm/min]}$$



Counter Feed (F_k)

Center Point Feed (F_m)

- D_w = Tool diameter [mm]
- n = RPM [min^{-1}]
- f_z = Feed per tooth [mm]
- Z = Number of teeth on tool (radial)
- D = Nominal diameter of thread = Diameter of external contour [mm]
- D_m = Diameter of the center point ($D - D_w$) [mm]

Thread Mill GTM21

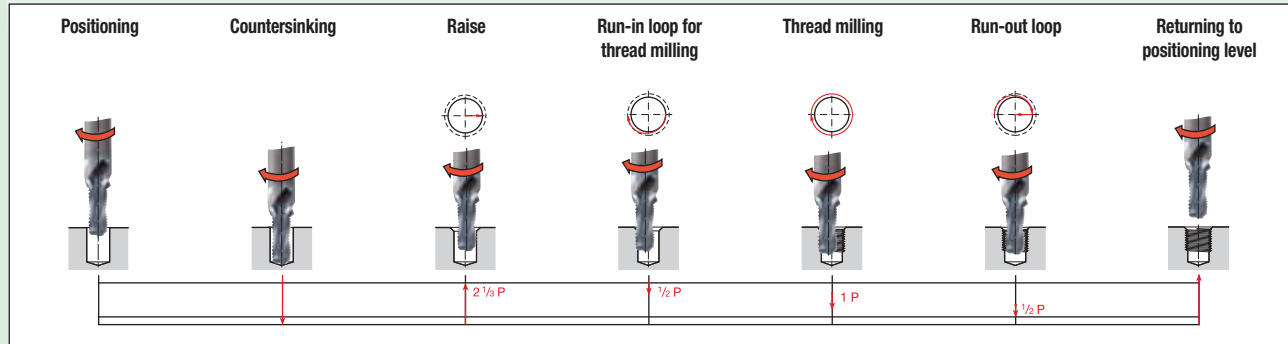
Preparation

Drilling of thread hole

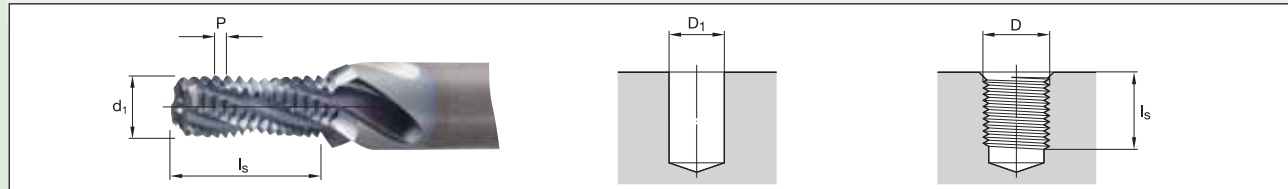
Process Principle

Countersinking, thread milling (conventional milling)

Cycle



Required Specification Values



Example

Size — M10-6H
Thread diameter D 10mm
Pitch 1,5mm
Core hole diameter D₁ 8,5mm
Material — Cast aluminum
Grade — WU12PV

Tool — GTM21
Catalog number GTM215004
Number of teeth Z 3
Tool diameter d₁ 8,2mm*
Tool radius compensation k¹ 0,1mm**
Tool radius to be programmed² 4mm***
Countersink depth l_s 21,2mm
Cutting speed v_c 250 m/min
Feed (countersinking) f_s 0,3 mm/U
Feed (milling) f_z 0,09 mm/tooth

$$N = \frac{v_c \cdot 1000}{d_1 \cdot \pi} \quad S = 9709$$

$$v_s = f_s \cdot n \quad F = 2913 \text{ (countersinking)}$$

$$v_f = f_z \cdot Z \cdot n \quad F = 2622 \text{ (contour)}$$

$$v_f = \frac{v_f \text{ contour} \cdot (D - d_1)}{D} \quad F = 472 \text{ (center point)}$$

*(measured on the cutting part)

** (0.01 x D)

*** (1/2 d₁ - k)

Program to DIN 66025 (conventional milling, on the contour, incremental)

Positioning the tool	N 10	G 54	G 90	G 00	X...	Y...	Z 2	S 9709	T01 ²	M03
Advancing tool to full thread depth	N 20	G 91	Z-21.200							
Countersinking	N 30	G 01	Z-2	F 2913 (countersink)						
Raise	N 40	G 00	Z 3.450							
Moving sideways to the starting point	N 50	G 42	G01	X 4.250	F 1311 (milling, 1/2 contour)		[F 236] ³ (milling, 1/2 center point)			
Run-in loop in arc	N 60	G 02	X-9.25	Y 0.000	Z-0.750	I-4.625	J 0			
Thread milling	N 70	G 02	X 0	Y 0	Z-1.500	I 5	J 0.000	F2622 [F 472] ³ (center point)		
Run-out loop in arc	N 80	G 02	X 9.25	Y 0.000	Z-0.750	I 4.625	J 0			
Exit	N 90	G 40	G 01	X-4.25						
Retracting tool to positioning level	N 100	G 90	G 00	Z 2						

Cutting time t_h

1.4 seconds

NOTES:

¹ The cutter radius measured over the tooth crests of the threaded part must be reduced by the amount of the cutter radius compensation. This is necessary to achieve a depth of cut to the middle of the 6H/ISO2 nut tolerance. Please note, however, that this also depends on the radial deflection of the tool (tensile strength of the material, projecting length of the tool).

² The cutter radius to be programmed is normally included in the tool memory.

³ The feed values in brackets must be used for controllers, which do not calculate the center point feed themselves.

Drill Thread Mill GTM41 • Right Hand

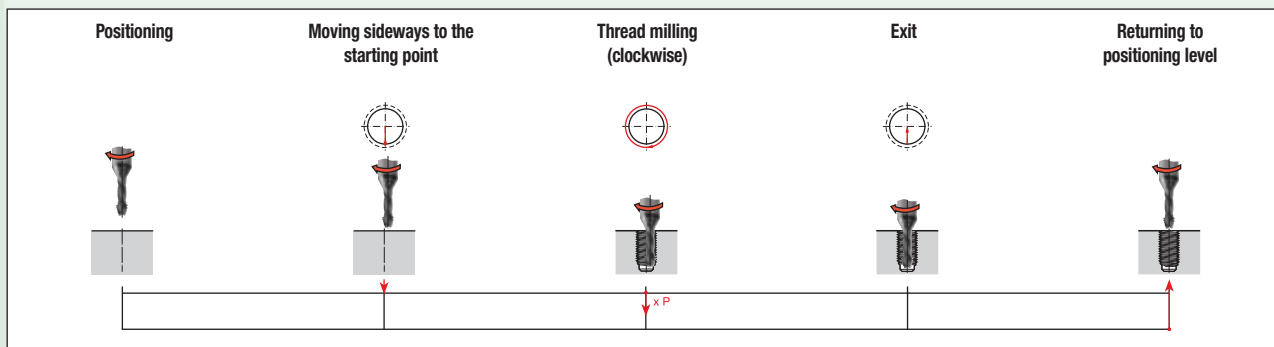
Preparation

None

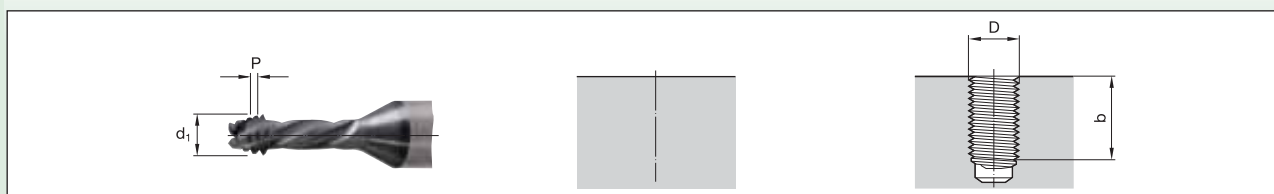
Process Principle

Milling thread and core hole, countersinking (conventional milling)

Cycle



Required Specification Values



Example

Size — M10-6H
Thread diameter D 10mm
Pitch.....1,5mm
Core hole diameter D_1 8,5mm

Material — Hard steel, 50 HRC

Grade — WU16PV

Tool — GTM41 Right Hand

Catalog number GTM415005
Number of teeth Z 4
Tool diameter d_1 7,75mm*
Tool radius compensation k^1 0,08mm**
Tool radius to be programmed ^{2} 3,795mm***
Thread depth b 20mm
Cutting speed v_c 100 m/min
Feed (milling) f_z 0,04 mm/tooth
Number of turns ^{5} 17

$$N = \frac{v_c \cdot 1000}{d_1 \cdot \pi} \quad S = 4109$$

$$v_f = f_z \cdot Z \cdot n \quad F = 657 \text{ (contour)}$$

$$N = \frac{v_f \text{ contour} \cdot (D - d_1)}{D} \quad F = 148 \text{ (center point)}$$

*(measured on the cutting part)

** $(0.01 \times D$; adjust to application)

*** $(1/2 d_1 - k)$

Program to DIN 66025 (conventional milling, on the contour, incremental)

Positioning the tool	N 10	G 54	G 90	G 00	X...	Y...	Z 1.500	S 4109	T01 ²	M03 ⁶
Incremental programming	N 20	G 91								
Moving sideways to the starting point	N 30	G 42	G 01	X 0	Y-5	F 657 (contour)	[F 148] ⁴ (center point)			
Thread milling	N 40	G 02		X 0	Y 0	Z-1.500	I 0	J 5.000		
Repeat thread milling	... ⁵									
Exit	N 50	G 40	G 01	X 0	Y 5					
Retracting tool to positioning level	N 70	G 90	G 00	Z 2						

Cutting time t_h

51.6 seconds

NOTES:

¹ The cutter radius measured over the tooth crests of the threaded part must be reduced by the amount of the cutter radius compensation. This is necessary to achieve a depth of cut to the middle of the 6H/ISO2 nut tolerance. Please note, however, that this also depends on the radial deflection of the tool (tensile strength of the material, projecting length of the tool).

² The cutter radius to be programmed is normally included in the tool memory.

³ The thread depth b must be divisible by the thread pitch P .

⁴ The feed values in brackets must be used for controllers, which do not calculate the center point feed themselves.

⁵ Set N40 must be repeated with the number of threads. Repetitions N = thread depth b /pitch P (rounded up to the nearest integer).

Drill Thread Mill GTM41 • Left Hand

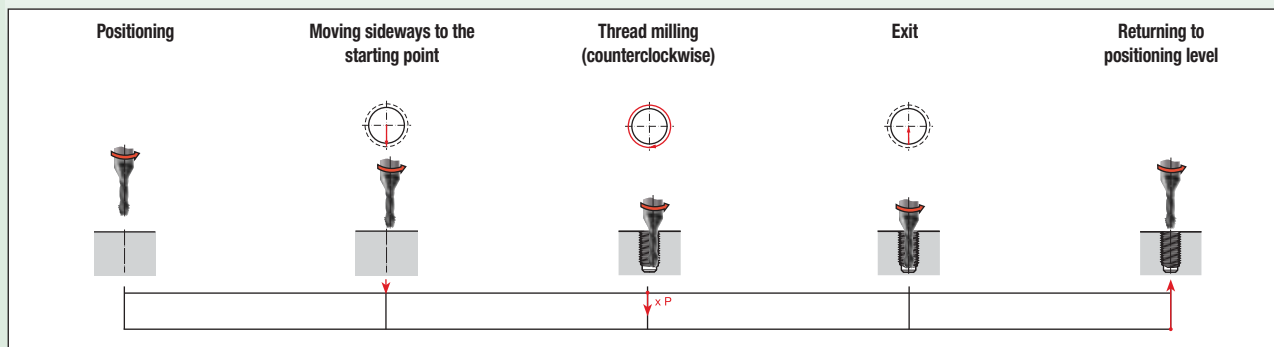
Preparation

None

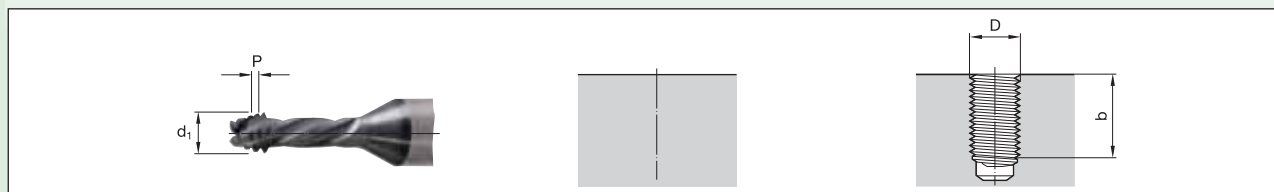
Process Principle

Milling thread and core hole, countersinking (climb milling)

Cycle



Required Specification Values



Example

Size — M10-6H
Thread diameter D 10mm
Pitch.....1,5mm
Core hole diameter D₁ 8,5mm
Material — TiAl6V4 titanium
Grade — WU16PV

Tool — GTM41 Left Hand
Catalog number GTM415045
Number of teeth Z 4
Tool diameter d₁ 7,75mm*
Tool radius compensation k¹ 0,08mm**
Tool radius to be programmed² 3,795mm***
Drilling/countersink depth l_E 20mm
Cutting speed v_c 100 m/min
Feed (milling) f_z 0,03 mm/tooth
Number of turns⁵ 17

*(measured on the cutting part)

**(0.01 x D)

***((1/2 d₁ - k)

$$N = \frac{v_c \cdot 1000}{d_1 \cdot \pi} \quad S = 4109$$

$$v_f = f_z \cdot Z \cdot n \quad F = 493 \text{ (contour)}$$

$$v_f = \frac{v_f \text{ contour} \cdot (D - d_1)}{D} \quad F = 111 \text{ (center point)}$$

Program to DIN 66025 (climb milling, on the contour, incremental)

Positioning the tool	N 10	G 54	G 90	G 00	X...	Y...	Z 1.500	S 4109	T01 ²	M04
Incremental programming	N 20	G 91								
Moving sideways to the starting point	N 30	G 42	G 01	X 0	Y-5	F 493 (contour)		[F 111] ⁴		(center point)
Thread milling	N 40	G 02		X 0	Y 0	Z-1.500	I 0	J 5.000		
Repeat thread milling	... ⁵									
Exit	N 50	G 40	G 01	X 0	Y 5					
Retracting tool to positioning level	N 70	G 90	G 00	Z 2						

Cutting time t_H

68.8 seconds

NOTES:

¹ The cutter radius measured over the tooth crests of the threaded part must be reduced by the amount of the cutter radius compensation. This is necessary to achieve a depth of cut to the middle of the 6H/ISO2 nut tolerance. Please note, however, that this also depends on the radial deflection of the tool (tensile strength of the material, projecting length of the tool).

² The cutter radius to be programmed is normally included in the tool memory.

³ The thread depth b must be divisible by the thread pitch P.

⁴ The feed values in brackets must be used for controllers, which do not calculate the center point feed themselves.

⁵ Set N40 must be repeated with the number of threads. Repetitions N = thread depth b/pitch P (rounded up to the nearest integer).

Drill Thread Mill GTM31

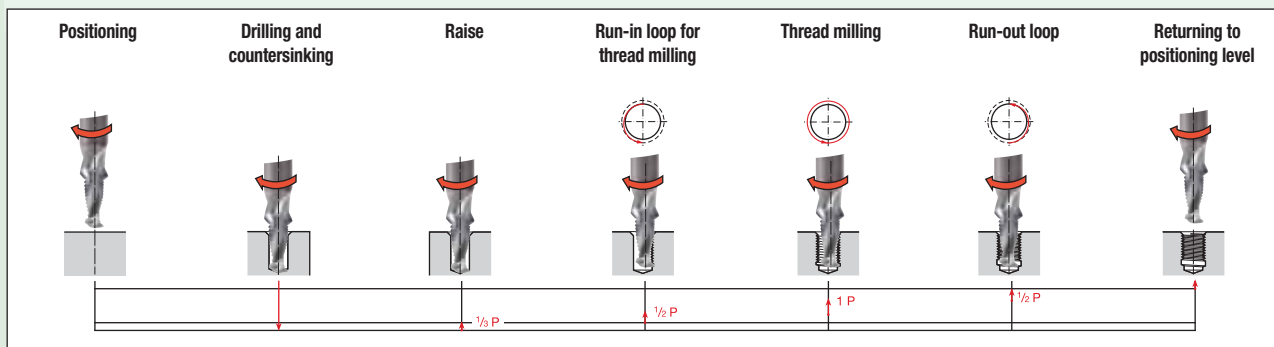
Preparation

None

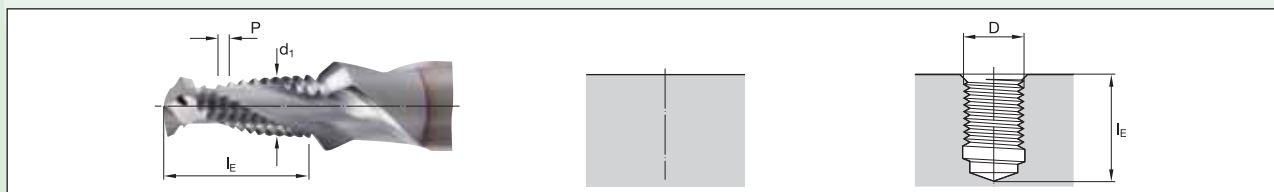
Process Principle

Drilling, countersinking, thread milling (climb milling)

Cycle



Required Specification Values



Example

Size — M10-6H
Thread diameter D 10mm
Pitch 1,5mm
Core hole diameter D₁ 8,5mm
Material — Gray cast iron
Grade — WU12PV

Tool — GTM31
Catalog number GTM315005
Number of teeth Z 2
Tool diameter d₁ 8,2mm*
Tool radius compensation k¹ 0,1mm**
Tool radius to be programmed² 4mm***
Drilling/countersink depth l_E 19,11mm
Cutting speed v_c 250 m/min
Feed (drilling, countersinking) f_b 0,25 mm/U
Feed (milling) f_z 0,1 mm/tooth

$$N = \frac{v_c \cdot 1000}{d_1 \cdot \pi} \quad S = 9709$$

$$v_b = f_b \cdot n \quad F = 2427 \text{ (drilling, countersinking)}$$

$$v_f = f_z \cdot Z \cdot n \quad F = 1942 \text{ (contour)}$$

$$v_f = \frac{v_f \text{ contour} \cdot (D - d_1)}{D} \quad F = 350 \text{ (center point)}$$

*(measured on the cutting part)

** (0.01 x D)

*** (1/2 d₁ - k)

Program to DIN 66025 (climb milling, on the contour, incremental)

Positioning the tool	N 10	G 54	G 90	G 00	X...	Y...	Z 2	S 9709	T01 2	M03
Drilling and countersinking	N 20	G 91	G 01	Z-21.110 F 2427 (drill, countersink)						
Raise	N 30	G 01	Z 0.500							
Moving sideways to the starting point	N 40	G 41	Y-4.250	F 971 (milling, 1/2 contour)				[F 175] 3 (1/2 center point)		
Run-in loop in arc	N 50	G 03	X 0	Y 9.250	Z 0.750	I 0	J 4.625			
Thread milling	N 60	G 03	X 0	Y 0	Z 1.500	I 0	J -5.000	F1942 [F 350] 3 (center point)		
Run-out loop in arc	N 70	G 03	X 0	Y-9.250	Z 0.750	I 0	J- 4.625			
Exit	N 80	G 00	G 40	X 0	Y 4.250					
Retracting tool to positioning level	N 90	G 90	Z 2							

Cutting time t_h

2.3 seconds

NOTES:

¹ The cutter radius measured over the tooth crests of the threaded part must be reduced by the amount of the cutter radius compensation. This is necessary to achieve a depth of cut to the middle of the 6H/ISO2 nut tolerance. Please note, however, that this also depends on the radial deflection of the tool (tensile strength of the material, projecting length of the tool).

² The cutter radius to be programmed is normally included in the tool memory.

³ The feed values in brackets must be used for controllers, which do not calculate the center point feed themselves.

Solid Carbide and Indexable Thread Mills

Features:

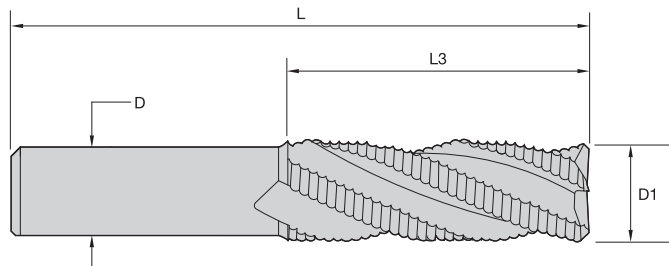
- Helical carbide thread mills with PVD TiAlN coating.
- Precision ground inserts and milled pocket with two flute holders.
- One tool for right- or left-hand threads for both internal and external threading applications.
- For fine or coarse pitch threads.

Benefits:

- Excellent resistance to wear and shock loading.
- Ensures accurate thread form alignment.
- Machines all materials.
- Produce threads in materials up to 62 Rc.



Helical Flute Solid Carbide Thread Mills



Features and Benefits:

- Manufactured from proprietary 12% cobalt micrograin carbide with excellent wear resistance and superior resistance to shock loading.
- PVD TiAlN coating standard.
- Helical flute design reduces chatter.
- Solid carbide thread mills produce full threads to within one pitch of a shoulder, 100% thread height to UN specifications.
- More cost effective than indexable thread mills.
- Same tool can produce:
 - Right- or left-hand threads.
 - Single or multiple lead threads.
 - Internal or external threads.
- Threads smaller than 1/2" (12mm) have reinforced shanks to minimize deflection.

Application Information:

- Steel
- Stainless steel
- Titanium
- High-temperature alloys
- Non-ferrous materials

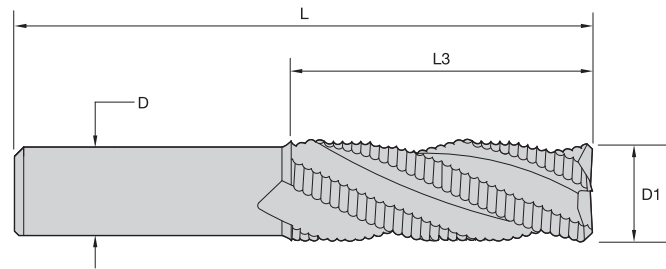
Solid Carbide Thread Mills

■ Series TMH-UN UNC/UNF Internal Threads

standard thread size	TPI	D1	L	L3	D	flutes	EDP number
8-10	32	.125	2.000	.375	.188	2	22602
10	24	.125	2.000	.375	.188	2	22604
1/4	28	.183	2.500	.562	.250	3	22603
1/4	20	.183	2.500	.562	.250	3	22606
5/16	18	.250	2.750	.750	.313	3	22608
5/16 & 3/8	24	.250	2.750	.750	.313	3	22605
3/8	16	.250	2.750	.750	.313	3	22610
7/16	14	.305	2.750	.875	.313	4	22612
7/16	14	.305	2.750	.875	.375	4	22622
7/16 & 1/2	20	.305	2.750	.875	.313	4	22607
7/16 & 1/2	20	.305	2.750	.875	.375	4	22621
1/2	13	.305	2.750	.875	.313	4	22614
1/2	13	.305	2.750	.875	.375	4	22623
5/8	11	.370	2.750	1.125	.375	4	22617
9/16 & 5/8	18	.370	2.750	1.125	.375	4	22609
9/16	12	.370	2.750	1.125	.375	4	22615
3/4	12	.495	3.219	1.250	.500	4	22616
3/4	10	.495	3.219	1.250	.500	4	22618
13/16 +	16	.495	3.219	1.250	.500	4	22611
7/8	14	.495	3.219	1.250	.500	4	22613
1	8	.620	3.938	1.562	.625	4	22620

NOTE: D1 = Cutter diameter
D = Shank diameter
L = Overall length
L3 = Thread length

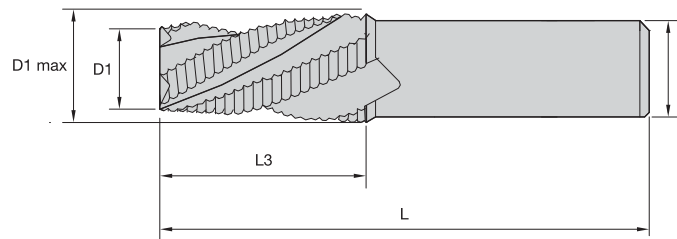
Metric Solid Carbide Thread Mills



Series TMH-ISO Internal Threads

standard thread size	D1	L	L3	D	flutes	EDP number
M4,5 x 0,75	.125	2.000	.375	.188	2	22637
M6 x 1	.183	2.500	.562	.250	3	22640
M8-M11 x 0,75	.250	2.750	.750	.313	3	22638
M8 x 1,25	.183	2.500	.562	.250	3	22642
M10 x 1,5	.250	2.750	.750	.313	3	22643
M12-M30 x 1	.305	2.750	.875	.313	4	22641
M12 x 1,75	.305	2.750	.875	.313	4	22646
M14-M80 x 1,5	.370	2.750	1.125	.375	4	22644
M16 x 2	.370	2.750	1.125	.375	4	22647
M18-M150 x 1,5	.495	3.219	1.250	.500	4	22645
M20 x 2,5	.495	3.219	1.250	.500	4	22648
M24 x 3	.620	3.938	1.562	.625	4	22649

NOTE: D1 = Cutter diameter
D = Shank diameter
L = Overall length
L3 = Thread length



Taper Pipe Size Solid Carbide Thread Mills

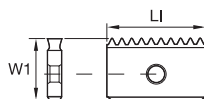
Series TMH-NPT and TMH-NPTF Internal and External Threads

standard thread size	TPI	D1*	D1 max*	L	L3	D	flutes	EDP number	
								NPT	NPTF
1/16 & 1/8	27	.2170	.248	2.500	.500	.250	3	22624	22630
1/4 & 3/8	18	.3120	.359	2.500	.750	.375	4	22625	22631
1/2 & 3/4	14	.4380	.500	2.500	1.000	.500	4	22626	22632
1/2 & 3/4	14	.4380	.500	2.750	1.000	.500	4	22636	22651
1-2	11 1/2	.5500	.620	2.750	1.125	.625	4	22627	22634
1-2	11 1/2	.5500	.620	3.500	1.125	.625	4	22650	22639

*D1 represents the small end diameter and D1 max represents the large end diameter; helical NPT/NPTF thread mills are tapered.

NOTE: D1 = Cutter diameter at small end
D1 max = Cutter diameter at large end
D = Shank diameter
L = Overall length
L3 = Thread length

Indexable Thread Mill Inserts • UN Threads



Features and Benefits:

- One grade machines all materials.
- Precision ground inserts and milled pockets ensure accurate thread form alignment with two flute holders.
- Produce threads in materials up to 62 Rc hardness.
- Ground to CNC tolerances for exact repeatability.
- Positive cutting geometry.
- Chamfered side, secure locking in dovetail pocket.
- Single screw and fixed pocket design, no presetting.
- 100% thread form geometry.
- Produces most accurate thread form in the industry.

Application Information:

- Steel
- Stainless steel
- Cast iron
- Non-ferrous materials

External UN Inserts

■ **14mm UN External**

external TPI	LI	W1	EDP number
32	.551	.295	85151
28	.551	.295	85152
24	.551	.295	85154
20	.551	.295	85155
18	.551	.295	85156
16	.551	.295	85157

■ **21mm UN External**

external TPI	LI	W1	EDP number
20	.827	.472	85170
18	.827	.472	85171
16	.827	.472	85172
14	.827	.472	85173
12	.827	.472	85174
10	.827	.472	85175
8	.827	.472	85176

Internal UN Inserts

■ **14mm UN Internal**

internal TPI	LI	W1	EDP number
40	.551	.295	85160
28	.551	.295	85162
24	.551	.295	85164
20	.551	.295	85165
18	.551	.295	85166
16	.551	.295	85167
14	.551	.295	85168
12	.551	.295	85169

■ **21mm UN Internal**

internal TPI	LI	W1	EDP number
32	.827	.472	85146
20	.827	.472	85177
18	.827	.472	85178
16	.827	.472	85179
14	.827	.472	85180
12	.827	.472	85181
8	.827	.472	85183

■ **30mm UN Internal**

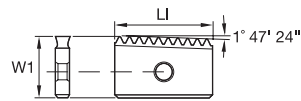
internal TPI	LI	W1	EDP number
16	1.181	.630	85194
12	1.181	.630	85196
8	1.181	.630	85198
6	1.181	.630	85200

■ **40mm UN Internal**

internal TPI	LI	W1	EDP number
16	1.575	.787	85214
4.5	1.575	.787	85221

NOTE: LI = Length of insert
W1 = Width of insert

NPT Pipe Thread Inserts and NPTF (Dryseal) Internal and External



Features and Benefits:

- One grade machines all materials.
- Precision ground inserts and milled pockets ensure accurate thread form alignment with two flute holders.
- Produce threads in materials up to 62 Rc hardness.
- Ground to CNC tolerances for exact repeatability.
- Positive cutting geometry.
- Chamfered side, secure locking in dovetail pocket.
- Single screw and fixed pocket design, no presetting.
- 100% thread form geometry.
- Produces most accurate thread form in the industry.

Application Information:

- Steel
- Stainless steel
- Cast iron
- Non-ferrous materials

Internal or External NPT Inserts

■ 14mm NPT

TPI	LI	W1	EDP number
18	.551	.295	85257
14	.551	.295	85258

■ 21mm NPT

TPI	LI	W1	EDP number
18	.827	.472	85259
14	.827	.472	85260
12	.827	.472	85261

■ 30mm NPT

TPI	LI	W1	EDP number
11 1/2	1.181	.630	85262
8	1.181	.630	85263

■ 40mm NPT

TPI	LI	W1	EDP number
11 1/2	1.575	.787	85264
8	1.575	.787	85265

Internal or External NPTF Inserts

■ 14mm NPTF

TPI	LI	W1	EDP number
18	.551	.295	85266
14	.551	.295	85267

■ 21mm NPTF

TPI	LI	W1	EDP number
18.0	.827	.472	85268
14.0	.827	.472	85269
11.5	.827	.472	85270

■ 30mm NPTF

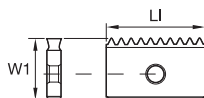
TPI	LI	W1	EDP number
11 1/2	1.181	.630	85271

■ 40mm NPTF

TPI	LI	W1	EDP number
8	1.575	.787	85274

NOTE: LI = Length of insert
W1 = Width of insert

ISO Metric Thread Mill Inserts • Internal



Features and Benefits:

- One grade machines all materials.
- Precision ground inserts and milled pockets ensure accurate thread form alignment with two flute holders.
- Produce threads in materials up to 62 Rc hardness.
- Ground to CNC tolerances for exact repeatability.
- Positive cutting geometry.
- Chamfered side, secure locking in dovetail pocket.
- Single screw and fixed pocket design, no presetting.
- 100% thread form geometry.
- Produces most accurate thread form in the industry.

Application Information:

- Steel
- Stainless steel
- Cast iron
- Non-ferrous materials

Internal ISO Metric Inserts

■ 14mm ISO

thread pitch mm	LI	W1	EDP number
1	.551	.295	85227
1,5	.551	.295	85228
2	.551	.295	85229

■ 21mm ISO

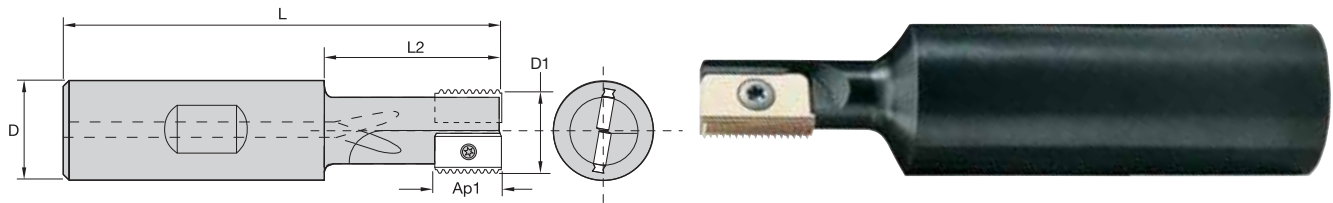
thread pitch mm	LI	W1	EDP number
1	.827	.472	85236
1,5	.827	.472	85237
2	.827	.472	85238
3	.827	.472	85240
3,5	.827	.472	85241

■ 30mm ISO

thread pitch mm	LI	W1	EDP number
1,5	1.181	.630	85248
2	1.181	.630	85249
3	1.181	.630	85251
4	1.181	.630	85253
4,5	1.181	.630	85254
5	1.181	.630	85255

NOTE: LI = Length of insert
W1 = Width of insert

Indexable Thread Mill Holders



Features and Benefits:

- Available in one- and two-flute styles.
- Precision milled pockets align inserts for accurate thread form production.
- Holders available to produce threads from 48 UN to three threads per inch.
- Can mill threads in materials up to 62 Rc hardness.
- Produce course threads using minimal horsepower.
- Allow low cost thread production for small lot runs.
- Produce internal or external, right or left hand threads with same tool holder.
- Produce single or multiple lead threads.
- Control pitch diameter or size to within .0001".
- Produce 100% thread form height to UN specifications.

Application Information:

- Steel
- Stainless steel
- Cast iron
- Non-ferrous materials

Single-Flute Indexable Thread Mill Holders

D1	D	L	L2	flutes	Ap1	insert screw	EDP number
.450	.750	3.390	1.000	1	14mm	85113	85099*
.500	.750	3.000	.800	1	14mm	85113	85100
.500	.750	3.350	1.000	1	14mm	85113	85101
.540	.750	3.390	1.250	1	14mm	85113	85116*
.540	.750	3.000	.880	1	14mm	85113	85117
.540	.750	3.390	1.000	1	14mm	85113	85118
.670	.750	3.390	1.180	1	14mm	85113	85102
.700	.750	3.750	1.375	1	21mm	85114	85119*
.750	.750	3.750	1.575	1	21mm	85114	85103
1.140	1.000	4.370	1.968	1	30mm	85115	85104
1.730	1.500	6.000	3.070	1	40mm	85115	85105

*For taper pipe thread inserts only.

Two-Flute Indexable Thread Mill Holders

D1	D	L	L2	flutes	Ap1	insert screw	EDP number
.790	.750	3.750	1.630	2	14mm	85113	85106
1.180	1.000	4.250	2.000	2	21mm	85114	85107
1.580	1.250	5.120	2.850	2	30mm	85114	85108
1.970	1.500	6.000	3.250	2	40mm	85114	85109

Insert Screws for Indexable Thread Mill Holders

wrench size	external thread size	description	EDP number
T7	M2.5	M2,5 x 0,45 ISO x 6,35 OAL	85113
T20	M4	M4 x 0,7 ISO x 10,15 OAL	85114
T20	M5	M5 x 0,8 ISO x 12,25	85115

NOTE: L = Overall length
 L2 = Useable length
 D = Shank diameter
 D1 = Head diameter
 Ap1 = Insert length

Our complete portfolio. Your complete satisfaction.

WIDIA 
RÜBIG

WIDIA 
CLAPPDICO

WIDIA 
GTD

From turning, holemaking, and indexable milling to solid carbide end milling, solid carbide drilling, and tapping, the most powerful tools in the business now proudly wear WIDIA™ brands. When you buy WIDIA products, you're not just purchasing speed, power, and precision, you're investing in quality and complete satisfaction.

Match the most expansive portfolio of precision-engineered products and custom solution services available today with a global, specialized network of authorized distributor partners and you have the tools you need — and the power that only comes from WIDIA brands. For product information or to schedule an onsite demonstration, visit www.widia.com.

WIDIA
HANITA

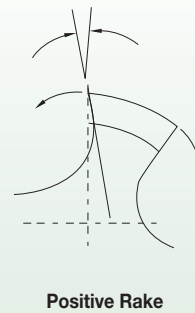
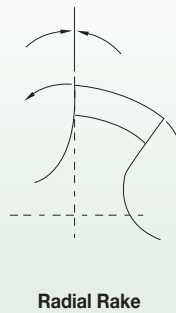
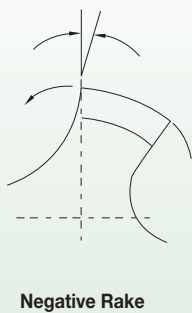
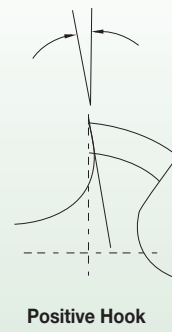
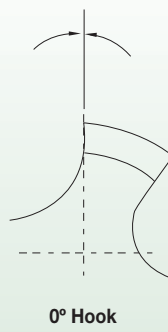
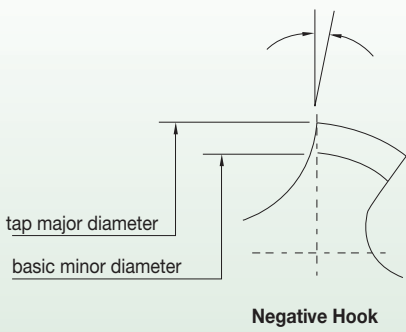
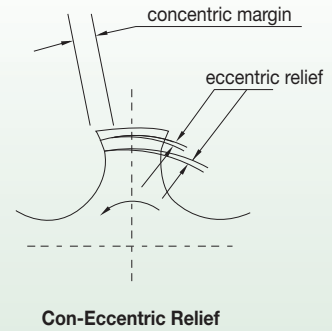
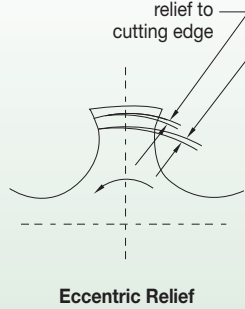
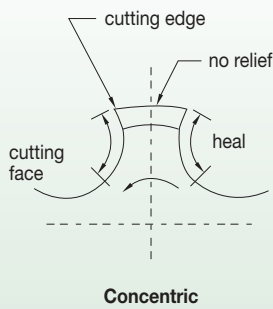
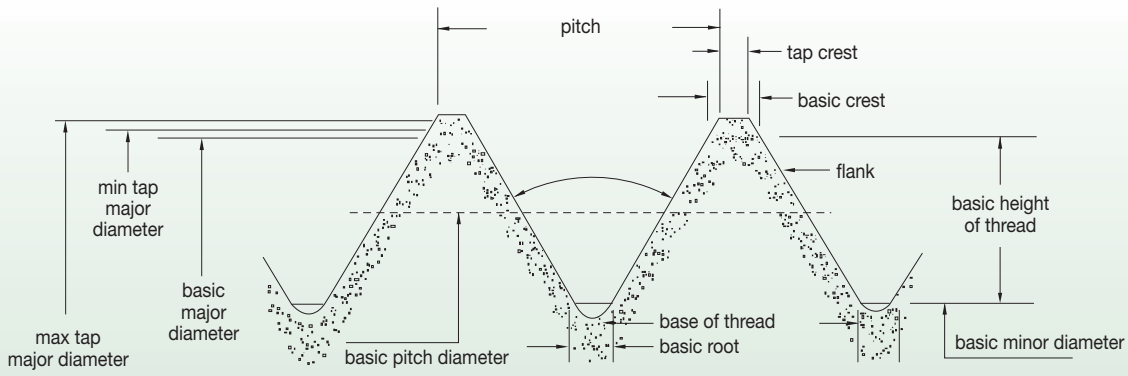
WIDIA
MANCHESTER

WIDIA
METCUT

WIDIA
CIRCLE

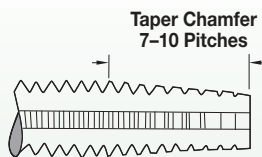
WIDIA
METAL REMOVAL

WIDIA

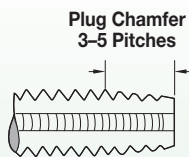


Reprinted with permission from United States Cutting Tool Institute (USCTI).

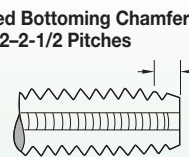
■ Tap Chamfers • ANSI Taps



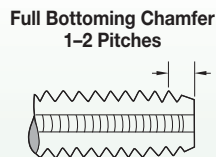
Taper Chamfer
7-10 Pitches



Plug Chamfer
3-5 Pitches



Modified Bottoming Chamfer
2-2 1/2 Pitches



Full Bottoming Chamfer
1-2 Pitches

Hand Tap Chamfers

Taper (7-10 pitches)

The taper chamfer has the longest standard chamfer ensuring easier starting. It requires less tapping torque because of more working teeth.

Plug (3-5 pitches)

The most common chamfer for use by hand or machine in through or blind holes. This chamfer is more efficient than a bottoming or modified bottoming chamfer.

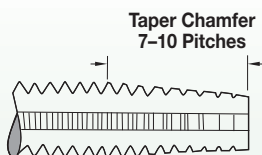
Semi-Bottom (2-2 1/2 pitches)

This short chamfer enables threading close to the bottom of blind holes. Due to the slightly longer chamfer and more working teeth, this chamfer is more efficient than a bottoming chamfer.

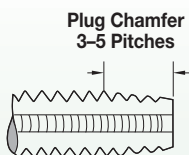
Bottoming (1-2 pitches)

For threading close to the bottom of blind holes, the bottoming chamfer is the least efficient chamfer available.

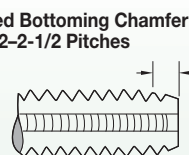
■ Tap Chamfers • DIN Taps



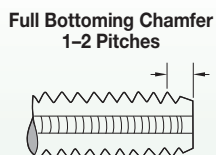
Taper Chamfer
7-10 Pitches



Plug Chamfer
3-5 Pitches



Modified Bottoming Chamfer
2-2 1/2 Pitches



Full Bottoming Chamfer
1-2 Pitches

Hand Tap Chamfers

Form A (6-8 pitches)

The Form A chamfer has the longest standard chamfer ensuring easier starting. It requires less tapping torque because of more working teeth.

Form B/D (3.5-5 pitches)

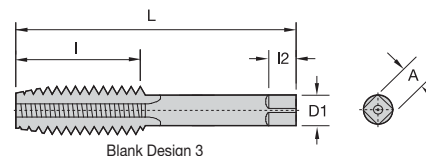
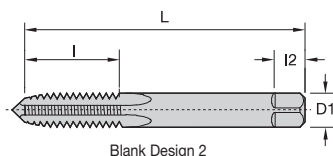
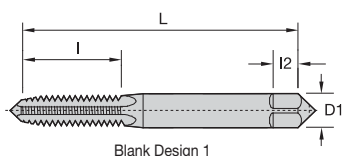
The most common chamfers for use by hand or machine in through or blind holes. Form B applies to spiral-point taps and Form D applies to straight-flute and spiral-flute taps. This chamfer is more efficient than a Form E or Form C chamfers.

Form C (2-2 1/2 pitches)

This short chamfer enables threading close to the bottom of blind holes. Due to the slightly longer chamfer and more working teeth, this chamfer is more efficient than a Form E chamfer.

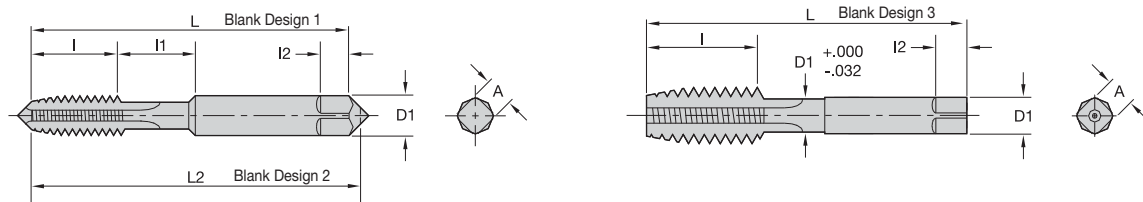
Form E (1.5-2 pitches)

For threading close to the bottom of blind holes, the Form E chamfer is the least efficient chamfer available.



nominal diameter range (in)	machine screw size number (in)	nominal fractional diameter (in)	nominal metric diameter mm (in)	blank design number	overall length L	thread length I	square length I2	shank diameter D1	square size A
.052-.065	0 (.0600)	—	M1.6 (.0630)	1	1.63	.31	.19	.1410	.110
.065-.078	1 (.0730)	—	M1.8 (.0709)	1	1.69	.38	.19	.1410	.110
.078-.091	2 (.0860)	—	M2 (.0787), M2.2 (.0866)	1	1.75	.44	.19	.1410	.110
.091-.104	3 (.0990)	—	M2.5 (.0984)	1	1.81	.50	.19	.1410	.110
.104-.117	4 (.1120)	—	—	1	1.88	.56	.19	.1410	.110
.117-.130	5 (.1250)	—	M3 (.1181)	1	1.94	.63	.19	.1410	.110
.130-.145	6 (.1380)	—	M3.5 (.1378)	1	2.00	.69	.19	.1410	.110
.145-.171	8 (.1640)	—	M4 (.1575)	1	2.13	.75	.25	.1680	.131
.171-.197	10 (.1900)	—	M4.5 (.1772), M5 (.1969)	1	2.38	.88	.25	.1940	.152
.197-.223	12 (.2160)	—	—	1	2.38	.94	.28	.2200	.165
.223-.260	—	1/4 (.2500)	M6 (.2362)	2	2.50	1.00	.31	.2550	.191
.260-.323	—	5/16 (.3125)	M7 (.2756), M8 (.3150)	2	2.72	1.13	.38	.3180	.238
.323-.395	—	3/8 (.3750)	M10 (.3937)	2	2.94	1.25	.44	.3810	.286
.395-.448	—	7/16 (.4375)	—	3	3.16	1.44	.41	.3230	.242
.448-.510	—	1/2 (.5000)	M12 (.4724)	3	3.38	1.66	.44	.3670	.275
.510-.573	—	9/16 (.5625)	M14 (.5512)	3	3.59	1.66	.50	.4290	.322
.573-.635	—	5/8 (.6250)	M16 (.6299)	3	3.81	1.81	.56	.4800	.360
.635-.709	—	11/16 (.6875)	M18 (.7087)	3	4.03	1.81	.63	.5420	.406
.709-.760	—	3/4 (.7500)	—	3	4.25	2.00	.69	.5900	.442
.760-.823	—	13/16 (.8125)	M20 (.7874)	3	4.47	2.00	.69	.6520	.489
.823-.885	—	7/8 (.8750)	M22 (.8661)	3	4.69	2.22	.75	.6970	.523
.885-.948	—	15/16 (.9375)	M24 (.9449)	3	4.91	2.22	.75	.7600	.570
.948-1.010	—	1 (1.0000)	M25 (.9843)	3	5.13	2.50	.81	.8000	.600
1.010-1.073	—	1-1/16 (1.0625)	M27 (1.0630)	3	5.13	2.50	.88	.8960	.672
1.073-1.135	—	1-1/8 (1.1250)	—	3	5.44	2.56	.88	.8960	.672
1.135-1.198	—	1-3/16 (1.1875)	M30 (1.1811)	3	5.44	2.56	1.00	1.0210	.766
1.198-1.260	—	1-1/4 (1.2500)	—	3	5.75	2.56	1.00	1.0210	.766
1.260-1.323	—	1-5/16 (1.3125)	M33 (1.2992)	3	5.75	2.56	1.06	1.1080	.831
1.323-1.385	—	1-3/8 (1.3750)	—	3	6.06	3.00	1.06	1.1080	.831
1.385-1.448	—	1-7/16 (1.4375)	M36 (1.4173)	3	6.06	3.00	1.13	1.2330	.925
1.448-1.510	—	1-1/2 (1.5000)	—	3	6.38	3.00	1.13	1.2330	.925
1.510-1.635	—	1-5/8 (1.6250)	M39 (1.5354)	3	6.69	3.19	1.13	1.3050	.979
1.635-1.760	—	1-3/4 (1.7500)	M42 (1.6535)	3	7.00	3.19	1.25	1.4300	1.072
1.760-1.885	—	1-7/8 (1.8750)	—	3	7.31	3.56	1.25	1.5190	1.139
1.885-2.010	—	2 (2.0000)	M48 (1.8898)	3	7.63	3.56	1.38	1.6440	1.233
2.010-2.135	—	2-1/8 (2.1250)	—	3	8.00	3.56	1.38	1.7690	1.327
2.135-2.260	—	2-1/4 (2.2500)	M56 (2.2047)	3	8.25	3.56	1.44	1.8940	1.420
2.260-2.385	—	2-3/8 (2.3750)	—	3	8.50	4.00	1.44	2.0190	1.514
2.385-2.510	—	2-1/2 (2.5000)	—	3	8.75	4.00	1.50	2.1000	1.575
2.510-2.635	—	2-5/8 (2.6250)	M64 (2.5197)	3	8.75	4.00	1.50	2.2250	1.669
2.635-2.760	—	2-3/4 (2.7500)	—	3	9.25	4.00	1.56	2.3500	1.762
2.760-2.885	—	2-7/8 (2.8750)	M72 (2.8346)	3	9.25	4.00	1.56	2.4750	1.856
2.885-3.010	—	3 (3.0000)	—	3	9.75	4.56	1.63	2.5430	1.907
3.010-3.135	—	3-1/8 (3.1250)	—	3	9.75	4.56	1.63	2.6680	2.001
3.135-3.260	—	3-1/4 (3.2500)	M80 (3.1496)	3	10.00	4.56	1.75	2.7930	2.095
3.260-3.385	—	3-3/8 (3.3750)	—	3	10.00	4.56	1.75	2.8830	2.162
3.385-3.510	—	3-1/2 (3.5000)	—	3	10.25	4.94	2.00	3.0080	2.256
3.510-3.635	—	3-5/8 (3.6250)	M90 (3.5433)	3	10.25	4.94	2.00	3.1330	2.350
3.635-3.760	—	3-3/4 (3.7500)	—	3	10.50	5.31	2.13	3.2170	2.413
3.760-3.885	—	3-7/8 (3.8750)	—	3	10.50	5.31	2.13	3.3420	2.506
3.885-4.010	—	4 (4.0000)	M100 (3.9370)	3	10.75	5.31	2.25	3.4670	2.600

Reprinted with permission from United States Cutting Tool Institute (USCTI). Published by Kennametal Inc. © 2005. All rights reserved.



General Dimensions

nominal diameter range (in)	machine screw size number (in)	nominal fractional diameter (in)	nominal metric diameter mm (in)	blank design number	Tap Dimensions—Inches					
					overall length L	thread length I	neck length I1	square length I2	shank diameter D1	size of square A
.104 .117	4 (.1120)	—	—	1	1.88	.31	.25	.19	.1410	.110
.117 .130	5 (.1250)	—	M3 (.1181)	1	1.94	.31	.31	.19	.1410	.110
.130 .145	6 (.1380)	—	M3.5 (.1378)	1	2.00	.38	.31	.19	.1410	.110
.145 .171	8 (.1640)	—	M4 (.1575)	1	2.13	.38	.38	.25	.1680	.131
.171 .197	10 (.1900)	—	M4.5 (.1772)	1	2.38	.50	.38	.25	.1940	.152
.197 .223	12 (.2160)	—	—	1	2.38	.50	.44	.28	.2200	.165
.223 .260	—	1/4 (.2500)	M6 (.2362)	2	2.50	.63	.38	.31	.2550	.191
.260 .323	—	5/16 (.3125)	M7(.2756), M8(.3150)	2	2.72	.69	.44	.38	.3180	.238
.323 .395	—	3/8 (.3750)	M10 (.3937)	2	2.94	.75	.50	.44	.3810	.286
.395 .448	—	7/16 (.4375)	—	3	3.16	.88	—	.41	.3230	.242
.448 .510	—	1/2 (.5000)	M12 (.4724)	3	3.38	.94	—	.44	.3670	.275
.510 .573	—	9/16 (.5625)	M14 (.5541)	3	3.59	1.00	—	.50	.4290	.322
.573 .635	—	5/8 (.6250)	M16 (.6299)	3	3.81	1.09	—	.56	.4800	.360
.635 .709	—	11/16 (.6875)	M18 (.7087)	3	4.03	1.09	—	.63	.5420	.406
.709 .760	—	3/4 (.7500)	—	3	4.25	1.22	—	.69	.5900	.442
.760 .823	—	13/16 (.8125)	M20 (.7874)	3	4.47	1.22	—	.69	.6520	.489
.823 .885	—	7/8 (.8750)	M22 (.8661)	3	4.69	1.34	—	.75	.3670	.523
.885 .948	—	15/16 (.9375)	M24 (.9449)	3	4.91	1.34	—	.75	.7600	.570
.948 1.010	—	1 (1.0000)	M25 (.9843)	3	5.13	1.50	—	.81	.8000	.600

Reprinted with permission from United States Cutting Tool Institute (USCTI). Published by Kennametal Inc. © 2005. All rights reserved.

NOTES: Thread length I is based on a length of 12 pitches of the UNC thread series. Thread length I is a minimum value and has no tolerance. When thread length I is added to neck length I1, the total shall be no less than the minimum USCTI Table 302 thread length I. Unless otherwise specified, all tolerances are in accordance with USCTI Table 302. For eccentricity tolerances, see USCTI Table 317. Table 302 is provided for reference only. WIDIA-GTD's tap dimensions may differ.

Tolerances

element	nominal diameter range (in)	direction	tolerance (in)
length overall — L	.0520–1.0100	plus or minus	.031
	1.0100–4.0100	plus or minus	.063
length of thread — I	.0520–.2230	plus or minus	.047
	.2230–.5100	plus or minus	.063
	.5100–1.5100	plus or minus	.094
length of square — I2	1.5100–4.0100	plus or minus	.125
	.0520–1.0100	plus or minus	.031
	1.0100–4.0100	plus or minus	.063
diameter of shank — d1	.0520–.2230	minus	.0015
	.2230–.6350	minus	.0015
	.6350–1.0100	minus	.0020
	1.0100–1.5100	minus	.0020
	1.5100–2.0100	minus	.0030
size of square — A	2.0100–4.0100	minus	.0030
	.0520–.5100	minus	.004
	.5100–1.0100	minus	.006
	1.0100–2.0100	minus	.008
	2.0100–4.0100	minus	.010

Reprinted with permission from United States Cutting Tool Institute (USCTI).

Special Taps

Unless otherwise specified:

Special taps over 1.010–1.510" diameter inclusive, having 14 or more threads per inch or 1.75mm pitch and finer, and sizes over 1.510" diameter with 10 or more threads per inch or 2.5mm pitch and finer, are made to general dimensions shown in USCTI Table 303.

Special tap thread limits are determined using the formulas shown in USCTI Table 331 for Unified Inch Screw Threads and USCTI Table 341 for metric m-profile screw threads.

NOTES:

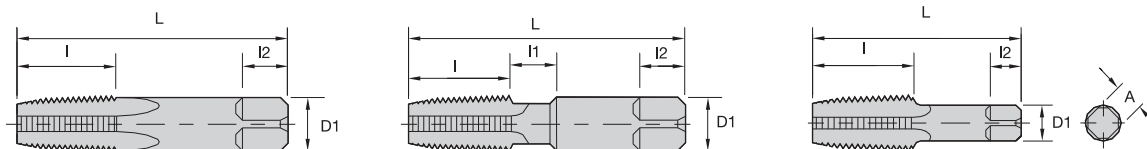
Tap sizes .395" and smaller have an external center on the thread end (may be removed on bottoming taps). Sizes .125" and smaller have an external center on the shank end. Sizes .224–.395" have truncated partial cone centers on the shank end (length of cone approximately 1/4 of diameter of shank). Sizes over .395" have internal centers on both the thread and shank ends.

For standard thread limits and tolerances for Unified Inch Screw Threads, see USCTI Table 327, and for metric threads, see USCTI Table 337.

For eccentricity tolerances of tap elements, see USCTI Table 317.

Technical Information

Standard Pipe Tap Dimensions • Straight and Taper • Ground Thread • Reference USCTI Table 311



General Dimensions

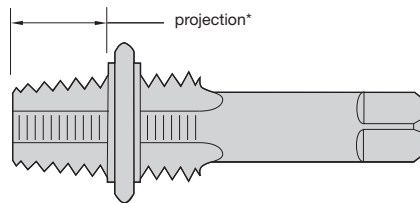
nominal size (in)	dimensions (in)					
	length overall L	length of thread l	length of square l2	diameter of shank D1	size of square A	length optional neck l1
1/16	2.13	.69	.38	.3125	.234	.375
1/8	2.13	.75	.38	.3125	.234	—
1/8	2.13	.75	.38	.4375	.328	.375
1/4	2.44	1.06	.44	.5625	.421	.375
3/8	2.56	1.06	.50	.7000	.531	.375
1/2	3.13	1.38	.63	.6875	.515	—
3/4	3.25	1.38	.69	.9063	.679	—
1	3.75	1.75	.81	1.1250	.843	—
1-1/4	4.00	1.75	.94	1.3125	.984	—
1-1/2	4.25	1.75	1.00	1.5000	1.125	—
2	4.25	1.75	1.13	1.8750	1.406	—
2-1/2	5.50	2.56	1.25	2.2500	1.687	—
3	6.00	2.63	1.38	2.6250	1.968	—
3-1/2	6.50	2.69	1.50	2.8125	2.108	—
4	6.75	2.75	1.56	3.0000	2.250	—

Tolerances

element	range	direction	tolerance
length overall — L	1/16–3/4 inc.	plus/minus	.031
	1–4 inc.	plus/minus	.063
length of thread — l	1/16–3/4 inc.	plus/minus	.063
	1–1-1/4 inc.	plus/minus	.094
length of square — l2	1-1/2–4	plus/minus	.125
	1/16–3/4 inc.	plus/minus	.031
diameter of shank — d1	1–4 inc.	plus/minus	.063
	1/16–1/8	minus	.0015
size of square — a	1/4–1 inc.	minus	.0020
	1-1/4–4 inc.	minus	.0030
	1/16–1/8	minus	.004
	1/4–3/4 inc.	minus	.006
	1–4 inc.	minus	.008

Reprinted with permission from United States Cutting Tool Institute (USCTI). Published by Kennametal Inc. © 2005. All rights reserved.

American National Standard Taper Pipe Thread Form (NPT)
Aeronautical National Taper Pipe Thread Form (ANPT)
Dryseal American National Standard Taper Pipe Thread Form (NPTF)



nominal size (in)	threads per inch	projection* (in)	projection tolerance + / -	taper per foot limits		length L1	tap drill size** NPT, ANPT, NPTF
				min	max		
1/16	27	.312	.063	.719	.781	.160	C
1/8	27	.312	.063	.719	.781	.1615	Q
1/4	18	.459	.063	.719	.781	.2278	7/16
3/8	18	.454	.063	.719	.781	.240	9/16
1/2	14	.579	.063	.719	.781	.320	45/64
3/4	14	.565	.063	.719	.781	.339	29/32
1	11-1/2	.678	.094	.719	.781	.400	1-9/64
1-1/4	11-1/2	.686	.094	.719	.781	.420	1-31/64
1-1/2	11-1/2	.699	.094	.719	.781	.420	1-23/32
2	11-1/2	.667	.094	.719	.781	.436	2-3/16
2-1/2	8	.925	.094	.734	.781	.682	2-39/64
3	8	.925	.094	.734	.781	.766	3-15/64
3-1/2	8	.938	.125	.734	.781	.821	—
4	8	.950	.125	.734	.781	.844	—

*Distance small end of tap projects through L1 taper thread ring gage.

**Recommended size given permits direct tapping without reaming the hole, but only gives a full thread for approximately the L1 length.

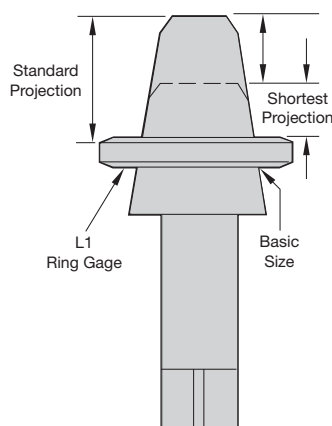
■ Pipe Taps

General-purpose pipe taps are appropriate for threading a wide variety of materials, both ferrous and non-ferrous.

Ground thread pipe taps are standard in American Standard Pipe Form (NPT) and American Standard Dryseal Pipe Form (NPTF). NPT threads require the use of a sealer, like Teflon® tape or pipe compound. Dryseal taps are used to tap fittings which will give a pressure-tight joint without the use of a sealer.

The nominal size of a pipe tap is that of the pipe fitting to be tapped, not the actual size of the tap. The thread tapers 3/4" per foot.

All pipe taps are furnished with 2-1/2–3-1/2 thread chamfer.

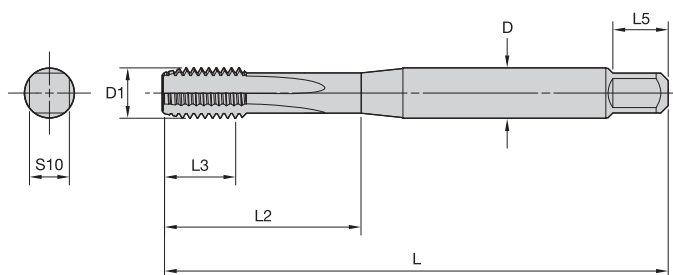


Short projection pipe taps are made with a projection shorter than standard for taper pipe tapping where the depth of tapping is limited.

Special short projection taper pipe taps can be furnished with American National Standard Taper Pipe thread (ANPT) or Dryseal American National Standard Taper Pipe thread (NPTF, PTF-SAE Short, or PTF-SPL Extra Short).

For information on short projection pipe taps and hole preparation for NPT, NPTF, and ANPT internal pipe threads, consult WIDIA-GTD Technical Bulletins.

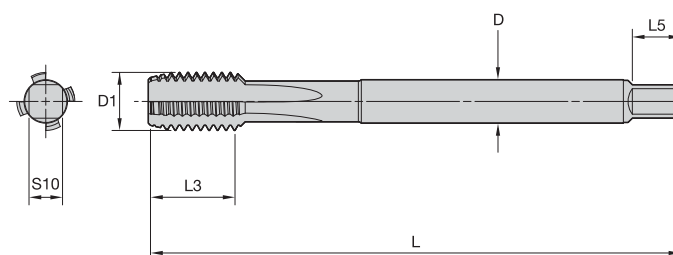
Special short projection pipe taps and left-hand pipe taps are available through Lightning Service.



■ DIN 371

D1	pitch	D	L	L3*	L2	L5	S10
M3	0.5	3.5	56	11	18	6	2.7
M3.5	0.6	4	56	12	20	6	3
M4	0.7	4.5	63	13	21	6	3.4
M4.5	0.75	6	70	16	25	8	4.9
M5	0.8	6	70	16	25	8	4.9
M6	1	6	80	19	30	8	4.9
M7	1	7	80	19	30	8	5.5
M8	0.75	8	80	18	30	9	6.2
M8	1.25	8	90	22	35	9	6.2
M9	0.75	9	80	18	30	10	7
M9	1.25	9	90	22	35	10	7
M10	1	10	90	20	35	11	8
M10	1.5	10	100	24	39	11	8

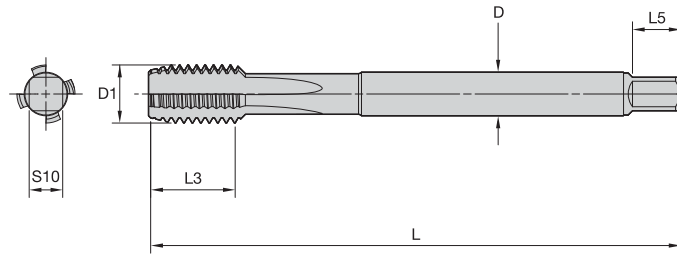
*Maximum



■ DIN 376

D1	pitch	D	L	L3*	L5	S10
M8	1.25	6	90	22	8	4.9
M9	1.25	7	90	22	8	5.5
M10	1.5	7	100	24	8	5.5
M11	1.5	8	100	24	9	6.2
M12	1.75	9	110	28	10	7
M14	2	11	110	30	12	9
M16	2	12	110	32	12	9
M18	2.5	14	125	34	14	11
M20	2.5	16	140	34	15	12
M22	2.5	18	140	34	17	14.5
M24	3	18	160	38	17	14.5
M27	3	20	160	38	19	16
M30	3.5	22	180	45	21	18
M33	3.5	25	180	50	23	20
M36	4	28	200	56	25	22
M39	4	32	200	60	27	24
M42	4.5	32	200	60	27	24
M45	4.5	36	220	65	32	29

*Maximum


DIN 374

pitch			D	L	L3*	L5	S10
D1	minimum	maximum					
M8	0.2	0.75	6	80	18	8	4.9
M8	—	1	6	90	22	8	4.9
M9	0.2	0.75	7	80	18	8	5.5
M9	—	1	7	90	22	8	5.5
M10	0.2	1	7	90	20	8	5.5
M10	—	1.25	7	100	24	8	5.5
M11	0.35	1	8	90	20	9	6.2
M12	0.35	1.5	9	100	22	10	7
M14	0.35	1.5	11	100	22	12	9
M16	0.35	1.5	12	100	22	12	9
M16	—	2	12	110	32	12	9
M18	0.35	1.5	14	110	25	14	11
M18	—	2	14	125	34	14	11
M20	0.35	1.5	16	125	25	15	12
M20	—	2	16	140	34	15	12
M22	0.35	1.5	18	125	25	17	14.5
M22	—	2	18	140	34	17	14.5
M24	0.35	2	18	140	28	17	14.5
M27	0.35	2	20	140	28	19	16
M30	0.35	2	22	150	28	21	18
M30	—	3	22	180	45	21	18

*Maximum

Need More Information about Round Tool Solutions from WIDIA™?

For more information regarding WIDIA's complete line of round tool solutions, please refer to the WIDIA Solid End Mills and Holemaking catalog, contact your local Authorized WIDIA Distributor, or visit us today at www.widia.com.

WIDIA
HANITA

WIDIA
RÜBIG



**SOLID END MILLS &
HOLEMAKING**

Through Holes Push Chips



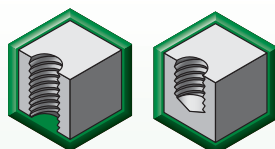
- GUN™ (spiral point) or LHSF (Left-Hand Spiral Flute).
- Ideal for materials with long chips.

Blind Holes Pull Chips



- RHSF (Right-Hand Spiral Flute).
- Ideal for materials with long chips.

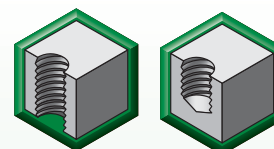
Blind or Through Holes Store Chips



- STFL (Straight Flute).
- Ideal for materials with short chips.

STFL

Blind or Through Holes No Chips



- Forming.
- Ideal for ductile materials <32 HRC.

TRU-LEDE®

■ Unified Inch Screw Threads

size	threads per inch		recommended tap limits		internal thread pitch diameter limits		
	NC UNC	NC UNC	class 2B	class 3B	min all classes (BASIC)	max class 2B	max class 3B
0	—	80	H2	H1	.0519	.0542	.0536
1	64	—	H2	H1	.0629	.0655	.0648
1	—	72	H2	H1	.0640	.0665	.0659
2	56	—	H2	H1	.0744	.0772	.0765
2	—	64	H2	H1	.0759	.0786	.0779
3	48	—	H2	H1	.0855	.0885	.0877
3	—	56	H2	H1	.0874	.0902	.0895
4	40	—	H2	H2	.0958	.0991	.0982
4	—	48	H2	H1	.0985	.1016	.100
5	40	—	H2	H2	.1088	.1121	.1113
5	—	44	H2	H1	.1102	.1134	.1126
6	32	—	H3	H2	.1177	.1214	.1204
6	—	40	H2	H2	.1218	.1252	.1243
8	32	—	H3	H2	.1437	.1475	.1465
8	—	36	H2	H2	.1460	.1496	.1487
10	24	—	H3	H3	.1629	.1672	.1661
10	—	32	H3	H2	.1697	.1736	.1726
12	24	—	H3	H3	.1889	.1933	.1922
12	—	28	H3	H3	.1928	.1970	.1959
1/4	20	—	H5	H3	.2175	.2224	.2211
1/4	—	28	H4	H3	.2268	.2311	.2300
5/16	18	—	H5	H3	.2764	.2817	.2803
5/16	—	24	H4	H3	.2854	.2902	.2890
3/8	16	—	H5	H3	.3344	.3401	.3387
3/8	—	24	H4	H3	.3479	.3528	.3516
7/16	14	—	H5	H3	.3911	.3972	.3957
7/16	—	20	H5	H3	.4050	.4104	.4091
1/2	13	—	H5	H3	.4500	.4565	.4548
1/2	—	20	H5	H3	.4675	.4731	.4717
9/16	12	—	H5	H3	.5084	.5152	.5135
9/16	—	18	H5	H3	.5264	.5323	.5308
5/8	11	—	H5	H3	.5660	.5732	.5714
5/8	—	18	H5	H3	.5889	.5949	.5934
3/4	10	—	H5	H5	.6850	.6927	.6907
3/4	—	16	H5	H3	.7094	.7159	.7143
7/8	9	—	H6	H4	.8028	.8110	.8089
7/8	—	14	H6	H4	.8286	.8356	.8339

The above recommended taps normally produce the class of thread indicated in average materials when used with reasonable care. However, if the tap specified does not give a satisfactory gage fit in the work, a choice of some other limit tap will be necessary.

Unified Inch Screw Threads

size	threads per inch		recommended tap limits		internal thread pitch diameter limits		
	NC UNC	NC UNC	class 2B	class 3B	min all classes (BASIC)	max class 2B	max class 3B
1	8	—	H8	H4	.9188	.9276	.9254
1	—	12	H8	H4	.9188	.9276	.9254
1	15 NS		H6	H4	.9536	.9609	.9590
2	7	—	H8	H4	1.0332	1.0416	1.0393
2	—	12	H6	H4	1.0709	1.0787	1.0768
1-1/4	7	—	H8	H4	1.1572	1.1668	1.1644
1-1/4	—	12	H6	H4	1.1959	1.2039	1.2019
1-3/8	6	—	H8	H4	1.2667	1.2771	1.2745
1-3/8	—	12	H6	H4	1.3209	1.3291	1.3270
1-1/2	6	—	H8	H4	1.3917	1.4022	1.3996
1-1/2	—	12	H6	H4	1.4459	1.4542	1.4522

Tap Recommendations for Class 6H Metric Screw Threads

thread Size		recommended tap limit number	internal thread — product limits — Class 6H			
			pitch diameter (mm)		pitch diameter (in)	
nominal diameter (mm)	pitch (mm)		min	max	min	max
1,6	0,35	D3	1,373	1,458	.05406	.05740
2	0,4	D3	1,740	1,830	.06850	.07205
2,5	0,45	D3	2,208	2,303	.08693	.09067
3	0,5	D3	2,675	2,775	.10531	.10925
3,5	0,6	D4	3,110	3,222	.12244	.12685
4	0,7	D4	3,545	3,663	.13957	.14421
4,5	0,75	D4	4,013	4,131	.15789	.16264
5	0,8	D4	4,480	4,605	.17638	.18130
6	1	D5	5,350	5,500	.21063	.21654
7	1	D5	6,350	6,500	.25000	.25591
8	1,25	D5	7,188	7,348	.28299	.28929
10	1,5	D6	9,026	9,206	.35535	.36244
12	1,75	D6	10,863	11,063	.42768	.43555
14	2	D7	12,701	12,913	.50004	.50839
16	2	D7	14,701	14,913	.57878	.58713
20	2,5	D7	18,376	18,600	.72346	.73228
24	3	D8	22,051	22,316	.86815	.87858
30	3,5	D9	27,727	28,007	1.09161	1.10264
36	4	D9	33,402	33,702	1.31504	1.32685

WIN WITH WIDIATM



VariMill IITM Solid Carbide End Mills

The next generation high-performance end mill, VariMill II dramatically improves metal removal rates without reducing tool life.

- Best suited for applications in the aerospace, medical, die and mold, automotive, and general engineering markets.
- Outstanding performance in stainless steel, titanium, INCONEL[®], and other high-temperature alloys and steels.
- Increased metal removal rates in roughing and finishing operations.
- Excellent performance in both slotting and profiling operations.

To learn more about our innovations, contact your local Authorized Distributor or visit www.widia.com.

WIDIA 

In addition to the nominal size and pitch of a tap, there is another important dimensional factor to be considered when selecting a ground thread tap for a given job. This factor is the pitch diameter tap limit, "H" and "L". "H" represents (high) above basic pitch diameter; "L" (low) is below basic pitch diameter. Tap limits have been established to provide a choice in the selection of the tap size best suited to produce the class of thread desired.

Figure 1 Illustrates the numbering system and the .0005" diameter increment separation between successive limits. Because the starting point is basic pitch diameter, dividing the limit number by two establishes, in thousandths of an inch, the amount the maximum tap pitch diameter is above basic in the "H" series and the amount the minimum tap pitch diameter is under basic in the "L" series.

Figure 2 Illustrates the positioning of the tap limits in relation to the various classes of threads for a 1/4-20 size.

Figure 1

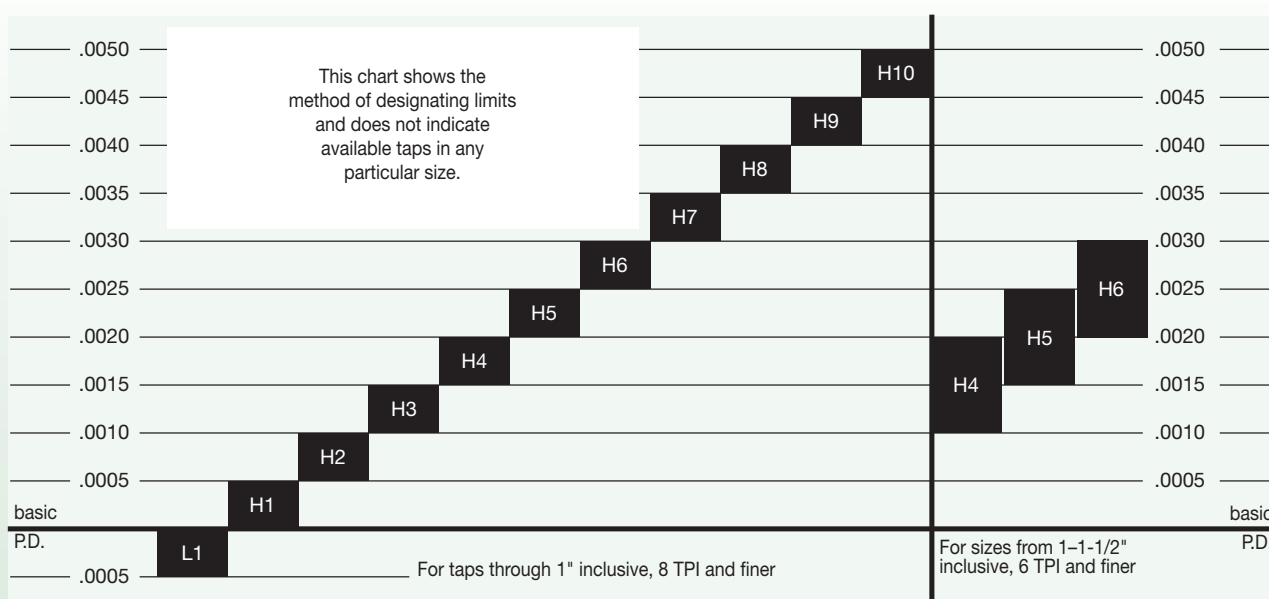
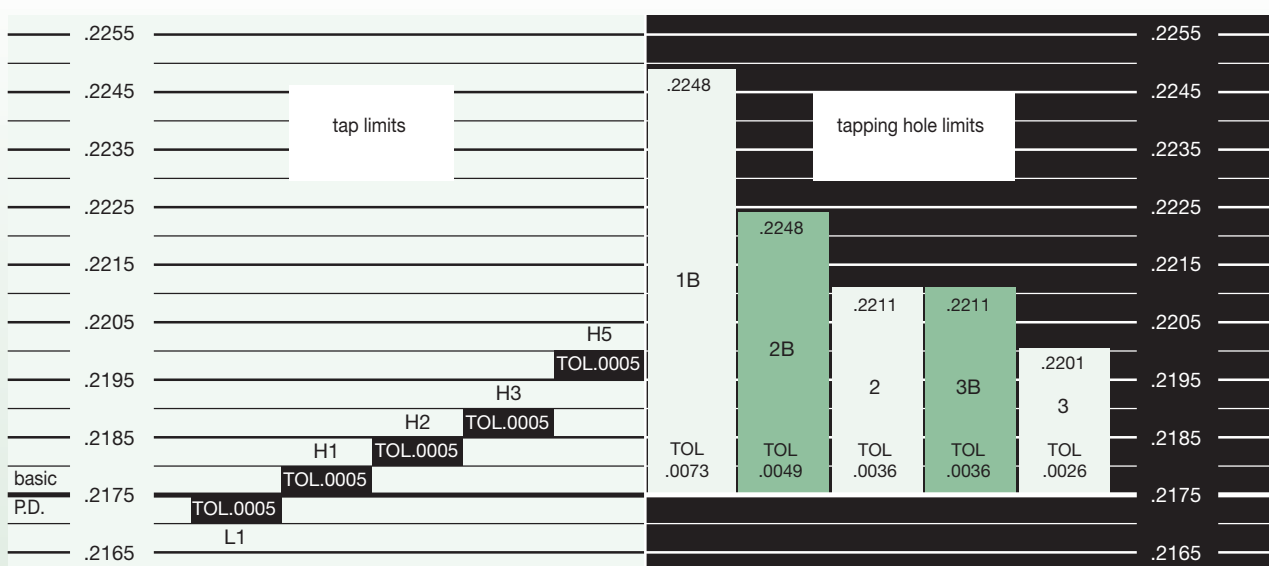
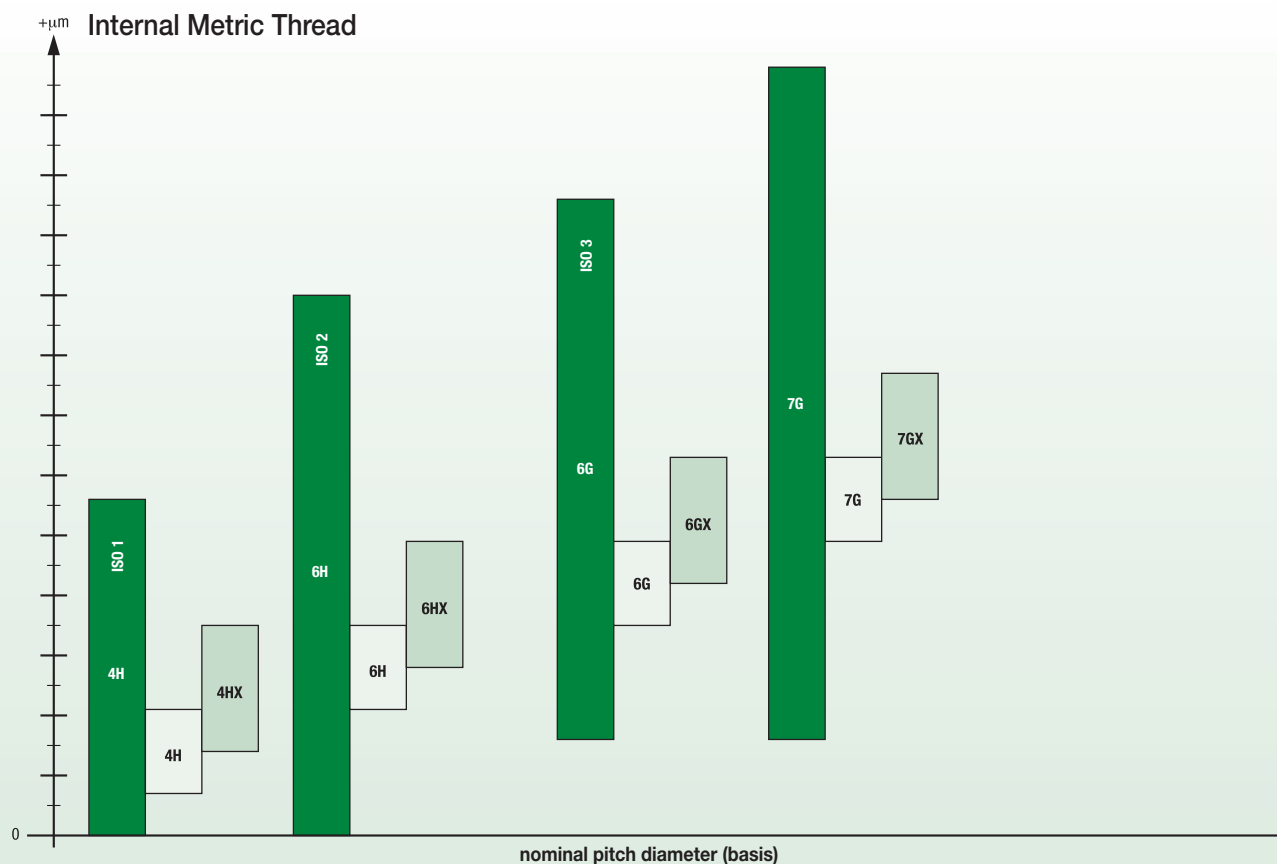
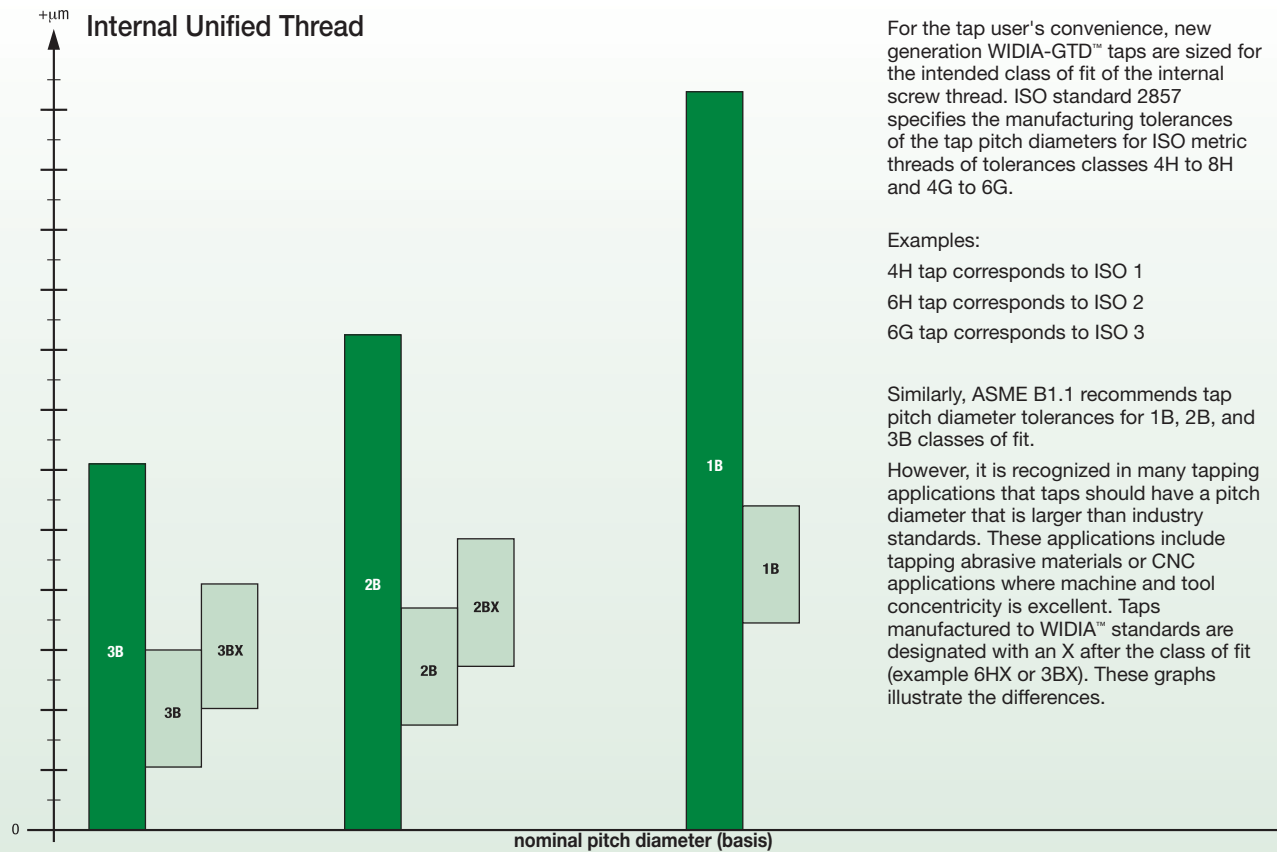


Figure 2

Class of Thread – 1/4 -20 UNC and NC





Fast response and superior performance when you need it.

The WIDIA™ Products Group provides exceptional application and design engineering services. Whether you need tools produced according to a blueprint, a finished part, or a drawing; assistance in process development; or expertise in optimizing an application, our world-renowned Advanced Engineering Team is available.

Our engineering departments are fully integrated with specialized production cells located in our focused factories throughout the world. ISO Certified manufacturing facilities with state-of-the-art CNC equipment, simulation capability, CAD/CAM production, and inspection processes ensure that customers receive the highest-quality product with accurate compliance to specifications and repeatability for future production.



Custom Solution Services:

- Blueprint specials
- Complex geometries
- Form tools
- Modified standards
- Application engineering and optimization
- Tool design
- Project development

Contact your local Authorized Distributor for more information.



It is generally recognized that, in mass production, it is impossible to reproduce in exact detail the theoretically perfect product as laid out on the drawing board. The allowed slight variation between the theoretically perfect product drawing and each unit of the actual product is called the tolerance.

Allowance

An intentional difference in correlated dimensions of mating parts. It is the minimum clearance or maximum interference between such parts.

Angle of Thread

The angle included between the flanks of the thread measured in an axial plane

Half Angle of Thread

The angle included between a flank of the thread and the normal (90°) to the axis, measured in an axial plane.

Lead of Thread

The distance a screw thread advances axially in one turn. On a single-thread screw, the lead and pitch are identical. On a double thread, the lead is 2x pitch; on a triple thread, the lead is 3x pitch, etc.

Major Diameter

The largest diameter of a straight-screw thread.

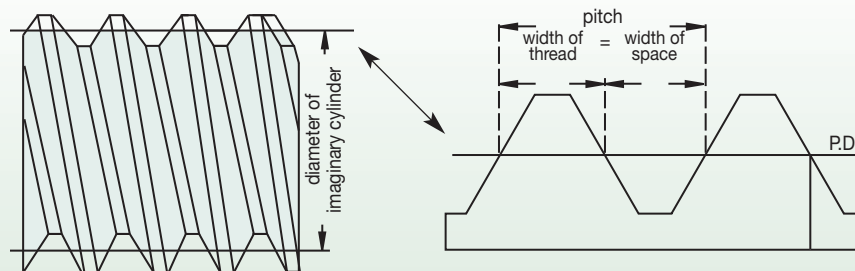
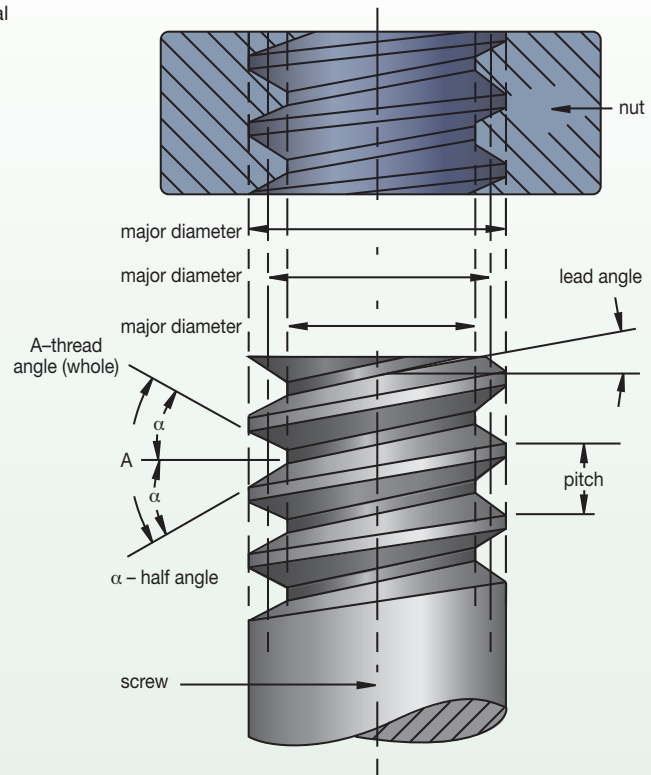
Minor Diameter

The smallest diameter of a straight-screw thread.

Pitch

The distance from a point on a screw thread to a corresponding point on the next thread measured parallel to the axis.

The pitch in inches = $\frac{1}{\text{number of threads per inch}}$



Pitch Diameter

On a straight-screw thread, the diameter of an imaginary cylinder that would pass through the threads at such points as to make equal the width of the threads and the width of the spaces cut by the surface of the cylinder.

Based on 65–75% threads, 1–2x diameter, through hole

		hardness		speed	EM-style taps *EM-									forming taps			
material	condition	BHN	HRC	FPM	SS	SS TiN	SS TiCN	mold	NI	NI TiCN	Ti	AL	ALS	EM-TL TiCN	TLD TiCN	#5500	GP+ GUN™
Low-Carbon Steel, Wrought 1005-1029, 1513-1522	Normalized or	<175	<9	50–75	●	●	●							●	●	●	●
	Cold Drawn	<276	<30	40–60	●	●	●										●
Medium-Carbon Steel, Wrought 1030-1055, 1525-1522	Normalized	<250	<25	30–50	●	●	●							●	●	●	●
	Hardened	<350	<38	15–25	■	■	■	●	●	●							
High-Carbon Steel, Wrought 1060-1069, 1070-1078	Annealed	<275	<30	30–50	●	●	●							●	●	●	●
1080-1086, 1095, 1561	Hardened	<350	<38	15–25				■	●	●							
Low-Carbon Alloy Steel, Wrought 4023, 4320, 5120	Normalized	<250	<25	30–45	●	●	●							●	●	●	●
8115, 8622	Hardened	<350	<38	25–35				●	●	●							
Medium-Carbon Alloy Steel, Wrought 4032, 4130	Normalized	<250	<25	25–35	●	●	●							●	●	●	●
5135, 8630	Hardened	<350	<38	15–20				●	●	●							
Aluminum Alloys, Wrought 2011-2025, 5050	Cold Drawn	<80	—	95–125	■†	●						●	●	■	■	●	
6061, 7075	Treated	<150	—	75–100	■†	●						●	●	■	■	●	
Aluminum Die Cast	As Cast	<100	—	100–150	■†	●						●	●	■	■	●	
	Treated	<125	—	70–100	■†	●						●	●	■	■	●	
High-Silicon Aluminum	Si >10%	<125	—	25–40	■†	●						●	●	■	■	●	■
Brass, Cast		—	—	50–70	■†	●		■						■	■	●	
Bronze, Cast		—	—	40–60	■†	●		■						■	■	●	
Copper		—	—	30–50	■†	●					■	●	●	■	■	●	
Copper, Beryllium		—	—	35–80	■†	●					■	●		■	■	●	
Magnesium Alloys		<100	—	100–150	■†	●					■	●		■	■	●	
Type 8 Exotic Cobalt-Based Alloys, Wrought and Cast																	
AiResist 213, V36, S-816	Treated	<230	<22	5–8	■				●	●							
Haynes 25(L-605), Stellite	Treated/Aged	<320	<34	3–5					●	●	■						
HS-31, HS-51	Cast/Aged	<290	<32	3–5					●	●	■						
Type 9 Exotic Iron-Based Alloys, Wrought																	
A-286, Discaloy, N-155	Treated	<230	<22	10–15	■	■			●								
V57, W-545, Incoloy 800, Incoloy 801	Treated/Aged	<320	<34	7–10					●		■						
Incoloy 802, 16-25-6, 19-90L		—	—						●								
Type 10 Tool Steels, Wrought																	
H10, H11, H12, H13, H14	Annealed	<250	<25	15–25	●	■	■	●									
H19, H21, H26, H42	Hardened	<375	<41	15–20				●	■	●							
D2, D3, D4, D5, D7, A7	Annealed	<150	—	30–45	●	■		●									
P2, P4, P5, P6	Annealed	<250	<25	10–15	■		■	●									
P20, P21	Annealed	<200	<16	25–35	■	■	■	●									
Type 11 Armor Plate, Wrought																	
HY80, HY100	Annealed	<250	<25	25–35	●	●		■	●	●							
MIL-S-12560, MIL-S-16216	Hardened	<300	<33	18–30	■	■		■	●	●							
	Hardened	<350	<38	15–25				■	●	●							
Type 12 High-Strength Steels, Wrought																	
300M, 4340, D6AC, 4340Si	Normalized	<350	<38	15–20	■	■	■	■	●	●							
98BV40	Normalized	<400	<43	10–15				■	●	●							
	Hardened	<460	<48	5–7					●	●							
HP9-4-20, HP25, HP30, HP45	Annealed	<375	<41	10–15				■	●	●							
	Hardened	<460	<48	7–10					●	●							
Type 13 Maraging Steels, Wrought																	
200 Grade, 250 Grade, 300 Grade	Annealed	<325	<35	15–20	■		■	■	●	●							
350 Grade, HY230																	
120 Grade, 180 Grade	Annealed	<325	<35	25–35	■		■	■	●	●							
	Maraged	<425	<45	7–10					●	●							

• First Choice ■ Alternate †Uncoated finish

*EM-TLD a TiCN-coated forming tap designed to tap dry, or mist coolant, for 1–1 1/2 diameters in tapping depth. EM forming taps and TRU-LEDE™ forming taps can be run 1.5–2x faster than the tapping speeds recommended for thread cutting taps.

Recommendations adapted from the Machining Data Handbook, 3rd edition, by permission of the Machinability Data Center, ©1980 by Metcut Research Associates, Inc.

(continued)

(continued)

		hardness		speed	EM-style taps							forming taps			
material	condition	BHN	HRC	FPM	SS	SS TiN	SS TiCN	mold	NI	NI TiCN	TI	EM-TL TiCN	*EM-TLD TiCN	GP+ GUN™	
Type 1 Ferritic Stainless Steel, Wrought															
405, 409, 430, 434, 436, 442, 446, 502	Annealed	<185	<12	25–40	●	●	●					●	■	●	
Type 2 Austenitic Stainless Steel, Wrought															
201, 202, 301, 302, 303, 304,	Annealed	<185	<12	18–25	●	●	●					●	■	●	
305, 308, 309, 310, 314, 316,	Cold Drawn	<275	<30	12–20	●	●	●		●	●		●	■	●	
317, 321, 330, 347, 384, 385															
Nitronic	Annealed	<250	<25	12–20	●	●	●		●	●		●	■	●	
	Cold Drawn	<375	<41	7–15		■	■		●	●					
Type 3 Martensitic Stainless, Steel Wrought															
403, 410, 420, 422	Annealed	<175	<9	25–40	●	●	●		■			●	■	●	
501, 502	Annealed	<225	<21	18–30	●	●	●		■			●	■	●	
	Hardened	<325	<35	18–25	■	●	●		●	●					
	Hardened	<425	<45	10–18		■	■		●	●					
414, 431	Annealed	<275	<30	18–25	■	■	■		●	●					
Greek Ascology	Hardened	<325	<35	12–20	■	■	■		●	●					
	Hardened	<425	<45	7–15					●	●					
440A, 440B, 440C	Annealed	<275	<30	12–20	■	■	■		●	●					
	Hardened	<325	<35	10–18		■	■		●	●					
	Hardened	<425	<45	7–15					●	●					
Type 4 Precipitation Hardening, Stainless Steel Wrought															
15-5PH, 16-6PH, 17-4PH	Annealed	<200	<16	18–30		■		●	●	●					
17-7PH, AF71, AM350, AM355	Hardened	<325	<35	15–25		■		■	●	●					
PH13-8MO, PH14-8MO, PH15-7MO	Hardened	<375	<41	12–20				■	●	●					
Custom 450 HNM	Hardened	<440	<47	6–12				■	●	●					
Type 5 Titanium Alloys, Wrought															
Commercial Pure	Annealed	<170	<7	40–60	●	●					●				
Commercial Pure	Annealed	<200	<16	30–50	■	■					●				
Commercial Pure	Annealed	<275	<30	25–40		■					●				
Ti-5AL-2.5Sn	Annealed	<340	<37	15–25							●				
Ti-6AL-4V	Annealed	<350	<38	15–20							●				
Ti-6AL-6V-2Sn	Annealed	<370	<40	10–15							●				
Ti-6AL-4V	Treated	<380	<41	7–10							●				
Ti-6AL-6V-2Sn	Treated	<440	<46	5–7							●				
Type 6 Nickel Alloys, Wrought and Cast															
Nickel 200 - Nickel 270	Annealed	<170	<7	15–25					●	●	■				
Monel 400, 401, 404, Monel R405	Annealed	<240	<23	15–20					●	●	■				
Monel 502, Monel K500	Treated	<360	<39	3–5					●	●	■				
Perma Nickel 300, Duranickel 301									●	●					
Type 7 Exotic Nickel-Based Alloys, Wrought and Cast															
INCONEL® 625, 702, 706, 718, 721, 722	Annealed	<300	<33	7–10					●	●	■				
INCONEL X-759, 751, 901, Haynes 263	Treated	<400	<43	4–7					●	●	■				
M252, Nimonic 75, 80, Waspaloy									●	●					
Astroloy, INCONEL 700	Treated	<300	<33	5–8					●	●	■				
Nimonic 90, 95, Rene 41, 63	Treated	<400	<43	3–5					●	●	■				
Udimett 500, 700, 710									●	●					
AF2-1DA, Rene 77, Rene 95	Treated	<390	<43	4–7					●	●	■				
Unitemp 1753	Treated	<475	<49	3–5					●	●	■				
Hastelloy B, C, G, S, X	Annealed	<220	<20	7–10					●	●	■				
Incoloy 804, Incoloy 825	Cold Drawn	<310	<34	4–7					●	●	■				
INCONEL 600, INCONEL 601									●	●					
Udimet 630, Retractaloy 26									●	●					
M252, Rene 80, Rene 125	As Cast or	<320	<34	3–5					●	●	■				
B-1900, GMR-235, IN-100, IN-738	Cast/Aged								●	●					
MAR-M200, 246, 421, 432									●	●					
INCONEL 718, Udimet 500, 700									●	●					

*See note on page A264.

● First Choice ■ Alternate

coating	properties and application	precautions
Titanium Nitride (TiN)	Proprietary TiN coating (hardness 2300 Vickers) offers significantly improved wear life and thread finish, often at higher tapping speeds, in a broad range of materials, especially steels, irons, and plastics. Golden color.	Use with caution in non-ferrous materials such as aluminum because of tendency to gall.
Titanium Carbonitride (TiCN)	Proprietary TiCN coating (hardness 3000 Vickers) is harder, tougher, and more wear resistant than TiN under conditions of moderate cutting temperatures. Like TiN, TiCN may be used at higher cutting speeds in a broad range of materials, especially steels and irons. Blue-gray color.	Use with caution in non-ferrous materials such as aluminum because of tendency to gall. TiAlN is a better choice when used at extreme temperatures.
Titanium Nitride + Chromium Carbide Carbon (TiN + CrC/C)	Proprietary coating (hardness 2300 Vickers) that combines the wear resistance of smooth TiN coating with a lubricous top layer of chromium carbide carbon. Effective in stainless steel and non-ferrous materials including aluminum and titanium. Ideal choice for 300 series stainless steels, wrought, and die cast aluminums. Black/gray color.	Effective in both ferrous and non-ferrous materials.
Titanium Aluminum Nitride (TiAlN)	Nanolayer TiAlN coating (hardness 3300 Vickers) offers improved wear life and thread finish, especially in conditions where high temperatures can be generated. Use for PH stainless steels and nickel-based alloys like INCONEL®. Violet/gray color.	Use with caution in non-ferrous materials because of tendency to gall.
Chromium Nitride (CrN)	CrN is medium hard (hardness 1800 Vickers) and has a lower wear resistance than TiN, TiCN, and TiAlN. However, unlike these coatings, CrN does not gall when used in some non-ferrous work materials. Use for brass, bronze, zinc alloys, and magnesium alloys. Silver color.	Ineffective in ferrous materials.
Nitride (MAXI #1)	Hardened case extends wear life in abrasive materials. Use for aluminum and other non-ferrous materials.	Avoid on taper pipe, fast spiral, and small diameter (<#6) or fine pitch taps due to tendency for thread chipping.
Oxide (SH-50)	Helps prevent galling in ferrous (iron-based) materials. For free machining steel. Use for steels, stainless steels, and irons.	Has a tendency to cause galling in non-ferrous materials such as aluminum.
Nitride and Oxide (SH-47)	Combines the benefits of nitride and oxide surface treatments. For steels, stainless steels, and nickel alloys.	See precautions for nitride and oxide surface treatments.

Anyone Can Regrind Your Tools — Only We Can Truly Recondition Them

Why recondition?

Our Reconditioning Services help optimize the total value of your metalcutting tools throughout their entire life cycle by giving them “like-new” performance characteristics — with rapid turnaround time — so the tools you need are always on-hand and perform just like new.

We recondition:

- Solid carbide drills
- Reamers
- Solid carbide taps
- Solid carbide endmills
- PCD/CBN tools

Reconditioning is an affordable way to make your tooling investment last longer and to achieve continued top performance of your drills and end mills.

By sending your worn drills and end mills for reconditioning, you will get:

- Proprietary geometry
- Certified coatings
- Superior quality
- Like-new performance
- Fast turnaround time
- Application support throughout the entire tool life cycle

Tools can often be reconditioned up to five times.



To use the WIDIA™ tool Reconditioning Services, follow these simple steps:

1. Contact the Customer Service center nearest you for instructions.
2. Package the tools in a sturdy box.
3. Find the reconditioning center nearest you:
 - North America
 - South America
 - Europe
 - Asia

Ship the tools with the instructions from Customer Service.
4. Reconditioned tools will be returned to you from the reconditioning center.

Contact your local Authorized WIDIA Distributor to get started.



Factors when trying to determine the best tapping speeds:

- Material to be tapped
- Length of chamfer on tap
- Percentage of full thread to be cut
- Length of hole (depth of thread)
- Pitch of thread
- Cutting fluids
- Machine equipment
- Horizontal or vertical tapping

The best and most efficient operating speeds for taps cannot be calculated with the same certainty, as for many other metalcutting tools.

With other tools, the feed per revolution can be set at any desired point and can be varied as conditions demand. Taps, on the other hand, must always be advanced at a rate equal to one pitch for every revolution. The style of tap may vary the conditions.

For example, with a bottoming tap, the first thread on each land cuts the full height of thread, while, with a taper or starting tap, a number of threads do their share of the cutting before the full height of thread is reached.

The depth of thread also varies, depending on the pitch. The coarser the thread, the greater the advance of the tap per revolution and the greater the amount of material removed.

The method of feeding the tap, and the type of equipment for driving, also influences the permissible speeds. If taps are mechanically fed at the proper rate of advance, they can be operated at higher speeds than if they are required to feed themselves and pull some part of the machine along with them.

Speeds may be modified to take into account any or all of these factors:

- Speeds must be lowered as length of thread increases because, in deep thread holes, the accumulated chips increase friction and interfere with lubrication.
- Bottoming taps must be run slower than plug taps.
- Tapping full height of thread calls for slower speed than if the commercial 75% height only is required.
- Coarse-thread taps in the larger diameters should be run more slowly than fine-thread taps of the same diameters.
- The quantity and quality of cutting fluid may affect the permissible speeds as much as 100%.
- Taper threaded taps, such as pipe taps, should be operated from 1/2–3/4 the speed of a straight thread tap of comparable major diameter.

■ RPM Formulas

SFM = Surface Feet per Minute

RPM = Revolutions per Minute

IPM = Inches per Minute

TPI = Threads per Inch

S m/m = Surface Meters per Minute

$\pi = 3.1416$

mm/min = millimeters per minute

P = Pitch (1/number of threads per inch)

Inch Sizes

$$\text{SFM} = \frac{\text{RPM} \times \text{tool diameter}}{3.82} \quad \text{or} \quad 0.26 \times \text{RPM} \times \text{tool diameter}$$

$$\text{RPM} = \frac{3.82 \times \text{SFM}}{\text{tool diameter}}$$

$$\text{IPM} = \frac{\text{RPM}}{\text{TPI}^*} \quad \text{or} \quad *P \times \text{RPM}$$

Metric Sizes

$$\text{S m/m} = \frac{\pi \times \text{tool diameter} \times \text{RPM}}{1000}$$

$$\text{RPM} = \frac{\text{mm/min} \times 1000}{\pi \times \text{tool diameter}}$$

$$\text{mm/min} = \text{mm P} \times \text{RPM}$$

■ UNC/UNF and NPT/NPTF

tap size	taper pipe taps	surface feet per minute (SFM)																	
		5'	10'	15'	20'	25'	30'	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'
		revolutions per minute (RPM)																	
0		318	637	955	1273	1592	1910	2546	3183	3820	4456	5093	5729	6366	7003	7639	8276	8913	9549
1		273	546	819	1046	1308	1570	2093	2617	3140	3663	4186	4710	5233	5756	6279	6805	7326	1849
2		212	424	637	888	1110	1333	1777	2221	2665	3109	3554	3999	4442	4886	5330	5774	6218	6662
3		191	382	573	772	964	1157	1543	1929	2315	2701	3086	3472	3858	4244	4629	5015	5401	5787
4		174	347	521	682	853	1023	1364	1705	2046	2387	2728	3069	3411	3751	4092	4434	4775	5115
5		147	294	441	611	764	917	1222	1528	1833	2139	2445	2750	3056	3361	3667	3973	4278	4584
6		136	273	409	553	691	829	1106	1382	1659	1935	2212	2488	2766	3042	3318	3595	3871	4148
8		119	239	358	466	583	699	932	1165	1398	1631	1864	2097	2330	2563	2796	3029	3262	3495
10		101	201	302	402	502	603	804	1005	1205	1406	1607	1808	2009	2210	2411	2612	2813	3014
12		87	174	260	354	442	531	707	884	1061	1238	1415	1592	1769	1945	2122	2300	2478	2653
1/4		76	153	229	306	382	458	611	764	917	1070	1222	1375	1528	1681	1833	1986	2139	2292
5/16		62	123	185	245	306	367	489	611	733	856	978	1100	1222	1345	1467	1589	1711	1833
3/8		50	101	151	204	255	305	407	509	611	713	815	917	1019	1120	1222	1324	1426	1528
7/16	1/8	43	87	130	175	219	262	349	437	524	611	698	786	873	960	1048	1135	1222	1310
1/2	—	38	76	115	153	191	229	305	382	458	535	611	688	764	840	917	993	1070	1146
9/16	1/4	34	68	102	137	172	206	274	342	410	478	547	616	683	752	820	888	952	1020
5/8	—	32	64	96	122	153	183	244	306	367	428	489	550	611	672	733	794	856	917
11/16	3/8	28	55	83	111	138	167	222	278	333	389	444	500	556	611	667	722	778	833
3/4	—	25	51	76	102	128	153	203	255	305	357	407	458	509	560	611	662	713	764
7/8	1/2	22	43	65	87	109	131	175	218	262	306	350	392	437	480	524	568	611	655
1	—	19	38	57	76	96	115	153	191	230	268	305	344	382	420	458	497	535	573
1-1/8	3/4	17	34	51	68	84	102	136	170	204	238	272	306	340	373	407	441	475	509
1-1/4	—	15	31	46	61	76	92	122	153	183	214	244	275	305	336	367	397	428	458
1-3/8	1	14	28	42	56	69	83	111	139	167	194	222	250	278	306	333	361	389	417
1-1/2	—	13	25	38	51	63	76	102	127	153	178	204	229	255	280	305	331	356	382
1-5/8		12	23	35	47	59	71	94	118	141	165	188	212	235	259	282	306	329	353
1-3/4		11	22	33	44	55	65	87	109	131	153	175	196	218	240	262	284	306	327
1-7/8		10	20	30	41	51	61	81	102	122	143	163	183	204	224	244	265	285	306
2		9	19	29	38	48	57	76	96	115	134	153	172	191	210	229	248	267	287

■ Metric

metric taps	surface feet per minute (SFM)																	
	5'	10'	15'	20'	25'	30'	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'
	revolutions per minute (RPM)																	
M1	490	979	1469	1959	2449	2938	3918	4897	5877	6856	7836	8815	9795	10774	11754	12733	13713	14692
M2	242	484	725	967	1209	1451	1934	2418	2901	3385	3868	4352	4835	5319	5803	6286	6770	7253
M3	162	324	486	647	809	971	1295	1619	1942	2266	2590	2914	3237	3561	3885	4208	4532	4856
M3.5	138	277	415	554	692	830	1107	1384	1661	1938	2214	2491	2768	3045	3322	3599	3875	4152
M4	122	243	365	487	608	730	973	1217	1460	1703	1946	2190	2433	2676	2920	3163	3406	3650
M5	97	194	291	388	485	582	776	970	1163	1357	1551	1745	1939	2133	2327	2521	2715	2905
M6	81	162	243	324	405	486	647	809	971	1133	1295	1457	1619	1781	1942	2104	2266	2428
M7	69	138	208	277	346	415	554	692	830	969	1107	1246	1384	1522	1661	1799	1938	2076
M8	61	121	182	243	303	364	485	606	728	849	970	1091	1213	1334	1455	1577	1698	1819
M10	48	97	145	194	242	291	388	485	582	679	776	873	970	1067	1163	1260	1357	1454
M12	40	81	121	162	202	243	324	405	486	567	647	728	809	890	971	1052	1133	1214
M14	35	69	104	139	173	208	277	347	416	485	555	624	693	763	832	901	971	1040
M16	30	61	91	121	152	182	243	303	364	424	485	546	606	667	728	788	849	910
M18	27	54	81	108	135	162	216	269	323	377	431	485	539	593	647	700	754	808
M20	24	49	73	97	121	146	194	243	291	340	388	437	485	534	582	631	680	728
M22	22	44	66	88	110	132	176	221	265	309	353	397	441	485	529	573	618	662
M24	20	40	61	81	101	121	162	202	243	283	323	364	404	445	485	526	566	606
M27	18	36	54	72	90	108	144	180	216	252	287	323	359	395	431	467	503	539
M30	16	32	49	65	81	97	129	162	194	226	259	291	323	356	388	420	453	485

Partial List of Solutions to Tapping Problems

application	symptom	common cause	remedy
general	gage out of limits	tap size and gage mismatch	select tap size for gage
	oversize thread	alignment, spindle feed	correct
	oversize at top	runout or alignment	correct
	go gage binds part way	worn tool, tap cuts off lead	replace tap, synchronous holder
	thread shaving	feed error, high axial force	program, synchronous holder
	chipping	high cutting force, worn tap	tap geometry, replace tap
	breakage	chip jamming flutes	tap geometry, tapping depth
	—	worn tool, high torque	replace tap with new tool
	short life, low speed	excessive wear	SC or HSS-E-PM HP taps
steel	birdnest blind hole	long, ductile chips	GT30 GP6505 (oxide), peck feed
	chipping	high material hardness	GT00, GT02 WP31MG (TiN)
	breakage in blind holes	hole depth >2D, chip jamming	GT04 WH36MG (TiN/MoS ₂)
stainless steel	oversize thread, low life	galling	GT20, GT30 GM6515 (TiN-CrC/C)
	short life	work hardened core hole	replace drill
cast iron	excessive wear	abrasion	GT40 GP6520 (TiCN)
aluminum, cast	excessive wear	high silicon	GT40 GP6520 (TiCN)
aluminum, wrought	oversize thread	galling	GT70, GT80 WN48EG (DLC)
nickel, cobalt alloys	short life	high cutting temperature	GT10, GT12 WS32MG (TiCN)
titanium	short life	high cutting temperature	GT14, GT16 WN35MG (TiN-DLC)

Thread Mills

	vibration marks	major crest wear	edge chipping	cone shaped thread	entry marks
cutting speed	check	reduce	—	—	—
feed per tooth	check	increase	reduce	—	—
workpiece clamping	improve	improve	improve	—	improve
machine tool stability	improve	improve	improve	—	improve
cantilever arm	shorten	shorten	—	—	shorten
helix angle	increase	reduce	—	—	—
radial runout	check	check	—	—	—
coating	—	improve	improve	—	—
milling operation	—	climb mill	climb mill	climb mill	
line feed/ entry ramp	check	check	—	—	improve
coolant pressure	—	check (>20 bar, 290 psi)	check (>20 bar, 290 psi)	—	—

drill size	decimal (in)	drill size	decimal (in)	drill size	decimal (in)	drill size	decimal (in)	drill size	decimal (in)	drill size	decimal (in)
0,30mm	.0118	54	.0550	3,10mm	.1220	5,50mm	.2165	8,50mm	.3346	9/16	.5625
0,32mm	.0126	1,40mm	.0551	1/18	.1250	7/32	.2188	8,60mm	.3386	14,50mm	.5709
80	.0135	1,45mm	.0571	3,20mm	.1260	5,60mm	.2205	R	.3390	37/64	.5781
0,35mm	.0138	1,50mm	.0591	30	.1285	2	.2210	8,70mm	.3425	14,75mm	.5807
79	.0145	53	.0595	3,30mm	.1299	5,70mm	.2244	11/32	.3438	15,00mm	.5906
0,38mm	.0150	1,55mm	.0610	3,40mm	.1339	1	.2280	8,80mm	.3465	19/32	.5938
1/64	.0156	1/16	.0625	29	.1360	5,80mm	.2283	S	.3480	15,25mm	.6004
0,40mm	.0157	1,60mm	.0630	3,50mm	.1378	5,90mm	.2323	8,90mm	.3504	39/64	.6094
78	.0160	52	.0635	28	.1405	A	.2340	9,00mm	.3543	15,50mm	.6102
0,42mm	.0165	1,65mm	.0650	9/64	.1406	15/64	.2344	T	.3580	15,75mm	.6201
0,45mm	.0177	1,70mm	.0669	3,60mm	.1417	6,00mm	.2362	9,10mm	.3583	5/8	.6250
77	.0180	51	.0670	27	.1440	B	.2380	23/64	.3594	16,00mm	.6299
0,48mm	.0189	1,75mm	.0689	3,70mm	.1457	6,10mm	.2402	9,20mm	.3622	16,25mm	.6398
0,50mm	.0197	50	.0700	26	.1470	C	.2420	9,30mm	.3661	41/64	.6406
76	.0200	1,80mm	.0709	25	.1495	6,20mm	.2441	U	.3680	16,50mm	.6496
75	.0210	1,85mm	.0728	3,80mm	.1496	D	.2460	9,40mm	.3701	21/32	.6562
0,55mm	.0217	49	.0730	24	.1520	6,30mm	.2480	9,50mm	.3740	16,75mm	.6594
74	.0225	1,90mm	.0748	3,90mm	.1535	1/4, E	.2500	3/8	.3750	17,00mm	.6693
0,60mm	.0236	48	.0760	23	.1540	6,40mm	.2520	V	.3770	43/64	.6719
73	.0240	1,95mm	.0768	5/32	.1562	6,50mm	.2559	9,60mm	.3780	17,25mm	.6791
0,62mm	.0244	5/64	.0781	22	.1570	F	.2570	9,70mm	.3819	11/16	.6875
72	.0250	47	.0785	4,00mm	.1575	6,60mm	.2598	9,80mm	.3858	17,50mm	.6890
0,65mm	.0256	2,00mm	.0787	21	.1590	G	.2610	W	.3860	45/64	.7031
71	.0260	2,05mm	.0807	20	.1610	6,70mm	.2638	9,90mm	.3898	18,00mm	.7087
0,70mm	.0276	46	.0810	4,10mm	.1614	17/64	.2656	25/64	.3906	23/32	.7188
70	.0280	45	.0820	4,20mm	.1654	H	.2660	10,00mm	.3937	18,50mm	.7283
69	.0292	2,10mm	.0827	19	.1660	6,80mm	.2677	X	.3970	47/64	.7344
0,75mm	.0295	2,15mm	.0846	4,30mm	.1693	6,90mm	.2717	10,20mm	.4016	19,00mm	.7480
68	.0310	44	.0860	18	.1695	I	.2720	Y	.4040	3/4	.7500
1/32	.0312	2,20mm	.0866	11/64	.1719	7,00mm	.2756	13/32	.4062	49/64	.7656
0,80mm	.0315	2,25mm	.0886	17	.1730	J	.2770	Z	.4130	19,50mm	.7677
67	.0320	43	.0890	4,40mm	.1732	7,10mm	.2795	10,50mm	.4134	25/32	.7812
66	.0330	2,30mm	.0906	16	.1770	K	.2810	27/64	.4219	20,00mm	.7874
0,85mm	.0335	2,35mm	.0925	4,50mm	.1772	9/32	.2812	10,80mm	.4252	51/64	.7969
65	.0350	42	.0935	15	.1800	7,20mm	.2835	11,00mm	.4331	20,50mm	.8071
0,90mm	.0354	3/32	.0938	4,60mm	.1811	7,30mm	.2874	7/16	.4375	13/16	.8125
64	.0360	2,40mm	.0945	14	.1820	L	.2900	11,20mm	.4409	21,00mm	.8268
63	.0370	41	.0960	4,70mm, 13	.1850	7,40mm	.2913	11,50mm	.4528	53/64	.8281
0,95mm	.0374	2,45mm	.0965	3/16	.1875	M	.2950	29/64	.4531	27/32	.8438
62	.0380	40	.0980	4,80mm, 12	.1890	7,50mm	.2953	11,80mm	.4646	21,50mm	.8465
61	.0390	2,50mm	.0984	11	.1910	19/64	.2969	15/32	.4688	55/64	.8594
1,00mm	.0394	39	.0995	4,90mm	.1929	7,60mm	.2992	12,00mm	.4724	22,00mm	.8661
60	.0400	38	.1015	10	.1935	N	.3020	12,20mm	.4803	7/8	.8750
59	.0410	2,60mm	.1024	9	.1960	7,70mm	.3031	31/64	.4844	22,50mm	.8858
1,05mm	.0413	37	.1040	5,00mm	.1969	7,80mm	.3071	12,50mm	.4921	57/64	.8906
58	.0420	2,70mm	.1063	8	.1990	7,90mm	.3110	1/2	.5000	23,00mm	.9055
57	.0430	36	.1065	5,10mm	.2008	5/16	.3125	12,80mm	.5039	29/32	.9062
1,10mm	.0433	7/64	.1094	7	.2010	8,00mm	.3150	13,00mm	.5118	59/64	.9219
1,15mm	.0453	35	.1100	13/64	.2031	O	.3160	33/64	.5156	23,50mm	.9252
56	.0465	2,80mm	.1102	6	.2040	8,10mm	.3189	13,20mm	.5197	15/16	.9375
3/64	.0469	34	.1110	5,20mm	.2047	8,20mm	.3228	17/32	.5312	24,00mm	.9449
1,20mm	.0472	33	.1130	5	.2055	P	.3230	13,50mm	.5315	61/64	.9531
1,25mm	.0492	2,90mm	.1142	5,30mm	.2087	8,30mm	.3268	13,80mm	.5433	24,50mm	.9646
1,30mm	.0512	32	.1160	4	.2090	21/64	.3281	35/64	.5469	31/32	.9688
55	.0520	3,00mm	.1181	5,40mm	.2126	8,40mm	.3307	14,00mm	.5512	25,00mm	.9843
1,35mm	.0531	31	.1200	3	.2130	Q	.3320	14,25mm	.5610	63/64	.9844
										1"	1.0000

■ Metric
 ■ Fractional
 ■ Wire gage
 ■ Letter size

Knowing the hardness of the work material to be tapped is essential in selecting the best tap for the job.

10 mm/min ball 3000 kg	120° cone 150 kg	1/16" ball 100 kg	model C	1000 lb per sq. in.	10 mm/min ball 3000 kg	120° cone 150 kg	1/16" ball 100 kg	model C	1000 lb per sq. in.
Brinell	Rockwell C	Rockwell B	Shore Scleroscope	tensile strength	Brinell	Rockwell C	Rockwell B	Shore Scleroscope	tensile strength
800	72	—	100	—	276	30	105	42	136
780	71	—	99	—	269	29	104	41	132
760	70	—	98	—	261	28	103	40	129
745	68	—	97	367	258	27	102	39	127
725	67	—	96	357	255	26	102	39	125
712	66	—	95	350	249	25	101	38	123
682	65	—	93	337	245	24	100	37	119
668	64	—	91	326	240	23	99	36	117
652	63	—	89	318	237	23	99	35	115
626	62	—	87	306	229	22	98	34	113
614	61	—	85	299	224	21	97	33	110
601	60	—	83	292	217	20	96	33	107
590	59	—	81	290	211	19	95	32	104
576	57	—	79	281	206	18	94	32	102
552	56	—	76	270	203	17	94	31	100
545	55	—	75	268	200	16	93	31	98
529	54	—	74	259	196	15	92	30	96
514	53	120	72	254	191	14	92	30	94
502	52	119	70	247	187	13	91	29	92
495	51	119	69	244	185	12	91	29	91
477	49	118	67	233	183	11	90	28	90
461	48	117	66	227	180	10	89	28	89
451	47	117	65	223	175	9	88	27	86
444	46	116	64	219	170	7	87	27	84
427	46	115	62	209	167	6	87	27	82
415	44	115	60	204	165	5	86	26	81
401	43	114	58	196	163	4	85	26	80
388	42	114	57	191	160	3	84	25	78
375	41	113	55	184	156	2	83	25	76
370	40	112	54	182	154	1	82	25	75
362	39	111	53	179	152	—	82	24	74
351	38	111	51	173	150	—	81	24	74
346	37	110	50	170	147	—	80	24	72
341	37	110	49	168	145	—	79	23	71
331	36	109	47	163	143	—	79	23	70
323	35	109	46	158	141	—	78	23	69
311	34	108	46	153	140	—	77	22	69
301	33	107	45	148	135	—	75	22	67
293	32	106	44	144	130	—	72	22	65
285	31	105	43	140	—	—	—	—	—

Taps Application Icons

 Chamfer	 Through Hole	 Blind Hole	 Tapered Hole
 HSS HSS Material	 HSS-E HSS-E Material	 HSS-E-PM HSS-E-PM Material	 HM Solid Carbide Material
 Hole Depth	 Flat-Bottom Hole	 Drilled Hole	 Cylindrical Shank
 Cylindrical Shank with Square	 6-8 Pitches	 3-4 Pitches	 2-3 Pitches
 3.5-5 Pitches	 1.5-2 Pitches	 3-5 Pitches	 2.5-3.5 Pitches
 4-6 Pitches	 1-2 Pitches	 2B 2B Class of Fit	 3B 3B Class of Fit
 6H 6H Class of Fit	 6HX 6HX Class of Fit	 2BX 2BX Class of Fit	 3BX 3BX Class of Fit
 ANSI UNC ANSI Tap Dimensions	 ANSI NPT American National Standard Taper Pipe Tap	 ANSI NPTF Dryseal American National Standard Taper Pipe Tap	 UNF Unified Inch Fine Pitch
 UNC Unified Inch Coarse Pitch	 M Metric Coarse Pitch	 MF Metric Fine Pitch	 DIN 371 DIN 371 Tap Dimensions
 DIN 374 DIN 374 Tap Dimensions	 DIN 376 DIN 376 Tap Dimensions	 DIN 2174 DIN 2174 Tap Dimensions	 Internal Radial Coolant
 Flood Coolant	 Internal Axial Coolant		

DIN — German Institute for Standardization

Our complete portfolio. Your complete satisfaction.



From turning, holemaking, and indexable milling to solid carbide end milling, solid carbide drilling, and tapping, the most powerful tools in the business now proudly wear WIDIA™ brands. When you buy WIDIA products, you're not just purchasing speed, power, and precision, you're investing in quality and complete satisfaction.

Match the most expansive portfolio of precision-engineered products and custom solution services available today with a global, specialized network of Authorized Distributor partners, and you have the tools you need — and the power that only comes from WIDIA brands. For product information, or to schedule an onsite demonstration, visit www.widia.com.

To learn more about our innovations, contact your local Authorized Distributor or visit www.widia.com.

WIDIA 



Services and Support

WIDIA ToolBOSS	.B2
Advanced Tool Management Software (ATMS)	.B3
WIDIA Services	.B4–B7
Customer Application Support	.B8–B9
WIDIA Shop	.B10–B13

WIDIA™ ToolBOSS™ Secure, high-capacity solutions.

Combined with our powerful WIDIA ToolBOSS Management Software, the 28 LEVEL cabinet provides a versatile, high-capacity solution to meet the unpredictable challenges of logistics and supply chain management.

- Cut tooling inventory.
- 24/7 stock availability.
- Unique reconfiguring.
- Decrease tooling spend.
- Reduce administrative costs.
- Accountability.
- Reduced cost per location.



Drawer Options

19 different drawer sizes available.

Compatibility

Fully compatible with existing ToolBOSS units.

Diagnostics

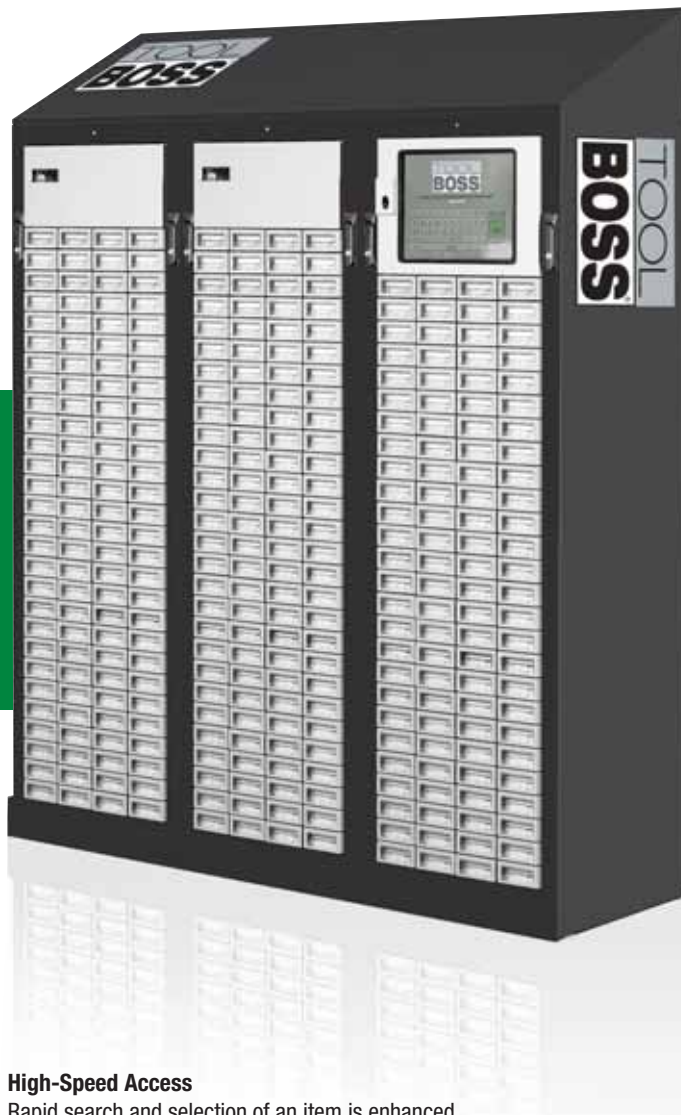
Built-in tray diagnostic port, facilitating improved remote system support, diagnosis, and repair.

Efficiency

Multiple drawers can be selected in one transaction, minimizing the time required to manage large stock volumes.

Future-Port

USB interface, as well as a DCS expansion port, for use with RFID and other ancillary equipment.



High-Speed Access

Rapid search and selection of an item is enhanced with LED identification system, guiding users to the correct drawer.

Traceability

Software provides a complete audit trail, tracking component usage details.

Expandability

Expandable up to 10 units per system, providing up to 1,121 secure locations.

To learn more about ToolBOSS, contact your local Authorized Distributor or visit www.widia.com.

Maximize uptime. Increase output.

ATMS is a powerful, cost effective software solution for the management and control of all tool types. It's an all-inclusive package, providing full tool management with inventory control, purchasing, and full audit trail.

Increase Productivity

- Eliminate downtime from stock-outs.
- Achieve up to 66% setup time reduction.

Improve Your Bottom Line

- Reduce on-hand inventory up to 55% in six months.
- Slash tool consumption up to 30%.
- Reduce acquisition costs up to 90%.

atms

ADVANCED TOOL MANAGEMENT SOFTWARE



Standard and Custom Reporting

An extensive suite of user-friendly standard and customizable reports.

Requesting and Purchasing

The purchasing facility enables internal requisitions to be raised and passed electronically to a business system.

Rework Control

Controls the full rework cycle, including internal and external rework departments.

Inspection Management

Tracks and trends data to identify tool and calibration maintenance needs.

Unlimited Points of Issue

Access to full reporting, ordering, and data management by location and point of issue.

Vending Machine Consolidation and Order Control

Streamlines data entry process consolidation for an unlimited amount of linked vending machines.

To learn more about ATMS, contact your local Authorized Distributor or visit www.widia.com.

Anyone Can Regrind Your Tools — Only We Can Truly Recondition Them

Why recondition?

Our Reconditioning Services help optimize the total value of your metalcutting tools throughout their entire life cycle by giving them “like-new” performance characteristics — with rapid turnaround time — so the tools you need are always on-hand and perform just like new.

By sending your worn drills and end mills for reconditioning, you will get:

- Proprietary geometry.
- Certified coatings.
- Superior quality.
- Like-new performance.
- Fast turnaround time.
- Application support throughout the entire tool life cycle.

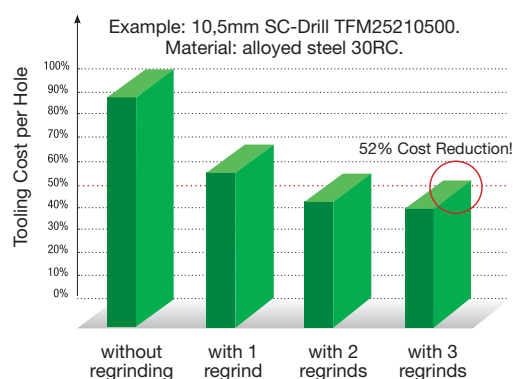
Tools can often be reconditioned up to five times.

Reconditioning Services make perfect sense

Our Reconditioning Services deliver considerable savings throughout the life of your cutting tools and can reduce your overall tooling costs by more than 50%.

Contact your Authorized Distributor to get started.

Reduce Tooling Costs by More than 50%



For facilities or to find the nearest Authorized Distributor, visit www.widia.com.

Get Cash or Credit for Your Used Carbide



Why recycle?

It's the right thing to do!

It's easy for your company to be environmentally conscious with our Carbide Recycling Program.

By sending us your used carbide tools, you help preserve and protect the environment and ensure that these products are recycled responsibly.

It's profitable!

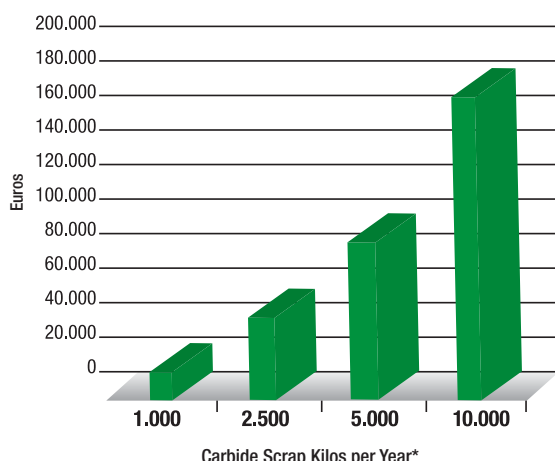
Not only does WIDIA make it easy for your company to be environmentally conscious, we offer an added incentive — it is profitable.

Through our Carbide Recycling Program, get the full value of your investment in metalcutting tools, improve profitability, and reduce your overall tooling spend. When you send us your used carbide, we will reward you with cash or credit. (Credit offer valid in U.S.A. only.)

It's EASY!

Our Carbide Recycling Program is available on the web and is easy to use. You can request a quote, arrange to send us your used carbide, and check the status of your shipment. To find out more, please contact your Authorized Distributor.

Your Potential Annual Returns*



*Actual returns may vary based on current market value for carbide recycled materials.



Green Boxes for green companies

The Green Box™ program is a safe and efficient way for you to package and ship your spent carbide tools to an authorized recycling location.

Qualified used carbide includes mixed coated and uncoated metalcutting tools free of chips, oil, and steel contamination. Material must be free of braze.

Sustainable Engineering

Environmental Responsibility

We are deeply committed to designing and manufacturing environmentally responsible products that deliver high performance and proven value. With decades of experience in tooling and manufacturing, and the synergies of superior engineering, leading technology, and customized solutions, we offer some of the most effective opportunities for sustainable manufacturing in the industry. Our comprehensive range of products and excellent customer service make us your complete supplier of sustainable tooling solutions.

Sustainable Engineering

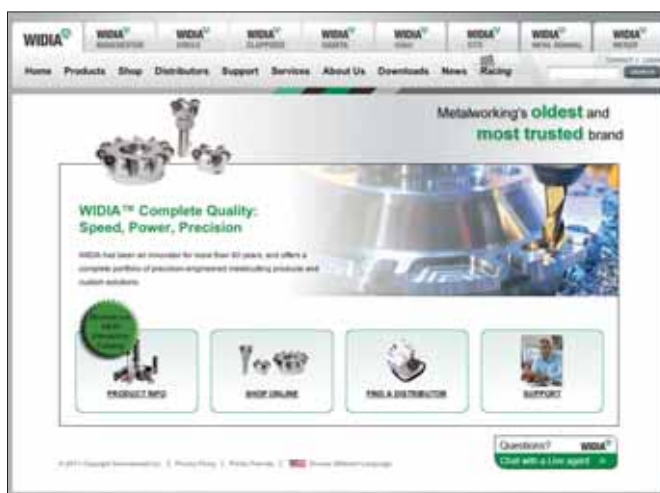
Leading the way with innovation, engineering, and service in standard and custom tooling — a proven methodology and partnership.

Successful project engineering requires planning, teamwork, and disciplined execution. Through our extensive experience in developing and implementing new project engineering strategies, we have pioneered a proven methodology to help you manufacture new products and bring them to market quickly. Service deliverables are carefully outlined and jointly agreed to before the project begins. We formally evaluate progress and results with you throughout the project through our stage-gate management systems.

We can provide your engineering teams and machine tool builders with process engineering support, advanced metalcutting technologies, and project management expertise to help you achieve your sustainability goals. With our best-in-class process, you will experience accelerated time-to-market, lower overall costs, and reduced risks to implement new technologies.



On the Web



Fast, Free, and Easy Registration

You can easily register with www.widia.com to obtain full access to the features of the site.

Find a Local Authorized WIDIA™ Distributor in Your Area

The WIDIA Products Group offers world-class products and services globally. Our distributors know us, and more importantly, they know you. They know better than anyone in the industry how to put the global power of WIDIA to work for you — in your industry, in your region, and for your business.

Contact Us

Our customers are important to us. We want to provide you the best customer service in the industry.

If you have a comment or question, please send it to us. We strive to respond to all inquiries within 24 hours.

WIDIA Products

Whether your operation is turning, milling, or holemaking, WIDIA brands are the high-performance tooling you need. We offer standard and custom solutions for the general engineering market.

Customer Application Support

Get fast and reliable answers to your toughest metalcutting problems.

Our Customer Application Support (CAS) Team is the metalworking industry's leading help desk resource for tooling application solutions and problem resolution!

- Easy access to proven metalworking expertise.
- Service level excellence.
- Best-in-class application support tools and technology.

Service Level Excellence:

- Fast telephone response.
- Quick technical solutions.
- Efficient case management.

Services Provided:

- Tooling selection.
- Operating parameters.
- Troubleshooting.
- Process optimization.
- Hardware support.

Best-in-Class Support Tools and Technology:

- Tooling performance experts.
- Materials database.
- Application calculators.



Customer Application Support

Easy access to proven metalworking expertise!

WIDIA™ Customer Application Engineers assist customers and engineering groups throughout the world with expert tool selection and application recommendations for the entire range of WIDIA tooling.

Convenient Access Options:

Originating Country	Language	Phone	Fax	E-mail
Australia	English	001-724-539-6921	001-724-539-6830	ap.techsupport@widia.com
Austria	German	0800 291630*	0800 291631*	eu.techsupport@widia.com
Belgium	English/French	0800 80410*	0800 80411*	eu.techsupport@widia.com
China	Chinese	440-889-2237	+86-21-58999985	w-cn.techsupport@widia.com
Denmark	English	808 89295*	808 89297*	na.techsupport@widia.com
Finland	English	0800 919413*	0800 919415*	na.techsupport@widia.com
France	French	080 5540 379*	080 5540 029*	eu.techsupport@widia.com
Germany	German	0800 1015774*	0800 0007531*	eu.techsupport@widia.com
India	English	001-724-539-6921	001-724-539-6830	ap.techsupport@widia.com
Israel	English	1809 449907	1809 439845	na.techsupport@widia.com
Italy	Italian	800 916568*	800 917749*	eu.techsupport@widia.com
Japan	English	001-724-539-6921	001-724-539-6830	ap.techsupport@widia.com
Korea (South)	English	001-724-539-6921	001-724-539-6830	ap.techsupport@widia.com
Malaysia	English	001-724-539-6921	001-724-539-6830	ap.techsupport@widia.com
Netherlands	English	0800 0201131*	0800 0201135*	na.techsupport@widia.com
New Zealand	English	001-724-539-6921	001-724-539-6830	ap.techsupport@widia.com
Norway	English	800 10081*	800 10001*	na.techsupport@widia.com
Poland	Polish	00800 4411943*	00800 4411940*	eu.techsupport@widia.com
Singapore	English	001-724-539-6921	001-724-539-6830	ap.techsupport@widia.com
South Africa	English	0800 981644*	0800 981645*	na.techsupport@widia.com
Sweden	English	020798794	020790477	na.techsupport@widia.com
Taiwan	English	001-724-539-6921	001-724-539-6830	ap.techsupport@widia.com
Thailand	English	001-724-539-6921	001-724-539-6830	ap.techsupport@widia.com
United Kingdom	English	0800 028 2996*	0800 028 5721*	na.techsupport@widia.com
USA	English	888-539-5145*	724-539-6830	na.techsupport@widia.com

* Toll-free number.

WIDIA Merchandise

Introducing a new line of WIDIA merchandise made available to you, our customer. Place your order for any of the following quality products with your Authorized WIDIA Distributor or visit www.widia.com.

Ordering Information

Use the order numbers shown in the tables below to order your WIDIA merchandise. For apparel, you can mix and match sizes. For the greatest value, order in quantities based on the minimum order quantities. These products are made to order, so no returns will be accepted.



■ Men's Performance Polo

100% polyester. Moisture wicking, antimicrobial, and raglan sleeves.

- Color: black/black silk

size	minimum order quantity	order number
S	12	5047847
M	12	5047848
L	12	5047849
XL	12	5047850
XXL	12	5047851
XXXL*	12	5047852

*XXXL sizes include a surcharge.

Available in Australia, Canada, Germany, Malaysia, Singapore, Thailand, UK, and USA.



■ Solid Performance Polo

100% polyester. No curl/rib-knit jacquard collar. Antimicrobial.

- Color: olive green

size	minimum order quantity	order number
S	1	5047853
M	1	5047854
L	1	5047855
XL	1	5047856
XXL	1	5047857
XXXL*	1	5047858

*XXXL sizes include a surcharge.

Discounts available for minimum orders of 6 or more.

Available in Australia, Canada, Germany, Malaysia, Singapore, Thailand, UK, and USA.



■ Clique Softshell Jacket

Clique by Cutter & Buck®. Softshell 98% polyester, 2% spandex. Bonded polyester microfleece lining, reflective piping, velcro cuffs, and inside zip pocket.

- Color: black

size	minimum order quantity	order number
S	12	5047871
M	12	5047872
L	12	5047873
XL	12	5047874
XXL	12	5047875
XXXL*	12	5047876

*XXXL sizes include a surcharge.

Available in Australia, Canada, Germany, Malaysia, Singapore, Thailand, UK, and USA.



■ 1/4-Zip Pullover

98% polyester, 2% spandex. Moisture wicking. 6.5 oz.

- Color: stone/graphite

size	minimum order quantity	order number
S	1	5047877
M	1	5047878
L	1	5047879
XL	1	5047880
XXL	1	5047881
XXXL*	1	5047882

*XXXL sizes include a surcharge.

Discounts available for minimum orders of 6 or more.

Available in Australia, Canada, Germany, Malaysia, Singapore, Thailand, UK, and USA.



■ Pinnacle Cap

Unstructured cap made of laundered cotton for a soft, comfortable fit. The contrast stitching and contrast underbill give this cap added styling. Pre-curved visor, six sewn eyelets, and hook-and-loop closure.

- Color: black/khaki

size	minimum order quantity	order number
one size	24	5047895

Available in Australia, Canada, Germany, Malaysia, Singapore, Thailand, UK, and USA.



■ Atlas Sport Bag

Durable, rugged sport bag features top bungee cord for extra storage. Adjustable, removable shoulder strap and top grab handles with handle wrap, and mesh zippered side pocket for water bottle (water bottle not included). Large main compartment for spacious storage and removable floor board for extra durability. Front zippered gusset pocket.

- Color: black

size	minimum order quantity	order number
one size	13	5047896

Available in Australia, Canada, Germany, Malaysia, Singapore, Thailand, UK, and USA.



■ 14 oz. Lucent Co-Moulded Tumbler

Dual-wall construction with a SAN liner and rubberized SAN outer shell. FDA-compliant materials feature a stainless steel rim with twist action. Spill-resistant lid and a non-skid bottom for stability. BPA free.

- Color: green/black

size	minimum order quantity	order number
one size	48	5047900

Available in Canada, China, Germany, India, Malaysia, Singapore, UK, and USA.



■ Titleist® DT SoLo® Golf Balls

The New DT SoLo golf ball will appeal to a broad range of golfers seeking the combination of long distance, exceptional feel, responsive short game control, and cut-proof cover durability.

- Color: white

size	minimum order quantity	order number
one size	6	5047897

*1 box = 12 balls.

Available in Australia, Canada, China, Germany, India, Malaysia, Singapore, Thailand, UK, and USA.



■ Metro Pen

Clip color matches grip. Comfort grip for easy writing. Medium point. Black ink.

- Color: green

size	minimum order quantity	order number
one size	250	5047898

Available in Australia, Canada, China, Germany, India, Malaysia, Singapore, Thailand, UK, and USA.



■ Franklin Covey® by A.T. Cross® — Norwich Ballpoint Pen

Contemporary detailing and a rubberized grip make the sporty Franklin Covey Norwich a unique blend of style and function. The Norwich is engineered to sit comfortably in your hand providing hours of effortless writing. Backed by a lifetime mechanical guarantee, the Norwich will be there to get you through even the most arduous projects.

- Color: satin chrome

size	minimum order quantity	order number
one size	50	5047899

Available in Australia, Canada, China, Germany, India, Malaysia, Singapore, Thailand, UK, and USA.

Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)
1295391	14130	A158	2705762	84820	A131	2707590	82515	A96	2728864	89615	A125
1295731	17018	A181	2705770	84819	A132	2707597	82514	A96	2728869	89614	A125
1295732	17020	A181	2705779	84818	A131	2707604	82513	A96	2728879	89613	A125
1617619	87525	A116	2705787	84816	A131	2707611	82510	A96	2728884	89607	A125
1726431	82679B	A94	2705802	84814	A131	2707618	82509	A96	2728895	89606	A125
1726432	84668B	A99	2705809	84813	A132	2707622	82507	A96	2728900	89604	A125
1773455	19228	A161	2705817	84812	A131	2707629	82505	A96	2728910	89602	A125
1775499	84056	A101	2705827	84811	A132	2707636	82501	A96	2728915	89601	A125
1775500	16022	A187	2705834	84810	A131	2707642	82500	A96	2728920	89599	A125
1779890	18849	A171	2705842	84809	A132	2707649	81657	A94	2728925	88432	A119
1825322	14472	A160	2705850	84808	A131	2707746	72931	A95	2728930	88430	A119
1830468	13166	A173-A175	2705857	84807	A132	2707753	72930	A95	2728935	88428	A119
1854370	14068	A163	2705867	84806	A131	2707814	72831	A95	2728940	88425	A119
1854963	16102	A193	2705875	84805	A132	2708362	71019	A134	2728944	88424	A119
1893987	19113	A173-A175	2705883	84804	A131	2708369	71017	A134	2728950	88423	A119
1916977	19106	A173-A175	2705891	84803	A132	2708383	71015	A134	2728955	88421	A119
1951472	14192	A163	2705899	84802	A131	2708390	71014	A133	2728964	88332	A119
1951473	14247	A159	2705903	84801	A132	2708403	71010	A133	2728970	88331	A119
1951476	14310	A164	2705933	84687	A97	2708411	71008	A133	2728975	88330	A119
2038474	14124	A163	2705943	84686	A99	2708417	71007	A134	2728980	88329	A119
2038865	14248	A163	2705998	84523	A104	2708425	71003	A134	2728985	88328	A119
2040972	19207	A156	2706006	84522	A104	2708433	71002	A133	2728988	88327	A119
2041048	19209	A161	2706015	84521	A104	2708440	71001	A134	2728993	88326	A119
2041049	19211	A156	2706022	84520	A104	2708447	71000	A133	2728998	88325	A119
2041050	19213	A161	2706032	84519	A104	2708474	70026	A129	2729003	88324	A119
2041051	19221	A156	2706039	84518	A104	2708501	70020	A129	2729010	88323	A119
2041052	19223	A161	2706047	84517	A104	2708520	70016	A129	2729014	88322	A119
2392089	87500	A118	2706054	84516	A104	2708527	70015	A130	2729019	88321	A119
2394323	70029	A130	2706072	84515	A104	2708534	70014	A129	2729023	88320	A119
2409831	13251	A173-A175	2706080	84514	A104	2708542	70012	A129	2729034	87712	A124
2415661	14282	A159	2706093	84513	A104	2708548	70011	A130	2729039	87711	A124
2435312	14087	A158	2706108	84510	A104	2708556	70010	A129	2729049	87710	A124
2448501	87554	A116	2706117	84509	A104	2708563	70009	A130	2729054	87709	A124
2448502	86404	A108	2706124	84507	A104	2708570	70008	A129	2729059	87708	A124
2449661	85562	A112	2706132	84505	A104	2708578	70007	A130	2729069	87706	A124
2463623	19226	A157	2706140	84501	A104	2708584	70006	A129	2729074	87705	A124
2463627	19247	A158	2706148	84500	A104	2708591	70005	A130	2729079	87704	A124
2463628	19251	A163	2706196	83875	A128	2708598	70004	A129	2729084	87703	A124
2463629	19253	A158	2706210	83874	A127	2708605	70003	A130	2729089	87702	A124
2463630	19256	A163	2706218	83870	A127	2708612	70002	A129	2729094	87701	A124
2603956	19231	A157	2706233	83868	A127	2708625	70000	A129	2729099	87700	A124
2603957	19233	A162	2706242	83865	A128	2709451	19860	A161	2729105	87695	A123
2603958	19707	A192	2706256	83863	A128	2709762	19781	A173-A175	2729110	87685	A123
2603959	19748	A192	2706264	83862	A127	2709796	19613	A153	2729115	87652	A122
2622810	19728	A192	2706272	83861	A128	2709804	19597	A153	2729120	87650	A122
2622811	19236	A157	2706303	83835	A128	2709810	19583	A153	2729125	87648	A122
2622812	19238	A162	2706327	83828	A127	2709816	19573	A153	2729130	87646	A122
2703925	89644	A126	2706343	83827	A128	2709823	19570	A161	2729135	87644	A122
2703933	89643	A126	2706351	83826	A127	2709830	19565	A156	2729141	87640	A122
2703941	89641	A126	2706367	83824	A127	2709836	19563	A153	2729146	87637	A122
2703960	89617	A125	2706391	83820	A127	2709867	19480	A164	2729151	87635	A122
2703985	88332B	A119	2706399	83819	A128	2709874	19475	A160	2729154	87629	A123
2703994	88328B	A119	2706407	83818	A127	2709881	19470	A164	2729165	87628	A123
2704002	88324B	A119	2706415	83817	A128	2709889	19465	A160	2729170	87627	A123
2704009	87638	A122	2706423	83816	A127	2709895	19443	A154	2729175	87626	A122
2704016	87588	A117	2706431	83815	A128	2709902	19407	A154	2729179	87625	A122
2704025	87586	A116	2706438	83814	A127	2709909	19377	A154	2729185	87624	A122
2704029	87585	A118	2706447	83813	A128	2709916	19354	A154	2729192	87623	A122
2704041	87565	A118	2706454	83812	A127	2709923	19278	A154	2729197	87622	A122
2704045	87559	A116	2706465	83811	A128	2709930	19257	A154	2729201	87621	A122
2704053	87558	A116	2706472	83810	A127	2709937	19237	A154	2729206	87620	A122
2704061	87557	A116	2706478	83809	A128	2709942	19208	A154	2729210	87619	A122
2704146	86889	A140	2706487	83808	A127	2709949	19167	A154	2729214	87618	A122
2704155	86888	A140	2706495	83807	A128	2710689	15460	A159	2729218	87617	A122
2704164	86887	A140	2706499	83806	A127	2710849	14479	A160	2729222	87616	A122
2704170	86886	A140	2706507	83667	A105	2728800	89646	A126	2729226	87615	A122
2704178	86885	A140	2706515	83666	A105	2728805	89645	A126	2729230	87614	A122
2704195	85566	A113	2706523	83665	A105	2728810	89628	A125	2729234	87613	A122
2704202	85565	A113	2706598	83647B	A105	2728815	89627	A125	2729240	87612	A122
2704210	85558	A113	2707535	82523	A96	2728820	89626	A125	2729245	87611	A123
2704217	85557	A113	2707541	82522	A96	2728824	89625	A125	2729248	87610	A122
2705670	84867	A132	2707548	82521	A96	2728829	89622	A125	2729255	87609	A122
2705678	84864	A131	2707555	82520	A96	2728834	89621	A125	2729260	87608	A123
2705694	84862	A131	2707562	82519	A96	2728840	89620	A125	2729266	87607	A122
2705704	84861	A132	2707570	82518	A96	2728844	89619	A125	2729270	87606	A123
2705711	84860	A131	2707578	82517	A96	2728849	89618	A125	2729275	87605	A122
2705737	84826	A131	2707586	82516	A96	2728859	89616	A125	2729279	87603	A122

Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)
2729285	87601	A122	2729955	87331	A114	2730684	86876	A140	2731218	86525	A110
2729290	87582	A117	2729960	87330	A114	2730689	86875	A138	2731223	86524	A110
2729295	87581	A117	2729965	87329	A114	2730694	86874	A140	2731228	86523	A110
2729300	87580	A117	2729970	87328	A114	2730701	86873	A138	2731233	86522	A110
2729305	87579	A117	2729975	87327	A114	2730706	86872	A140	2731238	86521	A110
2729310	87578	A116	2729980	87326	A114	2730710	86871	A138	2731243	86520	A110
2729315	87577	A117	2729985	87325	A114	2730715	86869	A138	2731248	86519	A110
2729320	87576	A116	2729990	87324	A114	2730721	86868	A138	2731253	86518	A110
2729325	87575	A117	2729995	87323	A114	2730726	86867	A138	2731258	86517	A110
2729330	87574	A116	2730001	87322	A114	2730730	86866	A138	2731264	86516	A110
2729334	87573	A118	2730005	87321	A114	2730735	86865	A138	2731270	86515	A110
2729338	87572	A115	2730011	87320	A114	2730740	86864	A138	2731275	86514	A110
2729343	87571	A115	2730016	87319	A116	2730750	86861	A137, A139	2731279	86513	A110
2729349	87570	A115	2730020	87318	A116	2730755	86860	A137, A139	2731283	86512	A110
2729354	87567	A115	2730026	87317	A116	2730770	86857	A137, A139	2731289	86511	A110
2729359	87566	A115	2730030	87316	A116	2730776	86856	A137, A139	2731294	86509	A110
2729364	87564	A116	2730035	87315	A116	2730790	86853	A137, A139	2731299	86508	A110
2729369	87563	A116	2730041	87314	A115	2730794	86852	A137, A139	2731304	86507	A110
2729374	87562	A115	2730044	87313	A115	2730810	86849	A137, A139	2731309	86506	A110
2729379	87561	A115	2730050	87310	A115	2730817	86848	A137, A139	2731315	86505	A110
2729384	87560	A115	2730054	87309	A115	2730832	86845	A137, A139	2731319	86504	A110
2729389	87556	A117	2730060	87307	A115	2730850	86841	A137, A139	2731324	86503	A110
2729394	87555	A116	2730068	87305	A115	2730855	86840	A137, A139	2731329	86502	A110
2729409	87552	A116	2730073	87304	A115	2730875	86837	A137, A139	2731334	86501	A110
2729425	87551	A116	2730078	87301	A115	2730880	86836	A137, A139	2731339	86500	A110
2729430	87550	A116	2730229	87238	A114	2730895	86833	A137, A139	2731344	86440	A109
2729435	87549	A116	2730234	87235	A114	2730900	86832	A137, A139	2731349	86439	A109
2729440	87548	A116	2730238	87234	A114	2730915	86829	A137, A139	2731354	86438	A109
2729455	87547	A116	2730263	87222	A116	2730920	86828	A137, A139	2731359	86437	A109
2729460	87546	A116	2730268	87221	A116	2730934	86825	A137, A139	2731364	86436	A109
2729465	87545	A116	2730273	87220	A116	2730940	86824	A137, A139	2731369	86435	A109
2729470	87544	A115	2730352	87079	A123	2730954	86821	A137, A139	2731374	86434	A109
2729475	87543	A115	2730357	87072	A117	2730959	86820	A137, A139	2731384	86431	A109
2729480	87542	A116	2730412	87052	A118	2730976	86817	A137, A139	2731389	86430	A109
2729484	87541	A115	2730417	87051	A118	2730980	86816	A137, A139	2731393	86429	A109
2729489	87540	A115	2730422	87050	A118	2730995	86813	A137, A139	2731398	86428	A109
2729494	87539	A115	2730427	87049	A118	2731000	86812	A137, A139	2731403	86427	A108
2729500	87538	A115	2730433	87048	A118	2731015	86809	A137, A139	2731408	86426	A108
2729506	87537	A115	2730437	87047	A117	2731020	86808	A137, A139	2731413	86425	A108
2729515	87535	A115	2730443	87046	A117	2731025	86807	A137, A139	2731418	86424	A108
2729520	87534	A115	2730448	87045	A117	2731030	86806	A137, A139	2731424	86423	A108
2729525	87533	A116	2730458	87043	A117	2731035	86805	A137, A139	2731428	86422	A108
2729530	87532	A116	2730468	87040	A117	2731040	86804	A137, A139	2731433	86421	A108
2729535	87531	A115	2730473	87039	A117	2731045	86803	A137, A139	2731439	86420	A108
2729540	87530	A115	2730478	87037	A117	2731050	86802	A137, A139	2731444	86419	A108
2729545	87529	A115	2730483	87035	A117	2731054	86801	A137, A139	2731450	86418	A108
2729550	87528	A116	2730488	87033	A118	2731058	86800	A137, A139	2731456	86417	A108
2729555	87527	A116	2730494	87032	A117	2731062	86799	A137, A139	2731461	86416	A108
2729560	87526	A116	2730498	87031	A117	2731068	86615	A136	2731466	86414	A108
2729579	87524	A115	2730512	87027	A118	2731072	86614	A136	2731470	86413	A108
2729584	87523	A115	2730522	87025	A118	2731077	86612	A136	2731476	86412	A108
2729590	87522	A116	2730532	87023	A123	2731082	86611	A136	2731480	86411	A108
2729599	87521	A116	2730537	87022	A118	2731086	86610	A136	2731486	86409	A108
2729604	87520	A116	2730540	87021	A123	2731093	86609	A135	2731489	86408	A108
2729610	87519	A116	2730545	87020	A123	2731098	86608	A135	2731494	86407	A108
2729619	87518	A116	2730549	87019	A118	2731101	86607	A135	2731507	86405	A108
2729624	87517	A116	2730554	87018	A123	2731106	86606	A135	2731517	86403	A108
2729630	87516	A116	2730559	87017	A117	2731111	86605	A135	2731522	86402	A108
2729639	87515	A116	2730564	87016	A123	2731117	86604	A135	2731527	86401	A108
2729644	87514	A115	2730569	87015	A117	2731122	86603	A135	2731532	86400	A108
2729649	87513	A115	2730579	87014	A123	2731127	86601	A135	2731546	86240	A107
2729654	87512	A115	2730585	87013	A117	2731132	86600	A135	2731551	86239	A107
2729659	87511	A115	2730600	87010	A123	2731137	86540	A111	2731556	86238	A107
2729670	87509	A115	2730605	87009	A117	2731142	86539	A111	2731561	86237	A107
2729674	87508	A118	2730615	87007	A123	2731146	86538	A111	2731568	86236	A107
2729679	87507	A115	2730620	87006	A117	2731156	86537	A111	2731572	86235	A107
2729684	87506	A115	2730625	87005	A117	2731161	86536	A111	2731576	86234	A107
2729689	87505	A115	2730635	87003	A117	2731166	86535	A111	2731581	86233	A107
2729694	87504	A115	2730640	87002	A117	2731171	86534	A111	2731585	86232	A107
2729699	87503	A115	2730645	87001	A123	2731176	86533	A111	2731590	86231	A107
2729704	87502	A115	2730651	86884	A140	2731182	86532	A111	2731595	86230	A107
2729709	87501	A115	2730655	86883	A138	2731187	86531	A111	2731602	86229	A107
2729858	87432	A114	2730661	86881	A138	2731192	86530	A111	2731607	86228	A107
2729864	87430	A114	2730665	86880	A140	2731197	86529	A111	2731612	86227	A106
2729894	87423	A114	2730669	86879	A138	2731202	86528	A111	2731617	86226	A106
2729900	87421	A114	2730674	86878	A140	2731207	86527	A110	2731622	86225	A106
2729950	87332	A114	2730680	86877	A138	2731212	86526	A110	2731627	86224	A106

Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)
2731631	86223	A106	2732031	85553	A113	2732419	84928	A99	2732861	84654	A99
2731640	86220	A106	2732036	85552	A113	2732426	84927	A99	2732866	84653B	A98
2731645	86219	A106	2732041	85551	A113	2732431	84926	A99	2732871	84653	A98
2731650	86218	A106	2732047	85550	A113	2732434	84925	A99	2732881	84652B	A98
2731656	86217	A106	2732051	85549	A113	2732440	84922	A98	2732886	84652	A98
2731661	86216	A106	2732056	85548	A113	2732445	84921	A98	2732895	84651B	A98
2731667	86215	A106	2732060	85547	A113	2732449	84920	A98	2732910	84650B	A98
2731672	86214	A106	2732066	85546	A113	2732455	84919	A98	2732917	84650	A98
2731676	86213	A106	2732070	85545	A112	2732460	84918	A98	2732921	84649B	A98
2731680	86212	A106	2732076	85544	A112	2732465	84917	A98	2732926	84649	A98
2731685	86211	A106	2732080	85543	A112	2732470	84916	A98	2732931	84648B	A98
2731690	86209	A106	2732085	85542	A112	2732475	84915	A98	2732936	84648	A98
2731695	86208	A106	2732090	85541	A112	2732480	84914	A98	2732946	84647B	A98
2731700	86207	A106	2732101	85540	A112	2732485	84913	A98	2732951	84647	A98
2731705	86206	A106	2732106	85539	A112	2732490	84910	A97	2732961	84646	A98
2731709	86205	A106	2732112	85538	A112	2732495	84909	A97	2732971	84645B	A98
2731715	86204	A106	2732116	85537	A112	2732500	84907	A97	2732976	84645	A98
2731721	86203	A106	2732122	85536	A112	2732505	84905	A97	2732981	84644B	A98
2731725	86202	A106	2732127	85535	A112	2732510	84903	A97	2733005	84643B	A98
2731731	86201	A106	2732132	85534	A112	2732515	84901	A97	2733011	84643	A98
2731736	86200	A106	2732137	85533	A113	2732519	84715B	A99	2733015	84642	A98
2731741	85712	A121	2732142	85532	A113	2732530	84711B	A99	2733020	84641	A98
2731746	85711	A121	2732147	85531	A112	2732534	84709B	A99	2733035	84640B	A97
2731751	85710	A121	2732152	85530	A112	2732540	84707B	A99	2733040	84640	A97
2731756	85709	A121	2732157	85529	A112	2732550	84705B	A99	2733044	84639B	A97
2731761	85708	A121	2732162	85528	A113	2732560	84703B	A99	2733049	84639	A97
2731766	85707	A121	2732167	85527	A113	2732565	84702B	A99	2733054	84638	A97
2731771	85706	A121	2732172	85526	A113	2732570	84701B	A99	2733064	84637B	A97
2731776	85705	A121	2732176	85525	A113	2732576	84699B	A99	2733068	84637	A97
2731781	85704	A121	2732181	85524	A112	2732582	84699	A99	2733078	84635B	A97
2731786	85703	A121	2732186	85523	A112	2732587	84698B	A99	2733083	84635	A97
2731790	85702	A121	2732191	85522	A113	2732592	84698	A99	2733088	84634B	A97
2731795	85701	A121	2732196	85521	A113	2732596	84697B	A99	2733093	84634	A97
2731799	85700	A121	2732201	85520	A113	2732601	84697	A99	2733098	84633	A98
2731810	85652	A120	2732206	85519	A113	2732611	84696B	A99	2733107	84631	A98
2731814	85651	A120	2732211	85518	A113	2732616	84696	A99	2733112	84630	A97
2731820	85650	A120	2732216	85517B	A113	2732621	84695B	A99	2733117	84629	A97
2731825	85649	A120	2732221	85517	A113	2732625	84695	A99	2733127	84628B	A99
2731830	85648	A120	2732227	85516B	A113	2732630	84694	A99	2733132	84628	A99
2731835	85647	A120	2732232	85516	A113	2732641	84693	A99	2733137	84627B	A99
2731839	85646	A120	2732237	85515	A112	2732646	84692	A98	2733142	84627	A99
2731844	85645	A120	2732242	85514B	A112	2732652	84691	A98	2733148	84626B	A99
2731849	85644	A120	2732248	85514	A112	2732655	84689	A98	2733153	84626	A99
2731854	85643	A120	2732253	85513	A112	2732660	84688	A98	2733157	84625B	A99
2731860	85640	A120	2732257	85512	A112	2732665	84685	A97	2733162	84625	A99
2731865	85639	A120	2732263	85511	A112	2732671	84684	A97	2733167	84624	A97
2731870	85637	A120	2732267	85510B	A112	2732675	84683	A97	2733173	84623	A97
2731875	85635	A120	2732272	85510	A112	2732681	84682	A98	2733178	84622B	A98
2731880	85623	A120	2732278	85509	A112	2732686	84681	A98	2733182	84622	A98
2731885	85622	A120	2732282	85508	A112	2732691	84680	A98	2733193	84621B	A98
2731891	85621	A120	2732287	85507	A112	2732696	84679	A98	2733197	84621	A98
2731896	85620	A120	2732292	85506	A112	2732701	84678	A98	2733203	84620B	A98
2731901	85619	A120	2732297	85505	A112	2732706	84677	A98	2733208	84620	A98
2731905	85618	A120	2732302	85504	A112	2732711	84676	A98	2733212	84619B	A98
2731910	85617	A120	2732307	85503	A112	2732716	84675	A98	2733217	84619	A98
2731916	85616	A120	2732312	85502	A112	2732721	84674	A98	2733222	84618B	A98
2731921	85615	A120	2732316	85501	A112	2732726	84673	A98	2733227	84618	A98
2731926	85614	A120	2732321	85422	A113	2732736	84672	A97	2733242	84617B	A98
2731930	85613	A120	2732326	85421	A113	2732751	84671B	A97	2733247	84617	A98
2731935	85610	A120	2732332	85420	A113	2732756	84671	A97	2733252	84616B	A98
2731940	85609	A120	2732336	85419	A113	2732760	84670	A97	2733256	84616	A98
2731945	85607	A120	2732342	85418	A113	2732765	84669	A97	2733261	84615B	A98
2731950	85605	A120	2732347	85417	A113	2732776	84667	A97	2733266	84615	A98
2731955	85603	A120	2732351	85416	A113	2732780	84666	A99	2733271	84614B	A98
2731960	85601	A120	2732356	85415	A112	2732785	84665	A97	2733286	84613B	A98
2731965	85578	A113	2732362	85414	A112	2732790	84664	A98	2733291	84613	A98
2731970	85576	A113	2732366	85413	A112	2732795	84663	A99	2733295	84612	A97
2731976	85574	A112	2732372	85410	A112	2732800	84662	A97	2733300	84611	A97
2731981	85570	A112	2732377	85409	A112	2732805	84661	A99	2733305	84610B	A97
2731986	85567	A112	2732382	85407	A112	2732810	84660	A97	2733311	84610	A97
2731992	85564	A113	2732386	85405	A112	2732815	84658	A98	2733325	84609B	A97
2731996	85563	A113	2732392	85401	A112	2732820	84657	A98	2733329	84609	A97
2732005	85561	A112	2732397	84997	A99	2732825	84656B	A99	2733346	84607B	A97
2732010	85560	A112	2732402	84996	A99	2732830	84656	A99	2733349	84607	A97
2732016	85556	A113	2732407	84995	A99	2732840	84655B	A99	2733354	84606	A97
2732021	85555	A113	2732412	84954	A99	2732845	84655	A99	2733359	84605B	A97
2732026	85554	A113	2732417	84953	A98	2732856	84654B	A99	2733363	84605	A97

Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)
2733368	84604	A97	2733922	83966	A105	2734435	82697	A94	2734881	82635B	A92
2733373	84603B	A97	2733926	83965	A105	2734440	82696B	A94	2734886	82635	A92
2733378	84603	A97	2733931	83964	A105	2734446	82696	A94	2734896	82634B	A92
2733383	84602	A97	2733936	83963	A105	2734449	82695B	A94	2734900	82634	A92
2733388	84601B	A97	2733941	83962	A105	2734454	82695	A94	2734905	82633	A93
2733393	84601	A97	2733945	83961	A105	2734459	82694	A94	2734909	82632	A93
2733484	84397	A99	2733950	83960	A105	2734464	82692	A93	2734913	82631	A93
2733489	84396	A99	2733955	83947	A105	2734469	82691	A93	2734919	82630	A92
2733493	84395	A99	2733959	83946	A105	2734474	82690	A92	2734923	82629	A92
2733498	84354	A99	2733964	83945	A105	2734479	82689	A93	2734928	82628B	A94
2733502	84353	A98	2733970	83944	A105	2734483	82688	A93	2734933	82628	A94
2733507	84328	A99	2733974	83943	A105	2734488	82686	A92	2734945	82627B	A94
2733512	84327	A99	2733977	83942	A105	2734493	82684	A92	2734948	82627	A94
2733517	84326	A99	2733982	83941	A105	2734498	82683	A92	2734953	82626B	A94
2733522	84325	A99	2733987	83940	A105	2734503	82682	A93	2734960	82626	A94
2733526	84322	A98	2734006	83666B	A105	2734508	82681	A93	2734965	82625B	A94
2733531	84321	A98	2734011	83665B	A105	2734513	82680	A93	2734968	82625	A94
2733536	84320	A98	2734016	83664B	A105	2734523	82678	A93	2734973	82624	A92
2733541	84319	A98	2734021	83664	A105	2734528	82677	A94	2734978	82623	A92
2733546	84318	A98	2734026	83663B	A105	2734532	82676	A93	2734987	82622B	A93
2733550	84317	A98	2734031	83663	A105	2734537	82675	A93	2734992	82622	A93
2733555	84316	A98	2734041	83662B	A105	2734542	82674	A93	2734997	82621B	A93
2733560	84315	A98	2734046	83662	A105	2734547	82673	A93	2735002	82621	A93
2733565	84314	A98	2734051	83661B	A105	2734551	82672	A94	2735007	82620B	A93
2733571	84313	A98	2734056	83661	A105	2734556	82671	A93	2735012	82620	A93
2733576	84310	A97	2734061	83660B	A105	2734561	82670	A92	2735016	82619B	A93
2733580	84309	A97	2734064	83660	A105	2734566	82669	A92	2735021	82619	A93
2733586	84307	A97	2734068	83647	A105	2734571	82668	A93	2735025	82618B	A93
2733590	84305	A97	2734078	83646B	A105	2734576	82667	A92	2735031	82618	A93
2733600	84301	A97	2734083	83646	A105	2734582	82666	A93	2735035	82617B	A93
2733688	84085	A100	2734093	83645B	A105	2734587	82665	A92	2735040	82617	A93
2733693	84084	A100	2734099	83645	A105	2734594	82664	A93	2735045	82616B	A93
2733697	84083	A100	2734110	83644B	A105	2734599	82663	A93	2735047	82616	A93
2733702	84077	A100	2734115	83644	A105	2734603	82662	A93	2735052	82615B	A93
2733712	84055	A101	2734124	83643B	A105	2734609	82661	A92	2735057	82615	A93
2733717	84054	A101	2734129	83643	A105	2734614	82660	A92	2735067	82614B	A93
2733722	84053	A101	2734134	83642B	A105	2734618	82659	A92	2735071	82614	A93
2733726	84052	A101	2734138	83642	A105	2734621	82658	A93	2735081	82613B	A93
2733731	84051	A101	2734148	83641B	A105	2734628	82657	A92	2735086	82613	A93
2733737	84050	A101	2734153	83641	A105	2734631	82656B	A94	2735091	82612	A92
2733741	84049	A100	2734158	83640B	A105	2734636	82656	A94	2735096	82611	A92
2733745	84048	A100	2734163	83640	A105	2734649	82655B	A94	2735106	82610B	A92
2733750	84047	A100	2734221	82997	A94	2734653	82655	A94	2735111	82610	A92
2733755	84046	A100	2734226	82996	A94	2734658	82654B	A94	2735116	82609B	A92
2733760	84045	A100	2734231	82995	A94	2734663	82654	A94	2735121	82609	A92
2733765	84044	A100	2734237	82994	A94	2734666	82653B	A94	2735126	82608	A92
2733770	84043	A100	2734241	82993	A94	2734671	82653	A94	2735130	82607B	A92
2733773	84040	A100	2734246	82928	A94	2734676	82652B	A93	2735135	82607	A92
2733779	84039	A100	2734251	82927	A94	2734681	82652	A93	2735140	82606	A92
2733783	84037	A100	2734256	82926	A94	2734692	82651B	A93	2735145	82605B	A92
2733788	84035	A100	2734261	82925	A94	2734696	82651	A93	2735148	82605	A92
2733793	84034	A100	2734267	82922	A93	2734701	82650B	A93	2735153	82604	A92
2733797	84033	A100	2734273	82921	A93	2734706	82650	A93	2735158	82603	A92
2733803	84028	A101	2734276	82920	A93	2734711	82649B	A93	2735163	82602	A92
2733808	84027	A101	2734282	82919	A93	2734716	82649	A93	2735168	82601B	A92
2733812	84026	A101	2734288	82918	A93	2734721	82648B	A93	2735173	82601	A92
2733817	84025	A101	2734292	82917	A93	2734726	82648	A93	2735178	82600	A92
2733822	84022	A101	2734298	82916	A93	2734744	82647B	A93	2735182	82397	A94
2733827	84021	A101	2734302	82915	A93	2734749	82647	A93	2735187	82396	A94
2733832	84020	A100	2734307	82914	A93	2734763	82646B	A93	2735192	82395	A94
2733837	84019	A100	2734312	82913	A93	2734769	82646	A93	2735197	82354	A94
2733842	84018	A100	2734317	82910	A92	2734777	82645B	A93	2735201	82353	A94
2733847	84017	A100	2734321	82909	A92	2734782	82645	A93	2735206	82328	A94
2733852	84016	A100	2734326	82907	A92	2734792	82644B	A93	2735211	82327	A94
2733856	84015	A100	2734331	82905	A92	2734796	82644	A93	2735216	82326	A94
2733861	84014	A100	2734336	82901	A92	2734806	82643B	A93	2735221	82325	A94
2733866	84013	A100	2734341	82710B	A94	2734811	82643	A93	2735225	82322	A93
2733871	84010	A100	2734346	82709B	A94	2734816	82642	A92	2735230	82321	A93
2733876	84009	A100	2734351	82708B	A94	2734819	82641	A92	2735234	82320	A93
2733881	84007	A100	2734361	82707B	A94	2734829	82640B	A92	2735240	82319	A93
2733886	84006	A100	2734366	82706B	A94	2734832	82640	A92	2735244	82318	A93
2733891	84005	A100	2734375	82705B	A94	2734842	82639B	A92	2735249	82317	A93
2733897	84004	A100	2734385	82703B	A94	2734847	82639	A92	2735254	82316	A93
2733901	84003	A100	2734399	82702B	A94	2734852	82638	A92	2735258	82315	A93
2733906	84002	A100	2734409	82701B	A94	2734862	82637B	A92	2735263	82314	A93
2733912	84001	A100	2734426	82700B	A94	2734866	82637	A92	2735268	82313	A93
2733916	83967	A105	2734431	82697B	A94	2734871	82636	A92	2735273	82310	A92

Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)
2735278	82309	A92	2735773	72628B	A95	2746302	19871	A182	2746492	19585	A157
2735283	82307	A92	2735778	72628	A95	2746304	19869	A182	2746494	19580	A161
2735288	82305	A92	2735784	72627B	A95	2746305	19866	A182	2746498	19576	A185
2735293	82301	A92	2735793	72626B	A95	2746307	19862	A182	2746500	19575	A156
2735359	74917	A102	2735798	72626	A95	2746309	19861	A182	2746502	19574	A185
2735364	74915	A102	2735803	72625B	A95	2746311	19857	A182	2746504	19572	A185
2735369	74827	A102	2735808	72625	A95	2746313	19856	A182	2746506	19571	A185
2735374	74825	A102	2735818	72624B	A95	2746315	19852	A182	2746508	19569	A185
2735379	74823	A102	2735823	72624	A95	2746318	19851	A182	2746510	19567	A185
2735384	74820	A102	2735828	72623B	A95	2746320	19849	A182	2746512	19566	A183
2735394	74817	A102	2735833	72623	A95	2746322	19847	A181	2746514	19555	A183
2735399	74633B	A102	2735838	72622B	A95	2746324	19846	A181	2746516	19554	A183
2735404	74633	A102	2735847	72621B	A95	2746325	19842	A181	2746518	19549	A183
2735409	74632B	A102	2735852	72621	A95	2746327	19841	A181	2746520	19548	A183
2735414	74632	A102	2735860	72620B	A95	2746331	19828	A181	2746522	19545	A182
2735416	74631B	A102	2735865	72620	A95	2746333	19827	A181	2746524	19542	A182
2735421	74631	A102	2735870	72619B	A95	2746336	19826	A181	2746526	19535	A182
2735426	74630B	A102	2735875	72619	A95	2746338	19824	A181	2746528	19532	A182
2735431	74630	A102	2735880	72617B	A95	2746340	19823	A181	2746530	19528	A182
2735436	74629B	A102	2735885	72617	A95	2746342	19822	A181	2746531	19527	A182
2735441	74628	A102	2735894	72616B	A95	2746344	19821	A181	2746533	19523	A182
2735446	74627B	A102	2735899	72616	A95	2746345	19818	A182	2746535	19522	A182
2735451	74627	A102	2735904	72615B	A95	2746347	19817	A182	2746537	19518	A182
2735456	74626B	A102	2735909	72615	A95	2746349	19816	A182	2746539	19514	A182
2735460	74626	A102	2745358	25873	A146	2746355	19778	A192	2746541	19506	A182
2735470	74625B	A102	2745360	25872	A146	2746357	19776	A192	2746547	19500	A182
2735476	74625	A102	2745362	25871	A146	2746359	19768	A192	2746553	19460	A164
2735486	74624B	A102	2745364	25870	A146	2746361	19766	A192	2746556	19455	A160
2735491	74624	A102	2745366	25869	A146	2746366	19760	A192	2746558	19450	A164
2735496	74623B	A102	2745368	25868	A146	2746373	19746	A192	2746560	19445	A160
2735500	74623	A102	2745370	25867	A146	2746378	19740	A192	2746562	19415	A164
2735505	74622B	A102	2745374	25864	A145	2746380	19738	A192	2746564	19410	A160
2735509	74622	A102	2745382	25856	A145	2746382	19736	A192	2746566	19380	A164
2735515	74621	A102	2745384	25854	A145	2746386	19730	A192	2746568	19375	A159
2735524	74620B	A102	2745386	25852	A145	2746393	19721	A192	2746570	19373	A164
2735530	74620	A102	2745388	25850	A145	2746397	19712	A192	2746572	19367	A160
2735535	74619B	A102	2745390	25848	A145	2746399	19710	A192	2746574	19363	A164
2735539	74619	A102	2745392	25843	A145	2746405	19702	A192	2746576	19360	A159
2735544	74617B	A102	2745394	25842	A145	2746407	19701	A192	2746578	19357	A160
2735549	74617	A102	2745396	25839	A145	2746411	19698	A192	2746580	19355	A163
2735554	74616	A102	2745398	25836	A145	2746413	19695	A192	2746582	19353	A164
2735558	74615B	A102	2745400	25833	A145	2746415	19691	A192	2746584	19337	A160
2735563	74615	A102	2745402	25830	A145	2746417	19690	A192	2746586	19333	A164
2735569	74032	A103	2746209	19955	A167	2746419	19675	A193	2746588	19327	A160
2735574	74031	A103	2746211	19954	A185	2746421	19665	A193	2746590	19323	A164
2735578	74026	A103	2746213	19953	A185	2746423	19656	A193	2746592	19317	A160
2735584	74025	A103	2746215	19952	A185	2746425	19655	A193	2746593	19310	A163
2735589	74024	A103	2746217	19951	A185	2746427	19651	A187	2746595	19297	A159
2735593	74023	A103	2746219	19950	A185	2746429	19650	A193	2746601	19293	A163
2735598	74022	A103	2746221	19949	A185	2746431	19649	A187	2746605	19291	A159
2735603	74021	A103	2746223	19948	A185	2746433	19648	A186	2746607	19287	A163
2735608	74020	A103	2746232	19943	A184	2746435	19647	A187	2746609	19285	A163
2735613	74019	A103	2746236	19941	A184	2746437	19646	A186	2746611	19283	A159
2735619	74017	A103	2746240	19939	A188	2746439	19644	A187	2746613	19281	A163
2735623	74016	A103	2746242	19938	A188	2746447	19643	A186	2746615	19280	A159
2735628	74015	A103	2746244	19937	A188	2746448	19642	A187	2746617	19277	A159
2735638	72925	A95	2746246	19936	A188	2746450	19641	A186	2746619	19275	A163
2735643	72923	A95	2746248	19935	A188	2746452	19639	A187	2746621	19273	A159
2735648	72920	A95	2746250	19934	A188	2746454	19638	A186	2746623	19271	A163
2735653	72919	A95	2746252	19933	A188	2746456	19637	A187	2746625	19268	A159
2735659	72917	A95	2746254	19932	A188	2746458	19636	A186	2746627	19266	A163
2735664	72915	A95	2746258	19930	A188	2746460	19634	A186	2746629	19265	A163
2735669	72827	A95	2746260	19929	A188	2746462	19633	A187	2746631	19263	A158
2735674	72825	A95	2746262	19928	A188	2746464	19632	A186	2746633	19261	A163
2735678	72823	A95	2746264	19927	A188	2746466	19631	A187	2746635	19260	A158
2735683	72820	A95	2746266	19926	A180	2746468	19629	A187	2746637	19258	A158
2735688	72819	A95	2746268	19925	A180	2746470	19628	A186	2746657	19245	A163
2735693	72817	A95	2746274	19922	A180	2746472	19627	A187	2746661	19243	A162
2735698	72815	A95	2746276	19921	A180	2746474	19626	A186	2746663	19241	A157
2735703	72633B	A95	2746278	19920	A180	2746476	19624	A186	2746665	19240	A158
2735709	72633	A95	2746282	19916	A168	2746478	19623	A187	2746677	19227	A167
2735719	72632B	A95	2746284	19915	A167	2746480	19622	A186	2746681	19225	A167
2735729	72631B	A95	2746288	19912	A167	2746482	19621	A187	2746683	19224	A167
2735748	72630B	A95	2746294	19907	A168	2746484	19619	A186	2746687	19222	A167
2735753	72630	A95	2746296	19874	A183	2746486	19615	A157	2746691	19220	A163
2735764	72629B	A95	2746298	19873	A183	2746488	19605	A162	2746693	19219	A167
2735769	72629	A95	2746300	19872	A183	2746490	19600	A157	2746695	19218	A161

Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)
2746697	19216	A156	2746855	19111	A173-A175	2747061	18843	A171	2747232	18362	A149
2746699	19214	A168	2746857	19108	A173-A175	2747063	18842	A171	2747233	18361	A149
2746701	19212	A168	2746861	19103	A173-A175	2747065	18840	A171	2747236	18360	A149
2746703	19210	A158	2746863	19102	A173-A175	2747067	18839	A171	2747238	18359	A149
2746707	19206	A168	2746865	19101	A173-A175	2747069	18837	A171	2747239	18358	A149
2746709	19205	A168	2746869	19096	A173-A175	2747070	18836	A171	2747241	18357	A149
2746711	19204	A161	2746877	19088	A173-A175	2747072	18834	A171	2747243	18356	A149
2746713	19203	A168	2746879	19086	A173-A175	2747074	18833	A171	2747246	18355	A149
2746715	19202	A156	2746889	19076	A173-A175	2747076	18828	A171	2747248	18354	A147
2746717	19199	A164	2746897	19071	A173-A175	2747078	18827	A171	2747249	18353	A148
2746719	19198	A164	2746899	19069	A173-A175	2747088	18766	A149	2747251	18352	A147
2746721	19197	A164	2746903	19062	A188	2747090	18765	A149	2747253	18351	A147
2746723	19194	A164	2746905	19061	A188	2747092	18764	A149	2747255	18350	A148
2746725	19193	A163	2746907	19059	A188	2747094	18763	A149	2747257	18349	A148
2746727	19192	A163	2746909	19058	A188	2747096	18762	A149	2747259	18348	A147
2746729	19191	A163	2746911	19057	A188	2747099	18761	A149	2747261	18347	A148
2746731	19189	A163	2746913	19056	A173-A175	2747101	18760	A149	2747263	18346	A148
2746733	19188	A163	2746915	19054	A188	2747113	18759	A149	2747265	18345	A147
2746735	19187	A163	2746917	19053	A188	2747115	18758	A149	2747267	18344	A147
2746737	19186	A163	2746919	19052	A188	2747117	18757	A149	2747269	18343	A148
2746739	19185	A163	2746920	19051	A188	2747118	18756	A149	2747271	18342	A148
2746741	19184	A163	2746922	19049	A188	2747120	18755	A149	2747273	18341	A147
2746743	19183	A162	2746924	19048	A188	2747122	18754	A147	2747275	18340	A147
2746745	19182	A162	2746926	19047	A188	2747124	18753	A148	2747277	18337	A147
2746747	19181	A162	2746928	19046	A173-A175	2747126	18752	A147	2747279	18336	A147
2746748	19180	A163	2746930	19045	A188	2747128	18751	A147	2747281	18335	A148
2746750	19179	A161	2746932	19044	A188	2747131	18750	A148	2747283	18334	A148
2746752	19178	A161	2746941	19039	A173-A175	2747133	18749	A148	2747286	18333	A147
2746754	19177	A161	2746942	19038	A173-A175	2747135	18748	A147	2747288	18332	A147
2746756	19176	A161	2746944	19037	A173-A175	2747137	18747	A148	2747289	18331	A148
2746758	19168	A187	2746946	19036	A173-A175	2747139	18746	A148	2747291	18330	A148
2746760	19166	A186	2746954	19031	A173-A175	2747141	18745	A147	2747293	18329	A147
2746762	19165	A187	2746956	19029	A173-A175	2747143	18744	A147	2747296	18328	A147
2746764	19164	A186	2746958	19028	A173-A175	2747145	18743	A148	2747298	18327	A148
2746766	19163	A187	2746960	19027	A173-A175	2747147	18742	A148	2747300	18326	A148
2746768	19162	A186	2746962	19026	A173-A175	2747149	18741	A147	2747302	18325	A147
2746770	19161	A187	2746964	19025	A173-A175	2747151	18740	A147	2747304	18324	A147
2746772	19160	A186	2746966	19024	A173-A175	2747152	18739	A148	2747306	18320	A147
2746776	19158	A187	2746968	19023	A173-A175	2747154	18738	A148	2747308	18319	A148
2746778	19157	A186	2746970	19022	A173-A175	2747156	18737	A147	2747310	18318	A148
2746780	19156	A187	2746972	19021	A173-A175	2747158	18736	A147	2747311	18317	A147
2746782	19155	A186	2746974	19020	A173-A175	2747160	18735	A148	2747313	18316	A147
2746784	19154	A187	2746976	19019	A173-A175	2747162	18734	A148	2747315	18314	A148
2746786	19153	A186	2746978	19018	A173-A175	2747165	18733	A147	2747318	18313	A148
2746788	19152	A187	2746980	19017	A173-A175	2747167	18732	A147	2747320	18312	A148
2746790	19151	A186	2746982	19016	A173-A175	2747169	18731	A148	2747322	18311	A147
2746792	19149	A187	2746984	19015	A173-A175	2747170	18730	A148	2747324	18310	A147
2746794	19148	A186	2746986	19014	A173-A175	2747172	18729	A147	2747326	18309	A148
2746796	19147	A187	2746988	19013	A173-A175	2747174	18728	A147	2747328	18308	A148
2746798	19146	A186	2746990	19012	A173-A175	2747177	18727	A148	2747330	18307	A147
2746800	19145	A187	2746991	19011	A173-A175	2747179	18726	A148	2747332	18306	A147
2746802	19144	A186	2746993	19010	A180	2747180	18721	A147	2747334	18305	A148
2746804	19142	A160	2746995	19009	A180	2747182	18720	A147	2747336	18304	A148
2746806	19141	A160	2746997	19008	A180	2747184	18719	A148	2747338	18303	A147
2746808	19140	A160	2746999	19007	A173-A175	2747186	18718	A148	2747340	18302	A147
2746810	19139	A160	2747001	19006	A173-A175	2747188	18717	A147	2747342	18301	A148
2746812	19138	A159	2747010	19004	A180	2747190	18716	A147	2747344	18300	A148
2746814	19137	A159	2747014	19002	A180	2747192	18715	A148	2747345	18266	A149
2746816	19136	A159	2747016	19001	A173-A175	2747194	18714	A148	2747347	18265	A149
2746818	19135	A159	2747018	18941	A177	2747196	18713	A148	2747351	18264	A149
2746820	19134	A159	2747020	18940	A177	2747198	18712	A148	2747353	18263	A149
2746822	19132	A159	2747022	18939	A177	2747200	18711	A147	2747355	18262	A149
2746824	19131	A158	2747024	18938	A177	2747202	18710	A147	2747357	18261	A149
2746826	19129	A158	2747026	18937	A177	2747204	18709	A148	2747360	18260	A149
2746827	19128	A158	2747028	18936	A177	2747206	18708	A148	2747364	18259	A149
2746830	19127	A157	2747029	18935	A177	2747208	18707	A147	2747365	18258	A149
2746831	19126	A157	2747031	18934	A177	2747210	18706	A147	2747367	18257	A149
2746833	19124	A156	2747033	18932	A177	2747212	18705	A148	2747369	18256	A149
2746835	19123	A156	2747035	18930	A177	2747214	18704	A148	2747371	18255	A149
2746837	19122	A156	2747037	18892	A171	2747215	18703	A147	2747374	18254	A147
2746839	19121	A156	2747039	18891	A171	2747218	18702	A147	2747376	18253	A148
2746841	19119	A173-A175	2747047	18855	A171	2747220	18701	A148	2747378	18252	A147
2746843	19118	A173-A175	2747049	18852	A171	2747222	18700	A148	2747379	18251	A147
2746845	19117	A173-A175	2747051	18851	A171	2747224	18366	A149	2747381	18250	A148
2746847	19116	A173-A175	2747055	18848	A171	2747226	18365	A149	2747383	18249	A148
2746849	19114	A173-A175	2747057	18846	A171	2747228	18364	A149	2747385	18248	A147
2746853	19112	A173-A175	2747059	18845	A171	2747230	18363	A149	2747387	18247	A148

Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)
2747389	18246	A148	2747578	17231	A182	2748026	16516	A190	2748275	16072	A188
2747391	18245	A147	2747580	17230	A182	2748028	16515	A189	2748281	16071	A188
2747393	18244	A147	2747584	17228	A182	2748030	16514	A190	2748284	16070	A188
2747397	18243	A148	2747588	17227	A182	2748032	16513	A189	2748285	16069	A188
2747399	18242	A148	2747589	17226	A182	2748034	16512	A190	2748288	16064	A188
2747401	18241	A147	2747591	17225	A182	2748037	16511	A189	2748291	16063	A188
2747403	18240	A147	2747595	17223	A182	2748038	16510	A190	2748293	16062	A188
2747405	18239	A148	2747598	17222	A182	2748040	16509	A189	2748295	16061	A188
2747407	18238	A148	2747600	17219	A182	2748042	16508	A190	2748296	16058	A188
2747409	18237	A147	2747601	17218	A182	2748044	16507	A189	2748297	16057	A188
2747411	18236	A147	2747604	17217	A182	2748046	16506	A190	2748300	16054	A188
2747413	18235	A148	2747605	17216	A182	2748048	16505	A189	2748302	16053	A188
2747415	18234	A148	2747607	17215	A182	2748050	16504	A190	2748307	16051	A186
2747417	18233	A147	2747609	17214	A182	2748052	16503	A189	2748309	16048	A187
2747419	18232	A147	2747611	17213	A182	2748054	16502	A190	2748311	16047	A186
2747421	18231	A148	2747613	17211	A182	2748056	16501	A189	2748314	16042	A187
2747423	18230	A148	2747615	17210	A182	2748066	16363	A196	2748315	16041	A186
2747425	18229	A147	2747617	17209	A182	2748068	16362	A196	2748317	16040	A187
2747427	18228	A147	2747619	17208	A182	2748070	16361	A196	2748318	16039	A186
2747431	18227	A148	2747621	17207	A182	2748072	16360	A196	2748321	16038	A187
2747433	18226	A148	2747623	17206	A182	2748074	16359	A196	2748323	16037	A186
2747435	18225	A147	2747625	17205	A182	2748076	16358	A196	2748325	16036	A187
2747437	18224	A147	2747627	17204	A182	2748078	16357	A196	2748328	16035	A186
2747439	18221	A147	2747631	17202	A182	2748080	16356	A196	2748329	16034	A187
2747441	18220	A147	2747633	17201	A182	2748082	16355	A196	2748332	16033	A186
2747443	18219	A148	2747635	17200	A182	2748084	16354	A196	2748335	16029	A186
2747445	18218	A148	2747856	17091	A184	2748086	16353	A196	2748336	16027	A186
2747447	18217	A147	2747858	17090	A184	2748088	16352	A196	2748339	16024	A187
2747449	18216	A147	2747860	17087	A184	2748090	16351	A196	2748342	16023	A186
2747451	18215	A148	2747864	17084	A184	2748091	16290	A194	2748348	16021	A186
2747453	18214	A148	2747866	17082	A184	2748094	16289	A194	2748351	16018	A187
2747455	18213	A148	2747868	17059	A181	2748096	16288	A194	2748352	16017	A186
2747457	18212	A148	2747872	17057	A181	2748099	16286	A194	2748353	16016	A187
2747459	18211	A147	2747874	17055	A181	2748101	16284	A194	2748355	16015	A186
2747461	18210	A147	2747876	17053	A181	2748108	16282	A194	2748356	16014	A187
2747463	18209	A148	2747878	17051	A181	2748109	16281	A194	2748360	16013	A186
2747467	18208	A148	2747880	17050	A181	2748143	16245	A192	2748361	16012	A187
2747469	18207	A147	2747882	17049	A181	2748145	16243	A192	2748363	16011	A186
2747471	18206	A147	2747884	17046	A181	2748147	16242	A192	2748366	16009	A186
2747473	18205	A148	2747886	17042	A181	2748151	16240	A192	2748367	16008	A187
2747475	18204	A148	2747888	17040	A181	2748153	16239	A192	2748369	16007	A186
2747477	18203	A147	2747892	17039	A181	2748155	16237	A192	2748370	16006	A187
2747479	18202	A147	2747894	17037	A181	2748159	16235	A192	2748372	16005	A186
2747483	18201	A148	2747898	17036	A181	2748163	16233	A195	2748375	16004	A187
2747485	18200	A148	2747902	17034	A181	2748165	16232	A192	2748377	16003	A186
2747493	17286	A183	2747904	17033	A181	2748169	16230	A192	2748549	15473	A167
2747495	17284	A183	2747906	17031	A181	2748171	16228	A195	2748550	15470	A159
2747497	17282	A183	2747910	17030	A181	2748173	16227	A192	2748552	15469	A159
2747499	17280	A183	2747914	17028	A181	2748177	16225	A192	2748556	15468	A163
2747501	17277	A185	2747916	17027	A181	2748179	16223	A195	2748558	15467	A159
2747505	17276	A185	2747918	17024	A181	2748181	16222	A192	2748560	15466	A159
2747509	17275	A185	2747920	17023	A181	2748185	16220	A192	2748561	15465	A163
2747513	17272	A185	2747922	17021	A181	2748187	16218	A195	2748563	15464	A159
2747515	17271	A185	2747954	16832	A178	2748189	16217	A192	2748565	15463	A163
2747518	17269	A185	2747955	16830	A178	2748193	16215	A192	2748566	15462	A158
2747522	17267	A185	2747959	16826	A178	2748196	16213	A195	2748568	15461	A163
2747524	17266	A183	2747965	16820	A178	2748199	16212	A192	2748569	15459	A159
2747528	17265	A183	2747967	16818	A178	2748203	16210	A192	2748571	15458	A163
2747530	17264	A183	2747971	16814	A178	2748206	16209	A192	2748573	15457	A163
2747531	17258	A183	2747973	16812	A178	2748210	16205	A192	2748574	15456	A158
2747534	17257	A183	2747975	16805	A178	2748216	16203	A192	2748576	15455	A163
2747535	17255	A183	2747995	16538	A190	2748225	16118	A193	2748577	15453	A158
2747537	17254	A183	2747997	16537	A189	2748230	16117	A193	2748585	15450	A157
2747541	17252	A183	2747998	16534	A190	2748234	16114	A193	2748590	15447	A162
2747543	17251	A183	2748000	16533	A189	2748237	16113	A193	2748592	15446	A162
2747547	17249	A183	2748002	16528	A190	2748238	16112	A193	2748593	15445	A162
2747549	17248	A183	2748005	16527	A189	2748244	16111	A193	2748595	15444	A157
2747551	17246	A182	2748006	16526	A190	2748247	16110	A193	2748597	15443	A162
2747554	17245	A182	2748008	16525	A189	2748250	16109	A193	2748598	15442	A157
2747559	17243	A182	2748011	16524	A190	2748255	16107	A193	2748604	15438	A161
2747561	17242	A182	2748012	16523	A189	2748257	16106	A193	2748606	15437	A156
2747563	17239	A182	2748014	16522	A190	2748259	16105	A193	2748607	15436	A161
2747566	17238	A182	2748016	16521	A189	2748262	16104	A193	2748612	15434	A161
2747568	17236	A182	2748018	16520	A190	2748264	16103	A193	2748614	15433	A156
2747569	17235	A182	2748020	16519	A189	2748270	16101	A193	2748616	15432	A161
2747574	17233	A182	2748022	16518	A190	2748271	16074	A188	2748623	15393	A165
2747576	17232	A182	2748024	16517	A189	2748273	16073	A188	2748624	15392	A162

Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)
2748628	15391	A157	2748852	15222	A161	2749123	14861	A155	2749338	14517	A160
2748631	15390	A153	2748855	15221	A156	2749125	14848	A168	2749340	14516	A154
2748637	15386	A165	2748858	15220	A153	2749127	14847	A168	2749342	14508	A160
2748641	15385	A162	2748860	15204	A156	2749131	14846	A167	2749350	14502	A166
2748643	15384	A157	2748863	15199	A165	2749134	14845	A155	2749352	14501	A164
2748645	15383	A153	2748864	15198	A161	2749136	14832	A168	2749354	14500	A160
2748658	15374	A157	2748867	15197	A156	2749141	14830	A167	2749356	14499	A154
2748661	15371	A162	2748869	15196	A153	2749144	14829	A155	2749358	14483	A164
2748662	15370	A157	2748874	15192	A156	2749145	14816	A168	2749359	14482	A160
2748663	15369	A162	2748876	15190	A161	2749151	14814	A167	2749361	14478	A169
2748666	15368	A157	2748878	15189	A156	2749152	14813	A155	2749363	14477	A169
2748670	15363	A165	2748880	15187	A165	2749153	14800	A168	2749365	14476	A169
2748675	15362	A162	2748882	15186	A161	2749160	14798	A167	2749367	14475	A169
2748678	15361	A157	2748885	15185	A156	2749161	14797	A155	2749368	14474	A166
2748679	15360	A153	2748887	15184	A153	2749167	14790	A167	2749370	14473	A164
2748680	15359	A162	2748889	15182	A156	2749171	14784	A168	2749374	14471	A154
2748681	15358	A157	2748891	15179	A156	2749177	14782	A167	2749376	14458	A164
2748682	15357	A162	2748902	15169	A165	2749181	14777	A168	2749379	14457	A160
2748684	15356	A157	2748906	15168	A161	2749182	14775	A168	2749380	14455	A169
2748685	15355	A165	2748911	15167	A156	2749186	14774	A167	2749382	14454	A169
2748689	15354	A162	2748913	15166	A153	2749189	14773	A155	2749384	14453	A169
2748692	15353	A157	2748914	15161	A161	2749191	14766	A167	2749386	14452	A169
2748694	15352	A153	2748916	15160	A156	2749192	14760	A168	2749388	14451	A166
2748697	15348	A157	2748918	15159	A165	2749194	14758	A167	2749392	14449	A160
2748700	15347	A165	2748920	15158	A161	2749197	14757	A155	2749394	14448	A154
2748702	15346	A162	2748924	15157	A156	2749199	14750	A167	2749396	14429	A164
2748706	15345	A157	2748925	15156	A153	2749202	14744	A168	2749397	14428	A160
2748708	15344	A153	2748926	15148	A165	2749204	14743	A168	2749400	14427	A154
2748722	15338	A162	2748928	15147	A165	2749205	14742	A167	2749402	14426	A166
2748726	15337	A157	2748930	15146	A161	2749207	14741	A155	2749403	14425	A164
2748728	15336	A161	2748933	15145	A156	2749210	14734	A167	2749405	14424	A160
2748730	15335	A157	2748935	15144	A153	2749219	14726	A167	2749406	14423	A154
2748731	15330	A165	2748936	15143	A161	2749221	14725	A155	2749411	14412	A164
2748733	15329	A162	2748938	15142	A156	2749224	14718	A167	2749414	14411	A160
2748736	15328	A157	2748940	15141	A153	2749231	14656	A166	2749418	14409	A169
2748738	15327	A153	2748942	15139	A161	2749233	14655	A164	2749420	14408	A169
2748740	15324	A157	2748943	15138	A156	2749234	14654	A160	2749421	14407	A169
2748743	15323	A165	2748945	15137	A165	2749237	14648	A166	2749424	14406	A169
2748744	15322	A162	2748947	15136	A161	2749240	14647	A164	2749426	14405	A166
2748746	15321	A157	2748950	15135	A156	2749241	14645	A154	2749428	14404	A164
2748747	15320	A153	2748951	15134	A153	2749243	14643	A166	2749431	14403	A160
2748749	15314	A157	2748954	15131	A165	2749246	14642	A164	2749432	14402	A154
2748756	15304	A165	2748955	15130	A161	2749247	14641	A160	2749434	14400	A160
2748758	15303	A161	2748956	15128	A153	2749249	14635	A166	2749436	14391	A160
2748761	15302	A157	2748959	15125	A156	2749251	14634	A164	2749441	14389	A164
2748764	15301	A153	2748961	15123	A165	2749252	14633	A160	2749444	14388	A160
2748766	15295	A157	2748962	15122	A161	2749254	14623	A166	2749445	14386	A169
2748768	15293	A157	2748963	15121	A156	2749256	14622	A164	2749447	14385	A169
2748773	15292	A161	2748964	15120	A153	2749258	14621	A160	2749449	14384	A169
2748774	15291	A157	2748966	15118	A156	2749260	14615	A166	2749451	14383	A169
2748781	15285	A161	2748968	15117	A165	2749261	14614	A164	2749454	14382	A166
2748785	15284	A157	2748970	15116	A161	2749263	14613	A160	2749456	14381	A164
2748787	15283	A153	2748972	15115	A156	2749265	14612	A154	2749458	14380	A160
2748791	15282	A161	2748975	15114	A153	2749267	14606	A166	2749460	14379	A154
2748792	15281	A157	2748977	15108	A161	2749269	14605	A164	2749461	14378	A160
2748795	15280	A161	2748979	15107	A156	2749271	14604	A160	2749463	14364	A159
2748800	15279	A156	2748981	15105	A165	2749274	14603	A154	2749464	14363	A169
2748801	15278	A165	2748985	15104	A161	2749275	14597	A166	2749466	14362	A169
2748803	15277	A161	2748988	15103	A156	2749278	14596	A164	2749468	14361	A169
2748804	15276	A157	2748991	15102	A153	2749280	14595	A160	2749470	14360	A169
2748806	15275	A153	2749073	14943	A168	2749281	14594	A154	2749472	14359	A166
2748810	15270	A161	2749076	14942	A167	2749282	14590	A167	2749474	14358	A164
2748811	15269	A161	2749077	14941	A155	2749284	14586	A167	2749475	14357	A159
2748813	15268	A157	2749081	14927	A168	2749288	14571	A166	2749476	14356	A154
2748816	15262	A156	2749084	14926	A167	2749292	14569	A160	2749478	14353	A159
2748818	15260	A165	2749086	14925	A155	2749294	14568	A154	2749481	14346	A159
2748820	15259	A161	2749093	14911	A168	2749297	14567	A160	2749482	14345	A169
2748825	15258	A156	2749094	14910	A167	2749305	14558	A160	2749484	14344	A169
2748827	15257	A153	2749096	14909	A155	2749308	14557	A154	2749485	14343	A169
2748835	15246	A161	2749099	14896	A168	2749311	14553	A160	2749486	14342	A169
2748836	15245	A156	2749102	14895	A168	2749320	14547	A166	2749488	14341	A166
2748838	15240	A165	2749104	14894	A167	2749324	14546	A164	2749491	14319	A159
2748840	15239	A161	2749106	14893	A155	2749326	14545	A160	2749493	14316	A159
2748843	15238	A156	2749113	14878	A167	2749327	14544	A154	2749495	14315	A169
2748845	15231	A153	2749117	14877	A155	2749329	14524	A160	2749497	14314	A169
2748850	15224	A156	2749119	14864	A168	2749335	14519	A166	2749499	14313	A169
2748851	15223	A165	2749122	14863	A168	2749336	14518	A164	2749502	14312	A169

Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)
2749503	14311	A166	2749695	14109	A158	2750013	13373	A180	2750223	13224	A173-A175
2749513	14309	A159	2749706	14105	A163	2750015	13371	A180	2750225	13223	A173-A175
2749514	14308	A154	2749709	14104	A158	2750017	13369	A180	2750228	13219	A173-A175
2749517	14301	A159	2749712	14103	A163	2750018	13367	A180	2750229	13218	A173-A175
2749519	14297	A159	2749714	14102	A158	2750023	13344	A173-A175	2750230	13217	A173-A175
2749520	14294	A164	2749716	14101	A163	2750024	13343	A173-A175	2750231	13215	A173-A175
2749526	14290	A163	2749719	14099	A169	2750028	13342	A173-A175	2750234	13214	A173-A175
2749530	14289	A159	2749721	14098	A169	2750029	13341	A176	2750236	13213	A173-A175
2749531	14288	A169	2749724	14097	A169	2750032	13340	A173-A175	2750238	13211	A173-A175
2749533	14287	A169	2749727	14096	A169	2750036	13339	A173-A175	2750241	13206	A173-A175
2749535	14286	A169	2749729	14095	A166	2750039	13336	A173-A175	2750243	13205	A173-A175
2749538	14284	A166	2749732	14094	A163	2750040	13334	A173-A175	2750246	13204	A173-A175
2749540	14283	A163	2749734	14093	A158	2750041	13333	A173-A175	2750248	13203	A173-A175
2749543	14281	A154	2749737	14092	A154	2750043	13332	A173-A175	2750249	13202	A173-A175
2749545	14275	A163	2749739	14088	A163	2750046	13331	A176	2750251	13201	A173-A175
2749548	14257	A163	2749742	14083	A163	2750047	13330	A173-A175	2750255	13199	A173-A175
2749550	14256	A159	2749744	14082	A158	2750052	13328	A173-A175	2750256	13197	A173-A175
2749552	14253	A169	2749751	14067	A158	2750053	13327	A173-A175	2750257	13195	A173-A175
2749554	14252	A169	2749755	14066	A163	2750054	13325	A173-A175	2750259	13193	A173-A175
2749557	14251	A169	2749757	14065	A158	2750055	13324	A173-A175	2750261	13189	A173-A175
2749560	14249	A166	2749758	14064	A163	2750058	13320	A173-A175	2750262	13185	A173-A175
2749568	14246	A154	2749759	14063	A158	2750060	13319	A173-A175	2750264	13183	A173-A175
2749570	14233	A163	2749764	14058	A166	2750062	13318	A173-A175	2750266	13180	A173-A175
2749572	14232	A159	2749766	14057	A163	2750066	13315	A173-A175	2750268	13176	A173-A175
2749573	14229	A159	2749772	14056	A158	2750067	13313	A173-A175	2750271	13170	A173-A175
2749575	14228	A169	2749775	14055	A154	2750069	13311	A173-A175	2750272	13169	A173-A175
2749576	14227	A169	2749777	14053	A158	2750074	13310	A176	2750276	13164	A173-A175
2749577	14226	A169	2749780	14052	A158	2750075	13309	A173-A175	2750277	13158	A173-A175
2749580	14225	A169	2749784	14048	A158	2750078	13307	A173-A175	2750278	13157	A173-A175
2749581	14224	A166	2749787	14041	A158	2750080	13306	A173-A175	2750280	13154	A173-A175
2749582	14223	A163	2749791	14039	A158	2750082	13305	A173-A175	2750282	13152	A173-A175
2749584	14222	A159	2749793	14037	A163	2750084	13303	A173-A175	2750284	13151	A173-A175
2749586	14221	A154	2749795	14036	A158	2750086	13302	A173-A175	2750286	13149	A173-A175
2749589	14202	A163	2749800	14033	A163	2750088	13300	A173-A175	2750287	13148	A173-A175
2749591	14201	A159	2749802	14032	A158	2750094	13298	A173-A175	2750290	13146	A173-A175
2749593	14199	A163	2749805	14031	A163	2750096	13297	A173-A175	2750291	13145	A173-A175
2749595	14198	A159	2749810	14029	A169	2750101	13296	A176	2750293	13142	A173-A175
2749597	14197	A169	2749811	14028	A169	2750103	13295	A173-A175	2750294	13141	A173-A175
2749599	14196	A169	2749813	14027	A169	2750105	13294	A173-A175	2750300	13137	A173-A175
2749601	14195	A169	2749814	14026	A169	2750109	13293	A173-A175	2750302	13136	A173-A175
2749603	14194	A169	2749815	14025	A166	2750111	13291	A173-A175	2750304	13134	A173-A175
2749605	14193	A166	2749818	14024	A163	2750112	13290	A173-A175	2750306	13132	A173-A175
2749609	14191	A159	2749824	14018	A166	2750115	13289	A173-A175	2750309	13131	A173-A175
2749611	14190	A154	2749826	14017	A163	2750118	13283	A173-A175	2750312	13128	A173-A175
2749613	14185	A159	2749830	14016	A158	2750119	13282	A173-A175	2750313	13126	A173-A175
2749614	14181	A163	2749832	14015	A154	2750128	13280	A173-A175	2750316	13123	A173-A175
2749616	14180	A159	2749834	14013	A166	2750129	13279	A173-A175	2750318	13121	A173-A175
2749617	14174	A159	2749836	14012	A163	2750132	13278	A173-A175	2750319	13119	A173-A175
2749625	14170	A163	2749837	14011	A158	2750135	13277	A173-A175	2750321	13117	A173-A175
2749629	14169	A159	2749838	14010	A154	2750139	13275	A176	2750324	13115	A173-A175
2749633	14166	A163	2749839	14009	A158	2750141	13274	A173-A175	2750325	13111	A173-A175
2749635	14165	A159	2749909	13642	A179	2750143	13273	A173-A175	2750356	12052	A203
2749636	14164	A169	2749912	13641	A179	2750148	13272	A173-A175	2750357	12051	A203
2749637	14163	A169	2749914	13639	A179	2750152	13270	A173-A175	2750359	12050	A203
2749639	14162	A169	2749915	13638	A179	2750154	13269	A173-A175	2750360	12049	A203
2749642	14161	A169	2749916	13636	A179	2750156	13268	A173-A175	2750363	12048	A203
2749644	14160	A166	2749919	13633	A179	2750159	13264	A173-A175	2750364	12047	A203
2749647	14159	A163	2749920	13630	A179	2750160	13262	A173-A175	2750367	12046	A203
2749649	14158	A159	2749924	13626	A179	2750165	13260	A173-A175	2750369	12045	A203
2749651	14157	A154	2749926	13625	A179	2750175	13257	A173-A175	2750370	12044	A203
2749652	14153	A163	2749931	13623	A179	2750177	13256	A173-A175	2750371	12043	A203
2749655	14152	A159	2749932	13620	A179	2750179	13255	A173-A175	2750373	12042	A203
2749656	14148	A163	2749935	13619	A179	2750185	13252	A173-A175	2750374	12041	A203
2749659	14147	A159	2749936	13617	A179	2750190	13250	A173-A175	2750375	12040	A203
2749662	14134	A163	2749939	13614	A179	2750192	13249	A173-A175	2750376	12039	A203
2749666	14133	A158	2749942	13609	A179	2750193	13246	A173-A175	2750377	12038	A203
2749669	14131	A163	2749943	13606	A179	2750195	13244	A173-A175	2750379	12037	A203
2749674	14129	A169	2749944	13602	A179	2750199	13242	A173-A175	2750381	12036	A203
2749675	14128	A169	2749977	13405	A180	2750202	13241	A173-A175	2750382	12035	A203
2749677	14127	A169	2749991	13389	A180	2750204	13240	A173-A175	2750384	12034	A203
2749679	14126	A169	2749995	13385	A180	2750206	13237	A173-A175	2750385	12033	A203
2749680	14125	A166	2750000	13383	A180	2750209	13235	A173-A175	2750387	12032	A203
2749686	14123	A158	2750002	13382	A180	2750210	13232	A173-A175	2750389	12031	A203
2749689	14122	A154	2750005	13381	A180	2750212	13231	A173-A175	2750391	12030	A203
2749691	14118	A158	2750009	13379	A180	2750214	13230	A173-A175	2750393	12027	A203
2749693	14114	A163	2750010	13377	A180	2750218	13229	A173-A175	2750397	11911	A202
2749694	14113	A158	2750012	13375	A180	2750220	13225	A173-A175	2750400	11910	A202

Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)
2750402	11909	A202	2750880	11670	A201	2751033	11584	A201	2865316	15211	A161
2750406	11908	A202	2750882	11669	A201	2751034	11561	A200	2865319	15210	A156
2750407	11907	A202	2750883	11668	A201	2751036	11559	A200	2865323	15209	A153
2750409	11906	A202	2750885	11667	A201	2751037	11558	A200	2865450	15129	A156
2750410	11905	A202	2750886	11666	A201	2751040	11557	A200	2866184	14340	A164
2750412	11904	A202	2750888	11665	A201	2751041	11556	A200	2866187	14339	A159
2750415	11903	A202	2750892	11664	A201	2751043	11554	A200	2866246	14285	A169
2750418	11902	A202	2750893	11663	A201	2751045	11553	A200	2866262	14274	A159
2750420	11901	A202	2750895	11662	A201	2751047	11552	A200	2866726	13634	A179
2750421	11900	A202	2750896	11661	A201	2751048	11551	A200	2866734	13629	A179
2750423	11809	A204	2750898	11660	A201	2751051	11550	A200	2866897	13312	A173-A175
2750425	11808	A204	2750900	11659	A201	2751053	11549	A200	2867063	13208	A173-A175
2750426	11807	A204	2750901	11658	A201	2751055	11548	A200	2867066	13207	A173-A175
2750428	11806	A204	2750902	11657	A201	2751056	11545	A200	2867820	11585	A201
2750430	11805	A204	2750904	11656	A201	2751058	11543	A200	2872853	87553	A116
2750431	11804	A204	2750906	11655	A201	2751060	11542	A200	2872854	87536	A115
2750435	11803	A204	2750907	11654	A201	2751064	11541	A200	2873745	84644	A98
2750437	11802	A204	2750910	11653	A201	2751066	11540	A200	2873746	16204	A192
2750441	11801	A204	2750912	11652	A201	2751068	11537	A200	2885052	11555	A200
2750443	11800	A204	2750915	11651	A201	2751070	11531	A200	2891496	15236	A161
2750611	11727	A201	2750916	11650	A201	2751071	11530	A200	2895934	87443	A117
2750617	11726	A201	2750917	11649	A201	2751073	11529	A200	2895937	86870	A140
2750620	11725	A201	2750918	11648	A201	2751075	11528	A200	2895939	86415	A108
2750621	11724	A201	2750920	11647	A201	2751077	11527	A200	2895940	85501B	A112
2750655	11723	A201	2750923	11646	A201	2751079	11526	A200	2895949	82665B	A92
2750667	11722	A201	2750926	11645	A201	2751080	11525	A200	2895995	74616B	A102
2750770	11721	A201	2750928	11644	A201	2751081	11524	A200	2896021	70023	A130
2750774	11720	A201	2750932	11643	A201	2751083	11521	A200	2896022	70013	A130
2750776	11719	A201	2750933	11642	A201	2751086	11519	A200	2896309	19875	A183
2750777	11718	A201	2750935	11641	A201	2751090	11518	A200	2896311	19511	A182
2750778	11717	A201	2750937	11640	A201	2751092	11517	A200	2896313	19201	A168
2750780	11716	A201	2750939	11639	A201	2751095	11516	A200	2950778	71011	A134
2750782	11715	A201	2750940	11638	A201	2751097	11513	A200	2955234	84873	A132
2750783	11714	A201	2750941	11637	A201	2817928	84651	A98	2956026	16287	A194
2750788	11713	A201	2750943	11636	A201	2852218	74629	A102	2956027	16283	A194
2750790	11712	A201	2750945	11635	A201	2863245	19906	A167	2956029	84614	A98
2750792	11711	A201	2750946	11634	A201	2863477	19620	A162	2956031	74028	A103
2750794	11710	A201	2750948	11633	A201	2863495	19590	A161	2957246	14293	A159
2750796	11709	A201	2750951	11632	A201	2863567	19347	A160	2957247	14023	A158
2750798	11708	A201	2750953	11631	A201	2863572	19343	A164	2962446	86432	A109
2750799	11707	A201	2750957	11630	A201	2863585	19313	A164	2966157	74628B	A102
2750801	11706	A201	2750959	11629	A201	2863589	19307	A160	2966218	19478	A173-A175
2750802	11705	A201	2750962	11628	A201	2863721	19174	A161	2969917	15294	A161
2750803	11704	A201	2750965	11627	A201	2863724	19172	A186	2972885	19442	A173-A175
2750805	11703	A201	2750967	11626	A201	2863727	19170	A158	2973471	87510	A115
2750807	11702	A201	2750969	11625	A201	2863790	19079	A173-A175	2978979	15474	A168
2750809	11701	A201	2750972	11624	A201	2863874	18854	A171	2985061	85515B	A112
2750812	11700	A201	2750975	11623	A201	2864289	17019	A181	2988737	84817	A132
2750817	11699	A201	2750980	11622	A201	2864295	17014	A181	3005011	19229	A167
2750822	11698	A201	2750983	11621	A201	2864298	17013	A181	3006761	14559	A164
2750824	11697	A201	2750984	11620	A201	2864301	17012	A181	3012774	14632	A154
2750827	11696	A201	2750985	11619	A201	2864304	17011	A181	3012775	14646	A160
2750831	11695	A201	2750986	11618	A201	2864307	17009	A181	3012776	14653	A154
2750832	11694	A201	2750988	11617	A201	2864310	17008	A181	3012777	14662	A167
2750834	11693	A201	2750990	11616	A201	2864313	17004	A181	3012779	16028	A187
2750835	11692	A201	2750991	11615	A201	2864316	17002	A181	3012795	74027	A103
2750837	11691	A201	2750993	11614	A201	2864319	17001	A181	3012797	74029	A103
2750838	11690	A201	2750995	11613	A201	2864322	17000	A181	3012798	74030	A103
2750841	11689	A201	2750996	11612	A201	2864356	16810	A178	3012799	74815	A102
2750843	11688	A201	2750998	11611	A201	2864359	16809	A178	3025956	86221	A106
2750845	11687	A201	2750999	11610	A201	2864362	16807	A178	3036838	86882	A140
2750848	11686	A201	2751001	11609	A201	2864368	16802	A178	3044179	15472	A168
2750852	11685	A201	2751002	11608	A201	2864545	16285	A194	3045147	84646B	A98
2750853	11684	A201	2751004	11607	A201	2864744	16115	A193	3047408	13139	A173-A175
2750854	11683	A201	2751007	11606	A201	2865166	15300	A157	3048619	86406	A108
2750856	11682	A201	2751008	11605	A201	2865185	15286	A165	3049357	83821	A128
2750857	11681	A201	2751010	11604	A201	2865268	15237	A153	3049563	15126	A161
2750862	11680	A201	2751011	11603	A201	2865271	15235	A156	3049572	71005	A134
2750865	11679	A201	2751013	11602	A201	2865274	15234	A165	3049573	71006	A133
2750867	11678	A201	2751015	11601	A201	2865277	15233	A161	3051129	84714B	A99
2750868	11677	A201	2751019	11600	A201	2865279	15232	A156	3051800	83667B	A105
2750871	11676	A201	2751020	11599	A201	2865286	15228	A165	3059259	84636	A97
2750873	11675	A201	2751023	11598	A201	2865289	15227	A161	3060377	19169	A186
2750875	11674	A201	2751025	11597	A201	2865292	15226	A156	3062992	85513B	A112
2750876	11673	A201	2751027	11596	A201	2865295	15225	A153	3063853	18338	A148
2750878	11672	A201	2751030	11587	A201	2865310	15214	A156	3063886	84874	A131
2750879	11671	A201	2751031	11586	A201	2865313	15212	A165	3064841	83878	A127

Index by Order Number

Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)
3064842	84878	A131	3171089	19376	A173-A175	3176001	74920	A102	3494722	12741 GP4535	A15
3083458	16052	A187	3171090	19378	A173-A175	3176084	74923	A102	3494723	12713 GP4535	A14
3083460	16030	A187	3171091	19379	A173-A175	3176086	74925	A102	3494724	12714 GP4535	A14
3083520	86844	A137, A139	3171092	19381	A173-A175	3176087	84303	A97	3494725	12715 GP4535	A14
3083563	16010	A187	3171093	19382	A173-A175	3177073	15215	A161	3494726	12716 GP4535	A14
3085868	88321B	A119	3171094	19383	A173-A175	3177076	19304	A154	3494727	12717 GP4535	A14
3093990	12427 GP4535	A14	3171095	19384	A173-A175	3177077	19305	A159	3494728	12718 GP4535	A14
3094221	12227 GP4535	A12	3171096	19385	A173-A175	3180806	14020	A158	3494729	12719 GP4535	A14
3095012	18339	A148	3171097	19387	A173-A175	3180807	14570	A164	3494730	12742 GP4535	A14
3098934	19386	A173-A175	3171098	19392	A173-A175	3180808	14450	A164	3494731	12743 GP4535	A14
3098935	19389	A173-A175	3171099	19393	A173-A175	3300118	70018	A129	3494732	12744 GP4535	A14
3098936	19391	A173-A175	3171100	19394	A173-A175	3300119	70024	A129	3494733	12745 GP4535	A14
3098937	19516	A173-A175	3171101	19440	A173-A175	3300122	74621B	A102	3494734	12746 GP4535	A14
3099008	19388	A173-A175	3171102	19441	A173-A175	3303672	72627	A95	3494735	12747 GP4535	A14
3102009	14030	A158	3171103	19444	A173-A175	3303673	83836	A127	3494736	12748 GP4535	A14
3102021	14100	A158	3171104	19446	A173-A175	3303679	84824	A131	3494737	12801 GP4535	A17
3102047	86433	A109	3171106	19448	A173-A175	3303682	84870	A131	3494738	12802 GP4535	A17
3102127	72927	A95	3171107	19449	A173-A175	3303687	84879	A132	3494740	12803 GP4535	A17
3105380	85507B	A112	3171109	19452	A173-A175	3303688	85505B	A112	3494741	12804 GP4535	A17
3108135	71013	A134	3171111	19454	A173-A175	3303689	85509B	A112	3494742	12805 GP4535	A17
3108136	85522B	A113	3171113	19459	A173-A175	3303690	85512B	A112	3494743	12806 GP4535	A17
3111251	15471	A167	3171114	19461	A173-A175	3303691	85518B	A113	3494744	12807 GP4535	A17
3113801	19303	A164	3171115	19462	A173-A175	3303692	85519B	A113	3494745	12808 GP4535	A17
3119743	71004	A133	3171116	19463	A173-A175	3303693	85520B	A113	3494746	12826 GP4535	A17
3123400	84865	A132	3171117	19464	A173-A175	3303694	85521B	A113	3494747	12827 GP4535	A17
3128814	12202 GP4535	A12	3171118	19466	A173-A175	3303695	86602	A135	3494748	12828 GP4535	A17
3128815	12204 GP4535	A12	3171119	19467	A173-A175	3303696	87000	A123	3494749	12829 GP4535	A17
3128843	12200 GP4535	A12	3171120	19468	A173-A175	3303725	88323B	A119	3494750	12830 GP4535	A17
3135828	12410 GP4535	A14	3171121	19469	A173-A175	3303726	88325B	A119	3494751	12809 GP4535	A16
3139335	14022	A154	3171122	19471	A173-A175	3303727	88330B	A119	3494752	12810 GP4535	A16
3139336	14338	A154	3171123	19472	A173-A175	3303763	72631	A95	3494753	12811 GP4535	A16
3139338	16201	A192	3171124	19473	A173-A175	3303764	72632	A95	3494754	12812 GP4535	A16
3170931	12201 GP4535	A12	3171125	19474	A173-A175	3303770	86222	A106	3494755	12813 GP4535	A16
3170932	12203 GP4535	A12	3171126	19476	A173-A175	3303775	14430	A166	3494756	12814 GP4535	A16
3170933	12205 GP4535	A12	3171127	19477	A173-A175	3303777	14560	A166	3494757	12815 GP4535	A16
3170934	12206 GP4535	A12	3171128	19479	A173-A175	3324580	18223	A148	3494758	12816 GP4535	A16
3170935	12207 GP4535	A12	3171129	19481	A173-A175	3324581	72622	A95	3494759	12831 GP4535	A16
3170936	12208 GP4535	A12	3171130	19482	A173-A175	3494651	12761 GP4535	A13	3494760	12832 GP4535	A16
3170937	12209 GP4535	A12	3171131	19483	A173-A175	3494683	12762 GP4535	A13	3494761	12833 GP4535	A16
3170938	12210 GP4535	A12	3171132	19484	A173-A175	3494684	12763 GP4535	A13	3494762	12834 GP4535	A16
3170944	12225 GP4535	A12	3171133	19485	A173-A175	3494685	12764 GP4535	A13	3494763	12835 GP4535	A16
3170945	12226 GP4535	A12	3171134	19486	A173-A175	3494686	12765 GP4535	A13	3527349	12836 GN1515	A18
3170946	12228 GP4535	A12	3171135	19487	A173-A175	3494687	12766 GP4535	A13	3527481	12838 GN1515	A18
3170947	12229 GP4535	A12	3171136	19488	A173-A175	3494688	12767 GP4535	A13	3527482	12839 GN1515	A18
3170948	12230 GP4535	A12	3171137	19489	A173-A175	3494689	12768 GP4535	A13	3527483	12840 GN1515	A18
3170959	12404 GP4535	A14	3171138	19490	A173-A175	3494690	12781 GP4535	A13	3527484	12841 GN1515	A18
3170960	12405 GP4535	A14	3171139	19492	A173-A175	3494691	12782 GP4535	A13	3527485	12843 GN1515	A18
3170961	12406 GP4535	A14	3171141	19494	A173-A175	3494692	12783 GP4535	A13	3527486	12844 GN1515	A18
3170962	12407 GP4535	A14	3171142	19496	A173-A175	3494693	12784 GP4535	A13	3527487	12845 GN1515	A18
3170963	12408 GP4535	A14	3171143	19497	A173-A175	3494694	12785 GP4535	A13	3527488	12846 GN1515	A18
3170964	12409 GP4535	A14	3171144	19498	A173-A175	3494695	12786 GP4535	A13	3527489	12847 GN1515	A18
3170965	12411 GP4535	A14	3171145	19499	A173-A175	3494696	12787 GP4535	A13	3527490	12848 GN1515	A18
3170974	12428 GP4535	A14	3171146	19501	A173-A175	3494697	12788 GP4535	A13	3527492	12850 GN1515	A18
3170975	12429 GP4535	A14	3171147	19502	A173-A175	3494698	12789 GP4535	A13	3527493	12851 GN1515	A18
3170976	12430 GP4535	A14	3171148	19504	A173-A175	3494699	12700 GP4535	A15	3527494	12852 GN1515	A18
3170977	12431 GP4535	A14	3171149	19505	A173-A175	3494700	12701 GP4535	A15	3527498	12853 GN1515	A18
3170978	12432 GP4535	A14	3171150	19507	A173-A175	3494701	12702 GP4535	A15	3527508	12854 GN1515	A18
3171054	14060	A169	3171151	19508	A173-A175	3494702	12703 GP4535	A15	3527522	12855 GN1515	A18
3171055	14250	A169	3171152	19509	A173-A175	3494703	12704 GP4535	A15	3527533	12856 GN1515	A18
3171056	14620	A154	3171153	19510	A173-A175	3494704	12705 GP4535	A15	3527544	12858 GN1515	A19
3171057	14640	A154	3171154	19512	A173-A175	3494705	12706 GP4535	A15	3527551	12859 GN1515	A19
3171060	15454	A158	3171155	19513	A173-A175	3494706	12707 GP4535	A15	3527563	12860 GN1515	A19
3171068	18315	A148	3171156	19515	A173-A175	3494707	12708 GP4535	A15	3527573	12861 GN1515	A19
3171069	18321	A147	3171157	19517	A173-A175	3494708	12709 GP4535	A15	3527574	12862 GN1515	A19
3171070	18323	A148	3171158	19519	A173-A175	3494709	12710 GP4535	A15	3527575	12863 GN1515	A19
3171071	18723	A148	3171159	19520	A173-A175	3494710	12711 GP4535	A15	3527576	12864 GN1515	A19
3171072	18724	A147	3171160	19521	A173-A175	3494711	12712 GP4535	A15	3527577	12865 GN1515	A19
3171073	18725	A147	3171161	19524	A173-A175	3494712	12731 GP4535	A15	3527578	12866 GN1515	A19
3171077	19171	A187	3171162	19525	A173-A175	3494713	12732 GP4535	A15	3527579	12867 GN1515	A19
3171078	19173	A187	3171163	19526	A173-A175	3494714	12733 GP4535	A15	3527580	12868 GN1515	A19
3171079	19175	A161	3171164	19529	A173-A175	3494715	12734 GP4535	A15	3527581	12869 GN1515	A19
3171080	19215	A168	3171193	19780	A173-A175	3494716	12735 GP4535	A15	3527582	12870 GN1515	A19
3171081	19217	A167	3171202	19848	A183	3494717	12736 GP4535	A15	3527593	12872 GN1515	A19
3171085	19370	A173-A175	3171581	74927	A102	3494718	12737 GP4535	A15	3527594	12873 GN1515	A19
3171086	19371	A173-A175	3175997	16108	A193	3494719	12738 GP4535	A15	3527595	12874 GN1515	A19
3171087	19372	A173-A175	3175999	74819	A102	3494720	12739 GP4535	A15	3527596	12875 GN1515	A19
3171088	19374	A173-A175	3176000	74919	A102	3494721	12740 GP4535	A15	3527597	12876 GN1515	A19

Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)
3527598	12877 GN1515	A20	3950315	17574	A146	3950436	17446	A144	3955035	GT305113 GP6520	A46
3527599	12878 GN1515	A20	3950316	17575	A146	3950437	17447	A144	3955036	GT305114 GP6520	A46
3527600	12879 GN1515	A20	3950317	17576	A146	3950438	17448	A144	3955037	GT305115 GP6520	A46
3527601	12880 GN1515	A20	3950318	17577	A146	3950439	17449	A144	3955038	GT215001 GM6515	A39
3527602	12881 GN1515	A20	3950319	17578	A146	3950440	17450	A144	3955039	GT215002 GM6515	A39
3527603	12882 GN1515	A20	3950344	17710	A144	3950441	17451	A144	3955040	GT215003 GM6515	A39
3527604	12883 GN1515	A20	3950345	17712	A144	3950442	17452	A144	3955041	GT215004 GM6515	A39
3527605	12884 GN1515	A20	3950346	17713	A144	3950443	17463	A146	3955042	GT215005 GM6515	A39
3527606	12885 GN1515	A20	3950347	17717	A144	3950444	17464	A146	3955044	GT205074 GP6520	A37
3527607	12886 GN1515	A20	3950348	17718	A144	3950445	17465	A146	3955045	GT205075 GP6520	A37
3527608	12887 GN1515	A20	3950349	17721	A144	3950446	17468	A146	3955046	GT205076 GP6520	A37
3527609	12888 GN1515	A20	3950350	17722	A144	3950447	17469	A146	3955047	GT205077 GM6515	A38
3527610	12889 GN1515	A20	3950351	17723	A144	3950448	17470	A146	3955048	GT205078 GM6515	A38
3527611	12890 GN1515	A20	3950352	17724	A144	3950449	17471	A146	3955049	GT205079 GM6515	A38
3527612	12891 GN1515	A20	3950353	17726	A144	3950450	17473	A146	3955050	GT205080 GM6515	A38
3527613	12892 GN1515	A20	3950354	17729	A144	3950451	17474	A146	3955051	GT205081 GM6515	A38
3527614	12893 GN1515	A20	3950355	17730	A144	3950452	17475	A146	3955052	GT205082 GM6515	A38
3527615	12894 GN1515	A20	3950356	17731	A144	3950453	17476	A146	3955053	GT215006 GM6515	A39
3527616	12895 GN1515	A21	3950357	17732	A144	3950454	17477	A146	3955054	GT215007 GP6520	A39
3527617	12896 GN1515	A21	3950358	17733	A144	3950455	17478	A146	3955055	GT215008 GP6520	A39
3527618	12897 GN1515	A21	3950359	17734	A144	3954929	GT305097 GP6520	A46	3955056	GT215009 GP6520	A39
3527619	12898 GN1515	A21	3950360	17736	A144	3954930	GT305098 GP6520	A46	3955057	GT215010 GP6520	A39
3527620	12899 GN1515	A21	3950361	17737	A144	3954931	GT305099 GP6520	A46	3955058	GT215011 GP6520	A39
3527621	12901 GN1515	A21	3950362	17738	A144	3954932	GT305100 GP6520	A46	3955059	GT215012 GP6520	A39
3527622	12902 GN1515	A21	3950363	17739	A144	3954966	GT205031 GP6520	A36	3955060	GT305061 GM6515	A45
3527623	12903 GN1515	A21	3950364	17740	A144	3954967	GT205032 GP6520	A36	3955061	GT305062 GM6515	A45
3527624	12904 GN1515	A21	3950365	17742	A144	3954968	GT205033 GP6520	A36	3955062	GT305063 GM6515	A45
3527625	12905 GN1515	A21	3950366	17743	A144	3954969	GT205034 GP6520	A36	3955063	GT305064 GM6515	A45
3527626	12906 GN1515	A21	3950367	17744	A144	3954970	GT205035 GP6520	A36	3955064	GT305065 GM6515	A45
3527627	12907 GN1515	A21	3950368	17745	A144	3954971	GT205036 GP6520	A36	3955065	GT305066 GM6515	A45
3527628	12908 GN1515	A21	3950369	17746	A144	3954983	GT205037 GP6520	A36	3955066	GT305067 GM6515	A45
3527629	12909 GN1515	A21	3950370	17747	A144	3954984	GT205038 GP6520	A36	3955067	GT305068 GM6515	A45
3527630	12911 GN1515	A21	3950371	17748	A144	3954985	GT205039 GP6520	A36	3955068	GT305069 GM6515	A45
3527631	12912 GN1515	A21	3950372	17749	A144	3954986	GT205040 GP6520	A36	3955069	GT305070 GP6520	A45
3527632	12914 GN1515	A21	3950373	17750	A144	3954987	GT205041 GP6520	A36	3955070	GT305071 GP6520	A45
3527633	12915 GN1515	A21	3950374	17751	A144	3954988	GT205042 GP6520	A36	3955071	GT305072 GP6520	A45
3950274	17508	A144	3950375	17752	A144	3954989	GT205043 GP6520	A36	3955072	GT305073 GP6520	A45
3950275	17510	A144	3950376	17763	A146	3954990	GT205044 GP6520	A36	3955073	GT205083 GM6515	A38
3950276	17512	A144	3950377	17764	A146	3954991	GT205045 GP6520	A36	3955074	GT205084 GM6515	A38
3950277	17513	A144	3950378	17765	A146	3954992	GT205046 GP6520	A36	3955075	GT205085 GM6515	A38
3950278	17517	A144	3950379	17768	A146	3954993	GT205047 GP6520	A36	3955076	GT205086 GM6515	A38
3950279	17518	A144	3950380	17769	A146	3954994	GT205048 GP6520	A36	3955077	GT205087 GM6515	A38
3950280	17521	A144	3950381	17770	A146	3954995	GT205049 GP6520	A36	3955078	GT205088 GM6515	A38
3950281	17522	A144	3950382	17771	A146	3954996	GT205050 GP6520	A36	3955079	GT205089 GM6515	A38
3950282	17523	A144	3950383	17773	A146	3954997	GT205051 GP6520	A36	3955080	GT205090 GM6515	A38
3950283	17524	A144	3950384	17774	A146	3954998	GT205052 GP6520	A36	3955081	GT205091 GM6515	A38
3950284	17526	A144	3950385	17775	A146	3954999	GT205053 GP6520	A36	3955082	GT205092 GM6515	A38
3950285	17529	A144	3950386	17776	A146	3955000	GT205054 GP6520	A36	3955083	GT205093 GM6515	A38
3950286	17530	A144	3950387	17777	A146	3955001	GT205055 GP6520	A36	3955084	GT205094 GP6520	A38
3950287	17531	A144	3950388	17778	A146	3955002	GT205056 GP6520	A36	3955085	GT205095 GP6520	A38
3950288	17532	A144	3950389	17708	A144	3955003	GT205057 GP6520	A36	3955086	GT205096 GP6520	A38
3950289	17533	A144	3950390	17408	A144	3955004	GT205058 GP6520	A36	3955087	GT205097 GP6520	A38
3950290	17534	A144	3950391	17410	A144	3955005	GT205059 GP6520	A36	3955088	GT205098 GP6520	A38
3950291	17536	A144	3950392	17412	A144	3955006	GT205060 GP6520	A36	3955089	GT205099 GP6520	A38
3950292	17537	A144	3950413	17413	A144	3955010	GT205061 GM6515	A37	3955090	GT205100 GP6520	A38
3950293	17538	A144	3950414	17417	A144	3955011	GT205062 GM6515	A37	3955091	GT205101 GP6520	A38
3950294	17539	A144	3950415	17418	A144	3955012	GT205063 GM6515	A37	3955092	GT205102 GP6520	A38
3950295	17540	A144	3950416	17421	A144	3955013	GT205064 GM6515	A37	3955093	GT305074 GP6520	A45
3950296	17542	A144	3950417	17422	A144	3955015	GT205066 GM6515	A37	3955094	GT305075 GP6520	A45
3950297	17543	A144	3950418	17423	A144	3955016	GT205067 GM6515	A37	3955095	GT305076 GP6520	A45
3950298	17544	A144	3950419	17424	A144	3955017	GT205068 GM6515	A37	3955096	GT305077 GP6520	A45
3950299	17545	A144	3950420	17426	A144	3955018	GT205069 GP6520	A37	3955097	GT305078 GP6520	A45
3950300	17546	A144	3950421	17429	A144	3955019	GT205070 GP6520	A37	3955098	GT305148 GM6515	A46
3950301	17547	A144	3950422	17430	A144	3955020	GT205071 GP6520	A37	3955099	GT305079 GM6515	A46
3950302	17548	A144	3950423	17431	A144	3955021	GT205072 GP6520	A37	3955100	GT305080 GM6515	A46
3950303	17549	A144	3950424	17432	A144	3955023	GT305101 GP6520	A46	3955101	GT305081 GM6515	A46
3950304	17550	A144	3950425	17433	A144	3955024	GT305102 GP6520	A46	3955102	GT305082 GM6515	A46
3950305	17551	A144	3950426	17434	A144	3955025	GT305103 GP6520	A46	3955103	GT305083 GM6515	A46
3950306	17552	A144	3950427	17436	A144	3955026	GT305104 GP6520	A46	3955104	GT305084 GM6515	A46
3950307	17563	A146	3950428	17437	A144	3955027	GT305105 GP6520	A46	3955105	GT305085 GM6515	A46
3950308	17564	A146	3950429	17438	A144	3955028	GT305106 GP6520	A46	3955106	GT305086 GM6515	A46
3950309	17565	A146	3950430	17439	A144	3955029	GT305107 GP6520	A46	3955107	GT305087 GM6515	A46
3950310	17568	A146	3950431	17440	A144	3955030	GT305108 GP6520	A46	3955108	GT305088 GM6515	A46
3950311	17569	A146	3950432	17442	A144	3955031	GT305109 GP6520	A46	3955109	GT305089 GM6515	A46
3950312	17570	A146	3950433	17443	A144	3955032	GT305110 GP6520	A46	3955110	GT305090 GM6515	A46
3950313	17571	A146	3950434	17444	A144	3955033	GT305111 GP6520	A46	3955111	GT305091 GM6515	A46
3950314	17573	A146	3950435	17445	A144	3955034	GT305112 GP6520	A46	3955112	GT305092 GM6515	A46

WIDIA
GTD™

C14 WWW.WIDIA.COM

Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)	Order No.	Catalog No.	Page(s)
4138577	GTM415042 WU16PV	A227	4153763	GT005015 WP31MG	A40	4158325	GX105003 WH16PG	A22	4159967	GT235014 WP31MG	A63
4138578	GTM415002 WU16PV	A226	4153764	GT005016 WP31MG	A40	4158326	GX105004 WH16PG	A22	4159968	GT235015 WP31MG	A63
4138579	GTM415043 WU16PV	A227	4153765	GT005017 WP31MG	A40	4158327	GX105005 WH16PG	A22	4159969	GT235016 WP31MG	A63
4138580	GTM415003 WU16PV	A226	4153766	GT005018 WP31MG	A40	4158328	GX105006 WH16PG	A22	4159970	GT235017 WP31MG	A63
4138581	GTM415044 WU16PV	A227	4153906	GT325001 GP6520	A48	4158329	GX105007 WH16PG	A22	4159971	GT235018 WP31MG	A63
4138582	GTM415004 WU16PV	A226	4153907	GT325002 GP6520	A48	4158330	GX105008 WH16PG	A22	4159972	GT235019 WP31MG	A63
4138583	GTM415045 WU16PV	A227	4153908	GT325003 GP6520	A48	4158331	GX105009 WH16PG	A22	4159993	GT235020 WP31MG	A63
4138584	GTM415005 WU16PV	A226	4153909	GT325004 GP6520	A48	4158332	GX105010 WH16PG	A22	4159994	GT235021 WP31MG	A63
4138585	GTM415046 WU16PV	A227	4153910	GT325005 GP6520	A48	4158333	GX105011 WH16PG	A22	4159995	GT235022 WP31MG	A63
4138586	GTM415006 WU16PV	A226	4153911	GT325006 GP6520	A48	4158334	GX105012 WH16PG	A22	4160036	GT705001 WN48EG	A41
4138587	GTM415008 WU16PV	A226	4153912	GT325007 GP6520	A48	4158335	GX105013 WH16PG	A22	4160037	GT705002 WN48EG	A41
4138588	GTM415009 WU16PV	A226	4153953	GT325008 GP6520	A48	4158471	GT045001 WH36MG	A52	4160038	GT705003 WN48EG	A41
4138589	GTM415010 WU16PV	A226	4153954	GT325009 GP6520	A48	4158472	GT045002 WH36MG	A52	4160039	GT705004 WN48EG	A41
4138590	GTM415011 WU16PV	A226	4153955	GT335001 GP6520	A49	4158495	GT225016 WP31MG	A62	4160040	GT705005 WN48EG	A41
4138591	GTM415012 WU16PV	A226	4153956	GT335002 GP6520	A49	4158496	GT225017 WP31MG	A62	4160041	GT705006 WN48EG	A41
4138592	GTM415014 WU16PV	A226	4153957	GT335003 GP6520	A49	4158497	GT225018 WP31MG	A62	4160042	GT705007 WN48EG	A41
4138593	GTM415015 WU16PV	A226	4153958	GT335004 GP6520	A49	4158498	GT225019 WP31MG	A62	4160054	GT805001 WN48EG	A51
4138594	GTM415016 WU16PV	A226	4153959	GT335005 GP6520	A49	4158499	GT225020 WP31MG	A62	4160055	GT805005 WN48EG	A51
4138595	GTM415013 WU16PV	A226	4153960	GT335006 GP6520	A49	4158500	GT225021 WP31MG	A62	4160056	GT805003 WN48EG	A51
4138596	GTM415017 WU16PV	A226	4153961	GT335007 GP6520	A49	4158501	GT225022 WP31MG	A62	4160057	GT805004 WN48EG	A51
4138597	GTM415047 WU16PV	A227	4153962	GT335008 GP6520	A49	4158502	GT225023 WP31MG	A62	4160058	GT805005 WN48EG	A51
4138598	GTM415007 WU16PV	A226	4153963	GT335009 GP6520	A49	4158513	GT225024 WP31MG	A62	4160059	GT805006 WN48EG	A51
4138599	GTM415018 WU16PV	A226	4154254	GT505001 GP6520	A68	4158514	GT225025 WP31MG	A62	4160060	GT805007 WN48EG	A51
4138600	GTM415019 WU16PV	A226	4154255	GT505002 GP6520	A68	4158515	GT225026 WP31MG	A62	4160061	GT805008 WN48EG	A51
4138601	GTM415020 WU16PV	A226	4154256	GT505003 GP6520	A68	4158516	GT225027 WP31MG	A62	4160062	GT805009 WN48EG	A51
4138602	GTM415021 WU16PV	A226	4154257	GT505004 GP6520	A68	4158517	GT225028 WP31MG	A62	4160063	GT705008 WN48EG	A41
4138603	GTM415022 WU16PV	A226	4154258	GT505005 GP6520	A68	4158518	GT225029 WP31MG	A62	4160093	GT145001 WN35MG	A43
4138604	GTM415023 WU16PV	A226	4154259	GT505006 GP6520	A68	4158519	GT225030 WP31MG	A62	4160094	GT145002 WN35MG	A43
4138605	GTM415024 WU16PV	A226	4154260	GT505007 GP6520	A68	4158763	GT045003 WH36MG	A52	4160095	GT145003 WN35MG	A43
4138606	GTM415029 WU16PV	A225	4154261	GT505008 GP6520	A68	4158764	GT045004 WH36MG	A52	4160096	GT145004 WN35MG	A43
4138607	GTM415031 WU16PV	A225	4154262	GT505009 GP6520	A68	4158765	GT045005 WH36MG	A52	4160097	GT145005 WN35MG	A43
4138608	GTM415032 WU16PV	A225	4154263	GT505010 GP6520	A68	4158766	GT045006 WH36MG	A52	4160098	GT145006 WN35MG	A43
4138609	GTM415040 WU16PV	A225	4154264	GT515001 GP6520	A69	4158767	GT045007 WH36MG	A52	4160099	GT145007 WN35MG	A43
4138610	GTM415025 WU16PV	A225	4154265	GT515002 GP6520	A69	4158768	GT045008 WH36MG	A52	4160100	GT105001 WS32MG	A42
4138611	GTM415026 WU16PV	A225	4154266	GT515003 GP6520	A69	4158769	GT045009 WH36MG	A52	4160101	GT105002 WS32MG	A42
4138612	GTM415027 WU16PV	A225	4154267	GT515004 GP6520	A69	4158770	GT045010 WH36MG	A52	4160102	GT105003 WS32MG	A42
4138613	GTM415028 WU16PV	A225	4154268	GT515005 GP6520	A69	4158771	GT045011 WH36MG	A52	4160103	GT105004 WS32MG	A42
4138614	GTM415030 WU16PV	A225	4154269	GT515006 GP6520	A69	4158772	GT045012 WH36MG	A52	4160104	GT105005 WS32MG	A42
4138615	GTM415037 WU16PV	A225	4154270	GT515007 GP6520	A69	4158773	GT045013 WH36MG	A52	4160105	GT105006 WS32MG	A42
4138616	GTM415039 WU16PV	A225	4154271	GT515008 GP6520	A69	4158774	GT045014 WH36MG	A52	4160106	GT105007 WS32MG	A42
4138617	GTM415033 WU16PV	A225	4154272	GT515009 GP6520	A69	4158775	GT045015 WH36MG	A52	4160107	GT105008 WS32MG	A42
4138618	GTM415034 WU16PV	A225	4154273	GT515010 GP6520	A69	4158776	GT045016 WH36MG	A52	4160108	GT105009 WS32MG	A42
4138619	GTM415035 WU16PV	A225	4154274	GT425001 GP6520	A60	4158777	GT045017 WH36MG	A52	4160109	GT105010 WS32MG	A42
4138620	GTM415036 WU16PV	A225	4154275	GT425002 GP6520	A60	4158778	GT045018 WH36MG	A52	4160437	GT165001 WN35MG	A55
4138621	GTM415038 WU16PV	A225	4154276	GT425003 GP6520	A60	4159522	GT235001 WN38MG	A63	4160438	GT165002 WN35MG	A55
4152638	GT025001 WP31MG	A50	4154277	GT425004 GP6520	A60	4159636	GT125001 WS32MG	A54	4160439	GT165003 WN35MG	A55
4152639	GT025002 WP31MG	A50	4154278	GT425005 GP6520	A60	4159637	GT125002 WS32MG	A54	4160440	GT165004 WN35MG	A55
4152640	GT025003 WP31MG	A50	4154279	GT425006 GP6520	A60	4159638	GT125003 WS32MG	A54	4160441	GT165005 WN35MG	A55
4152641	GT025004 WP31MG	A50	4154280	GT425007 GP6520	A60	4159639	GT125004 WS32MG	A54	4160442	GT165006 WN35MG	A55
4152642	GT025005 WP31MG	A50	4154281	GT425008 GP6520	A60	4159640	GT125005 WS32MG	A54	4160523	GT165007 WN35MG	A55
4152703	GT025006 WP31MG	A50	4154282	GT425009 GP6520	A60	4159641	GT125006 WS32MG	A54			
4152704	GT025007 WP31MG	A50	4154283	GT435001 GP6520	A61	4159642	GT125007 WS32MG	A54			
4152705	GT025008 WP31MG	A50	4154284	GT435002 GP6520	A61	4159644	GT235002 WN38MG	A63			
4152706	GT025009 WP31MG	A50	4154285	GT435003 GP6520	A61	4159645	GT235003 WN38MG	A63			
4152707	GT025010 WP31MG	A50	4154286	GT435004 GP6520	A61	4159646	GT235004 WN38MG	A63			
4152708	GT025011 WP31MG	A50	4154287	GT435005 GP6520	A61	4159647	GT235005 WN38MG	A63			
4152709	GT025012 WP31MG	A50	4154288	GT435006 GP6520	A61	4159648	GT235006 WN38MG	A63			
4152710	GT025013 WP31MG	A50	4154289	GT435007 GP6520	A61	4159649	GT235007 WN38MG	A63			
4152711	GT025014 WP31MG	A50	4154290	GT435008 GP6520	A61	4159650	GT235008 WN38MG	A63			
4152712	GT025015 WP31MG	A50	4154291	GT435009 GP6520	A61	4159651	GT235009 WN38MG	A63			
4152713	GT025016 WP31MG	A50	4154671	GT225001 WN38MG	A62	4159652	GT235010 WN38MG	A63			
4152714	GT025017 WP31MG	A50	4154672	GT225002 WN38MG	A62	4159653	GT235011 WN38MG	A63			
4152715	GT025018 WP31MG	A50	4154673	GT225003 WN38MG	A62	4159663	GT125008 WS32MG	A54			
4153679	GT005001 WP31MG	A40	4154674	GT225004 WN38MG	A62	4159664	GT125009 WS32MG	A54			
4153680	GT005002 WP31MG	A40	4154675	GT225005 WN38MG	A62	4159665	GT125010 WS32MG	A54			
4153681	GT005003 WP31MG	A40	4154676	GT225006 WN38MG	A62	4159913	GT065001 WS32MG	A53			
4153682	GT005004 WP31MG	A40	4154677	GT225007 WN38MG	A62	4159914	GT065002 WS32MG	A53			
4153753	GT005005 WP31MG	A40	4154678	GT225008 WN38MG	A62	4159915	GT065003 WS32MG	A53			
4153754	GT005006 WP31MG	A40	4154679	GT225009 WN38MG	A62	4159916	GT065004 WS32MG	A53			
4153755	GT005007 WP31MG	A40	4154680	GT225010 WN38MG	A62	4159917	GT065005 WS32MG	A53			
4153756	GT005008 WP31MG	A40	4154681	GT225011 WN38MG	A62	4159918	GT065006 WS32MG	A53			
4153757	GT005009 WP31MG	A40	4154682	GT225012 WN38MG	A62	4159919	GT065007 WS32MG	A53			
4153758	GT005010 WP31MG	A40	4154683	GT225013 WN38MG	A62	4159920	GT065008 WS32MG	A53			
4153759	GT005011 WP31MG	A40	4154684	GT225014 WN38MG	A62	4159921	GT065009 WS32MG	A53			
4153760	GT005012 WP31MG	A40	4154685	GT225015 WN38MG	A62	4159922	GT065010 WS32MG	A53			
4153761	GT005013 WP31MG	A40	4158323	GX105001 WH16PG	A22	4159965	GT235012 WP31MG	A63			
4153762	GT005014 WP31MG	A40	4158324	GX105002 WH16PG	A22	4159966	GT235013 WP31MG	A63			

Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)
12808 GP4535	A17	12899 GN1515	A21	13241	A173-A175	13385	A180
12809 GP4535	A16	12901 GN1515	A21	13242	A173-A175	13389	A180
12810 GP4535	A16	12902 GN1515	A21	13244	A173-A175	13405	A180
12811 GP4535	A16	12903 GN1515	A21	13246	A173-A175	13602	A179
12812 GP4535	A16	12904 GN1515	A21	13249	A173-A175	13606	A179
12813 GP4535	A16	12905 GN1515	A21	13250	A173-A175	13609	A179
12814 GP4535	A16	12906 GN1515	A21	13251	A173-A175	13614	A179
12815 GP4535	A16	12907 GN1515	A21	13252	A173-A175	13617	A179
12816 GP4535	A16	12908 GN1515	A21	13255	A173-A175	13619	A179
12826 GP4535	A17	12909 GN1515	A21	13256	A173-A175	13620	A179
12827 GP4535	A17	12911 GN1515	A21	13257	A173-A175	13623	A179
12828 GP4535	A17	12912 GN1515	A21	13260	A173-A175	13625	A179
12829 GP4535	A17	12914 GN1515	A21	13262	A173-A175	13626	A179
12830 GP4535	A17	12915 GN1515	A21	13264	A173-A175	13629	A179
12831 GP4535	A16	13111	A173-A175	13268	A173-A175	13630	A179
12832 GP4535	A16	13115	A173-A175	13269	A173-A175	13633	A179
12833 GP4535	A16	13117	A173-A175	13270	A173-A175	13634	A179
12834 GP4535	A16	13119	A173-A175	13272	A173-A175	13636	A179
12835 GP4535	A16	13121	A173-A175	13273	A173-A175	13638	A179
12836 GN1515	A18	13123	A173-A175	13274	A173-A175	13639	A179
12838 GN1515	A18	13126	A173-A175	13275	A176	13641	A179
12839 GN1515	A18	13128	A173-A175	13277	A173-A175	13642	A179
12840 GN1515	A18	13131	A173-A175	13278	A173-A175	14009	A158
12841 GN1515	A18	13132	A173-A175	13279	A173-A175	14010	A154
12843 GN1515	A18	13134	A173-A175	13280	A173-A175	14011	A158
12844 GN1515	A18	13136	A173-A175	13282	A173-A175	14012	A163
12845 GN1515	A18	13137	A173-A175	13283	A173-A175	14013	A166
12846 GN1515	A18	13139	A173-A175	13289	A173-A175	14015	A154
12847 GN1515	A18	13141	A173-A175	13290	A173-A175	14016	A158
12848 GN1515	A18	13142	A173-A175	13291	A173-A175	14017	A163
12850 GN1515	A18	13145	A173-A175	13293	A173-A175	14018	A166
12851 GN1515	A18	13146	A173-A175	13294	A173-A175	14020	A158
12852 GN1515	A18	13148	A173-A175	13295	A173-A175	14022	A154
12853 GN1515	A18	13149	A173-A175	13296	A176	14023	A158
12854 GN1515	A18	13151	A173-A175	13297	A173-A175	14024	A163
12855 GN1515	A18	13152	A173-A175	13298	A173-A175	14025	A166
12856 GN1515	A18	13154	A173-A175	13300	A173-A175	14026	A169
12858 GN1515	A19	13157	A173-A175	13302	A173-A175	14027	A169
12859 GN1515	A19	13158	A173-A175	13303	A173-A175	14028	A169
12860 GN1515	A19	13164	A173-A175	13305	A173-A175	14029	A169
12861 GN1515	A19	13166	A173-A175	13306	A173-A175	14030	A158
12862 GN1515	A19	13169	A173-A175	13307	A173-A175	14031	A163
12863 GN1515	A19	13170	A173-A175	13309	A173-A175	14032	A158
12864 GN1515	A19	13176	A173-A175	13310	A176	14033	A163
12865 GN1515	A19	13180	A173-A175	13311	A173-A175	14036	A158
12866 GN1515	A19	13183	A173-A175	13312	A173-A175	14037	A163
12867 GN1515	A19	13185	A173-A175	13313	A173-A175	14039	A158
12868 GN1515	A19	13189	A173-A175	13315	A173-A175	14041	A158
12869 GN1515	A19	13193	A173-A175	13318	A173-A175	14048	A158
12870 GN1515	A19	13195	A173-A175	13319	A173-A175	14052	A158
12872 GN1515	A19	13197	A173-A175	13320	A173-A175	14053	A158
12873 GN1515	A19	13199	A173-A175	13324	A173-A175	14055	A154
12874 GN1515	A19	13201	A173-A175	13325	A173-A175	14056	A158
12875 GN1515	A19	13202	A173-A175	13327	A173-A175	14057	A163
12876 GN1515	A19	13203	A173-A175	13328	A173-A175	14058	A166
12877 GN1515	A20	13204	A173-A175	13330	A173-A175	14060	A169
12878 GN1515	A20	13205	A173-A175	13331	A176	14063	A158
12879 GN1515	A20	13206	A173-A175	13332	A173-A175	14064	A163
12880 GN1515	A20	13207	A173-A175	13333	A173-A175	14065	A158
12881 GN1515	A20	13208	A173-A175	13334	A173-A175	14066	A163
12882 GN1515	A20	13211	A173-A175	13336	A173-A175	14067	A158
12883 GN1515	A20	13213	A173-A175	13339	A173-A175	14068	A163
12884 GN1515	A20	13214	A173-A175	13340	A173-A175	14082	A158
12885 GN1515	A20	13215	A173-A175	13341	A176	14083	A163
12886 GN1515	A20	13217	A173-A175	13342	A173-A175	14087	A158
12887 GN1515	A20	13218	A173-A175	13343	A173-A175	14088	A163
12888 GN1515	A20	13219	A173-A175	13344	A173-A175	14092	A154
12889 GN1515	A20	13223	A173-A175	13367	A180	14093	A158
12890 GN1515	A20	13224	A173-A175	13369	A180	14094	A163
12891 GN1515	A20	13225	A173-A175	13371	A180	14095	A166
12892 GN1515	A20	13229	A173-A175	13373	A180	14096	A169
12893 GN1515	A20	13230	A173-A175	13375	A180	14097	A169
12894 GN1515	A20	13231	A173-A175	13377	A180	14098	A169
12895 GN1515	A21	13232	A173-A175	13379	A180	14099	A169
12896 GN1515	A21	13235	A173-A175	13381	A180	14100	A158
12897 GN1515	A21	13237	A173-A175	13382	A180	14101	A163
12898 GN1515	A21	13240	A173-A175	13383	A180	14102	A158

Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)
14103.....	A163	14284.....	A166	14454.....	A169	14741.....	A155
14104.....	A158	14285.....	A169	14455.....	A169	14742.....	A167
14105.....	A163	14286.....	A169	14457.....	A160	14743.....	A168
14109.....	A158	14287.....	A169	14458.....	A164	14744.....	A168
14113.....	A158	14288.....	A169	14471.....	A154	14750.....	A167
14114.....	A163	14289.....	A159	14472.....	A160	14757.....	A155
14118.....	A158	14290.....	A163	14473.....	A164	14758.....	A167
14122.....	A154	14293.....	A159	14474.....	A166	14760.....	A168
14123.....	A158	14294.....	A164	14475.....	A169	14766.....	A167
14124.....	A163	14297.....	A159	14476.....	A169	14773.....	A155
14125.....	A166	14301.....	A159	14477.....	A169	14774.....	A167
14126.....	A169	14308.....	A154	14478.....	A169	14775.....	A168
14127.....	A169	14309.....	A159	14479.....	A160	14777.....	A168
14128.....	A169	14310.....	A164	14482.....	A160	14782.....	A167
14129.....	A169	14311.....	A166	14483.....	A164	14784.....	A168
14130.....	A158	14312.....	A169	14499.....	A154	14790.....	A167
14131.....	A163	14313.....	A169	14500.....	A160	14797.....	A155
14133.....	A158	14314.....	A169	14501.....	A164	14798.....	A167
14134.....	A163	14315.....	A169	14502.....	A166	14800.....	A168
14147.....	A159	14316.....	A159	14508.....	A160	14813.....	A155
14148.....	A163	14319.....	A159	14516.....	A154	14814.....	A167
14152.....	A159	14338.....	A154	14517.....	A160	14816.....	A168
14153.....	A163	14339.....	A159	14518.....	A164	14829.....	A155
14157.....	A154	14340.....	A164	14519.....	A166	14830.....	A167
14158.....	A159	14341.....	A166	14524.....	A160	14832.....	A168
14159.....	A163	14342.....	A169	14544.....	A154	14845.....	A155
14160.....	A166	14343.....	A169	14545.....	A160	14846.....	A167
14161.....	A169	14344.....	A169	14546.....	A164	14847.....	A168
14162.....	A169	14345.....	A169	14547.....	A166	14848.....	A168
14163.....	A169	14346.....	A159	14553.....	A160	14861.....	A155
14164.....	A169	14353.....	A159	14557.....	A154	14862.....	A167
14165.....	A159	14356.....	A154	14558.....	A160	14863.....	A168
14166.....	A163	14357.....	A159	14559.....	A164	14864.....	A168
14169.....	A159	14358.....	A164	14560.....	A166	14877.....	A155
14170.....	A163	14359.....	A166	14567.....	A160	14878.....	A167
14174.....	A159	14360.....	A169	14568.....	A154	14893.....	A155
14180.....	A159	14361.....	A169	14569.....	A160	14894.....	A167
14181.....	A163	14362.....	A169	14570.....	A164	14895.....	A168
14185.....	A159	14363.....	A166	14571.....	A166	14896.....	A168
14190.....	A154	14364.....	A159	14586.....	A167	14909.....	A155
14191.....	A159	14378.....	A160	14590.....	A167	14910.....	A167
14192.....	A163	14379.....	A154	14594.....	A154	14911.....	A168
14193.....	A166	14380.....	A160	14595.....	A160	14925.....	A155
14194.....	A169	14381.....	A164	14596.....	A164	14926.....	A167
14195.....	A169	14382.....	A166	14597.....	A166	14927.....	A168
14196.....	A169	14383.....	A169	14603.....	A154	14941.....	A155
14197.....	A169	14384.....	A169	14604.....	A160	14942.....	A167
14198.....	A159	14385.....	A169	14605.....	A164	14943.....	A168
14199.....	A163	14386.....	A169	14606.....	A166	15102.....	A153
14201.....	A159	14388.....	A160	14612.....	A154	15103.....	A156
14202.....	A163	14389.....	A164	14613.....	A160	15104.....	A161
14221.....	A154	14391.....	A160	14614.....	A164	15105.....	A165
14222.....	A159	14400.....	A160	14615.....	A166	15107.....	A156
14223.....	A163	14402.....	A154	14620.....	A154	15108.....	A161
14224.....	A166	14403.....	A160	14621.....	A160	15114.....	A153
14225.....	A169	14404.....	A164	14622.....	A164	15115.....	A156
14226.....	A169	14405.....	A166	14623.....	A166	15116.....	A161
14227.....	A169	14406.....	A169	14632.....	A154	15117.....	A165
14228.....	A169	14407.....	A169	14633.....	A160	15118.....	A156
14229.....	A159	14408.....	A169	14634.....	A164	15120.....	A153
14232.....	A159	14409.....	A169	14635.....	A166	15121.....	A156
14233.....	A163	14411.....	A160	14640.....	A154	15122.....	A161
14246.....	A154	14412.....	A164	14641.....	A160	15123.....	A165
14247.....	A159	14423.....	A154	14642.....	A164	15125.....	A156
14248.....	A163	14424.....	A160	14643.....	A166	15126.....	A161
14249.....	A166	14425.....	A164	14645.....	A154	15128.....	A153
14250.....	A169	14426.....	A166	14646.....	A160	15129.....	A156
14251.....	A169	14427.....	A154	14647.....	A164	15130.....	A161
14252.....	A169	14428.....	A160	14648.....	A166	15131.....	A165
14253.....	A169	14429.....	A164	14653.....	A154	15134.....	A153
14256.....	A159	14430.....	A166	14654.....	A160	15135.....	A156
14257.....	A163	14448.....	A154	14655.....	A164	15136.....	A161
14274.....	A159	14449.....	A166	14656.....	A166	15137.....	A165
14275.....	A163	14450.....	A164	14718.....	A167	15138.....	A156
14281.....	A154	14451.....	A166	14725.....	A155	15139.....	A161
14282.....	A159	14452.....	A169	14726.....	A167	15141.....	A153
14283.....	A163	14453.....	A169	14734.....	A167	15142.....	A156

Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)
15143.....	A161	15291.....	A157	15463.....	A163	16114.....	A193
15144.....	A153	15292.....	A161	15464.....	A159	16115.....	A193
15145.....	A156	15293.....	A157	15465.....	A163	16117.....	A193
15146.....	A161	15294.....	A161	15466.....	A159	16118.....	A193
15147.....	A165	15295.....	A157	15467.....	A159	16201.....	A192
15148.....	A165	15300.....	A157	15468.....	A163	16203.....	A192
15156.....	A153	15301.....	A153	15469.....	A159	16204.....	A192
15157.....	A156	15302.....	A157	15470.....	A159	16205.....	A192
15158.....	A161	15303.....	A161	15471.....	A167	16209.....	A192
15159.....	A165	15304.....	A165	15472.....	A168	16210.....	A192
15160.....	A156	15314.....	A157	15473.....	A167	16212.....	A192
15161.....	A161	15320.....	A153	15474.....	A168	16213.....	A195
15166.....	A153	15321.....	A157	16003.....	A186	16215.....	A192
15167.....	A156	15322.....	A162	16004.....	A187	16217.....	A192
15168.....	A161	15323.....	A165	16005.....	A186	16218.....	A195
15169.....	A165	15324.....	A157	16006.....	A187	16220.....	A192
15179.....	A156	15327.....	A153	16007.....	A186	16222.....	A192
15182.....	A156	15328.....	A157	16008.....	A187	16223.....	A195
15184.....	A153	15329.....	A162	16009.....	A186	16225.....	A192
15185.....	A156	15330.....	A165	16010.....	A187	16227.....	A192
15186.....	A161	15335.....	A157	16011.....	A186	16228.....	A195
15187.....	A165	15336.....	A161	16012.....	A187	16230.....	A192
15189.....	A156	15337.....	A157	16013.....	A186	16232.....	A192
15190.....	A161	15338.....	A162	16014.....	A187	16233.....	A195
15192.....	A156	15344.....	A153	16015.....	A186	16235.....	A192
15196.....	A153	15345.....	A157	16016.....	A187	16237.....	A192
15197.....	A156	15346.....	A162	16017.....	A186	16239.....	A192
15198.....	A161	15347.....	A165	16018.....	A187	16240.....	A192
15199.....	A165	15348.....	A157	16021.....	A186	16242.....	A192
15204.....	A156	15352.....	A153	16022.....	A187	16243.....	A192
15209.....	A153	15353.....	A157	16023.....	A186	16245.....	A192
15210.....	A156	15354.....	A162	16024.....	A187	16281.....	A194
15211.....	A161	15355.....	A165	16027.....	A186	16282.....	A194
15212.....	A165	15356.....	A157	16028.....	A187	16283.....	A194
15214.....	A156	15357.....	A162	16029.....	A186	16284.....	A194
15215.....	A161	15358.....	A157	16030.....	A187	16285.....	A194
15220.....	A153	15359.....	A162	16033.....	A186	16286.....	A194
15221.....	A156	15360.....	A153	16034.....	A187	16287.....	A194
15222.....	A161	15361.....	A157	16035.....	A186	16288.....	A194
15223.....	A165	15362.....	A162	16036.....	A187	16289.....	A194
15224.....	A156	15363.....	A165	16037.....	A186	16290.....	A194
15225.....	A153	15368.....	A157	16038.....	A187	16351.....	A196
15226.....	A156	15369.....	A162	16039.....	A186	16352.....	A196
15227.....	A161	15370.....	A157	16040.....	A187	16353.....	A196
15228.....	A165	15371.....	A162	16041.....	A186	16354.....	A196
15231.....	A153	15374.....	A157	16042.....	A187	16355.....	A196
15232.....	A156	15383.....	A153	16047.....	A186	16356.....	A196
15233.....	A161	15384.....	A157	16048.....	A187	16357.....	A196
15234.....	A165	15385.....	A162	16051.....	A186	16358.....	A196
15235.....	A156	15386.....	A165	16052.....	A187	16359.....	A196
15236.....	A161	15390.....	A153	16053.....	A188	16360.....	A196
15237.....	A153	15391.....	A157	16054.....	A188	16361.....	A196
15238.....	A156	15392.....	A162	16057.....	A188	16362.....	A196
15239.....	A161	15393.....	A165	16058.....	A188	16363.....	A196
15240.....	A165	15432.....	A161	16061.....	A188	16501.....	A189
15245.....	A156	15433.....	A156	16062.....	A188	16502.....	A190
15246.....	A161	15434.....	A161	16063.....	A188	16503.....	A189
15257.....	A153	15436.....	A161	16064.....	A188	16504.....	A190
15258.....	A156	15437.....	A156	16069.....	A188	16505.....	A189
15259.....	A161	15438.....	A161	16070.....	A188	16506.....	A190
15260.....	A165	15442.....	A157	16071.....	A188	16507.....	A189
15262.....	A156	15443.....	A162	16072.....	A188	16508.....	A190
15268.....	A157	15444.....	A157	16073.....	A188	16509.....	A189
15269.....	A161	15445.....	A162	16074.....	A188	16510.....	A190
15270.....	A161	15446.....	A162	16101.....	A193	16511.....	A189
15275.....	A153	15447.....	A162	16102.....	A193	16512.....	A190
15276.....	A157	15450.....	A157	16103.....	A193	16513.....	A189
15277.....	A161	15453.....	A158	16104.....	A193	16514.....	A190
15278.....	A165	15454.....	A158	16105.....	A193	16515.....	A189
15279.....	A156	15455.....	A163	16106.....	A193	16516.....	A190
15280.....	A161	15456.....	A158	16107.....	A193	16517.....	A189
15281.....	A157	15457.....	A163	16108.....	A193	16518.....	A190
15282.....	A161	15458.....	A193	16109.....	A193	16519.....	A189
15283.....	A153	15459.....	A159	16110.....	A193	16520.....	A190
15284.....	A157	15460.....	A159	16111.....	A193	16521.....	A189
15285.....	A161	15461.....	A163	16112.....	A193	16522.....	A190
15286.....	A165	15462.....	A158	16113.....	A193	16523.....	A189

Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)
16524.....	A190	17218.....	A182	17465.....	A146	17739.....	A144
16525.....	A189	17219.....	A182	17468.....	A146	17740.....	A144
16526.....	A190	17222.....	A182	17469.....	A146	17742.....	A144
16527.....	A189	17223.....	A182	17470.....	A146	17743.....	A144
16528.....	A190	17225.....	A182	17471.....	A146	17744.....	A144
16533.....	A189	17226.....	A182	17473.....	A146	17745.....	A144
16534.....	A190	17227.....	A182	17474.....	A146	17746.....	A144
16537.....	A189	17228.....	A182	17475.....	A146	17747.....	A144
16538.....	A190	17230.....	A182	17476.....	A146	17748.....	A144
16802.....	A178	17231.....	A182	17477.....	A146	17749.....	A144
16805.....	A178	17232.....	A182	17478.....	A146	17750.....	A144
16807.....	A178	17233.....	A182	17508.....	A144	17751.....	A144
16809.....	A178	17235.....	A182	17510.....	A144	17752.....	A144
16810.....	A178	17236.....	A182	17512.....	A144	17763.....	A146
16812.....	A178	17238.....	A182	17513.....	A144	17764.....	A146
16814.....	A178	17239.....	A182	17517.....	A144	17765.....	A146
16818.....	A178	17242.....	A182	17518.....	A144	17768.....	A146
16820.....	A178	17243.....	A182	17521.....	A144	17769.....	A146
16826.....	A178	17245.....	A182	17522.....	A144	17770.....	A146
16830.....	A178	17246.....	A182	17523.....	A144	17771.....	A146
16832.....	A178	17248.....	A183	17524.....	A144	17773.....	A146
17000.....	A181	17249.....	A183	17526.....	A144	17774.....	A146
17001.....	A181	17251.....	A183	17529.....	A144	17775.....	A146
17002.....	A181	17252.....	A183	17530.....	A144	17776.....	A146
17004.....	A181	17254.....	A183	17531.....	A144	17777.....	A146
17008.....	A181	17255.....	A183	17532.....	A144	17778.....	A146
17009.....	A181	17257.....	A183	17533.....	A144	18200.....	A148
17011.....	A181	17258.....	A183	17534.....	A144	18201.....	A148
17012.....	A181	17264.....	A183	17536.....	A144	18202.....	A147
17013.....	A181	17265.....	A183	17537.....	A144	18203.....	A147
17014.....	A181	17266.....	A183	17538.....	A144	18204.....	A148
17018.....	A181	17267.....	A185	17539.....	A144	18205.....	A148
17019.....	A181	17269.....	A185	17540.....	A144	18206.....	A147
17020.....	A181	17271.....	A185	17542.....	A144	18207.....	A147
17021.....	A181	17272.....	A185	17543.....	A144	18208.....	A148
17023.....	A181	17275.....	A185	17544.....	A144	18209.....	A148
17024.....	A181	17276.....	A185	17545.....	A144	18210.....	A147
17027.....	A181	17277.....	A185	17546.....	A144	18211.....	A147
17028.....	A181	17280.....	A183	17547.....	A144	18212.....	A148
17030.....	A181	17282.....	A183	17548.....	A144	18213.....	A148
17031.....	A181	17284.....	A183	17549.....	A144	18214.....	A148
17033.....	A181	17286.....	A183	17550.....	A144	18215.....	A148
17034.....	A181	17408.....	A144	17551.....	A144	18216.....	A147
17036.....	A181	17410.....	A144	17552.....	A144	18217.....	A147
17037.....	A181	17412.....	A144	17563.....	A146	18218.....	A148
17039.....	A181	17413.....	A144	17564.....	A146	18219.....	A148
17040.....	A181	17417.....	A144	17565.....	A146	18220.....	A147
17042.....	A181	17418.....	A144	17568.....	A146	18221.....	A147
17046.....	A181	17421.....	A144	17569.....	A146	18223.....	A148
17049.....	A181	17422.....	A144	17570.....	A146	18224.....	A147
17050.....	A181	17423.....	A144	17571.....	A146	18225.....	A147
17051.....	A181	17424.....	A144	17573.....	A146	18226.....	A148
17053.....	A181	17426.....	A144	17574.....	A146	18227.....	A148
17055.....	A181	17429.....	A144	17575.....	A146	18228.....	A147
17057.....	A181	17430.....	A144	17576.....	A146	18229.....	A147
17059.....	A181	17431.....	A144	17577.....	A146	18230.....	A148
17082.....	A184	17432.....	A144	17578.....	A146	18231.....	A148
17084.....	A184	17433.....	A144	17708.....	A144	18232.....	A147
17087.....	A184	17434.....	A144	17710.....	A144	18233.....	A147
17090.....	A184	17436.....	A144	17712.....	A144	18234.....	A148
17091.....	A184	17437.....	A144	17713.....	A144	18235.....	A148
17200.....	A182	17438.....	A144	17717.....	A144	18236.....	A147
17201.....	A182	17439.....	A144	17718.....	A144	18237.....	A147
17202.....	A182	17440.....	A144	17721.....	A144	18238.....	A148
17204.....	A182	17442.....	A144	17722.....	A144	18239.....	A148
17205.....	A182	17443.....	A144	17723.....	A144	18240.....	A147
17206.....	A182	17444.....	A144	17724.....	A144	18241.....	A147
17207.....	A182	17445.....	A144	17726.....	A144	18242.....	A148
17208.....	A182	17446.....	A144	17729.....	A144	18243.....	A148
17209.....	A182	17447.....	A144	17730.....	A144	18244.....	A147
17210.....	A182	17448.....	A144	17731.....	A144	18245.....	A147
17211.....	A182	17449.....	A144	17732.....	A144	18246.....	A148
17213.....	A182	17450.....	A144	17733.....	A144	18247.....	A148
17214.....	A182	17451.....	A144	17734.....	A144	18248.....	A147
17215.....	A182	17452.....	A144	17736.....	A144	18249.....	A148
17216.....	A182	17463.....	A146	17737.....	A144	18250.....	A148
17217.....	A182	17464.....	A146	17738.....	A144	18251.....	A147

Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)
18252.....	A147	18363.....	A149	18840.....	A171	19096.....	A173-A175
18253.....	A148	18364.....	A149	18842.....	A171	19101.....	A173-A175
18254.....	A147	18365.....	A149	18843.....	A171	19102.....	A173-A175
18255.....	A149	18366.....	A149	18845.....	A171	19103.....	A173-A175
18256.....	A149	18700.....	A148	18846.....	A171	19106.....	A173-A175
18257.....	A149	18701.....	A148	18848.....	A171	19108.....	A173-A175
18258.....	A149	18702.....	A147	18849.....	A171	19111.....	A173-A175
18259.....	A149	18703.....	A147	18851.....	A171	19112.....	A173-A175
18260.....	A149	18704.....	A148	18852.....	A171	19113.....	A173-A175
18261.....	A149	18705.....	A148	18854.....	A171	19114.....	A173-A175
18262.....	A149	18706.....	A147	18855.....	A171	19116.....	A173-A175
18263.....	A149	18707.....	A147	18891.....	A171	19117.....	A173-A175
18264.....	A149	18708.....	A148	18892.....	A171	19118.....	A173-A175
18265.....	A149	18709.....	A148	18930.....	A177	19119.....	A173-A175
18266.....	A149	18710.....	A147	18932.....	A177	19121.....	A156
18300.....	A148	18711.....	A147	18934.....	A177	19122.....	A156
18301.....	A148	18712.....	A148	18935.....	A177	19123.....	A156
18302.....	A147	18713.....	A148	18936.....	A177	19124.....	A156
18303.....	A147	18714.....	A148	18937.....	A177	19126.....	A157
18304.....	A148	18715.....	A148	18938.....	A177	19127.....	A157
18305.....	A148	18716.....	A147	18939.....	A177	19128.....	A158
18306.....	A147	18717.....	A147	18940.....	A177	19129.....	A158
18307.....	A147	18718.....	A148	18941.....	A177	19131.....	A158
18308.....	A148	18719.....	A148	19001.....	A173-A175	19132.....	A159
18309.....	A148	18720.....	A147	19002.....	A180	19134.....	A159
18310.....	A147	18721.....	A147	19004.....	A180	19135.....	A159
18311.....	A147	18723.....	A148	19006.....	A173-A175	19136.....	A159
18312.....	A148	18724.....	A147	19007.....	A173-A175	19137.....	A159
18313.....	A148	18725.....	A147	19008.....	A180	19138.....	A159
18314.....	A148	18726.....	A148	19009.....	A180	19139.....	A160
18315.....	A148	18727.....	A148	19010.....	A180	19140.....	A160
18316.....	A147	18728.....	A147	19011.....	A173-A175	19141.....	A160
18317.....	A147	18729.....	A147	19012.....	A173-A175	19142.....	A160
18318.....	A148	18730.....	A148	19013.....	A173-A175	19144.....	A186
18319.....	A148	18731.....	A148	19014.....	A173-A175	19145.....	A187
18320.....	A147	18732.....	A147	19015.....	A173-A175	19146.....	A186
18321.....	A147	18733.....	A147	19016.....	A173-A175	19147.....	A187
18323.....	A148	18734.....	A148	19017.....	A173-A175	19148.....	A186
18324.....	A147	18735.....	A148	19018.....	A173-A175	19149.....	A187
18325.....	A147	18736.....	A147	19019.....	A173-A175	19151.....	A186
18326.....	A148	18737.....	A147	19020.....	A173-A175	19152.....	A187
18327.....	A148	18738.....	A148	19021.....	A173-A175	19153.....	A186
18328.....	A147	18739.....	A148	19022.....	A173-A175	19154.....	A187
18329.....	A147	18740.....	A147	19023.....	A173-A175	19155.....	A186
18330.....	A148	18741.....	A147	19024.....	A173-A175	19156.....	A187
18331.....	A148	18742.....	A148	19025.....	A173-A175	19157.....	A186
18332.....	A147	18743.....	A148	19026.....	A173-A175	19158.....	A187
18333.....	A147	18744.....	A147	19027.....	A173-A175	19160.....	A186
18334.....	A148	18745.....	A147	19028.....	A173-A175	19161.....	A187
18335.....	A148	18746.....	A148	19029.....	A173-A175	19162.....	A186
18336.....	A147	18747.....	A148	19031.....	A173-A175	19163.....	A187
18337.....	A147	18748.....	A147	19036.....	A173-A175	19164.....	A186
18338.....	A148	18749.....	A148	19037.....	A173-A175	19165.....	A187
18339.....	A148	18750.....	A148	19038.....	A173-A175	19166.....	A186
18340.....	A147	18751.....	A147	19039.....	A173-A175	19167.....	A154
18341.....	A147	18752.....	A147	19044.....	A188	19168.....	A187
18342.....	A148	18753.....	A148	19045.....	A188	19169.....	A186
18343.....	A148	18754.....	A147	19046.....	A173-A175	19170.....	A158
18344.....	A147	18755.....	A149	19047.....	A188	19171.....	A187
18345.....	A147	18756.....	A149	19048.....	A188	19172.....	A186
18346.....	A148	18757.....	A149	19049.....	A188	19173.....	A187
18347.....	A148	18758.....	A149	19051.....	A188	19174.....	A161
18348.....	A147	18759.....	A149	19052.....	A188	19175.....	A161
18349.....	A148	18760.....	A149	19053.....	A188	19176.....	A161
18350.....	A148	18761.....	A149	19054.....	A188	19177.....	A161
18351.....	A147	18762.....	A149	19056.....	A173-A175	19178.....	A161
18352.....	A147	18763.....	A149	19057.....	A188	19179.....	A161
18353.....	A148	18764.....	A149	19058.....	A188	19180.....	A163
18354.....	A147	18765.....	A149	19059.....	A188	19181.....	A162
18355.....	A149	18766.....	A149	19061.....	A188	19182.....	A162
18356.....	A149	18827.....	A171	19062.....	A188	19183.....	A162
18357.....	A149	18828.....	A171	19069.....	A173-A175	19184.....	A163
18358.....	A149	18833.....	A171	19071.....	A173-A175	19185.....	A163
18359.....	A149	18834.....	A171	19076.....	A173-A175	19186.....	A163
18360.....	A149	18836.....	A171	19079.....	A173-A175	19187.....	A163
18361.....	A149	18837.....	A171	19086.....	A173-A175	19188.....	A163
18362.....	A149	18839.....	A171	19088.....	A173-A175	19189.....	A163

Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)
19191.....	A163	19323.....	A164	19483.....	A173-A175	19624.....	A186
19192.....	A163	19327.....	A160	19484.....	A173-A175	19626.....	A186
19193.....	A163	19333.....	A164	19485.....	A173-A175	19627.....	A187
19194.....	A164	19337.....	A160	19486.....	A173-A175	19628.....	A186
19197.....	A164	19343.....	A164	19487.....	A173-A175	19629.....	A187
19198.....	A164	19347.....	A160	19488.....	A173-A175	19631.....	A187
19199.....	A164	19353.....	A164	19489.....	A173-A175	19632.....	A186
19201.....	A168	19354.....	A154	19490.....	A173-A175	19633.....	A187
19202.....	A156	19355.....	A163	19492.....	A173-A175	19634.....	A186
19203.....	A168	19357.....	A160	19494.....	A173-A175	19636.....	A186
19204.....	A161	19360.....	A159	19496.....	A173-A175	19637.....	A187
19205.....	A168	19363.....	A164	19497.....	A173-A175	19638.....	A186
19206.....	A168	19367.....	A160	19498.....	A173-A175	19639.....	A187
19207.....	A156	19370.....	A173-A175	19499.....	A173-A175	19641.....	A186
19208.....	A154	19371.....	A173-A175	19500.....	A182	19642.....	A187
19209.....	A161	19372.....	A173-A175	19501.....	A173-A175	19643.....	A186
19210.....	A158	19373.....	A164	19502.....	A173-A175	19644.....	A187
19211.....	A156	19374.....	A173-A175	19504.....	A173-A175	19646.....	A186
19212.....	A168	19375.....	A159	19505.....	A173-A175	19647.....	A187
19213.....	A161	19376.....	A173-A175	19506.....	A182	19648.....	A186
19214.....	A168	19377.....	A154	19507.....	A173-A175	19649.....	A187
19215.....	A168	19378.....	A173-A175	19508.....	A173-A175	19650.....	A193
19216.....	A156	19379.....	A173-A175	19509.....	A173-A175	19651.....	A187
19217.....	A167	19380.....	A164	19510.....	A173-A175	19655.....	A193
19218.....	A161	19381.....	A173-A175	19511.....	A182	19656.....	A193
19219.....	A167	19382.....	A173-A175	19512.....	A173-A175	19665.....	A193
19220.....	A163	19383.....	A173-A175	19513.....	A173-A175	19675.....	A193
19221.....	A156	19384.....	A173-A175	19514.....	A182	19690.....	A192
19222.....	A167	19385.....	A173-A175	19515.....	A173-A175	19691.....	A192
19223.....	A161	19386.....	A173-A175	19516.....	A173-A175	19695.....	A192
19224.....	A167	19387.....	A173-A175	19517.....	A173-A175	19698.....	A192
19225.....	A167	19388.....	A173-A175	19518.....	A182	19701.....	A192
19226.....	A157	19389.....	A173-A175	19519.....	A173-A175	19702.....	A192
19227.....	A167	19391.....	A173-A175	19520.....	A173-A175	19707.....	A192
19228.....	A161	19392.....	A173-A175	19521.....	A173-A175	19710.....	A192
19229.....	A167	19393.....	A173-A175	19522.....	A182	19712.....	A192
19231.....	A157	19394.....	A173-A175	19523.....	A182	19721.....	A192
19233.....	A162	19407.....	A154	19524.....	A173-A175	19728.....	A192
19236.....	A157	19410.....	A160	19525.....	A173-A175	19730.....	A192
19237.....	A154	19415.....	A164	19526.....	A173-A175	19736.....	A192
19238.....	A162	19440.....	A173-A175	19527.....	A182	19738.....	A192
19240.....	A158	19441.....	A173-A175	19528.....	A182	19740.....	A192
19241.....	A157	19442.....	A173-A175	19529.....	A173-A175	19746.....	A192
19243.....	A162	19443.....	A154	19532.....	A182	19748.....	A192
19245.....	A163	19444.....	A173-A175	19535.....	A182	19760.....	A192
19247.....	A158	19445.....	A160	19542.....	A182	19766.....	A192
19251.....	A163	19446.....	A173-A175	19545.....	A182	19768.....	A192
19253.....	A158	19448.....	A173-A175	19548.....	A183	19776.....	A192
19256.....	A163	19449.....	A173-A175	19549.....	A183	19778.....	A192
19257.....	A154	19450.....	A164	19554.....	A183	19780.....	A173-A175
19258.....	A158	19452.....	A173-A175	19555.....	A183	19781.....	A173-A175
19260.....	A158	19454.....	A173-A175	19556.....	A183	19816.....	A182
19261.....	A163	19455.....	A160	19563.....	A153	19817.....	A182
19263.....	A158	19459.....	A173-A175	19565.....	A156	19818.....	A182
19265.....	A163	19460.....	A164	19567.....	A185	19821.....	A181
19266.....	A163	19461.....	A173-A175	19569.....	A185	19822.....	A181
19268.....	A159	19462.....	A173-A175	19570.....	A161	19823.....	A181
19271.....	A163	19463.....	A173-A175	19571.....	A185	19824.....	A181
19273.....	A159	19464.....	A173-A175	19572.....	A185	19826.....	A181
19275.....	A163	19465.....	A160	19573.....	A153	19827.....	A181
19277.....	A159	19466.....	A173-A175	19574.....	A185	19828.....	A181
19278.....	A154	19467.....	A173-A175	19575.....	A156	19841.....	A181
19280.....	A159	19468.....	A173-A175	19576.....	A185	19842.....	A181
19281.....	A163	19469.....	A173-A175	19580.....	A161	19846.....	A181
19283.....	A159	19470.....	A164	19583.....	A153	19847.....	A181
19285.....	A163	19471.....	A173-A175	19585.....	A157	19848.....	A183
19287.....	A163	19472.....	A173-A175	19590.....	A161	19849.....	A182
19291.....	A159	19473.....	A173-A175	19597.....	A153	19851.....	A182
19293.....	A163	19474.....	A173-A175	19600.....	A157	19852.....	A182
19297.....	A159	19475.....	A160	19605.....	A162	19856.....	A182
19303.....	A164	19476.....	A173-A175	19613.....	A153	19857.....	A182
19304.....	A154	19477.....	A173-A175	19615.....	A157	19860.....	A161
19305.....	A159	19478.....	A173-A175	19619.....	A186	19861.....	A182
19307.....	A160	19479.....	A173-A175	19620.....	A162	19862.....	A182
19310.....	A163	19480.....	A164	19621.....	A187	19866.....	A182
19313.....	A164	19481.....	A173-A175	19622.....	A186	19869.....	A182
19317.....	A160	19482.....	A173-A175	19623.....	A187	19871.....	A182

Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)
19872.....	A183	71000.....	A133	74024.....	A103	82327.....	A94
19873.....	A183	71001.....	A134	74025.....	A103	82328.....	A94
19874.....	A183	71002.....	A133	74026.....	A103	82353.....	A94
19875.....	A183	71003.....	A134	74027.....	A103	82354.....	A94
19906.....	A167	71004.....	A133	74028.....	A103	82395.....	A94
19907.....	A168	71005.....	A134	74029.....	A103	82396.....	A94
19912.....	A167	71006.....	A133	74030.....	A103	82397.....	A94
19915.....	A167	71007.....	A134	74031.....	A103	82500.....	A96
19916.....	A168	71008.....	A133	74032.....	A103	82501.....	A96
19920.....	A180	71010.....	A133	74615.....	A102	82505.....	A96
19921.....	A180	71011.....	A134	74615B.....	A102	82507.....	A96
19922.....	A180	71013.....	A134	74616.....	A102	82509.....	A96
19925.....	A180	71014.....	A133	74616B.....	A102	82510.....	A96
19926.....	A180	71015.....	A134	74617.....	A102	82513.....	A96
19927.....	A188	71017.....	A134	74617B.....	A102	82514.....	A96
19928.....	A188	71019.....	A134	74619.....	A102	82515.....	A96
19929.....	A188	72615.....	A95	74619B.....	A102	82516.....	A96
19930.....	A188	72615B.....	A95	74620.....	A102	82517.....	A96
19932.....	A188	72616.....	A95	74620B.....	A102	82518.....	A96
19933.....	A188	72616B.....	A95	74621.....	A102	82519.....	A96
19934.....	A188	72617.....	A95	74621B.....	A102	82520.....	A96
19935.....	A188	72617B.....	A95	74622.....	A102	82521.....	A96
19936.....	A188	72619.....	A95	74622B.....	A102	82522.....	A96
19937.....	A188	72619B.....	A95	74623.....	A102	82523.....	A96
19938.....	A188	72620.....	A95	74623B.....	A102	82600.....	A92
19939.....	A188	72620B.....	A95	74624.....	A102	82601.....	A92
19941.....	A184	72621.....	A95	74624B.....	A102	82601B.....	A92
19943.....	A184	72621B.....	A95	74625.....	A102	82602.....	A92
19948.....	A185	72622.....	A95	74625B.....	A102	82603.....	A92
19949.....	A185	72622B.....	A95	74626.....	A102	82604.....	A92
19950.....	A185	72623.....	A95	74626B.....	A102	82605.....	A92
19951.....	A185	72623B.....	A95	74627.....	A102	82605B.....	A92
19952.....	A185	72624.....	A95	74627B.....	A102	82606.....	A92
19953.....	A185	72624B.....	A95	74628.....	A102	82607.....	A92
19954.....	A185	72625.....	A95	74628B.....	A102	82607B.....	A92
19955.....	A167	72625B.....	A95	74629.....	A102	82608.....	A92
25830.....	A145	72626.....	A95	74629B.....	A102	82609.....	A92
25833.....	A145	72626B.....	A95	74630.....	A102	82609B.....	A92
25836.....	A145	72627.....	A95	74630B.....	A102	82610.....	A92
25839.....	A145	72627B.....	A95	74631.....	A102	82610B.....	A92
25842.....	A145	72628.....	A95	74631B.....	A102	82611.....	A92
25843.....	A145	72628B.....	A95	74632.....	A102	82612.....	A92
25848.....	A145	72629.....	A95	74632B.....	A102	82613.....	A93
25850.....	A145	72629B.....	A95	74633.....	A102	82613B.....	A93
25852.....	A145	72630.....	A95	74633B.....	A102	82614.....	A93
25854.....	A145	72630B.....	A95	74815.....	A102	82614B.....	A93
25856.....	A145	72631.....	A95	74817.....	A102	82615.....	A93
25864.....	A145	72631B.....	A95	74819.....	A102	82615B.....	A93
25867.....	A146	72632.....	A95	74820.....	A102	82616.....	A93
25868.....	A146	72632B.....	A95	74823.....	A102	82616B.....	A93
25869.....	A146	72633.....	A95	74825.....	A102	82617.....	A93
25870.....	A146	72633B.....	A95	74827.....	A102	82617B.....	A93
25871.....	A146	72815.....	A95	74915.....	A102	82618.....	A93
25872.....	A146	72817.....	A95	74917.....	A102	82618B.....	A93
25873.....	A146	72819.....	A95	74919.....	A102	82619.....	A93
70000.....	A129	72820.....	A95	74920.....	A102	82619B.....	A93
70002.....	A129	72823.....	A95	74923.....	A102	82620.....	A93
70003.....	A130	72825.....	A95	74925.....	A102	82620B.....	A93
70004.....	A129	72827.....	A95	74927.....	A102	82621.....	A93
70005.....	A130	72831.....	A95	81657.....	A94	82621B.....	A93
70006.....	A129	72915.....	A95	82301.....	A92	82622.....	A93
70007.....	A130	72917.....	A95	82305.....	A92	82622B.....	A93
70008.....	A129	72919.....	A95	82307.....	A92	82623.....	A92
70009.....	A130	72920.....	A95	82309.....	A92	82624.....	A92
70010.....	A129	72923.....	A95	82310.....	A92	82625.....	A94
70011.....	A130	72925.....	A95	82313.....	A93	82625B.....	A94
70012.....	A129	72927.....	A95	82314.....	A93	82626.....	A94
70013.....	A130	72930.....	A95	82315.....	A93	82626B.....	A94
70014.....	A129	72931.....	A95	82316.....	A93	82627.....	A94
70015.....	A130	74015.....	A103	82317.....	A93	82627B.....	A94
70016.....	A129	74016.....	A103	82318.....	A93	82628.....	A94
70018.....	A129	74017.....	A103	82319.....	A93	82628B.....	A94
70020.....	A129	74019.....	A103	82320.....	A93	82629.....	A92
70023.....	A130	74020.....	A103	82321.....	A93	82630.....	A92
70024.....	A129	74021.....	A103	82322.....	A93	82631.....	A93
70026.....	A129	74022.....	A103	82325.....	A94	82632.....	A93
70029.....	A130	74023.....	A103	82326.....	A94	82633.....	A93

Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)
82634.....	A92	82694.....	A94	83810.....	A127	84048.....	A100
82634B.....	A92	82695.....	A94	83811.....	A128	84049.....	A100
82635.....	A92	82695B.....	A94	83812.....	A127	84050.....	A101
82635B.....	A92	82696.....	A94	83813.....	A128	84051.....	A101
82636.....	A92	82696B.....	A94	83814.....	A127	84052.....	A101
82637.....	A92	82697.....	A94	83815.....	A128	84053.....	A101
82637B.....	A92	82697B.....	A94	83816.....	A127	84054.....	A101
82638.....	A92	82700B.....	A94	83817.....	A128	84055.....	A101
82639.....	A92	82701B.....	A94	83818.....	A127	84056.....	A101
82639B.....	A92	82702B.....	A94	83819.....	A128	84077.....	A100
82640.....	A92	82703B.....	A94	83820.....	A127	84083.....	A100
82640B.....	A92	82705B.....	A94	83821.....	A128	84084.....	A100
82641.....	A92	82706B.....	A94	83824.....	A127	84085.....	A100
82642.....	A92	82707B.....	A94	83826.....	A127	84301.....	A97
82643.....	A93	82708B.....	A94	83827.....	A128	84303.....	A97
82643B.....	A93	82709B.....	A94	83828.....	A127	84305.....	A97
82644.....	A93	82710B.....	A94	83835.....	A128	84307.....	A97
82644B.....	A93	82901.....	A92	83836.....	A127	84309.....	A97
82645.....	A93	82905.....	A92	83861.....	A128	84310.....	A97
82645B.....	A93	82907.....	A92	83862.....	A127	84313.....	A98
82646.....	A93	82909.....	A92	83863.....	A128	84314.....	A98
82646B.....	A93	82910.....	A92	83865.....	A128	84315.....	A98
82647.....	A93	82913.....	A93	83868.....	A127	84316.....	A98
82647B.....	A93	82914.....	A93	83870.....	A127	84317.....	A98
82648.....	A93	82915.....	A93	83874.....	A127	84318.....	A98
82648B.....	A93	82916.....	A93	83875.....	A128	84319.....	A98
82649.....	A93	82917.....	A93	83878.....	A127	84320.....	A98
82649B.....	A93	82918.....	A93	83940.....	A105	84321.....	A98
82650.....	A93	82919.....	A93	83941.....	A105	84322.....	A98
82650B.....	A93	82920.....	A93	83942.....	A105	84325.....	A99
82651.....	A93	82921.....	A93	83943.....	A105	84326.....	A99
82651B.....	A93	82922.....	A93	83944.....	A105	84327.....	A99
82652.....	A93	82925.....	A94	83945.....	A105	84328.....	A99
82652B.....	A93	82926.....	A94	83946.....	A105	84353.....	A98
82653.....	A94	82927.....	A94	83947.....	A105	84354.....	A99
82653B.....	A94	82928.....	A94	83960.....	A105	84395.....	A99
82654.....	A94	82953.....	A94	83961.....	A105	84396.....	A99
82654B.....	A94	82954.....	A94	83962.....	A105	84397.....	A99
82655.....	A94	82995.....	A94	83963.....	A105	84500.....	A104
82655B.....	A94	82996.....	A94	83964.....	A105	84501.....	A104
82656.....	A94	82997.....	A94	83965.....	A105	84505.....	A104
82656B.....	A94	83640.....	A105	83966.....	A105	84507.....	A104
82657.....	A92	83640B.....	A105	83967.....	A105	84509.....	A104
82658.....	A93	83641.....	A105	84001.....	A100	84510.....	A104
82659.....	A92	83641B.....	A105	84002.....	A100	84513.....	A104
82660.....	A92	83642.....	A105	84003.....	A100	84514.....	A104
82661.....	A92	83642B.....	A105	84004.....	A100	84515.....	A104
82662.....	A93	83643.....	A105	84005.....	A100	84516.....	A104
82663.....	A93	83643B.....	A105	84006.....	A100	84517.....	A104
82664.....	A93	83644.....	A105	84007.....	A100	84518.....	A104
82665.....	A92	83644B.....	A105	84009.....	A100	84519.....	A104
82665B.....	A92	83645.....	A105	84010.....	A100	84520.....	A104
82666.....	A93	83645B.....	A105	84013.....	A100	84521.....	A104
82667.....	A92	83646.....	A105	84014.....	A100	84522.....	A104
82668.....	A93	83646B.....	A105	84015.....	A100	84523.....	A104
82669.....	A92	83647.....	A105	84016.....	A100	84601.....	A97
82670.....	A92	83647B.....	A105	84017.....	A100	84601B.....	A97
82671.....	A93	83660.....	A105	84018.....	A100	84602.....	A97
82672.....	A94	83660B.....	A105	84019.....	A100	84603.....	A97
82673.....	A93	83661.....	A105	84020.....	A100	84603B.....	A97
82674.....	A93	83661B.....	A105	84021.....	A101	84604.....	A97
82675.....	A93	83662.....	A105	84022.....	A101	84605.....	A97
82676.....	A93	83662B.....	A105	84025.....	A101	84605B.....	A97
82677.....	A94	83663.....	A105	84026.....	A101	84606.....	A97
82678.....	A93	83663B.....	A105	84027.....	A101	84607.....	A97
82679B.....	A94	83664.....	A105	84028.....	A101	84607B.....	A97
82680.....	A93	83664B.....	A105	84033.....	A100	84609.....	A97
82681.....	A93	83665.....	A105	84034.....	A100	84609B.....	A97
82682.....	A93	83665B.....	A105	84035.....	A100	84610.....	A97
82683.....	A92	83666.....	A105	84037.....	A100	84610B.....	A97
82684.....	A92	83666B.....	A105	84039.....	A100	84611.....	A97
82686.....	A92	83667.....	A105	84040.....	A100	84612.....	A97
82688.....	A93	83667B.....	A105	84043.....	A100	84613.....	A98
82689.....	A93	83806.....	A127	84044.....	A100	84613B.....	A98
82690.....	A92	83807.....	A128	84045.....	A100	84614.....	A98
82691.....	A93	83808.....	A127	84046.....	A100	84614B.....	A98
82692.....	A93	83809.....	A128	84047.....	A100	84615.....	A98

Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)
84615B.....	A98	84664.....	A98	84867.....	A132	85519B.....	A113
84616.....	A98	84665.....	A97	84870.....	A131	85520.....	A113
84616B.....	A98	84666.....	A99	84873.....	A132	85520B.....	A113
84617.....	A98	84667.....	A97	84874.....	A131	85521.....	A113
84617B.....	A98	84668B.....	A99	84878.....	A131	85521B.....	A113
84618.....	A98	84669.....	A97	84879.....	A132	85522.....	A113
84618B.....	A98	84670.....	A97	84901.....	A97	85522B.....	A113
84619.....	A98	84671.....	A97	84903.....	A97	85523.....	A112
84619B.....	A98	84671B.....	A97	84905.....	A97	85524.....	A112
84620.....	A98	84672.....	A97	84907.....	A97	85525.....	A113
84620B.....	A98	84673.....	A98	84909.....	A97	85526.....	A113
84621.....	A98	84674.....	A98	84910.....	A97	85527.....	A113
84621B.....	A98	84675.....	A98	84913.....	A98	85528.....	A113
84622.....	A98	84676.....	A98	84914.....	A98	85529.....	A112
84622B.....	A98	84677.....	A98	84915.....	A98	85530.....	A112
84623.....	A97	84678.....	A98	84916.....	A98	85531.....	A112
84624.....	A97	84679.....	A98	84917.....	A98	85532.....	A113
84625.....	A99	84680.....	A98	84918.....	A98	85533.....	A113
84625B.....	A99	84681.....	A98	84919.....	A98	85534.....	A112
84626.....	A99	84682.....	A98	84920.....	A98	85535.....	A112
84626B.....	A99	84683.....	A97	84921.....	A98	85536.....	A112
84627.....	A99	84684.....	A97	84922.....	A98	85537.....	A112
84627B.....	A99	84685.....	A97	84925.....	A99	85538.....	A112
84628.....	A99	84686.....	A99	84926.....	A99	85539.....	A112
84628B.....	A99	84687.....	A97	84927.....	A99	85540.....	A112
84629.....	A97	84688.....	A98	84928.....	A99	85541.....	A112
84630.....	A97	84689.....	A98	84953.....	A98	85542.....	A112
84631.....	A98	84691.....	A98	84954.....	A99	85543.....	A112
84633.....	A98	84692.....	A98	84995.....	A99	85544.....	A112
84634.....	A97	84693.....	A99	84996.....	A99	85545.....	A112
84634B.....	A97	84694.....	A99	84997.....	A99	85546.....	A113
84635.....	A97	84695.....	A99	85401.....	A112	85547.....	A113
84635B.....	A97	84695B.....	A99	85405.....	A112	85548.....	A113
84636.....	A97	84696.....	A99	85407.....	A112	85549.....	A113
84637.....	A97	84696B.....	A99	85409.....	A112	85550.....	A113
84637B.....	A97	84697.....	A99	85410.....	A112	85551.....	A113
84638.....	A97	84697B.....	A99	85413.....	A112	85552.....	A113
84639.....	A97	84698.....	A99	85414.....	A112	85553.....	A113
84639B.....	A97	84698B.....	A99	85415.....	A112	85554.....	A113
84640.....	A97	84699.....	A99	85416.....	A113	85555.....	A113
84640B.....	A97	84699B.....	A99	85417.....	A113	85556.....	A113
84641.....	A98	84701B.....	A99	85418.....	A113	85557.....	A113
84642.....	A98	84702B.....	A99	85419.....	A113	85558.....	A113
84643.....	A98	84703B.....	A99	85420.....	A113	85560.....	A112
84643B.....	A98	84705B.....	A99	85421.....	A113	85561.....	A112
84644.....	A98	84706B.....	A99	85422.....	A113	85562.....	A112
84644B.....	A98	84707B.....	A99	85501.....	A112	85563.....	A113
84645.....	A98	84709B.....	A99	85501B.....	A112	85564.....	A113
84645B.....	A98	84711B.....	A99	85502.....	A112	85565.....	A113
84646.....	A98	84714B.....	A99	85503.....	A112	85566.....	A113
84646B.....	A98	84715B.....	A99	85504.....	A112	85567.....	A112
84647.....	A98	84801.....	A132	85505.....	A112	85570.....	A112
84647B.....	A98	84802.....	A131	85505B.....	A112	85574.....	A112
84648.....	A98	84803.....	A132	85506.....	A112	85576.....	A113
84648B.....	A98	84804.....	A131	85507.....	A112	85578.....	A113
84649.....	A98	84805.....	A132	85507B.....	A112	85601.....	A120
84649B.....	A98	84806.....	A131	85508.....	A112	85603.....	A120
84650.....	A98	84807.....	A132	85509.....	A112	85605.....	A120
84650B.....	A98	84808.....	A131	85509B.....	A112	85607.....	A120
84651.....	A98	84809.....	A132	85510.....	A112	85609.....	A120
84651B.....	A98	84810.....	A131	85510B.....	A112	85610.....	A120
84652.....	A98	84811.....	A132	85511.....	A112	85613.....	A120
84652B.....	A98	84812.....	A131	85512.....	A112	85614.....	A120
84653.....	A98	84813.....	A132	85512B.....	A112	85615.....	A120
84653B.....	A98	84814.....	A131	85513.....	A112	85616.....	A120
84654.....	A99	84816.....	A131	85513B.....	A112	85617.....	A120
84654B.....	A99	84817.....	A132	85514.....	A112	85618.....	A120
84655.....	A99	84818.....	A131	85514B.....	A112	85619.....	A120
84655B.....	A99	84819.....	A132	85515.....	A112	85620.....	A120
84656.....	A99	84820.....	A131	85515B.....	A112	85621.....	A120
84656B.....	A99	84824.....	A131	85516.....	A113	85622.....	A120
84657.....	A98	84826.....	A131	85516B.....	A113	85623.....	A120
84658.....	A98	84860.....	A131	85517.....	A113	85635.....	A120
84660.....	A97	84861.....	A132	85517B.....	A113	85637.....	A120
84661.....	A99	84862.....	A131	85518.....	A113	85639.....	A120
84662.....	A97	84864.....	A131	85518B.....	A113	85640.....	A120
84663.....	A99	84865.....	A132	85519.....	A113	85643.....	A120

Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)
85644.....	A120	86416.....	A108	86612.....	A136	87015.....	A117
85645.....	A120	86417.....	A108	86614.....	A136	87016.....	A123
85646.....	A120	86418.....	A108	86615.....	A136	87017.....	A117
85647.....	A120	86419.....	A108	86799.....	A137, A139	87018.....	A123
85648.....	A120	86420.....	A108	86800.....	A137, A139	87019.....	A118
85649.....	A120	86421.....	A108	86801.....	A137, A139	87020.....	A123
85650.....	A120	86422.....	A108	86802.....	A137, A139	87021.....	A123
85651.....	A120	86423.....	A108	86803.....	A137, A139	87022.....	A118
85652.....	A120	86424.....	A108	86804.....	A137, A139	87023.....	A123
85700.....	A121	86425.....	A108	86805.....	A137, A139	87025.....	A118
85701.....	A121	86426.....	A108	86806.....	A137, A139	87027.....	A118
85702.....	A121	86427.....	A108	86807.....	A137, A139	87031.....	A117
85703.....	A121	86428.....	A109	86808.....	A137, A139	87032.....	A117
85704.....	A121	86429.....	A109	86809.....	A137, A139	87033.....	A118
85705.....	A121	86430.....	A109	86812.....	A137, A139	87035.....	A117
85706.....	A121	86431.....	A109	86813.....	A137, A139	87037.....	A117
85707.....	A121	86432.....	A109	86816.....	A137, A139	87039.....	A117
85708.....	A121	86433.....	A109	86817.....	A137, A139	87040.....	A117
85709.....	A121	86434.....	A109	86820.....	A137, A139	87043.....	A117
85710.....	A121	86435.....	A109	86821.....	A137, A139	87045.....	A117
85711.....	A121	86436.....	A109	86824.....	A137, A139	87046.....	A117
85712.....	A121	86437.....	A109	86825.....	A137, A139	87047.....	A117
86200.....	A106	86438.....	A109	86828.....	A137, A139	87048.....	A118
86201.....	A106	86439.....	A109	86829.....	A137, A139	87049.....	A118
86202.....	A106	86440.....	A109	86832.....	A137, A139	87050.....	A118
86203.....	A106	86500.....	A110	86833.....	A137, A139	87051.....	A118
86204.....	A106	86501.....	A110	86836.....	A137, A139	87052.....	A118
86205.....	A106	86502.....	A110	86837.....	A137, A139	87072.....	A117
86206.....	A106	86503.....	A110	86840.....	A137, A139	87079.....	A123
86207.....	A106	86504.....	A110	86841.....	A137, A139	87220.....	A116
86208.....	A106	86505.....	A110	86844.....	A137, A139	87221.....	A116
86209.....	A106	86506.....	A110	86845.....	A137, A139	87222.....	A116
86211.....	A106	86507.....	A110	86848.....	A137, A139	87234.....	A114
86212.....	A106	86508.....	A110	86849.....	A137, A139	87235.....	A114
86213.....	A106	86509.....	A110	86852.....	A137, A139	87238.....	A114
86214.....	A106	86511.....	A110	86853.....	A137, A139	87301.....	A115
86215.....	A106	86512.....	A110	86856.....	A137, A139	87304.....	A115
86216.....	A106	86513.....	A110	86857.....	A137, A139	87305.....	A115
86217.....	A106	86514.....	A110	86860.....	A137, A139	87307.....	A115
86218.....	A106	86515.....	A110	86861.....	A137, A139	87309.....	A115
86219.....	A106	86516.....	A110	86864.....	A138	87310.....	A115
86220.....	A106	86517.....	A110	86865.....	A138	87313.....	A115
86221.....	A106	86518.....	A110	86866.....	A138	87314.....	A115
86222.....	A106	86519.....	A110	86867.....	A138	87315.....	A116
86223.....	A106	86520.....	A110	86868.....	A138	87316.....	A116
86224.....	A106	86521.....	A110	86869.....	A138	87317.....	A116
86225.....	A106	86522.....	A110	86870.....	A140	87318.....	A116
86226.....	A106	86523.....	A110	86871.....	A138	87319.....	A116
86227.....	A106	86524.....	A110	86872.....	A140	87320.....	A114
86228.....	A107	86525.....	A110	86873.....	A138	87321.....	A114
86229.....	A107	86526.....	A110	86874.....	A140	87322.....	A114
86230.....	A107	86527.....	A110	86875.....	A138	87323.....	A114
86231.....	A107	86528.....	A111	86876.....	A140	87324.....	A114
86232.....	A107	86529.....	A111	86877.....	A138	87325.....	A114
86233.....	A107	86530.....	A111	86878.....	A140	87326.....	A114
86234.....	A107	86531.....	A111	86879.....	A138	87327.....	A114
86235.....	A107	86532.....	A111	86880.....	A140	87328.....	A114
86236.....	A107	86533.....	A111	86881.....	A138	87329.....	A114
86237.....	A107	86534.....	A111	86882.....	A140	87330.....	A114
86238.....	A107	86535.....	A111	86883.....	A138	87331.....	A114
86239.....	A107	86536.....	A111	86884.....	A140	87332.....	A114
86240.....	A107	86537.....	A111	86885.....	A140	87421.....	A114
86400.....	A108	86538.....	A111	86886.....	A140	87423.....	A114
86401.....	A108	86539.....	A111	86887.....	A140	87430.....	A114
86402.....	A108	86540.....	A111	86888.....	A140	87432.....	A114
86403.....	A108	86600.....	A135	86889.....	A140	87443.....	A117
86404.....	A108	86601.....	A135	87000.....	A123	87500.....	A118
86405.....	A108	86602.....	A135	87001.....	A123	87501.....	A115
86406.....	A108	86603.....	A135	87002.....	A117	87502.....	A115
86407.....	A108	86604.....	A135	87003.....	A117	87503.....	A115
86408.....	A108	86605.....	A135	87005.....	A117	87504.....	A115
86409.....	A108	86606.....	A135	87006.....	A117	87505.....	A115
86411.....	A108	86607.....	A135	87007.....	A123	87506.....	A115
86412.....	A108	86608.....	A135	87009.....	A117	87507.....	A115
86413.....	A108	86609.....	A135	87010.....	A123	87508.....	A118
86414.....	A108	86610.....	A136	87013.....	A117	87509.....	A115
86415.....	A108	86611.....	A136	87014.....	A123	87510.....	A115

Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)	Catalog No.	Page(s)
87511.....	A115	87607.....	A122	89606.....	A125	GT065003 WS32MG.....	A53
87512.....	A115	87608.....	A123	89607.....	A125	GT065004 WS32MG.....	A53
87513.....	A115	87609.....	A122	89613.....	A125	GT065005 WS32MG.....	A53
87514.....	A115	87610.....	A122	89614.....	A125	GT065006 WS32MG.....	A53
87515.....	A116	87611.....	A123	89615.....	A125	GT065007 WS32MG.....	A53
87516.....	A116	87612.....	A122	89616.....	A125	GT065008 WS32MG.....	A53
87517.....	A116	87613.....	A122	89617.....	A125	GT065009 WS32MG.....	A53
87518.....	A116	87614.....	A122	89618.....	A125	GT065010 WS32MG.....	A53
87519.....	A116	87615.....	A122	89619.....	A125	GT105001 WS32MG.....	A42
87520.....	A116	87616.....	A122	89620.....	A125	GT105002 WS32MG.....	A42
87521.....	A116	87617.....	A122	89621.....	A125	GT105003 WS32MG.....	A42
87522.....	A116	87618.....	A122	89622.....	A125	GT105004 WS32MG.....	A42
87523.....	A115	87619.....	A122	89625.....	A125	GT105005 WS32MG.....	A42
87524.....	A115	87620.....	A122	89626.....	A125	GT105006 WS32MG.....	A42
87525.....	A116	87621.....	A122	89627.....	A125	GT105007 WS32MG.....	A42
87526.....	A116	87622.....	A122	89628.....	A125	GT105008 WS32MG.....	A42
87527.....	A116	87623.....	A122	89641.....	A126	GT105009 WS32MG.....	A42
87528.....	A116	87624.....	A122	89643.....	A126	GT105010 WS32MG.....	A42
87529.....	A115	87625.....	A122	89644.....	A126	GT125001 WS32MG.....	A54
87530.....	A115	87626.....	A122	89645.....	A126	GT125002 WS32MG.....	A54
87531.....	A115	87627.....	A123	89646.....	A126	GT125003 WS32MG.....	A54
87532.....	A116	87628.....	A123	GT005001 WP31MG.....	A40	GT125004 WS32MG.....	A54
87533.....	A116	87629.....	A123	GT005002 WP31MG.....	A40	GT125005 WS32MG.....	A54
87534.....	A115	87635.....	A122	GT005003 WP31MG.....	A40	GT125006 WS32MG.....	A54
87535.....	A115	87637.....	A122	GT005004 WP31MG.....	A40	GT125007 WS32MG.....	A54
87536.....	A115	87638.....	A122	GT005005 WP31MG.....	A40	GT125008 WS32MG.....	A54
87537.....	A115	87640.....	A122	GT005006 WP31MG.....	A40	GT125009 WS32MG.....	A54
87538.....	A115	87644.....	A122	GT005007 WP31MG.....	A40	GT125010 WS32MG.....	A54
87539.....	A115	87646.....	A122	GT005008 WP31MG.....	A40	GT145001 WN35MG.....	A43
87540.....	A115	87648.....	A122	GT005009 WP31MG.....	A40	GT145002 WN35MG.....	A43
87541.....	A115	87650.....	A122	GT005010 WP31MG.....	A40	GT145003 WN35MG.....	A43
87542.....	A116	87652.....	A122	GT005011 WP31MG.....	A40	GT145004 WN35MG.....	A43
87543.....	A115	87685.....	A123	GT005012 WP31MG.....	A40	GT145005 WN35MG.....	A43
87544.....	A115	87695.....	A123	GT005013 WP31MG.....	A40	GT145006 WN35MG.....	A43
87545.....	A116	87700.....	A124	GT005014 WP31MG.....	A40	GT145007 WN35MG.....	A43
87546.....	A116	87701.....	A124	GT005015 WP31MG.....	A40	GT165001 WN35MG.....	A55
87547.....	A116	87702.....	A124	GT005016 WP31MG.....	A40	GT165002 WN35MG.....	A55
87548.....	A116	87703.....	A124	GT005017 WP31MG.....	A40	GT165003 WN35MG.....	A55
87549.....	A116	87704.....	A124	GT005018 WP31MG.....	A40	GT165004 WN35MG.....	A55
87550.....	A116	87705.....	A124	GT025001 WP31MG.....	A50	GT165005 WN35MG.....	A55
87551.....	A116	87706.....	A124	GT025002 WP31MG.....	A50	GT165006 WN35MG.....	A55
87552.....	A116	87708.....	A124	GT025003 WP31MG.....	A50	GT165007 WN35MG.....	A55
87553.....	A116	87709.....	A124	GT025004 WP31MG.....	A50	GT205001 GM6515.....	A36
87554.....	A116	87710.....	A124	GT025005 WP31MG.....	A50	GT205002 GM6515.....	A36
87555.....	A116	87711.....	A124	GT025006 WP31MG.....	A50	GT205003 GM6515.....	A36
87556.....	A117	87712.....	A124	GT025007 WP31MG.....	A50	GT205004 GM6515.....	A36
87557.....	A116	88320.....	A119	GT025008 WP31MG.....	A50	GT205005 GM6515.....	A36
87558.....	A116	88321.....	A119	GT025009 WP31MG.....	A50	GT205006 GM6515.....	A36
87559.....	A116	88321B.....	A119	GT025010 WP31MG.....	A50	GT205007 GM6515.....	A36
87560.....	A115	88322.....	A119	GT025011 WP31MG.....	A50	GT205008 GM6515.....	A36
87561.....	A115	88323.....	A119	GT025012 WP31MG.....	A50	GT205009 GM6515.....	A36
87562.....	A115	88323B.....	A119	GT025013 WP31MG.....	A50	GT205010 GM6515.....	A36
87563.....	A116	88324.....	A119	GT025014 WP31MG.....	A50	GT205011 GM6515.....	A36
87564.....	A116	88324B.....	A119	GT025015 WP31MG.....	A50	GT205012 GM6515.....	A36
87565.....	A118	88325.....	A119	GT025016 WP31MG.....	A50	GT205013 GM6515.....	A36
87566.....	A115	88325B.....	A119	GT025017 WP31MG.....	A50	GT205014 GM6515.....	A36
87567.....	A115	88326.....	A119	GT025018 WP31MG.....	A50	GT205015 GM6515.....	A36
87570.....	A115	88327.....	A119	GT045001 WH36MG.....	A52	GT205016 GM6515.....	A36
87571.....	A115	88328.....	A119	GT045002 WH36MG.....	A52	GT205017 GM6515.....	A36
87572.....	A115	88328B.....	A119	GT045003 WH36MG.....	A52	GT205018 GM6515.....	A36
87573.....	A118	88329.....	A119	GT045004 WH36MG.....	A52	GT205019 GM6515.....	A36
87574.....	A116	88330.....	A119	GT045005 WH36MG.....	A52	GT205020 GM6515.....	A36
87575.....	A117	88330B.....	A119	GT045006 WH36MG.....	A52	GT205021 GM6515.....	A36
87576.....	A116	88331.....	A119	GT045007 WH36MG.....	A52	GT205022 GM6515.....	A36
87577.....	A117	88332.....	A119	GT045008 WH36MG.....	A52	GT205023 GM6515.....	A36
87578.....	A116	88332B.....	A119	GT045009 WH36MG.....	A52	GT205024 GM6515.....	A36
87579.....	A117	88421.....	A119	GT045010 WH36MG.....	A52	GT205025 GM6515.....	A36
87580.....	A117	88423.....	A119	GT045011 WH36MG.....	A52	GT205026 GM6515.....	A36
87581.....	A117	88424.....	A119	GT045012 WH36MG.....	A52	GT205027 GM6515.....	A36
87582.....	A117	88425.....	A119	GT045013 WH36MG.....	A52	GT205028 GM6515.....	A36
87585.....	A118	88428.....	A119	GT045014 WH36MG.....	A52	GT205029 GM6515.....	A36
87586.....	A116	88430.....	A119	GT045015 WH36MG.....	A52	GT205030 GM6515.....	A36
87588.....	A117	88432.....	A119	GT045016 WH36MG.....	A52	GT205031 GP6520.....	A36
87601.....	A122	89599.....	A125	GT045017 WH36MG.....	A52	GT205032 GP6520.....	A36
87603.....	A122	89601.....	A125	GT045018 WH36MG.....	A52	GT205033 GP6520.....	A36
87605.....	A122	89602.....	A125	GT065001 WS32MG.....	A53	GT205034 GP6520.....	A36
87606.....	A123	89604.....	A125	GT065002 WS32MG.....	A53	GT205035 GP6520.....	A36

WIDIA
GTD™

Catalog No.	Page(s)
GT315006 GP6521.....	A47
GT315007 GP6520.....	A47
GT315008 GP6520.....	A47
GT315009 GP6520.....	A47
GT315010 GP6520.....	A47
GT315011 GP6520.....	A47
GT315012 GP6520.....	A47
GT315014 GP6520.....	A67
GT315016 GP6520.....	A67
GT315017 GP6520.....	A67
GT315019 GP6520.....	A67
GT315021 GP6520.....	A67
GT315025 GP6520.....	A67
GT315027 GP6520.....	A67
GT315028 GP6520.....	A67
GT315030 GP6520.....	A67
GT315032 GP6520.....	A67
GT325001 GP6520.....	A48
GT325002 GP6520.....	A48
GT325003 GP6520.....	A48
GT325004 GP6520.....	A48
GT325005 GP6520.....	A48
GT325006 GP6520.....	A48
GT325007 GP6520.....	A48
GT325008 GP6520.....	A48
GT325009 GP6520.....	A48
GT335001 GP6520.....	A49
GT335002 GP6520.....	A49
GT335003 GP6520.....	A49
GT335004 GP6520.....	A49
GT335005 GP6520.....	A49
GT335006 GP6520.....	A49
GT335007 GP6520.....	A49
GT335008 GP6520.....	A49
GT335009 GP6520.....	A49
GT405001 GP6520.....	A58
GT405002 GP6520.....	A58
GT405003 GP6520.....	A58
GT405004 GP6520.....	A58
GT405005 GP6520.....	A58
GT405006 GP6520.....	A58
GT405007 GP6520.....	A58
GT405008 GP6520.....	A58
GT405009 GP6520.....	A58
GT405010 GP6520.....	A58
GT405011 GP6520.....	A58
GT405012 GP6520.....	A56
GT405013 GP6520.....	A56
GT405014 GP6520.....	A56
GT405015 GP6520.....	A56
GT405016 GP6520.....	A56
GT405017 GP6520.....	A56
GT405018 GP6520.....	A56
GT405019 GP6520.....	A56
GT405020 GP6520.....	A56
GT405021 GP6520.....	A56
GT405022 GP6520.....	A56
GT405023 GP6520.....	A56
GT405024 GP6520.....	A56
GT405025 GP6520.....	A56
GT405026 GP6520.....	A56
GT405027 GP6520.....	A56
GT405028 GP6520.....	A56
GT405029 GP6520.....	A56
GT405030 GP6520.....	A57
GT405031 GP6520.....	A57
GT405032 GP6520.....	A57
GT405033 GP6520.....	A57
GT405034 GP6520.....	A57
GT405035 GP6520.....	A57
GT405036 GP6520.....	A57
GT405037 GP6520.....	A57
GT405038 GP6520.....	A57
GT415001 GP6520.....	A59
GT415002 GP6520.....	A59
GT415003 GP6520.....	A59
GT415004 GP6520.....	A59
GT425001 GP6520.....	A60
GT425002 GP6520.....	A60
GT425003 GP6520.....	A60
GT425004 GP6520.....	A60
GT425005 GP6520.....	A60
GT425006 GP6520.....	A60
GT425007 GP6520.....	A60
GT425008 GP6520.....	A60
GT425009 GP6520.....	A60
GT435001 GP6520.....	A61
GT435002 GP6520.....	A61
GT435003 GP6520.....	A61
GT435004 GP6520.....	A61
GT435005 GP6520.....	A61
GT435006 GP6520.....	A61
GT435007 GP6520.....	A61
GT435008 GP6520.....	A61
GT435009 GP6520.....	A61
GT505001 GP6520.....	A68
GT505002 GP6520.....	A68
GT505003 GP6520.....	A68
GT505004 GP6520.....	A68
GT505005 GP6520.....	A68
GT505006 GP6520.....	A68
GT505007 GP6520.....	A68
GT505008 GP6520.....	A68
GT505009 GP6520.....	A68
GT505010 GP6520.....	A68
GT515001 GP6520.....	A69
GT515002 GP6520.....	A69
GT515003 GP6520.....	A69
GT515004 GP6520.....	A69
GT515005 GP6520.....	A69
GT515006 GP6520.....	A69
GT515007 GP6520.....	A69
GT515008 GP6520.....	A69
GT515009 GP6520.....	A69
GT515010 GP6520.....	A69
GT705001 WN48EG.....	A41
GT705002 WN48EG.....	A41
GT705003 WN48EG.....	A41
GT705004 WN48EG.....	A41
GT705005 WN48EG.....	A41
GT705006 WN48EG.....	A41
GT705007 WN48EG.....	A41
GT705008 WN48EG.....	A41
GT805001 WN48EG.....	A51
GT805002 WN48EG.....	A51
GT805003 WN48EG.....	A51
GT805004 WN48EG.....	A51
GT805005 WN48EG.....	A51
GT805006 WN48EG.....	A51
GT805007 WN48EG.....	A51
GT805008 WN48EG.....	A51
GT805009 WN48EG.....	A51
GTM115001 WU13PV.....	A220
GTM115002 WU13PV.....	A220
GTM115003 WU13PV.....	A220
GTM115004 WU13PV.....	A220
GTM115005 WU13PV.....	A220
GTM115006 WU13PV.....	A220
GTM115007 WU13PV.....	A220
GTM115008 WU13PV.....	A220
GTM115009 WU13PV.....	A220

North America

- United States**

General Sales: 800-979-4342
 Technical Support: 888-539-5145
w-na.service@widia.com

- Canada**

General Sales: 800-979-4342
 Technical Support: 888-539-5145
w-ca.service@widia.com

- Mexico**

General Sales: 001-888-402-4963
w-mx.service@widia.com

Central/South America

- Argentina**

General Sales: (011) 4719-0700
w-ar.service@widia.com

- Brazil**

General Sales: 55 19 3936 9200
w-br.service@widia.com

- Chile**

General Sales: 56-2-2641177
w-cl.service@widia.com

- El Salvador**

General Sales: (503) 2218 8096
prometca@salnet.net

- Venezuela**

General Sales: 305-595-5175
paxi@bellsouth.net

Africa

- Egypt**

General Sales: +20 2-263-9828
w-uk.service@widia.com

- South Africa**

General Sales: +27 11-397-3540
w-za.service@widia.com

Europe

- Austria**

General Sales: +43-2236-379898
 Technical Support: 0800 291630
w-at.service@widia.com

- Belgium**

General Sales: +32 4 248 48 48
 Technical Support: 0800 80410
w-be.service@widia.com

- Czech Republic**

General Sales: 800 900 840
w-cz.service@widia.com

- France**

General Sales: +33 1 69 77 83 83
 Technical Support: 080 5540 379
w-fr.service@widia.com

- Germany**

General Sales: +49 6172 737-0
 Technical Support: 0800 1015774
w-de.service@widia.com

- Great Britain**

General Sales: 0800 072 4528
 Technical Support: 0800 028 2996
w-uk.service@widia.com

- Hungary**

General Sales: +36 96 618 158
w-hu.service@widia.com

- Ireland**

General Sales: +44 28-9084-9433
w-ie.service@widia.com

- Italy**

General Sales: +39 02-895-961
 Technical Support: 800 916568
w-it.service@widia.com

- Luxembourg**

General Sales: +32 4 248 48 48
w-be.service@widia.com

- Netherlands**

General Sales: +31 26 384 48 51
 Technical Support: 0800 0201131
w-nl.service@widia.com

- Poland**

General Sales: +48 61 6656501
 Technical Support: 00800 4411943
w-pl.service@widia.com

- Portugal**

General Sales: +351 22 4119 400
w-pt.service@widia.com

- Russia**

General Sales: 81080021431044
w-ru.service@widia.com

- Slovakia**

General Sales: 0800-044053
w-sk.service@widia.com

- Spain**

General Sales: +34 93706 06 10
w-es.service@widia.com

- Turkey**

General Sales: +90 216-574-4780
w-tr.service@widia.com

East/Asia Pacific

• **Australia**

General Sales: 613 9755 5302

w-au.service@widia.com

• **Bahrain**

General Sales: 00 971 (0) 5572371

w-uk.service@widia.com

• **China**

General Sales: +86 400 889 2136

Technical Support: +86 400 889 2136

w-cn.service@widia.com

• **Dubai**

General Sales: +971 433 911 46

w-uk.service@widia.com

• **Hong Kong**

General Sales: +86 21 3860 8288

w-cn.service@widia.com

• **India**

General Sales: +91 80 2219 8341

w-in.service@widia.com

• **Indonesia**

General Sales: +62 81 1148 8217

w-sg.service@widia.com

• **Israel**

General Sales: 972 3 556 2211

w-il.service@widia.com

• **Japan**

General Sales: 813 3820 2855

w-jp.service@widia.com

• **Korea**

General Sales: +82 2-2109-5505

w-kr.service@widia.com

• **Kuwait**

General Sales: 00 971 (0) 5572371

w-uk.service@widia.com

• **Malaysia**

General Sales: (6) 03-5569 9080

w-my.service@widia.com

• **New Zealand**

General Sales: 613 9755 5302

w-nz.service@widia.com

• **Pakistan**

General Sales: +92 21 2465305

itsystem@brain.net.pk

• **Philippines**

General Sales: +65 6 2659222

w-sg.service@widia.com

• **Singapore**

General Sales: +65 6 265-9222

w-sg.service@widia.com

• **Taiwan**

General Sales: +886-4-2350 1920

w-tw.service@widia.com

• **Thailand**

General Sales: 662 642 3455

w-th.service@widia.com

• **Vietnam**

General Sales: +84 8 3520 2764

w-sg.service@widia.com



Metalcutting Safety

IMPORTANT SAFETY INSTRUCTIONS

Read before using the tools in this catalog!

Projectile and Fragmentation Hazards

Modern metalcutting operations involve high spindle and cutter speeds and high temperatures and cutting forces. Hot metal chips may fly off the workpiece during metalcutting. Although cutting tools are designed and manufactured to withstand high cutting forces and temperatures, they can sometimes fragment, particularly if they are subjected to over-stress, severe impact, or other abuse.

To avoid injury:

- Always wear appropriate personal protective equipment, including safety goggles, when operating metalcutting machines or working nearby.
- Always make sure all machine guards are in place.

Breathing and Skin Contact Hazards:

Grinding carbide or other advanced cutting tool materials produce dust or mist containing metallic particles. Breathing this dust or mist — especially over an extended period — can cause temporary or permanent lung disease or make existing medical conditions worse. Contact with this dust or mist can irritate eyes, skin, and mucous membranes and may make existing skin conditions worse.

To avoid injury:

- Always wear breathing protection and safety goggles when grinding.
- Provide ventilation control and collect and properly dispose of dust, mist, or sludge from grinding.
- Avoid skin contact with dust or mist.

For more information, read the applicable Material Safety Data Sheet provided by Kennametal and consult General Industry Safety and Health Regulations, Part 1910, Title 29 of the Code of Federal Regulations.

These safety instructions are general guidelines. Many variables affect machining operations. It is impossible to cover every specific situation. The technical information included in this catalog and recommendations on machining practices may not apply to your particular operation. For more information, consult Kennametal's Metalcutting Safety booklet, available free from Kennametal at 724.539.5747 or fax 724.539.5439. For specific product safety and environmental questions, contact our Corporate Environmental Health and Safety Office at 724.539.5066 or fax 724.539.5372.

CIRCLE, CLAPDICO, EM-MS, EM-NI, EM-TI, Erickson, GN515, GP6505, GP6520, Green Box, GT, GTD, GUN, HANITA, Lightning, MANCHESTER, METAL REMOVAL, METCUT, RUBIG, TN6525, ToolBOSS, TRU-LEDE, VariDrill, VariMill II, Victory, Widaflex, and WIDIA are trademarks of Kennametal, Inc. and are used as such herein. The absence of a product, service name, or logo from this list does not constitute a waiver of Kennametal's trademark or other intellectual property rights concerning that name or logo.

INCONEL® is a registered trademark of Special Metals Corporation.

©Copyright 2011 by Kennametal Inc., Latrobe, PA 15650. All rights reserved.

TAPPING | THREADING

World and Corporate Headquarters

Kennametal Inc.
WIDIA Products Group
1600 Technology Way
Latrobe, PA 15650 USA
Phone: 800.979.4342
E-mail: w-na.service@widia.com

European Headquarters

Kennametal Europe GmbH
WIDIA Products Group
Rheingoldstrasse 50
CH 8212 Neuhausen am Rheinfall
Switzerland
Phone: (41) 52.6750.100
E-mail: w-ch.service@widia.com

Asia-Pacific Headquarters

Kennametal (Singapore) Pte. Ltd.
WIDIA Products Group
No. 11 Gul Link Jurong
Singapore 629381
Phone: (65) 6.2659222
E-mail: w-sg.service@widia.com

India Headquarters

Kennametal India Limited
WIDIA Products Group
8/9th Mile, Tumkur Road
Bangalore - 560 073
Phone: +91 (80) 2839 4321
E-mail: w-in.service@widia.com

©2011 Kennametal Inc. All rights reserved. A-11-02667EN



WWW.WIDIA.COM