METALWORKING PRODUCTS

Deep hole drilling

Product catalog and application guide

DEEP HOLE DRILLING

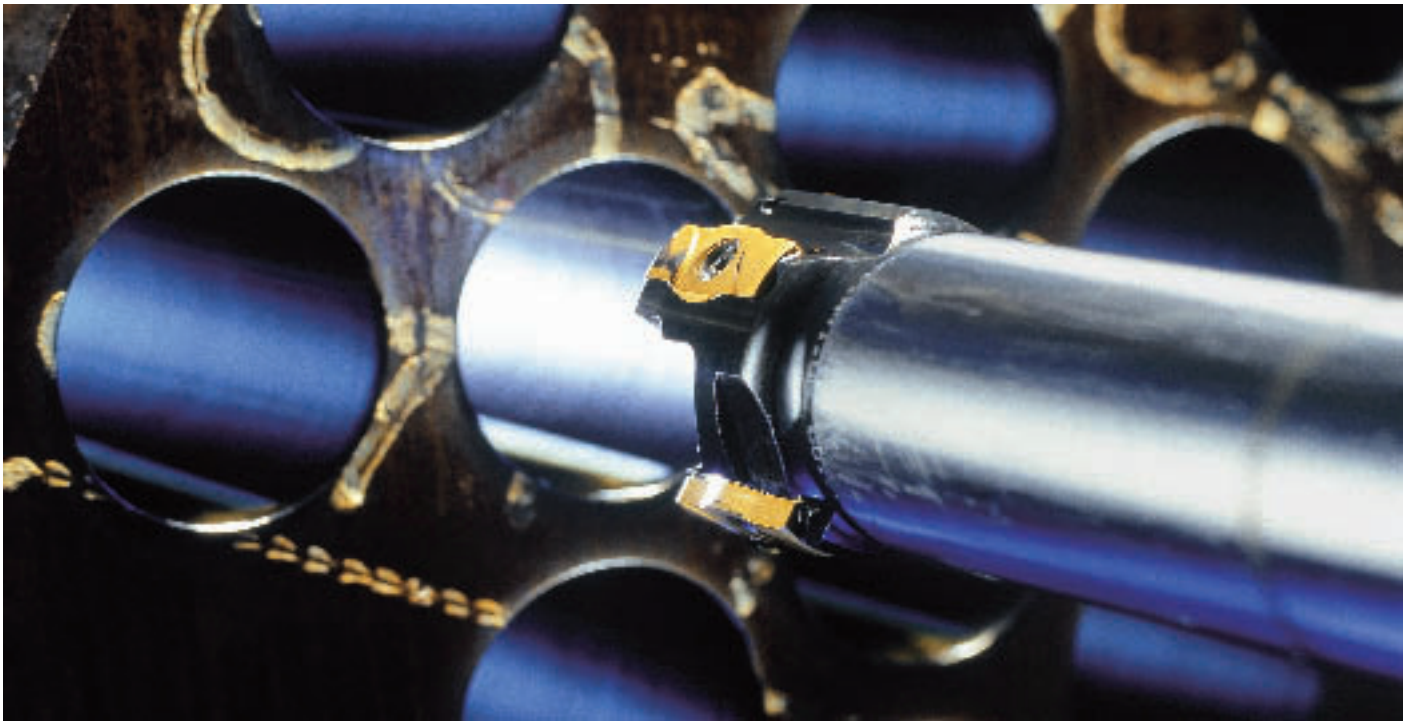
In CANADA, call us toll-free
1-800-268-0703

SANDVIK
Coromant

In the UNITED STATES call us toll-free
1-800-SANDVIK (1-800-726-3845)

Deep hole drilling

high material removal rate with high accuracy



For troublefree production – try the first deep hole drill for Ejector/STS with indexable inserts and fixed insert pockets.

Deep hole drilling is the machining of holes with a relatively large depth to diameter ratio, whereas normal drilling techniques produce holes where the depth is rarely more than five times the diameter. In deep hole drilling the ratio may reach 150:1, and any hole deeper than ten times the diameter should certainly be considered a deep hole, requiring a specialized drilling technique.

Deep hole drilling can employ various machine set-ups: rotating workpiece, rotating tool, or both tool and workpiece rotating. The most common, however, is for the workpiece to rotate, while the tool supplies the linear feed movement.

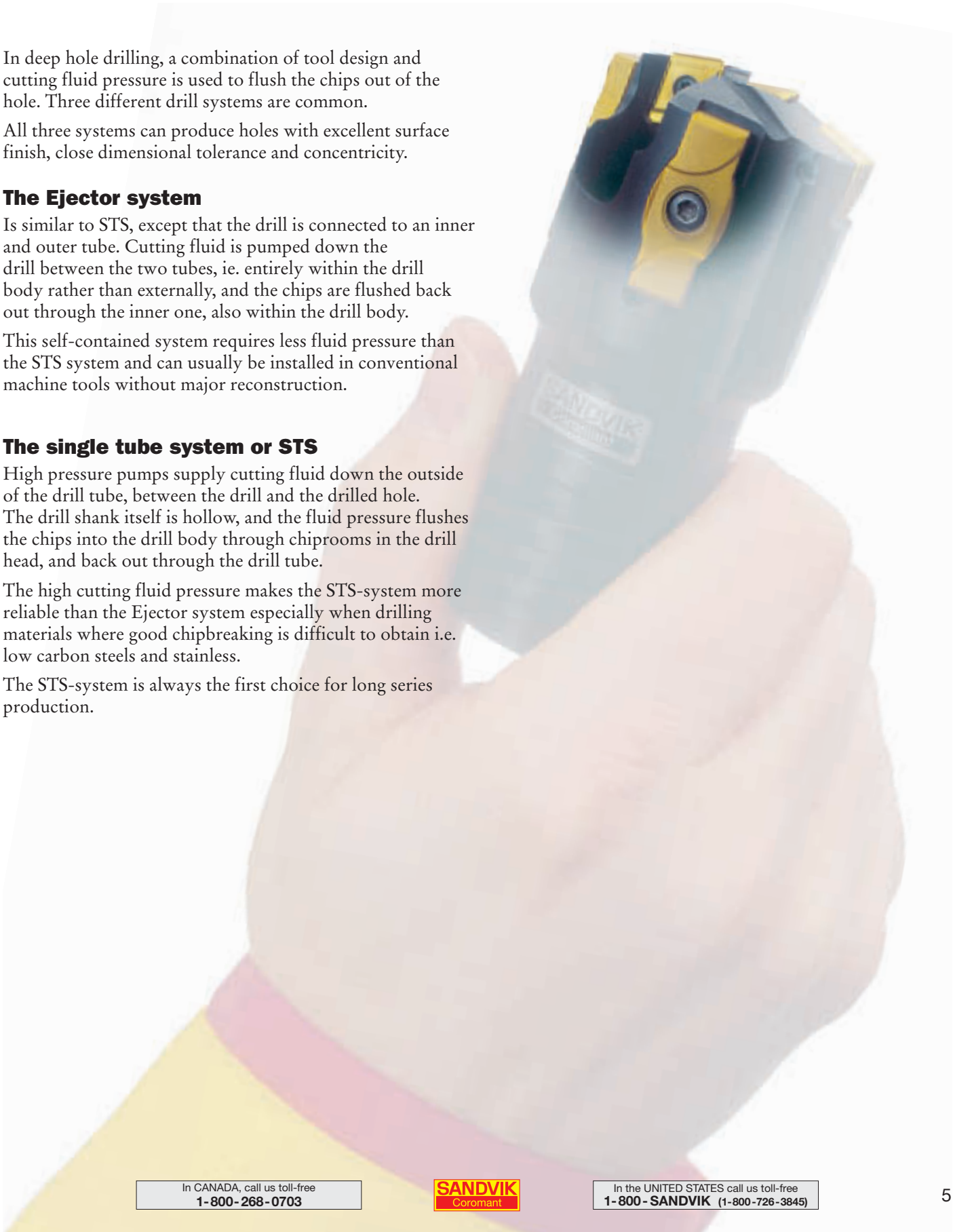
Whichever set-up is employed, the basic principles of drilling still apply, and the correct choice of cutting speeds and feeds are still crucial. Satisfactory chip breaking, and removing the chips from the cutting edges without damaging tool or workpiece, is essential.

Gun drilling is capable of producing smaller holes than the Single Tube System (STS), but the STS system is far more productive (4 – 6 times) and should always be the first choice when possible. The Ejector system is an alternative to STS when drilling smaller batch quantities as it does not require a special machine.

Different deep hole drilling systems

In deep hole drilling, a combination of tool design and cutting fluid pressure is used to flush the chips out of the hole. Three different drill systems are common.

All three systems can produce holes with excellent surface finish, close dimensional tolerance and concentricity.



The Ejector system

Is similar to STS, except that the drill is connected to an inner and outer tube. Cutting fluid is pumped down the drill between the two tubes, ie. entirely within the drill body rather than externally, and the chips are flushed back out through the inner one, also within the drill body.

This self-contained system requires less fluid pressure than the STS system and can usually be installed in conventional machine tools without major reconstruction.

The single tube system or STS

High pressure pumps supply cutting fluid down the outside of the drill tube, between the drill and the drilled hole. The drill shank itself is hollow, and the fluid pressure flushes the chips into the drill body through chiprooms in the drill head, and back out through the drill tube.

The high cutting fluid pressure makes the STS-system more reliable than the Ejector system especially when drilling materials where good chipbreaking is difficult to obtain i.e. low carbon steels and stainless.

The STS-system is always the first choice for long series production.

We are dedicated to supply your needs

Our technical staff will help you to reach your objectives in your applications.

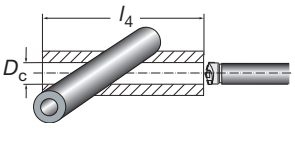
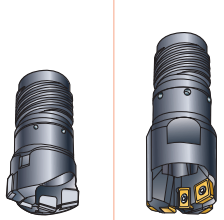
We provide you with quality products suitable for your business. Add to that our technical service, delivery and commercial service.

Together, we can strengthen your competitiveness. By working in close partnership with you, we contribute to improvements in your productivity, production economy and machine utilization.

Sandvik Coromant also recognizes your increasing demands for environmental concerns and offers a service to collect used carbide inserts, which are broken down to their original raw material state – in the most eco-friendly way.

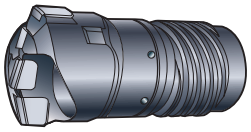
DEEP HOLE DRILLING

Ejector system

Data and applications • **Solid drill heads** • **Trepanning heads** • **Counterboring heads**	**Ejector** **Solid drilling**		**Ejector** **Solid drilling**	**Ejector** **Counterboring**		
	424.6	**800.24**	**424.10**	**424.31F**	**424.31**	**424.32**
						
Drill diameter, D_c **Drilling depth, l_4**	**.724 - 2.559** **100 × D_c**	**.984 - 2.559** **100 × D_c**	**≥ 2.500** **100 × D_c**	**.787 - 4.882** **100 × D_c**	**≥ 2.559** **100 × D_c**	**≥ 2.953** **100 × D_c**
Page	12	16	20	26	26	71
Machine						
– DHD machines	Yes		Yes	Yes		
– NC machines	Yes		Yes	Yes		
– Lathes	Yes		Yes	Yes		
– Most conventional machines	Yes		Yes	Yes		
– Machining centers	Yes		Yes	Yes		
– Special gun drilling machines	–		–	–		
Workpiece material						
– Steel **P**	✦✦✦	✦✦✦	✦✦✦	✦✦✦	✦✦✦	✦✦✦
– Stainless steel **M**	✦	✦✦	✦✦✦	✦✦✦	✦✦✦	✦✦✦
– Cast iron **K**	✦✦✦	✦✦✦	✦✦✦	✦✦✦	✦✦✦	✦✦✦
– Aluminum alloys **N**	✦✦	✦✦✦	✦✦✦	✦✦	✦✦	✦✦
– Heat resistant alloys **S**	✦	✦✦	✦✦✦			
Tool						
– Internal cutting fluid supply	Yes	Yes	Yes	Yes	Yes	Yes
– Insert type	–	800-XX T3 08M 800-XX T3 08H	TPMT/R424.9 TPMX/TPUN	R424.31F/ SNMG/SNMM	TPMX/TPUN SNMG/SNMM	TPMT/R424.9
Cutting data	See pages 86-98					

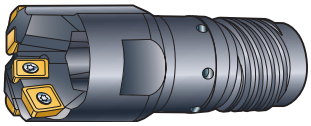
Good = ✦✦✦ ⟷ ✦ *= Fair*

Ground drill head 424.6



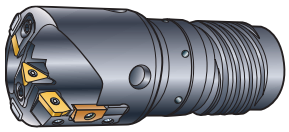
- 4-6 times faster than gun drilling
- The first choice for hole diameters .724 - .984 inch or for dia. .984 - 2.559 inch when extra close diameter tolerance is demanded
- Low investment cost for small batch production
- Standard program

CoroDrill™ 800.24



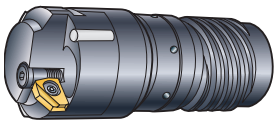
- The most productive choice for diameter range .984 - 2.559 inch
- Lowest cost per hole
- Consistent performance within a wide application range
- Standard program
- Developed and manufactured with the latest technology

T-MAX® drill 424.10



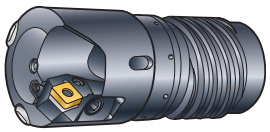
- The choice for larger diameters starting from 2.500 inch
- Setting possibilities on diameter
- Good hole straightness in long workpieces
- Stocked standard program
- Wide range of Tailor Made and engineered solutions

T-MAX® 424.31F counterboring head – on request



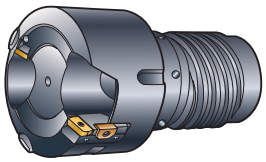
- When demands for precision, productivity and versatility are high
- Single insert design
- Adjustable insert cartridge head
- Stocked standard components

T-MAX® 424.31 counterboring head – on request



- When demands for productivity and versatility are high
- Single insert design
- Adjustable insert cartridge head
- Stocked standard components

T-MAX® 424.32 counterboring head – on request



- Multi-insert design
- Adjustable insert cartridge head
- Wide range of engineered solutions
- Stocked standard components

Tool mounting – solid drilling and counterboring

Diameter range, inch

Drill heads

Drill tubes

Vibration dampers (optional)

Solid drilling

Brazed drill head
424.6
Page 14

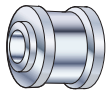
.724–2.559

CoroDrill™ indexable insert drill head 800.24
Page 18

.984–2.559

Outer tube 424.2-
Page 15/19

Vibration damper 342-
Page 76



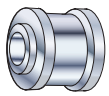
Inner tube 424.2-
Page 15/19

T-Max adjustable drill head 424.10
Page 22

2.500–7.240

Outer tube 424.2-
Page 23

Vibration damper 342-
Page 76



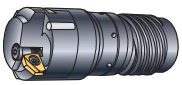
Inner tube 424.2-
Tube range 13
Page 23

Inner tube 424.2-
Tube range 14–25
Page 23

Counterboring

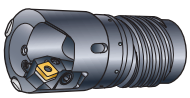
T-Max single insert counterboring head 424.31F
Page 28/30

.787–4.882



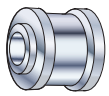
T-Max single insert counterboring head 424.31
Page 32

≥2.559



Outer tube 424.2-
Page 29/31/33

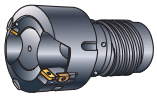
Vibration damper 342-
Page 76



Inner tube 424.2-
Tube range 00–13
Page 29/31

T-Max multi insert counterboring head 424.32
Page 71

≥2.953

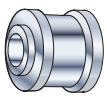


Inner tube 424.2-
Tube range 14–25
Page 31/33

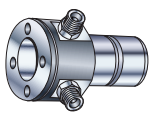
Suitable for drill diameter range 2.559–7.240

Outer tube 424.9S-
Tube range 14–25
Page 38

Vibration damper 342-
Page 76



Non rotating



Drill tube mounted
424.9S/232-1-
Page 38

Collet/ connecting sleeve

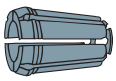
Sealing sleeve

O-ring

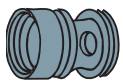
Connectors

Type of mounting

Tube range 00–13
Page 34

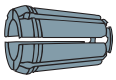


Tube range 00–13
Page 34

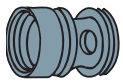


Tube range 00–13
Page 34

Tube range 13
Page 34

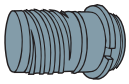


Tube range 13
Page 34



Tube range 13
Page 34

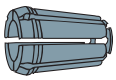
Tube range 14–25
Page 35



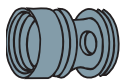
Tube range 14–25
Page 35

Tube range 14–25
Page 35

Tube range 00–13
Page 34

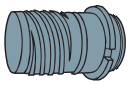


Tube range 00–13
Page 34



Tube range 00–13
Page 34

Tube range 14–25
Page 35

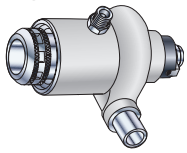


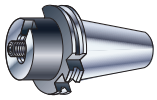
Tube range 14–25
Page 35

Tube range 14–25
Page 35

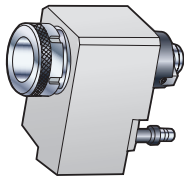
Rotating

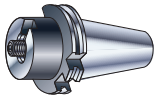
Varilock adapted – manual tool change
Page 36



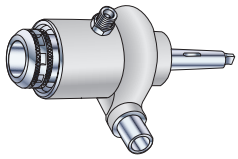


Varilock adapted – automatic tool change
Page 39



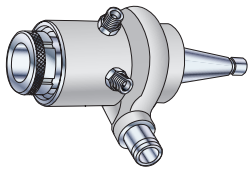


With Morse taper
Page 36



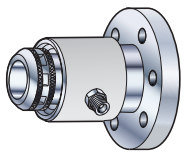
Morse taper

With ISO taper
Page 36



ISO taper

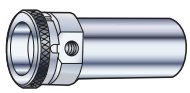
Flange mounted
Page 36



Flange mounted

Non rotating

Cylindrical
Page 37

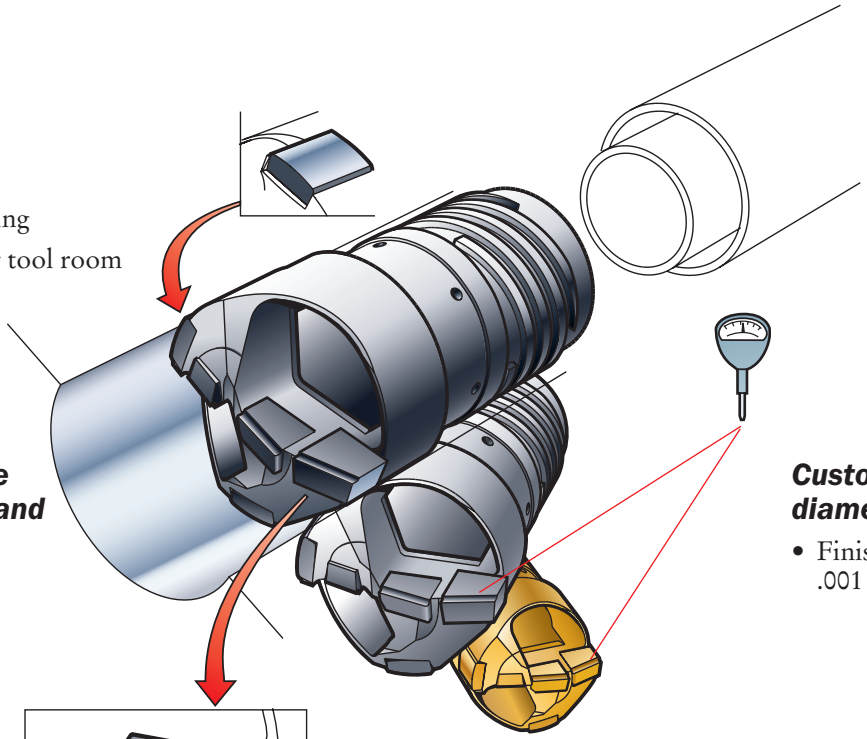


Cylindrical

Ground drill head 424.6

"The original" precision drill

Diameter range .724–2.559 inch



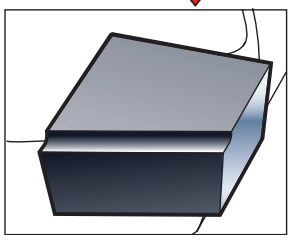
Easy to use

- No pre-setting
- No need for tool room service

Excellent hole straightness and surface finish

Customer specified diameter

- Finish ground within .001 inch increments



Reliable performance

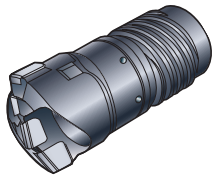
- Robust design enables high feed rates
- Sintered insert geometries ensure consistant troublefree chip control in most materials

Wide application area

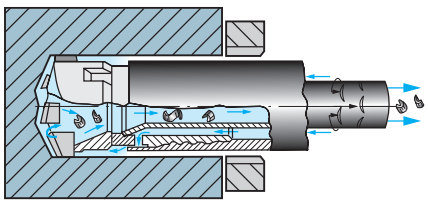
- Optimized grade- and geometry combinations for most workpiece materials

Ground drill head 424.6

- ***4 to 6 times faster than gun drilling***
- ***The first choice for hole diameters .724 – .984 inch, or in diameter range .984 – 2.559 when extra close diameter tolerance is demanded***
- ***Low investment cost for small batch production***
- ***Standard program***

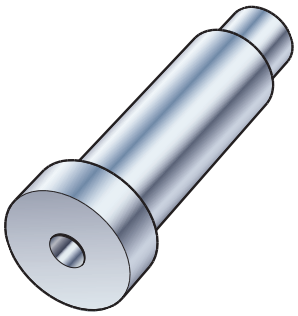


Preferred Ejector applications



- Modified lathes
- Economical and easy to apply to horizontal boring machines
  - NC lathes
  - Machining centers
- Transfer lines
- Easy machining workpiece materials

Typical components – Industry segments



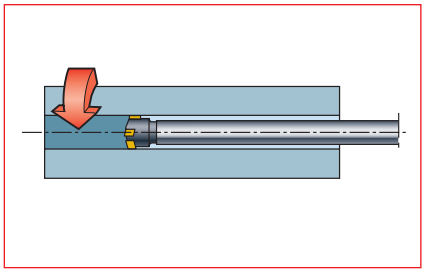
Machine spindle
Drill dia, D_c : 1.539 inch
Drill depth, l_4 : 17.992 inch

Automotive/truck industry
- Axles, piston pins
- Engine blocks (diesel)
- Hydraulic cylinders
- Track links

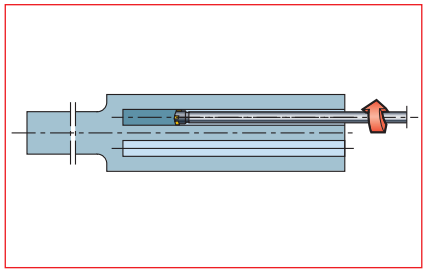
Process industry
- Oil holes

Ship yard
- Coolant/oil holes in engine blocks

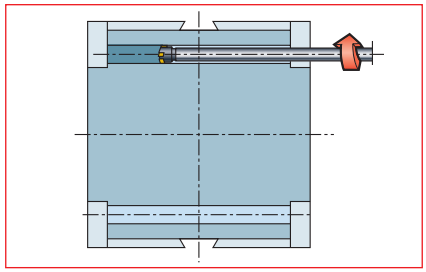
General engineering workshops
- M/C applications
- Mixed production – short series



Shaft
Drill dia, D_c : 1.969 inch
Drill depth, l_4 : 78.740 inch



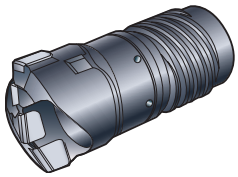
Stay axle
Drill dia, D_c : .945 inch
Drill depth, l_4 : 53.543 inch



Cylinder
Drill dia, D_c : 1.260 inch (x 26)
Drill depth, l_4 : 35.433 inch

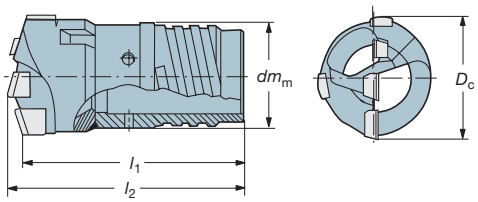
Ejector drill program - Ground brazed solid drill head 424.6

Diameter range .724 – 2.559 inch



Diameter range: .724–2.559 inch
Hole depth horizontal: 100 × Dia.
Hole depth vertical: 50 × Dia.
Cutting fluid: Neat oil or soluble

Drill heads are manufactured to minus tolerance.
Drill heads are delivered with standard chipbreaker, finish ground to the desired diameter to tolerance ISO h6.



dm_m is the same as dm_t for the drill tube

Diameter range, inch	Tube range	Ordering code, Drill head	P	M	K	N	S	Dimensions, inch		
			Chipbreaker (w)					Tolerances, inch l_2 = ± .039 l_1 = ± .039 dm_m = h8		
			4 4 3	4	4	4				
			Coromant grade combination (zz)[1]							
D_c inch			70 63 67	72	72	72		dm_m	l_2	l_1
.724- .755	00	**424.6- 001w Dx.xxx zz**	★ ☆ ★	★	★	★		.630	1.969	1.854
.756- .787		**002w Dx.xxx zz**	★ ☆ ★	★	★	★		.630	1.969	1.850
.788- .882	01	**424.6- 011w Dx.xxx zz**	★ ☆ ★	★	★	★		.709	2.205	2.083
.823- .858		**012w Dx.xxx zz**	★ ☆ ★	★	★	★		.709	2.205	2.075
.859- .901	02	**424.6- 021w Dx.xxx zz**	★ ☆ ★	★	★	★		.768	2.205	2.079
.902- .948		**022w Dx.xxx zz**	★ ☆ ★	★	★	★		.768	2.205	2.071
.949- .992	03	**424.6- 031w Dx.xxx zz**	★ ☆ ★	★	★	★		.827	2.264	2.126
.993-1.039		**032w Dx.xxx zz**	★ ☆ ★	★	★	★		.827	2.264	2.126
1.040-1.082	04	**424.6- 041w Dx.xxx zz**	★ ☆ ★	★	★	★		.925	2.382	2.236
1.083-1.129		**042w Dx.xxx zz**	★ ☆ ★	★	★	★		.925	2.382	2.236
1.130-1.173	05	**424.6- 051w Dx.xxx zz**	★ ☆ ★	★	★	★		1.004	2.500	2.343
1.174-1.220		**052w Dx.xxx zz**	★ ☆ ★	★	★	★		1.004	2.500	2.335
1.221-1.262	06	**424.6- 061w Dx.xxx zz**	★ ☆ ★	★	★	★		1.102	2.500	2.339
1.263-1.311		**062w Dx.xxx zz**	★ ☆ ★	★	★	★		1.102	2.500	2.327
1.312-1.370	07	**424.6- 071w Dx.xxx zz**	★ ☆ ★	★	★	★		1.181	2.776	2.598
1.371-1.425		**072w Dx.xxx zz**	★ ☆ ★	★	★	★		1.181	2.776	2.594
1.426-1.468	08	**424.6- 081w Dx.xxx zz**	★ ☆ ★	★	★	★		1.299	2.894	2.705
1.469-1.511		**082w Dx.xxx zz**	★ ☆ ★	★	★	★		1.299	2.894	2.697
1.512-1.559		**083w Dx.xxx zz**	★ ☆ ★	★	★	★		1.299	2.894	2.689
1.560-1.598	09	**424.6- 091w Dx.xxx zz**	★ ☆ ★	★	★	★		1.417	2.894	2.685
1.599-1.645		**092w Dx.xxx zz**	★ ☆ ★	★	★	★		1.417	2.894	2.677
1.646-1.692		**093w Dx.xxx zz**	★ ☆ ★	★	★	★		1.417	2.894	2.672
1.693-1.744	10	**424.6- 101w Dx.xxx zz**	★ ☆ ★	★	★	★		1.535	2.953	2.736
1.745-1.795		**102w Dx.xxx zz**	★ ☆ ★	★	★	★		1.535	2.953	2.728
1.796-1.850		**103w Dx.xxx zz**	★ ☆ ★	★	★	★		1.535	2.953	2.720
1.851-1.909	11	**424.6- 111w Dx.xxx zz**	★ ☆ ★	★	★	★		1.693	3.110	2.866
1.910-1.972		**112w Dx.xxx zz**	★ ☆ ★	★	★	★		1.693	3.110	2.862
1.973-2.035		**113w Dx.xxx zz**	★ ☆ ★	★	★	★		1.693	3.110	2.854
2.036-2.094	12	**424.6- 121w Dx.xxx zz**	★ ☆ ★	★	★	★		1.850	3.229	2.961
2.095-2.153		**122w Dx.xxx zz**	★ ☆ ★	★	★	★		1.850	3.229	2.972
2.154-2.212		**123w Dx.xxx zz**	★ ☆ ★	★	★	★		1.850	3.229	2.961
2.213-2.299	13	**424.6- 131w Dx.xxx zz**	★ ☆ ★	★	★	★		2.008	3.307	3.039
2.300-2.385		**132w Dx.xxx zz**	★ ☆ ★	★	★	★		2.008	3.307	3.016
2.386-2.472		**133w Dx.xxx zz**	★ ☆ ★	★	★	★		2.008	3.307	3.024
2.473-2.559		**134w Dx.xxx zz**	★ ☆ ★	★	★	★		2.008	3.307	3.012

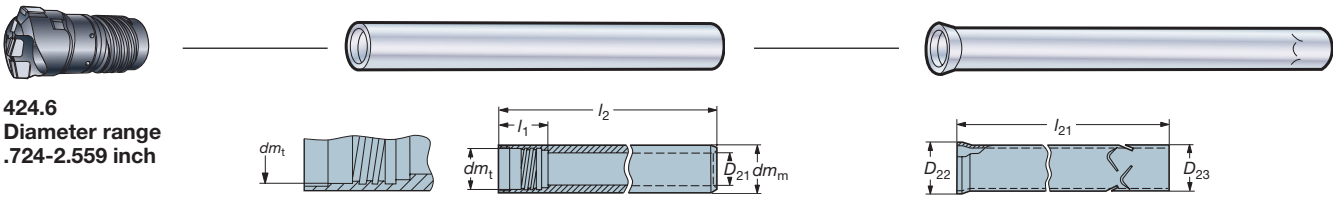
[1] Drills with other grade combinations are available on request.
★ = First choice

When ordering drill heads, state chipbreaker No (**w**) drill diameter (**x.xxx**) and grade combination (**zz**) in the ordering code.

Ordering example: 2 pieces 424.6-0014 D*.724* 70

SAFETY INFORMATION
Precautions when grinding and brazing of cemented carbide, see page 143.

Drill head **Outer tube** **Inner tube**



424.6
Diameter range
.724-2.559 inch

Note!
Drill tubes are supplied threaded in one end with an internal thread, the E-thread.

dm_t is the same as dm_m for the drill

Diameter range, inch	Tube range	Ordering code Outer tube[1]	Dimensions, inch Standard length l_2							Ordering code Inner tube[1]	Dimensions, inch Standard length l_{21}				
D_c inch			15.748	24.803	42.126	dm_m	dm_t	D_{21}	l_1		16.929	25.984	43.307	D_{22}	D_{23}
.724- .755 .756- .787	00	**424.2-800-**	**2**	**3**	**4**	.708	.629	.472	1.083	**424.2-850-**	**2**	**3**	**4**	.472	.394
.788- .822 .823- .858	01	**424.2-801-**	**2**	**3**	**4**	.768	.709	.551	1.181	**424.2-851-**	**2**	**3**	**4**	.551	.472
.859- .901 .902- .948	02	**424.2-802-**	**2**	**3**	**4**	.846	.768	.590	1.181	**424.2-852-**	**2**	**3**	**4**	.590	.512
.949- .992 .993-1.039	03	**424.2-803-**	**2**	**3**	**4**	.925	.827	.630	1.181	**424.2-853-**	**2**	**3**	**4**	.630	.551
1.040-1.082 1.083-1.129	04	**424.2-804-**	**2**	**3**	**4**	1.024	.925	.709	1.299	**424.2-854-**	**2**	**3**	**4**	.709	.630
1.130-1.173 1.174-1.220	05	**424.2-805-**	**2**	**3**	**4**	1.102	1.004	.787	1.299	**424.2-855-**	**2**	**3**	**4**	.787	.709
1.221-1.263 1.264-1.311	06	**424.2-806-**	**2**	**3**	**4**	1.201	1.102	.866	1.299	**424.2-856-**	**2**	**3**	**4**	.866	.787
1.312-1.370 1.371-1.425	07	**424.2-807-**	**2**	**3**	**4**	1.299	1.181	.945	1.575	**424.2-857-**	**2**	**3**	**4**	.945	.866
1.426-1.468 1.469-1.511 1.512-1.559	08	**424.2-808-**	**2**	**3**	**4**	1.398	1.299	1.024	1.575	**424.2-858-**	**2**	**3**	**4**	1.024	.945
1.560-1.598 1.599-1.645 1.646-1.692	09	**424.2-809-**	**2**	**3**	**4**	1.535	1.417	1.142	1.575	**424.2-859-**	**2**	**3**	**4**	1.142	1.063
1.693-1.744 1.745-1.795 1.796-1.850	10	**424.2-810-**	**2**	**3**	**4**	1.673	1.535	1.260	1.575	**424.2-860-**	**2**	**3**	**4**	1.260	1.181
1.851-1.909 1.910-1.972 1.973-2.035	11	**424.2-811-**	**2**	**3**	**4**	1.831	1.693	1.378	1.732	**424.2-861-**	**2**	**3**	**4**	1.378	1.260
2.036-2.094 2.095-2.153 2.154-2.212	12	**424.2-812-**	**2**	**3**	**4**	2.008	1.850	1.535	1.732	**424.2-862-**	**2**	**3**	**4**	1.535	1.417
2.213-2.299 2.300-2.385 2.386-2.472 2.473-2.559	13	**424.2-813-**	**2**	**3**	**4**	2.185	2.008	1.693	1.732	**424.2-863-**	**2**	**3**	**4**	**1**.693	1.574

[1] Other lengths can be manufactured by **customer request**, see page 25.

Ordering example for outer tube length 15.748 inch and inner tube 16.929 inch fitting drill head D_c = .724 inch:

1 piece 424.2-800-2 and 1 piece 424.2-850-2

NOTE!
The inner tube must be ordered 1.181 inch longer than the outer tube.

Vibration dampers 76 | Mounting parts 34-35 | Connectors 36-40 | Cutting data v_c 86 | Application guide 109

CoroDrill™ 800.24

The productivity drill

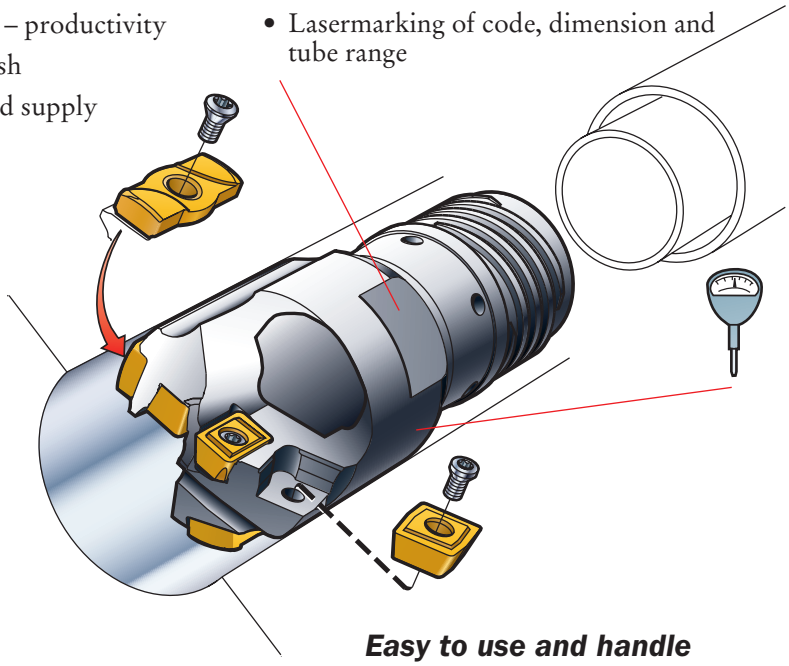
Diameter range .984 – 2.559 inch

Unique support pad design

- Indexable economy – two pads in one drill head
- Higher cutting speed – productivity
- Excellent surface finish
- Improves cutting fluid supply

Easy to identify

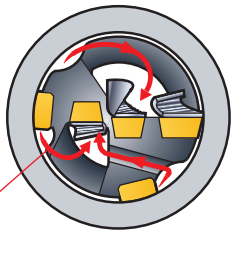
- Lasermarking of code, dimension and tube range



Reliable performance

- Robust design – high feed per rev. – productivity
- Wear resistant drill body manufactured in hardened steel
- Customer specified diameters
- Close tolerances

Excellent hole straightness and surface finish

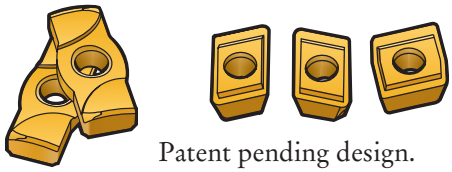


"Coolant accelerator"

- Patent pending design
- Ensures outstanding chip evacuation
- No chip clogging – no production stops

Easy to use and handle

- Fixed insert seats. No pre-setting – no need for tool room services
- Few spare parts – low inventory costs



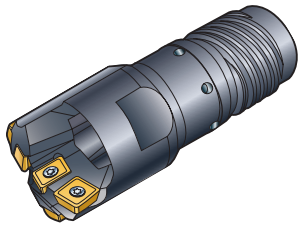
Patent pending design.

Productivity in a wide application range

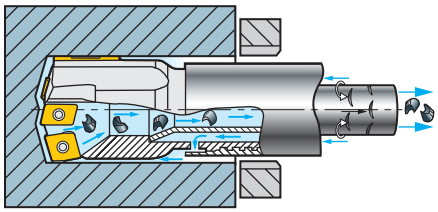
- Modern grade and geometry program covers most workpiece materials
- Few inserts and support pad sizes cover the whole diameter range
- Excellent chip control in both low and high feeds

CoroDrill™ 800.24

- ***The most productive choice for diameter range .984 – 2.559 inch***
- ***Lowest cost per hole***
- ***Consistent performance within a wide application area***
- ***Standard program***
- ***Developed and manufactured with the latest technology***

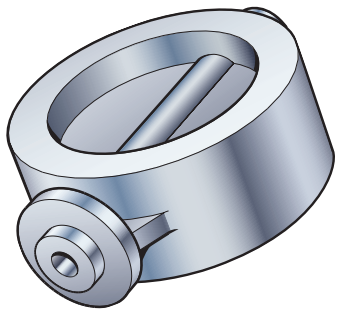


Preferred Ejector applications



- Modified lathes
- Economical and easy to apply to horizontal boring machines – NC lathes
- Machining centers with horizontal spindle
- Transfer lines
- Easy machining materials

Typical components – Industry segments



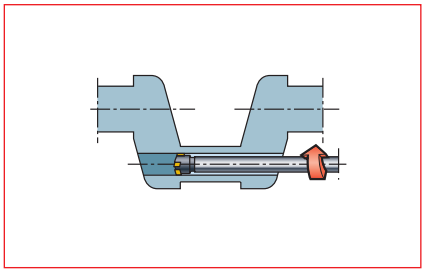
Throttle valve
Drill dia, D_c : 1.201 inch
Drill depth, l_4 : 16.142 inch

Automotive industry
- Axles, piston pins
- Engine blocks (diesel)
- Hydraulic cylinders
- Track links

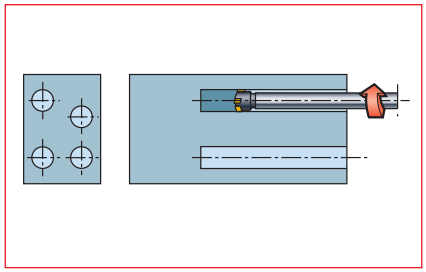
Process industry
- Oil holes

Ship yard
- Coolant/oil holes in engine blocks

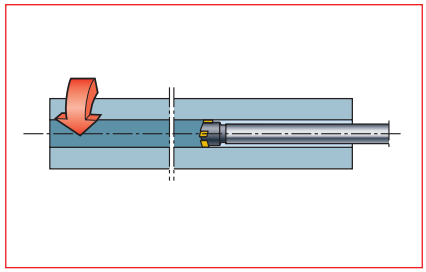
General engineering workshops
- M/C applications
- Mixed production – short series



Crank shaft
Drill dia, D_c : 1.378 inch
Drill depth, l_4 : 15.748 inch



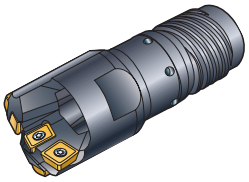
Valve body
Drill dia, D_c : 1.555 inch (x4)
Drill depth, l_4 : 16.338 inch

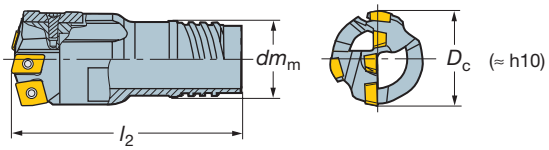


Hydraulic cylinder
Drill dia, D_c : 2.362 inch
Drill depth, l_4 : 59.055 inch

Ejector program – CoroDrill™ solid drill head 800.24

Indexable insert design
Diameter range
.984 – 2.559 inch





Diameter range: .984–2.559 inch
Hole depth: 100 × Dia.
Cutting fluid: Neat oil or soluble with EP-additives

Drill heads are manufactured to minus tolerance.

Note!
The drill is manufactured to minus tolerance so that it will not exceed the drill bush diameter, see page 126.

dm_m is the same as dm_t for the drill tube

Diameter range, inch	Tube range	Ordering code, Drill head	Dimensions, inch		Inserts			Support pads	
D_c inch			dm_m	$\leq l_2$	Central	Intermediate	Peripheral	Pad	No.
.984–1.309	03	**A800.24-03Dx.xxx**	.827	2.953	800-05 03 08M-C-G	800-05 03 08M-I-G	800-06 03 08H-P-G	800-06A	2
1.310–1.130	04	**A800.24-04Dx.xxx**	.925	3.071	800-05 03 08M-C-G	800-05 03 08M-I-G	800-06 03 08H-P-G	800-06A	2
1.131–1.220	05	**A800.24-M*05Dx.xxx**	1.004	3.150	800-06 T3 08M-C-G	800-05 03 08M-I-G	800-06 03 08H-P-G	800-06A	2
1.221–1.311	06	**A800.24-06Dx.xxx**	1.102	3.150	800-06 T3 08M-C-G	800-06 T3 08M-I-G	800-08 T3 08H-P-G	800-07A	2
1.312–1.425	07	**A800.24-07Dx.xxx**	1.181	3.543	800-06 T3 08M-C-G[1)] 800-08 T3 08M-C-G[1)]	800-06 T3 08M-I-G[1)] 800-08 T3 08M-I-G[1)]	800-08 T3 08H-P-G	800-07A	2
1.426–1.559	08	**A800.24-08Dx.xxx**	1.299	3.543	800-08 T3 08M-C-G	800-08 T3 08M-I-G	800-08 T3 08H-P-G[1)] 800-09 T3 08H-P-G[1)]	800-07A	2
1.560–1.692	09	**A800.24-09Dx.xxx**	1.417	3.740	800-08 T3 08M-C-G	800-08 T3 08M-I-G	800-09 T3 08H-P-G	800-08A	2
1.693–1.850	10	**A800.24-10Dx.xxx**	1.535	3.937	800-10 T3 08M-C-G	800-08 T3 08M-I-G	800-09 T3 08H-P-G	800-08A	2
1.851–2.035	11	**A800.24-11Dx.xxx**	1.693	4.331	800-12 T3 08M-C-G[1)] 800-10 T3 08M-C-G[1)]	800-08 T3 08M-I-G	800-09 T3 08H-P-G[1)] 800-11 T3 08H-P-G[1)]	800-10A	2
2.036-2.212	12	**A800.24-12Dx.xxx**	1.850	4.526	800-10 T3 08M-C-G	800-08 T3 08M-I-G[1)] 800-12 T3 08M-I-G[1)]	800-11 T3 08H-P-G	800-10A[1)] 800-12A[1)]	2 2
2.213-2.559	13	**A800.24-13Dx.xxx**	2.008	4.921	800-10 T3 08M-C-G[1)] 800-12 T3 08M-C-G[1)]	800-12 T3 08M-I-G	800-11 T3 08H-P-G	800-12A	2

[1)] To match insert/support pad sizes to required drill diameter, see table below.

When ordering drill heads, state drill diameter (x.xxx) in the ordering code.
Ordering example, drill head: 2 pieces A800.24-03D*.984*

M* = Makes the drill body stronger.

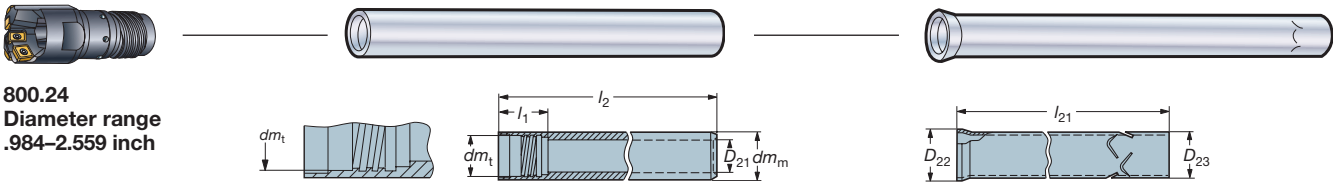
Drill diameter range – insert and pad sizes

Inserts (Ordered separately)
Intermediate and peripheral inserts are also available in L- geometry (for long chipping materials) see page 81.

Support pads (Ordered separately)

Diameter range, inch		Central	Diameter range, inch		Intermediate	Diameter range, inch		Peripheral	Diameter range, inch	Pad
.984–1.139	05	800-05 03 08M-C-G	**.984–1.220**	05	800-05 03 08M-I-G	**.984–1.220**	06	800-06 03 08H-P-G	**.984–1.220**	800-06A
1.140–1.338	06	800-06 T3 08M-C-G	**1.221–1.378**	06	800-06 T3 08M-I-G	**1.221–1.535**	08	800-08 T3 08H-P-G	**1.221–1.559**	800-07A
1.339–1.693	08	800-08 T3 08M-C-G	**1.379–2.165**	08	800-08 T3 08M-I-G	**1.536–1.968**	09	800-09 T3 08H-P-G	**1.560–1.850**	800-08A
1.694–1.850	10	800-10 T3 08M-C-G	**2.166–2.559**	12	800-12 T3 08M-I-G	**1.969–2.559**	11	800-11 T3 08H-P-G	**1.851–2.165**	800-10A
1.851–1.968	12	800-12 T3 08M-C-G							**2.166–2.559**	800-12A
1.969–2.283	10	800-10 T3 08M-C-G								
2.284–2.559	12	800-12 T3 08M-C-G								

Drill head **Outer tube** **Inner tube**



800.24
Diameter range
.984–2.559 inch

Note!
Drill tubes are supplied threaded in one end with an internal thread, the E-thread.

dm_t is the same as dm_m for the drill

Diameter range, inch	Tube range	Ordering code Outer tube[1]	Dimensions, inch Standard length l_2							Ordering code Inner tube[1]	Dimensions, inch Standard length l_{21}				
D_c inch			15.748	24.803	42.126	dm_m	dm_t	D_{21}	l_1		16.929	25.984	43.307	D_{22}	D_{23}
.984–1.039	03	**424.2-803-**	**2**	**3**	**4**	.925	.827	.630	1.181	**424.2-853-**	**2**	**3**	**4**	.630	.551
1.040–1.130	04	**424.2-804-**	**2**	**3**	**4**	1.024	.925	.709	1.299	**424.2-854-**	**2**	**3**	**4**	.709	.630
1.131–1.220	05	**424.2-805-**	**2**	**3**	**4**	1.024	1.102	.787	1.299	**424.2-855-**	**2**	**3**	**4**	.787	.709
1.221–1.311	06	**424.2-806-**	**2**	**3**	**4**	1.210	1.024	.866	1.299	**424.2-856-**	**2**	**3**	**4**	.866	.787
1.312–1.425	07	**424.2-807-**	**2**	**3**	**4**	1.299	1.181	.945	1.575	**424.2-857-**	**2**	**3**	**4**	.945	.866
1.426–1.559	08	**424.2-808-**	**2**	**3**	**4**	1.398	1.299	1.024	1.575	**424.2-858-**	**2**	**3**	**4**	1.024	.945
1.560–1.692	09	**424.2-809-**	**2**	**3**	**4**	1.535	1.417	1.142	1.575	**424.2-859-**	**2**	**3**	**4**	1.142	1.063
1.693–1.850	10	**424.2-810-**	**2**	**3**	**4**	1.673	1.535	1.260	1.575	**424.2-860-**	**2**	**3**	**4**	1.260	1.181
1.851–2.035	11	**424.2-811-**	**2**	**3**	**4**	1.831	1.693	1.378	1.732	**424.2-861-**	**2**	**3**	**4**	1.378	1.260
2.036–2.212	12	**424.2-812-**	**2**	**3**	**4**	2.008	1.850	1.535	1.732	**424.2-862-**	**2**	**3**	**4**	1.535	1.417
2.213–2.559	13	**424.2-813-**	**2**	**3**	**4**	2.185	2.008	1.693	1.732	**424.2-863-**	**2**	**3**	**4**	1.693	1.575

[1] Other lengths can be manufactured by **customer request**, see page 25.

Ordering example for outer tube, length 15.748 inch and inner tube 16.929 inch, fitting drill head D_c = .984 inch:

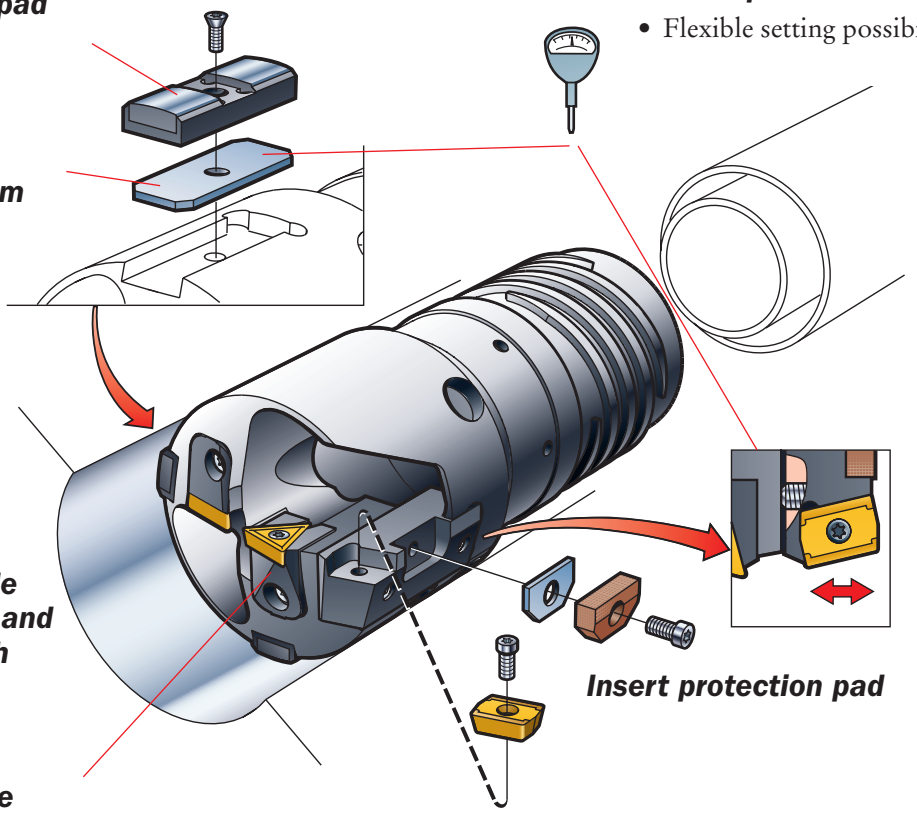
1 piece 424.2-803-2 and 1 piece 424.2-853-2

NOTE!
The inner tube must be ordered 1.181 inch longer than the outer tube.

T-MAX® drill 424.10

The adjustable drill

Diameter range 2.500 – 5.118* inch



Indexable twin edge support pad

Diameter adjusting shim

Built-in precision

- Flexible setting possibilities

Adjustable peripheral cartridge

- Easier radial setting
- Short setting time
- Improved precision

Excellent hole straightness and surface finish

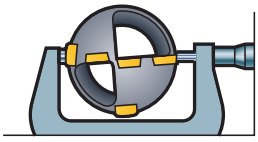
Insert protection pad

Few spare parts

Strong secure insert cartridges

Designed to protect the head from damage.

- Easy to change
- Good economy



Easy to pre-set

Tailor Made

- Intermediate diameters from 2.500 to 7.244* inch
- Two thread size options per head size

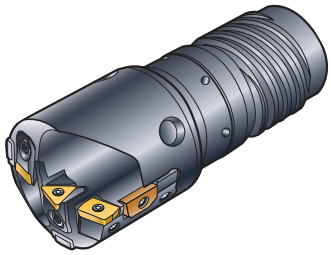
*) Larger diameter on request

Modern inserts – machining economy

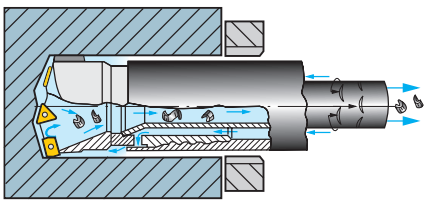
- Four insert types cover the whole diameter range
- Geometries and grades for drilling most materials
- Grade GC1025 the best choice for both steel and stainless steel
- High feed rate

T-MAX® drill 424.10

- ***Setting possibilities on diameter***
- ***Close diameter tolerance and high surface finish***
- ***Good hole straightness in long workpieces***
- ***Wide application area***
- ***High pentration rate in most materials***
- ***Stocked standard program***
- ***Wide range of engineered solutions***

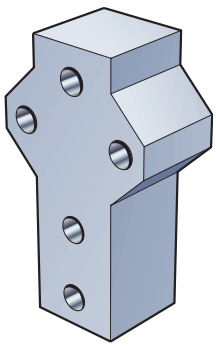


Preferred Ejector applications



- Modified lathes
- Economical and easy to apply to horizontal boring machines – NC lathes
- Machining centers with tool changer and horizontal spindle
- Transfer lines
- Easy machining materials

Typical components – Industry segments



Valve body
Drill dia, D_c : 4.724 inch (x 5)
Drill depth, l_4 : 21.614 inch

Automotive industry
- Engine blocks (diesel)

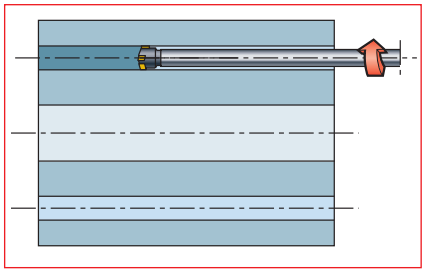
Process industry
- Oil holes

Aerospace industry
- Landing gear

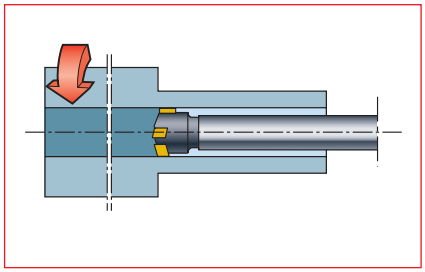
Ship yard
- Coolant / oil holes in engine blocks

General engineering workshops
- Mixed production – short series

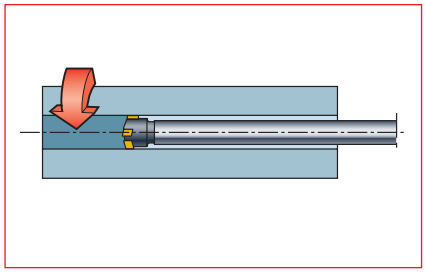
Defense industry
- Barrels



Hydroblock
Drill dia, D_c : 6.299 inch (x 2)
Drill depth, l_4 : 78.740 inch



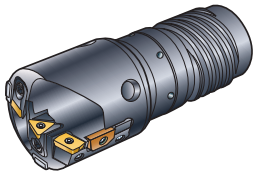
Shaft
Drill dia, D_c : 3.150 inch
Drill depth, l_4 : 120.945 inch



Shaft
Drill dia, D_c : 2.756 inch
Drill depth, l_4 : 74.803 inch

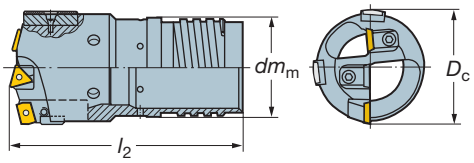
Ejector program – T-MAX® adjustable solid drill head A424.10 / 424.10

Indexable insert design
Diameter range
2.500-7.240 inch



Diameter range: 2.500–7.240 inch
Hole depth: 100 × Dia.
Cutting fluid: Neat oil or soluble with EP-additives

Drill heads are manufactured to minus tolerance.



dm_m is the same as dm_t for the drill tube

Diameter[2] range, inch D_c inch	Tube range	Ordering code, Drill head[1]	Dimensions, inch dm_m	l_2	Radial[3] adjustment	Cartridges Central	No.	Intermediate	No.	Peripheral	No.	Support pad	No.
2.500	13	**A424.10-2500**	2.008	4.528	+.039	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1516-16	1	430.32-12 D65.0	2
2.559	14	**424.10-0650**	2.047	5.906	+.059	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1516-16	1	430.32-12 D65.0	2
2.750	15	**A424.10-2750**	2.283	5.906	+.039	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1516-16	1	430.32-12 D65.0	2
2.756		**424.10-0700**	2.283	5.906	+.039	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1516-16	1	430.32-12 D70.0	2
2.813		**A424.10-2813**	2.283	5.906	+.029	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1516-16	1	430.32-12 D70.0	2
2.953	16	**424.10-0750**	2.480	6.299	+.079	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1822-22	1	430.32-12 D75.0	2
3.000		**A424.10-3000**	2.480	6.299	+.079	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1822-22	1	430.32-12 D75.0	2
3.150	17	**424.10-0800**	2.756	7.480	+.049	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1822-22	1	430.32-12 D80.0	2
3.250		**A424.10-3250**	2.756	7.480	+.029	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1822-22	1	430.32-12 D80.0	2
3.346		**424.10-0850**	2.756	7.480	+.069	L430.31-1522-22	1	R430.30-1216-16	1	R430.28-1822-22	1	430.32-12 D85.0	2
3.500	18	**A424.10-3500**	3.031	7.480	+.069	L430.31-1522-22	1	R430.30-1216-16	1	R430.28-1822-22	1	430.32-12 D85.0	2
3.543		**424.10-0900**	3.031	7.480	+.069	L430.31-1522-22	1	R430.30-1216-16	1	R430.28-1822-22	1	430.32-12 D90.0	2
3.740		**424.10-0950**	3.031	7.480	+.079	L430.31-1522-22	1	R430.30-15 22-22	1	R430.28-1822-22	1	430.32-12 D95.0	2
3.750		**A424.10-3750**	3.031	7.480	+.079	L430.31-1522-22	1	R430.30-15 22-22	1	R430.28-1822-22	1	430.32-12 D95.0	2
3.937	19	**424.10-1000**	3.504	7.677	+.039	L430.31-1522-22	1	R430.30-15 22-22	1	R430.28-1822-22	1	430.32-16 D100.0	2
4.000		**A424.10-4000**	3.504	7.677	+.049	L430.31-1522-22	1	R430.30-15 22-22	1	R430.28-1822-22	1	430.32-16 D100.0	2
4.134		**424.10-1050**	3.504	7.677	+.019	L430.31-1522-22	1	R430.30-15 22-22	1	R430.28-1822-22	1	430.32-16 D105.0	2
4.250		**A424.10-4250**	3.504	7.677	+.079	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1516-16	1	430.32-16 D105.0	2
4.331		**424.10-1100**	3.504	7.677	+.059	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1516-16	1	430.32-16 D110.0	2
4.500	20	**A424.10-4500**	3.976	8.661	+.069	L430.31-1216-16	1	R430.30-1216-16	3	R430.28-1516-16	1	430.32-16 D110.0	2
4.528		**424.10-1150**	3.976	8.661	+.059	L430.31-1216-16	1	R430.30-1216-16	3	R430.28-1516-16	1	430.32-16 D115.0	2
4.724		**424.10-1200**	3.976	8.661	+.059	L430.31-1216-16	1	R430.30-1216-16	3	R430.28-1516-16	1	430.32-16 D120.0	2
4.750		**A424.10-4750**	3.976	8.661	+.059	L430.31-1216-16	1	R430.30-1216-16	3	R430.28-1516-16	1	430.32-16 D120.0	2
4.921	21	**424.10-1250**	4.449	8.661	+.069	L430.31-1216-16	1	R430.30-1216-16	3	R430.28-1822-22	1	430.32-16 D125.0	2
5.000		**A424.10-5000**	4.449	8.661	+.049	L430.31-1216-16	1	R430.30-1216-16	3	R430.28-1822-22	1	430.32-16 D125.0	2
5.118		**424.10-1300**	4.449	8.661	+.019	L430.31-1216-16	1	R430.30-1216-16	3	R430.28-1822-22	1	430.32-16 D130.0	2
5.354-5.823	22	***Tailor Made***											
5.827-6.295	23	***Tailor Made***											
6.299-6.768	24	***Tailor Made***											
6.772-7.240	25	***Tailor Made***											

[1] "A" in the ordering code indicates drill with inch dimensions.

[2] Drills in other dimensions are available on request.

[3] For radial adjustment, see page 78.

Ordering example, complete drill head: 2 pieces A424.10-2500

For Ordering additional cartridge/support pad:
2 pieces L430.31-1216-16
4 pieces 430.32-12 D65.0

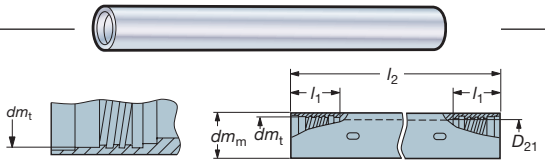
Inserts
(Ordered separately)

Central cartridge	Insert		Intermediate cartridge	Insert		Peripheral cartridge	Insert	
L430.31-1216-16	16	TPMT 16T312R-22	R430.30-1216-16	16	TPMT 16T312R-22	R430.28-1516-16	13	R424.9-13T308-22
	16	TPMT 16T312TR-23		16	TPMT 16T312TR-23		13	R424.9-13T308-23
L430.31-1522-22	22	TPMT 220612R-22	R430.30-1522-22	22	TPMT 220612R-22	R430.28-1822-22	18	R424.9-180608-22
	22	TPMT 220612TR-23		22	TPMT 220612TR-23		18	R424.9-180608-23

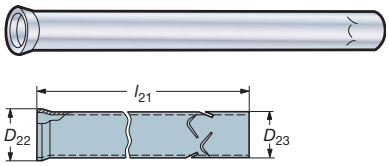
Drill head

A424.10 / 424.10
Diameter range
2.500-5.118 inch

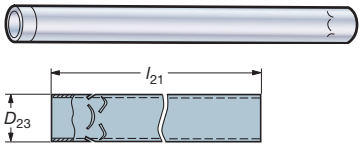
Outer tube, range 13–25



Inner tube, range 13



Inner tube, range 14–25



Note!
Drill tubes are supplied threaded in one or both ends with an internal thread, the E-thread. Except for Drill tube 424.9S which is threaded in one end.

dm_t is the same as dm_m for the drill

Diameter range, inch	Tube range	Ordering code Outer tube[1]	Dimensions, inch Standard length l_2							Ordering code Inner tube[1]	Dimensions, inch Standard length l_{21}				
D_c inch			15.748	24.803	42.126	dm_m	dm_t	D_{21}	l_1		16.929	25.984	43.307	D_{22}	D_{23}
2.500	13	**424.2-813-**	**2**	**3**	**4**	2.185	2.008	1.693	1.732	**424.2-863-**	**2**	**3**	**4**	1.693	1.575
2.559	14	**424.2-814-L[1]**	–	–	–	2.205	2.047	1.693	2.953	**424.2-864-L[1]**	–	–	–	–	1.575
2.750 2.756 2.813	15	**424.2-815-L[1]**	–	–	–	2.441	2.283	1.890	2.953	**424.2-865-L[1]**	–	–	–	–	1.732
2.953 3.000	16	**424.2-816-L[1]**	–	–	–	2.667	1.693	2.087	2.953	**424.2-866-L[1]**	–	–	–	–	1.890
3.150 3.250 3.346	17	**424.2-817-L[1]**	–	–	–	2.953	2.756	2.323	3.819	**424.2-867-L[1]**	–	–	–	–	2.126
3.500 3.543 3.740 3.750	18	**424.2-818-L[1]**	–	–	–	3.228	3.031	2.598	3.819	**424.2-868-L[1]**	–	–	–	–	2.362
3.937 4.000 4.134 4.250 4.331	19	**424.2-819-L[1]**	–	–	–	3.701	3.504	3.071	3.819	**424.2-869-L[1]**	–	–	–	–	2.756
4.500 4.528 4.724 4.750	20	**424.2-820-L[1]**	–	–	–	4.173	3.976	3.543	4.646	**424.2-870-L[1]**	–	–	–	–	3.150
4.921 5.000 5.118	21	**424.2-821-L[1]**	–	–	–	4.646	4.449	3.622	4.646	**424.2-871-L[1]**	–	–	–	–	3.150
5.354-5.823	22	**424.2-822-L[1]**	–	–	–	5.118	4.421	4.094	4.646	**424.2-872-L[1]**	–	–	–	–	3.740
5.827-6.295	23	**424.2-823-L[1]**	–	–	–	5.590	5.394	4.567	5.472	**424.2-873-L[1]**	–	–	–	–	3.937
6.299-6.768	24	**424.2-824-L[1]**	–	–	–	6.063	5.866	5.039	5.472	**424.2-874-L[1]**	–	–	–	–	4.724
6.772-7.240	25	**424.2-825-L[1]**	–	–	–	6.535	6.338	5.512	5.472	**424.2-875-L[1]**	–	–	–	–	5.118

[1] Lengths are manufactured by **customer request**, see page 25.

Note!

Inner tube 424.2 for drilling diameter 2.559–4.878 inch must be ordered 7.480 inch longer than the outer tube.

Inner tube 424.2 for drilling diameter 4.882–7.240 inch must be ordered 8.661 inch longer than the outer tube.

Ordering example for outer tube, length 15.748 inch and inner tube 16.929 inch, fitting drill head D_c = 2.500 inch:

1 piece 424.2-813-2 and 1 piece 424.2-863-2

Ordering example for drill tube, design to customer request, outer tube length 118.110 inch and inner tube 125.590 inch, fitting drill head D_c = 2.559 inch:

1 piece 424.2-814-L118.110 and 1 piece 424.2-864-L125.590

Tailor Made

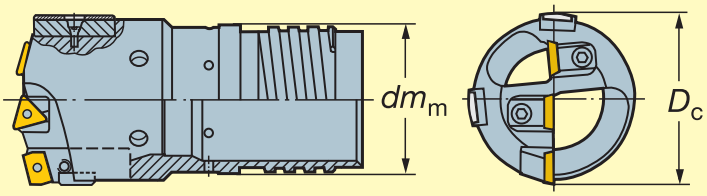
– Quick quotation
– Easy to order
– Competitive delivery

Even more possibilities thanks to tailored design!

If you do not find what you need in our comprehensive standard program, choose the tool shape you require and we will tailor it for you to *your* dimensions.

T-Max adjustable solid drill head 424.10

D_c = 2.500-7.244 inch, with E-thread



D_c	dm_m	E-thread range[1)]
2.500 - 2.558	2.008	13
2.559 - 2.637	2.008 / 2.047	13 / 14
2.638 - 2.874	2.047 / 2.283	14 / 15
2.875 - 3.149	2.283 / 2.480	15 / 16
3.150 - 3.425	2.480 / 2.756	16 / 17
3.426 - 3.937	2.756 / 3.031	17 / 18
3.938 - 4.409	3.031 / 3.504	18 / 19
4.410 - 4.881	3.504 / 3.976	19 / 20
4.882 - 5.354	3.976 / 4.449	20 / 21
5.355 - 5.826	4.449 / 4.921	21 / 22
5.827 - 6.299	4.921 / 5.394	22 / 23
6.300 - 6.771	5.394 / 5.866	23 / 24
6.772 - 7.244	5.866 / 6.339	24 / 25

1) Compare with drill tube
(424.2 – 8xx Ejector / 420.5 – 8xx STS)

Options

Note For specific details regarding the options, contact your Coromant sales representative.

D_c	Diameter – **2.500-7.244** inch
dm_m	Thread size – **2.008-6.339**

Drill tubes manufactured by customer request

Note! For specific details regarding the options, contact your Coromant sales representative.

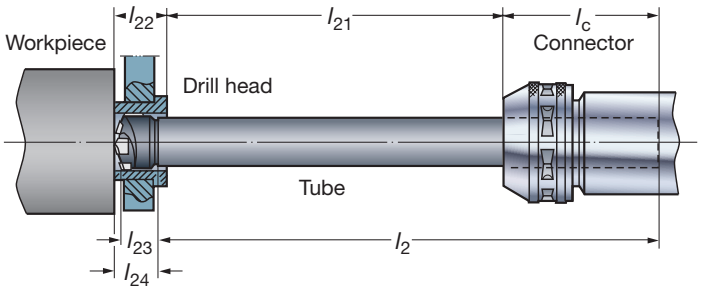
Drill head	Tube range	Outer tube Dimensions, inch Length to customer request l_2 (Min – Max)	Tube range	Inner tube Dimensions, inch Length to customer request l_{21} (Min – Max)	For drawings and complementary dimensions, see page:
424.6	00 – 13	**8.661 – 208.661**	00 – 13	**11.811 – 216.535**	**15**
800.24	03 – 13	**8.661 – 208.661**	03 – 13	**11.811 – 216.535**	**19**
424.10	13 14 – 18 19 – 25	**8.661 – 208.661** **8.661 – 196.850** **8.661 – 118.110**	13 – 25	**11.811 – 216.535**	**23**
424.31F	00 – 09	**8.661 – 208.661**	00 – 09	**11.811 – 216.535**	**29**
424.31F	10 – 13 14 – 21	**8.661 – 208.661** **8.661 – 196.850**	10 – 21	**11.811 – 216.535**	**31**
424.31	14 – 18 19 – 25	**8.661 – 196.850** **8.661 – 118.110**	14 – 25	**11.811 – 216.535**	**33**

Ordering example for drill tube, design to customer request, outer tube length 31.496 inch and inner tube 32.677 inch, fitting drill head D_c = 1.161 inch:

1 piece 424.2-805-L31.496 and 1 piece 424.2-855-L32.677

Calculation of special length tubes – Ejector system

For solid drill heads 424.6, 800.24 and 424.10



l_{24} = End of drill tube to tip of central Insert
l_{23} = End of drill tube to tip of peripheral insert
l_{21} = Hole depth
l_{22} = Minimum bushing length
l_c = Length of drill tube in connector

l_2 = Tube Length = $l_{21} + l_{22} + l_c - l_{24}$
(for brazed ejector drills)

Solid drill heads 424.6

Diameter range, inch D_c inch	l_{24}	l_{23}	$l_{22\ min}$	Diameter range, inch D_c inch	l_{24}	l_{23}	$l_{22\ min}$
.724- .787	.886	.772	1.102	**1.312-1.425**	1.201	1.024	1.417
.788- .858	1.024	.902	1.220	**1.426-1.559**	1.319	1.129	1.535
.859- .948	1.024	.897	1.220	**1.560-1.693**	1.319	1.110	1.535
.949-1.039	1.083	.945	1.299	**1.694-1.850**	1.378	1.161	1.575
1.040-1.129	1.083	.937	1.299	**1.851-2.035**	1.378	1.133	1.575
1.130-1.220	1.201	1.043	1.417	**2.036-2.212**	1.496	1.240	1.693
1.221-1.311	1.201	1.039	1.417	**2.213-2.559**	1.575	1.307	1.772

Solid drill heads 800.24

Diameter range, inch D_c inch	l_{24}	l_{23}	$l_{22\ min}$	Diameter range, inch D_c inch	l_{24}	l_{23}	$l_{22\ min}$
.984-1.039	1.929	1.654	1.969	**1.693-1.850**	2.362	2.126	2.559
1.040-1.130	1.929	1.654	1.969	**1.851-2.035**	2.598	2.323	2.795
1.131-1.220	1.850	1.654	2.047	**2.036-2.212**	2.795	2.500	2.992
1.221-1.311	1.850	1.673	2.047	**2.213-2.559**	3.189	2.835	3.386
1.312-1.425	1.969	1.772	2.165				
1.426-1.559	1.969	1.772	2.165				
1.560-1.692	2.165	1.929	2.365				

Note:
For tube ranges 14 through 20, inner tube must be 7.480" longer than outer tube.
For tube ranges 21 through 25, inner tube must be 8.661" longer than outer tube.

Connectors	l_c
424.2-400M 424.9S/170-1 and 424.2-410	4.724
424.2-401M 424.9S/231-1 and 424.2-411	4.055

Solid drill heads 424.10

Diameter range, inch D_c inch	l_{24}	$l_{22\ min}$	Diameter range, inch D_c inch	l_{24}	$l_{22\ min}$
2.500-2.559	2.795	2.992	**4.409-4.877**	3.031	3.228
2.500-2.633	2.953	3.150	**4.882-5.350**	4.016	4.213
2.638-2.870	2.953	3.150	**5.354-5.822**	4.409	4.606
2.874-3.145	3.346	3.543			
3.150-3.421	3.661	3.858			
3.425-3.933	3.661	3.858			
3.937-4.405	3.858	4.055			

T-MAX® 424.31F and 424.31 counterboring heads

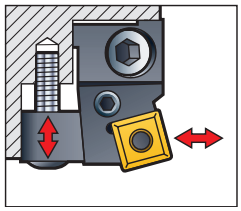
The productivity and precision single insert counterboring heads

Diameter range .787- 7.240 inch

Strong cartridges

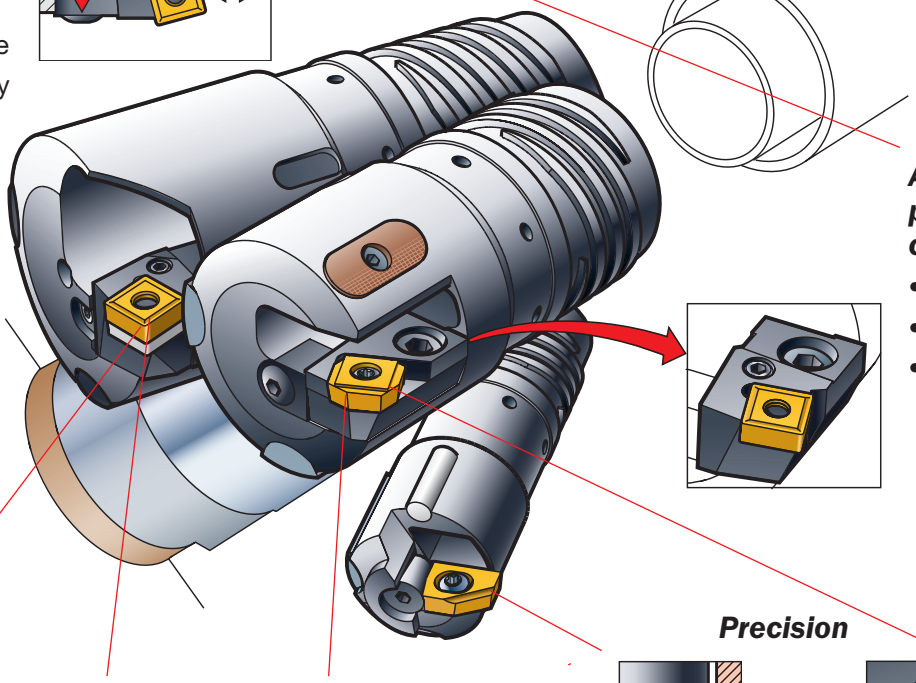
Designed to protect from damage.

- Easy to change
- Good economy



Built-in precision

- Radial adjustment



Adjustable peripheral cartridge

- Easier radial setting
- Short setting time
- Improved precision

Excellent hole straightness and surface finish

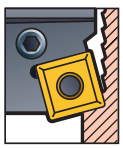
Productivity

424.31

TPxx insert

Dia. range
2.559–7.240 inch

a_p= .472–.669 inch

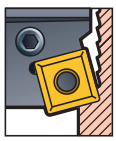


424.31

SNxx insert

Dia. range
2.559–7.240 inch

a_p= .394–.630 inch



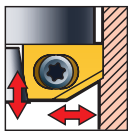
424.31F

SNxx insert

Dia. range
1.693–4.920 inch

a_p= .236 inch

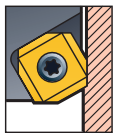
Precision



424.31F

Dia. range
.787–1.693 inch

a_p= .118 inch



424.31F

Dia. range
1.693–4.920 inch

a_p= .177 inch

Machining economy

- Insert grades for counterboring in most materials.
- Insert types, sizes and geometries to get higher productivity, closer hole tolerances and higher surface finish.

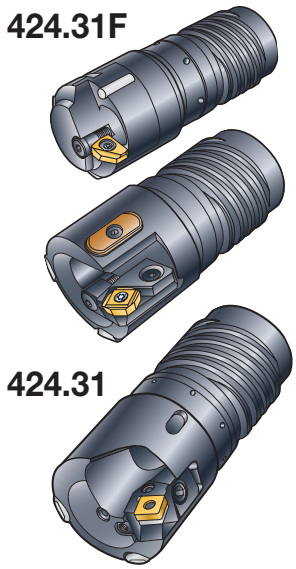
Note!

For applications requiring radial cut depths above .669 inch we recommend 424.32, see page 71.

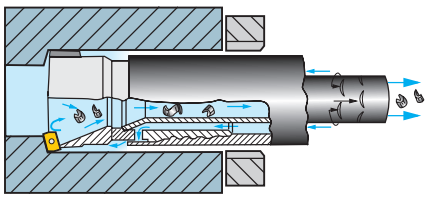
T-MAX® 424.31F and 424.31 counterboring heads

Designed for precision, productivity and versatility

- ***Stocked standard components***
- ***A complement to solid drilling***
  - ***– for final diameter and surface finish operations***
  - ***– to extend hole diameter when machine power is limited. The same tube can normally be used***
- ***Wide range of engineered solutions***

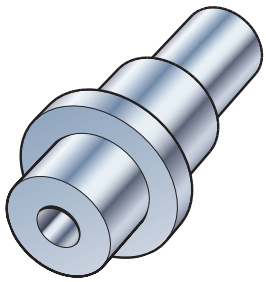


Preferred Ejector applications



- Modified lathes
- Economical and easy to apply to horizontal boring machines - NC lathes.
- Machining centers with tool changer and horizontal spindle
- Transfer lines
- Easy machining materials

Typical components – Industry segments



Rotor shaft
Bore dia, D_c : 2.874 inch (2.409 inch)
Drill depth, l_4 : 21.654 inch

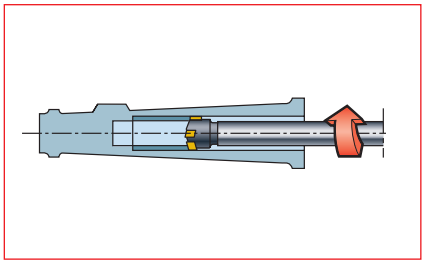
Process industry
- Oil holes

Aerospace industry
- Landing gears

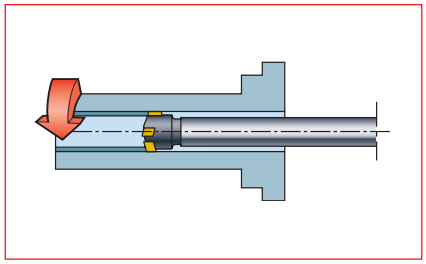
Ship yard
- Coolant/oil holes in engine blocks

General engineering workshops
- Mixed production – short series

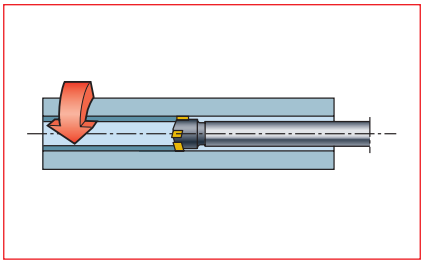
Defense industry
- Barrels



Fork leg
Bore dia, D_c : 1.378 inch (1.181 inch)
Drill depth, l_4 : 12.008 inch



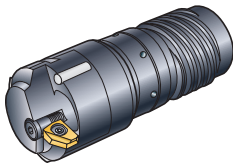
Lathe spindle
Bore dia, D_c : 3.563 inch (2.409 inch)
Drill depth, l_4 : 35.984 inch



Hollow bar
Bore dia, D_c : 1.575 inch (1.378 inch)
Drill depth, l_4 : 14.685 inch

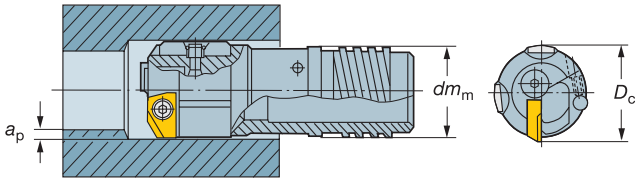
T-MAX® counterboring head 424.31F – manufactured by customer request

Single indexable insert design – close tolerance
Diameter range .787–1.693 inch



Diameter range: .787-1.693 inch
Hole depth: 100 × diameter
Cutting fluid: Neat oil or emulsion with EP-additives

Drill heads are manufactured to minus tolerance.



dm_m is the same as dm_t for the drill tube

Diameter range, inch	Max. cutting depth	Inserts[1]	Support pad set		Pressure pad set	
D_C inch	a_p inch	R424.31F		No.		No.
.787– .905	.118	04	**430.21 -06 D20.0**	2	**5636 010-011**	1
.906–1.023	.118	04	**430.21 -06 D23.0**	2	**5636 010-011**	1
1.024–1.220	.118	04	**430.21 -06 D26.0**	2	**5636 010-011**	1
1.221–1.338	.118	04	**430.21 -08 D31.0**	2	**5636 010-021**	1
1.339–1.496	.118	04	**430.21 -08 D34.0**	2	**5636 010-021**	1
1.497–1.693	.118	04	**430.21 -08 D38.0**	2	**5636 010-021**	1

[1] Inserts are ordered separately.

Ordering example: 2 pieces 430.21-06 D20.0

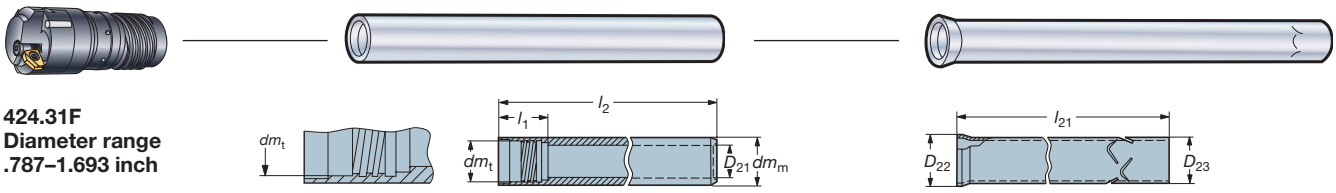
Ordering

When ordering counterboring heads the following must be stated:

- Drill diameter, D_c.
- Depth of cut or pre-bored size.
- Cartridges to be used – cartridge for close tolerances or for normal tolerances.
- Drilling system to be used – Ejector or STS.
- Drill tubes to be used and size dm_t.

For more information and advice, please contact your nearest Sandvik Coromant representative.

Counterboring head **Outer tube** **Inner tube**



424.31F
Diameter range
.787–1.693 inch

Note!
Drill tubes are supplied threaded in one end with an internal thread, the E-thread.

dm_t is the same as dm_m for the drill

Diameter range, inch	Tube range	Ordering code Outer tube[1)]	Dimensions, inch Standard length l_2							Ordering code Inner tube[1)]	Dimensions, inch Standard length l_{21}				
D_c inch			15.748	24.803	42.126	dm_m	dm_t	D_{21}	l_1		16.929	25.984	43.307	D_{22}	D_{23}
.787– .905	00	**424.2-800-**	**2**	**3**	**4**	.708	.630	.472	1.083	**424.2-850-**	**2**	**3**	**4**	.472	.394
	01	**424.2-801-**	**2**	**3**	**4**	.768	.708	.157	1.181	**424.2-851-**	**2**	**3**	**4**	.551	.472
	02	**424.2-802-**	**2**	**3**	**4**	.846	.768	.591	1.181	**424.2-852-**	**2**	**3**	**4**	.590	.512
.906–1.023	02	**424.2-802-**	**2**	**3**	**4**	.846	.768	.591	1.181	**424.2-852-**	**2**	**3**	**4**	.590	.512
	03	**424.2-803-**	**2**	**3**	**4**	.925	.827	.630	1.181	**424.2-853-**	**2**	**3**	**4**	.630	.551
1.024–1.220	03	**424.2-803-**	**2**	**3**	**4**	.925	827	.630	1.181	**424.2-853-**	**2**	**3**	**4**	.630	.551
	04	**424.2-804-**	**2**	**3**	**4**	1.024	1.004	.708	1.299	**424.2-854-**	**2**	**3**	**4**	.709	.630
	05	**424.2-805-**	**2**	**3**	**4**	1.102	1.004	.787	1.299	**424.2-855-**	**2**	**3**	**4**	.787	.709
1.221–1.338	06	**424.2-806-**	**2**	**3**	**4**	1.201	1.102	.866	1.299	**424.2-856-**	**2**	**3**	**4**	.866	.787
	07	**424.2-807-**	**2**	**3**	**4**	1.299	1.181	.945	1.575	**424.2-857-**	**2**	**3**	**4**	.945	.866
1.339–1.496	07	**424.2-807-**	**2**	**3**	**4**	1.299	1.181	.945	1.575	**424.2-857-**	**2**	**3**	**4**	.945	.866
	08	**424.2-808-**	**2**	**3**	**4**	1.398	1.299	1.024	1.575	**424.2-858-**	**2**	**3**	**4**	1.024	.945
1.497–1.693	08	**424.2-808-**	**2**	**3**	**4**	1.398	1.299	1.024	1.575	**424.2-858-**	**2**	**3**	**4**	1.024	.945
	09	**424.2-809-**	**2**	**3**	**4**	1.534	1.417	1.142	1.575	**424.2-859-**	**2**	**3**	**4**	1.142	1.063

[1)] Other lengths can be manufactured by **customer request**, see page 25.

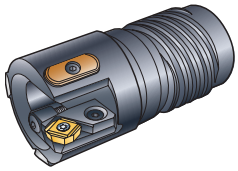
Ordering example for outer tube length 15.748 inch and inner tube 16.929 inch fitting drill head D_c = .787 inch:

1 piece 424.2-800-2 and 1 piece 424.2-850-2

NOTE!
The inner tube must be ordered 1.181 inch longer than the outer tube.

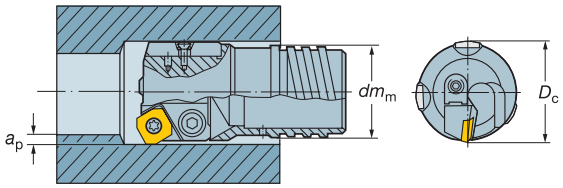
T-MAX® counterboring head 424.31F – manufactured by customer request

Single indexable insert design – close and normal tolerances
Diameter range 1.693 – 4.882 inch

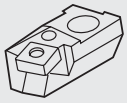
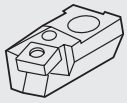


Diameter range: 1.693-4.882 inch
Hole depth: 100 × diameter
Cutting fluid: Neat oil or emulsion with EP-additives

Drill heads are manufactured to minus tolerance.



dm_m is the same as dm_t for the drill tube

Diameter range, inch	Cartridge	Max. cutting depth	Inserts[1]	Cartridge	Max. cutting depth	Inserts[1]	Support pad set		Pressure pad set	
			R424.31F			SNMG SNMM				
D_c inch	For close tolerances (IT9)	a_p inch		For normal tolerances (IT10)	a_p inch			No.		No.
1.693–1.849	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-10 D43.0**	2	**5636 020-011**	1
1.850–2.046	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-10 D47.0**	2	**5636 020-011**	1
2.047–2.282	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-10 D52.0**	2	**5636 020-011**	1
2.283–2.559	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-10 D58.0**	2	**5636 020-011**	1
2.560–2.755	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-12 D65.0**	2	**420.37-410-01**	3
2.756–2.952	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-12 D70.0**	2	**420.37-410-01**	3
2.953–3.149	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-12 D75.0**	2	**420.37-410-01**	3
3.150–3.345	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-12 D80.0**	2	**420.37-415-01**	3
3.346–3.543	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-12 D85.0**	2	**420.37-415-01**	3
3.544–3.739	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-16 D90.0**	2	**420.37-510-01**	3
3.740–3.936	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-16 D95.0**	2	**420.37-510-01**	3
3.937–4.133	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-16 D100.0**	2	**420.37-510-01**	3
4.134–4.330	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-16 D105.0**	2	**420.37-510-01**	3
4.331–4.527	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-16 D110.0**	2	**420.37-510-01**	3
4.528–4.724	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-16 D115.0**	2	**420.37-510-01**	3
4.725–4.882	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-16 D120.0**	2	**420.37-510-01**	3

[1] Inserts are ordered separately.

Ordering example: 2 pieces R430.24-1118-06

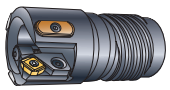
Ordering

When ordering counterboring heads the following must be stated:

- Drill diameter, D_c.
- Depth of cut or pre-bored size.
- Cartridges to be used – cartridge for close tolerances or for normal tolerances.
- Drilling system to be used – Ejector or STS.
- Drill tubes to be used and size dm_t.

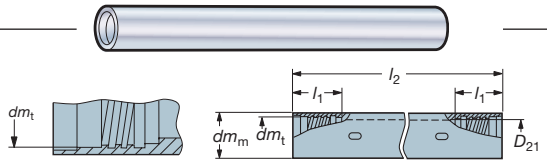
For more information and advice, please contact your nearest Sandvik Coromant representative.

Counterboring head

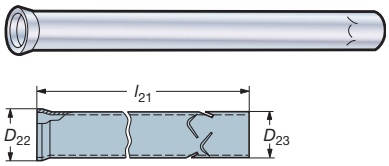


424.31F
Diameter range
1.693–4.882 inch

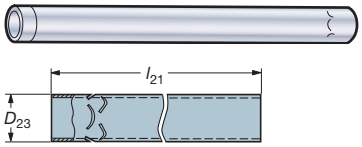
Outer tube, range 10–21



Inner tube, range 10–13



Inner tube, range 14–21



Note!
Drill tubes are supplied threaded in one or both ends with an internal thread, the E-thread. Except for Drill tube 424.9S which is threaded in one end.

dm_t is the same as dm_m for the drill

Diameter range, inch	Tube range	Ordering code Outer tube[1)]	Dimensions, inch Standard length l_2							Ordering code Inner tube[1)]	Dimensions, inch Standard length l_{21}				
D_C inch			15.748	24.803	42.126	dm_m	dm_t	D_{21}	l_1		16.929	25.984	43.307	D_{22}	D_{23}
1.693–1.849	10	**424.2-810-**	**2**	**3**	**4**	1.673	1.535	1.260	1.575	**424.2-860-**	**2**	**3**	**4**	1.260	1.181
1.850–2.046	11	**424.2-811-**	**2**	**3**	**4**	1.831	1.693	1.378	1.733	**424.2-861-**	**2**	**3**	**4**	1.378	1.260
	12	**424.2-812-**	**2**	**3**	**4**	2.008	1.850	1.535	1.733	**424.2-862-**	**2**	**3**	**4**	1.535	1.417
2.047–2.282	12	**424.2-812-**	**2**	**3**	**4**	2.008	1.850	1.535	1.733	**424.2-862-**	**2**	**3**	**4**	1.535	1.417
	13	**424.2-813-**	**2**	**3**	**4**	2.185	2.008	1.693	1.733	**424.2-863-**	**2**	**3**	**4**	1.699	1.575
2.283–2.559	13	**424.2-813-**	**2**	**3**	**4**	2.185	2.008	1.693	1.733	**424.2-863-**	**2**	**3**	**4**	1.699	1.575
2.560–2.755	14	**424.2-814-L[1)]**	**–**	**–**	**–**	2.441	2.283	1.890	2.953	**424.2-864-L[1)]**	**–**	**–**	**–**	**–**	1.575
2.756–2.952	15	**424.2-815-L[1)]**	**–**	**–**	**–**	2.441	2.283	1.890	2.953	**424.2-865-L[1)]**	**–**	**–**	**–**	**–**	1.732
	16	**424.2-816-L[1)]**	**–**	**–**	**–**	2.677	2.480	2.087	2.953	**424.2-866-L[1)]**	**–**	**–**	**–**	**–**	1.890
2.953–3.149	16	**424.2-816-L[1)]**	**–**	**–**	**–**	2.677	2.480	2.087	2.953	**424.2-866-L[1)]**	**–**	**–**	**–**	**–**	1.890
3.150–3.345	17	**424.2-817-L[1)]**	**–**	**–**	**–**	2.953	2.756	2.323	3.819	**424.2-867-L[1)]**	**–**	**–**	**–**	**–**	2.126
3.346–3.543	17	**424.2-817-L[1)]**	**–**	**–**	**–**	2.953	2.756	2.323	3.819	**424.2-867-L[1)]**	**–**	**–**	**–**	**–**	2.126
	18	**424.2-818-L[1)]**	**–**	**–**	**–**	3.228	3.031	3.386	3.819	**424.2-868-L[1)]**	**–**	**–**	**–**	**–**	2.362
3.544–3.739	18	**424.2-818-L[1)]**	**–**	**–**	**–**	3.228	3.031	3.386	3.819	**424.2-868-L[1)]**	**–**	**–**	**–**	**–**	2.362
3.740–3.936	18	**424.2-818-L[1)]**	**–**	**–**	**–**	3.701	3.504	3.071	3.819	**424.2-868-L[1)]**	**–**	**–**	**–**	**–**	2.756
3.937–4.133	19	**424.2-819-L[1)]**	**–**	**–**	**–**	3.701	3.504	3.071	3.819	**424.2-869-L[1)]**	**–**	**–**	**–**	**–**	2.756
4.134–4.330	19	**424.2-819-L[1)]**	**–**	**–**	**–**	3.701	3.504	3.071	3.819	**424.2-869-L[1)]**	**–**	**–**	**–**	**–**	2.756
4.331–4.527	19	**424.2-819-L[1)]**	**–**	**–**	**–**	4.173	3.976	3.543	4.646	**424.2-869-L[1)]**	**–**	**–**	**–**	**–**	3.150
	20	**424.2-820-L[1)]**	**–**	**–**	**–**	4.173	3.976	3.543	4.646	**424.2-870-L[1)]**	**–**	**–**	**–**	**–**	3.150
4.528–4.724	20	**424.2-820-L[1)]**	**–**	**–**	**–**	4.173	3.976	3.543	4.646	**424.2-870-L[1)]**	**–**	**–**	**–**	**–**	3.150
4.725–4.882	20	**424.2-820-L[1)]**	**–**	**–**	**–**	4.173	3.976	3.543	4.646	**424.2-870-L[1)]**	**–**	**–**	**–**	**–**	3.150
	21	**424.2-821-L[1)]**	**–**	**–**	**–**	4.646	4.449	3.622	4.646	**424.2-871-L[1)]**	**–**	**–**	**–**	**–**	3.150

[1)] Lengths are manufactured by **customer request**, see page 25.

Note:
For ranges 14 through 21, innertube must be 7.480" longer than outer tube.

Ordering example for outer tube length 15.748 inch and inner tube 16.929 inch fitting drill head D_c = 1.697 inch:

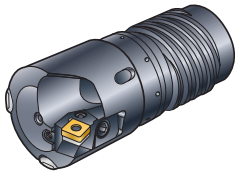
1 piece 424.2-810-2 and 1 piece 424.2-860-2

Ordering example for drill tube, design to customer request, outer tube length 31.496 inch and inner tube 32.677 inch, fitting drill head D_c = 2.563 inch:

1 piece 424.2-814-L31.496 and 1 piece 424.2-864-L32.677

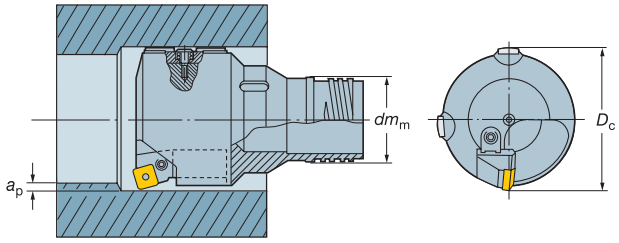
T-MAX® counterboring head 424.31 – manufactured by customer request

Single indexable insert design
Diameter range ≥ 2.559 inch



Diameter range: 2.559 – Max dia is dependent on machine capacity
Hole depth: 100 × diameter
Cutting fluid: Neat oil or soluble with EP-additives

Drill heads are manufactured to minus tolerance.



dm_m is the same as dm_t for the drill tube

Diameter range, inch D_c inch	T-Max P cartridge	Max. cutting depth a_p inch	Inserts (Ordered separately) SNMG SNMM	T-Max S cartridge	Max. cutting depth a_p inch	Inserts (Ordered separately) TPMX TPUN[2]	Support pad set No.
2.559-2.755	**R430.24-2024-12**	.394	12	**R430.23-2024-16**	.472	16	**430.21-12 D65.0** 2
2.756-2.952	**R430.24-2024-12**	.394	12	**R430.23-2024-16**	.472	16	**430.21-12 D70.0** 2
2.953-3.149	**R430.24-2024-12**	.394	12	**R430.23-2024-16**	.472	16	**430.21-12 D75.0** 2
3.150-3.346	**R430.24-2024-12**	.394	12	**R430.23-2024-16**	.472	16	**430.21-12 D80.0** 2
3.347-3.543	**R430.24-2024-12**	.394	12	**R430.23-2024-16**	.472	16	**430.21-12 D85.0** 2
3.544-3.739	**R430.24-2532-19**[1]	.630	19	**R430.23-2532-22**[1]	.669	22	**430.21-16 D90.0** 2
3.740-3.936	**R430.24-2532-19**[1]	.630	19	**R430.23-2532-22**[1]	.669	22	**430.21-16 D95.0** 2
3.937-4.133	**R430.24-2532-19**[1]	.630	19	**R430.23-2532-22**[1]	.669	22	**430.21-16 D100.0** 2
4.134-4.330	**R430.24-2532-19**[1]	.630	19	**R430.23-2532-22**[1]	.669	22	**430.21-16 D105.0** 2
4.331-4.527	**R430.24-2532-19**[1]	.630	19	**R430.23-2532-22**[1]	.669	22	**430.21-18 D110.0** 2
4.528-4.724	**R430.24-2532-19**[1]	.630	19	**R430.23-2532-22**[1]	.669	22	**430.21-18 D115.0** 2
4.725-4.920	**R430.24-2532-19**[1]	.630	19	**R430.23-2532-22**[1]	.669	22	**430.21-18 D120.0** 2
4.921-5.117	**R430.24-2532-19**[1]	.630	19	**R430.23-2532-22**[1]	.669	22	**430.21-18 D125.0** 2
5.118-5.511	**R430.24-2532-19**[1]	.630	19	**R430.23-2532-22**[1]	.669	22	**430.21-18 D130.0** 2
5.512-5.905	**R430.24-2532-19**[1]	.630	19	**R430.23-2532-22**[1]	.669	22	**430.21-18 D140.0** 2
5.906-6.298	**R430.24-2532-19**[1]	.630	19	**R430.23-2532-22**[1]	.669	22	**430.21-18 D150.0** 2
6.299-6.692	**R430.24-2532-19**[1]	.630	19	**R430.23-2532-22**[1]	.669	22	**430.21-18 D160.0** 2
6.693-7.086	**R430.24-2532-19**[1]	.630	19	**R430.23-2532-22**[1]	.669	22	**430.21-18 D170.0** 2
7.087-7.240	**R430.24-2532-19**[1]	.630	19	**R430.23-2532-22**[1]	.669	22	**430.21-18 D180.0** 2

[1] For small cutting depth use cartridges R430.24-2024-12 or R430.23-2024-16. Must be stated in order.

[2] Loose chipbreakers are to be used see page 102.

Note! for radial adjustment, see page 78.

When ordering additional support pads, D and the drilling diameter must be specified in the ordering code.

Ordering example for cartridge for counterboring head ∅ 2.559 inch: 1 piece R430.24-2024-12

Ordering example for support pad for counterboring head ∅ 2.559 inch: 1 piece 430.21-12 D65.0

Ordering

When ordering counterboring heads the following must be stated:

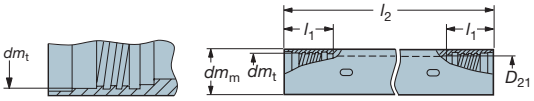
- Drill diameter, D_c.
- Depth of cut or pre-bored size.
- Insert clamping system to be used – T-Max P lever or T-Max S top clamp.
- Drilling system to be used – Ejector or STS.
- Drill tubes to be used and size dm_t.

For more information and advice, please contact your nearest Sandvik Coromant representative.

Counterboring head

424.31
Diameter range
≥ 2.559 inch

Outer tube, range 14–25



Inner tube, range 14–25

Note!
Drill tubes are supplied threaded in one or both ends with an internal thread, the E-thread. Except for Drill tube 424.9S which is threaded in one end.

dm_t is the same as dm_m for the drill

Diameter range, inch	Tube range	Ordering code Outer tube[1)]	Dimensions, inch				Ordering code Inner tube[1)]	Dimensions, inch
D_c inch			dm_m	dm_t	D_{21}	l_1		D_{23}
2.559-2.755	14	**424.2-814-L[1)]**	2.205	2.047	1.693	2.953	**424.2-864-L[1)]**	1.575
2.756-2.952	15	**424.2-815-L[1)]**	2.441	2.283	1.890	2.953	**424.2-865-L[1)]**	1.732
2.953-3.149	16	**424.2-816-L[1)]**	2.677	2.480	2.087	2.953	**424.2-866-L[1)]**	1.890
3.150-3.346	17	**424.2-817-L[1)]**	2.953	2.756	2.323	3.819	**424.2-867-L[1)]**	2.126
3.347-3.543	17 18	**424.2-817-L[1)]** **424.2-818-L[1)]**	2.953 3.228	2.756 3.031	2.323 2.598	3.819 3.819	**424.2-867-L[1)]** **424.2-868-L[1)]**	2.126 2.362
3.544-3.739	18	**424.2-818-L[1)]**	3.228	3.031	2.598	3.819	**424.2-868-L[1)]**	2.362
3.740-3.936	18	**424.2-818-L[1)]**	3.228	3.031	2.598	3.819	**424.2-868-L[1)]**	2.362
3.937-4.133	19	**424.2-819-L[1)]**	3.701	3.504	3.071	3.819	**424.2-869-L[1)]**	2.756
4.134-4.330	19	**424.2-819-L[1)]**	3.701	3.504	3.071	3.819	**424.2-869-L[1)]**	2.756
4.331-4.527	19 20	**424.2-819-L[1)]** **424.2-820-L[1)]**	3.701 4.173	3.504 3.975	3.071 3.543	3.819 4.646	**424.2-869-L[1)]** **424.2-870-L[1)]**	2.756 3.150
4.528-4.724	20	**424.2-820-L[1)]**	4.173	3.975	3.543	4.646	**424.2-870-L[1)]**	3.150
4.725-4.920	20 21	**424.2-820-L[1)]** **424.2-821-L[1)]**	4.173 4.646	3.975 4.449	3.543 3.622	4.646 4.646	**424.2-870-L[1)]** **424.2-871-L[1)]**	3.150 3.150
4.921-5.117	21	**424.2-821-L[1)]**	4.646	4.449	3.622	4.646	**424.2-871-L[1)]**	3.150
5.118-5.511	21 22	**424.2-821-L[1)]** **424.2-822-L[1)]**	4.646 5.118	4.449 4.921	3.622 4.094	4.646 4.646	**424.2-871-L[1)]** **424.2-872-L[1)]**	3.150 3.740
5.512-5.905	22 23	**424.2-822-L[1)]** **424.2-823-L[1)]**	5.118 5.590	4.921 5.394	4.094 4.567	4.646 5.472	**424.2-872-L[1)]** **424.2-873-L[1)]**	3.740 3.937
5.906-6.298	23	**424.2-823-L[1)]**	5.590	5.394	4.567	5.472	**424.2-873-L[1)]**	3.937
6.299-6.692	24	**424.2-824-L[1)]**	6.063	5.866	5.039	5.472	**424.2-874-L[1)]**	4.724
6.693-7.086	24 25	**424.2-824-L[1)]** **424.2-825-L[1)]**	6.063 6.535	5.866 6.299	5.039 5.512	5.472 5.472	**424.2-874-L[1)]** **424.2-875-L[1)]**	4.724 5.118
7.087-7.240	25	**424.2-825-L[1)]**	6.535	6.299	5.512	5.472	**424.2-875-L[1)]**	3.150

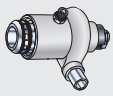
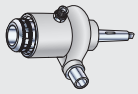
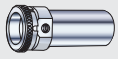
[1)] Lengths are manufactured by **customer request**, see page 25.

Ordering example for drill tube, design to customer request, outer tube length 31.496 inch and inner tube 32.677 inch, fitting drill head D_c = 2.559 inch:

1 piece 424.2-814-L31.496 and 1 piece 424.2-864-L32.677

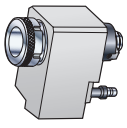
Note:
For tube ranges 14 through 20, inner tube must be 7.480" longer than outer tube.
For tube ranges 21 through 25, inner tube must be 8.661" longer than outer tube.

Mounting parts for rotating and non-rotating connectors, in diameter range .724 – 2.559 inch

Diameter range, inch	Tube range	Mounting parts				Connectors Rotating			Non- rotating
				O-rings: Two outer and one inner.		Varilock adapted	Morse taper	Flange mounting	
D_c inch		Collet 	Sealing sleeve 	Outer 	Inner 				Cylindrical 
.724- .787	00	424.2-421-00 424.2-420-00	424.2-431-00 424.2-430-00	424.2-445-51 424.2-445-50	424.2-445-00 424.2-445-00	424.2-400M-V63	424.2-401M 424.2-400M	424.9S/231-1 424.9S/170-1	424.2-411 424.2-410
.788- .858	01	424.2-421-01 424.2-420-01	424.2-431-01 424.2-430-01	424.2-445-51 424.2-445-50	424.2-445-01 424.2-445-01	424.2-400M-V63	424.2-401M 424.2-400M	424.9S/231-1 424.9S/170-1	424.2-411 424.2-410
.859- .948	02	424.2-421-02 424.2-420-02	424.2-431-02 424.2-430-02	424.2-445-51 424.2-445-50	424.2-445-02 424.2-445-02	424.2-400M-V63	424.2-401M 424.2-400M	424.9S/231-1 424.9S/170-1	424.2-411 424.2-410
.949-1.039	03	424.2-421-03 424.2-420-03	424.2-431-03 424.2-430-03	424.2-445-51 424.2-445-50	424.2-445-03 424.2-445-03	424.2-400M-V63	424.2-401M 424.2-400M	424.9S/231-1 424.9S/170-1	424.2-411 424.2-410
1.040-1.129	04	424.2-421-04 424.2-420-04	424.2-431-04 424.2-430-04	424.2-445-51 424.2-445-50	424.2-445-04 424.2-445-04	424.2-400M-V63	424.2-401M 424.2-400M	424.9S/231-1 424.9S/170-1	424.2-411 424.2-410
1.130-1.220	05	424.2-421-05 424.2-420-05	424.2-431-05 424.2-430-05	424.2-445-51 424.2-445-50	424.2-445-05 424.2-445-05	424.2-400M-V63	424.2-401M 424.2-400M	424.9S/231-1 424.9S/170-1	424.2-411 424.2-410
1.221-1.311	06	424.2-421-06 424.2-420-06	424.2-431-06 424.2-430-06	424.2-445-51 424.2-445-50	424.2-445-06 424.2-445-06	424.2-400M-V63	424.2-401M 424.2-400M	424.9S/231-1 424.9S/170-1	424.2-411 424.2-410
1.312-1.370 1.371-1.425	07	424.2-421-07 424.2-420-07	424.2-431-07 424.2-430-07	424.2-445-51 424.2-445-50	424.2-445-07 424.2-445-07	424.2-400M-V63	424.2-401M 424.2-400M	424.9S/231-1 424.9S/170-1	424.2-411 424.2-410
1.426-1.468 1.469-1.511 1.512-1.559	08	424.2-420-08	424.2-430-08	424.2-445-50	424.2-445-08	424.2-400M-V63	424.2-400M	424.9S/170-1	424.2-410
1.560-1.598 1.599-1.645 1.646-1.692	09	424.2-420-09	424.2-430-09	424.2-445-50	424.2-445-09	424.2-400M-V63	424.2-400M	424.9S/170-1	424.2-410
1.693-1.744 1.745-1.795 1.796-1.850	10	424.2-420-10	424.2-430-10	424.2-445-50	424.2-445-10	424.2-400M-V63	424.2-400M	424.9S/170-1	424.2-410
1.851-1.909 1.910-1.972 1.973-2.035	11	424.2-420-11	424.2-430-11	424.2-445-50	424.2-445-11	424.2-400M-V63	424.2-400M	424.9S/170-1	424.2-410
2.036-2.094 2.095-2.153 2.154-2.212	12	424.2-420-12	424.2-430-12	424.2-445-50	424.2-445-12	424.2-400M-V63	424.2-400M	424.9S/170-1	424.2-410
2.213-2.299 2.300-2.385 2.386-2.472 2.473-2.559	13	424.2-420-13	424.2-430-13	424.2-445-50	424.2-445-13	424.2-400M-V63	424.2-400M	424.9S/170-1	424.2-410

Ordering example: 2 pieces 424.2-421-00

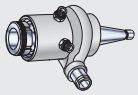
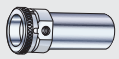
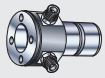
Varilock adapted connector for automatic tool change



Drill diameter range .724-2.559 inch

For ordering, see page 40.

Mounting parts for rotating and non-rotating connectors, in diameter range 2.559 – 7.240 inch

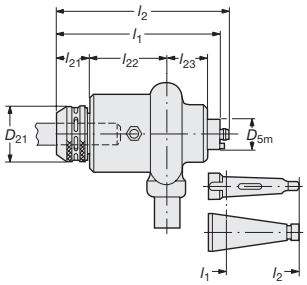
Diameter range, inch	Tube range	Mounting parts			Connectors			
					Rotating		Non- rotating	
		Connecting sleeve/collet	Sealing sleeve	O-ring	ISO taper	Flange mounting	Cylindrical	Tube mounted
D_c inch								
2.559-2.637	14	424.2-422-14	424.2-432-14	3671 010-143	424.2-402	424.9S/224-1	424.2 412	424.9S/232-1-14
2.638-2.873	15	424.2-422-15	424.2-432-15	3671 010-143	424.2-402	424.9S/224-1	424.2 412	424.9S/232-1-15
2.874-3.149	16	424.2-422-16	424.2-432-16	3671 010-143	424.2-402	424.9S/224-1	424.2 412	424.9S/232-1-16
3.150-3.424	17	424.2-422-17	424.2-432-17	3671 010-143	424.2-402	424.9S/224-1	424.2 412	424.9S/232-1-17
3.425-3.936	18	424.2-422-18	424.2-432-18	3671 010-143	424.2-402	424.9S/224-1	424.2 412	424.9S/232-1-18
3.937-4.408	19	424.2-422-19	424.2-432-19	3671 010-143	424.2-402	424.9S/224-1	424.2 412	424.9S/232-1-19
4.409-4.881	20	424.2-422-20	424.2-432-20	3671 010-143	424.2-402	424.9S/224-1	424.2 412	424.9S/232-1-20
2.559-2.637	14	424.2-422-14A[1)]	424.2-432-14	3671 010-143	424.2-402	424.9S/224-1	424.2 412	424.9S/232-1-14
2.638-2.873	15	424.2-422-15A[1)]	424.2-432-15	3671 010-143	424.2-402	424.9S/224-1	424.2 412	424.9S/232-1-15
2.874-3.149	16	424.2-422-16A[1)]	424.2-432-16	3671 010-143	424.2-402	424.9S/224-1	424.2 412	424.9S/232-1-16
3.150-3.424	17	424.2-422-17A[1)]	424.2-432-17	3671 010-143	424.2-402	424.9S/224-1	424.2 412	424.9S/232-1-17
3.425-3.936	18	424.2-422-18A[1)]	424.2-432-18	3671 010-143	424.2-402	424.9S/224-1	424.2 412	424.9S/232-1-18
3.937-4.408	19	424.2-422-19A[1)]	424.2-432-19	3671 010-143	424.2-402	424.9S/224-1	424.2 412	424.9S/232-1-19
4.409-4.881	20	424.2-422-20A[1)]	424.2-432-20	3671 010-143	424.2-402	424.9S/224-1	424.2 412	424.9S/232-1-20
4.882-5.353	21	424.2-423-21	424.2-433-21	3671 010-154	–	424.9S/245-1	424.2 413	424.9S/232-1-21
5.354-5.826	22	424.2-423-22	424.2-433-22	3671 010-154	–	424.9S/245-1	424.2 413	424.9S/232-1-22
5.827-6.298	23	424.2-423-23	424.2-433-23	3671 010-154	–	424.9S/245-1	424.2 413	424.9S/232-1-23
6.299-6.771	24	424.2-423-24	424.2-433-24	3671 010-154	–	424.9S/245-1	424.2 413	424.9S/232-1-24
6.772-7.240	25	424.2-423-25	424.2-433-25	3671 010-154	–	424.9S/245-1	424.2 413	424.9S/232-1-25

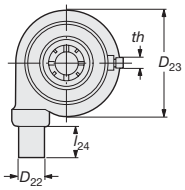
[1)] New reinforced sleeve. The sleeve has been shortened by .433 inch. Customers that have existing tubes must be notified that the inner tube will be too long and thus have to be cut off by .433 inch in the front end. Please note that the length l_2 of outer tube will stay the same and is not affected by the modification.

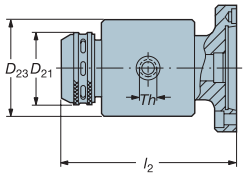
Ordering example: 2 pieces 424.2-422-14

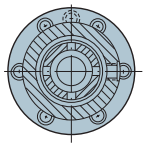
Rotating connectors

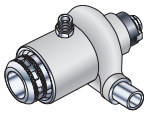
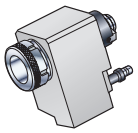
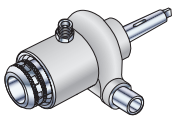
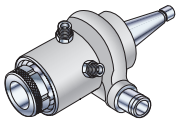
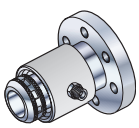
Diameter range: .724 – 7.240 inch









Type of connector	Diameter range, inch	Shank	Ordering code	Dimensions, inch											
	D_c inch			dm_m	D_{21}	D_{22}	D_{23}	l_1	l_2	l_{21}	l_{22}	l_{23}	l_{24}	th	Th
Varilock adapted for manual tool change 	.724–2.559	V63	**424.2-400M-V63**	2.480	4.527	2.087	8.268	12.008	–	2.638	5.315	3.346	2.362	R3/4″	–
Varilock adapted for automatic tool change 	.724–1.693 .724–2.559	V63 V80	For ordering and information, see page 40.												
Morse taper 	.724–1.425 .724–2.559	MT4 MT5	**424.2-401M** **424.2-400M**	– –	3.346 4.527	1.575 2.087	6.299 8.268	10.118 12.185	14.961 18.307	1.968 2.638	4.842 5.3150	2.520 3.346	1.968 2.362	R3/4″ R3/4″	– –
ISO taper 	2.559–4.878	ISO 50	**424.2-402**	–	6.457	3.937	12.283	15.394	20.512	2.402	7.874	4.252	3.937	R1″	–
Flange mounting 	.724–1.425 .724–2.559 2.559–4.878 4.882–7.240	Flange Flange Flange Flange	**424.9S/231-1**[1)] **424.9S/170-1**[1)] **424.9S/224-1**[1)] **424.9S/245-1**[1)]	– – – –	3.346 4.527 6.457 9.606	– – – –	5.118 6.299 8.858 14.173	– – – –	9.252 11.220 13.583 15.748	– – – –	– – – –	– – – –	– – – –	– – – –	R3/4″ R3/4″ R1″ R1 1/4″

[1)] Flange mounted, spindle nose type and size must be specified. Connectors are supplied with nut and spanner.

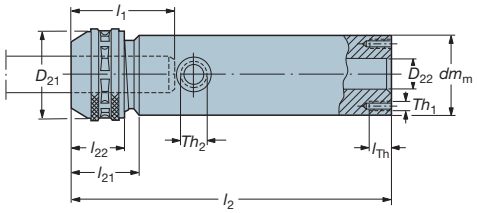
Ordering example: 1 piece 424.2-400M-V63

Spare parts
106

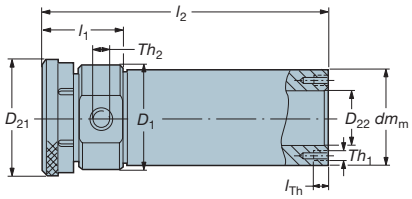
Non-rotating connectors

Diameter range: .724 – 7.240 inch

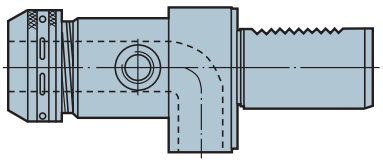
Cylindrical shank
Diameter .724-2.559 inch

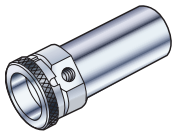


Diameter 2.559–7.240 inch



Example of connectors for NC lathes
Mounting specifications of turret lathe are required to design special connectors.



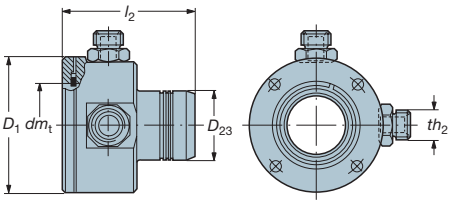
Type of shank	Diameter range, inch	Shank	Ordering code	Dimensions, inch									
	D_c inch	dm_m		D_1	D_{21}	D_{22}	l_2	l_1	l_{21}	l_{22}	l_{Th}	Th_1	Th_2
	.724-1.425	2.953	**424.2-411**	–	3.346	1.181	11.811	4.055	2.480	1.968	.787	M8	R1/2″
	.724-2.559	3.937	**424.2-410**	–	4.527	1.772	12.992	4.724	2.480	1.968	.787	M8	R3/4″
	2.559-4.878	5.512	**424.2-412**	6.299	6.457	3.189	16.378	4.567	–	–	.787	M8	R1″
	4.882-7.240	9.055	**424.2-413**	9.842	9.606	5.590	17.953	6.142	–	–	.787	M8	R1 1/4″

Connectors are supplied with nut and spanner.

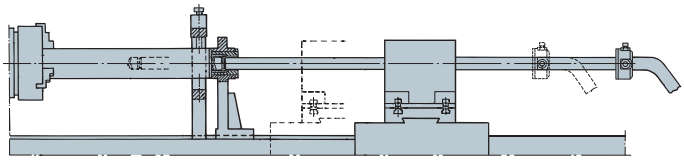
Ordering example: 1 piece 424.2-411

Drill mounted connectors – non-rotating

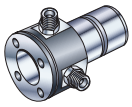
Diameter range: 2.559-7.240 inch



Mounting of drill tube mounted connector



Connectors are supplied with nut and spanner.

Type of shank	Diameter range, inch	Ordering code, connector	Dimensions, inch				
	D_c inch		dm_t	D_1	D_{23}	l_2	th_2
	2.559-2.634	**424.9S/232-1-14**	2.205	4.331	1.988	5.905	R1″
	2.638-2.870	**424.9S/232-1-15**	2.441	4.331	1.988	5.905	R1″
	2.874-3.146	**424.9S/232-1-16**	2.677	4.724	2.488	5.905	R1″
	3.150-3.421	**424.9S/232-1-17**	2.953	5.118	2.488	5.905	R1″
	3.425-3.933	**424.9S/232-1-18**	3.228	5.118	2.988	5.905	R1″
	3.937-4.405	**424.9S/232-1-19**	3.701	5.905	2.988	5.905	R1″
	4.409-4.878	**424.9S/232-1-20**	4.173	6.299	3.976	5.905	R1″
	4.882-5.350	**424.9S/232-1-21**	4.646	6.693	3.976	6.693	R1 1/4″
	5.354-5.823	**424.9S/232-1-22**	5.118	7.283	4.988	6.693	R1 1/4″
	5.827-6.295	**424.9S/232-1-23**	5.590	7.874	4.988	6.693	R1 1/4″
	6.299-6.768	**424.9S/232-1-24**	6.063	8.464	4.988	6.693	R1 1/4″
	6.772-7.240	**424.9S/232-1-25**	6.535	8.858	4.988	6.693	R1 1/4″

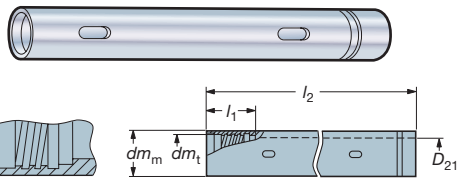
Note! For spare parts, see page 108.

Ordering example: 1 piece 424.9S/232-1-14

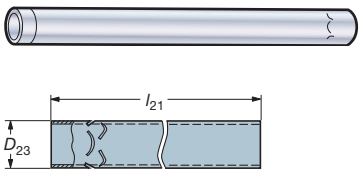
Drill tubes suitable for drill mounted connectors – non-rotating

Diameter range: .724 –7.240 inch

Outer tube, range 14–25



Inner tube, range 14–25



dm_t is the same as dm_m for the drill

Diameter range, inch	Tube range	Ordering code, outer tube	Dimensions, inch				Ordering code, inner tube	Dimensions, inch
D_c inch			dm_m	dm_t	D_{21}	l_1		D_{23}
2.559-2.634	14	**424.9S/233-14**[1)]	2.205	2.047	1.693	2.953	**424.2-864-L**[1)]	1.575
2.638-2.870	15	**424.9S/233-15**[1)]	2.441	2.283	1.890	2.953	**424.2-865-L**[1)]	1.732
2.874-3.146	16	**424.9S/233-16**[1)]	2.667	2.480	2.087	2.953	**424.2-866-L**[1)]	1.890
3.150-3.421	17	**424.9S/233-17**[1)]	2.953	2.756	2.323	3.819	**424.2-867-L**[1)]	2.126
3.425-3.933	18	**424.9S/233-18**[1)]	3.228	3.301	2.598	3.819	**424.2-868-L**[1)]	2.362
3.937-4.405	19	**424.9S/233-19**[1)]	3.701	3.504	3.071	3.819	**424.2-869-L**[1)]	2.756
4.409-4.878	20	**424.9S/233-20**[1)]	4.176	3.975	3.543	4.646	**424.2-870-L**[1)]	3.150
4.882-5.350	21	**424.9S/233-21**[1)]	4.646	4.449	3.622	4.646	**424.2-871-L**[1)]	3.150
5.354-5.823	22	**424.9S/233-22**[1)]	5.118	4.921	4.094	4.646	**424.2-872-L**[1)]	3.740
5.827-6.295	23	**424.9S/233-23**[1)]	5.591	5.394	4.567	5.472	**424.2-873-L**[1)]	3.937
6.299-6.768	24	**424.9S/233-24**[1)]	6.063	5.866	5.039	5.472	**424.2-874-L**[1)]	4.724
6.772-7.240	25	**424.9S/233-25**[1)]	6.535	6.299	5.512	5.472	**424.2-875-L**[1)]	5.118

[1)] Lengths are manufactured by **customer request**, see page 25.

Ordering example outer tube: 1 piece 424.9S/233-14

Note: Inner tubes for drill tube **424.9S/233** must be ordered 2.953 inches longer than the outer tube.

Varilock adapted connector for automatic tool change

Deep hole drilling operations are not normally performed on Machining Centers but carried out on conventional or special purpose built machines which require dedicated workholding facilities.

The Ejector system developed by Sandvik Coromant however, has been designed to allow deep hole drilling to be performed more effectively on Machining Centers.

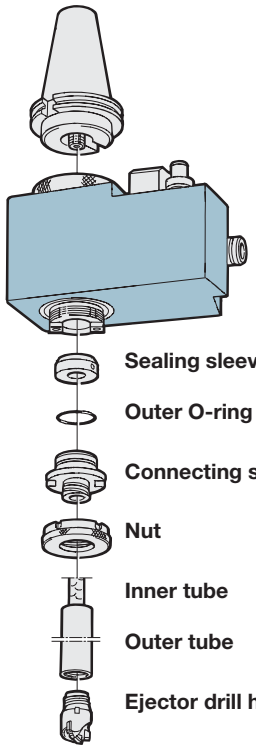
Ejector drilling requires high pressure coolant, a feature which most machining centers do not have. To enable this requirement to be incorporated, an extra coolant unit is necessary to obtain the benefits of Ejector drillling.

To deal with the copious amount of coolant supply needed to ensure good chip evacuation, Sandvik Coromant has introduced a Varilock connector with integral coolant supply housing, specially adapted for automatic tool changing.

A Varilock coupling is incorporated into the rear of the connector which allows interchangeability between a wide range of basic holders.

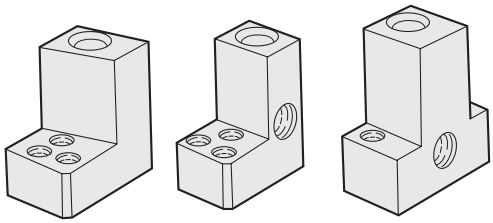
Rotating connector

For Ejector drilling in machining centers



Machine connection block

The illustration shows three types of machine connection blocks which are necessary if the machine is not already equipped for coolant supply adjacent to the spindle.
If you wish to order the machine connection block with the coolant connector, please send full details of the type of block you require and its position on the spindle nose.
If your machine is already fitted with a connection block, please send the details with your order.



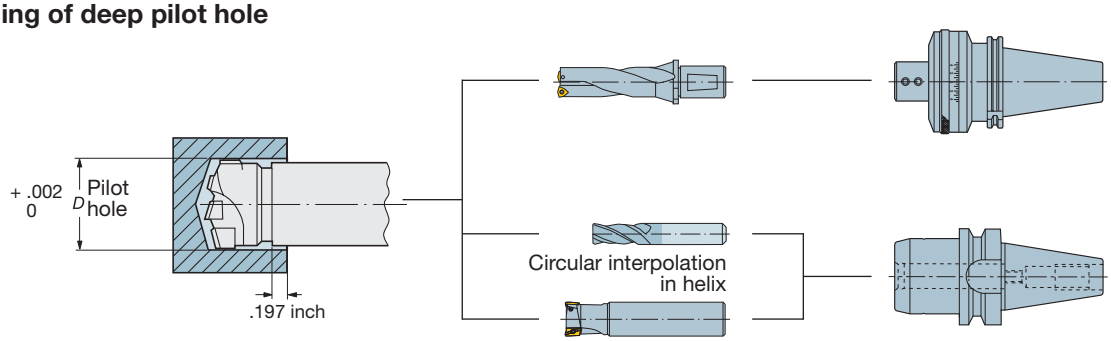
Pilot holes for Ejector drilling

Method of producing pilot holes:

A deep pilot hole is required when not using a bushing to guide the coolant.
The tolerance of the hole is plus in relation to the drill diameter.

See chart on page 126.

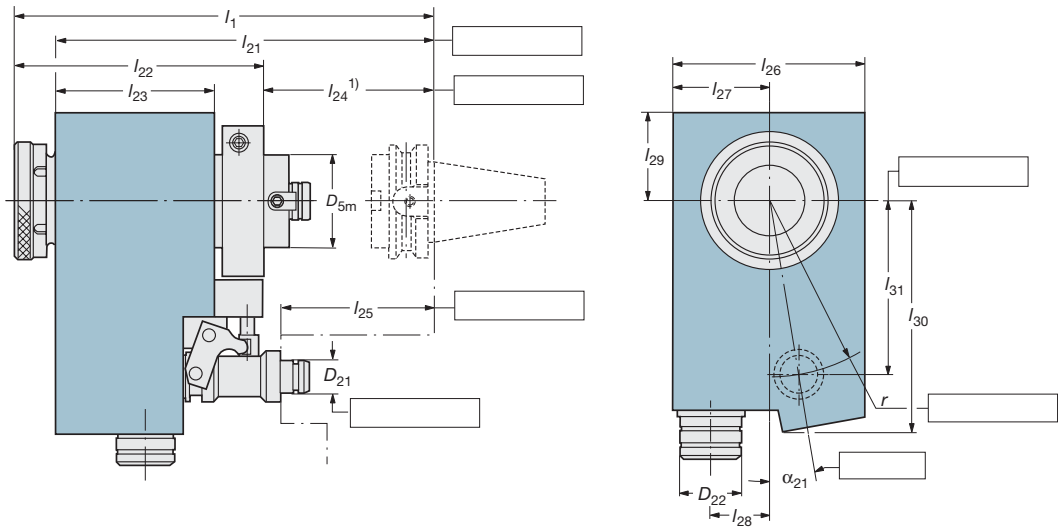
Drilling of deep pilot hole



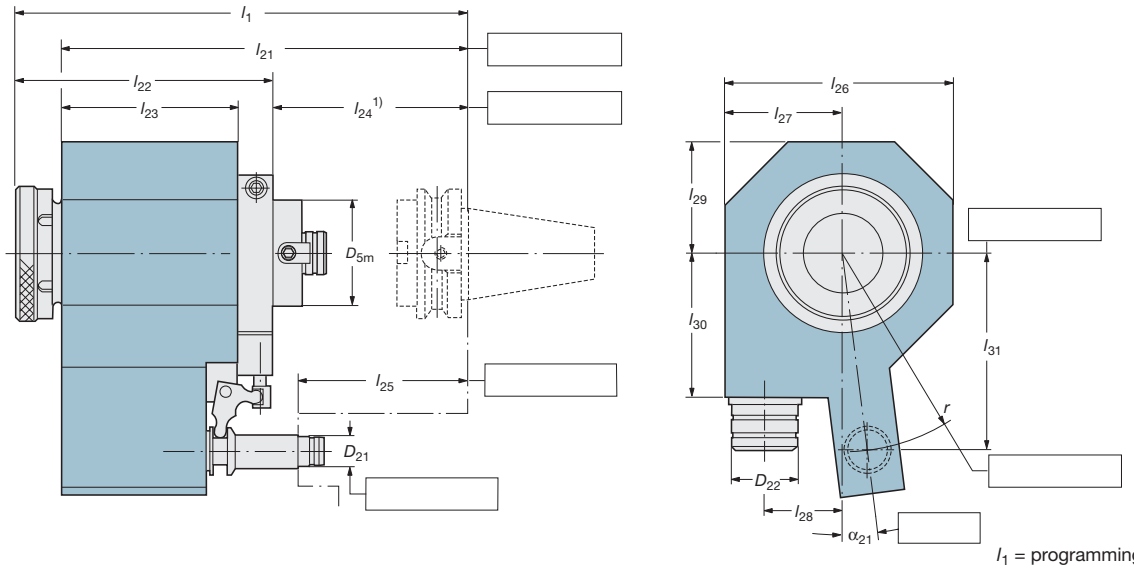
Varilock coolant connector

When ordering, please complete the details of your requirements below, and send your order or inquiry to your Sandvik Coromant sales representative.

Housing, size 1



Housing, size 2



l_1 = programming length

1) The connector provides limited space in front of the flange for the toolgripper. If the toolgripper requires a specific space (l_{24}) please make sure this measurement is stated on the order.

Housing size	Drill diameter range, inch	Varilock size	Dimensions, inch									Max rev/min	Cutting fluid pressure psi		Cutting fluid quantity
	D_c inch	D_{5m}	D_{22}	l_{22}	l_{23}	l_{26}	l_{27}	l_{28}	l_{29}	l_{30}	Lbs		Max	Recommended values	gpm
1	.724-1.693	63	1.575	6.693	4.212	5.118	2.559	1.575	2.362	6.299	33	3000	1770	708-1327	13-32
2	.724-2.559	80	1.968	7.874	5.315	6.890	3.543	2.362	3.346	4.331	55	2500	1770	531-1327	13-53

Drill tubes are manufactured by **customer request**.

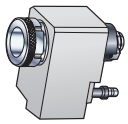
Ordering

When ordering the following must be stated:

- **Machine type**
- **Taper standard**
- **Taper size**
- **Drill diameter**
- **Drilling depth**
- **Drill tube length**

For more information and advice, please contact your nearest Sandvik Coromant representative.

Components for Varilock-adapted connector for automatic tool change in machining centers

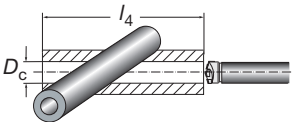
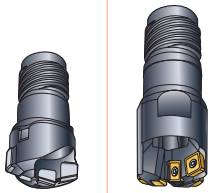
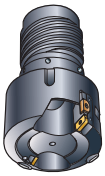
Tuberange	 Outer tube[1)]	 Inner tube[1)]	 Nut	 Connecting sleeve	 Sealing sleeve	 O-ring	**Connector** Rotating, Varilock-adapted  Size
00	424.9S/280 Pos 0	424.9S/281 Pos 0	424.9S/279-4.1 840110A16-4	424.9S/282 Pos 0 840110R31-2 Pos 0	424.9S/283 Pos 0 840110R32-2 Pos 0	1.260 x .063 1.850 x .118	1 2
01	424.9S/280 Pos 1	424.9S/281 Pos 1	424.9S/279-4.1 840110A16-4	424.9S/282 Pos 1 840110R31-2 Pos 1	424.9S/283 Pos 1 840110R32-2 Pos 1	1.260 x .063 1.850 x .118	1 2
02	424.9S/280 Pos 2	424.9S/281 Pos 2	424.9S/279-4.1 840110A16-4	424.9S/282 Pos 2 840110R31-2 Pos 2	424.9S/283 Pos 2 840110R32-2 Pos 2	1.260 x .063 1.850 x .118	1 2
03	424.9S/280 Pos 3	424.9S/281 Pos 3	424.9S/279-4.1 840110A16-4	424.9S/282 Pos 3 840110R31-2 Pos 3	424.9S/283 Pos 3 840110R32-2 Pos 3	1.260 x .063 1.850 x .118	1 2
04	424.9S/280 Pos 4	424.9S/281 Pos 4	424.9S/279-4.1 840110A16-4	424.9S/282 Pos 4 840110R31-2 Pos 4	424.9S/283 Pos 4 840110R32-2 Pos 4	1.260 x .063 1.850 x .118	1 2
05	424.9S/280 Pos 5	424.9S/281 Pos 5	424.9S/279-4.1 840110A16-4	424.9S/282 Pos 5 840110R31-2 Pos 5	424.9S/283 Pos 5 840110R32-2 Pos 6	1.260 x .063 1.850 x .118	1 2
06	424.9S/280 Pos 6	424.9S/281 Pos 6	424.9S/279-4.1 840110A16-4	424.9S/282 Pos 6 840110R31-2 Pos 6	424.9S/283 Pos 6 840110R32-2 Pos 6	1.260 x .063 1.850 x .118	1 2
07	424.9S/280 Pos 7	424.9S/281 Pos 7	424.9S/279-4.1 840110A16-4	424.9S/282 Pos 7 840110R31-2 Pos 7	424.9S/283 Pos 7 840110R32-2 Pos 7	1.260 x .063 1.850 x .118	1 2
08	424.9S/280 Pos 8	424.9S/281 Pos 8	424.9S/279-4.1 840110A16-4	424.9S/282 Pos 8 840110R31-2 Pos 8	424.9S/283 Pos 8 840110R32-2 Pos 8	1.260 x .063 1.850 x .118	1 2
09	424.9S/280 Pos 9	424.9S/281 Pos 9	424.9S/279-4.1 840110A16-4	424.9S/282 Pos 9 840110R31-2 Pos 9	424.9S/283 Pos 9 840110R32-2 Pos 9	1.260 x .063 1.850 x .118	1 2
10	424.9S/280 Pos 10	424.9S/281 Pos 10	840110A16-4	840110R31-2 Pos 10	840110R32-2 Pos 10	1.850 x .118	2
11	424.9S/280 Pos 11	424.9S/281 Pos 11	840110A16-4	840110R31-2 Pos 11	840110R32-2 Pos 11	1.850 x .118	2
12	424.9S/280 Pos 12	424.9S/281 Pos 12	840110A16-4	840110R31-2 Pos 12	840110R32-2 Pos 12	1.850 x .118	2
13	424.9S/280 Pos 13	424.9S/281 Pos 13	840110A16-4	840110R31-2 Pos 13	840110R32-2 Pos 13	1.850 x .118	2

[1)] Lengths are manufactured by **customer request**.

Ordering example: 1 piece 424.9S/280 Pos 0

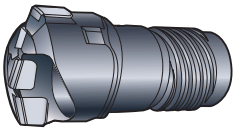
DEEP HOLE DRILLING

STS system

Data and applications • **Solid drill heads** • **Trepanning heads** • **Counterboring heads**	**STS** **Solid drilling**		**STS** **Trepanning**	**STS** **Solid drilling**	**STS** **Counterboring**		
	420.6	**800.20**	**420.7**	**424.10**	**424.31F**	**424.31**	**424.32**
							
Drill diameter, D_c **Drilling depth, l_4**	**.496–2.559** **150 × D_c**	**.984–2.559** **150 × D_c**	**≥ 4.407** **150 × D_c**	**≥ 2.559** **150 × D_c**	**.787–4.882** **150 × D_c**	**≥ 2.559** **150 × D_c**	**≥ 2.953** **150 × D_c**
Page	48	52	70	56	62	62	71
Machine							
– DHD machines		Yes		Yes		Yes	
– NC machines		–		–		–	
– Lathes		–		–		–	
– Most conventional machines		–		–		–	
– Machining centers		–		–		–	
Workpiece material							
– Steel **P**	✦✦✦	✦✦✦	✦✦✦	✦✦✦	✦✦✦	✦✦✦	✦✦✦
– Stainless steel **M**	✦✦✦	✦✦✦	✦✦✦	✦✦✦	✦✦✦	✦✦✦	✦✦✦
– Cast iron **K**	✦✦✦	✦✦✦	✦✦✦	✦✦✦	✦✦✦	✦✦✦	✦✦✦
– Aluminum alloys **N**	✦✦✦	✦✦✦	✦✦✦	✦✦✦	✦✦	✦✦	✦✦
– Heat resistant alloys **S**	✦✦✦	✦✦✦	✦✦✦	✦✦✦			
Tool							
– Internal cutting fluid supply	Yes	Yes	Yes	Yes	Yes	Yes	Yes
– Insert type	–	800-XX T3 08M 800-XX T3 08H	TPMT/R424.9 TPMX/TPUN	TPMT/R424.9 TPMX/TPUN	R424.31F/ SNMG/SNMM	TPMX/TPUN SNMG/SNMM	TPMT/R424.9
Cutting data	See pages 86-98						

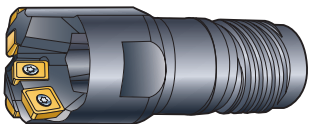
Good = ✦✦✦ ⟷ ✦ *= Fair*

Ground drill head 420.6



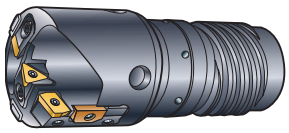
- 4-6 times faster than gun drilling
- The first choice for hole diameters .496-.984 inch or for dia. .984-2.559 inch when extra close diameter tolerance is demanded
- Low investment cost for small batch production
- Standard program

CoroDrill™ 800.20



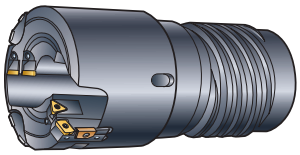
- The most productive choice for diameter range .984-2.559
- Lowest cost per hole
- Consistent performance within a wide application range
- Standard program
- Developed and manufactured with the latest technology

T-MAX® drill 424.10



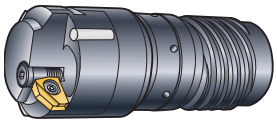
- The choice for large diameters starting from 2.500 inch
- Setting possibilities on diameter
- Good hole straightness in long workpieces
- Stocked standard program
- Wide range of Tailor Made and engineered solutions

T-MAX® 420.7 trepanning head – on request



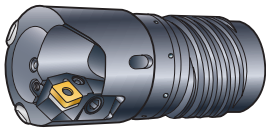
- Indexable insert design
- For trepanning large diameters with low power requirements
- Drilling depth up to 100 times diameter
- Max diameter depending on machine capacity
- Standard components

T-MAX® 424.31F counterboring head – on request



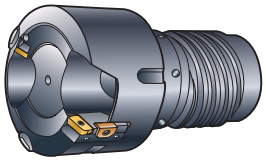
- When demands for precision, productivity and versatility are high
- Single insert design
- Adjustable insert cartridge head
- Stocked standard components

T-MAX® 424.31 counterboring head – on request



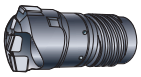
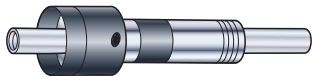
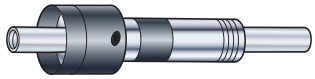
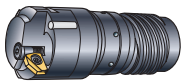
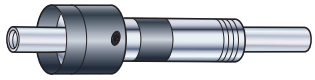
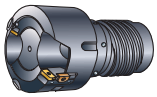
- When demands for productivity and versatility are high
- Single insert design
- Adjustable insert cartridge head
- Stocked standard components

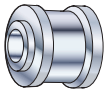
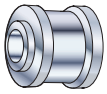
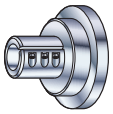
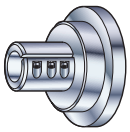
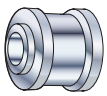
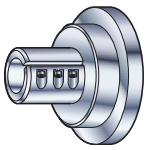
T-MAX® 424.32 counterboring head – on request



- Multi-insert design
- Adjustable insert cartridge head
- Wide range of engineered solutions
- Stocked standard components

Tool mounting – solid drilling and counterboring

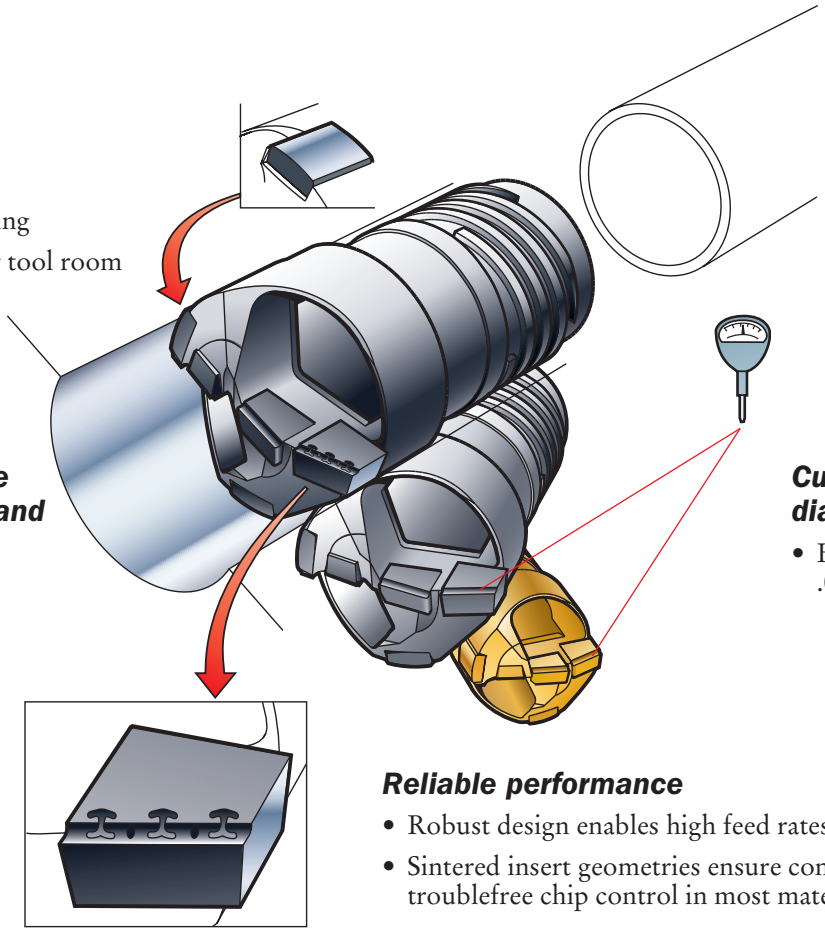
Diameter range, inch	Drill heads	Drill tubes	Oil pressure heads – with clamping cones – for face sealing only
Solid drilling			
.496–2.559	Brazed drill head 420.6 Page 50 	Drill tube 420.5- Page 51/55 	Head 420.9S/ Page 74 
.984–2.559	CoroDrill™ indexable insert drill head 800.20 Page 54 		
2.500–7.240	T-Max adjustable drill head 424.10 Page 58 	Drill tube 420.5- Page 59 	Head 420.9S/ Page 74 
Counterboring			
.787–4.882	T-Max single insert counterboring head 424.31F Page 64/66 		
≥2.559	T-Max single insert counterboring head 424.31 Page 68 	Drill tube 420.5/424.2– Page 65/67/69 	Head 420.9S/ Page 74 
≥2.953	T-Max multi insert counterboring head 424.32 Page 71 		

Vibration dampers (optional)	Connecting chucks, – rotating drills – non rotating drills	For drill tube diameter dm_m, inch	For drill diameter, inch
	Collet style		
Vibration damper 342- Page 76 	Chuck 420.9S/524 Page 75 	**.433–2.205**	**.496–2.559**
	Split bushing style		
	Chuck 420.9S/520 Page 75 	**1.850–4.173**	**2.035–4.878**
Vibration damper 342- Page 76 	Chuck 420.9S/521 Page 75 	**4.685–6.535**	**4.882–7.240**
	Chuck 420.9S/522 Page 75 	**7.008–9.370**	**7.244–10.075**
Vibration damper 342- Page 76 	Chuck 420.9S/523 Page 75 	**9.843–15.039**	**10.079–15.744**

Ground drill head 420.6

"The original" precision drill

Diameter range .496 – 2.559 inch



Easy to use

- No pre-setting
- No need for tool room service

Excellent hole straightness and surface finish

Customer specified diameter

- Finish ground within .001 inch increments

Reliable performance

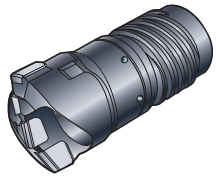
- Robust design enables high feed rates
- Sintered insert geometries ensure consistent troublefree chip control in most materials

Wide application area

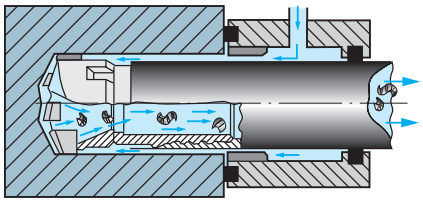
- Optimized grade and geometry combinations for most workpiece materials

Ground drill head 420.6

- ***4 to 6 times faster than gun drilling***
- ***The first choice for hole diameters .496 – .984 inch, or in diameter range .984 – 2.559 when extra close diameter tolerance is demanded***
- ***Low investment cost for small batch production***
- ***Standard program***

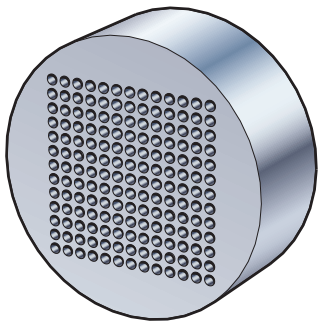


Preferred STS applications



- Special machines for mass production
- Special DHD machines
- Long run production
- Long workpieces
- Material with difficult chip-breaking or uneven structure
- Stainless and low carbon steel

Typical components – Industry segments



Heat exchanger plate
Drill dia, D_c : .764 inch
Drill depth, l_4 : 24.016 inch

Power generation
- Heat exchanger plates

Mold industry
- Coolant holes

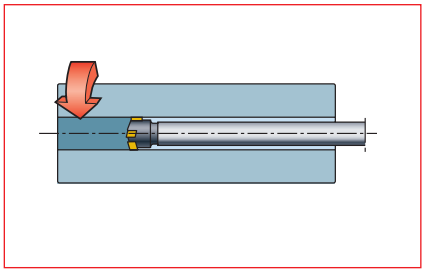
Automotive/truck industry
- Axles, piston pins
- Engine blocks (diesel)
- Hydraulic cylinders
- Track links

Steel industry
- Billets

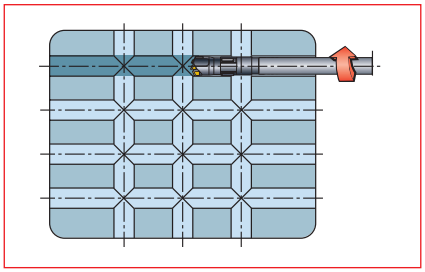
Process industry
- Oil holes

Aerospace industry
- Landing gear
- Gas turbine axels

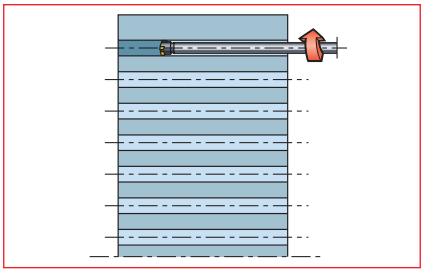
Ship yard
- Coolant/oil holes in engine blocks



Steel billet
Drill dia, D_c : 1.732 inch
Drill depth, l_4 : 23.622 inch



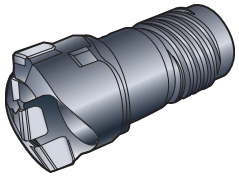
Mold coolant holes
Drill dia, D_c : .591 inch (x 9)
Drill depth, l_4 : 39.370 inch and 78.740 inch



Tube plate for boiler
Drill dia, D_c : 1.012 inch (x 200)
Drill depth, l_4 : 14.173 inch

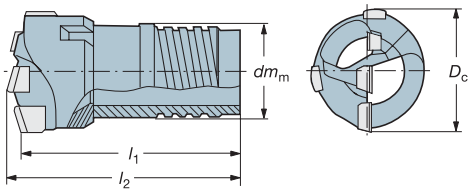
STS drill program - Ground brazed solid drill head 420.6

Diameter range .496 – 2.559 inch



Diameter range: .496-2.559 inch
Hole depth: 150 × Dia.
Cutting fluid: Neat oil or soluble

Drill heads are manufactured to minus tolerance.
Drill heads are delivered with standard chipbreaker, finish ground to the desired diameter to tolerance ISO h6.



dm_m is the same as dm_t for the drill tube

Diameter range, inch	Tube range	Ordering code, Drill head[1]	P	M	K	N	S	Dimensions, inch
			Chipbreaker (w)[2]					Tolerances, inch
			4 4	3/2 3	4	4	4	l_2 = ± .039
								l_1 = ± .039
			Coromant grade combination (zz)[1]					dm_m = h8
D_c inch		★ = First choice	70 63	20 67	72	72	72	dm_m l_2 l_1
.496– .515	94	**420.6- 941w Dx.xxx zz**	★ –	– ★	–	–	–	.323 1.693 1.650
.516– .535		**942w Dx.xxx zz**	★ –	– ★	–	–	–	.323 1.693 1.650
.536– .555	95	**420.6- 951w Dx.xxx zz**	★ –	– ★	–	–	–	.362 1.693 1.646
.556– .575		**952w Dx.xxx zz**	★ –	– ★	–	–	–	.362 1.693 1.646
.576– .594	96	**420.6- 961w Dx.xxx zz**	★ –	– ★	–	–	–	.402 1.693 1.642
.595– .614		**962w Dx.xxx zz**	★ –	– ★	–	★	★	.402 1.693 1.642
.615– .638	97	**420.6- 971w Dx.xxx zz**	★ –	– ★	–	★	★	.496 1.693 1.587
.639– .657		**972w Dx.xxx zz**	★ –	– ★	–	★	★	.496 1.693 1.587
.658– .677	98	**420.6- 981w Dx.xxx zz**	★ –	– ★	–	★	★	.535 1.693 1.587
.678– .696		**982w Dx.xxx zz**	★ –	– ★	–	★	★	.535 1.693 1.587
.697– .724	99	**420.6- 991w Dx.xxx zz**	★ –	– ★	–	★	★	.571 1.850 1.740
.725– .744		**992w Dx.xxx zz**	★ –	– ★	–	★	★	.571 1.850 1.736
.745– .755	00	**420.6- 001w Dx.xxx zz**	★ –	– ★	–	★	★	.610 1.850 1.736
.756– .787		**002w Dx.xxx zz**	★ –	– ★	–	★	★	.610 1.850 1.732
.788– .822	01	**420.6- 011w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	.630 2.069 1.945
.823– .858		**012w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	.630 2.069 1.937
.859– .901	02	**420.6- 021w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	.709 2.205 2.079
.902– .948		**022w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	.709 2.205 2.071
.949– .992	03	**420.6- 031w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	.768 2.264 2.126
.993–1.039		**032w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	.768 2.264 2.126
1.040–1.082	04	**420.6- 041w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	.826 2.264 2.118
1.083–1.129		**042w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	.826 2.264 2.118
1.130–1.173	05	**420.6- 051w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	.925 2.500 2.343
1.174–1.220		**052w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	.925 2.500 2.335
1.221–1.263	06	**420.6- 061w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.004 2.500 2.339
1.264–1.311		**062w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.004 2.500 2.327
1.312–1.370	07	**420.6- 071w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.102 2.500 2.323
1.371–1.425		**072w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.102 2.500 2.319
1.426–1.468	08	**420.6- 081w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.181 2.894 2.705
1.469–1.511		**082w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.181 2.894 2.697
1.512–1.559		**083w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.181 2.894 2.689
1.560–1.598	09	**420.6- 091w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.299 2.894 2.685
1.599–1.645		**092w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.299 2.894 2.677
1.646–1.692		**093w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.299 2.894 2.669
1.693–1.744	10	**420.6- 101w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.299 2.953 2.736
1.745–1.795		**102w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.299 2.953 2.728
1.796–1.850		**103w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.299 2.953 2.720
1.851–1.909	11	**420.6- 111w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.535 2.953 2.709
1.910–1.972		**112w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.535 2.953 2.705
1.973–2.035		**113w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.535 2.953 2.697
2.036–2.094	12	**420.6- 121w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.693 3.228 2.961
2.095–2.153		**122w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.693 3.228 2.972
2.154–2.212		**123w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.693 3.228 2.961
2.213–2.299	13	**420.6- 131w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.850 3.307 3.039
2.300–2.385		**132w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.850 3.307 3.020
2.386–2.472		**133w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.850 3.307 3.024
2.473–2.559		**134w Dx.xxx zz**	★ ☆	★ ☆	☆	★	★	1.850 3.307 3.012

[1] Drills with other grade combinations and drill diameters .496-.2.559 inch are available on request.

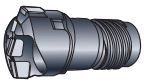
[2] No 2 is complementary chipbreaker when harder chipbreaking is required e.g. in duplex stainless steel.

When ordering drill heads, state chipbreaker No (**w**) drill diameter (**x.xxx**) and grade combination (**zz**) in the ordering code.

Ordering example: 2 pieces 420.6-9714 D*.615* 70

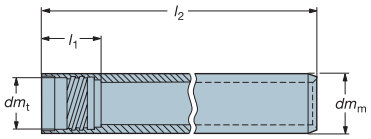
SAFETY INFORMATION
Precautions when grinding and brazing of cemented carbide, see page 143.

Drill head



420.6
Diameter range
.496–2.559 inch

Drill tube 420.5-



dm_t is the same as dm_m for the drill

Diameter range, inch D_c inch	Tube range	Ordering code Drill tube[1)]	Dimensions, inch Standard length l_2 62.992	102.362	dm_m	dm_t	l_1
.496– .515 .516– .535	94	**420.5-794-**	**2**	**–**	.433	.323	.866
.536– .555 .556– .575	95	**420.5-795-**	**2**	**–**	.472	.362	.866
.576– .594 .595– .614	96	**420.5-796-**	**2**	**–**	.512	.402	.827
.615– .638 .639– .657	97	**420.5-797-**	**2**	**–**	.551	.496	.827
.658– .677 .678– .696	98	**420.5-798-**	**2**	**–**	.591	.535	.827
.697– .724 .725– .744	99	**420.5-799-**	**2**	**–**	.630	.571	.866
.745– .755 .756– .787	00	**420.5-800-**	**2**	**–**	.669	.610	.866
.788– .822 .823– .858	01	**420.5-801-**	**–**	**4**	.709	.630	.984
.859– .901 .902– .948	02	**420.5-802-**	**–**	**4**	.787	.709	1.024
.949– .992 .993–1.039	03	**420.5-803-**	**–**	**4**	.866	.768	1.024
1.040–1.082 1.083–1.130	04	**420.5-804-**	**–**	**4**	.945	.827	1.024
1.131–1.173 1.174–1.220	05	**420.5-805-**	**–**	**4**	1.024	.925	1.141
1.221–1.263 1.264–1.311	06	**420.5-806-**	**–**	**4**	1.102	1.004	1.141
1.312–1.370 1.371–1.425	07	**420.5-807-**	**–**	**4**	1.181	1.102	1.141
1.426–1.468 1.469–1.511 1.512–1.559	08	**420.5-808-**	**–**	**4**	1.299	1.181	1.417
1.560–1.598 1.599–1.645 1.646–1.692	09	**420.5-809-**	**–**	**4**	1.417	1.299	1.417
1.693–1.744 1.745–1.795 1.796–1.850	10	**420.5-810-**	**–**	**4**	1.535	1.417	1.417
1.851–1.909 1.910–1.972 1.973–2.035	11	**420.5-811-**	**–**	**4**	1.693	1.535	1.417
2.036–2.094 2.095–2.153 2.154–2.212	12	**420.5-812-**	**–**	**4**	1.850	1.693	1.575
2.213–2.299 2.300–2.385 2.386–2.472 2.473–2.559	13	**420.5-813-**	**–**	**4**	2.008	1.850	1.575

[1)] Other lengths can be manufactured by **customer request**, see page 61.

Ordering example for drill tube length 62.992 inch fitting drill head D_c = .630inch:

1 piece 420.5-797-2

Ordering example for drill tube, design to customer request, length 15.748 inch fitting drill head D_c = .866 inch:

1 piece 420.5-802-L15.748

Vibration dampers 76 | Oil pressure heads 74 | Connecting chucks 75 | Cutting data v_c 86 | Application guide 109

CoroDrill™ 800.20

The productivity drill

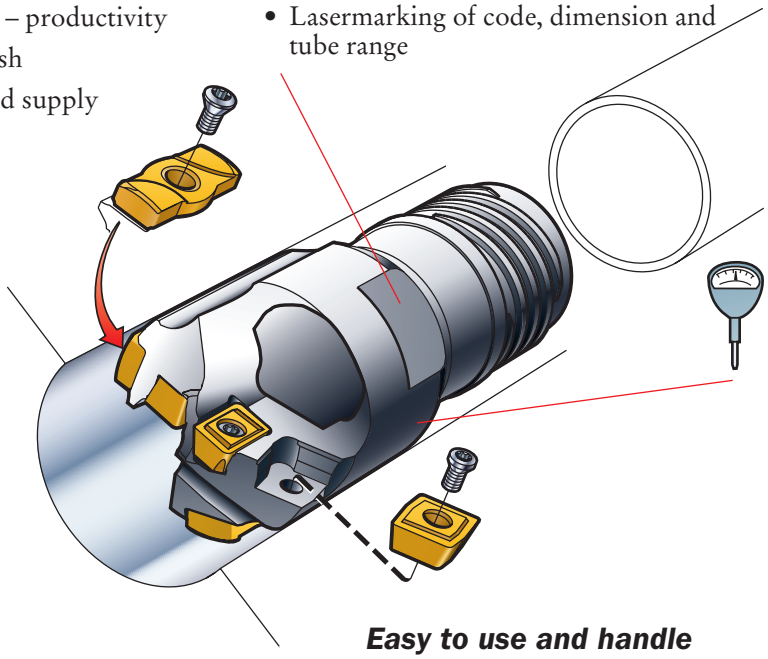
Diameter range .984 – 2.559 inch

Unique support pad design

- Indexable economy – two pads in one drill head
- Higher cutting speed – productivity
- Excellent surface finish
- Improves cutting fluid supply

Easy to identify

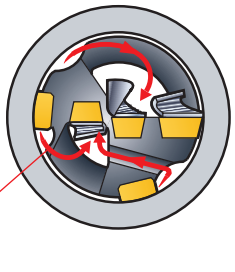
- Lasermarking of code, dimension and tube range



Reliable performance

- Robust design – high feed per rev. – productivity
- Wear resistant drill body manufactured in hardened steel
- Customer specified diameters
- Close tolerances

Excellent hole straightness and surface finish

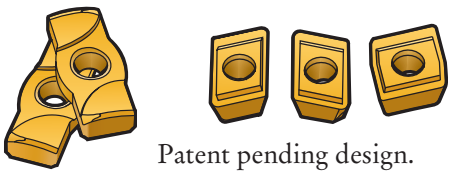


"Coolant accelerator"

- Patent pending design
- Ensures outstanding chip evacuation
- No chip clogging – no production stops

Easy to use and handle

- Fixed insert seats. No pre-setting – no need for tool room services
- Few spare parts – low inventory costs



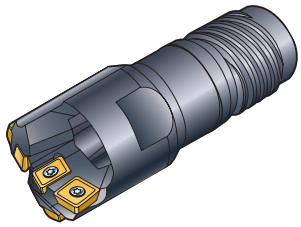
Patent pending design.

Productivity in a wide application range

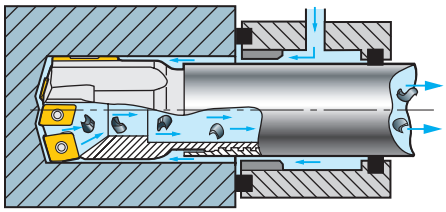
- Modern grade and geometry program cover most workpiece materials
- Few inserts and support pad sizes cover the whole diameter range
- Excellent chip control in both low and high feeds

CoroDrill™ 800.20

- ***The most productive choice for diameter range .984 – 2.559 inch***
- ***Lowest cost per hole***
- ***Consistent performance within a wide application area***
- ***Standard program***
- ***Developed and manufactured with the latest technology***

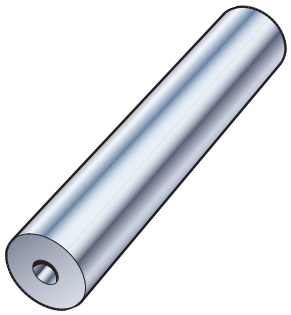


Preferred STS applications



- Special machines for mass production
- Special DHD machines
- Long workpieces
- Material with difficult chip-breaking or uneven structure
- Stainless and low carbon steel

Typical components – Industry segments



Billet for rock tools
Drill dia, D_c : 1.575 inch
Drill depth, l_4 : 51.181 inch

Automotive industry
- Axles, piston pins
- Engine blocks (diesel)
- Hydraulic cylinders
- Track links

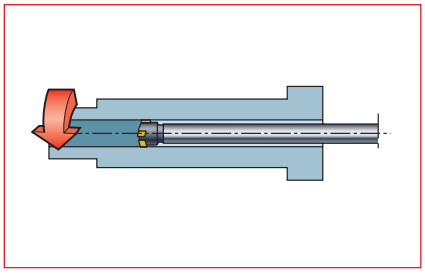
Steel industry
- Billets

Process industry
- Oil holes

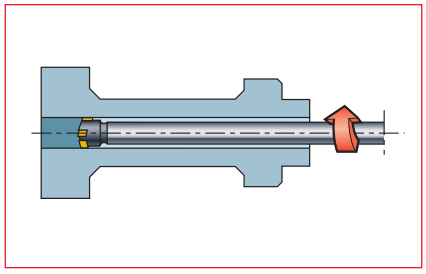
Aerospace industry
- Landing gear
- Gas turbine axles

Ship yard
- Coolant/oil holes in engine blocks

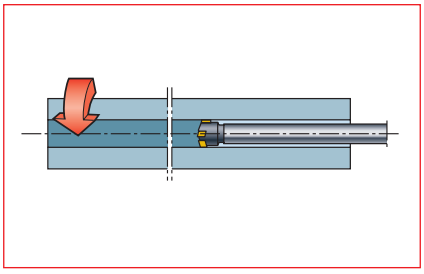
Defense industry
- Barrels



Machine spindle
Drill dia, D_c : 1.504 inch
Drill depth, l_4 : 22.047 inch



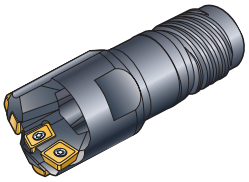
Hydraulic cylinder
Drill dia, D_c : 1.250 inch
Drill depth, l_4 : 19.685 inch



Cylinder
Drill dia, D_c : 1.260 inch (x26)
Drill depth, l_4 : 35.433 inch

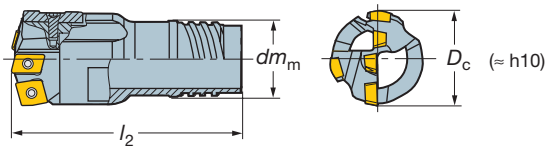
STS program – CoroDrill™ solid drill head 800.20

Indexable insert design
Diameter range
.984 – 2.559 inch



Diameter range: .984–2.559 inch
Hole depth: 150 × Dia.
Cutting fluid: Neat oil or soluble with EP-additives

Drill heads are manufactured to minus tolerance.



Note!
The drill is manufactured to minus tolerance so that it will not exceed the drill bush diameter, see page 126.

dm_m is the same as dm_t for the drill tube

Diameter range, inch	Tube range	Ordering code, Drill head	Dimensions, inch		Inserts			Support pads	
D_c inch			dm_m	$\leq l_2$	Central	Intermediate	Peripheral	Pad	No.
.984–1.039	03	**A800.20-03Dx.xxx**	.768	2.953	800-05 03 08M-C-G	800-05 03 08M-I-G	800-06 03 08H-P-G	800-06A	2
1.040–1.130	04	**A800.20-04Dx.xxx**	.827	3.071	800-05 03 08M-C-G	800-05 03 08M-I-G	800-06 03 08H-P-G	800-06A	2
1.131–1.220	05	**A800.20-M*05Dx.xxx**	.925	3.150	800-06 T3 08M-C-G	800-05 03 08M-I-G	800-06 03 08H-P-G	800-06A	2
1.221–1.311	06	**A800.20-06Dx.xxx**	1.004	3.346	800-06 T3 08M-C-G	800-06 T3 08M-I-G	800-08 T3 08H-P-G	800-07A	2
1.312–1.425	07	**A800.20-07Dx.xxx**	1.102	3.346	800-06 T3 08M-C-G[1)] 800-08 T3 08M-C-G[1)]	800-06 T3 08M-I-G[1)] 800-08 T3 08M-I-G[1)]	800-08 T3 08H-P-G	800-07A	2
1.426–1.559	08	**A800.20-08Dx.xxx**	1.181	3.740	800-08 T3 08M-C-G	800-08 T3 08M-I-G	800-08 T3 08H-P-G[1)] 800-09 T3 08H-P-G[1)]	800-07A	2
1.560–1.692	09	**A800.20-09Dx.xxx**	1.299	3.937	800-08 T3 08M-C-G	800-08 T3 08M-I-G	800-09 T3 08H-P-G	800-08A	2
1.693–1.850	10	**A800.20-10Dx.xxx**	1.417	3.937	800-10 T3 08M-C-G	800-08 T3 08M-I-G	800-09 T3 08H-P-G	800-08A	2
1.851–2.035	11	**A800.20-11Dx.xxx**	1.535	4.331	800-12 T3 08M-C-G[1)] 800-10 T3 08M-C-G[1)]	800-08 T3 08M-I-G	800-09 T3 08H-P-G[1)] 800-11 T3 08H-P-G[1)]	800-10A	2
2.036–2.212	12	**A800.20-12Dx.xxx**	1.693	4.724	800-10 T3 08M-C-G	800-08 T3 08M-I-G[1)] 800-12 T3 08M-I-G[1)]	800-11 T3 08H-P-G	800-10A[1)] 800-12A[1)]	2 2
2.213–2.559	13	**A800.20-13Dx.xxx**	1.850	4.921	800-10 T3 08M-C-G[1)] 800-12 T3 08M-C-G[1)]	800-12 T3 08M-I-G	800-11 T3 08H-P-G	800-12A	2

[1)] To match insert/support pad sizes to required drill diameter, see table below.

When ordering drill heads, state drill diameter (x.xxx) in the ordering code.
Ordering example, drill head: 2 pieces A800.20-03D*0.984*

M* = Makes the drill body stronger.

Drill diameter range – insert and pad sizes

Inserts (Ordered separately)
Intermediate and peripheral inserts are also available in L- geometry (for long chipping materials) see page 81.

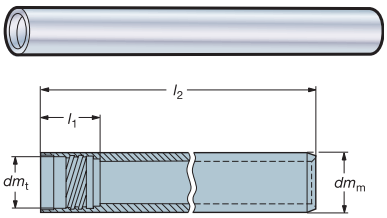
Support pads (Ordered separately)

Diameter range, inch		Central	Diameter range, inch		Intermediate	Diameter range, inch		Peripheral	Diameter range, inch	Pad
.984–1.139	05	800-05 03 08M-C-G	**.984–1.220**	05	800-05 03 08M-I-G	**.984–1.220**	06	800-06 03 08H-P-G	**.984–1.220**	800-06A
1.140–1.338	06	800-06 T3 08M-C-G	**1.221–1.378**	06	800-06 T3 08M-I-G	**1.221–1.535**	08	800-08 T3 08H-P-G	**1.221–1.559**	800-07A
1.339–1.693	08	800-08 T3 08M-C-G	**1.379–2.165**	08	800-08 T3 08M-I-G	**1.536–1.968**	09	800-09 T3 08H-P-G	**1.560–1.850**	800-08A
1.694–1.850	10	800-10 T3 08M-C-G	**2.166–2.559**	12	800-12 T3 08M-I-G	**1.969–2.559**	11	800-11 T3 08H-P-G	**1.851–2.165**	800-10A
1.851–1.968	12	800-12 T3 08M-C-G							**2.166–2.559**	800-12A
1.969–2.283	10	800-10 T3 08M-C-G								
2.284–2.559	12	800-12 T3 08M-C-G								

Drill head

800.20
Diameter range
.984–2.559 inch

Drill tube 420.5-



dm_t is the same as dm_m for the drill

Diameter range, inch	Tube range	Ordering code Drill tube[1)]	Dimensions, inch Standard length l_2			
D_c inch			**102.362**	dm_m	dm_t	l_1
.984–1.039	03	**420.5-803-**	**4**	.846	.768	1.024
1.040–1.130	04	**420.5-804-**	**4**	.925	.846	1.024
1.131–1.220	05	**420.5-805-**	**4**	1.024	.925	1.142
1.221–1.311	06	**420.5-806-**	**4**	1.102	1.004	1.142
1.312–1.425	07	**420.5-807-**	**4**	1.181	1.102	1.142
1.426–1.559	08	**420.5-808-**	**4**	1.299	1.181	1.417
1.560–1.692	09	**420.5-809-**	**4**	1.417	1.299	1.417
1.693–1.850	10	**420.5-810-**	**4**	1.535	1.417	1.417
1.851–2.035	11	**420.5-811-**	**4**	1.693	1.535	1.417
2.036–2.212	12	**420.5-812-**	**4**	1.850	1.693	1.575
2.213–2.559	13	**420.5-813-**	**4**	2.008	1.850	1.575

[1)] Other lengths can be manufactured by **customer request**, see page 61.

Ordering example for drill tube length 102.362 inch fitting drill head D_c = 1.181 inch:

1 piece 420.5-805-4

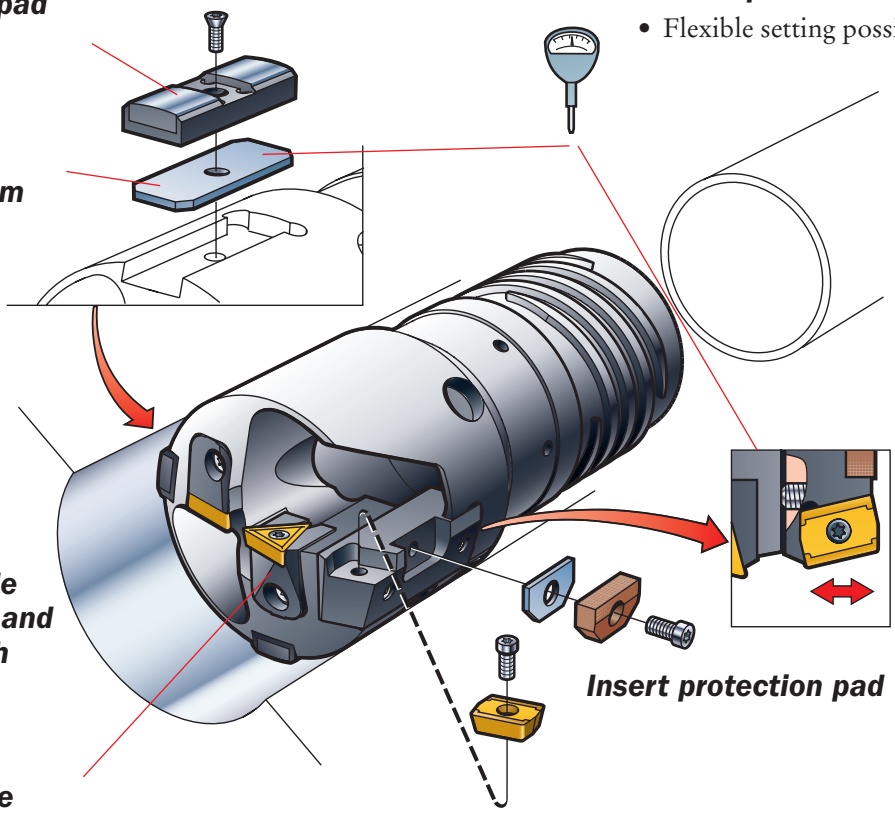
Ordering example for drill tube, design to customer request, length 15.748 inch fitting drill head D_c = 1.457 inch:

1 piece 420.5-808-L15.748

T-MAX® drill 424.10

The adjustable drill

Diameter range 2.500 – 5.118* inch



Indexable twin edge support pad

Diameter adjusting shim

Large chip-evacuation ports

Excellent hole straightness and surface finish

Strong secure insert cartridges

Designed to protect the head from damage.

- Easy to change
- Good economy

Built-in precision

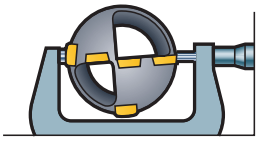
- Flexible setting possibilities

Adjustable peripheral cartridge

- Easier radial setting
- Short setting time
- Improved precision

Insert protection pad

Few spare parts



Easy to pre-set

Tailor Made

- Intermediate diameters from 2.500 to 7.244* inch
- Two thread size options per head size

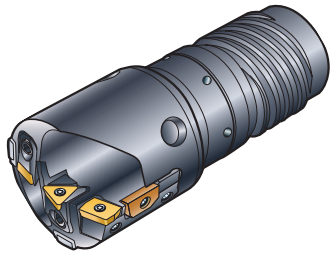
*) Larger diameters on request

Modern inserts – machining economy

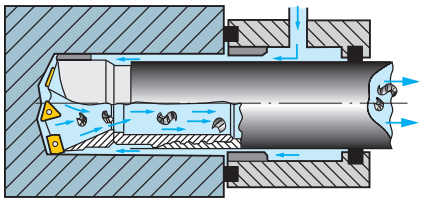
- Four insert types cover the whole diameter range
- Geometries and grades for drilling most materials
- Grade GC1025 the best choice for both steel and stainless steel
- High feed rate

T-MAX® drill 424.10

- ***Setting possibilities on diameter***
- ***Close diameter tolerance and high surface finish***
- ***Good hole straightness in long workpieces***
- ***Wide application area***
- ***High penetration rate in most materials***
- ***Stocked standard program***
- ***Wide range of engineered solutions***

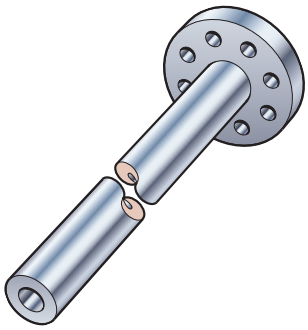


Preferred STS applications



- Special machines for mass production
- Special DHD machines
- Long run production
- Long workpieces
- Material with difficult chip-breaking or uneven structure
- Stainless and low carbon steel

Typical components – Industry segments



Propeller axle
Drill dia, D_c : 5.906 inch
Drill depth, l_4 : 551.181 inch

Automotive industry
- Engine blocks (diesel)

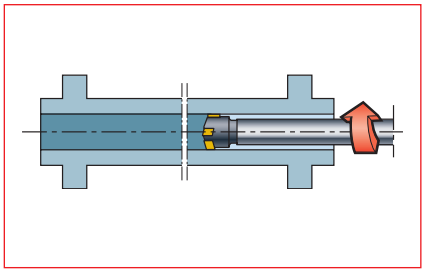
Steel industry
- Billets

Process industry
- Oil holes

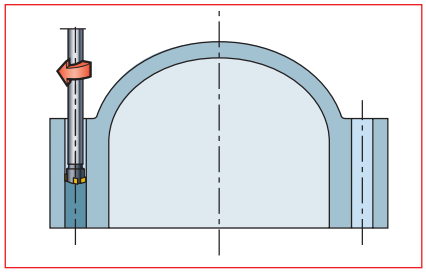
Aerospace industry
- Landing gear

Ship yard
- Propeller shafts
- Push rods
- Coolant/ oil holes in engine blocks

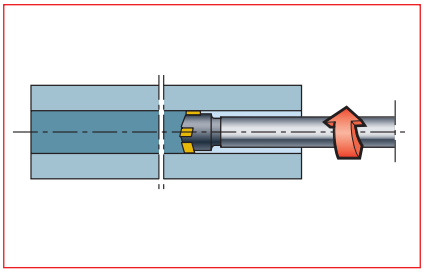
Defense industry
- Barrels



Propeller shaft
Drill dia, D_c : 12.992 inch
Drill depth, l_4 : 672.008 inch



Pressure head
Drill dia, D_c : 6.693 inch (x26)
Drill depth, l_4 : 43.307 inch

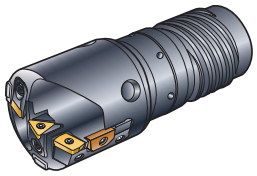


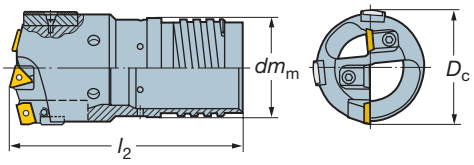
Rod
Drill dia, D_c : 3.031 inch
Drill depth, l_4 : 354.331 inch

STS program – T-MAX® adjustable solid drill head A424.10 / 424.10

Indexable insert design

Diameter range 2.500 – 7.240 inch





Diameter range: 2.500–7.240 inch
Hole depth: 100 × Dia.
Cutting fluid: Neat oil or soluble with EP-additives

Drill heads are manufactured to minus tolerance.

dm_m is the same as dm_t for the drill tube

Diameter[2] range, inch D_c inch	Tube range	Ordering code, Drill head[1]	Dimensions, inch dm_m	l_2	Radial[3] adjustment	Cartridges Central	No.	Intermediate	No.	Peripheral	No.	Support pad	No.
2.500	13	**A424.10-2500**	2.008	4.528	+.039	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1516-16	1	430.32-12 D65.0	2
2.559	14	**424.10-0650**	2.047	5.906	+.059	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1516-16	1	430.32-12 D65.0	2
2.750	15	**A424.10-2750**	2.283	5.906	+.039	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1516-16	1	430.32-12 D65.0	2
2.756		**424.10-0700**	2.283	5.906	+.039	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1516-16	1	430.32-12 D70.0	2
2.813		**A424.10-2813**	2.283	5.906	+.029	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1516-16	1	430.32-12 D70.0	2
2.953	16	**424.10-0750**	2.480	6.299	+.079	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1822-22	1	430.32-12 D75.0	2
3.000		**A424.10-3000**	2.480	6.299	+.079	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1822-22	1	430.32-12 D75.0	2
3.150	17	**424.10-0800**	2.756	7.480	+.049	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1822-22	1	430.32-12 D80.0	2
3.250		**A424.10-3250**	2.756	7.480	+.029	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1822-22	1	430.32-12 D80.0	2
3.346		**424.10-0850**	2.756	7.480	+.069	L430.31-1522-22	1	R430.30-1216-16	1	R430.28-1822-22	1	430.32-12 D85.0	2
3.500	18	**A424.10-3500**	3.031	7.480	+.069	L430.31-1522-22	1	R430.30-1216-16	1	R430.28-1822-22	1	430.32-12 D85.0	2
3.543		**424.10-0900**	3.031	7.480	+.069	L430.31-1522-22	1	R430.30-1216-16	1	R430.28-1822-22	1	430.32-12 D90.0	2
3.740		**424.10-0950**	3.031	7.480	+.079	L430.31-1522-22	1	R430.30-15 22-22	1	R430.28-1822-22	1	430.32-12 D95.0	2
3.750		**A424.10-3750**	3.031	7.480	+.079	L430.31-1522-22	1	R430.30-15 22-22	1	R430.28-1822-22	1	430.32-12 D95.0	2
3.937	19	**424.10-1000**	3.504	7.677	+.039	L430.31-1522-22	1	R430.30-15 22-22	1	R430.28-1822-22	1	430.32-16 D100.0	2
4.000		**A424.10-4000**	3.504	7.677	+.049	L430.31-1522-22	1	R430.30-15 22-22	1	R430.28-1822-22	1	430.32-16 D100.0	2
4.134		**424.10-1050**	3.504	7.677	+.019	L430.31-1522-22	1	R430.30-15 22-22	1	R430.28-1822-22	1	430.32-16 D105.0	2
4.250		**A424.10-4250**	3.504	7.677	+.079	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1516-16	1	430.32-16 D105.0	2
4.331		**424.10-1100**	3.504	7.677	+.059	L430.31-1216-16	1	R430.30-1216-16	1	R430.28-1516-16	1	430.32-16 D110.0	2
4.500	20	**A424.10-4500**	3.976	8.661	+.069	L430.31-1216-16	1	R430.30-1216-16	3	R430.28-1516-16	1	430.32-16 D110.0	2
4.528		**424.10-1150**	3.976	8.661	+.059	L430.31-1216-16	1	R430.30-1216-16	3	R430.28-1516-16	1	430.32-16 D115.0	2
4.724		**424.10-1200**	3.976	8.661	+.059	L430.31-1216-16	1	R430.30-1216-16	3	R430.28-1516-16	1	430.32-16 D120.0	2
4.750		**A424.10-4750**	3.976	8.661	+.059	L430.31-1216-16	1	R430.30-1216-16	3	R430.28-1516-16	1	430.32-16 D120.0	2
4.921	21	**424.10-1250**	4.449	8.661	+.069	L430.31-1216-16	1	R430.30-1216-16	3	R430.28-1822-22	1	430.32-16 D125.0	2
5.000		**A424.10-5000**	4.449	8.661	+.049	L430.31-1216-16	1	R430.30-1216-16	3	R430.28-1822-22	1	430.32-16 D125.0	2
5.118		**424.10-1300**	4.449	8.661	+.019	L430.31-1216-16	1	R430.30-1216-16	3	R430.28-1822-22	1	430.32-16 D130.0	2
5.354-5.823	22	***Tailor Made***											
5.827-6.295	23	***Tailor Made***											
6.299-6.768	24	***Tailor Made***											
6.772-7.240	25	***Tailor Made***											

[1] "A" in the ordering code indicates drill with inch dimensions.

[2] Drills in other dimensions are available on request.

[3] For radial adjustment, see page 78.

Ordering example, complete drill head: 2 pieces 424.10-0650

For ordering additional cartridge/support pad:
2 pieces L430.31-1216-16
4 pieces 430.32-12 D65.0

Inserts

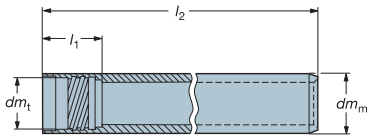
(Ordered separately)

Central cartridge	Insert		Intermediate cartridge	Insert		Peripheral cartridge	Insert	
L430.31-1216-16	16	TPMT 16T312R-22	R430.30-1216-16	16	TPMT 16T312R-22	R430.28-1516-16	13	R424.9-13T308-22
	16	TPMT 16T312TR-23		16	TPMT 16T312TR-23		13	R424.9-13T308-23
L430.31-1522-22	22	TPMT 220612R-22	R430.30-1522-22	22	TPMT 220612R-22	R430.28-1822-22	18	R424.9-180608-22
	22	TPMT 220612TR-23		22	TPMT 220612TR-23		18	R424.9-180608-23

Drill head

Drill tube 420.5-

A424.10 / 424.10
Diameter range
2.500 – 7.240 inch



dm_t is the same as dm_m for the drill

Diameter range, inch	Tube range	Ordering code Drill tube[1)]	Dimensions, inch Standard length l_2			
D_C inch			**102.362**	dm_m	dm_t	l_1
2.500	13	**420.5-813-**	**4**	2.008	1.850	1.575
2.559	14	**420.5-814-L**[1)]	**–**	2.205	2.047	2.953
2.750 2.756 2.813	15	**420.5-815-L**[1)]	**–**	2.441	2.283	2.953
2.953 3.000	16	**420.5-816-L**[1)]	**–**	2.677	2.480	2.953
3.150 3.250 3.346	17	**420.5-817-L**[1)]	**–**	2.953	2.756	3.819
3.500 3.543 3.740 3.750	18	**420.5-818-L**[1)]	**–**	2.047	3.031	3.819
3.937 4.000 4.134 4.250 4.331	19	**420.5-819-L**[1)]	**–**	3.701	3.504	3.819
4.500 4.528 4.724 4.750	20	**420.5-820-L**[1)]	**–**	4.173	3.976	4.646
4.921 5.000 5.118	21	**420.5-821-L**[1)]	**–**	4.646	4.449	4.646
5.354-5.823	22	**420.5-822-L**[1)]	**–**	5.118	4.921	4.646
5.827-6.295	23	**420.5-823-L**[1)]	**–**	5.591	5.394	5.472
6.299-6.768	24	**420.5-824-L**[1)]	**–**	6.063	5.866	5.472
6.772-7.240	25	**420.5-825-L**[1)]	**–**	6.535	6.339	5.472

[1)] Lengths are manufactured by **customer request**, see page 61.

Ordering example for drill tube length 102.362 inch fitting drill head D_c = 2.500 inch:

1 piece 420.5-813-4

Ordering example for drill tube, design to customer request, length 15.748 inch fitting drill head D_c = 2.953 inch:

1 piece 420.5-816-L15.748

Tailor Made

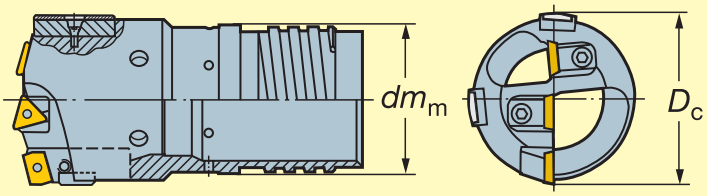
– Quick quotation
– Easy to order
– Competitive delivery

Even more possibilities thanks to tailored design!

If you do not find what you need in our comprehensive standard program, choose the tool shape you require and we will tailor it for you to *your* dimensions.

T-Max adjustable solid drill head 424.10

D_c = 2.500 – 7.244 inch, with E-thread



D_c	dm_m	E-thread range[1)]
2.500 - 2.558	2.008	13
2.559 - 2.637	2.008 / 2.047	13 / 14
2.638 - 2.874	2.047 / 2.283	14 / 15
2.875 - 3.149	2.283 / 2.480	15 / 16
3.150 - 3.425	2.480 / 2.756	16 / 17
3.426 - 3.937	2.756 / 3.031	17 / 18
3.938 - 4.409	3.031 / 3.504	18 / 19
4.410 - 4.881	3.504 / 3.976	19 / 20
4.882 - 5.354	3.976 / 4.449	20 / 21
5.355 - 5.827	4.449 / 4.921	21 / 22
5.827 - 6.299	4.921 / 5.394	22 / 23
6.300 - 6.771	5.394 / 5.866	23 / 24
6.772 - 7.244	5.866 / 6.339	24 / 25

1) Compare with drill tube
(424.2 – 8xx Ejector / 420.5 – 8xx STS)

Options

Note For specific details regarding the options, contact your Coromant sales representative.

D_c	Diameter – **2.500-7.244** inch
dm_m	Thread size – **2.008-6.339**

Drill tubes manufactured by customer request

Note! For specific details regarding the options, contact your Coromant sales representative.

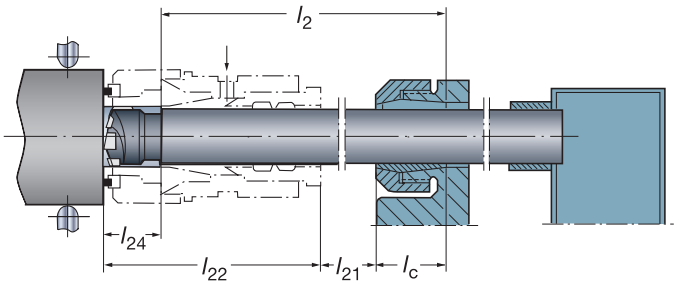
Drill head	Tube range	Outer tube Dimensions, inch Length to customer request l_2 (Min – Max)	For drawings and complementary dimensions, see page:	Drill head	Tube range	Outer tube Dimensions, inch Length to customer request l_2 (Min – Max)	For drawings and complementary dimensions, see page:
420.6	94 – 00 01 – 13	**8.661 – 157.480** **8.661 – 208.661**	**51**	**424.31F**	00 – 09	**8.661 – 196.850**	**65**
800.20	03 – 13	**8.661 – 208.661**	**55**	**424.31F**	10 – 18 19 – 21	**8.661 – 196.850** **8.661 – 118.110**	**67**
424.10	13 – 18 19 – 25	**8.661 – 196.850** **8.661 – 118.110**	**59**	**424.31**	14 – 18 19 – 33	**8.661 – 196.850** **8.661 – 196.850**	**69**

Ordering example for drill tube, design to customer request, length 31.496 inch fitting drill head D_c = 2.953 inch:

1 piece 420.5-816-L31.496

Calculation of special length tubes – STS system

For solid drill heads 420.6, 800.20 and 424.10



l_2 = Overall length of drill tube
l_{24} = End of drill tube to tip of central insert
l_{22} = Overall length of oil pressure head
l_{21} = Hole depth
l_c = Drill tube clamping length

$l_2 = l_{22} + l_{21} + l_c - l_{24}$ = overall length of drill tube (including thread).
IMPORTANT: If drill tube steady rests are used be sure to add their overall length to l_2.

Add length of vibration damper to the equation if one is required. Refer to page 76 for dimensions.

Solid drill heads 420.6 and 800.20

Drill 420.6 Diameter range, inch D_c inch	l_{24}	Drill 800.20 Diameter range, inch D_c inch	l_{24}
.496– .696	.886	**.984–1.039**	1.929
.697– .787	.984	**1.040–1.129**	1.929
.788– .858	1.083	**1.130–1.220**	2.008
.859– .948	1.181	**1.221–1.421**	2.205
.949–1.129	1.240	**1.422–1.559**	2.323
1.130–1.425	1.358	**1.560–1.850**	2.520
1.426–1.692	1.476	**1.851–2.035**	2.913
1.693–2.035	1.535	**2.036–2.212**	3.150
2.036–2.212	1.654	**2.213–2.559**	3.346
2.213–2.559	1.732		

T-Max adjustable solid drill heads A424.10 and 424.10

Diameter range, inch D_c inch	l_{24}	
2.500–2.813	2.953	**Standard drills**
2.953–3.000	3.346	
3.150–3.750	3.661	
3.937–4.331	3.858	
4.500–5.118	4.016	
5.119–7.240		**Tailor Made drills**

To request a quotation, please specify drill diameter, depth of hole and machine tool type. To discuss your application, please contact your nearest Sandvik Coromant representative.

T-MAX® 424.31F and 424.31 counterboring heads

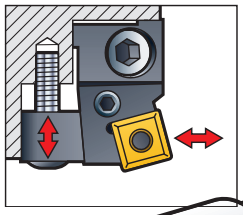
The productivity and precision single insert counterboring heads

Diameter range .787- 10.984 inch

Strong cartridges

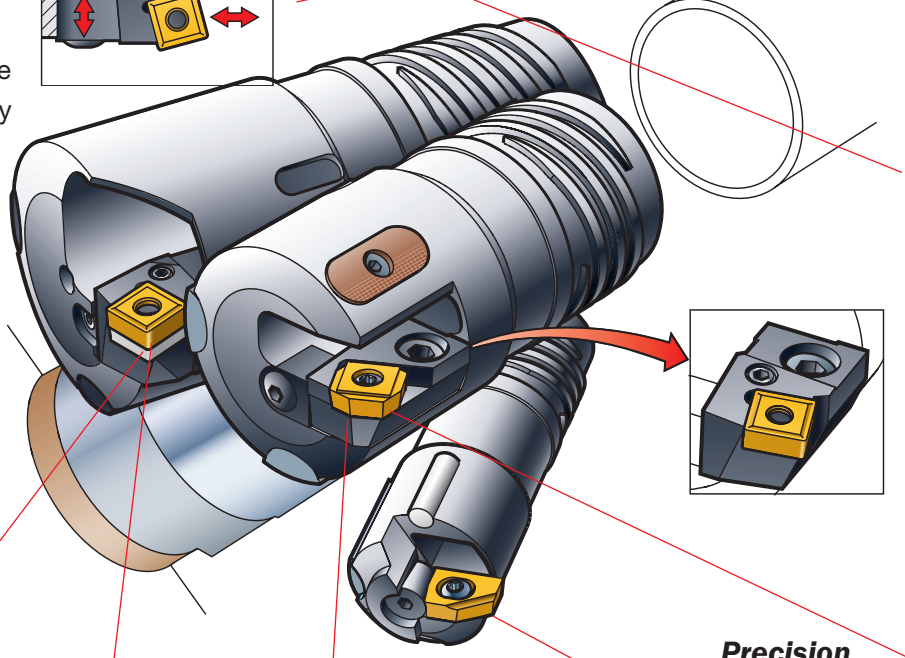
Designed to protect from damage.

- Easy to change
- Good economy



Built-in precision

- Radial adjustment



Adjustable peripheral cartridge

- Easier radial setting
- Short setting time
- Improved precision

Excellent hole straightness and surface finish

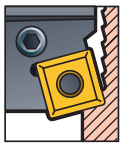
Productivity

424.31

TPxx insert

Dia. range
2.559–7.240 inch

a_p= .472–.669 inch

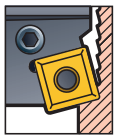


424.31

SNxx insert

Dia. range
2.559–7.240 inch

a_p= .394–.630 inch



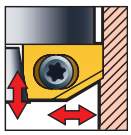
424.31F

SNxx insert

Dia. range
1.693–4.882 inch

a_p= .236 inch

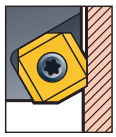
Precision



424.31F

Dia. range
.787–1.693 inch

a_p= .118 inch



424.31F

Dia. range
1.693–4.920 inch

a_p= .177 inch

Machining economy

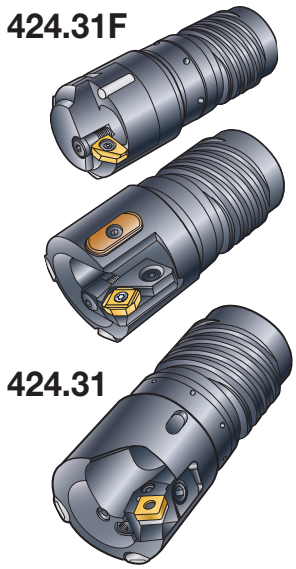
- Insert grades for counterboring in most materials.
- Insert types, sizes and geometries to get higher productivity, closer hole tolerances and higher surface finish.

Note!

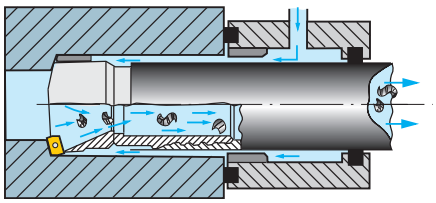
For applications requiring radial cut depths above .669 inch we recommend 424.32, see page 71.

T-MAX® 424.31F and 424.31 counterboring heads

- ***Designed for precision, productivity and versatility***
- ***Stocked standard components***
- ***A complement to solid drilling***
  - ***– for final diameter and surface finish operations***
  - ***– to extend hole diameter when machine power is limited. The same tube can normally be used***
- ***Wide range of engineered solutions***

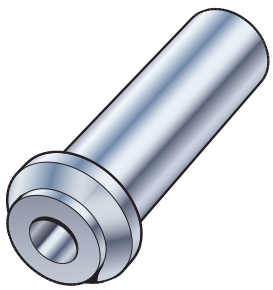


Preferred STS applications



- Special machines for mass production
- Special DHD machines
- Long run production
- Long workpieces
- Material with difficult chip-breaking or uneven structure
- Stainless and low carbon steel

Typical components – Industry segments



Shaft
Bore dia, D_c : 4.035 inch
Drill depth, l_4 : 47.244 inch

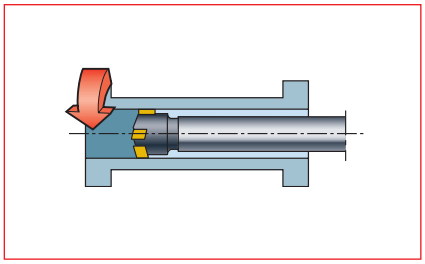
Steel industry
- Billets

Process industry
- Oil holes

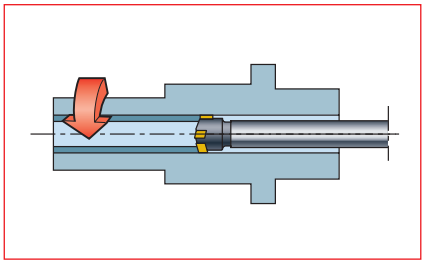
Aerospace industry
- Landing gear

Ship yard
- Propeller shafts
- Push rods

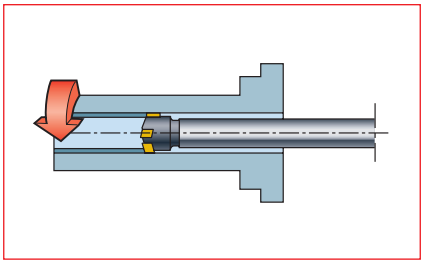
Defense industry
- Barrels



Shaft
Bore dia, D_c : 8.937 inch (8.661 inch)
Drill depth, l_4 : 473.425 inch



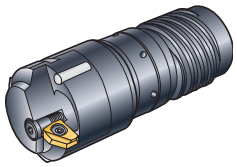
Rotor shaft
Bore dia, D_c : 2.756 inch (1.969 inch)
Drill depth, l_4 : 23.622 inch



Axle
Bore dia, D_c : 2.677 inch (1.969 inch)
Drill depth, l_4 : 47.244 inch

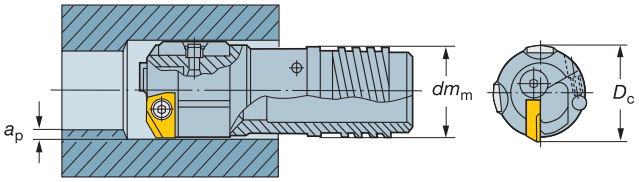
T-MAX® counterboring head 424.31F – manufactured by customer request

Single indexable insert design – close tolerance
Diameter range .787 – 1.693 inch



Diameter range: .787-1.693 inch
Hole depth: 150 × diameter
Cutting fluid: Neat oil or emulsion with EP-additives

Drill heads are manufactured to minus tolerance.



dm_m is the same as dm_t for the drill tube

Diameter range, inch	Max. cutting depth	Inserts[1]	Support pad set		Pressure pad set	
D_C inch	a_p inch	R424.31F		No.		No.
.787–.905	.118	04	**430.21 -06 D20.0**	2	**5636 010-011**	1
.906–1.023	.118	04	**430.21 -06 D23.0**	2	**5636 010-011**	1
1.024–1.220	.118	04	**430.21 -06 D26.0**	2	**5636 010-011**	1
1.221–1.338	.118	04	**430.21 -08 D31.0**	2	**5636 010-021**	1
1.339–1.496	.118	04	**430.21 -08 D34.0**	2	**5636 010-021**	1
1.497–1.693	.118	04	**430.21 -08 D38.0**	2	**5636 010-021**	1

[1] Inserts are ordered separately.

Ordering example: 2 pieces 430.21-06 D20.0

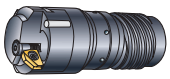
Ordering

When ordering counterboring heads the following must be stated:

- Drill diameter, D_c.
- Depth of cut or pre-bored size.
- Cartridges to be used – cartridge for close tolerances or for normal tolerances.
- Drilling system to be used – Ejector or STS.
- Drill tubes to be used and size dm_t.

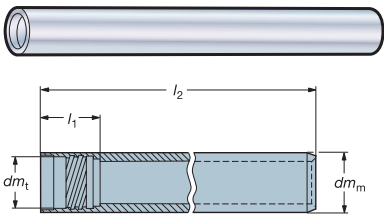
For more information and advice, please contact your nearest Sandvik Coromant representative.

Counterboring head



424.31F
Diameter range
.787–1.693 inch

Drill tube 420.5-



dm_t is the same as dm_m for the drill

Diameter range, inch	Tube range	Ordering code Drill tube[1)]	Dimensions, inch Standard length l_2				
D_c inch			62.992	102.362	dm_m	dm_t	l_1
.787-.905	00	**420.5-800-**	**2**	**–**	**.669**	.610	.866
	01	**420.5-801-**	**–**	**4**	.709	.630	.984
	02	**420.5-802-**	**–**	**4**	**.787**	.709	1.024
.906-1.023	02	**420.5-802-**	**–**	**4**	.787	.709	1.024
	03	**420.5-803-**	**–**	**4**	.866	.768	1.024
1.024-1.220	03	**420.5-803-**	**–**	**4**	.866	.768	1.024
	04	**420.5-804-**	**–**	**4**	.945	.827	1.024
	05	**420.5-805-**	**–**	**4**	1.024	.925	1.142
1.221–1.338	06	**420.5-806-**	**–**	**4**	1.102	1.004	1.142
	07	**420.5-807-**	**–**	**4**	1.181	1.102	1.142
1.339–1.495	07	**420.5-807-**	**–**	**4**	1.181	1.102	1.142
	08	**420.5-808-**	**–**	**4**	1.299	1.181	1.417
1.496–1.693	08	**420.5-808-**	**–**	**4**	1.299	1.181	1.417
	09	**420.5-809-**	**–**	**4**	1.417	1.299	1.417

[1)] Other lengths can be manufactured by **customer request**, see page 61.

Ordering example for drill tube length 62.992 inch fitting drill head D_c = .787 inch:

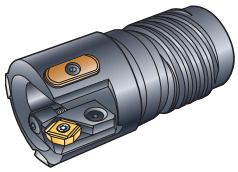
1 piece 420.5-800-2

Ordering example for drill tube, design to customer request, length 15.748 inch fitting drill head D_c = .905 inch:

1 piece 420.5-802-L15.748

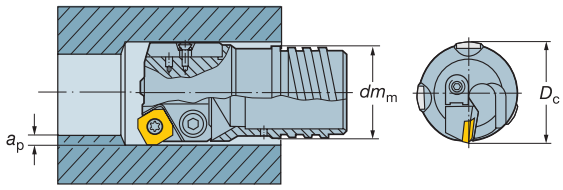
T-MAX® counterboring head 424.31F – manufactured by customer request

Single indexable insert design – close and normal tolerances
Diameter range 1.693 – 4.882 inch

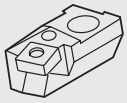
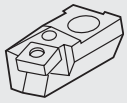


Diameter range: 1.693–4.882 inch
Hole depth: 150 × diameter
Cutting fluid: Neat oil or emulsion with EP-additives

Drill heads are manufactured to minus tolerance.



dm_m is the same as dm_t for the drill tube

Diameter range, inch	Cartridge	Max. cutting depth	Inserts[1]	Cartridge	Max. cutting depth	Inserts[1]	Support pad set		Pressure pad set	
			R424.31F			SNMG SNMM				
D_c inch	For close tolerances (IT9)	a_p inch		For normal tolerances (IT10)	a_p inch			No.		No.
1.693–1.849	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-10 D43.0**	2	**5636 020-011**	1
1.850–2.046	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-10 D47.0**	2	**5636 020-011**	1
2.047–2.282	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-10 D52.0**	2	**5636 020-011**	1
2.283–2.559	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-10 D58.0**	2	**5636 020-011**	1
2.560–2.755	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-12 D65.0**	2	**420.37-410-01**	3
2.756–2.952	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-12 D70.0**	2	**420.37-410-01**	3
2.953–3.149	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-12 D75.0**	2	**420.37-410-01**	3
3.150–3.345	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-12 D80.0**	2	**420.37-415-01**	3
3.346–3.543	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-12 D85.0**	2	**420.37-415-01**	3
3.544–3.739	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-16 D90.0**	2	**420.37-510-01**	3
3.740–3.936	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-16 D95.0**	2	**420.37-510-01**	3
3.937–4.133	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-16 D100.0**	2	**420.37-510-01**	3
4.134–4.330	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-16 D105.0**	2	**420.37-510-01**	3
4.331–4.527	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-16 D110.0**	2	**420.37-510-01**	3
4.528–4.724	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-16 D115.0**	2	**420.37-510-01**	3
4.725–4.882	**R430.24-1118-06**	.177	06	**R430.24-1018-09**	.236	09	**430.21-16 D120.0**	2	**420.37-510-01**	3

[1] Inserts are ordered separately.

Ordering example: 2 pieces R430.24-1118-06

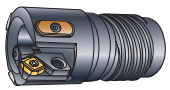
Ordering

When ordering counterboring heads the following must be stated:

- Drill diameter, D_c.
- Depth of cut or pre-bored size.
- Cartridges to be used – cartridge for close tolerances or for normal tolerances.
- Drilling system to be used – Ejector or STS.
- Drill tubes to be used and size dm_t.

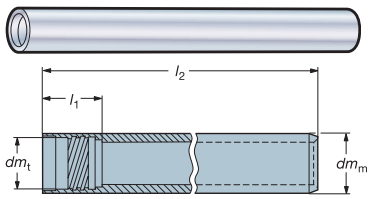
For more information and advice, please contact your nearest Sandvik Coromant representative.

Counterboring head



424.31F
Diameter range
1.693 – 4.882 inch

Drill tube 420.5-



dm_t is the same as dm_m for the drill

Diameter range, inch	Tube range	Ordering code Drill tube[1)]	Dimensions, inch Standard length l_2			
D_C inch			**102.362**	dm_m	dm_t	l_1
1.693–1.849	10	**420.5-810-**	**4**	1.535	1.417	1.417
1.850–2.046	11	**420.5-811-**	**4**	1.693	1.535	1.417
	12	**420.5-812-**	**4**	1.850	1.693	1.575
2.047–2.282	12	**420.5-812-**	**4**	1.850	1.693	1.575
	13	**420.5-813-**	**4**	2,008	1.850	1.575
2.283–2.559	13	**420.5-813-**	**4**	2,008	1.850	1.575
2.560–2.755	14	**420.5-814-L[1)]**	**–**	2.205	2.047	2.953
2.756–2.952	15	**420.5-815-L[1)]**	**–**	2.441	2.283	2.953
	16	**420.5-816-L[1)]**	**–**	2.677	2.480	2.953
2.953–3.149	16	**420.5-816-L[1)]**	**–**	2.677	2.480	2.953
3.150–3.345	17	**420.5-817-L[1)]**	**–**	2.953	2.756	3.819
3.346–3.543	17	**420.5-817-L[1)]**	**–**	2.953	2.756	3.819
	18	**420.5-818-L[1)]**	**–**	3.228	3.031	3.819
3.544– 3.739	18	**420.5-818-L[1)]**	**–**	3.228	3.031	3.819
3.740–3.936	18	**420.5-818-L[1)]**	**–**	3.228	3.031	3.819
3.937–4.133	19	**420.5-819-L[1)]**	**–**	3.701	3.504	3.819
4.134–4.330	19	**420.5-819-L[1)]**	**–**	3.701	3.504	3.819
4.331–4.527	19	**420.5-819-L[1)]**	**–**	3.701	3.504	3.819
	20	**420.5-820-L[1)]**	**–**	4.173	3.976	4.646
4.528–4.724	20	**420.5-820-L[1)]**	**–**	4.173	3.976	4.646
4.725–4.882	20	**420.5-820-L[1)]**	**–**	4.173	3.976	4.646
	21	**420.5-821-L[1)]**	**–**	4.646	4.449	4.646

[1)] Lengths are manufactured by **customer request**, see page 61.

Ordering example for drill tube length 102.362 inch fitting drill head D_c = 1.694 inch:

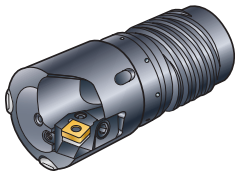
1 piece 420.5-810-4

Ordering example for drill tube, design to customer request, length 15.748 inch fitting drill head D_c = 2.047 inch:

1 piece 420.5-812-L15.748

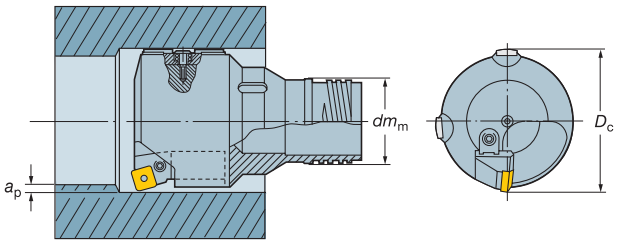
T-MAX® counterboring head 424.31 – manufactured by customer request

Single indexable insert design
Diameter range ≥ 2.559 inch



Diameter range: 2.559 – Max dia is dependent on machine capacity
Hole depth: 150 × diameter
Cutting fluid: Neat oil or soluble with EP-additives

Drill heads are manufactured to minus tolerance.



dm_m is the same as dm_t for the drill tube

Diameter range, inch D_c inch	T-Max P cartridge	Max. cutting depth a_p inch	Inserts (Ordered separately) SNMG SNMM	T-Max S cartridge	Max. cutting depth a_p inch	Inserts (Ordered separately) TPMX TPUN[2]	Support pad set	No.
2.559– 2.755	**R430.24-2024-12**	.394	1/2	**R430.23-2024-16**	.472	3/8	**430.21-12 D65.0**	2
2.756– 2.952	**R430.24-2024-12**	.394	1/2	**R430.23-2024-16**	.472	3/8	**430.21-12 D70.0**	2
2.953– 3.149	**R430.24-2024-12**	.394	1/2	**R430.23-2024-16**	.472	3/8	**430.21-12 D75.0**	2
3.150– 3.346	**R430.24-2024-12**	.394	1/2	**R430.23-2024-16**	.472	3/8	**430.21-12 D80.0**	2
3.347– 3.543	**R430.24-2024-12**	.394	1/2	**R430.23-2024-16**	.472	3/8	**430.21-12 D85.0**	2
3.544– 3.739	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-16 D90.0**	2
3.740– 3.936	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-16 D95.0**	2
3.937– 4.133	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-16 D100.0**	2
4.134– 4.330	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-16 D105.0**	2
4.331– 4.527	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-18 D110.0**	2
4.528– 4.724	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-18 D115.0**	2
4.725– 4.920	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-18 D120.0**	2
4.921– 5.117	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-18 D125.0**	2
5.118– 5.511	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-18 D130.0**	2
5.512– 5.905	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-18 D140.0**	2
5.906– 6.298	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-18 D150.0**	2
6.299– 6.692	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-18 D160.0**	2
6.693– 7.086	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-18 D170.0**	2
7.087– 7.480	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-18 D180.0**	2
7.481– 7.873	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-18 D190.0**	2
7.874– 8.858	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-18 D200.0**	2
8.859– 9.842	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-18 D225.0**	2
9.843–10.984	**R430.24-2532-19**[1]	.630	3/4	**R430.23-2532-22**[1]	.669	1/2	**430.21-18 D250.0**	2

[1] For small cutting depth use cartridges R430.24-2024-12 or R430.23-2024-16. Must be stated in order.

[2] Loose chipbreakers are to be used see page 102.

Note! for radial adjustment, see page 78.

When ordering additional support pads, D and the drilling diameter must be specified in the ordering code.

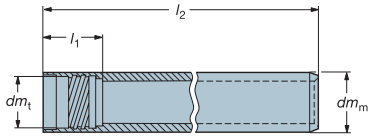
Ordering example for cartridge for counterboring head ∅ 2.559 inch: 1 piece R430.24-2024-12

Ordering example for support pad for counterboring head ∅ 2.559 inch: 1 piece 430.21-12 D65.0

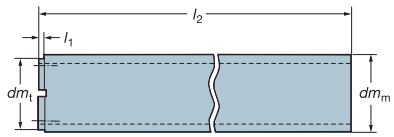
Counterboring head

424.31
Diameter range
≥ 2.559 inch

Drill tube 420.5- (Tube range 14–26)



Drill tube 420.5- (Tube range 27–33)



dm_t is the same as dm_m for the drill

Diameter range, inch	Tube range	Ordering code Drill tube[1)]	Dimensions, inch		
D_c inch			dm_m	dm_t	l_1
2.559– 2.755	14	**420.5-814-L[1)]**	2.205	2.047	2.953
2.756– 2.952	15	**420.5-815-L[1)]**	2.441	2.283	2.953
2.953– 3.149	16	**420.5-816-L[1)]**	2.677	2.480	2.953
3.150– 3.346	17	**420.5-817-L[1)]**	2.953	2.756	3.819
3.347– 3.543	17	**420.5-817-L[1)]**	2.953	2.756	3.819
	18	**420.5-818-L[1)]**	3.228	3.031	3.819
3.544– 3.739	18	**420.5-818-L[1)]**	3.228	3.031	3.819
3.740– 3.936	18	**420.5-818-L[1)]**	3.228	3.031	3.819
3.937– 4.133	19	**420.5-819-L[1)]**	3.701	3.504	3.819
4.134– 4.330	19	**420.5-819-L[1)]**	3.701	3.504	3.819
4.331– 4.527	19	**420.5-819-L[1)]**	3.701	3.504	3.819
	20	**420.5-820-L[1)]**	4.173	3.976	4.646
4.528– 4.724	20	**420.5-820-L[1)]**	4.173	3.976	4.646
4.725– 4.920	20	**420.5-820-L[1)]**	4.173	3.976	4.646
	21	**420.5-821-L[1)]**	4.646	4.449	4.646
4.921– 5.117	21	**420.5-821-L[1)]**	4.646	4.449	4.646
5.118– 5.511	21	**420.5-821-L[1)]**	4.646	4.449	4.646
	22	**420.5-822-L[1)]**	5.118	4.921	4.646
5.512– 5.905	22	**420.5-822-L[1)]**	5.118	4.921	4.646
	23	**420.5-823-L[1)]**	5.590	5.394	5.472
5.906– 6.298	23	**420.5-823-L[1)]**	5.590	5.394	5.472
6.299– 6.692	24	**420.5-824-L[1)]**	6.063	5.866	5.472
6.693– 7.086	24	**420.5-824-L[1)]**	6.063	5.866	5.472
	25	**420.5-825-L[1)]**	6.535	6.339	5.472
7.087– 7.479	25	**420.5-825-L[1)]**	6.535	6.339	5.472
	26	**420.5-826-L[1)]**	7.008	6.811	5.669
7.480– 7.873	26	**420.5-826-L[1)]**	7.008	6.811	5.669
	27	**420.5-827-L[1)]**	7.480	6.772	.314
7.874– 8.857	27	**420.5-827-L[1)]**	7.480	6.772	.314
	28	**420.5-828-L[1)]**	7.953	7.244	.314
	29	**420.5-829-L[1)]**	8.425	7.717	.314
8.858– 9.842	29	**420.5-829-L[1)]**	8.425	7.717	.314
	30	**420.5-830-L[1)]**	8.898	8.189	.314
	31	**420.5-831-L[1)]**	9.370	8.661	.314
9.843–10.984	31	**420.5-831-L[1)]**	9.370	8.661	.314
	32	**420.5-832-L[1)]**	9.843	9.134	.314
	33	**420.5-833-L[1)]**	10.315	9.606	.314

Ordering

When ordering counterboring heads the following must be stated:

- Drill diameter, D_c.
- Depth of cut or pre-bored size.
- Insert clamping system to be used – T-Max P lever or T-Max S top clamp.
- Drilling system to be used – Ejector or STS.
- Drill tubes to be used and size dm_t.

For more information and advice, please contact your nearest Sandvik Coromant representative.

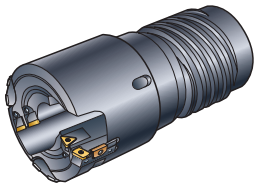
[1)] Lengths are manufactured by **customer request**, see page 61.

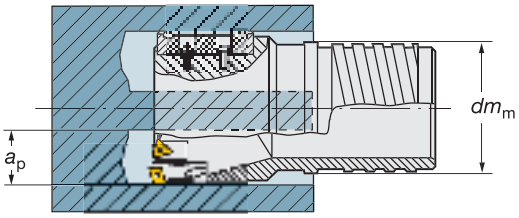
Ordering example for drill tube, design to customer request, length 15.748 inch fitting drill head D_c = 2.559 inch:

1 piece 420.5-814-L15.748

T-MAX® trepanning head 420.7 – manufactured by customer request

Indexable insert design
Diameter range
4.407 – 9.843 inch





Diameter range: 4.407–9.843 inch
Hole depth: 150 × Dia.
Cutting fluid: Neat oil or soluble

Drill heads are manufactured to minus tolerance.

dm_m is the same as dm_t for the drill tube

Diameter range, inch	Cartridges						
							a_p
D_c inch	Central	No.	Peripheral	No.	Support pad	No.	inch
4.407–4.724	L430.27-1216-16	3	R430.28-1516-16	1	(on request)	2	1.722
4.725–4.920	L430.27-1216-16	3	R430.28-1516-16	1	430.21-18D120.0	2	1.722
4.921–5.117	L430.27-1216-16	3	R430.28-1516-16	1	430.21-18D125.0	2	1.722
5.118–5.511	L430.27-1216-16	3	R430.28-1516-16	1	430.21-18D130.0	2	1.722
5.512–5.905	L430.27-1216-16	3	R430.28-1516-16	1	430.21-18D140.0	2	1.722
5.906–6.298	L430.27-1216-16	3	R430.28-1516-16	1	430.21-18D150.0	2	1.722
6.299–7.086	L430.27-1216-16	3	R430.28-1516-16	1	430.21-18D160.0	2	1.722
7.087–7.873	L430.27-1216-16	3	R430.28-1516-16	1	430.21-18D180.0	2	1.722
7.874–8.857	L430.27-1216-16	4	R430.28-1516-16	1	430.21-18D200.0	2	2.116
8.858–9.842	L430.27-1216-16	4	R430.28-1516-16	1	430.21-18D225.0	2	2.116
9.843	L430.27-1216-16	4	R430.28-1516-16	1	430.21-18D250.0	2	2.116

Note! for radial adjustment, see page 78.

Ordering

When ordering trepanning heads the following must be stated:

- Drill diameter, D_c.

For more information and advice, please contact your nearest Sandvik Coromant representative.

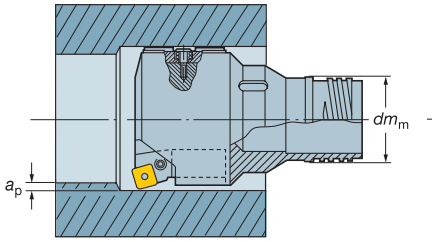
Inserts

(Ordered separately)

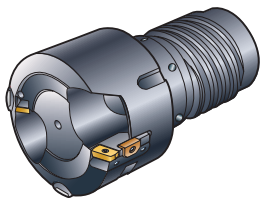
Central cartridge		Insert	Peripheral cartridge		Insert
L430.27-1216-16	16	TPMT 16T312R-22	R430.28-1516-16	13	R424.9-13T308-22
	16	TPMT 16T312TR-23		13	R424.9-13T308-23

T-MAX® counterboring head 424.32 – manufactured by customer request

Multi-indexable insert design
Diameter range ≥ 2.953 inch



dm_m is the same as dm_t for the drill tube



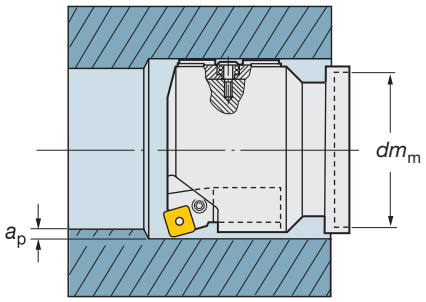
Diameter range:	2.953 – upwards Max. dia is dependent on machine capacity
Hole depth:	150 × diameter
Cutting fluid:	Neat oil or emulsion with EP-additives
Max cutting depth a_p:	From diameter 2.953, a_p = 1.181 inch From diameter 3.937, a_p = 1.575 inch From diameter 4.724, a_p = 1.968 inch From diameter 6.299, a_p = 2.638 inch

Drill heads are manufactured to minus tolerance.

Note! for radial adjustment, see page 78.

Adjustable Counterboring head – manufactured by customer request

Multi-indexable insert design,
Preferably for STS drills
Diameter range ≥ 3.937 inch



dm_m is the same as dm_t for the drill tube

Diameter range:	3.937 – upwards Max. dia is dependent on machine capacity
Diameter increasing:	.394-4.724 inch depending on diameter, by fitting shims behind pad blocks and cassettes
Hole depth:	150 × diameter
Cutting fluid:	Neat oil or emulsion with EP-additives
Cutting depth a_p:	.197 – 2.362 inch depending on diameter

Drill heads are manufactured to minus tolerance.

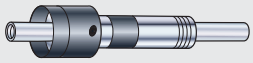
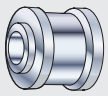
Ordering

When ordering above counterboring heads the following must be stated:

- Drill diameter, D_C
- Adjustability range, *only for adjustable counterboring head*
- Drilling system to be used – Ejector or STS
- Depth of cut or pre-bored size
- Drill tubes to be used and size dm_t

For more information and advice, please contact your nearest Sandvik Coromant representative.

Mounting parts for connectors, diameter range .496 – 12.909

Diameter range, inch	Tube range	Oil pressure head				Vibration damper	Connecting chucks	
								
		With clamping cones For non-rotating and rotating workpieces		For face sealing only. Without clamping cones For non-rotating and rotating workpieces			Collet style for drill diameter	Split bush for drill diameter
D_c inch		Non-rotating	Rotating	Non-rotating	Rotating		.496– 2.559 inch	2.035– 12.909 inch
.496– .535	94	420.9S/505	420.9S/500	420.9S/510	420.9S/515	342-0937-1	424.9S/524	–
.536– .575	95	420.9S/505	420.9S/500	420.9S/510	420.9S/515	342-0937-1	424.9S/524	–
.576– .614	96	420.9S/505	420.9S/500	420.9S/510	420.9S/515	342-0937-1	424.9S/524	–
.615– .657	97	420.9S/505	420.9S/500	420.9S/510	420.9S/515	342-0937-1	424.9S/524	–
.658– .696	98	420.9S/505	420.9S/500	420.9S/510	420.9S/515	342-0937-1	424.9S/524	–
.697– .744	99	420.9S/505	420.9S/500	420.9S/510	420.9S/515	342-0937-1	424.9S/524	–
.745– .787	00	420.9S/505	420.9S/500	420.9S/510	420.9S/515	342-0937-1	424.9S/524	–
.788– .858	01	420.9S/505	420.9S/500	420.9S/510	420.9S/515	342-0937-1	424.9S/524	–
.859– .948	02	420.9S/505	420.9S/500	420.9S/510	420.9S/515	342-0937-1	424.9S/524	–
.949– 1.039	03	420.9S/505	420.9S/500	420.9S/510	420.9S/515	342-0937-1	424.9S/524	–
1.040– 1.129	04	420.9S/505	420.9S/500	420.9S/510	420.9S/515	342-0937-1	424.9S/524	–
1.130– 1.220	05	420.9S/505	420.9S/500	420.9S/510	420.9S/515	342-0937-1	424.9S/524	–
1.221– 1.311	06	420.9S/505	420.9S/500	420.9S/510	420.9S/515	342-0937-1	424.9S/524	–
1.312– 1.425	07	420.9S/505	420.9S/500	420.9S/510	420.9S/515	342-0937-1	424.9S/524	–
1.426– 1.559	08	420.9S/505	420.9S/500	420.9S/510	420.9S/515	342-0937-1	424.9S/524	–
1.560– 1.692	09	420.9S/505	420.9S/500	420.9S/510	420.9S/515	342-0937-1	424.9S/524	–
1.693– 1.850	10	420.9S/506	420.9S/501	420.9S/511	420.9S/516	342-0937-1	424.9S/524	–
1.851– 2.035	11	420.9S/506	420.9S/501	420.9S/511	420.9S/516	342-0937-1	424.9S/524	–
2.036– 2.212	12	420.9S/506	420.9S/501	420.9S/511	420.9S/516	342-0937-1	424.9S/524	424.9S/520
2.213– 2.559	13	420.9S/506	420.9S/501	420.9S/511	420.9S/516	342-0937-1	424.9S/524	424.9S/520
2.559– 2.637	14	420.9S/506	420.9S/501	420.9S/511	420.9S/516	342-0937-1	420.9S/524	420.9S/520
2.638– 2.873	15	420.9S/506	420.9S/501	420.9S/511	420.9S/516	342-0937-1	–	420.9S/520
2.874– 3.149	16	420.9S/506	420.9S/501	420.9S/511	420.9S/516	342-0937-1	–	420.9S/520
3.150– 3.424	17	420.9S/507	420.9S/502	420.9S/512	420.9S/517	342-0938-1	–	420.9S/520
3.425– 3.936	18	420.9S/507	420.9S/502	420.9S/512	420.9S/517	342-0938-1	–	420.9S/520
3.937– 4.408	19	420.9S/507	420.9S/502	420.9S/512	420.9S/517	342-0938-1	–	420.9S/520
4.409– 4.881	20	420.9S/507	420.9S/502	420.9S/512	420.9S/517	342-0938-1	–	420.9S/520
4.882– 5.353	21	420.9S/507	420.9S/502	420.9S/512	420.9S/517	342-0938-1	–	420.9S/521
5.354– 5.826	22	420.9S/507	420.9S/502	420.9S/512	420.9S/517	342-0938-1	–	420.9S/521
5.827– 6.298	23	420.9S/507	420.9S/502	420.9S/512	420.9S/517	342-0938-1	–	420.9S/521
6.299– 6.767	24	420.9S/508	420.9S/503	420.9S/513	420.9S/518	342-0939-1	–	420.9S/521
6.772– 7.240	25	420.9S/508	420.9S/503	420.9S/513	420.9S/518	342-0939-1	–	420.9S/521
7.244– 7.712	26	420.9S/508	420.9S/503	420.9S/513	420.9S/518	342-0939-1	–	420.9S/522
7.717– 8.185	27	420.9S/508	420.9S/503	420.9S/513	420.9S/518	342-0939-1	–	420.9S/522
8.189– 8.657	28	420.9S/508	420.9S/503	420.9S/513	420.9S/518	342-0939-1	–	420.9S/522
8.661– 9.130	29	420.9S/508	420.9S/503	420.9S/513	420.9S/518	342-0939-1	–	420.9S/522
9.134– 9.602	30	420.9S/508	420.9S/503	420.9S/513	420.9S/518	342-0939-1	–	420.9S/522
9.606–10.075	31	420.9S/508	420.9S/503	420.9S/513	420.9S/518	–	–	420.9S/522
10.079–10.547	32	420.9S/509	420.9S/504	420.9S/514	420.9S/519	–	–	420.9S/523
10.551–11.020	33	420.9S/509	420.9S/504	420.9S/514	420.9S/519	–	–	420.9S/523
11.024–11.492	34	420.9S/509	420.9S/504	420.9S/514	420.9S/519	–	–	420.9S/523
11.496–11.964	35	420.9S/509	420.9S/504	420.9S/514	420.9S/519	–	–	420.9S/523
11.968–12.436	36	420.9S/509	420.9S/504	420.9S/514	420.9S/519	–	–	420.9S/523
12.440–12.909	37	420.9S/509	420.9S/504	420.9S/514	420.9S/519	–	–	420.9S/523

Ordering example: 1 piece 420.9S/505

STS oil pressure heads

For deep hole drilling with the Single Tube System, Sandvik Coromant offers a range of oil pressure heads for both rotating and non-rotating workpieces. The oil pressure head serves 4 major functions:

Introduces coolant to the cutting tool.
Seals against the face of the workpiece.
Holds the drill bushing.
Seals the external surface of the drill tube.

Oil pressure heads act as clamping devices and also serve to self-center the component.

Type 1 would typically be used where the component cannot rotate but is symmetrical and can be machined to suit the conical clamping rings.

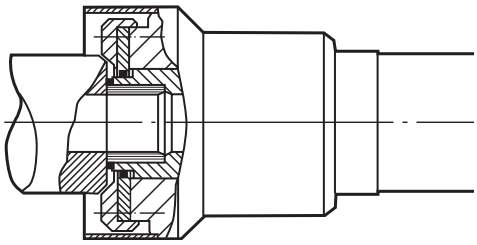
Type 2 is generally used with symmetrical, high volume components which can be rotated.

Type 3 oil pressure heads are used with unsymmetrical components which, for example, are fixtured on a workpiece table.

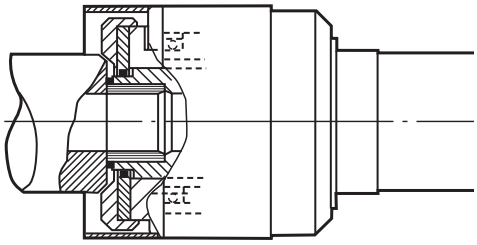
Type 4 oil pressure heads may be used for symmetrical components which can rotate and be placed in steady rests and are generally used for lower volume production.

The above mentioned pressure heads cover diameters from .496 to 15.744 inch in five drill diameter ranges per type.

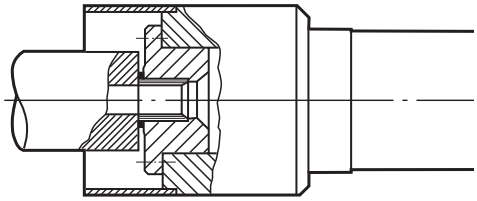
Type 1



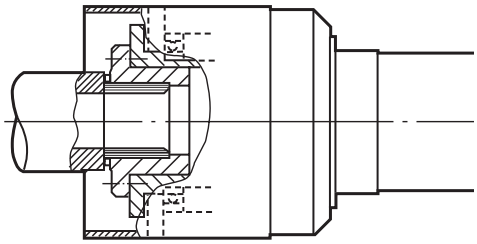
Type 2



Type 3



Type 4



Components

The conical clamping rings are manufactured according to the workpiece diameter. The sizes of the drill bushing, drill bushing holder, intermediate drill bushing holder, face seal ring, and 'O'-rings are determined by the tool diameter. If thin wall components must be drilled, the conical clamping ring, drill bushing, drill bushing holder, and intermediate drill bushing holder are of special design.

Drill tube sealing

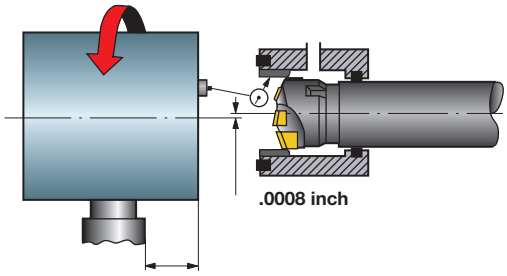
The outside diameter of the drill tube is sealed by means of the packing box at the rear of the oil pressure head. This packing box consists of the packing bushing, thrust rings, guide ring, threaded pressure nut, and flexible packing.

Sealing is accomplished by tightening the threaded pressure nut and forcing the flexible packing to seal around the drill tube. The locking screw ensures that the sealing pressure on the drill tube remains unchanged.

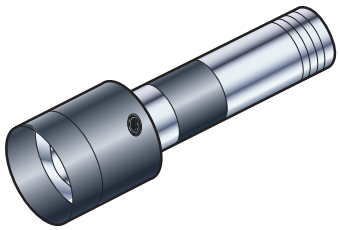
Packing boxes are purchased for each drill tube so that the entire assembly remains as one unit, which in effect means less changeover time.

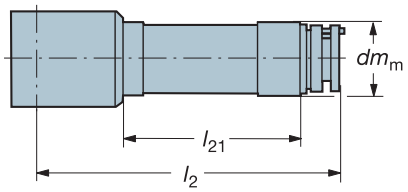
Alignment

- The pressure head must be mounted accurately to within .0008 inch of the machine center line, and seals kept in good condition to ensure efficient operation of the machine.
- It is recommended that the workpiece be supported with a steady, mounted as close as possible to the guide bush. The pressure head and the workpiece steady should be linked into one stable unit.



STS oil pressure heads
420.9S





Drill diameter:	.496-15.744 inch
Max spindle speed:	*n* 105-1800 rpm
Max coolant pressure:	*p* 135-600 psi
Max clamping force:	*F* 1200 - 3400 lbs/clamping
Permitted leakage:	*q* gal/min
Temperature in oil pressure head:	90-100° F

For stationary workpieces

Type	Diameter range, inch	Ordering code	Dimensions, inch			Specifications			
	D_c inch		l_2	l_{21}	dm_m	*n*	*p*	*F*	*q*
With clamping cones	.496- 1.693	**420.9S/505**	18.346	9.842	3.937	1800	850	2280	1.0
	1.693- 3.146	**420.9S/506**	20.906	9.842	5.512	1200	435	3409	1.5
	3.150- 6.295	**420.9S/507**	25.528	9.842	9.055	800	210	3900	2.0
	6.299-10.075	**420.9S/508**	28.150	11.811	13.976	350	175	4600	2.0
	10.079-15.744	**420.9S/509**	35.630	16.929	19.291	105	70	6800	3.3
For face sealing only without clamping cones	.496- 1.693	**420.9S/510**	16.260	9.842	3.937	1800	850	2280	1.0
	1.693- 3.146	**420.9S/511**	18.150	9.842	5.512	1200	435	3409	1.5
	3.150- 6.295	**420.9S/512**	20.709	9.842	9.055	800	210	3900	2.0
	6.299-10.075	**420.9S/513**	22.559	11.811	13.976	350	175	4600	2.0
	10.079-15.744	**420.9S/514**	28.150	16.929	19.291	105	70	6800	3.3

For rotating workpieces

Type	Diameter range, inch	Ordering code	Dimensions, inch			Specifications			
	D_c inch		l_2	l_{21}	dm_m	*n*	*p*	*F*	*q*
With clamping cones	.496- 1.693	**420.9S/500**	18.346	9.842	3.937	1800	850	5000	1.0
	1.693- 3.146	**420.9S/501**	20.906	9.842	5.512	1200	290	7500	1.5
	3.150- 6.295	**420.9S/502**	25.528	9.842	9.055	800	210	8500	2.0
	6.299-10.075	**420.9S/503**	28.150	11.811	13.976	350	175	10000	2.0
	10.079-15.744	**420.9S/504**	35.630	16.929	19.291	105	70	15000	3.3
For face sealing only without clamping cones	.496- 1.693	**420.9S/515**	18.346	9.842	3.937	1800	850	5000	1.0
	1.693- 3.146	**420.9S/516**	20.748	9.842	5.512	1200	290	7500	1.5
	3.150- 6.295	**420.9S/517**	25.528	9.842	9.055	800	210	8500	2.0
	6.299-10.075	**420.9S/518**	28.150	11.811	13.976	350	175	10000	2.0
	10.079-15.744	**420.9S/519**	35.630	16.929	19.291	105	70	15000	3.3

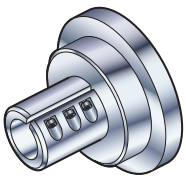
Ordering

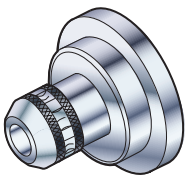
When ordering STS oil pressure heads the following must be stated:

- Ordering code for oil pressure head.
- Drill diameter, D_c.
- Drill tube diameter.
- Workpiece outer diameter.

For more information and advice, please contact your nearest Sandvik Coromant representative.

STS connecting chucks





Connecting chucks are manufactured to customer request and designed to a specific STS drill tube. Chucks are available in a variety of spindle nose styles and sizes. Suitable for rotating as well as stationary tools. Bushes must be manufactured to suit each drill tube diameter used.

Type	Diameter range, inch D_c	Ordering code	Drill tube diameter, inch dm_m
Collet style	.496- 2.559	**420.9S/524**	.433– 2.205
Split bushing style	2.035- 4.878	**420.9S/520**	1.850– 4.173
	4.882- 7.240	**420.9S/521**	4.656– 6.535
	7.244-10.075	**420.9S/522**	7.008– 9.370
	10.079-15.744	**420.9S/523**	9.842–15.039

Ordering

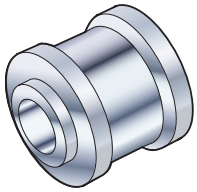
When ordering connecting chucks the following must be stated:

- Ordering code for connecting chuck.
- Information about spindle nose design.
- Drill tube diameter.

For more information and advice, please contact your nearest Sandvik Coromant representative.

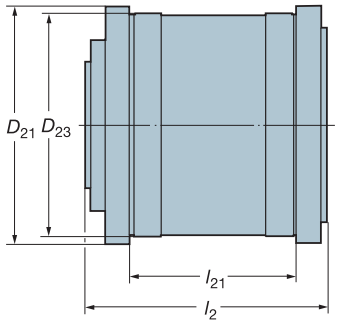
Vibration dampers

For Ejector and STS drills
Diameter range .496 – 9.602 inch



Vibrations not only affect the surface finish and shorten tool life, but also force changes in cutting data which result in production loss.

In order to control these vibrations better, Sandvik Coromant has designed a line of vibration dampers. These dampers are clamped externally to the drill tube and act as supports for the drill.



Diameter range, inch	Ordering code	Drill tube diameter, inch	Dimensions, inch			
D_c inch		dm_m	l_2	l_{21}	D_{21}	D_{23}
.496-3.146	**342-0937-1**	.433-2.677	7.677	5.315	7.677	7.086
3.150-6.295	**342-0938-1**	2.953-5.590	10.000	6.496	11.811	11.024
6.299-9.602	**342-0939-1**	6.063-8.898	11.260	6.496	14.764	13.976

When ordering vibration dampers the following must be stated:

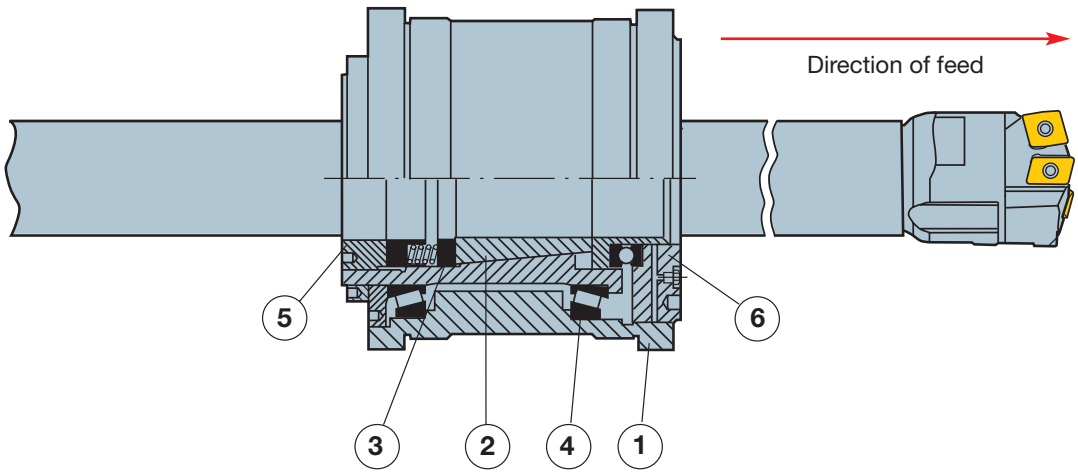
- Ordering code for vibration damper
- Drill tube diameter

For more information and advice, please contact your nearest Sandvik Coromant representative.

Vibration dampers for rotating drills

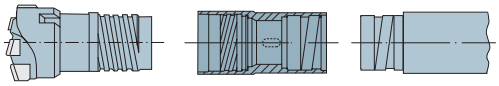
The damper assembly is mounted in a steady-rest(s), normally supplied by the machine builder. The damping pressure can be adjusted by the use of a wrench on the thrust ring (item no. 6). Phenolic collets for full contact are manufactured for each drill tube size and are slotted and tapered for maximum damping.

1. Body
2. Collet
3. Adjusting ring
4. Bearing
5. Pressure nut
6. Thrust ring

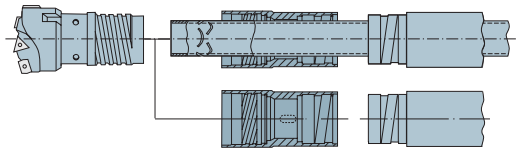


Adapters for converting from external to internal tube threads

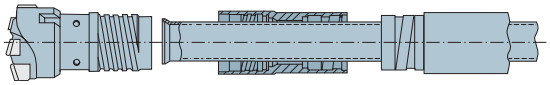
Diameter range: .787–2.559 inch
420.9S/188-xx – STS 420.6, 800.20



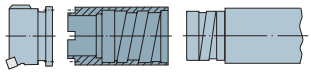
Diameter range: 2.559–7.713 inch
420.9S/344-xx – Ejector T-Max 424.10, STS T-Max 424.10



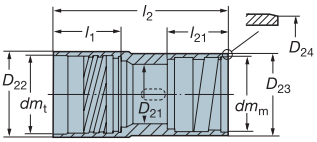
Diameter range: .787–2.559 inch
420.9S/173-xx – Ejector 424.6, 800.24



Diameter range: 7.717–14.326 inch
420.9S/348-xx – STS T-Max special drilling and counterboring heads

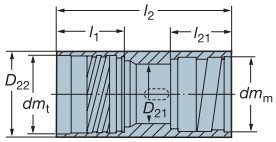


Diameter range: .787–2.559 inch
420.9S/188-xx – STS 420.6, 800.20
420.9S/173-xx – Ejector 424.6, 800.24



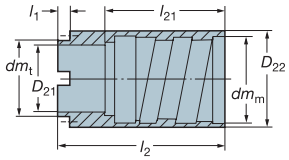
Adapters are delivered with one-start square thread, the Heller-thread, in one end and an internal four-start square thread, the E-thread, in the other end.

Diameter range: 2.559–7.713 inch
420.9S/344-xx – STS T-Max 424.10
Ejector T-Max 424.10



Adapters for drill diameters up to 7.713 inch are delivered with one-start square thread, the Heller-thread, in one end and an internal four-start square thread, the E-thread, in the other end.

Diameter range: 7.717–14.326 inch
420.9S/348-xx – STS T-Max special drilling and counterboring heads



Adapters for drill diameters > 7.717 inch are delivered with one-start square thread in one end and locations for flange mounting in the other end.

Diameter range, inch	Ordering code	Dimensions, inch								
		Ejector thread		BTA-thread						
D_c inch		dm_t	l_1	dm_m	l_{21}	D_{21}	D_{22}	D_{23}	D_{24}	l_2
STS – 420.6, 800.20										
.787– .858	**420.9S/188-1**	.630	1.083	.650	.984	.472	.740	.740	.709	2.953
.859– .980	**420.9S/188-2**	.709	1.181	.748	.984	.512	.827	.827	.787	3.071
.981–1.039	**420.9S/188-3**	.768	1.181	.787	.984	.551	.886	.886	.866	3.071
1.040–1.129	**420.9S/188-4**	.827	1.181	.866	.984	.610	.968	.968	.945	3.071
1.130–1.220	**420.9S/188-5**	.925	1.299	.945	.984	.669	1.051	1.051	1.024	3.307
1.221–1.311	**420.9S/188-6**	1.004	1.299	1.024	.984	.728	1.133	1.133	1.102	3.307
1.312–1.425	**420.9S/188-7**	1.102	1.299	1.063	1.575	.787	1.220	1.220	1.181	4.252
1.426–1.559	**420.9S/188-8**	1.181	1.575	1.181	1.575	.906	1.330	1.330	1.299	4.252
1.560–1.693	**420.9S/188-9**	1.299	1.575	1.299	1.575	1.004	1.448	1.448	1.417	4.252
1.694–1.850	**420.9S/188-10**	1.417	1.575	1.457	1.575	1.102	1.598	1.598	1.535	4.252
1.851–2.035	**420.9S/188-11**	1.535	1.575	1.614	1.575	1.220	1.748	1.748	1.693	4.252
2.036–2.212	**420.9S/188-12**	1.693	1.732	1.732	1.575	1.378	1.913	1.913	1.850	4.488
2.213–2.559	**420.9S/188-13**	1.850	1.732	1.929	1.575	1.535	2.087	2.087	2.008	4.488
Ejector – 424.6, 800.24										
.787– .858	**420.9S/173-1**	.709	1.181	.650	.984	.472	.768	.740	.709	3.071
.859– .980	**420.9S/173-2**	.768	1.181	.748	.984	.512	.846	.827	.787	3.071
.981–1.039	**420.9S/173-3**	.827	1.181	.787	.984	.551	.925	.886	.866	3.071
1.040–1.129	**420.9S/173-4**	.925	1.299	.866	.984	.610	1.024	.968	.945	3.307
1.130–1.220	**420.9S/173-5**	1.004	1.299	.945	.984	.669	1.102	1.051	1.024	3.307
1.221–1.311	**420.9S/173-6**	1.102	1.299	1.024	.984	.728	1.201	1.133	1.102	3.307
1.312–1.425	**420.9S/173-7**	1.181	1.575	1.063	1.575	.787	1.299	1.220	1.181	4.252
1.426–1.559	**420.9S/173-8**	1.299	1.575	1.181	1.575	.906	1.398	1.330	1.299	4.252
1.560–1.693	**420.9S/173-9**	1.417	1.575	1.299	1.575	1.004	1.535	1.448	1.417	4.252
1.694–1.850	**420.9S/173-10**	1.535	1.575	1.457	1.575	1.102	1.654	1.598	1.535	4.252
1.851–2.035	**420.9S/173-11**	1.693	1.732	1.614	1.575	1.220	1.811	1.748	1.693	4.488
2.036–2.212	**420.9S/173-12**	1.850	1.732	1.732	1.575	1.378	2.008	1.913	1.850	4.488
2.213–2.559	**420.9S/173-13**	2.008	1.732	1.929	1.575	1.535	2.165	2.087	2.008	4.488

Diameter range, inch	Ordering code	Dimensions, inch						
		Ejector thread		BTA-thread				
D_c inch		dm_t	l_1	dm_m	l_{21}	D_{21}	D_{22}	l_2
STS / Ejector – T-Max 424.10								
2.559– 2.633	**420.9S/344-14**	2.047	2.953	2.087	1.575	1.693	2.205	5.315
2.638– 2.870	**420.9S/344-15**	2.284	2.953	2.323	1.575	1.889	2.441	5.315
2.874– 3.146	**420.9S/344-16**	2.480	2.953	2.559	1.575	2.087	2.677	6.496
3.150– 3.421	**420.9S/344-17**	2.756	3.819	2.795	2.756	2.323	2.953	7.480
3.425– 3.933	**420.9S/344-18**	3.031	3.819	3.110	2.756	2.598	3.228	7.480
3.937– 4.405	**420.9S/344-19**	3.504	3.819	3.543	2.756	3.071	3.701	7.480
4.409– 4.878	**420.9S/344-20**	3.976	4.646	4.016	2.756	3.543	4.173	8.465
4.882– 5.311	**420.9S/344-21**	4.449	4.646	4.488	2.756	3.622	4.646	8.465
5.315– 5.823	**420.9S/344-22**	4.921	4.646	4.961	2.756	4.094	5.118	8.465
5.827– 6.295	**420.9S/344-23**	5.394	5.472	5.472	2.756	4.567	5.591	9.449
6.299– 6.768	**420.9S/344-24**	5.866	5.472	5.945	3.346	5.039	6.063	10.039
6.772– 7.240	**420.9S/344-25**	6.338	5.472	6.417	3.346	5.512	6.535	10.039
7.244– 7.713	**420.9S/344-26**	6.811	5.669	6.889	3.346	5.984	7.008	10.433
STS – T-Max special drilling and counterboring heads								
7.717– 8.185	**420.9S/348-27**	6.772	.315	7.362	3.346	6.063	7.480	5.118
8.189– 8.657	**420.9S/348-28**	7.244	.315	7.835	3.346	6.535	7.953	5.118
8.661– 9.130	**420.9S/348-29**	7.717	.315	8.307	3.346	7.008	8.425	5.118
9.134– 9.602	**420.9S/348-30**	8.189	.315	8.780	3.346	7.480	8.898	5.118
9.606–10.075	**420.9S/348-31**	8.661	.315	9.252	3.346	7.953	9.370	5.118
10.079–10.547	**420.9S/348-32**	9.134	.315	9.724	4.724	8.425	9.843	6.496
10.551–11.020	**420.9S/348-33**	9.606	.315	10.197	4.724	8.898	10.315	6.496
11.024–11.492	**420.9S/348-34**	10.079	.315	10.669	4.724	9.370	10.787	6.496
11.496–11.964	**420.9S/348-35**	10.551	.315	11.142	4.724	9.843	11.260	6.496
11.968–12.436	**420.9S/348-36**	11.024	.315	11.614	4.724	10.315	11.732	6.496
12.440–12.909	**420.9S/348-37**	11.496	.315	12.086	4.724	10.787	12.204	6.496
12.913–13.381	**420.9S/348-38**	11.968	.315	12.559	4.724	11.260	12.677	6.496
13.385–13.854	**420.9S/348-39**	12.440	.315	13.031	4.724	11.732	13.149	6.496
13.858–14.326	**420.9S/348-40**	12.913	.315	13.503	4.724	12.204	13.622	6.496

Note! Adapters for cross hole drilling are available on request.

Ordering example: 2 pieces 420.9S/188-1

For ordering information please contact your local Sandvik Coromant representative.

Setting deep hole drill head T-MAX® 424.10, 424.31, 424.32 and 420.7, from the nominal diameter upwards

1. Remove both support pads.

2. Check that the pad seats are free from burrs and dirt.

   Choose shim for the appropriate pads. Shims, suitable for each size of pad, are available in thicknesses .004, .008 and .012 inch. Two sets of shims are required for each head. See page 100 for ordering. Shims in other thicknesses, to be manufactured locally.

3. Place the shims under the respective pad and tighten the lock screws.

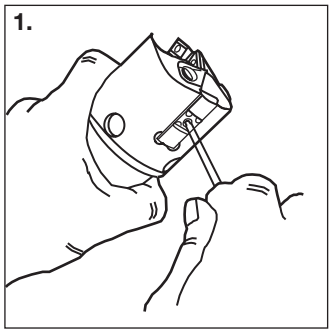
4. The support pad located opposite the periphery insert, should first be mounted in its upper position to allow checking of the tool diameter. The other pad has only one fixed location as it is not in position for the measuring operation.

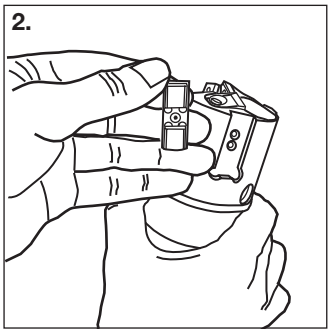
5. If necessary to adjust the diameter further, the position of the peripheral insert can easily be set by its cartridge setting screw. Tighten the cartridge clamping screw carefully.

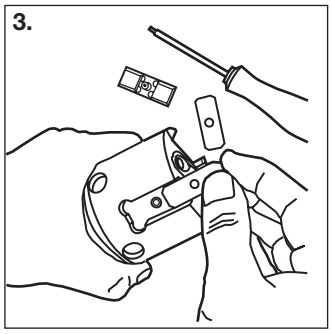
   Repeat the check of tool diameter after all setting or shim replacement operations.

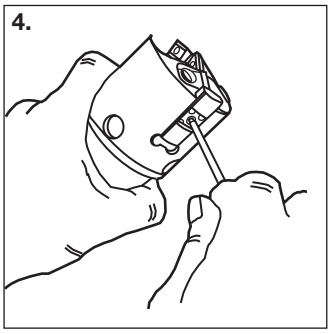
6. Check the tool diameter with a micrometer.

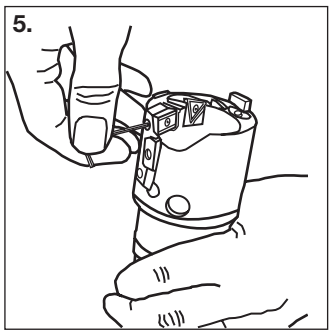
7. Relocate the pad opposite the peripheral insert to its lower position and tighten its lock screw.

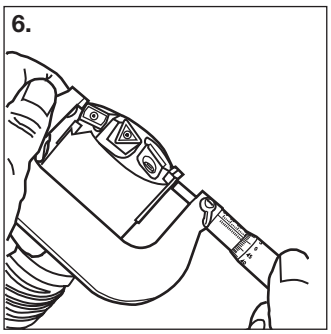


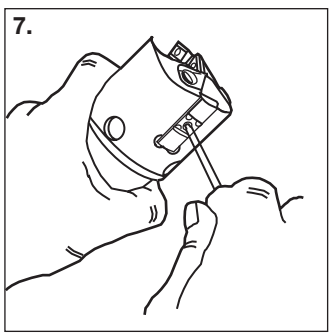


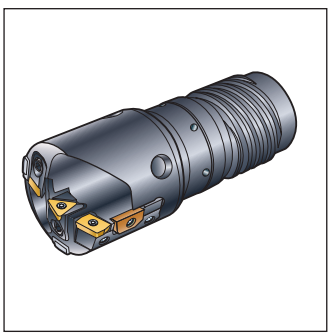




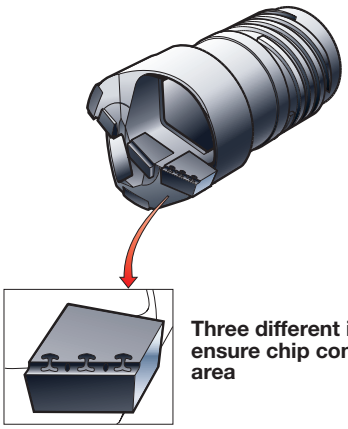








Choice of carbide grades and insert geometries for ground brazed solid drill heads 424.6 and 420.6



Three different insert geometry options ensure chip control in a wide application area

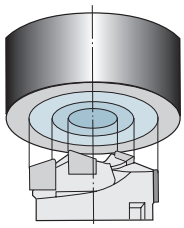
Geometry No. 2
For Duplex stainless steel

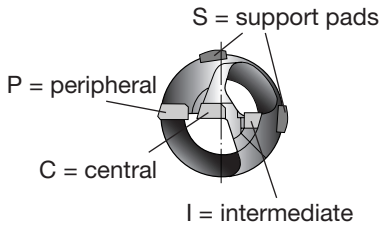
Geometry No. 3
For austenitic stainless steel

Geometry No. 4
General steel and cast iron machining

For long chipping materials ⟷ **For short chipping materials**

A wide range of carbide grade combinations





Insert	P		M		K		N		S	
	Chipbreaker									
	4	4	3/2	3	4		4		4	
	Grade combination									
	70	63	20	67	72		72		72	
C = Central	P40	P40	M35	M35	K20		N20		S15	
I = Intermediate	P30	P30	M35	M35	K20		N20		S15	
P = Peripheral	P10	P30	M25	M35	K20		N20		S15	
S = Support pad	P20	P20	M20	M20	K20		N20		S15	

ISO P

Grade combination 70 is the first choice for machining unalloyed and alloyed steel. The right grade combination for high cutting speed. If better toughness behavior is required choose grade combination 63.

ISO M

Grade combination 20 is the best choice for machining stainless steel. If better toughness behavior is required choose grade combination 67.

ISO K

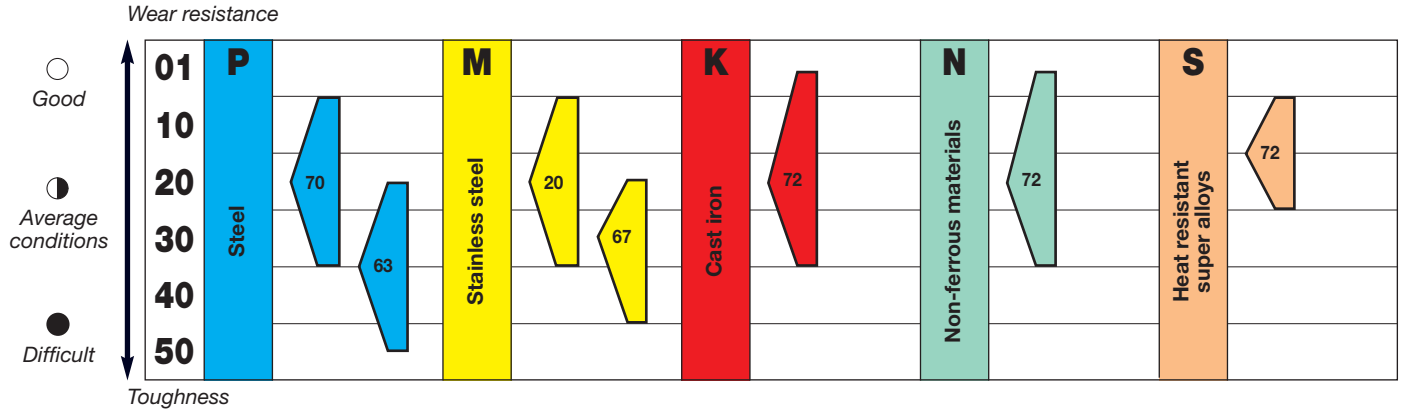
Grade combination 72 is the optimum choice for machining cast iron.

ISO N

Grade combination 72 is the best choice for machining aluminum alloys, copper and copper alloys.

ISO S

Grade combination 72 is the best choice for machining heat resistant super alloys and titanium.



Optimized grade and coating combinations for certain applications available on request.

SAFETY INFORMATION
Precautions when grinding and brazing of cemented carbide, see page 143.

Insert geometries and grades for CoroDrill™ 800.24 and 800.20 solid drill heads

Insert geometries

Geometry (G)

- General purpose geometry
- High cutting feeds and speeds
- Good chip control in most materials

Geometry (L)

- Gives improved chip control in long chipping materials, such as low carbon steels and Duplex stainless steels
- Secure production process in materials where chip jamming easily could occur

Support pad grades

New grade PM1

- Adds greater wear resistance in Duplex, stainless steels, titanium and heat resistant super alloys
- Complementary grade for steel
- New styling for easier identification and lower friction (black and yellow)

Grade P1

- First choice in steel applications

Grade M1

- First choice in ferritic and austenitic stainless and cast iron

Grade recommendations per ISO application area

ISO P

GC1025 (HC) (P15–P50)
A PVD coated universal grade with excellent wear resistance and toughness.

P1 (HC) (P15–P50)
Coated support pad with excellent wear resistance.

PM1 (HC) (P10–P35)
Support pad with new coating and substrate for tougher steels.

ISO M

GC1025 (HC) (M20–M40)
A universal grade for ISO M application area. PVD coated with excellent toughness and resistance against built-up edge.

M1 (HC) (M20–M40)
Coated support pad with excellent wear resistance.

PM1 (HC) (M15–M35)
Support pad with new coating and substrate for stainless/Duplex steels.

ISO K

GC1025 (HC) (K10–K30)
A universal grade for ISO K application area. Good combination of wear resistance and toughness.

M1 (HC) (K10–K30)
Coated support pad with excellent wear resistance.

ISO N

GC1025 (HC) (N10–N30)
Universal grade for aluminum alloys, copper and copper alloys.

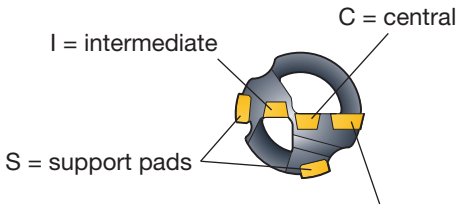
M1 (HC) (N10–N30)
Coated support pad with excellent wear resistance.

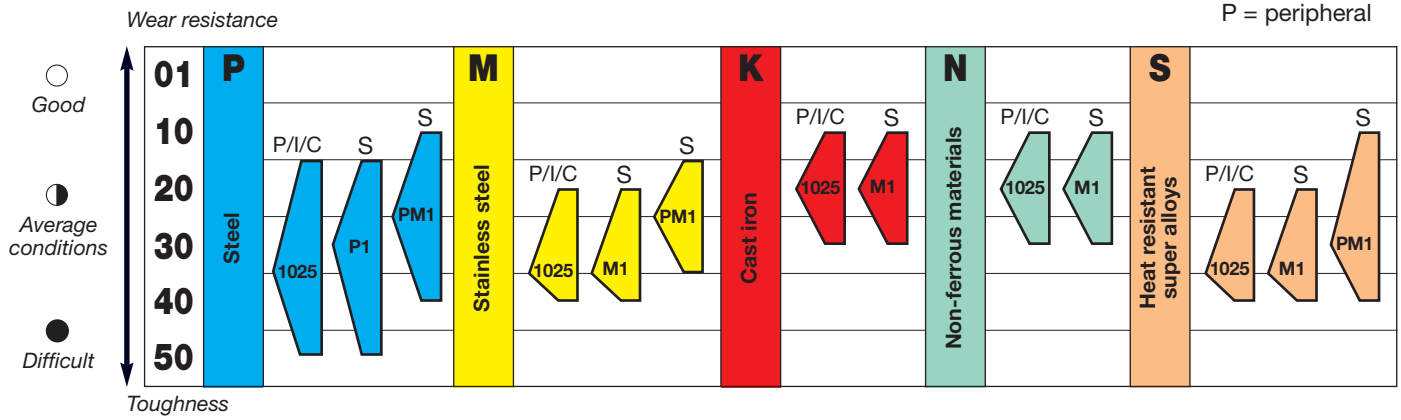
ISO S

GC1025 (HC) (S20–S40)
A PVD coated grade with excellent wear resistance and toughness. Resistance against built-up edge.

M1 (HC) (S20–S40)
Coated support pad with excellent wear resistance.

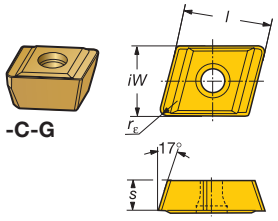
PM1 (HC) (S10–S40)
Support pad with new coating and substrate for heat resistant super alloys and titanium.





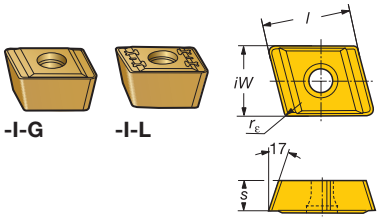
Inserts for CoroDrill™ 800.24 and 800.20 solid drill heads

Central



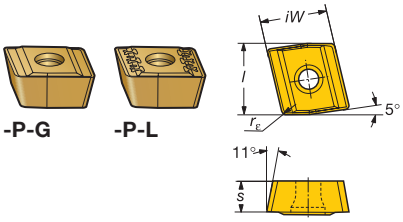
-C-G

Intermediate



-I-G -I-L

Peripheral



-P-G -P-L

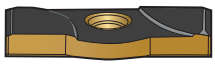
Insert size			Insert code	Coromant grades P GC 1025	M GC 1025	K GC 1025	N GC 1025	S GC 1025	Dimensions, inch iW	l	s	r_ε
			Central									
05			**800-05 03 08M-C-G**	★	★	★	★	★	.219	.389	.125	.031
06			**800-06 T3 08M-C-G**	★	★	★	★	★	.250	.389	.156	.031
08			**800-08 T3 08M-C-G**	★	★	★	★	★	.313	.389	.156	.031
10			**800-10 T3 08M-C-G**	★	★	★	★	★	.375	.389	.156	.031
12			**800-12 T3 08M-C-G**	★	★	★	★	★	.450	.389	.156	.031
			Intermediate									
	05		**800-05 03 08M-I-G**	★	★	★	★	★	.219	.389	.125	.031
			800-05 03 08M-I-L	★	★		★	★	.219	.389	.125	.031
	06		**800-06 T3 08M-I-G**	★	★	★	★	★	.250	.389	.156	.031
			800-06 T3 08M-I-L	★	★		★	★	.250	.389	.156	.031
	08		**800-08 T3 08M-I-G**	★	★	★	★	★	.313	.389	.156	.031
			800-08 T3 08M-I-L	★	★		★	★	.313	.389	.156	.031
	12		**800-12 T3 08M-I-G**	★	★	★	★	★	.450	.389	.156	.031
			800-12 T3 08M-I-L	★	★		★	★	.450	.389	.156	.031
			Peripheral									
		06	**800-06 03 08H-P-G**	★	★	★	★	★	.315	.256	.125	.031
			800-06 03 08H-P-L	★	★		★	★	.315	.256	.125	.031
		08	**800-08 T3 08H-P-G**	★	★	★	★	★	.354	.335	.156	.031
			800-08 T3 08H-P-L	★	★		★	★	.354	.335	.156	.031
		09	**800-09 T3 08H-P-G**	★	★	★	★	★	.354	.381	.156	.031
			800-09 T3 08H-P-L	★	★		★	★	.354	.381	.156	.031
		11	**800-11 T3 08H-P-G**	★	★	★	★	★	.354	.502	.156	.031
			800-11 T3 08H-P-L	★	★		★	★	.354	.502	.156	.031

GC = Coated carbide (ISO = HC)

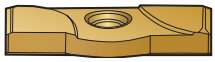
Ordering example: 10 pieces 800-05 03 08M-C-G 1025

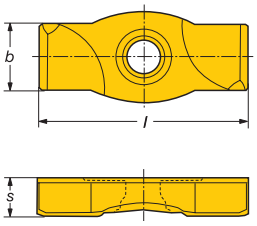
Support pads for CoroDrill™ 800 solid drill heads

Support pad PM1



Support pad P1 and M1





Support pad width, *b*	Support pad code	Coromant grades P GC P1	P GC PM1	M GC M1	M GC PM1	K GC M1	N GC M1	S GC M1	S GC PM1	Dimensions, inch b	l	s
06	**800-06A**	★	☆	★	☆	★	★	☆	★	.236	.709	.118
07	**800-07A**	★	☆	★	☆	★	★	☆	★	.276	.787	.138
08	**800-08A**	★	☆	★	☆	★	★	☆	★	.315	.984	.177
10	**800-10A**	★	☆	★	☆	★	★	☆	★	.394	1.181	.177
12	**800-12A**	★	☆	★	☆	★	★	☆	★	.472	1.378	.217

GC = Coated carbide (ISO = HC)

★= First choice

Ordering example: 10 pieces 800-06A P1

Insert geometries and grades for T-MAX® 424.10 solid drill heads

Insert geometries

Geometry -22

- General purpose geometry
- High cutting feeds and speeds
- Good chip control in most materials including: steel, cast iron, aluminum and other non-ferrous materials

Geometry -23

- First choice for long chipping materials such as: stainless steels, heat resistant super alloys
- Good chip control at moderate feeds and speeds

Grade recommendations per ISO application area

ISO P

GC1025 (HC) (P15-P50)
First choice for ISO P materials.
A PVD coated universal grade with excellent wear resistance and toughness.

GC235 (HC) (P25-P50)
Combines good wear resistance at low to moderate cutting speeds with excellent toughness behavior.

ISO M

GC1025 (HC) (M20-M40)
First choice for ISO M materials.
PVD coated grade with excellent edge toughness and resistance against built-up edge.

GC235 (HC) (M20-M40)
Good edge toughness and resistance against built-up edge. First choice for austenitic stainless steel.

ISO K

H13A (HW) (K10-K30)
Grade for low to moderate cutting speeds. Ideal choice for machining ferritic modular cast iron.

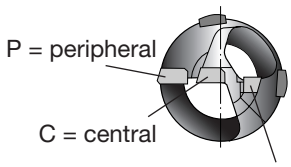
ISO N

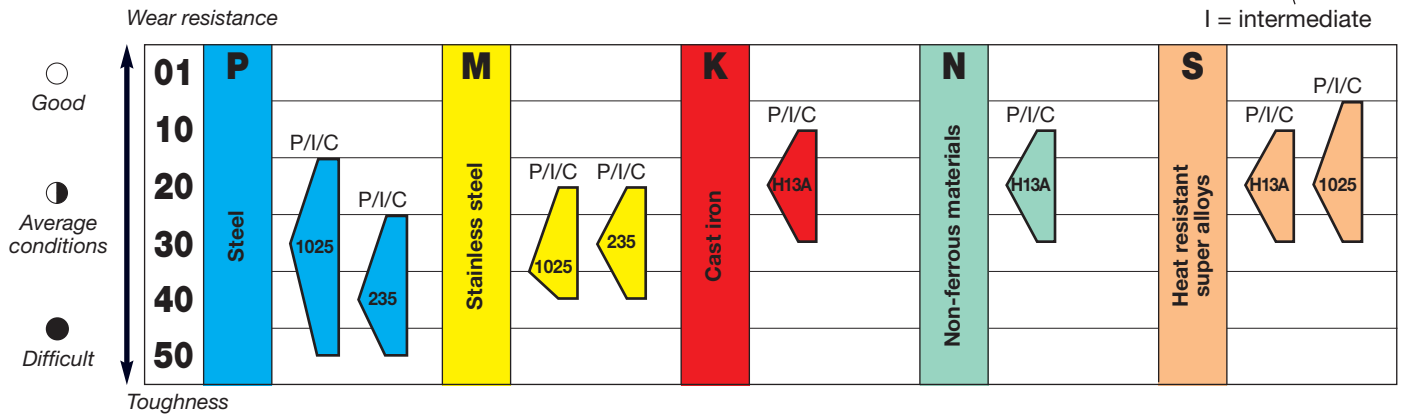
H13A (HW) (N10-N30)
Grade for low to moderate cutting speeds in aluminum alloys, copper and copper alloys.

ISO S

GC1025 (HC) (S05-S30)
A PVD coated grade with excellent wear resistance and toughness at moderate cutting speeds.

H13A (HW) (S10-S30)
The first choice for machining heat resistant super alloys and titanium.
Good edge sharpness, wear resistance and toughness.

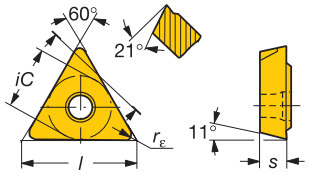




Inserts for T-MAX® 424.10 solid drill heads

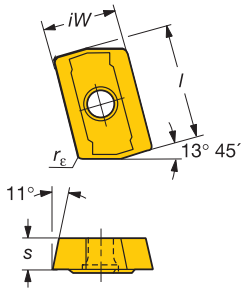
Central and intermediate

TPMT-22
TPMT-23



Peripheral

R424.9-22
R424.9-23



Insert size		Insert code	Coromant grades P GC	P GC	M GC	M GC	K –	K	N –	N	S GC	S –
			1025	235	1025	235	H13A		H13A		1025	H13A
		Central and intermediate										
16		**TPMT 16 T3 12R-22**	★	☆	★	☆					★	
		16 T3 12TR-23	★	☆	★	☆	★		★		☆	★
22		**TPMT 22 06 12R-22**	★	☆	★	☆					★	
		22 06 12TR-23	★	☆	★	☆	★		★		☆	★
		Peripheral										
	13	**R424.9- 13 T3 08-22**	★	☆	★	☆					★	
		13 T3 08-23	★	☆	★	☆	★		★		☆	★
	18	**R424.9- 18 06 08-22**	★	☆	★	☆					★	
		18 06 08-23	★	☆	★	☆	★		★		☆	★

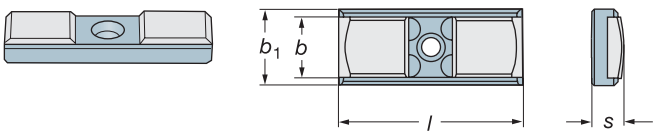
GC = Coated carbide (ISO = HC)
– = Uncoated cemented carbide (ISO = HW)

Dimensions, inch				
iC	*iW*	*l*	*s*	r_ε
.375	–	.650	.156	.047
.375	–	.650	.156	.047
.500	–	.866	.250	.047
.500	–	.866	.250	.047
–	.394	.579	.156	.031
–	.394	.579	.156	.031
–	.453	.811	.250	.031
–	.453	.811	.250	.031

★= First choice

Ordering example: 10 pieces TPMT 16 T3 12R-22 1025

Support pads for T-MAX® 424.10 solid drill heads



Support pad width, *b*	Support pad code [1]	Dimensions, inch *b*	b_1	*l*	*s*
12	**430.32-12 Dxx.x**	.472	.551	1.378	.276
16	**430.32-16 Dxx.x**	.630	.787	1.969	.335

[1] For complete ordering code, see pages 22 and 58

Insert geometries and grades for T-MAX® 424.31F/424.31 counterboring solid drill heads

Insert geometries

424.31F: hole diameter range .787–1.693 inch

- Good chip control and excellent surface finish in most materials including: steel, stainless steels, heat resistant super alloys, aluminum and other non-ferrous materials
- High cutting feeds and speeds

424.31F: hole diameter range 1.693–4.882 inch

- Good chip control and excellent surface finish in most materials including: steel, stainless steels, heat resistant super alloys, aluminum and other non-ferrous materials
- High cutting feeds and speeds

424.31F/424.31: hole diameter range 1.693–4.882 inch

SNMG (double sided)
- General purpose geometry for machining at medium feeds
- Suitable for short chipping materials

SNMM (single sided)
- For roughing and semi-finishing
- Strong straight cutting edge

SNMG-15 (double sided)
- Wide chipbreaking area
- Positive cutting action

TPMX (single sided)
- Parallel land for better surface finish
- Low cutting forces

TPUN (single sided)
- With loose chipbreaker
- Alternative for TPMX inserts if chipbreaking problems occur

Grade recommendations for ISO application area

ISO P

GC235 (HC) (P25-P50)
Combines good wear resistance at low to moderate cutting speeds with excellent toughness behavior.

GC4035 (HC) (P20-P45)
Good toughness and wear resistance. Relatively high cutting speeds.

S6 (HW) (P35-P45)
Good toughness. Low cutting speeds. For difficult machining conditions.

ISO M

GC235 (HC) (M20-M40)
The first choice for austenitic stainless steel. Good edge toughness and resistance against built-up edge.

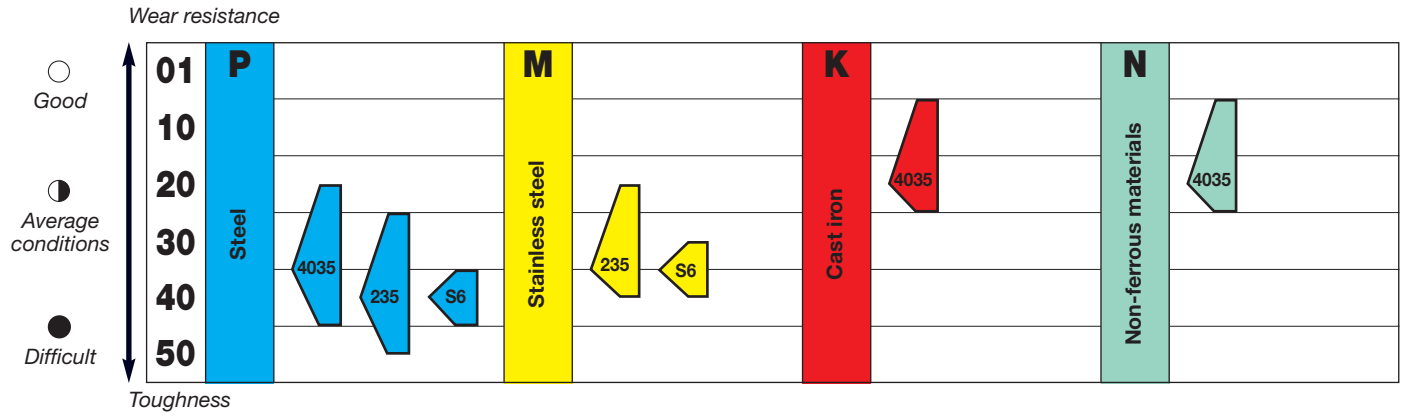
S6 (HW) (M30-M40)
Suitable for difficult machining conditions. Good edge toughness.

ISO K

GC4035 (HC) (K05-K25)
Good edge toughness in combination with wear resistance at moderate to high cutting speeds.

ISO N

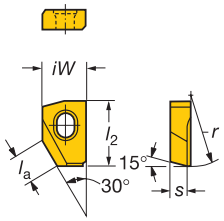
GC4035 (HC) (N05-N25)
Good edge toughness in combination with wear resistance at moderate to high cutting speeds.



Insert for T-MAX® 424.31F/424.31 counterboring solid drill heads

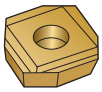
424.31F – close tolerance

424.31F

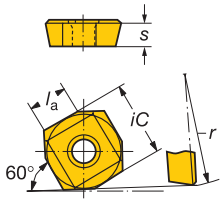


Drill diameter .787–1.693 inch
Max. cutting depth a_p .118 inch

424.31F – close tolerance

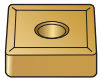


424.31F

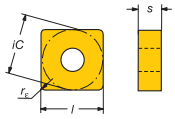


Drill diameter 1.694–4.882 inch
Max. cutting depth a_p .177 inch

424.31F/424.31 – normal tolerance



SNMG
SNMG-15
SNMM

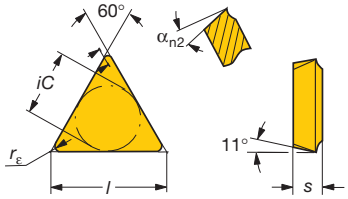


Drill diameter 1.694–4.882 inch
Max. cutting depth a_p
.236 inch (l = .354 inch)
.394 inch (l = .472 inch)
.630 inch (l = .748 inch)

424.31 – normal tolerance

TPMX

TPUN



Drill diameter 1.694–4.882 inch
Max. cutting depth a_p
.472 inch (l = .630 inch)
.669 inch (l = .866 inch)

Insert size		Insert code		Coromant grades								GC = Coated carbide ISO = HC) – = Uncoated cemented carbide (ISO = HW)								
				P			M		K		N									
				GC	GC	–	GC	–	GC		GC									
				235	4035	S6	235	S6	4035		4035	Dimensions, inch								
												l	l_2	*iC*	*iW*	*s*	l_a	*r*	r_ε	α_{n2}
		For 424.31F																		
04		**R424.31F-04 03 00**		★			★					–	.374	–	.256	.100	.173	.394	–	–
06		**R424.31F-06 T3 00**		★			★					–	–	.500	–	.156	.240	.787	–	–
09		**SNMG**	**09 03 08**		★	☆		★	★		★	.375	–	.375	–	.125	–	–	.031	–
			09 03 08-15		★				★		★	.375	–	.375	–	.125	–	–	.031	–
		SNMM	**09 03 08**		★				★		★	.375	–	.375	–	.125	–	–	.031	–
		For 424.31																		
12		**SNMG**	**12 04 12**		★	☆		★	★		★	.500	–	.500	–	.187	–	–	.047	–
			12 04 12-15		★				★		★	.500	–	.500	–	.187	–	–	.047	–
		SNMM	**12 04 12**		★				★		★	.500	–	.500	–	.187	–	–	.047	–
19		**SNMG**	**19 06 12**		★	☆		★	★		★	.750	–	.750	–	.250	–	–	.047	–
			19 06 12-15		★				★		★	.750	–	.750	–	.250	–	–	.047	–
		SNMM	**19 06 12**		★				★		★	.750	–	.750	–	.250	–	–	.047	–
	16	**TPMX**	**16 03 12 R22**	★		☆	★	☆				.650	–	.375	–	.125	–	–	.047	20°
	22	**TPMX**	**22 04 12 R22**	★		☆	★	☆				.866	–	.500	–	.187	–	–	.047	17°
	16	**TPUN**	**16 03 12**	★		☆	★	☆	★		★	.650	–	.375	–	.125	–	–	.047	–
	22	**TPUN**	**22 04 12**	★		☆	★	☆	★		★	.866	–	.500	–	.187	–	–	.047	–

★= First choice

Ordering example: 10 pieces R424.31F-04 03 00 235

Cutting data for ground brazed solid drill heads 424.6 and 420.6

ISO	CMC No.	Material	Description Condition	Specific cutting force k_c .016 lbs/in²	Hardness Brinell HB	Grade combination	Cutting speed v_c ft/min	Drill diameter, inch .496-.614 Feed, f_n in/rev	.615-.787	.788-1.220	1.221-1.693	1.694-2.559
P Steel	01.1 1018, 1020, 1215	Unalloyed	Non-hardened 0.1-0.25% C	290,000	90-200	70/63	230-390	.004-.006	.006-.008[1]	.006-.008[1]	.006-.010	.007-.011
	01.2 1045, 1050, 1335		Non-hardened 0.25-0.55% C	304,500	125-225	70/63	230-390	.004-.006	.006-.008[1]	.006-.008[1]	.006-.010	.007-.011
	01.3 1055, 1060		Non-hardened 0.55-0.80% C	316,100	150-250	70/63	230-390	.004-.006	.006-.008	.007-.010	.008-.012	.009-.013
	01.4 1095		High carbon steel, annealed	336,400	180-275	70/63	230-390	.004-.006	.006-.008	.007-.010	.008-.012	.009-.013
	02.1 4140, 52100, 8620	Low alloy	Non-hardened	290,000	150-260	70/63	230-330	.004-.007	.006-.008	.007-.010	.008-.012	.009-.013
	02.2 4140, 52100, 8620		Hardened and tempered	402.375	220-450	70/63	180-330	.004-.007	.006-.008	.007-.010	.008-.012	.009-.013
	03.11 D3, H13, A2	High alloy	Annealed	362,500	150-250	70/63	230-330	.004-.007	.006-.008	.007-.010	.008-.012	.009-.013
	03.13 M3, M35		Annealed HSS	398,750	150-250	70/63	230-330	.004-.007	.006-.008	.007-.010	.008-.012	.009-.013
	03.21 D3, H13, A2		Hardened tool steels	543,750	250-350	70/63	180-330	.004-.007	.006-.008	.007-.010	.008-.012	.009-.013
	03.22 D3, H13, A2		Hardened steels, others	580,000	250-450	70/63	180-330	.004-.007	.006-.008	.007-.010	.008-.012	.009-.013
	06.1 1018, 1045, 1055	Castings	Unalloyed	261,000	90-225	70/63	165-330	.004-.007	.005-.007	.006-.009	.008-.011	.009-.013
	06.2 4140, 52100, 8620		Low alloyed (alloying elements <5%)	290,000	150-250	70/63	165-100	.004-.007	.005-.007	.006-.009	.008-.011	.009-.013
	06.32	Castings	Stainless austenitic	333.500	150-250	20[2]/67	165-280	.003-.006	.006-.008	.007-.010	.009-.012	.009-.014
	06.33		Manganese steel 12-14% Mn	522,000	200-300	20[2]/67	115-230	.003-.006	.006-.008	.007-.010	.009-.012	.009-.014
M Stainless steel	05.11 403, 405, 410	Rolled/ forged	Ferritic, martensitic Non-hardened	333.500	150-270	20[2]/67	130-280	.005-.007	.006-.008	.007-.010	.009-.012	.009-.014
	05.21 304, 316, 318	Rolled/ forged	Austenitic	377,000	150-275	20[2]/67	130-280	.005-.006	.006-.008	.007-.010	.009-.012	.009-.014
	05.51 S31500, S32900	Rolled/ forged	Austenitic/ferritic (Duplex) non-weldable ≥ 0.05% C	377,000	180-290	20[2]/67	120-195	.005-.007	.005-.006	.008-.011	.009-.012	.010-.014
	05.52 S32304, S31803		Austenitic/ferritic (Duplex) Weldable <0.05% C	435,000	200-320	20[2]/67	120-195	.005-.007	.005-.006	.008-.011	.009-.012	.010-.014
K Cast iron	07.1 32510	Malleable	Ferritic	137,750	110-145	72	260-330	.004-.006	.006-.008	.007-.010	.009-.012	.009-.013
	07.2 40010, 50005		Pearlitic	159,500	150-270	72	260-330	.004-.006	.006-.008	.007-.010	.008-.012	.009-.013
	08.1 Class 20, 25, 30	Grey	Low tensile strength	159,500	150-220	72	195-330	.003-.006	.005-.007	.006-.009	.008-.011	.009-.013
	08.2 Class 45, 50, 60		High tensile strength	187,050	200-330	72	195-330	.003-.006	.005-.007	.006-.009	.008-.011	.009-.013
	09.1 60-40-18, 80-55-56	Nodular	Ferritic	152,250	125-230	72	165-330	.003-.006	.005-.007	.006-.009	.008-.011	.009-.013
	09.2 100-70-03		Pearlitic	253,750	200-300	72	165-330	.003-.006	.005-.007	.006-.009	.008-.011	.009-.013
N Non-ferrous metals	30.11 7075, 2024, 7010	Aluminum alloys	Wrought or wrought and coldworked, non-aged	72,500	30-100	72	210-600	.003-.007	.004-.008	.006-.010	.007-.012	.008-.018
				116,000	30-150	72	210-600	.003-.007	.004-.008	.006-.010	.007-.012	.008-.018
	30.12 7075, 2024, 7010		Wrought or wrought and aged									
	30.21 7075, 2024, 7010	Aluminum alloys	Cast, non-aged	108,750	40-100	72	210-600	.003-.007	.004-.008	.006-.010	.007-.012	.008-.018
	30.22 7075, 2024, 7010		Cast or cast and aged	130,500	70-140	72	210-600	.003-.007	.004-.008	.006-.010	.007-.012	.008-.018
	33.1 Copper	Copper and copper alloys	Free cutting alloys Pb >1%	101,500	70-160	72	210-600	.003-.007	.004-.008	.006-.010	.007-.012	.008-.018
	33.2 Copper		Brass and leaded bronzes Pb ≤1%	101,500	50-200	72	210-600	.003-.007	.004-.008	.006-.010	.007-.012	.008-.018
S Heat resistant super alloys	20.11 330	Iron base	Annealed or solution treated	435,000	180-230	72	30-165	.003-.005	.004-.007	.006-.008	.007-.010	.008-.012
	20.21 Waspaloy, Inconel	Nickel base	Annealed or solution treated	481,400	140-300	72	30-165		.004-.007	.006-.008	.007-.010	.008-.012
	20.31 Air resistant 213, Jetalloy 209	Cobalt base	Annealed or solution treated	478,500	180-230	72	30-165		.004-.007	.006-.008	.007-.010	.008-.012
	23.21 Ti6Al4V	Titanium	Alpha, near alpha and alpha + beta alloys annealed	242,875	Rm[3] 600-1100	72	100-165	.004-.005	.006-.006	.006-.009	.007-.010	.008-.012

[1] Ejector drills in small diameters, not recommended for CMC 01.1 with carbon ≤ 0.18%. STS drills are the recommended alternative.

[2] Only for STS drills.

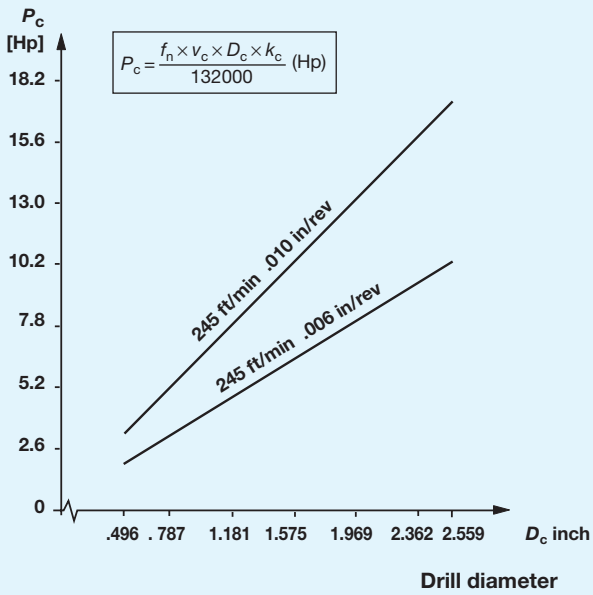
[3] Rm = ultimate tensile strength measured im MPa.

Graphs see page 87-88.

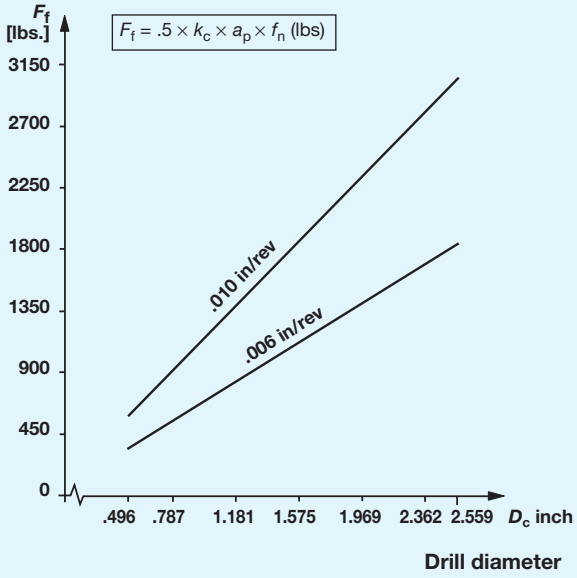
For carbide grades and grade combination, see page 79.

Graphs for Ejector and STS drill head 424.6 and 420.6

Net power



Feed force



Terminology and units

D_c	Drill diameter	inch	F_f	Feed force	lbs
a_p	Cutting depth $\left(\frac{D_c}{2}\right)$	inch	F_μ	Feed force caused by friction	lbs
			M_c	Torque	ft.lbs
v_c	Cutting speed	ft./min	M_μ	Torque caused by friction	ft.lbs
n	Spindle speed	rev/min	P_c	Net power	Hp
v_f	Feed speed	ft./min	P_μ	Power caused by friction	Hp
f_n	Feed per rev.	in./rev	κ_r	Cutting edge angle	Degrees
Q	Material removal rate	$inch^3/min$	q	Cutting fluid quantity	gpm
k_c	Specific cutting force	lbs/in^2	p	Cutting fluid pressure	psi
$k_{c\ .016}$	Specific cutting force for f_z =.016	lbs/in^2			

For cutting data calculations, see pages 133-134.

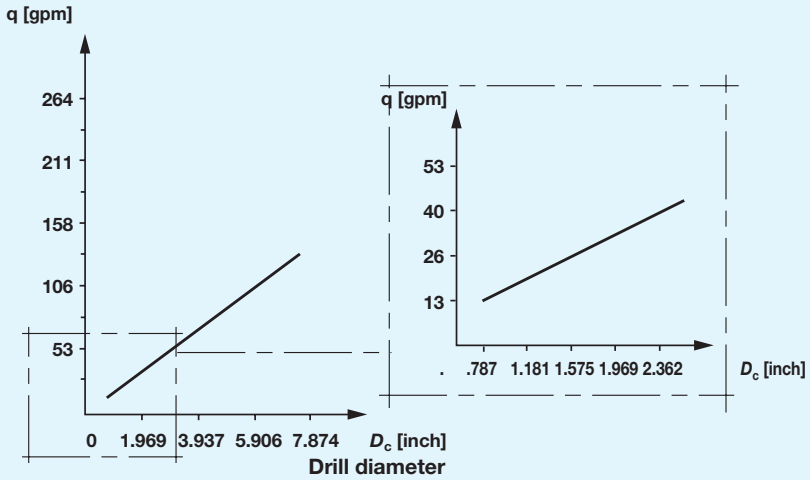
The graphs show nominal values which should not be regarded as strict recommendations. The values may need adjusting depending on the machining conditions e.g., the type of material.

Note that only net power ratings are given. Allowance must be made for the efficiency of the machine and the cutting edge wear.

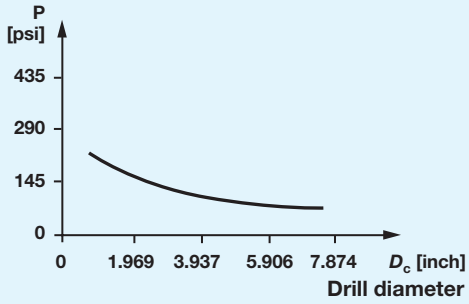
Graphs for Ejector and STS drill head 424.6 and 420.6

Ejector – 424.6

Cutting fluid flow



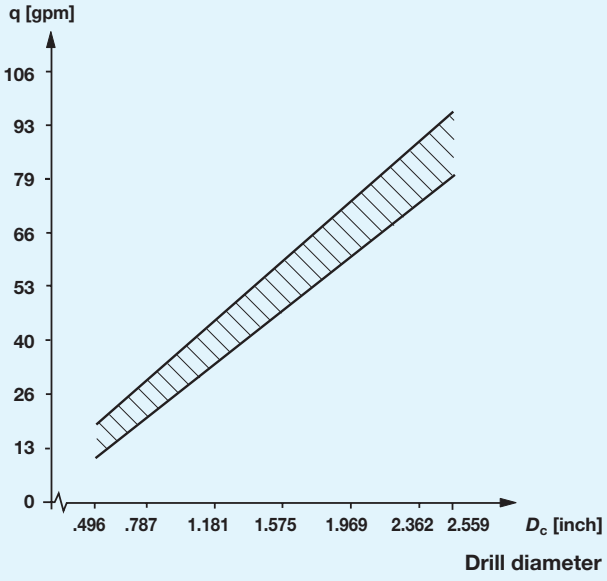
Cutting fluid pressure



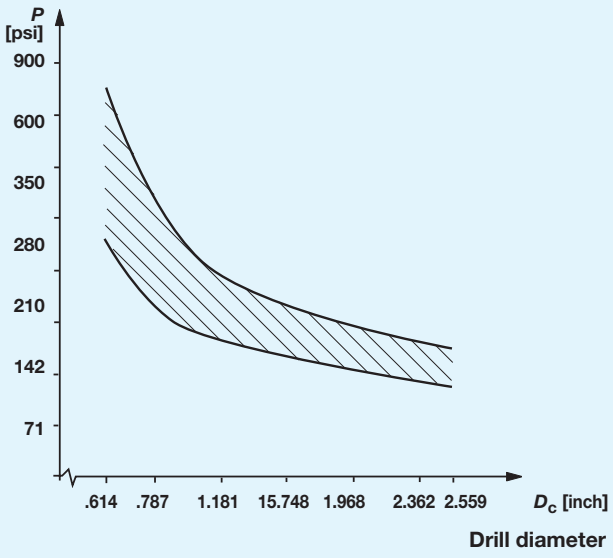
For optimal tool life, use at least 10% mixture when emulsion is used.

STS – 420.6

Cutting fluid flow



Cutting fluid pressure



For cutting data calculations, see pages 133-134.

The graphs show nominal values which should not be regarded as strict recommendations. The values may need adjusting depending on the machining conditions e.g., the type of material.

Note that only net power ratings are given. Allowance must be made for the efficiency of the machine and the cutting edge wear.

Cutting data for CoroDrill™ solid drill heads 800.24 and 800.20

ISO	CMC No.	Material Description Condition		Specific cutting force k_c .016	Hardness Brinell	Geometry/grade Insert*)			Support pad grade	Cutting speed	Feed, f_n in/rev Drill diameter, inch	
				lbs/in²	HB	P	I	C		v_c ft/min	.984-1.693	1.694-2.559
P Steel	01.1 1018, 1020, 1215	Unalloyed	Non-hardened 0.1-0.25% C	290,000	90-200	G/1025	G/1025	G/1025	P1	230-425	.004-.016	.005-.017
	01.2 1045, 1050, 1335		Non-hardened 0.25-0.55% C	304.500	125-225	G/1025	G/1025	G/1025	P1	230-425	.004-.016	.005-.017
	01.3 1055, 1060		Non-hardened 0.55-0.80% C	316,100	150-250	G/1025	G/1025	G/1025	P1	230-425	.004-.016	.005-.017
	01.4 1095		High carbon steel, annealed	336,400	180-275	G/1025	G/1025	G/1025	P1	230-425	.004-.016	.005-.017
	02.1 4140, 52100, 8620	Low alloy	Non-hardened	290,000	150-260	G/1025	G/1025	G/1025	P1	230-390	.004-.016	.007-.017
	02.2 4140, 52100, 8620		Hardened and tempered	402,375	220-450	G/1025	G/1025	G/1025	P1	180-360	.004-.016	.007-.017
	03.11 D3, H13, A2	High alloy	Annealed	362,500	150-250	G/1025	G/1025	G/1025	P1	230-390	.004-.016	.007-.017
	03.13 M3, M35		Annealed HSS	398,750	150-250	G/1025	G/1025	G/1025	P1	230-390	.004-.016	.007-.017
	03.21 D3, H13, A2		Hardened tool steels	543,750	250-350	G/1025	G/1025	G/1025	P1	180-360	.004-.014	.007-.015
	03.22 D3, H13, A2		Hardened steels, others	580,000	250-450	G/1025	G/1025	G/1025	P1	180-360	0,20-.014	.007-.015
	06.1 1018, 1045, 1055	Castings	Unalloyed	261,000	90-225	G/1025	G/1025	G/1025	P1	180-360	.004-.016	.007-.017
	06.2 4140, 52100, 8620		Low alloyed (alloying elements <5%)	290,000	150-250	G/1025	G/1025	G/1025	P1	180-360	.004-.016	.007-.017
	06.32	Castings	Stainless austenitic	333,500	150-250	G/1025	G/1025	G/1025	P1	160-330	.004-.012	.007-.014
	06.33		Manganese steel 12-14% Mn	522,000	200-300	G/1025	G/1025	G/1025	P1	115-280	.004-.012	.007-.014
M Stainless steel	05.11 403, 405, 410	Rolled/ forged	Ferritic, martensitic Non-hardened	333,500	150-270	G/1025	G/1025	G/1025	M1	130-360	.004-.016	.007-.017
	05.21 304, 316, 318	Rolled/ forged	Austenitic	377,000	150-275	G/1025	G/1025	G/1025	M1	130-360	.004-.016	.007-.017
	05.51 S31500, S32900	Rolled/ forged	Austenitic/ferritic (Duplex) non-weldable ≥ 0,05% C	377,000	180-290	G/1025	G/1025	G/1025	M1	130-360	.004-.012	.007-.013
	05.52 S32304, S31803		Austenitic/ferritic (Duplex) Weldable <0,05% C	435,000	200-320	G/1025	G/1025	G/1025	M1	130-360	.004-.012	.007-.013
K Cast iron	07.1 32510	Malleable	Ferritic	137,750	110-145	G/1025	G/1025	G/1025	M1	260-390	.004-.014	.009-.016
	07.2 40010, 50005		Pearlitic	159,500	150-270	G/1025	G/1025	G/1025	M1	260-390	.004-.014	.009-.016
	08.1 Class 20, 25, 30	Grey	Low tensile strength	159,500	150-220	G/1025	G/1025	G/1025	M1	195-360	.004-.014	.009-.016
	08.2 Class 45, 50, 60		High tensile strength	187,050	200-330	G/1025	G/1025	G/1025	M1	195-360	.004-.014	.009-.016
	09.1 60-40-18, 80-55-56	Nodular	Ferritic	152,250	125-230	G/1025	G/1025	G/1025	M1	160-360	.004-.014	.009-.016
	09.2 100-70-03		Pearlitic	253,750	200-300	G/1025	G/1025	G/1025	M1	160-360	.004-.014	.009-.016
N Non-ferrous metals	30.11 7075, 2024, 7010	Aluminum alloys	Wrought or wrought and coldworked, non-aged	72,500 116,000	30-100 30-150	G/1025	G/1025	G/1025	M1	210-600	.003-.012	.009-.013
	30.12 7075, 2024, 7010		Wrought or wrought and aged			G/1025	G/1025	G/1025	M1	210-600	.003-.012	.009-.013
	30.21 7075, 2024, 7010	Aluminum alloys	Cast, non-aged	108,750	40-100	G/1025	G/1025	G/1025	M1	210-600	.003-.012	.009-.013
	30.22 7075, 2024, 7010		Cast or cast and aged	130,500	70-140	G/1025	G/1025	G/1025	M1	210-600	.003-.012	.009-.013
	33.1 Copper	Copper and copper alloys	Free cutting alloys Pb >1%	101,500	70-160	G/1025	G/1025	G/1025	M1	210-600	.003-.012	.009-.013
	33.2 Copper		Brass and leaded bronzes Pb ≤1%	101,500	50-200	G/1025	G/1025	G/1025	M1	210-600	.003-.012	.009-.013
S Heat resistant super alloys	20.11 330	Iron base	Annealed or solution treated	435,000	180-230	G/1025	G/1025	G/1025	PM1	30-180	.003-.011	.007-.012
	20.21 Waspaloy, Inconel	Nickel base	Annealed or solution treated	481,400	140-300	G/1025	G/1025	G/1025	PM1	30-180	.003-.011	.007-.012
	20.31 Air resistant 213, Jetalloy 209	Cobalt base	Annealed or solution treated	478,500	180-230	G/1025	G/1025	G/1025	PM1	30-180	.003-.011	.007-.012
	23.21 Ti6Al4V	Titanium	Alpha, near alpha and alpha + beta alloys annealed	242,875	Rm[3] 600-1100	G/1025	G/1025	G/1025	PM1	115- 195	.003-.011	.007-.012

***) Insert position – P, I, C**
P= Peripheral, I= Intermediate, C= Central

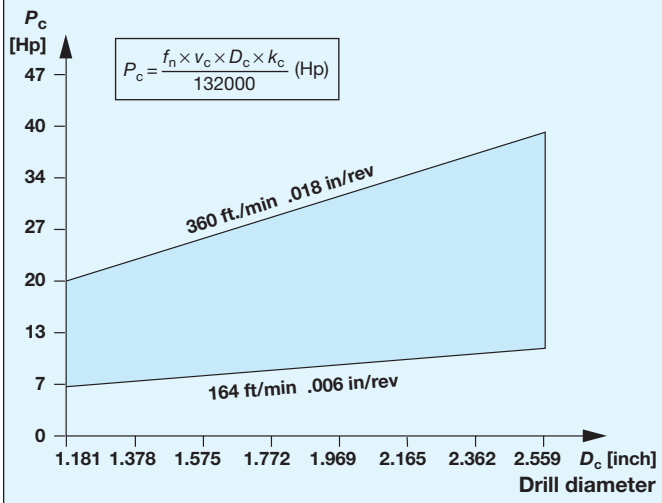
[2] Rm = ultimate tensile strength measured in MPa

A straight oil improves the tool life compared to mixed emulsion.

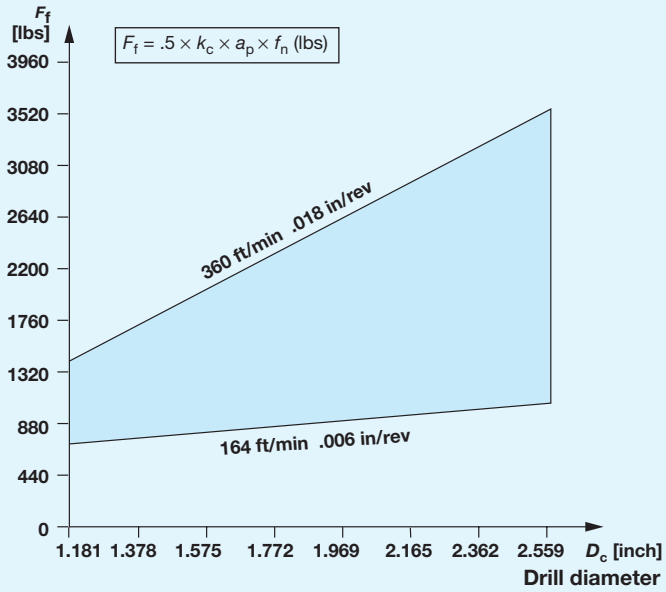
Graphs see page 90-91.

Graphs for Ejector and STS drills 800.24 and 800.20

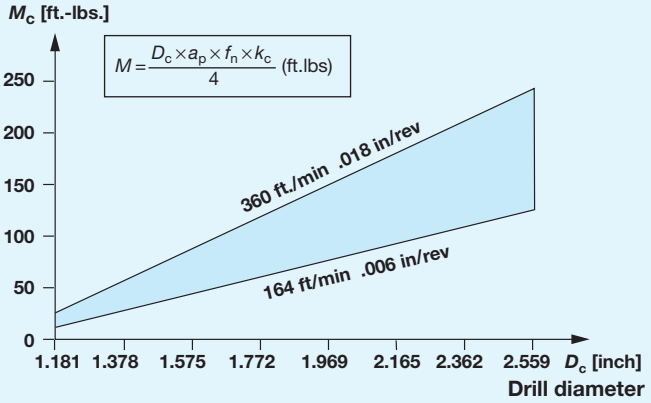
Net power



Feed force



Torque



Terminology and units

D_c	Drill diameter		inch
a_p	Cutting depth	$\left(\frac{D_c}{2}\right)$	inch
v_c	Cutting speed		ft./min
n	Spindle speed		rev/min
v_f	Feed speed		ft./min
f_n	Feed per rev.		in./rev
Q	Material removal rate		$inch^3$/min
k_c	Specific cutting force		lbs/in^2
$k_{c\ .016}$	Specific cutting force for f_z =.016		lbs/in^2

F_f	Feed force	lbs
F_μ	Feed force caused by friction	lbs
M_c	Torque	ft.lbs
M_μ	Torque caused by friction	ft.lbs
P_c	Net power	Hp
P_μ	Power caused by friction	Hp
κ_r	Cutting edge angle	Degrees
q	Cutting fluid quantity	gpm
p	Cutting fluid pressure	psi

For cutting data calculations, see pages 133-134.

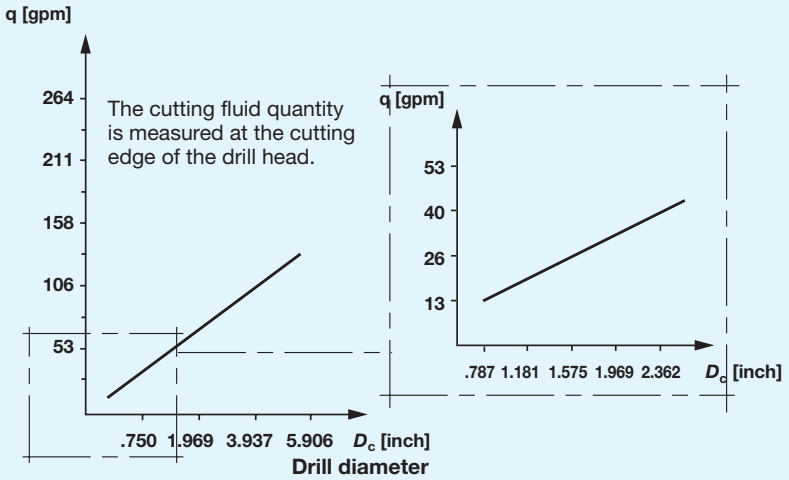
The graphs show nominal values which should not be regarded as strict recommendations. The values may need adjusting depending on the machining conditions e.g., the type of material.

Note that only net power ratings are given. Allowance must be made for the efficiency of the machine and the cutting edge wear.

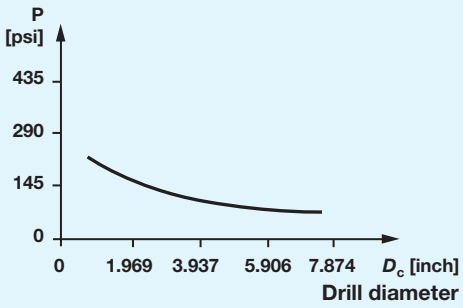
Graphs for Ejector and STS drills 800.24 and 800.20

Ejector – 800.24

Cutting fluid flow



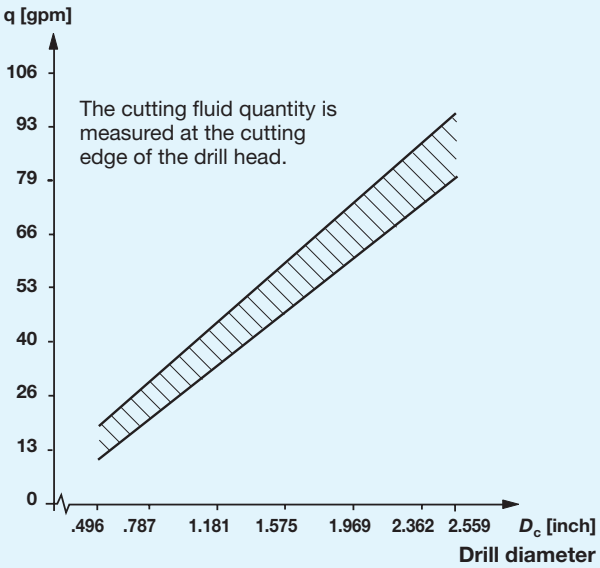
Cutting fluid pressure



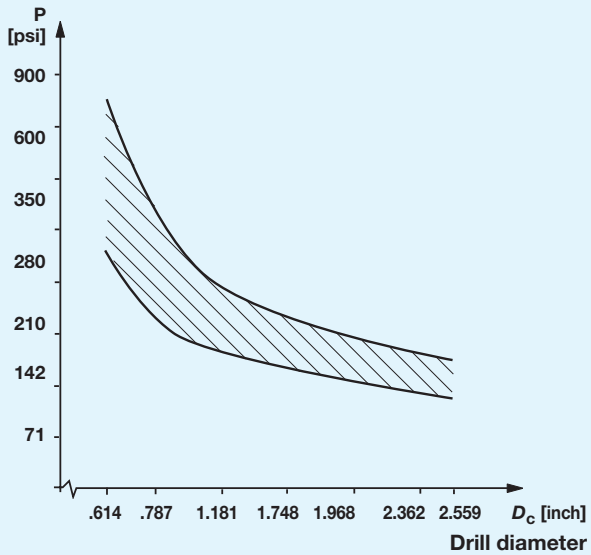
For optimal tool life, use at least 10% mixture when emulsion is used.

STS – 800.20

Cutting fluid flow



Cutting fluid pressure



Terminology and units

D_c	Drill diameter	inch	F_f	Feed force	lbs
a_p	Cutting depth	inch	F_μ	Feed force caused by friction	lbs
v_c	Cutting speed	ft./min	M_c	Torque	ft.lbs
n	Spindle speed	rev/min	M_μ	Torque caused by friction	ft.lbs
v_f	Feed speed	ft./min	P_c	Net power	Hp
f_n	Feed per rev.	in./rev	P_μ	Power caused by friction	Hp
Q	Material removal rate	cm^3/min	κ_r	Cutting edge angle	Degrees
k_c	Specific cutting force	lbs/in^2	q	Cutting fluid quantity	gpm
$k_{c\ .016}$	Specific cutting force for f_z =.016	lbs/in^2	p	Cutting fluid pressure	psi

For cutting data calculations, see pages 133-134.

The graphs show nominal values which should not be regarded as strict recommendations. The values may need adjusting depending on the machining conditions e.g., the type of material.

Note that only net power ratings are given. Allowance must be made for the efficiency of the machine and the cutting edge wear.

Cutting data for T-MAX® adjustable solid drill head 424.10

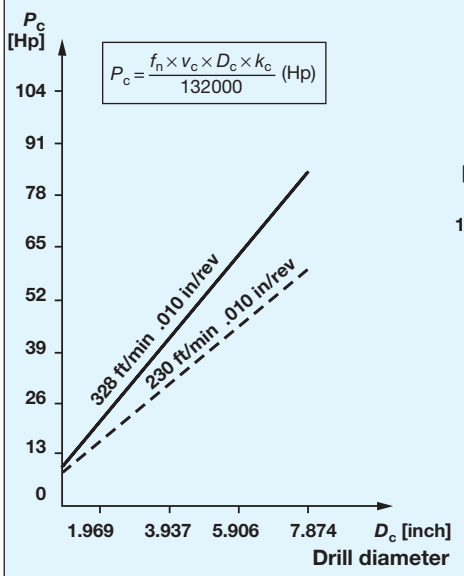
ISO	CMC No.	Material	Description Condition	Specific cutting force k_c .016 lbs/in²	Hardness Brinell HB	Geometry/ grade	Cutting speed v_c ft/min	Drill diameter, inch ≥ 2.500 Feed, f_n in/rev
P Steel	**01.1** 1018, 1020, 1215	**Unalloyed**	Non-hardened 0.1-0.25% C	290,000	90-200	-22/-23/1025	260-330	.007-.014
	01.2 1045, 1050, 1335		Non-hardened 0.25-0.55% C	304,500	125-225	-22/1025	260-330	.007-.014
	01.3 1055, 1060		Non-hardened 0.55-0.80% C	316,100	150-250	-22/1025	260-330	.007-.014
	01.4 1095		High carbon steel, annealed	336,400	180-275	-22/1025	260-330	.007-.014
	02.1 4140, 52100, 8620	**Low alloy**	Non-hardened	304,500	150-260	-22/1025	230-330	.007-.014
	02.2 4140, 52100, 8620		Hardened and tempered	402,400	220-450	-22/1025	200-330	.006-.014
	03.11 D3, H13, A2	**High alloy**	Annealed	362,500	150-250	-22/1025	230-330	.007-.012
	03.13 M3, M35		Annealed HSS	398,750	150-250	-22/1025	230-330	.007-.012
	03.21 D3, H13, A2		Hardened tool steels	543,750	250-350	-22/1025	200-330	.007-.012
	03.22 D3, H13, A2		Hardened steels, others	580,000	250-450	-22/1025	200-330	.007-.012
	06.1 1018, 1045, 1055	**Castings**	Unalloyed	261,000	90-225	-22/1025	165-330	.006-.012
	06.2 4140, 52100, 8620		Low alloyed (alloying elements <5%)	304,500	150-250	-22/1025	165-330	.006-.012
M Stainless steel	**05.11** 403, 405, 410	**Rolled/ forged**	Ferritic, martensitic Non-hardened	333,500	150-270	-22/1025	165-300	.006-.014
	05.21 304, 316, 318	**Rolled/ forged**	Austenitic	377,000	150-270	-23/1025	165-300	.006-.014
K Cast iron	**07.1** 3250	**Malleable**	Ferritic	137,750	110-145	-22/H13A	260-330	.007-.012
	07.2 40010, 5005		Pearlitic	159,500	150-270	-22/H13A	260-330	.007-.012
	08.1 Class 20, 25, 30	**Grey**	Low tensile strength	159,500	150-220	-22/H13A	200-330	.006-.014
	08.2 Class 45, 50, 60		High tensile strength	187,050	200-330	-22/H13A	200-330	.006-.014
	09.1 60-40-18, 80-55-56	**Nodular**	Ferritic	152,250	125-230	-22/H13A	165-330	.006-.014
	09.2 100-70-03		Pearlitic	253,750	200-300	-22/H13A	165-330	.006-.014
N Non-ferrous metals	**30.11** 7075, 2024, 7010	**Aluminum alloys**	Wrought or wrought and coldworked, non-aged	72,500	30-100	-23/H13A	210-600	.004-.012
				116,000	30-150	-23/H13A	210-600	.004-.012
	30.12 7075, 2024, 7010		Wrought or wrought and aged					
	30.21 7075, 2024, 7010	**Aluminum alloys**	Cast, non-aged	108,750	40-100	-23/H13A	210-600	.004-.012
	30.22 7075, 2024, 7010		Cast or cast and aged	130,500	70-140	-23/H13A	210-600	.004-.012
	33.1 Copper	**Copper and copper alloys**	Free cutting alloys Pb >1%	101,500	70-160	-23/H13A	210-600	.004-.012
	33.2 Copper		Brass and leaded bronzes Pb ≤1%	101,500	50-200	-23/H13A	210-600	.004-.012
S Heat resistant super alloys	**20.11** 330	**Iron base**	Annealed or solution treated	435,000	180-230	-22/1025	65-210	.006-.012
	20.21 Waspaloy, Inconel	**Nickel base**	Annealed or solution treated	481,400	140-300	-23/1025	65-210	.006-.012
	20.31 Air resistant 213, Jetalloy 209	**Cobalt base**	Annealed or solution treated	478,500	180-230	-23/H13A	65-210	.006-.012
	23.21 Ti6Al4V	**Titanium**	Alpha, near alpha and alpha + beta alloys annealed	242,875	**Rm**[1] 600-1100	-23/H13A -22/1025	100-330 100-330	.006-.012 .006-.012

[1] **Rm** = Ultimate tensile strength measured in MPa

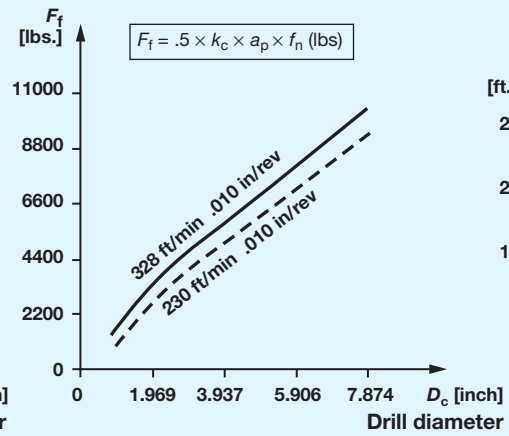
Graphs see page 93-94.

Graphs for Ejector drill head 424.10

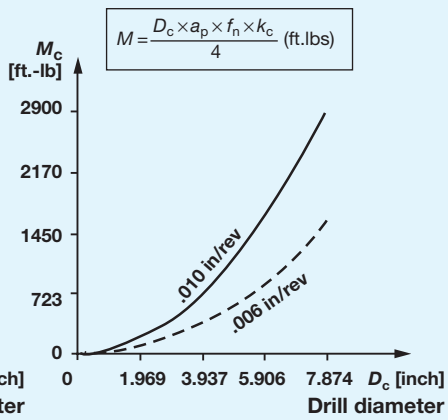
Net power



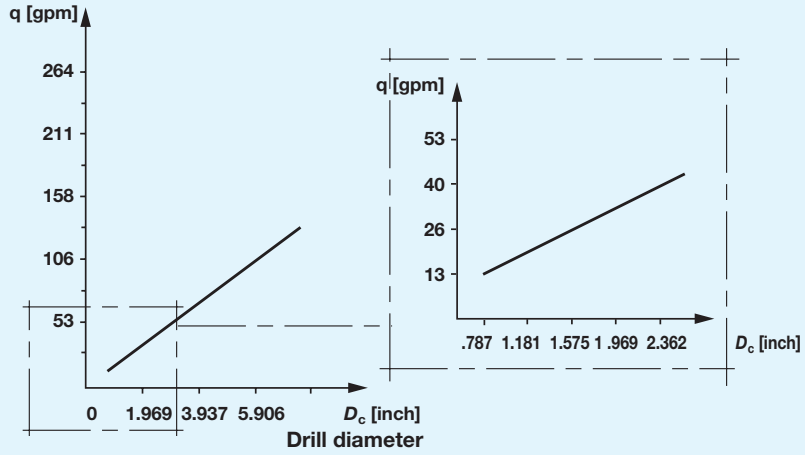
Feed force



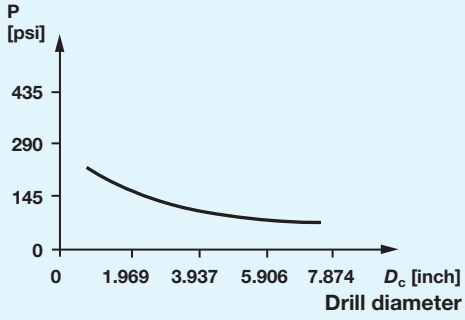
Torque



Cutting fluid flow



Cutting fluid pressure



For optimal tool life, use at least 10% mixture when emulsion is used.

Terminology and units

D_c	Drill diameter	inch	F_f	Feed force	lbs
a_p	Cutting depth $\left(\frac{D_c}{2}\right)$	inch	F_μ	Feed force caused by friction	lbs
			M_c	Torque	ft.lbs
v_c	Cutting speed	ft./min	M_μ	Torque caused by friction	ft.lbs
n	Spindle speed	rev/min	P_c	Net power	Hp
v_f	Feed speed	ft./min	P_μ	Power caused by friction	Hp
f_n	Feed per rev.	in./rev	κ_r	Cutting edge angle	Degrees
Q	Material removal rate	$inch^3/min$	q	Cutting fluid quantity	gpm
k_c	Specific cutting force	lbs/in^2	p	Cutting fluid pressure	psi
$k_{c\ .016}$	Specific cutting force for f_z =.016	lbs/in^2			

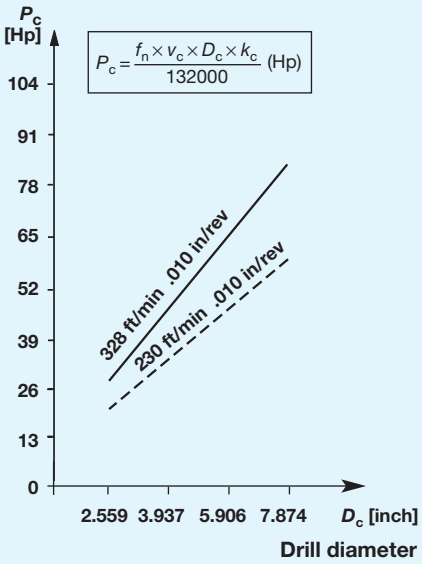
For cutting data calculations, see pages 133-134.

The graphs show nominal values which should not be regarded as strict recommendations. The values may need adjusting depending on the machining conditions e.g., the type of material.

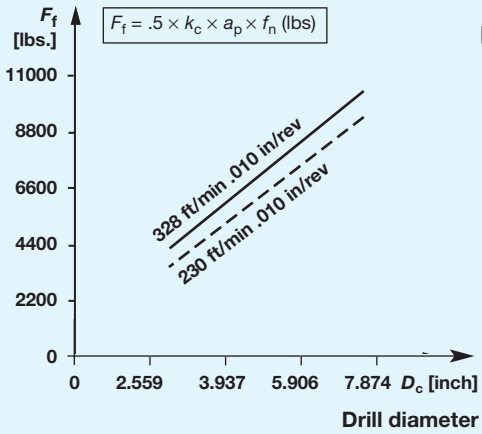
Note that only net power ratings are given. Allowance must be made for the efficiency of the machine and the cutting edge wear.

Graphs for STS drill head 424.10

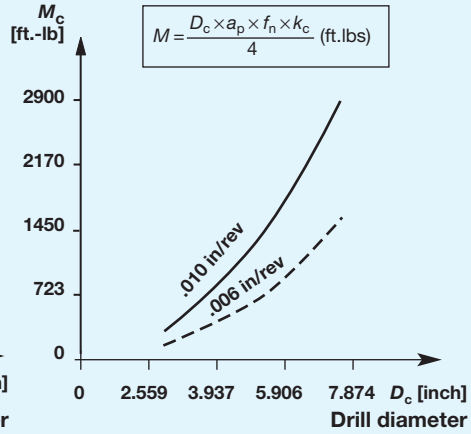
Net power



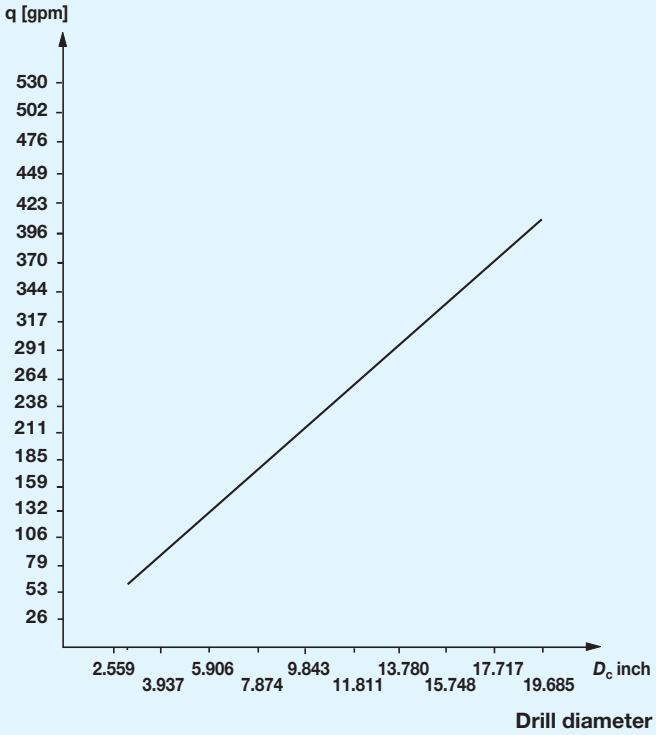
Feed force



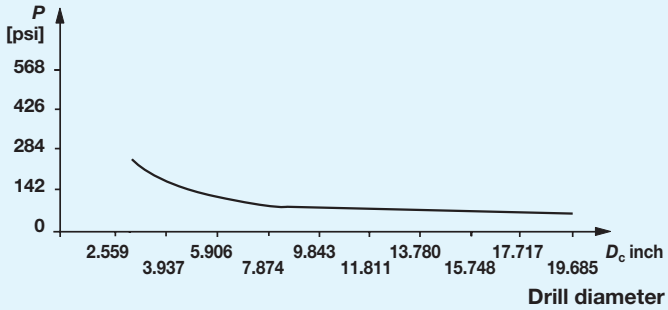
Torque



Cutting fluid flow



Cutting fluid pressure



Terminology and units

D_c	Drill diameter	inch
a_p	Cutting depth $\left(\frac{D_c}{2}\right)$	inch
v_c	Cutting speed	ft./min
n	Spindle speed	rev/min
v_f	Feed speed	ft./min
f_n	Feed per rev.	in./rev
Q	Material removal rate	$inch^3/min$
k_c	Specific cutting force	lbs/in^2
$k_{c\ .016}$	Specific cutting force for f_z =.016	lbs/in^2
F_f	Feed force	lbs
F_μ	Feed force caused by friction	lbs
M_c	Torque	ft.lbs
M_μ	Torque caused by friction	ft.lbs
P_c	Net power	Hp
P_μ	Power caused by friction	Hp
κ_r	Cutting edge angle	Degrees
q	Cutting fluid quantity	gpm
p	Cutting fluid pressure	psi

For cutting data calculations, see pages 133-134.

The graphs show nominal values which should not be regarded as strict recommendations. The values may need adjusting depending on the machining conditions e.g., the type of material.

Note that only net power ratings are given. Allowance must be made for the efficiency of the machine and the cutting edge wear.

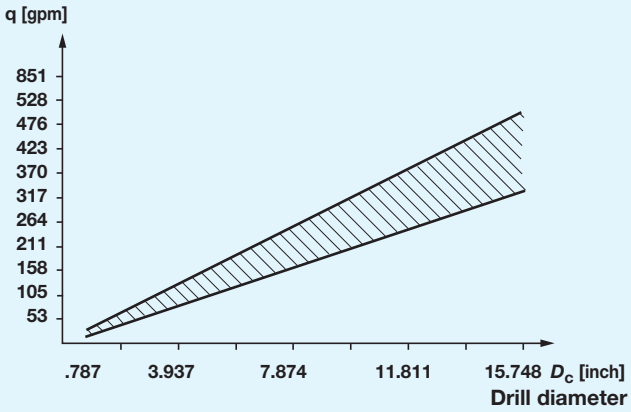
Cutting data for T-MAX® counterboring heads 424.31F, 424.31 and 424.32

ISO	CMC No.	Material		Specific cutting force k_c .016 lb/in²	Hardness Brinell HB	Grade	Cutting speed v_c ft/min	Depth of cut, inch .039-.118 Feed, f_n in/rev	.118-.315	≥ .315
P Steel	01.1	Unalloyed	Non-hardened 0.1-0.25% C	290,000	90-200	235/4035	200-460	.006-.016	.008-.016	.007-.016
	01.2		Non-hardened 0.25-0.55% C	304,500	125-225	235/4035	200-395	.006-.016	.008-.016	.007-.016
	01.3		Non-hardened 0.55-0.80% C	316,100	150-250	235/4035	165-330	.006-.016	.008-.016	.007-.014
	02.1	Low alloy	Non-hardened	304,500	150-260	235/4035	165-130	.006-.016	.008-.016	.007-.016
	02.2		Hardened and tempered	402,375	220-450	235/4035	165-395	.006-.016	.008-.016	.007-.016
	03.11	High alloy	Annealed	362,500	150-250	235/4035	165-330	.006-.016	.008-.016	.007-.016
	03.13		Annealed HSS	398,750	150-250	235/4035	165-330	.006-.016	.008-.016	.007-.016
	03.21		Hardened tool steels	543,750	250-350	235/4035	200-330	.006-.016	.008-.016	.007-.016
	03.22		Hardened steels, others	580,000	250-450	235/4035	200-330	.006-.016	.008-.016	.007-.016
	06.1	Castings	Unalloyed	261,000	90-225	235/4035	200-395	.008-.016	.008-.016	.007-.016
	06.2		Low alloyed (alloying elements <5%)	304,500	150-250	235/4035	165-360	.008-.016	.008-.016	.007-.016
M Stainless steel	05.11	Rolled/forged	Ferritic, martensitic Non-hardened	333,500	150-270	235/S6	165-310	.008-.016	.008-.016	.007-.016
	05.21	Rolled/forged	Austenitic	377,000	150-270	235/S6	165-310	.008-.016	.008-.016	.007-.016
K Cast iron	07.1	Malleable	Ferritic	137,750	110-145	4035	200-395	.008-.016	.008-.016	.006-.016
	07.2		Pearlitic	159,500	150-270	4035	200-395	.008-.016	.008-.016	.006-.016
	08.1	Grey	Low tensile strength	159,500	150-220	4035	165-395	.008-.016	.008-.016	.006-.016
	08.2		High tensile strength	187,050	200-330	4035	165-395	.008-.016	.008-.016	.006-.016
	09.1	Nodular	Ferritic	152,250	125-230	4035	200-395	.008-.016	.008-.016	.006-.016
	09.2		Pearlitic	253,750	200-300	4035	200-395	.008-.016	.008-.016	.006-.016
N Non-ferrous metals	30.11	Aluminum alloys	Wrought or wrought and coldworked, non-aged	72,500	30-100	4035	210-985	.008-.016	.008-.016	.008-.016
	30.12		Wrought or wrought and aged	116,000	30-150	4035	210-985	.008-.016	.008-.016	.008-.016
	30.21	Aluminum alloys	Cast, non-aged	108,750	40-100	4035	210-985	.008-.016	.008-.016	.008-.016
	30.22		Cast or cast and aged	130,500	70-140	4035	210-985	.008-.016	.008-.016	.008-.016
	33.1	Copper and copper alloys	Free cutting alloys Pb >1%	101,500	70-160	4035	210-985	.008-.016	.008-.016	.008-.016
	33.2		Brass and leaded bronzes Pb ≤1%	101,500	50-200	4035	210-985	.008-.016	.008-.016	.008-.016

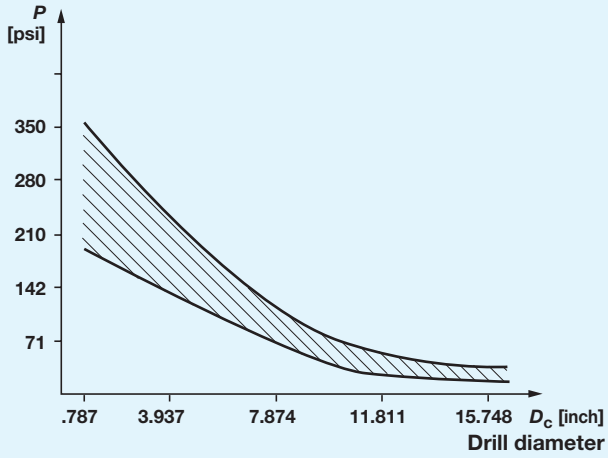
Graphs see page 96.

Graphs for T-MAX® counterboring heads 424.31F, 424.31 and 424.32

Cutting fluid flow



Cutting fluid pressure



Terminology and units

D_c	Drill diameter		inch
a_p	Cutting depth	$\left(\frac{D_c}{2}\right)$	inch
v_c	Cutting speed		ft./min
n	Spindle speed		rev/min
v_f	Feed speed		ft./min
f_n	Feed per rev.		in./rev
Q	Material removal rate		$inch^3/min$
k_c	Specific cutting force		lbs/in^2
$k_{c\ .016}$	Specific cutting force for f_z =.016		lbs/in^2

F_f	Feed force	lbs
F_μ	Feed force caused by friction	lbs
M_c	Torque	ft.lbs
M_μ	Torque caused by friction	ft.lbs
P_c	Net power	Hp
P_μ	Power caused by friction	Hp
κ_r	Cutting edge angle	Degrees
q	Cutting fluid quantity	gpm
p	Cutting fluid pressure	psi

For cutting data calculations, see pages 133-134.

The graphs show nominal values which should not be regarded as strict recommendations. The values may need adjusting depending on the machining conditions e.g., the type of material.

Note that only net power ratings are given. Allowance must be made for the efficiency of the machine and the cutting edge wear.

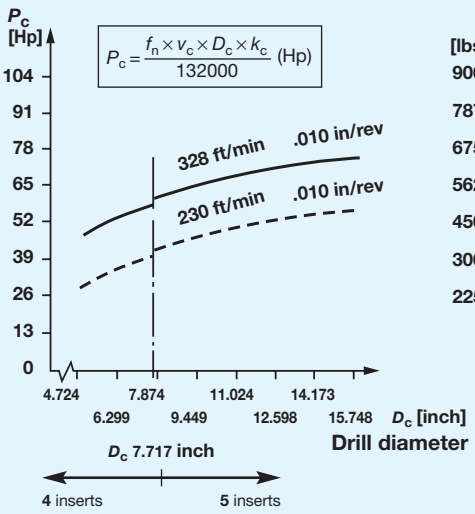
Cutting data for T-MAX® trepanning head 420.7

ISO	CMC No.	Material		Specific cutting force k_c .016 lbs/in²	Hardness Brinell HB	Geometry/ grade	Cutting speed v_c ft/min	Drill diameter, inch ≥ 4.724 Feed, f_n inch/r
P Steel	01.1	Unalloyed	Non-hardened 0.1-0.25% C	290,000	90-200	-22/-23/235	260-330	.007-.012
	01.2		Non-hardened 0.25-0.55% C	304,500	125-225	-22/235	260-330	.007-.012
	01.3		Non-hardened 0.55-0.80% C	316,100	150-250	-22/235	260-330	.007-.012
	01.4		High carbon steel, annealed	336,400	180-275	-22/235	260-330	.007-.012
	02.1	Low alloy	Non-hardened	304,500	150-260	-22/235	230-330	.007-.012
	02.2		Hardened and tempered	402,375	220-450	-22/235	200-330	.007-.012
	03.11	High alloy	Annealed	362,500	150-250	-22/235	230-330	.007-.012
	03.13		Annealed HSS	398,750	150-250	-22/235	230-330	.007-.012
	03.21		Hardened tool steels	543,750	250-350	-22/235	200-330	.006-.012
	03.22		Hardened steels, others	580,000	250-450	-22/235	200-330	.006-.012
	06.1	Castings	Unalloyed	216,000	90-225	-22/235	165-330	.006-.012
	06.2		Low alloyed (alloying elements <5%)	304,500	150-250	-22/235	165-330	.006-.012
M Stainless steel	05.11	Rolled/forged	Ferritic, martensitic Non-hardened	333,500	150-270	-22/235	165-295	.006-.012
	05.21	Rolled/forged	Austenitic	377,000	150-275	-23/235	165-295	.006-.012
K Cast iron	07.1	Malleable	Ferritic	137,750	110-145	-23/H13A	260-330	.007-.012
	07.2		Pearlitic	159,500	150-270	-23/H13A	260-330	.007-.012
	08.1	Grey	Low tensile strength	159,500	150-220	-23/H13A	200-330	.006-.012
	08.2		High tensile strength	187,050	200-330	-23/H13A	200-330	.006-.012
	09.1	Nodular	Ferritic	152,250	125-230	-23/H13A	165-330	.006-.012
	09.2		Pearlitic	253,750	200-300	-23/H13A	165-330	.006-.012
N Non-ferrous metals	30.11	Aluminum alloys	Wrought or wrought and coldworked, non-aged	72,500	30-100	-23/H13A	210-430	.004-.012
	30.12		Wrought or wrought and aged	116,000	30-150	-23/H13A	210-430	.004-.012
	30.21	Aluminum alloys	Cast, non-aged	108,750	40-100	-23/H13A	210-430	.004-.012
	30.22		Cast or cast and aged	137,750	70-140	-23/H13A	210-430	.004-.012
	33.1	Copper and copper alloys	Free cutting alloys Pb >1%	101,500	70-160	-23/H13A	210-430	.004-.012
	33.2		Brass and leaded bronzes Pb ≤1%	101,500	50-200	-23/H13A	210-430	.004-.012

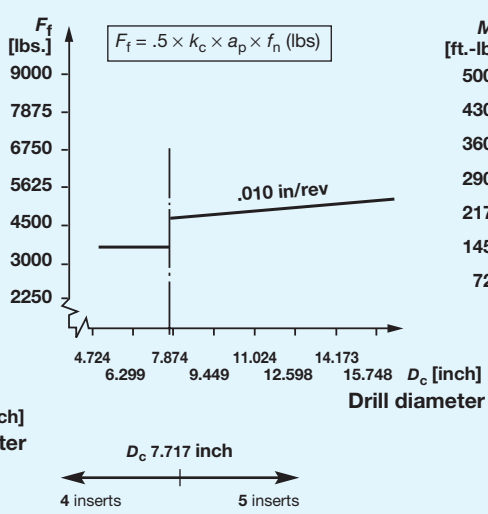
Graphs see page 98.

Graphs for T-MAX® trepanning head 420.7

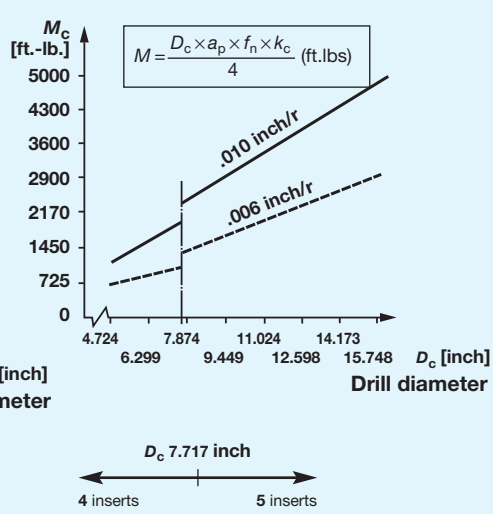
Net power



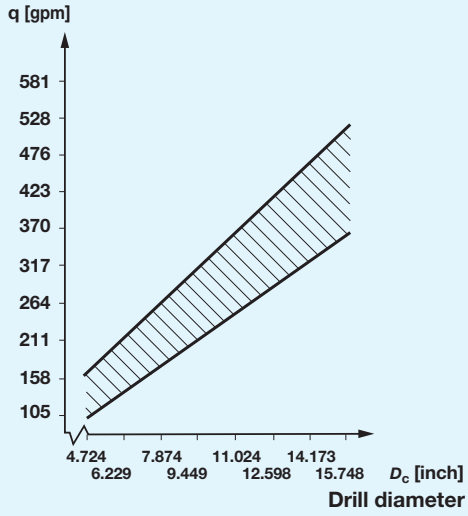
Feed force



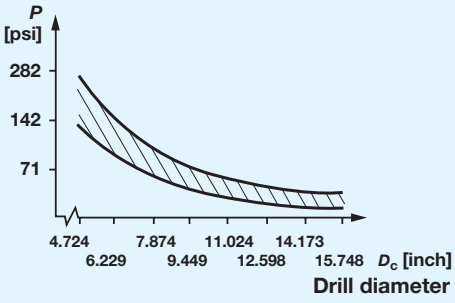
Torque



Cutting fluid flow



Cutting fluid pressure



Terminology and units

D_c	Drill diameter		inch
a_p	Cutting depth	$\left(\frac{D_c}{2}\right)$	inch
v_c	Cutting speed		ft./min
n	Spindle speed		rev/min
v_f	Feed speed		ft./min
f_n	Feed per rev.		in./rev
Q	Material removal rate		$inch^3/min$
k_c	Specific cutting force		lbs/in^2
$k_{c\ .016}$	Specific cutting force for f_z =.016		lbs/in^2

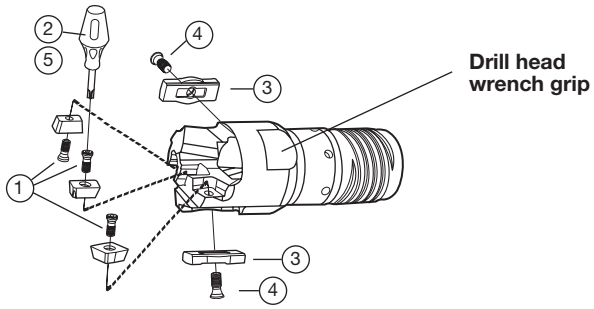
F_f	Feed force	lbs
F_μ	Feed force caused by friction	lbs
M_c	Torque	ft.lbs
M_μ	Torque caused by friction	ft.lbs
P_c	Net power	Hp
P_μ	Power caused by friction	Hp
κ_r	Cutting edge angle	Degrees
q	Cutting fluid quantity	gpm
p	Cutting fluid pressure	psi

For cutting data calculations, see pages 133-134.

The graphs show nominal values which should not be regarded as strict recommendations. The values may need adjusting depending on the machining conditions e.g., the type of material.

Note that only net power ratings are given. Allowance must be made for the efficiency of the machine and the cutting edge wear.

Spare parts for CoroDrill™ 800 solid drill heads



Diameter range, inch	Inserts		Support pad		
	1	2	3	4	5
D_C inch	Screw	Key (Torx Plus)	Pad	Screw	Key (Torx Plus)
.984–1.220	5513 020-05	5680 046-03 (7IP)	**06A**	5513 020-20	5680 046-03 (7IP)
1.221–1.559	5513 020-20	5680 046-03 (7IP)	**07A**	416.1-832	5680 046-04 (9IP)
1.560–2.559	5513 020-20	5680 046-03 (7IP)	**08A – 12A**	5513 020-16	5680 046-05 (10IP)

Ordering example: 10 pieces 5513 020-05

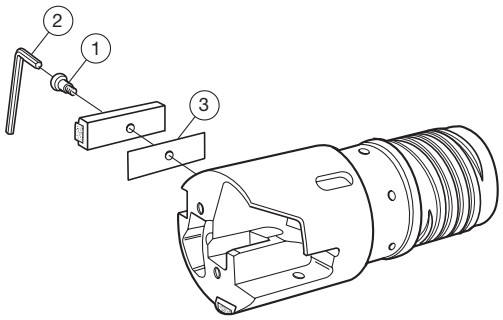
Wrench width of jaws

Diameter range, inch	Width of jaws, inch
D_C inch	s
.984<– ≤1.063	.866
1.063<– ≤1.181	.945
1.181<– ≤1.260	1.063
1.260<– ≤1.378	1.102
1.378<– ≤1.425	1.181
1.425<– ≤1.559	1.260
1.559<– ≤1.693	1.417
1.693<– ≤1.850	1.496
1.850<– ≤2.035	1.614
2.035<– ≤2.126	1.811
2.126<– ≤2.213	1.969
2.213<– ≤2.362	1.969
2.362<– ≤2.480	2.165
2.480<– ≤2.559	2.362

Note!

There are no specific wrenches for the CoroDrill 800 heads. An adjustable wrench, or a regular box wrench, should be used. The width of the jaws for each drill is shown in the table below.

Spare parts for T-MAX® solid drill head 424.10

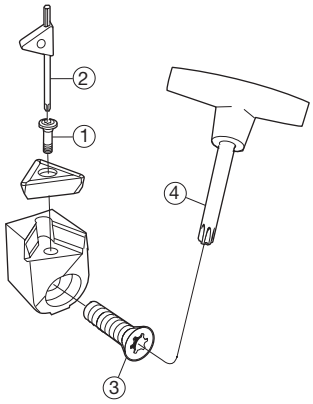


Support pad	1[1] Screw	2[2] Key (Torx Plus)	3[2] Shim	(Thickness)
430.32-12 D	5513 020-01	5680 043-13 (15IP)	5549 127-01 5549 127-02 5549 127-03	(.004) (.008) (.012)
430.32-16 D	5513 020-26	5680 043-14 (20IP)	5549 126-01 5549 126-02 5549 126-03	(.004) (.008) (.012)

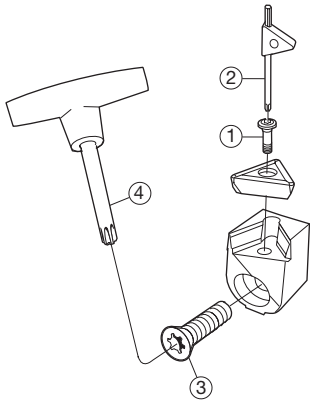
[1] Delivered with pads.
[2] Not delivered with the pad, must be ordered separately.

T-MAX U cartridges

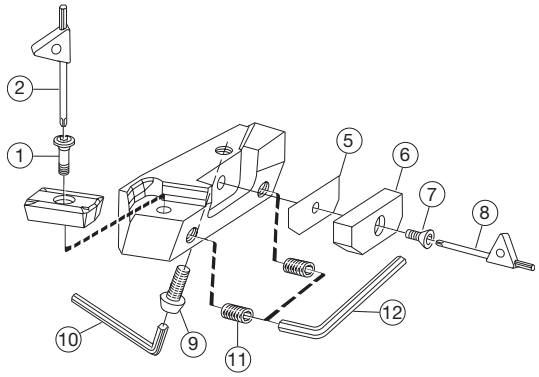
Central cartridge L430.31



Intermediate cartridge R430.30



Peripheral cartridge R430.28



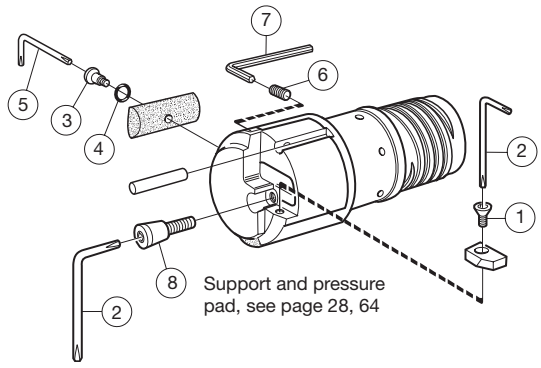
Central cartridge	Intermediate cartridge	1 Screw	2 Key (Torx Plus)	3 Screw	4 Key (Torx Plus)
L430.31-1216-16	**R430.30-1216-16**	5513 020-04	5680 049-03 (9IP)	5513 020-26	5680 048-03 (20IP)
L430.31-1522-22	**R430.30-1522-22**	5513 020-25	5680 049-02 (15IP)	5513 020-26	5680 048-03 (20IP)

Peripheral cartridge	1 Screw	2 Key (Torx Plus)	5 Shim (inch)	6 Insert protection pad	7 Screw	8 Key (Torx Plus)	9 Screw	10 Key (mm)	11 Screw	12 Key (mm)
R430.28-1516-16	5513 020-24	5680 049-03 (9IP)	5549 024-01 (.004) 5549 024-02 (.008) 5549 024-03 (.016) 5549 024-04 (.031)	5636 030-01	154.3-835	5680 049-03 (9IP)	430.21-825	3021 010-040 (4.0)	3214 010-357	174.1-864 (3.0)
R430.28-1822-22	5513 020-25	5680 049-02 (15IP)	5549 024-05 (.004) 5549 024-06 (.008) 5549 024-07 (.016) 5549 024-08 (.031)	5636 030-02	154.3-835	5680 049-03 (9IP)	430.21-825	3021 010-040 (4.0)	3214 010-357	174.1-864 (3.0)

Ordering example: 10 pieces 5513 020-24

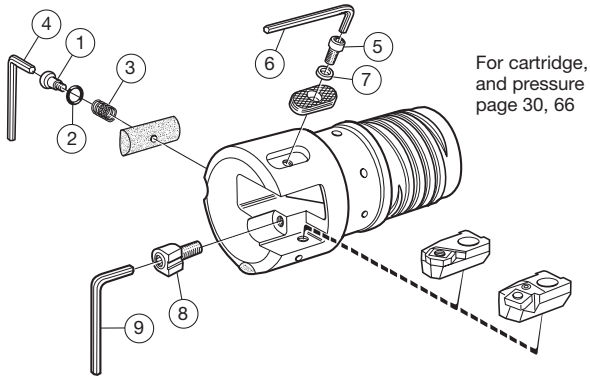
Spare parts for T-MAX® counterboring heads 424.31F

Diameter range .787–1.693 inch



Support and pressure pad, see page 28, 64

Diameter range 1.693–4.882 inch



For cartridge, support and pressure pad, see page 30, 66

Diameter range .787–1.693 inch

Diameter range, inch	1	2	3	4	5	6	7	8
D_C inch	Screw	Key (Torx Plus)	Screw	O-ring	Key (Torx Plus)	Screw	Key (mm)	Screw
.787–1.220	416.1-830	5680 046-03 (7IP)	5513 030-01[1)]	5641 001-13[1)]	5680 051-01[1)] (7IP)	3214 040-154[1)]	3021 012-013[1)] (1.27)	5513 014-01
1.221–1.693	416.1-830	5680 046-03 (7IP)	5513 030-02[1)]	5641 001-13[1)]	5680 051-01[1)] (7IP)	3214 040-206[1)]	174.1-862[1)] (1.5)	5513 014-01

Ordering example: 10 pieces 416.1-830

Diameter range 1.694–4.882 inch

Diameter range, inch	1	2	3	4	5	6	7	8	9
D_C inch	Screw	O-ring	Spring	Key (mm)	Screw	Key (mm)	Washer	Wedge set	Key (mm)
1.694–2.559	5513 011-01[1)]	3671 010-110[1)]	–	174.1-870[1)] (2.0)	3213 010-206[1)]	174.1-870[1)] (2.0)	–	5332 040-011	174.1-864 (3.0)
2.559–3.146	430.21-820[1)]	–	430.21-821[1)]	174.1-864 (3.0)	3212 010-207	174.1-863 (2.5)	3411 010-032	5332 040-011	174.1-864 (3.0)
3.150–3.539	430.21-820[1)]	–	430.21-821[1)]	174.1-864 (3.0)	3212 010-307	3021 010-040 (4.0)	3411 011-053	5332 040-011	174.1-864 (3.0)
3.543–4.882	430.21-820[1)]	–	430.21-821[1)]	174.1-864 (3.0)	3212 010-358	3021 010-050 (5.0)	3411 011-064	5332 040-011	174.1-864 (3.0)

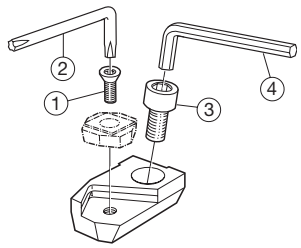
[1)] Delivered with pad.

Ordering example: 10 pieces 5513 011-01

Cartridges for T-MAX® counterboring heads 424.31F

R430.24-1118-06

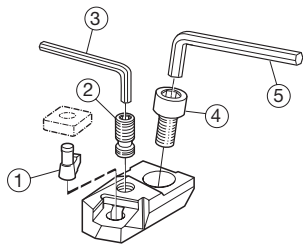
Cartridge for close tolerances



1	2	3	4
Screw	Key (Torx Plus)	Screw	Key (mm)
416.1-833	5680 046-05 (10IP)	3212 010-307	3021 010-040 (4.0)

R430.24-1018-09

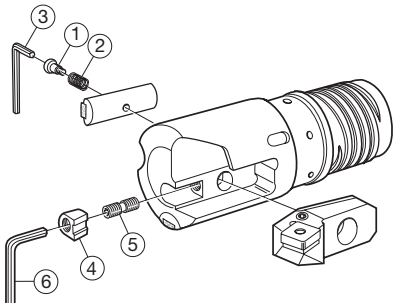
Cartridge for normal tolerances



1	2	3	4	5
Lever	Screw	Key (mm)	Screw	Key (mm)
174.3-845-1	174.3-829	174.1-870 (2.0)	3212 010-307	3021 010-040 (4.0)

Ordering example: 10 pieces 416.1-833

Spare parts for T-MAX® counterboring heads 424.31



For cartridge and support pad, see page 32, 68

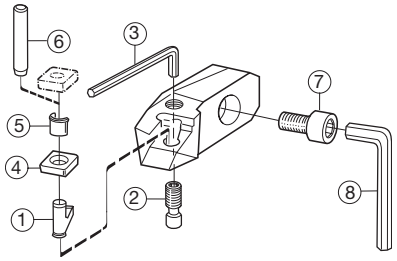
Diameter range, inch	1[1]	2[1]	3	4	5	6
D_C inch	Screw	Spring	Key (mm)	Wedge	Screw	Key (mm)
2.559–10.984	430.21-820	430.21-821	174.1-864 (3.0)	430.23-820	269-833	3021 010-040 (4.0)
10.984–	430.21-823	430.21-824	3021 010-040 (4.0)	430.23-820	269-833	3021 010-040 (4.0)

[1] Delivered with pad.

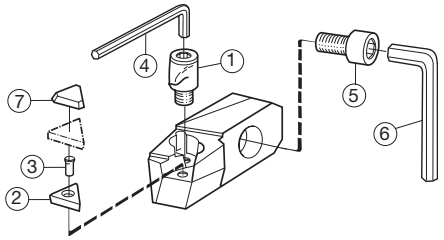
Ordering example: 10 pieces 430.21-820

Cartridges for T-MAX® counterboring heads 424.31

T-MAX P lever design cartridge R430.24



T-MAX S top clamp design cartridge R430.23



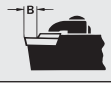
T-MAX P Cartridge R430.24	1	2	3	4	5	6	7	8
	Lever	Screw	Key (mm)	Shim	Shim pin	Shim pin punch	Screw	Key (mm)
R430.24-2024-12	174.3-841M (.118)	174.3-821	174.1-864 (6.0)	174.3-851M	174.3-861	174.3-871	3212 010-412	3021 010-060[1]
R430.24-2532-19	174.3-842M (.157)	174.3-822M	3021 010-040 (8.0)	174.3-852M	174.3-862	174.3-872	3212 010-464	3021 010-080[1]

T-MAX S Cartridge R430.23	1	2	3	4	5	6
	Clamp set	Shim	Shim pin	Key (mm)	Screw	Key (mm)
R430.23-2024-16	174.9-837-1	175.2-850	174.1-865	174.1-864 (3.0)	3212 010-412	3021 010-060[1] (6.0)
R430.23-2532-22	174.9-838-1	175.2-851	174.1-866	3021 010-040 (4.0)	3212 010-464	3021 010-080[1] (8.0)

[1] Supplied on request

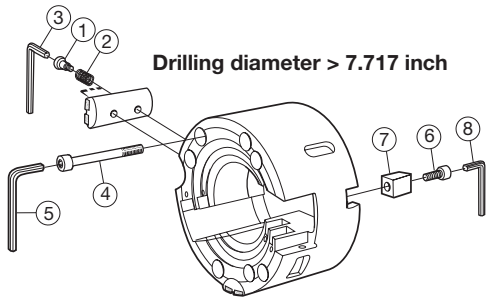
Ordering example: 10 pieces 174.9-837-1

Optional parts

Cartridge	Are to be used for TPUN inserts and loose chipbreaker. Available separately.			
	1	4	7	
	Clamp set	Key (mm)	Chipbreaker	
R430.23-2024-16	174.9-833-2	174.1-864 (3.0)	DO 212 H35 (B = .047 inch)	DO 220 H35 (B = .079 inch)
R430.23-2532-22	174.9-835-1	3021 010-040 (4.0)	DO 320 H35 (B = .079 inch)	DO 325 H35 (B = .098 inch)

Ordering example: 10 pieces 174.9-833-2

Spare parts for T-MAX trepanning head 420.7



Support pad set	1[1]	2[1]	3
	Screw	Spring	Key (mm)
430.21-12 D 430.21-16 D 430.21-18 D	430.21-820	430.21-821	174.1-864 (3.0)

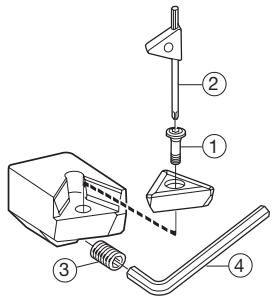
[1] Delivered with pad.

4	5	6	7	8
Screw	Key (mm)	Screw	Wedge	Key (mm)
3212 010-473	3021 010-080 (8.0)	3212 010-396	420.7-820	3021 010-050 (5.0)

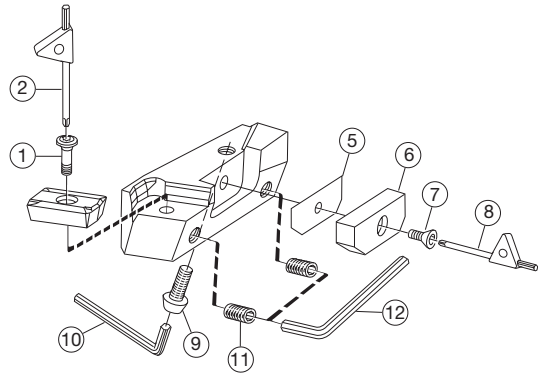
Ordering example: 10 pieces 430.21-820

T-MAX U cartridges

Central cartridge L430.27



Peripheral cartridge R430.28

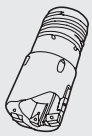
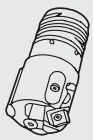
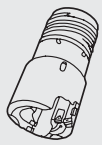


Central cartridge	1	2	3	4
	Screw	Key (Torx Plus)	Screw	Key (mm)
L430.27-1216-16	5513 020-24	5680 049-03 (9IP)	437.5-822	174.1-864 (3.0)
L430.27-1522-22	5513 020-25	5680 049-02 (15IP)	437.5-822	174.1-864 (3.0)

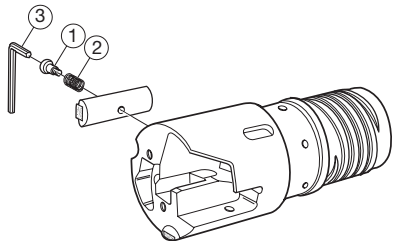
Peripheral cartridge	1	2	5	6	7	8	9	10	11	12
	Screw	Key (Torx Plus)	Shim (inch)	Insert protection pad	Screw	Key (Torx Plus)	Screw	Key (mm)	Screw	Key (mm)
R430.28-1516-16	5513 020-24	5680 049-03 (9IP)	5549 024-01 (.004) 5549 024-02 (.008) 5549 024-03 (.016) 5549 024-04 (.031)	5636 030-01	154.3-835	5680 049-03 (9IP)	430.21-825	3021 010-040 (4.0)	3214 010-357	174.1-864 (3.0)
R430.28-1822-22	5513 020-25	5680 049-02 (15IP)	5549 024-05 (.004) 5549 024-06 (.008) 5549 024-07 (.016) 5549 024-08 (.031)	5636 030-02	154.3-835	5680 049-03 (9IP)	430.21-825	3021 010-040 (4.0)	3214 010-357	174.1-864 (3,0)

Ordering example: 10 pieces 5513 020-24

Hook spanners for deep hole drills

Solid drill head 424.6 and 420.6  D_c	**Solid drill head 424.10 Counterboring head 424.32**  D_c	**Counterboring head 424.31F**  D_c	**Trepanning head 420.7**  D_c	**Hook spanner**  (DIN 1810)
.949 - 1.039	–	.787 - .921	–	3022 010-016
1.040 - 1.311	–	.922 - 1.220	–	3022 010-025
1.312 - 1.425	–	1.221 - 1.378	–	3022 010-030
1.426 - 1.692	–	1.379 - 1.575	–	3022 010-034
1.693 - 1.850	–	1.576 - 1.850	–	3022 010-040
1.851 - 2.212	–	1.851 - 2.165	–	3022 010-045
2.213 - 2.472	–	2.166 - 2.362	–	3022 010-052
2.473 - 2.559	2.559, (2.559E), 2.756	2.363 - 2.870	–	3022 010-058
–	2.953, 3.150	2.871 - 3.146	–	3022 010-068
–	3.346, 3.543, 3.740	3.147 - 3.933	–	3022 010-080
–	3.937, 4.134, 4.331	3.934 - 4.406	–	3022 010-095
–	4.528, 4.724	4.407 - 4.878	4.724	3022 010-110
–	4.921, 5.118	–	4.921, 5.118, 5.512	3022 010-120
–	5.906	–	5.906	3022 010-135
–	6.299, 6.693	–	6.299, 6.693	3022 010-155
–	7.087	–	7.087	3022 010-180

Spare parts for obsolete tools T-MAX solid drill head 424.9

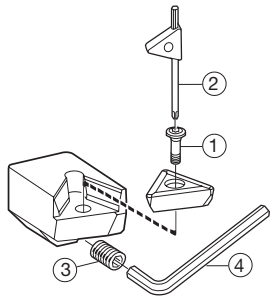


	TPMX	TPUN	★= First choice	P		M		K		N	
				GC	–	GC	–	GC		GC	
				235	S6	235	S6	4035		4035	
16	TPMX	16 03 12 R22		★	☆	★	☆				
22	TPMX	22 04 12 R22		★	☆	★	☆				
16	TPUN	16 03 12		★	☆	★	☆	★		★	
22	TPUN	22 04 12		★	☆	★	☆	★		★	

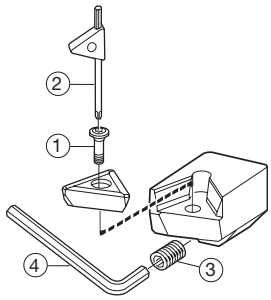
Support pad set	1 Screw	2 Spring	3 Key (mm)
430.21-12 D 430.21-16 D 430.21-18 D	430.21-820	430.21-821	174.1-864 (3.0)

Ordering example: 10 pieces 430.21-820

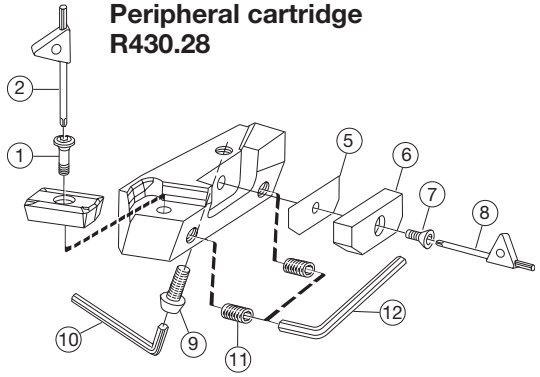
Central cartridge L430.27



Intermediate cartridge R430.26



Peripheral cartridge R430.28



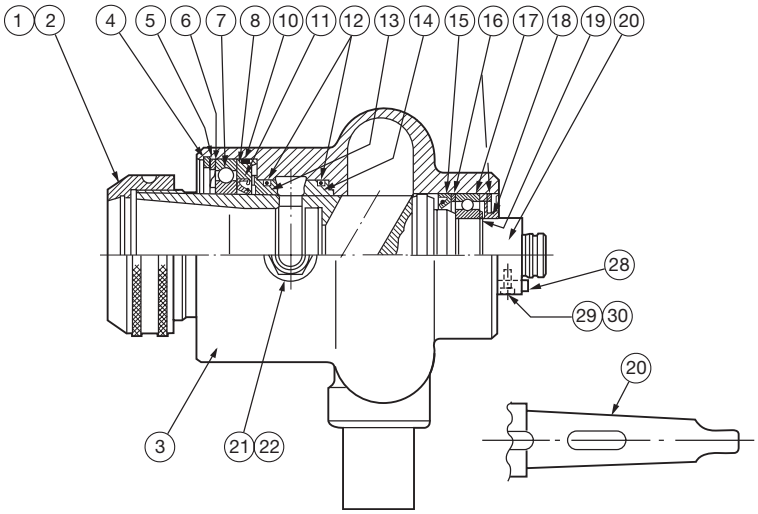
Central cartridge	Intermediate cartridge	1 Screw	2 Key (Torx Plus)	3 Screw	4 Key (mm)
L430.27-1216-16	**R430.26-1216-16**	5513 020-24	5680 049-03 (9IP)	437.5-822	174.1-864 (3.0)
L430.27-1522-22	**R430.26-1522-22**	5513 020-25	5680 049-02 (15IP)	437.5-822	174.1-864 (3.0)

Peripheral cartridge	1 Screw	2 Key (Torx Plus)	5 Shim (inch)	6 Insert protection pad	7 Screw	8 Key (Torx Plus)	9 Screw	10 Key (mm)	11 Screw	12 Key (mm)
R430.28-1516-16	5513 020-24	5680 049-03 (9IP)	5549 024-01 (.004) 5549 024-02 (.008) 5549 024-03 (.016) 5549 024-04 (.031)	5636 030-01	154.3-835	5680 049-03 (9IP)	430.21-825	3021 010-040 (4.0)	3214 010-357	174.1-864 (3.0)
R430.28-1822-22	5513 020-25	5680 049-02 (15IP)	5549 024-05 (.004) 5549 024-06 (.008) 5549 024-07 (.016) 5549 024-08 (.031)	5636 030-02	154.3-835	5680 049-03 (9IP)	430.21-825	3021 010-040 (4.0)	3214 010-357	174.1-864 (3.0)

Ordering example: 10 pieces 5513 020-24

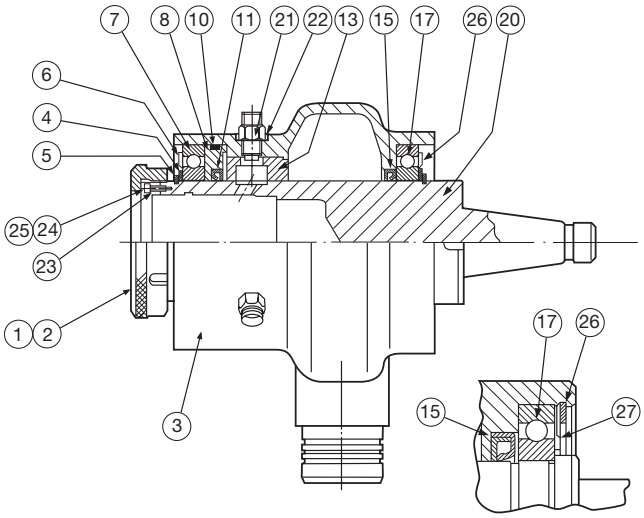
Rotating connectors

424.2-401M, 424.2-400M, 424.2-400M-V63



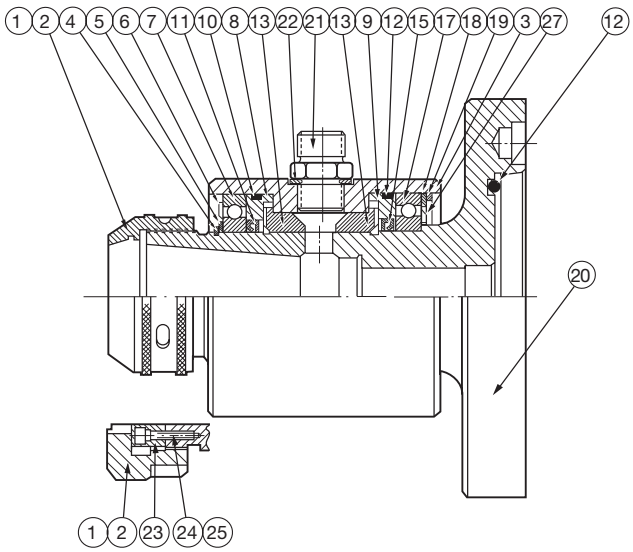
Type of shank		Connector code	1 Nut	2 Hook spanner
Varilock adapted		424.2-400M-V63	424.2-400-01	3022 010-110
Morse taper	3	424.2-401M	424.2-401-01	3022 010-080
	4	400M	424.2-400-01	3022 010-110
ISO taper	50	424.2 -402	424.2-402-03	3022 010-155
Flange mounting		424.9S/231-1	424.2-401-01	3022 010-080
		424.9S/170-1	424.2-400-01	3022 010-110
		424.9S/224-1	424.2-402-03	3022 010-155
		424.9S/245-1	424.2-403-03	3022 010-230

424.2-402



Type of shank		Connector code	11 Sealing ring	12 O-ring
Varilock adapted		424.2-400M-V63	424.2-400-27	424.2-400-28
Morse taper	3	424.2-401M	424.2-401-27	424.2-401-28
	4	400M	424.2-400-27	424.2-400-28
ISO taper	50	424.2-402	B1 130 × 160 × 12	–
Flange mounting		424.9S/231-1	BA 70 × 85 × 7	109.5 × 3
		424.9S/170-1	B2 95 × 120 × 15	144.5 × 3
		424.9S/224-1	B1 130 × 160 × 12	199.3 × 5.7
		424.9S/245-1	B1 200 × 230 × 15	319.3 × 5.7

424.9S/231-1 424.9S/224-1
424.9S/170-1 424.9S/245-1



Type of shank		Connector code	21 Nipple	22 Sealing ring
Varilock adapted		424.2-400M-V63	424.2-400-29	3672 020-270
Morse taper	3	424.2-401M	424.2-401-29	3672 020-215
	4	400M	424.2-400-29	3672 020-270
ISO taper	50	424.2-402	424.2-402-07	U36.7 × 46 × 2
Flange mounting		424.9S/231-1	424.2-401-29	3672 020-270
		424.9S/170-1	424.2-400-29	3672 020-270
		424.9S/224-1	424.2-402-07	U36.7 × 46 × 2
		424.9S/245-1	424.2-403-07	U42.7 × 53 × 3

3	4	5	6	7	8	9	10
							
Housing	Circlip[1)]	Clamping ring	Sealing washer	Ball bearing	Support ring	Support ring	O-ring
424.2-400-10M	424.2-400-12(H)	424.2-400-03M	424.2-400-04	424.2-400-25	424.2-400-20	–	424.2-400-26
424.2-401-10M 424.2-400-10M	424.2-401-12(H) 424.2-400-12(H)	424.2-401-03M 424.2-400-03M	424.2-401-04 424.2-400-04	424.2-401-25 424.2-400-25	424.2-401-20 424.2-400-20	– –	424.2-401-26 424.2-400-26
424.2-402-01	3421 100-130(A)	424.2-402-04	23126 AV	SKF 16026	424.2-402-05	–	3671 010-162
424.9S/231-7 424.9S/170-8 424.9S/224-3 424.9S/245-3	SgA 70(A) SgA 95(A) 3421 100-130(A) 3421 100-200(A)	424.9S/231-2 424.9S/170-2 424.2-402-04 424.2-403-04	16014 AV 16019 AV 23126 AV 16040 AV	SKF 16014 SKF 16019 SKF 16026 SKF 16040	424.9S/231-3 424.9S/170-3 424.2-402-05 424.2-403-05	424.9S/231-5 424.9S/170-5 424.9S/224-2 424.9S/245-2	104.5 × 3 139.5 × 3 3671 010-162 3671 010-174

1) (H) = For hole (A) = For shank

13	14	15	16	17	18	19	20
							
Spacing rings outer	inner	Sealing ring	Circlip[1)]	Ball bearing	Sealing sleeve	Circlip[1)]	Shank
424.2-400-21	424.2-400-23	424.2-400-08	424.2-400-14(H)	424.2-400-15	424.2-400-09	424.2-400-16(A)	5622 033-01
424.2-401-21 424.2-400-21	424.2-401-23 424.2-400-23	424.2-401-08 424.2-400-08	424.2-401-14(H) 424.2-400-14(H)	424.2-401-15 424.2-400-15	424.2-401-09 424.2-400-09	424.2-401-16(A) 424.2-400-16(A)	424.2-401-11M 424.2-400-11M
424.2-402-06	–	B2 FG135 × 170 × 35	–	SKF 16028	–	–	424.2-402-02
424.9S/231-4 424.9S/170-4 424.2-402-06 424.2-403-06	– – – –	BA75 × 90 × 8 B2 100 × 120 × 15 B2 FG135 × 170 × 15 B2 210 × 240 × 15	– – – –	SKF 16015 SKF 16020 SKF 16028 SKF 16044	424.9S/231-6 424.9S/170-6 – –	SgH 115(H) SgH 150(H) 3221 110-210(H) –	Depending on spindle nose type and size

1) (H) = For hole (A) = For shank

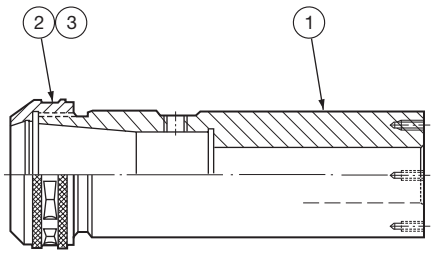
23	24	25	26	27	28	29	30
							
Driving key	Screw	Key (mm)	Circlip[1)]	Sealing washer	Driving key	Screw	Key (mm)
–	–	–	–	–	5631 010-05	3212 010-358	3021 010-050 (5.0)
– –	– –	– –	– –	– –	– –	– –	– –
424.2-402-08	3212 010-310	3021 010-040 (4.0)	3421 110-210(H)	16028 JV	–	–	–
– – 424.2-402-08 424.2-403-08	– – 3212 010-310 3212 010-362	– – 3021 010-040 (4.0) 3021 010-050 (5.0)	– – – –	16015 JV 16020 JV 16028 JV 424.9S/245-5	– – – –	– – – –	– – – –

1) (H) = For hole (A) = For shank

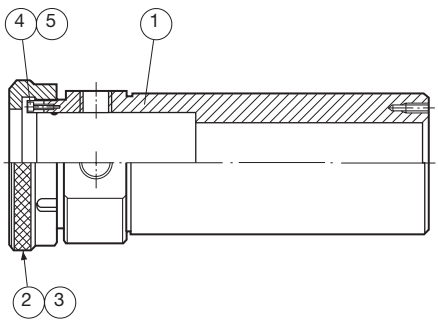
Ordering example: 2 pieces 424.2-400-01

Non-rotating connectors

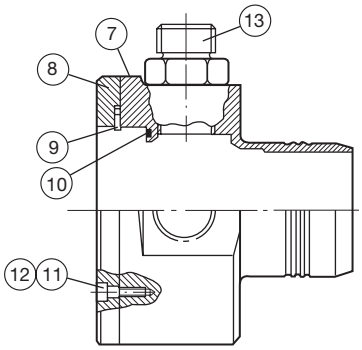
Cylindrical
424.2-410
424.2-411



Cylindrical
424.2-412
424.2-413



Drill tube mounted
424.9S/232-1



Cylindrical

Connector	1 Shank	2 Nut	3 Hook spanner	4 Driving key	5 Screw	6 Key (mm)
424.2- 411	424.2-411-01	424.2-401-01	3022 010-080	–	–	–
410	424.2-410-01	424.2-400-01	3022 010-110	–	–	–
412	424.2-412-01	424.2-402-03	3022 010-155	424.2-402-08	3212 010-310	3021 010-040 (4.0)
413	424.2-413-01	424.2-403-03	3022 010-230	424.2-403-08	3212 010-362	3021 010-050 (5.0)

Ordering example: 2 pieces 424.2-411-01

Drill tube mounted

Connector	7 Body	8 Cover	9 Circlip	10 O-ring	11 Screw	12 Key (mm)	13 Nipple
424.9S/232-1-14	424.9S/232-2-14	424.9S/232-3-14	SgA 56	49.5 × 3	3212 010-360	3021 010-050 (5.0)	BSP04000-16
424.9S/232-1-15	424.9S/232-2-15	424.9S/232-3-15	SgA 62	54.5 × 3	3212 010-360	3021 010-050 (5.0)	BSP04000-16
424.9S/232-1-16	424.9S/232-2-16	424.9S/232-3-16	SgA 68	59.5 × 3	3212 010-360	3021 010-050 (5.0)	BSP04000-16
424.9S/232-1-17	424.9S/232-2-17	424.9S/232-3-17	SgA 75	64.5 × 3	3212 010-360	3021 010-050 (5.0)	BSP04000-16
424.9S/232-1-18	424.9S/232-2-18	424.9S/232-3-18	SgA 82	74.5 × 3	3212 010-360	3021 010-050 (5.0)	BSP04000-16
424.9S/232-1-19	424.9S/232-2-19	424.9S/232-3-19	SgA 95	84.5 × 3	3212 010-360	3021 010-050 (5.0)	BSP04000-16
424.9S/232-1-20	424.9S/232-2-20	424.9S/232-3-20	SgA 105	99.5 × 3	3212 010-360	3021 010-050 (5.0)	BSP04000-16
424.9S/232-1-21	424.9S/232-2-21	424.9S/232-3-21	SgA 118	109.5 × 3	3212 010-410	3021 010-060 (6.0)	BSP04000-20
424.9S/232-1-22	424.9S/232-2-22	424.9S/232-3-22	SgA 130	119.5 × 3	3212 010-410	3021 010-060 (6.0)	BSP04000-20
424.9S/232-1-23	424.9S/232-2-23	424.9S/232-3-23	SgA 140	134.5 × 3	3212 010-410	3021 010-060 (6.0)	BSP04000-20
424.9S/232-1-24	424.9S/232-2-24	424.9S/232-3-24	SgA 155	144.5 × 3	3212 010-410	3021 010-060 (6.0)	BSP04000-20
424.9S/232-1-25	424.9S/232-2-25	424.9S/232-3-25	SgA 165	154.5 × 3	3212 010-410	3021 010-060 (6.0)	BSP04000-20

Ordering example: 2 pieces 424.9S/232-2-14

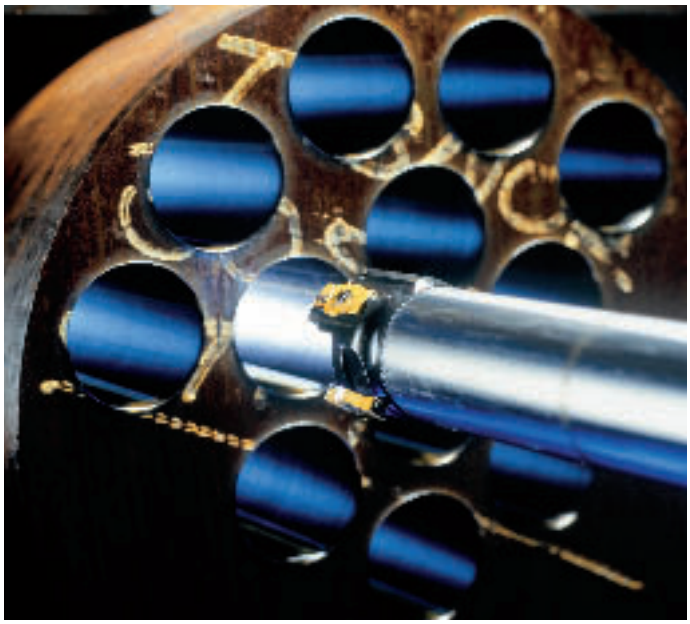
DEEP HOLE DRILLING

Application guide

Deep hole drilling

Common examples of deep hole drilling are characterized by high material removal rate plus high accuracy with regard to the straightness of the hole, dimensional tolerances and surface finish. The extreme conditions which apply when drilling deep holes place high demands on the tool, machine and associated equipment.

Deep hole drilling applications are found within a wide range of industries, such as steel, nuclear power, aerospace, oil and gas. Here, high demands are placed on quality as well as dimension and shape tolerances.



Workpieces can be very expensive and rejections can result in economic consequences. Reliability during the operation is therefore usually given high priority. All in all, this means that the tools and drilling systems which are developed to satisfy these requirements offer qualities which, in certain applications, are desirable even when drilling short holes.

Deep hole drilling with Sandvik Coromant

Deep holes are defined by a high ratio between hole depth and hole diameter.

Deep-hole drilling is the preferred method for drilling hole depths of more than 10 times the diameter. During drilling, it is important that the chips are broken and that they can be transported away without jamming and affecting the drilled surface.

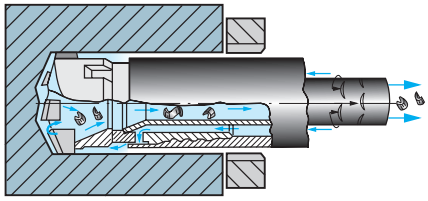
In deep-hole drilling, cutting fluid supply and chip transport have been provided for the development of three different systems that permit trouble-free machining of hole depths of more than 100 times the diameter.

- **Ejector system (two-tube system)**
- **Single Tube System (STS)**

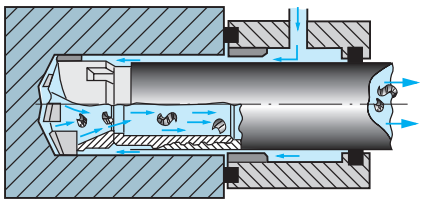
Sandvik Coromant is a world leading manufacturer of deep hole machining tools for these systems.

The tools are available as standard, special or TailorMade and there is an excellent worldwide delivery -and service facility.

The Ejector system



The STS system



When to choose Ejector and STS systems

Ejector system:

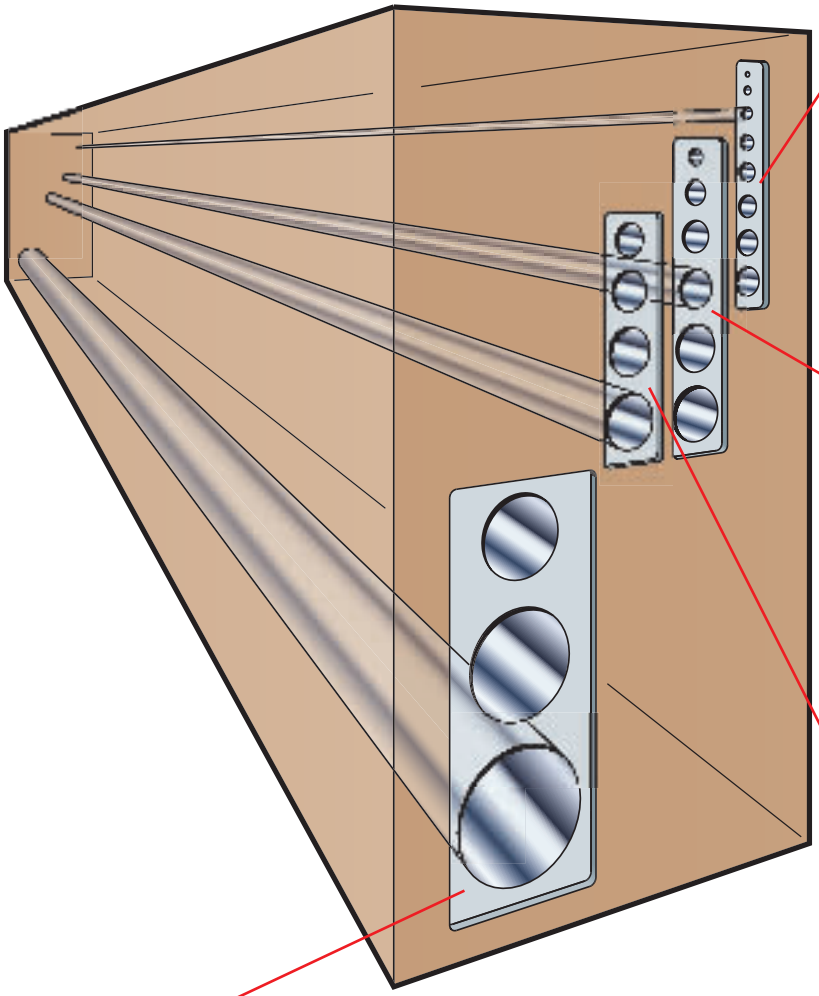
- Requires no seal between the workpiece and the drill bushing.
- Adapted easily to existing machines, preferable in conventional lathes, turning centers, machining centers and horizontal boring machines.
- For machining workpieces where sealing problems can arise.
- An advantage when it is possible to use a pre-drilled hole instead of a drill bushing for guidance, for example in machining centers.

STS system:

- In materals with poor chip forming properties such as stainless steel, and low-carbon steel.
- In materials with an uneven structure when chipbreaking problems exist.
- More advantageous for long series production.
- Uniform and extremely long workpieces.
- For hole diameters larger than 7.874 inch.
- Requires special deep hole drilling machine.

Tool overview

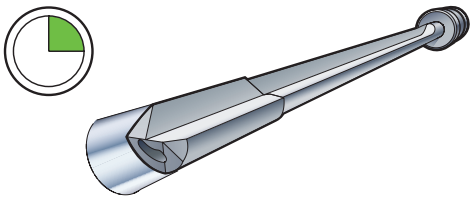
A wide variety of tools is available in regards to types of drills and diameter ranges. Today's program covers from .039 to 10.984. Dimensions above that available on customer request.



Gun drill

Diameter range .039–1.594 inch
100 x D_c

Productivity

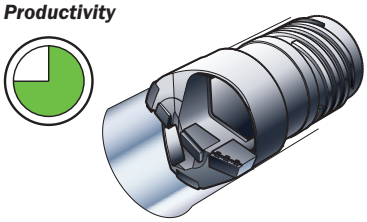


Brazed drill head

Ejector
424.6
Diameter range
.724–2.559 inch
100 x D_c

STS
420.6
Diameter range
.496–2.559 inch
150 x D_c

Productivity

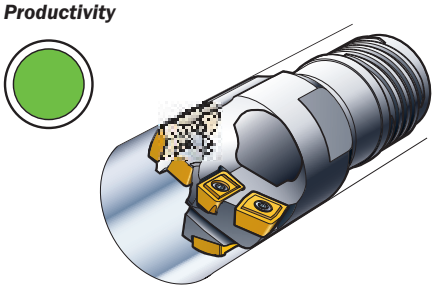


CoroDrill™

Ejector
800.24
Diameter range
.984–2.559 inch
100 x D_c

STS
800.20
Diameter range
.984–2.559 inch
150 x D_c

Productivity

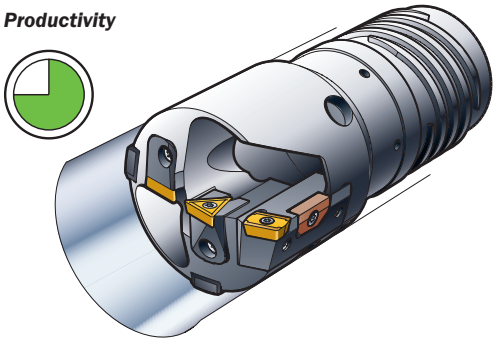


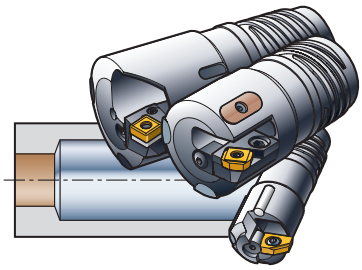
T-MAX head

Ejector
424.10
Diameter range
2.500–5.118 inch
100 x D_c

STS
424.10
Diameter range
2.500–5.118 inch
150 x D_c

Productivity





Counterboring heads T-MAX

Ejector
424.31F
Diameter range
.787–4.882 inch
100 x D_c

STS
424.31F
Diameter range
.787–4.882 inch
150 x D_c

424.31
Diameter range
2.559–7.240 inch
100 x D_c

424.31
Diameter range
2.559–10.984 inch
150 x D_c

T-Max heads outside the standard range can be quoted as Tailor Made or as specials. For specific details regarding the options, contact your Coromant sales representative.

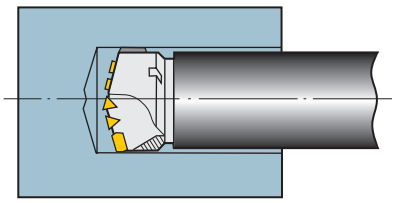
Deep hole machining methods

Solid drilling

Solid drilling is the most common method. It involves the machining of a hole in solid material.

Often, the hole diameter, straightness and surface finish are so good that no subsequent machining is required.

Solid drilling



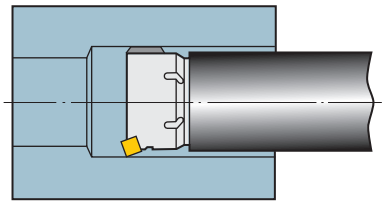
Counterboring

Counterboring a pre-drilled hole is normally used to obtain better surface finish and tolerances when machining forged, cast, pressed or extruded components.

If the machine power is insufficient for solid drilling in one operation, the hole can be pre-drilled with a smaller solid drill and then counterbored to the desired diameter.

Hardening, tempering, stress relief annealing or other operations are sometimes performed between solid drilling and counterboring.

Counterboring



Trepanning

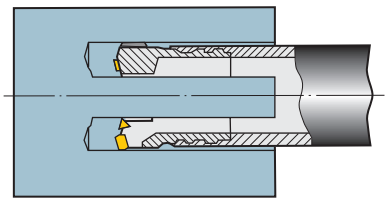
Trepanning is performed without pre-drilling, but instead of machining away all the material in the form of chips, the tool leaves a solid core in the middle of the hole. This method is chiefly used when machine power is limited, since the power requirement is lower than in solid drilling. In the case of large and expensive workpieces, it may be difficult to obtain suitable sample material. The core can then be used for tensile test specimens and material analysis.

Particularly in the case of expensive material, the core should be recovered and used for other purposes.

Note:
In the drilling of blind holes, a special tool is needed to crop off the core.

In deep holes, the core will deflect because of its own weight and must be supported to prevent problems with insert breakages.

Trepanning



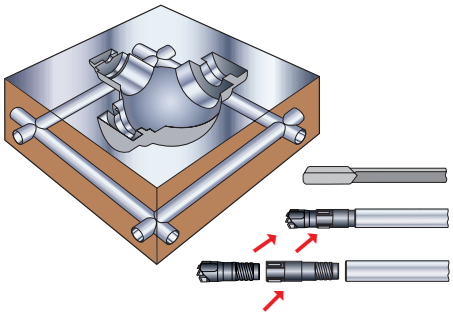
Cross hole drilling

Cross hole drilling is used in many different applications, e.g. when drilling mold bases regarding coolant holes and channels for the medium.

Another application is drilling pneumatic and hydraulic components.

The operation can be performed by gundrilling or STS.

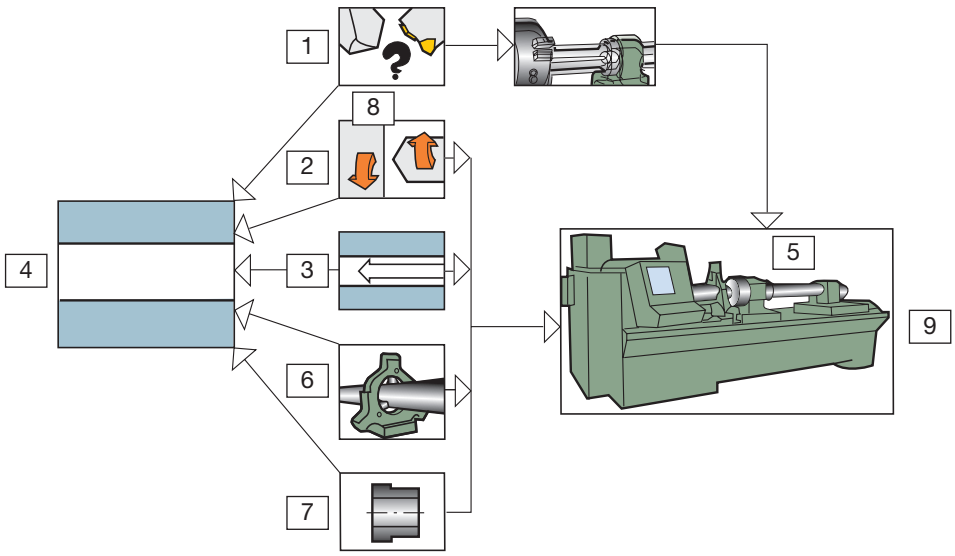
Cross hole drilling



Adapter for cross hole drilling

Factors affecting hole straightness

1. Tool
2. Rotation
3. Feed
4. Workpiece
5. Vibration damper
6. Steady rest
7. Bushing
8. Pressure head
9. Machine tool



Hole – straightness affected by workpiece/drill rotation

Hole depths of 50-100 times diameter can be drilled by the Ejector method and 100 times diameter by STS. The following hole depths can be achieved by gun drilling:

- Non-rotating drill without support: 50–80 x diameter
- Rotating drill without support: 30–40 x diameter

With several supports for the drill tube, these values can be exceeded in the hole.

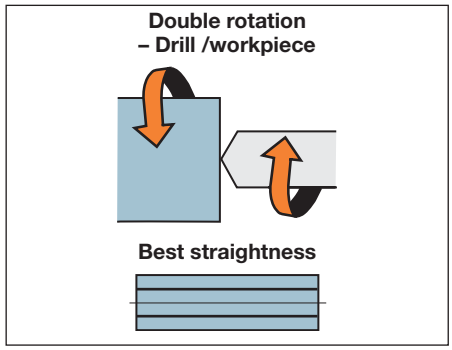
The factors which affect the roundness of the hole are generally the same as in short hole drilling.

The straightness of the hole is more critical due to the depth of the hole.

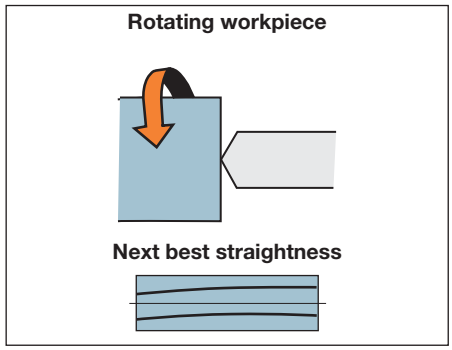
Worn or incorrectly positioned drill bushings affect the straightness of the hole in a negative way.

With deep holes, where great emphasis is placed on straightness, additional steady rests can improve the results considerably.

The straightness of the hole should not be confused with radial offset between its inlet and its outlet.

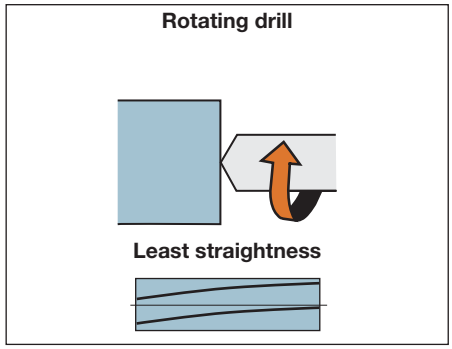


- The best straightness is obtained with counter rotation, i.e. both the drill and the workpiece rotate opposite directions to each other.



- The next best straightness is obtained with a rotating workpiece.

For a non-rotating drill, the deviation of the hole's straightness is usually expressed in simplified terms as .002-.003 inch/foot of drilled length.



- The least straightness is obtained with a rotating tool.

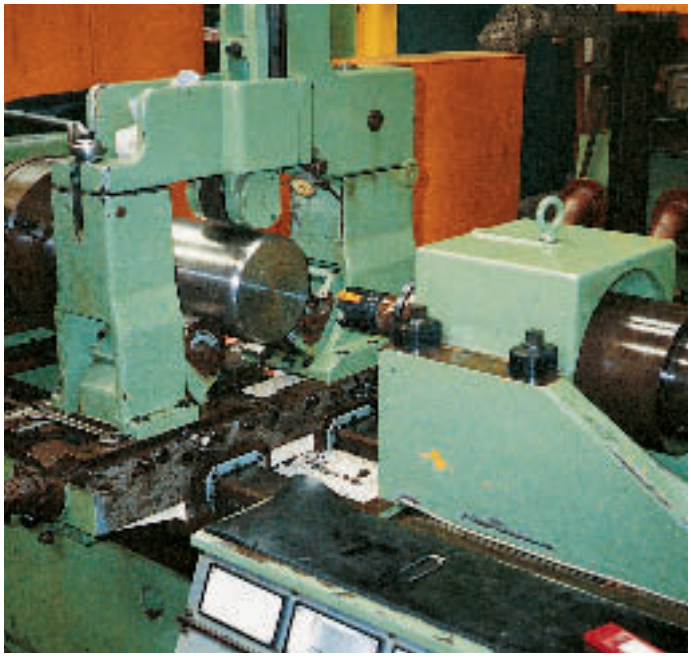
With a rotating drill, relatively good straightness is obtained for short holes, but is greatly reduced for long holes due to deflection of the drill tube. For a rotating drill, a deviation of .003–.006 inch/foot of drilled length is an approximate guide.

Center alignment

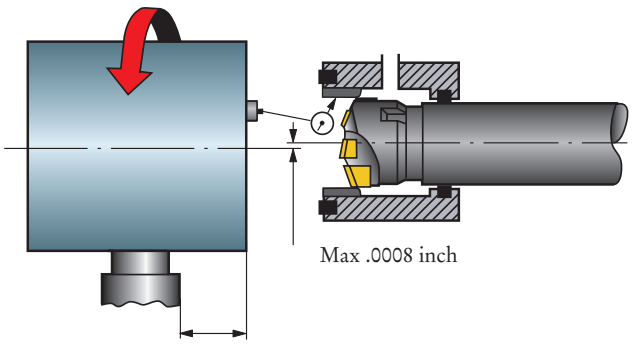
Due to the large ratio of hole depth to hole diameter, plus the accuracy which is required, the drill will need to be supported during the actual machining process. Therefore, deep hole drilling support pads are used, not only to balance the cutting forces but also to guide the drill against the surface of the drilled hole.

The drill starts in a drill bushing, the task of which is to guide and support the drill from initial penetration until the support pads bear against the drilled surface.

The drilling of deep holes should preferably not start or finish in inclined surfaces. The Ejector system can be used if inclined initial penetration is necessary and then the design of the drill bushing should correspond with the inclination of the workpiece. In addition, an extra support pad is recommended with inclined penetration and also when crossing holes.



Set up recommendation

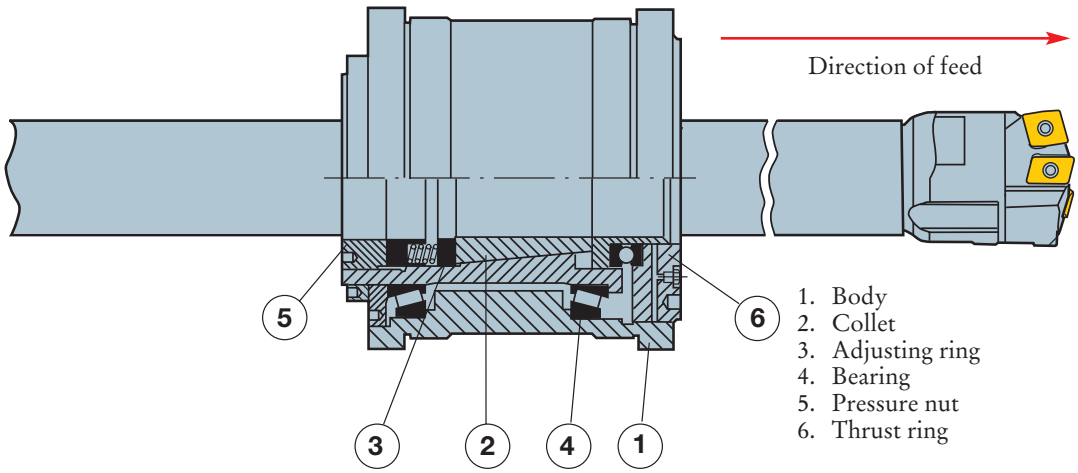


Minimize this distance for best alignment and stability

Vibration

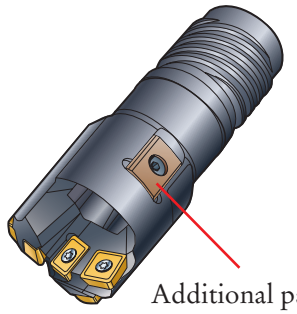
Vibrations can affect the surface finish and hole quality.

To eliminate vibrations a vibration damper can be applied, see also page 125. Order information page 76.



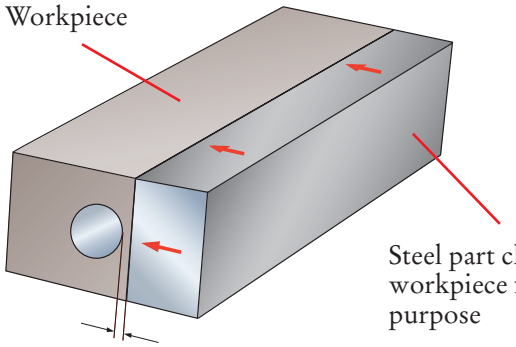
Tool design – hole straightness

In specific cases such as inclined penetration, cross holes or when counterboring large diameters with long drilling depth, additional pads can be employed. In the latter case additional pads aid the straightness by balancing the weight of the drill head and tubing. When counterboring with a small a_p (radial cut depth) additional pads also improve straightness.



Workpiece configuration

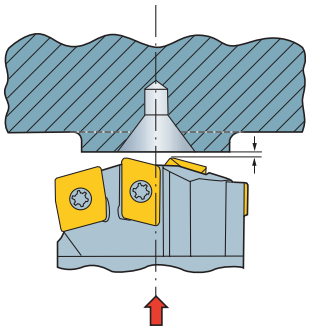
When drilling a hole close to the edge of the workpiece the effect of the heat produced gives a deviation towards the thinner wall. By clamping another piece of material to the thinner wall side this application can be controlled.

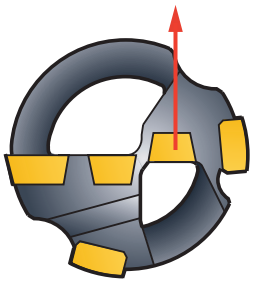


Hole close to side of workpiece

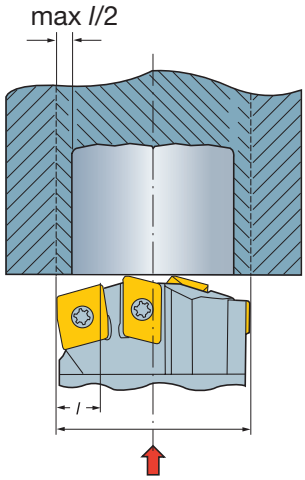
Center drill hole

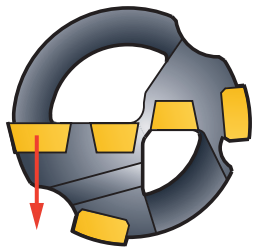
A conventional center drill hole can create problems when entering the workpiece.





Intermediate insert enters workpiece first instead of the central insert, which will make the drill move in wrong direction where no support pad is located.



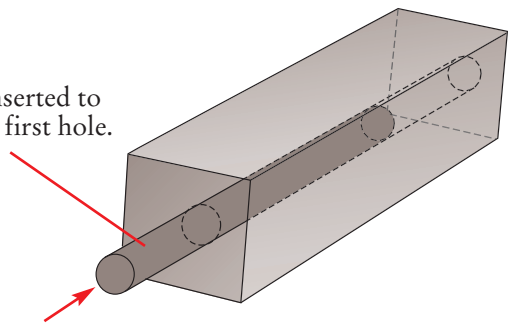


By using a larger prebored hole the peripheral insert enters first and creates a cutting force in the right direction. The drill will work as a counterbore.

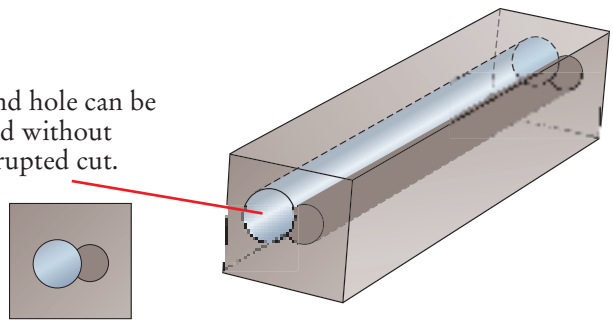
Overlapping holes

If two holes overlapping each other have to be drilled, the second hole can be drilled by plugging the first hole.

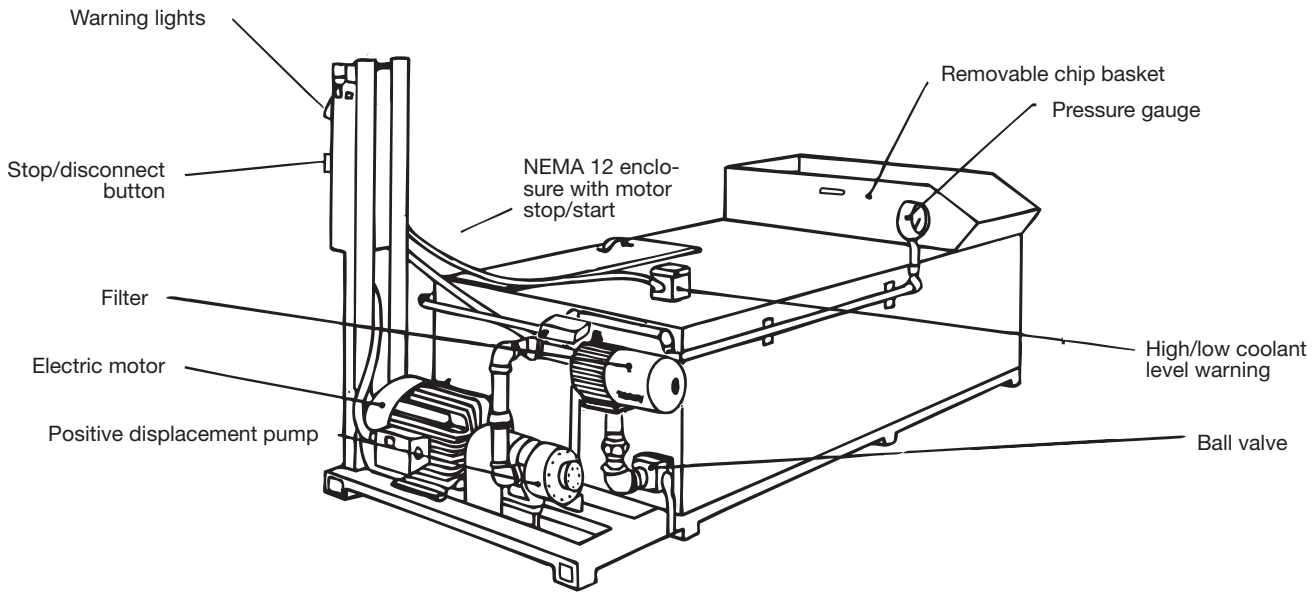
Rod inserted to fill the first hole.



Second hole can be drilled without interrupted cut.



Example of coolant system



Drilling diameter D_c	Ordering code	Filtration Micron	Motor hp	Max. pressure psi	Flow capacity gpm	Tank capacity gallon	Dimensions, inch		
							A	B	C
.724-2.559	**420-409S-99**	40	7.5	300	45	400	48	39	113

Coolant system

The purposes of coolant in a drilling system are:
– support and lubrication of the pads
– improvement of the tool life
– dissipation of heat
– chip evacuation

The coolant system has to provide an adequate supply of clean coolant to the tool at the correct pressure and temperature. Many materials can be drilled using the Ejector system with a soluble oil which should contain EP additives (EP = Extreme Pressure). Information can be obtained from your nearest Sandvik Coromant office.

High pressure pump

The two basic parameters are pressure and quantity. Different types of coolant pumps such as gear or screw pumps may be used in the Single Tube System, and for larger coolant requirements, two or more pumps could be connected to a manifold to obtain sufficient supply. To avoid excessive wear, it is important that for a specific coolant, the pumps are equipped with the correct seals. Furthermore, when using soluble emulsion, it is important to ensure that the solution contains sufficient additives to give the necessary lubrication.

Cutting fluid

The quality of a hole drilled by means of a tool with support pads, such as STS and Ejector drill, depends partly on the quality of the cutting fluid. There are special cutting oils on the market for deep hole drilling methods, which incorporate EP (Extreme Pressure) additives for extreme temperatures at the cutting edge and extreme pressure at the support pads. If a soluble emulsion is chosen, the dilution should be at least 1:10.

Filtration of cutting fluid

There are two important considerations for good filtration of the cutting fluid. First, the required surface of the drilled hole and the excessive wear characteristics of the support pad. Second, prevent the high pressure pump from wear or even damage. Band filters, sleeve case filters, automatic filters, and magnetic filters are the most common types used. Adequate coolant filtration, down to 10–20 µm increases tool-life.

Reservoir – tank volume

The reservoir capacity should be approximately ten times the highest pump delivery per minute to allow for settling dirt and heat dissipation. In many cases, the tank has a sleeve-type chip container above the compartment for dirty coolant. The compartment for the clean coolant has baffles to allow any air to escape from the coolant.

Heat exchanger

Almost all the energy put into chip formation, plus a good deal of the power exerted by the pump, is converted into heat which is absorbed by the cutting fluid. When the temperature of the cutting fluid exceeds 135° F, the tool and the pump do not receive correct lubrication and the coolant ages extremely quickly. The best results are achieved with a temperature of 90-100° F. A large reservoir can provide sufficient cooling effect of the air circulation within the plant. In continuous production, however, it is recommended to use a refrigerated or water-operated heat exchange.

Tank volume – cooling power

The volume of the tank should be sufficient to provide effective filtration and cooling. Ordinarily a filter is necessary to separate chips and small particles from the cutting fluid. Normally, the cutting fluid tank should be 10 times the capacity of the pump. The dwell time in the tank should be 5–10 minutes for effective cooling.

As already mentioned, the temperature of the cutting fluid should lie in the range of 90-100° F. The factors that have a heating versus a cooling effect in connection with deep hole drilling are given in the tables.

The tank is heated by:

- Drilling energy, which is generated only during the drill's cutting time. Since this is the largest heat source, the cutting time is completely decisive for heating of the tank.
- Pumping energy. All of the pumping energy is converted to heat, 95% of which is absorbed by the cutting fluid.

The tank is cooled by:

- The tank giving off heat as soon as the temperature of the cutting fluid is higher than that of the surroundings. If the tank is enclosed, heat loss is greatly reduced.
- The workpiece is generally at ambient temperature and has a cooling effect. In the tables, this cooling effect is calculated for a workpiece with the following dimensions: Outside diameter = 2 x hole diameter Length = 20 x hole diameter.

Max cutting time without extra cooling:

The following formulas can be used to calculate the time (T) it takes to raise the temperature of the tank from 68° F to 122° F:

Oil: $T = \frac{14.25 \times V}{P}$ hours

Water: $T = \frac{33.8 \times V}{P}$ hours

where V is the tank volume in m^3 and P is the resultant heating effect in kW.

Example:

Solid drilling by means of the Ejector system to a hole diameter of 100 mm. The actual cutting time is estimated at 50%. The tank volume is 8 m^3.

Heating power, total	16 kW
– Cooling power, total	6 kW
Surplus heat to be cooled away	10 kW

When oil is used, it takes

$$T = \frac{14.25 \times V}{P} = \frac{14.25 \times 8}{10} = 11 \text{ hours}$$

to heat up a tank to 122° F. This means that no extra cooling is required with single-shift operation.

Drill diameter D_c inch	Heating power kW			Cooling power kW				Surplus heat kW		
	Drill	Pump	Total	Work-piece	Tank, m^3 *(gal.)*			Tank, m^3 *(gal.)*		
					1 *(264)*	8 *(2114)*	30 *(7926)*	1 *(264)*	8 *(2114)*	30 *(7926)*
STS-drilling										
.787	6	9	15	1	2	7	16	12	7	–
1.181	9	10	19	1	2	7	16	16	11	2
1.575	12	12	24	2	2	7	16	20	15	6
2.632	18	15	33	3	2	7	16	28	23	14
2.755	21	17	38	3	2	7	16	33	28	19
3.937	30	20	50	5	2	7	16	43	38	29
4.724	36	20	56	5	2	7	16	49	44	35
5.906	45	20	65	7	2	7	16	56	51	42
7.874	60	20	80	9	2	7	16	69	64	55
9.843	65	20	95	12	2	7	16	81	76	67
11.811	90	20	110	13	2	7	16	95	90	81
15.748	120	20	130	18	2	7	16	110	105	96
Ejector drilling										
.787	6	2	8	1	2	7	16	5	–	–
1.181	9	2	11	1	2	7	16	8	3	–
1.575	12	3	15	2	2	7	16	11	6	–
2.632	18	4	22	3	2	7	16	17	12	3
2.755	21	4	25	3	2	7	16	20	15	6
3.937	30	5	35	5	2	7	16	28	23	14
4.724	36	5	41	5	2	7	16	34	29	20
5.906	45	6	51	7	2	7	16	42	37	28
7.874	60	7	67	9	2	7	16	56	51	42
9.843	75	9	81	12	2	7	16	67	62	53
Trepanning										
4.724	35	20	55	5	2	7	16	48	43	34
5.906	37	20	57	7	2	7	16	48	43	34
7.874	47	20	67	9	2	7	16	56	51	42
9.843	50	20	70	12	2	7	16	56	51	42
11.811	52	20	72	13	2	7	16	57	52	43
15.748	54	20	74	18	2	7	16	54	40	40

Heating and cooling factors at 100% cutting time. The cooling effects are calculated at a tank temperature of 122° F.

Drill diameter D_c inch	Heating power kW	Cooling power kW			Surplus heat kW		
		Tank, m^3 *(gal.)*			Tank, m^3 *(gal.)*		
		1 *(264)*	8 *(2114)*	30 *(7926)*	1 *(264)*	8 *(2114)*	30 *(7926)*
STS-drilling							
.787	7	2	6	12	5	1	–
1.818	9	2	6	12	7	3	–
1.575	11	2	6	12	9	5	–
2.632	15	2	6	12	13	9	3
2.755	18	2	6	12	16	12	6
3.937	23	2	6	12	21	17	11
4.724	26	2	6	12	24	20	14
5.906	30	2	6	12	28	24	18
7.874	37	2	6	12	35	31	25
9.843	43	2	6	12	41	37	32
11.811	60	2	6	12	48	44	38
15.748	60	2	6	12	56	52	46
Ejector drilling							
.787	4	2	6	12	2	–	–
1.818	5	2	6	12	3	–	–
1.575	7	2	6	12	5	1	–
2.632	10	2	6	12	8	4	–
2.755	11	2	6	12	9	5	–
3.937	16	2	6	12	14	10	4
4.724	18	2	6	12	16	12	6
5.906	22	2	6	12	20	16	10
7.874	30	2	6	12	28	24	18
9.843	36	2	6	12	34	30	22
Trepanning							
4.724	26	2	6	12	24	20	12
5.906	26	2	6	12	24	20	12
7.874	30	2	6	12	28	24	18
9.843	30	2	6	12	28	24	18
11.811	30	2	6	12	28	24	18
15.748	30	2	6	12	28	24	18

Heating and cooling factors at 50% cutting time. The cooling effects are calculated at a tank temperature of 122° F.

Types of cutting fluid

Neat cutting oils: ie. oils not mixed with water, are often a combination of mineral and fatty oils along with other EP (extreme pressure) additives. This mixture must be kept between 90-100° F or it will decompose.

Oil cutting fluids promote tool life and uniform chip breaking, and are more straightforward to employ than emulsions.

Oil emulsions: are dispersions of oil in a water carrier, combining the oil's lubricating properties with the heat transfer capacity of water. Numerous additives, such as emulsifiers, lubricators, anti-bacterial agents and EP additives, are required to maintain this mixture. These ingredients are supplied as concentrates, which must be carefully prepared by the user following a defined recipe and in clean, controlled conditions.

Emulsions can be more suitable for high speed machining operations, or situations where multiple machines are fed by a central fluid supply. They also clean the workpiece while is use, which oils do not. However their preparation can be complicated, and the mixture must be carefully monitored and maintained, both during use and while machines are idle.

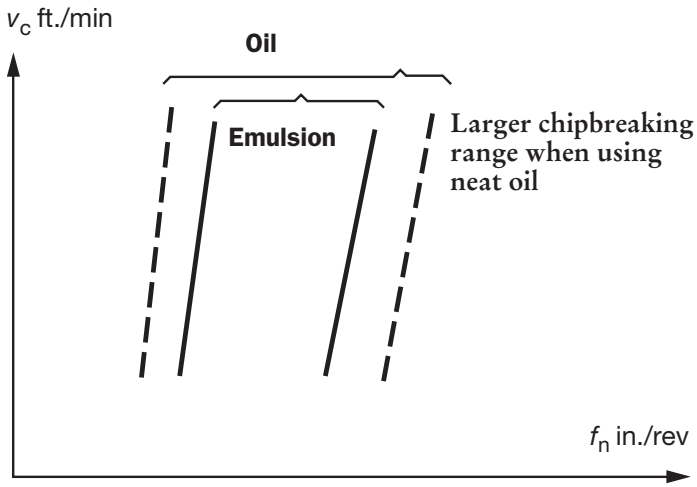
Recommendations

Oil: is recommended as the first choice for the following reasons:

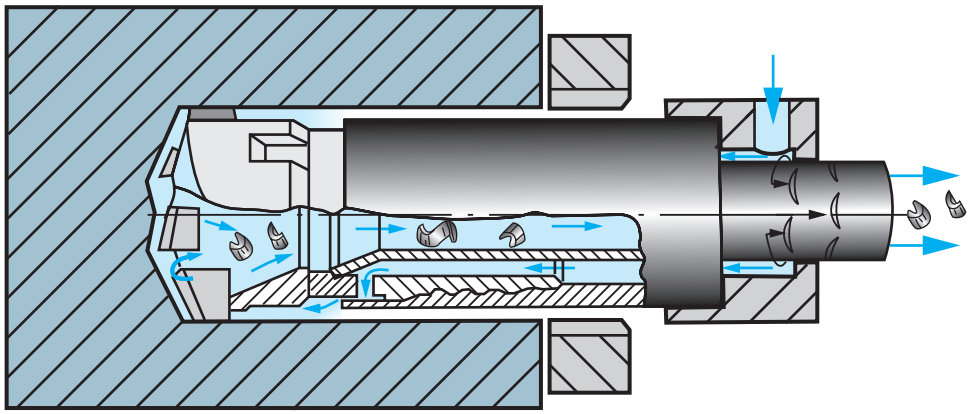
- Longer tool life. The difference can be very significant and naturally depends on the choice of cutting oil and emulsion. Normally, however, 30% longer tool life is obtained when oil is used.
- More uniform chipbreaking and a larger chipbreaking range.
- When emulsion is used, there is a risk of stagnation if the machine is not operating continuously. When the machine is idle, the tank should be aerated in order to prevent the emulsion becoming stagnant.

Emulsion: is recommended as a second choice.
The arguments for the use of emulsion are the following:

- It can be complicated to use straight oil if drilling is performed on a line of machines or on a group of machines with a central system.
- Drilling is performed on a machining center where most of the machining is high speed machining, secondary operations.
- With emulsion, the workpiece is cleaned during the machining process. When oil is used, it can sometimes be necessary to wash the workpiece to remove the oil prior to the next operation or storage.



The Ejector system

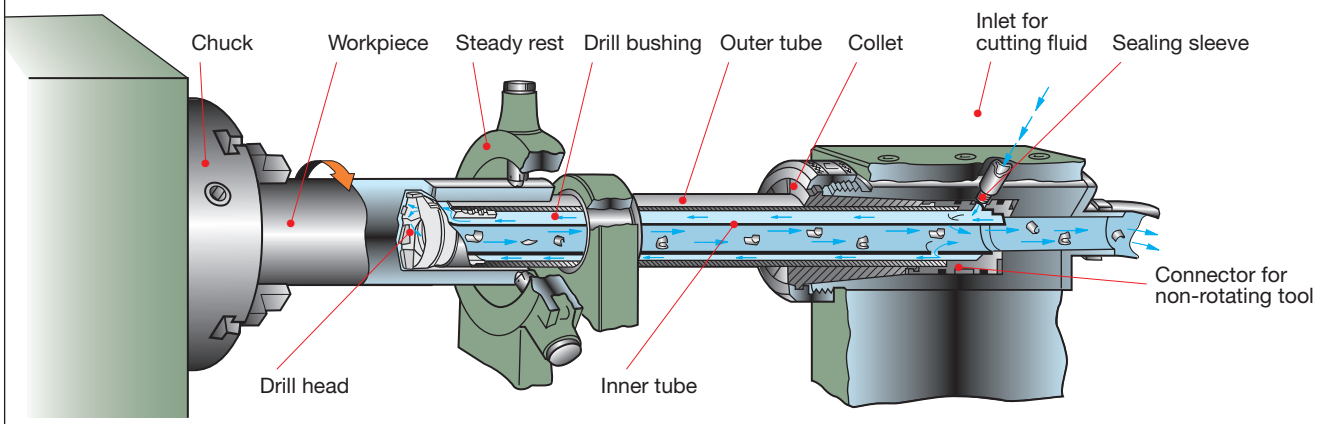


The Ejector system is easy and inexpensive to apply in machines with horizontal spindle (lathes, machining centers). It consists of a drill head, outer tube, inner tube, connector, collet and sealing sleeve.

The drill head is mounted to the drill tube by means of a four-start square thread.

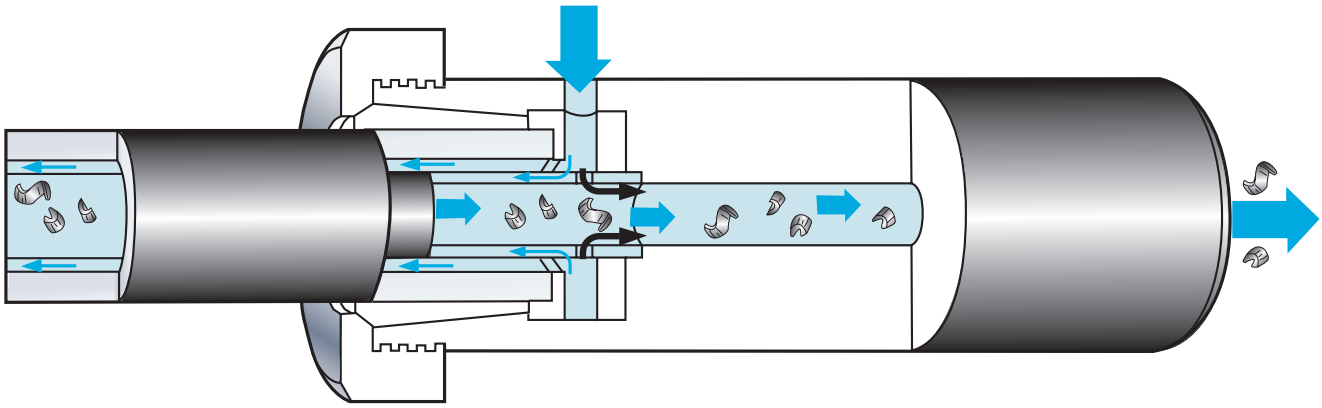
The drill tube and the inner tube are attached to the connector by means of a collet and a sealing sleeve.

The collet and sealing sleeve must be changed for different diameter ranges, i.e. drill tube diameters.



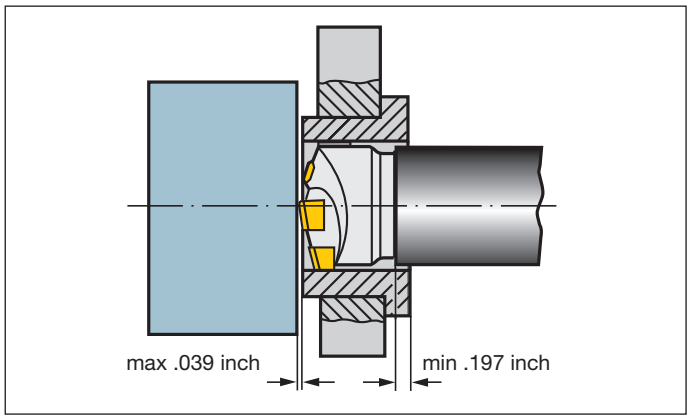
Ejector system:

- Requires no seal between the workpiece and the drill bushing.
- Adapted easily to existing machines, preferable in conventional lathes, turning centers, machining centers and horizontal boring machines.
- For machining workpieces where sealing problems can arise.
- An advantage when it is possible to use a pre-drilled hole instead of a drill bushing for guidance, for example in machining centers.



Connector for non-rotating drill

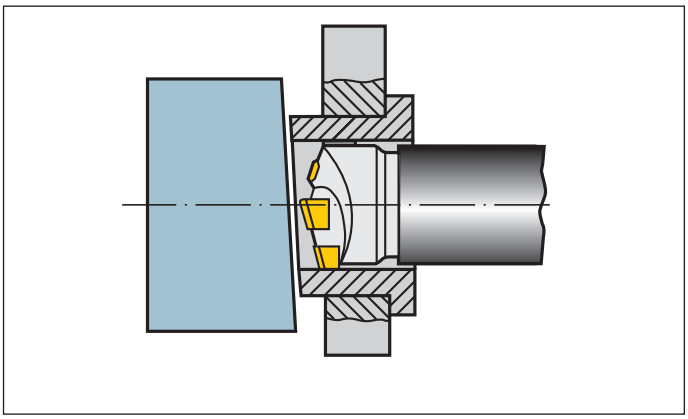
Positioning of drill bushing in Ejector drilling



When the Ejector system is used, no seal is required between the workpiece and the drill bushing. The drill bushing should be positioned as close to the workpiece as possible and, since the support pads are relatively short, the distance should not exceed .039 inch to ensure good initial penetration.

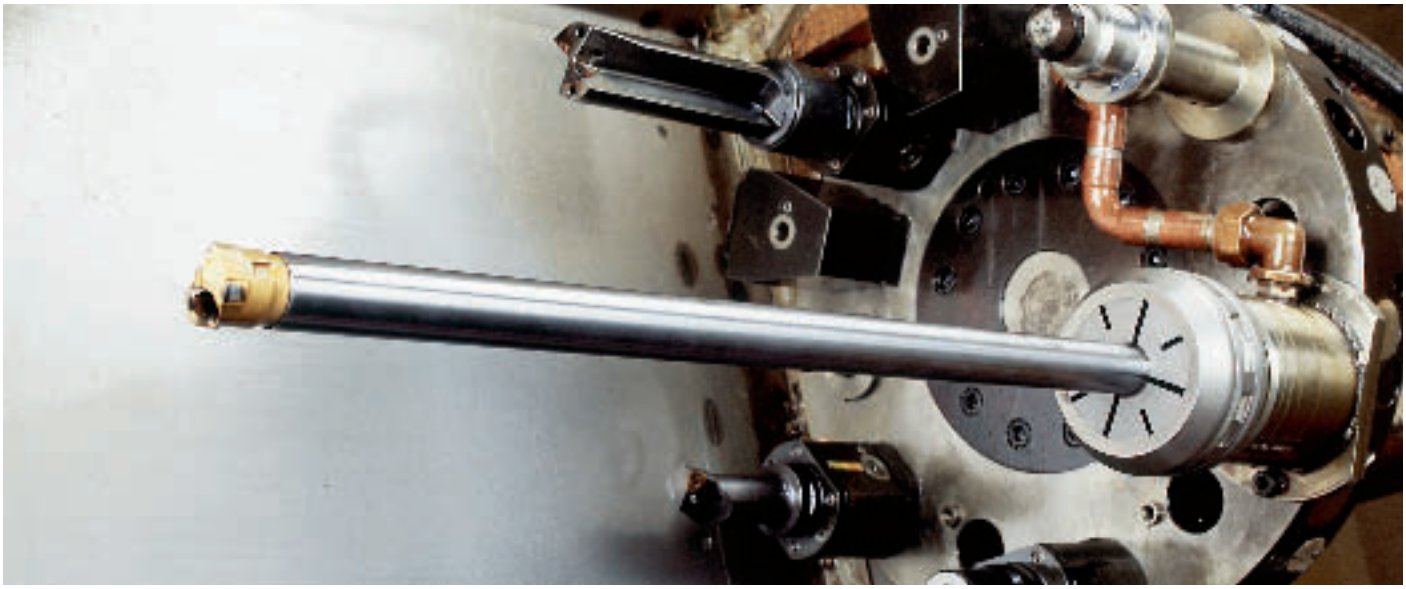
For an efficient cutting fluid supply, the length of the drill bushing should be at least .197 inch longer than the length that the drill head extends in front of the drill tube.

For applications with a rotating drill, it is important that the drill's support pads bear against the drill bushing. Otherwise, the peripheral insert will cut into the drill bushing thus enlarging it, which means that the drill will not get sufficient support during initial penetration.

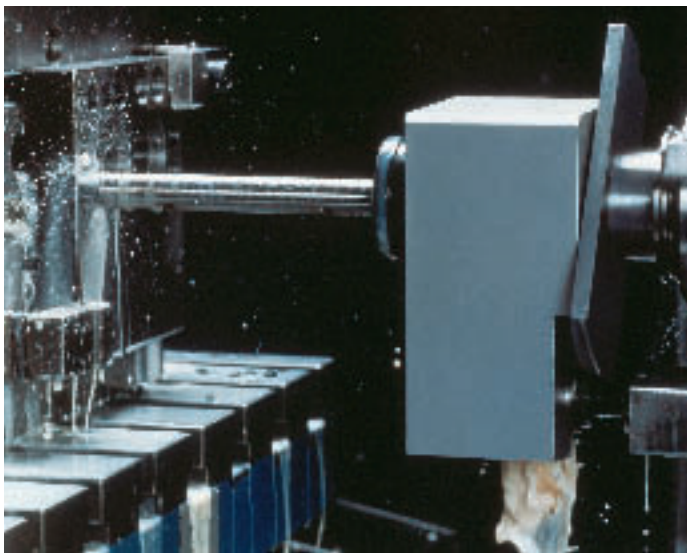


Drilling should not be started on interrupted or angular end faces. If such an operation is necessary, the bushing should conform to the angle of the workpiece face. An extra support pad is recommended for drilling into an inclined face and for cross hole drilling.

Ejector drilling in modern machines



By pre-drilling a pilot hole with a Coromant U drill the need for a separate drill bush is eliminated, and makes Ejector drilling possible in modern NC-lathes and Machining centers.

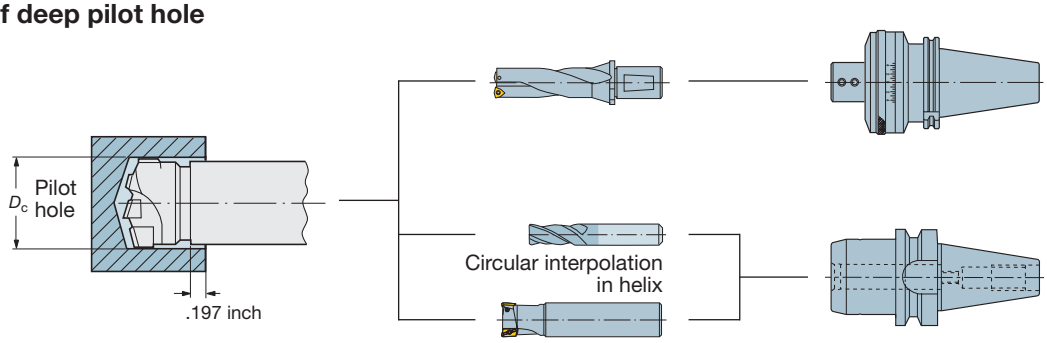


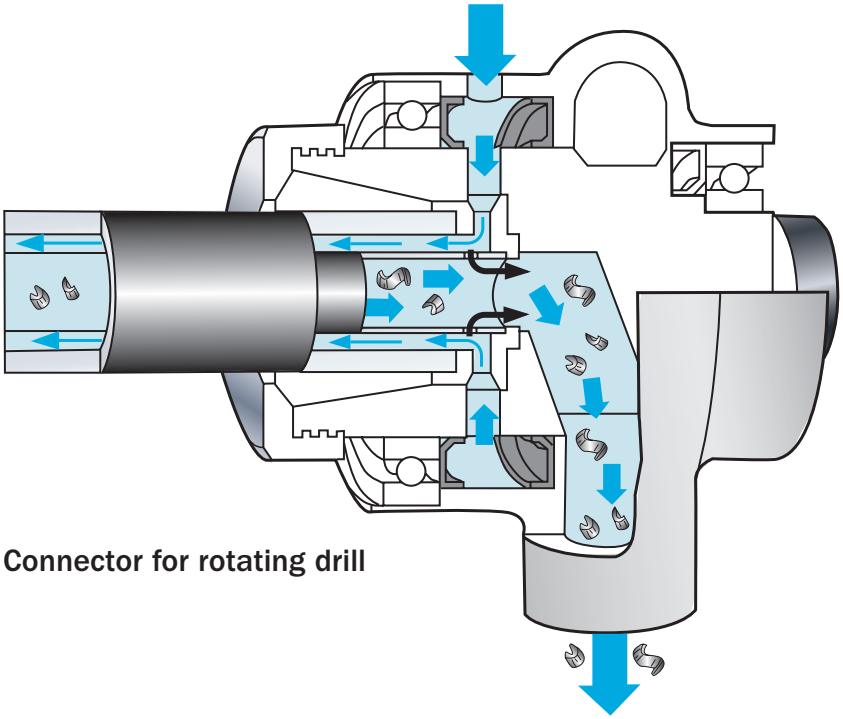
Pilot holes for Ejector drilling

Method of producing pilot holes:

A deep pilot hole is required when not using a bush to guide the coolant. The tolerance of the hole is plus in relation to the drill diameter. See chart on page 126.

Drilling of deep pilot hole





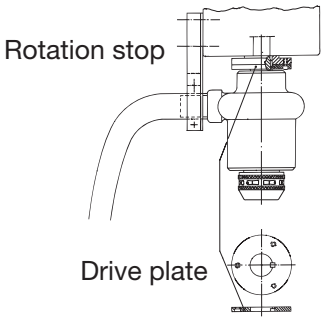
Connector for rotating drill

Caution (rotating drill)

When using a machine with a rotating drill connector, a stop to prevent the connector housing from rotating must be used.

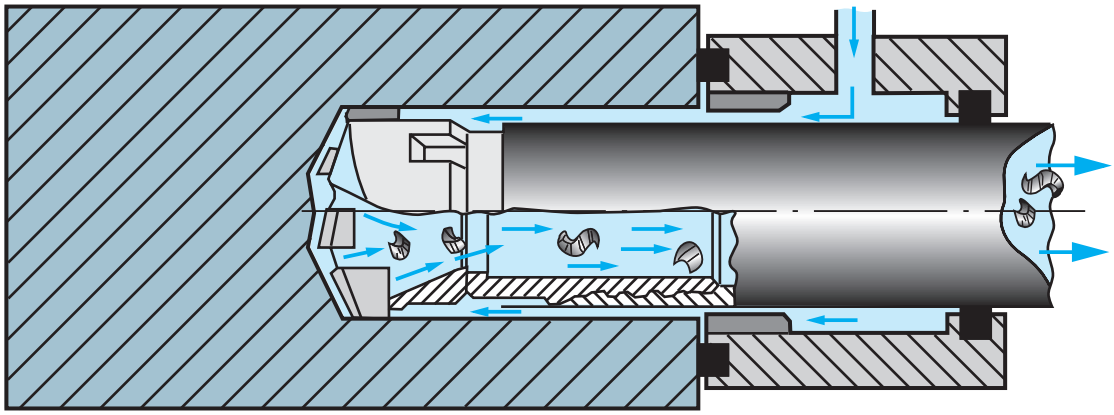
If the seals or bearings are damaged the connector housing can rotate and consequently the supply tubing will be pulled around with the connector, which could cause a serious accident.

If the rotating connector has not been used for some time, check that it will freely rotate before the machine spindle is started.



Transmission of the torque on rotating drills is via keyways and drive plate.

The Single Tube System – STS



The first choice for high productivity

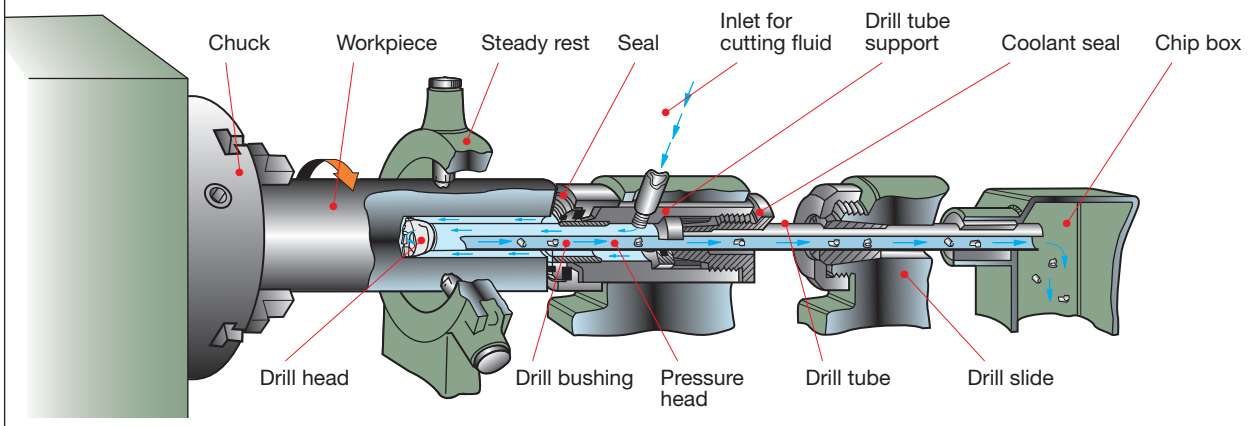
The Single Tube System is based on external cutting fluid supply and internal chip transport.

As a rule, the drill head is screwed onto the drill tube.

The cutting fluid is supplied via the space beween the drill tube and the drilled hole.The cutting fluid is then removed along with the chips through the drill tube.

The velocity of the cutting fluid is so high that chip transport takes place through the tube without disturbances.

Since chip evacuation is internal, no chipflute is required in the shank, so its cross-section can be made completely round, which provides much higher rigidity than in the gun-drill system. The productivity for the STS drilling is up to 6 times higher than for gun drilling.

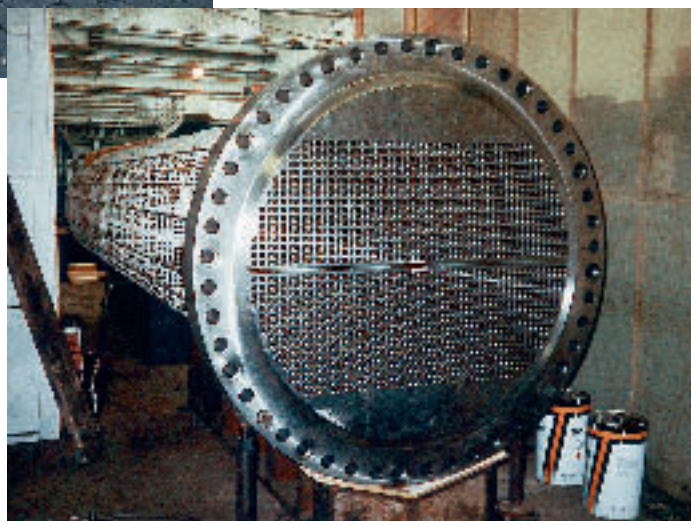


STS system :

- In materals with poor chip forming properties such as stainless steel, and low-carbon steel.
- In materials with an uneven structure when chip-breaking problems exist.
- More advantageous for long series production.
- Uniform and extremely long workpieces.
- For hole diameters larger than 7.874 inch.
- Requires special deep hole drilling machine.

Example STS-drilled components

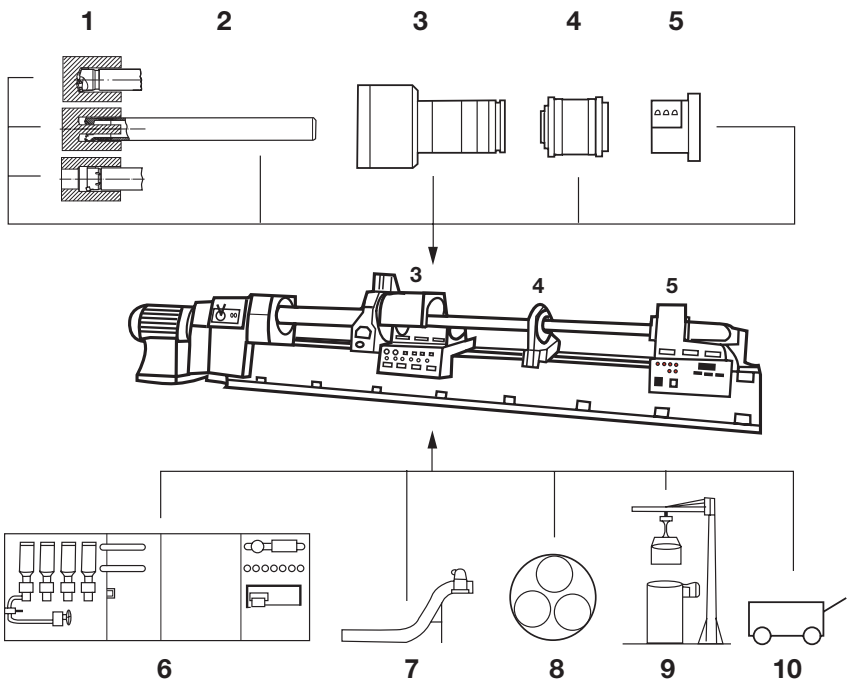
Propeller shaft.



Heat exchangerplate for steam generator.

Coolant holes in a mold base.

Deep hole drilling machine equipment – STS-system

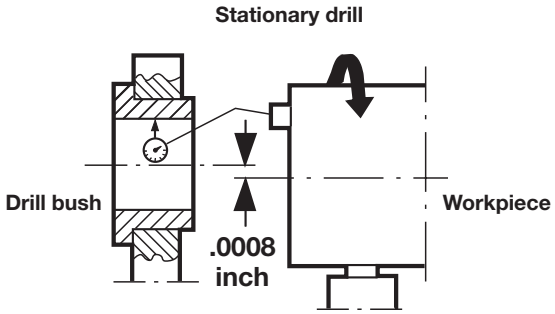


1. Tools for solid drilling, trepanning and counterboring
2. Tube
3. Pressure head
4. Vibration damper
5. Chuck
6. Cutting fluid unit (tank and cooling)
7. Chip conveyor
8. Chip carousel
9. Chip centrifuge and hoist
10. Chip basket

Setting up the STS and Ejector systems

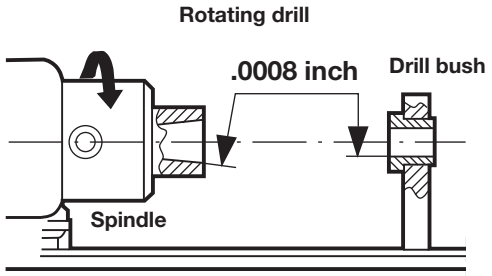
Stationary drill

- The combined arrangement of a stationary drill and rotating workpiece is generally employed on workpieces which are symmetrical about their axes of rotation, on lathes and deep hole drilling machines.
- Compared to a rotating drill, this method produces straighter holes and results in less wear on the drill bush.
- The connector shank must be accurately aligned to provide a common axis of rotation with the machine spindle.
- The total run-out between drill bush and machine spindle should not exceed .0008 inch.



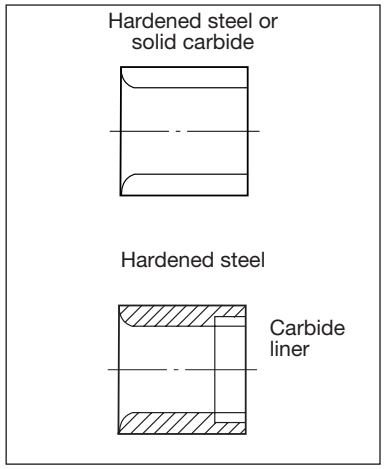
Rotating drill

- Rotating drill and stationary workpiece are employed on both symmetrical and non-symmetrical workpieces.
- Setting up the machine spindle must be carried out with great accuracy, with the run-out, measured on the inside taper of the connector, not to exceed .0008 inch.



Drill bush design

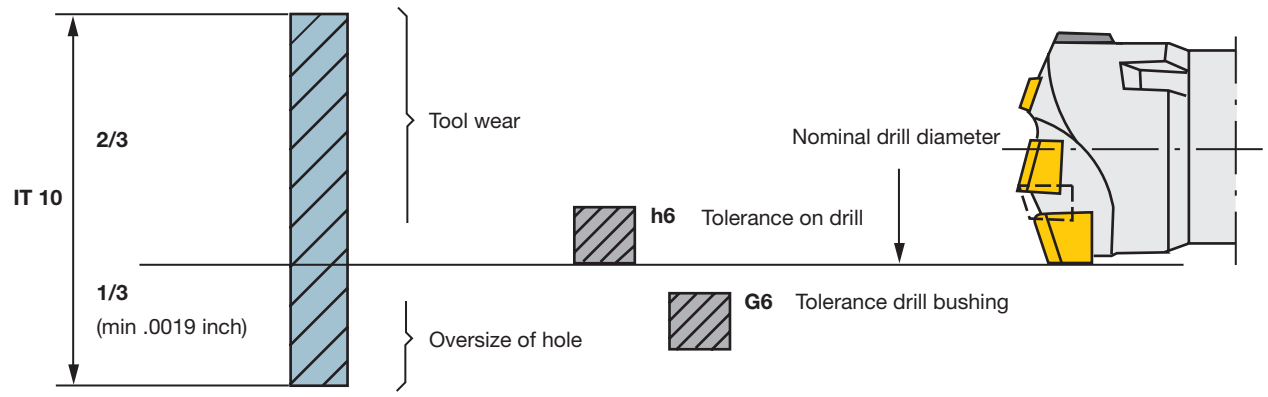
Drill bushings guide the drill head into the workpiece during the initial stages. To achieve long tool life and holes of good quality, the drill bushing is ground to the same nominal diameter as the drill head but on the plus side of the tolerance (as shown in the table). A suitable choice is a cemented carbide bushing of grade CG25 or CG40.



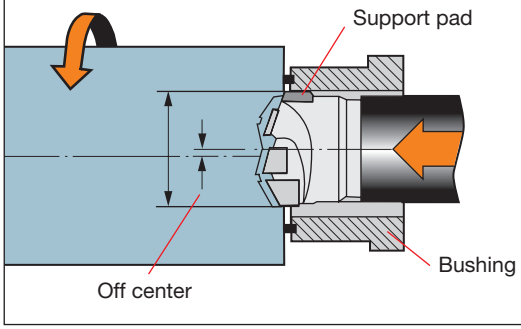
Nominal bushing size	Tolerances (G6)
.496– .708	+.00023 – +.00066
.709– 1.181	+.00027 – +.00078
1.182– 1.968	+.00035 – +.00098
1.969– 3.150	+.00039 – +.00114
3.151– 4.724	+.00047 – +.00133
4.725– 7.087	+.00055 – +.00153
7.088– 9.843	+.00059 – +.00173
9.844–12.402	+.00066 – +.00192
12.403–15.748	+.00070 – +.00212
15.749–19.685	+.00078 – +.00236

Example:
Drill diameter 1.555 inch. Drill bushings should be manufactured to diameter 1.5554 to 1.5560 inch.

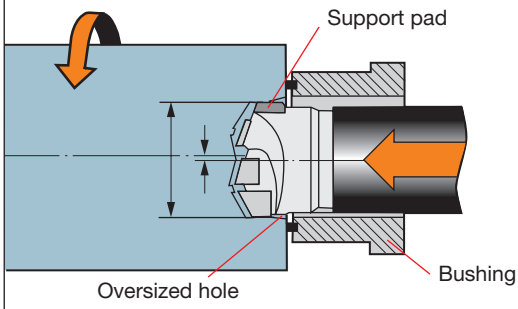
Example: Ground drill head 424.6/420.6



Too small hole initially



Oversized hole



Drill bush too large

An oversized drill bushing initially causes a smaller drilled hole when the cutting forces press the drill's support pads against the drill bushing.

When the support pads climb up onto the rim of the hole, the drill is pressed over against the other side and the peripheral insert creates an oversized hole.

With a brazed drill head, the radial offset between the drill and the workpiece will gradually disappear. This results in the start of the hole becoming oversized – “Bellmouth”.

For drill bushing recommendations, see page 126.

The design of the bushing is an important factor in determining the quality of the drilled hole.

- Excessive clearance reduces the life of the drill.
- Dimensional accuracy has an influence on surface quality and straightness of the hole.
- Cemented carbide bushing lasts at least ten times longer than a steel bushing.
- In some cases, rotating bushings are used to reduce wear.

A new bushing should be .00019 inch larger than the drill. The bushing becomes worn and should be replaced when the clearance is greater than .00059– .00078 inch between the drill and the bushing if close tolerances are required.

Machining recommendations

There are four factors that, in varying degrees, affect the choice of economical cutting data in both Ejector and STS drilling, namely:

1. Chip formation (suitable chip form)
2. Cutting force (available machine power)
3. Tool life (length of life)
4. Surface finish and tolerance (as specified on drawings)

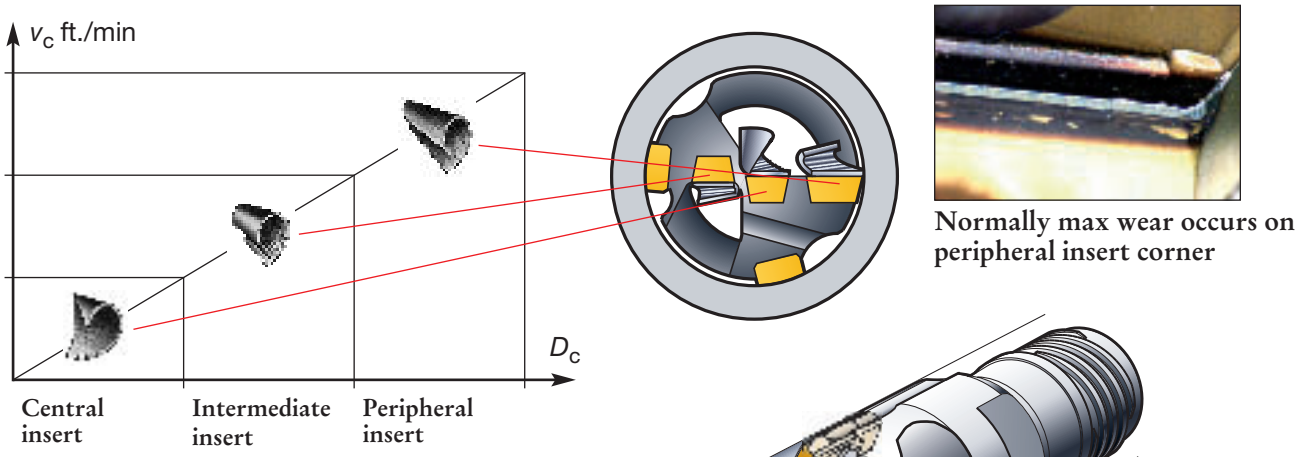
One of the points that guarantees the functioning of the Ejector and STS drills is trouble-free movement of chips through the drill head and inner tube. This is why chip formation is listed as the No. 1 priority. The second priority is available machine power. Tool life, as a critical bearing on the choice of economical cutting data, is a less important factor.

Chip formation

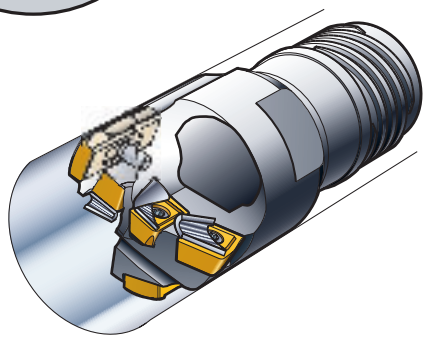
With its short-chipping properties, cast iron seldom causes chip formation problems. When drilling steel, good chip formation is obtained through a combination of chip-breaker geometry, speed, feed and for certain materials, the choice of cutting oil. The essential thing is that the chips must be formed and broken away to yield a shape and size that will flow smoothly and steadily through the chip ducts.

The picture below shows the three different chipforms generated by the central, intermediate and peripheral insert as a consequence of the cutting speed.

Chip formation



Normally max wear occurs on peripheral insert corner



Chipbreaking

Of primary importance in drilling operations is transporting the chips away from the cutting edges of the drill, i.e. obtaining satisfactory chipbreaking. Excessively long and large chips can get stuck in the chip ducts. A suitable chip is as long as it is wide. However, the chips should not be broken harder than necessary, since chipbreaking is power consuming and the heat that is generated increases wear on the cutting edges. Chips with a length 3–4 times their width can be acceptable, provided that they can pass through the chip duct and drill tube without difficulties. Chip formation is affected by the work material, chipbreaker geometry, cutting speed, feed and choice of cutting fluid.

Influence of cutting speed and feed

For most materials it is generally possible to make wide variations in both feed and cutting speed in order to obtain the desired production result. However, when determining the cutting data for some difficult to machine materials, wear is entirely dependent on chipbreaking. It may happen in testing that good chip formation is achieved from the central and intermediate tips while the peripheral tip gives an unacceptably long chip.

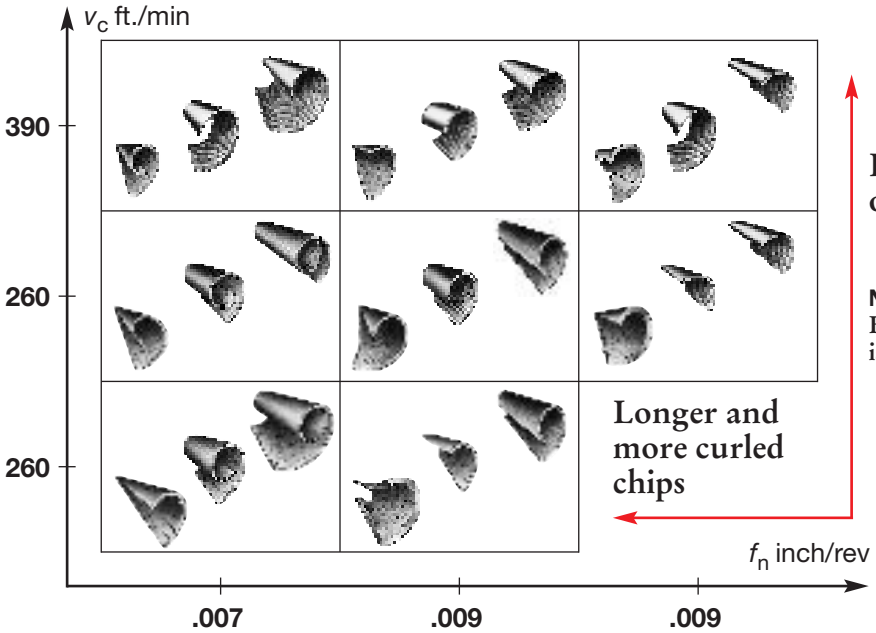
In order to get shorter chips, the feed is usually increased, which may result in the chips being too tight at the central and intermediate tips.

Where a thick compacted chip, in the form of a long strip, is obtained from the central tip, it can be overcome by reducing the feed to correct the chip form.

The speed can then be reduced (this has the effect of shortening the chip) so that an acceptable chip is obtained from the peripheral tip. Certain materials are difficult to machine, e.g. nitrited steel; consequently, it may be necessary to slow the cutting speed down to about 130 ft./min, in order to get acceptable chipbreaking from all tips. The following method is recommended for the choice of cutting data:

1. Check that the motor rating is sufficient. Remember to make allowances for the machine's efficiency.
2. Select cutting speed from the lower part of the 230 - 330 ft./min range.
3. Start at low end of feed range and work upwards.
4. Carry out chipbreaking trials. A few seconds run is sufficient to obtain enough chips and thus determine the cutting data.

Chip breaking influenced by speed and feed



Note!
From left to right in the box the order is central, intermediate and peripheral chip.

Chipbreaking is affected by cutting speed and feed. The chipbreaking range for a drilling tool is illustrated in the picture above. The tool is test-run in the same work material but with different combinations of cutting speed and feed. Once a number of values have been run, the different chip forms obtained are studied. The portion of the diagram where satisfactory chip forms are obtained constitutes the chipbreaking range for the drill and material in question.

Shorter chips are obtained by increasing the feed and/or reducing the cutting speed.
The most economical alternative is chosen from among the possible cutting data combinations.

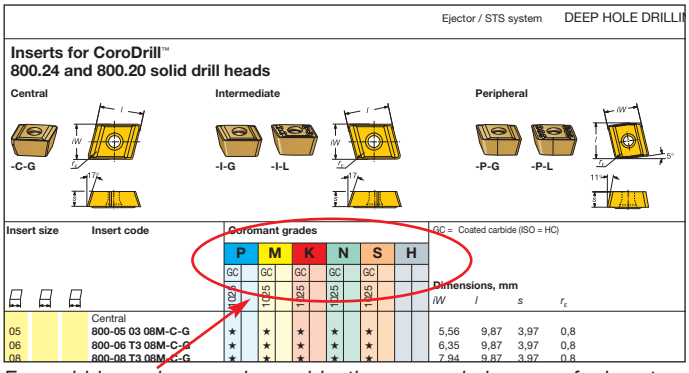
Choice of cutting data

The primary consideration when selecting cutting data for drilling is to obtain satisfactory chipbreaking. The following steps show how to systematically choose the optimum cutting data:

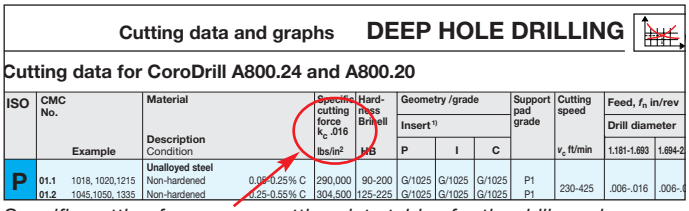
– Find the work material in the cutting data recommendations.
– Choose the appropriate cemented carbide grade or grade combination for the given machining conditions.

Different coated cemented carbide grades can be used for the indexable insert drill heads. A grade with higher wear resistance can be used at the periphery where the cutting speed is greatest, while the central insert requires a tougher grade. The choice of grade in relation to the work material is the same as for turning. Since the cutting speed rarely exceeds 330 ft/min, the extremely wear resistant but brittle grades are secondary. Most important are safety against breakage and avoiding built-up edge.

– Choose approximate cutting data from the cutting data recommendations.



For carbide grade or grade combination, see ordering page for insert and drill respectively.



Specific cutting forces, see cutting data tables for the drill used.

– Calculate the maximum permissible cutting speed in view of the machine's maximum spindle speed and support pad wear. Support pad wear increases considerably at cutting speeds above 330 ft./min.
– Calculate the power requirement and make sure that reserve power is available for tool wear and slightly altered cutting data. Idling power can easily be measured on machines with power meters.

Cutting speed (ft./min)

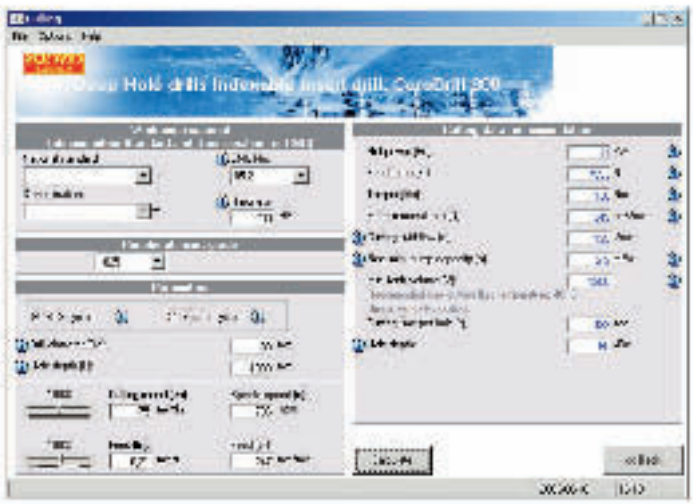
$$v_c = \frac{\pi \times D_c \times n}{12} \quad \text{ft./min}$$

Net power P_c (Hp)

$$P_c = \frac{f_n \times v_c \times D_c \times k_c}{132000} \quad \text{(Hp)}$$

Cutting Data Module

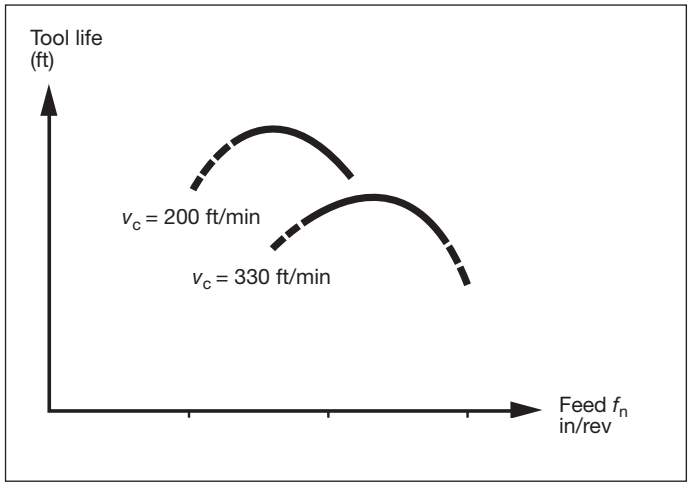
Cutting Data Module



The Cutting Data Module is available on our website (www.coromant.sandvik.com/us), or contact your Sandvik Coromant representative to get the Cutting Data Module to simplify your choice of cutting data.

Example:

In a long-term test, tool life has been plotted as a function of feed/rev at cutting speed of 200 ft/min and 330 ft/min.



Lowest tool cost, i.e. the longest life per drill is obtained with the following data:

Cutting speed	v_c	= 200 ft/min
Feed/rev	f_n	= .008 in./rev
Feed/min	v_f	= 4.78 in./min
Tool life	l_m	= 65 ft/drill

Drill time/metre. $\frac{l_m}{v_f} = \frac{1 \text{ ft.}}{4.78 \text{ in./min}} \times 12 = 2.5 \text{min}$

Highest material removal rate, i.e. shortest drill time was obtained with the following data:

Cutting speed	v_c	= 330 ft./min
Feed/rev	f_n	= .011 in./rev
Feed/min	v_f	= 11 in./min
Tool life	l_m	= 46 ft/drill

Drill time/ft. $\frac{l_m}{v_f} = \frac{1 \text{ ft}}{11 \text{ in./min}} \times 12 = 1.1 \text{ min}$

Case 1 – High machine cost

Assume that the tool cost is $ 50/drill and the fixed cost is $ 100/h, i.e $\frac{150}{60}$ /min

	Lowest tool cost v_c = 200 ft./min	Highest material removal rate v_c = 330 ft./min
Fixed cost $/ft.	$\frac{150}{60} \times 2.5 =$ $6.25	$\frac{150}{60} \times 1.1 =$ $2.75
Tool cost $/ft.	$\frac{50}{65} =$ $0.76	$\frac{50}{46} =$ $1.09
Machining cost $/drilled ft.	$7.01	$3.84

Case 2 – Low machine cost

Assume instead that the fixed cost is $ 50/h, i.e $\frac{50}{60}$ /min

	Lowest tool cost v_c = 200 ft./min	Highest material removal rate v_c = 330 ft./min
Fixed cost $/ft.	$\frac{50}{60} \times 2.5 =$ $2.08	$\frac{50}{60} \times 1.1 =$ $0.92
Tool cost $/ft.	$0.76	$1.09
Machining cost $/drilled ft.	$2.84	$2.01

Case 3 – High machine cost/low workload

Assume that the figures in case 1 apply but that the machine is only used 15% of the shift due to a low workload in the shop.

	Lowest tool cost v_c = 200 ft./min	Highest material removal rate v_c = 330 ft./min
Fixed cost $/ft.	$0.15 \times \frac{150}{6} \times 2.5 =$ $0.94	$0.15 \times \frac{150}{6} \times 1.1 =$ $0.41
Tool cost $/ft.	$0.76	$1.09
Machining cost $/drilled ft.	$1.70	$1.50

Note!

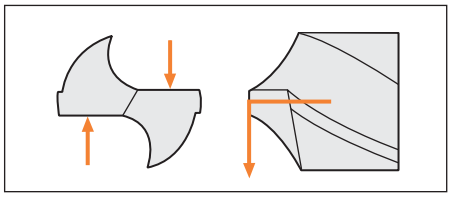
In the above calculation, the cost figures are estimated. Please use your own figures.

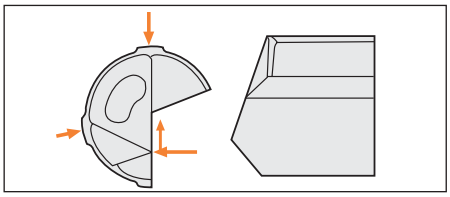
Balanced and unbalanced drills

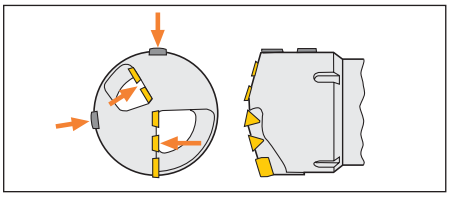
Geometric design varies between different types of drills. When the drill tip is located in the center, symmetry is obtained and the cutting forces balance each other out. The cutting speed decreases from the periphery in towards the center, where the drill tip is virtually stationary and is pushed into the material.

This problem can be avoided by inward inclination of the center part. The clearance on the insert increases and the axial pressure on the drill tip is considerably reduced. The asymmetric geometry which is obtained means that the cutting forces do not balance each other out.

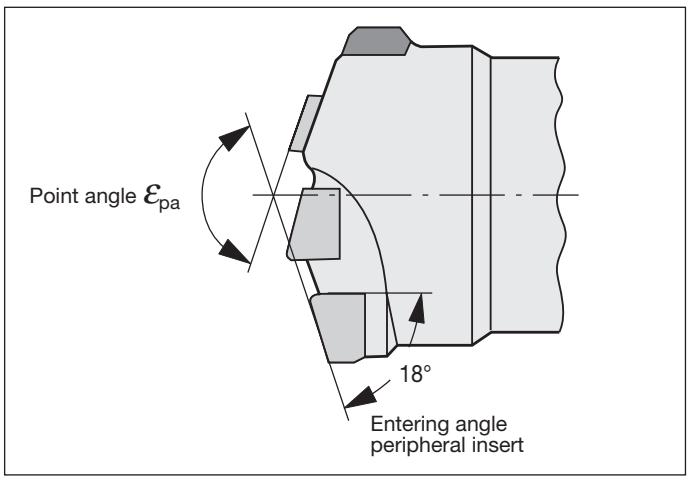
In order to absorb the radial cutting forces on the drill periphery, these so-called "unbalanced drills" are provided with support pads. The resultant force should fall between the support pad and the guide pad, however being closer to the support pad can result in an oversized hole. By dividing the cutting edge into a number of cutting edges located on both sides of the centerline of the drill, it is possible to eliminate a large proportion of the forces on the support pad, see figure.

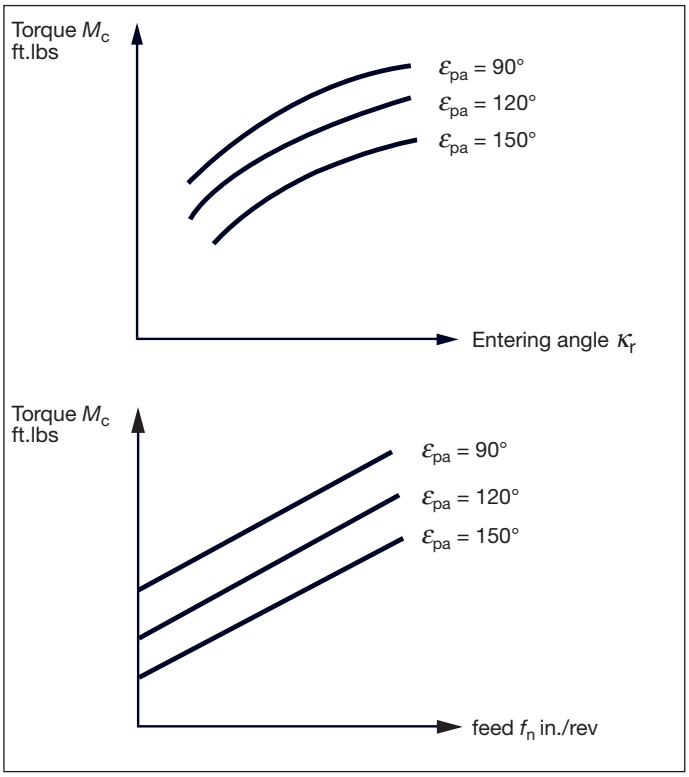




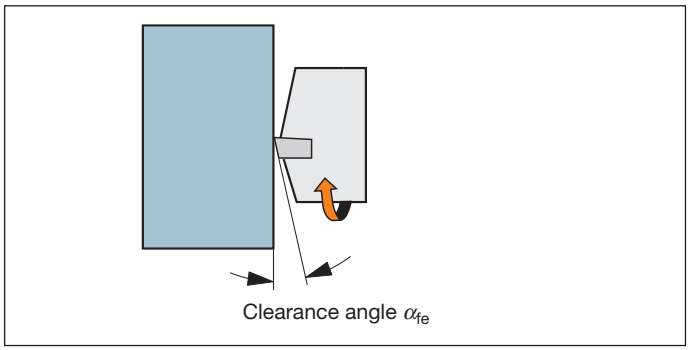


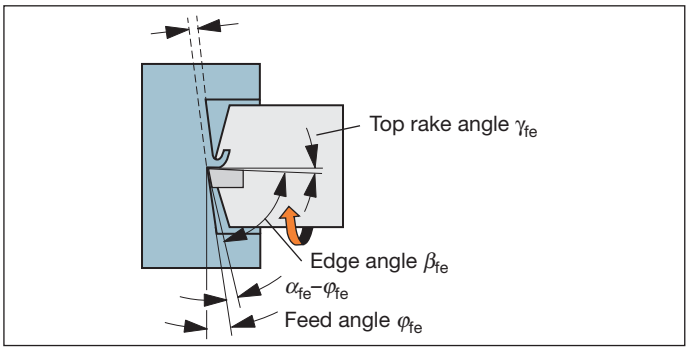
The cutting edge geometry of the drilling tool is the same in principle as for turning and milling. There is a rake angle γ_{fe} and an edge angle β_{fe}. The size of the clearance angle α_{fe} is in proportion to the feed f_z and the diameter D_c. The feed angle φ_{fe} increases with increasing feed, which causes a reduced clearance on the cutting edge. This reduction is greatest nearest the center. The clearance angle on the insert in the center must therefore be made larger than in the periphery. The entering angle and the point angle affect the torque as shown in the diagram.



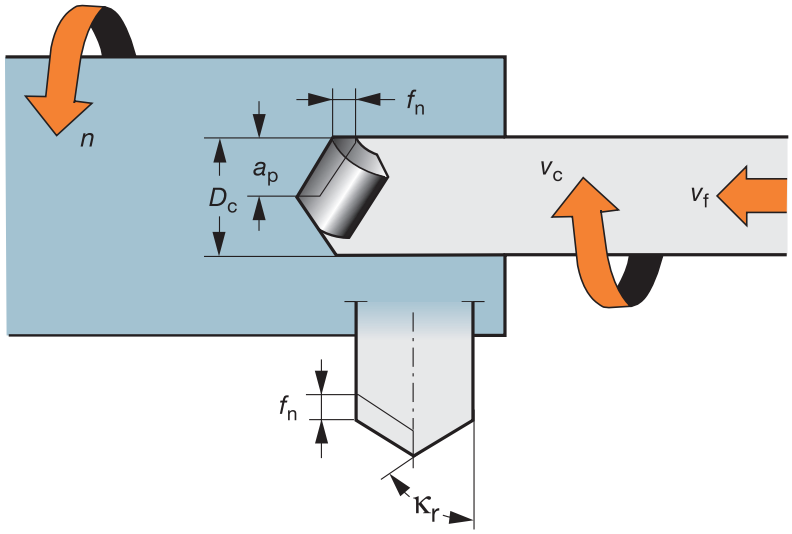


A large point angle gives a low torque. The torque increases with increasing feed and increasing entering angle.





Cutting data calculations



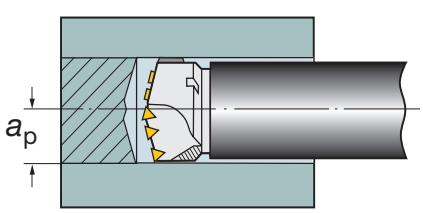
As far as cutting data calculations are concerned, drilling has many similarities to turning and milling. The cutting speed v_c is the difference in speed between the periphery of the drill and the wall of the drilled hole.

The depth of cut a_p is expressed in inch and is measured, as in the case of turning, on half the diameter.

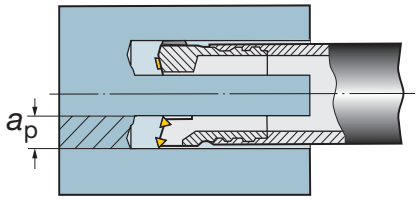
Cutting speed (ft/min)	$v_c = \frac{\pi \times D_c \times n}{12}$
Spindle speed (rev/min)	$n = \frac{v_c \times 12}{\pi \times D_c}$
Feed speed (ft./min)	$v_f = f_n \times n$
Metal removal rate (inch³/min)	$Q = a_p \times f_n \times \frac{v_{c\,max} - v_{c\,min}}{2}$

Terminology and units

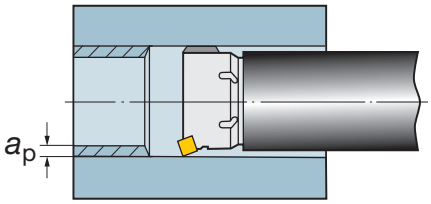
D_c	Drill diameter	inch	F_f	Feed force	lbs
a_p	Cutting depth $\left(\frac{D_c}{2}\right)$	inch	F_μ	Feed force caused by friction	lbs
			M_c	Torque	ft.lbs
v_c	Cutting speed	ft./min	M_μ	Torque caused by friction	ft.lbs
n	Spindle speed	rev/min	P_c	Net power	Hp
v_f	Feed speed	ft./min	P_μ	Power caused by friction	Hp
f_n	Feed per rev.	in./rev	κ_r	Cutting edge angle	Degrees
Q	Material removal rate	inch³/min	q	Cutting fluid quantity	gpm
k_c	Specific cutting force	lbs/in²	p	Cutting fluid pressure	psi
$k_{c\,.016}$	Specific cutting force for f_z =.016	lbs/in²			



Depth of cut in solid drilling



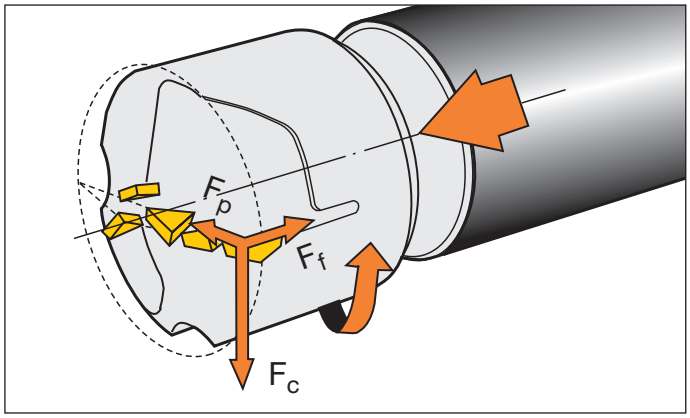
Depth of cut in trepanning



Depth of cut in counterboring

Cutting forces

The cutting forces that arise during drilling are illustrated in the figure. The axial force F_f gives rise to an opposite feed force. The tangential cutting force F_c causes the torque M_c and F_p is the radial force that acts on the guide pad.



The cutting forces can be determined experimentally. If the specific cutting force k_c (lbs/in²) for the material is known, the size of the cutting forces can be calculated.

Tangential force $F_c = k_c \times f_n \times a_p$ (lbs)

The specific cutting force, like the coefficient of friction for support pads, is difficult to calculate exactly. The formulas for feed force, torque and power requirement are therefore only approximate.

Note:

These formulas give the net power requirement at the cutting tip but power losses in the machine itself have not been included in the calculation. Feed force, torque and power at idling speed must be included.

The power requirement is calculated on the basis of a new tool. For a tool with normal wear, the power requirement is 10–30% higher, depending upon the size of the drill.

Feed force (F_f lbs)

$$F_f = .5 \times k_c \times a_p \times f_n \text{ (lbs)}$$

Torque (M_c ft.lbs)

$$M = \frac{Dc \times a_p \times f_n \times k_c}{4} \text{ (ft. lbs)}$$

Power requirement (P_c Hp)

$$P_c = \frac{f_n \times v_c \times D_c \times k_c}{132000} \text{ (Hp)}$$

Specific cutting force

These values are based on a mean chip thickness h_m = .016 inch and a rake angle ν = +6°. The following corrections are deviations from these values:

– The specific cutting force k_c must be corrected for the rake angle. k_c should be changed about 1% for every degree of change of the rake angle. The greater the rake angle, the smaller the specific cutting force k_c.

Cutting Data Module

When using the Cutting Data Module program F_f, M_c and P_c are calculated, see page 130.

Cutting data and graphs **DEEP H**

Cutting data for CoroDrill A800.24 and A800.20

ISO	CMC No.	Example	Material: Description / Condition		Specific cutting force k_c .016 lbs/in²	Hardness Brinell HB	Geometry / Insert [1] P	
P			**Unalloyed steel**					
	01.1	1018, 1020,1215	Non-hardened	0.05-0.25% C	290,000	90-200	G/1025	G/10
	01.2	1045,1050, 1335	Non-hardened	0.25-0.55% C	304,500	125-225	G/1025	G/10
	01.3	1055, 1060	Non-hardened	0.55-0.80% C	316,100	150-225	G/1025	G/10
	01.4	1095	High carbon & carbon tool steel			180-225	G/1025	G/10
			Low alloy steel					
	02.1	4140, 52100, 8620	Non-hardened		304,500	150-260	G/1025	G/10
	02.2	4140, 52100, 8620	Hardened		402,400	220-400	G/1025	G/10
			High alloy steel					
	03.11	D3, H13, A2	Annealed		362,500	150-250	G/1025	G/10
	03.13	M3, M35	Annealed HSS			150-250	G/1025	G/10
	03.21	D3, H13, A2	Hardened tool steel		543,700	250-350	G/1025	G/10
	03.22	D3, H13, A2	Hardened steel			250-400	G/1025	G/10

Specific cutting forces, see cutting data tables on pages 86–98.

Problem:	Cause:	Remedy:
Poor surface finish in drilled hole	1. Cutting speed too low, support pads experiencing build up and scoring the hole surface.	Increase speed (rev/min).
	2. Wrong cutting oil, temperature too high, over 135° F. Sulphur or lubricant is being dissipated by heat.	Have oil sample checked by manufacturer.
	3. Poor filtration, small material particles being reproduced over the support pads.	Increase to proper filtration (40 microns).
	4. Worn support pads.	Replace drill and check cutting speed (rev/min). Check for proper drill grade.
	5. Vibration, unstable machine or component fixturing.	Strengthen machine and / or set up.
Chip jamming in the drill head or the inner tube	1. Inadequate cutting fluid volume.	Repair or replace pump. Check the viscosity of the cutting fluid. Check whether filter is clogged. Check whether the pump is rotating in the right direction. Check the plumb between the pump and the connector. Check that the drain line slopes towards the tank.
Correct volume and pressure but cutting fluid is not reaching drill head adequately	1. Inner tube too short in relation to outer tube.	Replace with correct length tube.
	2. Worn support surface in sealing sleeve for inner tube or missing "O" ring in inner diameter of sealing sleeve.	Replace sealing sleeve or inner "O" ring.
	3. The venturi slots in the rear part of the inner tube are worn so that excessive amount of cutting fluid escapes through the exhaust.	Replace inner tube.
	4. Clogged exhaust line, blocked inner tube.	Clear all blockages.
Cutting fluid leaks out between drill bushing and outer tube excessively	1. Chip jamming in drill head or flare in inner tube.	Clear all system blockages.
	2. Exhaust line does not slope towards chip disposal area.	Adjust exhaust line in a downward position.
	3. Inner tube is inverted in the wrong direction.	Correct inner tube direction (flare to drill and venturies towards exhaust).
Drill breakage or insert/inserts chipping prematurely, despite good chip breaking	1. Poor Ejector effect	Check inside diameter of the connections for blockage, whether the drain line slopes evenly, whether the inner tube is constricted or the venturi slots have collapsed or too large.
	2. Chip jamming in drill or inner tube.	Built-up edge on the central insert can cause crumbling so that long chips are formed and chip flow is blocked. Decrease feed per revolution.
	3. Incorrect start of drilling i.e. center drilled hole, irregular surface, oversize bushing.	Check the clamping of the workpiece so that the workpiece does not move when drilling starts. Change the bushing if it is worn. Check to make sure that the bushing is aligned properly. If there is a center hole in the workpiece, enlarge it so that peripheral insert starts cutting first, or reduce the bore so that the central inserts starts to cut first.

Continued...

Problem:	Cause:	Remedy:
...continued	4. Cross drilling (intersecting holes).	Do not cross drill into and through, other holes.
	5. Overloading of the insert.	Decrease the feed per revolution.
	6. Lack of stability.	Strengthen machine or fixture, check all drill connections i.e. connector.
Center line deviation of hole	1. Machine is out of alignment.	Align machine (.0008 inch head stock to tailstock or fixture).
	2. Component is misaligned.	Align component (same tolerance as machine).
	3. Oversized bushing.	Change to new bushing (see chart on page 126).
	4. Drill tube length excessive.	Apply tube support (every 48 inches).
	5. Workpiece material (e.g. cast iron often gives poor support).	Adjust cutting data.
Premature tool life and/or insert breakage	1. Cutting speed and feed too low.	Increase cutting data.
	2. Misalignment (machine and component).	Align machine or component (.0008 inch).
	3. Cutting speed too high.	Reduce cutting speed.
	4. Heavy wear on support pad and peripheral insert.	Change cutting oil. Check filtration of cutting oil. Check drill bushing wear and make sure that the bushing is within required tolerances (see page 126).
	5. Unsuitable grade.	Switch to suitable grade.
	6. Incorrect coolant volume and pressure, or poor quality coolant.	Check catalog graphs for correct volume and pressure.
Oversized hole	1. New drill.	Hone periphery corner.
	2. Oversize bushing or misalignment of bushing.	Change bushing (see chart on page 126), realign bushing (rev/min).
	3. Unstable machine or set up.	Increase stability of machine and/or fixture.
Spiraling effect in hole	1. Fragmented support pad.	Replace drill.
	2. Misalignment (machining or component).	Align machine or component (.0008 inch).
	3. Lack of lubricity in coolant.	Increase lubrication additives (E.P. i.e. sulphur).
	4. Lack of coolant volume.	Check for blockages, adjust pressure relief valve. Check inner tube.
Bell mouth at start of hole	1. Oversized bushing.	Replace bushing (see page 126).
	2. Lack of rigidity in bush housing.	Strengthen housing.

ISO	Coromant Material Classification (CMC)	Country									
		USA	Great Britain		Sweden	Germany		France	Italy	Spain	Japan
		Standard									
		AISI/SAE	BS	EN	SS	W.-nr.	DIN	AFNOR	UNI	UNE	JIS
P Steel	**Unalloyed steel**										
	01.1	A570.36	4360 40 C		1311	1.0038	RSt.37-2	E 24-2 Ne			STKM 12A;C
	01.1	1115	030A04	1A	1325	1.0038	GS-CK16	-	-	-	-
	01.1	A573-81 65	4360 40 B		1312	1.0116	St.37-3	E 24-U	Fe37-3		
	01.1	1015	080M15	-	1350	1.0401	C15	CC12	C15C16	F.111	-
	01.1	1020	050A20	2C/2D	1450	1.0402	C22	CC20	C20C21	F.112	-
	01.1	1213	230M07	-	1912	1.0715	9SMn28	S250	CF9SMn28	11SMn28	SUM22
	01.1	12L13	-	-	1914	1.0718	9SMnPb28	S250Pb	CF9SMnPb28	11SMnPb28	SUM22L
	01.1	-	-	-	-	1.0722	10SPb20	10PbF2	CF10SPb20	10SPb20	-
	01.1	1215	240M07	1B	-	1.0736	9SMn36	S 300	CF9SMn36	12SMn35	-
	01.1	12L14	-	-	1926	1.0737	9SMnPb36	S300Pb	CF9SMnPb36	12SMnP35	-
	01.1	1015	080M15	32C	1370	1.1141	Ck15	XC12	C16	C15K	S15C
	01.1	1025	-	-	-	1.1158	Ck25	-	-	-	S25C
	01.1	A572-60	4360 55 E		2145	1.8900	StE 380	-	FeE390KG		
	01.1	A572-60	4360 55 E		2142	-	17 MnV 6	NFA 35-501 E 36	-	-	
	01.2	1035	060A35	-	1550	1.0501	C35	CC35	C35	F.113	-
	01.2	1045	080M46	-	1650	1.0503	C45	CC45	C45	F.114	-
	01.2	1140	212M36	8M	1957	1.0726	35S20	35MF4	-	F210G	-
	01.2	1039	150M36	15	-	1.1157	40Mn4	35M5	-	-	-
	01.2	1335	-	-	2120	1.1167	36MN5	40M5	-	36Mn5	SMn438(H)
	01.2	1330	150M28	14A	-	1.1170	28Mn6	20M5	C28Mn	-	SCMn1
	01.2	1035	060A35	-	1572	1.1183	Cf35	XC38TS	C36	-	S35C
	01.2	1045	080M46	-	1672	1.1191	Ck45	XC42	C45	C45K	S45C
	01.2	1050	060A52	-	1674	1.1213	Cf53	XC48TS	C53	-	S50C
	01.3	1055	070M55	-	1655	1.0535	C55	-	C55	-	-
	01.3	1060	080A62	43D	-	1.0601	C60	CC55	C60	-	-
	01.3	1055	070M55	-	-	1.1203	Ck55	XC55	C50	C55K	S55C
	01.3	1060	080A62	43D	1678	1.1221	Ck60	XC60	C60	-	S58C
	01.4	1095	060 A 96		1870	1.1274	Ck 101	XC 100	-	F-5117	
	01.4	W 1	BW 1A		1880	1.1545	C 105 W1	Y105	C36KU	F-5118	SK 3
	01.4	W210	BW2	-	2900	1.1545	C105W1	Y120	C120KU	F.515	SUP4
	Low-alloy steel *(02.1 = Non-hardened, 02.2 = Hardened and tempered)*										
	02.1	A573-81	4360 43C		1412	1.0144	St.44-2	E 28-3	-	-	SM 400A;B;C
	02.1	-	4360 50B		2132	1.0570	St.52-3	E36-3	Fe52BFN/Fe52CFN	-	SM490A;B;C;YA;YB
	02.1	5120	150 M 19		2172	1.0841	St.52-3	20 MC 5	Fe52	F-431	
	02.1	9255	250A53	45	2085	1.0904	55Si7	55S7	55Si8	56Si7	-
	02.1	9262	-	-	-	1.0961	60SiCr7	60SC7	60SiCr8	60SiCr8	-
	02.1	52100	534A99	31	2258	1.3505	100Cr6	100C6	100Cr6	F.131	SUJ2
	02.1	ASTM A204Gr.A	1501-240	-	2912	1.5415	15Mo3	15D3	16Mo3KW	16Mo3	-
	02.1	4520	1503-245-420	-	-	1.5423	16Mo5	-	16Mo5	16Mo5	-
	02.1	ASTM A350LF5	-	-	-	1.5622	14Ni6	16N6	14Ni6	15Ni6	-
	02.1	8620	805M20	362	2506	1.6523	21NiCrMo2	20NCD2	20NiCrMo2	20NiCrMo2	SNCM220(H)
	02.1	8740	311-Type 7	-	-	1.6546	40NiCrMo22	-	40NiCrMo2(KB)	40NiCrMo2	SNCM240
	02.1	-	820A16	-	-	1.6587	17CrNiMo6	18NCD6	-	14NiCrMo13	-
	02.1	5015	523M15	-	-	1.7015	15Cr3	12C3	-	-	SCr415(H)
	02.1	5140	-	-	2245	1.7045	42Cr4	-	-	42Cr4	SCr440
	02.1	5155	527A60	48	-	1.7176	55Cr3	55C3	-	-	SUP9(A)
	02.1	-	-	-	2216	1.7262	15CrMo5	12CD4	-	12CrMo4	SCM415(H)
	02.1	ASTM A182 F11;F12	1501-620Gr27	-	-	1.7335	13CrMo4 4	15CD3.5 15CD4.5	14CrMo4 5	14CrMo45	-
	02.1	ASTM A182 F.22	1501-622 Gr.31;45	- -	2218	1.7380	10CrMo9 10	12CD9, 10 -	12CrMo9, 10	TU.H -	- -
	02.1	-	1503-660-440	-	-	1.7715	14MoV6 3	-	-	13MoCrV6	-
	02.1	-	722 M 24		2240	1.8515	31 CeMo 12	30 CD 12	30CrMo12	F-1712	
	02.1	-	897M39	40C	-	1.8523	39CrMoV13 9	-	36CrMoV12	-	-
	02.1	L1	524A14	-	2092	1.7039	34MoCrS4 G	-	105WCR 5	-	-
	02.1	8620	605A32	-	2108	1.5419	20MoCrS4	-	-	F520.S	-
	02.1	-	823M30	33	2512	1.7228	55NiCrMoV6G	-	653M31	-	-
	02.1	-	-	-	2127	1.7139	16MnCr5	-	-	-	-
	02.1	-	830 M 31		2534	-	31NiCrMo134	-	-	F-1270	
	02.1	L6	-		2550	1.2721	50NiCr13	55NCV6	-	F-528	
	02.2	3135	640A35	111A	-	1.5710	36NiCr6	35NC6	-	-	SNC236
	02.2	3415	-	-	-	1.5732	14NiCr10	14NC11	16NiCr11	15NiCr11	SNC415(H)
	02.2	3415;3310	655M13; A12	36A	-	1.5752	14NiCr14	12NC15	-	-	SNC815(H)
	02.2	9255	-	-	2090	1.0904	55Si7	55S7	-	-	-

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		Standard									
		AISI/SAE	BS	EN	SS	W.-nr.	DIN	AFNOR	UNI	UNE	JIS
P	02.1/02.2	9840	816M40	110	-	1.6511	36CrNiMo4	40NCD3	38NiCrMo4(KB)	35NiCrMo4	-
	02.1/02.2	4340	817M40	24	2541	1.6582	35CrNiMo6	35NCD6	35NiCrMo6(KB)	-	-
	02.1/02.2	5132	530A32	18B	-	1.7033	34Cr4	32C4	34Cr4(KB)	35Cr4	SCr430(H)
	02.1/02.2	5140	530A40	18	-	1.7035	41Cr4	42C4	41Cr4	42Cr4	SCr440(H)
	02.1/02.2	5115	(527M20)	-	2511	1.7131	16MnCr5	16MC5	16MnCr5	16MnCr5	-
	02.1/02.2	4130	1717CDS110	-	2225	1.7218	25CrMo4	25CD4	25CrMo4(KB)	55Cr3	SCM420;SCM430
										AM26CrMo4	
	02.1/02.2	4137;4135	708A37	19B	2234	1.7220	34CrMo4	35CD4	35CrMo4	34CrMo4	SCM432;SCCRM3
	02.1/02.2	4140;4142	708M40	19A	2244	1.7223	41CrMo4	42CD4TS	41CrMo4	42CrMo4	SCM 440
	02.1/02.2	4140	708M40	19A	2244	1.7225	42CrMo4	42CD4	42CrMo4	42CrMo4	SCM440(H)
	02.1/02.2	-	722M24	40B	2240	1.7361	32CrMo12	30CD12	32CrMo12	F.124.A	-
	02.1/02.2	6150	735A50	47	2230	1.8159	50CrV4	50CV4	50CrV4	51CrV4	SUP10
	02.1/02.2	-	905M39	41B	2940	1.8509	41CrAlMo7	40CAD6, 12	41CrAlMo7	41CrAlMo7	-
	02.1/02.2	L3	BL3	-	-	1.2067	100Cr6	Y100C6	-	100Cr6	-
	02.1/02.2	-	-	-	2140	1.2419	105WCr6	105WC13	10WCr6	105WCr5	SKS31
									107WCr5KU		SKS2, SKS3
	02.1/02.2	L6	-	-	-	1.2713	55NiCrMoV6	55NCDV7	-	F.520.S	SKT4
	High-alloy steel										
	03.11	ASTM A353	1501-509;510	-	-	1.5662	X8Ni9	-	X10Ni9	XBNi09	-
	03.11	2515	-	-	-	1.5680	12Ni19	Z18N5	-	-	-
	03.11	-	832M13	36C	-	1.6657	14NiCrMo134	-	15NiCrMo13	14NiCrMo131	-
	03.11	D3	BD3	-	-	1.2080	X210Cr12	Z200C12	X210Cr13KU X250Cr12KU	X210Cr12	SKD1
	03.11				2314	1..2083					
	03.11	H13	BH13	-	2242	1.2344	X40CrMoV5 1	Z40CDV5	X35CrMoV05KU X40CrMoV511KU	X40CrMoV5	SKD61
	03.11	A2	BA2	-	2260	1.2363	X100CrMoV5 1	Z100CDV5	X100CrMoV51KU	X100CrMoV5	SKD12
	03.11	-	-	-	2312	1.2436	X210CrW12	-	X215CrW12 1KU	X210CrW12	SKD2
	03.11	S1	BS1	-	2710	1.2542	45WCrV7	-	45WCrV8KU	45WCrSi8	-
	03.11	H21	BH21	-	-	1.2581	X30WCrV9 3 X30WCrV9 3KU	Z30WCV9	X28W09KU X30WCrV9 3KU	X30WCrV9	SKD5
	03.11	-	-	-	2310	1.2601	X165CrMoV 12	-	X165CrMoW12KU	X160CrMoV12	-
	03.11	HW3	401S45	52	-	1.4718	X45GrSi93	Z45CS9	X45GrSi8	F322	SUH1
	03.11	D3	4959BA2	-	2715	1.3343	S6-5-2	Z40CSD10	15NiCrMo13	-	SUH3
	03.13	M 2	BM 2		2722	1.3343	S6/5/2	Z 85 WDCV	HS 6-5-2-2	F-5603.	SKH 51
	03.13	M 35	BM 35		2723	1.3243	S6/5/2/5	6-5-2-5	HS 6-5-2-5	F-5613	SKH 55
	03.13	M 7	-		2782	1.3348	S2/9/2	-	HS 2-9-2	F-5607	-
	03.21	HNV3	-	-	2736	1.2379	X210Cr12 G	-	-	-	-
	Steel castings										
	06.2	-	-	-	2223	-	-	-			
	06.33	-	Z120M12	-	-	1.3401	G-X120Mn12	Z120M12	XG120Mn12	X120Mn12	SCMnH/1
	06.33		BW 10		2183	1.3401		2120 M12	GX120 Mn12	F-8251	SEMn H1
		Trade names									
	02.1	OVAKO 520M (Ovako Steel)									
	02.1	FORMAX (Uddeholm Tooling)									
	02.1	IMACRO NIT (Imatra Steel)									
	02.2	INEXA 482 (XM) (Inexa Profil)									
		S355J2G3(XM)									
		C45(XM)									
		16MnCrS5(XM)									
		INEXA280(XM)									
		070M20(XM)									
	02.2	HARDOX 500 (SSAB - Swedish Steel Corp.)									
	02.2	WELDOX 700 (SSAB - Swedish Steel Corp.)									

ISO	Coromant Material Classification (CMC)	Country									
		USA	Great Britain		Sweden	Germany		France	Italy	Spain	Japan
		Standard									
		AISI/SAE	BS	EN	SS	W.-nr.	DIN	AFNOR	UNI	UNE	JIS
M	**Stainless steels**										
	Ferritic / martensitic materials *(05.11, 12 = Forged, 15.11, 12 = Cast)*										
Stainless steel	**05.11/15.11**	403	403S17	-	2301	1.4000 1.4001	X7Cr13 X7Cr14	Z6C13 -	X6Cr13 -	F.3110 F.8401	SUS403 -
	05.11/15.11	416	416 S 21		2380	1.4005	X12CrS13	Z11CF13	X12 CrS 13	F-3411	SUS 416
	05.11/15.11	430	430S15	960	2320	1.4016	X8Cr17	Z8C17	X8Cr17	F3113	SUS430
	05.11/15.11	410	410S21	56A	2302	1.4006	X10Cr13	Z10C14	X12Cr13	F.3401	SUS410
	05.11/15.11	430	430S17	60	2320	-	X8Cr17	Z8C17	X8Cr17	F.3113	SUS430
	05.11/15.11	-	420S45	56D	2304	1.4034	X46Cr13	Z40CM Z38C13M	X40Cr14	F.3405	SUS420J2
	05.11/15.11	405	405S17	-	-	1.4002	-	Z8CA12	X6CrAl13	-	-
	05.11/15.11	420	420S37	-	2303	1.4021	-	Z20C13	X20Cr13	-	-
	05.11/15.11	431	431S29	57	2321	1.4057	X22CrNi17	Z15CNi6.02	X16CrNi16	F.3427	SUS431
	05.11/15.11	430F	-	-	2383	1.4104	X12CrMoS17	Z10CF17	X10CrS17	F.3117	SUS430F
	05.11/15.11	434	434S17	-	2325	1.4113	X6CrMo17	Z8CD17.01	X8CrMo17	-	SUS434
	05.11/15.11	CA6-NM	425C11	-	2385	1.4313	X5CrNi13 4	Z4CND13.4M	(G)X6CrNi304	-	SCS5
	05.11/15.11	405	403S17	-	-	1.4724	X10CrA113	Z10C13	X10CrA112	F.311	SUS405
	05.11/15.11	430	430S15	60	-	1.4742	X10CrA118	Z10CAS18	X8Cr17	F.3113	SUS430
	05.11/15.11	HNV6	443S65	59	-	1.4747	X80CrNiSi20	Z80CSN20.02	X80CrSiNi20	F.320B	SUH4
	05.11/15.11	446	-	-	2322	1.4762	X10CrA124	Z10CAS24	X16Cr26	-	SUH446
	05.11/15.11	EV8	349S54	-	-	1.4871	X53CrMnNiN21 9	Z52CMN21.09	X53CrMnNiN21 9	-	SUH35, SUH36
	05.11/15.11	S44400	-		2326	1.4521	X1CrMoTi18 2		-	-	-
	05.11/15.11	-	-		2317	1.4922	X20CrMoV12-1	-	X20CrMoNi 12 01	-	-
	05.12/15.12	630	-	-	-	1.4542/ 1.4548	-	Z7CNU17-04	-	-	-
	Austenitic materials *(05.21, 22, 23 = Forged, 15.21, 22, 23 = Cast)*										
	05.21/15.21	304L	304S11	-	2352	1.4306	-	Z2CN18-10	X2CrNi18 11	-	-
	05.21/15.21	304	304S31	58E	2332/2333	1.4350	X5CrNi189	Z6CN18.09	X5CrNi18 10	F.3551 F.3541 F.3504	SUS304
	05.21/15.21	303	303S21	58M	2346	1.4305	X12CrNiS18 8	Z10CNF 18.09	X10CrNiS 18.09	F.3508	SUS303
	05.21/15.21	304	304S15 304C12	58E	2332 2333	1.4301	X5CrNi189	Z6CN18.09 Z3CN19.10	X5CrNi18 10 -	F.3551 -	SUS304 SUS304L
	05.21/15.21	304L	304S12	-	2352	1.4306	X2CrNi18 9	Z2CrNi18 10	X2CrNi18 11	F.3503	SCS19
	05.21/15.21	301	-	-	2331	1.4310	X12CrNi17 7	Z12CN17.07	X12CrNi17 07	F.3517	SUS301
	05.21/15.21	304LN	304S62	-	2371	1.4311	X2CrNiN18 10	Z2CN18.10	-	-	SUS304LN
	05.21/15.21	316	316S16	58J	2347	1.4401	X5CrNiMo18 10	Z6CND17.11	X5CrNiMo17 12	F.3543	SUS316
	05.21/15.21	316LN	-	-	2375	1.4429	X2CrNiMoN18 13	Z2CND17.13	-	-	SUS316LN
	05.21/15.21	316L	316S13		2348	1.4404	-	Z2CND17-12	X2CrNiMo1712	-	-
	05.21/15.21	316L	316S13	-	2353	1.4435	X2CrNiMo18 12	Z2CND17.12 -	X2CrNiMo17 12 -	- -	SCS16 SUS316L
	05.21/15.21	316	316S33	-	2343 2347	1.4436	-	Z6CND18-12-03	X8CrNiMo1713	-	-
	05.21/15.21	317L	317S12	-	2367	1.4438	X2CrNiMo18 16	Z2CND19.15	X2CrNiMo18 16	-	SUS317L
	05.21/15.21	UNS V 0890A	-		2562	1.4539	X1NiCrMo	Z2 NCDU25-20	-	-	-
	05.21/15.21	321	321S12	58B	2337	1.4541	X10CrNiTi18 9	Z6CNT18.10	X6CrNiTi18 11	F.3553 F.3523	SUS321
	05.21/15.21	347	347S17	58F	2338	1.4550	X10CrNiNb18 9	Z6CNNb18.10	X6CrNiNb18 11	F.3552 F.3524	SUS347
	05.21/15.21	316Ti	320S17	58J	2350	1.4571	X10CrNiMoTi18 10	Z6NDT17.12	X6CrNiMoTi17 12	F.3535	-
	05.21/15.21	318	-	-	-	1.4583	X10CrNiMoNb 18 12	Z6CNDNb17 13B	X6CrNiMoNb17 13	-	-
	05.21/15.21	309	309S24	-	-	1.4828	X15CrNiSi20 12	Z15CNS20.12	-	-	SUH309
	05.21/15.21	310S	310S24	-	2361	1.4845	X12CrNi25 21	Z12CN25 20	X6CrNi25 20	F.331	SUH310
	05.21/15.21	308	301S21	58C	2370	1.4406	X10CrNi18.08	Z1NCDU25.20	-	F.8414	SCS17
	15.21	-	-		2387	1.4418	X4 CrNiMo16 5	Z6CND16-04-01			
	05.22/15.22	17-7PH	316S111	-	-	1.4568/	- 1.4504	Z8CNA17-07	X2CrNiMo1712	-	-
	05.23/15.23	NO8028	-	-	2584	1.4563	-	Z1NCDU31-27-03	-	-	-
	05.23/15.23	S31254	-	-	2378	-	-	Z1CNDU20-18-06AZ	-	-	-
	Austenitic / ferritic materials (Duplex) *(05.51, 52 = Forged, 15.51, 52 = Cast)*										
	05.51/15.51	S31500	-	-	2376	1.4417	X2CrNiMoSi19 5	-	-	-	-
	05.51/15.51	S32900	-	-	2324	-	X8CrNiMo27 5	-	-	-	-
	05.52/15.52	S32304	-	-	2327	-	X2CrNiN23 4	Z2CN23-04AZ	-	-	-
	05.52/15.52	-	-	-	2328	-	-	-	-	-	-
	05.52/15.52	S31803	-	-	2377	-	X2CrNiMoN22 53	Z2CND22-05-03	-	-	-

ISO	Coromant Material Classification (CMC)	Country									
		USA	Great Britain		Sweden	Germany		France	Italy	Spain	Japan
		Standard									
		AISI/SAE	BS	EN	SS	W.-nr.	DIN	AFNOR	UNI	UNE	JIS
M		**Trade names**									
		Stainless steels									
	05.21/15.21	SANMAC 304 (Sandvik Steel)									
	05.21/15.21	SANMAC 304L (Sandvik Steel)									
	05.21/15.21	SANMAC 316 (Sandvik Steel)									
	05.21/15.21	SANMAC 316L (Sandvik Steel)									
	05.23/15.23	254 SMO									
	05.23/15.23	654 SMO									
	05.23/15.23	SANMAC SANICRO (Sandvik Steel)									
	05.52/15.52	SANMAC SAF 2205 (Sandvik Steel)									
	05.52/15.52	SANMAC SAF 2507 (Sandvik Steel)									
K		**Malleable cast iron**									
	07.1		8 290/6		0814		-	MN 32-8			FCMB310
	07.1	32510	B 340/12		0815		GTS-35	MN 35-10			FCMW330
	07.2	40010	P 440/7		0852	0.8145	GTS-45	Mn 450	GMN 45		FCMW370
	07.2	50005	P 510/4		0854	0.8155	GTS-55	MP 50-5	GMN 55		FCMP490
		70003	P 570/3		0858		GTS-65	MP 60-3			FCMP540
	07.2	A220-70003	P570/3		0856	0.8165	GTS-65-02	Mn 650-3	GMN 65	-	FCMP590
	07.3	A220-80002	P690/2		0862	0.8170	GTS-70-02	Mn700-2	GMN 70		FCMP690
		Grey cast iron									
	08.1				0100						
	08.1	No 20 B			0110		GG 10	Ft 10 D			FC100
	08.1	No 25 B	Grade 150		0115	0.6015	GG 15	Ft 15 D	G 15	FG 15	FC150
	08.1	No 30 B	Grade 220		0120	0.6020	GG 20	Ft 20 D	G 20		FC200
	08.2	No 35 B	Grade 260		0125	0.6025	GG 25	Ft 25 D	G 25	FG 25	FC250
		No 40 B									
	08.2	No 45 B	Grade 300		0130	0.6030	GG 30	Ft 30 D	G 30	FG 30	FC300
	08.2	No 50 B	Grade 350		0135	0.6035	GG 35	Ft 35 D	G 35	FG 35	FC350
	08.2	No 55 B	Grade 400		0140	0.6040	GG 40	Ft 40 D			
	08.3	A436 Type 2	L-NiCuCr202		0523	0.6660	GGL-NiCr202	L-NC 202	-	-	
		Nodular cast iron									
	09.1	60-40-18	SNG 420/12		0717-02	0.7040	GGG 40	FCS 400-12	GS 370-17	FGE 38-17	FCD400
	09.1	-	SNG 370/17		0717-12		GGG 40.3	FGS 370-17			
	09.1	-	-		0717-15	0.7033	GGG 35.3	-			
	09.1	80-55-06	SNG 500/7		0727-02	0.7050	GGG 50	FGS 500-7	GS 500	FGE 50-7	FCD500
	09.1	A43D2	Grade S6		0776	0.7660	GGG-NiCr202	S-NC 202	-	-	
	09.2	-	SNG 600/3		0732-03		GGG 60	FGS 600-3			FCD600
	09.2	100-70-03	SNG 700/2		0737-01	0.7070	GGG 70	FGS 700-2	GS 700-2	FGS 70-2	FCD700

Cast iron

ISO	Coromant Material Classification (CMC)	Country									
		USA	Great Britain		Sweden	Germany		France	Italy	Spain	Japan
		Standard									
		AISI/SAE	BS	EN	SS	W.-nr.	DIN	AFNOR	UNI	UNE	JIS
N Non-ferrous metals	**Aluminum alloys**										
	30.21	SC64D	-	-	4251	3.2373	G-AlSi9MgWA	A-S7G	-	-	C4BS
	30.21	GD-AlSi12	LM5	-	4252	-	G-ALMG5	A-SU12	-	-	AC4A
	30.21/30.22	356.1	LM25		4244						A5052
		A413.0			4247		GD-AlSi12				A6061
		A380.1	LM24		4250		GD-AlSi8Cu3				A7075
		A413.1	LM20		4260		G-AlSi12(Cu)				ADC12
		A413.2	LM6		4261		G-AlSi12				
		A360.2	LM9		4253		G-AlSi10Mg(Cu)				
S Heat resistant super alloys	**Heat resistant super alloys**										
	20.11	330	-	-	-	1.4864	X12NiCrSi36 16	Z12NCS35.16	F-3313	-	SUH330
	20.11	-	330C11	-	-	1.4865	G-X40NiCrSi38 18	-	XG50NiCr39 19	-	SCH15
	20.21	5390A	-	-	-	2.4603	-	NC22FeD	-	-	
	20.21	5666	-	-	-	2.4856	NiCr22Mo9Nb	NC22FeDNB	-	-	
	20.21	-	HR5,203-4	-	-	2.4630	NiCr20Ti	NC20T	-	-	
	20.22	5660	-	-	-	LW2.4662	NiFe35Cr14MoTi	ZSNCDT42	-	-	
	20.22	5391	3146-3	-	-	LW2 4670	S-NiCr13A16MoNb	NC12AD	-	-	
	20.22	5383	HR8	-	-	LW2.4668	NiCr19Fe19NbMo	NC19eNB	-	-	
	20.22	4676	3072-76	-	-	2.4375	NiCu30Al	-	-	-	
	20.22	-	Hr401,601	-	-	2.4631	NiCr20TiAk	NC20TA	-	-	
	20.22	AMS 5399	-	-	-	2.4973	NiCr19Co11MoTi	NC19KDT	-	-	
	20.22	AMS 5544	-	-	-	LW2.4668	NiCr19Fe19NbMo	NC20K14	-	-	
	20.24	AMS 5397	-	-	-	LW2 4674	NiCo15Cr10MoAlTi	-	-	-	
	20.32	5537C	-	-	-	LW2.4964	CoCr20W15Ni	KC20WN	-	-	
		AMS 5772	-	-	-	-	CoCr22W14Ni	KC22WN	-	-	
		Titanium alloys									
	23.22	AMS R54520	TA14/17	-	-	-	TiAl5Sn2.5	T-A5E	-	-	
	23.22	AMS R56400	TA10-13/TA28	-	-	-	TiAl6V4	T-A6V	-	-	
	23.22	AMS R56401	TA11	-	-	-	TiAl6V4ELI	-	-	-	
	23.22	-	-	-	-	-	TiAl4Mo4Sn4Si0.5	-	-	-	

Trade names

Heat resistant super alloys

Iron base

20.11 Incoloy 800

Nickel base

20.2 Haynes 600
20.2 Nimocast PD16
20.2 Nimonic PE 13
20.2 Rene 95
20.21 Hastelloy C
20.21 Incoloy 825
20.21 Inconel 600
20.21 Monet 400
20.22 Inconel 700
20.22 Inconel 718
20.22 Mar - M 432
20.22 Nimonic 901
20.22 Waspaloy
20.24 Jessop G 64

Cobalt base

20.3 Air Resist 213
20.3 Jetalloy 209

H	**Hardened materials**										
	04.1	440A	-	-	2258-08	1.4108	X100CrMo13	-	-	-	C4BS
	04.1	610	-	-	2534-05	1.4111	X110CrMoV15	-	-	-	AC4A
	04.1	0-2	-	-	2541-06	-	X65CrMo14	-	-	-	AC4A

Easier handling with ergonomic Torx Plus®

The new Torx Plus grip with the elliptical shape can transfer 25% more torque than the existing Torx. The new shape and a tighter grip means less risk of damage to the screw head and makes handling more stable.

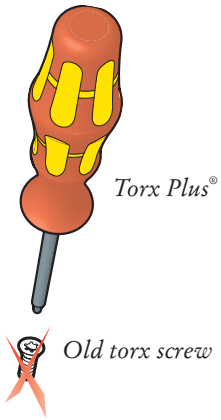
Sandvik Coromant has introduced the Torx Plus system on all insert screws to ensure improved and secure clamping.

The new Torx Plus screws will keep their previous ordering codes, while the keys will change codes (see table below).

All keys for insert clamping affected are: screwdrivers, T-style keys, L-style keys, flag style keys and combination keys (Torx Plus/hex). All of them, except the L-keys and bits, are easily identified by the red and yellow handle.

Cross section

Torx Plus is a registered trademark of Camcar-Textron (USA).



Note!

We want to point out to all our customers that the new Torx Plus keys and screwdrivers do NOT fit into the standard Torx screws.

However, the standard Torx keys and screwdrivers will fit the new Torx Plus screws.

Cross reference list – Torx to Torx Plus

Type of key	Old Torx keys			*New Torx Plus keys*		Comments
	Torx size	Code	Torx designation	**Code**	**Torx Plus designation**	
T-keys 	15	5680 045-02	T15	**5680 048-01**	**15IP**	
	10	5680 045-06	T10	**5680 048-02**	**10IP**	
	20	5680 045-03	T20	**5680 048-03**	**20IP**	Length 2.087 inch
	20	5680 045-01	T20	**5680 048-04**	**20IP**	Length 3.543 inch
	25	5680 045-05	T25	**5680 048-05**	**25IP**	Length 2.756 inch
	25	5680 045-04	T25	**5680 048-06**	**25IP**	Length 4.331 inch
	30	5680 045-07	T30	**5680 048-07**	**30IP**	
Flag keys 	6	5680 041-02	T6	**5680 051-01**	**6IP**	
	7	5680 041-01	T7	**5680 051-02**	**7IP**	
	9	5680 016-03	T9	**5680 049-03**	**9IP**	Combination key – 9IP and hex .138
	9	170.3-865	T9	**5680 051-03**	**9IP**	
	15	5680 016-01	T15	**5680 049-01**	**15IP**	Combination key – 15IP and hex .138 inch
	15	5680 016-02	T15	**5680 049-02**	**15IP**	Combination key – 15IP and hex .157 inch
Drivers 	7	416.1-860	T7	**5680 046-03**	**7IP**	
	8	416.1-861	T8	**5680 046-01**	**8IP**	
	9	416.1-862	T9	**5680 046-04**	**9IP**	
	10	416.1-863	T10	**5680 046-05**	**10IP**	
	15	416.1-864	T15	**5680 046-02**	**15IP**	
	20	416.1-865	T20	**5680 046-06**	**20IP**	
	25	416.1-866	T25	**5680 046-07**	**25IP**	
	30	416.1-867	T30	**–**		
L-keys 	8	5680 043-08	T8	**5680 043-10**	**8IP**	
	9	5680 043-01	T9	**5680 043-11**	**9IP**	
	10	5680 043-05	T10	**5680 043-12**	**10IP**	
	15	5680 043-09	T15	**5680 043-13**	**15IP**	
	20	5680 043-03	T20	**5680 043-14**	**20IP**	
	25	5680 043-04	T25	**5680 043-15**	**25IP**	
	27	5680 043-06	T27	**5680 043-16**	**27IP**	
	30	5680 043-07	T30	**5680 043-17**	**30IP**	
Bits 	7	5680 081-01	T7	**5680 084-04**	**7IP**	Length 1.969 inch
	8	5680 081-02	T8	**5680 084-01**	**8IP**	Length 1.969 inch
	9	5680 081-03	T9	**5680 084-05**	**9IP**	Length 1.969 inch
	10	5680 081-04	T10	**5680 084-06**	**10IP**	Length 1.969 inch
	15	5680 081-05	T15	**5680 084-02**	**15IP**	Length 1.969 inch
	–	–	–	**5680 084-03**	**15IP**	Length 3.524 inch
	20	5680 081-06	T20	**5680 084-07**	**20IP**	Length 1.969inch
	–	–	–	**5680 084-08**	**20IP**	Length 3.504 inch
	25	5680 081-07	T25	**5680 084-09**	**25IP**	Length 3.504 inch
	30	5680 081-08	T30	**5680 084-10**	**30IP**	Length 3.504 inch
Bits set	7 – 25	5680 082-01	T7 – T25	**–**	**–**	

METAL CUTTING SAFETY

Most grades of hardmetal contain cobalt, a substance classified as hazardous by OSHA and the present threshold limit (TLV) for cobalt metal from dust in the air is 0.02[1)] mg/m^3. Products described in this catalog also contain one or more of the following: Tungsten Carbide, Titanium Carbide, Tantalum Carbide, Chromium Cadmium and Nickel. These materials are also classified as hazardous by OSHA. Before using any of the products described in this catalog, read the appropriate Material Safety Data sheet for the product.

It is necessary when grinding advanced cutting tool materials that dust, mist or sludge from the process be collected and disposed of properly. Exposure to dust or mist containing metallic particles can be hazardous to health. This is particularly true if exposure continues over an extended period of time. Exposure may cause eye, skin and mucous membrane irritation and temporary or permanent respiratory disease. Existing pulmonary and skin conditions may be aggravated.

Wet grinding is strongly recommended. Adequate ventilation, respiratory protection and eye protection should be provided when grinding and workers should avoid breathing of and prolonged skin contact with dust or mist. General Industry Safety and Health Regulations, Part 1910, U.S. Department of Labor, published in Title 29 of the Code of Federal Regulations should be consulted.

Hardmetal is frequently brazed with silver solder. When it is brazed or debrazed fumes of cadmium oxide, zinc oxide and other substances may be given off from the brazing material and suitable precautions must be taken to prevent inhalation of these fumes.

You are advised to consult your Factory Inspector regarding future amendments to the ceiling values and threshold limit values (TLV) given above as they are always subject to further reduction.

Precautions are necessary in handling hardmetal because of its inherently brittle nature. It can be fractured by shock or impact which may cause pieces to be detached at high velocity. Tools and components containing hardmetal should not be hammered or fitted with undue force, and when such operations must be carried out, suitable eye protection must be used by the workers. Such eye protection must also be used in normal operations because there is a danger of breakage of tools or components during normal usage.

Further copies of this information and appropriate material safety data sheets are available on request and can be obtained directly from Sandvik Coromant Co.

[1)] Threshold values established by the American Conference of Government Industrial Hygienists (ACGIH).

GRADE DESIGNATIONS TO CURRENT MATERIAL SAFETY DATA SHEETS

If a grade is not listed or for additional information, please call 1-800-SANDVIK

LIT-MSDS 1. (Issue Date: 1/1/03, Supersedes: 10/1/02):
Chemical name *Cemented tungsten carbide product with cobalt binder*
Chemical family: *Refractory metal carbide*
Trade name and synonyms:
All Sandvik Coromant cemented tungsten carbide grades (including grades: 20, 63, 63C, 67, 70, 70C, 72, 72C, ABD, BAB, C2, C6, CD1810, GC-A, GC1005, GC1010, GC1015, GC1020, GC1025, GC1030, GC1040, GC1120, GC120, GC2015, GC2025, GC2030, GC2035, GC2040, GC2135, GC2145, GC215, GC225, GC235, GC3005, GC3015, GC3020, GC3025, GC3040, GC3115, GC315, GC320, GC3205, GC3210, GC3215, GC4005, GC4015, GC4020, GC4025, GC4030, GC4035, GC4040, GC4125, GC415, GC425, GC435, H10, H10A, H10F, H10P, H13A, H1P, H20, H35, HM, K05A, K20, K20W, LC25, MC45, P20, P40, R4, S05F, S10, S1P, S2, S30, S35, S4, S6, SH, SM30, SMA, TN6)

LIT-MSDS 2. (Issue Date: 1/3/03, Supersedes: 10/1/02):
Chemical name *Cemented tungsten carbide product with cobalt/nickel binder*
Chemical family: *Refractory metal carbide*
Trade name and synonyms:
All Sandvik Coromant cermet grades (including grades: C01T, GC1525, CT5005, CT5015, CT515, CT520, CT525, CT530

LIT-MSDS 3. (Issue Date: 1/1/03, Supersedes: 7/1/98):
Chemical name *Silicon carbide whisker reinforced aluminum oxide*
Chemical family: *Ceramic composite*
Trade name and synonyms: CC670

LIT-MSDS 4. (Issue Date: 1/1/03, Supersedes: 7/1/98):
Chemical name *Aluminum oxide product*
Chemical family: *Ceramic composite*
Trade name and synonyms: CC620

LIT-MSDS 5. (Issue Date: 1/1/03, Supersedes: 7/1/98):
Chemical name *Aluminum oxide product*
Chemical family: *Ceramic composite*
Trade name and synonyms: CC650 and CC6050

LIT-MSDS 6. (Issue Date: 1/1/03, Supersedes: 7/1/98):
Chemical name *Sialon product*
Chemical family: *Ceramic composite*
Trade name and synonyms: CC680 and CC6080

LIT-MSDS 7. (Issue Date: 1/1/03, Supersedes: 7/1/98):
Chemical name *Silicon nitride product*
Chemical family: *Ceramic composite*
Trade name and synonyms: CC690, CC6090 and CC1690

LIT-MSDS 8. (Issue Date: 1/1/03, Supersedes: 7/1/98):
Chemical name *Dow corning 1000 high temp. antiseize paste*
Chemical family: *Lubricant*
Trade name and synonyms: Molykote 1000

LIT-MSDS 9. (Issue Date: 1/1/03, Supersedes: 7/1/98):
Chemical name *Sintered polycrystalline cubic boron nitride on a cemented tungsten carbide substrate with cobalt binder*
Chemical family: *Sintered PCBN and refractory metal carbide*
Trade name and synonyms: CBN (including grades: CB7020, CB7050, CB20, CB50, CB7099.

LIT-MSDS 10. (Issue Date: 1/1/03, Supersedes: 7/1/98):
Chemical name *Sintered polycrystalline diamond on a cemented tungsten carbide substrate with cobalt binder*
Chemical family: *Sintered PCD and refractory metal carbide*
Trade name and synonyms: PCD (including grades: CD10, CD51, CD61

SANDVIK Coromant

Carbide Insert Recycling

Ordering code: LIT-LABEL-RECYCLE-INFO

Max Size: 2 in. × 2 in × 1/2 in.

Sandvik Coromant recognizes today's increasing demands for environmental concerns. Current recycling methods allow used carbide products to be broken down to their original raw material states.

Sandvik Coromant is proud to offer a service to recycle used carbide inserts.

Recycling through Sandvik Coromant is Simple and Easy

1. Call 1-800-SANDVIK and ask the Regional Customer Service Center to have a Recycling Kit sent to you today.

2. Use the collection boxes at each machine or cell. Then, fill the transportation boxes with inserts collected from each machine or cell.

3. Call 1-800-SANDVIK to get a Recycle Return Authorization (RRA) number and current price per pound. Then, ship the transportation boxes using the shipping label included in the Recycling Kit.

The service is easy for customers to use. Sandvik Coromant will provide a recycling kit, free of charge, to customers interested in using the service. The kit includes instructions, a recycling form, a plastic collection box and a transportation box.

A refund check, based on current price per pound of carbide times the weight of the returned inserts, will be forwarded to the customer within 2-3 weeks after the receipt of the shipment.

Any customers wishing to take advantage of this service can obtain a recycling kit by calling a Sandvik Coromant regional customer service center at 1-800-SANDVIK.