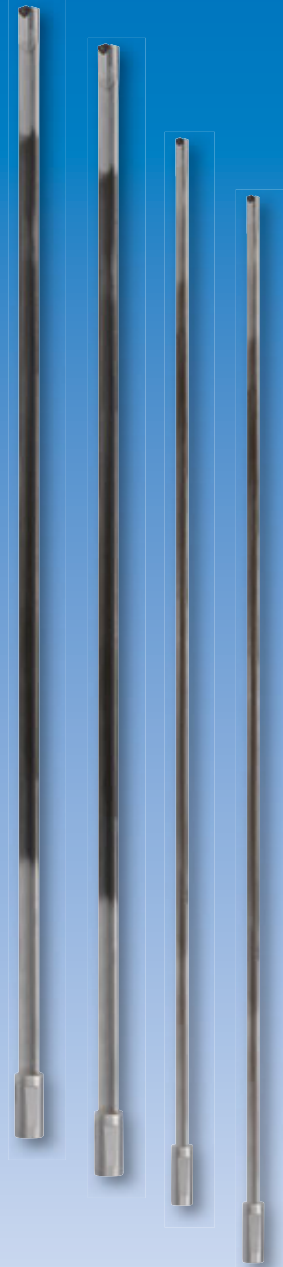




TRI-LG

UNITAC Report No. 03-E

www.unitacinc.com



The days of spending money on drilling are over

The first direct-mounting drill head 3-cornered insert in the market

TRI-LG

Features

- Excellent hole accuracy
- High productivity
- Applicable for a wide range of cutting conditions
- Long tool life due to 3-cornered insert
- No diameter setting necessary (Direct-mounting type)
- No regrinding necessary (Indexable insert)

Same head design as BTA drill
Hole diameter deviation: within 0.07 mm

Large flute angle
Good chip evacuation

Large oil hole
- Efficient lubrication
- Long tool life

Available in 3 types of drivers

Highly rigid body
Long tool life for high-speed and high-feed cutting

Highly accurate 3-cornered insert
- Peripherally ground insert provides highly accurate hole diameter of IT10
- The first 3-cornered insert in the market
- Long tool life

Low cutting force by serrated cutting edge geometry and chipbreakers formation

Chip formation by serrated cutting edge



Positive chipbreaker with low cutting force

S chipbreaker



Practical examples

Long tool life and high productivity

Camshaft for truck

Drill diameter : ϕD_c (mm)	20 (L/D = 50)
Workpiece material	SCM440 (ISO42CrMo4, AISI4140)
Cutting speed : V_c (m/min)	72
Number of revolutions: n (min^{-1})	1150
Feed : f (mm/rev)	0.13
Feed speed : V_f (mm/min)	150
Hole depth : H (mm)	1050
Machine	Gundrill machine (Tool rotating)

Comparison with competitor's indexable drill:
 Tool life of insert - 2.5 times longer
 Tool life of guide pad - 70 m/piece

Highly efficient deep hole drilling

Die & Mold (Cooling hole)

Drill diameter : ϕD_c (mm)	21
Workpiece material	SCM440
Cutting speed : V_c (m/min)	99
Number of revolutions: n (min^{-1})	1500
Feed : f (mm/rev)	0.17
Feed speed : V_f (mm/min)	250
Hole depth : H (mm)	300
Machine	Gundrill machine (Tool rotating)

Comparison with brazed gundrill:
 Productivity - 6.25 times higher
 Tool life - 5.25 times longer

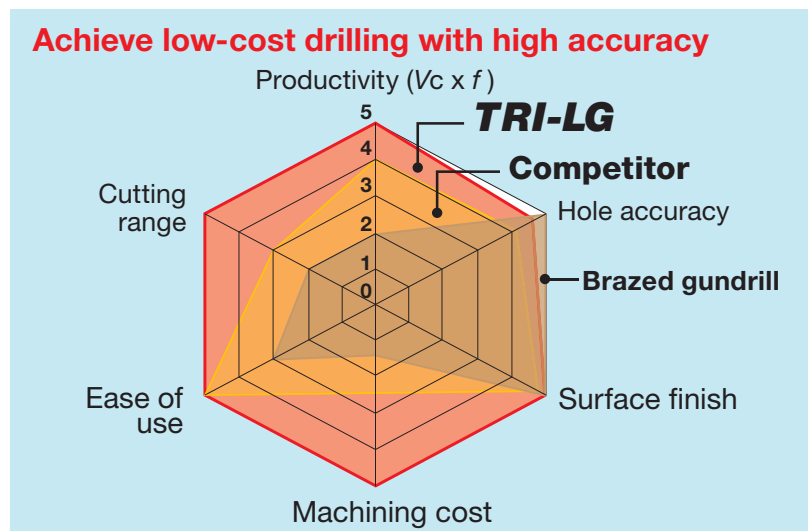
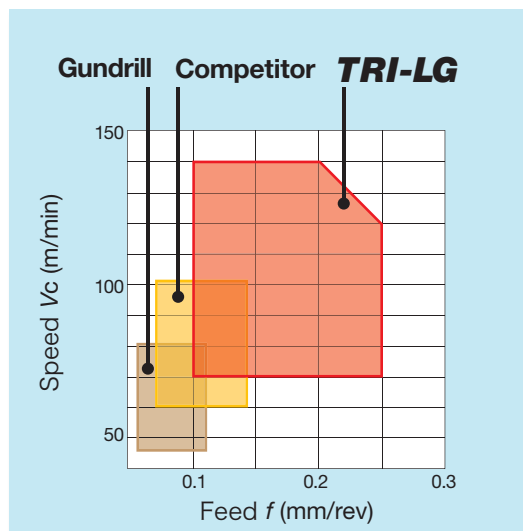
High productivity achieved by switching from brazed gundrill

Die & Mold (Cooling hole)

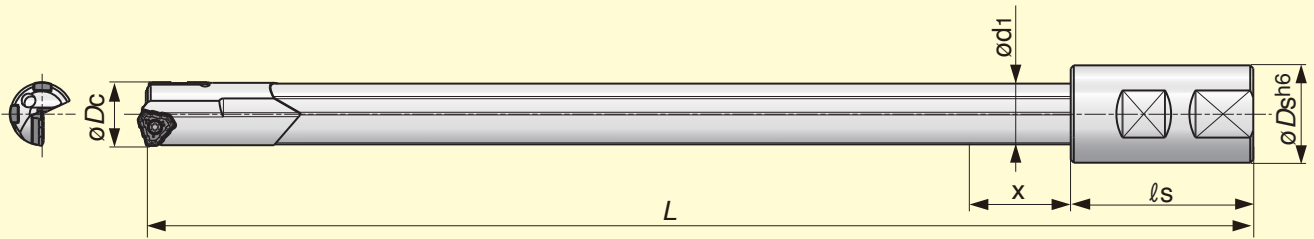
Drill diameter : ϕD_c (mm)	18 (L/D \geq 55)
Workpiece material	S55C (AISI P20)
Cutting speed : V_c (m/min)	60
Number of revolutions: n (min^{-1})	1062
Feed : f (mm/rev)	0.1
Feed speed : V_f (mm/min)	106 mm/min
Hole depth : H (mm)	1000
Machine	Gundrill machine (Tool rotating)

Comparison with brazed gundrill:
 Feed rate - 2.6 times higher

Comparison with competitor's product

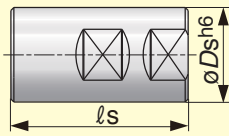


● Drill body

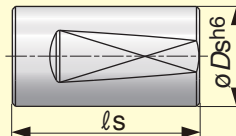


■ Driver code

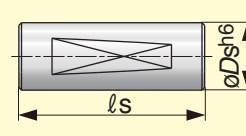
23, 24, 25



35, 36



U4, U5, U6



Drill dia. øDc (mm)	Drill dia. L (mm)	Cat. No.	Stock	Dimensions (mm)				Driver code	Insert
				ød1	x	øDs	ls		
16.00	800	TRLG 16.00X800-23	●	15.5	24	25	56	23	TOHT08RS
16.00	800	TRLG 16.00X800-U04	●	15.5	24	25.4	70	U04	TOHT08RS
16.00	800	TRLG 16.00X800-35	●	15.5	24	25	56	35	TOHT08RS
16.00	1000	TRLG 16.00X1000-23	●	15.5	24	25	56	23	TOHT08RS
16.00	1000	TRLG 16.00X1000-U04	●	15.5	24	25.4	70	U04	TOHT08RS
16.00	1000	TRLG 16.00X1000-35	●	15.5	24	25	56	35	TOHT08RS
16.00	1500	TRLG 16.00X1500-U04	●	15.5	24	25.4	70	U04	TOHT08RS
16.00	1500	TRLG 16.00X1500-23	●	15.5	24	25	56	23	TOHT08RS
16.00	1500	TRLG 16.00X1500-35	●	15.5	24	25	56	35	TOHT08RS
17.00	1000	TRLG 17.00X1000-23	●	16.2	25	25	56	23	TOHT08RS
17.00	1000	TRLG 17.00X1000-U04	●	16.2	25	25.4	70	U04	TOHT08RS
17.00	1000	TRLG 17.00X1000-35	●	16.2	25	25	56	35	TOHT08RS
17.00	1500	TRLG 17.00X1500-23	●	16.2	25	25	56	23	TOHT08RS
17.00	1500	TRLG 17.00X1500-U04	●	16.2	25	25.4	70	U04	TOHT08RS
17.00	1500	TRLG 17.00X1500-35	●	16.2	25	25	56	35	TOHT08RS
18.00	800	TRLG 18.00X800-23	●	17.2	27	25	56	23	TOHT08RS
18.00	800	TRLG 18.00X800-U04	●	17.2	27	25.4	70	U04	TOHT08RS
18.00	800	TRLG 18.00X800-35	●	17.2	27	25	56	35	TOHT08RS
18.00	1000	TRLG 18.00X1000-23	●	17.2	27	25	56	23	TOHT08RS
18.00	1000	TRLG 18.00X1000-U04	●	17.2	27	25.4	70	U04	TOHT08RS
18.00	1000	TRLG 18.00X1000-35	●	17.2	27	25	56	35	TOHT08RS
18.00	1500	TRLG 18.00X1500-U04	●	17.2	27	25.4	70	U04	TOHT08RS
18.00	1500	TRLG 18.00X1500-23	●	17.2	27	25	56	23	TOHT08RS
18.00	1500	TRLG 18.00X1500-35	●	17.2	27	25	56	35	TOHT08RS
19.00	800	TRLG 19.00X800-23	●	18.2	28	25	56	23	TOHT09RS
19.00	800	TRLG 19.00X800-U04	●	18.2	28	25.4	70	U04	TOHT09RS
19.00	800	TRLG 19.00X800-35	●	18.2	28	25	56	35	TOHT09RS
19.00	1000	TRLG 19.00X1000-23	●	18.2	28	25	56	23	TOHT09RS
19.00	1000	TRLG 19.00X1000-U04	●	18.2	28	25.4	70	U04	TOHT09RS
19.00	1000	TRLG 19.00X1000-35	●	18.2	28	25	56	35	TOHT09RS
19.00	1500	TRLG 19.00X1500-U04	●	18.2	28	25.4	70	U04	TOHT09RS
19.00	1500	TRLG 19.00X1500-23	●	18.2	28	25	56	23	TOHT09RS
19.00	1500	TRLG 19.00X1500-35	●	18.2	28	25	56	35	TOHT09RS

● : Stocked items

Drill dia. øDc (mm)	Drill dia. L (mm)	Cat. No.	Stock	Dimensions (mm)				Driver code	Insert
				ød1	x	øDs	ℓs		
20.00	800	TRLG 20.00X800-24	●	19	30	32	60	24	TOHT09RS
20.00	800	TRLG 20.00X800-U05	●	19	30	31.75	70	U05	TOHT09RS
20.00	800	TRLG 20.00X800-36	●	19	30	32	60	36	TOHT09RS
20.00	1000	TRLG 20.00X1000-24	●	19	30	32	60	24	TOHT09RS
20.00	1000	TRLG 20.00X1000-U05	●	19	30	31.75	70	U05	TOHT09RS
20.00	1000	TRLG 20.00X1000-36	●	19	30	32	60	36	TOHT09RS
20.00	1500	TRLG 20.00X1500-24	●	19	30	32	60	24	TOHT09RS
20.00	1500	TRLG 20.00X1500-U05	●	19	30	31.75	70	U05	TOHT09RS
20.00	1500	TRLG 20.00X1500-36	●	19	30	32	60	36	TOHT09RS
21.00	1000	TRLG 21.00X1000-24	●	20	31	32	60	24	TOHT10RS
21.00	1000	TRLG 21.00X1000-U05	●	20	31	31.75	70	U05	TOHT10RS
21.00	1000	TRLG 21.00X1000-36	●	20	31	32	60	36	TOHT10RS
21.00	1500	TRLG 21.00X1500-24	●	20	31	32	60	24	TOHT10RS
21.00	1500	TRLG 21.00X1500-U05	●	20	31	31.75	70	U05	TOHT10RS
21.00	1500	TRLG 21.00X1500-36	●	20	31	32	60	36	TOHT10RS
22.00	1000	TRLG 22.00X1000-24	●	21	33	32	60	24	TOHT11RS
22.00	1000	TRLG 22.00X1000-U05	●	21	33	31.75	70	U05	TOHT11RS
22.00	1000	TRLG 22.00X1000-36	●	21	33	32	60	36	TOHT11RS
22.00	1500	TRLG 22.00X1500-24	●	21	33	32	60	24	TOHT11RS
22.00	1500	TRLG 22.00X1500-U05	●	21	33	31.75	70	U05	TOHT11RS
22.00	1500	TRLG 22.00X1500-36	●	21	33	32	60	36	TOHT11RS
23.00	1000	TRLG 23.00X1000-24	●	22	34	32	60	24	TOHT11RS
23.00	1000	TRLG 23.00X1000-U05	●	22	34	31.75	70	U05	TOHT11RS
23.00	1000	TRLG 23.00X1000-36	●	22	34	32	60	36	TOHT11RS
23.00	1500	TRLG 23.00X1500-24	●	22	34	32	60	24	TOHT11RS
23.00	1500	TRLG 23.00X1500-U05	●	22	34	31.75	70	U05	TOHT11RS
23.00	1500	TRLG 23.00X1500-36	●	22	34	32	60	36	TOHT11RS
24.00	1000	TRLG 24.00X1000-24	●	23	36	32	60	24	TOHT11RS
24.00	1000	TRLG 24.00X1000-U05	●	23	36	31.75	70	U05	TOHT11RS
24.00	1000	TRLG 24.00X1000-36	●	23	36	32	60	36	TOHT11RS
24.00	1500	TRLG 24.00X1500-24	●	23	36	32	60	24	TOHT11RS
24.00	1500	TRLG 24.00X1500-U05	●	23	36	31.75	70	U05	TOHT11RS
24.00	1500	TRLG 24.00X1500-36	●	23	36	32	60	36	TOHT11RS
25.00	1000	TRLG 25.00X1000-24	●	24	37	32	60	24	TOHT11RS
25.00	1000	TRLG 25.00X1000-U05	●	24	37	31.75	70	U05	TOHT11RS
25.00	1000	TRLG 25.00X1000-36	●	24	37	32	60	36	TOHT11RS
25.00	1500	TRLG 25.00X1500-24	●	24	37	32	60	24	TOHT11RS
25.00	1500	TRLG 25.00X1500-U05	●	24	37	31.75	70	U05	TOHT11RS
25.00	1500	TRLG 25.00X1500-36	●	24	37	32	60	36	TOHT11RS
26.00	1000	TRLG 26.00X1000-25	●	25	39	40	70	25	TOHT12RS
26.00	1000	TRLG 26.00X1000-U06	●	25	39	38.1	70	U06	TOHT12RS
26.00	1500	TRLG 26.00X1500-25	●	25	39	40	70	25	TOHT12RS
26.00	1500	TRLG 26.00X1500-U06	●	25	39	38.1	70	U06	TOHT12RS
27.00	1000	TRLG 27.00X1000-25	●	26	40	40	70	25	TOHT12RS
27.00	1000	TRLG 27.00X1000-U06	●	26	40	38.1	70	U06	TOHT12RS
27.00	1500	TRLG 27.00X1500-25	●	26	40	40	70	25	TOHT12RS
27.00	1500	TRLG 27.00X1500-U06	●	26	40	38.1	70	U06	TOHT12RS
28.00	1000	TRLG 28.00X1000-25	●	27	42	40	70	25	TOHT12RS
28.00	1000	TRLG 28.00X1000-U06	●	27	42	38.1	70	U06	TOHT12RS
28.00	1500	TRLG 28.00X1500-25	●	27	42	40	70	25	TOHT12RS
28.00	1500	TRLG 28.00X1500-U06	●	27	42	38.1	70	U06	TOHT12RS

Designation system

TRLG	16.50	X	900	-	23
Series	Drill dia. øDc (mm)		Length L (mm)		Driver code

Designation for special drills

Drill dia. øDc (mm)	Dimensions (mm)		
	ød1	L	x
16.00 - 16.79	15.5	400 - 2400	24
16.80 - 17.69	16.2	400 - 2400	25
17.70 - 18.69	17.2	400 - 2400	27
18.70 - 19.69	18.2	400 - 2400	28
19.70 - 20.69	19	400 - 2400	30
20.70 - 21.69	20	400 - 2400	31
21.70 - 22.69	21	400 - 2400	33

Drill dia. øDc (mm)	Dimensions (mm)		
	ød1	L	x
22.70 - 23.69	22	400 - 2400	34
23.70 - 24.69	23	400 - 2400	36
24.70 - 25.69	24	400 - 2400	37
25.70 - 26.69	25	400 - 2400	39
26.70 - 27.69	26	400 - 2400	40
27.70 - 28.00	27	400 - 2400	42

Insert

TOHT080305R-NDJ

TOHT090305R-NDJ - TOHT120405R-NDJ

S chipbreaker

- Low cutting force
- Great for high-feed machining

Drill dia. øDc (mm)	Cat. No.	Grade		Dimensions (mm)	
		AH725		ød	T
16.00 - 18.00	TOHT080305R-NDJ	●		8.55	2.8
18.01 - 20.00	TOHT090305R-NDJ	●		8.32	3.0
20.01 - 21.99	TOHT100305R-NDJ	●		9.23	3.3
22.00 - 25.00	TOHT110405R-NDJ	●		10.40	3.8
25.01 - 28.00	TOHT120405R-NDJ	●		11.59	4.3

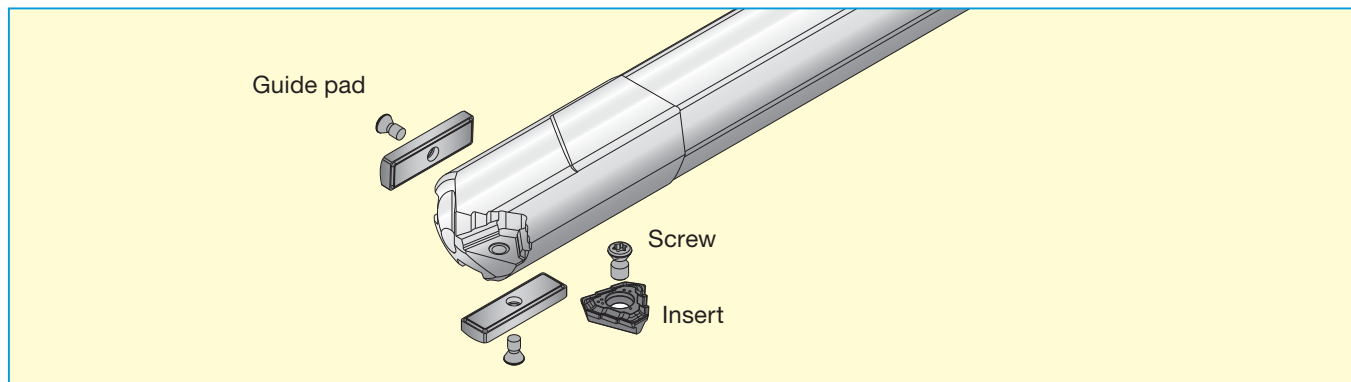
● : Stocked items

Grade area

ISO	Grade	ISO area						
		10	15	20	25	30	35	40
P	AH725							
M	AH725							
K	AH725							
S	AH725							
N	AH725							
H	AH725							

● Replacement parts

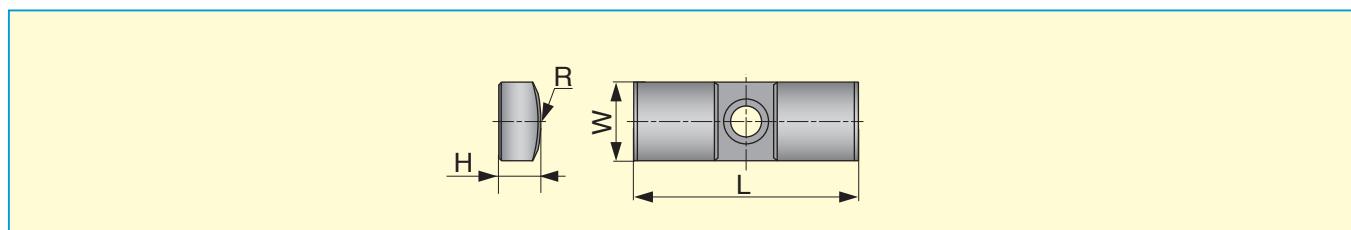
Screw and wrench



Drill dia. $\varnothing D_c$ (mm)	Insert			Guide pad		
	Cat. No.	Screw 	Wrench 	Cat. No.	Screw 	Wrench
16.00 - 18.00	TOHT080305R-NDJ	SR14-560/S	T-8F	GP06-075	SR34-508	T-7F
18.01 - 20.00	TOHT090305R-NDJ	SR14-560/S	T-8F	GP06-085	SR34-508	T-7F
20.01 - 21.00	TOHT100305R-NDJ	SR34-506	T-9F	GP06-085	SR34-508	T-7F
21.01 - 21.99	TOHT100305R-NDJ	SR34-506	T-9F	GP06-100	SR34-508	T-7F
22.00 - 25.00	TOHT110405R-NDJ	SR14-571/S	T-15F	GP06-100	SR34-508	T-7F
25.01 - 28.00	TOHT120405R-NDJ	SR14-506	T-15F	GP06	SR34-508	T-7F

- Drill head comes with 1 set of screws and wrenches for the insert and guide pad.
- Inserts and guide pads are not included and must be ordered separately.

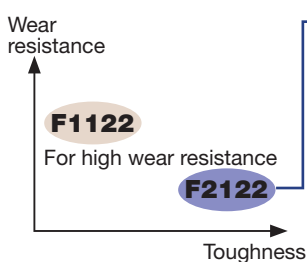
Screw and wrench



Drill dia. $\varnothing D_c$ (mm)	Cat. No.	Grade			Dimensions (mm)			
		F1122	F2122	W	L	H	R	
16.00 - 18.00	GP06-075	●	●	6.0	20.0	3.0	7.5	
18.01 - 21.00	GP06-085	●	●	6.0	20.0	3.0	8.5	
21.01 - 25.00	GP06-100	●	●	6.0	20.0	3.0	10.0	
25.01 - 28.00	GP06	●	●	6.0	20.0	3.0	12.0	

● : Stocked items

Grade



First recommendation

- Suitable for various workpiece materials
- Long tool life due to unique substrate and coating
- Applicable for both water-soluble and water-insoluble cutting coolant

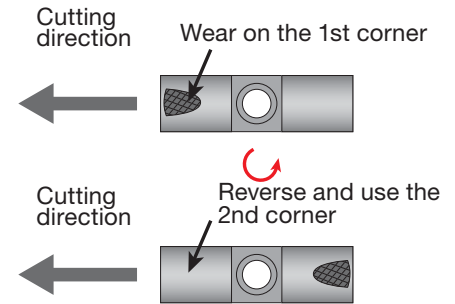
Designation system

GP	06-075	F2122
Series	Size	Grade

Replacing guide pads

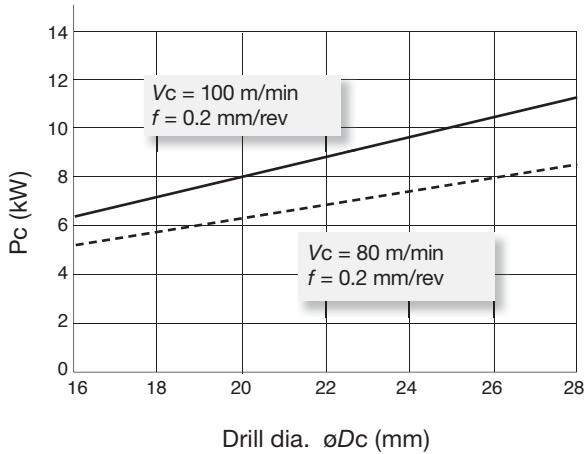
Guide pads are subject to wear like inserts

- Each guide pad has 2 corners.
- When half the carbide on the 1st corner shows wear, reverse the guide pad and use the 2nd corner.
- Replace the guide pad with a new one when the 2nd corner shows the same wear as on the 1st corner.

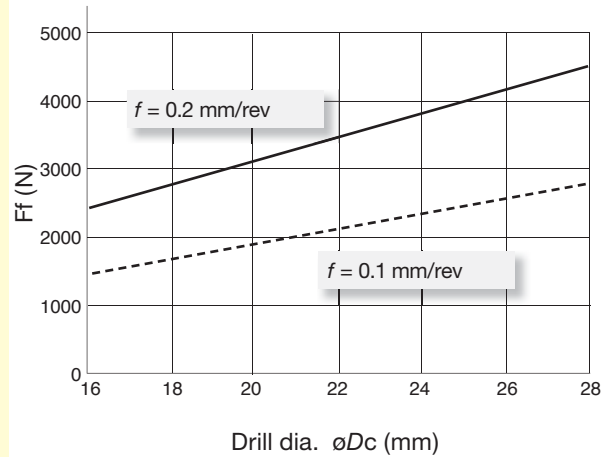


Machine setting

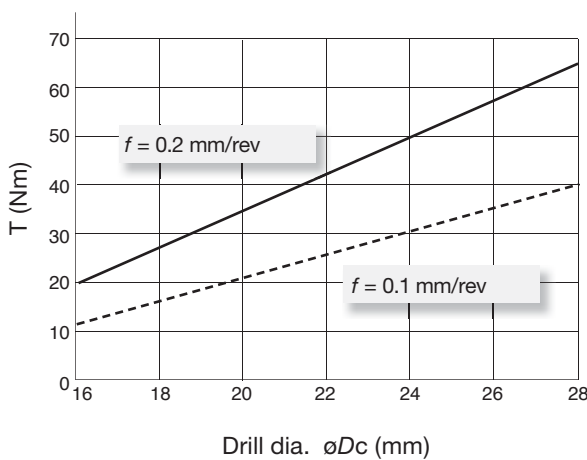
Net power



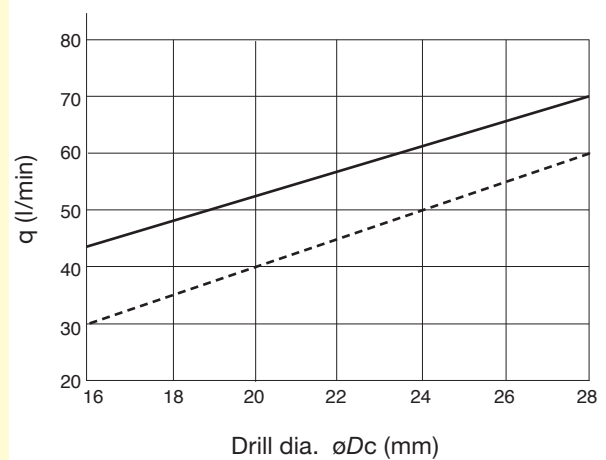
Feed force



Torque



Coolant volume

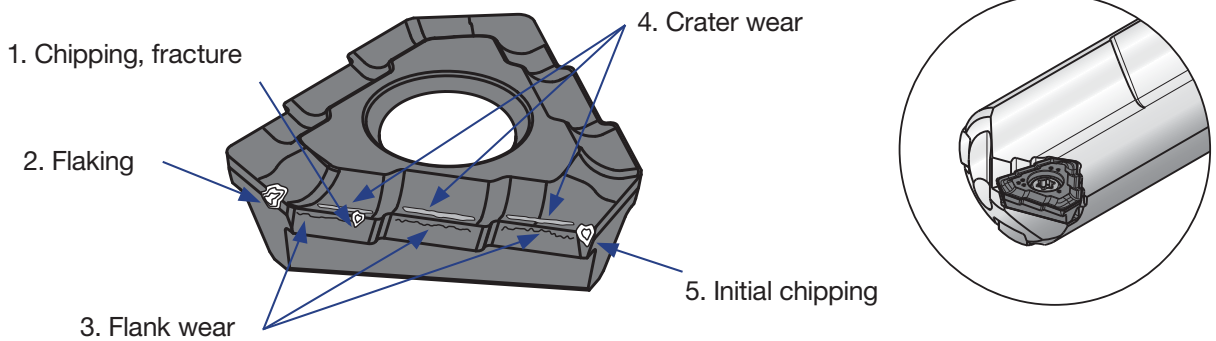


Standard cutting conditions

ISO	Workpiece materials				Hardness (HB)	Cutting speed Vc (m/min)	Feed	
							f (mm/rev) Drill dia. øDc (mm) 16.00 - 28.00	
P	Carbon steels	S10C - S25C, SS	0.10 - 0.25%C	Non-hardened	125	80 - 140	0.10 - 0.20	
		Casting steels	S25C - S55C	0.25 - 0.25%C	Non-hardened	190	80 - 140	0.10 - 0.20
	0.25 - 0.25%C			Hardened and tempered	250	80 - 140	0.10 - 0.20	
	High carbon steels	SK	0.55 - 0.80%C	Non-hardened	220	80 - 140	0.10 - 0.20	
	Carbon tool steels		0.55 - 0.80%C	Hardened and tempered	300	80 - 140	0.10 - 0.20	
	Low alloy steels	SNC, DCr, SNCM SCM, SMn		Non-hardened	200	80 - 120	0.10 - 0.20	
	Casting steels			Hardened and tempered	275	80 - 120	0.10 - 0.20	
			(alloying element < 5%)		Hardened and tempered	300	80 - 120	0.10 - 0.20
					Hardened and tempered	350	80 - 120	0.10 - 0.20
	High alloy steels	SNS, SKD, SKT SKH, SK		Non-hardened	200	80 - 120	0.10 - 0.20	
Casting steel Tool steels			Hardened and tempered	325	80 - 120	0.10 - 0.20		
M	Stainless steels	SUS430		Ferritic	200	80 - 140	0.08 - 0.10	
		SUS410, 420J		Martensite	240	80 - 140	0.08 - 0.10	
		SUS304, SUS316L		Austenite	180	80 - 140	0.08 - 0.10	
K	Ductile cast irons	FCD400 - FCD450		Ferritic / Pearlitic	180	80 - 140	0.10 - 0.30	
		FCD500 - FCD700		Pearlitic	180	80 - 140	0.10 - 0.30	
	Gray cast irons	FC100 - FC200		Low tensile strength	180	80 - 140	0.10 - 0.30	
		FC250 - FC350		High tensile strength	180	80 - 140	0.10 - 0.30	
	Malleable cast irons	FCMB, FCMW		Ferritic	180	80 - 140	0.10 - 0.30	
		FCMWP, FCMP		Pearlitic	180	80 - 140	0.10 - 0.30	
N	Aluminum alloys Forging			Non-aged	60	65 - 130	0.10 - 0.20	
				Soluted, Aged	100	65 - 130	0.08 - 0.18	
	Aluminum alloys Casting		≤ 12% Si		Non-aged	75	65 - 130	0.08 - 0.18
					Soluted, Aged	90	65 - 130	0.08 - 0.18
		> 12% Si		High silicon	130	65 - 130	0.08 - 0.18	
	Copper alloys		> 1% Pb		Free cutting copper	110	65 - 130	0.08 - 0.18
					Brass, Red brass	90	65 - 130	0.08 - 0.18
				Electrolytic copper	100	65 - 130	0.08 - 0.18	
S	Nickel-based alloys		Fe base	Non-aged	200	20 - 50	0.08 - 0.18	
				Soluted, Aged	280	20 - 50	0.08 - 0.18	
			Ni / Co base	Non-aged	250	20 - 50	0.08 - 0.18	
				Soluted, Aged	350	20 - 50	0.08 - 0.18	
	Titanium alloys		α		Rm400	30 - 60	0.08 - 0.18	
			α-β		Rm1050	30 - 60	0.08 - 0.18	

● Troubleshooting for insert wear

Examples of trouble with cutting edge



Problem	Cause	Solution	
		Grade	Cutting conditions / other
Chipping, fracture	- Excessive vibration or shock - Separated built-up edge	Use tough grade	- Reduce feed rate - Remove vibration
Flaking	Excessive vibration or shock	Use tough grade	- Reduce feed rate - Remove vibration
Flank wear	- Cutting speed that is too high - Inadequate tool toughness	- Use grade with high wear resistance - Use coated grade	- Reduce cutting speed - Reduce feed rate - Use proper coolant
Crater wear	- Cutting speed that is too high - Feed rate that is too high - Inadequate tool toughness	- Use grade with high wear resistance - Use coated grade	- Reduce cutting speed - Reduce feed rate - Use proper coolant
Initial chipping	- Inappropriate guide bush or pilot hole - Misalignment	Use tough grade	- Adjust or change guide bush or pilot hole - Reduce feed rate - Correct misalignment

● Cutting condition and chip form

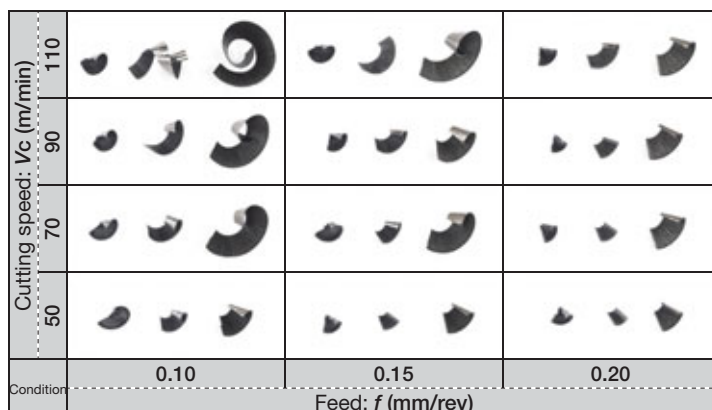
How to decide the chip form

Generally, chip length should be 3 - 4 times its width, but it tends to be longer with difficult-to-cut materials. In that case, smooth chip evacuation will be provided by making chips thinner, in other words, reducing the feed rate.

Below picture shows chip formation for different cutting speeds and feeds. Short chips are delivered reducing the cutting speed or increasing the feed.

Chip formation

Chip formation is affected by multiple factors, such as workpiece material, chipbreaker geometry, cutting speed, feed, type of coolant, and coolant temperature. Suitable chip formation depends on each cutting operation but is controllable by changing the cutting conditions.



Workpiece material: Low alloy steel (AISI4340)

UNITAC drill series for deep hole drilling

BTA system

Solid drilling



Single tube system



Double tube system

Code	Appearance	Diameter range øDc (mm)	Hole tolerance IT	Surface finish Ra (µm)	Drill head type	STS Single Tube System		DTS Double Tube System	Feature
						Outer thread	Inner thread		
MBU		8.00 - 14.79	9	2	Brazed tips	○	-	-	- Higher productivity and better surface finish than gundrill - Good chip breaking with 3-step cutting edges
UTE		12.60 - 20.00	9	2		○	-	-	- Higher productivity and better surface finish than gundrill - Good chip breaking with 3-step cutting edges
BTU		12.60 - 65.00	9	2		○	-	-	- Good chip breaking with 3-step cutting edges - Covers all materials with various carbide grade combinations
ETU		18.40 - 65.00	9	2		-	-	○	- Good chip breaking with 3-step cutting edges - Covers all materials with various carbide grade combinations
FNTR		16.00 - 28.00	10	3	Indexable inserts	○	○	○	- Direct-mounting type avoid diameter setting - The first H-class, 3-cornered insert, insert type in the market
FNBM		25.00 - 65.00	10	3		○	○	○	- Direct-mounting type avoid diameter setting - Highly accurate hole drilling with H class insert
KUSTS KUDTS		38.00 - 247.99	10	3		○	○	○	- Cartridge type with adjustable diameter - Covers a wide application area with various options

Counterboring

Code	Appearance	Diameter range øDc (mm)	Hole tolerance IT	Surface finish Ra (µm)	Drill head type	STS Single Tube System		DTS Double Tube System	Feature
						Outer thread	Inner thread		
KUSTR KUDTR		25.00 - 293.99	10	1 - 2	Indexable inserts	○	○	○	- Cartridge type with adjustable diameter - Covers a wide application area with various options

Trepanning

Code	Appearance	Diameter range øDc (mm)	Hole tolerance IT	Surface finish Ra (µm)	Drill head type	STS Single Tube System		DTS Double Tube System	Feature
						Outer thread	Inner thread		
UTT		100.00 - 328.00	10	1 - 2	Indexable inserts	○	○	-	- Cartridge type with adjustable diameter - Covers a wide application area with various options

Indexable deep drills for conventional machines

Code	Appearance	Diameter range øDc (mm)	Hole tolerance IT	Surface finish Ra (µm)	Drill head type	Feature
MCTR		16.00 - 28.00	10	3	Indexable inserts	- High productivity for L/D = 8 - 25 for conventional machines - The first H-class, 3-cornered insert in the market
TRLG		16.00 - 28.00	10	3		- High productivity for L/D = 26 or more for gundrill machines - The first H-class, 3-cornered insert in the market
HFBM		25.00 - 69.00	10	3		- High productivity for L/D = 6 - 15 for M/C's and lathes - Highly accurate hole drilling with H class insert

- The above values may change depending on the machining conditions, materials, etc.

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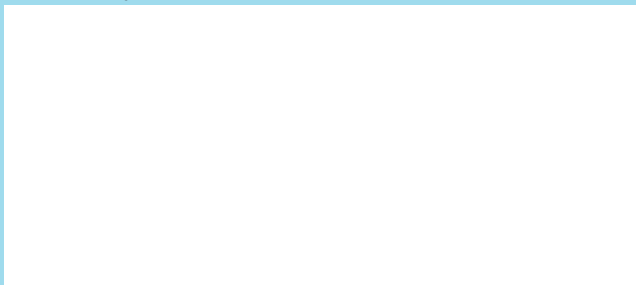
Deep hole tooling manufacturer

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