UNITAC
Member IMC Group

TRI-DRILL

UNITAC Report No. 02-E

www.unitacinc.com

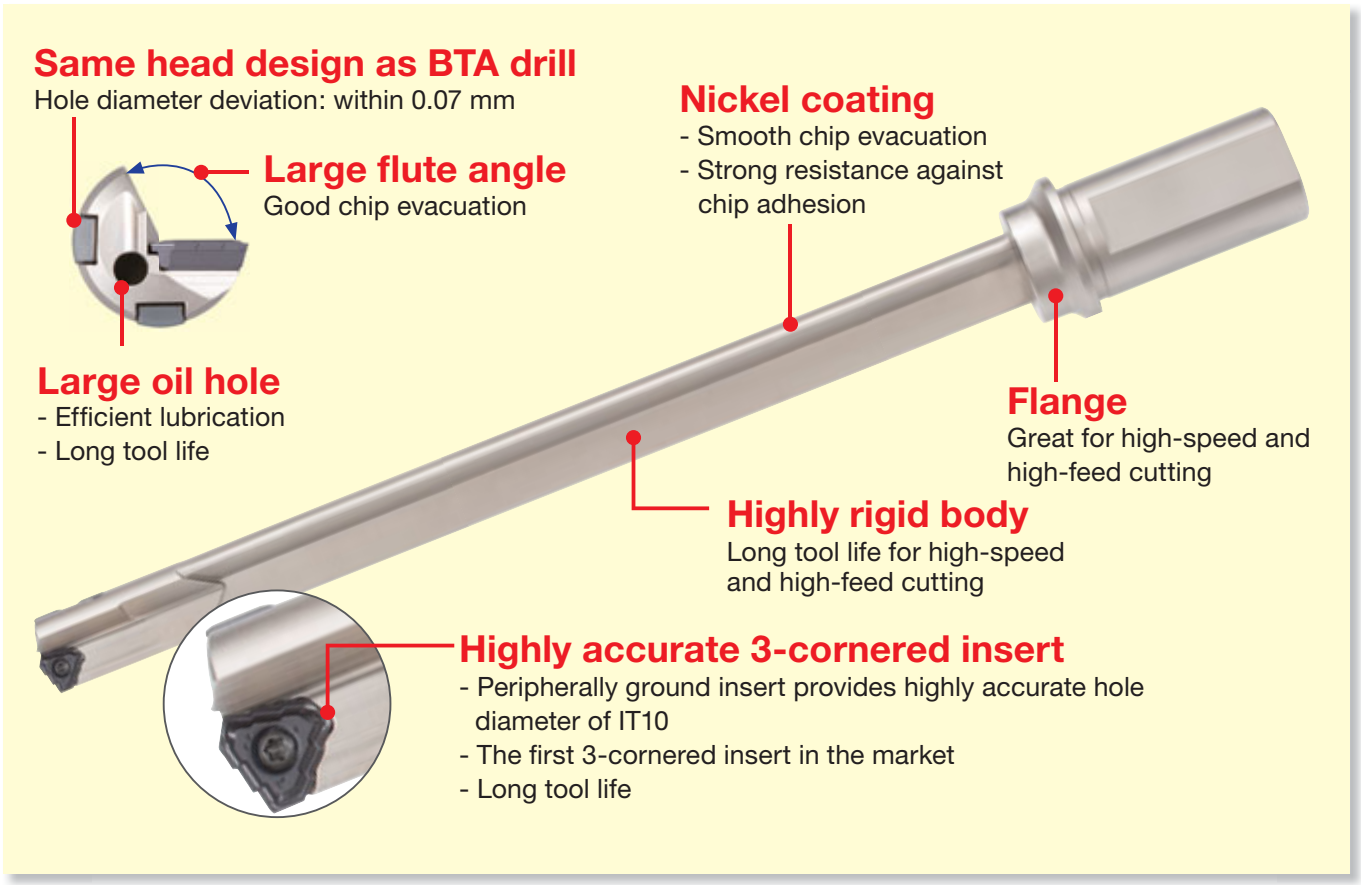
The days of spending money on drilling are over

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

TRI-DRILL

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)



Low cutting force by serrated cutting edge geometry and chipbreakers formation

Practical examples

Achieve a high-efficiency machining

Die & Mold (Prehardened steel)

Drill diameter :øDc (mm)	21
Workpiece material	SKD (Prehardened steel)
Cutting speed :Vc (m/min)	70
Feed : f (mm/rev)	0.07
Hole depth : H (mm)	200
Machine	Horizontal M/C

Comparison with brazed gundrill:
Productivity - 4 times higher

High feed machining (Feed speed: *Vf* = 214 mm/min)

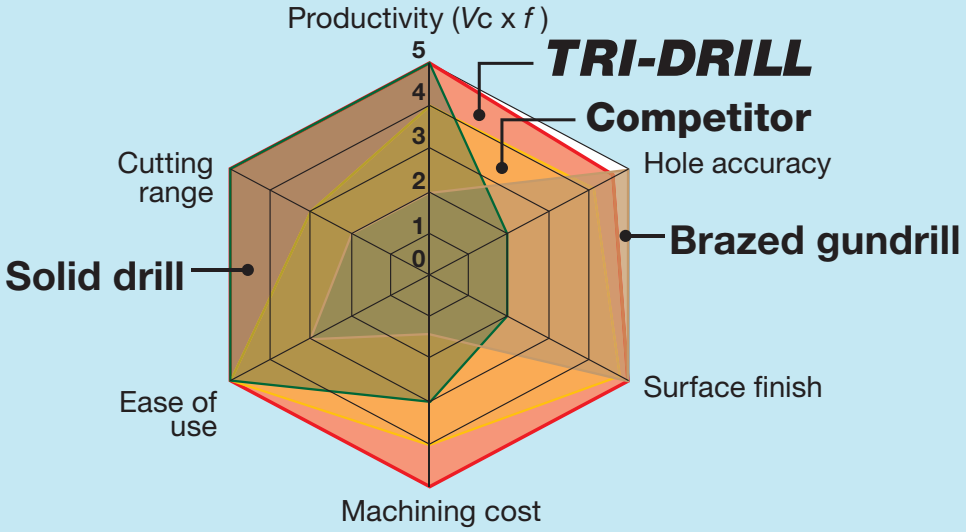
Tube sheet

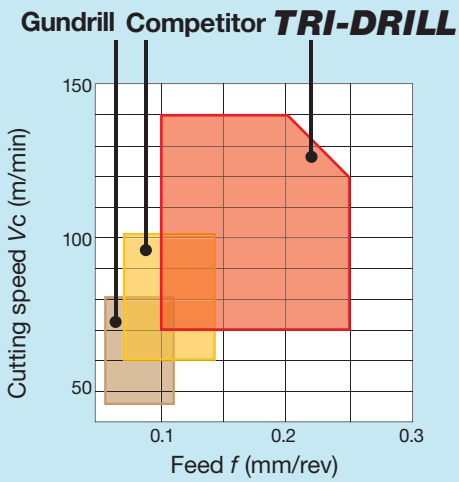
Drill diameter :øDc (mm)	16.40
Workpiece material	SB450
Cutting speed :Vc (m/min)	100
Feed : f (mm/rev)	0.11
Hole depth : H (mm)	260
Machine	M/C

Comparison with competitor:
Productivity - 2.2 times higher
Tool life - 3 times longer

Comparison with competitor's product

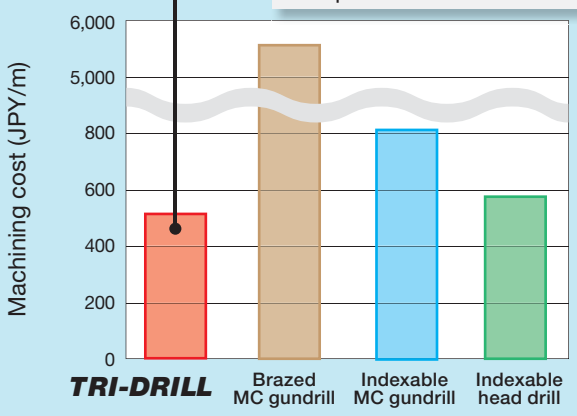
Achieve low-cost drilling with high accuracy



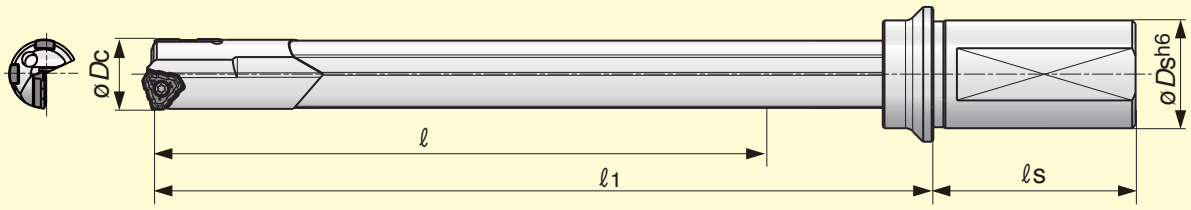


12 % of cost reduction

Drill diameter : øDc = ø20 mm
: L/D = 12
Workpiece material: Low alloy steels



Drill body



L/D = 10

Drill dia. øDc (mm)	Cat. No.	Stock	Dimensions (mm)					Insert
			ød1	ℓ	øDs	ℓs	ℓ1	
16.00	MCTR 16.00XM25-10	●	15.5	170	25	56	209	TOHT08RS
16.50	MCTR 16.50XM25-10	●	15.5	170	25	56	209	TOHT08RS
17.00	MCTR 17.00XM25-10	●	16.2	180	25	56	220	TOHT08RS
18.00	MCTR 18.00XM25-10	●	17.2	190	25	56	232	TOHT08RS
19.00	MCTR 19.00XM25-10	●	18.2	200	25	56	243	TOHT09RS
20.00	MCTR 20.00XM32-10	●	19	210	32	60	255	TOHT09RS

L/D = 15

Drill dia. øDc (mm)	Cat. No.	Stock	Dimensions (mm)					Insert
			ød1	ℓ	øDs	ℓs	ℓ1	
16.00	MCTR 16.00XM25-15	●	15.5	255	25	56	294	TOHT08RS
16.50	MCTR 16.50XM25-15	●	15.5	255	25	56	294	TOHT08RS
17.00	MCTR 17.00XM25-15	●	16.2	270	25	56	310	TOHT08RS
17.50	MCTR 17.50XM25-15	●	16.2	270	25	56	310	TOHT08RS
18.00	MCTR 18.00XM25-15	●	17.2	285	25	56	327	TOHT08RS
18.50	MCTR 18.50XM25-15	●	17.2	285	25	56	327	TOHT09RS
19.00	MCTR 19.00XM25-15	●	18.2	300	25	56	343	TOHT09RS
19.50	MCTR 19.50XM25-15	●	18.2	300	25	56	343	TOHT09RS
20.00	MCTR 20.00XM32-15	●	19	315	32	60	360	TOHT09RS
21.00	MCTR 21.00XM32-15	●	20	330	32	60	376	TOHT10RS
22.00	MCTR 22.00XM32-15	●	21	345	32	60	393	TOHT11RS
23.00	MCTR 23.00XM32-15	●	22	360	32	60	409	TOHT11RS
24.00	MCTR 24.00XM32-15	●	23	375	32	60	426	TOHT11RS
25.00	MCTR 25.00XM32-15	●	24	390	32	60	442	TOHT11RS
26.00	MCTR 26.00XM40-15	●	25	405	40	70	449	TOHT12RS
27.00	MCTR 27.00XM40-15	●	26	420	40	70	465	TOHT12RS
28.00	MCTR 28.00XM40-15	●	27	420	40	70	467	TOHT12RS

● : Stocked items

L/D = 25

Drill dia. øDc (mm)	Cat. No.	Stock	Dimensions (mm)					Insert
			ød1	ℓ	øDs	ℓs	ℓ1	
16.00	MCTR 16.00XM25-25	●	15.5	425	25	56	464	TOHT08RS
16.50	MCTR 16.50XM25-25	●	15.5	425	25	56	464	TOHT08RS
17.00	MCTR 17.00XM25-25	●	16.2	450	25	56	490	TOHT08RS
17.50	MCTR 17.50XM25-25	●	16.2	450	25	56	490	TOHT08RS
18.00	MCTR 18.00XM25-25	●	17.2	475	25	56	517	TOHT08RS
18.50	MCTR 18.50XM25-25	●	17.2	475	25	56	517	TOHT09RS
19.00	MCTR 19.00XM25-25	●	18.2	500	25	56	543	TOHT09RS
19.50	MCTR 19.50XM25-25	●	18.2	500	25	56	543	TOHT09RS
20.00	MCTR 20.00XM32-25	●	19	525	32	60	570	TOHT09RS
21.00	MCTR 21.00XM32-25	●	20	550	32	60	596	TOHT10RS
22.00	MCTR 22.00XM32-25	●	21	575	32	60	623	TOHT11RS
23.00	MCTR 23.00XM32-25	●	22	600	32	60	649	TOHT11RS
24.00	MCTR 24.00XM32-25	●	23	625	32	60	676	TOHT11RS
25.00	MCTR 25.00XM32-25	●	24	650	32	60	702	TOHT11RS
26.00	MCTR 26.00XM40-25	●	25	675	40	70	719	TOHT12RS
27.00	MCTR 27.00XM40-25	●	26	700	40	70	745	TOHT12RS
28.00	MCTR 28.00XM40-25	●	27	700	40	70	747	TOHT12RS

Designation system

MCTR	16.50	XM	25	-	22
Series	Drill dia. øDc (mm)		Driver dia. øDs (mm)		L/D

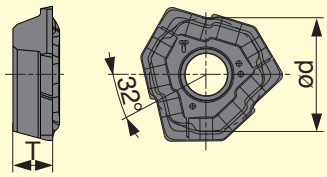
Designation for special drills

Drill dia. øDc (mm)	Dimensions (mm)				
	ød1	ℓ	øDs	ℓs	ℓ1
16.00 - 16.79	15.5	136 - 425	25	56	175 - 464
16.80 - 17.69	16.2	144 - 450	25	56	184 - 490
17.70 - 18.69	17.2	152 - 475	25	56	194 - 517
18.70 - 19.69	18.2	160 - 500	25	56	203 - 543
19.70 - 20.69	19	168 - 525	32	60	213 - 570
20.70 - 21.69	20	176 - 550	32	60	222 - 596
21.70 - 22.69	21	184 - 575	32	60	232 - 623
22.70 - 23.69	22	192 - 600	32	60	241 - 649
23.70 - 24.69	23	200 - 625	32	60	251 - 676
24.70 - 25.69	24	208 - 650	32	60	260 - 702
25.70 - 26.69	25	216 - 675	40	70	270 - 719
26.70 - 27.69	26	224 - 700	40	70	279 - 745
27.70 - 28.00	27	224 - 700	40	70	281 - 747

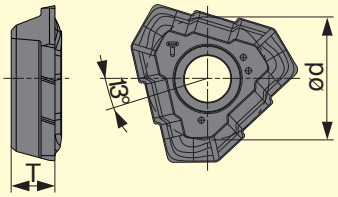
● : Stocked items

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

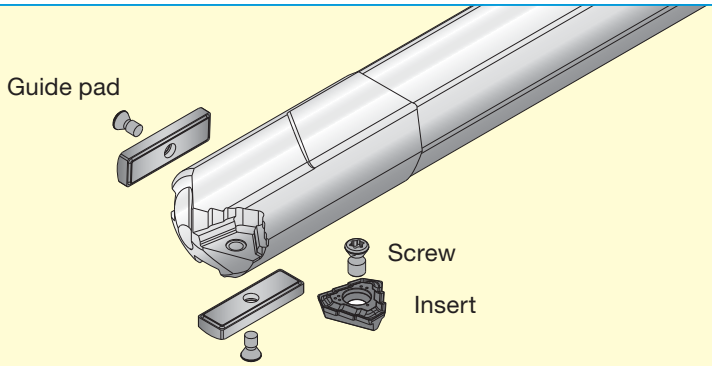
● : Stocked items

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

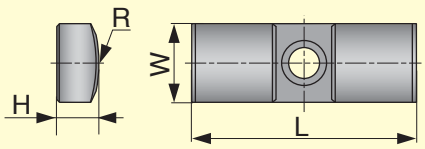
Screw and wrench



Drill dia. øDc (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.

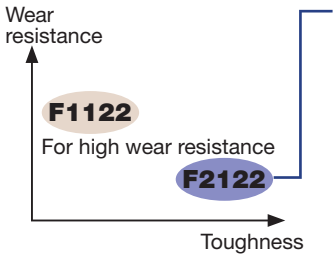
Guide pad



Drill dia. øDc (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

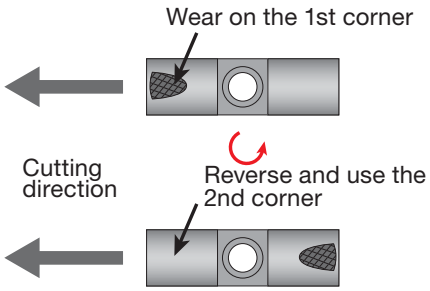
Designation system

GP	06-075	F2122
Series	Size	Grade

Replacing guide pads

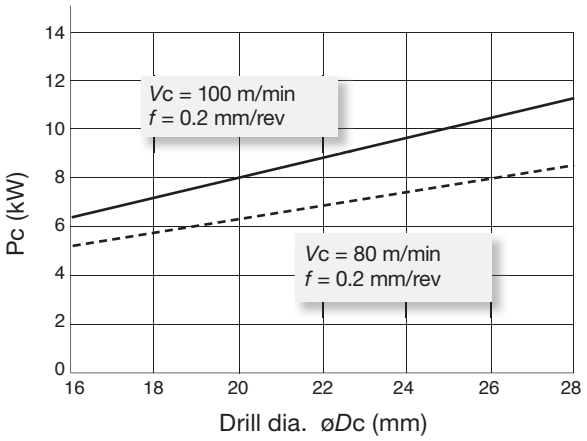
Guide pads are subject to wear like inserts

- 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.

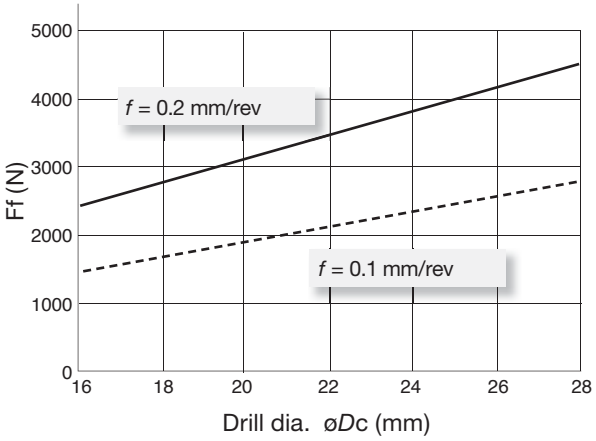


Machine setting

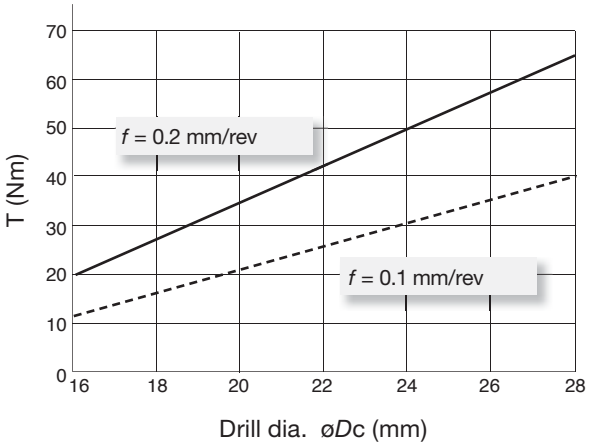
Net power



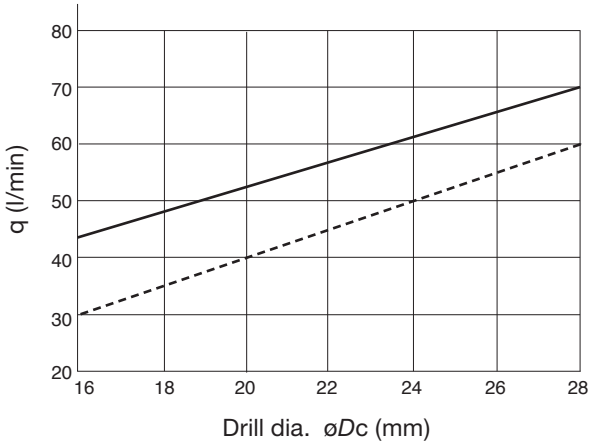
Feed force



Torque



Coolant volume



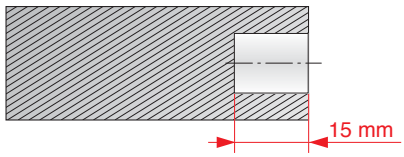
- The above values are only for reference and may need adjustments depending on the machining conditions and workpiece materials.

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 Casting steels High carbon steels Carbon tool steels	S10C - S25C, SS	0.10 - 0.25%C	Non-hardened	125	80 - 140	0.10 - 0.20
		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
		SK	0.55 - 0.80%C	Non-hardened	220	80 - 140	0.10 - 0.20
			0.55 - 0.80%C	Hardened and tempered	300	80 - 140	0.10 - 0.20
	Low alloy steels Casting steels (alloying element < 5%)	SNC, DCr, SNCM SCM, SMn		Non-hardened	200	80 - 120	0.10 - 0.20
				Hardened and tempered	275	80 - 120	0.10 - 0.20
				Hardened and tempered	300	80 - 120	0.10 - 0.20
				Hardened and tempered	350	80 - 120	0.10 - 0.20
	High alloy steels Casting steel Tool steels	SNS, SKD, SKT SKH, SK		Non-hardened	200	80 - 120	0.10 - 0.20
				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
				Casted	320	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

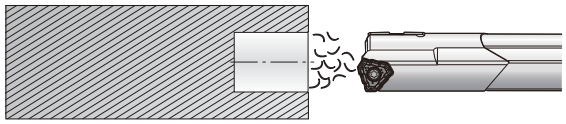
NC cycle

Use NC cycle as instructed below in order to optimize the tool performance safely.



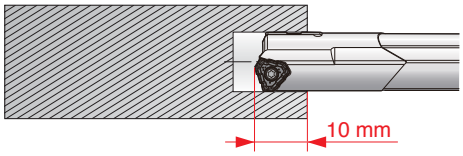
1. Drill a pilot hole

Hole dia. = tool nominal dia. +0.03 - +0.1 mm
Hole depth = 15 mm



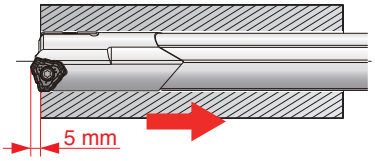
2. Slowly insert Tri-Drill into the pilot hole at low speed with coolant

Vc = 5 - 10 m/min
f = 0.5 - 1.0 mm/rev
Hole depth = 10 mm



3. Start drilling up to the depth of 25 mm

Vc : 100 %
f : 80 %



4. Increase feed and continue drilling until the drill head passes through the workpiece material by 5 mm.

Vc : 100 %
f : 100 %

5. Finish drilling

For safety, be sure to stop rotating and coolant supply before moving the drill head back to the starting position.

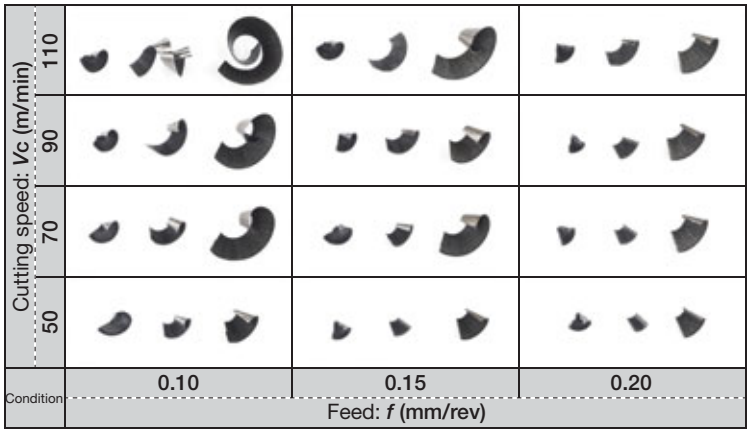
Cutting condition and chip form

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

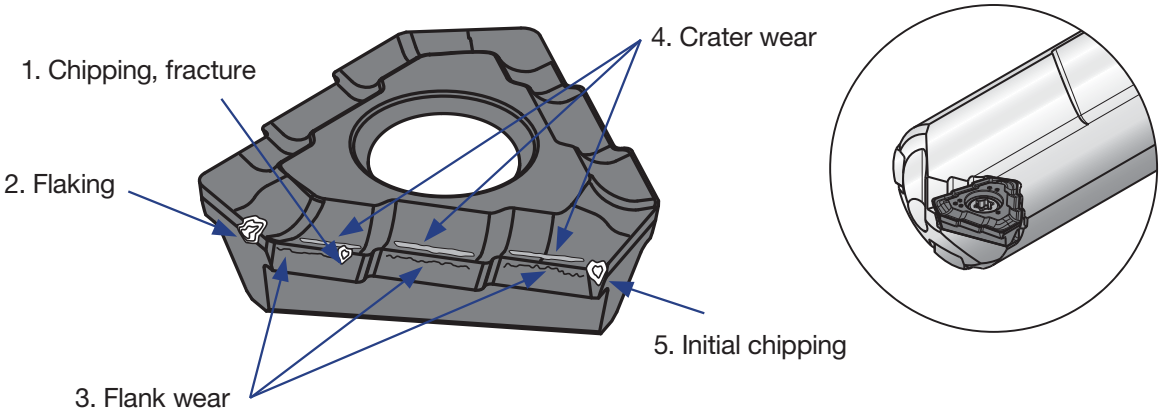
Chip formation is affected by multiple factors, such as workpiece material, chipbreaker geometry, cutting speed, feed, type of coolant, and coolant temperature. Suitable chip formation depends on each cutting operation but is controllable by changing the cutting conditions.



Workpiece material: Low alloy steel (AISI4340)

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

UNITAC drill series for deep hole drilling

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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