Tungaloy
Member IMC Group

Keeping the Customer First

Tungaloy Report No. 409-E

DRILLLINE Indexable drill

TUNGSIX-DRILL

NEW

TDS type

PREMIUMTEC
TUNGALOY

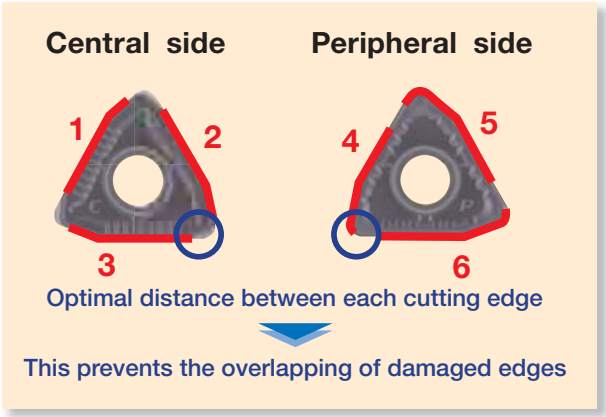
The most economical solution for drilling!

Synergy created with 6-cutting edg grade to provide incredibly econo

Features

Double-sided insert with 6-cutting edges

TungSixDrill is the first indexable drill in the world to adapt double-sided inserts with 6-cutting edges. The 6-cutting edges reduce the number of inserts consumed.



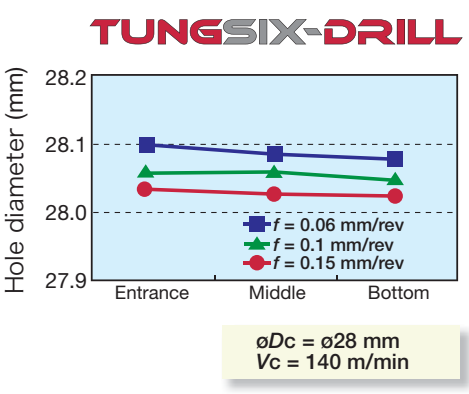
One insert type can be used on both the central and peripheral edge

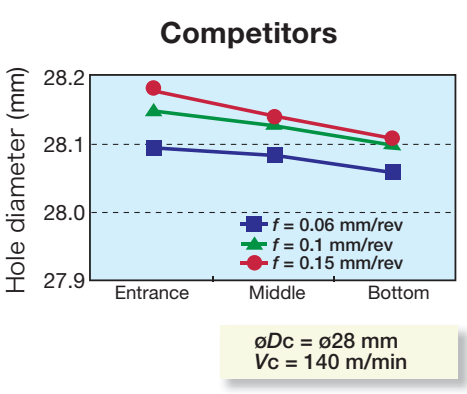
Customers only require one type of insert. This simplifies inventory control.

Optimized cutting balance

Optimized cutting balance of TungSix-Drill provides excellent hole accuracy.

■ Hole diameter

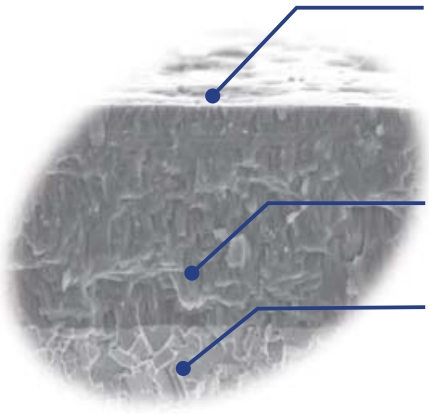




es & revolutionary mical solution

New revolutionary grade

AH9030 PVD coated grade



Special Surface Technology
PREMIUMTEC
TUNGALOY

Smooth insert surface prevents chip adhesion and provides smooth chip flow.

New generation PVD coating

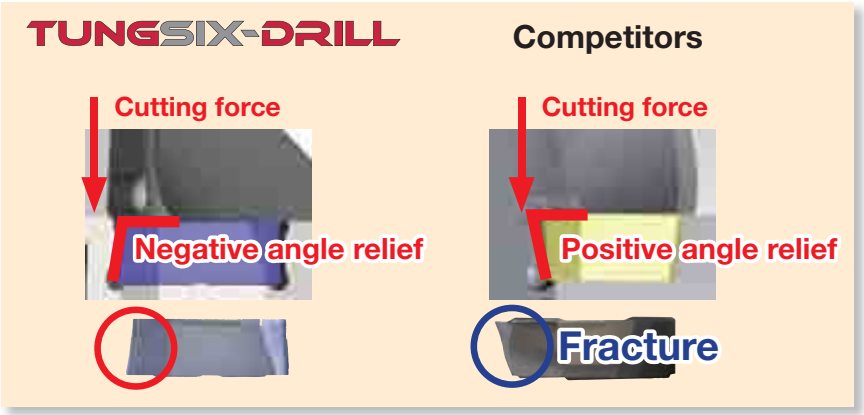
Advanced wear and oxidation resistance.

Adhesion reinforcement technology

This specialized treatment enhances the adhesion between the coating and the substrate. Drastically improves chipping and fracture resistance.

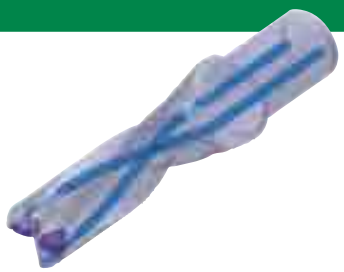
Enhanced corner of central insert

The corner of the central cutting edge on the TungSix-Drill improves performance by adapting a negative angle relief. This enhanced corner prevents fracture.



Twisted coolant holes

Twisted coolant holes improve coolant flow. This improves chip evacuation, cooling and lubrication of the cutting edges.



Chipbreakers

DJ type

General purpose chipbreaker for almost all applications. Features low cutting forces and allows stable drilling.

Central insert

Identification for central edge side

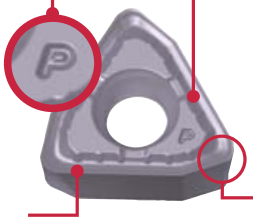
Chipbreaker for central edge

The chipbreaker has thick width and gentle curves. This prevents chips from packing.

Low cutting forces and long tool life

Bumps and grooves formed on the rake face reduce cutting forces and deliver longer tool life.

Peripheral insert



Identification for peripheral edge side

Chipbreaker for peripheral edge

The high rake angle and high breaker wall reduce cutting forces and improve chipbreaking.

Wiper design

Can improve surface finish

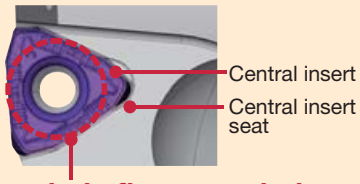
System to avoid wrong insert clamping

TungSix-Drill has been adapted to ensure the new system prevents incorrect insert clamping. Incorrect clamping of central and peripheral insert does not happen.

Note: The drill is designed to avoid wrong insert clamping. Please check the central and peripheral insert faces before setting the insert.

Correct clamping

OK Central insert ▸ Central insert seat

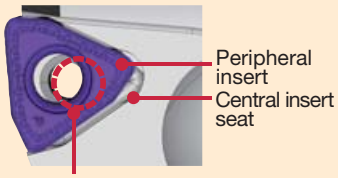


Insert hole fits screw hole

Correctly clamped !

Incorrect clamping

Pheripheral insert ▸ Central insert seat



Insert hole doesn't fit screw hole

Screw can't enter screw hole

Grades

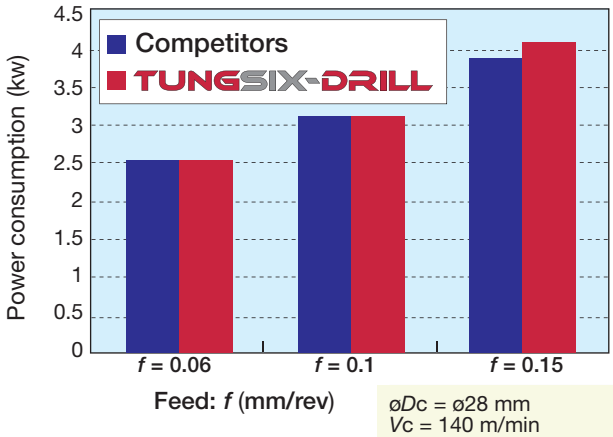
Application	Grade	Substrate			Coating layer		Features
	Application code	Specific gravity	Hardness (HRA)	T.R.S. (GPa)	Main Composition	Thickness (μm)	
P Steel	AH9030 P20 - P35	14.5	90.8	2.8	(Ti, Al)N	5	**For steels and stainless steels** Excellent wear and oxidation resistance in medium to high cutting speed conditions. "PremiumTec" prevents edge welding.
M Stainless	AH9030 M20 - M35	14.5	90.8	2.8	(Ti, Al)N	5	

Cutting performance

Reduction of cutting force

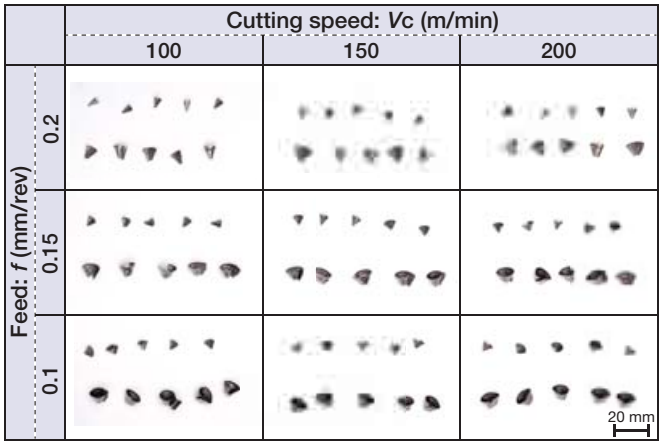
TungSix-Drill adapts its positive land, this enables the drill to reduce the cutting forces even when using double-sided inserts. The cutting forces are almost equal to competitors with single sided inserts.

Spindle power consumption



øDc = ø28 mm
Vc = 140 m/min
Work material: S55C / C55

Chip control

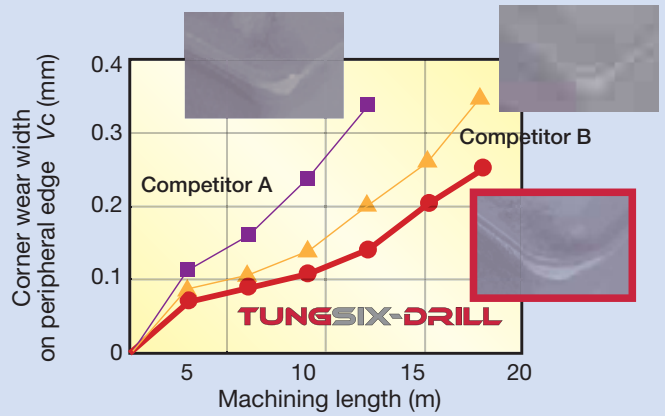


Chips are stably controlled in this range. The chips created are the ideal shape.

Drill	: TDS280W32-3
Insert	: WWMU08X408R-DJ
Grade	: AH9030
Work material	: S45C / C45
Machine	: NC lathe
Hool diameter	: ø28 mm
Hole depth	: H = 70 mm
Coolant	: Wet

Tool life

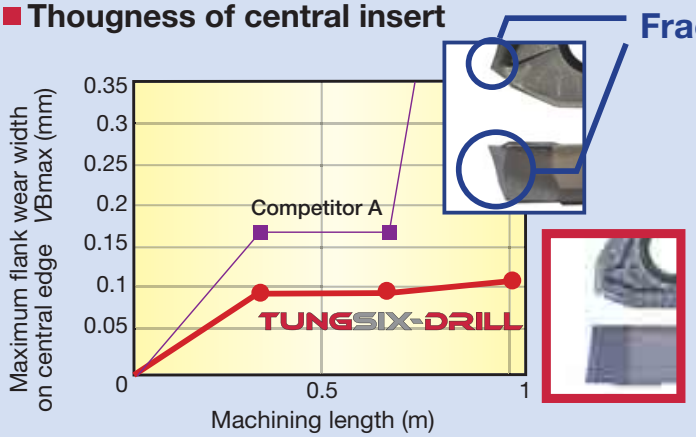
Excellent wear resistance of AH9030



Drill	: TDS280W32-3
Insert	: WWMU08X408R-DJ
Grade	: AH9030
Work material	: S55C / C55
Cutting speed	: *Vc* = 140 m/min
Feed	: *f* = 0.1 mm/rev
Hole diameter	: ø28 mm
Hole depth	: H = 84 mm
Machine	: Horizontal M/C, BT40
Coolant	: Wet (Internal supply)

AH9030 offers superior to wear resistance against competitors.

Thougness of central insert

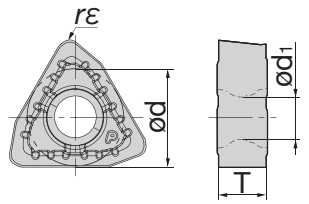


Drill	: TDS280W32-3
Insert	: WWMU08X408R-DJ
Grade	: AH9030
Work material	: Pre-hardened steel (40HRC)
Cutting speed	: *Vc* = 100 m/min
Feed	: *f* = 0.08 mm/rev
Hole diameter	: ø28 mm
Hole depth	: H = 28 mm
Machine	: Vertical M/C, BT50
Coolant	: Wet (Internal supply)

Enhanced corner of central cutting edge prevents fracture even in pre-hardened steel machining.

Inserts

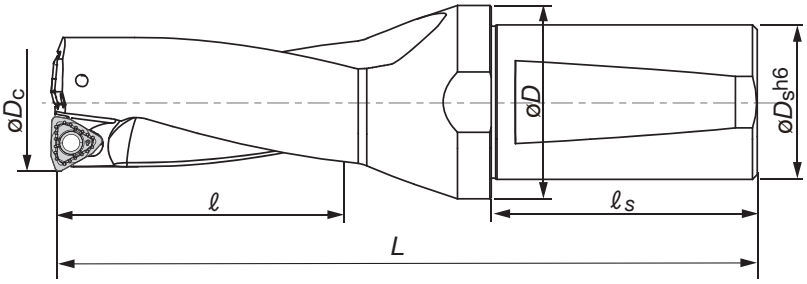
DJ chipbreaker



Cat. No.	Stocked grades PREMIUMTEC NEW AH9030	Dimensions (mm) ød	T	ød1	rε	Applicable drill diameters øDc (mm)
WWMU08X408R-DJ	●	8.0	3.9	3.4	0.8	ø28.0 ~ ø32.0
WWMU09X510R-DJ	●	9.7	4.9	4.4	1.0	ø33.0 ~ ø38.0
WWMU11X512R-DJ	●	11.3	5.7	5.5	1.2	ø39.0 ~ ø46.0
WWMU13X512R-DJ	●	13.0	5.7	5.5	1.2	ø47.0 ~ ø54.0

Drills

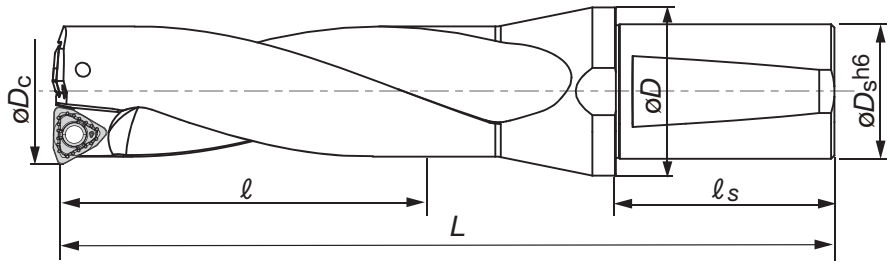
L/D = 2



Cat. No	Stock	Dimensions (mm) øDc	øDs	øD	ℓ	ℓ s	L	Max Offset (Radius)	Weight (kg)	Applicable inserts	Clamping screw	Torx driver
TDS280W32-2	●	28	32	40	56	55	145	1.3	0.6	WWMU08X408R-DJ	CSTB-3	T-9D
TDS290W32-2	●	29			58		148	1.1	0.7			
TDS300W32-2	●	30			60		151	0.8	0.7			
TDS310W32-2	●	31			62		154	0.5	0.7			
TDS320W32-2	●	32			64		157	0.2	0.8			
TDS330W40-2	●	33	40	50	66	65	170	1.7	1.2	WWMU09X510R-DJ	CSTB-4	T-15D
TDS340W40-2	●	34			68		173	1.4	1.2			
TDS350W40-2	●	35			70		176	1.2	1.2			
TDS360W40-2	●	36			72		179	0.9	1.3			
TDS370W40-2	●	37			74		182	0.7	1.3			
TDS380W40-2	●	38			76		185	0.4	1.3			
TDS390W40-2	●	39	40	50	78	65	188	2.2	1.4	WWMU11X512R-DJ	CSTB-5	T-20D
TDS400W40-2	●	40			80		191	1.9	1.4			
TDS410W40-2	●	41			82		194	1.7	1.5			
TDS420W40-2	●	42		55	84		197	1.5	1.6			
TDS430W40-2	●	43			86		200	1.3	1.6			
TDS440W40-2	●	44			88		203	1	1.7			
TDS450W40-2	●	45			90		206	0.7	1.7			
TDS460W40-2	●	46			92		209	0.4	1.8			
TDS470W40-2	●	47	40	55	94	65	212	2.6	1.9	WWMU13X512R-DJ	CSTB-5	T-20D
TDS480W40-2	●	48			96		215	2.4	1.9			
TDS490W40-2	●	49			98		218	2.2	1.9			
TDS500W40-2	●	50			100		221	2	2.0			
TDS510W40-2	●	51			102		224	1.7	2.1			
TDS520W40-2	●	52			104		227	1.5	2.2			
TDS530W40-2	●	53			106		230	1.3	2.3			
TDS540W40-2	●	54			108		233	1	2.4			

● : Stocked items

L/D = 3



Cat. No	Stock	Dimensions (mm)						Max Offset (Radius)	Weight (kg)	Applicable inserts	Clamping screw	Torx driver
		øDc	øDs	øD	ℓ	ℓ s	L					
TDS280W32-3	●	28	32	40	84	55	173	1.3	0.7	WWMU08X408R-DJ	CSTB-3	T-9D
TDS290W32-3	●	29			87		177	1.1	0.7			
TDS300W32-3	●	30			90		181	0.8	0.8			
TDS310W32-3	●	31			93		185	0.5	0.8			
TDS320W32-3	●	32			96		189	0.2	0.9			
TDS330W40-3	●	33	40	50	99	65	203	1.7	1.3	WWMU09X510R-DJ	CSTB-4	T-15D
TDS340W40-3	●	34			102		207	1.4	1.3			
TDS350W40-3	●	35			105		211	1.2	1.3			
TDS360W40-3	●	36			108		215	0.9	1.4			
TDS370W40-3	●	37			111		219	0.7	1.4			
TDS380W40-3	●	38			114		223	0.4	1.5			
TDS390W40-3	●	39	40	50	117	65	227	2.2	1.6	WWMU11X512R-DJ	CSTB-5	T-20D
TDS400W40-3	●	40			120		231	1.9	1.6			
TDS410W40-3	●	41			123		235	1.7	1.7			
TDS420W40-3	●	42		55	126		239	1.5	1.8			
TDS430W40-3	●	43			129		243	1.3	1.8			
TDS440W40-3	●	44			132		247	1	1.9			
TDS450W40-3	●	45			135		251	0.7	2.0			
TDS460W40-3	●	46			138		255	0.4	2.1			
TDS470W40-3	●	47	40	55	141	65	259	2.6	2.2	WWMU13X512R-DJ	CSTB-5	T-20D
TDS480W40-3	●	48			144		263	2.4	2.3			
TDS490W40-3	●	49			147		267	2.2	2.3			
TDS500W40-3	●	50			150		271	2	2.4			
TDS510W40-3	●	51			153		275	1.7	2.5			
TDS520W40-3	●	52			156		279	1.5	2.6			
TDS530W40-3	●	53			159		283	1.3	2.7			
TDS540W40-3	●	54			162		287	1	2.9			

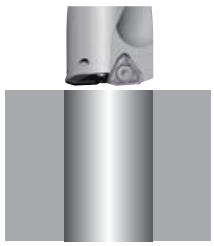
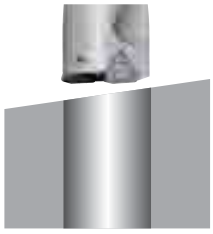
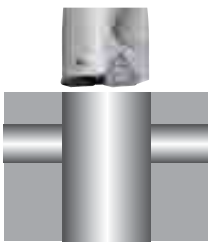
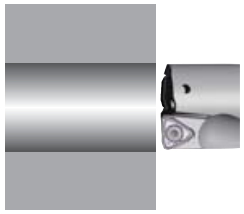
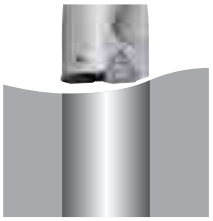
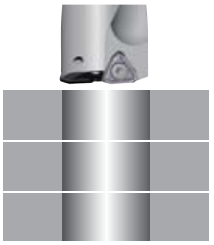
● : Stocked items

Standard cutting conditions

Work materials	Cutting Speed *Vc* (m/min)	Feed: *f* (mm/rev)	
		øDc (mm)	
		ø28 ~ ø32	ø33 ~ ø54
Low carbon steels (C < 0.3) SS400, SM490, S25C etc. (St42-1, St52-3, C25 etc.)	160 - 320	0.04 - 0.10	0.04 - 0.10
Carbon steels (C > 0.3) S45C, S55C etc. (C45, C55 etc.)	80 - 250	0.06 - 0.15	0.08 - 0.18
Low alloy steels SCM415 etc.	160 - 250	0.06 - 0.12	0.06 - 0.14
Alloy steels SCM440, SCr420 etc. (42CrMo4, 20Cr4 etc.)	80 - 200	0.06 - 0.15	0.08 - 0.18
Stainless steels (Austenitic) SUS304, SUS316 etc. (X5CrNi18-9, X5CrNiMo17-12-2 etc.)	100 - 200	0.04 - 0.12	0.04 - 0.12
Stainless steels (Martensitic and ferritic) SUS430, SUS416 etc. (X6Cr17, X20Cr13 etc.)	100 - 200	0.04 - 0.12	0.04 - 0.12
Stainless steels (Precipitation hardening) SUS630 etc. (X5CrNiCuNb16-4 etc.)	80 - 120	0.04 - 0.10	0.06 - 0.10
Grey cast irons FC250 etc. (GG25 etc.)	80 - 250	0.06 - 0.18	0.08 - 0.20
Ductile cast irons FCD700 etc. (GGG70 etc.)	80 - 200	0.06 - 0.18	0.08 - 0.20

Application range

In case of Interrupted cutting, feed should be decreased.

Feed *f* (mm/rev)	Upper table	0.05	0.05	0.05
Application	OK Plane surface 	OK Slant surface 	OK Cross hole 	OK Plunging 
Feed *f* (mm/rev)	0.1	0.05	Disapprove	Disapprove
Application	OK Boring 	OK Round surface 	✕ Stacked plate 	✕ Back boring 

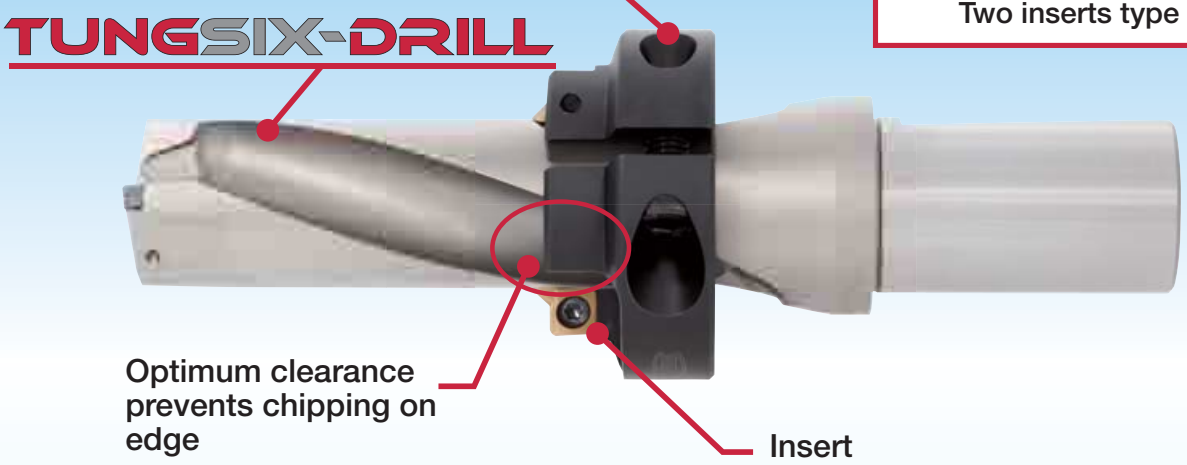
New chamfering tool "TDXCF Series"

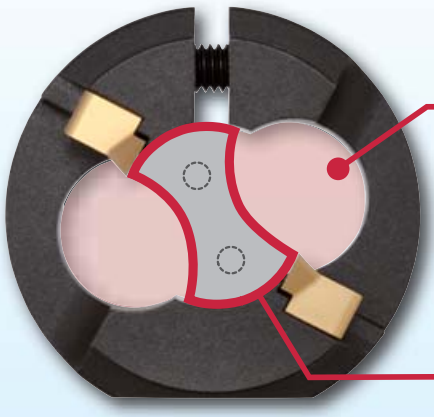
The TDXCF Series with the TungSix-Drill completes both drilling and chamfering at the same time.
This reduces machining processes by chamfering and drilling simultaneously.

Features

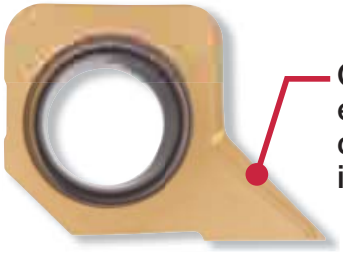
- High productivity with two inserts.
- Optimum space between the drill body and chamfering inserts prevents cutting edges from fracture.

Max. chamfering width: C 2.5 mm
Chamfering angle: 45°
Two inserts type



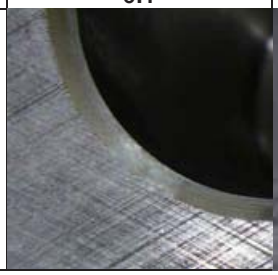


- Insert grade is GH130 which has TiCNO coating for steels.
- Suitable for machining steel, stainless steels and cast irons.



Cutting performance

Surface finish

Tool		Feed: *f* (mm/rev) 0.1	0.13
TDS280W25-3 (L/D = 3)	TDXCF		

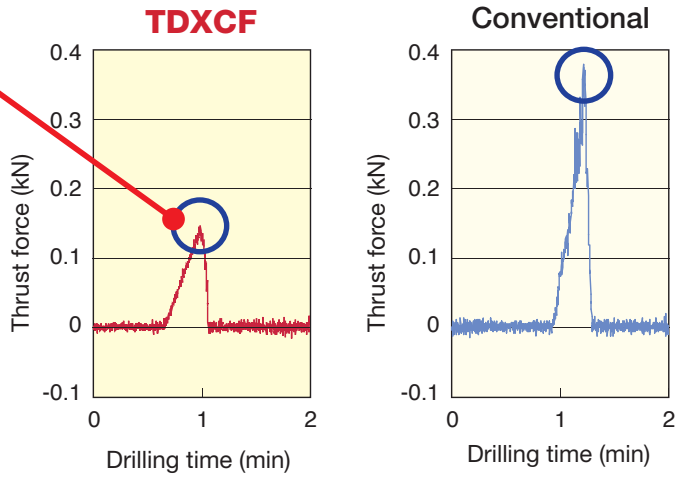
Tool : TDXCF280L30
Work material : Carbon steel S55C / C55 (245HB)
Machine : Vertical M/C, BT40
Coolant : Wet
Cutting condition : *Vc* = 140 m/min
Chamfering width : C = 2.0 mm

- New chamfering tools TDXCF provides stable surface finish.

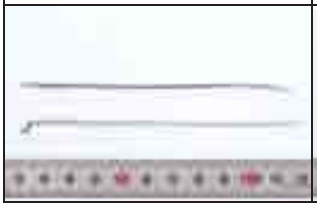
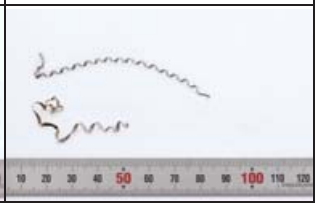
Cutting force

Sharp cutting edge decreases cutting forces by 50% !!

Tool : TDXCF280L30
Work material : Carbon steel S55C / C55 (245HB)
Machine : Vertical M/C, BT40
Coolant : Wet
Cutting condition : *Vc* = 140 m/min
Feed : *f* = 0.10 m/rev
Chamfering width : C = 2.0 mm



Chip control

TDXCF	Conventional
	

- Continuous spiral chips prevent them from wrapping around the drill body or work piece.

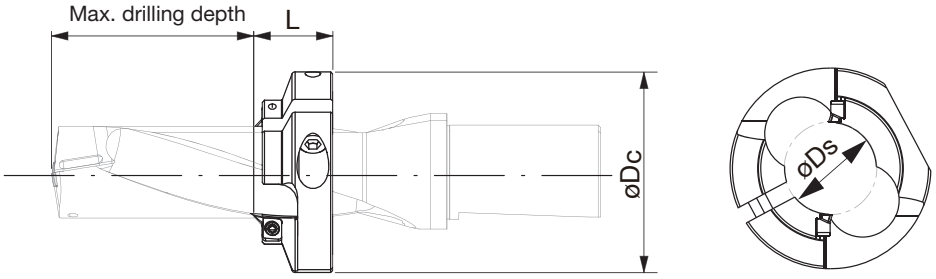
Tool : TDXCF280L30
Work material : Carbon steel S55C / C55 (245HB)
Machine : Vertical M/C, BT40
Coolant : Wet
Cutting condition : *Vc* = 140 m/min
Chamfering width : C = 2.0 mm

Chamfering tool insert & part list

Cat. No.	Insert	Grade, Stock GH130	Insert clamping screw	Torque (N·m)	Ring clamping screw	Torque (N·m)	Wrench for insert	Wrench for ring
TDXCF280L30 ~ TDXCF540L30	XHGX090700R-45A	●	CSPB-4S	3.5	CM8 x 20	8.0	T-15D	P-5

● : Stocked items

Chamfering ring (TDXCF Series)

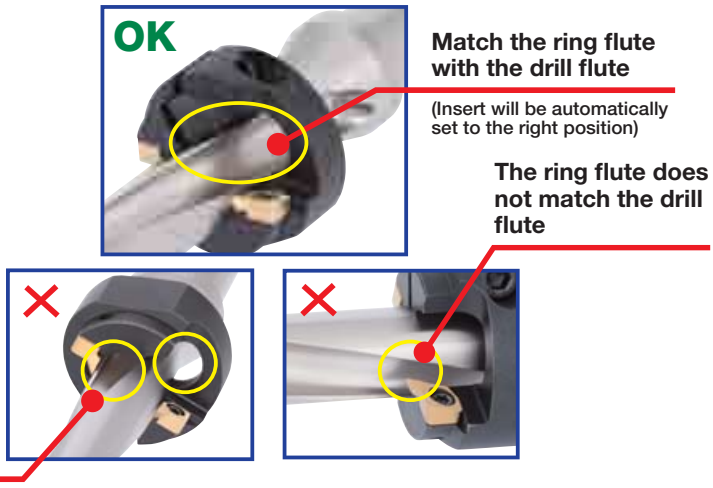


Cat. No.	Stock	Dimensions (mm)				Application drill	Max. drilling depth (mm)	
		øDs	øDc	L	Drill dia. *øDc*		L/D = 2	L/D = 3
TDXCF280L30	●	26.9	64	30	28	**TDS280W32-□**	36.9	64.9
TDXCF290L30	●	27.9	64	30	29	**TDS290W32-□**	39.2	68.2
TDXCF300L30	●	28.9	64	30	30	**TDS300W32-□**	41.5	71.5
TDXCF310L30	●	29.9	64	30	31	**TDS310W32-□**	43.8	74.8
TDXCF320L30	●	30.9	64	30	32	**TDS320W32-□**	46.1	78.1
TDXCF330L30		31.8	64	30	33	**TDS330W40-□**	48.4	81.4
TDXCF340L30		32.8	64	30	34	**TDS340W40-□**	50.7	84.7
TDXCF350L30		33.8	64	30	35	**TDS350W40-□**	53.0	88
TDXCF360L30		34.8	85	30	36	**TDS360W40-□**	56.3	92.3
TDXCF370L30		35.8	85	30	37	**TDS370W40-□**	57.6	94.6
TDXCF380L30		36.8	85	30	38	**TDS380W40-□**	59.9	97.9
TDXCF390L30		37.8	85	30	39	**TDS390W40-□**	62.2	101.2
TDXCF400L30		38.8	85	30	40	**TDS400W40-□**	64.5	104.5
TDXCF410L30		39.8	85	30	41	**TDS410W40-□**	66.8	107.8
TDXCF420L30		40.6	85	30	42	**TDS420W40-□**	69.1	111.1
TDXCF430L30		41.6	85	30	43	**TDS430W40-□**	71.4	114.4
TDXCF440L30		42.6	85	30	44	**TDS440W40-□**	73.7	117.7
TDXCF450L30		43.6	85	30	45	**TDS450W40-□**	76.0	121
TDXCF460L30		44.6	85	30	46	**TDS460W40-□**	79.3	125.3
TDXCF470L30		45.6	85	30	47	**TDS470W40-□**	80.6	127.6
TDXCF480L30		46.6	85	30	48	**TDS480W40-□**	82.9	130.9
TDXCF490L30		47.6	85	30	49	**TDS490W40-□**	85.2	134.2
TDXCF500L30		48.6	85	30	50	**TDS500W40-□**	87.5	137.5
TDXCF510L30		49.6	85	30	51	**TDS510W40-□**	89.8	140.8
TDXCF520L30		50.6	85	30	52	**TDS520W40-□**	92.1	144.1
TDXCF530L30		51.6	85	30	53	**TDS530W40-□**	94.4	147.4
TDXCF540L30		52.6	85	30	54	**TDS540W40-□**	96.7	150.7

● : Stocked items

Points of caution when mounting the chamfering ring on drill body

① Place the ring on the drill body and match the ring flute with the drill flute. Temporarily clamp the ring on the body by lightly tightening the ring screw. Place the inserts on the ring and lightly tighten the insert screws.
② Adjust the ring to the right position with a Presetter, height gauge or Vernier caliper.
③ Securely tighten the ring screw and then the insert screw.

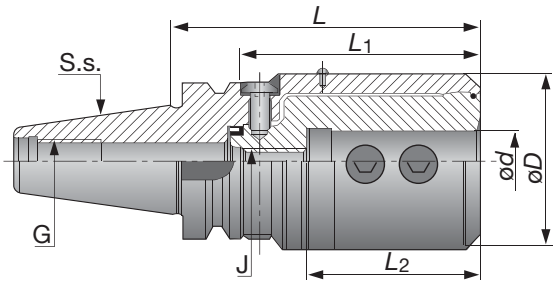


TUNGBORE Adjustable drilling diameter holder

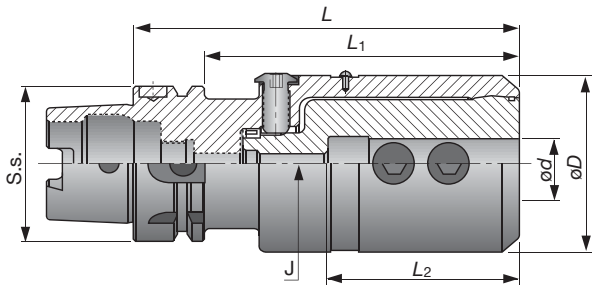
Enables diameter of TungSix-Drill to adjust easily

Specification

BT / DIN69871 type

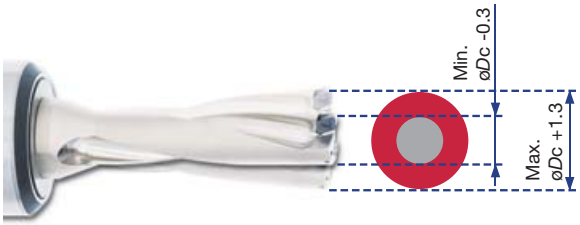


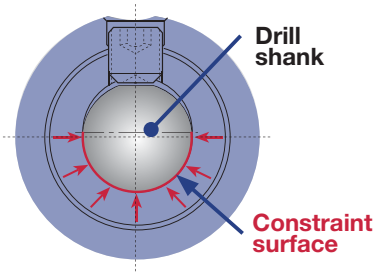
HSK type



Cat. No.	Stock	Dimensions (mm)								Tool Dia. (mm)
		S.s.	ød	øD	L	L1	L2	J	G	
TUNGBORE BT40 EM32	●	40	32.00	72.0	123.50	96.5	71.0	M10	M16	ø28.0 - ø32.0
TUNGBORE BT40 EM40	●	40	40.00	72.0	123.50	96.5	71.0	M10	M16	ø33.0 - ø54.0
TUNGBORE BT50 EM32	●	50	32.00	72.0	134.50	96.5	71.0	M10	M24	ø28.0 - ø32.0
TUNGBORE BT50 EM40	●	50	40.00	72.0	134.50	96.5	71.0	M10	M24	ø33.0 - ø54.0
TUNGBORE HSK A 63 EM32	●	63	32.00	72.0	142.00	116.0	71.0	M10	-	ø28.0 - ø32.0
TUNGBORE HSK A 63 EM40	●	63	40.00	72.0	142.00	116.0	71.0	M10	-	ø33.0 - ø54.0
TUNGBORE DIN69871 40 EM32		40	32	72	135.6	116.5	71	M10	M16	ø28.0 - ø32.0
TUNGBORE DIN69871 40 EM40		40	40	72	135.6	116.5	71	M10	M16	ø33.0 - ø54.0
TUNGBORE DIN69871 50 EM32		50	32	72	115.6	96.5	71	M10	M24	ø28.0 - ø32.0
TUNGBORE DIN69871 50 EM40		50	40	72	115.6	96.5	71	M10	M24	ø33.0 - ø54.0

● : Stocked items





The bore section is actually made from two shifted circular sections. The clamping screw pushes the drill shank through a narrow opening, forcing elastic deformation of the holder. Contact is made around more than 180°, providing a high clamping force.

TUNGBORE

■ TUNGSIX-DRILL

Adjustable range of TungSix-Drill combined with TungBore

Tool diameter øDc (mm)	Adjustable range (mm)		Tool diameter øDc (mm)	Adjustable range (mm)	
	Min. dia. ø	Max. dia. ø		Min. dia. ø	Max. dia. ø
28	28	29.3	**42**	42	43.3
29	29	30.3	**43**	43	44.3
30	30	31.3	**44**	44	45.3
31	31	32	**45**	45	46.3
32	32	32.4	**46**	46	46.8
33	33	34.3	**47**	47	48.3
34	34	35.3	**48**	48	49.3
35	35	36.3	**49**	49	50.3
36	36	37.3	**50**	50	51.3
37	37	38.3	**51**	51	52.3
38	38	38.8	**52**	52	53.3
39	39	40.3	**53**	53	54.3
40	40	41.3	**54**	54	55.3
41	41	42.3			

Regarding adjustment, please refer to the operating instructions in the TungBore leaflet for the TungHold (No. 389-E)

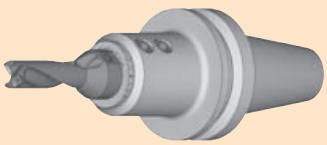
EZ sleeve (Eccentric sleeves for TungSix-Drill)

The function of EZ sleeves

Adjusting the hole diameter when drilling

Adjusting the hole diameter in tool-rotating applications.

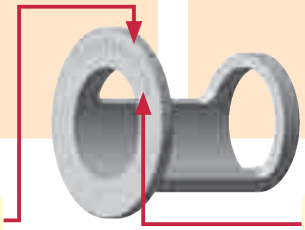
By using EZ sleeve, the hole diameter can be adjusted in the range from +0.6 mm to -0.2 mm.



Adjusting cutting edge height on lathe

Adjusting the cutting edge height in rotating work applications.

By using EZ sleeve, the cutting edge height can be adjusted in the range from +0.3 mm to -0.2 mm. That reduces troubles caused by improper cutting-edge height.



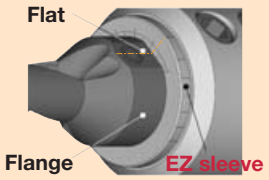
Scale for adjusting the hole diameter in milling machine (Periphery of sleeve)

Scale for adjusting cutting edge height in turning (Front face of sleeve)

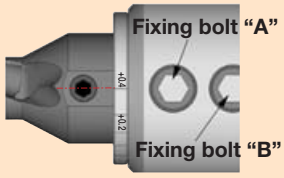
Setting of EZ sleeve

Adjusting the hole diameter on M/C

Set the EZ sleeve between the drill shank and the holder. Align the scale on the periphery of EZ sleeve with the center of the flat on drill flange.



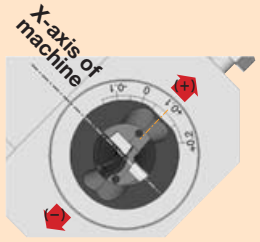
In the figure shown on right, the sleeve is set and the hole diameter will be increased by 0.4 mm.



Adjusting cutting edge height on lathe

Set the EZ sleeve between the drill shank and the toolblock. Align the scale on the front face of the EZ sleeve with the center of the flat on drill flange.

In the figure shown on right, the sleeve is set and the center of the drill will shift by 0.1 mm to the plus (+) direction.

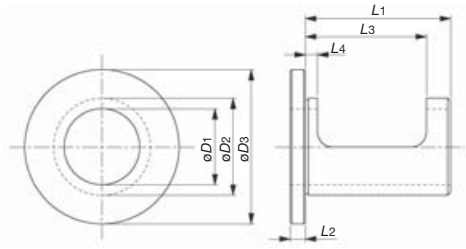


When rotating EZ sleeve, fixing bolts "A" and "B" have to be loosened. After setting the hole diameter, fix the drill body with bolt "A". Then lightly tighten the bolt "B" to fix EZ sleeve. If the bolt "B" is over tightened, EZ sleeve may be damaged.

Cautious points

- Cannot be used for collet chuck holders.
- For adjustments over L/D 4, please reduce feed rate.
- For smaller adjustment, the drill itself will interfere with the hole diameter. It is recommended that hole diameter should be adjusted to a larger diameter than the drill diameter.

Specifications



Sleeve Cat. No.	Stock	øD1	øD2	øD3	L1	L2	L3	L4	Adjusting range of finishing diameter	Adjusting range of cutting edge height
EZ2025	●	20	25	46	49	5	32.5	4	+0.4 ~ -0.2	+0.2 ~ -0.15
EZ2532	●	25	32	51	52	5	38	4	+0.4 ~ -0.2	+0.2 ~ -0.15
EZ3240	●	32	40	54	62	5	43	4	+0.4 ~ -0.2	+0.2 ~ -0.15
EZ4050	●	40	50	69	63	5	55	4	+0.6 ~ -0.2	+0.3 ~ -0.2

Note: Select the sleeve so that the D1 of the sleeve will be same as the diameter of the drill shank.

Cautious points

Using TungSix-Drill

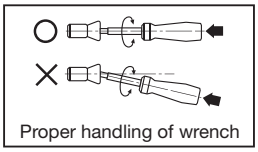
- Ensure that the drilling machine to be used has sufficient rigidity and motor output.
- Not recommended for drilling stacked plates.
- Be sure to carry out proper alignment when drilling is to be performed on a rotating workpiece.

Cutting fluid

- Be sure to supply cutting fluid through the tool.
- A water soluble emulsifiable type cutting fluid should be used.
- Fluid pressure of 1 MPa or higher and fluid quantity of 7 l/min or more are essential. For 4D and 5D type, a fluid pressure of 1.5 MPa or higher and fluid quantity of 10 l/min or more is recommended.

Cautionary points for setting inserts

- Before installing the insert in the drill body, remove all foreign matter from the insert pocket.
- When clamping and unclamping the insert, the center-line of the wrench should be aligned with the center-line of the screw. Misalignment may result in deformation of the socket of the screw head or the tip of the wrench.
- When installing the insert, eliminate all play between the insert pocket and the bottom face of the insert.
- Replace the screw before it is excessively deformed or worn out by long term use.

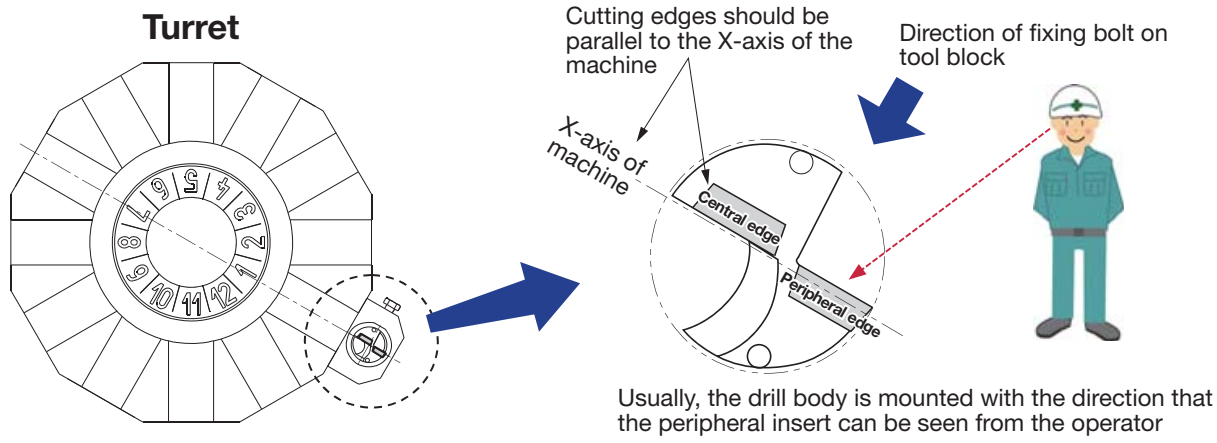

Proper handling of wrench

Use of TungSix-Drill on lathes

Setting of drill body is an important issue for stable machining

Mounting the drill on turret (tool post)

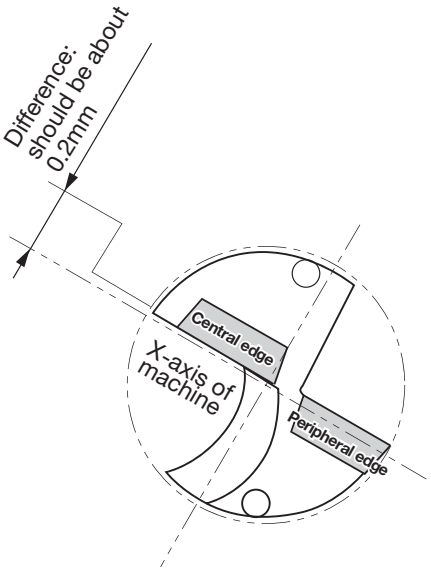
- When mounting drill body, the cutting edges should be parallel to the X-axis of the machine.
- Usually, the drill body is mounted with the direction that the peripheral insert can be seen by the operator.
- As the cotter on shank is parallel to the cutting edges, by tightening the flat with the fixing screw, the cutting edges are guaranteed to be parallel to the X-axis of the machine.



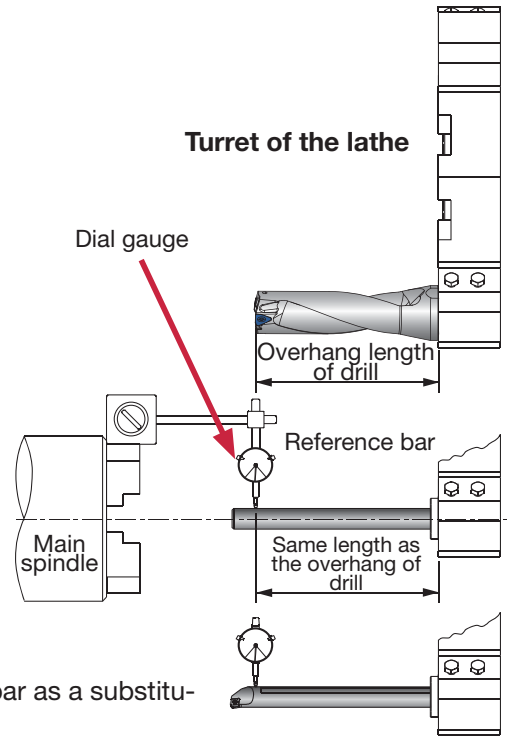
Usually, the drill body is mounted with the direction that the peripheral insert can be seen from the operator

Checking of cutting edge height

- The cutting edge height is an important factor for stable machining.
- The cutting edge of central insert should be 0.2mm lower than the rotating axis of machine.
- For checking the difference between rotating center and the tool block, please use a reference bar that is from ground solid bar.
- In this case, the checking of the center height should be measured at the same position as the overhang length of the drill required.
- When there isn't a reference bar, the ground part of a boring bar can be used as a substitute.



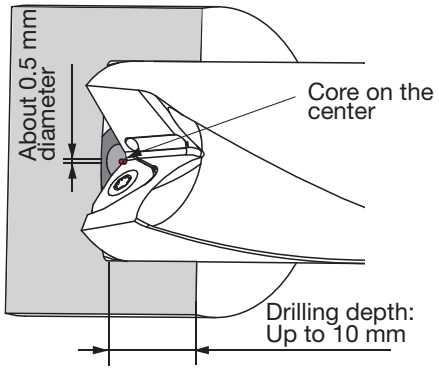
If the condition of cutting edge height is not good, basically the height should be set by adjusting the turret.
But, a simple method is shown in page 16.



Boring bar as a substitution

Checking of setting conditions by trial cutting

- After mounting the drill body, the tool center should be checked by trial cutting before production.
- When the drill body is properly set, a core with about ø0.5 mm diameter is left on the bottom of hole.
- If there is no core, the drill is “above center”. If the core diameter is larger than ø1mm, it is “excessively below center”. In these cases, the cutting edge height has to be checked again.
- When trial cutting, the feed should be 0.1 mm/rev or less, drilling depth should be up to 10 mm.



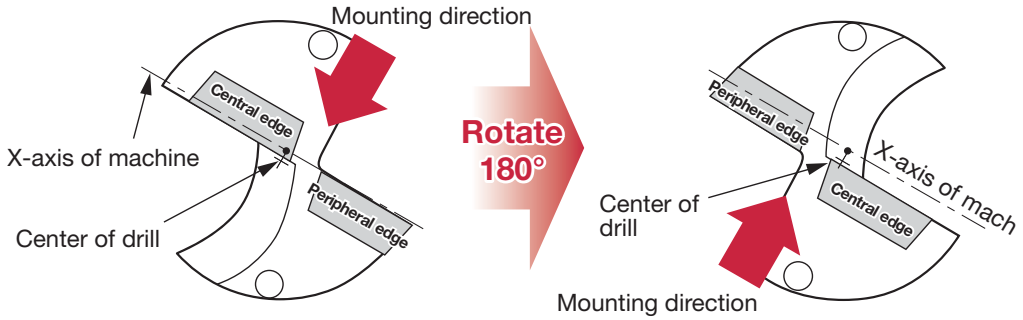
Adjusting of cutting edge height

When the condition of the cutting edge height is incorrect, the height should be adjusted with the following methods.

①In the case of “above-center”

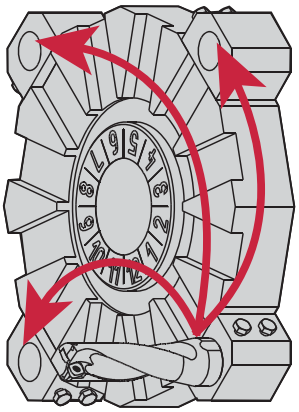
When machining with such condition, the central cutting edge may be easily chipped. So this condition has to be rectified.

Solution #1: Change the mounting direction.
Solution #2: Rotate drill body 180°
In #2, additional cotter is required on the opposite side.



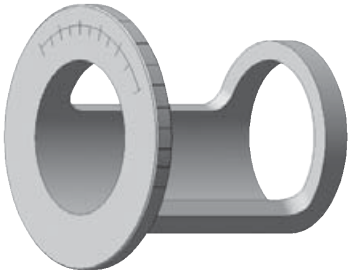
②In the case of “slightly above-center” (about 0.05 mm)

In this case, shifting the mounting position to another position may improve the condition.



③In the case of “excessive below-center” (0.2 mm or more)

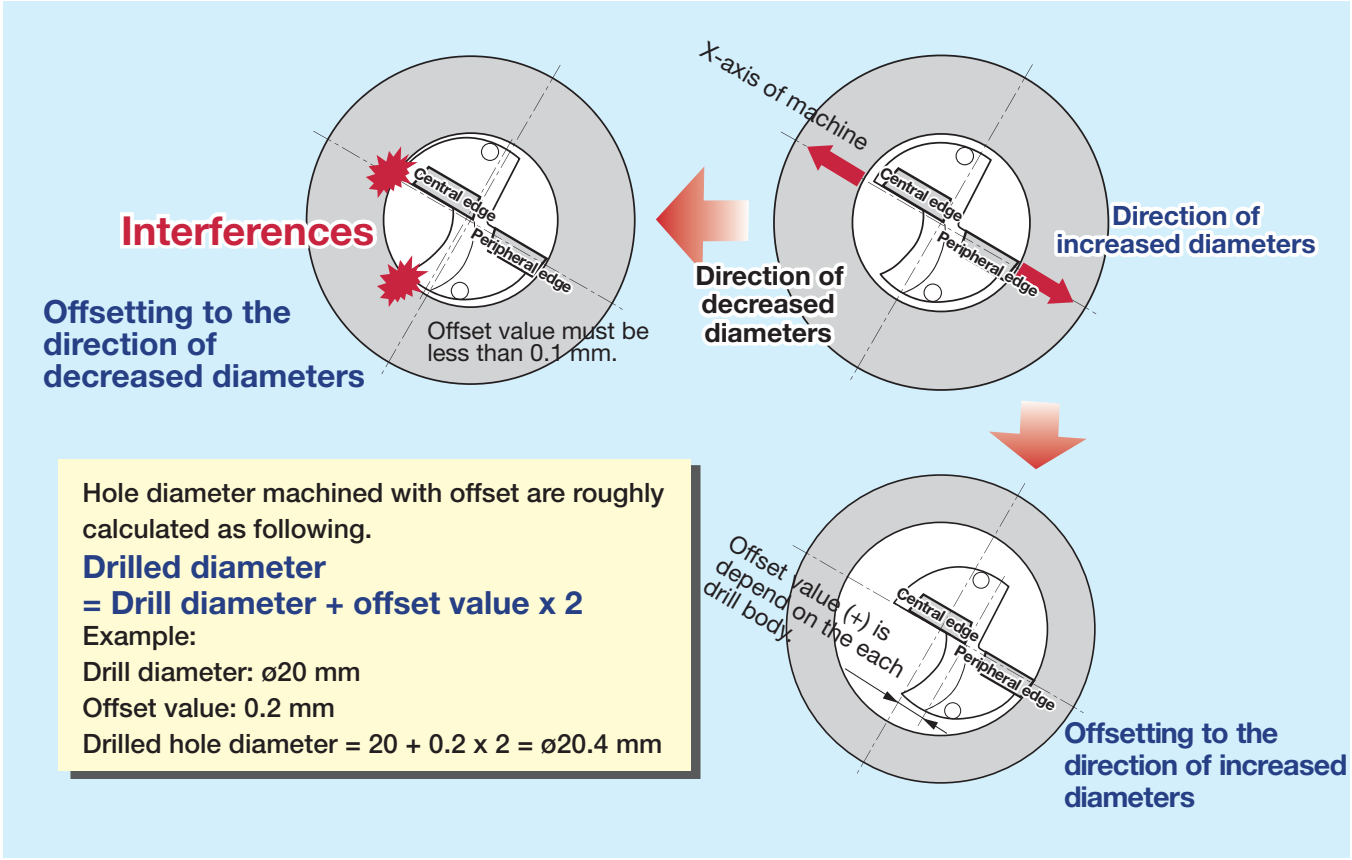
When this occurs, the large diameter of the core remains and heavy vibration may occur. To improve this situation: Use EZ sleeve (the eccentric sleeve) and adjust the cutting edge height to correct value. Information on EZ sleeve, is on page 13.



A larger hole than the drill diameter can be machined !

● Drilling with offset

- When drilling on the lathe, the hole diameter can be adjusted by offsetting the drill body along the X-axis of machine.
- When drilling with offset, the drill body must be correctly mounted with cutting edges parallel to the X-axis of the machine. “Mounting the drill on the turret” can be viewed on page 15.



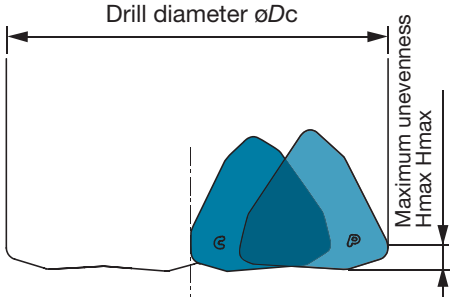
Shapes of hole bottom

Un-evenness of the hole-bottom face when machined with TungSix-Drill is smaller than with HSS drills !

The shape of the hole bottom machined with TungSix-Drill is closer to flat compared with those machined with HSS drills.

Drill diameter ø*Dc* (mm)	ø28 ~32	ø33 ~38	ø39 ~ 46	ø47 ~ 54
Hmax (mm)	1.8	2.1	2.5	2.7

■Hole bottom shape obtained with TungSix-Drill



Troubleshooting

Type and place of trouble			Cause	Countemeasures
Abnormal wear of insert	Central cutting edge	Relief surface	Inappropriate cutting conditions	● Increase the cutting speed by 10 % within standard conditions. ● Lower the feed rate by 10 %.
	Peripheral cutting edge	Relief surface	Inappropriate cutting conditions	● Decrease the cutting speed by 10 % within standard conditions. ● When the feed rate is extremely low or high, set to standard conditions.
	Common	Relief surface	Coolant types and supply method	● Confirm that the cutting fluid flow is higher than 7 liter/min. ● The concentration of coolant must be higher than 5 %. ● Use the coolant superior in lubricity. ● Change to internal coolant supply from external one.
			Vibration during machining	● Change to the machine with higher torque. ● Change to the clamp method with rigidity. ● Change the drill holding method.
			Looseness of insert clamping	● Tighten the screw.
		Crater wear	Excessive heat occurrence	● Change to internal cutting fluid supply from external one. ● Increase the supply rate of the cutting fluid. (Higher than 10 liter/min.) ● Lower the feed rate by 20 % within standard conditions. ● Lower the cutting speed by 20 % within standard conditions.
			Remarkable chip rubbing	● Lower the feed rate by 20 % within standard conditions. ● Lower the cutting speed by 20 % within standard conditions.
		Chipbreaker	Improper chip control, chip packing	● Increase the cutting speed by 20% and lower the feed rate by 20% within standard conditions. ● Raise the coolant pressure (for higher than 1.5 MPa).
Chipping and fracture of insert	Central cutting edge	Rotating center of drill	Misalignment in work rotating	● Set the misalignment to 0 ~ 0.2 mm.
			Machining with large offset	● Check the manual and use the tool in the allowable offset range.
			Drilling into non flat surface	● Flatten the entry surface in pre-machining. ● Set the feed rate for lower than 0.05 mm/rev in rough surface area.
			Too high a feed rate	● Lower the feed rate by 20 ~ 50 % within standard conditions.
			Reuse of chipped corner	● Confirm the corner when exchanging inserts.
	Peripheral cutting edge	Peripheral corner area	Use of insert in excess of tool life	● Exchange the corner or the peripheral insert before the corner wear reaches 0.3 mm.
			Drilling into non flat surface	● Flatten the entry surface in pre-machining. ● Set the feed rate for lower than 0.05 mm/rev at rough surface area.
			Presence of interrupted portion on the way of machining	● Set the feed rate for lower than 0.05 mm/rev in interrupted area.
			Reuse of chipped corner	● Confirm the corner when exchanging inserts.
	Common	Unused corner and cutting edge	Improper chip control, chip packing	● Increase the cutting speed by 20 % and lower the feed rate by 20 % within standard conditions. ● Raise the fluid pressure (for higher than 1.5 MPa).
			Chip recutting	● Lower the feed rate by 20 % within standard conditions.
			Mechanical impact	● Change to continuous feed in case of pick feeding.
		Contact boundary	Use of insert in excess of tool life	● Exchange the corner or the insert before the notch wear reaches 0.3 mm.
			Vibration during machining	● Change to the machine with higher rigidity. ● Change to the clamp method with rigidity. ● Change the drill setting method.
		Flaking	Work hardness is too high	● Set the feed rate for lower than 0.05 mm/rev.
			Thermal impact	● Change to internal cutting fluid supply from external one. ● Lower the feed rate by 20 % within standard conditions.
		Common	Looseness in insert clamping	● Tighten the screw.

Type and place of trouble		Cause	Countemeasures
Rubbing scratch on drill body	Periphery of drill body	Misalignment in work-rotating	● Set the misalignment to 0 ~ 0.2 mm.
		Offset-machining in excess of allowable value	● Use the tool in the allowable offset range.
		Offsetting toward decreasing diameter	● Set offset direction extended diameter of workpiece
		Drilling into or through non flat surface	● Flatten the entry surface in pre-machining. ● Set the feed rate for lower than 0.05 mm/rev in rough surface area.
		Fracturing of peripheral insert	● Exchange the insert.
		Workpiece deflection	● Change to the clamp method with rigidity.
		Chip packing	● Increase the cutting speed by 20 % and lower the feed rate by 20 % within standard conditions. ● Raise the fluid pressure (for higher than 1.5 MPa).
Inferior hole accuracy	Hole diameter	Misalignment in work-rotating	● Set the misalignment to 0 ~ 0.2 mm.
		Improper offsetting.	● Adjust offset contents.
		Drilling into or through non flat surface	● Flatten the entry surface in pre-machining. ● Set the feed rate for lower than 0.05 mm/rev at rough surface area.
		Workpiece deflection	● Change to the clamp method with rigidity.
	Surface finish	Coolant types and supply method	● The concentration of coolant must be higher than 5 %. ● Use the coolant superior in lubricity. ● Change to internal coolant supply from external one.
		Improper cutting conditions	● Increase the cutting speed by 20 % within standard conditions. ● Lower the feed rate by 20 % within standard conditions.
	Common	Insert failure	● Exchange the insert.
		Chip packing	● Increase the cutting speed by 20 % and lower the feed rate by 20 % within standard conditions. ● Raise the coolant pressure (for higher than 1.5 MPa).
		Looseness of insert clamping screw	● Tighten the screw.
Chip control	Entangling	Improper cutting conditions	● Work within standard conditions. ● Increase the cutting speed by 10 % within standard conditions. ● Increase the feed rate by 10 % within standard conditions.
		Insert failure	● Exchange inserts.
		External coolant supplying	● Change to internal coolant supply from external one. ● Work by step feed. ● Use dwell function for 0.1 sec approximately.
		Chips produced by central edge	● There is a tendency to shorten the chips when shifting to higher speed and feed.
	Chip packing	Improper coolant supply	● Change to internal coolant supply from external one. ● Raise the coolant pressure (for higher than 1.5 MPa).
		Improper cutting conditions	● Increase the cutting speed by 20 % and lower the feed rate by 20 % within standard conditions. ● Raise the coolant pressure (for higher than 1.5 MPa).
	Common	Use of excessively damaged drill body	● Exchange the drill holder.
		Looseness of insert clamping screw	● Tighten the screw.
Other trouble	Chatter	Improper cutting conditions	● Lower the cutting speed by 20 % within standard conditions. ● Increase the feed rate by 10 % within standard conditions.
		Excessively worn insert	● Exchange the insert.
		Vibration during machining	● Change to the machine with higher torque rigidity. ● Change to the clamp method with rigidity. ● Change the drill holding method.
		Looseness of insert clamping screw	● Tighten the screw.
	Machine stop	Insufficient machine power and torque	● Use the range of number of revolutions suited machine spec. Lower the feed rate by 20 ~ 50 %.
		Galling	● Exchange inserts before the failure becomes larger. ● Check that the coolant flows powerfully from the drill. ● Lower the cutting speed and the feed rate by 20 % within standard conditions.
	Large burr	Insert failure	● Exchange the insert.
		Improper cutting conditions	● Lower the feed rate by 20 ~ 50 % just before leaving from the workpiece.

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