KORLOY TECH-NEWS

WE CREATE YOUR TOMORROW!

TPDB

TOP SOLID PIERCING DRILL BLADE

- High precision clamping system.
- Cutting edge produces good surface finishes.
- Holder with superb durability.

KORLOY

TPDB

Code system

• Holder

TPD | B | 200 - 25 - □

- **Top Solid Piercing Drill**
- **Insert type** B : Blade type
- **Drill dia.** 200 : Ø20.0
- **Shank dia.** 25 : Ø25
- **Aspect ratio** 3D, 5D, 8D

• Insert

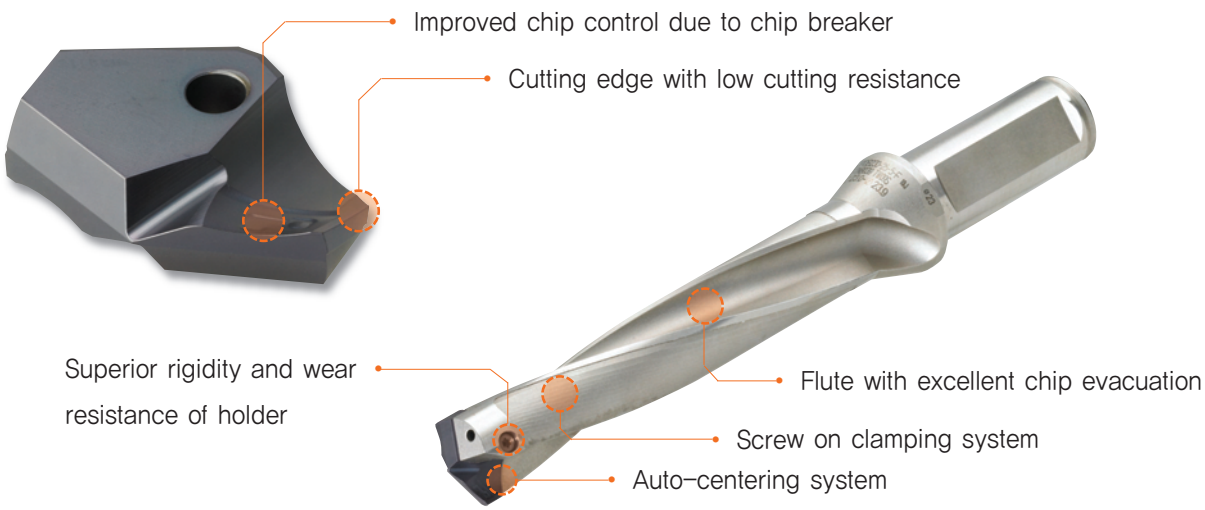
TPD | 200 | B

- **Top Solid Piercing Drill**
- **Drill dia.** 200 : Ø20.0
- **Insert type** B : Blade type

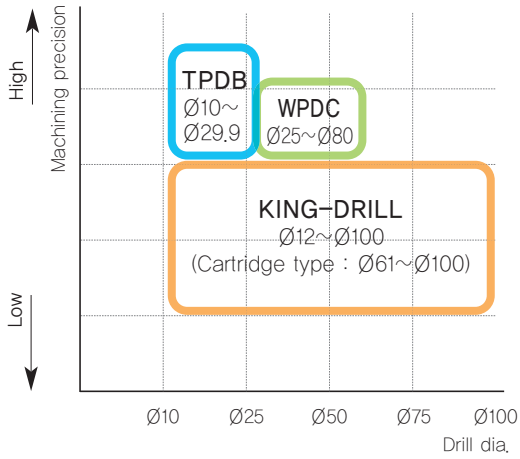
Features

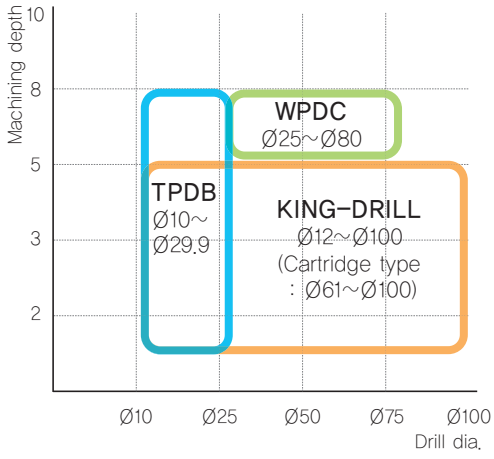
- **High precision clamping system**
  ···› High precision grinding and superior clamping precision with auto-centering system.
- **Screw on clamping system**
  ···› Easy clamping system of TPDB insert.
- **Sharp cutting edge**
  ···› Improved chip evacuation, low cutting load, longer tool life with ultra-fine substrate and exclusive coating layer.
- **Holder with excellent durability**
  ···› Holder with high rigidity and superb wear resistance due to special surface treatment.

Features of holder



Application range



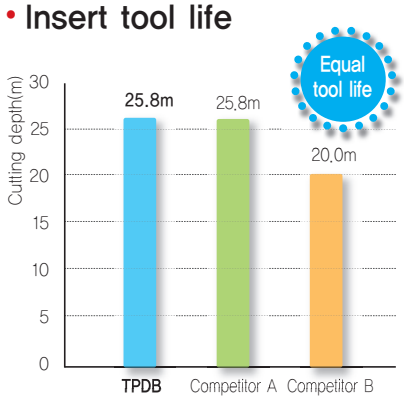


Tools	Application range					
	Drill dia.	L/D	Tolerance of drill dia.	Tolerance	Surface finish of hole	Material
TPDB	Ø10~Ø29.9	~8D	h7	IT10	Ra ~2.0㎛	P M K S H
KING-DRILL	Ø12~Ø100	~5D	h12	-0.1~+0.3	Ra ~4.0㎛	P M K N S H
WPDC	Ø25~Ø80	~8D	h12	-0.1~+0.3	Ra ~3.0㎛	P M K N S H

TPDB

Cutting performance

• Insert tool life



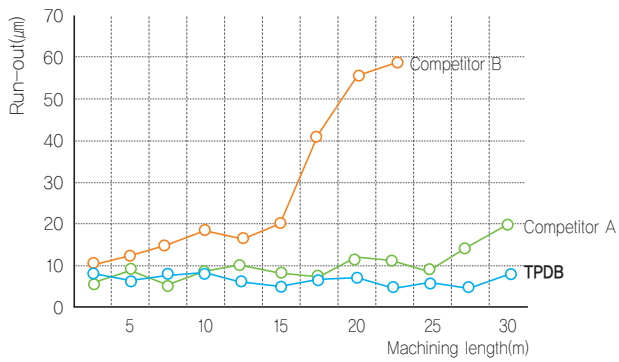
• TPDB
25.8m
Normal wear, mormachinable

• Competitor A
25.8m
Fracture on cutting edge

• Competitor B
20.0m
Notch wear, chipping

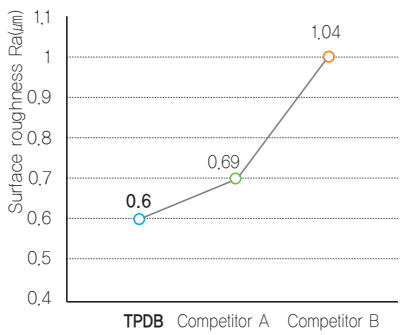
• Workpiece : SCM440
• Cutting condition : vc(m/min)=100, fn(mm/rev)=0.3
ap(mm)=90(pass through), wet
• Tools : Insert TPD200B(PC5300), Holder TPDB200-25-5

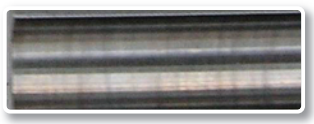
• Run-out



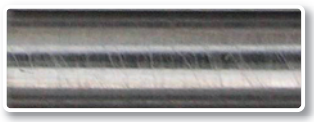
• Workpiece : SCM440
• Cutting condition : vc(m/min)=90
fn(mm/rev)=0.25
ap(mm)=80(pass through), wet
• Tools : Insert TPD180B(PC5300)
Holder TPDB180-25-5

• Surface roughness

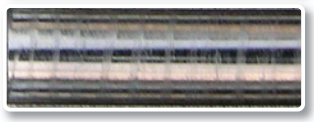




• TPDB : Good surface roughness
(No scratch or rifling from chip)



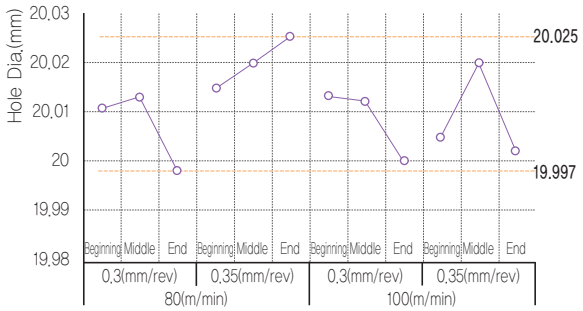
• Competitor A : Scratch from chip evacuating

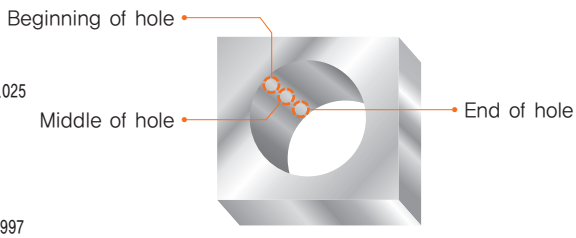


• Competitor B : Scratch and rifling from chip evacuating

• Workpiece : SCM440
• Cutting condition : vc(m/min)=100, fn(mm/rev)=0.2, ap(mm)=60(pass through), wet
• Tools : Insert TPD180B(PC5300), Holder TPDB180-25-5

• Precision



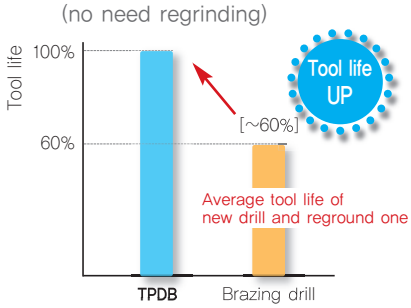


- Workpiece : SM45C
- Cutting condition : vc(m/min)=80/100, fn(mm/rev)=0.3/0.35
  ap(mm)=90(pass though), wet
- Tools : Insert TPD200B(PC5300)
  Holder TPDB200-25-5

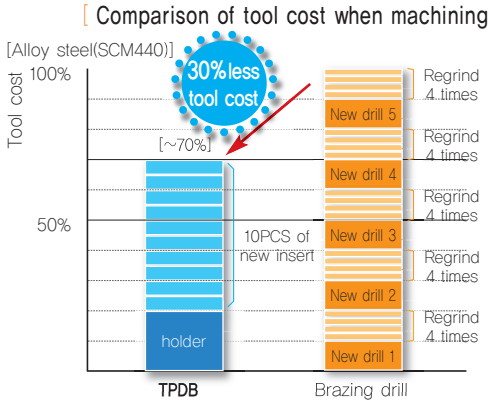
• Tool Cost

[Comparison of 1 insert tool life]

- Exclusive coating and substrate
- Usable till the end of wear
  (no need regrinding)



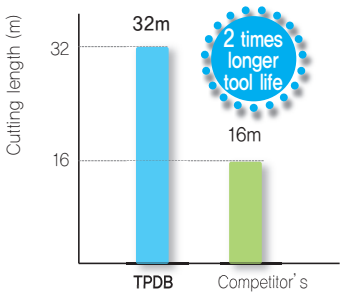
[Comparison of tool cost when machining 1000PCS of workpiece]



- 40% longer tool life
- No need regrind
- Less insert change
- 30% less tool cost

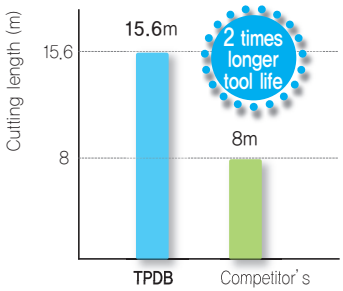
Application example

• Part of automobile



- 200% longer tool life than competitor's
- Workpiece : GCD 500
- Cutting condition : vc(m/min)=98
  fn(mm/rev)=0.31, ap(mm)=40
  Inner coolant system
- Tools : Insert TPD195B(PC5300)
  Holder TPDB195-25-3
- Machine : MCT (vertical)

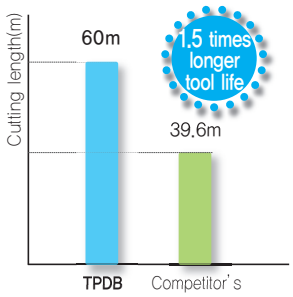
• Part of heavy equipment



- 200% longer tool life than competitor's
- Workpiece : Hot Forged Stee
- Cutting condition : vc(m/min)=85
  fn(mm/rev)=0.2, ap(mm)=20
  Inner coolant system
- Tools : Insert TPD210B(PC5300)
  Holder TPDB210-25-3
- Machine : MCT (vertical)

TPDB

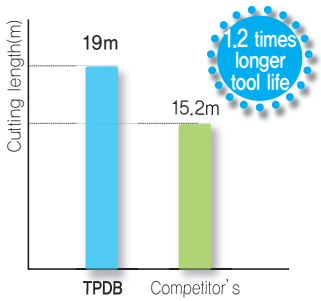
• Part of machine

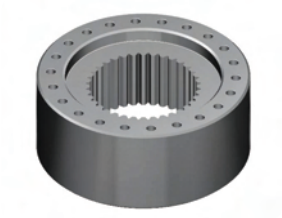


• 200% longer tool life than competitor's

- Workpiece : GC25
- Cutting condition : vc(m/min)=75
  fn(mm/rev)=0.26
  ap(mm)=60, Outer coolant
- Tools : Insert TPD160B(PC5300)
  Holder TPDB160-20-5
- Machine : MCT / vertical

• Part of heavy equipment





• 150% longer tool life than competitor's

- Workpiece : SM45C
- Cutting condition : vc(m/min)=40
  fn(mm/rev)=0.14
  ap(mm)=95
  Inner coolant system
- Tools : Insert TPD130B(PC5300)
  Holder TPDB130-16-8
- Machine : MCT / Horizontal

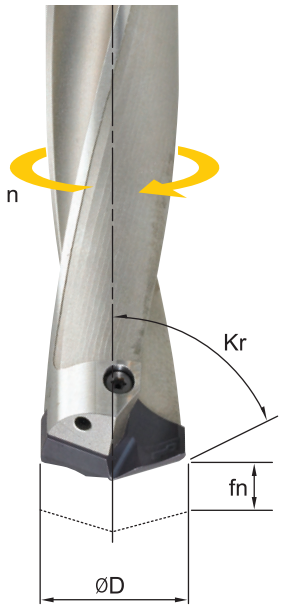
Recommended Cutting Condition

(mm)

Workpiece			Grade	vc	fn(aspect ratio=3D~5D) Feed(mm/rev) per drill diameter(mm)		
ISO	Workpiece	HB		m/min	10~15.9	16~24.9	25~29.9
P Carbon steel	Low carbon steel	80~120	PC 5300	110(80~140)	0.15~0.30	0.20~0.35	0.25~0.40
	High carbon steel	180~280	PC 5300	100(70~130)	0.15~0.30	0.20~0.35	0.25~0.40
P Alloy steel	Low alloy steel	140~260	PC 5300	110(80~140)	0.18~0.35	0.23~0.38	0.28~0.43
	Low pre-hardened steel	200~400	PC 5300	75(50~100)	0.18~0.35	0.23~0.38	0.28~0.43
	High alloy steel	50~260	PC 5300	70(50~90)	0.18~0.30	0.20~0.35	0.25~0.40
	High pre-hardened steel	220~450	PC 5300	60(40~80)	0.18~0.30	0.20~0.35	0.25~0.40
M Stainless Steel	Austenite series	135~275 Ni〉8%	PC 5300	50(30~70)	0.13~0.25	0.15~0.30	0.17~0.33
	Ferrite series Martensite series	135~275	PC 5300	55(40~70)	0.13~0.25	0.15~0.30	0.17~0.33
K Cast Iron	Gray cast iron	150~230	PC 5300	110(80~140)	0.18~0.35	0.20~0.40	0.25~0.45
	Ductile cast iron	160~260	PC 5300	100(70~130)	0.18~0.35	0.20~0.40	0.25~0.45
S Heat Resisting Steel	Ni pre-hardened steel	130~400	PC 5300	40(20~60)	0.10~0.20	0.12~0.22	0.13~0.25
	Ti pre-hardened steel	130~400	PC 5300	40(20~60)	0.10~0.20	0.12~0.22	0.13~0.25
	High hardened steel	400 above	PC 5300	35(20~50)	0.10~0.20	0.12~0.22	0.13~0.25

- In case of 8D, reduce the cutting conditions to 40~50% or machine the beginning of hole first.(1.5D)
- In case of interrupted machining, reduce the feed to 30~50% machining around the interrupted part.

Formulas for machining



vc	fn	tc
vc=(π x D x n)/1000 vc(m/min) : Cutting speed π : Circular constant (3.14) D(mm) : Drill diameter n(mim^{-1}) : RPM	**fn=vf/n** fn(mm/rev) : Feed per revolution vf(mm/min) : Table feed n(mim^{-1}) : RPM	**tc=(ld x i)/(n x fn)** tc(min) : Machining time ld(mm) : Depth of drilling i : Number of drilling holes n(mim^{-1}) : RPM fn(mm/rev) : Feed per revolution

Cutting torque and thrust (Formulas)

Mc=K x D^2 x (0.0631+1.686 x fn)(kg.cm)
Tc=57.95 x K x D x fn0.85(kg)

Mc(kg · cm) : Cutting torque
Tc(kg) : Cutting thrust
fn(mm/rev) : Feed per revolution
D(mm) : Drill diameter
K : Material coefficient

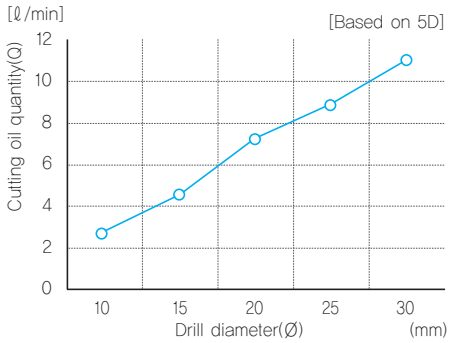
Cutting power
Pc=(D x fn x kc x vc)/(240 x 103) (Kw)
Feed Ff=0.5 x (D/2) x fn x kc x sinKr(N)
Cutting load : kc=2000(N/mm^2)

	Workpiece	Tensile strength(kg/mm^2)	HB	Material coefficient
Cast iron	Common grade cast iron	21	177	1.00
	Cast iron	28	198	1.39
	High grade cast iron	35	224	1.88
General steel	Carbon steel(C0.2)	55	160	2.22
	Free-cutting steel(C0.12, S0.2)	62	183	1.42
	Manganese steel(Mn1.75)	63	197	1.45
Ni-chrome steel	3115(Ni1.25, Cr0.6, Mn0.5)	53	163	1.56
	3120(Ni1.25, Cr0.6, Mn0.7)	69	174	2.02
	3140	88	241	2.32
Chrome-molybdenum steel	4115(Cr0.5, Mo0.11, Mn0.8)	63	167	1.62
	4130(Cr0.95, Mo0.2, Mn0.5)	77	229	2.10
	4140(Cr0.95, Mo0.2, Mn0.85)	94	269	2.41
Ni-molybdenum steel	4615(Ni1.8, Mo0.25, Mn0.5)	75	212	2.12
	4820(Ni3.5, Mo0.25, Mn0.6)	140	390	3.44
Chrome steel	5150(Cr0.8, Mn0.8)	95	277	2.46
Chrome-vanadium steel	6115(Cr0.6, Mn0.6, V0.12)	58	174	2.08
	6120(Cr0.8, Mn0.8, V0.1)	80	255	2.22

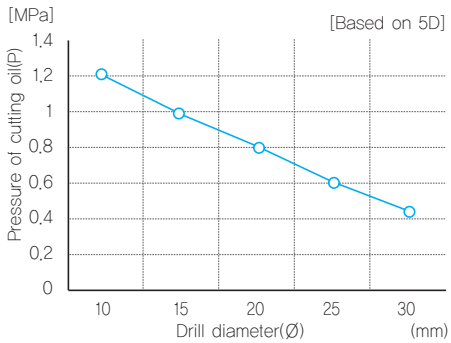
TPDB

Technical information

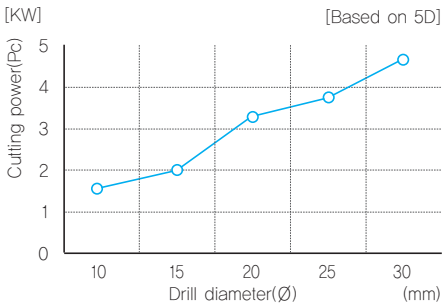
• Cutting oil quantity



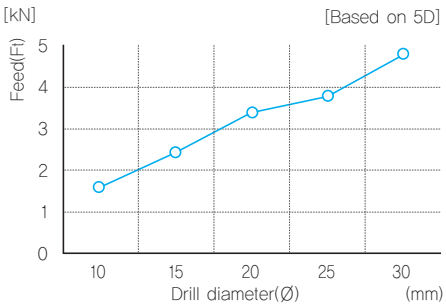
• Pressure of cutting oil



• Cutting power



• Feed

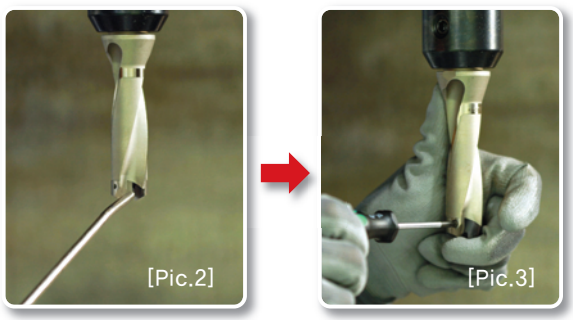


How to clamp a TPDB insert

• Clamping an insert on a holder

⋯› Put an insert in the holder.
⋯› As the **Pic.1**, clamp the insert while pushing it to the V shaped groove of the holder.
⋯› Screw the insert.

• Changing an insert on the machine



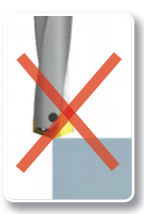
⋯› Separate the insert from the holder.
⋯› As the **Pic.2**, clean the insert seat
⋯› Place the insert to the mounting seat.
⋯› As the **Pic.3**, clamp the insert while pushing it to the V shaped groove of the holder.

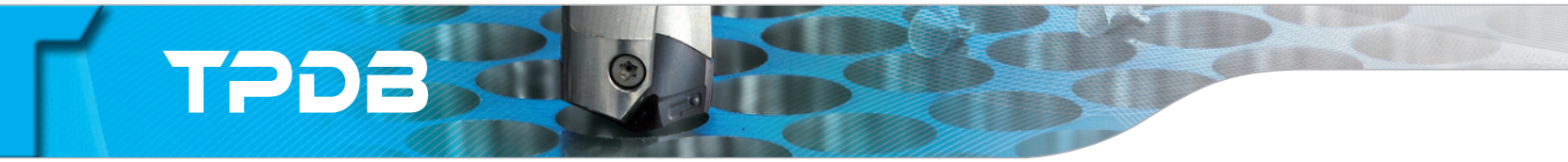
Solution for cutting failure

↑ increasing ↓ decreasing ○ coolant

Failure	Factor	Solution															
		Cutting condition					Dimension					Toughness Hardness	Hardness	Etc.			
		vc	fn	Coolant	fn (inthe beginning)	Depth of cut	Relief angle	Point angle	Thinning angle	Honing	Flute width rate			Rigidity of machine	Chattering of machine	Fixing workpiece	Overhang
Chipping	Improper cutting condition Less rigidity of tool Built-up-edge Improper grade Chattering	↓	↓	○			↓		↓	↑		↑		↑	↓	↑	↓
Wear	Excessive cutting speed (wear on margine)	↓	↓	○													
	Low cutting speed (wear in the center of drill)	↑	↓	○													
Fracture	Improper cutting condition Too much cutting load Too long overhang Less rigidity of machine	↓	↓	○	↓	↓								↑		↑	↓
Bad chip evacuation	Improper cutting condition		↓	○		↓					↑						
Poor surface roughness	Built-up-edge Chattering Improper cutting condition	↑	↓	○	↓			↓		↓				↑	↓		↓
Precision of hole	Low cutting speed (wear in the center of drill)	↑	↓											↑	↓		↓

Precaution in drilling

Machining of bevel	Machining of stack panel
The approach angle and departure angle should be below 6°. Reduce the feed to 3~50% in the beginning and end of machining bevel. 	Clamp the insert tightly to prevent fracture of drill. 
Plunging	**Boring**
Fracture and deformation of drill are expected due to cutting load. 	Possibility to have wear and chipping on the corner of insert. 



Types of damage to drill and solutions

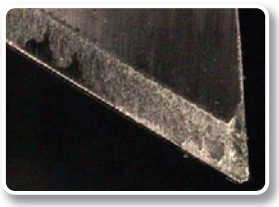
Scratches on the margin

Factor

- Lack of coolant.
- Lack of lubrication in deep drilling of MQL machining.
- Bend of drill due to improper holding or insufficient rigidity drill length.
- Low rigidity or concentricity.

Solution

- Use more coolant.
- Fix the workpiece tightly and check the concentricity.
- Check the precision of installment of drill. • Low cutting speed.



Wear on the margin

Factor

- Machining of all-metal or heat resisting alloy.
- Dissolution of back-tapper due to excessive drill wear.
- Unstable machining on the end of hole due to interrupted part.
- Lack of lubrication of coolant due to contacting the workpiece and outside of holder.

Solution

- Check grade and cutting parameters for material.
- Check the types of machining.
- Check the kind and concentration of coolant.

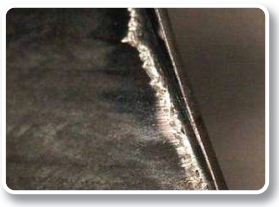
Chipping on the corner

Factor

- In interrupted machining.
- Chattering in drilling.
  (unstable clamping, low rigidity of machine and bending)
- Chattering due to concentricity of drill.

Solution

- Check the machining part. • Low cutting speed.
- Fix the workpiece accurately. • Check the machinability of the machine.
- Check the precision of drill installment. (below 0.02mm)



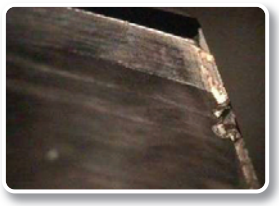
Wear on the bevel

Factor

- Machining in low cutting speed.
- Machining in free-cutting steel.
- Chip erosion of flute.
- Lack of coolant.

Solution

- Increase cutting speed. • Low thinning angle.
- Reduce the honing. • Use more coolant.



Chipping on the bevel

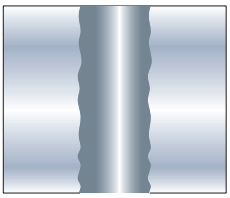
Factor

- Pre-treatment on the center of hole makes fracture on the cutting edge partially.
- Unstable chip evacuation due to step drilling.
- Chattering in drilling and less precision of installment.

Solution

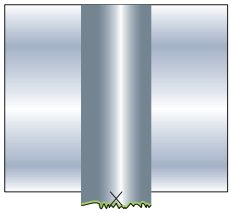
- Check the pre-machining.
- Check the clamping of workpiece.
- Check the precision of drill installment. (below 0.02mm)

Types of damage to workpiece and check-point



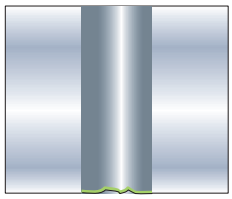
Poor surface roughness (bending, scratch)

Factor	• Low rigidity of machine, improper clamping of workpiece. • Poor concentricity, lack of coolant.
Solution	• Clamp the workpiece properly and check the concentricity. • Use more coolant and increase the pressure.



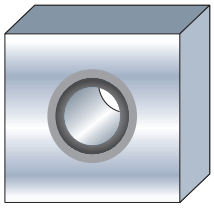
Burr in the end of hole

Factor	• High feed, excess honing on the cutting edge. • Too much wear and chipping.
Solution	• Reduce feed, use a new drill. • Increase point angle or reduce honing.



Flaking the end of hole

Factor	• In machining of low toughness materials as cast iron. • Rapid feed and much honing on the cutting edge. • Too much wear and chipping.
Solution	• Reduce the feed. • Reduce honing on the cutting edge. • Use a new drill.



Thermal deformation and oxidation of the end of hole

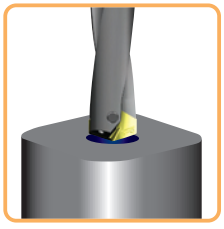
Factor	• Rapid feed. • Excessive cutting load. • Lack of coolant. • Too much wear and chipping.
Solution	• Reduce the feed and honing on the cutting edge. • Use more coolant and use a new drill.

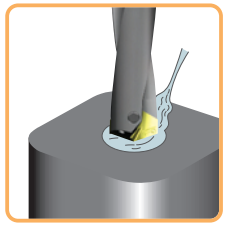
Check-point of drilling

- Clamping of workpiece
- Holder
- Coolant (pressure, flow, concentration)
- Revolution of the main axis of machine
- Run-out of drill (Max.0.03mm)
- Chip evacuation

Supply of coolant

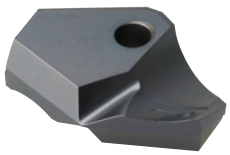
- Supply enough coolant to the beginning of the hole.
- Minimum oil pressure of coolant : above 5 bar
- Minimum flow : above 5l/min

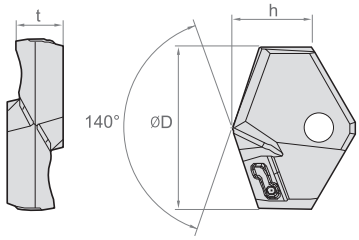




TPDB

Insert





(mm)

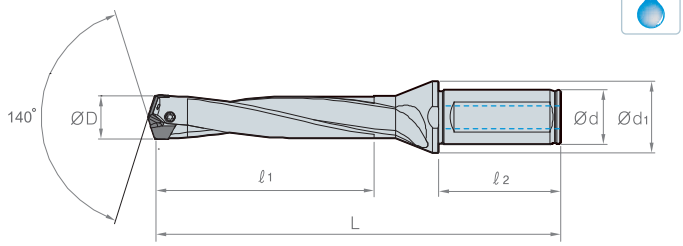
Designation		Grade	ØD	h	t
TPD	100B~109B	PC5300	10.0 ~ 10.9	5.5	3.5
	110B~119B	PC5300	11.0 ~ 11.9	5.8	3.5
	120B~129B	PC5300	12.0 ~ 12.9	6.3	3.5
	130B~139B	PC5300	13.0 ~ 13.9	6.5	4.0
	140B~149B	PC5300	14.0 ~ 14.9	6.8	4.0
	150B~159B	PC5300	15.0 ~ 15.9	7.0	4.0
	160B~169B	PC5300	16.0 ~ 16.9	7.7	5.5
	170B~179B	PC5300	17.0 ~ 17.9	7.9	5.5
	180B~189B	PC5300	18.0 ~ 18.9	8.1	6.0
	190B~199B	PC5300	19.0 ~ 19.9	8.3	6.0
	200B~209B	PC5300	20.0 ~ 20.9	9.7	6.5
	210B~219B	PC5300	21.0 ~ 21.9	9.4	6.5
	220B~229B	PC5300	22.0 ~ 22.9	9.6	7.0
	230B~239B	PC5300	23.0 ~ 23.9	9.8	7.0
	240B~249B	PC5300	24.0 ~ 24.9	10.7	7.5
	250B~259B	PC5300	25.0 ~ 25.9	10.9	7.5
	260B~269B	PC5300	26.0 ~ 26.9	11.0	8.5
	270B~279B	PC5300	27.0 ~ 27.9	11.8	8.5
	280B~289B	PC5300	28.0 ~ 28.9	12.6	9.5
	290B~299B	PC5300	29.0 ~ 29.9	12.9	9.5

Parts

(mm)

Designation		Drill diameter	Screw	Ranch	Torque
TPD	100B~129B	10.0 ~ 12.9	FTNB0209	TW06P	0.4
	130B~149B	13.0 ~ 14.9	FTNB02512	TW07S	0.8
	150B~179B	15.0 ~ 17.9	FTNB02514	TW07S	0.8
	180B~199B	18.0 ~ 19.9	FTNB0316	TW09S	1.2
	200B~239B	20.0 ~ 23.9	FTNB0319	TW09S	1.2
	240B~259B	24.0 ~ 25.9	FTNB03522	TW15S	3
	260B~279B	26.0 ~ 27.9	FTNB03524	TW15S	3
	280B~299B	28.0 ~ 29.9	FTNB0426	TW15S	3

TPDB–3D

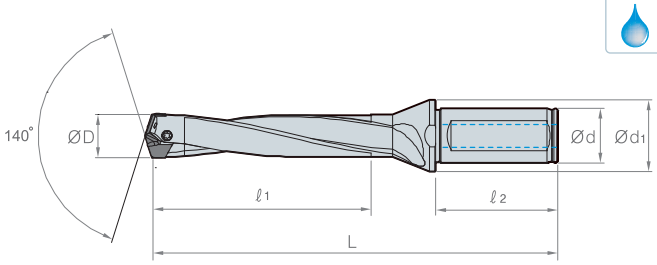


(mm)

Designation		ØD	Ød	Ød1	ℓ1	ℓ2	L	Insert
TPDB	100-16-3	10.0~10.4	16	20	30.0	48	95	TPD100B-104B
	105-16-3	10.5~10.9	16	20	31.5	48	96	TPD105B-109B
	110-16-3	11.0~11.4	16	20	33.0	48	98	TPD110B-114B
	115-16-3	11.5~11.9	16	20	34.5	48	99	TPD115B-119B
	120-16-3	12.0~12.4	16	20	36.0	48	102	TPD120B-124B
	125-16-3	12.5~12.9	16	20	37.5	48	104	TPD125B-129B
	130-16-3	13.0~13.4	16	20	39.0	48	107	TPD130B-134B
	135-16-3	13.5~13.9	16	20	40.5	48	109	TPD135B-139B
	140-16-3	14.0~14.4	16	20	42.0	48	111	TPD140B-144B
	145-16-3	14.5~14.9	16	20	43.5	48	114	TPD145B-149B
	150-20-3	15.0~15.4	20	25	45.0	50	118	TPD150B-154B
	155-20-3	15.5~15.9	20	25	46.5	50	120	TPD155B-159B
	160-20-3	16.0~16.4	20	25	48.0	50	122	TPD160B-164B
	165-20-3	16.5~16.9	20	25	49.5	50	124	TPD165B-169B
	170-20-3	17.0~17.4	20	25	51.0	50	127	TPD170B-174B
	175-20-3	17.5~17.9	20	25	52.5	50	129	TPD175B-179B
	180-25-3	18.0~18.4	25	33	54.0	56	137	TPD180B-184B
	185-25-3	18.5~18.9	25	33	55.5	56	139	TPD185B-189B
	190-25-3	19.0~19.4	25	33	57.0	56	142	TPD190B-194B
	195-25-3	19.5~19.9	25	33	58.5	56	144	TPD195B-199B
	200-25-3	20.0~20.4	25	33	60.0	56	146	TPD200B-204B
	205-25-3	20.5~20.9	25	33	61.5	56	148	TPD205B-209B
	210-25-3	21.0~21.4	25	33	63.0	60	151	TPD210B-214B
	215-25-3	21.5~21.9	25	33	64.5	60	153	TPD215B-219B
	220-25-3	22.0~22.4	25	33	66.0	60	155	TPD220B-224B
	225-25-3	22.5~22.9	25	33	67.5	60	157	TPD225B-229B
	230-25-3	23.0~23.4	25	33	69.0	60	160	TPD230B-234B
	235-25-3	23.5~23.9	25	33	70.5	60	162	TPD235B-239B
	240-32-3	24.0~24.4	32	43	72.0	60	168	TPD240B-244B
	245-32-3	24.5~24.9	32	43	73.5	60	170	TPD245B-249B
	250-32-3	25.0~25.4	32	43	75.0	60	173	TPD250B-254B
	255-32-3	25.5~25.9	32	43	76.5	60	175	TPD255B-259B
	260-32-3	26.0~26.9	32	43	78.0	60	177	TPD260B-269B
	270-32-3	27.0~27.9	32	43	81.0	60	182	TPD270B-279B
	280-32-3	28.0~28.9	32	43	84.0	60	186	TPD280B-289B
	290-32-3	29.0~29.9	32	43	87.0	60	191	TPD290B-299B

TPDB

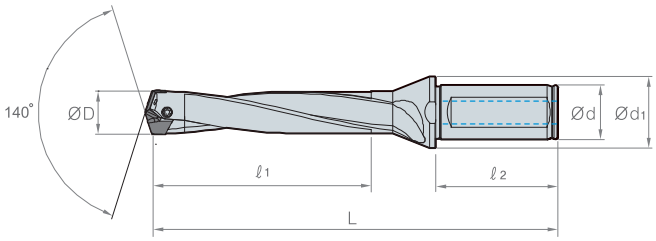
TPDB–5D



(mm)

Designation		ØD	Ød	Ød1	ℓ1	ℓ2	L	Insert
TPDB	100-16-5	10.0~10.4	16	20	50.0	48	115	TPD100B-104B
	105-16-5	10.5~10.9	16	20	52.5	48	117	TPD105B-109B
	110-16-5	11.0~11.4	16	20	55.0	48	120	TPD110B-114B
	115-16-5	11.5~11.9	16	20	57.5	48	123	TPD115B-119B
	120-16-5	12.0~12.4	16	20	60.0	48	126	TPD120B-124B
	125-16-5	12.5~12.9	16	20	62.5	48	129	TPD125B-129B
	130-16-5	13.0~13.4	16	20	65.0	48	133	TPD130B-134B
	135-16-5	13.5~13.9	16	20	67.5	48	136	TPD135B-139B
	140-16-5	14.0~14.4	16	20	70.0	48	139	TPD140B-144B
	145-16-5	14.5~14.9	16	20	72.5	48	143	TPD145B-149B
	150-20-5	15.0~15.4	20	25	75.0	50	148	TPD150B-154B
	155-20-5	15.5~15.9	20	25	77.5	50	151	TPD155B-159B
	160-20-5	16.0~16.4	20	25	80.0	50	154	TPD160B-164B
	165-20-5	16.5~16.9	20	25	82.5	50	157	TPD165B-169B
	170-20-5	17.0~17.4	20	25	85.0	50	161	TPD170B-174B
	175-20-5	17.5~17.9	20	25	87.5	50	164	TPD175B-179B
	180-25-5	18.0~18.4	25	33	90.0	56	173	TPD180B-184B
	185-25-5	18.5~18.9	25	33	92.5	56	176	TPD185B-189B
	190-25-5	19.0~19.4	25	33	95.0	56	180	TPD190B-194B
	195-25-5	19.5~19.9	25	33	97.5	56	183	TPD195B-199B
	200-25-5	20.0~20.4	25	33	100.0	56	186	TPD200B-204B
	205-25-5	20.5~20.9	25	33	102.5	56	189	TPD205B-209B
	210-25-5	21.0~21.4	25	33	105.0	60	193	TPD210B-214B
	215-25-5	21.5~21.9	25	33	107.5	60	196	TPD215B-219B
	220-25-5	22.0~22.4	25	33	110.0	60	199	TPD220B-224B
	225-25-5	22.5~22.9	25	33	112.5	60	202	TPD225B-229B
	230-25-5	23.0~23.4	25	33	115.0	60	206	TPD230B-234B
	235-25-5	23.5~23.9	25	33	117.5	60	209	TPD235B-239B
	240-32-5	24.0~24.4	32	43	120.0	60	216	TPD240B-244B
	245-32-5	24.5~24.9	32	43	122.5	60	219	TPD245B-249B
	250-32-5	25.0~25.4	32	43	125.0	60	223	TPD250B-254B
	255-32-5	25.5~25.9	32	43	127.5	60	226	TPD255B-259B
	260-32-5	26.0~26.9	32	43	130.0	60	229	TPD260B-269B
	270-32-5	27.0~27.9	32	43	135.0	60	236	TPD270B-279B
	280-32-5	28.0~28.9	32	43	140.0	60	242	TPD280B-289B
	290-32-5	29.0~29.9	32	43	145.0	60	249	TPD290B-299B

TPDB–8D



(mm)

Designation		ØD	Ød	Ød1	ℓ1	ℓ2	L	Insert
TPDB	100-16-8	10.0~10.4	16	20	80	48	145.0	TPD100B-104B
	105-16-8	10.5~10.9	16	20	84	48	149.0	TPD105B-109B
	110-16-8	11.0~11.4	16	20	88	48	153.0	TPD110B-114B
	115-16-8	11.5~11.9	16	20	92	48	157.0	TPD115B-119B
	120-16-8	12.0~12.4	16	20	96	48	162.0	TPD120B-124B
	125-16-8	12.5~12.9	16	20	100	48	166.5	TPD125B-129B
	130-16-8	13.0~13.4	16	20	104	48	172.0	TPD130B-134B
	135-16-8	13.5~13.9	16	20	108	48	176.5	TPD135B-139B
	140-16-8	14.0~14.4	16	20	112	48	181.0	TPD140B-144B
	145-16-8	14.5~14.9	16	20	116	48	186.5	TPD145B-149B
	150-20-8	15.0~15.4	20	25	120	50	193.0	TPD150B-154B
	155-20-8	15.5~15.9	20	25	124	50	197.5	TPD155B-159B
	160-20-8	16.0~16.4	20	25	128	50	202.0	TPD160B-164B
	165-20-8	16.5~16.9	20	25	132	50	206.5	TPD165B-169B
	170-20-8	17.0~17.4	20	25	136	50	212.0	TPD170B-174B
	175-20-8	17.5~17.9	20	25	140	50	216.5	TPD175B-179B
	180-25-8	18.0~18.4	25	33	144	56	227.0	TPD180B-184B
	185-25-8	18.5~18.9	25	33	148	56	231.5	TPD185B-189B
	190-25-8	19.0~19.4	25	33	152	56	237.0	TPD190B-194B
	195-25-8	19.5~19.9	25	33	156	56	241.5	TPD195B-199B
	200-25-8	20.0~20.4	25	33	160	56	246.0	TPD200B-204B
	205-25-8	20.5~20.9	25	33	164	56	250.5	TPD205B-209B
	210-25-8	21.0~21.4	25	33	168	60	256.0	TPD210B-214B
	215-25-8	21.5~21.9	25	33	172	60	260.5	TPD215B-219B
	220-25-8	22.0~22.4	25	33	176	60	265.0	TPD220B-224B
	225-25-8	22.5~22.9	25	33	180	60	269.5	TPD225B-229B
	230-25-8	23.0~23.4	25	33	184	60	275.0	TPD230B-234B
	235-25-8	23.5~23.9	25	33	188	60	279.5	TPD235B-239B
	240-32-8	24.0~24.4	32	43	192	60	288.0	TPD240B-244B
	245-32-8	24.5~24.9	32	43	196	60	292.5	TPD245B-249B
	250-32-8	25.0~25.4	32	43	200	60	298.0	TPD250B-254B
	255-32-8	25.5~25.9	32	43	204	60	302.5	TPD255B-259B
	260-32-8	26.0~26.9	32	43	208	60	307.0	TPD260B-269B
	270-32-8	27.0~27.9	32	43	216	60	317.0	TPD270B-279B
	280-32-8	28.0~28.9	32	43	224	60	326.0	TPD280B-289B
	290-32-8	29.0~29.9	32	43	232	60	336.0	TPD290B-299B

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