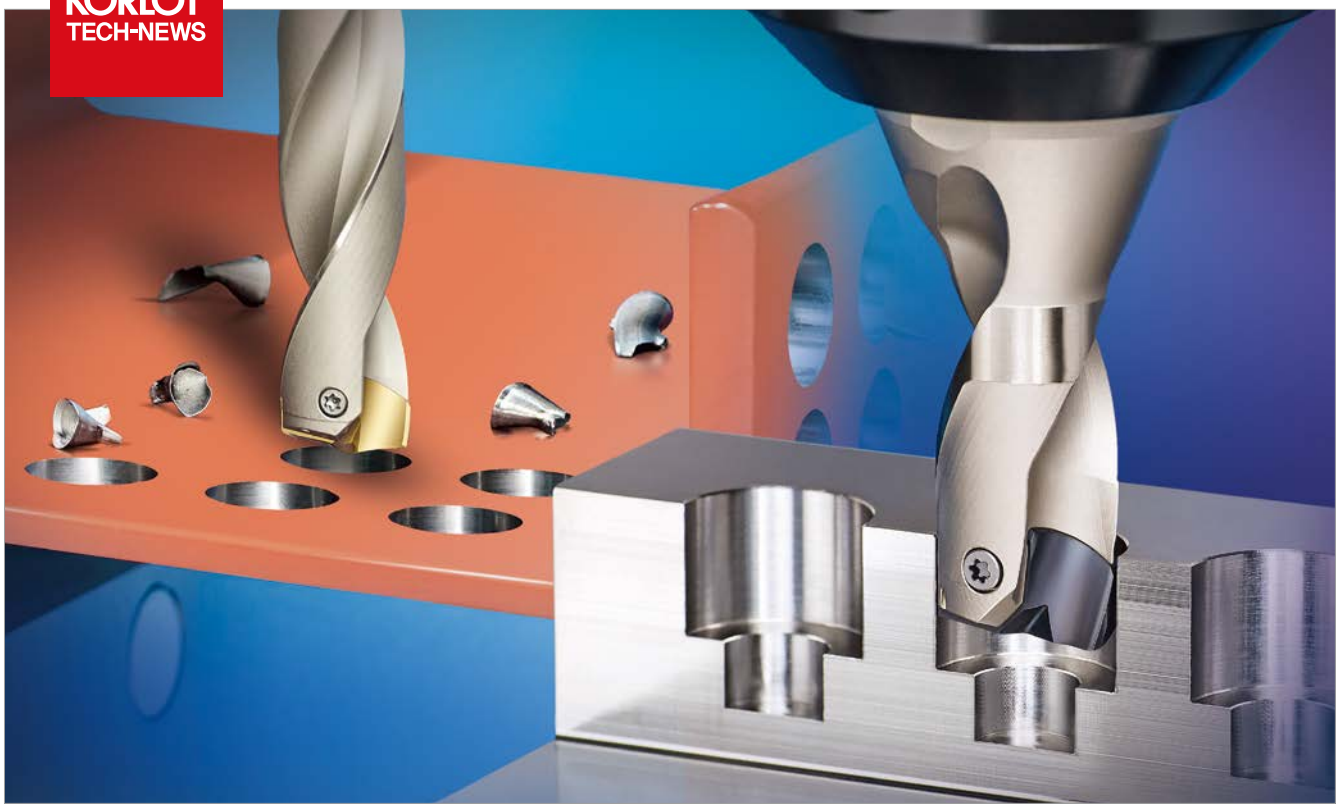
Highly precise and efficient top solid indexable drill

TPDB Plus Drill

(TPDB Plus/ TPDB-F new / TPDB-H new)

KORLOY TECH-NEWS



- Increased productivity with stable machining.
- Optimized flute design and excellent chip evacuation ensure high quality of hole condition.
- TPDB Plus Drill is available for machining of variously shaped surfaces and steel structure frames.

KORLOY

TECH-NEWS

Highly precise and efficient top solid indexable drill

TPDB Plus Drill

To obtain better work efficiency, excellent machining performance and reduced cutting time are always in need for various industries. Thus, the demands for efficient cutting tools are steadily increasing.

KORLOY newly launched high quality and efficient indexable drill, TPDB Plus Drill in accordance with the market's needs.

TPDB Plus implemented high helix flute, which enhanced chip evacuation, and it leads to higher qualified machining with surface finish of hole and roundness.

In addition, TPDB-F for drilling various workpiece with various shaped surfaces and TPDB-H, an exclusive indexable drill for drilling steel structural frame are launched for various industries.

TPDB-F is available for drilling of angled surface, curved surface drilling, plunging and boring. It is suitable for drilling flat bottom and drilling pilot hole. In addition, by using the least tools, it reduces the time for tool exchanging and cycle time as well.

The TPDB-H insert, with its exclusive low cutting resistance cutting edge design enhancing centering, reduces cutting load and increases quality of hole condition. Its high helix angled flutes also devote to improve machining stability and productivity by preventing chip jamming which causes chattering nor unexpected breakage.

Excellent machinability

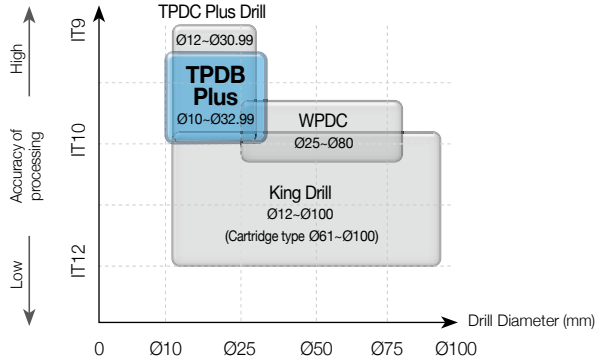
- Fine drilling performance with exclusive edge per application
- Enhanced chip evacuation with high helix angle

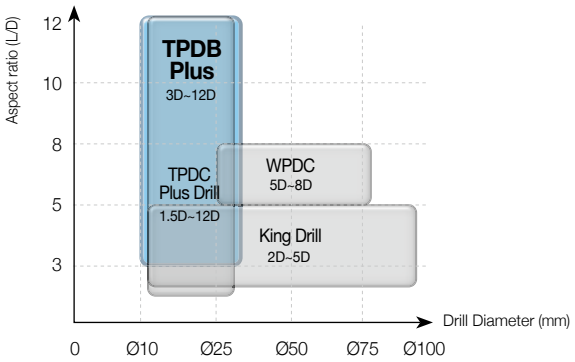
Increased productivity

- Reduced cycle time by using the least tools (TPDB-F)
- High durability due to special surface treatment

TPDB Plus

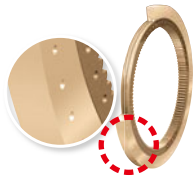
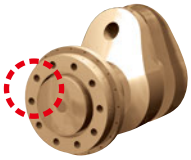
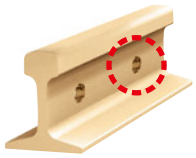
Application range





Tools	Application range					
	Drill Diameter (Ø)	Aspect ratio (L/D)	Tolerance of drill dia.	Tolerance of hole	Surface finish of hole (Ra)	Workpiece material
TPDB Plus	10 - 32.99 mm	3, 5, 8, 10, 12	h7	IT10	≤ 2.0 ㎛	P, K

Applicable industries

Generation of wind and nuclear power	Shipbuilding	Railway and construction	Aircraft	Automobile
				

Code system

【Holder】

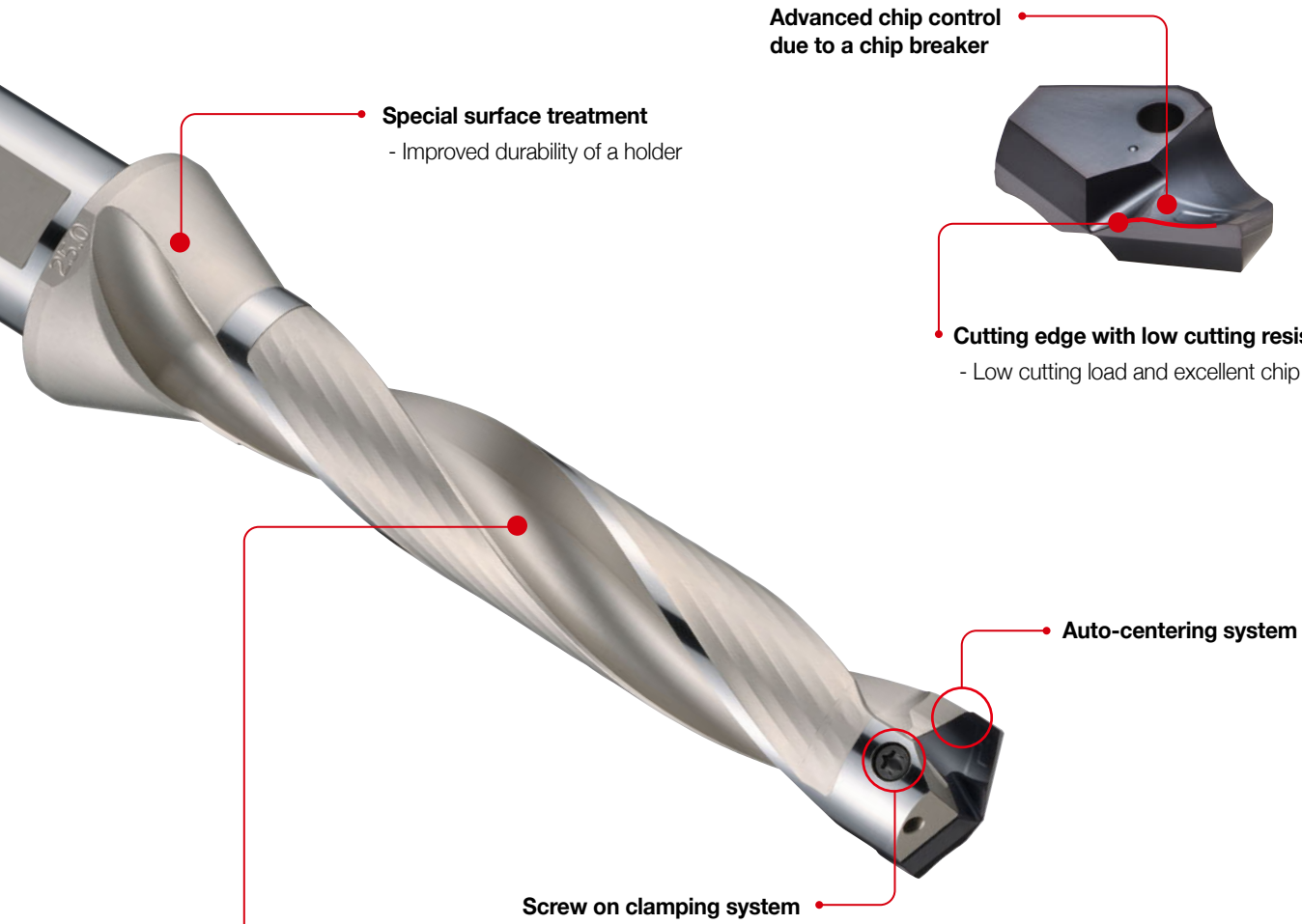
TPD	B	200	-	25	-	5	-	P
Top solid Piercing Drill	Insert type B: Blade type	Drill dia. 200: Ø20.0		Shank dia. 25: Ø25		Aspect ratio (L/D) 3D, 5D, 8D, 10D, 12D		Plus

【Insert】

TPD	200	B
Top solid Piercing Drill	Drill dia. 200: Ø20.0	Insert type B: Blade type

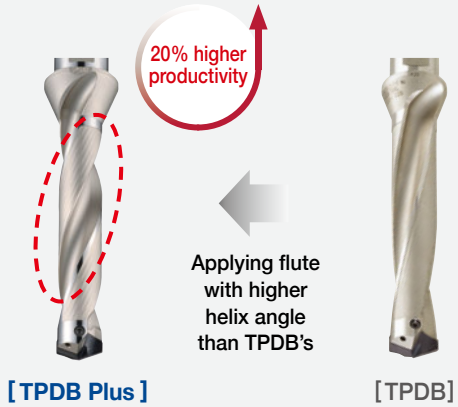
Features

- **Highly precise clamping system** - Superior clamping precision with auto-centering system and highly precise grinding clamping parts
- **Screw on clamping system** - Easy to replace inserts
- **Sharp cutting edge** - Low cutting load and good chip control
- **Holder with excellent durability** - Holder with high rigidity and excellent wear resistance due to special surface treatment
- **Holder with excellent chip control** - Low cutting resistance and outstanding chip evaluation by applying high helix angle

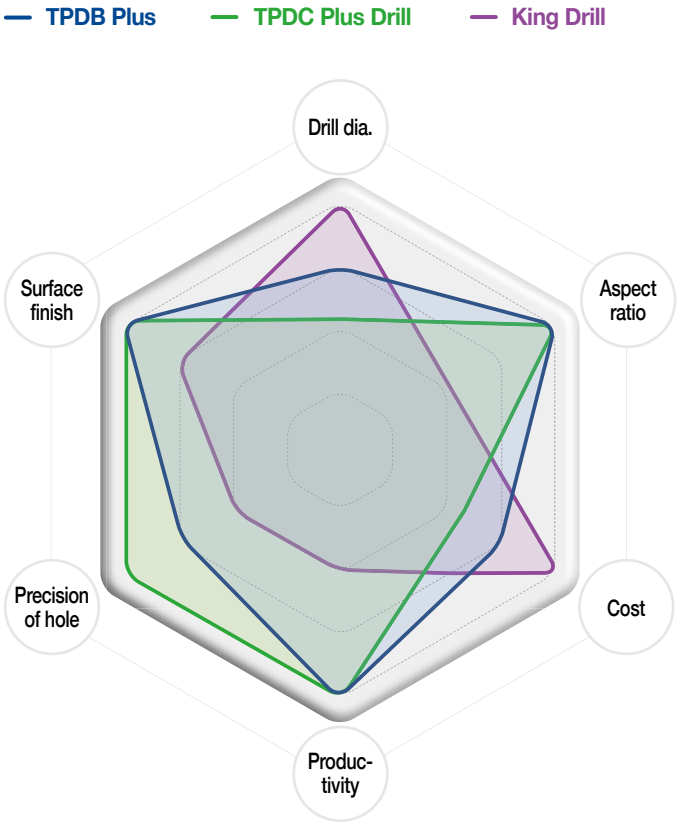


High helix angle

- **High productivity**
  - Stable chip evacuation realizes stable machinability
  - Decreased cycle time by applying improved cutting conditions
- **Improvement in machining quality**
  - Good surface finish and regular size of the hole



Indexable drill selection guide



TPDB Plus new

- Good surface finish
- High productivity
- 3D, 5D, 8D, 10D, 12D

TPDC Plus Drill new

- One step clamping
- High precision of hole
- 1.5D, 3D, 5D, 8D, 10D, 12D

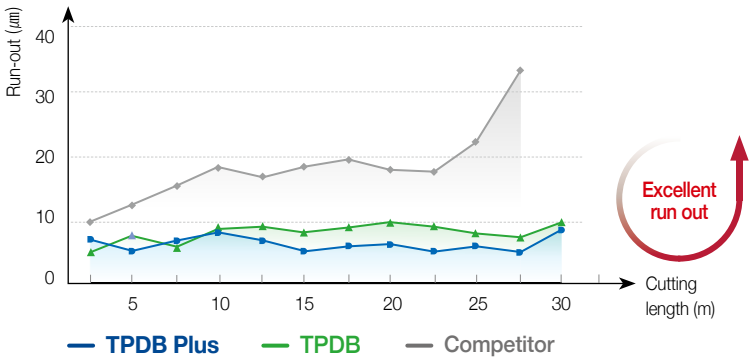
King Drill

- 4 corners (central and peripheral)
- 2D, 3D, 4D, 5D

Tools	Drill dia.	Aspect ratio	Cost	Productivity	Precision of hole	Surface finish
TPDB Plus new	★★★	★★★★	★★★	★★★★	★★★	★★★★
TPDC Plus Drill new	★★	★★★★	★★	★★★★	★★★★★	★★★★
King Drill	★★★★	★★	★★★★	★★	★★	★★★

Run-out

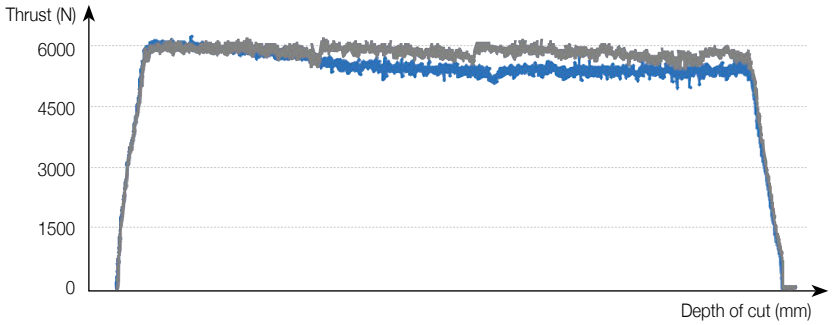
- **Workpiece** Alloy steel (42CrMo4)
- **Cutting conditions** vc (m/min) = 90
  fn (mm/rev) = 0.25
  ap (mm) = 120
  wet (20 bar)
- **Tools** **Insert** TPD250B (PC5300)
  Holder TPDB250-32-5-P
  (Drill dia. = Ø25 mm)



Performance evaluation

Cutting load

- **Workpiece** Alloy steel (42CrMo4)
- **Cutting conditions** vc (m/min) = 120, fn (mm/rev) = 0.25, ap (mm) = 120, wet (20 bar)
- **Tools** **Insert** TPD250B(PC5300) **Holder** TPDB250-32-5-P (Drill dia. = Ø25 mm)



10% lower cutting load

— TPDB Plus
Average thrust 4998N

— Competitor
Average thrust 5492N

Surface finish

- **Workpiece** Alloy steel (42CrMo4)
- **Cutting conditions** vc (m/min) = 120
  fn (mm/rev) = 0.35
  ap (mm) = 120
  wet (20 bar)
- **Tools** **Insert** TPD250B (PC5300)
  Holder TPDB250-32-5-P
  (Drill dia. = Ø25 mm)

7% better surface finish

[TPDB Plus]
Ra = 0.54 ㎛

[Competitor]
Ra = 0.57 ㎛

Chip control

- **Workpiece** Alloy steel (42CrMo4)
- **Cutting conditions** vc (m/min) = 120
  fn (mm/rev) = 0.35
  ap (mm) = 120
  wet (20 bar)
- **Tools** **Insert** TPD250B (PC5300)
  Holder TPDB250-32-5-P
  (Drill dia. = Ø25 mm)

Regular chip shape and size

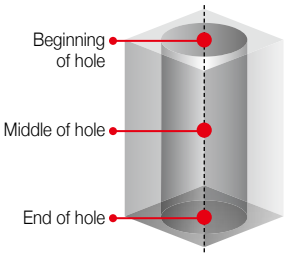
[TPDB Plus]

[Competitor]

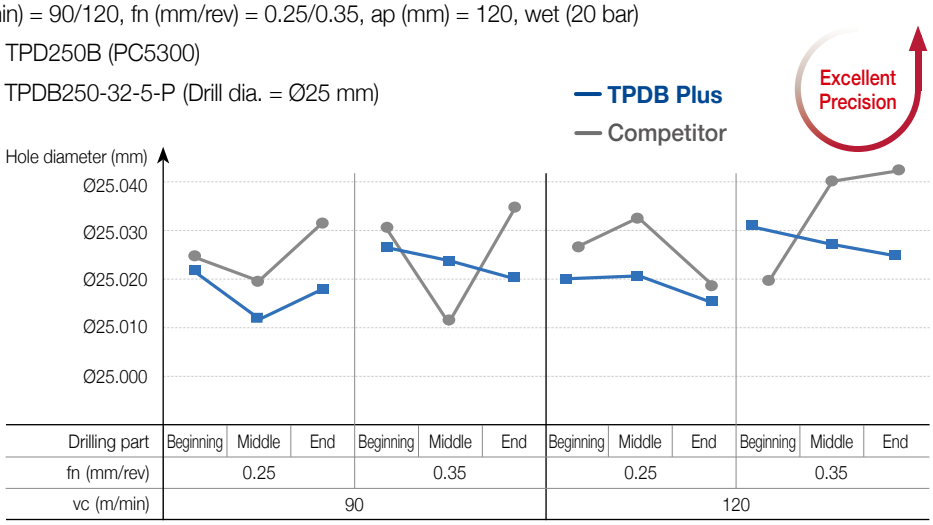
Performance evaluation

Precision

- **Workpiece** Alloy steel (42CrMo4)
- **Cutting conditions** vc (m/min) = 90/120, fn (mm/rev) = 0.25/0.35, ap (mm) = 120, wet (20 bar)
- **Tools** **Insert** TPD250B (PC5300)
  Holder TPDB250-32-5-P (Drill dia. = Ø25 mm)



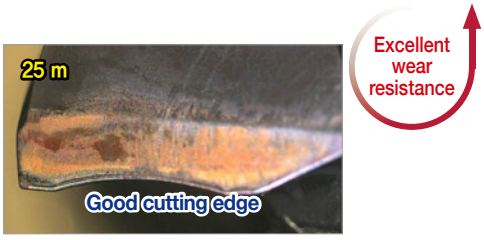
[Drilling part]



Drilling part	Beginning	Middle	End	Beginning	Middle	End	Beginning	Middle	End	Beginning	Middle	End
fn (mm/rev)	0.25			0.35			0.25			0.35		
vc (m/min)	90						120					

Wear resistance

- **Workpiece** Alloy steel (42CrMo4)
- **Cutting conditions** vc (m/min) = 100, fn (mm/rev) = 0.3, ap (mm) = 100, wet (30 bar)
- **Tools** **Insert** TPD250B (PC5300) **Holder** TPDB250-32-5-P (Drill dia. = Ø25 mm)



[TPDB Plus] [Competitor]

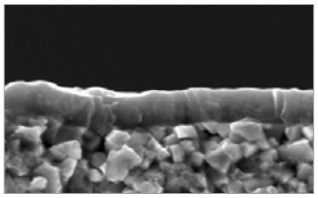
▶ Improved built up edge and chipping resistance lead stable wear on TPDB Plus insert's edge and obtain longer Max. tool life.

- **Workpiece** Carbon steel (C45)
- **Cutting conditions** vc (m/min) = 100, fn (mm/rev) = 0.3, ap (mm) = 100, wet (30 bar)
- **Tools** **Insert** TPD250B (PC5335) **Holder** TPDB250-32-5-P (Drill dia. = Ø25 mm)

[TPDB Plus] [Competitor]

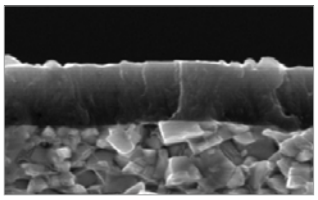
▶ Sharper cutting edge than competitor's improves built up edge resistance and tool life.

Grade features



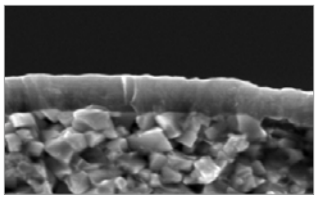
PC5300

- Applying PVD coating with high hardness and stability in machining at high temperature
- Stable drilling due to high cutting edge strength and excellent chipping resistance
- Optimal grade for drilling alloy steel and cast iron



PC5335

- Applying PVD coating with high toughness and excellent lubrication
- Coating layer highly adhering to substrate
- Optimal grade for general structural carbon steel (FE360B, etc.) and machine structural carbon steel (C45, etc.) machining



PC330P

- Applying PVD coating with high surface finish and excellent lubrication
- Coating layer with excellent hardness at high temperature and oxidation resistance
- Optimal grade for welding structural carbon steel (E355DD, etc.)

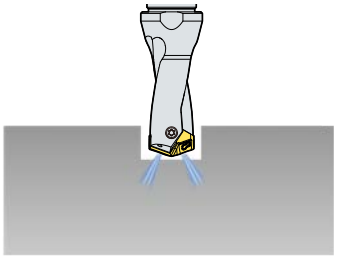
Recommended cutting conditions

Workpiece			Grade	vc (m/min)	Aspect ratio (L/D) = 3D, 5D Feed rate (mm/rev) per drill dia. (mm)		
ISO	Workpiece materials	HB			Ø10 - Ø16.9	Ø17 - Ø26.9	Ø27 - Ø32.9
P Carbon steel	Low carbon steel	80 - 120	PC5335 PC330P	**110** (80-140)	0.15 - 0.30	0.20 - 0.35	0.25 - 0.40
	High carbon steel	180 - 280	PC5335 PC330P	**100** (70-130)	0.15 - 0.30	0.20 - 0.35	0.25 - 0.40
P Alloy steel	Low alloy steel	140 - 260	PC5300	**110** (80-140)	0.18 - 0.35	0.23 - 0.38	0.28 - 0.43
	Low alloy heat treated steel	200 - 400	PC5300	**75** (50-100)	0.18 - 0.35	0.23 - 0.38	0.28 - 0.43
	High alloy steel	50 - 260	PC5300	**70** (50-90)	0.18 - 0.30	0.20 - 0.35	0.25 - 0.40
	High alloy heat treated steel	220 - 450	PC5300	**60** (40-80)	0.18 - 0.30	0.20 - 0.35	0.25 - 0.40
K Cast iron	Gray cast iron	150 - 230	PC5300	**110** (80-140)	0.18 - 0.35	0.20 - 0.40	0.25 - 0.45
	Ductile cast iron	160 - 260	PC5300	**100** (70-130)	0.18 - 0.35	0.20 - 0.40	0.25 - 0.45

※ In case of 8D, machine in 20 - 30% lower cutting conditions than the mentioned above, or machine the beginning of hole (1.5D) before drilling.
※ In interrupted machining, reduce the feed to 0.1 - 0.15 machining around the interrupted part.
※ Refer to the 'Recommended drilling method' on the page 10 for drilling of 10D - 12D.

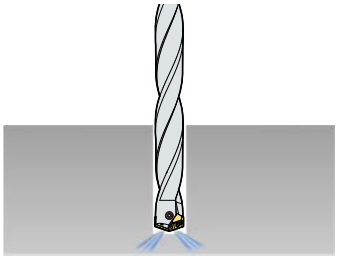
Recommended drilling method (10D, 12D)

Machine a pilot hole (with a pilot drill)

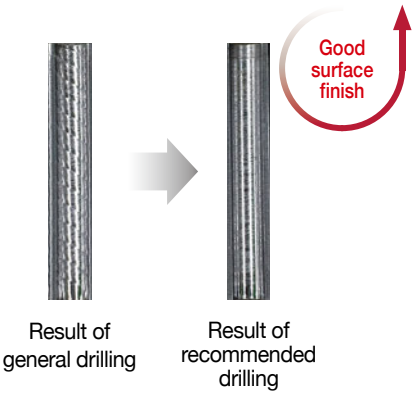


- Machine a pilot hole with the depth of cut as 0.5D and at 30% lower speed using a 1.5D or 3D drill.

Start drilling



- After machining the pilot hole, replace the pilot drill to a drill for further operation and machine in recommended cutting conditions.



Result of general drilling

Result of recommended drilling

Precaution in drilling

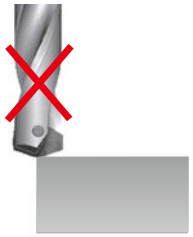
Angled surface drilling

- The approach angle between drill and the workpiece at the beginning and the end should be less than 6°.
- Reduce the feed (fn) to 30-50% than general cutting conditions at the beginning and the end of angled surface.

Stacked plates drilling

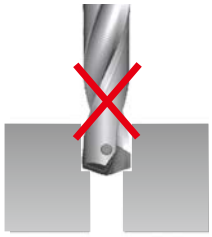
- Gap between the plates could make wrong chip evacuation causing fracture of the drill.
- Place stacked plates without any gap between each.

Plunging



- Irregular cutting resistance in plunging could cause fracture and deformation of the drill.

Boring



- Boring is not recommended due to wear and chipping in the corner of the insert.

How to clamp an insert

Clamping an insert to a holder

① Put an insert on the tip seat of the holder.
② As the **[Pic.1]**, push the insert to the v-shaped groove of the holder.
③ Screw and clamp the insert.

Changing the used insert to a new one

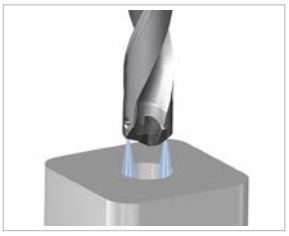
① Unscrew and separate the used insert from the holder.
② As the **[Pic.2]**, clean the insert seat.
③ Put a new insert on the tip seat.
④ As the **[Pic.3]**, clamp the insert pushing it with a hand not to separate from the holder.

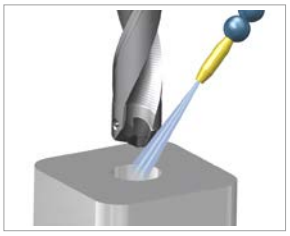
Check point in drilling

- Condition of the clamped workpiece
- Revolution of the main axis of the machine
- Condition of the holder
- Run-out of the clamped drill (Max. 0.03 mm)
- Condition of supplying coolant (pressure, flow, concentration)
- Chip evacuation

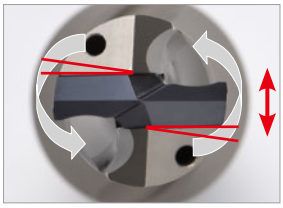
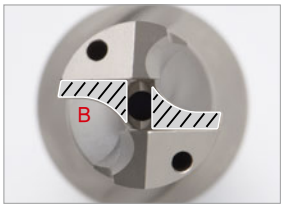
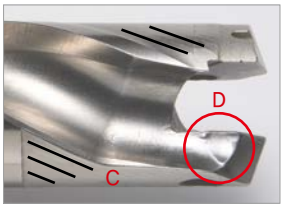
Supply of coolant

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

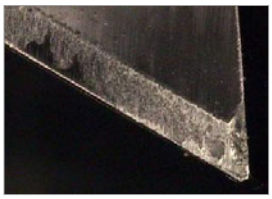
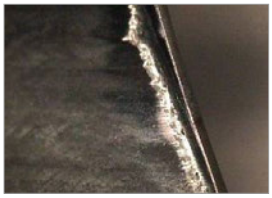
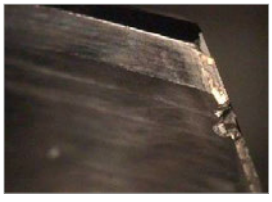




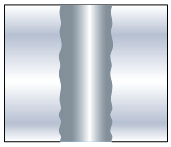
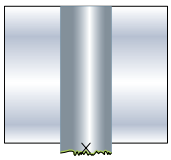
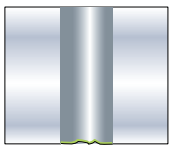
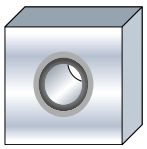
Replacement of holders and screws

Worn part	How to check	Description
[Pic.1] 	[Pic.2] Check the gap 	• In case of drilling for a long time as shown in the **[Pic.1]** the 'A' part is torn and twisted due to torque. • As shown in the **[Pic.2]** check the gap between the insert and the tip seat turning the clamped insert from side to side. If there is a gap between them, replace the used holder to a new one.
[Pic.3] 	[Pic.4] Check the moving 	• The insert could move up or down due to the load on the Z-axis in drilling over an extended period of time which causes wear on the 'B' part as shown the **[Pic.3]**. • After clamping an insert, if the insert is moving or there is a gap between the insert and the tip seat as shown in the **[Pic.4]** replace the used holder to a new one.
[Pic.5] 	Check the moving 	• After an extended period of use, the screw can be worn as shown in the 'E' part of **[Pic.5]** which could decrease the clamping force of the insert. When the screw is worn, replace the old screw to a new one among the enclosed extras. • Spreading the grease on the screw makes it last longer.
[Pic.6] ① Check the 'C' and 'D' parts as shown in the **[Pic.6]** ② Check whether the chips are getting longer or not.		• Winding or jamming of long and tiny chips in drilling causes wear or scratch on the 'C' part as shown in the **[Pic.6]** due to chattering from machining in improper cutting conditions. In that case, reset the cutting conditions and check the Run-out before machining. • The excessive wear of the part 'D' as shown in the **[Pic.6]** relating to chip curling might cause long chips.

Types of damage to drill and solutions

Scratches on the margin		
	Factors	• Lack of coolant lubrication • Lack of coolant in deep drilling due to MQL system • Bend of drill due to improperly placed holder or using a long holder • Low rigidity or large concentricity
	Solutions	• Use more coolant. • Place workpiece tightly and check the concentricity. • Check the precision of installment of drill. (below 0.03 mm) • Reduce the cutting speed.
Wear on the margin		
	Factors	• Due to machining pure metal or heat resisting alloy • Less back taper due to using a holder for a long time • Unstable machining at the end of hole due to interruption • Lack of coolant lubrication on the peripheral section of holder contacting workpiece
	Solutions	• Set up proper tool life and manage its usage. • Check the shape of machining part. • Check the kind and concentration of coolant.
Chipping on the corner		
	Factors	• Interrupted machining (End of hole is inclined or curved shape, junction hole in the middle of hole.) • Chattering in drilling due to unstable clamping, low rigidity of machine or bending of drill • Chattering due to unstable clamping of drill
	Solutions	• Check the part of machining. • Machine in lower cutting speed. • Place workpiece tightly. • Check the performance of the machine. • Check the precision of installment of drill. (below 0.03 mm)
Wear on the rake face		
	Factors	• Low cutting speed • Machining free-cutting steel • Erosion of chip and flute • Lack of coolant lubrication
	Solutions	• Increase cutting speed. • Set a lower thinning angle. • Reduce the honing. • Use more coolant.
Chipping on the rake face		
	Factors	• Fracture on the cutting edge partially due to pre-treatment on the center of hole • Unstable chip evacuation due to step drilling and external coolant • Chattering in drilling and low precision of holder installment
	Solutions	• Check if there is pre-machining or not. • It is recommended to use internal coolant in step drilling. • Check the state of clamping workpiece and the precision of drill installment. (below 0.03 mm)

Types of damage to workpiece and check points

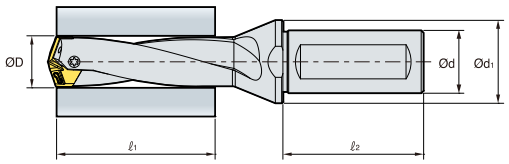
Poor surface finish (rough, scratch, etc.)		
	Factors	• Low rigidity of machine and improperly clamped workpiece • Large concentricity and lack of coolant
	Solutions	• Clamp the workpiece properly and check the concentricity. • Increase the amount and pressure of coolant
Remained lots of burr at the end of the drilled hole		
	Factors	• High feed and excessive honing of the cutting edge • Exceeded cutting tool's tool life (Too much wear and chipping)
	Solutions	• Reduce feed (Especially at the end of hole) and use a new drill. • Increase point angle or reduce honing.
Flaking the end of the drilled hole		
	Factors	• Machining of low toughness materials as cast iron • Rapid feed and excessive honing of the cutting edge • Exceeded cutting tool's tool life (Too much wear and chipping)
	Solutions	• Reduce the feed. (Especially at the end of hole) • Use a new drill. • Reduce honing on the cutting edge.
Thermal deformation and oxidation of the end of the drilled hole		
	Factors	• Rapid feed • Lack of coolant • Excessive cutting load • Exceeded cutting tool's tool life (Too much wear and chipping)
	Solutions	• Reduce the feed and honing on the cutting edge. • Use more coolant and use a new drill.

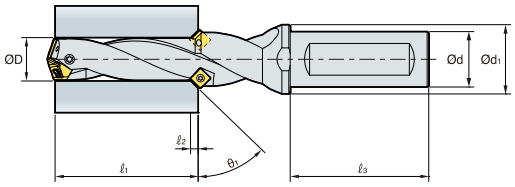
Solutions for troubles

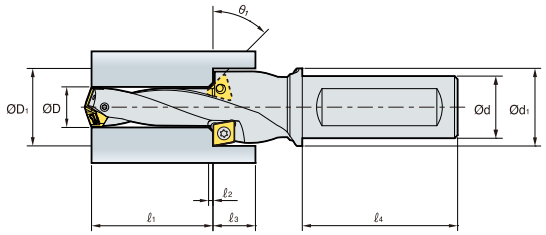
↑ Increase ↓ Decrease ○ Use

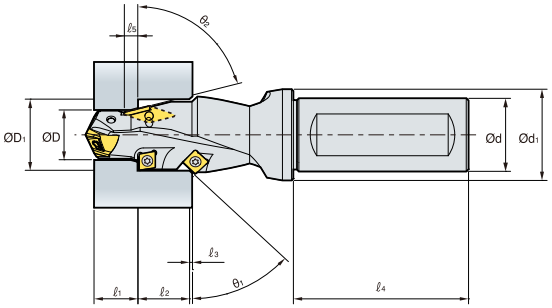
Trouble	Designation	Solutions															
		Cutting conditions					Tool shape					Grade		The others			
		vc	fn	Coolant	fn (in the beginning)	Depth of cut	Relief angle	Point angle	Thinning angle	Honing	Flute width rate	Toughness	Hardness	Rigidity of machine	Chattering of machine	Fixing workpiece	Overhang
Chipping	• Improper cutting conditions • Low rigidity of tool • Built-up edge • Improper grade • Chattering	↓	↓	○			↓		↓	↑		↑		↑	↓	↑	↓
Wear	• Excessive cutting speed (wear on margin)	↓	↓	○									↑				
	• Low cutting speed (wear in the center of drill)	↑	↓	○									↑				
Fracture	• Improper cutting conditions • Too much cutting load • Too long overhang • Less rigidity of machine	↓	↓	○	↓	↓								↑		↑	↓
Poor chip evacuation	• Improper cutting conditions		↓	○		↓					↑						
Poor surface finish	• Built-up edge • Chattering • Improper cutting conditions	↑	↓	○	↓			↓		↓				↑	↓	↑	↓
Poor accuracy of hole	• Low cutting speed (wear in the center of drill)	↑	↓											↑	↓		↓

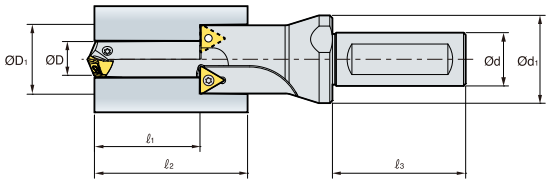
Special drill order form











Hole type

☐ Blind hole ☐ Through hole

Coolant type

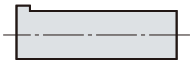
☐ Internal ☐ External

Special note

- Currently using tool:
- Current cutting condition
  - n (rpm) or vc (m/min):
  - vf (mm/min) or fn (mm/rev):
  - Depth of cut, ap (mm):
- Standard of measuring tool life:
- Currently using machine
  - Machining center:
  - General lathe:
  - CNC lathe:

Shank type

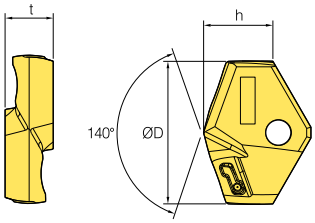
☐  Plain type

☐  Flat type

☐  Weldon type

☐  Whistle notch type

Insert



(mm)

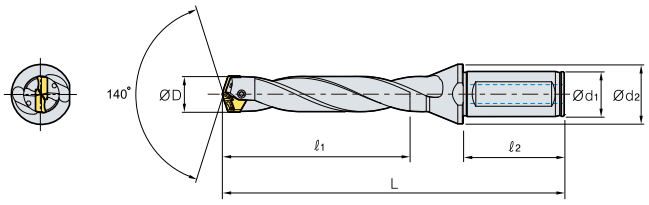
Designation		Coated			ØD	h	t
		PC5300	PC5335	PC330P			
TPD	100B	●			10.0	5.5	3.5
	105B	●			10.5	5.5	3.5
	110B	●	●		11.0	5.8	3.5
	115B	●			11.5	5.8	3.5
	120B	●	●		12.0	6.3	3.5
	125B	●	●		12.5	6.3	3.5
	130B	●			13.0	6.5	4.0
	135B	●			13.5	6.5	4.0
	140B	●	●		14.0	6.8	4.0
	145B	●	●		14.5	6.8	4.0
	150B	●	●		15.0	7.0	4.0
	155B	●	●		15.5	7.0	4.0
	160B	●	●		16.0	7.7	5.5
	165B	●			16.5	7.7	5.5
	170B	●	●		17.0	7.9	5.5
	175B	●	●		17.5	7.9	5.5
	180B	●	●		18.0	8.1	6.0
	185B	●	●		18.5	8.1	6.0
	190B	●	●		19.0	8.3	6.0
	195B	●			19.5	8.3	6.0
	200B	●	●		20.0	9.7	6.5
	205B	●			20.5	9.7	6.5
	210B	●	●		21.0	9.4	6.5
	215B	●			21.5	9.4	6.5
	220B	●	●		22.0	9.6	7.0
	225B	●			22.5	9.6	7.0
	230B	●	●		23.0	9.8	7.0
	235B	●			23.5	9.8	7.0
	240B	●	●		24.0	10.7	7.5
	245B	●			24.5	10.7	7.5
	250B	●	●		25.0	10.9	7.5
	255B	●			25.5	10.9	7.5
	260B	●	●		26.0	11.0	8.5
	265B	●			26.5	11.0	8.5
	270B	●			27.0	11.8	8.5
	275B	●			27.5	11.8	8.5
	280B	●			28.0	12.6	9.5
	285B	●			28.5	12.6	9.5
	290B	●			29.0	12.9	9.5
	295B	●			29.5	12.9	9.5
	300B	●			30.0	13.0	10.0
	305B	●			30.5	13.0	10.0
	310B	●			31.0	13.2	10.0
	315B	●			31.5	13.2	10.0
	320B	●			32.0	13.4	10.0
	325B	●			32.5	13.4	10.0

※ We can provide nonstock items with Ø10.00 - Ø32.99 ●: Stock item

Parts

Designation		Drill diameter ØD (mm)	Screw	Wrench	Torque (N·m)
TPD	100B - 129B	10.0 - 12.9	FTNB0209-P	TW06P	0.4
	130B - 149B	13.0 - 14.9	FTNB02512-P	TW07S	0.8
	150B - 179B	15.0 - 17.9	FTNB02514-P	TW07S	0.8
	180B - 199B	18.0 - 19.9	FTNB0316-P	TW09S	1.2
	200B - 239B	20.0 - 23.9	FTNB0319	TW09S	1.2
	240B - 259B	24.0 - 25.9	FTNB03522	TW15S	3.0
	260B - 279B	26.0 - 27.9	FTNB03524	TW15S	3.0
	280B - 299B	28.0 - 29.9	FTNB0426	TW15S	3.0
	300B - 329B	30.0 - 32.9	FTNB0528	TW20-100	4.0

TPDB Plus (3D)

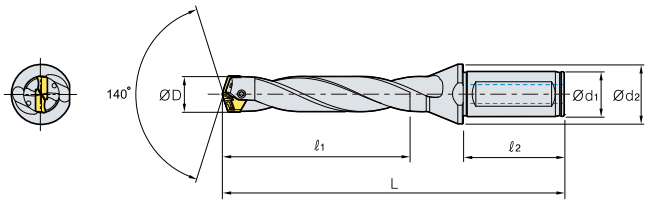


(mm)

Designation		Stock	ØD	Ød1	Ød2	ℓ1	ℓ2	L	Insert
TPDB	100-16-3-P	●	10.0 - 10.4	16	20	30.0	48	96.6	TPD100B - 104B
	105-16-3-P	●	10.5 - 10.9	16	20	31.5	48	97.6	TPD105B - 109B
	110-16-3-P	●	11.0 - 11.4	16	20	33.0	48	99.7	TPD110B - 114B
	115-16-3-P	●	11.5 - 11.9	16	20	34.5	48	100.7	TPD115B - 119B
	120-16-3-P	●	12.0 - 12.4	16	20	36.0	48	104.1	TPD120B - 124B
	125-16-3-P	●	12.5 - 12.9	16	20	37.5	48	106.2	TPD125B - 129B
	130-16-3-P	●	13.0 - 13.4	16	20	39.0	48	109.3	TPD130B - 134B
	135-16-3-P	●	13.5 - 13.9	16	20	40.5	48	111.4	TPD135B - 139B
	140-16-3-P	●	14.0 - 14.4	16	20	42.0	48	113.5	TPD140B - 144B
	145-16-3-P	●	14.5 - 14.9	16	20	43.5	48	116.6	TPD145B - 149B
	150-20-3-P	●	15.0 - 15.4	20	25	45.0	50	120.7	TPD150B - 154B
	155-20-3-P	●	15.5 - 15.9	20	25	46.5	50	122.7	TPD155B - 159B
	160-20-3-P	●	16.0 - 16.4	20	25	48.0	50	124.9	TPD160B - 164B
	165-20-3-P	●	16.5 - 16.9	20	25	49.5	50	126.9	TPD165B - 169B
	170-20-3-P	●	17.0 - 17.4	20	25	51.0	50	130.1	TPD170B - 174B
	175-20-3-P	●	17.5 - 17.9	20	25	52.5	50	132.1	TPD175B - 179B
	180-25-3-P	●	18.0 - 18.4	25	33	54.0	56	140.2	TPD180B - 184B
	185-25-3-P	●	18.5 - 18.9	25	33	55.5	56	142.2	TPD185B - 189B
	190-25-3-P	●	19.0 - 19.4	25	33	57.0	56	145.3	TPD190B - 194B
	195-25-3-P	●	19.5 - 19.9	25	33	58.5	56	147.3	TPD195B - 199B
	200-25-3-P	●	20.0 - 20.4	25	33	60.0	56	149.5	TPD200B - 204B
	205-25-3-P	●	20.5 - 20.9	25	33	61.5	56	151.5	TPD205B - 209B
	210-25-3-P	●	21.0 - 21.4	25	33	63.0	60	154.7	TPD210B - 214B
	215-25-3-P	●	21.5 - 21.9	25	33	64.5	60	156.7	TPD215B - 219B
	220-25-3-P	●	22.0 - 22.4	25	33	66.0	60	158.9	TPD220B - 224B
	225-25-3-P	●	22.5 - 22.9	25	33	67.5	60	160.9	TPD225B - 229B
	230-25-3-P	●	23.0 - 23.4	25	33	69.0	60	164.1	TPD230B - 234B
	235-25-3-P	●	23.5 - 23.9	25	33	70.5	60	166.1	TPD235B - 239B
	240-32-3-P	●	24.0 - 24.4	32	43	72.0	60	172.3	TPD240B - 244B
	245-32-3-P	●	24.5 - 24.9	32	43	73.5	60	174.3	TPD245B - 249B
	250-32-3-P	●	25.0 - 25.4	32	43	75.0	60	177.5	TPD250B - 254B
	255-32-3-P	●	25.5 - 25.9	32	43	76.5	60	179.5	TPD255B - 259B
	260-32-3-P	●	26.0 - 26.9	32	43	78.0	60	181.7	TPD260B - 269B
	270-32-3-P	●	27.0 - 27.9	32	43	81.0	60	186.9	TPD270B - 279B
	280-32-3-P	●	28.0 - 28.9	32	43	84.0	60	191.0	TPD280B - 289B
	290-32-3-P	●	29.0 - 29.9	32	43	87.0	60	196.2	TPD290B - 299B
	300-32-3-P	●	30.0 - 30.9	32	43	90.0	60	199.4	TPD300B - 309B
	310-32-3-P	●	31.0 - 31.9	32	43	93.0	60	204.6	TPD310B - 319B
	320-32-3-P	●	32.0 - 32.9	32	43	96.0	60	206.8	TPD320B - 329B

●: Stock item

TPDB Plus (5D)

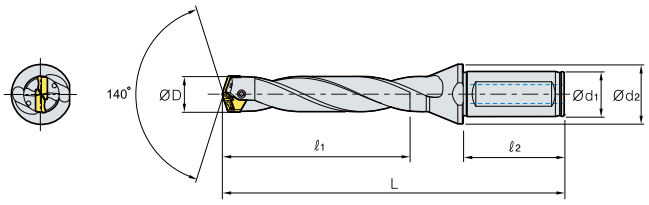


(mm)

Designation		Stock	ØD	Ød1	Ød2	ℓ1	ℓ2	L	Insert
TPDB	100-16-5-P	●	10.0 - 10.4	16	20	50.0	48	116.1	TPD100B - 104B
	105-16-5-P	●	10.5 - 10.9	16	20	52.5	48	118.9	TPD105B - 109B
	110-16-5-P	●	11.0 - 11.4	16	20	55.0	48	121.7	TPD110B - 114B
	115-16-5-P	●	11.5 - 11.9	16	20	57.5	48	124.5	TPD115B - 119B
	120-16-5-P	●	12.0 - 12.4	16	20	60.0	48	128.1	TPD120B - 124B
	125-16-5-P	●	12.5 - 12.9	16	20	62.5	48	131.2	TPD125B - 129B
	130-16-5-P	●	13.0 - 13.4	16	20	65.0	48	135.3	TPD130B - 134B
	135-16-5-P	●	13.5 - 13.9	16	20	67.5	48	138.4	TPD135B - 139B
	140-16-5-P	●	14.0 - 14.4	16	20	70.0	48	141.5	TPD140B - 144B
	145-16-5-P	●	14.5 - 14.9	16	20	72.5	48	145.6	TPD145B - 149B
	150-20-5-P	●	15.0 - 15.4	20	25	75.0	50	150.7	TPD150B - 154B
	155-20-5-P	●	15.5 - 15.9	20	25	77.5	50	153.7	TPD155B - 159B
	160-20-5-P	●	16.0 - 16.4	20	25	80.0	50	156.9	TPD160B - 164B
	165-20-5-P	●	16.5 - 16.9	20	25	82.5	50	159.9	TPD165B - 169B
	170-20-5-P	●	17.0 - 17.4	20	25	85.0	50	164.1	TPD170B - 174B
	175-20-5-P	●	17.5 - 17.9	20	25	87.5	50	167.1	TPD175B - 179B
	180-25-5-P	●	18.0 - 18.4	25	33	90.0	56	176.2	TPD180B - 184B
	185-25-5-P	●	18.5 - 18.9	25	33	92.5	56	179.2	TPD185B - 189B
	190-25-5-P	●	19.0 - 19.4	25	33	95.0	56	183.3	TPD190B - 194B
	195-25-5-P	●	19.5 - 19.9	25	33	97.5	56	186.3	TPD195B - 199B
	200-25-5-P	●	20.0 - 20.4	25	33	100.0	56	189.5	TPD200B - 204B
	205-25-5-P	●	20.5 - 20.9	25	33	102.5	56	192.5	TPD205B - 209B
	210-25-5-P	●	21.0 - 21.4	25	33	105.0	60	196.7	TPD210B - 214B
	215-25-5-P	●	21.5 - 21.9	25	33	107.5	60	199.7	TPD215B - 219B
	220-25-5-P	●	22.0 - 22.4	25	33	110.0	60	202.9	TPD220B - 224B
	225-25-5-P	●	22.5 - 22.9	25	33	112.5	60	205.9	TPD225B - 229B
	230-25-5-P	●	23.0 - 23.4	25	33	115.0	60	210.1	TPD230B - 234B
	235-25-5-P	●	23.5 - 23.9	25	33	117.5	60	213.1	TPD235B - 239B
	240-32-5-P	●	24.0 - 24.4	32	43	120.0	60	220.3	TPD240B - 244B
	245-32-5-P	●	24.5 - 24.9	32	43	122.5	60	223.3	TPD245B - 249B
	250-32-5-P	●	25.0 - 25.4	32	43	125.0	60	227.5	TPD250B - 254B
	255-32-5-P	●	25.5 - 25.9	32	43	127.5	60	230.5	TPD255B - 259B
	260-32-5-P	●	26.0 - 26.9	32	43	130.0	60	233.7	TPD260B - 269B
	270-32-5-P	●	27.0 - 27.9	32	43	135.0	60	240.9	TPD270B - 279B
	280-32-5-P	●	28.0 - 28.9	32	43	140.0	60	247.0	TPD280B - 289B
	290-32-5-P	●	29.0 - 29.9	32	43	145.0	60	254.2	TPD290B - 299B
	300-32-5-P	●	30.0 - 30.9	32	43	150.0	60	259.4	TPD300B - 309B
	310-32-5-P	●	31.0 - 31.9	32	43	155.0	60	266.6	TPD310B - 319B
	320-32-5-P	●	32.0 - 32.9	32	43	160.0	60	270.8	TPD320B - 329B

●: Stock item

TPDB Plus (8D)

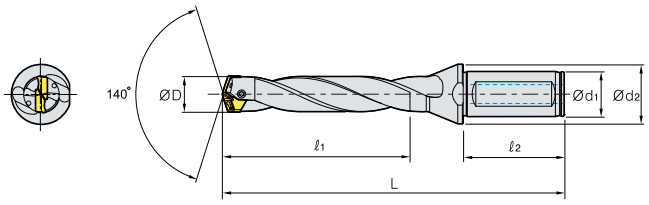


(mm)

Designation		Stock	ØD	Ød1	Ød2	ℓ1	ℓ2	L	Insert
TPDB	100-16-8-P	●	10.0 - 10.4	16	20	80	48	146.1	TPD100B - 104B
	105-16-8-P	●	10.5 - 10.9	16	20	84	48	150.4	TPD105B - 109B
	110-16-8-P	●	11.0 - 11.4	16	20	88	48	154.7	TPD110B - 114B
	115-16-8-P	●	11.5 - 11.9	16	20	92	48	159.0	TPD115B - 119B
	120-16-8-P	●	12.0 - 12.4	16	20	96	48	164.1	TPD120B - 124B
	125-16-8-P	●	12.5 - 12.9	16	20	100	48	168.7	TPD125B - 129B
	130-16-8-P	●	13.0 - 13.4	16	20	104	48	174.3	TPD130B - 134B
	135-16-8-P	●	13.5 - 13.9	16	20	108	48	178.9	TPD135B - 139B
	140-16-8-P	●	14.0 - 14.4	16	20	112	48	183.5	TPD140B - 144B
	145-16-8-P	●	14.5 - 14.9	16	20	116	48	189.1	TPD145B - 149B
	150-20-8-P	●	15.0 - 15.4	20	25	120	50	195.7	TPD150B - 154B
	155-20-8-P	●	15.5 - 15.9	20	25	124	50	200.2	TPD155B - 159B
	160-20-8-P	●	16.0 - 16.4	20	25	128	50	204.9	TPD160B - 164B
	165-20-8-P	●	16.5 - 16.9	20	25	132	50	209.4	TPD165B - 169B
	170-20-8-P	●	17.0 - 17.4	20	25	136	50	215.1	TPD170B - 174B
	175-20-8-P	●	17.5 - 17.9	20	25	140	50	219.6	TPD175B - 179B
	180-25-8-P	●	18.0 - 18.4	25	33	144	56	230.2	TPD180B - 184B
	185-25-8-P	●	18.5 - 18.9	25	33	148	56	234.7	TPD185B - 189B
	190-25-8-P	●	19.0 - 19.4	25	33	152	56	240.3	TPD190B - 194B
	195-25-8-P	●	19.5 - 19.9	25	33	156	56	244.8	TPD195B - 199B
	200-25-8-P	●	20.0 - 20.4	25	33	160	56	249.5	TPD200B - 204B
	205-25-8-P	●	20.5 - 20.9	25	33	164	56	254.0	TPD205B - 209B
	210-25-8-P	●	21.0 - 21.4	25	33	168	60	259.7	TPD210B - 214B
	215-25-8-P	●	21.5 - 21.9	25	33	172	60	264.2	TPD215B - 219B
	220-25-8-P	●	22.0 - 22.4	25	33	176	60	268.9	TPD220B - 224B
	225-25-8-P	●	22.5 - 22.9	25	33	180	60	273.4	TPD225B - 229B
	230-25-8-P	●	23.0 - 23.4	25	33	184	60	279.1	TPD230B - 234B
	235-25-8-P	●	23.5 - 23.9	25	33	188	60	283.6	TPD235B - 239B
	240-32-8-P	●	24.0 - 24.4	32	43	192	60	292.3	TPD240B - 244B
	245-32-8-P	●	24.5 - 24.9	32	43	196	60	296.8	TPD245B - 249B
	250-32-8-P	●	25.0 - 25.4	32	43	200	60	302.5	TPD250B - 254B
	255-32-8-P	●	25.5 - 25.9	32	43	204	60	307.0	TPD255B - 259B
	260-32-8-P	●	26.0 - 26.9	32	43	208	60	311.7	TPD260B - 269B
	270-32-8-P	●	27.0 - 27.9	32	43	216	60	321.9	TPD270B - 279B
	280-32-8-P	●	28.0 - 28.9	32	43	224	60	331.0	TPD280B - 289B
	290-32-8-P	●	29.0 - 29.9	32	43	232	60	341.2	TPD290B - 299B
	300-32-8-P	●	30.0 - 30.9	32	43	240	60	349.4	TPD300B - 309B
	310-32-8-P	●	31.0 - 31.9	32	43	248	60	359.6	TPD310B - 319B
	320-32-8-P	●	32.0 - 32.9	32	43	256	60	366.8	TPD320B - 329B

●: Stock item

TPDB Plus (10D)

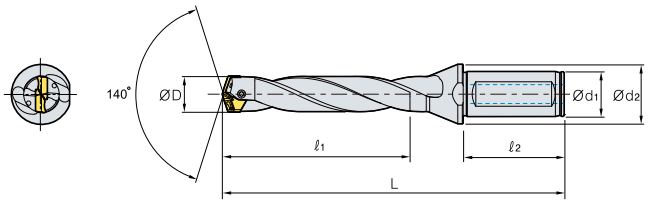


(mm)

Designation		Stock	ØD	Ød1	Ød2	ℓ1	ℓ2	L	Insert
TPDB	100-16-10-P	●	10.0 - 10.4	16	20	100	48	166.6	TPD100B - 104B
	105-16-10-P	●	10.5 - 10.9	16	20	105	48	171.6	TPD105B - 109B
	110-16-10-P	●	11.0 - 11.4	16	20	110	48	176.7	TPD110B - 114B
	115-16-10-P	●	11.5 - 11.9	16	20	115	48	181.7	TPD115B - 119B
	120-16-10-P	●	12.0 - 12.4	16	20	120	48	188.1	TPD120B - 124B
	125-16-10-P	●	12.5 - 12.9	16	20	125	48	193.7	TPD125B - 129B
	130-16-10-P	●	13.0 - 13.4	16	20	130	48	200.3	TPD130B - 134B
	135-16-10-P	●	13.5 - 13.9	16	20	135	48	205.9	TPD135B - 139B
	140-16-10-P	●	14.0 - 14.4	16	20	140	48	211.5	TPD140B - 144B
	145-16-10-P	●	14.5 - 14.9	16	20	145	48	218.1	TPD145B - 149B
	150-20-10-P	●	15.0 - 15.4	20	25	150	50	225.7	TPD150B - 154B
	155-20-10-P	●	15.5 - 15.9	20	25	155	50	231.2	TPD155B - 159B
	160-20-10-P	●	16.0 - 16.4	20	25	160	50	236.9	TPD160B - 164B
	165-20-10-P	●	16.5 - 16.9	20	25	165	50	242.4	TPD165B - 169B
	170-20-10-P	●	17.0 - 17.4	20	25	170	50	249.1	TPD170B - 174B
	175-20-10-P	●	17.5 - 17.9	20	25	175	50	254.6	TPD175B - 179B
	180-25-10-P	●	18.0 - 18.4	25	33	180	56	266.2	TPD180B - 184B
	185-25-10-P	●	18.5 - 18.9	25	33	185	56	271.7	TPD185B - 189B
	190-25-10-P	●	19.0 - 19.4	25	33	190	56	278.3	TPD190B - 194B
	195-25-10-P	●	19.5 - 19.9	25	33	195	56	283.8	TPD195B - 199B
	200-25-10-P	●	20.0 - 20.4	25	33	200	56	289.5	TPD200B - 204B
	205-25-10-P	●	20.5 - 20.9	25	33	205	56	295.0	TPD205B - 209B
	210-25-10-P	●	21.0 - 21.4	25	33	210	60	301.7	TPD210B - 214B
	215-25-10-P	●	21.5 - 21.9	25	33	215	60	307.2	TPD215B - 219B
	220-25-10-P	●	22.0 - 22.4	25	33	220	60	312.9	TPD220B - 224B
	225-25-10-P	●	22.5 - 22.9	25	33	225	60	318.6	TPD225B - 229B
	230-25-10-P	●	23.0 - 23.4	25	33	230	60	325.1	TPD230B - 234B
	235-25-10-P	●	23.5 - 23.9	25	33	235	60	330.6	TPD235B - 239B
	240-32-10-P	●	24.0 - 24.4	32	43	240	60	340.3	TPD240B - 244B
	245-32-10-P	●	24.5 - 24.9	32	43	245	60	345.8	TPD245B - 249B
	250-32-10-P	●	25.0 - 25.4	32	43	250	60	352.5	TPD250B - 254B
	255-32-10-P	●	25.5 - 25.9	32	43	255	60	358.0	TPD255B - 259B
	260-32-10-P	●	26.0 - 26.9	32	43	260	60	363.7	TPD260B - 269B
	270-32-10-P	●	27.0 - 27.9	32	43	270	60	375.9	TPD270B - 279B
	280-32-10-P	●	28.0 - 28.9	32	43	280	60	387.0	TPD280B - 289B
	290-32-10-P	●	29.0 - 29.9	32	43	290	60	399.2	TPD290B - 299B
	300-32-10-P	●	30.0 - 30.9	32	43	300	60	409.4	TPD300B - 309B
	310-32-10-P	●	31.0 - 31.9	32	43	310	60	421.6	TPD310B - 319B
	320-32-10-P	●	32.0 - 32.9	32	43	320	60	430.8	TPD320B - 329B

●: Stock item

TPDB Plus (12D)



(mm)

Designation		Stock	ØD	Ød1	Ød2	ℓ1	ℓ2	L	Insert
TPDB	100-16-12-P	●	10.0 - 10.4	16	20	120	48	186.6	TPD100B - 104B
	105-16-12-P	●	10.5 - 10.9	16	20	126	48	192.6	TPD105B - 109B
	110-16-12-P	●	11.0 - 11.4	16	20	132	48	198.7	TPD110B - 114B
	115-16-12-P	●	11.5 - 11.9	16	20	138	48	204.7	TPD115B - 119B
	120-16-12-P	●	12.0 - 12.4	16	20	144	48	212.1	TPD120B - 124B
	125-16-12-P	●	12.5 - 12.9	16	20	150	48	218.7	TPD125B - 129B
	130-16-12-P	●	13.0 - 13.4	16	20	156	48	226.3	TPD130B - 134B
	135-16-12-P	●	13.5 - 13.9	16	20	162	48	232.9	TPD135B - 139B
	140-16-12-P	●	14.0 - 14.4	16	20	168	48	239.5	TPD140B - 144B
	145-16-12-P	●	14.5 - 14.9	16	20	174	48	247.1	TPD145B - 149B
	150-20-12-P	●	15.0 - 15.4	20	25	180	50	255.7	TPD150B - 154B
	155-20-12-P	●	15.5 - 15.9	20	25	186	50	262.2	TPD155B - 159B
	160-20-12-P	●	16.0 - 16.4	20	25	192	50	268.9	TPD160B - 164B
	165-20-12-P	●	16.5 - 16.9	20	25	198	50	275.4	TPD165B - 169B
	170-20-12-P	●	17.0 - 17.4	20	25	204	50	283.1	TPD170B - 174B
	175-20-12-P	●	17.5 - 17.9	20	25	210	50	289.6	TPD175B - 179B
	180-25-12-P	●	18.0 - 18.4	25	33	216	56	302.2	TPD180B - 184B
	185-25-12-P	●	18.5 - 18.9	25	33	222	56	308.7	TPD185B - 189B
	190-25-12-P	●	19.0 - 19.4	25	33	228	56	316.3	TPD190B - 194B
	195-25-12-P	●	19.5 - 19.9	25	33	234	56	322.8	TPD195B - 199B
	200-25-12-P	●	20.0 - 20.4	25	33	240	56	329.5	TPD200B - 204B
	205-25-12-P	●	20.5 - 20.9	25	33	246	56	336.0	TPD205B - 209B
	210-25-12-P	●	21.0 - 21.4	25	33	252	60	343.7	TPD210B - 214B
	215-25-12-P	●	21.5 - 21.9	25	33	258	60	350.2	TPD215B - 219B
	220-25-12-P	●	22.0 - 22.4	25	33	264	60	356.9	TPD220B - 224B
	225-25-12-P	●	22.5 - 22.9	25	33	270	60	363.6	TPD225B - 229B
	230-25-12-P	●	23.0 - 23.4	25	33	276	60	371.1	TPD230B - 234B
	235-25-12-P	●	23.5 - 23.9	25	33	282	60	377.6	TPD235B - 239B
	240-32-12-P	●	24.0 - 24.4	32	43	288	60	388.3	TPD240B - 244B
	245-32-12-P	●	24.5 - 24.9	32	43	294	60	394.8	TPD245B - 249B
	250-32-12-P	●	25.0 - 25.4	32	43	300	60	402.5	TPD250B - 254B
	255-32-12-P	●	25.5 - 25.9	32	43	306	60	409.0	TPD255B - 259B
	260-32-12-P	●	26.0 - 26.9	32	43	312	60	415.7	TPD260B - 269B
	270-32-12-P	●	27.0 - 27.9	32	43	324	60	429.9	TPD270B - 279B
	280-32-12-P	●	28.0 - 28.9	32	43	336	60	443.0	TPD280B - 289B
	290-32-12-P	●	29.0 - 29.9	32	43	348	60	457.2	TPD290B - 299B
	300-32-12-P	●	30.0 - 30.9	32	43	360	60	469.4	TPD300B - 309B
	310-32-12-P	●	31.0 - 31.9	32	43	372	60	483.6	TPD310B - 319B
	320-32-12-P	●	32.0 - 32.9	32	43	384	60	494.8	TPD320B - 329B

●: Stock item

TPDB-F

Code system

【Holder】

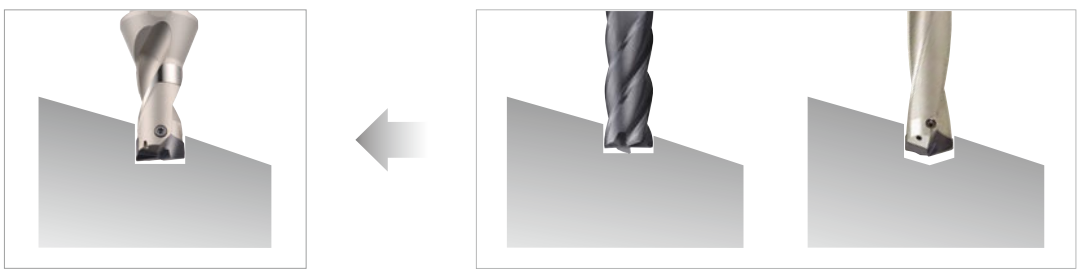
TPD	B	220	-	25	-	1.5	-	F
Top solid Piercing Drill	Insert type B: Blade type	Drill dia. 220: Ø22.0		Shank dia. 25: Ø25		Aspect ratio (L/D) 1.5D		Flat

【Insert】

TPD	200	B	-	F
Top solid Piercing Drill	Drill dia. 200: Ø20.0	Insert type B: Blade type		Cutting edge F: Flat FC: Flat Candle

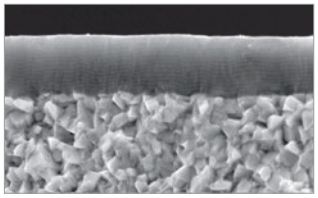
Features

- **High precision clamping system** - High precision clamping due to high precise grinding and auto-centering
- **Screw on clamping system** - Easy to replace insert
- **Cutting edge with 180° point angle** - Flat bottom machining
- **Low cutting load cutting edge** - Low cutting load and excellent chip control
- **High durability holder** - Improved wear resistance and durability with special surface treatment implementation
- **Holder with good chip evacuation** - Good chip evacuation and reduced cutting load with high helix angle



[Endmill + Drill] [Endmill] [Drill]

Grade features



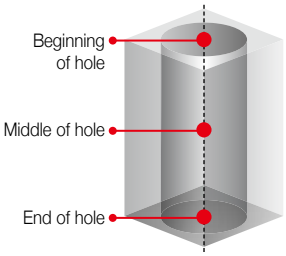
PC5400

- PVD coating technology with high lubrication, built up edge resistance and chipping resistance
- Excellent chipping resistance due to high toughness coating with high adhesive strength
- Enhanced fracture resistance and stable machinability due to ultra-fine substrate with high toughness substrate

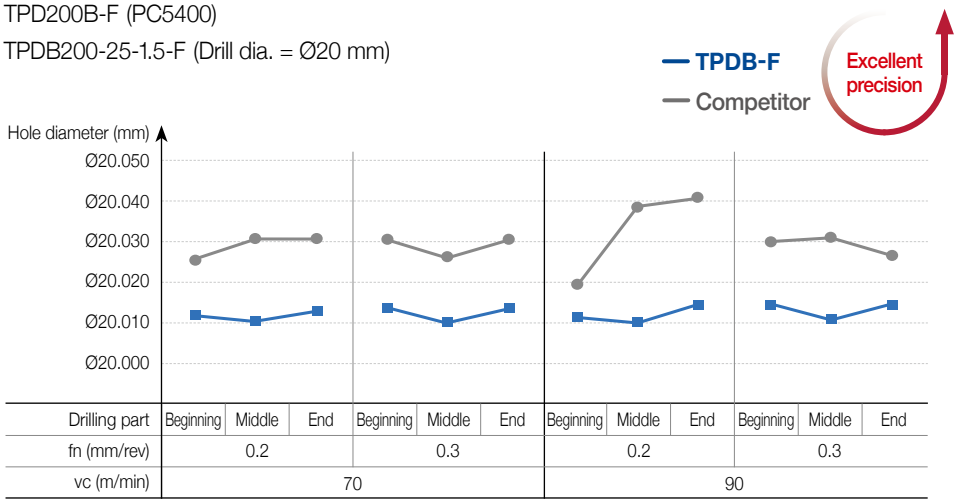
Performance evaluation

Precision

- **Workpiece** Alloy steel (42CrMo4, HRC22)
- **Cutting conditions** vc (m/min) = 70/90, fn (mm/rev) = 0.2/0.3, ap (mm) = 30, wet (20 bar)
- **Tools** **Insert** TPD200B-F (PC5400)
  Holder TPDB200-25-1.5-F (Drill dia. = Ø20 mm)



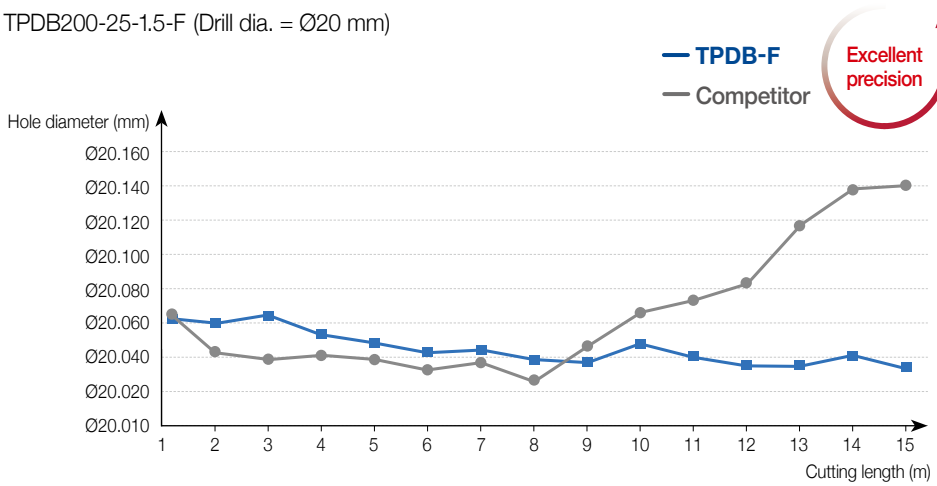
[Drilling part]



▶ Cutting edge with low cutting load enhances high precision.

- **Workpiece** Alloy steel (42CrMo4, HRC22), Angled surface 15°
- **Cutting conditions** vc (m/min) = 70, fn (mm/rev) = 0.21, ap (mm) = 20, wet (20 bar)
- **Tools** **Insert** TPD200B-F (PC5400)
  Holder TPDB200-25-1.5-F (Drill dia. = Ø20 mm)

[Angled surface drilling]



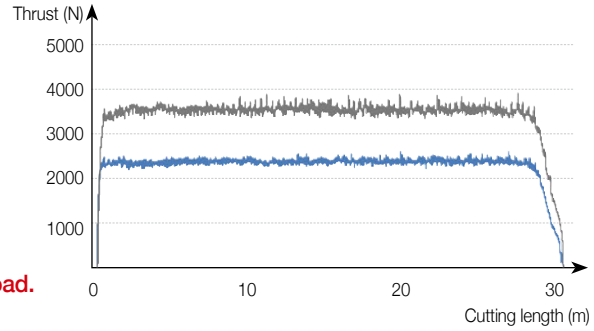
▶ Cutting edge with low cutting load enhances high precision.

Performance evaluation

Cutting load

- **Workpiece** Alloy steel (42CrMo4, HRC22)
- **Cutting conditions** vc (m/min) = 70
  fn (mm/rev) = 0.25
  ap (mm) = 30
  wet (20 bar)
- **Tools** **Insert** TPD200B-F (PC5400)
  Holder TPDB200-25-1.5-F
  (Drill dia. = Ø20 mm)

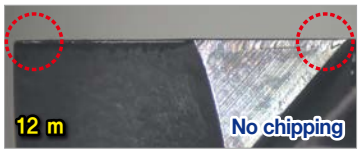
▶ The sharp point shape reduces cutting load.



Wear resistance

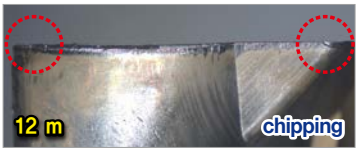
- **Workpiece** Alloy steel (42CrMo4, HRC22), Angled surface 15°
- **Cutting conditions** vc (m/min) = 70
  fn (mm/rev) = 0.21
  ap (mm) = 20
  wet (20 bar)
- **Tools** **Insert** TPD200B-F (PC5400)
  Holder TPDB200-25-1.5-F
  (Drill dia. = Ø20 mm)

▶ Enhanced chipping resistance increases too life due to stable wear on the cutting edge.



[TPDB-F]

Excellent wear resistance and chipping resistance



[Competitor]

Surface finish

- **Workpiece** Alloy steel (42CrMo4, HRC22), Angled surface 15°
- **Cutting conditions** vc (m/min) = 90
  fn (mm/rev) = 0.18
  ap (mm) = 20
  wet (20bar)
- **Tools** **Insert** TPD150B-F (PC5400)
  Holder TPDB150-16-1.5-F
  (Drill dia. = Ø15 mm)

▶ Low cutting load cutting edge ensures good surface finish.

[TPDB-F]

Enhanced surface finish

[Competitor]

Chip control

- **Workpiece** Carbon steel (C45, HRC18)
- **Cutting conditions** vc (m/min) = 90
  fn (mm/rev) = 0.25
  ap (mm) = 30
  wet (20 bar)
- **Tools** **Insert** TPD200B-F (PC5400)
  Holder TPDB200-25-1.5-F
  (Drill dia. = Ø20 mm)

▶ Stable chip curling controls chip shape.

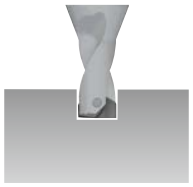
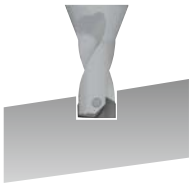
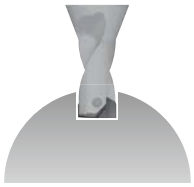
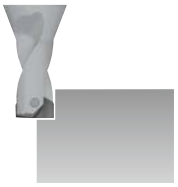
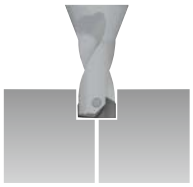
[TPDB-F]

Excellent chip control

[Competitor]

Recommended cutting condition

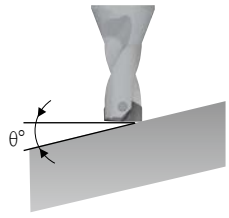
Workpiece			Grade	vc (m/min)	Aspect ratio (L/D) = 1.5D Feed rate (mm/rev) per drill dia. (mm)	
ISO	Workpiece	HB			Ø14.0 - Ø21.9	Ø22.0 - Ø30.9
P Carbon steel	Low carbon steel (C10, C25 etc)	80 - 120	PC5400	**80** (60 - 100)	0.2 - 0.3	0.22 - 0.32
	High carbon steel (C45, C50 etc)	180 - 280		**70** (50 - 90)	0.2 - 0.3	0.22 - 0.32
P Alloy steel	Low alloy steel (18CrMo4, 42CrMo4 etc)	140 - 260		**70** (50 - 90)	0.2 - 0.3	0.22 - 0.32
	High alloy steel (34CrMo4 etc)	260 - 320		**60** (40 - 80)	0.2 - 0.3	0.22 - 0.32

Machining	Flat surface drilling	Angled surface drilling	Curved surface drilling	Plunging	Boring
Pic.					
1.5D	○	○	○	○	○

※ Please refer to the precaution in drilling in case of angled surface, curved surface drilling, plunging and boring.

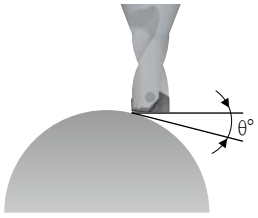
Precaution in drilling

Angled surface drilling



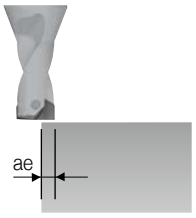
- Reduce the feed (fn) to 30% than general cutting conditions at the beginning and the end of angled surface. (In case, θ is over 30˚, reduce it to 50%.)

Curved surface drilling



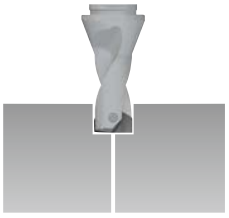
- Reduce the feed (fn) to 30% than general cutting conditions at the beginning of curved surface. (In case, θ is over 30˚, reduce it to 50%.)

Plunging



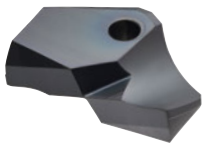
- Reduce the depth of cut (ae) to shorter than 1/2 of drill diameter.
- In case, the depth of cut is longer than drill diameter, plunge with divided depth of cut.

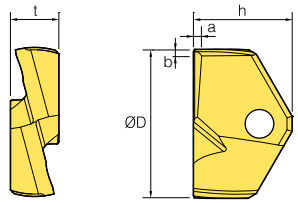
Boring



- Reduce the feed (fn) to 30% than general cutting conditions at the beginning of boring.
- Start with 2 mm stepping before boring to prevent long chip.

Insert





(mm)

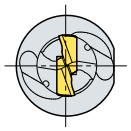
Designation		Coated PC5400	ØD	h	t	a	b
TPD	140B-F		14.0	8.75	4.0	0.065	0.055
	145B-F		14.5	8.75	4.0	0.065	0.055
	150B-F		15.0	9.25	4.0	0.065	0.055
	155B-F		15.5	9.25	4.0	0.065	0.055
	160B-F		16.0	10.25	5.5	0.065	0.055
	165B-F		16.5	10.25	5.5	0.065	0.055
	170B-F		17.0	10.75	5.5	0.065	0.055
	175B-F		17.5	10.75	5.5	0.065	0.055
	180B-F		18.0	11.75	6.0	0.065	0.055
	185B-F		18.5	11.75	6.0	0.065	0.055
	190B-F		19.0	12.25	6.0	0.065	0.055
	195B-F		19.5	12.25	6.0	0.065	0.055
	200B-F		20.0	12.75	6.5	0.065	0.055
	205B-F		20.5	12.75	6.5	0.065	0.055
	210B-F		21.0	13.25	6.5	0.065	0.055
	215B-F		21.5	13.25	6.5	0.065	0.055
	220B-F		22.0	13.75	7.0	0.065	0.055
	225B-F		22.5	13.75	7.0	0.065	0.055
	230B-F		23.0	14.25	7.0	0.065	0.055
	235B-F		23.5	14.25	7.0	0.065	0.055
	240B-F		24.0	14.75	7.5	0.065	0.055
	245B-F		24.5	14.75	7.5	0.065	0.055
	250B-F		25.0	15.25	7.5	0.065	0.055
	255B-F		25.5	15.25	7.5	0.065	0.055
	260B-F		26.0	15.75	8.5	0.065	0.055
	265B-F		26.5	15.75	8.5	0.065	0.055
	270B-F		27.0	16.75	8.5	0.065	0.055
	275B-F		27.5	16.75	8.5	0.065	0.055
	280B-F		28.0	17.75	9.5	0.065	0.055
	285B-F		28.5	17.75	9.5	0.065	0.055
	290B-F		29.0	18.25	9.5	0.065	0.055
	295B-F		29.5	18.25	9.5	0.065	0.055
	300B-F		30.0	18.75	10.0	0.065	0.055
	305B-F		30.5	18.75	10.0	0.065	0.055

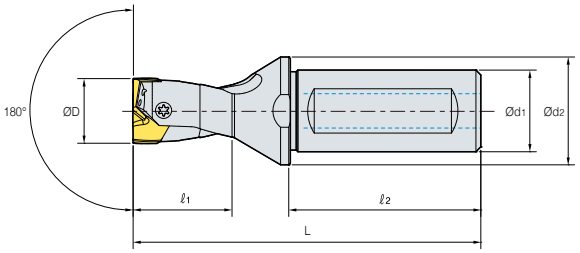
※ We can provide nonstock items with Ø14.00 - Ø30.99 ●: Stock item

Parts

Designation		Drill diameter ØD (mm)	Screw	Wrench	Torque (N·m)
TPD	140B-F ~ 149B-F	14.0 - 14.9	FTNB02512-P	TW07S	0.8
	150B-F ~ 179B-F	15.0 - 17.9	FTNB02514-P	TW07S	0.8
	180B-F ~ 199B-F	18.0 - 19.9	FTNB0316-P	TW09S	1.2
	200B-F ~ 239B-F	20.0 - 23.9	FTNB0319	TW09S	1.2
	240B-F ~ 259B-F	24.0 - 25.9	FTNB03522	TW15S	3.0
	260B-F ~ 279B-F	26.0 - 27.9	FTNB03524	TW15S	3.0
	280B-F ~ 299B-F	28.0 - 29.9	FTNB0426	TW15S	3.0
	300B-F ~ 309B-F	30.0 - 30.9	FTNB0528	TW20-100	4.0

TPDB-F (1.5D)





(mm)

Designation		Stock	ØD	Ød1	Ød2	ℓ1	ℓ2	L	Insert
TPDB	140-16-1.5-F		14.0 - 14.4	16	20	28.0	48	86.0	TPD140B-F~TPD144B-F
	145-16-1.5-F		14.5 - 14.9	16	20	29.0	48	87.0	TPD145B-F~TPD149B-F
	150-20-1.5-F		15.0 - 15.4	20	25	30.0	50	93.0	TPD150B-F~TPD154B-F
	155-20-1.5-F		15.5 - 15.9	20	25	31.0	50	94.0	TPD155B-F~TPD159B-F
	160-20-1.5-F		16.0 - 16.4	20	25	32.0	50	95.0	TPD160B-F~TPD164B-F
	165-20-1.5-F		16.5 - 16.9	20	25	33.0	50	96.0	TPD165B-F~TPD169B-F
	170-20-1.5-F		17.0 - 17.4	20	25	34.0	50	97.0	TPD170B-F~TPD174B-F
	175-20-1.5-F		17.5 - 17.9	20	25	35.0	50	98.0	TPD175B-F~TPD179B-F
	180-20-1.5-F		18.0 - 18.4	20	25	36.0	50	99.0	TPD180B-F~TPD184B-F
	185-20-1.5-F		18.5 - 18.9	20	25	37.0	50	100.0	TPD185B-F~TPD189B-F
	190-25-1.5-F		19.0 - 19.4	25	33	38.0	56	101.0	TPD190B-F~TPD194B-F
	195-25-1.5-F		19.5 - 19.9	25	33	39.0	56	102.0	TPD195B-F~TPD199B-F
	200-25-1.5-F		20.0 - 20.4	25	33	40.0	56	116.0	TPD200B-F~TPD204B-F
	205-25-1.5-F		20.5 - 20.9	25	33	41.0	56	117.0	TPD205B-F~TPD209B-F
	210-25-1.5-F		21.0 - 21.4	25	33	42.0	56	118.0	TPD210B-F~TPD214B-F
	215-25-1.5-F		21.5 - 21.9	25	33	43.0	56	119.0	TPD215B-F~TPD219B-F
	220-25-1.5-F		22.0 - 22.4	25	33	44.0	56	120.0	TPD220B-F~TPD224B-F
	225-25-1.5-F		22.5 - 22.9	25	33	45.0	56	121.0	TPD225B-F~TPD229B-F
	230-25-1.5-F		23.0 - 23.4	25	33	46.0	56	122.0	TPD230B-F~TPD234B-F
	235-25-1.5-F		23.5 - 23.9	25	33	47.0	56	123.0	TPD235B-F~TPD239B-F
	240-32-1.5-F		24.0 - 24.4	32	43	48.0	60	128.5	TPD240B-F~TPD244B-F
	245-32-1.5-F		24.5 - 24.9	32	43	49.0	60	129.5	TPD245B-F~TPD249B-F
	250-32-1.5-F		25.0 - 25.4	32	43	50.0	60	130.5	TPD250B-F~TPD254B-F
	255-32-1.5-F		25.5 - 25.9	32	43	51.0	60	131.5	TPD255B-F~TPD259B-F
	260-32-1.5-F		26.0 - 26.4	32	43	52.0	60	132.5	TPD260B-F~TPD264B-F
	265-32-1.5-F		26.5 - 26.9	32	43	53.0	60	133.5	TPD265B-F~TPD269B-F
	270-32-1.5-F		27.0 - 27.4	32	43	54.0	60	134.5	TPD270B-F~TPD274B-F
	275-32-1.5-F		27.5 - 27.9	32	43	55.0	60	135.5	TPD275B-F~TPD279B-F
	280-32-1.5-F		28.0 - 28.4	32	43	56.0	60	136.5	TPD280B-F~TPD284B-F
	285-32-1.5-F		28.5 - 28.9	32	43	57.0	60	137.5	TPD285B-F~TPD289B-F
	290-32-1.5-F		29.0 - 29.4	32	43	58.0	60	138.5	TPD290B-F~TPD294B-F
	295-32-1.5-F		29.5 - 29.9	32	43	59.0	60	139.5	TPD295B-F~TPD299B-F
	300-32-1.5-F		30.0 - 30.4	32	43	60.0	60	140.5	TPD300B-F~TPD304B-F
	305-32-1.5-F		30.5 - 30.9	32	43	61.0	60	141.5	TPD305B-F~TPD309B-F

●: Stock item

TPDB-H

Code system

【Holder】

TPD	B	220	-	25	-	4	-	H
Top solid Piercing Drill	Insert type B: Blade type	Drill dia. 220: Ø22.0		Shank dia. 25: Ø25		Aspect ratio (L/D) 3D, 4D, 8D ※ Flange shank (8F) for 8D		H-Beam

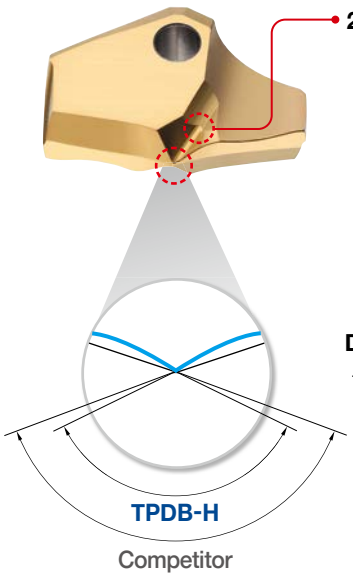
【Insert】

TPD	200	B	-	H
Top solid Piercing Drill	Drill dia. 200: Ø20.0	Insert type B: Blade type		H-Beam

Features

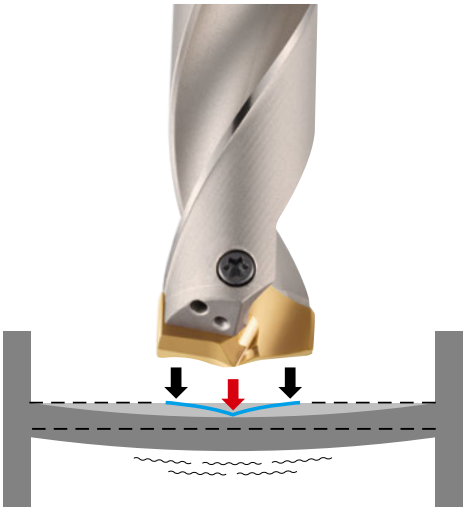
- **High precision clamping system** - High precision clamping due highly precise grinding and auto-centering
- **Screw on clamping system** - Easy to replace insert
- **Edge design with excellent centering** - Low cutting load and good chip control
- **High durability holder** - Improved wear resistance and durability with special surface treatment implementation
- **Holder with good chip evacuation** - Good chip evacuation and reduced cutting load with high helix angle
- **Optimally designed oil hole** - Long tool life

Insert features



2-step thinning shape
- Good chip control

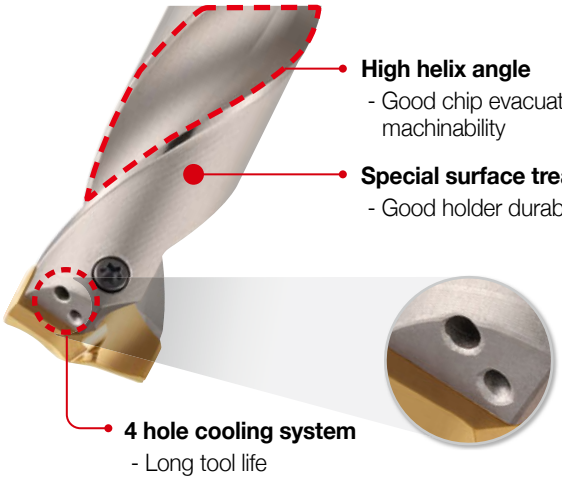
Double R point cutting edge
- Stable centering and machinability



Applied Double R point edge design is optimized for excellent centering and stable machinability.

Machinability and productivity are improved by minimizing both workpiece's bending and chipping at edge corner section.

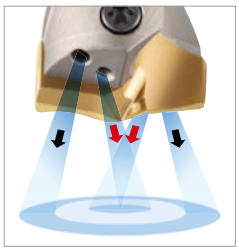
Holder features



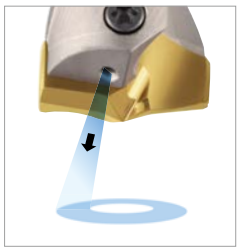
High helix angle
- Good chip evacuation and machinability

Special surface treatment
- Good holder durability

4 hole cooling system
- Long tool life



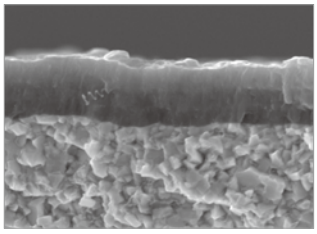
[TPDB-H]



[Competitor]

Concentrated coolant injection on delicate cutting edge increases tool life.

Grade features



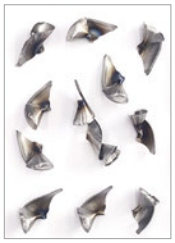
PC340Q new

- Application of high hardness lubricative PVD coating technology with excellent resistance on wear, built up edge and chipping.
- The special surface treatment improves chip evacuation and reduces wear on the rake face and relief face.
- High hardness ultra-fine substrate ensures high rigidity of cutting edge and good chipping resistance.

Performance evaluation

Chip control

- **Workpiece** Carbon steel (SS275, SM355A)
- **Cutting conditions** vc (m/min) = 80, fn (mm/rev) = 0.2, ap (mm) = 30, wet
- **Tools** **Insert** TPD270B-H (PC340Q), **Holder** TPDB270-32-4-H (Drill dia. = Ø27 mm)

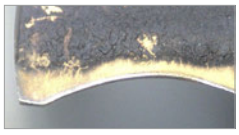


[SS275]

[SM355A]

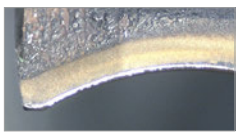
Wear resistance

- **Workpiece** Carbon steel (SS275)
- **Cutting conditions** vc (m/min) = 65, fn (mm/rev) = 0.25, ap (mm) = 30, wet
- **Tools** **Insert** TPD220B-H (PC340Q), **Holder** TPDB220-25-4-H (Drill dia. = Ø22 mm)

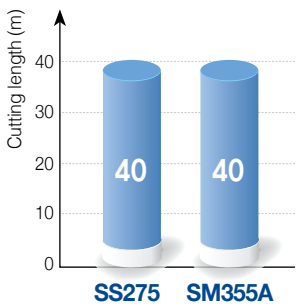


[SS275]

- **Workpiece** Carbon steel (SM355A)
- **Cutting conditions** vc (m/min) = 70, fn (mm/rev) = 0.25, ap (mm) = 30, wet
- **Tools** **Insert** TPD270B-H (PC340Q), **Holder** TPDB270-32-4-H (Drill dia. = Ø27 mm)

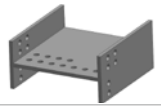
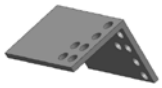
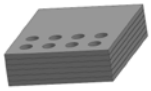


[SM355A]



▶ Normal wear and still usable

Workpiece and recommended cutting conditions

ISO	Workpiece		Workpiece materials	Grade	vc (m/min)	Aspect ratio (L/D) = 3D, 4D Feed rate (mm/rev) per drill dia. (mm)	
						Ø14.0-Ø21.0	Ø22.0-Ø30.0
P Carbon steel	H-Beam		SS275 (SS400*) SM355 (SM490*) SHN355 (SHN490*)	PC340Q	65 (60-75)	0.2-0.25	0.2-0.3
	Angle						
	Plate						
	Plate (Stacked)				60 (55-65)	0.15-0.25	0.15-0.25

* : Old symbol

Precaution in drilling

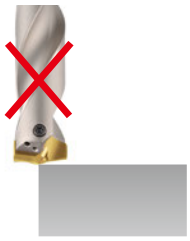
Angled surface drilling

- The approach angle between drill and the workpiece at the beginning and the end should be less than 6°.
- Reduce the feed (fn) to 30-50% than general cutting conditions at the beginning and the end of angled surface.

Stacked plates drilling

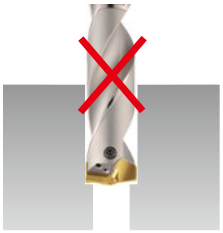
- Gap between the plates could make wrong chip evacuation causing fracture of the drill.
- Place stacked plates without any gap between each.

Plunging



- Irregular cutting resistance in plunging could cause fracture and deformation of the drill.

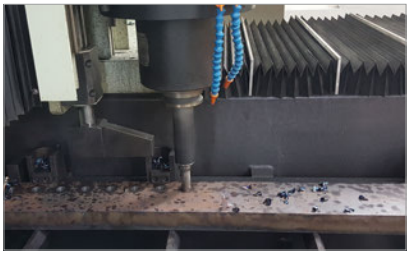
Boring



- Boring is not recommended due to wear and chipping in the corner of the insert.

Application examples

Carbon steel (SM355)



- **Cutting conditions** vc (m/min) = 60, fn (mm/rev) = 0.25, ap (mm) = 50, wet
- **Tools** **Insert** TPD240B-H (PC340Q)
  Holder TPDB240-32-3-H
  (Drill dia. = Ø24 mm)
- **Tool life** 60 m (Normal wear)

▶ Stable chip evacuation ensures tool life as 60 m in even machining with over 40 mm thickness.

Carbon steel (SM355)

- **Cutting conditions** vc (m/min) = 70, fn (mm/rev) = 0.25, ap (mm) = 24, wet
- **Tools** **Insert** TPD270B-H (PC340Q)
  Holder TPDB270-32-3-H
  (Drill dia. = Ø27 mm)
- **Tool life** 40 m (Normal wear)

▶ High speed and high feed machining saves machining hours.

Carbon steel (SS275)

- **Cutting conditions** vc (m/min) = 60, fn (mm/rev) = 0.20, ap (mm) = 12, wet
- **Tools** **Insert** TPD220B-H (PC340Q)
  Holder TPDB220-32-3-H
  (Drill dia. = Ø22 mm)
- **Tool life** 35 m (Normal wear)

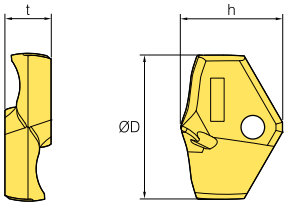
▶ Stable machinability and long tool life are realized in machining various workpieces such as SM355, SS275, SHN355 etc.

Carbon steel (SM355)

- **Cutting conditions** vc (m/min) = 65, fn (mm/rev) = 0.20, ap (mm) = 22, wet
- **Tools** **Insert** TPD240B-H (PC340Q)
  Holder TPDB240-32-3-H
  (Drill dia. = Ø24 mm)
- **Tool life** 40 m (Normal wear)

▶ Minimized cutting load in horizontal machining ensures high quality machining.

Insert



(mm)

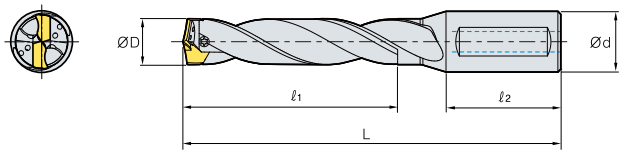
Designation		Coated PC340Q	ØD	h	t
TPD	140B-H		14.0	10.0	4.0
	145B-H		14.5	10.0	4.0
	150B-H		15.0	10.5	4.0
	155B-H		15.5	10.5	4.0
	160B-H		16.0	11.5	5.5
	165B-H		16.5	11.5	5.5
	170B-H		17.0	12.0	5.5
	175B-H		17.5	12.0	5.5
	180B-H		18.0	13.0	6.0
	185B-H		18.5	13.0	6.0
	190B-H		19.0	13.5	6.0
	195B-H		19.5	13.5	6.0
	200B-H		20.0	14.5	6.5
	205B-H		20.5	14.5	6.5
	210B-H		21.0	15.0	6.5
	215B-H		21.5	15.0	6.5
	220B-H		22.0	15.5	7.0
	225B-H		22.5	15.5	7.0
	230B-H		23.0	16.0	7.0
	235B-H		23.5	16.0	7.0
	240B-H		24.0	16.5	7.5
	245B-H		24.5	16.5	7.5
	250B-H		25.0	17.0	7.5
	255B-H		25.5	17.0	7.5
	260B-H		26.0	17.5	8.5
	265B-H		26.5	17.5	8.5
	270B-H		27.0	18.5	8.5
	275B-H		27.5	18.5	8.5
	280B-H		28.0	19.5	9.5
	285B-H		28.5	19.5	9.5
	290B-H		29.0	20.0	9.5
	295B-H		29.5	20.0	9.5
	300B-H		30.0	20.5	10.0
	305B-H		30.5	20.5	10.0

※ We can provide nonstock items with Ø14.00 - Ø30.99 ●: Stock item

Parts

Designation		Drill diameter ØD (mm)	Screw	Wrench	Torque (N·m)
TPD	140B-H ~ 149B-H	14.0 - 14.9	FTNB02512-P	TW07S	0.8
	150B-H ~ 179B-H	15.0 - 17.9	FTNB02514-P	TW07S	0.8
	180B-H ~ 199B-H	18.0 - 19.9	FTNB0316-P	TW09S	1.2
	200B-H ~ 239B-H	20.0 - 23.9	FTNB0319	TW09S	1.2
	240B-H ~ 259B-H	24.0 - 25.9	FTNB03522	TW15S	3.0
	260B-H ~ 279B-H	26.0 - 27.9	FTNB03524	TW15S	3.0
	280B-H ~ 299B-H	28.0 - 29.9	FTNB0426	TW15S	3.0
	300B-H ~ 309B-H	30.0 - 30.9	FTNB0528	TW20-100	4.0

TPDB-H (3D)

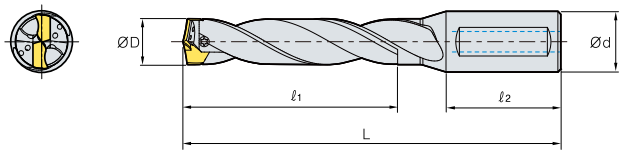


(mm)

Designation		Stock	ØD	Ød	ℓ1	ℓ2	L	Insert
TPDB	140-16-3-H		14.0 - 14.4	16	42	48	98.8	TPD140B-144B-H
	145-16-3-H		14.5 - 14.9	16	43.5	48	100.8	TPD145B-149B-H
	150-20-3-H		15.0 - 15.4	20	45	50	104.4	TPD150B-154B-H
	155-20-3-H		15.5 - 15.9	20	46.5	50	106.4	TPD155B-159B-H
	160-20-3-H		16.0 - 16.4	20	48	50	108.0	TPD160B-164B-H
	165-20-3-H		16.5 - 16.9	20	49.5	50	110.0	TPD165B-169B-H
	170-20-3-H		17.0 - 17.4	20	51	50	111.5	TPD170B-174B-H
	175-20-3-H		17.5 - 17.9	20	52.5	50	113.5	TPD175B-179B-H
	180-20-3-H		18.0 - 18.4	20	54	50	115.1	TPD180B-184B-H
	185-20-3-H		18.5 - 18.9	20	55.5	50	117.1	TPD185B-189B-H
	190-20-3-H		19.0 - 19.4	20	57	50	118.7	TPD190B-194B-H
	195-20-3-H		19.5 - 19.9	20	58.5	50	120.7	TPD195B-199B-H
	200-25-3-H		20.0 - 20.4	25	60	56	128.3	TPD200B-204B-H
	205-25-3-H		20.5 - 20.9	25	61.5	56	130.3	TPD205B-209B-H
	210-25-3-H		21.0 - 21.4	25	63	56	131.9	TPD210B-214B-H
	215-25-3-H		21.5 - 21.9	25	64.5	56	133.9	TPD215B-219B-H
	220-25-3-H		22.0 - 22.4	25	66	56	135.5	TPD220B-224B-H
	225-25-3-H		22.5 - 22.9	25	67.5	56	137.5	TPD225B-229B-H
	230-25-3-H		23.0 - 23.4	25	69	56	139.1	TPD230B-234B-H
	235-25-3-H		23.5 - 23.9	25	70.5	56	141.1	TPD235B-239B-H
	240-32-3-H		24.0 - 24.4	32	72	60	146.8	TPD240B-244B-H
	245-32-3-H		24.5 - 24.9	32	73.5	60	148.8	TPD245B-249B-H
	250-32-3-H		25.0 - 25.4	32	75	60	150.3	TPD250B-254B-H
	255-32-3-H		25.5 - 25.9	32	76.5	60	152.3	TPD255B-259B-H
	260-32-3-H		26.0 - 26.4	32	78	60	153.8	TPD260B-264B-H
	265-32-3-H		26.5 - 26.9	32	79.5	60	155.8	TPD265B-269B-H
	270-32-3-H		27.0 - 27.4	32	81	60	157.5	TPD270B-274B-H
	275-32-3-H		27.5 - 27.9	32	82.5	60	159.5	TPD275B-279B-H
	280-32-3-H		28.0 - 28.4	32	84	60	161.0	TPD280B-284B-H
	285-32-3-H		28.5 - 28.9	32	85.5	60	163.0	TPD285B-289B-H
	290-32-3-H		29.0 - 29.4	32	87	60	164.6	TPD290B-294B-H
	295-32-3-H		29.5 - 29.9	32	88.5	60	166.6	TPD295B-299B-H
	300-32-3-H		30.0 - 30.9	32	90	60	168.2	TPD300B-309B-H

● : Stock item

TPDB-H (4D)

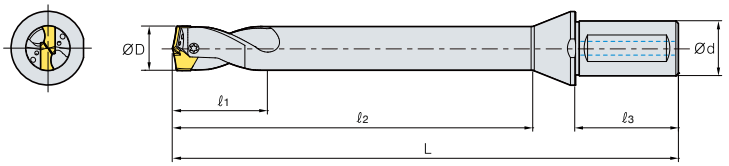


(mm)

Designation		Stock	ØD	Ød	ℓ1	ℓ2	L	Insert
TPDB	140-16-4-H		14.0 - 14.4	16	56	48	112.8	TPD140B-144B-H
	145-16-4-H		14.5 - 14.9	16	58	48	115.3	TPD145B-149B-H
	150-20-4-H		15.0 - 15.4	20	60	50	119.4	TPD150B-154B-H
	155-20-4-H		15.5 - 15.9	20	62	50	121.9	TPD155B-159B-H
	160-20-4-H		16.0 - 16.4	20	64	50	124.0	TPD160B-164B-H
	165-20-4-H		16.5 - 16.9	20	66	50	126.5	TPD165B-169B-H
	170-20-4-H		17.0 - 17.4	20	68	50	128.5	TPD170B-174B-H
	175-20-4-H		17.5 - 17.9	20	70	50	131.0	TPD175B-179B-H
	180-20-4-H		18.0 - 18.4	20	72	50	133.1	TPD180B-184B-H
	185-20-4-H		18.5 - 18.9	20	74	50	135.6	TPD185B-189B-H
	190-20-4-H		19.0 - 19.4	20	76	50	137.7	TPD190B-194B-H
	195-20-4-H		19.5 - 19.9	20	78	50	140.2	TPD195B-199B-H
	200-25-4-H		20.0 - 20.4	25	80	56	148.3	TPD200B-204B-H
	205-25-4-H		20.5 - 20.9	25	82	56	150.8	TPD205B-209B-H
	210-25-4-H		21.0 - 21.4	25	84	56	152.9	TPD210B-214B-H
	215-25-4-H		21.5 - 21.9	25	86	56	155.4	TPD215B-219B-H
	220-25-4-H		22.0 - 22.4	25	88	56	157.5	TPD220B-224B-H
	225-25-4-H		22.5 - 22.9	25	90	56	160.0	TPD225B-229B-H
	230-25-4-H		23.0 - 23.4	25	92	56	162.1	TPD230B-234B-H
	235-25-4-H		23.5 - 23.9	25	94	56	164.6	TPD235B-239B-H
	240-32-4-H		24.0 - 24.4	32	96	60	170.8	TPD240B-244B-H
	245-32-4-H		24.5 - 24.9	32	98	60	173.3	TPD245B-249B-H
	250-32-4-H		25.0 - 25.4	32	100	60	175.3	TPD250B-254B-H
	255-32-4-H		25.5 - 25.9	32	102	60	177.8	TPD255B-259B-H
	260-32-4-H		26.0 - 26.4	32	104	60	179.8	TPD260B-264B-H
	265-32-4-H		26.5 - 26.9	32	106	60	182.3	TPD265B-269B-H
	270-32-4-H		27.0 - 27.4	32	108	60	184.5	TPD270B-274B-H
	275-32-4-H		27.5 - 27.9	32	110	60	187.0	TPD275B-279B-H
	280-32-4-H		28.0 - 28.4	32	112	60	189.0	TPD280B-284B-H
	285-32-4-H		28.5 - 28.9	32	114	60	191.5	TPD285B-289B-H
	290-32-4-H		29.0 - 29.4	32	116	60	193.6	TPD290B-294B-H
	295-32-4-H		29.5 - 29.9	32	118	60	196.1	TPD295B-299B-H
	300-32-4-H		30.0 - 30.9	32	120	60	198.2	TPD300B-309B-H

●: Stock item

TPDB-H (8D)



(mm)

Designation		Stock	ØD	Ød	ℓ1	ℓ2	ℓ3	L	Insert
TPDB	140-16-8F-H		14.0 - 14.4	16	50	112	48	176.3	TPD140B-144B-H
	145-16-8F-H		14.5 - 14.9	16	50	116	48	180.3	TPD145B-149B-H
	150-20-8F-H		15.0 - 15.4	20	50	120	50	187.4	TPD150B-154B-H
	155-20-8F-H		15.5 - 15.9	20	50	124	50	191.4	TPD155B-159B-H
	160-20-8F-H		16.0 - 16.4	20	50	128	50	196.5	TPD160B-164B-H
	165-20-8F-H		16.5 - 16.9	20	50	132	50	200.5	TPD165B-169B-H
	170-20-8F-H		17.0 - 17.4	20	50	136	50	205.5	TPD170B-174B-H
	175-20-8F-H		17.5 - 17.9	20	50	140	50	209.5	TPD175B-179B-H
	180-20-8F-H		18.0 - 18.4	20	50	144	50	215.6	TPD180B-184B-H
	185-20-8F-H		18.5 - 18.9	20	50	148	50	219.6	TPD185B-189B-H
	190-20-8F-H		19.0 - 19.4	20	50	152	50	223.7	TPD190B-194B-H
	195-20-8F-H		19.5 - 19.9	20	50	156	50	227.7	TPD195B-199B-H
	200-25-8F-H		20.0 - 20.4	25	50	160	56	237.8	TPD200B-204B-H
	205-25-8F-H		20.5 - 20.9	25	50	164	56	241.8	TPD205B-209B-H
	210-25-8F-H		21.0 - 21.4	25	50	168	56	245.9	TPD210B-214B-H
	215-25-8F-H		21.5 - 21.9	25	50	172	56	249.9	TPD215B-219B-H
	220-25-8F-H		22.0 - 22.4	25	50	176	56	254.0	TPD220B-224B-H
	225-25-8F-H		22.5 - 22.9	25	50	180	56	263.0	TPD225B-229B-H
	230-25-8F-H		23.0 - 23.4	25	50	184	56	267.1	TPD230B-234B-H
	235-25-8F-H		23.5 - 23.9	25	50	188	56	271.1	TPD235B-239B-H
	240-32-8F-H		24.0 - 24.4	32	50	192	60	279.3	TPD240B-244B-H
	245-32-8F-H		24.5 - 24.9	32	50	196	60	283.3	TPD245B-249B-H
	250-32-8F-H		25.0 - 25.4	32	50	200	60	287.3	TPD250B-254B-H
	255-32-8F-H		25.5 - 25.9	32	50	204	60	291.3	TPD255B-259B-H
	260-32-8F-H		26.0 - 26.4	32	50	208	60	295.3	TPD260B-264B-H
	265-32-8F-H		26.5 - 26.9	32	50	212	60	299.3	TPD265B-269B-H
	270-32-8F-H		27.0 - 27.4	32	50	216	60	303.5	TPD270B-274B-H
	275-32-8F-H		27.5 - 27.9	32	50	220	60	307.5	TPD275B-279B-H
	280-32-8F-H		28.0 - 28.4	32	50	224	60	313.5	TPD280B-284B-H
	285-32-8F-H		28.5 - 28.9	32	50	228	60	317.5	TPD285B-289B-H
	290-32-8F-H		29.0 - 29.4	32	50	232	60	322.6	TPD290B-294B-H
	295-32-8F-H		29.5 - 29.9	32	50	236	60	326.6	TPD295B-299B-H
	300-32-8F-H		30.0 - 30.9	32	50	240	60	330.7	TPD300B-309B-H

※ The maximum length of flute could be ℓ2.

●: Stock item

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