

PCD Tools for Carbide and Hard Brittle Material Turning

SUMIDIA BINDERLESS **NPD10** / ^{New} SUMIDIA **DA1090**



SUMIDIA BINDERLESS

NPD10 Achieving the ultimate in high-precision machining



SUMIDIA

^{New} **DA1090** Coarse-grained polycrystalline diamond that takes on even higher-load machining

SumiSmall

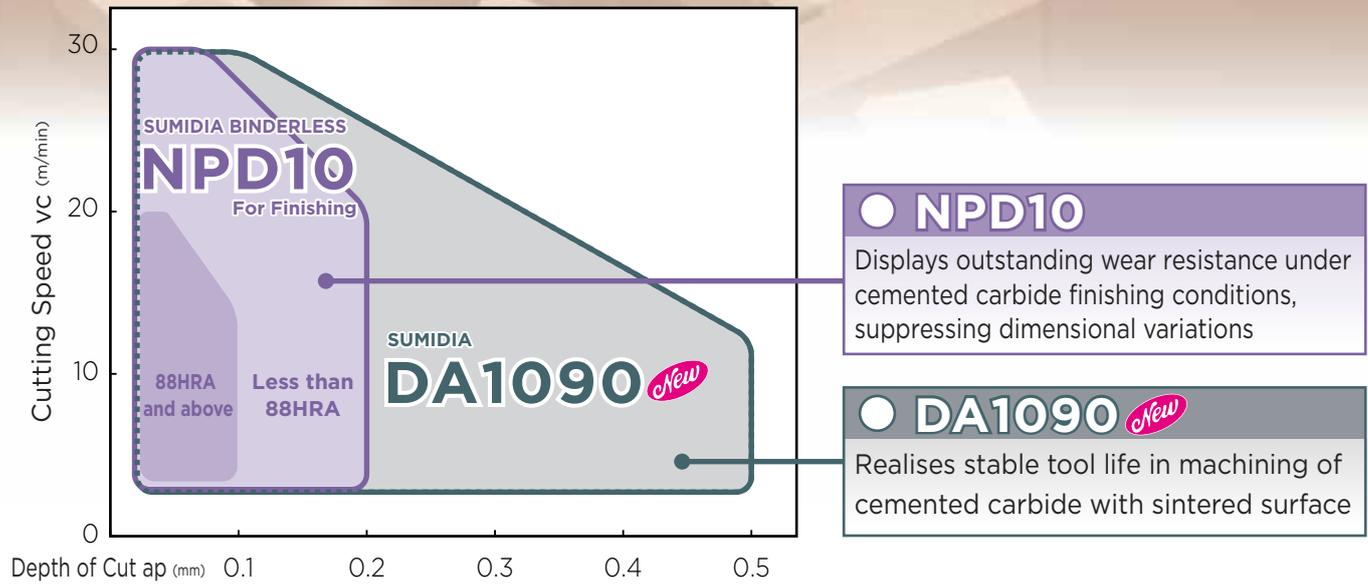


SUMIDIA BINDERLESS (NPD10) Small Diameter Boring Bars

^{New} **DABX series** Ideal for high-precision machining of small diameters (ø3mm and up) Switching from electrical discharge machining to cutting reduces machining time and total costs

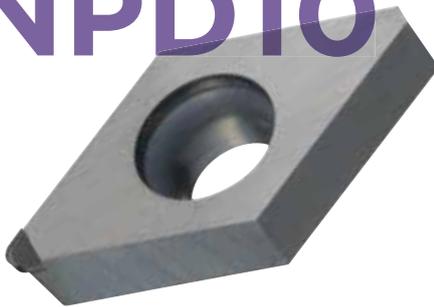
NPD10/DA1090 *New*

Application Range (Cemented Carbide)



SUMIDIA BINDERLESS

NPD10



Cutting edge is 100% diamond material made from high-hardness nano-crystalline diamond which, unlike single-crystal diamonds, has no anisotropy. Achieves longer tool life and higher machining accuracy than conventional diamonds in the machining of cemented carbide and other hard brittle materials.

Ideal for finishing of cemented carbide and other hard brittle materials

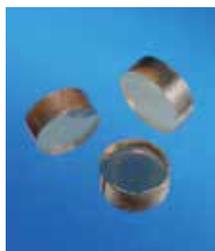
The outstanding wear resistance of nano-polycrystalline diamond enables high-precision machining of cemented carbides

Maintains excellent dimensional accuracy for a long time

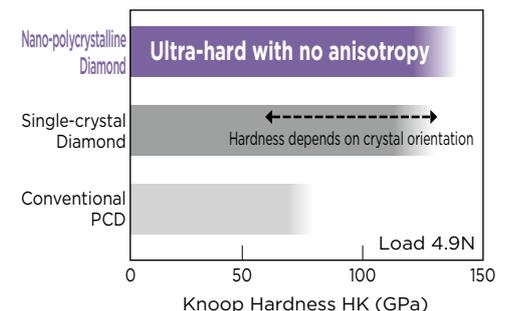
Compared to conventional diamond tools, the number of tool changes is drastically reduced, improving work efficiency and reducing total costs.

● Nano-polycrystalline diamond

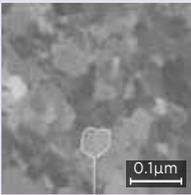
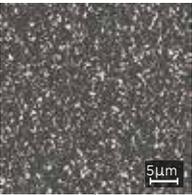
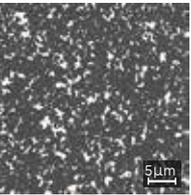
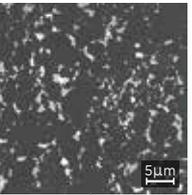
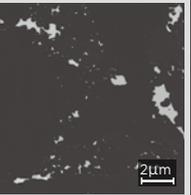
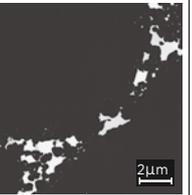
Nano-polycrystalline diamond is a polycrystalline diamond that directly binds nano-order diamond particles with high strength without using any binders. Harder than single-crystal diamond, it has no cleavability, enabling machining of hard brittle materials such as cemented carbide and making new machining methods possible.



● Hardness



■ SUMIDIA Grades List

Grade	SUMIDIA BINDERLESS NPD10	SUMIDIA DA1000	SUMIDIA DA2200	SUMIDIA DA150	<i>New</i> SUMIDIA DA1090	SUMIDIA DA90
Structure	 Diamond particles					
		* White areas in the image are the binder material				
Binder	—	Co	Co	Co	Co	Co
Grain Size (µm)	up to 0.05	up to 0.5	0.5	5	up to 50	50
Content (%)	100	90 to 95	85 to 90	85 to 90	92 to 97	90 to 95

SUMIDIA

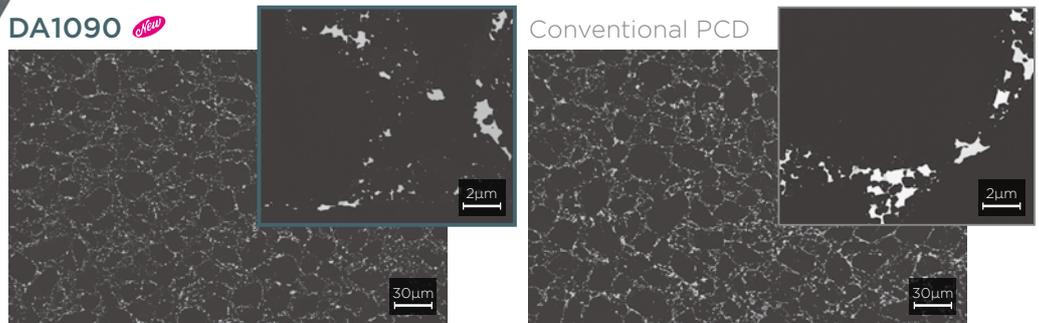
DA1090

New



A polycrystalline diamond material with the highest diamond content, made by sintering coarse diamond particles at high density.

High density and enhanced particle binding strength exhibit excellent wear and fracture resistance.



Realising high density and enhanced particle binding strength

*Black areas in image are diamond particles

Ideal for roughing of cemented carbide and other hard brittle materials

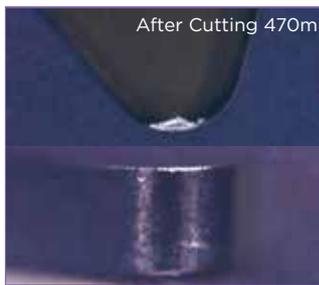
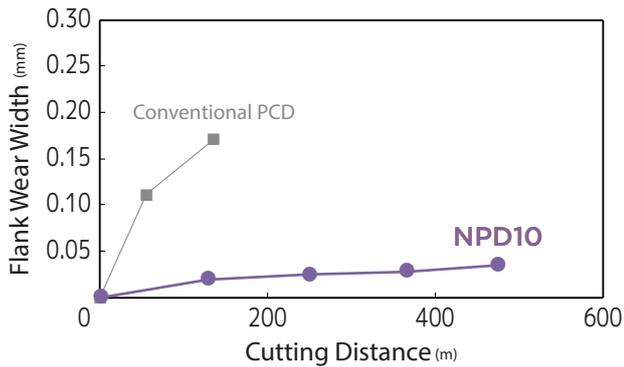
Coarse-grain polycrystalline diamond with excellent wear resistance and enhanced particle binding strength improve fracture resistance, realising stable machining in high-load roughing of cemented carbide and other hard brittle materials

■ Applications of NPD10 and DA1090 (Cemented Carbide Machining)

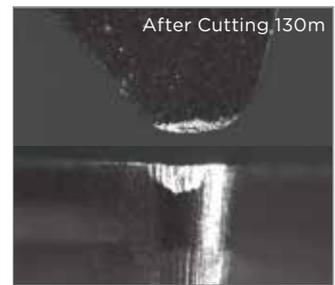
Grade	SUMIDIA BINDERLESS NPD10	<i>New</i> SUMIDIA DA1090
Dimensional Tolerance	⊙ Best	△ The first recommendation is NPD10
Tool Life (Wear Resistance)	⊙ Best	○ ap = 0.2mm or above can also be used
Machining Cemented Carbide With Sintered Surface	✕ Not Applicable	⊙ Best
Machined Surface Quality	⊙ Best	△ The first recommendation is NPD10

■ NPD10 Wear Resistance Performance

Shows outstanding wear resistance



NPD10
($V_B = 0.034\text{mm}$)

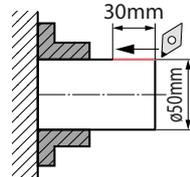
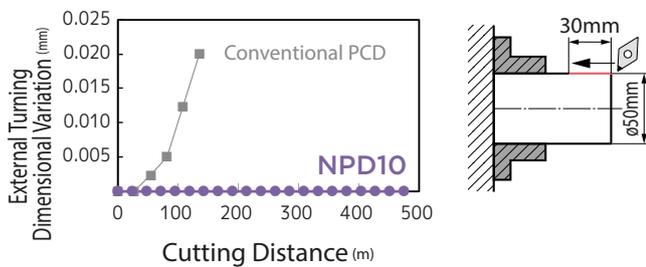


Conventional PCD
($V_B = 0.171\text{mm}$)

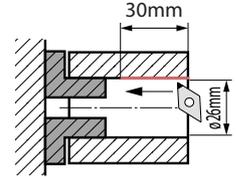
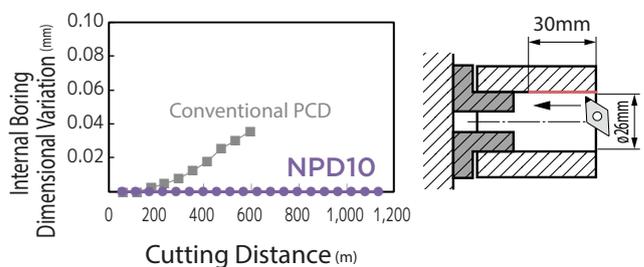
Work Material: Cemented Carbide (87HRA) Tool: DCMW11T304RH
Cutting Conditions: $v_c=20\text{m/min}$ $f=0.1\text{mm/rev}$ $a_p=0.1\text{mm}$ Dry

■ NPD10 Machining Precision

No dimensional variation even after 450m of cutting



No dimensional variation even after 1,100m of cutting

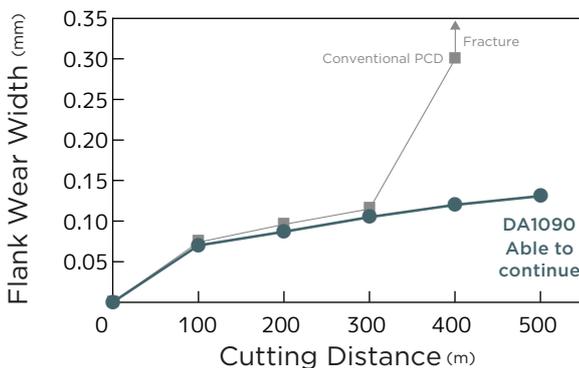


Work Material: Cemented Carbide VC50 (87HRA)
Tool: DCMW11T304RH
Cutting Conditions: $v_c = 20\text{m/min}$ $f = 0.1\text{mm/rev}$
 $a_p = 0.1\text{mm}$ Dry

Work Material: Cemented Carbide VM30 (91HRA)
Tool: DCMW11T304RH
Cutting Conditions: $v_c = 20\text{m/min}$ $f = 0.05\text{mm/rev}$
 $a_p = 0.05\text{mm}$ Dry

■ DA1090 Wear Resistance Performance

Displays excellent wear resistance in roughing conditions



DA1090
Normal wear



Conventional PCD
Large wear and flaking

Work Material: Cemented Carbide VM30 Equivalent (91HRA)
Tool: NF-DCMW11T308
Cutting Conditions: $v_c=30\text{m/min}$ $f=0.05\text{mm/rev}$ $a_p=0.2\text{mm}$ Dry

■ **Features**

Lineup of SUMIDIA BINDERLESS Small Diameter Boring Bars for internal boring ($\phi 3.0\text{mm}$, $\phi 4.0\text{mm}$)

The use of a high-rigidity shank design and nanopolycrystalline diamond tip enables finishing of cemented carbide

* For internal boring of $\phi 5\text{mm}$ or above, NPD10 inserts with indexable type holders can also be used. Refer to the chapter on "Boring Bars" in the General Catalogue for details.



Superior wear resistance maintains cutting edge sharpness for a long time

Wear resistance evaluation on cemented carbide (88HRA)



Minimal wear even after cutting distance of 4,000m

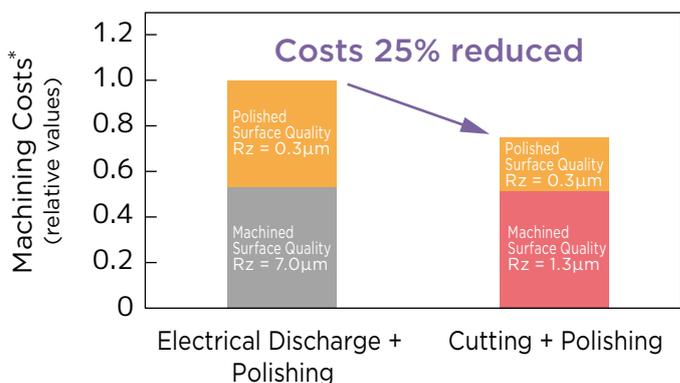
Utilising cutting to reduce machining time and total costs

Switch from electrical discharge machining (EDM) to cutting

Cemented Carbide G5 (88HRA) Header Former Mold

2.5 Times the Machining Efficiency

Machining Time
 90min \longrightarrow 35min

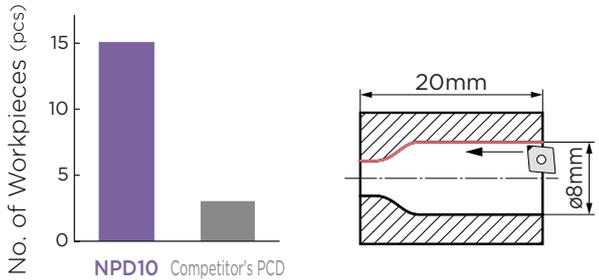
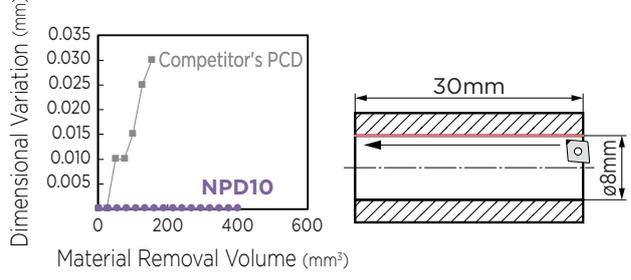


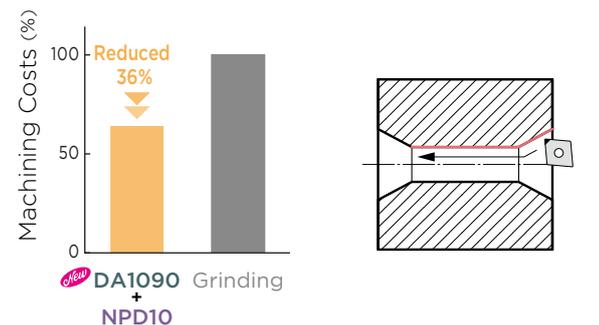
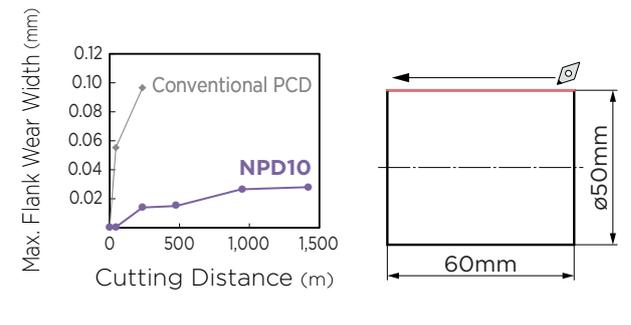
- Cutting
- Electrical Discharge Machining
- Polishing

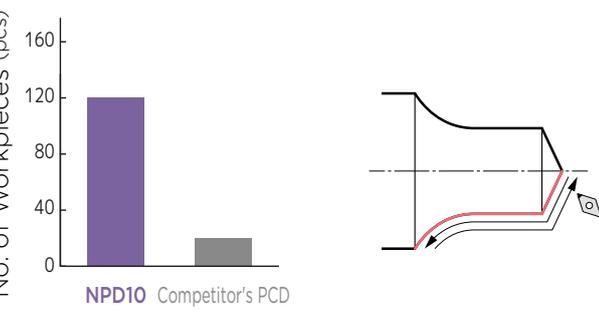
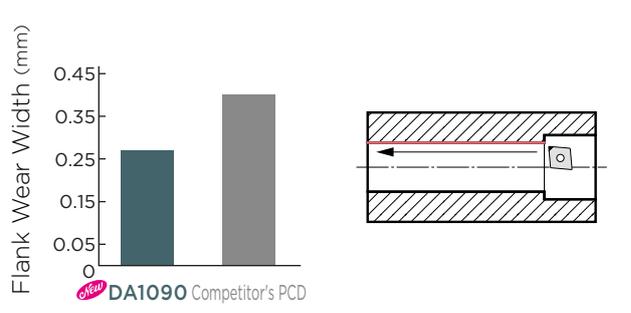
Switching from EDM to cutting - Surface roughness of cutting: $Rz1.3\mu\text{m}$, against Surface roughness of EDM: $Rz7.0\mu\text{m}$, thus Shortening time for polishing ($Rz0.3\mu\text{m}$) Achieving 2.5x higher machining efficiency with 25% total cost reduction.

*Assuming $\phi 4.0 \rightarrow \phi 4.5 \times L20$ turning with machining costs at 3,500 JPY/h, calculating tool life at 30 units/pc

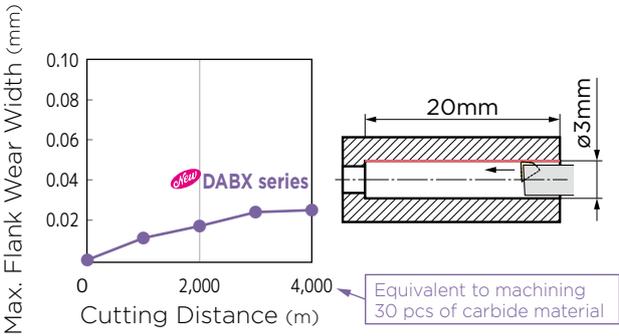
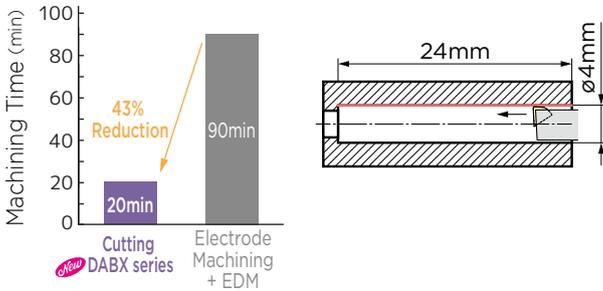
■ Application Examples (Inserts)

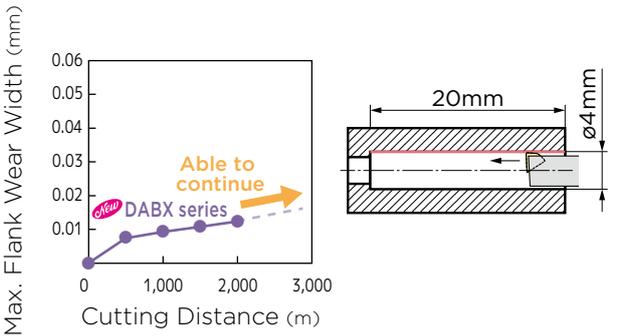
Cemented Carbide VC40 (89HRA) Die Mold	Cemented Carbide VM70 (84HRA) Die Mold																		
<p>NPD10 achieves 5 times the tool life of competitors' PCD</p>  <p>No. of Workpieces (pcs)</p> <table border="1"> <tr> <th>Tool</th> <th>No. of Workpieces (pcs)</th> </tr> <tr> <td>NPD10</td> <td>15</td> </tr> <tr> <td>Competitor's PCD</td> <td>3</td> </tr> </table>	Tool	No. of Workpieces (pcs)	NPD10	15	Competitor's PCD	3	<p>NPD10 has 4 times higher machining efficiency and more stable dimensional tolerance than competitor's PCD</p>  <p>Dimensional Variation (mm)</p> <table border="1"> <tr> <th>Material Removal Volume (mm³)</th> <th>Competitor's PCD (mm)</th> <th>NPD10 (mm)</th> </tr> <tr> <td>0</td> <td>0.005</td> <td>0.005</td> </tr> <tr> <td>100</td> <td>0.010</td> <td>0.005</td> </tr> <tr> <td>200</td> <td>0.030</td> <td>0.005</td> </tr> </table>	Material Removal Volume (mm³)	Competitor's PCD (mm)	NPD10 (mm)	0	0.005	0.005	100	0.010	0.005	200	0.030	0.005
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100	0.010	0.005																	
200	0.030	0.005																	
<p>Tool: CCMW04X104RH (NPD10) Internal Boring Cutting Conditions: $v_c = 15\text{m/min}$ $f = 0.015\text{mm/rev}$ $a_p = 0.07\text{mm}$ Dry</p>	<p>Tool: CCMW03X102RH (NPD10) Internal Boring Cutting Conditions: NPD10 $v_c = 25\text{m/min}$ $f = 0.05\text{mm/rev}$ $a_p = 0.05\text{mm}$ Dry Competitors' PCD $v_c = 5\text{m/min}$ $f = 0.03\text{mm/rev}$ $a_p = 0.10\text{mm}$ Dry</p>																		

Cemented Carbide VM30 (91HRA) Die Mold	Alumina (99% pure)																								
<p>Machining costs reduced by 36% compared to conventional grinding by using DA1090 for roughing and NPD10 for finishing</p>  <p>Machining Costs (%)</p> <table border="1"> <tr> <th>Method</th> <th>Machining Costs (%)</th> </tr> <tr> <td>DA1090 Grinding + NPD10</td> <td>64 (36% Reduced)</td> </tr> <tr> <td>Conventional Grinding</td> <td>100</td> </tr> </table>	Method	Machining Costs (%)	DA1090 Grinding + NPD10	64 (36% Reduced)	Conventional Grinding	100	<p>NPD10 displays excellent wear resistance even on alumina material</p>  <p>Max. Flank Wear Width (mm)</p> <table border="1"> <tr> <th>Cutting Distance (m)</th> <th>Conventional PCD (mm)</th> <th>NPD10 (mm)</th> </tr> <tr> <td>0</td> <td>0.00</td> <td>0.00</td> </tr> <tr> <td>200</td> <td>0.10</td> <td>0.02</td> </tr> <tr> <td>500</td> <td>-</td> <td>0.02</td> </tr> <tr> <td>1000</td> <td>-</td> <td>0.03</td> </tr> <tr> <td>1500</td> <td>-</td> <td>0.03</td> </tr> </table>	Cutting Distance (m)	Conventional PCD (mm)	NPD10 (mm)	0	0.00	0.00	200	0.10	0.02	500	-	0.02	1000	-	0.03	1500	-	0.03
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200	0.10	0.02																							
500	-	0.02																							
1000	-	0.03																							
1500	-	0.03																							
<p>Tool : Roughing NF-CCMW060202 (DA1090) Internal Boring Finishing CCMW060202RH (NPD10) Internal Boring Cutting Conditions: Roughing $v_c = 20\text{m/min}$ $f = 0.10\text{mm/rev}$ $a_p = 0.10\text{mm}$ Dry Finishing $v_c = 20\text{m/min}$ $f = 0.02\text{mm/rev}$ $a_p = 0.02\text{mm}$ Dry</p>	<p>Tool: DNMA150408RH (NPD10) External Turning Cutting Conditions: $v_c = 300\text{m/min}$ $f = 0.03\text{mm/rev}$ $a_p = 0.01\text{mm}$ Wet</p>																								

Cemented Carbide VF10 (93HRA) Carbide Pin	Cemented Carbide VC70 (84HRA) Carbide Mold												
<p>NPD10 achieves 6 times the tool life of competitors' PCD</p>  <p>No. of Workpieces (pcs)</p> <table border="1"> <tr> <th>Tool</th> <th>No. of Workpieces (pcs)</th> </tr> <tr> <td>NPD10</td> <td>120</td> </tr> <tr> <td>Competitor's PCD</td> <td>20</td> </tr> </table>	Tool	No. of Workpieces (pcs)	NPD10	120	Competitor's PCD	20	<p>DA1090 reduces wear by 35% with excellent wear resistance</p>  <p>Flank Wear Width (mm)</p> <table border="1"> <tr> <th>Tool</th> <th>Flank Wear Width (mm)</th> </tr> <tr> <td>DA1090</td> <td>0.28</td> </tr> <tr> <td>Competitor's PCD</td> <td>0.40</td> </tr> </table>	Tool	Flank Wear Width (mm)	DA1090	0.28	Competitor's PCD	0.40
Tool	No. of Workpieces (pcs)												
NPD10	120												
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Tool	Flank Wear Width (mm)												
DA1090	0.28												
Competitor's PCD	0.40												
<p>Tool: DCMW11T302 (NPD10) External Turning Cutting Conditions: $v_c = 30\text{m/min}$ $f = 0.01\text{mm/rev}$ $a_p = 0.1\text{mm}$ Dry</p>	<p>Tool: NF-CCMW060204 (DA1090) Internal Boring Cutting Conditions: $v_c = 15\text{m/min}$ $f = 0.09\text{mm/rev}$ $a_p = 0.1\text{mm}$ Dry</p>												

Application Examples (Boring Bars)

Cemented Carbide G5 (88HRA) Header Former Mold	Cemented Carbide G5 (88HRA) Header Former Mold
<p>DABX series displays excellent wear resistance in small-diameter machining of cemented carbide</p>  <p>Max. Flank Wear Width (mm)</p> <p>Cutting Distance (m)</p> <p>Equivalent to machining 30 pcs of carbide material</p>	<p>Achieving more than 3x higher machining efficiency by switching from EDM to small-diameter cutting of cemented carbide</p>  <p>Machining Time (min)</p> <p>43% Reduction</p> <p>20min Cutting DABX series</p> <p>90min Electrode Machining + EDM</p>
<p>Tool: DABX025R-02 (NPD10) Internal Boring Cutting Conditions: $v_c = 10\text{m/min}$ $f = 0.05\text{mm/rev}$ $a_p = 0.025\text{mm}$ Dry</p>	<p>Tool: DABX035R-04 (NPD10) Internal Boring Cutting Conditions: $v_c = 10\text{m/min}$ $f = 0.05\text{mm/rev}$ $a_p = 0.05\text{mm}$ Dry</p>

Cemented Carbide G2 (91HRA) Header Former Mold
<p>DABX series displays excellent wear resistance even in small-diameter machining of high-hardness cemented carbide</p>  <p>Max. Flank Wear Width (mm)</p> <p>Cutting Distance (m)</p> <p>Able to continue</p>
<p>Tool: DABX035R-02 (NPD10) Internal Boring Cutting Conditions: $v_c = 10\text{m/min}$ $f = 0.05\text{mm/rev}$ $a_p = 0.025\text{mm}$ Dry</p>

■ NPD10 Stock List

Negative Inserts

Shape	Cat. No.	Stock		Dimensions (mm)			
		NPD10	CBN	Inscribed Circle	Thickness	Hole Dia.	Corner Radius
	DNMA 150408RH	○	1.8	12.7	4.76	5.16	0.8
	150412RH	○	1.8	12.7	4.76	5.16	1.2
	SNMA 120408RH	○	1.7	12.7	4.76	5.16	0.8
	120412RH	○	1.7	12.7	4.76	5.16	1.2
	VNMA 160408RH	○	1.8	9.525	4.76	3.81	0.8
	160412RH	○	1.5	9.525	4.76	3.81	1.2

Positive Inserts

Shape	Relief Angle	Cat. No.	Stock		Dimensions (mm)			
			NPD10	CBN	Inscribed Circle	Thickness	Hole Dia.	Corner Radius
	7°	CCMW 03X102RH	○	1.3	3.5	1.4	1.9	0.2
		03X104RH	○	1.3	3.5	1.4	1.9	0.4
		04X102RH	○	1.7	4.3	1.8	2.3	0.2
		04X104RH	○	1.7	4.3	1.8	2.3	0.4
	7°	CCMW 060202RH	○	1.7	6.35	2.38	2.8	0.2
		060204RH	○	1.7	6.35	2.38	2.8	0.4
		CCMW 09T302RH	○	1.7	9.525	3.97	4.4	0.2
		09T304RH	○	1.7	9.525	3.97	4.4	0.4
	7°	09T308RH	○	1.6	9.525	3.97	4.4	0.8
		DCMW 070202RH	○	2.1	6.35	2.38	2.8	0.2
		070204RH	○	2.0	6.35	2.38	2.8	0.4
		DCMW 11T302RH	○	2.1	9.525	3.97	4.4	0.2
	7°	11T304RH	○	1.9	9.525	3.97	4.4	0.4
		11T308RH	○	1.6	9.525	3.97	4.4	0.8
		TPMW 080202RH	○	1.2	4.76	2.38	2.3	0.2
		080204RH	○	1.0	4.76	2.38	2.3	0.4
	11°	TPMW 110302RH	○	1.5	6.35	3.18	3.4	0.2
		110304RH	○	1.3	6.35	3.18	3.4	0.4
		110308RH	○	1.0	6.35	3.18	3.4	0.8
		TPMW 160402RH	○	2.2	9.525	4.76	4.4	0.2
	7°	160404RH	○	2.0	9.525	4.76	4.4	0.4
		160408RH	○	1.6	9.525	4.76	4.4	0.8
		VCMW 080201RH	○	2.2	4.76	2.38	2.3	0.1
		080202RH	○	1.9	4.76	2.38	2.3	0.2
	7°	080204RH	○	1.5	4.76	2.38	2.3	0.4
		VCMW 110302RH	○	2.1	6.35	3.18	2.8	0.2
		110304RH	○	1.7	6.35	3.18	2.8	0.4
		VCMW 160402RH	○	2.1	9.525	4.76	4.4	0.2
	7°	160404RH	○	1.7	9.525	4.76	4.4	0.4
		160408RH	○	1.8	9.525	4.76	4.4	0.8
		160412RH	○	1.5	9.525	4.76	4.4	1.2

* The radius portion of the cutting edge is cylindrical shaped.

■ DA1090 Stock List

Negative Inserts NF type

Shape	Cat. No.	Stock		Dimensions (mm)			
		DA1090	CBN	Inscribed Circle	Thickness	Hole Dia.	Corner Radius
	NF-DNMA 150408	○	2.0	12.7	4.76	5.16	0.8
	150412	○	2.0	12.7	4.76	5.16	1.2
	NF-SNMA 120408	○	2.4	12.7	4.76	5.16	0.8
	120412	○	2.4	12.7	4.76	5.16	1.2
	NF-VNMA 160408	○	1.9	9.525	4.76	3.81	0.8
	160412	○	1.7	9.525	4.76	3.81	1.2

Positive Inserts NF type

Shape	Relief Angle	Cat. No.	Stock		Dimensions (mm)			
			DA1090	CBN	Inscribed Circle	Thickness	Hole Dia.	Corner Radius
	7°	NF-CCMW 03X102	○	1.1	3.5	1.4	1.9	0.2
		03X104	○	1.1	3.5	1.4	1.9	0.4
		NF-CCMW 04X102	○	1.5	4.3	1.8	2.3	0.2
		04X104	○	1.5	4.3	1.8	2.3	0.4
	7°	NF-CCMW 060202	○	2.4	6.35	2.38	2.8	0.2
		060204	○	2.4	6.35	2.38	2.8	0.4
		NF-CCMW 09T302	○	2.4	9.525	3.97	4.4	0.2
		09T304	○	2.4	9.525	3.97	4.4	0.4
	7°	09T308	○	2.3	9.525	3.97	4.4	0.8
		NF-DCMW 070202	○	2.6	6.35	2.38	2.8	0.2
		070204	○	2.4	6.35	2.38	2.8	0.4
		NF-DCMW 11T302	○	2.6	9.525	3.97	4.4	0.2
	7°	11T304	○	2.4	9.525	3.97	4.4	0.4
		11T308	○	2.0	9.525	3.97	4.4	0.8
		NF-TPMW 080202	○	2.5	4.76	2.38	2.3	0.2
		080204	○	2.4	4.76	2.38	2.3	0.4
	11°	NF-TPMW 110302	○	2.5	6.35	3.18	3.4	0.2
		110304	○	2.4	6.35	3.18	3.4	0.4
		110308	○	2.1	6.35	3.18	3.4	0.8
		NF-TPMW 160402	○	2.5	9.525	4.76	4.4	0.2
	7°	160404	○	2.4	9.525	4.76	4.4	0.4
		160408	○	2.1	9.525	4.76	4.4	0.8
		NF-VCMW 080202	○	3.2	4.76	2.38	2.3	0.2
		080204	○	2.8	4.76	2.38	2.3	0.4
	7°	NF-VCMW 110302	○	3.2	6.35	3.18	2.8	0.2
		110304	○	2.8	6.35	3.18	2.8	0.4
		NF-VCMW 160402	○	3.7	9.525	4.76	4.4	0.2
		160404	○	3.3	9.525	4.76	4.4	0.4
	7°	160408	○	2.4	9.525	4.76	4.4	0.8
		160412	○	2.1	9.525	4.76	4.4	1.2

* The radius portion of the cutting edge is cylindrical shaped.

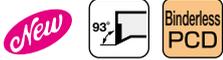
■ ALNEX ANX series Blade Stock List

Shape	Cat. No.	Stock		Wiper Flat Shape	Applications
		DA1090	CBN		
	ANB 1600R-GB	●	6.0	Arc-Shaped	Bi-metal Milling*

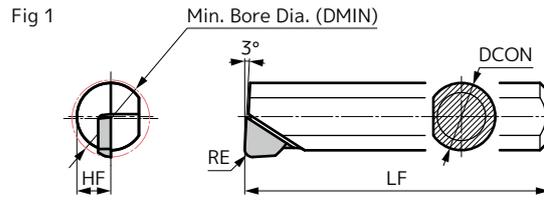
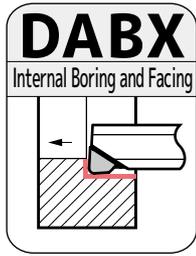
*Cast Iron/Aluminum Alloy

For details on the ANX series cutter body, see Tooling News No. 53 "ALNEX ANX series" and the General Catalogue.

DABX series *New*



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Brazed

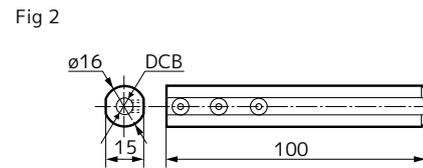
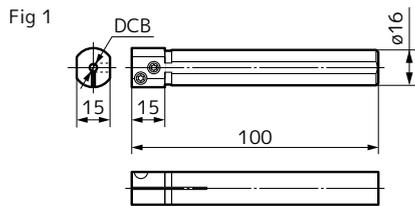


■ DABX series Boring Bar Stock List

Dimensions (mm)

Cat. No.	Stock	Min. Bore Dia. DMIN	Diameter DCON	Cutting Edge Distance HF	Overall Length LF	Corner Radius RE	Applicable Sleeves	Fig
	NPD10							
DABX025R-01	○	3	2.5	1.25	40	0.1	HBX2516	1
DABX025R-02	○	3	2.5	1.25	40	0.2	HBX2516	1
DABX025R-04	○	3	2.5	1.25	40	0.4	HBX2516	1
DABX035R-01	○	4	3.5	1.75	40	0.1	HBX3516	1
DABX035R-02	○	4	3.5	1.75	40	0.2	HBX3516	1
DABX035R-04	○	4	3.5	1.75	40	0.4	HBX3516	1

DABX bars can be used with HBB type sleeves, but HBX type sleeves are recommended for machining when rigidity is required.



■ Sleeves (HBX type)

Dimensions (mm)

Cat. No.	Stock	Bore Dia. DCB	Applicable Boring Bar	Fig
HBX 2516	○	2.5	DABX 025R	1
HBX 3516	○	3.5	DABX 035R	1

■ Sleeves (HBB type)

Dimensions (mm)

Cat. No.	Stock	Bore Dia. DCB	Applicable Boring Bar	Fig
HBB 2516	○	2.5	DABX 025R	2
HBB 3516	○	3.5	DABX 035R	2

■ Parts (for Adapter Sleeve)

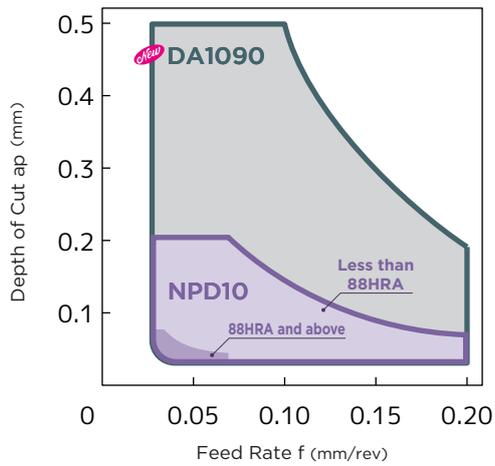
Applicable Sleeve	Flat Insert Screw		Set Screw	Wrench
		N·m		
HBX 2516	BFTX0409N	1.5	BT06035T	TRD (For Torx Hole)
HBX 3516	BFTX0409N	3.0	BT06035T	TRD15 (For Torx Hole)
HBB ○○○○	—	—	BT0404	LH (For Hexagonal Hole)

Recommended Cutting Conditions

Work Material			Grades	Cutting Conditions		
Classification	Hardness (HRA)	Our Grades		Cutting Speed v_c (m/min)	Feed Rate f (mm/rev)	Depth of Cut a_p (mm)
VM,VC	40	88 or more	G5,D2	5 - 15 - 20	0.03 - 0.05 - 0.07	0.03 - 0.05 - 0.07
VM,VC	70,60,50	83 to less than 88	G7,G6			
VM,VC	-	83 or more	G7,G6,G5,D2	5 - 20 - 30	0.03 - 0.10 - 0.20	0.03 - 0.10 - 0.50

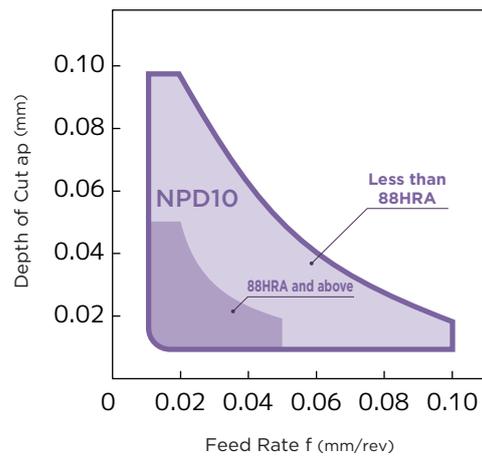
Min. - **Optimum** - Max. Lubrication: Dry

Application Range for NPD10 and DA1090



* Carbide shanked holders are recommended for internal boring.

Application Range for DABX series Boring Bars



MEMO

A large grid of dotted lines for writing a memo. The grid consists of 20 columns and 30 rows of small squares, providing a structured space for text.



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