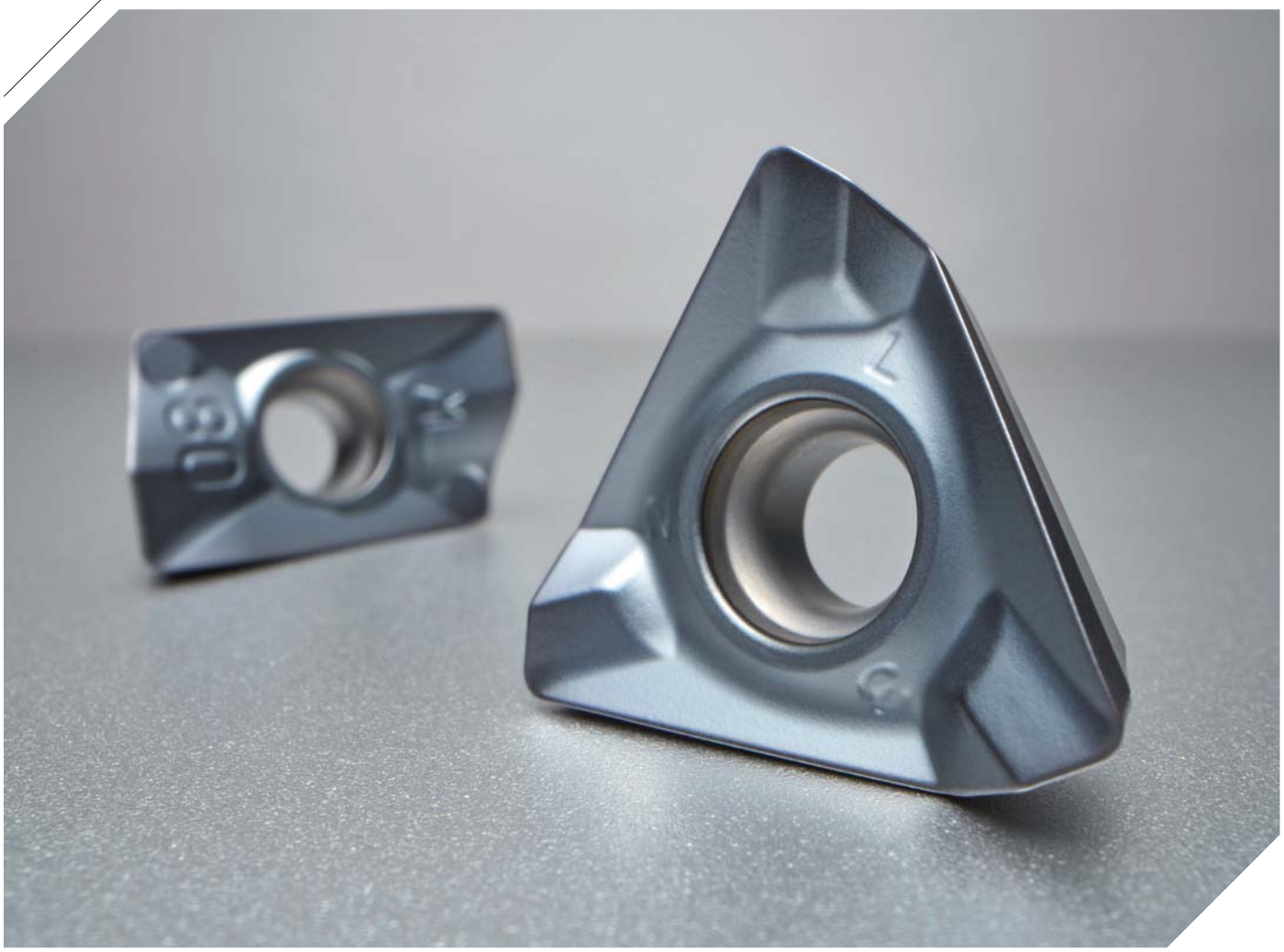
KORLOY TECH-NEWS

PC5535

PVD insert for general milling

- General use for all kinds of workpiece materials milling; P, M, K, H and S
- Long tool life and stable machining due to PVD Omega tech and Edge tech



KORLOY

PVD insert for general milling

PC5535

With active application of alloy, forging and heat treatment, recent metal materials and spare parts are getting stonger and harder. In addition, unstable clamping faces due to complex shapes of parts increases interupttion frequency so it is more often to experience vibration and chattering while machining. Under this circumstance, tool life decrease, differentiation in tool life, and decrease in machining quality are more commonly happening.

KORLOY launched PC5535 to provide high machining quality and stability with increased productivity in hard-to-cut material milling with unstable cutting conditions.

The **PC5535**, an optimal PVD grade for general milling, is applied general substrate with the balance of wear resistance and toughness is applicable for almost all kinds of workpieces, P, M, K, H and S.

The KORLOY's exclusive PVD fusion coating technology, '**Omega tech**', uniting various components keep their own natural characteristics, optains various features like wear resistance, oxidation resistance, thermal crack resistance, built up edge resistance and chipping resistance and maximizes them. The high lubrication edge technology, '**Edge tech**' prevents chipping from welding and unexpected fracture enhances stable tool life.

Through those technology, PC5535 ensures excellent performance in hard-to-cut steel and cast iron cutting from continuous to interrupted conditions. Also, PC5535 provides longer tool life and machining stability in high hardened steel, stainless steel, inconel and hard-to-cut materials.

» General use for various workpieces

- Applicable for various kinds of workpiece materials; P, M, K, H and S
- Usable for special materials such as alloy steel, forged steel and heat-treated steel

» Stable cutting

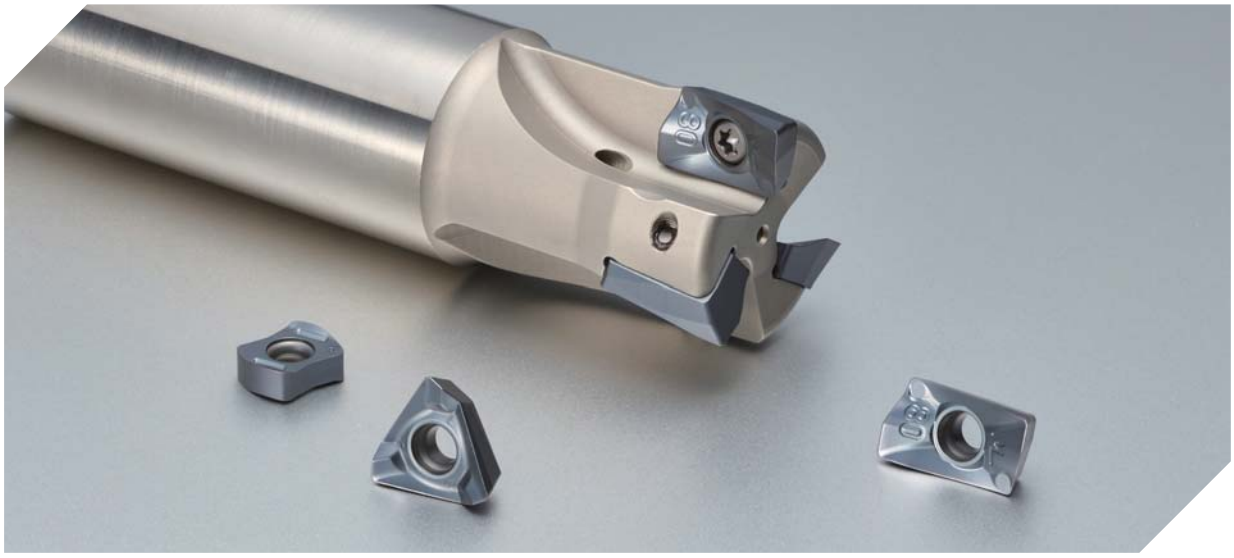
- Preventing unexpected tool breakage under heavily interrupted and vibrated cutting
- Enhanced tool life stability for each corner of insert

» Enhanced cutting performance

- Maximized tool life and machining performance by applying exclusive PVD coating and edge technology

» Higher productivity

- Available for high speed and high feed cutting from improved product quality
- Various cutting rage from continuous to interrupted cutting

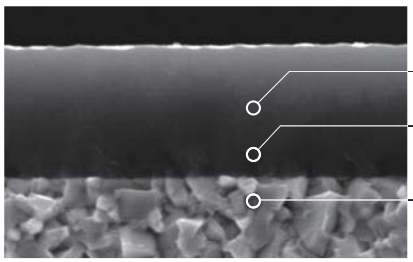


Features

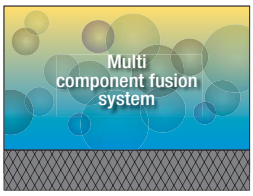
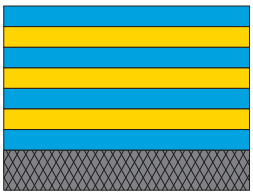
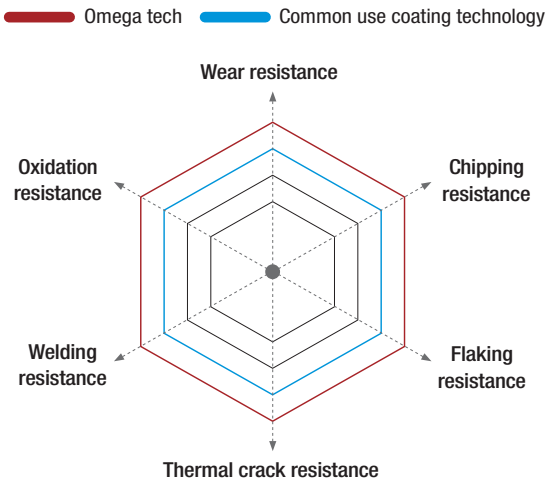
PC5535

- General use due to high toughness substrate with balance of wear resistance and toughness
- Maximized tool life by applying the omega tech overcoming primary troubles in milling
- Achieved stable cutting by implementing Edge tech and preventing welding, chipping and unexpected fracture
- PVD coated grade optimized for general milling

Omega tech - applying PVD fusion coating technology



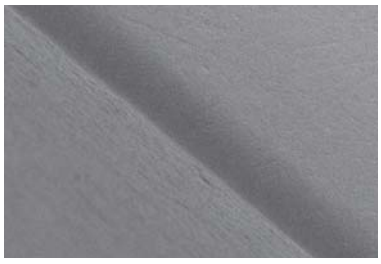
- Maximized coating performance by applying exclusive PVD fusion coating technology
- Increased adherence between substrate and coating layer with the application of newly designed layer
- Fine substrate with balance of wear resistance and toughness

Omega technology	Existing and common use coating technology	Comparison of coating technologies
		
• One strong coating layer unifying various components • Enhanced general use and cutting performance due to increased mechanical and chemical stability	• Combination and laminating of coating layers, Tin, TiAlN, AlTiN, AlCrN and etc. • Limit of general use and adherence	

Edge tech - applying high lubricated edge technology

Edge technology

- Preventing welding, chipping and unexpected fracture
- Longer tool life and stable cutting

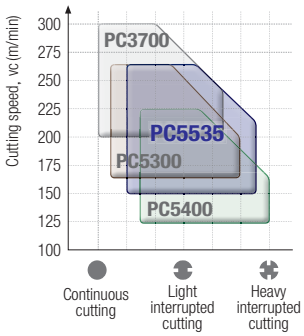


[PC5535]

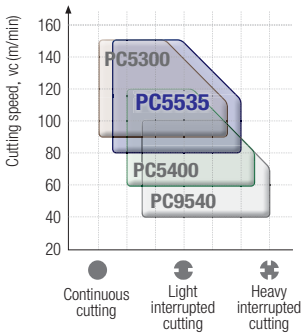
[Competitor]

Application range

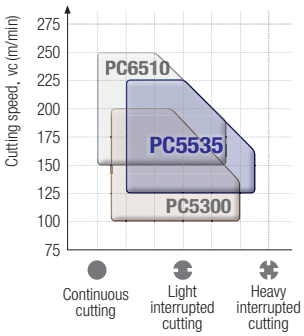
P Steel



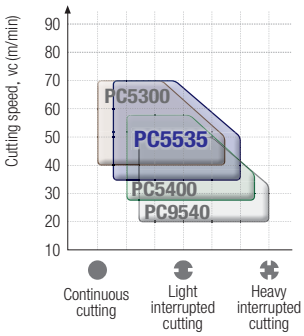
M Stainless steel



K Cast iron



S HRSA

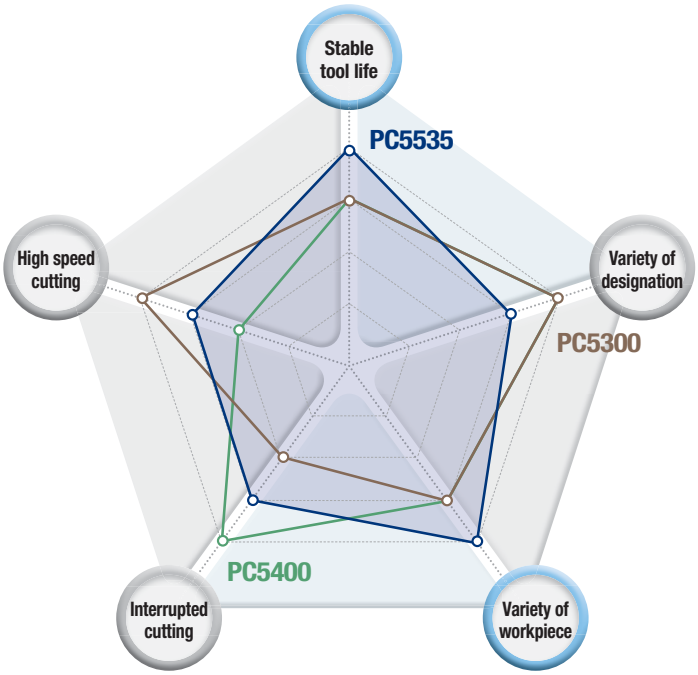


Recommended cutting conditions

* quenching + tempering heat treatment

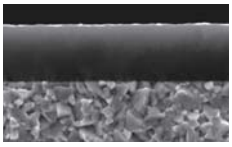
Workpiece				Specific cutting force (N/mm²)	Brinell hardness (HB)	Recommended cutting conditions		
ISO	Workpiece materials	ISO (DIN)	AISI/SAE/ UNS/ASTM			PC5535	Facing / shouldering	High feed cutting
						vc (m/min)	fz (mm/t)	
P	Low carbon steel	C15	1015	1500	120~210	180	0.30	1.50
		C25	1025			**250**	**0.20**	**1.00**
		C35	1035			320	0.10	0.50
	High carbon steel	C45	1045	1700	140~250	160 (130*)	0.30	1.50
		C53	1050	1820*	200~290*	**220 (180*)**	**0.20**	**1.00**
		C55	1055			280 (230*)	0.10	0.50
	Low alloy steel	20Cr4	5120	1700	170~270	150 (80*)	0.30 (0.25*)	1.50 (1.30*)
		42CrMo4	4140	2000*	220~360*	**200 (120*)**	**0.20 (0.15*)**	**1.00 (0.80*)**
		21NiCrMo2	8615			250 (160*)	0.10 (0.05*)	0.50 (0.30*)
	High alloy steel (alloy tool steel)	(X100CrMoV5 1)	D2	1950	200~320	140 (40*)	0.25 (0.20*)	1.30 (0.90*)
		X40CrMoV5-1	H13	3100*	480~650*	**180 (70*)**	**0.15 (0.10*)**	**0.80 (0.60*)**
		HS6-5-2	M2			220 (100*)	0.05 (0.05*)	0.30 (0.30*)
	Mold steel (pre-hardened steel)	-	-	2000	286~421	60	0.25	1.30
		-	P21			**100**	**0.15**	**0.80**
		-	420			140	0.05	0.30
M	Ferritic/ martensitic series	X6CrAl13	405	1650	≤ 183	120	0.25	1.30
		X6Cr17	430			**160**	**0.15**	**0.80**
						200	0.05	0.30
		-	403	1800	≤ 200	100	0.25	1.30
		X12Cr13	410			**140**	**0.15**	**0.80**
						180	0.05	0.30
	Austenite series	X5CrNi18-9	304	2000	≤ 187	80	0.25	1.10
		X5CrNiMo17-12-2	316			**120**	**0.15**	**0.70**
						160	0.05	0.30
	Austenite-ferritic series (duplex)	(X2CrNiMoN22-5-3)	S31803	2200	≤ 310	60	0.25	1.10
		(X2CrNiMoCuN25-6-3)	S32205			**90**	**0.15**	**0.70**
		(X2CrNiMoN 25-7-4)	S32750			120	0.05	0.30
	Precipitation series	X5CrNiCuNb16-4	630 (17-4PH)	2800	≤ 350	60	0.25	1.10
						90	**0.15**	**0.70**
						120	0.05	0.30
K	Gray cast iron	150	No25B	900	≤ 212	150	0.30	1.30
		250	No35B	1100	≤ 248	**200**	**0.20**	**0.80**
		350	No50B	1300	≤ 277	250	0.10	0.30
	Ductile cast iron	500	80-55-06	1200	170~241	100	0.30	1.30
		600	-	1440	192~269	**150**	**0.20**	**0.80**
		700	100-70-03	1650	229~302	200	0.10	0.30
S	Ti alloy steel	(TiAl5Sn2.5)	R54520	1400	301~381	40	0.20	0.90
		(TiAl6V4)	R56401			**70**	**0.10**	**0.60**
						100	0.05	0.30
	Fe base	-	N08800	2400	≤ 200	40	0.20	0.90
						55	**0.10**	**0.60**
						70	0.05	0.30
	Ni base	-	N07041	3000	286~409	30	0.20	0.90
			N04400			**45**	**0.10**	**0.60**
			N07718			60	0.05	0.30
	Co Base	-	R30006	3100	336~421	20	0.20	0.90
						30	**0.10**	**0.60**
						40	0.05	0.30

General milling grade selection guide



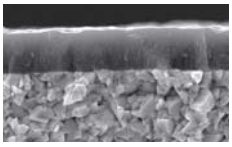
PC5535 New

- Stable tool life
- Medium to finishing and interrupted cutting



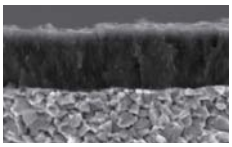
PC5300

- Good wear resistance
- Medium and continuous cutting

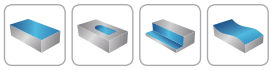
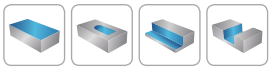


PC5400

- Good chipping resistance
- Roughing, heavy interrupted cutting



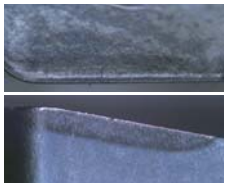
Grade	Stable tool life	Variety of designation	Variety of workpiece	Interrupted cutting	High speed cutting
PC5535 New	★★★★	★★★	★★★★	★★★	★★★
PC5300	★★★	★★★★	★★★	★★	★★★★
PC5400	★★★	★★★★	★★★	★★★★	★★

Grade		PC5535 New	PC5300	PC5400
Recommended workpieces		• Alloy steel, forged steel and heat treated steel • High alloy steel and plastic mold steel • Ductile cast iron • Stainless steel and HRSA	• High carbon steel • Low alloy steel (without heat treatment) • Gray cast iron • Stainless steel and HRSA	• Low carbon steel (mild steel) • Low alloy steel (without heat treatment) • Stainless steel and HRSA
Recommended cutting conditions	Type			
	Interruption	Light interrupted cutting Medium interrupted cutting	Continuous cutting Light interrupted cutting	Medium interrupted cutting Heavy interrupted cutting
	Depth of cut	Finishing ~ Medium roughing	Medium finishing ~ Medium roughing	Medium cutting ~ roughing
	Overhang	Long ~ Very long	Short ~ Long	Long ~ Very long
	Clamping	Normal ~ Unstable	Stable ~ Normal	Normal ~ Unstable
Recommended chip breaker		MF, ML	MM, MF	MM, MF

Performance evaluation

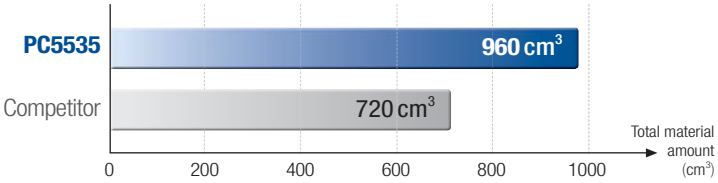
Low alloy steel (42CrMo4)

Workpiece use	Steel rectangular tube, 300 (L) × 200 (W) × 100 (H)
Cutting conditions	vc (m/min) = 250, fz (mm/t) = 0.2, ap (mm) = 2.0, dry
Tools	**Insert** SNMX1206ANN-MM (PC5535) **Holder** RM8ACM4125HR-M



[PC5535]

[Competitor]



• Material removal rate Q (cm³/min): 254.6 • Cutting time (min): 6.1

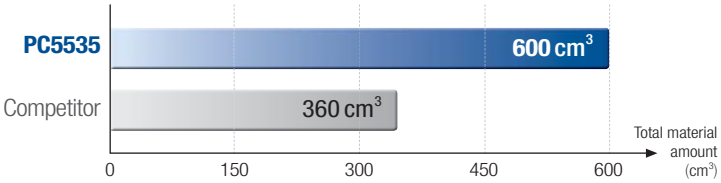
High alloy steel (X100CrMoV5 1*)

(*: DIN)

Workpiece use	Steel rectangular tube, 300 (L) × 200 (W) × 100 (H)
Cutting conditions	vc (m/min) = 120, fz (mm/t) = 0.2, ap (mm) = 5.0, dry
Tools	**Insert** ADKT170608PESR-MM (PC5535) **Holder** AMXS032R-3W32-125-AD17

[PC5535]

[Competitor]



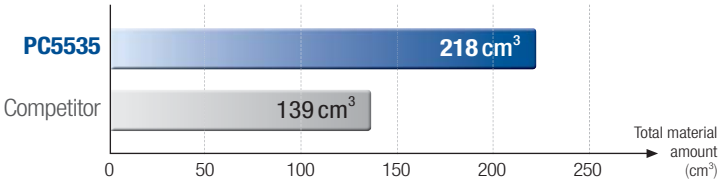
• Material removal rate Q (cm³/min): 9.2 • Cutting time (min): 85.5

Ductile cast iron (600)

Workpiece use	Steel rectangular tube, 300 (L) × 200 (W) × 100 (H)
Cutting conditions	vc (m/min) = 200, fz (mm/t) = 0.2, ap (mm) = 2.0, wet
Tools	**Insert** SNMX1206ANN-MF (PC5535) **Holder** RM8ACM4125HR-M

[PC5535]

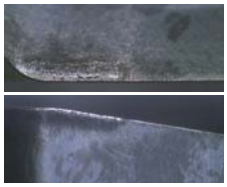
[Competitor]



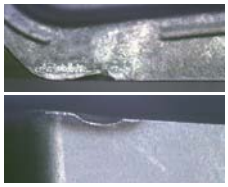
• Material removal rate Q (cm³/min): 67.2 • Cutting time (min): 5.2

Stainless steel (X5CrNiMo17-12-2)

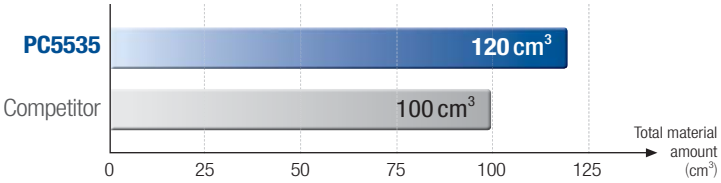
Workpiece use	Steel rectangular tube, 300 (L) × 200 (W) × 100 (H)
Cutting conditions	vc (m/min) = 90, fz (mm/t) = 0.1, ap (mm) = 1.0, wet
Tools	**Insert** SNMX1206ANN-MF (PC5535) **Holder** RM8ACM4063HR-H



[PC5535]



[Competitor]



• Material removal rate Q (cm³/min): 9.2 • Cutting time (min): 19.8

Application examples

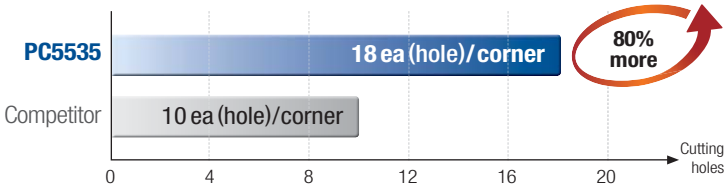
High carbon steel (C45)

Workpiece materials Clutch for marine vessel and brake plate

Cutting conditions vc(m/min) = 175, fz(mm/t) = 0.3, ap(mm) = 2.0, wet

Tools Insert APMT1604PDSR-MM(PC5535) Holder AMS3040HS

Cutting type	Helical	Interruption	Light interrupted cutting
Overhang	Long	Clamping	Stable



» Cutting 80% or above more holes than competitor

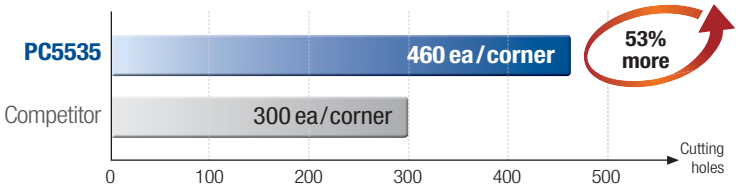
Low alloy steel (S36CVTiS2)

Workpiece materials Automobile engine connecting road

Cutting conditions vc(m/min) = 110, fz(mm/t) = 0.05, ap(mm) = 1.0, wet

Tools Insert APMT1103PDSR-MM(PC5535) Holder AMS2020HS-2L20

Cutting type	Perpendicularity	Interruption	Medium interrupted cutting
Overhang	Very long	Clamping	Stable



» Cutting 53% or above more holes than competitor

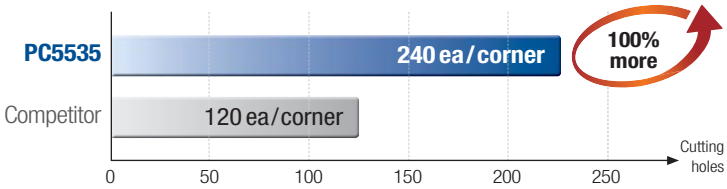
Ductile cast iron (600)

Workpiece materials Automobile transmission gear shift fork

Cutting conditions vc(m/min) = 314, fz(mm/t) = 0.02, ap(mm) = 5.5, wet

Tools Insert TNKT160608PEER-ML(PC5535) Holder TPMCM050R-22-5-TN16

Cutting type	Shouldering	Interruption	Light interrupted cutting
Overhang	Short	Clamping	Normal



» Cutting 100% or above more holes than competitor

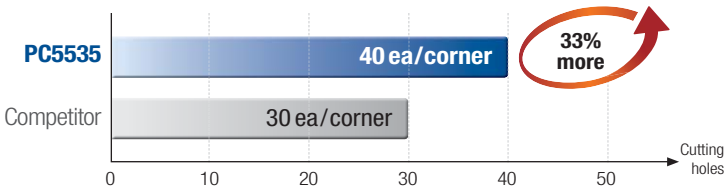
Stainless steel (X5CrNi18-9)

Workpiece materials Automobile engine valve housing

Cutting conditions vc(m/min) = 150, fz(mm/t) = 0.13, ap(mm) = 0.7, wet

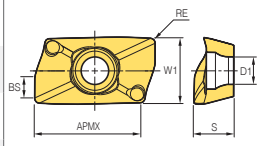
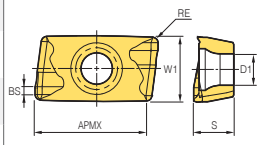
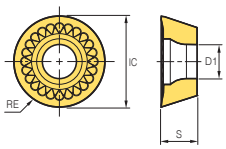
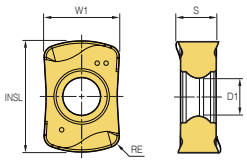
Tools Insert SNMX1206ANN-MF(PC5535) Holder RM8AC4063HR-M

Cutting type	Flat surface cutting	Interruption	Medium interrupted cutting
Overhang	Short	Clamping	Unstable

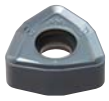
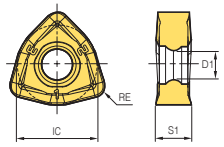
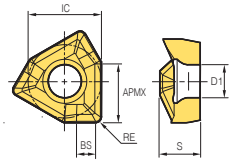
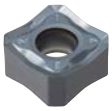
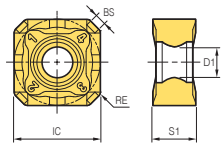
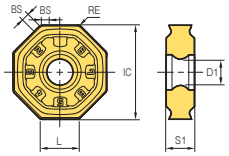
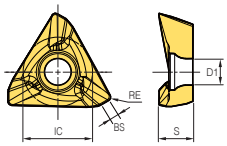


» Cutting 33% or above more holes than competitor

Stock items

Items	Picture	Designation		Coated PC5535	Dimensions (mm) APMX/INSL	IC/W1	S/S1	RE	D1	BS	Geometries
Alpha Mill		APMT	0903PDSR-MM	●	9.4	6.21	3.6	0.4	2.8	0.9	
			090308PDSR-MM	●	9.4	6.21	3.6	0.8	2.8	0.5	
			090320R-MM	●	9.2	6.21	3.6	2.0	2.8	-	
			11T3PDSR-MF	●	11.2	6.467	3.6	0.5	2.85	1.2	
			11T3PDSR-MM	●	11.2	6.467	3.6	0.5	2.85	1.2	
			11T308PDSR-MM	●	11.2	6.467	3.6	0.8	2.85	0.9	
			11T312PDSR-MM	●	11.2	6.467	3.6	1.2	2.85	0.5	
			11T316R-MM	●	11.0	6.467	3.6	1.6	2.85	-	
			11T324R-MM	●	11.0	6.467	3.6	2.4	2.85	-	
			1604PDSR-MF	●	16.4	9.41	5.76	0.8	4.5	1.1	
			160404PDSR-MM	●	16.4	9.41	5.76	0.4	4.5	1.5	
			1604PDSR-MM	●	16.4	9.41	5.76	0.8	4.5	1.1	
			160410PDSR-MM	●	16.4	9.41	5.76	1.0	4.5	0.9	
			160416PDSR-MM	●	16.4	9.41	5.76	1.6	4.5	0.3	
			160424R-MM	●	16.0	9.41	5.76	2.4	4.5	-	
			160430R-MM	●	16.0	9.41	5.76	3.0	4.5	-	
			160432R-MM	●	16.0	9.41	5.76	3.2	4.5	-	
			160450R-MM	●	16.0	9.41	5.76	5.0	4.5	-	
			1806PDSR-MM	●	17.4	10.98	6.35	0.8	4.5	2.2	
			180612PDSR-MM	●	17.4	10.98	6.35	1.2	4.5	1.8	
Alpha Mill-X		ADKT	10T304PEER-ML	●	9.5	6.424	3.819	0.4	2.8	0.96	
			10T304PESR-MM	●	9.5	6.424	3.819	0.4	2.8	1.2	
			120408PESR-ML	●	11.5	7.813	4.824	0.8	3.4	1.71	
			120408PESR-MM	●	11.5	7.813	4.824	0.8	3.4	1.71	
			170608PESR-ML	●	16.5	10.843	6.529	0.8	4.5	3.5	
			170608PESR-MM	●	16.5	10.843	6.529	0.8	4.5	3.3	
Future Mill		RDKT	10T3M0-MM	●	5.0	10.0	3.97	5.0	3.85	-	
			1204M0-MM	●	6.0	12.0	4.76	6.0	4.5	-	
Future Mill P-positive		RPMT	10T3M0E-MF	●	5.0	10.0	3.97	5.0	3.85	-	
			10T3M0S-MM	●	5.0	10.0	3.97	5.0	3.85	-	
			1204M0S-MM	●	6.0	12.0	4.76	6.0	4.5	-	
			1606M0S-MM	●	8.0	16.0	6.35	8.0	5.5	-	
HFMD		LNMX	100412R-MF	●	12.0	10.0	4.2	1.2	4.65	-	
			100412R-ML	●	12.0	10.0	4.2	1.2	4.65	-	
			100412R-MM	●	12.0	10.0	4.2	1.2	4.65	-	

●: Stock item

Items	Picture	Designation		Coated	Dimensions (mm)						Geometries
				PC5535	APMX/ INSL	IC/W1	S/S1	RE	D1	BS	
HRMD		WNMX	060312ZNN-MM	●	1.0	6.35	3.18	1.2	2.86	1.2	
			09T316ZNN-MM	●	1.5	9.525	3.97	1.6	3.6	1.7	
			130520ZNN-MM	●	2.0	12.7	5.56	2.0	4.65	2.5	
Rich Mill (RM3)		XNKT	060405PNER-ML	●	5.5	6.5	4.0	0.5	3.4	1.3	
			060408PNER-ML	●	5.5	6.5	4.0	0.8	3.4	1.1	
			060405PNSR-MM	●	5.5	6.5	4.0	0.5	3.4	1.3	
			060408PNSR-MM	●	5.5	6.5	4.0	0.8	3.4	1.1	
			080508PNER-ML	●	8.0	10.0	5.5	0.8	4.5	2.2	
			080520PNER-ML	●	8.0	10.0	5.5	2.0	4.5	1.05	
			080508PNSR-MM	●	8.0	10.0	5.5	0.8	4.5	2.2	
			080516PNSR-MM	●	8.0	10.0	5.5	1.6	4.5	1.43	
			120608PNSR-MM	●	12.0	12.0	6.5	0.8	5.5	2.76	
Rich Mill (RM8)		SNMX	1206ANN-MF	●	6.0	12.7	6.35	0.8	4.5	1.56	
			1206ENN-MF	●	9.0	12.7	6.35	1.0	5.2	1.32	
			1206QNN-MF	●	11.5	12.7	6.35	0.8	5.2	1.394	
			1206ANN-MM	●	6.0	12.7	6.35	0.8	4.5	1.56	
			1206ENN-MM	●	9.0	12.7	6.35	1.0	5.2	1.32	
			1206QNN-MM	●	11.5	12.7	6.35	0.8	5.2	1.394	
Rich Mill (RM16)		ONMX	0606ANN-MF	●	4.0	16.0	6.0	0.8	5.6	1.03	
			060608-MM	●	4.0	16.0	6.0	0.8	5.6	-	
			0606ANN-MM	●	4.0	16.0	6.0	0.8	5.6	1.03	
Triple Mill		TNKT	110508PEER-ML	●	8.0	8.0	4.5	0.8	3.4	1.3	
			110508PESR-MM	●	8.0	8.0	4.5	0.8	3.4	1.3	
			160608PEER-ML	●	11.5	11.7	5.5	0.8	4.5	1.5	
			160608PESR-MM	●	11.5	11.7	5.5	0.8	4.5	1.5	

●: Stock item

⚠ For the safe metalcutting

- Use safety supplies such as protective gloves to prevent possible injury while touching the edge of tools.
- Use safety glasess or safety cover to hedge possible dangers. Inappropriate usage or excessive cutting condition may lead tool's breakage or even the fragment's scattering.
- Clamp the workpiece tightly enough to prevent its movement while its machining.
- Properly manage the tool change phase because the inordinately used tool can be easily broken under the excessive cutting load or severe wear, and it may threat the operator's safety.
- Use safety cover because chips evacuated during cutting are hot and sharp and may cause burns and cuts. To remove chips safely, stop machining, put on protective gloves, and use a hook or other tools.
- Prepare for fire prevention measures as the use of the non-water soluble cutting oil may cause fire.
- Use safety cover and other safety supplies because the spare parts or the inserts can be pulled out due to centrifugal force while high speed machining.

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