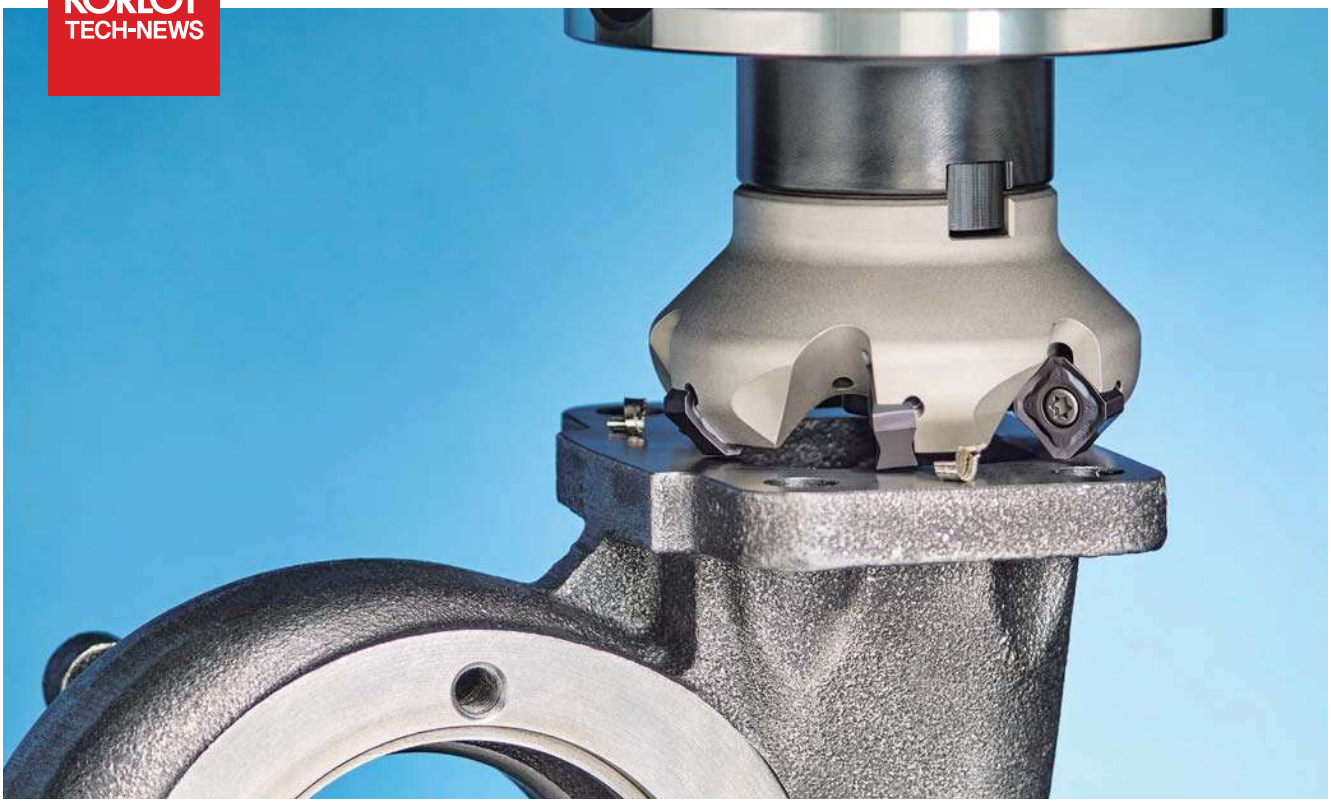
Insert for hard-to-cut stainless steel milling

PC9540

KORLOY TECH-NEWS



- 50% longer tool life with optimal high toughness substrate for hard-to-cut stainless steel (turbo chargers etc.) than the existing grade
- Stable machinability due to PVD oxide film for preventing wear and heating of inserts caused by high temperature in machining

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TECH-NEWS

Insert for hard-to-cut stainless steel milling

PC9540

Stainless steel is a kind of metal material widely used in industries such as food, medical appliances, automobile parts, and construction materials. It is widely used because of it resistance to corrosion and its strength and luster.

Lately, the demand of high strength and heat resistance stainless steel for turbo charger turbine housings has risen significantly.

High strength and heat resistance stainless steel is grouped into hard-to-cut stainless steel which more often provides high temperature occurring wear on inserts, fractures and chipping on tools due to heat and welding making high shear resistance than general stainless steel.

The existing grades of M25 to M35 grade reaches the limitation of improving tool life and cycle time in highly unstable and interrupted machining with hard-to-cut stainless steel.

Moreover, KORLOY recommends a new rising grade, **PC9540** for improving productivity in hard-to-cut stainless steel milling.

The PC9540 which is an exclusive grade for M40 grade stainless steel maximizes chipping and fracture resistance in medium to rough cutting and interrupted milling due to its **high toughness substrate**. It also allows stable machinability in high strength and heat resistance stainless steel by applying the new rising **PVD oxide film** with oxidation and heat resistance.

Therefore, the average tool life of the PC9540 is 50% longer in hard-to-cut stainless steel machining than the existing grade and it provides high productivity in general stainless steel machining.

The 9540 is the latest grade providing solutions to improve productivity and achieve stable stainless steel machining.

Long tool life

- Increased resistance to breakage due to high toughness in the substrate
- Long tool life in medium to rough cutting and highly interrupted machining

Stable machining

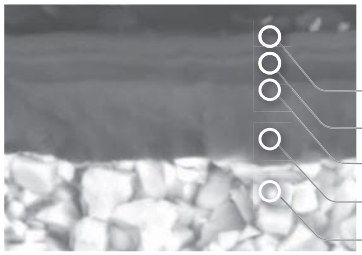
- Increased oxidation and welding resistance with PVD oxide film
- Preventing built-up edge, notch chipping and unexpected breakage

Generally usable for stainless steel machining

- General stainless steel: ferritic, martensitic, and austenitic stainless steels
- High strength and heat resisting stainless steel: duplex, precipitation hardening, and heat resistance stainless steels

Features

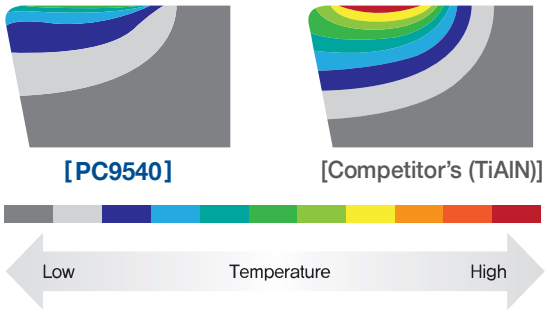
- Optimal PVD grade for medium to rough cutting and highly interrupted milling in stainless steel
- Longer tool life due to higher breakage resistance applying high toughness substrate controlling crack growth
- Excellent and new PVD oxide film with oxidation and heat resistance overcoming the limit of hard-to-cut materials machining
- Stable machinability by preventing welding and chipping due to applying special coating surface treatment



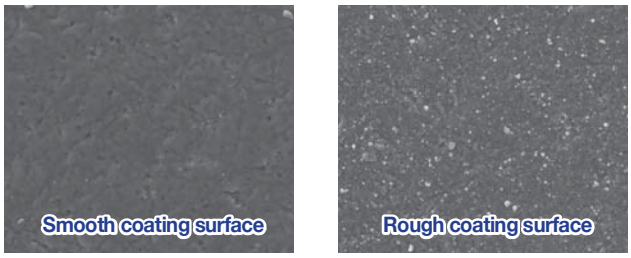
PC9540 new

- Improved surface finish → Good welding resistance
- PVD multilayer → Controlling crack growth
- PVD oxide film → Good oxidation and heat resistance
- PVD nitride film → Good wear resistance
- High toughness substrate → Good breakage resistance

[New PVD oxide film (comparison of thermal conductivity)]



[Special coating surface treatment technology]



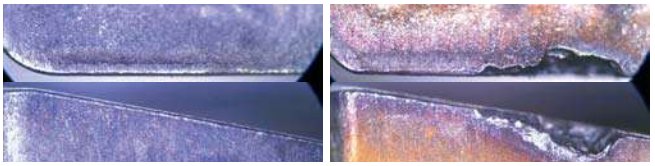
[PC9540] [Existing grade]

Development effect

Medium interrupted machining

- **Workpiece** Stainless steel (X5CrNiMo17-12-2)
- **Cutting conditions** vc (m/min) = 150, fz (mm/t) = 0.1, ap (mm) = 2.0, dry

▶ Improved welding and chipping resistance



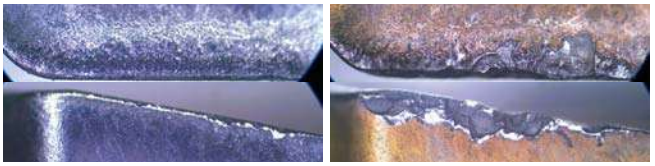
[PC9540] [Competitor's]

(*: DIN)

Highly interrupted machining

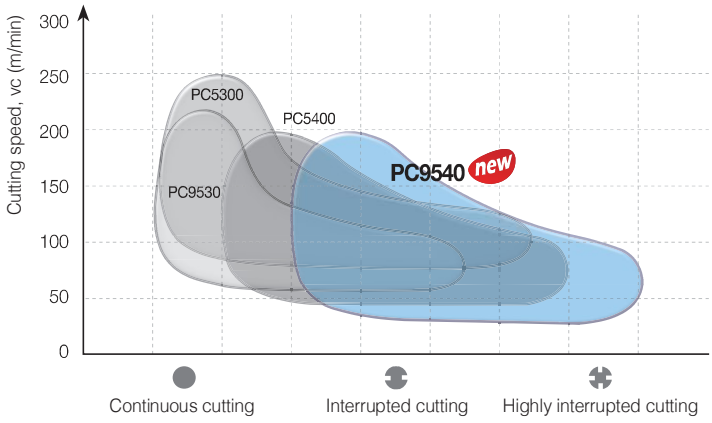
- **Workpiece** Heat resistance stainless steel (1.4848)*
- **Cutting conditions** vc (m/min) = 90, fz (mm/t) = 0.2, ap (mm) = 2.0, dry

▶ Controlling unexpected breakage

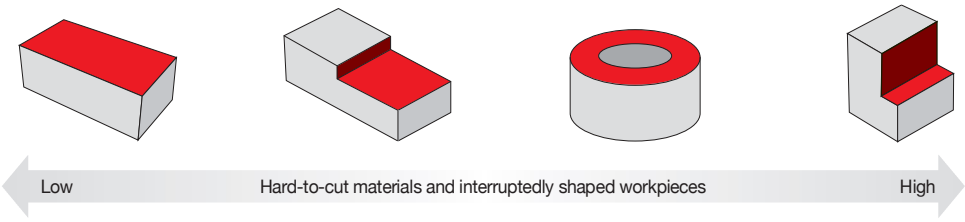


[PC9540] [Competitor's]

Application range



Guideline for grades application

Section	High speed and continuous cutting	Medium speed and interrupted cutting	Medium to low speed and highly interrupted cutting
ISO	M25 - M30	M35 - M40	M40
Recommended grade	**PC5300, PC9530**	**PC5400, PC9540**	**PC9540**
Parts	General stainless steel blocks, molds and large workpieces	Automobiles and machinery parts, turbo charger turbine housings	Oil pumps, aero parts, turbo charger turbine housings
Workpiece shape			

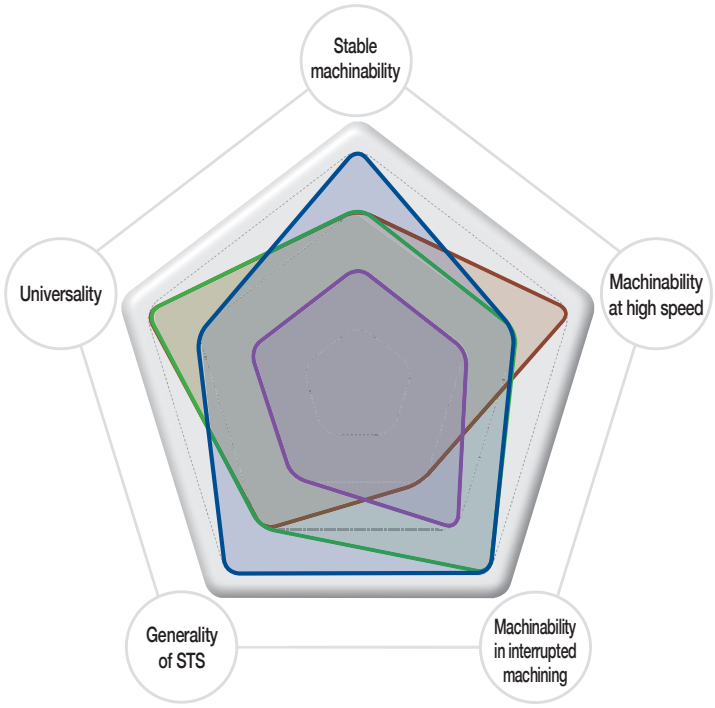
Main machining examples guideline (turbo charger turbine housings)

(*: DIN)

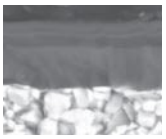
Section	Finishing	Medium cutting to roughing	Highly interrupted cutting
ISO	M25 - M30	M40	M40
Recommended grade	**PC5300, PC9530**	**PC9540**	**PC9540**
Workpiece	Heat resistance stainless steel (1.48□□)*	Heat resistance stainless steel (1.48□□)*	Heat resistance stainless steel (1.48□□)*
Machining	Wet machining with low depth of cut on rough machining	Dry machining with high depth of cut on wider machining	Unstable and highly interrupted machining
Machining part			

Grade for stainless steel milling selection guide

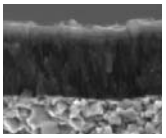
PC9540 PC5400 PC9530 PC5300



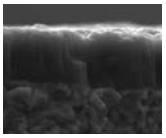
PC9540 (M40) new
- Stable machinability
- Medium to rough cutting and highly interrupted machining



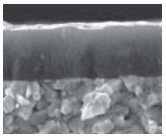
PC5400 (M35)
- Good wear resistance in interrupted machining
- Universal grade



PC9530 (M30)
- Good welding resistance in low speed machining
- Continuous cutting of general STS



PC5300 (M25)
- Good wear resistance in high speed machining
- Universal grade



Grade	Stable machinability	Machinability at high speed	Machinability in interrupted machining	Generality of STS	Universality
PC9540 (M40) new	★★★★	★★★	★★★★	★★★★	★★★
PC5400 (M35)	★★★	★★★	★★★★	★★★	★★★★
PC9530 (M30)	★★	★★	★★★	★★	★★
PC5300 (M25)	★★★	★★★★	★★	★★★	★★★★

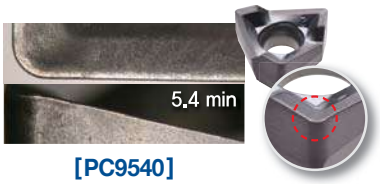
Recommended cutting conditions

Workpiece					Hardness (HB)	Recommended cutting conditions	
ISO	Workpiece	ISO (DIN)*	AISI	KS		vc (m/min)	fz (mm/t)
M	Austenitic stainless steel	X5CrNi18-9 X5CrNiMo17-12-2	304 316	STS304 STS316	160 - 180	90 - 150	0.05 - 0.3
	Ferritic and martensitic stainless steel	X6Cr17 X12Cr13	430 410	STS430 STS410	180 - 200	120 - 200	0.05 - 0.35
	Precipitation hardening stainless steel	X5CrNiCuNb16-4 (1.4462)*	630 F60	STS630 -	280 - 300	70 - 120	0.05 - 0.25
	Heat resistance stainless steel	(1.4837)* (1.4848)*	- -	- -	160 - 200	60 - 100	0.05 - 0.2

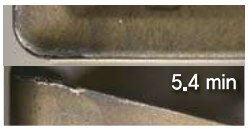
Performance evaluation

Austenitic stainless steel (X5CrNi18-9, HB160)

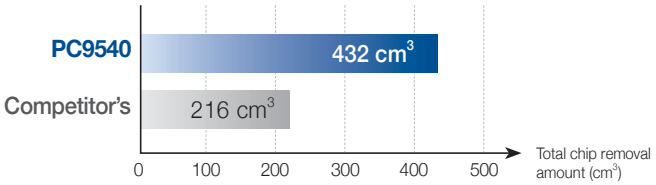
- **Workpiece** Square bar (300×200×100)
- **Cutting conditions** vc (m/min) = 120, fz (mm/t) = 0.1, ap (mm) = 1.5, ae (mm) = 20, wet
- **Tools** **Insert** XNKT080508PNER-ML **Holder** RM3PCM4063HR



[PC9540]



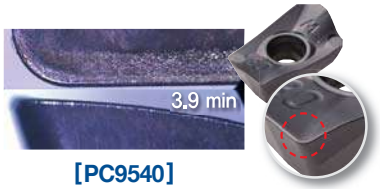
[Competitor's]



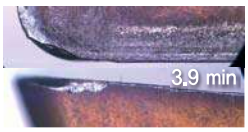
- Chip removal rate Q (cm^3/min) : 40.2
- Machining hours (min) : 10.8

Austenitic stainless steel (X5CrNiMo17-12-2, HB160)

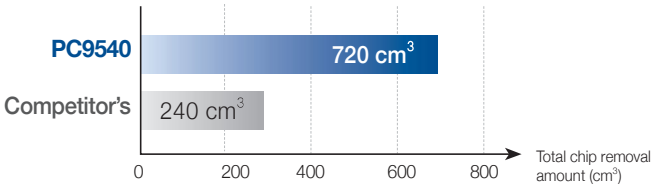
- **Workpiece** Square bar (300×200×100)
- **Cutting conditions** vc (m/min) = 120, fz (mm/t) = 0.15, ap (mm) = 5.0, ae (mm) = 10, dry
- **Tools** **Insert** ADKT170608PESR-ML **Holder** AMXS032R-3W32-125-AD17



[PC9540]



[Competitor's]

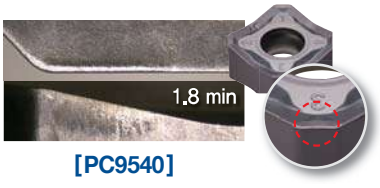


- Chip removal rate Q (cm^3/min) : 61.0
- Machining hours (min) : 11.8

(*: DIN)

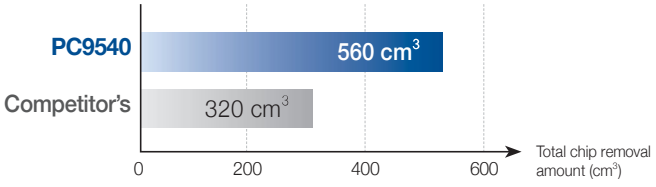
Heat resistance stainless steel (1.4848*, HB180)

- **Workpiece** Square bar (100×100×100)
- **Cutting conditions** vc (m/min) = 90, fz (mm/t) = 0.2, ap (mm) = 2.0, ae (mm) = 25, wet
- **Tools** **Insert** SNMX1206ANN-MF **Holder** RM8ACM4063HR-H



[PC9540]

[Competitor's]



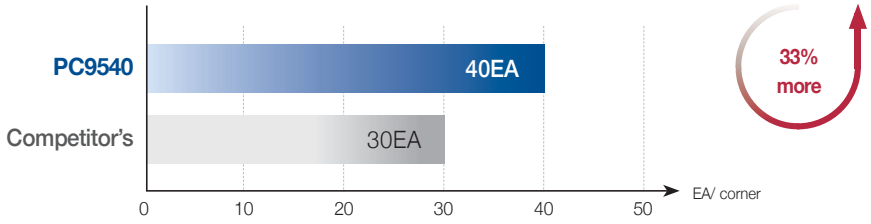
- Chip removal rate Q (cm^3/min) : 178.5
- Machining hours (min) : 3.1

Application examples

(*: DIN)

Heat resistance stainless steel (1.4837)*

- **Workpiece use** Turbo charger turbine housing
- **Cutting conditions** vc (m/min) = 100, fz (mm/t) = 0.16, ap (mm) = 2.2, dry
- **Tools** **Insert** SNMX1206ANN-MF **Holder** RM8AC4100HR

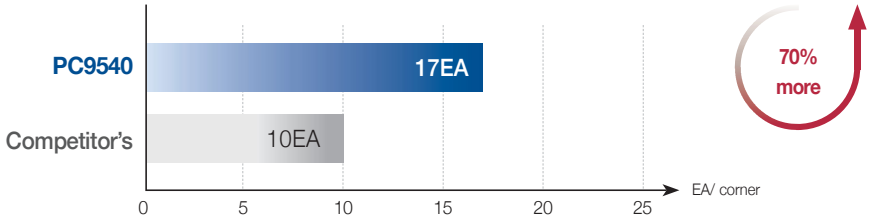


▶ Machining 33% more than competitor's

(*: DIN)

Heat resistance stainless steel (1.4848)*

- **Workpiece use** Turbo charger turbine housing
- **Cutting conditions** vc (m/min) = 80, fz (mm/t) = 0.2, ap (mm) = 1.2, dry
- **Tools** **Insert** ONMX060608-MM **Holder** RM16AC6100HR-M

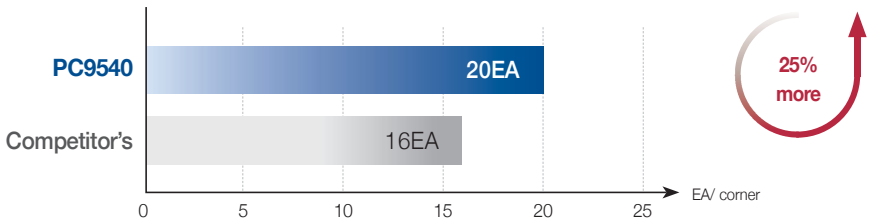


▶ Machining 70% more than competitor's

(*: DIN)

Heat resistance stainless steel (1.4848)*

- **Workpiece use** Turbo charger turbine housing
- **Cutting conditions** vc (m/min) = 100, fz (mm/t) = 0.15, ap (mm) = 1.5, wet
- **Tools** **Insert** XNKT060405PNSR-MM **Holder** RM3PS3025HR-3L20



▶ Machining 25% more than competitor's

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TN80-EM-01 / 20191230