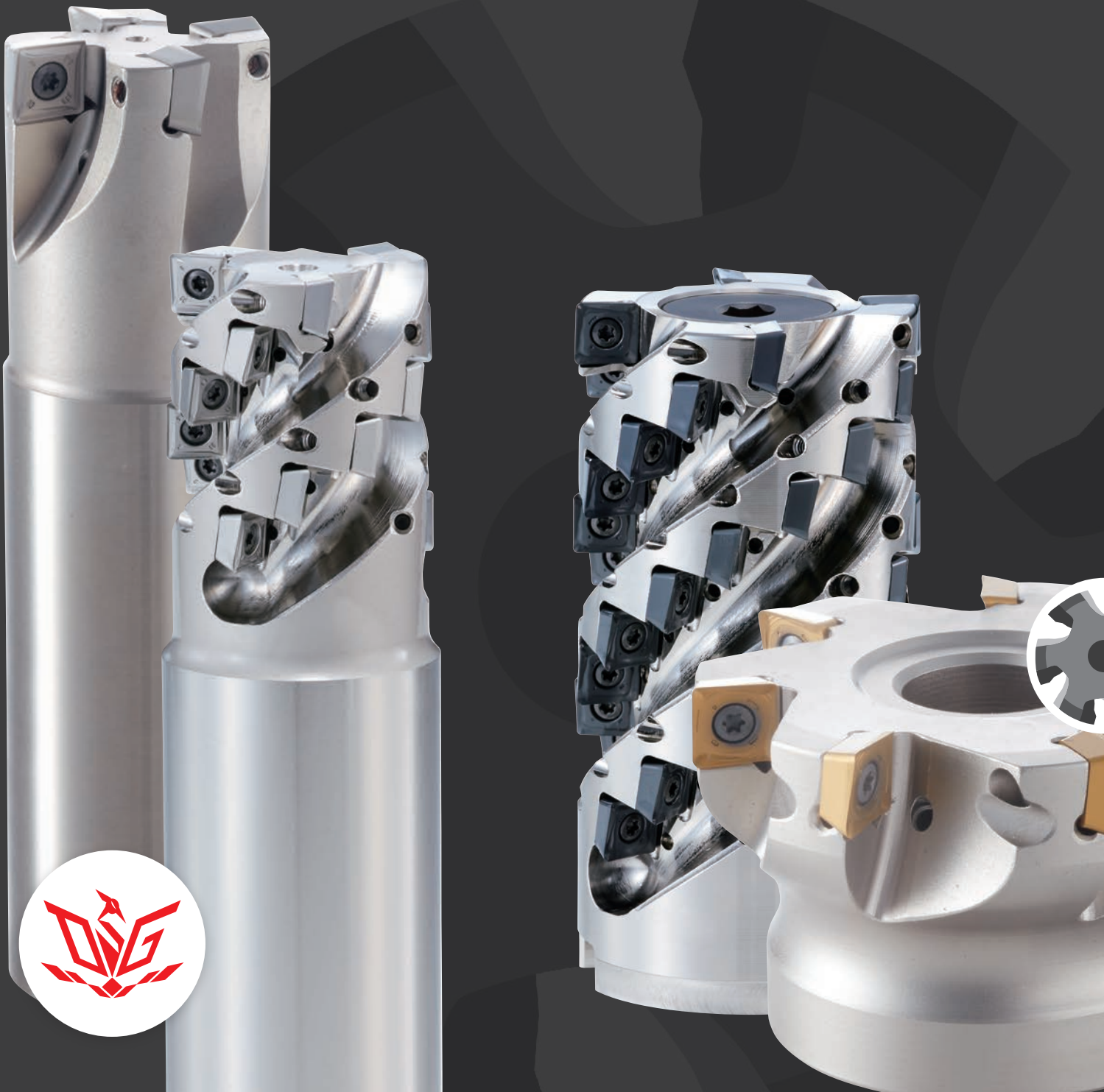




New Phoenix anti-chatter roughing end mill cutter

# PSF • PSFL

Volume 1



# KEY FEATURES: PHOENIX PSF

**1** 90° shoulder cutter

**2** 4 corners inserts

**3** Cylindrical type



# PHOENIX PSF

## Insert form

- Four-corner type: Positive square type insert.
- Compact size insert for low depth of cut.
- The sharpness of the three-dimensional breaker insert enable low-resistance milling.



## Optimal for milling with compact machining center





Superior performance for short cutting depths ( $a_p = 3\text{mm}$  or less)

- Long tool life
- High efficiency

Multiple corners for high cost performance

- Using 4 corners - maximum cutting depth 5mm
- Using 2 corners - maximum cutting depth 8mm

## Insert variations to accommodate a wide range of work materials – from general steel to difficult-to-machine materials

Insert Breaker	NM	GL	GM	GR
Application	Aluminum alloy & Non-ferrous metal	Low-resistance machining-Heat-resistant alloy & Difficult-to-machine material	Multi-purpose machining & General steel milling	Intermittent machining & Cast iron machining
				

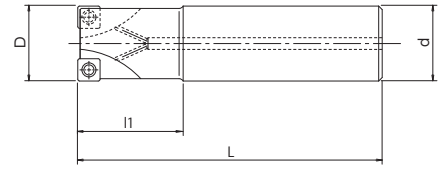
# PSF SS

Milling | Indexables

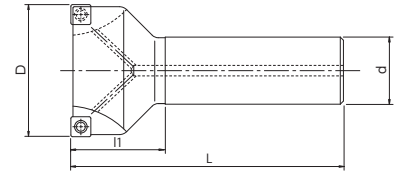


- Shoulder cutter with coolant holes
- 4 corners inserts
- Cylindrical type
- 25 - 40 mm

Type 1



Type 2



page 13



page 6



EDP	Designation	Z	D	d	L	l1	ap max	Applicable Insert	Type	Price
7803001	PSF09R025SS25-3S	3	25	25	120	35	5	SD*T09	1	
7803002	PSF09R032SS32-4S	4	32	32	130	45	5	SD*T09	1	
7803003	PSF09R040SS32-5S	5	40	32	140	50	5	SD*T09	2	

Milling | Indexables



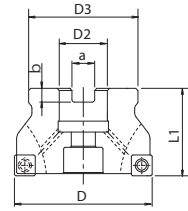
90 degrees

### Accessories & spare parts

Applicable cutter Ø	 Clamping screw		 Wrench	
	Ø 25 ~ 40	7808110	FS30573 (Torx 8)	7808205

# PSF BORE

Milling | Indexables





- Shoulder cutter with coolant holes
- 4 corners inserts
- Bore type
- 50 - 80 mm



EDP	Designation	Z	D	L1	D3	D2	a	b	ap max	Applicable Insert	Price
7803011	PSF09R050M22-6	6	50	40	45	22	10,4	6,3	5	SD*T09	
7803012	PSF09R063M22-7	7	63	40	50	22	10,4	6,3	5	SD*T09	
7803013	PSF09R080M25.4-9	9	80	50	60	25,4	9,5	6	5	SD*T09	
47803013	PSF09R080M27-9	9	80	50	60	27	12,4	7	5	SD*T09	

Accessories & spare parts

Applicable cutter Ø	 Clamping screw		 Wrench	
	7808110	FS30573 (Torx 8)	7808205	T8-D (Torx 8)
Ø 50 ~ 80	7808110	FS30573 (Torx 8)	7808205	T8-D (Torx 8)

Milling | Indexables



90 degrees

# CUTTING CONDITIONS

Milling | Indexables | Cutting conditions

## PSF

4 corner shoulder cutter

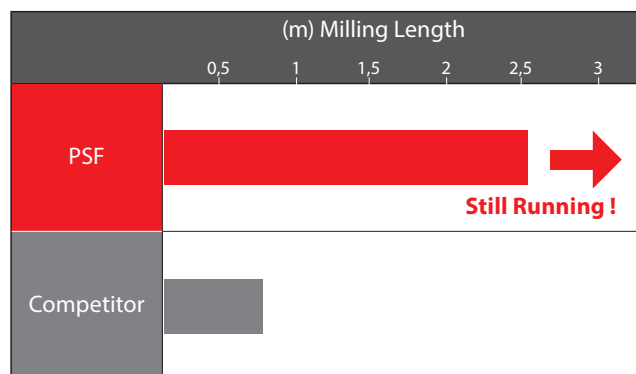
	Work Material	Tensile Strength / Hardness	Milling Speed Vc (m/min)	Feed per Tooth fz (mm/t)	Depth of Cut ap (mm)	Grade
P	Mild Steel-Carbon Steel (SS400-S10C)	~180HB	180 (100~ 250)	0,12 (0,05 ~ 0,2)	3	XP3035 XP2040
	Carbon Steel-Alloy Steel (S50C-SCM440)	~280HB	180 (100 ~ 250)	0,12 (0,05 ~ 0,2)	3	XP3035 XP2040
	Die Steel (SKD11-SKD61)	~280HB	150 (80 ~ 200)	0,1 (0,05 ~ 0,18)	3	XP3035 XP2040
M	Stainless Steel (coolant) (SUS304-SUS420)	~250HB	80 (60~ 120)	0,1 (0,05 ~ 0,18)	2	XP2040
	Stainless Steel (Dry) (SUS304-SUS420)	~250HB	150 (80~ 200)	0,1 (0,05 ~ 0,18)	2	XC5035
K	Cast Iron (FC250)	~350N/mm <sup>2</sup>	180 (100~ 350)	0,12 (0,05 ~ 0,2)	3	XC1015
	Ductile Cast Iron (FCD400)	~800N/mm <sup>2</sup>	180 (100~270)	0,12 (0,05 ~ 0,2)	3	XC1015
N	Alluminium Alloy	~13%Si	300 (200~ 1.500)	0,15 (0,1 ~ 0,25)	3	CK010
S	Heat Resistant Alloy (Wet) (Inconel 718)	-	35 (25~60)	0,1 (0,05 ~ 0,15)	1,5	XC5040
	Titanium Alloy (Wet) (Ti-6Al-4V)	-	40 (30~120)	0,1 (0,05 ~ 0,18)	1,5	XC5040
H	Pre-hardened Steel (NAK80)	40~43HRC	90 (40~ 150)	0,1 (0,08 ~ 0,2)	1,5	XP2040
	Steel for Die Casting (DAC55-DH31)	43~48HRC	70 (40 ~ 120)	0,08 (0,06 ~ 0,15)	0,5	XP2040
	Hardened Steel (SKD11)	50~55HRC	50 (40 ~ 90)	0,06 (0,05 ~ 0,1)	0,5	XP2040



# CUTTING DATA

## Anticorrosion equipment (duplex stainless steel) milling

Tool	PSF09R025SS25-3S (Ø25x3)	Competitor
Insert Grade	SDKT09T308SR-GL (XC5040)	Coated carbide insert
Work Material	Duplex Stainless Steel	
Cutting Speed	80m/min (800min <sup>-1</sup> )	
Feed	300mm/min (0,1mm/t)	
Depth of Cut	ap=2mm ae=15mm	
Coolant	Water-Soluble	
Machine	Vertical Machining Center	



The competitor's product became chipped early on, making it difficult to mill. However, the PSF (XC5040) could mill in a stable manner, resulting in a long tool life.

## Semi-conductor equipment parts (SUS304) milling

Tool	PSF09R050M22-6 (Ø50x6)	Competitor
Insert Grade	SDKT09T308SR-GL (XP2040)	Coated carbide insert
Work Material	SUS304	
Cutting Speed	160m/min (1.000min <sup>-1</sup> )	
Feed	1.200mm/min (0,2mm/t)	
Depth of Cut	ap=2mm ae=30mm	
Coolant	Air Blow	
Machine	Vertical Machining Center	

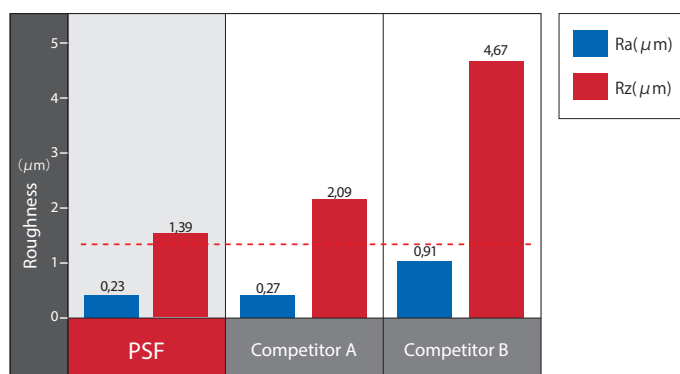
After 10 meters of milling  
Average relief wear VB : 0.073mm



After milling 10 meters, the competitor's product became chipped, without being able to continue milling. The PSF exhibited normal (slight) wear, was able to continue milling, with durability increased by 50%.

## Superior milling surface roughness

Tool	PSF09R050M22-6 (Ø50x6)	Competitor
Insert Grade	SDKT09T308SR-GL (XP2040)	Coated carbide insert
Work Material	SUS304	
Cutting Speed	150m/min (955min <sup>-1</sup> )	
Feed	570mm/min (0,1mm/t)	
Depth of Cut	ap=2mm ae=32mm	
Coolant	Water-soluble	
Machine	Horizontal Machining Center	



# KEY FEATURES: PHOENIX PSFL

**1** 90° shoulder cutter

**2** 4 corners roughing end mill

**3** Straight shank type

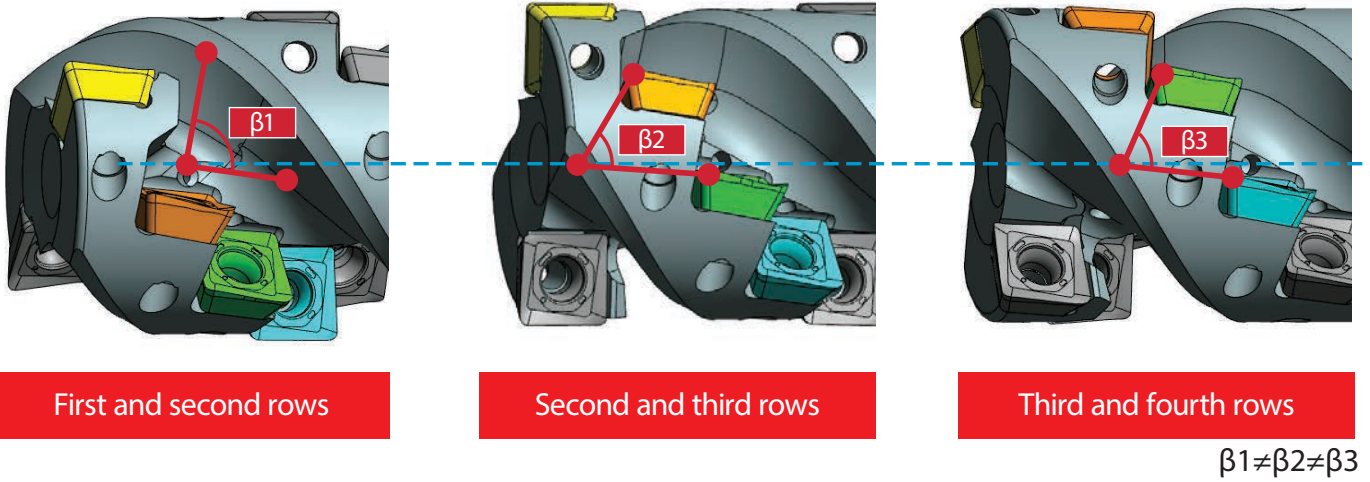




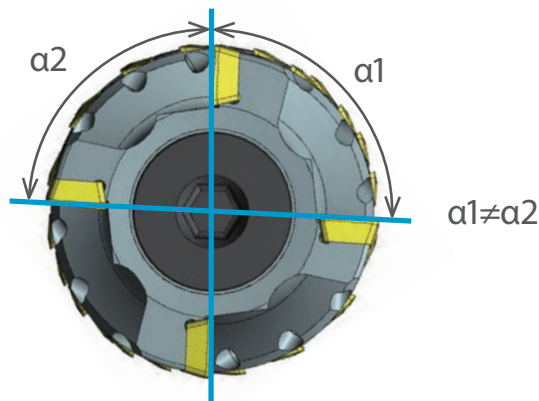
# PHOENIX PSFL

## Special body design prevents vibration

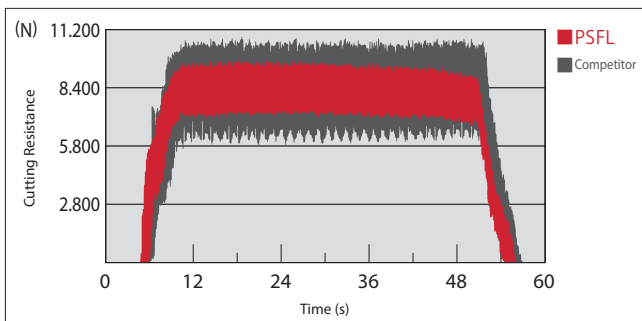
- Unequal lead alignment



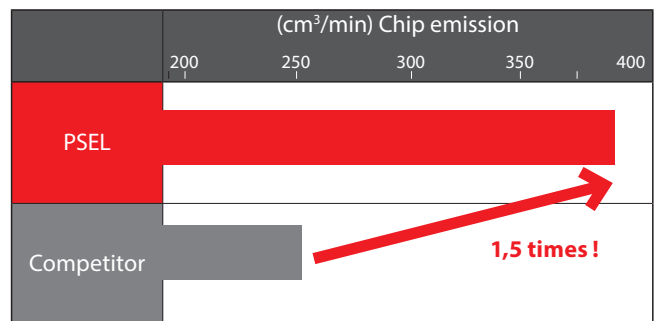
- Unequal spacing teeth



- The anti-vibration feature of the special body design enables the suppression of chattering



- High productivity milling with 1.5 times efficiency



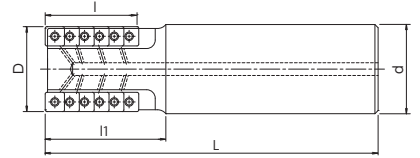
Tool	PSFL09R050M27-4-78 (Ø50x4)
Work Material	Ti-6Al-4V
Cutting Speed	60m/min (382min <sup>-1</sup> )
Feed	230mm/min (0,15mm/t)
Depth of Cut	a <sub>p</sub> =78mm a <sub>e</sub> =10mm
Coolant	Water-Soluble (Internal)
Machine	Horizontal Machining Center

Tool	PSFL12R063M27-4-100 (Ø63x4)	Competitor
Work Material	FC300	
Cutting Speed	180m/min (910min <sup>-1</sup> )	150m/min (758min <sup>-1</sup> )
Feed	910mm/min (0,25mm/t)	606mm/min (0,2mm/t)
Depth of Cut	a <sub>p</sub> =60mm a <sub>e</sub> =7mm	
Coolant	Air Blow	
Machine	Horizontal Machining Center	

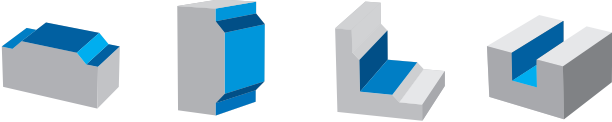


# PSFL SS

Milling | Indexables





- Shoulder long edge end mill with coolant holes
- 4 corners roughing end mill
- Straight shank type
- 32 - 40 mm



EDP	Designation	Z	D	No. of inserts per flute	Total No. of inserts	d	l	L	l1	Applicable insert	Price
7803700	PSFL09R032SS32-2-36	2	32	5	10	32	36	140	60	SD*T09	
7803701	PSFL09R040SS42-3-43	3	40	6	18	42	43	140	60	SD*T09	

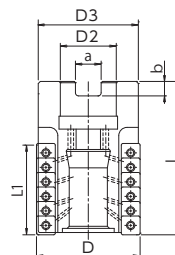
Milling | Indexables  
90 degrees

### Accessories & spare parts

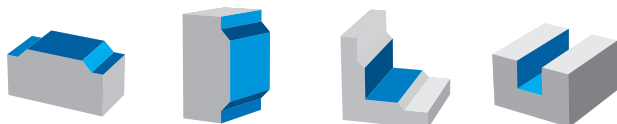
Applicable cutter Ø	 Clamping screw		 Wrench	
	7808110	FS30573 (Torx 8)	7808205	T8-D (Torx 8)
SD*T09...Ø32 ~ 40	7808110	FS30573 (Torx 8)	7808205	T8-D (Torx 8)

# PSFL BORE

Milling | Indexables



- Shoulder long edge end mill with coolant holes
- 4 corners roughing end mill
- Bore type
- 50 - 100 mm



EDP	Designation	Z	D	No. of inserts per flute	Total No. of inserts	L1	L	D3	D2	a	b	Applicable insert	Price
7803702	PSFL09R050M22-4-50	4	50	7	28	50	75	48.5	22	10.4	6.3	SD*T09	
7803703	PSFL09R050M22-4-78	4	50	11	44	78	100	48.5	22	10.4	6.3	SD*T09	
7803704	PSFL09R050M27-4-50	4	50	7	28	50	75	48.5	27	12.4	7	SD*T09	
7803705	PSFL09R050M27-4-78	4	50	11	44	78	100	48.5	27	12.4	7	SD*T09	
7803706	PSFL12R063M27-4-60	4	63	6	24	60	85	60.5	27	12.4	7	SD*T12	
7803707	PSFL12R063M27-4-100	4	63	10	40	100	125	60.5	27	12.4	7	SD*T12	
7803708	PSFL12R080M32-5-70	5	80	7	35	70	95	77.3	32	14.4	8	SD*T12	
7803709	PSFL12R080M32-5-110	5	80	11	55	110	143	77.3	32	14.4	8	SD*T12	
7803710*	PSFL12R100M32-6-120	6	100	12	72	120	153	97	32	16.4	9	SD*T12	

\* Special order item

## Accessories & spare parts

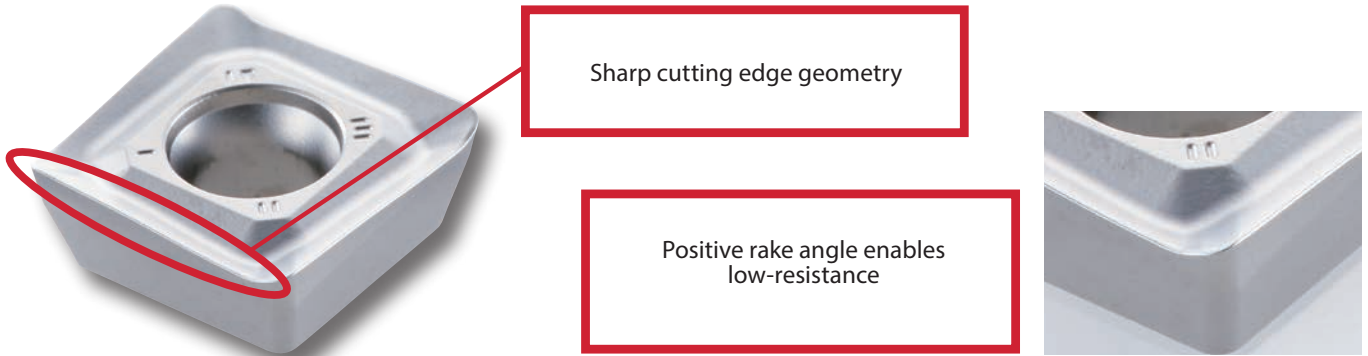
Applicable cutter Ø	Clamping screw		Coolant cap bolt		Wrench	
SD*T09...Ø50	7808110	FS30573 (Torx 8)			7808205	T8-D (Torx 8)
SD*T12...Ø63~100	7808129	FS40511 (Torx 15)			7808208	T8-D (Torx 15)
Ø50			7808132	OCB-M20-08		
Ø63			7808133	OCB-M24-10		
Ø80, Ø100			7808134	OCB-M30-14		



# PHOENIX PSFL

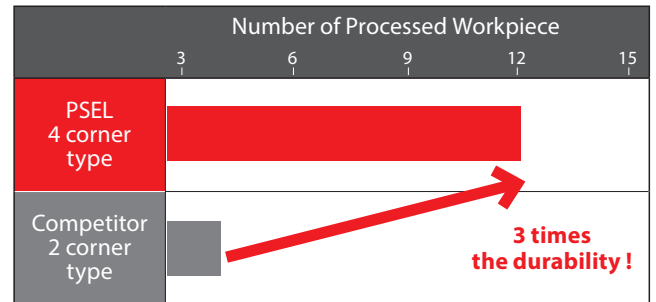
## Economical high durability 4-corner insert

- The 3-dimensional breaker insert's sharp cutting edge and large positive rake angle reduce cutting resistance



- Comparison of processed workpieces of PSFL (4-corner) versus competitor product (2-corner)

Tool	PSFL12R080M32-5-110 (Ø80x5)	Competitor's Roughing Cutter (Ø80x5)
Insert Grade	SDKT120508SR-GM (XP3035)	Coated Carbide Insert (2-corner Type)
Work Material	SS400	
Cutting Speed	180m/min (720min <sup>-1</sup> )	
Feed	400mm/min (0,11mm/t)	
Depth of Cut	ap=85mm ae=10mm	
Coolant	Water-Soluble (Internal)	
Machine	Horizontal Machining Center	



Due to grade of insert and anti-vibration feature of the special body design.

1,5 times x 2 times = 3 times the durability

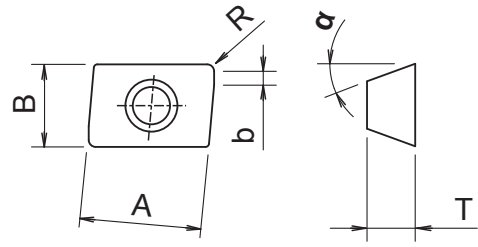
## Insert variations to accommodate a wide range of work materials – from general steel to difficult-to-machine materials

Insert Breaker	NM	GL	GM	GR
Application	Aluminum alloy & Non-ferrous metal	Low-resistance machining Heat resistant alloy Difficult-to-machine material	Multi-purpose machining General steel milling	Intermitted machining & Cast iron machining



# PSF & PSFL INSERTS

Milling | Indexables



- 4 corners inserts
- Suitable for both PSF & PSFL

EDP	Designation	Z	A x B	T	α	R	b	ap max	Grade	P		M		K		N		S		H		Price
										dry	⊖	dry	⊖	GG	GGG	dry	⊖	dry	⊖	dry	⊖	
7811076	SDHT09T308FR-NM	4	9,07x9,07	3,97	15°	0,8	2,5	5	CK010								⊖					
7811625	SDHT120508FR-NM	4	12,38x12,38	5	15°	0,8	1,2	5	CK010								⊖					
7825073	SDKT09T308SR-GL	4	9,07x9,07	3,97	15°	0,8	2,5	5	XC3030	⊖												
7825074	SDKT09T308SR-GM	4	9,07x9,07	3,97	15°	0,8	2,5	5	XC3030	⊖												
7825622	SDKT120508SR-GM	4	12,38x12,38	5	15°	0,8	1,2	5	XC3030	⊖												
7814073	SDKT09T308SR-GL	4	9,07x9,07	3,97	15°	0,8	2,5	5	XP3035	⊖	⊖											
7814074	SDKT09T308SR-GM	4	9,07x9,07	3,97	15°	0,8	2,5	5	XP3035	⊖	⊖											
7814621	SDKT120508SR-GM	4	12,38x12,38	5	15°	0,8	1,2	5	XP3035	⊖	⊖											
7813073	SDKT09T308SR-GL	4	9,07x9,07	3,97	15°	0,8	2,5	5	XP2040	⊖	⊖											
7813074	SDKT09T308SR-GM	4	9,07x9,07	3,97	15°	0,8	2,5	5	XP2040	⊖	⊖											
7813623	SDKT120508SR-GL	4	12,38x12,38	5	15°	0,8	1,2	5	XP2040	⊖	⊖											
7812075	SDKT09T308SR-GR	4	9,07x9,07	3,97	15°	0,8	2,5	5	XC1015													
7812624	SDKT120508SR-GR	4	12,38x12,38	5	15°	0,8	1,2	5	XC1015													
7816073	SDKT09T308SR-GL	4	9,07x9,07	3,97	15°	0,8	2,5	5	XC5040													
7816620	SDKT120508SR-GL	4	12,38x12,38	5	15°	0,8	1,2	5	XC5040													



# CUTTING CONDITIONS

Milling | Indexables | Cutting conditions

## PSFL

90° shoulder cutter

	Work Material	Tensile Strength / Hardness	Insert Size			
			SD-T09...		SD-T12...	
			Milling Speed Vc (m/min)	Feed per Tooth fz (mm/t)	Milling Speed Vc (m/min)	Feed per Tooth fz (mm/t)
P	Mild Steel-Carbon Steel (S5400-S10C)	~180HB	160 (100~200)	0,25 (0,2~0,4)	160 (100~200)	0,3 (0,2~0,4)
	Carbon Steel-Alloy Steel (S50C-SCM440)	~280HB	150 (100~200)	0,2 (0,15~0,3)	150 (100~200)	0,25 (0,15~0,3)
	Die Steel (SKD11-SKD61)	~280HB	130 (80~180)	0,2 (0,15~0,3)	130 (80~180)	0,25 (0,15~0,3)
M	Stainless Steel (Dry) (SUS304-SUS420)	~250HB	150 (100~200)	0,12 (0,1~0,3)	150 (100~200)	0,15 (0,1~0,3)
	Stainless Steel (Coolant) (SUS304-SUS420)	~250HB	80 (60~120)	0,12 (0,1~0,3)	80 (60~120)	0,15 (0,1~0,3)
K	Cast Iron (FC250)	~350N/mm <sup>2</sup>	160 (100~300)	0,2 (0,2~0,35)	160 (100~300)	0,25 (0,2~0,4)
	Ductile Cast Iron (FCD400)	~800N/mm <sup>2</sup>	160 (100~250)	0,2 (0,15~0,3)	160 (100~250)	0,2 (0,15~0,35)
N	Aluminium Alloys	~13%Si	300 (200~1.000)	0,25 (0,1~0,4)	300 (200~1.000)	0,3 (0,1~0,4)
S	Heat Resistant Alloys (Wet) (Inconel 718)	-	35 (25~60)	0,15 (0,08~0,3)	35 (25~60)	0,18 (0,1~0,3)
	Titanium Alloy (Wet) (Ti-6Al-4V)	-	40 (30~120)	0,15 (0,08~0,3)	40 (30~120)	0,18 (0,1~0,3)
H	Pre-hardened Steel (NAK80)	40~43HRC	100 (40~150)	0,15 (0,08~0,3)	100 (40~150)	0,18 (0,1~0,3)
	Steel for Die Casting (DAC55-DH31)	43~48HRC	60 (40~120)	0,12 (0,05~0,2)	60 (40~120)	0,15 (0,05~0,2)

## Ratio of cutting condition by cutting depth to the above standard condition

Depth of cut ap (mm)	Maximum width of Cut ae (mm)	Ratio to adjust cutting speed vp	Ratio to adjust feed rate fP
~ 0,2D	1D	0,8	0,5
0,2 ~ 0,3D	0,7D	0,8	0,6
0,4 ~ 0,5D	0,5D	0,9	0,7
0,6 ~ 0,7D	0,3D	0,9	0,8
0,8 ~ 1D	0,2D	1	0,9
1,1 ~ 1,5D	0,1D	1	1

**Example:**

- SD-T09...
- Ø50
- ap= 50mm
- S50C

insert size SD-T09..., for cutting Ø32, ap=30, side milling, for carbon steel (S50C) machining

- 150m/min (Vc) x 1,0 (VP)=150m/min
- 0,2mm/t (fz) x 0,9 (fP)=0,18mm/t
- ae: 0,2 x Ø50= 10mm

Milling | Indexables



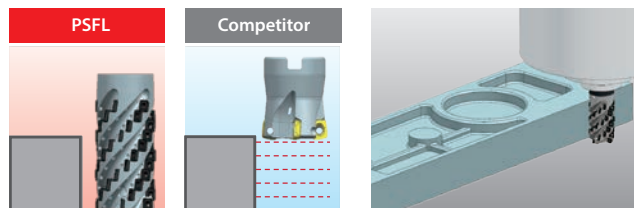
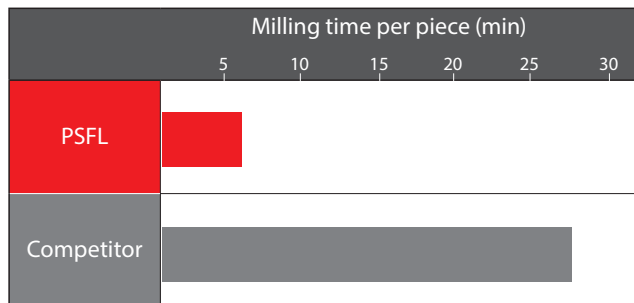
Inserts

# CUTTING DATA

## High productivity side milling of cast plate

Tool	PSFL12R063M27-4-100 (Ø63x4)	Competitor
Insert Grade	SDKT120508SR-GR (XC1015)	Coated carbide insert
Work Material	FC300	
Cutting Speed	120m/min (606min <sup>-1</sup> )	110m/min (700min <sup>-1</sup> )
Feed	500mm/min (0,2mm/t)	2.800mm/min (0,133mm/t)
Depth of Cut	a <sub>p</sub> =50mm a <sub>e</sub> =10mm	a <sub>p</sub> =2mm a <sub>e</sub> =10mm
Coolant	Air Blow	
Machine	Double column machining center	

Conventionally, in order to suppress chatter vibrations caused by an unstable work clamp, the high feed radius cutter is used with a smaller a<sub>p</sub>. With the PSFL's unequal spacing and variable lead design, stable milling with no chattering can be achieved even at a<sub>p</sub>=50mm



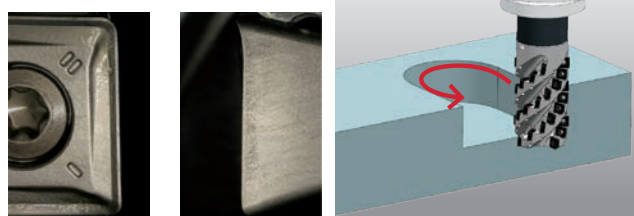
## Trochoid milling in titanium inox

Tool	PSFL09R050M22-4-50 (Ø50x4)	Competitor
Insert Grade	SDKT09T308SR-GL (XC5040)	Coated carbide insert
Work Material	Ti-6Al-4V	
Cutting Speed	60 m/min (382 min <sup>-1</sup> )	
Feed	152 mm/min (0,1 mm/t)	
Depth of Cut	a <sub>p</sub> =50 mm a <sub>e</sub> =10 mm	
Coolant	Water-Soluble (Internal)	
Machine	Vertical Machining Center	

The competitor tool encountered chipping after milling for 40 minutes. The PSFL, on the other hand, had no chipping, normal wear, and can continue to be used even after 50 minutes of machining.



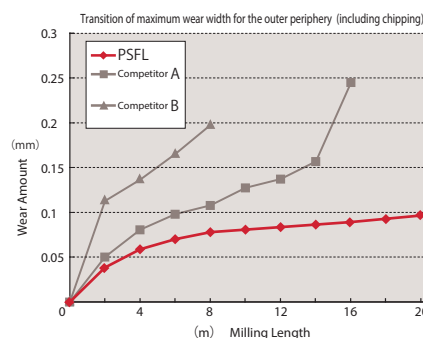
• After 50m of milling



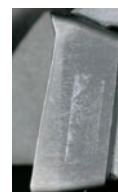
## Long tool life in FC250

Tool	PSEL15R063M27-3-50 (Ø63x3)	Competitor A	Competitor B
Insert Grade	SDKT120508SR-GR (XC1015)	Coated carbide insert	Coated carbide insert
Work Material	FC250		
Cutting Speed	100 m/min (505 min <sup>-1</sup> )		
Feed	505 mm/min (0,25 mm/t)		
Depth of Cut	a <sub>p</sub> =100 mm a <sub>e</sub> = 10 mm		
Coolant	Air Blow		
Machine	Horizontal Machining Center		

Large chattering occurred during processing with the competitor tool, which led to early chipping. On the other hand, the PSFL's anti-vibration feature allows it to suppress chattering significantly, which led to minimized chipping and long tool life.



• After 20m of milling





shaping your dreams

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