

MillLine

SLOTMILL SERIES

www.tungaloy.com

Tungaloy Report No. 423-G

SLOTMILL SERIES

Stable slot milling operation with
excellent chip control!





ACCELERATED MACHINING

MillLine

SLOTMILL SERIES

TUNGALOY



Tungaloy SlotMill Series is an **economical and well-designed** slot milling line for improved surface finish in slotting, face milling, and back-face milling.

An **economical** slot milling solution with stable chip formation allowing deeper slots thus **increasing productivity** and **stability** in machining!

Exceptional chip evacuation

Offers stable deep slot milling!

SLOTMILL SERIES

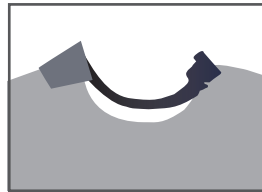
OK



Optimum chipbreaker and big gullets create compact chip formation and smooth evacuation!

Competitor

X



Unformed chip and narrow gullet cause chip packing.

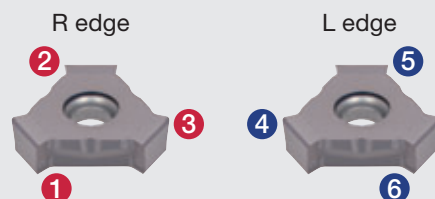
Innovative inserts

Tough cutting edges lead to high stability

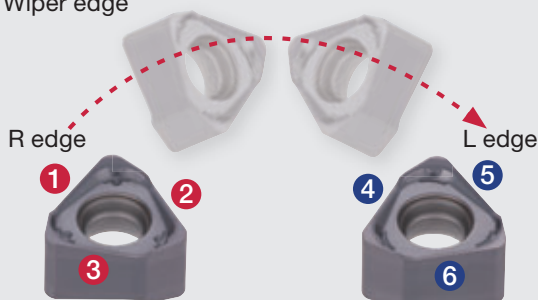
TUNG M^{SLIT} S/ASG type
For parting-off and thin slotting
Precision insert ($W \pm 0.04$)
 $W = 1.6, 1.85, 2.65, 4.0 \text{ mm}$



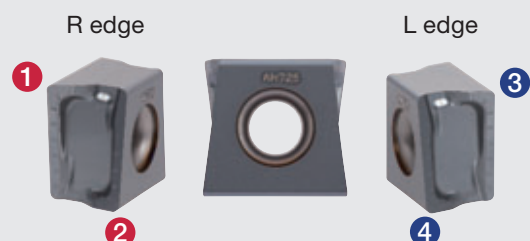
TUNG T^{SLIT} ASV type
6 corners available
 $W = 4, 5, 6, 8 \text{ mm}$



TUNG U^{NIVERSAL} SLO ASW / TSW type
6 corners available
With Wiper edge
 $W = 10, 12, 14, 16 \text{ mm}$



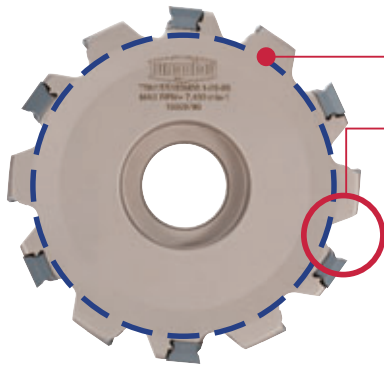
TEC T^{ANGENTIAL} SLO ASN / TSN type
4 corners available
With Wiper edge
 $W = 16, 19, 25 \text{ mm}$



High productivity due to a large number of edge lines

- High density insert cutters for TungThinSlit, TungUniversalSlot, TecTangentialSlot!
- 1.3 - 1.7 times higher productivity than conventional tools

Sample: **TECT^{TANGENTIAL}SLOT**



Highly rigid cutter body with tangential insert

Excellent chip evacuation with an optimized chip gullet

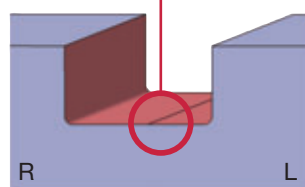
Comparison of no. of edge lines (Edge width: $W = 16$ mm)

Tool dia. ϕD_c (mm)	TECT^{TANGENTIAL}SLOT	Competitor A	Competitor B
$\phi 100$	5	-	3
$\phi 125$	6	5	4
$\phi 160$	7	6	5
$\phi 200$	8	7	6

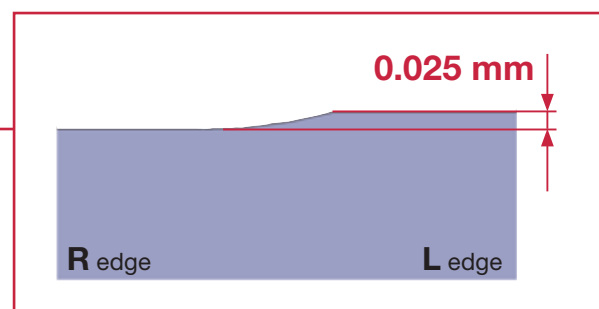
Small gap between R edge and L edge

Precise runout due to the ground inserts

Machining example: **TECT^{TANGENTIAL}SLOT**



Workpiece



Tool diameter : $\phi D_c = \phi 125$ mm
 Workpiece : S55C / C55 (200HB)
 Cutting speed : $V_c = 150$ m/min
 Chip thickness : $t = 0.13$ mm
 Edge width : $W = 16$ mm
 Depth of slot : $a_e = 6$ mm
 Machine : Vertical M/C, BT50

*Dimension shown is under ideal condition.

CUTTING PERFORMANCE

Comparison of chip control

Smooth chip evacuation!
Better than conventional tools!

Tool diameter : $\phi D_c = \phi 125$ mm Feed per : $f_z = 0.19$ mm/t ($a_e = 10$ mm)
Cutting speed : $V_c = 150$ m/min edge line $f_z = 0.14$ mm/t ($a_e = 20$ mm)
Chip thickness : $t = 0.1$ mm $f_z = 0.125$ mm/t ($a_e = 25$ mm)
No. of edge lines: 1 edge line $f_z = 0.12$ mm/t ($a_e = 30$ mm)
Machine : Vertical M/C, BT50

TUNG^{THIN}SPLIT ASV type

○ : Good

✕ : Bad, chip packing

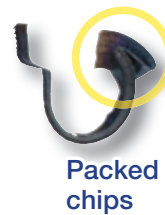
P **Steel** S55C / C55 (200HB)
Edge width: $W = 4$ mm, Dry (with air)
Corner radius: $r_\epsilon = 0.4$ mm

Cutter	Depth of slot: a_e (mm)		
	10	20	25
TUNG ^{THIN} SPLIT	○	○	○
Competitor A	○	○	✕
Competitor B	○	✕	✕

Chips at $a_e = 25$ mm depth



Competitor A



Packed chips

Competitor B



No chip control

M **Stainless** SUS304 / X5CrNi18-9 (180HB)
Edge width: $W = 6$ mm, Wet
Corner radius: $r_\epsilon = 0.8$ mm

Cutter	Depth of slot: a_e (mm)		
	10	20	30
TUNG ^{THIN} SPLIT	○	○	○
Competitor A	○	✕	✕

Chips at $a_e = 30$ mm depth



Competitor A



Packed chips

TUNG^{UNIVERSAL}SLOT ASW / TSW type

P **Steel** S55C / C55 (200HB)
Edge width: $W = 10$ mm, Dry
Corner radius: $r_\epsilon = 0.8$ mm

Cutter	Depth of slot: a_e (mm)		
	10	20	30
TUNG ^{UNIVERSAL} SLOT	○	○	○
Competitor A	○	○	✕

Chips at $a_e = 30$ mm depth



Competitor A



Packed chips



Chips are packed because of bad chip control and flow.

Comparison of tool life

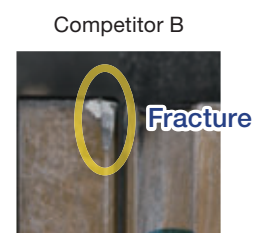
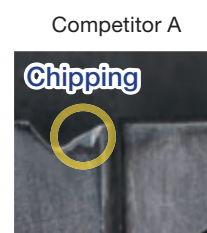
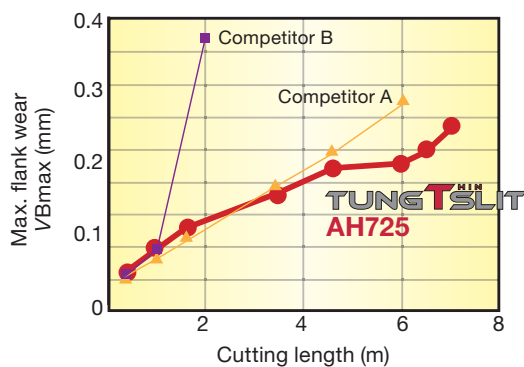
Longer tool life than competitors tools!

Tool diameter : $\phi D_c = \phi 125 \text{ mm}$
Cutting speed : $V_c = 150 \text{ m/min}$
Chip thickness : $t = 0.1 \text{ mm}$

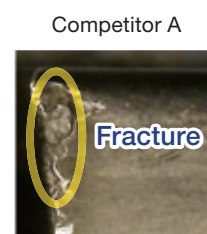
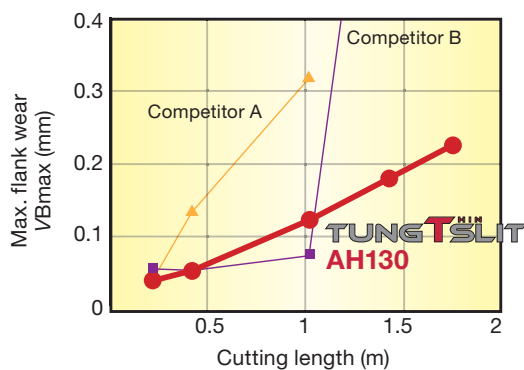
Feed per edge line : $f_z = 0.19 \text{ mm/t}$
Depth of slot : $a_e = 10 \text{ mm}$
No. of edge lines : 1 edge line
Machine : Vertical M/C, BT50

TUNG^{THIN}SLIT ASV type

P Steel S55C / C55 (200HB)
Edge width: $W = 4 \text{ mm}$, Dry
Corner radius: $r_\epsilon = 0.4 \text{ mm}$

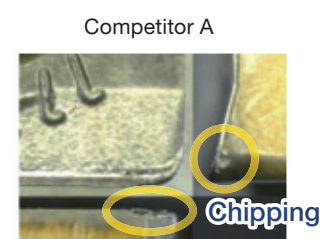
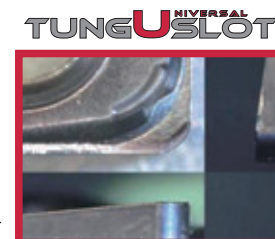
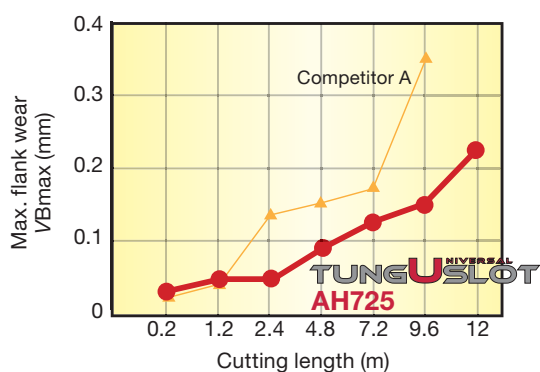


M Stainless SUS304 / X5CrNi18-9 (180HB)
Edge width: $W = 6 \text{ mm}$, Wet
Corner radius: $r_\epsilon = 0.8 \text{ mm}$



TUNG^{UNIVERSAL}SLOT ASW / TSW type

P Steel S55C / C55 (200HB)
Edge width: $W = 10 \text{ mm}$, Dry
Corner radius: $r_\epsilon = 0.8 \text{ mm}$



Comparison of tool life

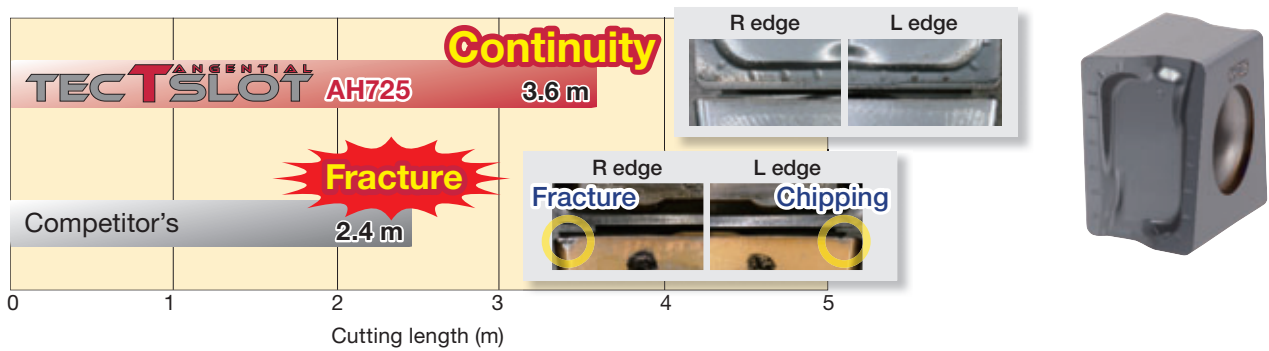
Reliable insert with tough cutting edge!

TEC^TSLOT^{ANGENTIAL} ASN / TSN type

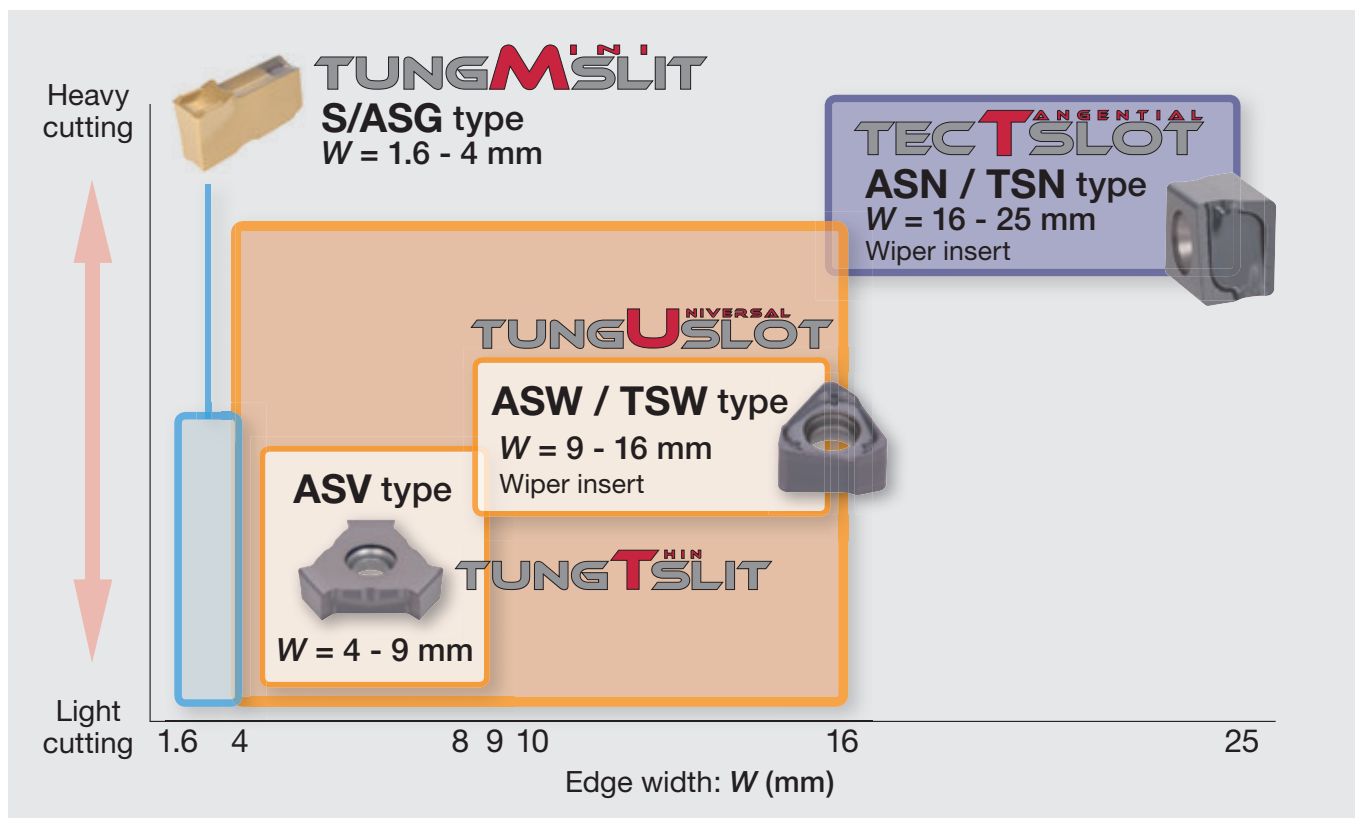
P Steel S55C / C55 (200HB)
Edge width: $W = 16$ mm, Dry
Corner radius: $r_c = 0.8$ mm

Tool diameter : $\phi D_c = \phi 125$ mm
Cutting speed : $V_c = 150$ m/min
Chip thickness : $t = 0.2$ mm
Feed per edge line : $f_z = 0.3$ mm/t

Edge width : $W = 16$ mm
Depth of slot : $a_e = 16$ mm
No. of edge lines : 1 edge line
Machine : Vertical M/C, BT50



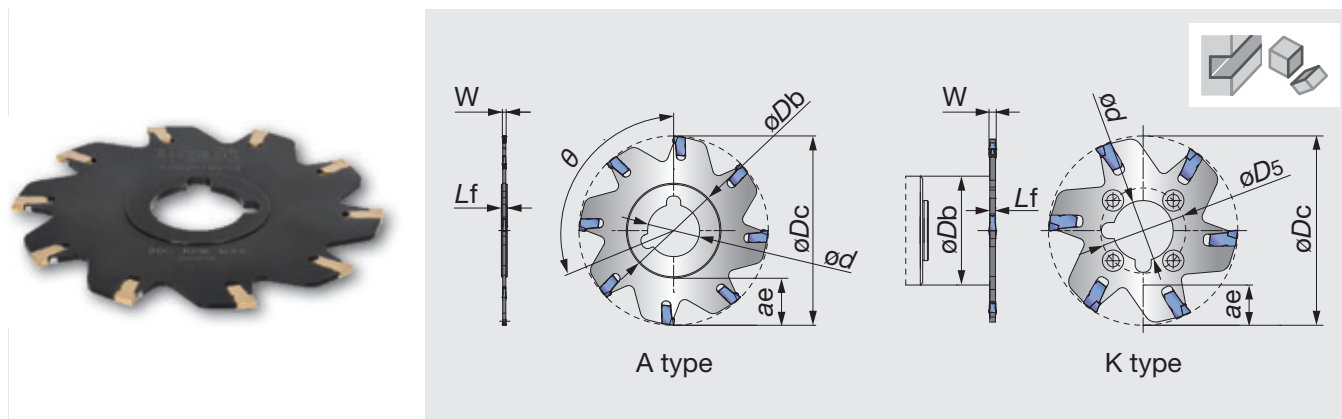
APPLICATION RANGE



Side cutter for thin slitting and cutting off

CUTTER - AXIAL DRIVE

TungMiniSlit S/ASG



Designation	W min	W max	øDc	z	øDb	ød	øD5	Lf	Max. ae	θ°	SS	SS	Drive flange	type	Insert
SSG01R063-E1.6	1.6	1.6	63	6	32	10	22	2.4	14	0	SW25-32	SW1.00-32	-	K	SSS16N
ASG01N076-1.6	1.6	1.6	76.2	8	39	25.4	-	2.4	14	112.5	-	-	-	A	SSS16N
ASG01N080-E1.6	1.6	1.6	80	8	39	22	-	2.4	16	112.5	-	-	-	A	SSS16N
ASG01N100-1.6	1.6	1.6	100	10	39	25.4	-	2.4	30	90	-	-	-	A	SSS16N
ASG01N100-E1.6	1.6	1.6	100	10	39	22	-	2.4	30	90	-	-	-	A	SSS16N
ASG01N125-1.6	1.6	1.6	125	12	64	31.75	-	2.4	30	75	-	-	-	A	SSS16N
ASG01N125-E1.6	1.6	1.6	125	12	64	27	-	2.4	30	75	-	-	-	A	SSS16N
SSG02R063-E2	1.85	2.5	63	6	32	10	22	2.4	15	0	SW25-32	SW1.00-32	-	K	SSM/S22N
ASG02N076-2	1.85	2.5	76.2	8	39	25.4	-	2.4	17	112.5	-	-	-	A	SSM/S22N
ASG02N080-E2	1.85	2.5	80	8	39	22	-	2.4	20	112.5	-	-	-	A	SSM/S22N
ASG02N100-2	1.85	2.5	100	10	39	25.4	-	2.4	30	90	-	-	-	A	SSM/S22N
ASG02N100-E2	1.85	2.5	100	10	39	22	-	2.4	30	90	-	-	-	A	SSM/S22N
ASG02N125-2	1.85	2.5	125	12	60	31.75	-	2.4	32	75	-	-	-	A	SSM/S22N
ASG02N125-E2	1.85	2.5	125	12	60	27	-	2.4	32	75	-	-	-	A	SSM/S22N
SSG03R063-E3	2.65	3.5	63	5	32	10	22	2.4	15	0	SW25-32	SW1.00-32	-	K	SSM/S31N
SSG03R080-3	2.65	3.5	80	6	46	25.4	36	2.4	16	0	SW32-25.4-46-J	SW1.25-46	R1.00-46	K	SSM/S31N
SSG03R080-E3	2.65	3.5	80	6	40 ⁽¹⁾	22	32	2.4	19 ⁽²⁾	0	SW32-40	-	R22-46	K	SSM/S31N
SSG03R100-3	2.65	3.5	100	6	46	25.4	36	2.4	26	0	SW32-25.4-46-J	SW1.25-46	R1.00-46	K	SSM/S31N
SSG03R100-E3	2.65	3.5	100	6	40 ⁽¹⁾	22	32	2.4	29 ⁽³⁾	0	SW32-40	-	R22-46	K	SSM/S31N
SSG03R125-3	2.65	3.5	125	8	55	31.75	45	2.4	34	0	-	-	R1.25-55	K	SSM/S31N
SSG03R125-E3	2.65	3.5	125	8	55	32	45	2.4	34	0	S32-55	-	R32-55	K	SSM/S31N
SSG04R063-E4	4	4.5	63	5	32	10	22	3.2	15	0	SW25-32	SW1.00-32	-	K	SSM/S41N
SSG04R080-4	4	4.5	80	6	46	25.4	36	3.2	16	0	SW32-25.4-46-J	SW1.25-46	R1.00-46	K	SSM/S41N
SSG04R080-E4	4	4.5	80	6	40 ⁽¹⁾	22	32	3.2	19 ⁽²⁾	0	SW32-40	-	R22-46	K	SSM/S41N
SSG04R100-4	4	4.5	100	6	46	25.4	36	3.2	26	0	SW32-25.4-46-J	SW1.25-46	R1.00-46	K	SSM/S41N
SSG04R100-E4	4	4.5	100	6	40 ⁽¹⁾	22	32	3.2	29 ⁽³⁾	0	SW32-40	-	R22-46	K	SSM/S41N
SSG04R125-4	4	4.5	125	8	55	31.75	45	3.2	34	0	-	-	R1.25-55	K	SSM/S41N
SSG04R125-E4	4	4.5	125	8	55	32	45	3.2	34	0	S32-55	-	R32-55	K	SSM/S41N

(1) When using a drive flange, øDb = 46 mm

(2) When using a drive flange, Max. ae = 16 mm

(3) When using a drive flange, Max. ae = 26 mm

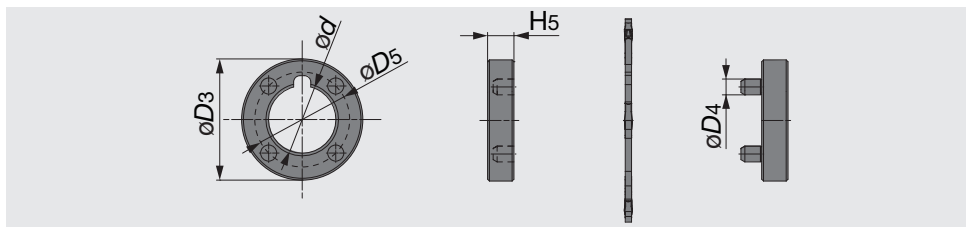
SPARE PARTS

Designation	Grip	Extractor
SSG01/02...	ESG0.5	-
ASG01/02...	ESG0.5	-
SSG03/04...	-	ESG1

TUNGSLIT

R (drive flange set)

Drive flange set for side cutters

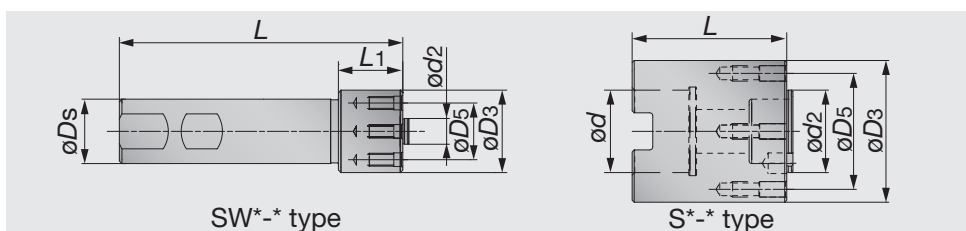


Designation	ϕd	$\phi D3$	$\phi D4$	$\phi D5$	H5
R1.00-46	25.4	46	5	36	10
R22-46	22	46	6	32	10
R1.25-55	31.75	55	6	45	10
R32-55	32	55	6	45	10

TUNGSLIT

SW/S

Drive shanks for side cutters



Designation	ϕDs	ϕd	$\phi d2$	$\phi D3$	$\phi D5$	L1	L
SW25-32	25	-	10	32	22	25	110
SW32-40	32	-	22	40	32	30	120
SW32-25.4-46-J	32	-	25.4	46	36	30	120
SW1.00-32	25.5	-	10	32	22	25.4	110
SW1.25-46	31.75	-	25.4	46	36	30	120
S32-55	-	32	32	55	45	-	60

SPARE PARTS



Designation	Screw	Wrench		
		Mono block type	Torx bit	Handle
SW25-32	SR76-961	SETT-15/5	-	-
SW32-40	SR76-963	SETT-15/5	-	-
SW32-25.4-46-J	SR76-963	SETT-15/5	-	-
SW1.00-32	SR76-961	SETT-15/5	-	-
SW1.25-46	SR76-963	SETT-15/5	-	-
S32-55	SR76-943	-	BT20M	H-TB

COMBINATION OF ARBORS / ATTACHMENTS

Cutter bodies : “A” type

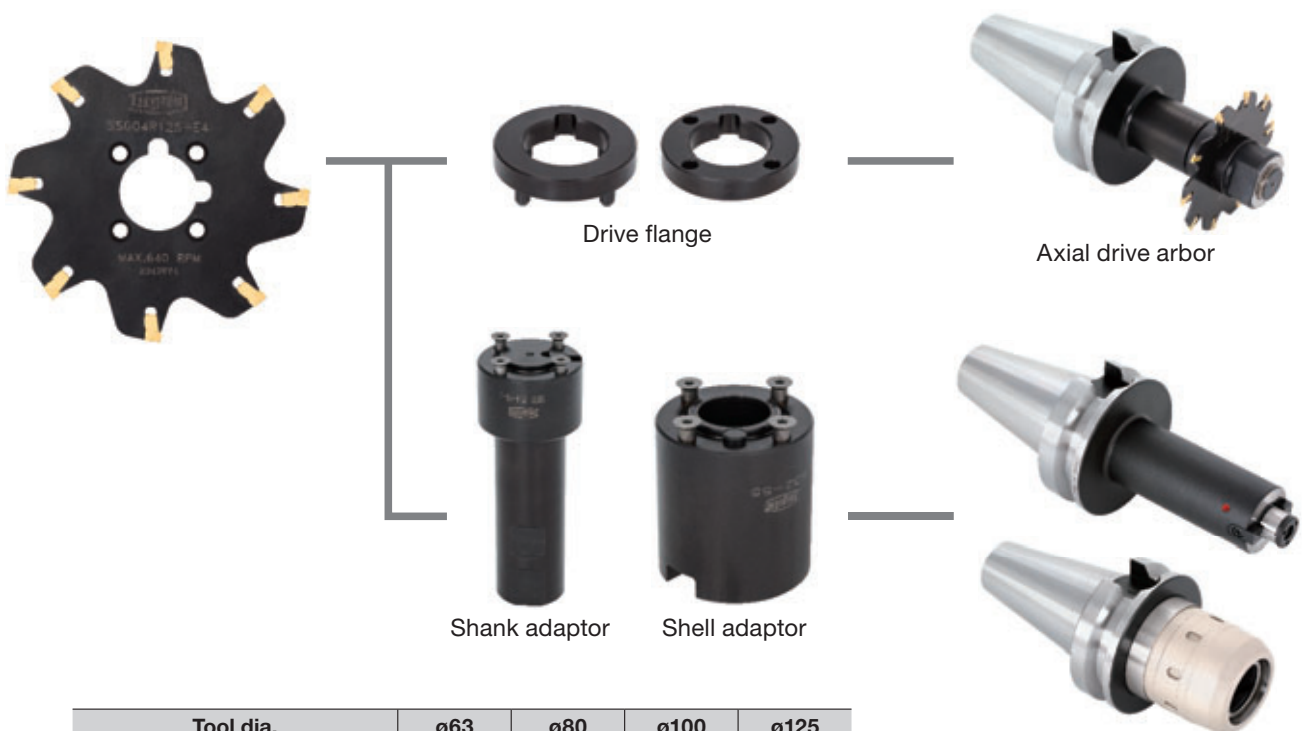
A-type disk cutters are without clamping holes on the hub and can be mounted only by using axial drive arbors.



Axial drive arbor

Cutter bodies : “K” type

K-type disk cutters are with clamping holes on the hub and can be mounted by using intermediate shanks or shell adaptors, making it possible to use endmills / shell mill arbors.



Axial drive arbor

Shank adaptor

Shell adaptor

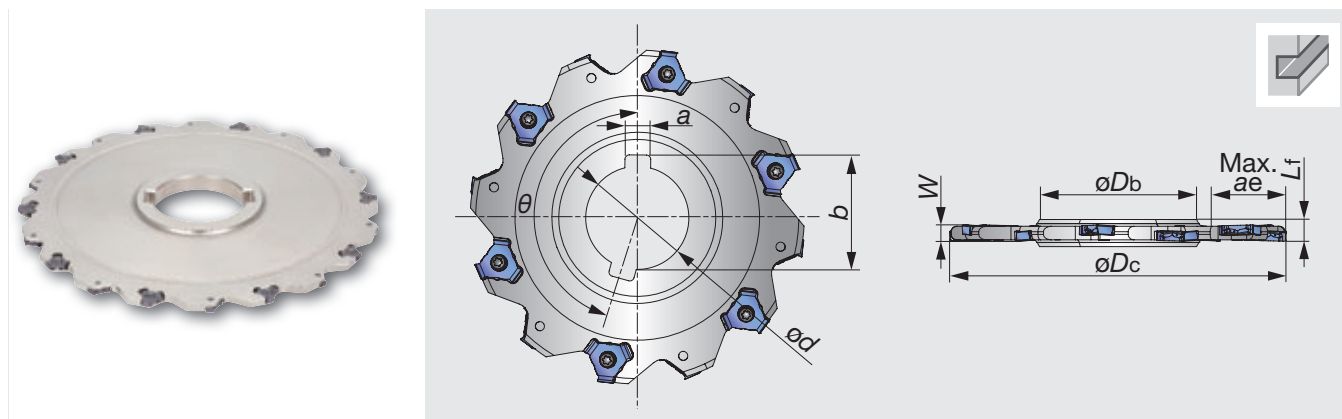
Shell mill / Endmill arbor

Tool dia.	ø63	ø80	ø100	ø125
Drive flange	-	✓	✓	✓
Shank / Shell adaptor	✓	✓	✓	✓

Axial drive type slot milling cutter with face mounted inserts

CUTTER - AXIAL DRIVE

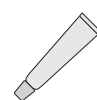
TungThinSlit ASV + TVKX



Designation	W	øDc	Z eff	øDb	ød	Lf	b	a	Max. ae	θ	z	Insert
ASV02N080-4	4	80	5	41	25.4	6	28	6.35	15	162°	10	TVKX0202...
ASV02N080-E4	4	80	5	41	27	6	29.8	7	15	162°	10	TVKX0202...
ASV02N100-4	4	100	6	48	31.75	6	35.2	7.92	20	165°	12	TVKX0202...
ASV02N100-E4	4	100	6	47	32	6	34.8	8	20	165°	12	TVKX0202...
ASV02N125-4	4	125	8	58	38.1	6	42.3	9.52	30	168.75°	16	TVKX0202...
ASV02N125-E4	4	125	8	55	40	6	43.5	10	30	168.75°	16	TVKX0202...
ASV02N160-4	4	160	10	58	38.1	6	42.3	9.52	45	171°	20	TVKX0202...
ASV02N160-E4	4	160	10	55	40	6	43.5	10	45	171°	20	TVKX0202...
ASV03N080-5	5	80	5	41	25.4	6.5	28	6.35	15	162°	10	TVKX03X3...
ASV03N080-E5	5	80	5	41	27	6.5	29.8	7	15	162°	10	TVKX03X3...
ASV03N100-5	5	100	6	48	31.75	6.5	35.2	7.92	20	165°	12	TVKX03X3...
ASV03N100-E5	5	100	6	47	32	6.5	34.8	8	20	165°	12	TVKX03X3...
ASV03N125-5	5	125	8	58	38.1	6.5	42.3	9.52	30	168.75°	16	TVKX03X3...
ASV03N125-E5	5	125	8	55	40	6.5	43.5	10	30	168.75°	16	TVKX03X3...
ASV03N160-5	5	160	10	58	38.1	6.5	42.3	9.52	45	171°	20	TVKX03X3...
ASV03N160-E5	5	160	10	55	40	6.5	43.5	10	45	171°	20	TVKX03X3...
ASV04N080-6	6	80	4	41	25.4	8	28	6.35	17	157.5°	8	TVKX04H3...
ASV04N080-E6	6	80	4	41	27	8	29.8	7	17	157.5°	8	TVKX04H3...
ASV04N100-6	6	100	5	48	31.75	8	35.2	7.92	23.5	162°	10	TVKX04H3...
ASV04N100-E6	6	100	5	47	32	8	34.8	8	23.5	162°	10	TVKX04H3...
ASV04N125-6	6	125	6	58	38.1	8	42.3	9.52	31	165°	12	TVKX04H3...
ASV04N125-E6	6	125	6	55	40	8	43.5	10	32.5	165°	12	TVKX04H3...
ASV04N160-6	6	160	8	58	38.1	8	42.3	9.52	48.5	168.75°	16	TVKX04H3...
ASV04N160-E6	6	160	8	55	40	8	43.5	10	50	168.75°	16	TVKX04H3...
ASV04N200-6	6	200	10	69	50.8	8	55.8	12.7	63	171°	20	TVKX04H3...
ASV04N200-E6	6	200	10	69	50	8	53.5	12	63	171°	20	TVKX04H3...
ASV05N080-8	8	80	4	41	25.4	10	28	6.35	17	157.5°	8	TVKX0504...
ASV05N080-E8	8	80	4	41	27	10	29.8	7	17	157.5°	8	TVKX0504...

Designation	<i>W</i>	<i>øDc</i>	<i>Z</i> eff	<i>øDb</i>	<i>ød</i>	<i>Lf</i>	<i>b</i>	<i>a</i>	Max. <i>ae</i>	<i>θ</i>	<i>z</i>	Insert
ASV05N100-8	8	100	5	48	31.75	10	35.2	7.92	23.5	162°	10	TVKX0504...
ASV05N100-E8	8	100	5	47	32	10	34.8	8	23.5	162°	10	TVKX0504...
ASV05N125-8	8	125	6	58	38.1	10	42.3	9.52	31	165°	12	TVKX0504...
ASV05N125-E8	8	125	6	55	40	10	43.5	10	32.5	165°	12	TVKX0504...
ASV05N160-8	8	160	8	58	38.1	10	42.3	9.52	48.5	168.75°	16	TVKX0504...
ASV05N160-E8	8	160	8	55	40	10	43.5	10	50	168.75°	16	TVKX0504...
ASV05N200-8	8	200	10	69	50.8	10	55.8	12.7	63	171°	20	TVKX0504...
ASV05N200-E8	8	200	10	69	50	10	53.5	12	63	171°	20	TVKX0504...

SPARE PARTS

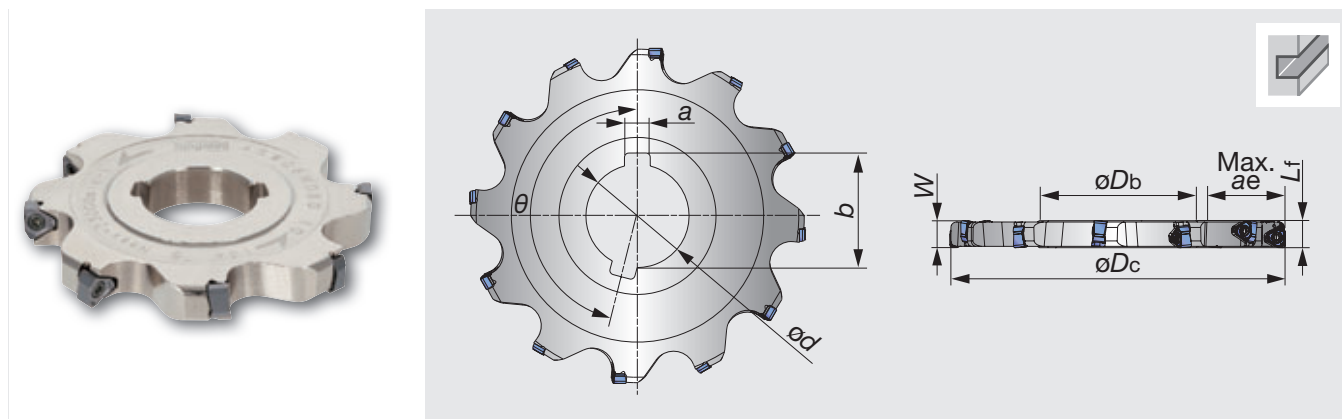


Designation	Clamping screw	Wrench			Lubricant
		Mono block type	Bit	Grip	
ASV02N...	SR114-018-L3.40	T-6D	-	-	M-1000
ASV03N...	SR114-018-L3.40	T-6D	-	-	M-1000
ASV04N...	SR14-500/L5.1	-	BT15S	H-TB2W	M-1000
ASV05N...	SR14-500-L7.0	-	BT15S	H-TB2W	M-1000

Axial drive type slot milling cutter

CUTTER - AXIAL DRIVE

TungUniversalSlot ASW + WNGU



Designation	W	øDc	Z eff	øDb	ød	Lf	b	a	Max. ae	θ	z	Insert
ASW06N080-10	10	80	4	41	25.4	10	28	6.35	18.5	157.5°	8	WNGU0603...
ASW06N080-E10	10	80	4	41	27	10	29.8	7	18.5	157.5°	8	WNGU0603...
ASW06N100-10	10	100	5	48	31.75	10	35.2	7.92	25	162°	10	WNGU0603...
ASW06N100-E10	10	100	5	47	32	10	34.8	8	25.5	162°	10	WNGU0603...
ASW06N125-10	10	125	6	58	38.1	10	42.3	9.52	32.5	165°	12	WNGU0603...
ASW06N125-E10	10	125	6	55	40	10	43.5	10	34	165°	12	WNGU0603...
ASW06N160-10	10	160	7	58	38.1	10	42.3	9.52	50	167.14°	14	WNGU0603...
ASW06N160-E10	10	160	7	55	40	10	43.5	10	51.5	167.14°	14	WNGU0603...
ASW07N100-12	12	100	5	48	31.75	12	35.2	7.92	25	162°	10	WNGU07T3...
ASW07N100-E12	12	100	5	47	32	12	34.8	8	25.5	162°	10	WNGU07T3...
ASW07N125-12	12	125	6	58	38.1	12	42.3	9.52	32.5	165°	12	WNGU07T3...
ASW07N125-E12	12	125	6	55	40	12	43.5	10	34	165°	12	WNGU07T3...
ASW07N160-12	12	160	7	58	38.1	12	42.3	9.52	50	167.14°	14	WNGU07T3...
ASW07N160-E12	12	160	7	55	40	12	43.5	10	51.5	167.14°	14	WNGU07T3...
ASW09N100-14	14	100	5	48	31.75	14	35.2	7.92	25	162°	10	WNGU0904...
ASW09N100-E14	14	100	5	47	32	14	34.8	8	25.5	162°	10	WNGU0904...
ASW09N160-14	14	160	7	58	38.1	14	42.3	9.52	50	167.14°	14	WNGU0904...
ASW09N160-E14	14	160	7	55	40	14	43.5	10	51.5	167.14°	14	WNGU0904...
ASW09N160-16	16	160	7	58	38.1	16	42.3	9.52	50	167.14°	14	WNGU0904...
ASW09N160-E16	16	160	7	55	40	16	43.5	10	51.5	167.14°	14	WNGU0904...

SPARE PARTS

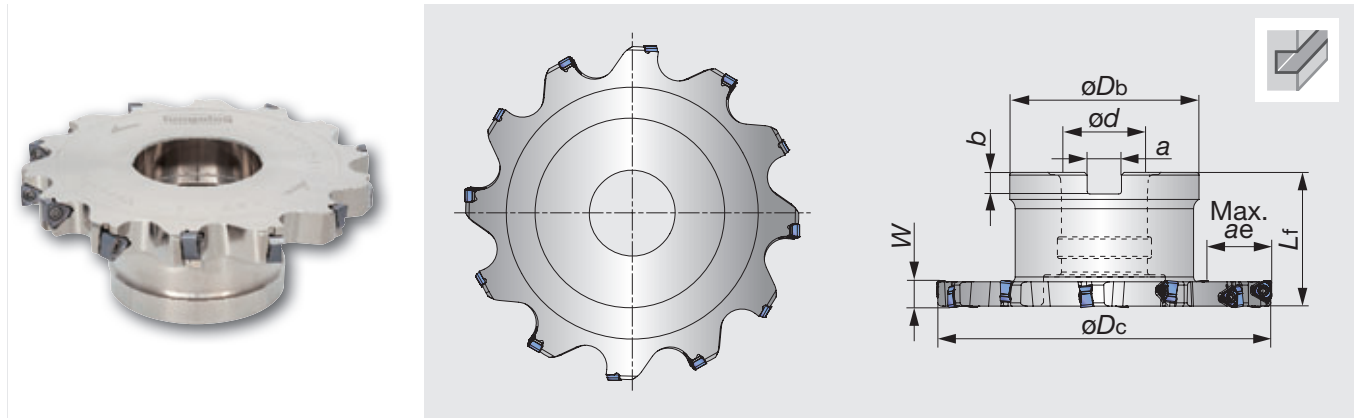


Designation	Clamping screw		Wrench				Lubricant
			Mono block type	Bit	Grip		
ASW06N...	CSPB-2.5	-	IP-8D	-	-	-	M-1000
ASW07N100...	CSPD-3	-	-	BLD IP10/S7	SW6-SD	-	M-1000
ASW07N125...	CSPD-3	-	-	BLD IP10/S7	SW6-SD	-	M-1000
ASW07N160...	CSPD-3	-	IP-10D	-	-	-	M-1000
ASW09N100...	-	CSPB-3.5	-	BLD IP15/S7	-	H-TB2W	M-1000
ASW09N160...	-	CSPB-3.5	IP-15D	-	-	-	M-1000

Radial drive type slot milling cutter

CUTTER - RADIAL DRIVE

TungUniversalSlot TSW + WNGU



Designation	W	øDc	Z eff	øDb	ød	Lf	b	a	Max. ae	z	Insert
TSW06R100-10	10	100	5	50	25.4	50	6	9.5	24	10	WNGU0603...
TSW06R100-E10	10	100	5	58	27	50	7	12.4	20	10	WNGU0603...
TSW06R125-10	10	125	6	70	31.75	50	8	12.7	26.5	12	WNGU0603...
TSW06R125-E10	10	125	6	66	32	50	8	14.4	28.5	12	WNGU0603...
TSW06R160-10	10	160	7	100	38.1	63	10	15.9	29	14	WNGU0603...
TSW06R160-E10	10	160	7	82	40	63	9	16.4	38	14	WNGU0603...
TSW07R100-12	12	100	5	50	25.4	50	6	9.5	24	10	WNGU07T3...
TSW07R100-E12	12	100	5	58	27	50	7	12.4	20	10	WNGU07T3...
TSW07R125-12	12	125	6	70	31.75	50	8	12.7	26.5	12	WNGU07T3...
TSW07R125-E12	12	125	6	66	32	50	8	14.4	28.5	12	WNGU07T3...
TSW07R160-12	12	160	7	100	38.1	63	10	15.9	29	14	WNGU07T3...
TSW07R160-E12	12	160	7	82	40	63	9	16.4	38	14	WNGU07T3...
TSW09R160-16	16	160	7	100	38.1	63	10	15.9	29	14	WNGU0904...
TSW09R160-E16	16	160	7	82	40	63	9	16.4	38	14	WNGU0904...

SPARE PARTS

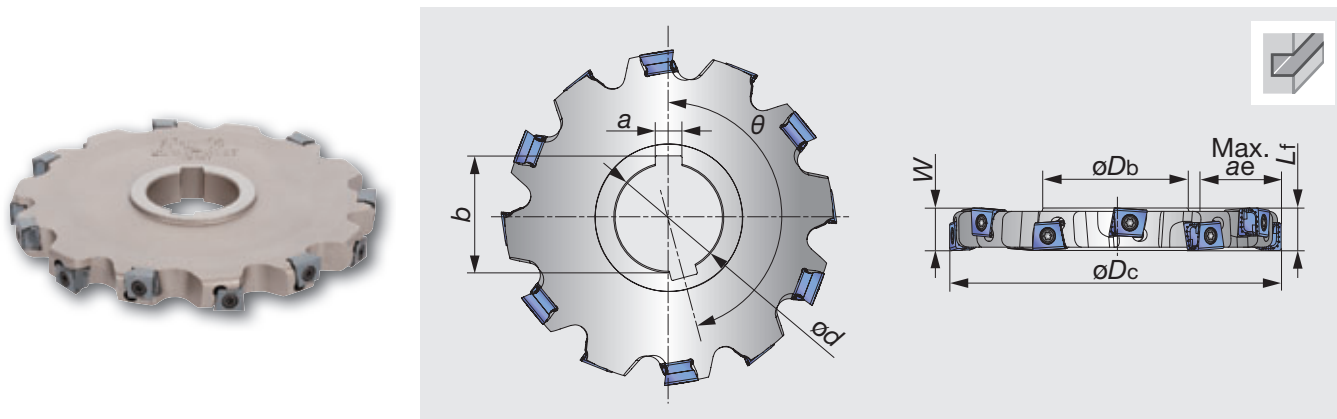


Designation	Clamping screw		Wrench		Grip	Lubricant
			Mono block type	Bit		
TSW06R...	CSPB-2.5	-	IP-8D	-	-	M-1000
TSW07R100...	CSPD-3	-	-	BLD IP10/S7	SW6-SD	M-1000
TSW07R125...	CSPD-3	-	-	BLD IP10/S7	SW6-SD	M-1000
TSW07R160...	CSPD-3	-	IP-10D	-	-	M-1000
TSW09R...	-	CSPB-3.5	IP-15D	-	-	M-1000

Axial drive type slot milling cutter with tangentially mounted inserts

CUTTER - AXIAL DRIVE

TecTangentialSlot ASN + LMEU



Designation	W	ϕD_c	Z eff	ϕD_b	ϕd	Lf	b	a	Max. ae	θ	z	Insert
ASN10R100M31.7-16-05	16	100	5	48	31.75	16	35.2	7.92	25	162°	10	LMEU1008...
ASN10R100M32.0E16-05	16	100	5	47	32	16	34.8	8	25.5	162°	10	LMEU1008...
ASN10R125M38.1-16-06	16	125	6	58	38.1	16	42.3	9.52	32.5	165°	12	LMEU1008...
ASN10R125M40.0E16-06	16	125	6	55	40	16	43.5	10	34	165°	12	LMEU1008...
ASN10R160M38.1-16-07	16	160	7	58	38.1	16	42.3	9.52	50	167.14°	14	LMEU1008...
ASN10R160M40.0E16-07	16	160	7	55	40	16	43.5	10	51.5	167.14°	14	LMEU1008...
ASN10R200M50.0E16-08	16	200	8	69	50	16	53.6	12	64.5	168.75°	16	LMEU1008...
ASN12R100M31.7-19-05	19	100	5	48	31.75	19	35.2	7.92	25	162°	10	LMEU1208...
ASN12R100M32.0E19-05	19	100	5	47	32	19	34.8	8	25.5	162°	10	LMEU1208...
ASN12R125M38.1-19-06	19	125	6	58	38.1	19	42.3	9.52	32.5	165°	12	LMEU1208...
ASN12R125M40.0E19-06	19	125	6	55	40	19	43.5	10	34	165°	12	LMEU1208...
ASN12R160M38.1-19-07	19	160	7	58	38.1	19	42.3	9.52	50	167.14°	14	LMEU1208...
ASN12R160M40.0E19-07	19	160	7	55	40	19	43.5	10	51.5	167.14°	14	LMEU1208...
ASN12R200M50.0E19-08	19	200	8	69	50	19	53.6	12	64.5	168.75°	16	LMEU1208...
ASN12R250M50.0E19-09	19	250	9	84	50	19	53.6	12	82	170°	18	LMEU1208...
ASN15R125M38.1-25-05	25	125	5	58	38.1	25	42.3	9.52	32.5	162°	10	LMEU1509...
ASN15R125M40.0E25-05	25	125	5	55	40	25	43.5	10	34	165°	10	LMEU1509...
ASN15R160M38.1-25-06	25	160	6	58	38.1	25	42.3	9.52	50	165°	12	LMEU1509...
ASN15R160M40.0E25-06	25	160	6	55	40	25	43.5	10	51.5	167.14°	12	LMEU1509...
ASN15R200M50.0E25-07	25	200	7	69	50	25	53.6	12	64.5	168.75°	14	LMEU1509...
ASN15R250M50.0E25-08	25	250	8	84	50	25	53.6	12	82	170°	16	LMEU1509...

SPARE PARTS

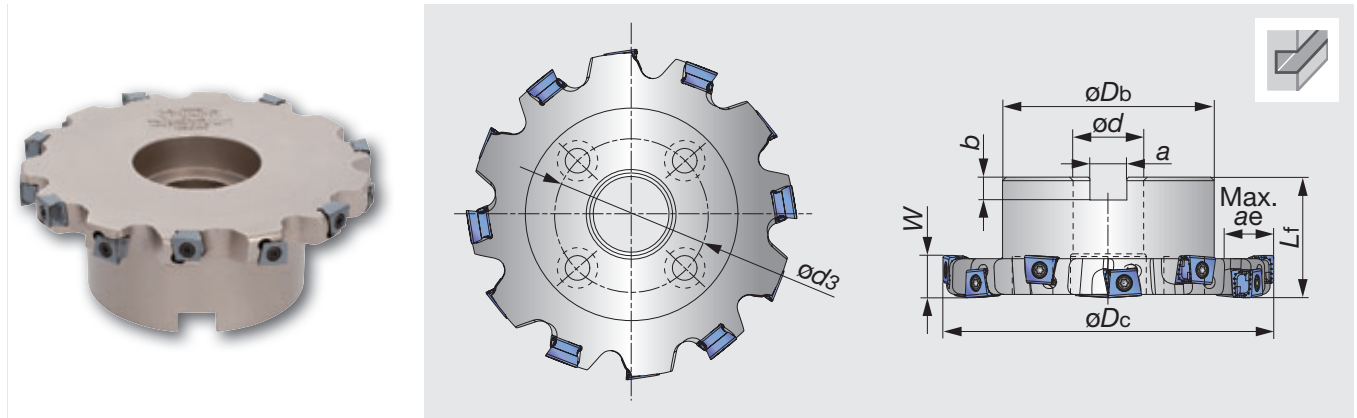


Designation	Clamping screw	Wrench	
		Bit	Grip
ASN10R...	SM40-143-H0	BT15S	H-TB
ASN12R...	SM40-143-H0	BT15S	H-TB
ASN15R...	CSTB-5L159	BT20S	H-TB

Radial drive type slot milling cutter with tangentially mounted inserts

CUTTER - RADIAL DRIVE

TecTangentialSlot TSN + LMEU



Designation	W	ϕD_c	Z eff	ϕD_b	ϕd	Lf	b	a	Max. ae	ϕd_3	z	Insert
TSN10R100M25.4-16-05	16	100	5	50	25.4	50	6	9.5	24	-	10	LMEU1008...
TSN10R100M27.0E16-05	16	100	5	58	27	50	7	12.4	20	-	10	LMEU1008...
TSN10R125M31.7-16-06	16	125	6	70	31.75	50	8	12.7	26.5	-	12	LMEU1008...
TSN10R125M32.0E16-06	16	125	6	66	32	50	8	14.4	28.5	-	12	LMEU1008...
TSN10R160M38.1-16-07	16	160	7	100	38.1	63	10	15.9	29	-	14	LMEU1008...
TSN10R160M40.0E16-07	16	160	7	82	40	63	9	16.4	38	-	14	LMEU1008...
TSN10R200M47.6-16-08	16	200	8	135	47.625	63	14	25.4	31.5	101.6	16	LMEU1008...
TSN10R200M40.0E16-08	16	200	8	88	40	63	9	16.4	55	66.7	16	LMEU1008...
TSN12R100M25.4-19-05	19	100	5	50	25.4	50	6	9.5	24	-	10	LMEU1208...
TSN12R100M27.0E19-05	19	100	5	58	27	50	7	12.4	20	-	10	LMEU1208...
TSN12R125M31.7-19-06	19	125	6	70	31.75	50	8	12.7	26.5	-	12	LMEU1208...
TSN12R125M32.0E19-06	19	125	6	66	32	50	8	14.4	28.5	-	12	LMEU1208...
TSN12R160M38.1-19-07	19	160	7	100	38.1	63	10	15.9	29	-	14	LMEU1208...
TSN12R160M40.0E19-07	19	160	7	82	40	63	9	16.4	38	-	14	LMEU1208...
TSN12R200M40.0E19-08	19	200	8	88	40	63	9	16.4	55	66.7	16	LMEU1208...
TSN12R200M47.6-19-08	19	200	8	135	47.625	63	14	25.4	31.5	101.6	16	LMEU1208...
TSN12R250M47.6-19-09	19	250	9	140	47.625	63	14	25.4	54	101.6	18	LMEU1208...
TSN12R250M60.0E19-09	19	250	9	128	60	63	14	25.7	60	101.6	18	LMEU1208...
TSN15R125M31.7-25-05	25	125	5	70	31.75	50	8	12.7	26.5	-	10	LMEU1509...
TSN15R125M32.0E25-05	25	125	5	66	32	50	8	14.4	28.5	-	10	LMEU1509...
TSN15R160M38.1-25-06	25	160	6	100	38.1	63	10	15.9	29	-	12	LMEU1509...
TSN15R160M40.0E25-06	25	160	6	82	40	63	9	16.4	38	-	12	LMEU1509...
TSN15R200M40.0E25-07	25	200	7	88	40	63	9	16.4	55	66.7	14	LMEU1509...
TSN15R200M47.6-25-07	25	200	7	135	47.625	63	14	25.4	31.5	101.6	14	LMEU1509...
TSN15R250M47.6-25-08	25	250	8	140	47.625	63	14	25.4	54	101.6	16	LMEU1509...
TSN15R250M60.0E25-08	25	250	8	128	60	63	14	25.7	60	101.6	16	LMEU1509...

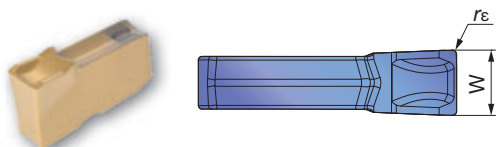
SPARE PARTS



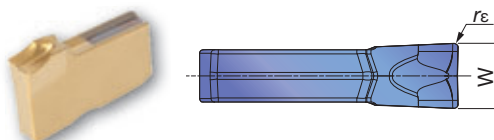
Designation	Clamping screw	Wrench	
		Bit	Grip
TSN10R...	SM40-143-H0	BT15S	H-TB
TSN12R...	SM40-143-H0	BT15S	H-TB
TSN15R...	CSTB-5L159	BT20S	H-TB

INSERTS

SSM



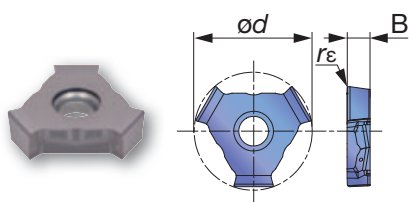
SSS



Designation	r_ϵ	$W_{\pm 0.04}$	GH130			
SSM22N	0.2	2.2	●	●	●	
SSM31N	0.2	3.1	●	●	●	
SSM41N	0.25	4.1	●	●	●	
SSS16N	0.16	1.6	●	●	●	
SSS22N	0.2	2.2	●	●	●	
SSS31N	0.2	3.1	●	●	●	
SSS41N	0.25	4.1	●	●	●	
			P	M	K	S

● First choice

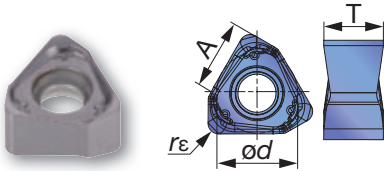
TVKX-MJ



Designation	B	ϕd	r_ϵ	AH725				AH130				AH120			
TVKX020202TN-MJ	2.4	9.4	0.2	●	○	●							●		
TVKX020204TN-MJ	2.4	9.4	0.4	●	○	●							●		
TVKX03X302TN-MJ	3.2	9.4	0.2	●	○	●							●		
TVKX03X304TN-MJ	3.2	9.4	0.4	●	○	●							●		
TVKX04H304TN-MJ	3.5	16.9	0.4	●		●	○	●	○				●		
TVKX04H308TN-MJ	3.5	16.9	0.8	●		●	○	●	○				●		
TVKX050404TN-MJ	4.5	16.9	0.4	●		●	○	●	○				●		
TVKX050408TN-MJ	4.5	16.9	0.8	●		●	○	●	○				●		
				P	M	K	S	P	M	K	S	P	M	K	S

● First choice

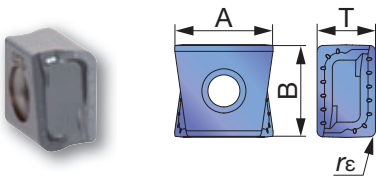
WNGU-MJ



Designation	A	ød	T	rε	AH725	AH130	AH120
WNGU060308TN-MJ	5.6	6.1	4.4	0.8	●	○	○
WNGU060316TN-MJ	5.6	6.1	4.4	1.6	●	○	○
WNGU07T308TN-MJ	6.8	7.4	5.5	0.8	●	○	○
WNGU07T316TN-MJ	6.8	7.4	5.5	1.6	●	○	○
WNGU090408TN-MJ	8.5	8.6	6.5	0.8	●	○	○
WNGU090416TN-MJ	8.5	8.6	6.5	1.6	●	○	○
					P M K S	P M K S	P M K S

● First choice

LMEU-MJ

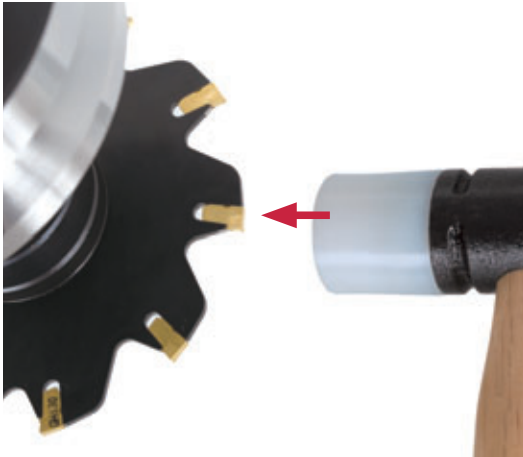


Designation	A	B	T	rε	AH725	AH140	AH120
LMEU100808ZNEN-MJ	12.7	10.5	8	0.8	●	○	○
LMEU100816ZNEN-MJ	12.5	10.5	8	1.6	●	○	○
LMEU100824ZNEN-MJ	12.4	10.5	8	2.4	●	○	○
LMEU100832ZNEN-MJ	12.2	10.5	8	3.2	●	○	○
LMEU120808ZNEN-MJ	13.6	12.7	8	0.8	●	○	○
LMEU120816ZNEN-MJ	13.4	12.7	8	1.6	●	○	○
LMEU120824ZNEN-MJ	13.2	12.7	8	2.4	●	○	○
LMEU120832ZNEN-MJ	13.1	12.7	8	3.2	●	○	○
LMEU150908ZNEN-MJ	15.6	15	9.5	0.8	●	○	○
LMEU150916ZNEN-MJ	15.4	15	9.5	1.6	●	○	○
LMEU150924ZNEN-MJ	15.3	15	9.5	2.4	●	○	○
LMEU150932ZNEN-MJ	15.1	15	9.5	3.2	●	○	○
					P M K S	P M K S	P M K S

● First choice

INSERT INSTALLATION AND REMOVAL

Installation



Before installing inserts, clear chips and dust from the insert seats by air blast or waste rag.

Lightly press the insert into the insert seat by hand, then use a plastic hammer to fix the insert in firmly into the position.

Make sure that there is no gap between the insert and the insert seat.



OK



X

Removal

SSG01/02 type



Insert the wrench (included in the package) in the hole and tilt the wrench in the arrowed direction.

SSG03/04 type



Insert the wrench in the hole and turn the wrench to the arrowed direction.

STANDARD CUTTING CONDITIONS

S/ASG type

ISO	Work piece materials	Hardness (HB)	Insert	Cutting speed V _c (m/min)	Chip thickness t (mm)
P	Low carbon steel (SS400, S15C, etc.)	- 200	SSM...	150 - 230	0.05 - 0.15
	High carbon steel (S45C, S55C, etc.)	200 - 300	SSM...	100 - 170	0.04 - 0.13
	Alloy steels (SCM440, SCr415, etc.)	150 - 300	SSM...	90 - 160	0.04 - 0.13
	Tool steel (SKD11, SKD61, etc.)	- 300	SSM...	70 - 120	0.04 - 0.13
M	Stainless steel (SUS304, SUS316, etc.)	-	SSS...	90 - 200	0.04 - 0.13
K	Grey cast iron (FC250, FC300, etc.)	150 - 250	SSM...	100 - 200	0.05 - 0.15
	Ductile cast iron (FCD400, etc.)	150 - 250	SSM...	80 - 130	0.05 - 0.15



STANDARD CUTTING CONDITIONS

ASV, ASW / TSW, ASN / TSN type

ISO	Workpiece materials	Hardness	Priority	Grades	Cutting speed	Feed per edge line: fz (mm/t)	
						ASV	
						ae / øDc (mm)	
		(HB)			Vc (m/min)	10%	20%
P	Low carbon steel (SS400 / E275A, etc.)	- 200	First choice	AH725	90 - 180	0.08 - 0.25	0.06 - 0.19
		- 200	For impact resistance	AH130, AH140	90 - 180	0.08 - 0.25	0.06 - 0.19
	High carbon steel (S45C / C45, etc.)	200 - 300	First choice	AH725	90 - 180	0.07 - 0.22	0.05 - 0.16
		200 - 300	For impact resistance	AH130, AH140	90 - 180	0.07 - 0.22	0.05 - 0.16
	Alloy steel (SCM440 / 42CrMo4, etc.)	150 - 300	First choice	AH725	90 - 180	0.07 - 0.22	0.05 - 0.16
		150 - 300	For impact resistance	AH130, AH140	90 - 180	0.07 - 0.22	0.05 - 0.16
	Tool steel (SKD61 / X40CrMoV5-1, etc.)	- 300	First choice	AH725	90 - 180	0.07 - 0.22	0.05 - 0.16
		- 300	For impact resistance	AH130, AH140	90 - 180	0.07 - 0.22	0.05 - 0.16
M	Stainless steel (SUS304 / X5CrNi18-9, etc.)	-	-	AH130, AH140	90 - 200	0.07 - 0.22	0.05 - 0.16
K	Grey cast iron (FC250 / 250, etc.)	150 - 250	-	AH120	120 - 230	0.08 - 0.25	0.06 - 0.19
	Ductile cast iron (FCD400, etc.)	150 - 250	-	AH120	90 - 150	0.08 - 0.25	0.06 - 0.19
S	Titanium alloys (Ti-6Al-4V, etc.)	-	First choice	AH725	30 - 40	0.07 - 0.12	0.05 - 0.09
		-	For impact resistance	AH130	30 - 40	0.07 - 0.12	0.05 - 0.09
	Nickel-based alloys (Inconel 718, etc.)	-	First choice	AH725	20 - 35	0.07 - 0.12	0.05 - 0.09
		-	For impact resistance	AH130	20 - 35	0.07 - 0.12	0.05 - 0.09

■ Chip thickness “t”

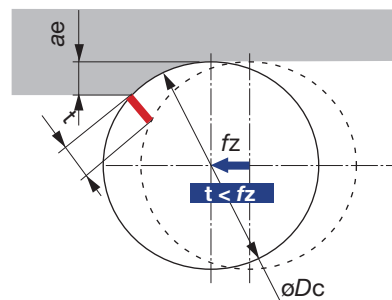
- Chip thickness “t” is one of the most important factors for chip evacuation in slot milling.
- Therefore, setup feed per edge line (fz) should be calculated according to chip thickness (t).

Slotting with a slot milling cutter

$$t \cong 2 \times fz \times \sqrt{(ae / \phi Dc) \times (1 - (ae / \phi Dc))}$$

$$fz \cong t / 2 / \sqrt{(ae / \phi Dc) \times (1 - (ae / \phi Dc))}$$

ϕDc : Tool diameter (mm)
 fz : Feed per edge line (mm/t)
 ae : Depth of slot (mm)



Feed per edge line: fz (mm/t)									
ASV		ASW / TSW				ASN / TSN			
ae / øDc (mm)		ae / øDc (mm)				ae / øDc (mm)			
30%	≤ 50%	10%	20%	30%	≤ 50%	10%	20%	30%	≤ 50%
0.05 - 0.16	0.05 - 0.15	0.12 - 0.33	0.09 - 0.25	0.07 - 0.21	0.07 - 0.2	0.22 - 0.42	0.16 - 0.31	0.14 - 0.27	0.13 - 0.25
0.05 - 0.16	0.05 - 0.15	0.12 - 0.33	0.09 - 0.25	0.07 - 0.21	0.07 - 0.2	0.22 - 0.42	0.16 - 0.31	0.14 - 0.27	0.13 - 0.25
0.04 - 0.14	0.04 - 0.13	0.12 - 0.33	0.09 - 0.25	0.07 - 0.21	0.07 - 0.2	0.22 - 0.42	0.16 - 0.31	0.14 - 0.27	0.13 - 0.25
0.04 - 0.14	0.04 - 0.13	0.12 - 0.33	0.09 - 0.25	0.07 - 0.21	0.07 - 0.2	0.22 - 0.42	0.16 - 0.31	0.14 - 0.27	0.13 - 0.25
0.04 - 0.14	0.04 - 0.13	0.12 - 0.33	0.09 - 0.25	0.07 - 0.21	0.07 - 0.2	0.22 - 0.42	0.16 - 0.31	0.14 - 0.27	0.13 - 0.25
0.04 - 0.14	0.04 - 0.13	0.12 - 0.33	0.09 - 0.25	0.07 - 0.21	0.07 - 0.2	0.22 - 0.42	0.16 - 0.31	0.14 - 0.27	0.13 - 0.25
0.04 - 0.14	0.04 - 0.13	0.12 - 0.33	0.09 - 0.25	0.07 - 0.21	0.07 - 0.2	0.22 - 0.42	0.16 - 0.31	0.14 - 0.27	0.13 - 0.25
0.04 - 0.14	0.04 - 0.13	0.12 - 0.33	0.09 - 0.25	0.07 - 0.21	0.07 - 0.2	0.22 - 0.42	0.16 - 0.31	0.14 - 0.27	0.13 - 0.25
0.04 - 0.14	0.04 - 0.13	0.12 - 0.33	0.09 - 0.25	0.07 - 0.21	0.07 - 0.2	0.22 - 0.42	0.16 - 0.31	0.14 - 0.27	0.13 - 0.25
0.05 - 0.16	0.05 - 0.15	0.12 - 0.42	0.09 - 0.31	0.07 - 0.27	0.07 - 0.25	0.22 - 0.5	0.16 - 0.38	0.14 - 0.32	0.13 - 0.3
0.05 - 0.16	0.05 - 0.15	0.12 - 0.42	0.09 - 0.31	0.07 - 0.27	0.07 - 0.25	0.22 - 0.33	0.16 - 0.25	0.14 - 0.21	0.13 - 0.2
0.04 - 0.07	0.04 - 0.07	0.1 - 0.17	0.08 - 0.13	0.06 - 0.11	0.06 - 0.1	0.12 - 0.22	0.09 - 0.16	0.07 - 0.14	0.07 - 0.13
0.04 - 0.07	0.04 - 0.07	0.1 - 0.17	0.08 - 0.13	0.06 - 0.11	0.06 - 0.1	0.12 - 0.22	0.09 - 0.16	0.07 - 0.14	0.07 - 0.13
0.04 - 0.07	0.04 - 0.07	0.1 - 0.17	0.08 - 0.13	0.06 - 0.11	0.06 - 0.1	0.12 - 0.22	0.09 - 0.16	0.07 - 0.14	0.07 - 0.13
0.04 - 0.07	0.04 - 0.07	0.1 - 0.17	0.08 - 0.13	0.06 - 0.11	0.06 - 0.1	0.12 - 0.22	0.09 - 0.16	0.07 - 0.14	0.07 - 0.13



GUIDELINE FOR ORDERING SPECIAL TOOL

Tailor made cutters and inserts are available upon request. Please verify if your desired specification is possible from the table below. When requesting the quotation, please fill in the information sheet on the next page and send it to us.

■ Cutter

(A) Edge width: Depending on the edge width, insert type should be selected. (Please see Table #1 for detail.)

(B) Tool diameter: Depending on the insert type selected, tool diameter may be limited.

(C) Mount specification, bore diameter: For mount specification, axial drive or radial drive can be selected. If other specification is required, please provide the specification on the information sheet.

Tool designation can be determined with information A, B and C

Table #1: Available range of edge width and tool diameter

Edge width W (mm)	Insert Designation	Tool Designation (tool shape)	Tool diameter range ⁽²⁾ øDc (mm)
4.0 - 4.5	TVKX02***	ASV02...	ø50 -
4.5 - 6.0	TVKX03***	ASV03...	ø50 -
6.0 - 7.4	TVKX04****(1)	T/ASV04...	ø80 -
7.4 - 9.0	TVKX05****(1)	T/ASV05...	ø80 -
8.7 - 11.0	WNGU0603**	T/ASW06...	ø50 -
10.6 - 13.2	WNGU07T3**	T/ASW07...	ø50 -
12.6 - 16.7	WNGU0904**	T/ASW09...	ø50 -
15.1 - 18.6	LMEU1008**	T/ASN10...	ø80 -
17.5 - 23.1	LMEU1208**	T/ASN12...	ø80 -
19.8 - 27.6	LMEU1509**	T/ASN15...	ø80 -

(1) Special inserts may be required depending on the edge width.

(2) Max tool diameter should be confirmed when requesting quotation.

■ Example of tool designation

T		SW06		R	110.5 - 9.8		M	25.4		
1		2		3	4		5	6	7	
1 Mount specification				4 Tool diameter øDc (mm)				6 Bore specification		
T		Radial drive		100		ø100		M		JIS
A		Axial drive		110.5		ø110.5		E		ISO
2 Tool shape				5 Edge width W (mm)				7 Bore diameter ød (mm)		
Please see table #1				9.8		9.8		25.4		ø25.4
3 Hand of tool				11		11		27.0		ø27.0
R		Right								
L		Left								

■ Insert

Special corner radius is available.

Available range

Insert Designation	Edge width W (mm)	Corner radius r _ε (mm)	Grades
SSM...	1.70 - 2.52	0.2 - 1.0	GH130
	2.53 - 3.52	0.2 - 1.5	
	3.53 - 4.52	0.2 - 2.0	
TVKX02,03	-	0 - 1.0	AH725, AH130, AH120
TVKX04,05	-	0 - 2.0	

Insert Designation	Corner radius r _ε (mm)	Grades
WNGU06	0 - 2.0	AH725, AH130, AH120
WNGU07	0 - 2.4	
WNGU09	0 - 2.8	
LMEU...	0.4 - 4.0	AH725, AH140, AH120

■ Example of insert designation

WNGU07T3	08	-	12345	AH725
1	2		3	4
1 Insert shape		2 Corner radius r_ε (mm)		3 Identification #
Please see table #1		08	0.8	Decided by Tungaloy
		13	1.3	
4 Grade				

■ Information sheet for quotation & order

When requesting a quotation,
please make a COPY of this page and send to us.

Company:

Name:

Phone:

Tool information

Tool diameter: $\varnothing D_c$	$\varnothing D_c =$ mm	Sketch of tool:
Edge width: W	$W =$ mm	
Tool type	☐ Axial drive ☐ Radial drive ☐ Other	
Bore diameter: $\varnothing d$	$\varnothing d =$ mm	
Corner radius: r_ϵ	$r_\epsilon =$ mm	

Tool Designation:

Insert Designation:

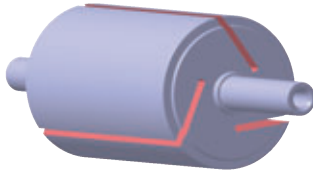
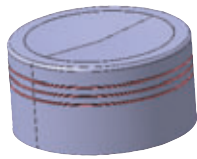
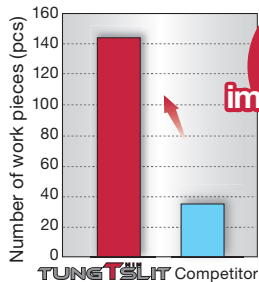
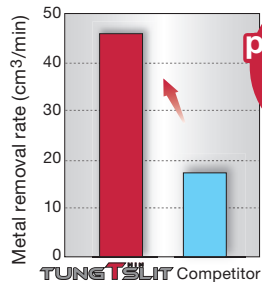
Workpiece information

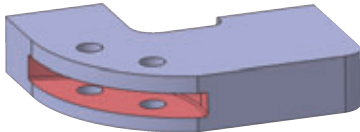
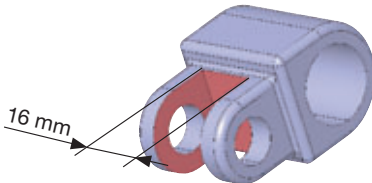
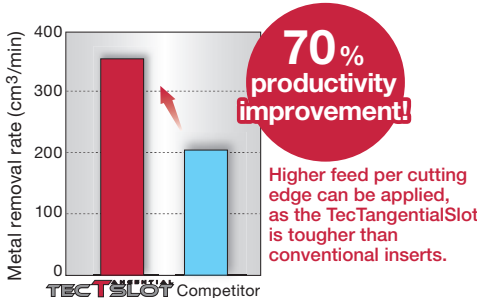
Tolerance of slot width required		Sketch of component:
Slot depth	mm	
Name of component		
Material, hardness		

Machine information

Machine type	☐ Horizontal ☐ Vertical ☐ Other	Note: e.g. Angled head attachment is used.
Spindle motor power		
Spindle adaptation		

PRACTICAL EXAMPLES

Workpiece type		Rotor	Piston head
Cutter		ASV02N160-E4 (ø100, 5 edge lines)	ASV05N100-8 (ø100, 5 edge lines)
Insert		TVKX020204-TN MJ	TVKX050404TN-MJ
Grade		AH130	AH725
Workpiece material		AVP- Alloyed Steel P40	Alloy steel
		 P	 P
Cutting conditions	Cutting speed: V_c (m/min)	161	120
	Chip thickness: t (mm)	0.01	0.12
	Feed per edge line: f_z (mm/t)	0.07	0.15
	Feed speed : V_f (mm/min)	200	286
	Edge width : W (mm)	4	8
	Depth of slot: a_e (mm)	41	20
	Coolant	Air blast	Dry
	Machine	ISO50, 20Kw, 3Axis VMC	HSK100
Results		 4 times tool life improvement! TungThinSlit could machine the complete slot in one pass without finish as the surface quality was good.	 productivity 3 times! Due to the incredible rigidity, 3 times higher productivity and improved surface finish are achieved without chattering.

Workpiece type		Machine parts	Machine parts												
Cutter		ASW06N100-10 (ø100, 5 edge lines)	TSN10R125M31.7-16-06 (ø125, 6 edge lines)												
Insert		WNGU060308TN-MJ	LMEU100808ZNEN-MJ												
Grade		AH725	AH120												
Workpiece material		SKD11 / X153CrMoV12	FCD450 / 450-10S												
															
Cutting conditions	Cutting speed: V_c (m/min)	110	150												
	Chip thickness: t (mm)	0.08	0.15												
	Feed per edge line: f_z (mm/t)	0.1	0.2												
	Feed speed : V_f (mm/min)	175	358												
	Edge width : W (mm)	10	16												
	Depth of slot: a_e (mm)	23	22												
	Coolant	Dry	Dry												
	Machine	Vertical M/C, BT40	Vertical M/C, BT50												
Results	<table><tr><td></td><td>TUNGUSLOT</td><td>Competitor</td></tr><tr><td>Number of passes</td><td>1</td><td>2</td></tr><tr><td>Chip evacuation</td><td>Good</td><td>Bad</td></tr><tr><td>Chattering</td><td>No</td><td>With</td></tr></table>			TUNGUSLOT	Competitor	Number of passes	1	2	Chip evacuation	Good	Bad	Chattering	No	With	
		TUNGUSLOT	Competitor												
Number of passes	1	2													
Chip evacuation	Good	Bad													
Chattering	No	With													

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