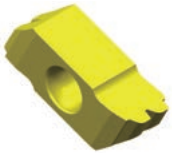
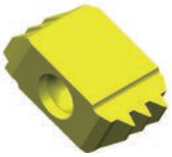
Thread Whirling

Features

New Double-lead video is on WATCH ON YouTube

- NTK's unique patented design technology makes precise and correct inserts possible the first time, *without any redesign or remanufacturing even if it is a multiple-lead thread*
- The sharper cutting edges produce a better surface finish and longer tool life than competitor's inserts

Form Double-lead or Multiple-lead with Single Pass

	Double-lead threads	Triple-lead threads
Work	Bone screw	Worm gear
Work material	Ti-6Al-4V ELI	brass
Work appearance		
Insert appearance		
Major Dia.	ϕ4.0mm	ϕ7.0mm
Minor Dia.	ϕ2.4mm	ϕ4.7mm
Lead [Pitch×No. of Lead]	3.42mm (1.71mm×2)	4.9mm (1.63mm×3)

- Can reduce cycle time by more than half
- NTK can achieve what other competitors cannot

Double-lead Bone Screw Process Example

1. 1st thread whirl at taper part
2. Rotate the bar 180° and whirl the 2nd thread on same part as 1
3. Thread whirl whole straight part
4. Thread whirl at very last part to get two-exits, after back of bar has been backed up a half lead (one pitch) and rotated 180°

Special Item Capability

- Even though almost all bone screw shapes are special, NTK thread whirling inserts can make the correct shape of thread the first time, without any redesign or remanufacturing
- Basically NTK thread whirling inserts are ground with topping and coated

Recommended Cutting Conditions

No. of teeth / Conditions		9	6	4	
Main spindle	RPM	**10 - 40**	10 - 25	7 - 15	Faster RPM reduces machining time
Whirling cutter	RPM	**1500 - 4000**			
Feed Rate		**Same as thread-lead**			
Bar stock	ϕ	**~ϕ10.0 ***		~ϕ5.0	* For cutter with ϕ12㎜ ID
Work Material		**Ti-6Al-4V ELI / SUS316 / Titanium**			

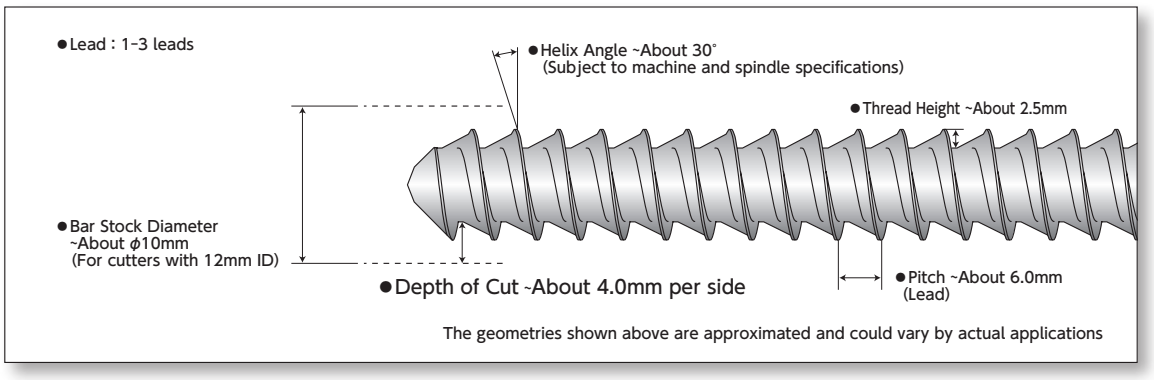
- Formula for calculating thread whirling process time

$$T\ (\text{Seconds}) = \frac{60 \times \text{Thread length}}{\text{Main spindle rpm} \times \text{Feed rate (Thread lead)}}$$

Ex.) Double lead / 50㎜ length / 2.54 lead (2×1.27 pitch) / 30 rpm

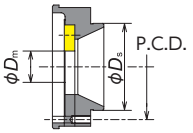
$$T\ (\text{Seconds}) = \frac{60 \times 50}{30 \times 2.54} = 40\ \text{Seconds}$$

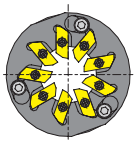
Applicable Thread Geometry (Approximated)

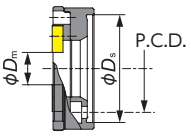


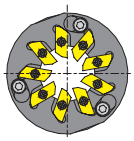
Thread Whirling System

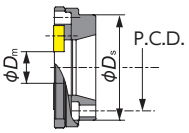

Type 1



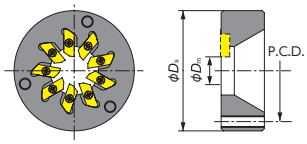

Type 2
Quick-change



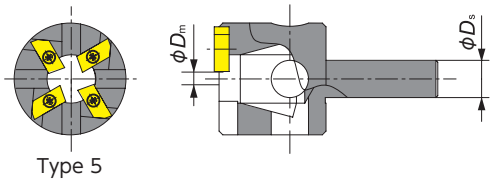

Type 3
Quick-change



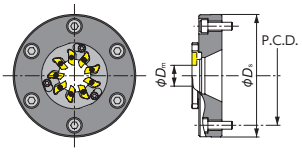
Machine make	Model	Location	Spindle make	Spindle model	Helix angle	NTK Thread whirling system	Stock	No. of tooth	ϕD_m (mm)	Type	ϕD_s	P.C.D.	Mount adapter bolt
CITIZEN	M32-VIII	Gang	CITIZEN	BTW-4000	0° – 15°	TWC9C0746HP1	●	9	φ12	1	φ46	φ35	M3
	L20/L20E/L20X	Gang		BTW-3000 BTW-3100	0° – 15°								
	L32/L32X			BTW-3100	0° – 15°								
	D25	Gang		BTW-6000	±25°	TWC9C1040HP1 TWC6C1040HP1 TWC9C1040HP1-D16	● ● ●	9 6 9	φ12 φ12 φ16	1	φ33	φ40	M3 (Provided with spindle)
	L32X												
	L20X			BTW-5000	±25°								
	M16				0° – 15°								
	A20			BTW-2000	±25°								
	A32												
	L20/L20X												
	L32/L32X												
	M20												
	M32												
	C32			BTW-1000	±25°								
	L20												
	M20				+20° – −25°								
	M32				±25°								
	C12/16	Gang	CITIZEN	LTR0170	±15°	TWC9C1037P2	●	9	φ12	2	φ37	φ30.5	CS0310(M3)
	M12/16	Turret		LTR0128/LTR0168									
	M12/16III			MSW105									
	M20/32III			KSW110									
	L20	Gang		LTR0183	±15°	TWC9J1040P2		9	φ12	2	φ40	φ32.5	H-M4 × 12
	M20/32												
	M20/32	Turret		LTR0169									
	K16	Attachment	PCM	GSW-101	±15°	TWC6P1620HP1-D9		6	φ9	1	φ32	φ26	M4 (Provided with spindle)
	L20	Gang		LSW-101-L20	±10°	TWC9P1340P2	●	9	φ12	2	φ40	φ32.5	M4 (Provided with spindle)
	M12/16	Turret		MSW-101									
	M20/M32			KSW-101									
STAR	SW-12	Attachment	STAR	10159	±20°	TWC4S1433HP1	●	4	φ8	7	φ38	φ27	CS0310(M3)
	ECAS-12/20			54178	±10°	TWC9S1640P2	●	9	φ12	3	φ40	φ33	CS04148S(M4)
	SB-20R			OM171	−20° – 0°								
	SR-20J/20RIII 20RIV/32JII			68172	−20° – 0°								
	SR-38			10172	±10°								
	ECAS-20T	Turret		59172	−20° – 0°								
	ECAS-32T			58171	±20°								
	ST-38			43156	±20°								
	SV-12			45172	±10°								
	SV-20/SV-20R			42173	±10°								
	SV-32			43172	±10°								
	SV-38R			43156	±20°								
TSUGAMI	BH20/BH38	Turret	TSUGAMI	3263-Y481	±10°	TWC9TS2252P2	●	9	φ12	3	φ52	φ42	CS0515(M5)
	BS20	Attachment		3214-Y1371	±10°	TWC9TS20550P2		9	φ16	3	φ50	φ40	CS0515(M5)
	SS20/SS26/SS32 B0265/B0266-II B0325/B0326-II	Attachment		3268-Y450 3268-Y451	0° – 10°	TWC9TS2244HP1	●	9	φ12	4	φ52	φ44	CS0520(M5)
	S205/S206			3281-Y450 3281-Y451	0° – 20°	TWC9TS1944HP1	●	9	φ12	4	φ52	φ44	CS0520(M5)
	B0123/B0124/B0125/ B0126-II/III B0203/B0204/B0205/ B0205/B0206-II/III			3220-Y6540 3220-Y6541	0° – 25°	TWC9TS1644HP1	●	9	φ12	4	φ52	φ44	CS0515(M5)
					0° – 30°	TWC9TS1044HP1	●	9	φ12	4	φ52	φ44	CS0515(M5)
	SS20/SS26/SS32			3268-Y271	0° – 10°	TWC9TS1952P2BK		9	φ12	4	φ52	φ38	CS0515(M5)
					0° – 20°	TWC9TS1652P2BK		9	φ12	4	φ52	φ38	CS0515(M5)
	SS207/SS267/SS327	—	Using B-axis		0° – 15°	TWC4TS3010HP1	●	4	φ7	5	φ10	For single-corner inserts only	



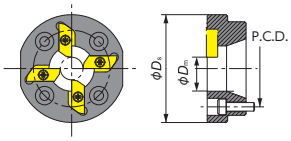
Type 4



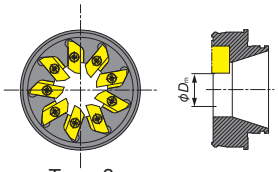
Type 5



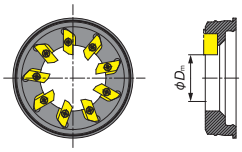
Type 6
Quick-change



Type 7



Type 8



Type 9

Machine make	Model	Location	Spindle make	Spindle model	Helix angle	NTK Thread whirling system	Stock	No. of tooth	ϕD_m (mm)	Type	ϕD_s	P.C.D.	Mount adapter bolt
TORNOS	DECO 10/10a	Attachment	TORNOS	224-1900	±15°	TWC6TO11542HP1		6	ϕ12	4	ϕ42	ϕ32	CS0410(M4)
	Evo DECO 10/10			242-1900									
	DECO 13a/13e			226-1900	±15°	TWC9TO10540P2		9	ϕ12	3	ϕ40	ϕ31	CS0410(M4)
	Evo DECO 16/10			243-1900									
	Swiss ST26			246-1900									
	DECO 20a			223-1900									
	DECO 26a			225-1900									
	Sigma 20			234-2750	±25°	TWC9TO12050P2-D18		9	ϕ18	3	ϕ50	ϕ40	CS0410(M4)
	Sigma 32			236-2750									
HASEGAWA	JS-1W	—	HASEGAWA	—	0° - 20°	TWC9HA22594P2		9	ϕ16	6	ϕ94	ϕ76	CS0620(M6)
Various Machines			WTO	42BJ	-22° ※1	TWC9WT42BJ20D12RH ※2		9	ϕ12	8	—	—	—
				54BJ	30°	TWC9WT54BJ30D12RH ※2		9	ϕ12	9	—	—	—
					30°	TWC9WT54BJ25D22RH ※2		9	ϕ22	9	—	—	—

※1 Would be changed by spindle
※2 Designed for 6.5mm thickness inserts

Spare Insert Holder (Cartridge)

Item number	No. of tooth	ϕD_m (mm)	Compatible cutters
TWC6HP2	6	12	For Type 2 and Type 3*
TWC9HP2	9	12	For Type 2 and Type 3*
TWC9HP2-D16	9	12	For Type 6

Note: Insert holder comes with insert screws and wrench
Insert holder mounting screw is not included
*Cannot be used for TWC9TS20550P2, TWC9TO12050P2-D18 and TWC9HA22594P2

Spare Parts

Description		Item number
Insert Screw	For 4mm thick inserts	FSI17-2.2×6.0
	For 6.5mm thick inserts	FSI24-2.2×7.9
Wrench		T-07
Insert Holder Mounting Bolt		CS0309-TW

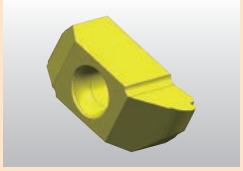
NTK's Unique Attachment System

NTK's whirling insert holder can be attached and detached without removing mounting screws

① Loosen the Mounting Screws
② Rotate the Insert Holder 10 degrees
③ Detach the Insert Holder without removing the Mounting Screws

Basic Insert Grade

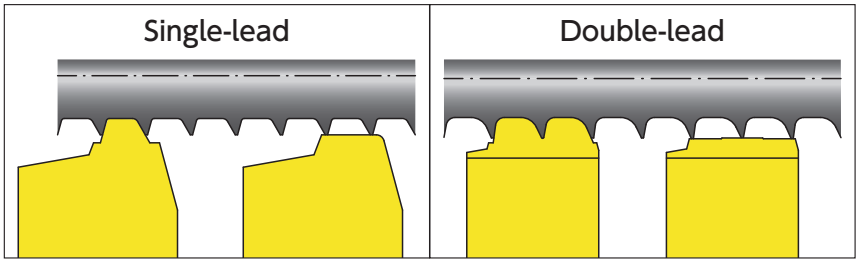
ZM3



- ZM3 is our basic grade for NTK thread whirling
- ZM3 offers excellent surface finish
- NTK can make inserts with other coatings to meet customers demands

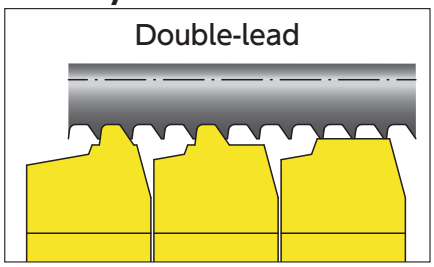
NTK Experiences and Solutions Example

For absolute flat on OD



- Two insert combination brings absolute flat on OD to meet the drawing

For tiny thread

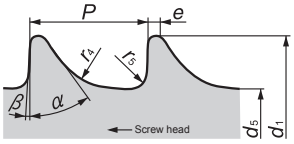


- NTK's Thread Whirling system can machine small diameter multi-lead screws to spec, with lower tool pressure, by using several types of specially designed and accurately ground inserts on the cutter.

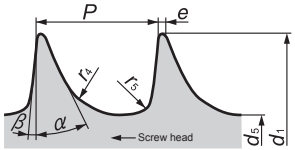
Standard Thread Whirling Inserts (two-sided) for Medical ISO Style Threads

4mm thickness insert

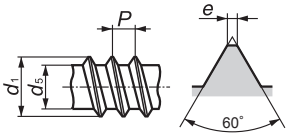
(Note: Must use Thread whirling cutters with 12㎜ ϕDm dimension. See page U18-19 to find ϕDm for each cutter.)



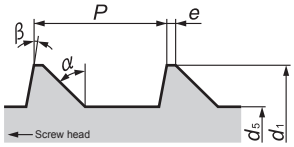
ISO5835 HA



ISO5835 HB



ISO9268 HC



ISO9268 HD

Metric dimensions

Item number	ISO Standard		d_1	d_5	P	e	r_4	r_5	α	β	Supposition material Dia.	Coated Carbide ZM3
TW5835-HA1.5-D12	ISO5835	HA1.5	$1.5^{0}_{-0.15}$	$1.1^{0}_{-0.1}$	0.5	0.1	0.3	0.1	35°	3°	ϕ8	●
TW5835-HA2.0-D12		HA2.0	$2.0^{0}_{-0.15}$	$1.3^{0}_{-0.1}$	0.6	0.1	0.4	0.1	35°	3°		●
TW5835-HA2.7-D12		HA2.7	$2.7^{0}_{-0.15}$	$1.9^{0}_{-0.15}$	1	0.1	0.6	0.2	35°	3°		●
TW5835-HA3.5-D12		HA3.5	$3.5^{0}_{-0.15}$	$2.4^{0}_{-0.15}$	1.25	0.1	0.8	0.2	35°	3°		●
TW5835-HA4.0-D12		HA4.0	$4.0^{0}_{-0.15}$	$2.9^{0}_{-0.15}$	1.5	0.1	0.8	0.2	35°	3°		●
TW5835-HA4.5-D12		HA4.5	$4.5^{0}_{-0.15}$	$3.0^{0}_{-0.15}$	1.75	0.1	1	0.3	35°	3°		●
TW5835-HA5.0-D12		HA5.0	$5.0^{0}_{-0.15}$	$3.5^{0}_{-0.15}$	1.75	0.1	1	0.3	35°	3°	ϕ10	●
TW5835-HB4.0-D12		HB4.0	$4.0^{0}_{-0.15}$	$1.9^{0}_{-0.15}$	1.75	0.1	0.8	0.3	25°	5°	ϕ8	●
TW5835-HB6.5-D12		HB6.5	$6.5^{0}_{-0.15}$	$3.0^{0}_{-0.15}$	2.75	0.2	1.2	0.8	25°	5°	ϕ10	●
TW9268-HC2.9-D12	ISO9268	HC2.9	2.79 to 2.9	2.03 to 2.18	1.06	0.1max	—	—	—	—	ϕ8	
TW9268-HC3.5-D12		HC3.5	3.43 to 3.53	2.51 to 2.64	1.27	0.1max	—	—	—	—		
TW9268-HC3.9-D12		HC3.9	3.78 to 3.91	2.77 to 2.92	1.27	0.1max	—	—	—	—		
TW9268-HC4.2-D12		HC4.2	4.09 to 4.22	2.95 to 3.25	1.27	0.1max	—	—	—	—		
TW9268-HD4.0-D12		HD4.0	4.0±0.03	2.92±0.03	1.59	0.1	—	—	45°	10°		
TW9268-HD4.5-D12		HD4.5	4.5±0.03	2.92±0.03	2.18	0.1	—	—	45°	10°		

Application Examples

Double-lead Bone Screw			
Work Material : Ti-6Al-4v ELI			
Bar Stock Dia.	ϕ9.5	Number of start	2
Major Dia.	ϕ4.0	Helix Angle	28.5°
Minor Dia.	ϕ2.5	Hand of thread	Right
Cutting condition			
Main Spindle Speed (rpm)	15	Speed of whirling cutter (rpm)	3,500
Lead = Feed (mm/rev)	5.5	Result	OK
NTK Thread Whirling	Dramatically improved productivity		
Competitor's Thread Whirling	*Cannot complete with single pass. Requires feeding stock multiple times and two passes for threading each time.*		
NTK thread whirling succeeded in double lead screw machining when one of the major thread whirling suppliers has failed many times.			

Double-lead Bone Screw			
Work Material : Ti-6Al-4v ELI			
Bar Stock Dia.	ϕ8.9	Number of start	2
Major Dia.	ϕ4.57	Helix Angle	23.0°
Minor Dia.	ϕ3.05	Hand of thread	Right
Cutting condition			
Main Spindle Speed (rpm)	12	Speed of whirling cutter (rpm)	2,500
Lead = Feed (mm/rev)	5.08	Result	OK
NTK Thread Whirling	Dramatically improved productivity		
Competitor's Thread Whirling	*Cannot complete with single pass. Requires feeding stock multiple times and two passes for threading each time.*		
The customer could not get perfect double lead thread form in single pass from other manufacturers. NTK got perfect thread form with a single pass on first trial saving cycle time.			

Double-lead Bone Screw			
Work Material : Ti-6Al-4v ELI			
Bar Stock Dia.	ϕ6.35	Number of start	2
Major Dia.	ϕ3.0	Helix Angle	15.4°
Minor Dia.	ϕ2.1	Hand of thread	Right
Cutting condition			
Main Spindle Speed (rpm)	11	Speed of whirling cutter (rpm)	2,200
Lead = Feed (mm/rev)	2.2	Result	OK
NTK Thread Whirling	Dramatically improved productivity		
Competitor's Thread Whirling	*Cannot complete with single pass. Requires feeding stock multiple times and two passes for threading each time.*		
Customer was concerned with stock rigidity and long cycle time. NTK applied three geometry inserts to achieve single pass machining, in dramatically short time. The up-sharp cutting edges and low cutting pressure produced "excellent" surface finish.			

Single-lead Bone Screw			
Work Material : 316SS			
Bar Stock Dia.	ϕ8.0	Number of start	1
Major Dia.	ϕ3.45	Helix Angle	7.5°
Minor Dia.	ϕ2.67	Hand of thread	Right
Cutting condition			
Main Spindle Speed (rpm)	23	Speed of whirling cutter (rpm)	2,000
Pitch = Feed (mm/rev)	1.24	Result	OK
NTK Thread Whirling	2600 pcs		
Competitor's Thread Whirling	1000 pcs		
Some thread whirling manufacturers offer 6-teeth or 12-teeth systems, too many teeth cause chip packing issues and more tool pressure. Fewer teeth means greater cycle time. NTK concluded that 9-teeth is the best configuration. Our customers can run 1.5 times faster and get longer tool life.			

Single-lead Bone Screw			
Work Material : Ti-6Al-4v ELI			
Bar Stock Dia.	ϕ5.0	Number of start	1
Major Dia.	ϕ2.3	Helix Angle	5.3°
Minor Dia.	ϕ1.7	Hand of thread	Right
Cutting condition			
Main Spindle Speed (rpm)	30	Speed of whirling cutter (rpm)	3,100
Pitch = Feed (mm/rev)	0.58	Result	OK
NTK Thread Whirling	2200 pcs		
This thread is up to 32 mm length with a small pitch. Cycle time could be increased with a single-point threading tool. NTK's inserts, designed for lower tool pressure, ran 2,200 pcs/corner at 30 rpm of bar stock (F10,800). It only took 110 seconds to finish a 32 mm length thread.			

Triple-lead Worm Gear			
Work Material : Brass			
Bar Stock Dia.	ϕ8.0	Number of start	3
Major Dia.	ϕ7.0	Helix Angle	14.6°
Minor Dia.	ϕ4.7	Hand of thread	Left
Cutting condition			
Main Spindle Speed (rpm)	20	Speed of whirling cutter (rpm)	3,500
Lead = Feed (mm/rev)	4.8	Result	OK
Multi-lead threads, common in the Worm Gear industry are made by a forming or cutting process. The large helix angle is difficult to machine with single-point threading. NTK now makes thread whilring inserts for multi-lead threads. Cycle time is reduced with a one pass process and thread form dimensions are stable with the low tool pressure.			