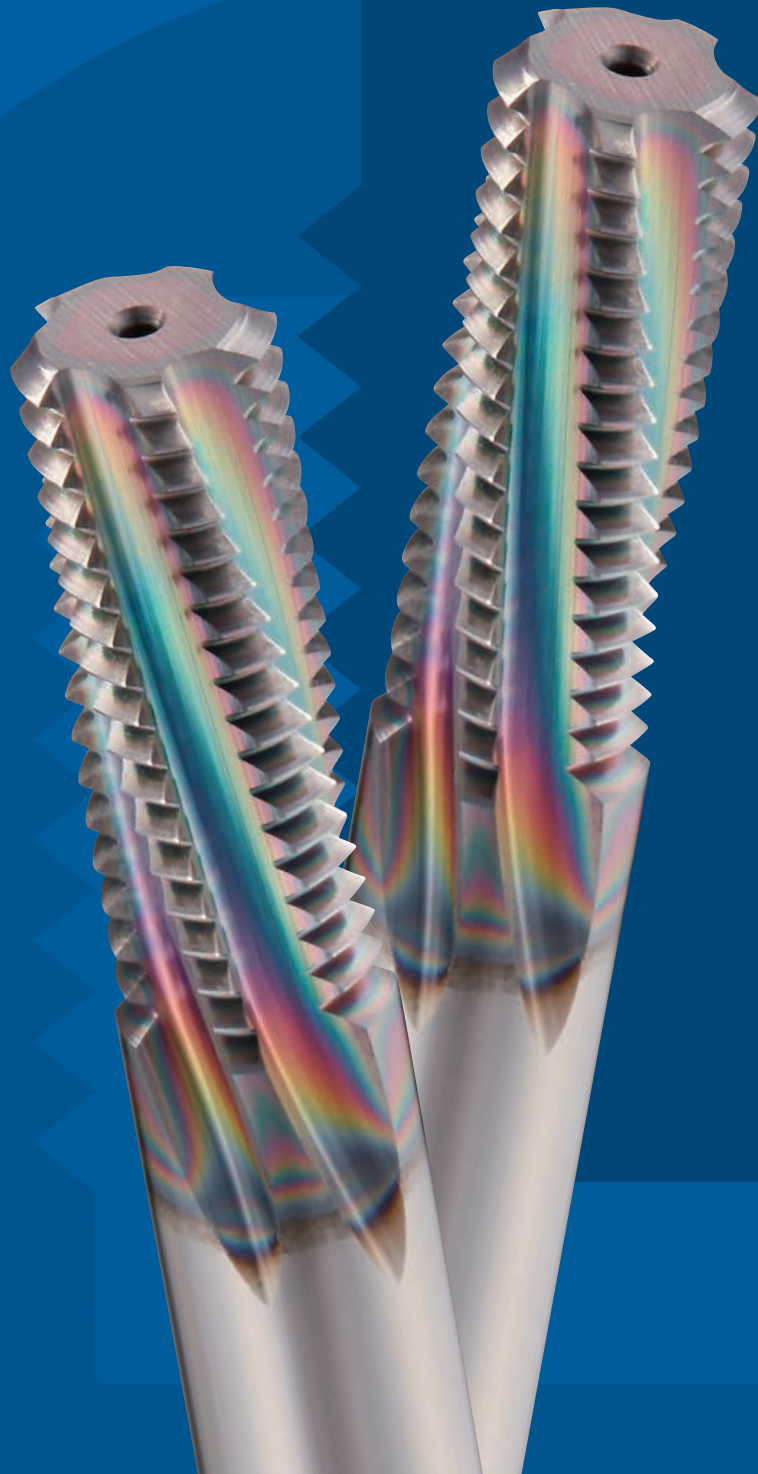




One Pass Thread Mill

# AT-1

Volume 1



# KEY FEATURES: AT-1

**1** Unequal spacing with variable lead flute reduces vibration

**2** Right-hand cut & left-hand helix geometry prevents bending

**3** EgiAs coating with exceptional wear resistance and toughness

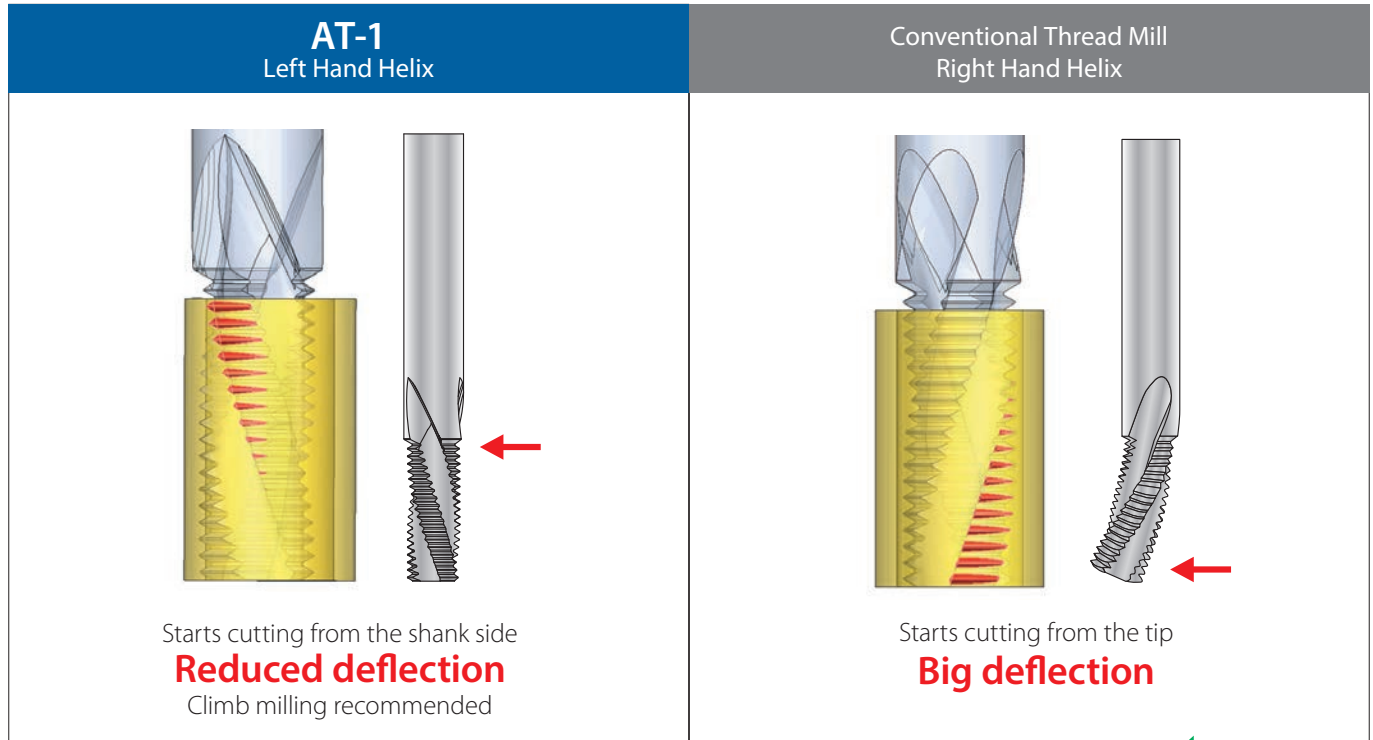
**4** Ultra-Fine Grain Carbide with high wear resistance and toughness



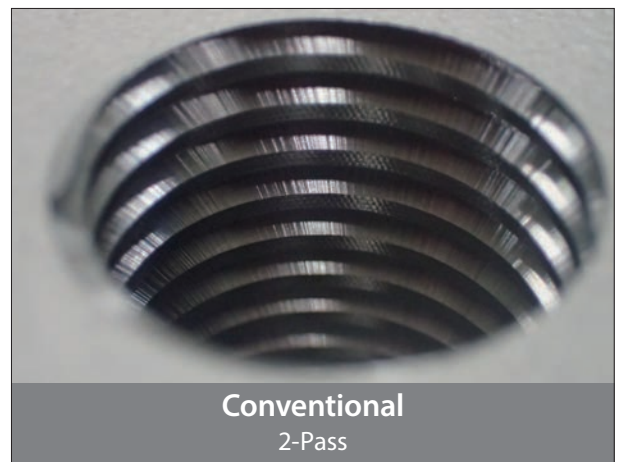
# AT-1: THE SECRET TO 1-PASS CUTTING

## The secret to 1-pass cutting

Evolution from conventional 2-pass cutting to 1-pass cutting by preventing bending, reducing cutting time.



## High quality internal threading



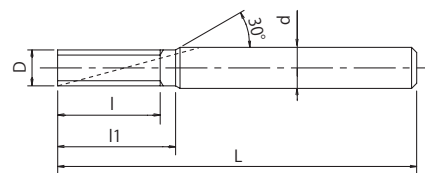
Size	Ø19,7 x 54 P3 6F
Work Material	SUS304
Cutting Speed	40 m/min (646min <sup>-1</sup> )
Feed	14 mm/min (0,02mm/t)
Internal Thread Size	M24 x 3
Tapping length	45 mm
Coolant	Water-Soluble
Machine	Horizontal Machining Center

# AT-1

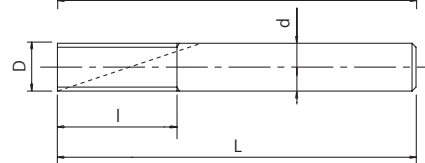
Threading | Thread milling | Metric



Type 1



Type 2



- First choice in quality and performance
- One pass thread mill
- EgiAs coating
- Milling for internal thread

<b>P</b> C: ≤0,2%	<b>P</b> C: 0,25-0,4%	<b>P</b> C: ≥0,45%	<b>P</b> SCM	<b>M</b> INOX	<b>K</b> GG	<b>K</b> GGG	<b>N</b> Al	<b>N</b> AC,ADC	<b>H</b> 25-35 HRC	<b>H</b> 35-45 HRC	m/min
80-160	80-160	80-160	60-120	60-120	80-160	60-120	80-160	100-300	80-200	80-200	



EDP	M	P	D	L	l	l1	d	Z	Type	Price
8331000	6	0,75	4,5	75	13,5	16	6	4	1	
8331001	6	1	4,5	75	14	16	6	4	1	
8331002	8	0,5	5,7	75	17	-	6	4	2	
8331003	8	1	5,7	75	18	-	6	4	2	
8331004	8	1,25	5,7	75	18,75	-	6	4	2	
8331005	10	1	7,7	85	22	-	8	4	2	
8331006	10	1,25	7,7	85	22,5	-	8	4	2	
8331007	10	1,5	7,7	85	24	-	8	4	2	
8331008	12	1	9,7	100	26	-	10	5	2	
8331009	12	1,25	9,7	100	27,5	-	10	5	2	
8331010	12	1,5	9,7	100	27	-	10	5	2	
8331011	12	1,75	9,7	100	28	-	10	5	2	
8331012	14	0,5	11,7	120	29	-	12	5	2	
8331013	14	0,75	11,7	120	30	-	12	5	2	
8331014	14	1	11,7	120	30	-	12	5	2	
8331015	14	1,5	10,7	120	31,5	34,5	12	5	1	
8331016	14	2	9,7	100	32	-	10	5	2	
8331017	16	1	13,7	135	34	39	16	5	1	
8331018	16	1,5	13,7	135	36	39	16	5	1	
8331019	16	2	11,7	120	36	-	12	5	2	
8331020	18	2,5	11,7	120	42,5	-	12	5	2	
8331021	20	1,5	15,7	135	43,5	-	16	5	2	
8331022	20	2,5	13,7	135	45	50	16	5	1	
8331023	24	1,5	19,7	150	51	-	20	6	2	
8331024	24	2	19,7	150	52	-	20	6	2	
8331025	24	3	19,7	150	54	-	20	6	2	

Threading | Thread milling

Metric



# SUPPORT TOOLS FOR YOUR THREAD MILLING NEEDS

Reduce setup, machining time, and achieve stable tool life with these 3 support tools.

Reference value of  
tool radius offset

1  
**RPRG**

## Thread Milling Support Tools

2  
**ThreadPro**

3  
**DCT**

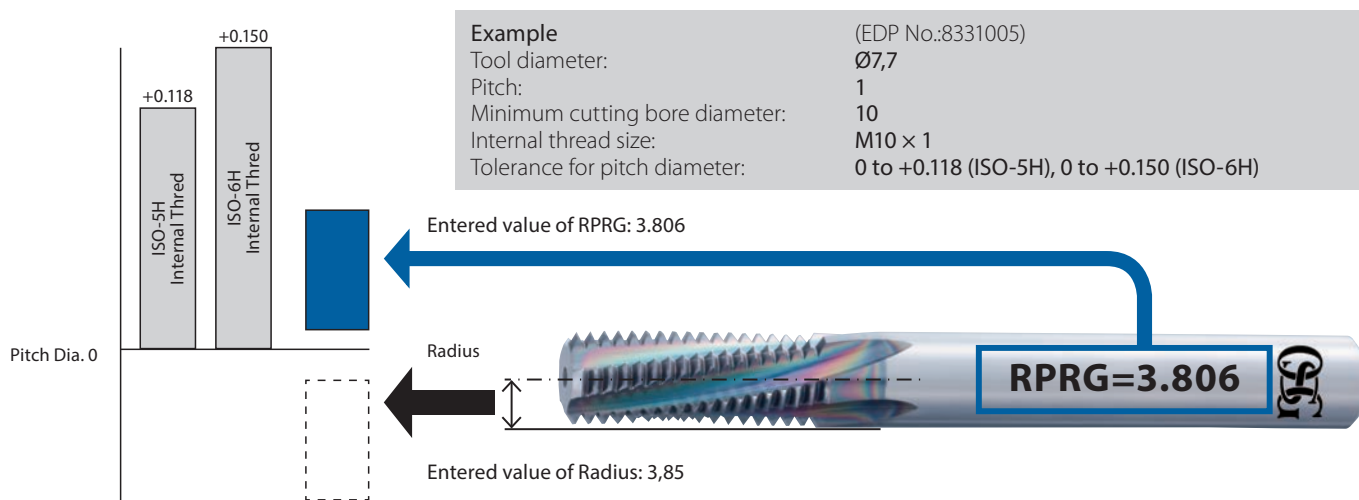
Thread Milling NC Code  
Generator Software

Diameter Correction Tool for  
Thread Mills

# SUPPORT TOOLS FOR YOUR THREAD MILLING NEEDS

## 1 RPRG

Use RPRG to reduce the workload. RPRG is the reference value of tool radius offset.



### Notes

1. RPRG are reference values. Optimal values for actual cutting depend on the machining environment. Determine optimal values after trial cutting.
2. RPRG values are optimally established to achieve ISO:5H (formerly Grade 1) internal thread limits for metric threads and ANSI:3B internal thread limits for unified threads. RPRG values established for taper pipes (R/Rc) are effective when using the thread milling NC code generator software ThreadPro available on our website.
3. For diameters of thread mills, RPRG values are calculated based on the minimum cutting bore diameter (the minimum cutting internal thread size of the tool diameter). To cut other diameters, it is necessary to use a smaller value than RPRG.

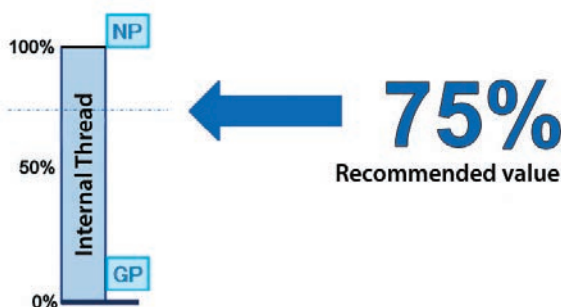
## 2 Revamped Thread Milling NC Code Generator Software "ThreadPro"

Create machining programs at ease with OSG's revamped NC code generator software ThreadPro.



## 3 Achieve stable tool life with the DCT for accurate diameter measurement

The internal thread effective diameter, which used to be difficult to determine, can now be measured with readable values.



## Troubled by the following problems?

Unsure of diameter correction value. Increase passes which results in longer setup time.

An incorrect diameter correction that result in a defective internal thread (gauge-out).

Unstable tool life

## Solved with the Diameter Correction Tool DCT



Simple measurement of pitch diameter by visual judgment

Visibility of internal thread pitch diameter at entry enables the reduction of passes to minimize setup time significantly.  
Moreover, the DCT is able to measure pitch diameter smaller than the tolerance limit. The DCT can measure the pitch diameter of the female internal thread even if it does not fit into the Go-Gauge.

Visibility of internal thread pitch diameter at entry enables reliable diameter corrections.  
The DCT is useful for reducing defective workpieces.

Digitized measurement ensures consistent internal thread pitch diameters after tool changes. The same starting and finishing position ensures consistent and stable tool life.



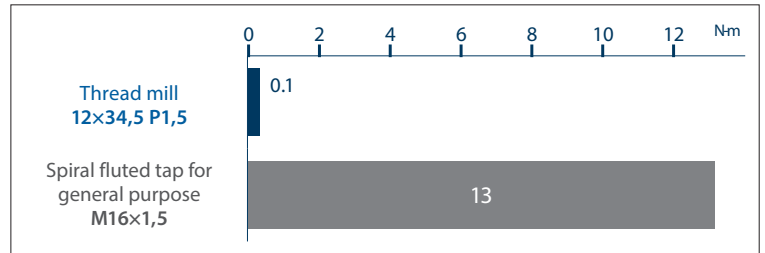
# ADVANTAGES OF USING THREAD MILLS

## A single tool cuts various sizes of diameters

A single tool can cut different threads such as M10 × 1.5, M12 × 1.5, and M16 × 1.5 if their pitch is the same.

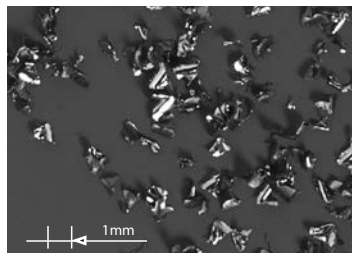
## Cuts large-diameter threads on low-power machine

The internal thread effective diameter, which used to be difficult to determine, can now be measured with readable values.

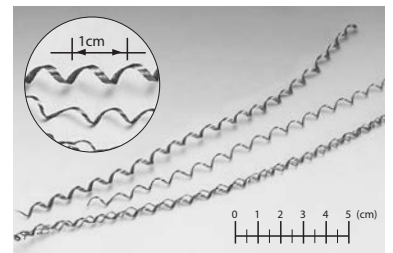


## Smooth handling of chips to reduce problems

Thread mills break chips into small pieces and eject them smoothly, ensuring stable, problem-free thread cutting.



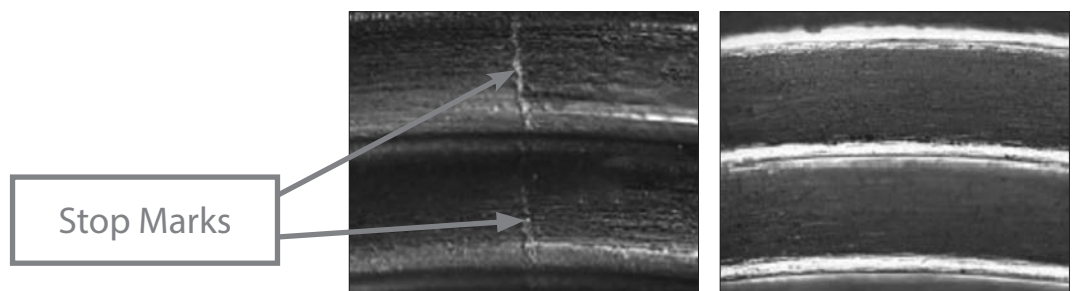
Thread mill chips  
Material S45C



Spiral fluted tap chips

## High-precision taper pipe threading (no stop marks)

Airtight threads by having no stop marks.



## Thread cutting in drill holes with little allowance

Thread milling cuts the thread closer to the bottom of a hole than tapping, leaving only one incomplete crest of thread



# CUTTING DATA

## Effects of left-hand helix

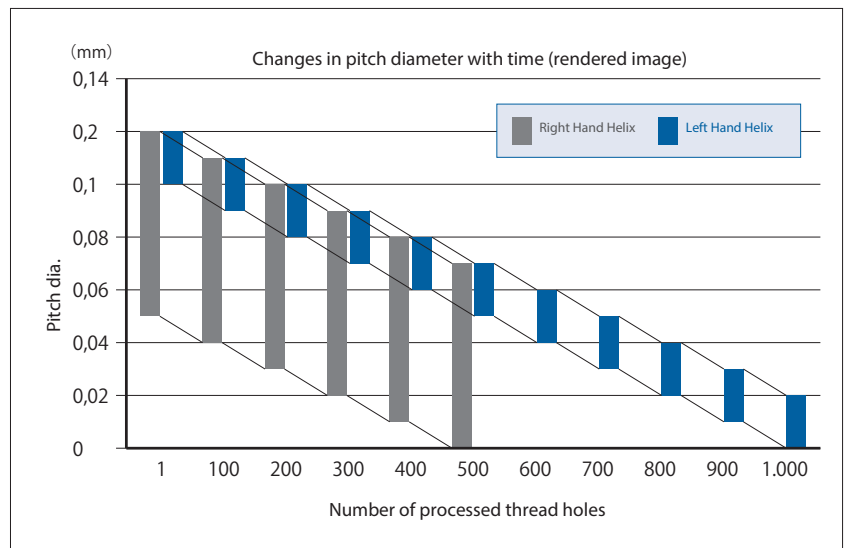
Comparison of differences in internal thread pitch diameter at initial cutting stage.

Size	Ø7,7 × 22 P1 4F
Work Material	SCM440 (30 HRC)
Cutting Speed	100 m/min (4.136min <sup>-1</sup> )
Feed	380 mm/min (0,1mm/t)
Internal Thread Size	M10 x 1 mm
Drill Hole Size	Ø9 × 18 mm (Through)
Threading Length	15 mm
Machining Method	Climb milling 1-Pass
Coolant	Water-Soluble
Machine	Vertical Machining Center

The left-hand helix's small pitch diameter difference between the hole entry and inner hole allows a delay in gauge-out failure. Moreover, longer tool life can be achieved with "zero cutting" for correcting bending being eliminated.

	Hole Entry	Inner Hole Area	Dia. Difference
Right Hand Helix	+0,120 ~ +0,140	+0,040 ~ +0,060	0,060 ~ 0,100
Left Hand Helix	+0,120 ~ +0,140	+0,120 ~ +0,140	<b>0 ~ +0,020</b>

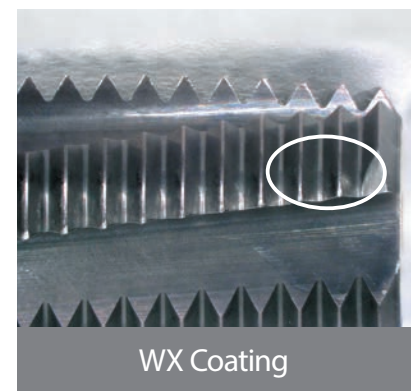
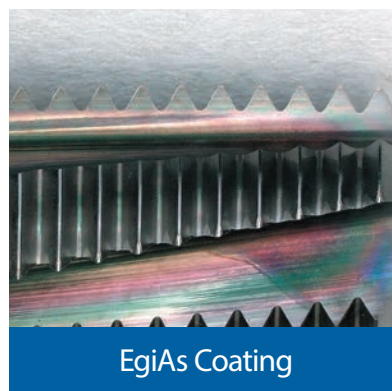
Pitch diameter measurement method : Step gauge



## Effects of EgiAs coating

Cutting edge after threading 2.000 holes.

Size	Ø7,7 × 22 P1 4F
Work Material	SCM440 (30 HRC)
Cutting Speed	100 m/min (4.136min <sup>-1</sup> )
Feed	380 mm/min (0,1mm/t)
Internal Thread Size	M10 x 1 mm
Drill Hole Size	Ø9 × 18 mm (Through)
Threading Length	15 mm
Coolant	Water-Soluble
Machine	Vertical Machining Center



# CUTTING DATA

Work materials ① to ② are machined under the conditions shown below.

Internal Thread Size	M10 x 1 mm
Drill Hole Size	Ø9 x 25 mm (Blind)
Threading Length	19 mm
Coolant	Water-Soluble
Machine	Vertical Machining Center

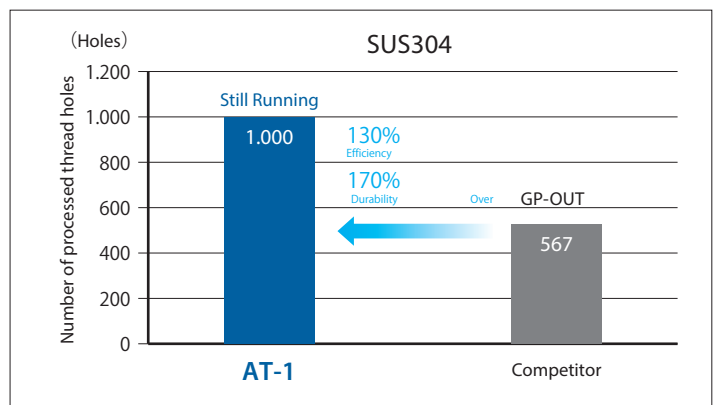
1. Internal thread pitch diameter difference between hole entry and inner hole area: 20µm or less

Eg: +0.080 step gauge passes completely, +0.100 step gauge stops less than or equal to one revolution.

2. Fastest cutting condition (including number of passes) while fulfilling the requirement of Condition 1.

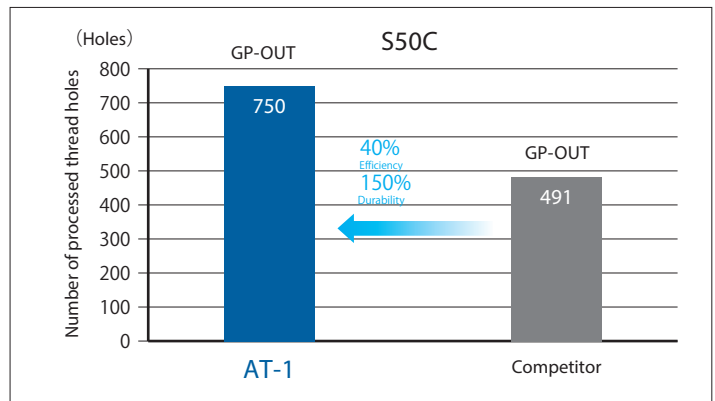
## ① Machining SUS304

Tool	AT-1 Ø7,7x22 P1 4F	Competitor
Cutting Speed	120m/min (4.961min <sup>-1</sup> )	140m/min (5.122min <sup>-1</sup> )
Feed	228mm/min (0,05mm/t)	200mm/min (0,1mm/t)
Number of Passes	1-Pass	2-Passes
Cutting Time	2,26 sec	3,03 sec



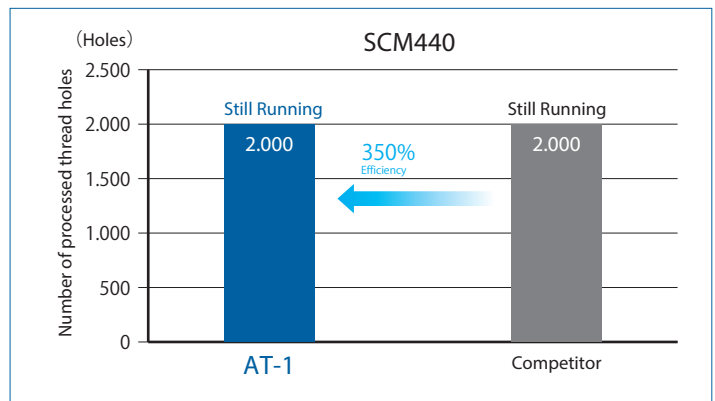
## ② Machining S50C

Tool	AT-1 Ø7,7x22 P1 4F	Competitor
Cutting Speed	160m/min (6.614min <sup>-1</sup> )	140m/min (5.122min <sup>-1</sup> )
Feed	122mm/min (0,02mm/t)	200mm/min (0,1mm/t)
Number of Passes	1-Pass	3-Passes
Cutting Time	4,28 sec	45,4 sec



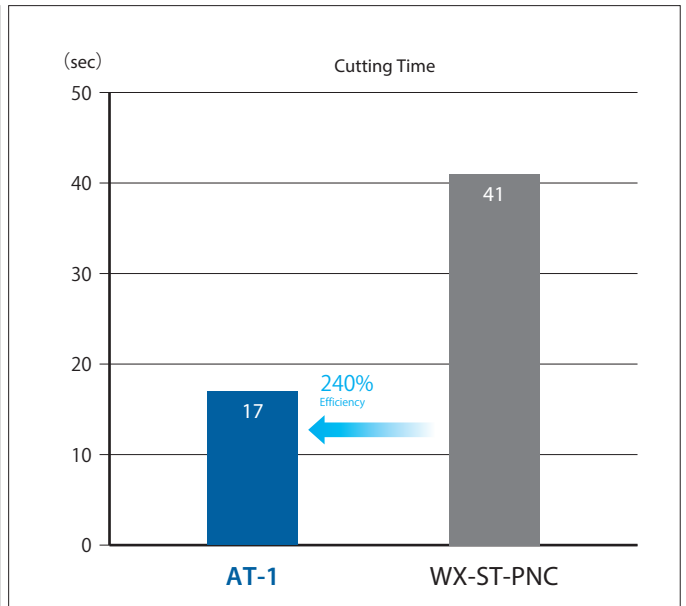
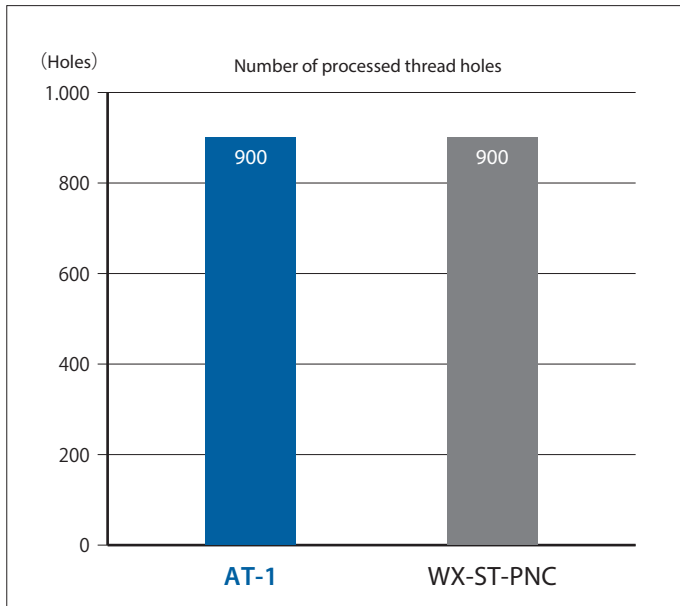
## ③ Machining SCM440

Tool	AT-1 Ø7,7x22 P1 4F	Competitor
Cutting Speed	80m/min (3.307min <sup>-1</sup> )	140m/min (5.122min <sup>-1</sup> )
Feed	30mm/min (0,01mm/t)	200mm/min (0,1mm/t)
Number of Passes	1-Pass	4-Passes
Cutting Time	17,12 sec	60,54 sec



## SUS304 durability test result

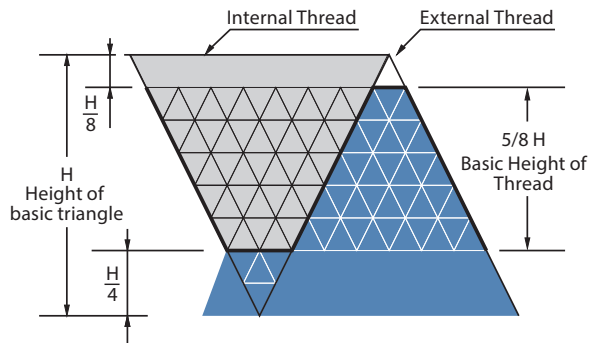
Tool	AT-1 Ø9,7×27 P1,5 5F	WX-ST-PNC Ø9,5×22,5 P1,5
Work Material	SUS304	
Cutting Speed	100m/min (3.283min <sup>-1</sup> )	120m/min (4.021min <sup>-1</sup> )
Feed	12,5mm/min (0,01mm/t)	42mm/min (0,01mm/t)
Internal Thread Size	M12 x 1,5	
Drill Hole Size	Ø10,5 × 25 mm (Through)	
Threading Length	22,5 mm	
Coolant	Water-Soluble	
Machine	Vertical Machining Center	
Number of Passes	1-Pass	2-Passes



# Q&A FAQ ABOUT THREAD MILLING

## Why internal thread cutting tools cannot be used to cut external threads?

Metric and unified threads have different thread profiles between internal and external threads. For these threads, internal thread cutting tools cannot be used to cut external threads because in their basic thread profiles, the crest and root shapes are not uniform. However, for pipe threads, which have uniform crests and roots, thread cutting tools can be shared for internal and external thread cutting.



Compare the shapes of internal and external threads.

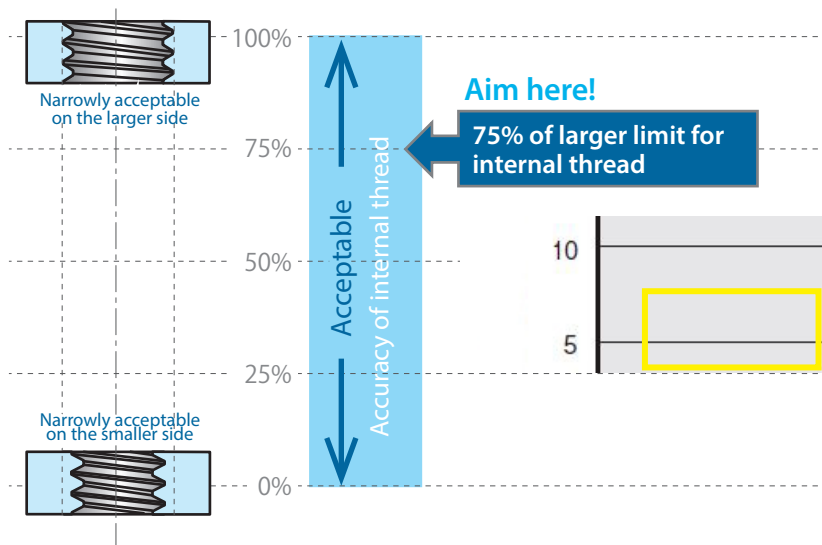
?	1/8 H	1/4 H
Height cut off from crest:	External Thread	Internal Thread
?	1/4 H	1/8 H
Height cut off at root:	External Thread	Internal Thread

Both threads have the same basic height of thread (5/8H). However, their shapes are different from each other.

Example of basic thread profile (metric thread)

## What does the number "75" under "Fit %" mean, which is displayed on the data entry screen of ThreadPro?

It means to aim at the acceptable range of threads. Default values are 75% (larger side) for internal threads and 25% (smaller side) for external threads in light of their engagement. You can change these to your desired values.



## Is ThreadPro compatible with NC programs developed for custom-made thread mills ?

Yes, please consult our sales representatives.

# CUTTING CONDITIONS

Threading | Thread milling | Cutting conditions

## AT-1

Work Material		Vc (m/min)	F (mm/tooth)
Low Tensile Strength Steel	C~0,25%	80~160	0,01~0,05
Medium Tensile Strength Steel	C~0,25% ~ 0,45%	80~160	0,01~0,05
High Tensile Strength Steel	C0,45%~	80~160	0,01~0,05
Alloy Steel	SCM	60~120	0,01~0,05
Hardened Steel	25~45 HRC	80~200	0,01~0,05
	45~55 HRC	-	-
	50~60 HRC	-	-
Stainless Steel	SUS	60~120	0,01~0,05
Tool Steel	SKD	-	-
Cast Steel	SC	60~120	0,01~0,05
Cast Iron	FC	80~160	0,01~0,05
Ductile Cast Iron	FCD	60~120	0,01~0,05
Copper	Cu	80~160	0,03~0,1
Brass	Bs	80~160	0,03~0,1
Brass Casting	BsC	80~160	0,03~0,1
Bronze	PB	80~160	0,03~0,1
Aluminium Rolled Steel	AL	80~160	0,03~0,1
Aluminium Alloy Casting	AC, ADC	100~300	0,05~0,2
Magnesium Alloy Casting	MC	100~300	0,05~0,2
Zinc Alloy Casting	ZDC	100~300	0,05~0,2
Titanium Alloys	Ti-6AL-4V	-	-
Nickel Alloys	Inconel®	-	-
Thermosetting plastic	-	80~160	0,03~0,1
Thermoplastic	-	80~160	0,03~0,1

1. The indicated speeds and feeds are for water-soluble oil.
2. Water-soluble oil is not suitable for tapping magnesium alloy.
3. Please adjust the cutting conditions depending on the rigidity of machine, tool holders, and workpiece clamping.
4. If the tapping length is long, or when machining a large-pitch thread, select a smaller feed rate and separate the machining process into a few segments.
5. If a machined parallel internal thread is tapered and prevents the go-gauge from going through, add a zero cut (finish machining).

## Formula for calculating the feed rate of thread mill

$$V_f = \frac{f \times z \times n \times (D_m \pm D_c)}{D_m} \text{ (mm/min)}$$

$v_f$	Feed (mm/min)	$z$	Number of Flutes
$D_m$	Actual Dia. (mm)	$f$	Feed (mm/t)
$D_c$	Tool Dia. (mm)	$n$	Speed (min <sup>-1</sup> )

Note Internal: – External: +

For the arc cutting process of machining external and internal threads, the feed rate at the tool center can be obtained by multiplying the linear cut feed rate with a coefficient. The formulas for calculating coefficients vary between external and internal thread cutting. The formula listed left are for calculating the tool feed rate during arc-cutting, including calculating the coefficients to be used for multiplication with the linear-cut feed rate.



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*shaping your dreams*

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