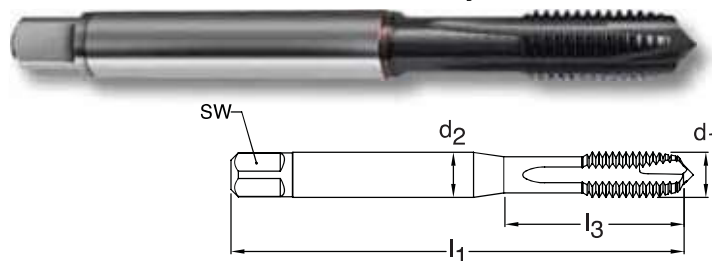


METRIC FINE *Ti / Ti Alloys*



Series	2903
Standard	DIN 371
Tool Material	HSS-E PM
Spiral Point	Straight flute
Chamfer Form B • 3.5 - 5	
Class of Fit	6HX



Through holes



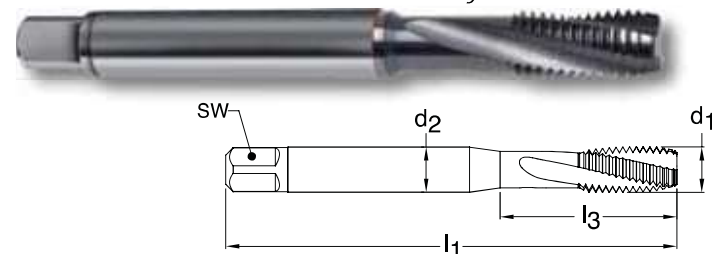
TiCN coated



External cooling

d1 - P	D Limits	Tap Drill Range mm	Number of Flutes	d2 mm	SW mm	l1 mm	l3 mm	Order Code	EDP Number	Stock
M3 X 0.35	D3/D4	2.621 - 2.721	3	3.50	2.70	56.00	18.00	3.002	9029030030020	●
M4 X 0.50	D4/D5	3.459 - 3.599	3	4.50	3.40	63.00	21.00	4.003	9029030040030	●
M5 X 0.50	D4/D5	4.459 - 4.599	3	6.00	4.90	70.00	25.00	5.003	9029030050030	○
M6 X 0.50	D4/D5	5.460 - 5.600	3	6.00	4.90	80.00	30.00	6.003	9029030060030	●
M6 X 0.75	D4/D5	5.188 - 5.378	3	6.00	4.90	80.00	30.00	6.004	9029030060040	●
M8 X 0.75	D4/D5	7.188 - 7.378	4	8.00	6.20	80.00	30.00	8.004	9029030080040	●
M8 X 1.00	D5/D6	6.917 - 7.153	4	8.00	6.20	90.00	35.00	8.005	9029030080050	○
M10 X 1.00	D5/D6	8.917 - 9.153	4	10.00	8.00	90.00	35.00	10.005	9029030100050	○

METRIC FINE *Ti / Ti Alloys*



Series	2910
Standard	DIN 371
Tool Material	HSS-E PM
Spiral Flute	15° Helix
Chamfer Form C • 2-3	
Class of Fit	6HX



Blind holes



TiCN coated



External cooling

d1 - P	D Limits	Tap Drill Range mm	Number of Flutes	d2 mm	SW mm	l1 mm	l3 mm	Order Code	EDP Number	Stock
M3 X 0.35	D3/D4	2.621 - 2.721	3	3.50	2.70	56.00	18.00	3.002	9029100030020	○
M4 X 0.50	D4/D5	3.459 - 3.599	3	4.50	3.40	63.00	21.00	4.003	9029100040030	○
M5 X 0.50	D4/D5	4.459 - 4.599	3	6.00	4.90	70.00	25.00	5.003	9029100050030	○
M6 X 0.50	D4/D5	5.460 - 5.600	3	6.00	4.90	80.00	30.00	6.003	9029100060030	○
M6 X 0.75	D4/D5	5.188 - 5.378	3	6.00	4.90	80.00	30.00	6.004	9029100060040	○
M8 X 0.75	D4/D5	7.188 - 7.378	3	8.00	6.20	80.00	30.00	8.004	9029100080040	○
M8 X 1.00	D5/D6	6.917 - 7.153	3	8.00	6.20	90.00	35.00	8.005	9029100080050	○
M10 X 1.00	D5/D6	8.917 - 9.153	3	10.00	8.00	90.00	35.00	10.005	9029100100050	○

Technical Information

Cutting rate recommendations for **CUT** taps

Material group		Approximate Rc	Approximate HB	Recommended SFM					
				HSS-E		HSS-E-PM		Solid carbide	
				bright finish	hard coated	bright finish	hard coated	bright finish	hard coated
	Structural steels, free-cutting steels		<180	30-50	40-70	50-70	55-95	-	-
	Unalloyed case hardened steels	<20	<230	20-40	30-70	40-65	40-80	-	-
	Unalloyed heat-treatable steels	<25	<250	15-35	25-50	30-60	35-75	-	-
	Structural steels, free-cutting steels	<20	<230	40-50	40-75	40-65	40-80	-	-
	Case hardened steels, heat-treatable steels	<25	<250	30-45	30-65	30-60	35-75	-	-
	Nitriding steels, spheroidal graphite iron	<30	<280	20-30	30-55	30-50	35-65	-	-
		<35	<320	15-25	20-35	25-45	30-60	-	-
		<38	<380	10-25	20-40	20-45	30-55	-	-
	Stainless- and acid-resistant steels, sulphured		<180	25-35	40-55	30-55	35-70	-	-
	austenitic	<25	<250	20-30	30-40	30-50	35-60	-	-
	martensitic	<30	<280	20-30	25-40	25-45	30-50	-	-
		<35	<320	10-20	20-30	20-35	25-50	-	-
	Alloyed case hardened steels	<25	<250	10-20	30-40	30-50	35-70	-	-
	Alloyed heat-treatable steels	<30	<280	25-35	30-50	25-45	35-65	-	-
	Alloyed tool steels	<35	<320	15-30	20-40	20-45	30-60	-	-
	High speed tool steels	<38	<380	8-15	10-30	15-35	25-55	-	-
		<44	<415	-	-	4-10	8-15	4-8	8-16
		<60		-	-	-	4-10	3-6	6-12
	Cast iron		<180	50-70	60-90	55-85	65-110	70-100	80-130
	Spheroidal graphite iron	<25	<250	30-50	45-85	40-70	60-100	70-100	80-130
	Malleable cast iron	<35	<320	15-35	20-40	25-45	35-55	60-110	70-120
	Aluminum and Al-alloys	SILICON CONTENT	WROUGHT ALUMINUM						
		< 6%	n/a	30-50	50-75	50-70	65-80	80-140	90-165
	Al cast alloys	6-10%	n/a	25-35	40-50	40-65	65-80	80-140	90-165
		>10%	n/a	-	25-35	40-65	65-80	60-130	80-140
	Al wrought alloys	n/a	30-80	50-65	65-100	-	-	-	-
		n/a	75-150	35-60	50-65	-	-	-	-
	Titanium and Ti-alloys		140-275	-	-	12-25	20-30	-	-
			300-380	-	-	6-12	10-18	-	-
	Nickel and Ni-alloys		200-300	-	-	6-12	10-18	-	-
			>300	-	-	3-6	6-12	-	-
	Plastics			15-30	-	20-40	-	30-60	-
	Magnesium-alloys			90-140	-	-	-	110-180	-
	Brass, short-chipping			30-45	-	45-60	-	80-100	-
	long-chipping			30-45	-	45-60	-	80-100	-

Technical Information

Tapping Formulas and Calculations

RPM for UNC/UNF Taps

$$\text{RPM} = (\text{revolution / minute}) = \frac{\text{cutting speed (SFM)} \times 3.82}{\text{tap diameter}}$$

Feed Rate for UNC/UNF Taps

$$\text{IPR} = (\text{inch / revolution}) = \frac{1 \text{ inch}}{\text{threads per inch (TPI)}}$$

$$\text{IPM} = (\text{inch / minute}) = \frac{\text{RPM}}{\text{threads per inch (TPI)}}$$

RPM for M/MF Taps

$$\text{RPM} = (\text{revolution / minute}) = \frac{\text{cutting speed (SFM)} \times 97.028}{\text{tap diameter (mm)}}$$

Feed Rate for M/MF Taps

$$\text{IPR} = (\text{inch / revolution}) = \text{pitch (mm)} \times 0.03937$$

$$\text{IPM} = (\text{inch / minute}) = \text{RPM} \times \text{pitch (mm)} \times 0.03937$$

To calculate Tap Drill Size

UNC/UNF and M/MF Cut Taps – General Requirements

$$\text{Tap Drill Size} = \text{Tap basic major diameter} - \text{pitch}$$

UNC/UNF Cut Taps – Special Percentage of Thread Requirements

$$\text{Drill Size} = \text{Basic major diameter} - \frac{0.01299 \times \text{desired percentage of thread}^*}{\text{threads per inch (TPI)}}$$

M/MF Cut Taps – Special Percentage of Thread Requirements

$$\text{Drill Size (mm)} = \text{Basic major diameter} - \frac{\text{desired percentage of thread}^* \times \text{pitch (mm)}}{76.98}$$

UNC/UNF and M/MF Form Taps – General Requirements

$$\text{Tap Drill Size} = \text{Basic major diameter} - \frac{\text{pitch}}{2}$$

UNC/UNF Form Taps – Special Percentage of Thread Requirements

$$\text{Drill Size} = \text{Basic major diameter} - \frac{0.0068 \times \text{desired percentage of thread}^*}{\text{threads per inch (TPI)}}$$

M/MF Form Taps – Special Percentage of Thread Requirements

$$\text{Drill Size (mm)} = \text{Basic major diameter} - \frac{\text{desired percentage of thread}^* \times \text{pitch (mm)}}{147.06}$$

* Actual percentage will vary from desired percentage due to runout of drilling operation.

Technical Information

Troubleshooting - Application problems with new taps

Problem

Possible causes

Solution

1 Thread produced is too large



- incorrect tap, tap geometry not suitable for the application
- tapping size hole too small
- alignment error of tapping size hole or position
- machine spindle axially restricted
- cold welding at the flank of the tap
- lead of tap unsatisfactory due to insufficient thread depth
- cutting speed too high
- insufficient lubrication or coolant supply
- tolerance specification on tap does not correspond to specifications on drawing and/or thread gauge

- apply correct tap for the material to be machined
- observe tapping size hole table in the technical section. Note different tapping size hole diameters for fluteless taps.
- - check for correct tool clamping
- - apply floating tap holder
- - check core drill
- - use mechanical feed
- - apply tension/compression tap chuck
- - apply new tap
- - apply coated tap
- - optimize lubrication
- - tap with forced feed
- - apply tap with modified lead
- - reduce cutting speed
- - improve lubrication
- ensure sufficient and suitable coolant supply and check concentration
- apply correct tap for required tolerances

2 Thread axially miscut



- spiral-fluted taps, corresponding to our design, are applied with too much pressure for initial tapping
- initial tapping pressure too low for taps with spiral point corresponding to our form "B"

- with spiral-fluted taps only light pressure required for initial tapping. The tap should immediately be applied within the tension/compression range
- taps with spiral point or left hand spiral require higher axial pressure. Ensure tap operates within the tension/compression range

3 Thread produced is too small



- tolerance specification on tap does not correspond to specifications on drawing and/or thread gauge
- incorrect tap
- tap does not cut accurately (thread plug gauge)
- machine spindle is axially too rigid

- apply correct tap for required tolerance
- apply correct tap for the material to be machined
- avoid strong axial forces during the cutting process
- apply tension/compression chuck

Troubleshooting - Application problems with new taps

Problem

Possible causes

Solution

4 Thread surface not according to requirements



- cutting edge geometry not suitable for the application
- cutting speed too high
- insufficient coolant (concentration and supply)
- chip congestion
- tapping size hole too small
- with tough, hard materials loading on tool too much or pitch too steep
- built-up edge
- cold welding

- apply "correct" tap for the material to be machined
- - reduce cutting speed
- - optimize lubrication
- ensure suitable coolant and sufficient volume
- apply suitable tap type
- observe tapping size hole diameter specifications to DIN 336 or respective standards. Observe table for fluteless taps
- apply hand tap sets
- apply coated tap
- improve coolant supply

5 Tool life insufficient

- surface hardening of tapping size hole
- reasons listed under: "thread surface not according to requirements"
- chip congestion

- - check drill (cutting edge) for wear
- - heat or surface treatment following thread production
- reasons listed under: thread surface "not according to requirements"
- apply correct tap

6 Tool breakage during advance or return



- tapping size hole too small
- teeth of chamfer lead overloaded
- tap hits bottom of tapping size hole
- - lack of or incorrect chamfer of tapping size hole
- - position or angle error of tapping size hole
- - tool hardness not suitable for the application
- - cutting edge geometry not suitable for the application

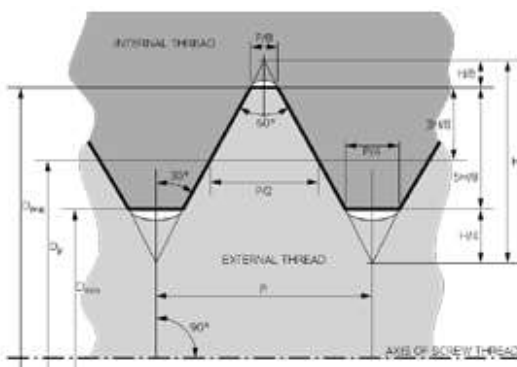
- observe tapping size hole dia. acc. to DIN 336 or respective standards
- - longer chamfer lead (blind or through hole)
- - increase no. of teeth of chamfer lead by increasing no. of flutes
- - apply tap sets
- - check hole depth
- - apply tension/compression tap chuck
- - correct chamfer angle of tapping size hole
- - ensure correct tool clamping
- - apply floating tap holder
- - check core drill
- apply suitable tap for the individual application

TI / NI CUT TAPS

Titanium and Ti-alloys
Nickel and Ni-alloys

Material group	Approximate Rc	Approximate HB	Recommended SFM					
			HSS-E		HSS-E-PM		Solid carbide	
			bright finish	hard coated	bright finish	hard coated	bright finish	hard coated
Titanium and Ti-alloys	—	140-275	—	—	—	20-30	—	—
	—	300-380	—	—	—	10-18	—	—
Nickel and Ni-alloys	—	200-300	—	—	—	10-18	—	—
	—	>300	—	—	—	6-12	—	—

If you have customers who are suppliers to the aerospace or military Industries, you will encounter “J” or “Controlled root radius” thread requirements.



The differences between these and UNC or UNF threads are as follows:

The external thread is manufactured with radii in the root of the thread for added strength, and to extend the integrity of the threading tool.

The internal thread is manufactured to 3B class of fit tolerancing for the pitch diameter, and will need to use a larger drill for the minor diameter to accommodate the root radius in the bolt.

ANY UN-3B tap will produce a legitimate “UNJ” internal thread.