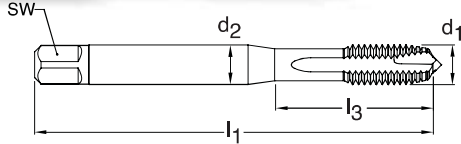


UNF



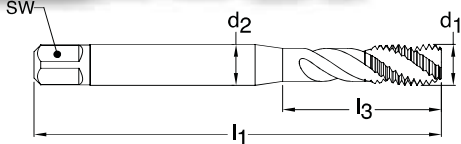
Series 3947
Standard ANSI
Tool Material HSS-E (Cobalt)
Spiral Point Straight flute
Chamfer Form B • 3.5 - 5
Class of Fit 2B



Through holes **TiCN coated** **External cooling**

d1 - P	H Limits	Tap Drill Range inch	Number of Flutes	d2 inch	SW inch	l1 inch	l3 inch	Order Code	EDP Number	Stock
2-64	H2/H3	0.069 - 0.075	3	0.141	0.110	1.752	0.441	2.184	9039470021840	●
3-56	H2/H3	0.080 - 0.086	3	0.141	0.110	1.811	0.500	2.515	9039470025150	●
4-48	H2/H3	0.089 - 0.097	3	0.141	0.110	1.882	0.709	2.845	9039470028450	●
5-44	H2/H3	0.100 - 0.108	3	0.141	0.110	1.941	0.709	3.175	9039470031750	●
6-40	H2/H3	0.111 - 0.119	3	0.141	0.110	2.000	0.748	3.505	9039470035050	●
8-36	H2/H3	0.134 - 0.142	3	0.168	0.131	2.130	0.827	4.166	9039470041660	●
10-32	H3/H4	0.156 - 0.164	3	0.194	0.152	2.382	0.945	4.826	9039470048260	●
12-28	H3/H4	0.177 - 0.186	3	0.220	0.165	2.382	1.024	5.486	9039470054860	●
1/4-28	H3/H4	0.211 - 0.220	3	0.255	0.191	2.500	1.181	6.350	9039470063500	●
5/16-24	H3/H4	0.267 - 0.277	3	0.318	0.238	2.721	1.377	7.938	9039470079380	●
3/8-24	H3/H4	0.330 - 0.340	3	0.381	0.286	2.941	1.456	9.525	9039470095250	●
7/16-20	H4/H5	0.383 - 0.395	3	0.323	0.242	3.161	N/A	11.113	9039470111130	●
1/2-20	H4/H5	0.446 - 0.457	4	0.367	0.275	3.382	N/A	12.700	9039470127000	●
9/16-18	H4/H5	0.502 - 0.515	4	0.429	0.322	3.591	N/A	14.288	9039470142880	●
5/8-18	H4/H5	0.565 - 0.578	4	0.480	0.360	3.811	N/A	15.875	9039470158750	●
3/4-16	H5/H6	0.682 - 0.696	4	0.590	0.442	4.252	N/A	19.050	9039470190500	●
7/8-14	H6/H7	0.798 - 0.813	4	0.697	0.523	4.689	N/A	22.225	9039470222250	●
1-12	H6/H7	0.910 - 0.928	4	0.800	0.600	5.130	N/A	25.400	9039470254000	●
1 1/8- 12	H6/H7	1.035 - 1.053	4	0.896	0.672	5.441	N/A	28.575	9039470285750	●
1 1/4-12	H7/H8	1.160 - 1.178	4	1.021	0.766	5.748	N/A	31.750	9039470317500	●
1 3/8- 12	H7/H8	1.285 - 1.303	6	1.108	0.831	6.063	N/A	34.925	9039470349250	●
1 1/2-12	H7/H8	1.410 - 1.428	6	1.233	0.925	6.378	N/A	38.100	9039470381000	●

UNF



Series 3950
Standard ANSI
Tool Material HSS-E (Cobalt)
Spiral Flute 40° Helix
Chamfer Form C • 2-3
Class of Fit 2B



Blind holes **TiCN coated** **External cooling**

d1 - P	H Limits	Tap Drill Range inch	Number of Flutes	d2 inch	SW inch	l1 inch	l3 inch	Order Code	EDP Number	Stock
2-64	H2/H3	0.069 - 0.075	3	0.141	0.110	1.752	0.441	2.184	9039500021840	●
3-56	H2/H3	0.080 - 0.086	3	0.141	0.110	1.811	0.500	2.515	9039500025150	●
4-48	H2/H3	0.089 - 0.097	3	0.141	0.110	1.882	0.709	2.845	9039500028450	●
5-44	H2/H3	0.100 - 0.108	3	0.141	0.110	1.941	0.709	3.175	9039500031750	●
6-40	H2/H3	0.111 - 0.119	3	0.141	0.110	2.000	0.748	3.505	9039500035050	●
8-36	H2/H3	0.134 - 0.142	3	0.168	0.131	2.130	0.827	4.166	9039500041660	●
10-32	H3/H4	0.156 - 0.164	3	0.194	0.152	2.382	0.945	4.826	9039500048260	●
12-28	H3/H4	0.177 - 0.186	3	0.220	0.165	2.382	1.024	5.486	9039500054860	●
1/4-28	H3/H4	0.211 - 0.220	3	0.255	0.191	2.500	1.181	6.350	9039500063500	●
5/16-24	H3/H4	0.267 - 0.277	3	0.318	0.238	2.721	1.377	7.938	9039500079380	●
3/8-24	H3/H4	0.330 - 0.340	3	0.381	0.286	2.941	1.456	9.525	9039500095250	●
7/16-20	H4/H5	0.383 - 0.395	3	0.323	0.242	3.161	N/A	11.113	9039500111130	●
1/2-20	H4/H5	0.446 - 0.457	3	0.367	0.275	3.382	N/A	12.700	9039500127000	●
9/16-18	H4/H5	0.502 - 0.515	3	0.429	0.322	3.591	N/A	14.288	9039500142880	●
5/8-18	H4/H5	0.565 - 0.578	4	0.480	0.360	3.811	N/A	15.875	9039500158750	●
3/4-16	H5/H6	0.682 - 0.696	4	0.590	0.442	4.252	N/A	19.050	9039500190500	●
7/8-14	H6/H7	0.798 - 0.813	4	0.697	0.523	4.689	N/A	22.225	9039500222250	●
1-12	H6/H7	0.910 - 0.928	4	0.800	0.600	5.130	N/A	25.400	9039500254000	●
1 1/8- 12	H6/H7	1.035 - 1.053	4	0.896	0.672	5.441	N/A	28.575	9039500285750	●
1 1/4-12	H6/H7	1.160 - 1.178	4	1.021	0.766	5.748	N/A	31.750	9039500317500	●
1 1/2-12	H6/H7	1.410 - 1.428	6	1.233	0.925	6.378	N/A	38.100	9039500381000	●

"Tap drill Range" given is per the Class of Fit shown per Series #
 Additional Tap Drill sizes & percent of thread engagement can be found on pages 229-237.

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 Unalloyed case hardened steels Unalloyed heat-treatable steels			<180	30-50	40-70	50-70	55-95	-	-
		<20	<230	20-40	30-70	40-65	40-80	-	-
		<25	<250	15-35	25-50	30-60	35-75	-	-
● Structural steels, free-cutting steels Case hardened steels, heat-treatable steels Nitriding steels, spheroidal graphite iron		<20	<230	40-50	40-75	40-65	40-80	-	-
		<25	<250	30-45	30-65	30-60	35-75	-	-
		<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 austenitic martensitic			<180	25-35	40-55	30-55	35-70	-	-
		<25	<250	20-30	30-40	30-50	35-60	-	-
		<30	<280	20-30	25-40	25-45	30-50	-	-
		<35	<320	10-20	20-30	20-35	25-50	-	-
● Alloyed case hardened steels Alloyed heat-treatable steels Alloyed tool steels High speed tool steels		<25	<250	10-20	30-40	30-50	35-70	-	-
		<30	<280	25-35	30-50	25-45	35-65	-	-
		<35	<320	15-30	20-40	20-45	30-60	-	-
		<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 Spheroidal graphite iron Malleable cast iron			<180	50-70	60-90	55-85	65-110	70-100	80-130
		<25	<250	30-50	45-85	40-70	60-100	70-100	80-130
		<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
		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
		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 long-chipping				30-45	-	45-60	-	80-100	-
				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

GREEN RING CUT TAPS

Structural steels,
free-cutting steels
Case hardened steels,
heat-treatable steels
Nitriding steels,
spheroidal graphite iron

Material group	Approximate Rc	Approximate HB	Recommended SFM			
			HSS-E		HSS-E-PM	
			bright finish	hard coated	bright finish	hard coated
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	10-23	20-40	20-45	30-55