STANLEY®
Engineered Fastening

OPTIA®

Spiralock® Self-Locking Threaded Solutions

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On the following pages you will find information on Spiralock product selection. If for any reason your required thread size is not listed in this catalog, please contact our offices at (800) 521-2688 or send an email to slinfo@sbdinc.com. We are able to supply and/or design nearly any thread size your application may require. For additional information on Spiralock technology, products and applications, please visit our website:
www.StanleyEngineeredFastening.com/brands/optia/spiralock

The Optia® brand of Stanley® Engineered Fastening represents engineered threaded fastening solutions for critical and custom applications. Optia products include nuts and nut assemblies, wire thread inserts, bolts, screws, studs, assemblies and special finishes, large diameter bolts, pins, critical components and high temperature fasteners, metal clips and fasteners mechanically designed to withstand vibration induced thread loosening.

The Optia portfolio is comprised of brands such as Heli-Coil®, Spiralock®, Dodge®, iForm®, Gripco®, Camcar®, Specialty Bar Products Company™, Automatic SMP®, EBC industries™, Ferry Cap™ and Tog Manufacturing®.

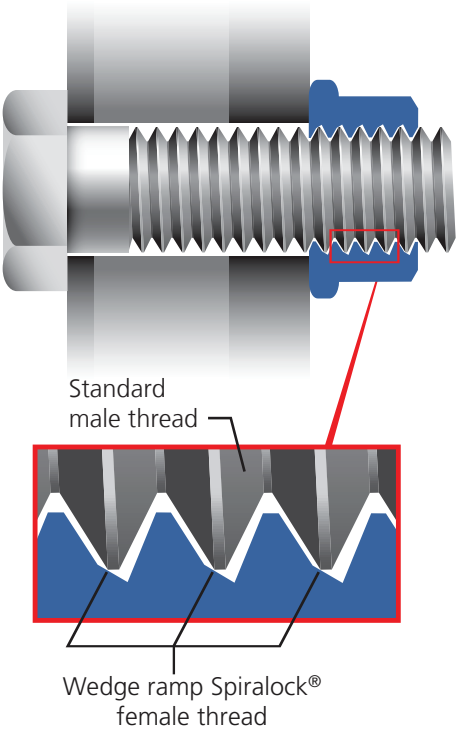
Product Introduction

For more than three decades, industry has turned to Spiralock when it needs to keep critical and demanding threaded joints from coming apart. Spiralock's unique self-locking thread technology adds a locking feature to tapped holes that prevents vibration loosening while still allowing standard external threaded parts to spin freely during assembly.

This achievement is the result of a carefully engineered wedge ramp at the root of the internal thread that only engages when the joint starts to build clamp load during tightening. At that point, the crest of the standard external threads draws tightly against the wedge ramp, eliminating all radial clearance and creating a continuous spiral line of contact between the internal and external threads.

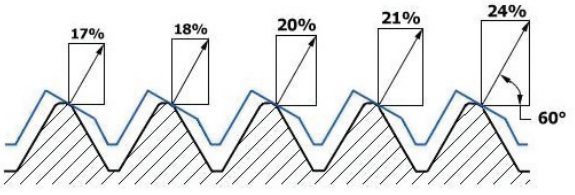
The outcome is a simple yet effective way to transform a traditional threaded joint into a safer and more reliable design element.

Spiralock offers a full line of products to serve a wide range of customer needs, including fasteners, wire thread inserts, cutting tools, and thread gages. Spiralock products solve fastening issues in a variety of applications across a wide range of industries, including aerospace/ defense, electronics, medical, automotive, truck, farm and construction, oil and gas and others.

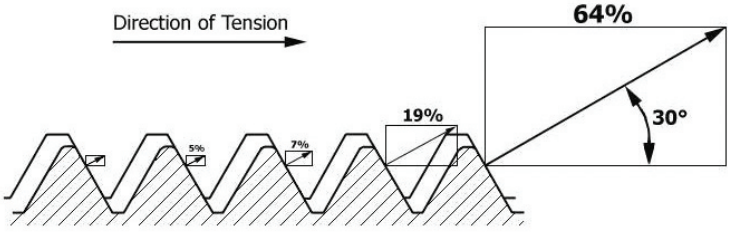


Load Distribution

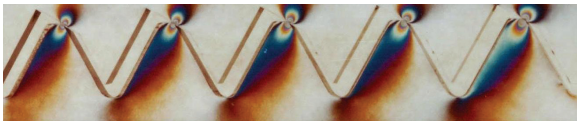
Research studies performed by Lawrence Livermore National Laboratory, Massachusetts Institute of Technology, and others have confirmed that the load carried by Spiralock threads is much more uniform than it is in standard 60° threads. Additionally, they show that the percentage of load on the first engaged thread produced with a Spiralock tap is significantly lower. The images below show two different ways to visualize the stress carried by the Spiralock threads vs standard 60° threads.

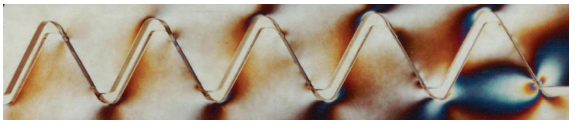


Spiralock Thread



Standard 60° Thread

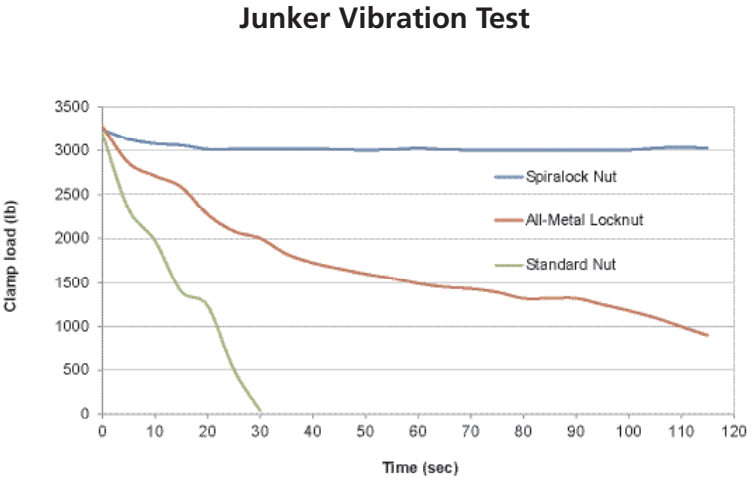




The uniform thread loading reduces the load concentration at the first engaged thread, thereby decreasing joint failures due to shearing and improving product performance. Additionally, the Spiralock thread form distributes the joint load in a radial direction, which prevents the threads from slipping even in extremely high vibration environments.

Product Introduction

Vibration Resistance



Extensive testing on Junker's transverse vibration equipment has proven that Spiralock self-locking threads outperform other thread locking devices.

Testing conducted by the Goddard Space Flight Center also determined that the Spiralock thread form was the only product able to withstand the vibrations imposed by the Space Shuttle's solid rocket boosters. Even tests that were ten times the specifications for the Space Shuttle did not loosen the Spiralock fasteners.

Test Parameters: ¼"-28 nuts run @ 12.5 Hz with ±0.033" amplitude of transverse movement

Torque/Tension Relationship

The Spiralock thread form design creates a helical line of contact between the crest of the bolt threads and its 30-degree wedge ramp. In order to generate similar joint tension as compared to 60-degree threads, the Spiralock threaded joint generally requires 10% - 20% greater torque due to the redirecting of some assembly forces from an axial direction to a radial direction.

Although higher torque is required in all Spiralock threaded joints, the increase in required torque will vary depending on the types of materials and coatings being used (nut, bolt, joint, etc.). This torque/tension relationship should be evaluated in the actual joint to determine the proper torque required to develop the specified tension.

Testing performed by the Goddard Space Flight Center has shown that Spiralock offers a consistent pattern of friction, especially when the threads are lubricated. Spiralock's more consistent friction factor directly relates to a more consistent joint tension or preload.

Why change to Spiralock threads?

- Exceptionally resistant to vibration loosening
- Eliminates need for other locking devices
- Accepts standard male fasteners
- Improves joint fatigue life
- Consistent reusability
- Eases assembly, reducing assembly time
- Reduces life cycle cost of threaded joints

Where should Spiralock be used?

- Any hard joint
- Thin gasket application

How can a threaded joint be converted to Spiralock?

- Replace standard nut or threading tool with the Spiralock thread form and eliminate the need for other thread locking devices!

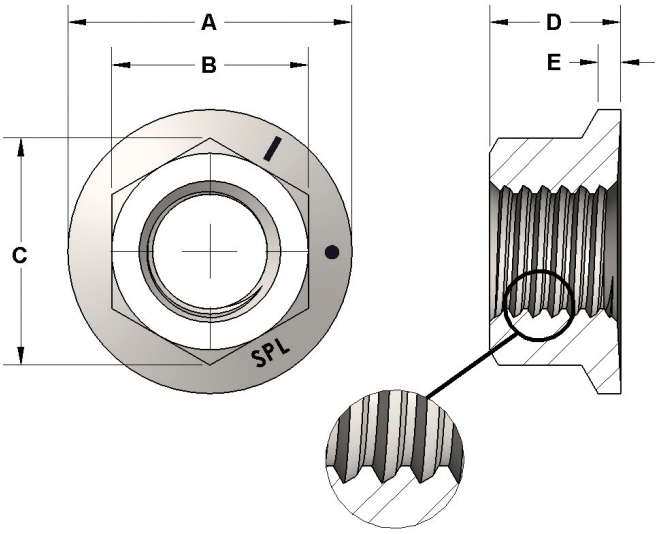
Fastener Product Offering

Products	Styles	Sizes*	Options	NAS/MS Part Number Equivalents
Nuts	Hex Hex Flange Weld Spanner T-slot Channel Extension	#2 to 4″ M2 to M100	Grade 5 or 8; Property Class 9 or 10 Stainless Steel Small Production Runs Made to standard: SAE/IFI/ASTM Nickel-base alloys Exotic materials Finish/Coating	MS21043, MS21042 (hex flange nuts)
Self-Clinching Nuts	Blind Fasteners Miniature Nuts Computer Board Flush Fasteners Standoffs	#2 to ½″ M2 to M12 Mostly made to order	Brass Steel Stainless Steel Pilot length Finish/Coating	
Wire Inserts	Tanged Drive Notch® (no tang)	#2 to 1/4″ MOQ for other sizes	1 to 3 Diameter Lengths Cadmium Silver Dry Film Lube Passivate Installation Accessories	NAS1130, NAS8846
Threaded Inserts	Pre-Molded Post-Molded Ultrasonic Key-Locking	#0 to ¼″ M1 to M12 Mostly made to order	Brass Steel Stainless Steel A286	MS51830, MS51831, MS51832 (key inserts)
Made to Order	Float Nut 12 Point Nut Captive Washer Captive Belleville Washer Potted Inserts		Please contact Spiralock for sizes and material options	MS21060, MS21072, MS21076 (float nuts) MS3376B (captive washer nuts) NAS1832-NAS1836 (potted inserts)

* Please inquire about sizes not listed above.

Fractional Hex Flange Nuts

Standard Spiralock nuts are SAE Grade 8 equivalent and are compatible with standard 2A, 3A and UNJ class of fit bolts. Spiralock nuts conform dimensionally to IFI standards. The standard plating is clear zinc chromate. Other nut styles, platings, and materials including Stainless Steel, Inconel, A26 and others are available upon request.

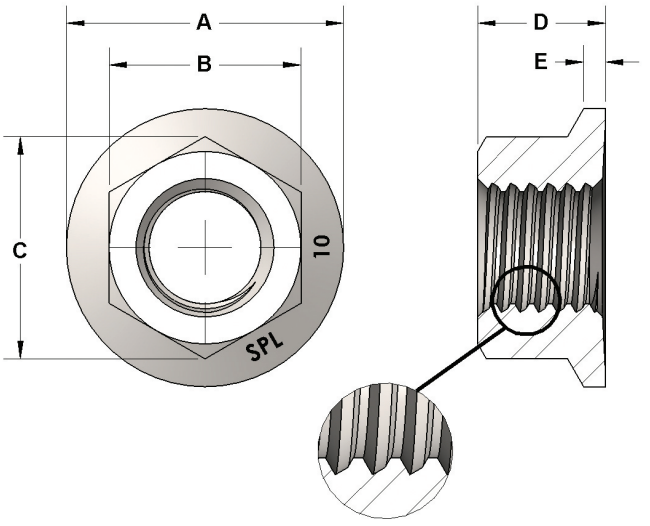


Nominal Nut Size	Part Number		A Flange Diameter	B Across Flats	C Across Corners	D Nut Thickness	E Flange Edge Thickness Min.
1/4–20	F04200M	Max.	0.594	0.438	0.505	0.236	0.040
1/4–28	F04280M	Min.	0.574	0.428	0.488	0.222	
5/16–18	F05180M	Max.	0.680	0.500	0.577	0.283	0.040
5/16–24	F05240M	Min.	0.660	0.489	0.557	0.268	
3/8–16	F06160M	Max.	0.750	0.562	0.650	0.347	0.040
3/8–24	F06240M	Min.	0.728	0.551	0.628	0.330	
7/16–14	F07140M	Max.	0.937	0.688	0.794	0.395	0.040
7/16–20	F07200M	Min.	0.910	0.675	0.768	0.375	
1/2–13	F08130M	Max.	1.031	0.750	0.866	0.458	0.050
1/2–20	F08200M	Min.	1.000	0.736	0.840	0.437	
9/16–12	F09120M	Max.	1.188	0.875	1.010	0.506	0.050
9/16–18	F09180M	Min.	1.155	0.861	0.982	0.483	
5/8–11	F10110M	Max.	1.281	0.938	1.083	0.569	0.050
5/8–18	F10180M	Min.	1.248	0.922	1.051	0.545	
3/4–10	F12100M	Max.	1.500	1.125	1.299	0.675	0.060
3/4–16	F12160M	Min.	1.460	1.088	1.240	0.627	
7/8–9	F14090M	Max.	1.750	1.312	1.515	0.788	0.070
7/8–14	F14140M	Min.	1.706	1.269	1.446	0.735	
1–8	F16080M	Max.	2.000	1.500	1.732	0.900	0.080
1–12	F16120M	Min.	1.950	1.450	1.653	0.850	

Mechanical properties per: SAE J995, Grade 8
Dimensional properties per: IFI 2014
All dimensions in inches

Metric Hex Flange Nuts

The standard Spiralock flange nuts are Property Class 10 equivalent and are compatible with standard 4g6g, 6g6h, and MJ class of fit bolts. Spiralock nuts conform dimensionally to ISO and ANSI standards. The standard plating is clear zinc chromate. Other nut styles, platings, and materials including Stainless Steel, Inconel, A26 and others are available upon request.



Nominal Nut Size	Part Number		A Flange Diameter	B Across Flats	C Across Corners	D Nut Thickness	E Flange Edge Thickness Min.
M5 x 0.8	M05080M	Max.	11.81	8.00	9.25	5.00	0.99
		Min.		7.77	8.79	4.70	
M6 x 1.0	M06100M	Max.	14.20	10.00	11.55	6.00	1.10
		Min.		9.78	11.05	5.70	
M8 x 1.00	M08100M	Max.	17.90	13.00	15.01	8.00	1.20
M8 x 1.25	M08125M	Min.		12.73	14.38	7.60	
M10 x 1.25	M10125M	Max.	21.80	15.00	17.32	10.00	1.50
M10 x 1.50	M10150M	Min.		14.73	16.64	9.60	
M12 x 1.25	M12125M	Max.	26.00	18.00	20.78	12.00	1.80
M12 x 1.75	M12175M	Min.		17.73	20.03	11.60	
M14 x 1.50	M14150M	Max.	29.90	21.00	24.25	14.00	2.10
M14 x 2.00	M14200M	Min.		20.67	23.35	13.30	
M16 x 1.50	M16150M	Max.	34.50	24.00	27.71	16.00	2.40
M16 x 2.00	M16200M	Min.		23.67	26.75	15.30	
M20 x 1.50	M20150M	Max.	42.80	30.00	34.64	20.00	3.00
M20 x 2.50	M20250M	Min.		29.16	32.95	18.90	
M24 x 2.00	M24200M	Max.	51.73	36.00	41.57	24.00	3.60
M24 x 3.00	M24300M	Min.		34.80	39.67	22.86	

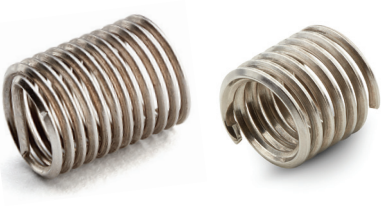
Mechanical properties per: ASTM A563M and ISO 898-2, Class 10
Dimensional properties per: ISO 4161 and ANSI B18.2.4.4M
All dimensions in millimeters

Wire Thread Inserts

Spiralock wire thread inserts are helically-coiled fastening devices that provide permanent, wear resistant screw threads in ductile materials. The inserts are designed to reinforce tapped holes and protect against failures due to stripping, seizing, corrosion, and wear. Spiralock inserts incorporate our 30° wedge ramp thread form, combining the customary advantages of wire thread inserts with the superior vibration resistance and load distribution traits unique to Spiralock.

Features and Benefits of Spiralock Wire Thread Inserts

- Threads into conventional STI (Screw Thread Insert) holes per NASM33537
- Accepts standard 2A/3A bolts (4g6g or 6g metric)
- Complies with wire requirements of NASM8846
- Similar to NASM1130 inserts per fit, form and function
- Replaces wire inserts with prevailing torque
- Reusable



Tanged **Drive Notch®**

Spiralock Wire Thread Insert Characteristics

Spiralock inserts are made of cold-rolled Grade 304 stainless steel wire (AS7245), work-hardened to a tensile strength above 200,000 psi, having a hardness of Rockwell C 43-50. The finished surface (8-16 micro inches) is exceedingly smooth, virtually eliminating friction-induced thread erosion.

The resilient characteristics of each coil in the Spiralock insert allows it to adjust independently to secure the maximum surface contact with individual threads in the parent material. As a result, loads are distributed more evenly. During assembly, each coil can flex independently to contact the greatest amount of parent material thread surface. Once installed, the outward spring-like force of the coils holds the insert into place. As a bolt is screwed into the insert and torque is applied, the crests of the bolt push radially outward on the 30° ramp of the insert's Spiralock thread form. The insert then transfers the energy outward into the parent material, thereby locking the insert into the material.

Selecting the proper insert length balances the bolt tensile strength against the shear strength of the parent material. The lengths are multiples of the nominal thread size, or diameter (Dia.), of the insert. Using the specified insert length from the tables below will produce a thread system strong enough to fracture a bolt before it will strip or damage either the parent material or the insert.

Recommended Insert Lengths, Expressed in Diameters

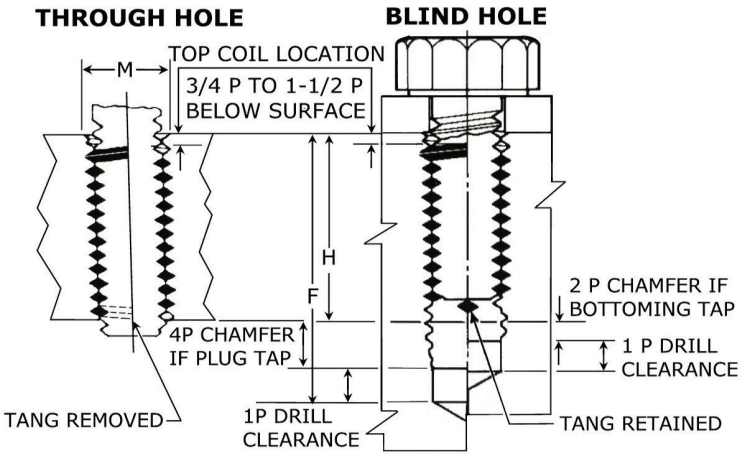
Unified Sizes

Parent Material: Shear Strength, ksi	Bolt Material: Minimum Ultimate Tensile Strength, ksi								
	54	**75**	**96**	**108**	**125**	**132**	**160**	**180**	**220**
10	2	2-1/2	3	-	-	-	-	-	-
15	1-1/2	1-1/2	2	2-1/2	2-1/2	3	3	-	-
20	1	1-1/2	1-1/2	2	2	2	2-1/2	3	3
25	1	1	1-1/2	1-1/2	1-1/2	2	2	2-1/2	2-1/2
30	1	1	1	1-1/2	1-1/2	1-1/2	2	2	2-1/2
40	1	1	1	1	1	1-1/2	1-1/2	1-1/2	2
50	1	1	1	1	1	1	1	1-1/2	1-1/2

Metric Sizes

Parent Material: Shear Strength, MPa	Bolt Material: Minimum Ultimate Tensile Strength, MPa							
	300	**400**	**500**	**600**	**800**	**1000**	**1200**	**1400**
70	1-1/2	2	2-1/2	2-1/2	-	-	-	-
100	1	1-1/2	1-1/2	2	2-1/2	3	-	-
150	1	1	1-1/2	2	2	2	2-1/2	3
200	1	1	1	1	1-1/2	1-1/2	2	2-1/2
250	1	1	1	1	1	1-1/2	1-1/2	2
300	1	1	1	1	1	1-1/2	1-1/2	1-1/2
350	1	1	1	1	1	1	1-1/2	1-1/2

Wire Thread Insert Hole Drilling Specifications

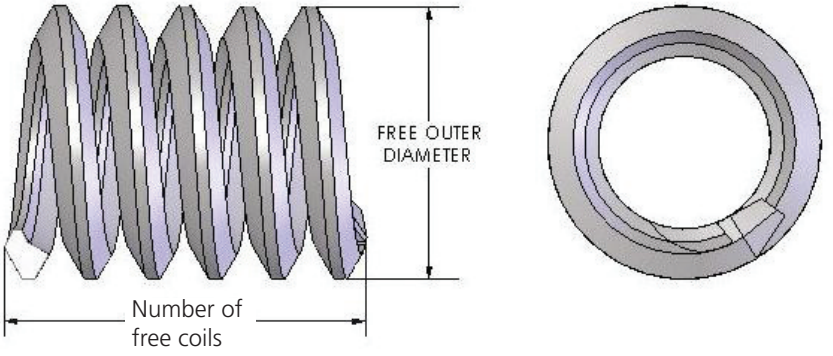


Nominal Thread Size**	Minor Diameter (after tapping)			Suggested Drill Size*		Countersink Diameter		Pitch Diameter		
	Min. all Classes	Max Class 3B	Max Class 2B	Alumi-num	Steel, Plastic, Magne-sium	Min.	Max.	Min.	3B Max	2B Max
Unified										
#2-56	0.0899	0.0961	0.0961	3/32 (.0938)	#41 (.0960)	0.09	0.11	0.0976	0.0989	0.0996
#4-40	0.1175	0.1252	0.1252	#31 (.1200)	#31 (.1200)	0.14	0.17	0.1283	0.1299	0.1306
#6-32	0.1448	0.1527	0.1527	#26 (.1470)	#25 (.1495)	0.18	0.21	0.1583	0.1601	0.1611
#8-32	0.1708	0.1781	0.1781	#17 (.1730)	#16 (.1770)	0.20	0.23	0.1843	0.1862	0.1872
#10-32	0.1968	0.2041	0.2041	#7 (.2010)	13/64 (.2031)	0.23	0.26	0.2103	0.2123	0.2133
¼-20	0.2608	0.2704	0.2723	H (.2660)	H (.2660)	0.31	0.34	0.2825	0.2851	0.2863
¼-28	0.2577	0.2646	0.2661	G (.2610)	6.7mm (.2638)	0.29	0.32	0.2732	0.2754	0.2765

** Standard drill size drills are suggested even though some sizes vary slightly from minor diameter specifications in NASM33537*

***** Sizes not listed above are available on made-to-order basis***

Wire Thread Insert Dimensions



Nominal Thread Size**	Nominal Length*					Number of free Coils				
	1 Dia.	1.5 Dia.	2 Dia.	2.5 Dia.	3 Dia.	1 Dia.	1.5 Dia.	2 Dia.	2.5 Dia.	3 Dia.
Unified										
#2-56	0.086	0.129	0.172	0.215	0.258	3	5-1/4	7-3/8	9-5/8	11-7/8
#4-40	0.112	0.168	0.224	0.280	0.336	2-3/4	4-3/4	6-3/4	8-7/8	10-7/8
#6-32	0.138	0.207	0.276	0.345	0.414	2-3/4	4-3/4	6-7/8	8-7/8	10-7/8
#8-32	0.164	0.246	0.328	0.410	0.492	3-1/2	6	8-3/8	10-3/4	13-1/4
#10-32	0.190	0.285	0.380	0.475	0.570	4-1/8	6-7/8	9-1/2	12-1/4	14-7/8
1/4-20	0.250	0.375	0.500	0.625	0.750	3-3/8	5-3/4	8	10-3/8	12-3/4
1/4-28	0.250	0.375	0.500	0.625	0.750	5	8-1/4	11-3/8	14-1/2	17-5/8

** Nominal length is a calculated number and cannot be measured in the free state. It is the actual installed length plus ½ pitch*

***** Sizes not listed above are available on made-to-order basis.***

Wire Thread Insert Part Numbers

Ordering Code: SPL part number **+ Insert Type**

Tanged styles uses no suffix
Drive Notch specified with 'DN'

+ Finish

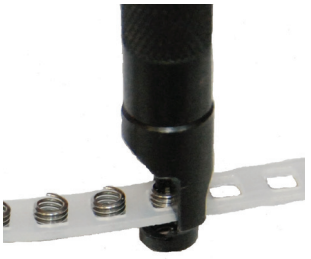
-301 › Cadmium (QQ-P-416, Type II)
-310 › Silver* (AMS 2410)
-337 › Passivate (ASTM A967)
-352 › Dry Film Lube (AS5272, Type I)

Example: **SPL96070DN352** is a #6-32 x 1 Dia. length Drive Notch style insert with dry film lubricant coating

Size*	1 Dia.	1.5 Dia.	2 Dia.	2.5 Dia.	3 Dia.
#2-56	SPL96010	SPL96011	SPL96012	SPL96013	SPL96014
#4-40	SPL96020	SPL96021	SPL96022	SPL96023	SPL96024
#6-32	SPL96070	SPL96071	SPL96072	SPL96073	SPL96074
#8-32	SPL96000	SPL96001	SPL96002	SPL96003	SPL96004
#10-32	SPL96100	SPL96101	SPL96102	SPL96103	SPL96104
1/4-20	SPL96150	SPL96151	SPL96152	SPL96153	SPL96154
1/4-28	SPL96200	SPL96201	SPL96202	SPL96203	SPL96204

Drive Notch inserts typically come on a strip to provide orientation
Tanged inserts are only available in bulk packaging
Silver plating is not available for #2-56 inserts

**** Sizes not listed above are available on made-to-order basis.***



ADVANTAGES OF SPIRALOCK DRIVE NOTCH (DN™) INSERTS

- Speeds installation and reduces labor costs due to elimination of breaking off tangs, retrieval, and accounting for them
- Eliminates the potential of foreign object damage (FOD-free design) or short-circuiting of electronics by loose tangs
- Prevents harm to expensive castings by invasive tang removal techniques
- Eliminates messy and environmentally unfriendly chemicals or adhesives

STI Hole Preparation

Engineering Data

Conventional machining methods are used for Spiralock assemblies.
The process is simple… 1. Drill 2. Countersink 3. Tap 4. Gage

1. Drilling

The suggested drill sizes listed for aluminum on p. 9 are within the minor diameter limits specified in NASM33537 or MA1567. Drill sizes listed for steel, magnesium and plastic are larger (in most cases) allowing for parent material "close-in" in soft materials and increased tap wear life in hard materials. The drill depths listed in this table allow for tap end clearance, maximum insert "set-down", countersink, and the chamfer on the tap. These drill depths are minimum and should be increased where possible, especially when using Spiral Pointed Taps, to allow for chip clearance. The formula for the drill depth may be found in NASM33537.

2. Countersinking

Countersinking the drilled hole is recommended to prevent a feather edge at the top of the tapped hole and to help guide the insert into the tapped threads. A 120° included angle countersink is necessary to ensure that the angle of the tapped thread and the countersink are the same (120° ÷ 2 = 60° tapped thread).

3. Tapping

The dimensions for the depth of the full tapped thread found in NASM33537 are MINIMUM for blind holes with countersinks. For through holes without a countersink the minimum full tapped thread depth must be equal to the insert nominal length (p.10).

Heli-Coil® 2B class taps are recommended for use with Spiralock wire thread inserts. Spiralock offers the specific tooling below. Please see the Heli-Coil® catalog or website for product offerings. Examples of Heli-Coil® STI taps include:

a. Straight, Flute, Plug & Bottoming style which are used for hand and short run production.

b. Spiral Point Plug taps (chips are pushed forward) are used for through holes and blind hole with ample chip clearance at the bottom.

c. High Spiral Flute Bottoming taps (chips are pulled out of the hole) are used for deep or blind holes in soft stringy materials and holes with minimal chip clearance.

d. Roughing taps (7/16-1") are available for materials difficult to tap to reduce the load and wear on the finishing tap.

If it is necessary to decrease the Minimum Depth of the drilled and tapped hole, one or more of the following steps may be helpful:

Action	Amount of Reduction
Remove the male center on plug taps 5/16, M8 & under	one half of the bolt diameter
Use a bottoming tap	2 pitches
Eliminate the countersink	1/2 pitch
Reduce insert "set-down" to 1/4-1/2 pitch	up to 1/2 pitch

4. Gaging

Spiralock thread plug gages are the preferred gages for checking the tapped holes before installation of the Spiralock inserts. Please reference the Spiralock catalog for gage part numbers and further gaging data.

Preparing Process Sheets

A sample process sheet for preparing a tapped hole for Spiralock inserts is shown below. Highlighted are references to the various dimensional data and part number specifications listed in the tables on pages listed. Insert installation and tang break off are covered in subsequent pages.

Hole preparation for #4-40, Spiralock Insert, .168" long, Part No. SPL96021DN352
Blind Hole, Class 2B, tapped with a bottoming tap in aluminum

Sequence	Operation Description	Tool or Gage
1	Drill hole .1175/.1252" diameter to minimum depth	#31 drill (.1200),
2	Countersink 120°±5° to .14/.17" diameter	120° countersink
3	Tap #4-40 (.112"-40) UNC-2B STI Thread Depth .200"	Spiralock tap 6905-04
4	Remove chips	Air Nozzle
5	Gage according to your sampling plan	Spiralock gage 1442-04
6	Install SPL96021DN352 insert 3/4 to 1-1/2 pitch below surface	Installation Tool SPL9602-MPW-DN

Tanged Wire Thread Insert Taps & Fitting Tools

Type II Prewinder

Prewinder for finer pitch tangless inserts

Threaded mandrel for coarse pitch tangless inserts

Thread Size	Manual Prewinder	Heli-Coil® Reference (Tanged)	Heli-Coil® Reference (Tangless)	Stick Mandrel (Tangless-DN)	Heli-Coil® Reference (Tangless)
#2-56	SPL9601-MPW	N/A	17551-02	SPL96019-DN	7571-02B
#4-40	SPL9602-MPW	7551-04	17551-04	SPL96029-DN	7571-04B
#6-32	SPL9607-MPW	7551-06	17551-06	SPL96079-DN	7571-06B
#8-32	SPL9600-MPW	7551-2	17551-2	SPL96009-DN	7571-2B
#10-32	SPL9610-MPW	7552-3	17552-3	SPL96109-DN	7572-3B
1/4/-20	SPL9615-MPW	7551-4	17551-4	N/A	7571-4B
1/4/-28	SPL9620-MPW	7552-4	17552-4	N/A	N/A

To specify a manual prewinder for Drive Notch inserts, add the suffix 'DN'
Note: *Electronic power installation tooling is also available, please inquire with customer service*

Made to Order Key Locking Threaded Inserts

MS51831 / NAS1395 Spiralock commercial equivalent

Spiralock Part Number	Spiralock Internal Thread Size*	External Thread Size (Modified)	Material	Coating	MS Series Equivalent
FE04-40-0043	4-40	10-28	A286	Passivated	51830CA102 (Mini)
FE04-40-0044	4-40	10-28	SS303	Passivated	51830-102 (Mini)
FE04-40-0045	4-40	10-28	A286	Dry Film Lube	51830CA102L (Mini)
FE04-40-0046	4-40	10-28	SS303	Dry Film Lube	51830-102L (Mini)
FE06-32-0048	6-32	12-28	SS303	Passivated	MS51830-103 (Mini)
FE06-32-0076	6-32	12-28	A286	Passivated	51830CA103 (Mini)
FE06-32-0077	6-32	12-28	A286	Dry Film Lube	51830CA103L (Mini)
FE06-32-0078	6-32	12-28	SS303	Dry Film Lube	51830-103L (Mini)
FE08-32-0025	8-32	¼-28	SS303	Passivated	MS51830-104 (Mini)
FE08-32-0049	8-32	5/16-18	SS303	Dry Film Lube	MS51831 (HW)
FE10-32-0059	10-32	5/16-18	SS303	Passivated	MS51830-201 (LW)
FE10-32-0063	10-32	3/8-16	A286	Dry Film Lube	MS51831CA201L (HW)
FE10-32-0067	10-32	5/16-18	SS303	Dry Film Lube	MS51830-201L (LW)
FE10-32-0071	10-32	3/8-16	SS303	Dry Film Lube	MS51831-201L (HW)
FE10-32-0072	10-32	7/16-14	SS303	Dry Film Lube	MS51832-201L (EHW)
FF0250-28-0055	¼-28	3/8-16	SS303	Passivated	MS51830-202 (LW)
FF0250-28-0057	¼-28	3/8-16	A286	Dry Film Lube	MS51830CA202L (LW)
FF0250-28-0058	¼-28	3/8-16	SS303	Dry Film Lube	MS51830-202L (LW)
FF0250-28-0059	¼-28	7/16-14	A286	Dry Film Lube	MS51831CA202L (HW)
FF0250-28-0062	¼-28	3/8-16	4140	Cadmium	MS51830A202 (LW)
FF0250-28-0064	¼-28	7/16-14	SS303	Dry Film Lube	MS51831-202L (HW)
FF0250-28-0065	¼-28	½-13	SS303	Dry Film Lube	MS51832-202L (EHW)
FF0250-28-0077	¼-28	3/8-16	A286	Passivated	51830CA202 (LW)
FF0250-28-0078	¼-28	3/8-16	SS303	Dry Film Lube	51830-202L (LW)
FF0500-20-0025	½-20	11/16-11	A286	Passivated	MS51831CA206 (HW)
FF0375-16-0040	3/8-16	9/16-12	SS303	Passivated	MS51831-104 (HW)
FF0375-16-0041	3/8-16	9/16-12	A286	Passivated	MS51831CA104 (HW)
FF0375-24-0051	3/8-24	½-13	SS303	Dry Film Lube	MS51830-204 (LW)
FM0050X080-0019	M5 x 0.08	M8 x 1.25	SS303	Passivated	NA0148 (LW)
FM0120X125-0025	M12 x 1.25	M18 x 1.5	SS303	Passivated	NA0149 (HW)

Mini: Miniature / LW: Lightweight / HW: Heavyweight / EHW: Extra Heavy Weight
**Other sizes and materials are also available upon request*

Material

- Insert body – Stainless Steel Grade 303, 4140 or alloy A286 (140 ksi min)
- Keys – Stainless Steel, Grade 302

Finish Options

- Coating / Plating – As Required, Passivation
- Lubrication Option – Dry Film Lube, Silver

Added Benefits of Spiralock® combined with the key staking feature

- Free-spinning bolt assembly
- High strength and reliability
- No tang to break off after installation
- Preload locking with the application of torque
- Significantly increases torque-down and load capability in weaker materials
- Keys eliminate rotational movement of insert within parent material
- Hole preparation with standard drill and tap
- Impossible to cross thread during installation
- No special prewinder, free spinning installation

Made to Order Fasteners

Double-hex (12-Point) Nuts

Spiralock Thread Size*	Width Across Flats	Nut Height Max	Flange Diameter Max.	Perpendicularity**
1/4-28	0.376 - 0.367	0.300	0.460	0.003
5/16-24	0.439 - 0.430	0.363	0.560	0.004
3/8-24	0.502 - 0.492	0.425	0.670	0.005
7/16-20	0.564 - 0.553	0.488	0.770	0.006
1/2-20	0.627 - 0.616	0.550	0.870	0.007

Material: Alloy steel, 48 HRC Max.; other materials available upon request
Coating / Plating: Per customer requirements

** Sizes #8 through 1" are available on made-to-order basis*
*** Thread pitch diameter to bearing surface*

Captive Washer Nuts

Spiralock Thread Size*	Width Across Flats	Nut Height Max.	Flange Diameter Max.
#8-36	0.220	0.170	0.340
#10-32	0.250	0.188	0.380
1/4-28	0.312	0.219	0.460
5/16-24	0.375	0.266	0.560
3/8-24	0.437	0.282	0.660
7/16-20	0.500	0.328	0.760
1/2-20	0.562	0.480	0.860
9/16-18	0.687	0.540	1.000
5/8-18	0.750	0.600	1.100
3/4-16	0.875	0.720	1.310
7/8-14	1.000	0.800	1.480
1-12	1.125	0.960	1.690

Materials: **Nut:** Alloy Steel with Cadmium Plate
Washer: Carbon Steel with Dry Film Lube

*Metric sizes and other materials are also available

Captive Belleville Washer Nuts

Spiralock Thread Size	Width Across Flats	Nut Height**	Flange Diameter Max.	Minimum Spring Load	Maximum Spring Load
1/4–28	0.312	0.22 - 0.37	0.68	200	1200
5/16–24	0.375	0.30 - 0.41	0.80	250	1600
3/8–24	0.438	0.32 - 0.43	0.87	250	2000
7/16–20	0.500	0.36 - 0.47	0.93	TBD	TBD

Materials: **Nut:** 17–4 PH, Condition H1025
Washer: 17–7 PH, Condition H1050
Coating / Plating: As required

Metric sizes and other materials are also available
***Overall height will vary as spring is compressed*

Made to Order Fasteners

Potted (with Epoxy) Inserts or Mechanically Installed Self-Locking Insert Honeycomb Panel Mechanical Fastening Hardware

Applications

- Aerospace/Aircraft: interior structures, stow bins, galleys
- Satellites: composite panels, structures
- Transportation: land and sea vehicles
- Recreation: snow boards, wake boards, skis

Materials Titanium Alloy: 6AL4V per AMS 4928 or AMS 4965 Aluminum Alloy: 7075 – T651 per AMS 4122 Stainless Steel: 316 per AMS 5648 Other materials as required

Finish Options Anodize (Blue), Passivate, Dry Film Lube, CAD Other finishes as required

Installation Tab Furnished in plastic or AL Alloy, adhesive backed

Micro Threaded Inserts for Compact Electronics

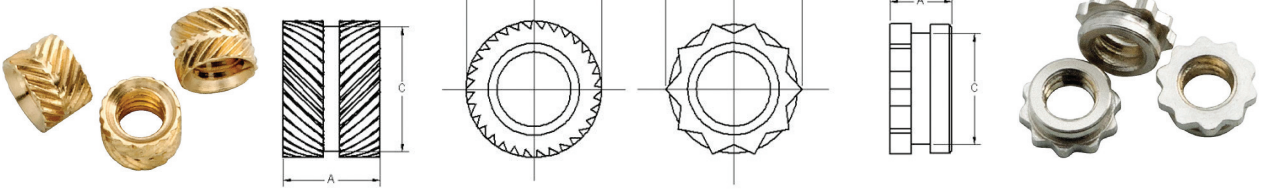
Spiralock Brass Ultrasonic Insert	A (mm)	C (mm)	E (mm)
M1.6x0.35	1.75 ± 0.05	2.30 ± 0.05	2.50 - 2.43

Material: Brass 360, no coating

Spiralock Steel Pressed-in Insert	A (mm)	C (mm)	E (mm)
M1.6x0.35	1.15 ± 0.05	2.05 ± 0.05	2.76 ± 0.04

Material: Carbon Steel 1214, electroless Nickel coating

Other sizes and configurations can be provided. Please contact Spiralock sales and engineering for details.



New Spiralock micro threaded inserts for plastics introduce ideal fastener solutions to attach components in compact electronic assemblies. Installation is achieved by pressing the insert into a mounting hole using either ultrasonic insertion equipment or a thermal press. When installed ultrasonically, the frictional heat caused by the vibration then melts the plastic surrounding the insert and, when the vibration ceases, the plastic solidifies to lock the insert into place. Use of a thermal press will melt the plastic surrounding the insert to result in permanent installation.

Introducing Spectralock®

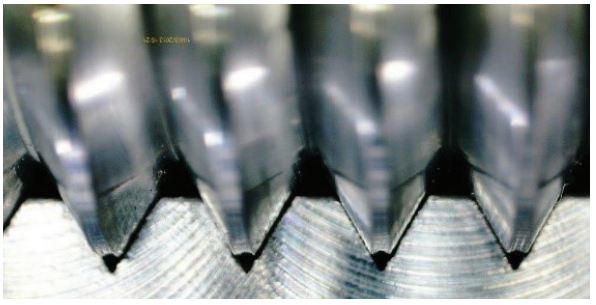
Stanley Engineered Fastening is excited to introduce a self-locking male thread form to our vibration loosening resistant technology offering under the Optia® brand. Spectralock® modifies basic joint behavior instead of relying on thread friction. Its asymmetric thread design limits the clearance between threads to create three specific contact points engaging with the female thread form. The Spectralock patented design is an advantageous fastening solution which allows for a standard female threaded hole to utilize this self-locking bolt for consistent locking and reusability in situations where cyclic or high temperatures are present and severe vibration occurs.

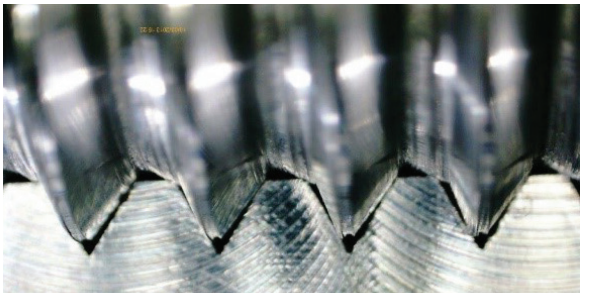
Thread Tolerances

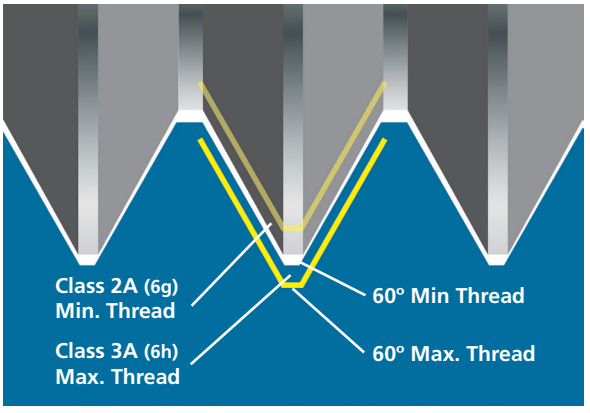
Poly-directional thread tolerances enable multiple contact points on the female thread against the Spectralock bolt geometry to ensure a self-locking threaded assembly.

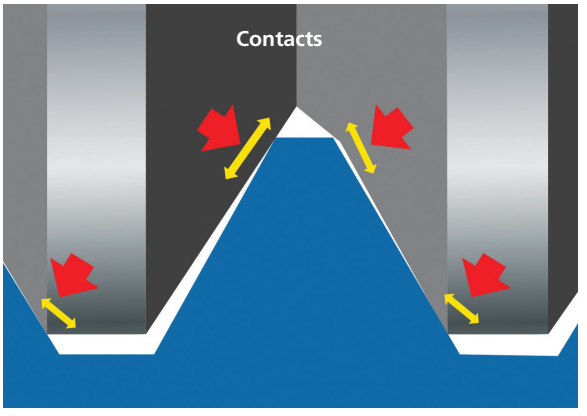
Asymmetric Thread Form

- Major thread crest locked with female thread
- Minor thread root locked with female thread
- Compatible with both metric and inch internal thread tolerances









Key Competitive/ Value Added Features:

- Resistance to thread loosening
- Minimized fatigue failure
- Tightened load evenly distributed at root diameter
- Elimination of ancillary locking devices

Spectralock products are made to order. Please contact customer service for more information.

Tooling Product Offering

Products	Styles	Sizes*	Options
Taps	Multi Purpose T-10 Cold Forming High Performance	#0–80 to 1"-14 M1.6 X 0.35 to M24 X 3.00	Carbide R/L Hand "TT" Direction
Threading Inserts	Single Point Multi-Tooth End Mount Face Mount Triangular Square	80 – 4 TPI 0.5 – 4.00 mm pitch	
Thread Gages**	Standard Plug Depth Control Location	#0 – 80 to 1"-14 M1.6 x 0.35 to M24 x 3.0	
Thread Milling Cutters	Shank Type Single Thread	80 – 4 TPI 0.25" – 2" Dia. 0.5 – 4.0 mm pitch 4 – 50 mm Dia.	M42 Steel T15 Steel Carbide

* Sizes shown above reflect a typical range. We have capabilities to provide other sizes outside of this range on a made to order basis.
** Leitech Depth Gage Extension Handles available

The purchaser of Spiralock® tools shall have the right to use Spiralock tools to thread blind and through holes in all elements other than "Fasteners", which are defined to mean discrete male and female threaded elements, the primary purpose of which is to engage or accept a complementary threaded element. If your application requires a Spiralock® Fastener, Stanley Engineered Fastening offers a full line of Spiralock fasteners to meet your needs.

Standard Tap Styles

Multi-Purpose

- High speed steel
- TiN coating
- Replaces General Purpose taps; can be used for hand tapping
- Plug chamfer uses spiral point design
- Bottom chamfer uses a spiral flute design (sizes larger than #3 or M2.5)

Designed for a wide variety of low-hardness materials that generate long chips. The spiral point pushes chips ahead of the tap in a through hole, while the spiral flute design provides good chip removal from a blind hole. Necked blanks allow better access for lubrication. These taps can be used for hand tapping.

T-10 Straight Flute

- High speed steel
- TiN coating
- Minimal contact with workpiece
- Available with plug or bottom chamfer

Specialized geometry for short-chipping materials such as cast iron and hardened alloy steels. The straight flutes do not provide chip transport, so these taps should not be used on deep blind holes unless tap is extracted mid-way to evacuate chips. TiN coating adds durability and lubricity. The T-10 tap range is intended for use on CNC machining centers.

Cold Forming

- Powdered metallurgy grade of high speed steel
- Material flows without generating chips and makes threads stronger
- Lower risk of breakage, particularly in small diameters
- Plug and bottom chamfer

Cold forming taps produce a thread by deforming material instead of removing it. The starting minor diameter is larger and must be held to a tighter tolerance than with standard taps to ensure the threads fill out properly. Forming taps are suitable for all ductile materials with an elongation value above 10%, such as aluminum, brass, copper, and mild steels. Lubrication with cutting oil is preferred.

High Performance

- Specially adjusted geometry reduces friction between the tool and workpiece
- Intended for abrasive and high tensile strength materials
- Powdered metallurgy grade of high speed steel
- Dual layer PVD coating
- Spiral point with plug chamfer, or spiral flute with bottom chamfer (sizes larger than #3 or M2.5)

An innovative line of cutting taps with cutting geometry tailored for cutting threads in traditionally difficult materials, including high nickel alloys and alloys of titanium. Every aspect of the tool is designed to provide good chip flow and to keep cutting edges sharp. Use of cutting oil for lubrication is essential.

Spiralock taps are furnished with ramp angles as shown here. This is referred to as style "BT" for bottom tapping. When tapping from the opposite end of a through hole, you must specify Spiralock style "TT" (top tapping), which has the ramp angle facing the opposite direction.

How to order: All Spiralock taps are identified by a 6-digit catalog code. This code and the quantity are all you need when ordering.

OPTIA®

Choosing a Tap

Tap Recommendations

Category	Examples	1st Choice	2nd choice	3rd choice
Carbon & alloy steels, normalized (< Rc30)	1010,1045, 12L14, 4340, 8640	Multi-Purpose	Cold Forming	
Carbon & alloy steels, hardened (≥ Rc30)	4140PH, Stressproof	T-10	High Performance	Multi-Purpose
Stainless steels	304, 316, 410	Multi-Purpose	Cold Forming	
Precipitation Hardened Stainless Steels	17-4PH, 15-5PH, 17-7PH	High Performance	T-10	
Cast Iron, gray	Class G20 - G50	T-10		
Cast iron, ductile 'SG'	ASTM A536	Multi-Purpose	Cold Forming	
Aluminum, wrought	6061-T6, 2024, 7075	Cold Forming	Multi-Purpose	T-10
Aluminum, cast	A360, A380	Multi-Purpose	T-10	
Copper, brass, bronze, zinc, magnesium	360 brass, Beryllium Copper	Multi-Purpose	Cold Forming (excl. Zn, Mg)	
Titanium, wrought/cast	6Al-4V	High Performance	T-10	
Nickel alloys and superalloys	Inconel®, A286, Nimonic®, P550	High Performance	T-10	Cold Forming (1st choice P550)

Cold Forming Taps

Forming taps and cutting taps produce threads that gage identically and are interchangeable, but they produce these threads in a different manner. Forming taps push and displace material instead of removing material like a cutting tap. Thread forming offers several advantages over cut tapping:

- Doesn't generate chips — *Material is displaced, not cut, eliminating chips and swarf – perfect for blind holes*
- Makes stronger threads — *The material grain aligns to the thread contour, increasing thread strength*
- Improves thread gaging — *The possibility of producing oversized threads is greatly reduced*
- Taps are stronger — *Forming taps don't need flutes to evacuate chips, so the core diameter is larger*
- Taps last longer — *Without cutting edges to dull, forming taps can last 3 to 20x longer than cutting taps*
- Works with non-lead screw tappers — *Forming taps generate their own lead*

Recommended Applications

In general, materials that produce a stringy chip are good candidates for cold forming.
Common materials are aluminum, brass, copper, lead, diecast zinc, low carbon steel, 300/400 series stainless steels, and nickel alloys.

Pre-Tap Hole Size

Thread forming taps require a larger pre-tap hole size than cutting taps because they do not produce a chip during tapping. The hole tolerance must be tightly controlled to prevent after-tap minor diameter problems. All formed threads contain a cup or "U" in the crest due to the nature of the forming process. Tapping with too small of a hole size results in excessive tapping torque, tap wear, and possible tap breakage.

Lubrication and Tapping Speeds

The quality and type of lubrication becomes more important to tap life and thread quality as speed increases. Cutting oils are generally preferred for lubrication because of their lubricity compared to that of water soluble coolants. For non-ferrous materials, water soluble may be used at increased concentrations. Water soluble coolants can also work in softer steels and stainless steels when the tap is coated with TiN. A high sulfur/high chlorine tapping oil with a fat additive is recommended when thread forming in steels and stainless steels. In general, the suggested cold-form tapping speed is the same as that of cutting taps. In soft and fine pitch applications (20+ TPI), tapping speeds of 1.5 to 2 times higher may be achievable.

Tapping Speeds

Tapping speeds for the Spiralock thread form depend on many factors, including the machine, the material being tapped, the design of the hole, the lubricant, and the style of tap used. No exact rules can be given that take in account all of these variables, but the information on these pages can be used as a guide in determining a starting point and course to follow for obtaining maximum performance.

Material being tapped	Peripheral Speed of Tap, SFM (surface feet per minute)	Peripheral Speed of Tap, m/min (meters per minute)
Aluminum and Magnesium	90 - 110	30 - 40
Brass - soft	140 - 200	45 - 65
Brass - hard	80 - 130	25 - 45
Bronze - soft	60 - 100	20 - 35
Bronze - hard	30 - 40	10 - 15
Malleable Iron	35 - 60	10 - 20
Cast Iron - soft	90 - 110	30 - 40
Cast Iron -medium	75 - 95	25 - 30
Cast Iron - hard	65 - 85	20 - 30
Cast Steel	20 - 35	5 - 10
Copper - soft	50 - 80	15 - 25
Copper - hard, Beryllium	30 - 50	10 - 15
Nickel Alloys	10 - 15	3 - 5
Steel Forgings	50 - 65	15 - 20
Steel - 200 Brinell	70 - 90	20 - 30
Steel - 300 Brinell	40 - 65	10 - 20
Steel - 400 Brinell	15 - 25	5 - 8
Steel - 500 Brinell	5 - 15	2 - 5
Stainless Steel	10 - 35	3 - 10
300 Series Stainless Steel	20 - 30	5 - 10
400 Series Stainless Steel	15 - 20	5 - 8
Titanium Alloys	10 - 15	3 - 5
Tool Steel	25 - 40	8 - 15
Zinc Die Castings	90 - 110	30 - 40

These speeds should be used for coarse and fine threads. Coarse thread taps should be run near the low end of the range while fine threads can be run at the upper end of the range. These values should also be modified according to the following suggestions:

- Deep blind holes (> 2.5 dia.) -20%
- Multiple threads -50%
- Very coarse threads -50%
- Cold Form taps +50%
- TiN or other PVD coated taps +50%
- Carbide taps +100%

How to use the tables on the next page:

1. Select material in the above table.
2. Find the corresponding peripheral speed of tap, SFM in the column next to the material.
3. Take the data to the next page to select tap size within the specified SFM range.

Except in a few isolated cases, the use of lower speeds is not detrimental except as it affects production. In fact, limitations of equipment often make it necessary to use considerably reduced speeds. This is especially true with the smaller sizes of machine taps where imitations of spindle design make it impossible to obtain the recommended speeds

OPTIA

Tapping Speeds

Periph. Speed, SFM	Tap Size – English & Fractional																		
	0	1	2	3	4	5	6	8	10	12	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1
20	1273	1046	888	772	682	611	554	466	402	354	306	244	204	175	153	122	102	87	76
25	1592	1308	1110	965	853	764	692	582	503	442	382	306	255	218	191	153	127	109	95
30	1910	1570	1332	1157	1023	917	830	699	603	531	458	367	306	262	229	183	153	131	115
35	2228	1831	1555	1350	1194	1070	969	815	704	619	535	428	357	306	267	214	178	153	134
40	2546	2093	1777	1543	1364	1222	1107	932	804	707	611	489	407	349	306	244	204	175	153
45	2865	2355	1999	1736	1535	1375	1246	1048	905	736	688	550	458	393	344	275	229	196	172
50	3183	2616	2221	1929	1705	1528	1384	1165	1005	884	764	611	509	437	382	306	255	218	191
55	3501	2879	2443	2122	1876	1681	1522	1281	1106	973	841	673	560	480	420	336	280	240	210
60	3820	3139	2665	2315	2046	1833	1661	1397	1206	1061	917	733	611	524	458	367	306	262	229
65	4138	3401	2887	2508	2217	1986	1799	1514	1307	1149	993	795	662	568	497	397	331	284	248
70	4456	3663	3109	2701	2387	2139	1938	1630	1407	1238	1070	856	713	611	535	428	357	306	267
75	4775	3924	3331	2894	2558	2292	2076	1747	1508	1326	1146	917	764	655	573	458	382	327	286
80	5093	4186	3553	3086	2728	2445	2214	1863	1608	1415	1222	978	815	698	611	489	407	349	306
85	5411	4448	3775	3280	2899	2597	2353	1980	1709	1503	1299	1038	866	742	649	519	433	371	325
90	5730	4709	3997	3472	3069	2750	2491	2096	1809	1592	1375	1100	917	786	688	550	458	393	344
95	6048	4971	4219	3665	3240	2903	2630	2213	1910	1680	1451	1160	968	829	726	581	484	415	363
100	6366	5232	4442	3858	3410	3056	2768	2329	2010	1768	1528	1222	1019	873	764	611	509	437	382
110	7003	5756	4886	4244	3751	3361	3045	2562	2211	1945	1681	1345	1120	960	840	672	560	480	420
120	7639	6279	5330	4630	4093	3667	3321	2795	2412	2122	1833	1467	1222	1048	917	733	611	524	458
130	8276	6802	5774	5016	4434	3973	3598	3028	2613	2299	1986	1589	1324	1135	993	794	662	567	497
140	8913	7325	6218	5402	4775	4278	3875	3261	2815	2476	2139	1711	1426	1222	1070	856	713	611	535
150	9549	7849	6662	5787	5116	4584	4151	3494	3016	2653	2292	1833	1528	1310	1146	917	764	655	573

Peripheral Speed, m/min	Tap Size (mm)													
	3	3.5	4	4.5	5	6	7	8	9	10	11	12	14	16
3	318	273	239	212	191	159	136	119	106	95	87	80	68	60
4	424	364	318	283	255	212	182	159	141	127	116	106	91	80
5	531	455	398	354	318	265	227	199	177	159	145	133	114	99
6	637	546	477	424	382	318	273	239	212	191	174	159	136	119
7	743	637	557	495	446	371	318	279	248	223	203	186	159	139
8	849	728	637	566	509	424	364	318	283	255	232	212	182	159
9	955	819	716	637	573	477	409	358	318	286	260	239	205	179
10	1061	909	796	707	637	531	455	398	354	318	289	265	227	199
12	1273	1091	955	849	764	637	546	477	424	382	347	318	273	239
14	1485	1273	1114	990	891	743	637	557	495	446	405	371	318	279
16	1698	1455	1273	1132	1019	849	728	637	566	509	463	424	364	318
18	1910	1637	1432	1273	1146	955	819	716	637	573	521	477	409	358
20	2122	1819	1592	1415	1273	1061	909	796	707	637	579	531	455	398
25	2653	2274	1989	1768	1592	1326	1137	995	884	796	723	663	568	497
30	3183	2728	2387	2122	1910	1592	1364	1194	1061	955	868	796	682	597
35	3714	3183	2785	2476	2228	1857	1592	1393	1238	1114	1013	928	796	696
40	4244	3638	3183	2830	2547	2122	1819	1592	1415	1273	1158	1061	909	796
45	4775	4093	3581	3183	2865	2387	2046	1791	1592	1432	1302	1194	1023	895
50	5305	4547	3979	3537	3183	2653	2274	1989	1768	1592	1447	1326	1137	995

Hole Sizes for Cut Tapping

These charts are supplied as a recommendation only. Actual sizes may vary depending on application and the material being tapped.
Other thread and hole sizes are available upon request or on our website drill size calculator at www.spiralock.com

- For aluminum or other soft materials a hole minor diameter on the low side of the suggested range is recommended. For harder materials a hole minor diameter near the high end of the suggested range is recommended.
- Spiralock threaded holes require the use a larger minor diameter than conventional threads.

English/ Fractional Thread Size	Hole Minor Diameter Min. (in)	Hole Minor Diameter Max. (in)	Suggested Drill Size*
0 – 80	0.052	0.054	#55
1 – 64	0.063	0.065	#52
1 – 72	0.064	0.066	#52
2 – 56	0.074	0.077	#48
2 – 64	0.076	0.078	1.95mm
3 – 48	0.086	0.088	#44
3 – 56	0.087	0.090	#43
4 – 40	0.096	0.099	#41
4 – 48	0.099	0.101	#40
5 – 40	0.109	0.112	7/64
5 – 44	0.110	0.113	#35
6 – 32	0.112	0.118	#33
6 – 40	0.122	0.125	1/8″
8 – 32	0.138	0.144	#28
8 – 36	0.146	0.150	#26
10 – 24	0.155	0.163	#21
10 – 32	0.164	0.170	#19
12 – 24	0.181	0.189	#13
12 – 28	0.186	0.193	#12
1/4 – 20	0.208	0.218	#4
1/4 – 28	0.220	0.227	#2
5/16 – 18	0.266	0.276	H
5/16 – 24	0.277	0.285	J
3/8 – 16	0.322	0.334	P
3/8 – 24	0.340	0.348	11/32
7/16 –14	0.377	0.391	V
7/16 – 20	0.395	0.405	X
1/2 – 13	0.435	0.450	7/16
1/2 – 20	0.458	0.468	11.75mm
9/16 – 12	0.492	0.508	1/2
9/16 – 18	0.516	0.526	33/64
5/8 – 11	0.548	0.566	14 mm
5/8 – 18	0.578	0.589	37/64
3/4 – 10	0.666	0.685	43/64
3/4 – 16	0.697	0.709	45/64
7/8 – 9	0.781	0.803	25/32
7/8 – 14	0.815	0.829	21 mm
1″ – 8	0.895	0.919	29/32
1″ – 12	0.930	0.946	15/16
1″ – 14	0.940	0.954	24 mm

Metric Thread Size	Hole Minor Diameter Min. (mm)	Hole Minor Diameter Max. (mm)	Suggested Drill Size*
M1.6 x 0.35	1.37	1.42	#54
M2.0 x 0.40	1.74	1.79	#50
M2.5 x 0.45	2.21	2.27	#43
M3.0 x 0.50	2.68	2.74	#36
M3.5 x 0.60	3.11	3.19	1/8
M4.0 x 0.70	3.55	3.64	#28
M4.5 x 0.75	4.01	4.11	#21
M5.0 x 0.80	4.32	4.48	11/64
M6.0 x 1.00	5.16	5.35	#5
M7.0 x 1.00	6.16	6.35	C
M8.0 x 1.00	7.16	7.35	9/32
M8.0 x 1.25	6.94	7.19	J
M9.0 x 1.25	7.94	8.19	8 mm
M10 x 1.25	8.94	9.19	T
M10 x 1.50	8.73	9.03	S
M11 x 1.50	9.73	10.03	W
M12 x 1.25	10.94	11.19	11 mm
M12 x 1.75	10.52	10.86	27/64
M14 x 1.25	12.94	13.19	33/64
M14 x 1.50	12.73	13.03	13 mm
M14 x 2.00	12.31	12.70	31/64
M16 x 1.50	14.73	15.03	15 mm
M16 x 2.00	14.31	14.70	9/16
M18 x 1.50	16.73	17.03	17 mm
M18 x 2.50	15.89	16.38	5/8
M20 x 1.50	18.73	19.03	19 mm
M20 x 2.50	17.89	18.38	23/32
M22 x 1.50	20.73	21.03	21 mm
M22 x 2.50	19.89	20.38	20 mm
M24 x 3.00	21.47	22.05	55/64

**Drill size callouts were determined to best fit the hole minor diameter range*

OPTIA

Hole Sizes for Cold Form Tapping

These charts are supplied as a recommendation only. Finding the correct drill size for a Spiralock tap may be a "Cut and Try" process:

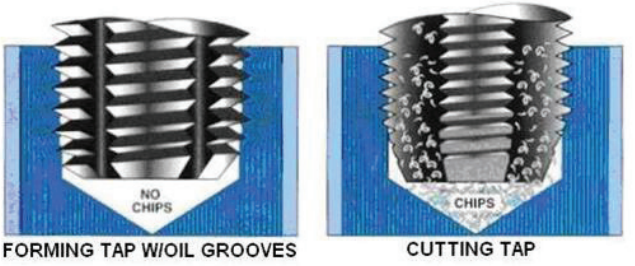
- Not all drills are alike - to get good results, verify the actual hole size being produced by the drill
- Thin wall parts may expand during tapping and produce oversize after-tap minor diameters

After tapping, the hole size should fall within the Spiralock recommended minor diameter range for cut threads

- If the final minor diameter is below the range for a cut thread, use a larger drill. Do the opposite for a final minor diameter that is larger than the recommended range for cut taps.

Fractional Thread Size	Minor Dia. Min. (in)	Minor Dia. Max. (in)
0 – 80	0.0559	0.0567
1 – 64	0.0678	0.0688
1 – 72	0.0684	0.0693
2 – 56	0.0801	0.0812
2 – 64	0.0808	0.0818
3 – 48	0.0921	0.0933
3 – 56	0.0931	0.0942
4 – 40	0.1038	0.1050
4 – 48	0.1051	0.1063
5 – 40	0.1168	0.1180
5 – 44	0.1175	0.1187
6 – 32	0.1248	0.1279
6 – 40	0.1298	0.1311
8 – 32	0.1508	0.1539
8 – 36	0.1548	0.1562
10 – 24	0.1724	0.1765
10 – 32	0.1768	0.1799
12 – 24	0.1984	0.2025
12 – 28	0.2009	0.2044
1/4 – 20	0.2289	0.2338
1/4 – 28	0.2349	0.2384
5/16 – 18	0.2890	0.2945
5/16 – 24	0.2949	0.2990
3/8 – 16	0.3486	0.3547
3/8 – 24	0.3574	0.3615
7/16 – 14	0.4073	0.4143
7/16 – 20	0.4164	0.4213
1/2 – 13	0.4675	0.4750
1/2 – 20	0.4789	0.4838
9/16 – 12	0.5273	0.5354
9/16 – 18	0.5390	0.5445
5/8 – 11	0.5866	0.5955
5/8 – 18	0.6015	0.6070
3/4 – 10	0.7078	0.7175
3/4 – 16	0.7236	0.7297
7/8 – 9	0.8281	0.8389
7/8 – 14	0.8448	0.8518
1" – 8	0.9472	0.9594
1" – 12	0.9648	0.9729
1" – 14	0.9698	0.9768

Metric Thread Size	Minor Dia. Min. (mm)	Minor Dia. Max. (mm)
M1.6 x 0.35	1.483	1.506
M2.0 x 0.40	1.867	1.892
M2.5 x 0.45	2.352	2.380
M3.0 x 0.50	2.835	2.865
M3.5 x 0.60	3.302	3.335
M4.0 x 0.70	3.769	3.805
M4.5 x 0.75	4.257	4.308
M5.0 x 0.80	4.658	4.735
M6.0 x 1.00	5.578	5.679
M7.0 x 1.00	6.574	6.675
M8.0 x 1.00	7.582	7.671
M8.0 x 1.25	7.468	7.595
M9.0 x 1.25	8.478	8.590
M10 x 1.25	9.472	9.599
M10 x 1.50	9.370	9.510
M11 x 1.50	10.363	10.516
M12 x 1.25	11.474	11.588
M12 x 1.75	11.257	11.435
M14 x 1.25	13.477	13.592
M14 x 1.50	13.363	13.515
M14 x 2.00	13.160	13.350
M16 x 1.50	15.367	15.519
M16 x 2.00	15.151	15.354
M18 x 1.50	17.369	17.508
M18 x 2.50	16.937	17.191
M20 x 1.50	19.373	19.512
M20 x 2.50	18.857	18.908
M22 x 1.50	21.364	21.516
M22 x 2.50	20.945	21.186
M24 x 3.00	22.731	23.023



FORMING TAP W/OIL GROOVES CUTTING TAP

Tap and Gage Part Numbers – English

**MTO = Made To Order*

Thread Size	Chamfer	Multi- Purpose	T-10 Straight Flute	Cold Forming	High Performance	Gage Set
#0-80	Plug	SPL56436A	MTO	SPL56438A	MTO	SPL56348
	Bottom	SPL56422A	MTO	SPL56439A	MTO	
Gage Members		GO Plug: SPL56340	Handle: SPL56341	HI Ramp: SPL56342		
#1-64	Plug	SPL56456A	MTO	SPL56458A	MTO	SPL56358
	Bottom	SPL56442A	MTO	MTO	MTO	
Gage Members		GO Plug: SPL56350	Handle: SPL56351	HI Ramp: SPL56352		
#1-72	Plug	MTO	MTO	SPL56478A	SPL22018A	SPL56368
	Bottom	MTO	MTO	SPL56479A	SPL22015A	
Gage Members		GO Plug: SPL56360	Handle: SPL56361	HI Ramp: SPL56362		
#2-56	Plug	SPL56515A	SPL56510A	SPL56518A	SPL22023A	SPL56708
	Bottom	SPL56507A	SPL56512A	SPL56519A	SPL22020A	
Gage Members		GO Plug: SPL56700	Handle: SPL56701	HI Ramp: SPL56702		
#2-64	Plug	MTO	SPL56490A	MTO	MTO	SPL56378
	Bottom	MTO	MTO	MTO	MTO	
Gage Members		GO Plug: SPL56370	Handle: SPL56371	HI Ramp: SPL56372		
#3-48	Plug	SPL56535A	SPL56530A	MTO	SPL22033A	SPL56718
	Bottom	MTO	MTO	MTO	SPL22030A	
Gage Members		GO Plug: SPL56710	Handle: SPL56711	HI Ramp: SPL56712		
#3-56	Plug	SPL56555A	MTO	MTO	SPL22038A	SPL56728
	Bottom	MTO	MTO	MTO	SPL22035A	
Gage Members		GO Plug: SPL56720	Handle: SPL56721	HI Ramp: SPL56722		
#4-40	Plug	SPL56575A	MTO	SPL56578A	SPL22043A	SPL56738
	Bottom	SPL56574A	SPL56572A	SPL56579A	SPL22040A	
Gage Members		GO Plug: SPL56730	Handle: SPL56731	HI Ramp: SPL56732		
#4-48	Plug	MTO	MTO	MTO	MTO	SPL56748
	Bottom	MTO	MTO	SPL56599A	MTO	
Gage Members		GO Plug: SPL56740	Handle: SPL56741	HI Ramp: SPL56742		
#5-40	Plug	MTO	MTO	MTO	SPL22053A	SPL56758
	Bottom	SPL56614A	SPL56612A	MTO	SPL22050A	
Gage Members		GO Plug: SPL56750	Handle: SPL56751	HI Ramp: SPL56752		
#5-44	Plug	SPL56635A	MTO	MTO	SPL22058A	SPL56768
	Bottom	SPL56634A	MTO	MTO	SPL22055A	
Gage Members		GO Plug: SPL56760	Handle: SPL56761	HI Ramp: SPL56762		
#6-32	Plug	SPL17035A	SPL17030A	SPL17043A	SPL22063A	SPL49508
	Bottom	SPL17041A	SPL17032A	SPL17044A	SPL22060A	
Gage Members	GO Plug: SPL49500	GO Handle: SPL49501	HI P.D.: SPL49502	HI Ramp: SPL49503	HI Handle: SPL49504	
#6-40	Plug	SPL56655A	SPL56650A	MTO	SPL22068A	SPL56778
	Bottom	SPL56663A	SPL56652A	SPL56669A	SPL22065A	
Gage Members		GO Plug: SPL56770	Handle: SPL56771	HI Ramp: SPL56772		
#8-32	Plug	SPL17075A	SPL17070A	SPL17083A	SPL22073A	SPL49518
	Bottom	SPL17081A	SPL17072A	SPL17084A	SPL22070A	
Gage Members	GO Plug: SPL49510	GO Handle: SPL49511	HI P.D.: SPL49512	HI Ramp: SPL49513	HI Handle: SPL49514	

OPTIA

Tap and Gage Part Numbers – English

**MTO = Made To Order*

Thread Size	Chamfer	Multi- Purpose	T-10 Straight Flute	Cold Forming	High Performance	Gage Set
#8-36	Plug	MTO	MTO	MTO	SPL22078A	SPL56788
	Bottom	SPL56693A	MTO	MTO	SPL22075A	
Gage Members		GO Plug: SPL56780	Handle: SPL56781	HI Ramp: SPL56782		
#10-24	Plug	SPL17115A	MTO	MTO	SPL22083A	SPL49528
	Bottom	SPL17121A	SPL17112A	SPL17124A	SPL22080A	
Gage Members	GO Plug: SPL49520	GO Handle: SPL49521	HI P.D.: SPL49522	HI Ramp: SPL49523	HI Handle: SPL49524	
#10-32	Plug	SPL17155A	SPL17150A	SPL17163A	SPL22088A	SPL49538
	Bottom	SPL17161A	SPL17152A	SPL17164A	SPL22085A	
Gage Members	GO Plug: SPL49530	GO Handle: SPL49531	HI P.D.: SPL49532	HI Ramp: SPL49533	HI Handle: SPL49534	
#12-24	Plug	SPL17185A	MTO	MTO	MTO	SPL49548
	Bottom	SPL17191A	MTO	SPL17204A	SPL22090A	
Gage Members	GO Plug: SPL49540	GO Handle: SPL49541	HI P.D.: SPL49542	HI Ramp: SPL49543	HI Handle: SPL49544	
#12-28	Plug	MTO	MTO	MTO	SPL22098A	SPL49558
	Bottom	MTO	MTO	MTO	SPL22095A	
Gage Members	GO Plug: SPL49550	GO Handle: SPL49551	HI P.D.: SPL49552	HI Ramp: SPL49553	HI Handle: SPL49554	

Tap and Gage Part Numbers – Fractional

Thread Size	Chamfer	Multi- Purpose	T-10 Straight Flute	Cold Forming	High Performance	Gage Set
1/4-20	Plug	SPL17270A	SPL17260A	SPL17283A	SPL22103A	SPL49568
	Bottom	SPL17281A	SPL17262A	SPL17284A	SPL22100A	
Gage Members	GO Plug: SPL49560	GO Handle: SPL49561	HI P.D.: SPL49562	HI Ramp: SPL49563	HI Handle: SPL49564	
1/4-28	Plug	SPL17310A	SPL17300A	SPL17323A	SPL22108A	SPL49578
	Bottom	SPL17321A	SPL17302A	SPL17324A	SPL22105A	
Gage Members	GO Plug: SPL49570	GO Handle: SPL49571	HI P.D.: SPL49572	HI Ramp: SPL49573	HI Handle: SPL49574	
5/16-18	Plug	SPL17350A	SPL17340A	MTO	SPL22113A	SPL49588
	Bottom	SPL17361A	SPL17342A	SPL17364A	SPL22110A	
Gage Members	GO Plug: SPL49580	GO Handle: SPL49581	HI P.D.: SPL49582	HI Ramp: SPL49583	HI Handle: SPL49584	
5/16-24	Plug	SPL17380A	SPL17396A	SPL17403A	SPL22118A	SPL49598
	Bottom	SPL17391A	SPL17398A	SPL17404A	SPL22115A	
Gage Members	GO Plug: SPL49590	GO Handle: SPL49591	HI P.D.: SPL49592	HI Ramp: SPL49593	HI Handle: SPL49594	
3/8-16	Plug	SPL17430A	SPL17420A	MTO	SPL22123A	SPL49608
	Bottom	SPL17438A	SPL17422A	SPL17444A	SPL22120A	
Gage Members	GO Plug: SPL49600	GO Handle: SPL49601	HI P.D.: SPL49602	HI Ramp: SPL49603	HI Handle: SPL49604	
3/8-24	Plug	SPL17470A	MTO	SPL17483A	SPL22128A	SPL49618
	Bottom	SPL17478A	SPL17457A	MTO	SPL22125A	
Gage Members	GO Plug: SPL49610	GO Handle: SPL49611	HI P.D.: SPL49612	HI Ramp: SPL49613	HI Handle: SPL49614	
7/16-14	Plug	SPL17510A	MTO	MTO	SPL22133A	SPL49628
	Bottom	SPL17518A	SPL17497A	MTO	SPL22130A	
Gage Members	GO Plug: SPL49620	GO Handle: SPL49621	HI P.D.: SPL49622	HI Ramp: SPL49623	HI Handle: SPL49624	

Tap and Gage Part Numbers – Fractional

**MTO = Made To Order*

Thread Size	Chamfer	Multi- Purpose	T-10 Straight Flute	Cold Forming	High Performance	Gage Set
7/16-20	Plug	SPL17550A	SPL17535A	SPL17563A	SPL22138A	SPL49638
	Bottom	SPL17558A	SPL17537A	MTO	SPL22135A	
Gage Members	GO Plug: SPL49630	GO Handle: SPL49631	HI P.D.: SPL49632	HI Ramp: SPL49633	HI Handle: SPL49634	
1/2-13	Plug	SPL17590A	SPL17575A	MTO	SPL22143A	SPL49648
	Bottom	SPL17598A	SPL17577A	SPL17604A	SPL22140A	
Gage Members	GO Plug: SPL49640	GO Handle: SPL49641	HI P.D.: SPL49642	HI Ramp: SPL49643	HI Handle: SPL49644	
1/2-20	Plug	SPL17630A	MTO	SPL17643A	MTO	SPL49658
	Bottom	SPL17638A	MTO	SPL17644A	SPL22145A	
Gage Members	GO Plug: SPL49650	GO Handle: SPL49651	HI P.D.: SPL49652	HI Ramp: SPL49653	HI Handle: SPL49654	
9/16-12	Plug	MTO	MTO	MTO	MTO	SPL49668
	Bottom	MTO	MTO	MTO	MTO	
Gage Members	GO Plug: SPL49660	GO Handle: SPL49661	HI P.D.: SPL49662	HI Ramp: SPL49663	HI Handle: SPL49664	
9/16-18	Plug	SPL17695A	MTO	MTO	MTO	SPL49678
	Bottom	SPL17700A	SPL17687A	MTO	SPL22155A	
Gage Members	GO Plug: SPL49670	GO Handle: SPL49671	HI P.D.: SPL49672	HI Ramp: SPL49673	HI Handle: SPL49674	
5/8-11	Plug	SPL17725A	MTO	MTO	SPL22163A	SPL49688
	Bottom	SPL17730A	SPL17717A	MTO	SPL22160A	
Gage Members	GO Plug: SPL49680	GO Handle: SPL49681	HI P.D.: SPL49682	HI Ramp: SPL49683	HI Handle: SPL49684	
5/8-18	Plug	SPL17755A	MTO	MTO	SPL22168A	SPL49698
	Bottom	SPL17760A	SPL17747A	MTO	SPL22165A	
Gage Members	GO Plug: SPL49690	GO Handle: SPL49691	HI P.D.: SPL49692	HI Ramp: SPL49693	HI Handle: SPL49694	
3/4-10	Plug	SPL17785A	SPL17775A	MTO	MTO	SPL49708
	Bottom	SPL17790A	MTO	MTO	MTO	
Gage Members	GO Plug: SPL49700	GO Handle: SPL49701	HI P.D.: SPL49702	HI Ramp: SPL49703	HI Handle: SPL49704	
3/4-16	Plug	SPL17815A	SPL17805A	MTO	MTO	SPL49718
	Bottom	SPL17820A	SPL17807A	MTO	SPL22175A	
Gage Members	GO Plug: SPL49710	GO Handle: SPL49711	HI P.D.: SPL49712	HI Ramp: SPL49713	HI Handle: SPL49714	
7/8-9	Plug	SPL17825A	MTO	MTO	MTO	SPL49728
	Bottom	SPL17827A	SPL17837A	MTO	MTO	
Gage Members	GO Plug: SPL49720	GO Handle: SPL49721	HI P.D.: SPL49722	HI Ramp: SPL49723	HI Handle: SPL49724	
7/8-14	Plug	SPL17855A	MTO	MTO	MTO	SPL49738
	Bottom	SPL17857A	MTO	MTO	SPL22185A	
Gage Members	GO Plug: SPL49730	GO Handle: SPL49731	HI P.D.: SPL49732	HI Ramp: SPL49733	HI Handle: SPL49734	
1-8	Plug	SPL17885A	MTO	SPL17893A	MTO	SPL49748
	Bottom	SPL17887A	MTO	MTO	SPL22190A	
Gage Members	GO Plug: SPL49740	GO Handle: SPL49741	HI P.D.: SPL49742	HI Ramp: SPL49743	HI Handle: SPL49744	
1-12	Plug	SPL17895A	MTO	MTO	MTO	SPL49758
	Bottom	MTO	MTO	MTO	SPL22195A	
Gage Members	GO Plug: SPL49750	GO Handle: SPL49751	HI P.D.: SPL49752	HI Ramp: SPL49753	HI Handle: SPL49754	
1-14	Plug	SPL17905A	MTO	MTO MTO	SPL22203A	SPL49768
	Bottom	SPL17907A	MTO	MTO	MTO	
Gage Members	GO Plug: SPL49760	GO Handle: SPL49761	HI P.D.: SPL49762	HI Ramp: SPL49763	HI Handle: SPL49764	

OPTIA

Tap and Gage Part Numbers – Metric

**MTO = Made To Order*

Thread Size	Chamfer	Multi- Purpose	T-10 Straight Flute	Cold Forming	High Performance	Gage Set
M1.6x0.35	Plug	SPL56981D	MTO	SPL56983D	SPL23003D	SPL59418
	Bottom	SPL56967D	MTO	SPL56984D	SPL23000D	
Gage Members		GO Plug: SPL59410	Handle: SPL59411	HI Ramp: SPL59412		
M1.8x0.35	Plug	MTO	MTO	SPL57003D	MTO	SPL59428
	Bottom	MTO	MTO	SPL57004D	SPL23010D	
Gage Members		GO Plug: SPL59420	Handle: SPL59421	HI Ramp: SPL59422		
M2.0x0.40	Plug	SPL57021D	MTO	SPL57023D	SPL23018D	SPL59438
	Bottom	SPL57007D	SPL57017D	SPL57024D	SPL23015D	
Gage Members		GO Plug: SPL59430	Handle: SPL59431	HI Ramp: SPL59432		
M2.2x0.45	Plug	MTO	MTO	MTO	MTO	SPL59448
	Bottom	MTO	MTO	MTO	MTO	
Gage Members		GO Plug: SPL59440	Handle: SPL59441	HI Ramp: SPL59442		
M2.5x0.45	Plug	SPL56815D	MTO	SPL56818D	SPL23028D	SPL59458
	Bottom	SPL56807D	SPL56812D	SPL56819D	SPL23025D	
Gage Members		GO Plug: SPL59450	Handle: SPL59451	HI Ramp: SPL59452		
M3.0x0.50	Plug	SPL56835D	MTO	SPL56838D	SPL23033D	SPL59468
	Bottom	SPL56827D	SPL56832D	SPL56839D	SPL23030D	
Gage Members		GO Plug: SPL59460	Handle: SPL59461	HI Ramp: SPL59462		
M3.5x0.60	Plug	MTO	SPL56850D	MTO	MTO	SPL59478
	Bottom	MTO	MTO	MTO	SPL23035D	
Gage Members		GO Plug: SPL59470	Handle: SPL59471	HI Ramp: SPL59472		
M4.0x0.70	Plug	SPL56895D	MTO	MTO	SPL23043D	SPL59488
	Bottom	SPL56901D	SPL56892D	SPL56904D	SPL23040D	
Gage Members		GO Plug: SPL59480	Handle: SPL59481	HI Ramp: SPL59482		
M4.5x0.75	Plug	SPL57075D	MTO	MTO	MTO	SPL59498
	Bottom	MTO	MTO	MTO	MTO	
Gage Members		GO Plug: SPL59490	Handle: SPL59491	HI Ramp: SPL59492		
M5.0x0.80	Plug	SPL57115D	SPL57110D	SPL57123D	SPL23053D	SPL59528
	Bottom	SPL57121D	SPL57112D	SPL57124D	SPL23050D	
Gage Members	GO Plug: SPL59520	GO Handle: SPL59521	HI P.D.: SPL59522	HI Ramp: SPL59523	HI Handle: SPL59524	
M6x1.00	Plug	SPL57150D	MTO	MTO	SPL23058D	SPL59538
	Bottom	SPL57161D	MTO	MTO	SPL23055D	
Gage Members	GO Plug: SPL59530	GO Handle: SPL59531	HI P.D.: SPL59532	HI Ramp: SPL59533	HI Handle: SPL59534	
M7x1.00	Plug	SPL57190D	MTO	MTO	MTO	SPL59548
	Bottom	MTO	MTO	SPL57204D	MTO	
Gage Members	GO Plug: SPL59540	GO Handle: SPL59541	HI P.D.: SPL59542	HI Ramp: SPL59543	HI Handle: SPL59544	
M8x1.00	Plug	SPL57230D	SPL57220D	MTO	MTO	SPL59558
	Bottom	SPL57241D	SPL57222D	SPL57244D	MTO	
Gage Members	GO Plug: SPL59550	GO Handle: SPL59551	HI P.D.: SPL59552	HI Ramp: SPL59553	HI Handle: SPL59554	
M8x1.25	Plug	SPL57270D	MTO	SPL57283D	SPL23073D	SPL59568
	Bottom	SPL57281D	SPL57262D	SPL57284D	SPL23070D	
Gage Members	GO Plug: SPL59560	GO Handle: SPL59561	HI P.D.: SPL59562	HI Ramp: SPL59563	HI Handle: SPL59564	

Tap and Gage Part Numbers – Metric

**MTO = Made To Order*

Thread Size	Chamfer	Multi- Purpose	T-10 Straight Flute	Cold Forming	High Performance	Gage Set
M9x1.25	Plug	MTO	MTO	MTO	MTO	SPL59578
	Bottom	MTO	MTO	MTO	MTO	
Gage Members	GO Plug: SPL59570	GO Handle: SPL59571	HI P.D.: SPL59572	HI Ramp: SPL59573	HI Handle: SPL59574	
M10x1.25	Plug	SPL57350D	MTO	MTO	MTO	SPL59588
	Bottom	SPL57361D	MTO	MTO	SPL23080D	
Gage Members	GO Plug: SPL59580	GO Handle: SPL59581	HI P.D.: SPL59582	HI Ramp: SPL59583	HI Handle: SPL59584	
M10x1.50	Plug	SPL57380D	SPL57375D	SPL57403D	SPL23088D	SPL59598
	Bottom	SPL57401D	SPL57377D	SPL57404D	SPL23085D	
Gage Members	GO Plug: SPL59590	GO Handle: SPL59591	HI P.D.: SPL59592	HI Ramp: SPL59593	HI Handle: SPL59594	
M11x1.50	Plug	MTO	MTO	MTO	MTO	SPL59608
	Bottom	MTO	MTO	MTO	MTO	
Gage Members	GO Plug: SPL59600	GO Handle: SPL59601	HI P.D.: SPL59602	HI Ramp: SPL59603	HI Handle: SPL59604	
M12x1.25	Plug	SPL57470D	MTO	MTO	SPL23098D	SPL59618
	Bottom	SPL57478D	MTO	MTO	SPL23095D	
Gage Members	GO Plug: SPL59610	GO Handle: SPL59611	HI P.D.: SPL59612	HI Ramp: SPL59613	HI Handle: SPL59614	
M12x1.75	Plug	SPL57510D	MTO	MTO	SPL23103D	SPL59628
	Bottom	SPL57518D	MTO	MTO	SPL23100D	
Gage Members	GO Plug: SPL59620	GO Handle: SPL59621	HI P.D.: SPL59622	HI Ramp: SPL59623	HI Handle: SPL59624	
M14x1.25	Plug	MTO	MTO	MTO	MTO	SPL59638
	Bottom	MTO	MTO	MTO	MTO	
Gage Members	GO Plug: SPL59630	GO Handle: SPL59631	HI P.D.: SPL59632	HI Ramp: SPL59633	HI Handle: SPL59634	
M14x1.5	Plug	SPL57590D	MTO	MTO	MTO	SPL59648
	Bottom	SPL57598D	MTO	MTO	MTO	
Gage Members	GO Plug: SPL59640	GO Handle: SPL59641	HI P.D.: SPL59642	HI Ramp: SPL59643	HI Handle: SPL59644	
M14x2.0	Plug	SPL57630D	MTO	MTO	MTO	SPL59658
	Bottom	MTO	MTO	MTO	SPL23115D	
Gage Members	GO Plug: SPL59650	GO Handle: SPL59651	HI P.D.: SPL59652	HI Ramp: SPL59653	HI Handle: SPL59654	
M16x1.5	Plug	SPL57665D	MTO	MTO	MTO	SPL59668
	Bottom	MTO	SPL57657D	MTO	MTO	
Gage Members	GO Plug: SPL59660	GO Handle: SPL59661	HI P.D.: SPL59662	HI Ramp: SPL59663	HI Handle: SPL59664	
M16x2.0	Plug	SPL57695D	MTO	MTO	MTO	SPL59678
	Bottom	SPL57700D	MTO	MTO	SPL23125D	
Gage Members	GO Plug: SPL59670	GO Handle: SPL59671	HI P.D.: SPL59672	HI Ramp: SPL59673	HI Handle: SPL59674	
M18x1.5	Plug	SPL57725D	MTO	MTO	SPL23133D	SPL59688
	Bottom	SPL57730D	MTO	MTO	SPL23130D	
Gage Members	GO Plug: SPL59680	GO Handle: SPL59681	HI P.D.: SPL59682	HI Ramp: SPL59683	HI Handle: SPL59684	
M18x2.5	Plug	MTO	MTO	MTO	SPL23138D	SPL59698
	Bottom	MTO	MTO	SPL57764D	SPL23135D	
Gage Members	GO Plug: SPL59690	GO Handle: SPL59691	HI P.D.: SPL59692	HI Ramp: SPL59693	HI Handle: SPL59694	

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Tap and Gage Part Numbers – Metric

**MTO = Made To Order*

Thread Size	Chamfer	Multi- Purpose	T-10 Straight Flute	Cold Forming	High Performance	Gage Set
M20x1.5	Plug	MTO	MTO	MTO	SPL23143D	SPL59708
	Bottom	SPL57790D	MTO	MTO	SPL23140D	
Gage Members	GO Plug: SPL59700	GO Handle: SPL59701	HI P.D.: SPL59702	HI Ramp: SPL59703	HI Handle: SPL59704	
M20x2.5	Plug	MTO	MTO	MTO	MTO	SPL59718
	Bottom	SPL57820D	MTO	MTO	MTO	
Gage Members	GO Plug: SPL59710	GO Handle: SPL59711	HI P.D.: SPL59712	HI Ramp: SPL59713	HI Handle: SPL59714	
M22x1.5	Plug	SPL57825D	MTO	MTO	SPL23153D	SPL59728
	Bottom	MTO	SPL57837D	MTO	SPL23150D	
Gage Members	GO Plug: SPL59720	GO Handle: SPL59721	HI P.D.: SPL59722	HI Ramp: SPL59723	HI Handle: SPL59724	
M22x2.5	Plug	SPL57845D	MTO	MTO	MTO	SPL59738
	Bottom	SPL57847D	MTO	MTO	MTO	
Gage Members	GO Plug: SPL59730	GO Handle: SPL59731	HI P.D.: SPL59732	HI Ramp: SPL59733	HI Handle: SPL59734	
M24x3.0	Plug	MTO	MTO	MTO	SPL23163D	SPL59748
	Bottom	MTO	SPL57877D	MTO	SPL23160D	
Gage Members	GO Plug: SPL59740	GO Handle: SPL59741	HI P.D.: SPL59742	HI Ramp: SPL59743	HI Handle: SPL59744	

Recommended Gaging Practices

Gaging Spiralock threads requires the use of special gages to ensure proper function of the thread. Only genuine Spiralock gages can determine the functionality of Spiralock threads.

Gage Utilization

Gages are to be installed in the same direction as the external (male) thread will be assembled into the hole.

The GO member checks for minimum thread profile and should enter the threads hole for the full length of thread engagement. The gage member should spin freely to minimize wear with a slight drag allowable.

The NO-GO gage members check for maximum thread profile and are designed not to enter the threaded hole. However, the thread is acceptable if the gage enters the thread up to a maximum of three (3) revolutions. This allows for any errors in starting the threading process.

When gaging Spiralock threads that will be heat treated, all gage members (GO & NO-GO) must function properly both before and after heat treating.

Spiralock GO and NO-GO gages should be utilized before plating to determine acceptability. If the thread gages successfully before plating, the Spiralock thread form will function properly.

Gage Illustrations

Conventional Spiralock Thread Gages:
This three part gaging system is used with all Spiralock cutting tools making equal to or coarser than 32 TPI (0.80 mm)

GO - Pitch Diameter and Ramp

NO-GO Pitch Diameter

NO-GO Ramp

Spiralock Sawtooth Thread Gages:
Two gage system for use with all Spiralock cutting tools making finer than a 32 TPI (0.80 mm).

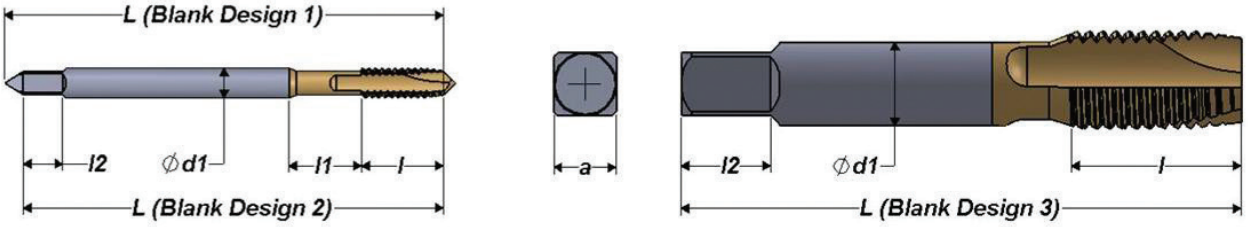
GO Pitch Diameter

NO-GO Ramp Gage

A unique serial number is assigned to each gage member for traceability at the time of manufacture, and a long form certification is supplied for each gage member. Gage re-certification is performed exclusively through Spiralock and should be based on the number of uses of a gage (rather than a fixed time period) to ensure that used gages remain within specification.

This gaging practice is based on FED-STD-H28, Section 6.3, Gaging and Gaging Procedures.

Standard Tap Dimensions

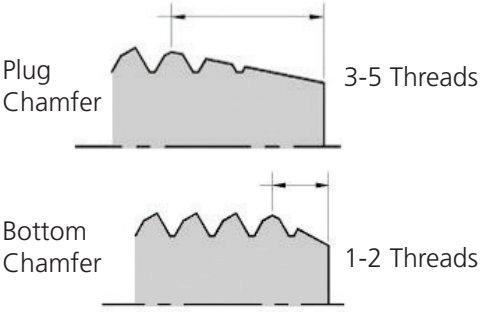


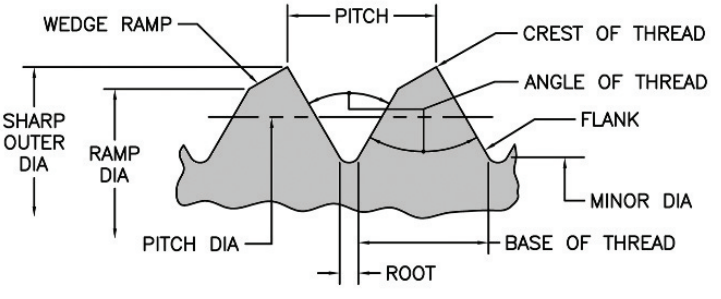
English and Fractional Sizes

English Screw Size	Nominal Diameter	Blank Design No.	L Overall Length	l Thread Length	l1 Neck Length	l2 Square Length	d1 Shank Diameter	a Size of Square
0	**.060**	1	1.63	.31		.19	.1410	.110
1	**.073**	1	1.69	.38		.19	.1410	.110
2	**.086**	1	1.75	.44		.19	.1410	.110
3	**.099**	1	1.81	.50		.19	.1410	.110
4	**.112**	1	1.88	.31	.25	.19	.1410	.110
5	**.125**	1	1.94	.31	.31	.19	.1410	.110
6	**.138**	1	2.00	.38	.31	.19	.1410	.110
8	**.164**	1	2.13	.38	.38	.25	.1680	.131
10	**.190**	1	2.38	.50	.38	.25	.1940	.152
12	**.216**	1	2.38	.50	.44	.28	.2200	.165
	1/4	2	2.5	.63	.38	.31	.2550	.191
	5/16	2	2.72	.69	.44	.38	.3180	.238
	3/8	2	2.94	.75	.50	.44	.3810	.286
	7/16	3	3.16	.88		.41	.3230	.242
	1/2	3	3.38	.94		.44	.3670	.275
	9/16	3	3.59	1.00		.50	.4290	.322
	5/8	3	3.81	1.09		.56	.4800	.360
	3/4	3	4.25	1.22		.69	.5900	.442
	7/8	3	4.69	1.34		.75	.6970	.523
	1"	3	5.13	1.50		.81	.8000	.600

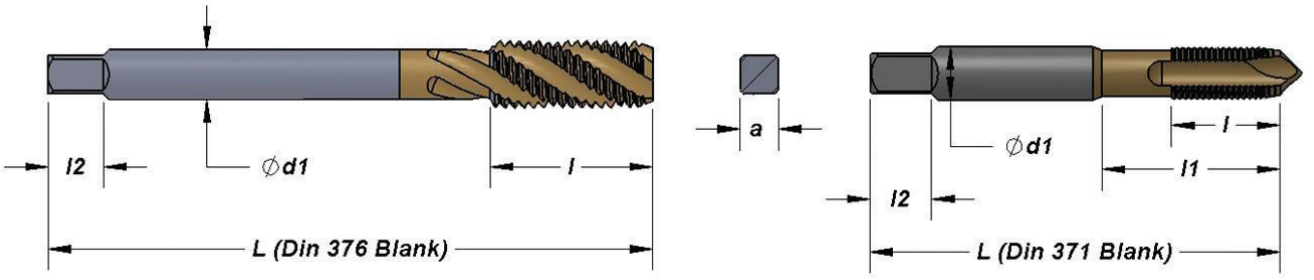
All dimensions in inches

Tap Terminology





Standard Tap Dimensions



Metric Sizes

Nominal Thread Diameter	Blank Style	L Overall Length	l Thread Length	l1 Length with Neck	l2 Square Length	d1 Shank Diameter	a Size of Square
M1.4	DIN 371	40	7		5	2.5	2.1
M1.6	DIN 371	40	8		5	2.5	2.1
M1.7	DIN 371	40	8		5	2.5	2.1
M1.8	DIN 371	40	8		5	2.5	2.1
M2	DIN 371	45	8		5	2.8	2.1
M2.2	DIN 371	45	9		5	2.8	2.1
M2.5	DIN 371	50	9		5	2.8	2.1
M3	DIN 371	56	11	18	6	3.5	2.7
M3.5	DIN 371	63	12	20	6	4	3
M4	DIN 371	63	13	21	6	4.5	3.4
M4.5	DIN 371	70	16	25	8	6	4.9
M5	DIN 371	70	16	25	8	6	4.9
M6	DIN 371	80	19	30	8	6	4.9
M7	DIN 371	80	19	30	8	7	5.5
M8	DIN 371	90	22	35	9	8	6.2
M9	DIN 371	90	22	35	10	9	7
M10	DIN 371	100	24	39	11	10	8
M11	DIN 376	100	24		9	8	6.2
M12	DIN 376	110	28		10	9	7
M14	DIN 376	110	30		12	11	9
M16	DIN 376	110	32		12	12	9
M18	DIN 376	125	34		14	14	11
M20	DIN 376	140	34		15	16	12
M22	DIN 376	140	34		17	18	14.5
M24	DIN 376	160	38		17	18	14.5

**Coarse pitch shown – dimensions also apply to fine pitches*

All dimensions in millimeters

OPTIA®

Tapping Troubleshooting

GO Gage Problems: GO gage will not enter the hole or will not go all the way into the hole

Possible Cause	Solution
Tap worn on cutting edge	Regrind or replace tap
Tap worn on major diameter	Replace tap
Burrs on entry or exit side of hole	Remove burrs from thread, increase coolant concentration
Minor diameter is too small	Select proper size from Spiralock Drill Chart
Tapered thread	Tap not aligned with hole. Check alignment with dial indicator
Fixture clamping distorts part during tapping	Change clamp points to remove stress from tapped hole
Damaged thread(s)	Use proper reversing speed when exiting hole and clear tool completely from hole when finished tapping
Re-sharpened tap not within specifications	Discard tap and use a new tap
Material closing in on tapped hole	Common occurrence in thin-walled tubing or elastic materials. Increase tapping speed and feed. Reduce jaw pressure on workpiece
Debris on gage	Thoroughly clean gage and tapped hole

NO-GO Gage Problems: Gaging oversize – either "NO-GO" gage enters the hole more than 3 full turns

Possible Cause	Solution
Poor spindle alignment	Realign/rebuild spindle assembly to achieve accuracy required
Tapered or bell-mouthed hole	1. Check that part is fixtured properly and movement of part does not occur during tapping operation 2. Re-align tap to drilled hole
Tap holder not concentric with spindle	Change to a rigid tool holder
Too much feed/pull-out force	Decrease feed pressure, allowing tap to freely cut its own lead
Loading on tap teeth (metal welds on tap)	Increase coolant concentration, direct coolant to end of tap, or change tap lubricant
Chips packed in flutes of tap	Use spiral flute tap, or peck tap to rinse chips from tap and hole
Incorrect flute hook for material being tapped	Consult Spiralock sales or engineering for correct style tap
Gage worn undersize	Return to Spiralock for recertification or purchase new gage

Rough Threads: Poor surface finish found on minor diameter and/or in thread flanks

Possible Cause	Solution
Incorrect flute hook for material being tapped	Consult Spiralock sales or engineering for correct style of tap
Incorrect lead chamfer	Change to tap with increased chamfer
Improper thread relief	Consult Spiralock sales or engineering for correct style of tap
Wrong or insufficient lubricant	Consult lube specialist for proper cutting oils
Loading on tap teeth (metal welds to tap)	Increase coolant concentration; change to cutting oil
Tap drill too small	Select proper size from Spiralock Drill Chart
Chips packed in tap flutes	Increase amount of coolant; direct coolant to end of tap
Chipped teeth on tap	Replace tap
Tap worn on cutting edge	Regrind or replace tap

Tapping Troubleshooting

Taps are breaking:

Possible Cause	Solution
Taps are dull	Re-sharpen taps or replace with new taps
Material too hard	Switch to a tap designed for harder materials
Incorrect lubrication	Consult lubrication specialist for proper cutting oils
Misalignment of tap with drilled hole	Check accuracy of axis in machinery and alignment to drilled hole
Minor diameter too small	Select proper size from Spiralock Drill Chart
Not enough chip clearance	Clean out chips before tapping or drill minor diameter deeper to provide more area for chips
Tap not cutting freely	Modify feeds to improve cutting ability of taps
Tap bottoming in blind holes	Clean out chips before tapping or drill minor diameter deeper to provide more area for chips
Loose or poor fixturing of part	Check that part is fixtured correctly and movement of part does not occur during tapping operation
Poor lubrication	Increase amount of coolant; peck tap to re-wet deep holes
Not enough thread relief	Switch to style of tap with greater thread relief
Improper tap coating	Consult Spiralock engineers for change in tap surface coating specification
Hand tapping in work hardening materials	Machine tap in one pass; if not possible, contact Spiralock for custom solution

Poor Tool Life:

Possible Cause	Solution
Misalignment	Check accuracy of axis in machinery or realign/rebuild spindle
Tap run out in holder	Change to a rigid tool holder
Wrong or insufficient lubricant	Consult lubrication specialist for proper cutting oils
Minor diameter too small	Select proper size from Spiralock Drill Chart
Minor diameter work hardened during drilling	Use a carbide drill bit or ream the minor diameter after drilling
Hard spots in material	Anneal material if possible
Chips packed in flute	Clean out chips before tapping or drill minor diameter deeper to provide more area for chips
Incorrect flute hook for material being tapped	Obtain material specifications and consult Spiralock sales for correct style tap
Incorrect lead chamfer	Change to tap with increased chamfer. This may require drilling deeper for blind holes
Tap requires a special surface treatment	Obtain material specifications and consult Spiralock sales for correct surface treatment
Tap teeth are chipping	Verify that tap is not cutting into an angled or contoured surface
Tap over-cutting or under-cutting its lead	Change to a rigid tool holder. Verify gaging is correct
Loading on tap teeth	Increase amount of coolant, direct coolant to end of tap
Tap worn on cutting edge	Regrind or replace tap
Excessive tapping torque	Increase tapping speed or change tap style

Application Profile

Questions to consider while evaluating the Spiralock solution:

Application description:
Current problem with application:
Reason for interest in Spiralock?
Type of test/definition of success:
Application time line – prototype:
Application time line – pre-production:
Application time line – production
Application life cycle?
Customer application prints available?
Application samples needed?
Material / hardness?
Thread size:
Is this a hard joint?
Is there a gasket in the joint?
Peak temperature at bolt / stud:
Peak temperature at nut:
Competitive fastening method in use:
Male thread material type:
Male thread grade / class:
Other components being used in joint:
Plating type on male and female thread:
Torque-current levels in use:
Specific clamp load required:
Any other special requirements?
Mil. Spec. compliance required?
Quality compliance required?
Material being tapped?
Machine cutting fluid?
Machine type & model?
Hole type:
Hole depth being tapped?
Current tool life performance?
Components per year x holes per?
Est. annual tooling usage?
Thread mill style:

About Stanley Engineered Fastening

Stanley® Engineered Fastening — a division of Stanley Black & Decker — is the global leader in precision fastening and assembly solutions. Our industry-leading brands, Avdel®, Integra™, Nelson®, Optia®, POP®, Stanley® Assembly Technologies and Tucker® elevate what our customers create. Backed by a team of passionate and responsive problem-solvers, we empower engineers to create the future.

A True Partner
Our close customer relationships allow for early involvement in the design and development of new projects and programs. From the very beginning of the design process, we are a true partner with our customers, ensuring that the fastener selection, installation method, and assembly layout are optimized prior to the start of production. This also guarantees that fastening will not be an issue when it comes time for product assembly. Our extensive field service network is there to ensure rapid onsite response to any customer issue.

Cost-Effective Process
In addition to developing fasteners that uniquely resolve assembly issues, Stanley Engineered Fastening also provides an extremely cost-effective tooling and installation process. In some cases, we will take full responsibility for the complete design of the entire assembly process. Our emphasis on a total fastening system ensures that a customer's "in place" assembly cost is driven to an absolute minimum.

Broad Customer Base
There is virtually no industry in which a Stanley Engineered Fastening product or installation tool or system is not used. Industries we predominately serve include aerospace and defense, agriculture/ heavy equipment, appliances, industrial assembly equipment, automotive, construction, electronics, energy, medical, telecommunications and transportation. Anything that is manufactured is touched by Stanley Engineered Fastening.

STANLEY
Engineered Fastening

STANLEY ENGINEERED FASTENING FAMILY OF BRANDS

AVDEL. INTEGRA NELSON OPTIA POP STANLEY Assembly Technologies TUCKER

Stanley Engineered Fastening Family of Brands

AVDEL

Structural Blind Fasteners

Avdel® represents the broadest range of highly engineered structural blind fasteners available, ensuring that our customers are offered the most appropriate technology for their application.

Products include: Specialist & Structural Blind Fasteners, Lockbolts, Speed Fasteners, Avseal® Blind Sealing Plugs, Blind Rivet Nuts

INTEGRA

Plastic Components

To support the sustainable development of electric vehicles, the highly engineered Integra product range includes lightweight parts and employs production strategies with the lowest possible material requirement.

Products include: Pipe Clips, Electrical Connection Solutions, Trim and Panel Fixation Solutions, Functional Plastic Parts and Bus Bars.

NELSON

Stud Welding

The market-leading Nelson® Stud Welding platform has been developed to overcome the toughest welding challenges in construction, industrial and shipbuilding industries.

Products include: Drawn Arc Stud Welding Equipment, Capacitor Discharge Stud Welding Equipment, Inverter Stud Welding Equipment, Welding Guns and Nelson Studs.

OPTIA

Threaded Fasteners

We offer complete customization on the Optia range – delivering design flexibility, fast prototyping and condensed development lead times.

Products include: Internally Threaded Fasteners, Externally Threaded Fasteners, Engineered Specials, Metal Clips and Self-locking, Vibration Loosening Resistant Fasteners.

POP®

Non-structural Blind Fasteners

The highly engineered POP® product range is available in a variety of material specifications to provide reliable fastening in soft, brittle and thin metals and plastics. All solutions are supported by the global network of Stanley Engineered Fastening application engineers.

Products include: Premium Engineered Blind Rivets, POPNut®, WellNut® and Hand Tools.

STANLEY
Assembly Technologies

Specialist Assembly

To serve the complex needs of industrial and automotive manufacturing, installation equipment from Stanley Assembly Technologies can be fully customized with varying degrees of automation, error proofing and data capture.

Products include: Precision Threaded Fastening Equipment and Blind Fastening Equipment (for rivets, lockbolts and speed fasteners)

TUCKER®

Automated Fastener Systems

Early collaboration during the design phase and complete understanding of the customer's challenge ensures that we can offer the best possible technical solution and the lowest total c ost of ownership.

Products include: No-hole Fastening System and Mechanical Joining System.

For more information on each strategic brand and its product portfolio please visit our website, **www.stanleyengineeredfastening.com**

STANLEY
Engineered Fastening

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