THREDFLOER HOLE SIZE AND CLASS OF FIT

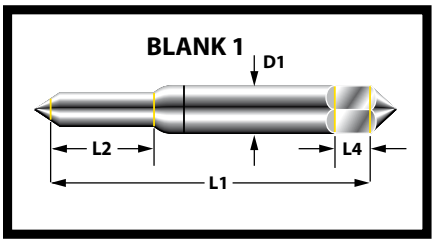
The following table gives the hole size for three thread percentages when used with the recommended "H" or "D" numbers. The largest "H" or "D" numbers will place the finished thread pitch diameter .0005 to .0010 under the "NO-GO" P.D. limit. They will also provide the longest tap life before the tap wears under size. For a slightly tighter fit, the smaller recommended "H" or "D" numbers may be used.

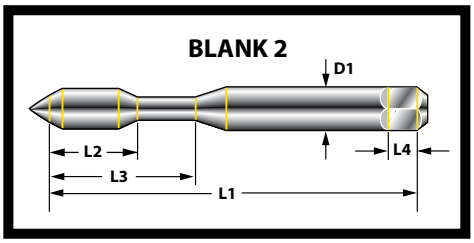
THREDFLOERS – MACHINE SCREW AND FRACTIONAL SIZE

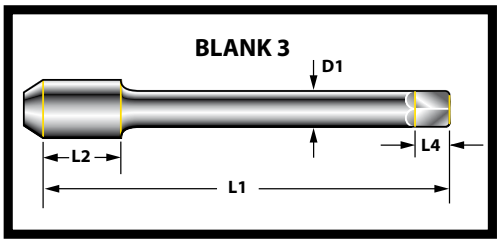
SIZE	THREADS PER INCH NC UNC	THREADS PER INCH NF UNF	HOLE SIZES REQUIRED FOR: 75% THREAD	65% THREAD	55% THREAD	TAP DRILL SIZE (65% THREAD)	"H" NUMBER PER CLASS OF FIT 2B	3B	2	STOCK "H" NUMBER
000		120	.0303	.0307	.0311	#68	-	-	-	2
00	90		.0417	.0422	.0426	#58	-	-	-	2
		96	.0420	.0425	.0430	#58	-	-	-	
0		80	.0546	.0552	.0558	#54 OR 1.4 mm*	3, 2	2	2	2, 3, 4, 5, 6, 7
1	64		.066	.067	.068	#51 OR 1.7 mm	4, 3	3, 2	3, 2	
		72	.067	.068	.069	#51 OR 1.75 mm	4, 3	3, 2	3, 2	
2	56		.078	.079	.080	#47 OR 2.0 mm	4, 3	3, 2	3, 2	
		64	.079	.080	.081	2.0 mm*	4, 3	3, 2	3, 2	
3	48		.090	.091	.092	2.3 mm*	5, 4	3, 2	3, 2	
		56	.091	.092	.093	2.3 mm*	5, 4	3, 2	3, 2	
4	40		.100	.101	.103	#39	5, 4	4, 3	4, 3	
		48	.103	.104	.105	#37	5, 4	4, 3	3, 2	
5	40		.113	.114	.116	#33 OR 2.9 mm	5, 4	4, 3	4, 3	
		44	.114	.115	.117	#33 OR 2.9 mm	5, 4	4, 3	4, 3	
6	32		.124	.125	.126	3.1 mm	6, 5	4, 3	5, 4	2, 3, 4, 5, 6, 7, 8, 9, 10
		40	.126	.127	.128	1/8" OR 3.2 mm*	5, 4	4, 3	4, 3	
8	32		.149	.150	.152	#25 OR 3.8 mm	6, 5	4, 3	4, 3	
		36	.151	.152	.153	#24	5, 4	4, 3	3, 2	
10	24		.170	.172	.174	11/64"	7, 6, 5	5, 4	5, 4	
		32	.175	.176	.178	#16 OR .176"*	6, 5	4, 3	4, 3	
12	24		.196	.198	.200	#9 OR 5.0 mm	7, 6, 5	5, 4	5, 4	
		28	.199	.201	.203	#7 OR 5.1 mm	7, 6, 5	4, 3	4, 3	
1/4"	20		.225	.227	.230	5.75 mm*	8, 7, 6	5, 4	5, 4	
		28	.233	.235	.237	"A"	7, 6, 5	5, 4	4, 3	
5/16"	18		.285	.287	.291	7.25 mm*	9, 8, 7	6, 5	6, 5	
		24	.292	.294	.297	.293"*	8, 7, 6	5, 4	5, 4	
3/8"	16		.344	.347	.350	"S" OR 11/32"	9, 8, 7	7, 6	7, 6	4, 5, 6, 7, 8, 9, 10, 11, 12
		24	.355	.357	.359	9.0 mm*	8, 7, 6	6, 5	5, 4	
7/16"	14		.402	.405	.409	"Y"	10, 9, 8	7, 6	8, 7, 6	
		20	.414	.416	.418	"Z" OR 10.5 mm*	9, 8, 7	6, 5	5, 4	
1/2"	13		.462	.466	.470	.463"*	11, 10, 9	8, 7, 6	8, 7, 6	
		20	.475	.477	.480	.476"*	9, 8, 7	6, 5	5, 4	
9/16"	12		.520	.524	.528	.521"*	11, 10, 9	8, 7, 6	9, 8, 7	
		18	.535	.537	.540	.536"*	9, 8, 7	7, 6, 5	7, 6, 5	
5/8"	11		.579	.583	.586	37/64"	12, 11, 10	9, 8, 7	9, 8, 7	
		18	.598	.600	.603	.598"*	10, 9, 8	7, 6, 5	7, 6, 5	
3/4"	10		.700	.704	.709	45/64"	13, 12, 11	9, 8, 7	11, 10, 9	6, 7, 8, 9, 10, 11, 12, 13, 14
		16	.720	.723	.726	23/32"	11, 10, 9	8, 7, 6	7, 6, 5	
7/8"	9		.818	.823	.829	.823"	14, 13, 12	10, 9, 8	12, 11, 10	
		14	.839	.843	.845	27/32"	12, 11, 10	9, 8, 7	8, 7, 6	
1"	8		.935	.942	.948	15/16"	14, 13, 12	11, 10, 9	13, 12, 11	
		12	.959	.963	.967	.963"	13, 12, 11	10, 9, 8	10, 9, 8	

NOTE: *Drill Sizes were selected wherever possible to produce approximately 65% thread. The drills marked * are stocked by Balax.*

ANSI CNC TAP BLANK DIMENSIONS







DIMENSIONS ARE FROM TABLE 302 of MCTI TAP STANDARDS

AMERICAN SIZE	METRIC SIZE	BLANK	LENGTH			SHANK	SQUARE	
			L1 (in.)	L2 (in.)	L3 (in.)	D1 (in.)	(in.)	L4 (in.)
000	M.7, M.8	1	1-5/8	.190	–	.141	.110	3/16
00	M.9 -M1.2	1	1-5/8	.250	–	.141	.110	3/16
0	M1.4, M1.6	1	1-5/8	.312	–	.141	.110	3/16
1	–	1	1-11/16	.375	–	.141	.110	3/16
2	M2.0	1	1-3/4	.438	–	.141	.110	3/16
3	M2.5	1	1-13/16	.500	–	.141	.110	3/16
4	–	1	1-7/8	.563	–	.141	.110	3/16
5	M3.0	1	1-15/16	.626	–	.141	.110	3/16
6	M3.5	2	2	.450	11/16	.141	.110	3/16
8	M4.0	2	2-1/8	.470	3/4	.168	.131	1/4
10	M5.0	2	2-3/8	.600	7/8	.194	.152	1/4
12	–	2	2-3/8	.620	15/16	.220	.165	9/32
1/4	M6.0	2	2-1/2	.790	1	.255	.191	5/16
5/16	M8.0	2	2-23/32	.880	1-1/8	.318	.238	3/8
3/8	M10	2	2-15/16	.950	1-1/4	.381	.286	7/16
7/16	M11	3	3-5/32	.950	–	.323	.242	13/32
1/2	M12	3	3-3/8	1	–	.367	.275	7/16
9/16	M14	3	3-19/32	1	–	.429	.322	1/2
5/8	M16	3	3-13/16	1	–	.480	.360	9/16
11/16	M18	3	4-1/32	1	–	.542	.406	5/8
3/4	–	3	4-1/4	1	–	.590	.442	11/16
13/16	M20	3	4-15/32	1	–	.652	.489	11/16
7/8	M22	3	4-11/16	1	–	.697	.523	3/4
15/16	M24	3	4-29/32	1	–	.760	.570	3/4
1	–	3	5-1/8	1	–	.800	.600	13/16

STANDARD PIPE TAP BLANK DIMENSIONS

DIMENSIONS ARE FROM TABLE 311 OF MCTI TAP STANDARDS

SIZE	BLANK	LENGTH		SHANK	SQUARE	
		L1 (in.)	L2 (in.)	D1 (in.)	(in.)	L4 (in.)
1/16	1	2-1/8	.687	.3125	.234	3/8
1/8	3	2-1/8	.750	.3125	.234	3/8
1/8	1	2-1/8	.750	.4375	.328	3/8
1/4	1	2-7/16	1.062	.5625	.421	7/16
3/8	1	2-9/16	1.062	.7000	.531	1/2
1/2	3	3-1/8	1.375	.6875	.515	5/8
3/4	3	3-1/4	1.375	.9063	.679	11/16
1	3	3-3/4	1.750	1.1250	.843	13/16

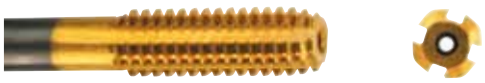
SUGGESTED TAPPING SPEEDS

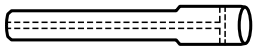
MATERIAL	SFM	TAPPING RPM																		
		#0 M1.6	#1	#2 M2	#3 M2.5	#4	#5 M3	#6 M3.5	#8 M4	#10 M5	#12	1/4 M6	5/16 M8	3/8 M10	7/16 M11	1/2 M12	5/8 M16	3/4 M18	1" M24
LOW CARBON STEEL	55	3503	2879	2444	2123	1877	1682	1523	1282	1106	973	841	674	561	481	420	336	280	210
MEDIUM CARBON STEEL	35	2229	1832	1555	1351	1194	1070	969	816	704	619	535	429	357	306	268	214	178	134
HIGH CARBON STEEL	10	637	524	444	386	341	306	277	233	201	177	153	122	102	87	76	61	51	38
CAST STEEL	25	1592	1309	1111	965	853	764	692	583	503	442	382	306	255	219	191	153	127	96
300 SERIES STAINLESS STEEL	20	1274	1047	889	772	682	611	554	466	402	354	306	245	204	175	153	122	102	76
400 SERIES STAINLESS STEEL	15	955	785	667	579	512	459	415	350	302	265	229	184	153	131	115	92	76	57
GREY CAST IRON	70	4459	3665	3111	2702	2389	2140	1939	1631	1408	1238	1070	857	713	612	535	428	357	268
DUCTILE CAST IRON	50	3185	2618	2222	1930	1706	1529	1385	1165	1006	885	764	612	510	437	382	306	255	191
ALLOY CAST IRON	40	2548	2094	1778	1544	1365	1223	1108	932	805	708	611	490	408	350	306	245	204	153
ALUMINUM CAST ALLOYS	60	3822	3141	2666	2316	2047	1834	1662	1398	1207	1062	917	735	611	525	459	367	306	229
ALUMINUM DIECAST ALLOYS	70	4459	3665	3111	2702	2389	2140	1939	1631	1408	1238	1070	857	713	612	535	428	357	268
ALUMINUM WROUGHT ALLOYS	80	5096	4188	3555	3088	2730	2446	2215	1864	1609	1415	1223	980	815	700	611	489	408	306
ZINC DIECASTINGS	80	5096	4188	3555	3088	2730	2446	2215	1864	1609	1415	1223	980	815	700	611	489	408	306
COPPER	60	3822	3141	2666	2316	2047	1834	1662	1398	1207	1062	917	735	611	525	459	367	306	229
BRASS, FREE MACHINING	60	3822	3141	2666	2316	2047	1834	1662	1398	1207	1062	917	735	611	525	459	367	306	229
CAST BRONZE	50	3185	2618	2222	1930	1706	1529	1385	1165	1006	885	764	612	510	437	382	306	255	191
NICKEL ALLOYS	10	637	524	444	386	341	306	277	233	201	177	153	122	102	87	76	61	51	38
TITANIUM ALLOYS	10	637	524	444	386	341	306	277	233	201	177	153	122	102	87	76	61	51	38
PLASTIC, THERMOSETTING	40	2548	2094	1778	1544	1365	1223	1108	932	805	708	611	490	408	350	306	245	204	153
PLASTIC, THERMOPLASTIC	80	5096	4188	3555	3088	2730	2446	2215	1864	1609	1415	1223	980	815	700	611	489	408	306

1. Speeds are starting points for cold forming taps or for cutting taps in thru hole applications.
2. Fine pitch cold forming taps less than 1/2" diameter may be run faster in soft material with good lubrication. Increase tapping RPM gradually until tap heat buildup due to lubrication failure begins to occur.
3. For cutting taps in blind holes, reduce RPM by 25% to 50%.
4. Tap Feed Rate = Tap RPM x Tap Pitch (Displacement/Revolution)
   Example: 1/4-28 Tap @ 1000 RPM
   Feed Rate = 1000 Rev/Min. x 1/28 Inch/Rev)= 35.71 in/Min
   Example: M6 x 1.0 Tap @ 1000 RPM
   Feed Rate = 1000 Rev/Min. x 1.0 mm/Rev)= 1000 mm/Min

COOLANT-THRU TAPS

THRU - COOLANT





RADIAL - COOLANT

ANGULAR - COOLANT

FAST DELIVERY ON STANDARD COOLANT-THRU TAPS

Using Balax's EDM process, almost any standard Thredshaver or Thredfloer tap can be modified into the coolant-thru tap style of your choice: thru-coolant, radial coolant, or angular coolant. It's economical and turn-around time is fast.

SPECIAL COOLANT-THRU TAPS FOR CUSTOM APPLICATIONS

For processes requiring an engineered special coolant-thru tap, custom tap blanks are made with coolant-thru holes in the style best suited for the tapping application.

THREDFLOER APPLICATION DATA – *CONTINUED*

SURFACE TREATMENT / LUBRICATION SELECTOR

Surface treatments and proper lubrication are very important and can have a major effect on tap life and threaded part quality. Use the following application guidelines to determine the correct treatment and lubricant for the material being tapped.

MATERIAL CATAGORY	MATERIAL TYPE	TAP TREATMENT	LUBRICATION RECOMMENDED
Soft	Aluminum (plate or wrought material), Diecast Zinc, or wrought Brass	Bright finish for most application, or add hard chrome for tap wear and lubricity	Water soluble 5:1 or light tapping oil.
Soft and Abrasive	Diecast Aluminum	Nitride, Super TiN, or Bal-Plus	Water soluble 5:1 or light tapping oil.
	Copper	Balwear or Nitride/Balwear	
Itermediate Hardness	Mild Steel	Nitride or Super TiN	Extreme pressure rated tapping oil with high sulphur and high chlorine content. Balax has developed Bal-Tap "S", a specialized tapping oil, designed specifically for cold forming taps.
	300 Series Stainless	Nitride/Steam Oxide or Super TiN	
Hard Materials	Alloyed Steels and 400 Series Stainless	Nitride/Steam Oxide or Super TiN	

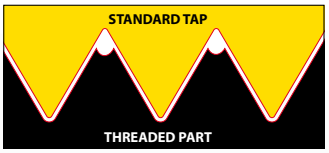
CONTROL ROOT DIAMETER "CRD"

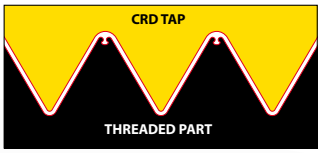
The root diameter of a forming tap may be ground to a specific size or diameter to serve several functions:

- Smooth or flatten the "U" shaped cup in the crest of the formed thread to reduce cross-threading.
- Smooth the crest of the thread to eliminate burrs or roughness and to improve the appearance of the thread.
- Size the after-tap minor diameter to a specific tolerance to minimize the effects of pre-tap hole size variations.
- Works best for thin walled stampings or diecast parts where some porosity is present.

The root diameter for a "CRD" Thredfloer Tap is calculated and carefully ground to a definite dimension to perform the burnishing or sizing of the thread crest. Most common application is to size the"CRD" for 65-75 percent thread height.

Consult with a Balax "Tapplication Engineer" to confirm the intended use and specifications for any "CRD" taps you wish to purchase.





DIECAST CORED HOLES

Diecast cored holes can be tapped directly with cold forming taps without the need for pre-tap drilling.

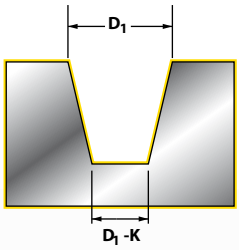
The procedure for determining core pin size is as follows:

1. Determine D1, which is the diameter of the hole at the top, by selecting the 65 percent thread pre-tap hole size from the applicable Thredfloer hole size chart.

2. Determine the diameter of the hole at the bottom by subtracting the following constant "K" from the D1 hole size diameter at the top.

Note: *The draft angle or core pin taper should be kept as straight as possible to provide uniform after-tap thread percentage. The above procedures will result in an after-tap hole with 65% thread at the top and 100% thread at the bottom.*

TAP THREAD PITCH	"K" VALUE
10 to 14 threads per inch	.012"
15 to 25 threads per inch	.010"
26 threads per inch or more, and tap size #4 (M3) or larger	.007"
26 threads per inch or more, and tap size smaller than #4 (M3)	.004"



D_1 = Hole diameter at top = 65% hole size from charts

D_1-K = Hole diameter at bottom

IMPORTANT NOTES ON THREDFLOER PRE-TAP HOLE SIZES

DETERMINING DRILL SIZE

Thread forming taps require a larger pre-tap hole size than cutting taps because they do not produce a chip during tapping. The pre-tap hole size tolerance for smaller fine-pitch taps must be controlled more closely to prevent after-tap minor diameter problems.

Finding the correct drill size for a Thredfloer Tap may be a "Cut and Try" process. Not all drills are alike and therefore the pre-tap holes produced by different drills may be vastly different. What matters is the actual pre-tap hole size, how consistently this hole size is maintained, and finally, the after-tap thread percentage or minor diameter. To get good results, you must know the actual hole size and not just the drill size! Thin wall parts may expand during tapping and produce oversize after-tap minor diameters. Diecast parts may contain porosity which may cause oversize holes due to shrinkage.

THREAD INSPECTION PROCEDURES

Pitch Diameter: The easy part is getting the "GO" and "NO-GO" thread gages, which check pitch diameter, to work correctly. As a rule of thumb, Thredfloer Taps should be two to three "H" or "D" numbers larger than cutting taps in order to gage correctly. Threads that are tight or loose after tapping can be rectified by increasing or decreasing tap pitch diameter ("H" or "D" number).

Minor Diameter: The most common problem is thread percentage. Unless otherwise specified, acceptance criteria are the minimum and maximum minor diameters for various thread sizes and classes of fit, as published by the ANSI Standards. These measurements are checked with cylindrical plug gages. It is important that these criteria be inspected during the initial "Testing" stage of drilling and tapping. Failure to check minor diameters may be very expensive.

It is often possible to fine tune the after-tap minor diameter by varying the tap pitch diameter. Changing a Thredfloer Tap by one "H" or "D" number is the same as changing the drill size by .0005 inches. For example, if the after tap minor diameter is too large, it may be reduced by using a larger tap pitch diameter, providing the no-go gage doesn't pass the part.

Example: A 1/4-20 Class 2B minor diameter should be .196/.207 inches. After tapping with an H5 tap, the part measured .205/.206", which is almost oversize. By switching to an H7 tap, you can reduce the after-tap minor diameter to .202/.203".

Suggested Procedure for Using a Thredfloer Tap

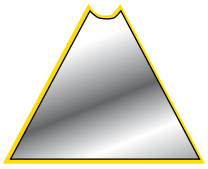
1. Test drill a part and measure the pretap hole size.
2. Test tap the part. Check pitch diameter with go and no-go gages. Check the thread percentage or minor diameter against the customer requirement.
3. Establish a maximum condition for the pre-tap hole size and monitor this frequently during the production tap run.

VISUAL THREAD INSPECTION

All formed threads have a cup or "U" in the crest due to the nature of the thread forming process. A properly sized hole should result in a thread percentage of 65-75%. Tapping with too small of a pre-tap hole size results in excessive tapping torque, tap wear, and possible tap breakage.

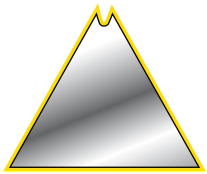
Always check your hole size after drilling. Do Not expect the drill will cut the size hole marked on the drill. Use a drill that will produce a 75% hole size where after-tap minor diameter gaging to 2B or 3B tolerances is required.

Correct Hole



Pre-tap hole size is correct. Thread percentage is 65-75%, and the after-tap minor diameter is in specification.

Too Small

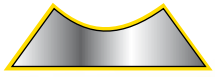


Resulting in a high thread percentage (90-100%) and an after-tap minor diameter which is too small.

Large

Suitable for some applications. Thread percentage is 55%. After-tap minor diameter is too large for 2B and 3B tolerances.

Too Large



Resulting in a low thread percentage (40%) and an after-tap minor diameter which is too big.

SEVEN MAJOR ADVANTAGES OF THREAD FORMING – VS – CUTTING TAPS

Forming taps and cutting taps produce threads that gage identically and are interchangeable, but the similarity stops there. The way they produce threads is completely different: Forming taps displace metal — cutting taps remove it.

1. CHIPLESS TAPPING

Since the thread is formed and not cut, there are no chips to interfere with the tapping process or to cause chip-removal problems in blind holes.

2. STRONGER THREADS

The grain flow of formed threads follows the contour of the thread resulting in greater thread strength. This is especially true for materials that work-harden such as steel and stainless steel.

3. BETTER THREAD GAGING

Forming taps rearrange the metal in the hole to create the thread. Because no metal is cut away, the possibility of producing oversized threads is greatly reduced.

4. STRONGER TAPS

The absence of chips eliminates the need for flutes, resulting in a solid, stronger tap.

5. LONGER TAP LIFE

Forming taps last 3 to 20 times longer than cutting taps because they have no cutting edge to dull.

6. MORE EFFICIENT PRODUCTION

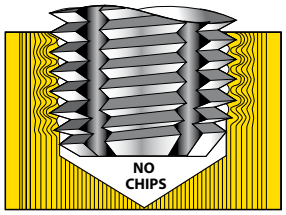
Longer tap life, less tap breakage, and faster tapping speeds combine to reduce cycle time and machine downtime.

7. IDEAL FOR NON-LEAD SCREW TAPPERS

The ability to form their own leads makes Thredfloer Taps especially well suited for CNC machines or other machines without lead screws.

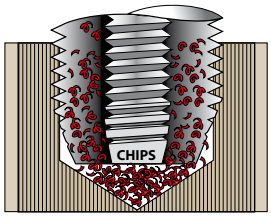
FORMING TAPS

Re-arrange the grain of the material.



CUTTING TAPS

Create chips that interferes with tapping.



WHY CHOOSE BALAX THREDFLOER'S ?

BALAX stands for "BALanced AXially," which is an important feature for all of our Thredfloer Cold Forming Taps. Balax Thredfloers are ground using our proprietary thread grinders that have a differential lead compensation device that produces cold forming taps with their lead crests exactly on pitch.

Other forming taps have lead thread cold forming teeth that are not ground on pitch. These forming taps actually cold-work the thread twice: **(1)** to form the in-accurate lead thread and **(2)** to move it on pitch. This creates an axial thrust on the tap which increases tapping torque and reduces tap life.

Balax Thredfloers form the thread exactly on pitch the first time with no axial thrust, hence the name "BALanced AXially". All Thredfloers require less tapping torque and provide longer tap life than forming taps ground with conventional methods.