

Technical Information

Troubleshooting Guide

TAPPING

TAP DOES NOT START

Check the following:

Program depth:	Compression stroke may use up the entire program depth.
Tap drill size:	Check for tap drill size.
Tap sharpness:	Check for dull tap.

PREMATURE TORQUING OF UNIT

Check the following:

Tap sharpness:	Dull taps require more driving torque than sharp taps. NUMERTAP systems sense dull taps. Replace to prevent possible breakage.
Tap drill size and adequate drill depth:	Check for correct size and depth.
Tap sharpness:	Check for dull tap.

OVERSIZED THREADS

Check the following:

Feeds and speeds:	Oversized threads mean that the space between adjacent teeth is too large. This is caused either by forcing or retarding the feed rate with respect to the speed. Check program feed versus tap pitch.
Tension stroke of tapping head:	Check to ensure that the tension stroke does not stick.

POOR THREAD QUALITY

Check the following:

Feeds and speeds:	Oversized threads mean that the space between adjacent teeth is too large. This is caused either by forcing or retarding the feed rate with respect to the speed. Check program feed versus tap pitch.
Tap sharpness and condition:	Check for dull tap or broken teeth. Replace as required.

Consult NUMERTAP Tap Guide for proper tapping speeds, lubricants, geometry, and tap drill sizes for specific H limits and specific materials. If you are not using NUMERTAP taps, consult the tap manufacturer.

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Tapping Torque Requirements & Speeds

TAPPING SPEEDS

Material	Tapping Speed (SFM)
Aluminum	90 - 110
Brass	80 - 100
Bronze	40 - 60
Copper	70 - 90
Copper-Beryllium	40 - 50
Inconel, Hastalloy, Waspalloy	5 - 15
Iron-Cast	65 - 75
Iron-Malleable	30 - 60
Magnesium	90 - 110
Plastics	60 - 90
Steel-Cast	30 - 40
Steel-Free Machining	50 - 80
Steel-Chromium	25 - 40
Steel-Alloy	20 - 35
Steel-Stainless	15 - 30
Titanium	10 - 25
Zinc-Die Cast	80 - 120

$$RPM = \frac{3.82 \times SFM}{Tap\ Diameter}$$

$$FEED\ (IPR) = \frac{1}{Pitch}$$

$$FEED\ (IPM) = FEED\ (IPR) \times Speed\ (RPM)$$

Tapping speeds are for general purpose taps. Consult tap manufacturer for high geometry taps.

TORQUE REQUIREMENTS

Tap Size	Brass	Aluminum & Leaded Brass	200 BHN Steel	300 BHN Steel	400 BHN Steel	Approx. Breaking Torque
#6	4	2	7	9	10	8
#8	4.5	2.25	8	10	11	30
#10	8.5	4.25	15	19	21	42
1/4	16	8	28	36	40	106
5/16	24	12	42	54	60	180
3/8	37	18.5	65	83	93	240
7/16	54	27	94.5	122	135	500
1/2	68	34	119	153	170	700
9/16	88	44	154	198	220	850
5/8	119	59.5	208	268	298	1000
3/4	170	85	298	383	425	1500
7/8	238	119	416	536	595	2100
1"	337	168.5	590	758	842	2700
1 1/4	544	277	970	1246	1385	3000+
1 1/2	850	425	1488	1912	2125	3000+
1 3/4	1411	706	2471	3177	3530	3000+
2	1904	952	3332	4284	4760	3000+
2 1/4	2159	1080	3780	4860	5400	3000+
2 1/2	2975	1488	5208	6996	7440	3000+
2" - 8	533	267	933	1199	1333	3000+
2 1/2" - 8	663	332	1160	1492	1658	3000+
3" - 8	1139	570	1995	2565	2850	3000+
4" - 8	1411	706	2471	3177	3530	3000+
5" - 8	1768	884	3094	3978	4420	3000+
6" - 8	2125	1063	3720	4784	5315	3000+

All values in table above are in inch/lbs. Approximate values based on sharp, 4 Flute coarse pitch hand taps at 65% thread height. Dull taps require approximately 50% more torque. For 55% and 75% thread heights, multiply above values by .75 and 1.25 respectively. Torque values for helical flute taps are approximately 70% of those shown. Torque values for chip drive taps are approximately 60% of those shown. Torque values for fine pitch threads are approximately 50% of those shown.

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Programming Information

TAPPING

Experience has shown that a tap will cut the best quality threads when allowed to act as its own lead screw, feeding precisely on pitch to exactly the required depth of thread. The machine must be prevented from forcing the tap to do anything else or the thread quality will suffer or the tap may break. The tension stroke in the NUMERTAP® provides the freedom required to cut the best quality threads with the least risk of breakage.

NUMERTAP Systems can be used on any suitable machine tool which has a reversing spindle. Effective choices of spindle speeds and feeds for particular tapping requirements can be made by the following the sample calculations:

TAPPING A 3/4 –10 THREAD, 1" DEEP IN MILD STEEL:

RPM = (12 x SFM)/(3.82 X SFM)/D where D is the tap diameter.

Use the chart on the previous page to find the tapping speed in SFM.

RPM = (3.82 x .50)/.75 – 255 RPM

Tap Feed Rate = Pitch x RPM = .100 x 255 = 25.5 inches/minute.

Feed in and out at the same feed rate.

When using a conventional tapping cycle, optimum performance is insured by slightly underfeeding the tap, normally by 2% - 10%. This forces the tension stroke of the tapping head to be used and eliminates any effect of the machine tool. The Z axis feed distance must be reduced by this same percentage. The axial float in the NUMERTAP takes up the difference between the required thread depth and the programmed depth. If a 10% underfeed was selected, the calculations would be as follows:

Program Feed Rate = .90 x on pitch feed rate = .90 x 25.5 = 22.95"/minute.

Spindle Z-Axis Travel = .90 x required depth = .90 x 1.000 = .900".

Axial Float used = 1.000 - .900 = .100"

Do not allow the Axial Float used to equal the tension stroke length (.56).

If the tapping cycle is controlled by a "canned" program which calculates its own feed rates from an input of pitch and speed. The desired underfeed can be obtained by deliberately entering a reduced value of pitch or an increased value of threads per inch as follows:

Actual TPI = 10 (pitch = 1/10 = .100")

Input TPI = 11 (pitch = 1/11 = .091")

Program Feed Rate = .091 x 255 = 23.2"/minute

Program Feed Depth = .91 x 1.000 = .910"

If the CNC machine has a slow spindle reversal, the program must compensate for any drive system inertia by including a dwell not long enough for the spindle to come to a full stop when the tap has reached full thread depth. If the spindle has not stopped when the program calls for it to feed out, the tap could break or be pulled out of the adapter, or the threads could be ruined. These problems can be rectified using a program similar to the following:

Spindle clockwise

Feed to depth (incorporating underfeed)

Spindle stop

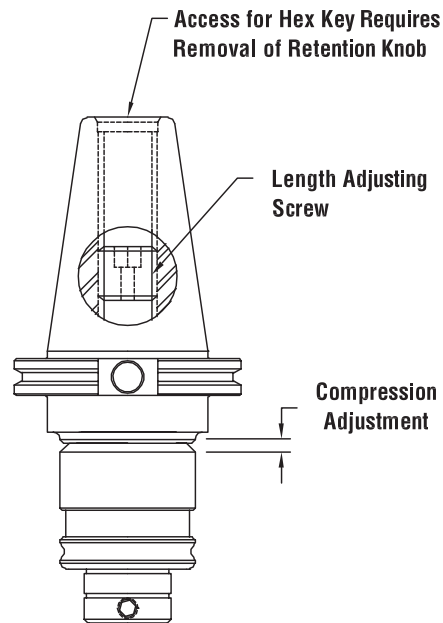
When using a **synchronous tapping cycle**, the drive system inertia may create the undesirable effect of tap elongation, or thread distortion. The best answer to this problem is the use of tension only tapping heads. Refer to the selection guide (pages 161-162).

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Compression Stroke Adjustment

NUMERTAP 100, 200, 300, 700 & 770 UNITS

The NUMERTAP® 100, 200, 300, 700 and 770 series tapping attachments with machine tapers, feature a length adjustment screw. This allows the compression stroke to be reduced or eliminated, if desired, to provide more accurate depth control. Adjusting the compression stroke to zero will result in a tension only set-up, the best solution for synchronous tapping. Turning the length adjustment screw counterclockwise reduces the compression stroke but does not affect the tension stroke.



The projections of the unit can be adjusted by turning the screw in either direction until the desired length is reached. Changing the length in this manner does not affect the tension stroke. This is an important feature if redundant tools are being set or if reground taps are being used in existing programs.

Adjust the compression stroke counterclockwise until the tapping attachment body contacts the shank. This will set for tension only. This is recommended to eliminate or avoid tap elongation in synchronous tapping cycles.

TENSION-ONLY, THE BEST SOLUTION FOR SYNCHRONOUS TAPPING

The NUMERTAP 100, 200, 300, 700 and 770 units can be purchased as tension only units (TT) or can be adjusted to tension only units by following the instructions above. Tension only is the best solution for synchronous tapping. If the unit is purchased as a TT, the tension spring is eliminated during assembly.

The unit will be the same length as a TA unit. If a TA unit is adjusted to eliminate the compression stroke, the unit will be 1/4" shorter than its original projection length. NUMERTAP 700 units can be adjusted for tension only, but cannot be used in synchronous tapping cycles.

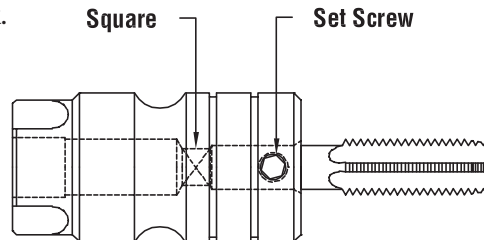
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Tap Installation

NUMERTAP 80, 88, 700, 6000 & 6500 ADAPTERS

1. Loosen the set screw in the tap adapter.
2. Insert the tap into the adapter and twist until the square on the tap is aligned with the square in the adapter. Push back until the adapter is fully seated against the shoulder of the square.
3. Do not grind grooves or flats on the tap shank.

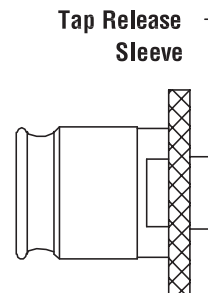
If, for some reason a tap sticks in a hole, the set screw will allow the tap to pull out of the adapter without damaging the part, tapping head or tap. Grinding flats on the tap shank overrides this safety feature.



NUMERTAP 100, 200, 300 & 7716QR ADAPTERS

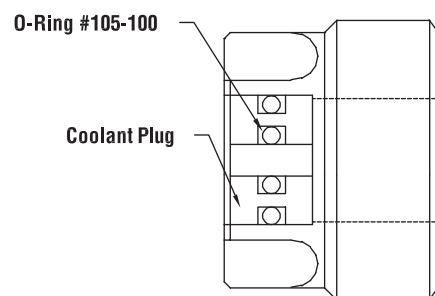
1. Push back the tap release sleeve.
2. Insert the tap into the adapter and twist until the square on the tap is aligned with the square in the adapter. Push back until the adapter is fully seated against the shoulder of the square.

Both fine and course pitch taps are used in the same adapters. Left or right hand taps can be used in any NUMERTAP system without alteration.



COOLANT FED 700 & 770 ADAPTERS

When used in through-spindle-coolant applications, coolant fed NUMERTAP units must be used with coolant fed tap adapters. Coolant fed tap adapters feature a sealing plug at the back. The "O" ring in the ID of the plug should be periodically checked for cuts or tears. If damage is noted, the "O" ring should be replaced.



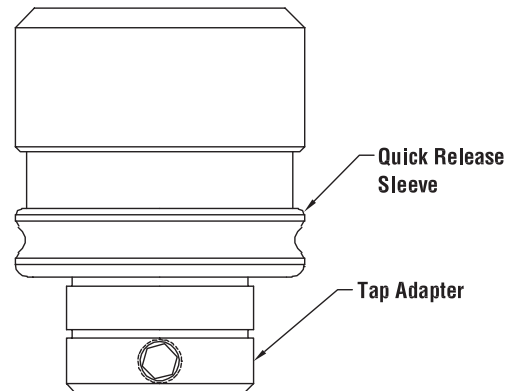
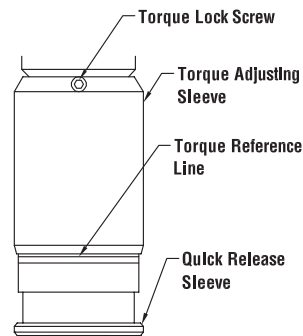
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Installing Taps in Numertap[®] Adapters

NUMERTAP 80, 700 & 770 ADAPTERS

To install a tap adapter into a NUMERTAP 80, 700 or 770:

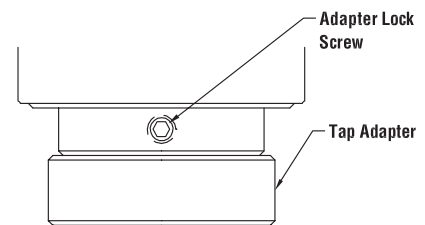
1. Pull back the quick-release sleeve.
2. Insert the tap adapter into the unit and push back until it seats. A slight twisting motion while pushing will ensure proper seating.
3. Release the quick release sleeve. It should return to its normal position. If it does not return, the adapter is not seated. Twist and push back until it seats.



NUMERTAP 6000

To install a tap adapter into a NUMERTAP 6000:

1. Loosen the adapter lock set screw.
2. Insert the tap adapter into the unit and push back until it seats. A slight twisting motion while pushing will ensure proper seating.
3. Tighten the adapter lock screw.



NUMERTAP 80

The factory setting for the torque adjusting sleeve is at maximum torque. In this state, the first (closest to the tap) torque reference line will be barely visible. This setting provides a large safety factor against tap breakage and should not need to be changed unless low tensile materials are being tapped.

When tapping soft materials, particularly with small taps, it is advisable to use less torque to prevent thread distortion when the tap bottoms.

To adjust the torque, loosen the torque lock screw and rotate the torque adjusting sleeve to its upper limit. All three torque reference lines will be visible. Take a test cut. If the tap does not cut, increase the torque by turning the adjusting sleeve. When the proper setting is reached and there is enough torque pressure, turn the torque adjusting ring another 1/8 turn and secure the lock screw. Always adjust the torque to coarse pitch when using more than one tap in the same tapping head.