CONTENTS

Multiple Spindle Gearless Drill & Tap Heads

Multi-spindle heads from Zagar are unmatched by any other on the market. Our engineers can design or modify for any and all holemaking needs—close centers, any pattern, any material—precisely as specified, with machinery you can depend on year after year. Let us calculate your increased productivity potential with Zagar equipment.

JOB PROVEN FEATURES

A. Closest possible spindle centers for greater production.

B. Fixed spindle construction for better spindle/drill bushing alignment; better tool life; lower maintenance.

C. Minimum backlash for improved tapping and prolonged tool life.

D. Simultaneous multiple pitch tapping.

E. Spindles can be added or relocated reducing future retooling costs.

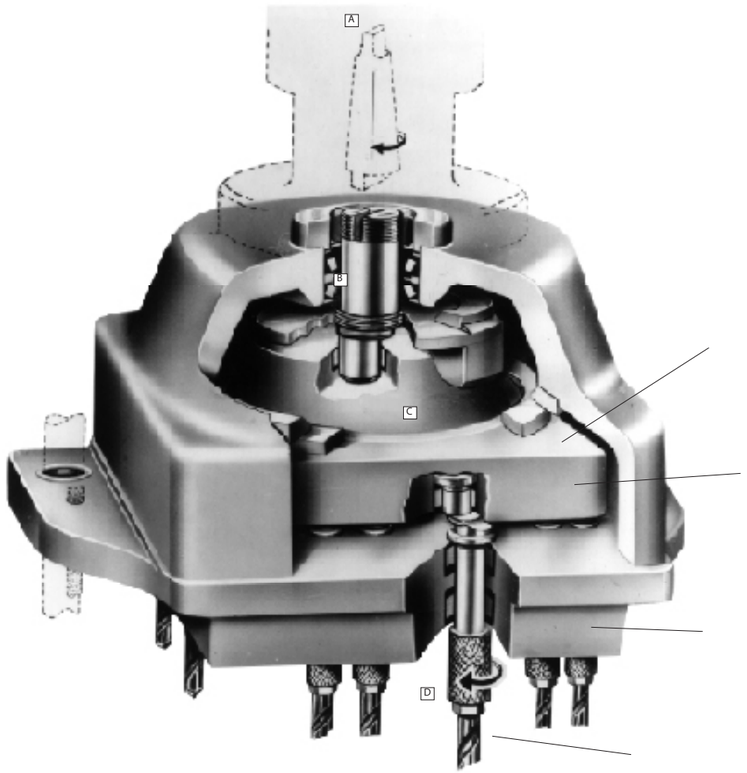
F. Spindle locations are not restricted to gear train configurations allowing for completely random patterns. Spindle patterns can be combined to reduce cost and minimize changeover time.

G. Spindle lengths accommodating varying part elevation and facilitating use of standard length cutting tools vs. expensive non-standard cutting tools.

H. Comes assembled reducing set-up costs.

The cut-away view illustrates the exclusive and unique "GEARLESS" principle by ZAGAR which is the reason why a ZAGAR multiple spindle GEARLESS HEAD can give you the closest possible centers, in one pass, of any head in the industry today.

Since there are NO GEARS, the spindles can be placed on close centers (see Pages 6 and 7).



The machine spindle turns Driver A which turns Drive Crank B of the multiple spindle head. The Drive Crank B moves the Oscillator C in a small oscillating motion, which turns the individual spindles D in the same direction and at the same speed as Drive Crank B.

Your Guide To... selecting the Right Head and accessories for your job!

1. Select Spindle Series

a) The largest hole in the spindle pattern should not exceed capacity of Basic Spindle of Series selected.

b) EXCEPTION. Larger drill sizes are permissible if lesser than normal feed rates are used due to smaller drills on other spindles.

c) HEAVY DUTY PRODUCTION. Use Series one size larger if spindle sizes required are available in the larger series. See Pages 6 and 7.

2. Select Spindle Sizes

Use the Basic Spindle whenever center distance between holes is not limited. If limited, select spindle size to suit. When tool sizes vary, proportion spindle sizes accordingly. If tool size exceeds capacity of small spindles, analysis of the problem is necessary (consult factory).

3. Select Head Size

The outside of extreme spindles in the hole pattern must be within the maximum spindle area of head. See Pages 9 thru 12. Select head with style of drive suitable for speed and torque requirements of operation.

4. Select Spindle Accessories

Use the following guidelines:

a) TANG COLLETS are preferred to insure against slippage when drilling, reaming, etc.

b) THREADED NOSES and Z-LOCK DRILL HOLDERS are desirable when using a large number of one drill size and/or for rapid changeovers.

c) SOLDERED TYPE DRILL HOLDERS are required with spindle sizes .187 and .218. They can also be used on .250 and .312 spindle sizes for tool shank diameters exceeding available collets.

d) TAP COLLETS are used for convenience of change-over from drilling to tapping with the same spindle. Use tap Collets when float on tap is undesirable.

e) TAP HOLDERS are available in all spindle sizes and accommodate greater tap capacity than tap collets for the same spindle size. QUICK-RELEASE TAP HOLDERS are necessary on tapping operation where return stroke is not positive (No lead screw or cam). SLIP LOCK OR Z-LOCK TAP HOLDERS are ideal to use with lead screw tapping.

5. ORDER NOW!

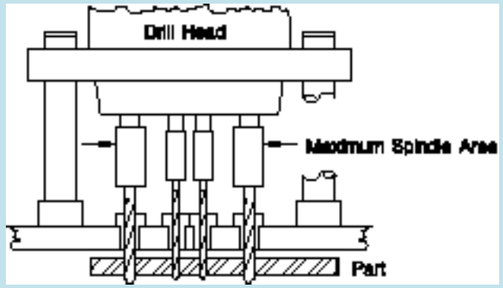
Delays mean profit loss—so you gain by specifying Zagar Gearless Heads. Order now by calling Zagar, Inc at (216) 731-0500 or by contacting your local representative.

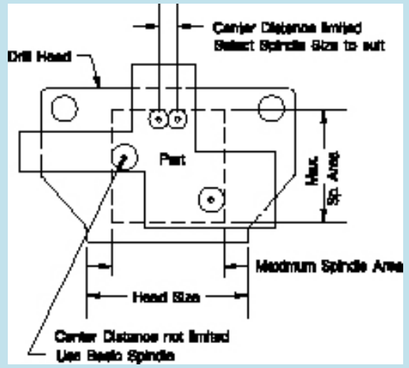
APPLICATION DATA

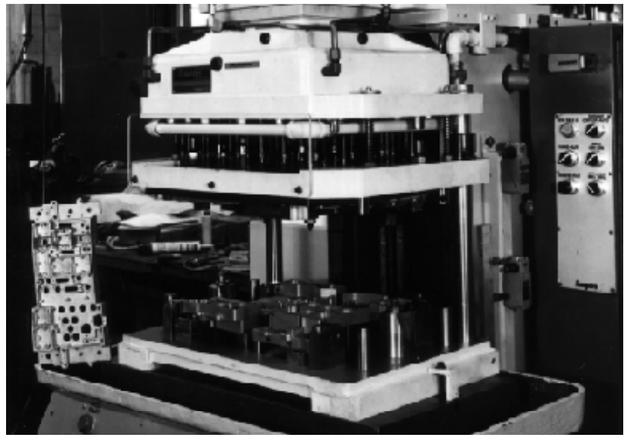
The selection of a proper Drilling and/or Tapping Machine for your job is important. Drill press must have adequate H.P., Thrust, Gap between table and quill and the proper throat. Press mounting dimensions must be known. On popular machines, we need only to know the make and model number. Head must be tied-in with the fixture for the job. Pattern orientation to the head and the Guide Pin locations must be specified.

Send for our Application Data Sheet to formalize information on mounting the head and the proper tie-in of tooling.

The data presented in our catalog for multiple spindle head applications should be used as a guide only.

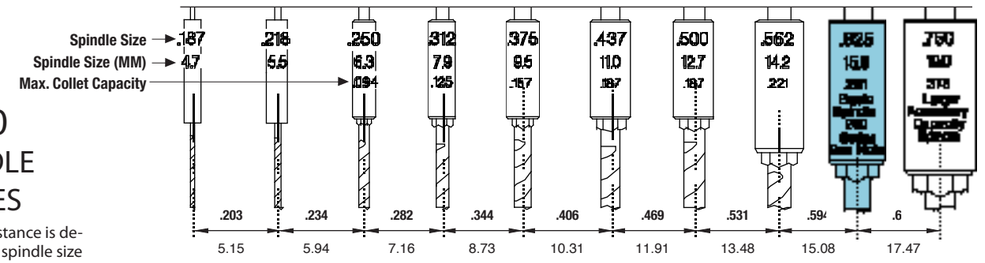






Select Spindle Series & Sizes *(by holes, spacing & materials)*

SPINDLE NO. 708-3130



200 SPINDLE SERIES

Minimum Center Distance is determined by adding spindle size and dividing by two.

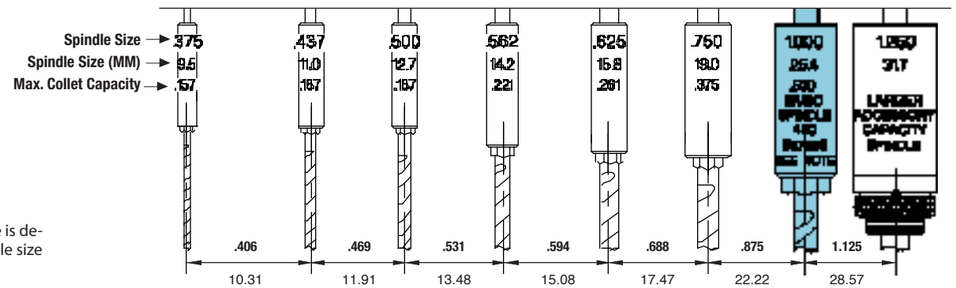
Drill Shanks must be turned down on sizes shown if greater than Collet Capacity

Capacities when Drilling	STEEL	.070 1.78	.080 2.03	.100 2.54	.125 3.18	.156 3.96	.172 4.37	.187 4.75	.218 5.54	.233 5.92	.233 5.92
	CAST IRON	.080 2.03	.100 2.54	.125 3.18	.156 3.96	.172 4.27	.187 4.75	.218 5.54	.250 6.35	.281 7.14	.281 7.14
	ALUM.	.125 3.18	.156 3.96	.187 4.75	.250 6.35	.281 7.14	.312 7.92	.343 8.71	.406 10.16	.468 11.89	.468 11.89

Capacities when Tapping	SPINDLE SIZE 4.75		.187 5.54	.218 6.35	.250 7.92	.312 9.35	.375 11.10	.437 12.70	.500 14.27	.562 15.88	.625 19,05	.750
	Steel or Brass	Thread Size	2-56 M 2x0.4	3-48 M 2.5x0.45	4-40 M 2.5x0.45	5-40 M 3x0.5	6-32 M 3.5x0.6	8-32 M 4x0.7	10-24 M 4.5x0.75	12-24 M 5 x 0.8	1/4-20 M 6x1	1/4-20 M 6x1
	Alum. Mag. Zinc	Thread Size	3-48 M 2.5x0.45	4-40 M 2.5x0.45	6-32 M 3.5x0.6	8-32 M 4x0.7	10-24 M4.5x0.75	12-24 M 5x0.8	1/4-20 M 6x1	5/16-18 M 6 x 1	3/8-16 M 8x1.25	3/8-16 M 8x1.25

NOTE: THE BASIC SPINDLE (.625) IN THE 200 SERIES SHOULD BE USED WHEN THE CENTER DISTANCE BETWEEN SPINDLES IS NOT LIMITED

SPINDLE NO. 708-3140



400 SPINDLE SERIES

Minimum Center Distance is determined by adding spindle size and dividing by two.

Drill Shanks must be turned down on sizes shown if greater than Collet Capacity

Capacities when Drilling	STEEL	.172 4.37	.187 4.75	.218 5.54	.233 5.92	.281 7.14	.406 10.16	.500 12.70	.500 12.70
	CAST IRON	.187 4.75	.218 5.54	.250 6.35	.282 7.16	.312 7.92	.453 11.50	.625 15.88	.625 15.88
	ALUM.	.343 8.71	.375 9.53	.453 11.50	.500 12.70	.578 14.68	.656 16.66	.875 21.44	.875 21.44

Capacities when Tapping	SPINDLE SIZE		.375 9.53	.437 11.10	.500 12.70	.562 14.27	.625 15.88	.750 19.05	1.000 25.40	1.250 31.75
	Steel or Brass	Thread Size	6-32 M 3.5x0.6	8-32 M4x0.7	10-24 M 4.5x0.75	12-24 M 5x0.8	1/4-20 M6x1	3/8-16 M 8x1.25	1/2-13 M 12x1.75	5/8-11 M 14x2
	Alum. Mag. Zinc	Thread Size	10-24 M 4.5x0.75	12-24 M 5x0.8	1/4-20 M 6x1	5/16-18 M 6x1	3/8-16 M 8x1.25	1/2-13 M 12x1.75	5/8-11 M 14x2	3/4-10 M 24x3

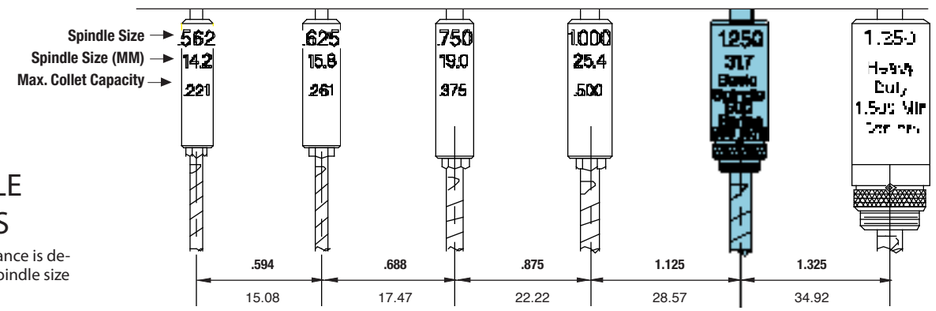
NOTE: THE BASIC SPINDLE (1.00) IN THE 400 SERIES SHOULD BE USED WHEN THE CENTER DISTANCE BETWEEN SPINDLES IS NOT LIMITED

Capacities shown are not absolute and are subject to modification.

NOTE: Smaller numbers are metric conversions.

Select Spindle Series & Sizes *(by holes, spacing & materials)*

SPINDLE NO. 708-3601



500 SPINDLE SERIES

Minimum Center Distance is determined by adding spindle size and dividing by two.

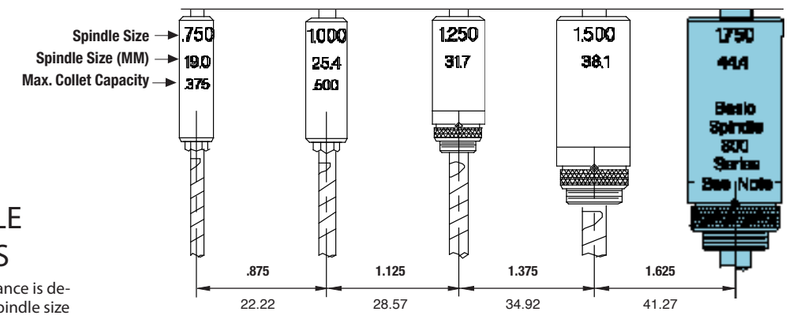
Drill Shanks must be turned down on sizes shown if greater than Collet Capacity

Capacities when Drilling	STEEL	.233 5.92	.281 7.14	.406 10.16	.531 13,49	.625 15.88	.687 17.45
	CAST IRON	.282 7.16	.312 7.92	.453 11.50	.656 16,66	.750 19.05	.812 20.62
	ALUM.	.500 12.70	.594 15.09	.687 17.45	.937 23,80	1.125 28.58	1.250 31.75

Capacities when Tapping	SPINDLE SIZE		.562 14.27	.625 15.88	.750 19.05	1.000 25.40	1.250 31.75	1.500 38.10
	Steel or Brass	Thread Size	12-24	1/4-20 M 6x1	3/8-16 M 8x1.25	1/2-13 M 12x1.75	5/8-11 M 14x2	3/4-10 M 20x2.5
	Alum. Mag. Zinc	Thread Size	5/16-18	3/8-16 M 8x1.25	1/2-13 M 12x1.75	3/4-16 M 20x2.5	1"-8 M 24x 3	1-1/8-7 M30x3.5

NOTE: THE BASIC SPINDLE (1.250) IN THE 500 SERIES SHOULD BE USED THEN THE CENTER DISTANCE BETWEEN SPINDLES IS NOT LIMITED

SPINDLE NO. 708-3110



800 SPINDLE SERIES

Minimum Center Distance is determined by adding spindle size and dividing by two.

Drill Shanks must be turned down on sizes shown if greater than Collet Capacity

Capacities when Drilling	STEEL	.437 11.10	.562 14.27	.687 17.45	.750 19.05	.875 21.45
	CAST IRON	.500 12.70	.687 17.45	.812 20.62	.875 21.44	1.000 25.40

Capacities when Tapping	SPINDLE SIZE		.750 19.05	1.000 25.40	1.250 31.75	1.500 38.10	1.750 44.45
	Steel or Brass	Thread Size	3/8-16 M 8x1.25	1/2-13 M 12x1.75	5/8-11 M 14x2	3/4-10 M 20x2.5	1"-8 M 24x3

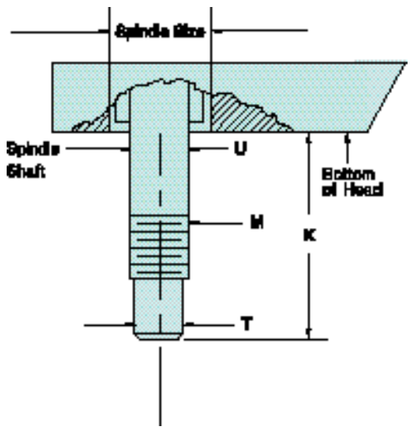
NOTE: THE BASIC SPINDLE (1.750) IN THE 800 SERIES SHOULD BE USE WHEN THE CENTER DISTANCE BETWEEN SPINDLES IS NOT LIMITED

Capacities shown are not absolute and are subject to modification.

NOTE: Smaller numbers are metric conversions.

Spindle Specifications

SPINDLE SPECIFICATIONS
For Spindles with Zagar Threaded End



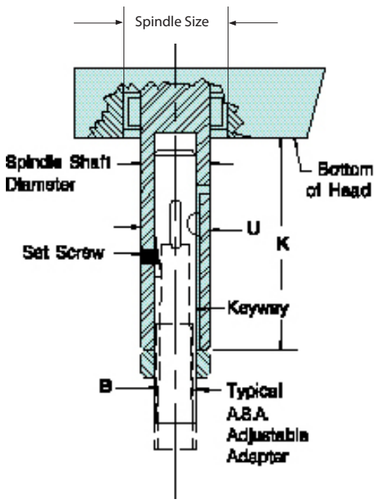
Spindle size is the minimum spindle center available.

SPINDLE SIZE	K			U	T	M
	BASIC	MAX	In Steps Of	-.0003	+.0002	
.187 4.75	.94 23.88	1.94 49.28	.25 6.35	.1405 3.57	.1090 2.77	6(.138)-40
.218 5.54	.94 23.88	2.44 61.98	.25 6.35	.1640 4.17	.1350 3.43	8(.164)-36
.250 6.35	.94 23.88	2.94 74.68	.25 6.35	.1798 4.57	.1560 3.96	10(.190)-32
.312 7.93	.94 23.88	2.94 74.68	.25 6.35	.2178 5.53	.1860 4.72	12(.216)-32
.375 9.53	.94 23.88	3.44 87.38	.25 6.35	.2501 6.35	.2205 5.60	1/4(.250)-32
.437 11.10	.94 23,88	3.69 93.73	.25 6.35	.3126 7.94	.2810 7.14	5/16(.312)-32
.500 12.70	.94 23,88	3.69 93.73	.25 6.35	.3126 7.94	.2810 7.14	5/16(.312)-32
.562 14.27	1.19 30.23	3.94 100.08	.25 6.35	.3751 9.53	.3335 8.47	3/8(.375)-24
.625 15.88	1.19 30.23	3.94 100.08	.25 6.35	.4375 11.12	.3890 9.88	7/16(.437)-20
*.750 19.05	1.19 30.23	4.19 100.43	.25 6.35	.4375 11.12	.5140 13.06	9/16(.562)-18
.750 19.05	1.19 30.23	4.19 100.43	.50 12.7	.5625 14.29	.5140 13.06	9/16(.562)-18
1.000 25.40	1.69 42.93	4.69 119.13	.50 12.7	.7501 19.05	.6840 17.37	3/4(.750)-16
1.250 31.75	2.19 55.63	5.19 131.83	.50 12.7	1.0001 25.40	.9250 23.50	1(1.000)-14
1.500 38.10	2.44 61.97	4.44 112.77	.50 12.7	1.1251 28.56	1.0560 26.82	1-1/8(1.125)-12
1.750 44.45	2.44 61.97	4.44 112.77	.50 12.7	1.2500 31.75	1.1250 28.58	1-1/4(1.250)-7

NOTE: Extension blocks are used with spindle lengths greater than 1 1/2" over basic.

* This spindle is for 200 Series only.

SPINDLE SPECIFICATIONS
For Spindles with Integral Spindle Bores



When ordering adjustable adapters:
For A.S.A adapters— match spindle bore "b" with A.S.A. Adapter O.D. given on Page 20.
For Zagar adapters—match "u" dimension given above with spindle size given on Page 19.

SPINDLE SIZE	K			U	B Maximum		MAX. TOOL HOLDER CAP.
	BASIC	MAX.	In Steps Of	-.0003	Zagar	A.S.A.	
.562 14.27	1.00 25.4	2.50 63.5	.50 12.7	.3751 9.53	.250 6.35	—	.157 Collet 3.99
.625 15.88	1.25 31.75	2.75 69.85	.50 12.7	.4375 11.11	.312 7.92	—	.187 Collet 4.75
.750 19.05	1.25 31.75	3.25 82.55	.50 12.7	.5625 14.29	.375 9.53	—	.221 Collet 5.62
1.000 25.4	1.25 31.75	3.25 82.55	.50 12.7	.7501 19.05	.562 14.27	—	.375 Collet 9.53
1.250 31.75	1.25 31.75	3.25 82.55	.50 12.7	1.000 25.4	.750 19.05	—	.500 Collet 12.7
1.000 25.4	1.75 44.45	3.75 95.25	.50 12.7	.7501 19.05	—	.500 12.7	#0 M.T.
1.250 31.75	1.75 44.45	3.75 95.25	.50 12.7	1.0001 25.4	—	.625 15.88	#1 M.T.
1.500 38.1	1.75 44.45	3.75 95.25	.50 12.7	1.2500 31.75	—	.875 22.23	#2 M.T.
1.750 44.45	2.00 50.80	4.00 101.60	.50 12.7	1.2500 31.75	—	.875 22.23	#2 M.T.

NOTE: Smaller numbers are metric conversions

Gearless Head Capacities

HEAD DRIVE CAPACITIES		
DRIVE STYLE	TORQUE CAPACITY	
A	0.5 H.P. @	1,800 RPM
B	2 H.P. @	1,200 RPM
C	6 H.P. @	900 RPM
D	10 H.P. @	900 RPM
E	15 H.P. @	600 RPM
F	20 H.P. @	400 RPM
G	Designed per Application up to 100 H.P.	

Lower speeds and feeds may be required depending upon; number of spindles needed, material to be machined, horsepower, torque, thrust and rigidity available, as well as part and chip handling considerations.

SQUARE HEAD WEIGHTS

Head Size	Series	Weight (Lbs.)
3.00 76.20	200	5.0
4.50 114.30	200	12.0
6.00 162.40	200	21.0
8.00 203.20	200	41.0
8.00 203.20	400	52.5

Head Size	Series	Weight (Lbs.)
10.00 254.00	200	55.0
10.00 254.00	400	67.5
10.00 254.00	500	93.5
12.00 304.80	200	93.0
16.00 406.40	200	136.0
16.00 406.40	400	157.0
	500	495.0*

Weights of Zagar Standard Gearless Aluminum Drill Heads (Does not include Quill Camp, Driver or Spindle Accessories)
*Cast iron construction

MAXIMUM HEAD R.P.M.					
HEAD SIZE	DRIVE STYLE	HEAD SERIES			
		200	400	500	800
3	A	5,000	—	—	—
4 -1/2	B	4,500	—	—	—
6	B	4,000	—	—	—
8	C or D	(C)3,600	(C)3,300	—	—
10	C or D	(C)3,200	(C)2,900	(D)2,600	—
12	C or D	(C)2,800	(C)2,500	(D)2,200	—
16	C or D	(C)2,400	(C)2,100	(D)1,800	—
5x10	B	3,400	—	—	—
6x8	B	3,400	2,900	—	—
8x12	C	3,200	2,900	—	—
8x16	C	3,000	2,700	—	—
10x15	C	2,800	2,500	—	—
10x20	C	2,600	2,300	—	—
12x18	C	2,400	2,100	—	—
12x24	C	2,200	1,900	—	—
16x16	D or E	2,400	2,100	1,800	1,500
16x24	D or E	2,100	1,800	1,500	1,200
16x32	D or E	1,800	1,500	1,200	900
20x20	D or E	2,200	1,900	1,600	1,300
20x30	E	1,900	1,600	1,300	1,000
20x40	E	1,600	1,300	1,000	700
24x24	E	2,000	1,700	1,400	1,100
24x36	E	1,700	1,400	1,100	800
28x28	E	1,800	1,500	1,200	900
28x44	E	1,500	1,200	900	600
32x32	E	1,600	1,300	1,000	700
36x36	E	1,400	1,100	800	500
32x60	F	1,200	900	600	300

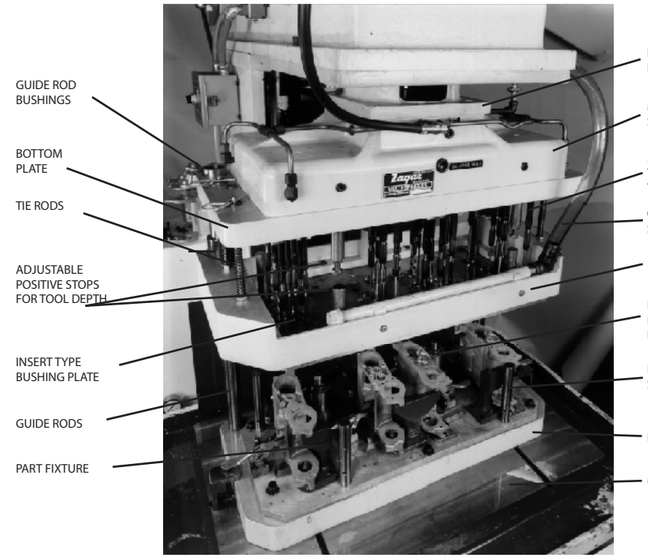
NOTE: Standard Heads Should Not Exceed 80% of Speeds Listed Above. Speeds Above 80% Up To Maximum Will Be Quoted As Special.

STANDARD SQUARE AND DIAGONAL HEADS THRUST CAPACITY

Drill Head Number	Description	Max. Thrust Capacity
708-3630 708-3640 708-3550	3" Sq. 4.5" Sq. 6" Sq.	250 600 1500
708-3560 708-3570	8" Sq. 10" Sq.	2500 4500
708-3580 708-3620	12" Sq. 16" Sq.	7000 13,500

All Zagar Gearless Heads are subject to total thrust limitations. Use this chart for thrust capacity.

MULTIPLE OPERATIONS



Zagar rectangular drill head and fixture assembly installed in a Zagar 26" Openside Machine used to drill and ream both sides of an aircraft component.

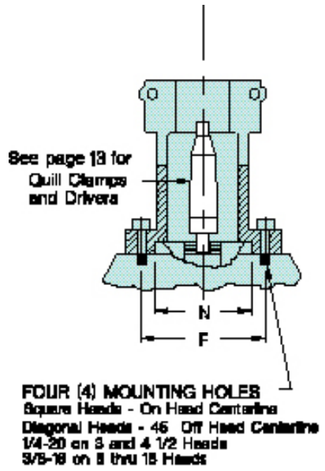
NOTE: Smaller numbers are metric conversions.

Square or Diagonal *(Multiple Spindle Heads)*

SQUARE HEAD CAPACITY

Maximum Spindle Area - See Note			
HEAD SIZE	HEAD SERIES 200	400	500
*3	1.670	—	—
76.20	42.42		
4.5	2.935	—	—
114.30	74.55		
6	4.475	—	—
152.40	113.67		
8	5.915	5.575	—
203.20	150.24	141.61	
10	7.880	7.540	7.030
254.00	200.15	191.52	178.56
12	9.880	9.540	9.030
304.80	250.95	242.32	229.36
16	13.725	13.385	12.925
406.40	346.62	339.98	328.16

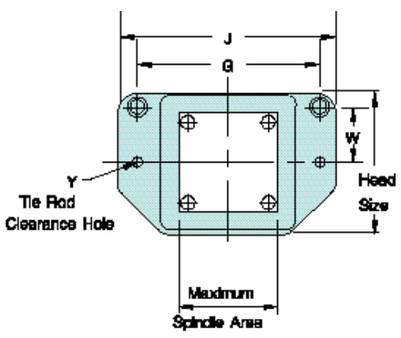
*3" Head - .375 Maximum Spindle

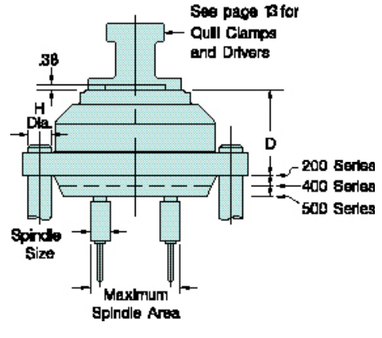


DIAGONAL HEAD IN-LINE CAP.

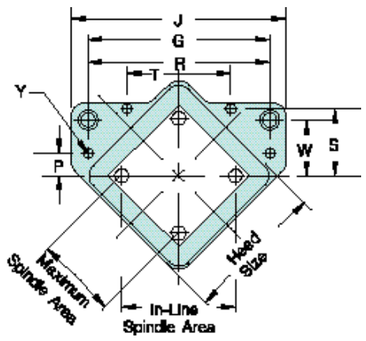
In-Line Spindle Ctr. Dist. - See Note			
HEAD SIZE	HEAD SERIES 200	400	500
*3	1.830	—	—
76.20	46.48		
4.5	3.111	—	—
114.30	79.02		
6	5.374	—	—
152.40	136.50		
8	7.410	6.400	—
203.20	188.21	162.56	
10	10.190	9.179	8.170
254.00	258.83	233.15	207.51
12	13.018	12.006	11.000
304.80	330.66	304.94	279.40
16	18.455	17.444	16.510
406.40	466.76	443.09	419.35

*3" Head - .375 Maximum Spindle
NOTE: In-line capacity calculated on basic spindle size for each series.





SQUARE HEAD
View looking thru top of head.



DIAGONAL and STRAIGHT LINE HEADS
View looking thru top of head.

Head Assembly No.	HEAD SIZE	HEAD SPECIFICATIONS G Guide Pin	W	R Tie Rod	P	T	S	J	N -.001 -.003	F	D HEAD SERIES 200	400	500	Tie Rod Pin. Dia. Y	Guide H	Driver (See	Drive Pg. 12)
708-3630 +SERIES	*3	4.7500	1.0000	3.30	1.70	—	—	6.25	2.125	2.56	4.71	—	—			MORSE	
	76.20	120.65	25.40	83.82	43.19			152.40	53.98	65.02	119.63					TAPER	**A
708-3640 +SERIES	4.5	6.6250	1.6870	6.62	.60	—	—	8.12	3.000	3.50	5.44	—	—	.44	.6250	1-2-3	
	114.30	168.28	42.85	168.14	15.24			200.15	76.20	88.90	138.17			11.18	15.88	JACOBS	
708-3550 +SERIES	6	8.2500	2.5000	8.25	1.00	—	—	9.75	3.000	4.88	5.63	—	—			TAPER	**B
	152.40	209.55	63.50	209.55	25.40			241.30	76.20	123.95	143.00					1-2-33	
708-3560 +SERIES	8	10.1250	3.1250	10.12	1.50	—	—	12.25	4.500	5.50				.44	1.0000		**C
	203.20	257.18	79.38	257.04	38.10			307.85	114.30	139.70				11.18	25.40		FOR
708-3570 SERIES	10	12.3750	3.8750	12.88	1.75	—	—	14.88	4.500	5.50							200
	254.00	314.33	98.43	327.15	44.45			374.65	114.30	139.70							and
708-3580 +SERIES	12	14.3750	4.8750	14.37	2.25	10.00	4.87	16.88	4.500	5.50	6.50	8.00	9.94	.56	1.2500	MORSE	400
	304.80	365.13	123.83	364.99	57.15	254.00	123.69	425.45	114.30	139.70	165.10	203.20	252.47	14.22	31.75	TAPER	D FOR
708-3620 +SERIES	16	18.3750	6.8750	18.37	3.00	14.00	6.87	SEE	4.500	5.50						2-3-4-5	500
	406.40	446.73	174.63	466.59	76.20	355.60	174.49	NOTE	114.30	139.70							Series

*3" Head - .375 Maximum Spindle

NOTE: J=20.88 for 16" Square Heads
J=22.50 for 16" Diagonal Heads

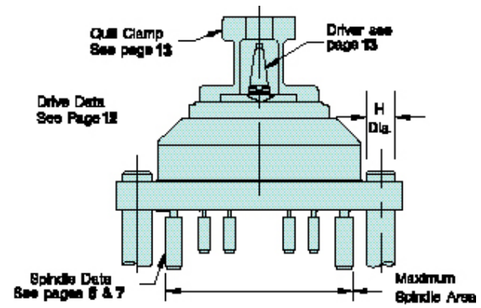
**See Page 9 for Drive Capacities

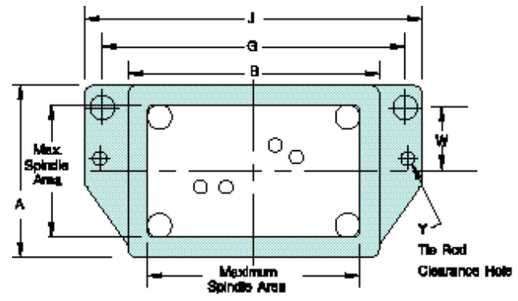
NOTE: Smaller numbers are metric conversions.

See Pages 26 - 38 for Standard Drilling and Tapping Fixtures and Components
See Page 34 for Single Pitch Head Lead Screw Tapping.

Heavy Duty Square & Rectangular *(Multiple Spindle Heads)*

See ordering





Data below Head Assembly No.	DRIVE STYLE	HEAD SIZE A	B	HEAD SPECIFICATIONS J	G	W	Y	H	Drill Head and/or Tapping Head Series 200 SERIES WIDTH	LENGTH	400 SERIES WIDTH	LENGTH	500 SERIES WIDTH	LENGTH	800 SERIES WIDTH	LENGTH
735-242	B	5x10		15.50	12.5000	1.250	.44	1.2500	2.90	7.90	—	—	—	—	—	—
		127x254		393.70	317.50	31.75	11.18	31.75	73.66	200.66						
735-202	C	8x12		17.50	14.5000	2.875	.44	1.2500	5.90	9.90	5.19	9.19	—	—	—	—
		203x305		444.50	368.30	72.89			149.86	251.46	131.82	232.82				
735-203	C	8x16		21.50	18.5000	2.875	.44	1.2500	5.78	13.40	5.06	12.69	—	—	—	—
		203x406		546.10	469.90				146.81	340.36	128.52	322.32				
735-205	C	10x15		20.50	17.5000	3.875	.56	1.2500	7.53	12.40	6.81	11.69	—	—	—	—
		254x381		520.70	444.50	98.29	14.22		191.26	314.96	172.97	296.92				
735-206	C	10x20		25.00	22.5000	3.875	.56	1.2500	7.40	17.40	6.69	16.69	—	—	—	—
		254x508		635.00	571.50				187.96	441.96	169.92	423.92				
735-208	C	12x18		23.50	20.5000	4.750	.56	1.2500	9.15	15.40	8.44	14.69	—	—	—	—
		203x457		596.90	520.70	120.65			232.41	391.16	214.37	373.12				
735-209	C	12x24		29.50	26.5000	4.750	.56	1.2500	9.40	21.15	8.69	20.44	—	—	—	—
		203x610		749.30	673.10				238.76	537.21	220.72	519.17				
735-213	D	16x16		22.50	19.0000	6.750	.56	1.5000	13.40	13.40	12.69	12.69	12.35	12.35	11.75	11.00
735-221	E	406x406		571.50	486.60	171.45		38,10	340.36	340.36	322.32	322.32	313.69		289.45	279.40
735-214	D	16x24		30.50	27.0000	6.750	.56	1.5000	13.15	21.40	12.44	20.69	12.30	20.35	11.50	19.75
735-222	E	406x610		774.70	685.80				334.01	543.56	315.97	525.52	312.42	516.89	292.10	501.65
735-215	D	16x32		38.50	35.0000	6.750	.56	1.5000	12.90	29.40	12.19	28.69	11.85	28.35	11.25	27.75
735-223	E	406x813		977.90	889.00				327.66	746.76	309.72	300.99	720.09	720.10	285.75	704.85
735-219	D	20x20		26.50	23.0000	8.750	.56	1.5000	17.15	17.15	16.44	16.44	16.15	16.15	15.58	115.58
735-227	E	508x508		673.10	584.20	222.25			435.61		417.57		410.21		395.73	
735-228	E	20x30		36.50	33.0000	8.750	.56	1.5000	16.90	27.16	16.19	26.44	15.80	26.10	15.25	25.50
		508x762		927.10	838.20				429.26	689.86	411.22	671.57	401.32	622.94	387.35	647.70
735-229	E	20x40		46.50	43.0000	8.750	.56	1.5000	16.90	37.15	16.19	36.44	15.85	36.10	15.25	35.50
		508x1016		1181.10	1092.20				429.26	943.61		925.57	402.59	916.94		901.70
735-230	E	24x24		30.50	27.0000	10.625	.56	1.7500	21.18	21.18	20.44	20.44	20.15	20.15	19.55	19.55
		610x610		774.70	685.80	269.74		44,45	537.97		519.17		511.81		496.57	
735-231	E	24x36		42.50	39.0000	10.625	.56	1.7500	20.90	33.15	20.19	32.44	19.85	32.10	19.25	31.50
		610x914		1079.50	990.60				530.86	842.01	512.82	823.97	504.19	815.34	488.95	800.10
735-232	E	28x28		34.50	31.0000	12.625	.56	1.7500	24.90	24.90	24.19	24.19	23.85	23.85	23.25	23.25
		711x711		876,30	787,40	320.54			632.46		614.12		605.79		590.55	
735-233	E	28x44		50.50	47.0000	12.625	.56	1.7500	24.90	40.90	24.19	39.19	23.85	39.85	23.25	39.29
		711x1118		1282,70	1193,80				632.46	1038.86		995.42		1012.19		997.96
735-234	E	32x32		38.50	35.0000	14.625	.56	1.7500	28.90	28.90	28.19	28.19	27.85	27.85	27.25	27.25
		813x813		977,90	889,00	371.37			734.06		716.02		707.39		692.15	
735-235	E	36x36		42.50	39.0000	16.625	.56	1.7500	32.90	32.90	32.18	31.18	33.15	31.85	31.25	31.25
		914x914		1079,50	990,60	422.14			835.66		817.37		842.01		793.75	
735-245	F	32x60		66.50	63.0000	13.000	.56	1.7500	28.28	56.28	27.56	55.56	27.30	55.30	26.70	54.70
		813x1524		1689,10	1600,20	330.20			718.31	1429.51	700.02	1411.22	693.42	1404.82	678.18	1389.38

Sizes shaded in chart are used only when space is a factor, otherwise refer to Square Heads on Page 10

Note: (2) Drive Styles Available

MAXIMUM SPINDLE AREA

When ordering use Head Ass'm No. plus Series

Example 735-242-200 DRIVE C Standard Duty Drill Press DRIVE D Heavy Duty Drill Press DRIVE E Heavy Duty Machine Drive DRIVE B Standard Duty Drill Press DRIVE F Special Drive

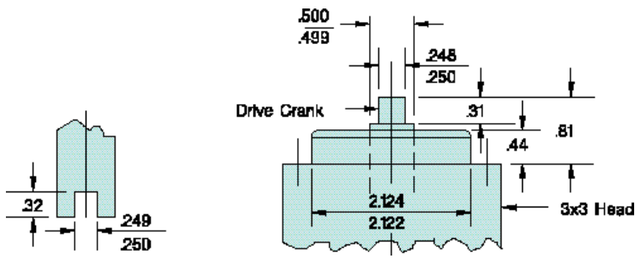
NOTE: Smaller numbers are metric conversions.

See Pages 26 - 38 for Standard Drilling and Tapping Fixtures and Components

Drive Assembly Data *(for multiple spindle heads)*

STYLE A DRIVE

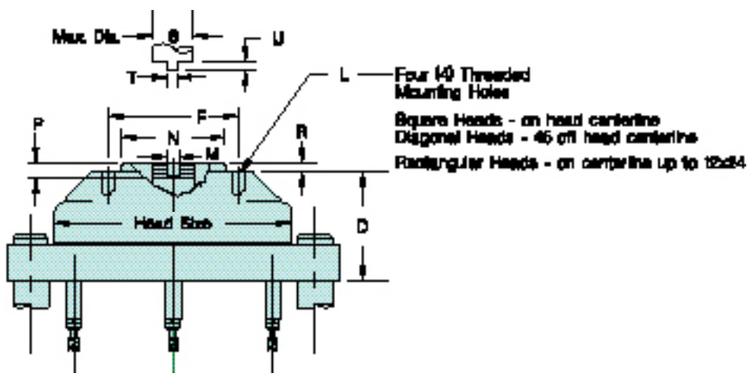
CAUTION: Driver must not bottom out against head drive crank



STYLE B,C, and D Drives

Drive Style	Size	Head F	L	M	N	P	R	S	T	U	
		4.50	3.50	1/4(.250)-20	.312	2.999	.281	.38	.906	.309	.312
DRIVE	B	114.30	88.90		.315	2.997				.307	
		6.00	4.88	3/8(.375)-16	7.92	76.17	7.14	9.65	23.01	7.85	7.92
		152.40	123.95		8.00	76.12				7.80	
		8.00			.438	4.499				.434	
	C	203.20	5.50	3/8(.375)-16	.441	4.497	.406	.38	1.906	.431	.500
DRIVE	and	and	139.70		11.13	114.27	10.31	9.65	48.41	11.02	12.70
	D	over			11.20	114.22				10.95	

NOTE: Special drives are available on request.



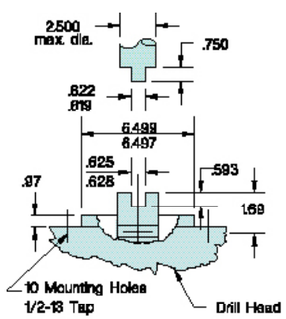
Style B, C, D and E Drives

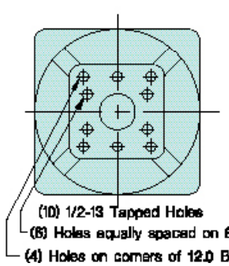
Drive Style	Drill Head Size	D HEAD SERIES 200	400	500	800
	5x10	5.55	—	—	—
		140.97			
B	6x8	5.62	7.12	—	—
		142.75	180.85		
	8x12				
	8x16				
C	10x15	6.50	8.00	—	—
DRIVE	10x20	165.10	203.20		
	12x18				
	12x24				
	14x14				
	14x21				
	14x28				
	16x16				
D	16x24	7.75	9.25	9.94	—
DRIVE	16x32	196.85	234.95	252.47	
	18x18				
	18x27				
	18x36				
	20x20				
	16x16				
	16x24				
	16x32				
	18x18				
	18x27	10.62	12.12	13.12	14.50
	18x36	269.74	307.84	333.24	368.30
	20x20				
E	20x30				
DRIVE	20x40				
	24x24				
	28x28				
	24x36				
	32x32	10.75	12.25	13.24	14.50
	28x44	273.05	311.15	326.55	368.30
	36x36				
	32x60				

HEAVY DUTY MACHINE DRIVES

Style E Flange Mount

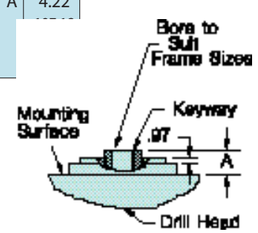
Style F Direct Motor Drive





HEAD SIZE

16x16	A	4.50
20x20		114.30
24x24		
28x28		4.22
32x32		
32" Dia.		
40" Dia.		



NOTE: Smaller numbers are metric conversions.

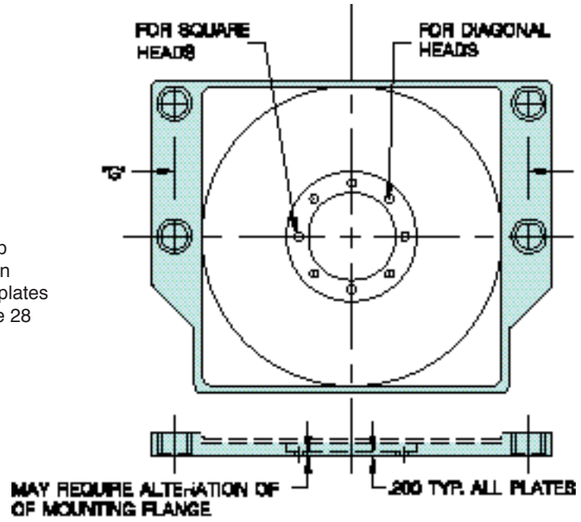
Quill Clamps & Drivers *(for popular drill presses & feed units)*

Drill Press & Quill Dia.	Taper	Driver No.	Driver Style	Quill Clamp No. & Head Mounting Bolt Circle 3.500 B.C.	4.875 B.C.	5.500 B.C.
				717-3120	717-4062	—
Allen #2 2.750 Dia.	2 M.T.	708-1834	B	—	717-4112	—
		708-1782	C&D	—	—	717-5343
Allen #2 & 35 2.750 Dia.	3 M.T.	708-1835	B	717-3364	717-4062	—
		708-1783	C&D	—	—	717-5077-1
Allen #2 2.750 Dia. With Power Feed	3 M.T.	708-1835	B	717-3364	717-4375	—
		708-1783	C&D	—	—	717-5375
Atlas 15" 1.812 Dia.	1 M.T.	708-1833	B	717-3109	—	—
	2 M.T.	708-1834	B	717-3238	717-4241	—
Atlas 15" 1.812 Dia.	33 J.T.	708-3518	B	717-3152	717-4153	—
		708-3525	C&D	—	—	717-5175
Avey #2 3.500 Dia.	2 M.T.	708-1834	B	717-3467	717-4732	—
		708-1782	C&D	—	—	717-5078
Avey #2 3.500 Dia.	3 M.T.	708-1835	B	717-3467	717-4732	—
		708-1783	C&D	—	—	717-5078
Avey #3 BMA 4.250 Dia.	3 M.T.	708-1835	B	717-3100	717-4086	—
		708-1783	C&D	—	—	717-5090
Avey #3 BMA 4.250 Dia.	4 M.T.	708-1835 with 3 to 4 M.T. Sleeve	B	717-3468	717-4367	—
		708-1784	C&D	—	—	717-5102
Buffalo #15 1.750 Dia.	33 J.T.	708-3518	B	717-3150	717-4151	—
		708-3525	C&D	—	—	717-5243
Buffalo #16 1.875 Dia.	2 M.T.	708-1834	B	717-3205-6 with Sleeve	717-4206-4 with Sleeve	—
		708-1782	C&D	—	—	717-5207-4 with Sleeve
Buffalo #16 1.875 Dia.	3 M.T.	708-1835	B	717-3205-6 with sleeve	717-4206-4 with sleeve	—
		708-1783	C&D	—	—	717-5207-4 with Sleeve
Buffalo #18 2.375 Dia.	2 M.T.	708-1834	B	717-3205-2	717-4206-2	—
		708-1782	C&D	—	—	717-5207-2
Buffalo #18 2.375 Dia.	3 M.T.	708-1835	B	717-3205-2	717-4206-2	
		708-1783	C&D	—	—	717-5207-2
Clausing 15" 1.988 Dia.	2 M.T.	708-1834	B	717-3191	717-4116	—
		708-1782	C&D	—	—	717-5311
Clausing 15" 1.988 Dia.	33 J.T.	708-3518	B	717-3197	717-4318	—
		708-3525	C&D	—	—	717-5197
Clausing 18" 2.365 Dia.	3 M.T.	708-1835	B	717-3178	717-4130	—
		708-1783	C&D	—	—	717-5067
Clausing 20" 2.488 Dia.	3 M.T.	708-1835	B	717-3082	717-4127	—
		708-1783	C&D	—	—	717-5196
Dumore #24, 26, & 28 1.750 Dia.	2 J.T.	708-3517	B	717-3150	717-4151	—
		708-3522	C&D	—	—	717-5243
Hypneumat Series 200 1.625 Dia.	2 J.T.	708-3517	B	717-3158	717-4159	—
		708-3522	C&D	—	—	717-5274
Hypneumat Series 300 & 350 1.750 Dia.	2 J.T.	708-3517	B	717-3160	717-4161	—
		708-3522	C&D	—	—	717-5162
Hypneumat Series 400 2.375 Dia.	2 M.T.	708-1834	B	717-3369	717-4355	--
		708-1782	C&D	—	—	717-5374
Hypneumat Series 400 2.375 Dia.	3 M.T.	708-1835	B	717-3192	717-4176	—
		708-1783	C&D	—	—	717-5277
Leland Gifford #2 LMS 2.875 Dia.	2 M.T.	708-1834	B	717-3347	717-4348	—
		708-1782	C&D	—	—	717-5349
Leland Gifford #2 LMS &23 2.875 Dia.	3 M.T.	708-1835	B	717-3400	717-4088	—
		708-1783	C&D	—	—	717-5346
Powermatic 15" 2.186 Dia.	2 M.T.	708-1834	B	717-3179	717-4320	—
		708-1782	C&D	—	—	717-5256
Powermatic 15" 2.186 Dia.	33 J.T.	708-3518	B	717-3252	717-4388	—
		708-3525	C&D	—	—	717-5391
Powermatic 20" 2.750 Dia.	2 M.T.	708-1834	B	717-3364	717-4062-1	—
		708-1782	C&D	—	—	717-5420
Powermatic 20" 2.750 Dia.	3 M.T.	708-1835	B	717-3364	717-4062-1	—
		708-1783	C&D	—	—	717-5240
Rockwell Delta 14" 1.750 Dia.	1 M.T.	708-1833	B	717-3300	717-4995	—
		—	C&D	—	—	—
Rockwell Delta 14" 1.750 Dia.	2 M.T.	708-1834	B	717-3300	717-4995	—
		708-1782	C&D	—	—	--
Rockwell Delta 14" 1.750 Dia.	2 J.T.	708-3517	B	717-3150	717-4151	--
		708-3522	C&D	--	--	717-5243
Rockwell Delta 15" 2.000 Dia.	1 M.T.	708-1833	B	717-3185	717-4050	—
		—	C&D	—	—	—
Rockwell Delta 15" 2.000 Dia.	2 M.T.	708-1834	B	717-3185	717-4070	—
		708-1782	C&D	—	—	717-5317
Rockwell Delta 15" 2.000 Dia.	33 J.T.	708-3518	B	717-3154	717-4155	—
		708-3525	C&D	—	—	717-5429
Rockwell Delta 17" 2.250 Dia.	2 M.T.	708-1834	B	717-3301	717-4998	—
		708-1782	C&D	--	--	717-5449
Rockwell Delta 17 2.250 Dia.	33 J.T.	708-3518	B	717-3156	717-4157	--
		708-3525	C&D	--	--	717-5157
Rockwell Delta 20" 2.375 Dia.	2 M.T.	708-1834	B	717-3205-1	717-4206-1	—
		708-1782	C&D	—	—	717-5207-1
Rockwell Delta 20" 2.375 Dia.	3 M.T.	708-1835	B	717-3205-1	717-4206-1	—
		708-1783	C&D	—	—	717-5207-1
Snow Drill Unit #1 3.000 Dia.	1 M.T.	708-1833	B	717-3432	717-4405	—
		—	C&D	—	—	—
Snow Drill Unit #2 3.437 Dia.	2 M.T.	708-1834	B	717-3434	717-4435	—
		708-1782	C&D	—	—	717-5436
Snow Drill Unit #3 3.750 Dia.	2 M.T.	708-1834	B	717-3437	717-4438	—
		708-1782	C&D	—	—	717-5439
Sugino ESB-6020 & ESBW-6020 1.968 Dia.	1 J.T.	708-3516	B	717-3472	717-4463	—
		708-3521	C&D	—	—	—
Sugino ESB-6030 ESBW-6030 1.968 Dia.	1 J.T.	708-3516	B	717-3472	717-4463	—
		708-3521	C&D	—	—	—
Sugino ESB-W1308-U 1.968 Dia.	33 J.T.	708-3518	B	717-3473	—	—
		708-3525	C&D	—	—	—
Sugino ESBPW1318-U 1.968 Dia.	33 J.T.	708-3518	B	717-3474	717-4460	—
		708-3525	C&D	—	—	717-5901
Sugino ESC-W1323-U 2.952 Dia.	33 J.T.	708-3518	B	717-3475	717-4461	—
		708-3525	C&D	—	—	—
Sugino ESB-W1305U 3.739 Dia.	33 J.T.	708-3518	B	717-3476	717-4462	—
		708-3525	C&D	—	—	717-5903
Sugino ESD-W1315U 3.739 Dia.	33 J.T.	708-3518	B	717-3476	717-4462	—
		708-3525	C&D	—	—	717-5903
Sugino ESD-W2403 3.739 Dia.	2 M.T.	708-1834	B	717-3477	—	—
		708-1782	C&D	—	—	—
Sugino STB-108U 1.968 Dia.	33 J.T.	708-3518	B	717-3473	717-4459	—
		708-3525	C&D	—	—	717-5900
Walker-Turner 15" 2.000 Dia.	2 M.T.	708-1834	B	717-3185	717-4070	—
		708-1782	C&D	—	—	717-5317
Walker-Turner 15" 1.812 Dia.	33 J.T.	708-3518	B	717-3152	717-4153	—
		708-3525	C&D	—	—	717-5175
Walker-Turner 17" 2.250 Dia.	2 M.T.	708-1834	B	717-3301	717-4998	—
		708-1782	C&D	—	—	717-5449
Walker-Turner 20" 2.375 Dia.	2 M.T.	708-1834	B	717-3428	717-4187	—
		708-1782	C&D	—	—	717-5113
Walker-Turner 20" 2.375 Dia.	3 M.T.	708-1835	B	717-3428	717-4187	—
		708-1783	C&D	—	—	717-5207-1
Universal Automatic A-30 600 & A-30 601 2.250 Dia.	—	708-3519	B	717-3254	717-4255	—
		708-3520	C&D	—	—	717-5412
Universal Automatic Model "A" 2.250 Dia.	—	708-3519	B	717-3254	717-4255	—
		708-3520	C&D	—	—	717-5412
Zagar Thruster-250 1.875 Dia.	33 J.T.	708-3518	B	717-3050	717-4050	—
		708-3525	C-D	—	—	717-5050
Zagar Thruster-500 2.000 Dia.	33 J.T.	708-3518	B	717-3051	717-4051	—
		708-3525	C-D	—	—	717-5051
Zagar Thruster-1000 3.000 Dia.	3 J.T.	—	B	—	—	717-4052
		708-3523	C-D	—	—	717-5052

NOTE: Smaller numbers are metric conversions.

Rear Support Plate Assembly *(for square & diagonal assemblies)*

Rear support plate assemblies are recommended for increased stability and linear tracking of complete drill or tap head fixture assemblies. Rear support assemblies contain guide rod bushings at standard guide rod positions. The plates are made from standard bushing plate castings, see Page 28 for dimensions.

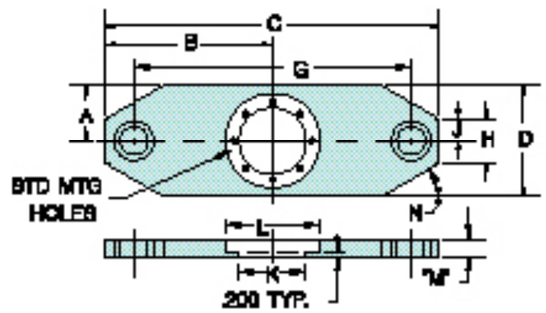


HEAD SIZE	ORDER NO. 709-	DESCRIPTION
3.00 76.20	-3820-2	Guide rod standard rear position
	-3820-3	Guide rod on horizontal centerline
	-3820-4	Guide rod and mounting for diagonal heads
4.50 114.30	-3821-2	Guide rod standard rear position
	-3821-3	Guide rod on horizontal centerline
	-3821-4	Guide rod and mounting for diagonal heads
6.00 152.40	-3822-2	Guide rod for standard rear position
	-3822-3	Guide rod on horizontal centerline
	-3822-4	Guide rod and mounting for diagonal heads
8.00 203.20	-3823-2	Guide rod for standard rear position
	-3823-3	Guide rod on horizontal centerline
	-3823-4	Guide rod and mounting for diagonal heads
10.00 254.00	-3824-2	Guide rod standard rear position
	-3824-3	Guide rod on horizontal centerline
	-3824-4	Guide rod and mounting for diagonal heads
12.00 304.80	-3825-2	Guide rod standard rear position
	-3825-3	Guide rod on horizontal centerline
	-3825-4	Guide rod and mounting for diagonal heads
16.00 406.40	-3826-2	Guide rod standard rear position
	-3826-3	Guide rod on horizontal centerline
	-3826-4	Guide rod and mounting for diagonal heads

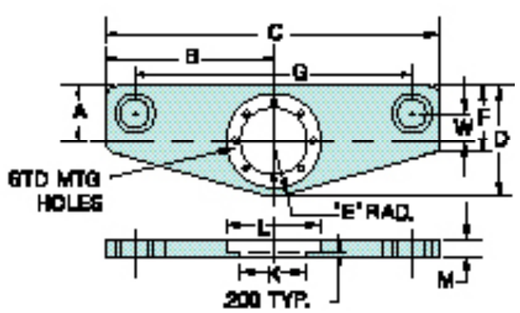
NOTE: Smaller numbers are metric conversions.

Rear Support Plate Assembly *(heavy duty square & rectangular*

HORIZONTAL CENTERLINE



STANDARD REAR POSITION



DRIVE STYLE	HEAD SIZE	735-	A	B	C	D	E	F	G	H	J	K	L	M	N	W
B	5.00 x 10.00	-0701-0510-2	2.50	7.50	15.00	5.00	1.75	3.00	6.500	—	—	3.000	4.25	.750	—	1.250
		-0701-0510-3	2.50	7.50	15.00	5.00	—	—	6.500	2.00	1.00	3.000	4.25	.750	30°	—
C	8.00 x 12.00	-0702-0812-2	4.12	8.50	17.00	7.88	3.75	3.00	14.500	—	—	4.500	6.75	.750	—	2.875
		-0702-0812-3	3.75	8.50	17.00	7.50	—	—	14.500	4.00	2.00	4.500	6.75	.750	30°	—
	8.00 x 16.00	-0702-0816-2	4.12	10.50	21.00	8.88	3.75	3.00	18.500	—	—	4.500	6.75	.750	—	2.875
		-0702-0816-3	4.75	10.50	21.00	7.50	—	—	18.500	4.00	2.00	4.500	6.75	.750	30°	—
	10.00 x 15.00	-0702-1015-2	5.12	10.00	20.00	8.88	3.75	3.00	17.500	—	—	4.500	6.75	.750	—	3.875
		-0702-1015-3	3.75	10.00	20.00	7.50	—	—	17.500	4.00	2.00	4.500	6.75	.750	30°	—
	10.00 x 20.00	-0702-1020-2	5.12	12.50	25.00	9.75	3.75	3.25	22.500	—	—	4.500	6.75	.750	—	3.875
		-0702-1020-3	3.75	12.50	25.00	8.00	—	—	22.500	4.00	2.00	4.500	6.75	.750	30 °	—
	12.00 x 18.00	-0702-1218-2	6.00	11.50	23.00	9.75	3.75	3.25	20.500	—	—	4.500	6.75	.750	—	4.750
		-0702-1218-3	4.00	11.50	23.00	8.00	—	—	20.500	4.00	2.00	4.500	6.75	.750	30 °	—
	12.00 x 24.00	-0702-1224-2	6.00	14.50	29.00	9.75	3.75	3.50	26.500	—	—	4.500	6.75	.750	—	4.750
D		-0702-1224-3	4.00	14.50	29.00	8.00	—	—	26.500	4.00	2.00	4.500	6.75	.750	30°	—
	16.00 x 16.00	-0703-1616-2	8.50	11.00	22.00	14.50	6.00	6.00	19.000	—	—	4.500	10.50	1.000	—	6.750
		-0703-1616-3	6.00	11.00	22.00	12.00		—	19.000	4.00	2.00	4.500	10.50	1.000	45°	—
	16.00 x 24.00	-0703-1624-2	8.50	15.00	30.00	14.50	6.00	6.00	27.000	—	—	4.500	10.50	1.000	—	6.750
		-0703-1624-3	6.50	15.00	30.00	13.00	—	—	27.000	4.00	2.00	4.500	10.50	1.000	45°	—
	16.00 x 32.00	-0703-1632-2	8.50	19.00	38.00	14.50	6.00	6.00	35.000	—	—	4.500	10.50	1.000	—	6.750
		-0703-1632-3	6.50	19.00	38.00	13.00	—	—	35.000	4.00	2.00	4.500	10.50	1.000	45°	—
	20.00 x 20.00	-0703-2020-2	10.50	13.00	26.00	16.50	6.00	6.00	23.000	—	—	6.500	10.50	1.000	—	8.750
		-0703-2020-3	6.00	13.00	26.00	12.00	—	—	23.000	4.00	2.00	6.500	10.50	1.000	45°	—
	16.00 x 16.00	-0704-1616-2	8.50	11.00	22.00	14.50	6.00	6.00	19.000	—	—	6.500	10.50	1.000	—	6.750
		-0704-1616-3	6.00	11.00	22.00	12.00	—	—	19.000	4.00	2.00	6.500	10.50	1.000	45 °	—
E	16.00 x 24.00	-0704-1624-2	8.50	15.00	30.00	14.50	6.00	6.00	27.000	—	—	6.500	10.50	1.000	—	6.750
		-0704-1624-3	6.50	15.00	30.00	13.00	—	—	27.000	4.00	2.00	6.500	10.50	1.000	45°	—
	16.00 x 32.00	-0704-1632-2	8.50	19.00	38.00	14.50	6.00	6.00	35.000	—	—	6.500	10.50	1.000	—	6.750
		-0704-1632-3	6.50	19.00	38.00	13.00	—	—	35.000	4.00	2.00	6.500	10.50	1.000	45°	—
	20.00 x 20.00	-0704-2020-2	10.50	13.00	26.00	16.50	6.00	6.00	23.000	—	—	6.500	10.50	1.000	—	8.750
		-0704-2020-3	6.00	13.00	26.00	12.00	—	—	23.000	4.00	2.00	6.500	10.50	1.000	45°	—
	20.00 x 30.00	-0704-2030-2	10.50	18.00	36.00	16.50	6.00	6.00	33.000	—	—	6.500	10.50	1.000	—	8.750
		-0704-2030-3	6.50	18.00	36.00	13.00	—	—	33.000	4.00	2.00	6.500	10.50	1.000	45°	—
	20.00 x 40.00	-0704-2040-2	10.50	23.00	46.00	16.50	6.00	6.00	43.000	—	—	6.500	10.50	1.000	—	8.750
		-0704-2040-3	6.50	23.00	46.00	13.00	—	—	43.000	4.00	2.00	6.500	10.50	1.000	45°	—
	24.00 x 24.00	-0704-2424-2	12.38	15.12	30.25	18.38	6.00	9.00	27.000	—	—	6.500	10.50	1.000	—	10.625
		-0704-2424-3	6.50	15.12	30.25	13.00	—	—	27.000	4.00	2.00	6.500	10.50	1.000	45°	—
	24.00 x 36.00	-0704-2436-2	12.38	21.12	42.25	18.38	6.00	9.00	39.000	—	—	6.500	10.50	1.000	—	10.625
		-0704-2436-3	6.50	21.12	42.25	13.00	—	—	39.000	4.00	2.00	6.500	10.50	1.000	45°	—
	28.00 x 28.00	-0705-2828-2	14.38	17.12	34.25	22.62	8.25	11.00	31.000	—	—	6.500	13.50	1.000	—	12.625
		-0705-2828-3	8.00	17.12	34.25	16.00	—	—	31.000	5.00	2.50	6.500	13.50	1.000	45°	—
	28.00 x 44.00	-0705-2844-2	14.38	25.12	50.25	22.62	8.25		47.000	—	—	6.500	13.50	1.000	—	12.625
		-0705-2844-3	8.00	25.12	50.25	16.00	—		47.000	5.00	2.50	6.500	13.50	1.000	45°	—
	36.00 x 36.00	-0705-3636-2	18.38	21.12	42.25	26.62	8.25		39.000	—	—	6.500	13.50	1.000	—	16.625
		-0705-3636-3	8.00	21.12	42.25	16.00	—		39.000	5.00	2.50	6.500	13.50	1.000	45°	—

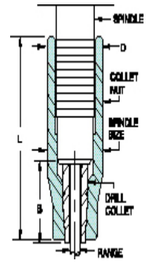
NOTE: Smaller numbers are metric conversions.

DRILL COLLETS and COLLET NUTS

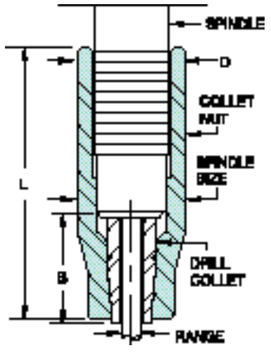
Spindle Size	TANG COLLET *Collet No.	TANG COLLET Range	PLAIN COLLET *Collet No.	PLAIN COLLET Range	Collet Dimensions A	Collet Dimensions B	Collet Nut Dimensions Collet Nut No.	Collet Nut Dimensions D	Collet Nut Dimensions L	Close Center Wrench
.250	—	—	708-2239	.013 thru .042	.16	.50	708-2186	.25	1.06	708-139
6.35			708-2229	.046 thru .093	4.06	12.70		6.35	26.92	
.312	708-2328	.125	708-2240	.013 thru .042	.19	.50	708-1007	.31	1.06	708-1043
7.92			708-2230	.046 thru .125	4.83			7.87		
					.22					
			708-2244	.013 thru .042	5.59		708-1707			
.375	708-1231	.125 thru .156	708-2230	.046 thru .125	.19	.50	708-3030	.37	1.19	708-1713
9.53								7.40	30.23	
			708-2231	.128 thru .156	.22		708-1707			
.437										
11.10	708-1232	.125 thru .187	708-2245	.013 thru .042	.28	.62	708-2007	.43	1.38	708-2339
.500			708-2232	.046 thru .187	7.11	15.75		10.92	35.05	
12.70										
									1.56	
.562	708-1232	.125 thru .156	708-2232	.046 thru .156	.28	.62	708-3031	.56	39.62	708-2469
14.27	708-2659	.157 thru .221	708-2656	.157 thru .221	.31	.88	708-2657	14.22	1.81	
					7.87	22.35			45.97	
	708-1232	.125 thru .156	708-2232	.046 thru .156	.28	.62	708-3032		1.56	
.625					.38	.88		.62	1.81	708-2539
15.88	708-1233	.157 thru .261	708-2233	.157 thru .261	9.65		708-2307	15.75		
	708-1232	.125 thru .156	708-2232	.046 thru .157	.28	.62	708-3033		1.62	708-2539
									71.15	
.750	708-1233	.157 thru .261	708-2233	.157 thru .261	.38	.88	708-3034	.75	1.88	708-3039
19.05								19.05	47.75	
	708-1234	.261 thru .375	708-2234	.260 thru .375	.50	1.00	708-2507		2.00	
					12.70	25.40			50.80	
	708-1233	.157 thru .261	708-2233	.157 thru .261	.38	.88	708-3035		2.09	708-3039
									53.09	
1.000	708-1234	.261 thru .375	708-2234	.260 thru .375	.50	1.00	708-3036	1.00	2.22	708-3043
25.40								25.40	56.39	
	708-1235	.377 thru .500	—	—	.68	1.38	708-3007		2.62	
					17.27	35.05			66.55	
	708-1234	.261 thru .375	708-2234	.260 thru .375	.50	1.00	708-3037		2.66	708-3043
									67.56	
1.250	708-1235	.377 thru .500	—	—	.58	1.38	708-3038	1.25	3.06	—
31.75								31.75	77.72	
	708-1236	.515 thru .625	—	—	.91	1.56	708-4007		3.25	
					23.11	36.92			82.55	

Note: Tang Collets are for Drill Manufacturer's Standard Tangs.

*NOTE: Exact tool size required to complete Collet No.



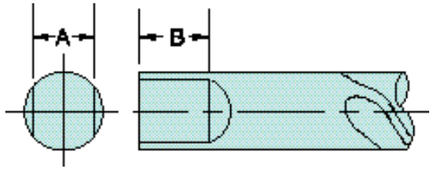
Collet Nut



Plain Collet

Tang Collet

Note: TANG COLLETS are preferred to insure against slippage when drilling, reaming, etc.



ASA DIMENSIONS of TANGS

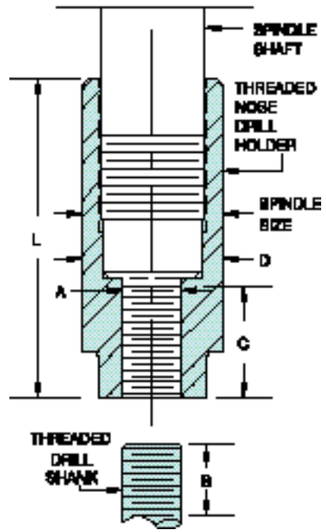
Shank Diameter Inches	Tang Dimensions A	Tang Dimensions B
.1250 thru .1875	.092	.28
Over .1875 thru .2500	.120	.31
Over .2500 thru .3125	.160	.34
Over .3125 thru .3750	.201	.38
Over .3750 thru .4687	.241	.44
Over .4687 thru .5625	.300	.50
Over .5625 thru .6562	.370	.56
Over .6562 thru .7500	.440	.62

NOTE: Smaller numbers are metric conversions.

Threaded Nose Drill Holders are desirable when using large numbers of one size drill as well as for rapid changing of drills. Also

see Z-Lock drill holders on Page 18.

THREADED NOSE DRILL HOLDER



Spindle Size	Part No.	Minimum Thread	Maximum Thread	Thread Length	C	D	L	Close Center Wrench
.187	708-2728	#2(.086)-56	#5(.125)-40	.44	.31	.186	.94	708-2764
4,75				11.18	7.87	4.83	23.88	
.218	708-2729	#2(.086)-56	#6(.138)-32	.44	.31	.22	.94	708-2765
5,54				11.18	7.87	5.59	23.88	
.250	708-2187	#2(.086)-56	#7(.151)-32	.44	.31	.246	.94	708-1039
6,35				11.18	7.87	6.35	23.88	
.312	708-1027	#2(.086)-56	#8(.164)-32	.50	.31	.298	.94	708-1039
7,92				12.70	7.87	7.62	23.88	
.375	708-1703	#2(.086)-56	#12(.216)-32	.62	.38	.365	1.19	708-1713
9.53				15.75	9.65	9.40	30.23	
.437	708-2027	#2(.086)-56	1/4(.250)-20	.62	.38	.425	1.19	708-2039
11.10				15.75	9.65	10.92	30.23	
.500	708-2027	#2(.086)-56	1/4(.250)-20	.62	.38	.425	1.19	708-2039
12.70				15.75	9.65	10.92	30.23	
.500	708-1627	5/16(.312)-185	5/16(.312)-18	.62	.38	.490	1.19	708-2339
12.70				15.75	9,65	12.45	30.23	
.562	708-2658	#7(.151)-32	5/16(.312)-18	.62	.50	.555	1.50	708-2469
14.27				15.75	12.70	14.22	38.10	
.625	708-2327	#7(.151)-32	3/8(.375)-16	.62	.50	.62	1.50	708-2539
15.88				15.75	12.70	15.75	38.10	
.750	708-2527	#10(.190)-32	7/16(.437)-14	.75	.62	.730	1.69	708-2539
19.05				19.05	15.75	18.80	42.93	
1.000	708-3027	#12(.216)-32	1/2(.500)-13	1.12	.94	.990	2.25	708-3039
25.40				28.45	23.88	25.15	57.15	

ZAGAR STANDARD THREAD SIZES

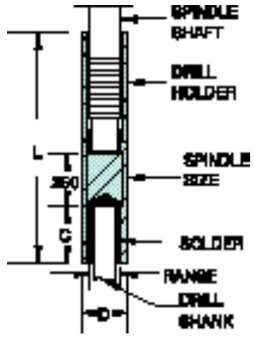
Drill Diameter	Thread	Drill Diameter	Thread	Drill

Minimum Drill Diameter	Maximum Drill Diameter	Size Thread
.078	.089	#2(.086)-56
1.98	2.26	
.090	.104	#3(.099)-48
2.29	2.64	
.105	.116	#4(.112)-40
2.67	2.95	
.117	.129	#5(.125)-40
2.97	3.28	
.130	.141	#6(.138)-32
3.30	3.58	

Minimum Drill Diameter	Maximum Drill Diameter	Size Thread
.142	.154	#7(.151)-32
3.61	3.91	
.155	.166	#8(.164)-32
3.94	4.22	
.167	.180	#9(.177)-32
4.24	4.57	
.181	.194	#10(.190)-32
4.60	4.93	
.209	.221	#12(.216)-32
5.31	5.61	

(TURN DRILL SHANKS WHEN NECESSARY)

Minimum Drill Diameter	Maximum Drill Diameter	Size Thread
.222	.250	1/4(.250)-20
5.64	6.35	
.281	.312	5/16(.312)-18
7.14	7.93	
.344	.375	3/8(.375)-16
8.74	9.53	
.406	.437	7/16(.437)-14
10.31	11.10	
.469	.500	1/2(.500)-13
11.91	12.70	



SOLDERED TYPE DRILL HOLDER

Soldered type drill holders are required for use with spindle sizes .187 and .218. They can also be used on .250 and .312 spindle sizes for tool shank diameters exceeding available collets.

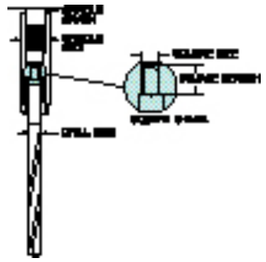
Spindle Size	Drill Range	Holder No.	C	D	L	Wrench
.187	.015 thru .125	708-2726	.312	.184	1.187	708-2764
4.75	0.38 3.18		7.92	4.67*	30,15	
.218	.015 thru .156	708-2727	.312	.215	1.187	708-2765
5.54	3.96			5.46		
.250	.015 thru .187	708-3164	.312	.246	1.187	708-2755
6.35				6.25		
.312	.015 thru .250	708-3166	.312	.298	1.187	708-2756
7.92				7.57		

NOTE: Smaller numbers are metric conversions.

Z-Lock Drill Holders

Drilling with a Z-Lock holder requires that you square the shank of the drill. Refer to the chart below for holder number and square size.

Note: It is not necessary to use a cross pin for drilling unless there is a slot in the bottom face of the spindle normally provided for tapping.



Spindle Dia.	Assembly No. 708-	Drill Sizes .xxxx thru .xxxx	Square Size-Length
.250 6.35	3946-133	.1250 - .1330	.110 x .187
	-141	.1335 - .1410	.110 x .187
.312 7.92	3947-133	.1250 - .1330	.110 x .187
	-141	.1335 - .1410	.110 x .187
	-154	.1415 - .1540	.110 x .187
	-168	.1545 - .1680	.131 x .250
.375 9.53	3948-133	.1250 - .1330	.092 x .200
	-141	.1335 - .1410	.110 x .187
	-154	.1415 - .1540	.110 x .187
	-168	.1545 - .1680	.131 x .250
	-181	.1685 - .1810	.152 x .250
	-194	.1815 - .1940	.152 x .250
.437 11.10	3949-133	.1250 - .1330	.092 x .200
	-141	.1335 - .1410	.110 x .187
	-154	.1415 - .1540	.110 x .187
	-168	.1545 - .1680	.131 x .250
	-181	.1685 - .1810	.152 x .250
	-194	.1815 - .1940	.152 x .250
.500 12.70	3950-133	.1250 - .1330	.092 x .200
	-141	.1335 - .1410	.110 x .187
	-154	.1415 - .1540	.110 x .187
	-168	.1545 - .1680	.131 x .250
	-181	.1685 - .1810	.152 x .250
	-194	.1815 - .1940	.152 x .250
	-207	.1945 - .2070	.165 x .281
	-220	.2075 - .2200	.165 x .281
	-237	.2205 - .2370	.191 x .321
	-255	.2375 - .2550	.191 x .321
.562 14.27	3951-133	.1250 - .1330	.092 x .200
	-141	.1335 - .1410	.110 x .187
	-154	.1415 - .1540	.110 x .187
	-168	.1545 - .1680	.131 x .250
	-181	.1685 - .1810	.152 x .250
	-184	.1815 - .1940	.152 x .250
	-207	.1945 - .2070	.165 x .281
	-220	.2075 - .2200	.165 x .281
	-237	.2205 - .2370	.191 x .321
	-255	.2375 - .2550	.191 x .321
	-266	.2555 - .2670	.238 x .375
	-285	.2675 - .2850	.238 x .375
	-302	.2855 - .3020	.238 x .375
	-318	.3025 - .3180	.238 x .375
.625 15.88	3952-133	.1250 - .1330	.092 x .200
	-141	.1335 - .1410	.110 x .187
	-154	.1415 - .1540	.110 x .187
	-168	.1545 - .1680	.138 x .250
	-181	.1685 - .1810	.152 x .250
	-194	.1815 - .1940	.152 x .250
	-207	.1945 - .2070	.165 x .281
	-220	.2075 - .2200	.165 x .281

Spindle Dia.	Assembly No. 708-	Drill Sizes .xxxx thru .xxxx	Square Size-Length
.625 15.88	3952-237	.2205 - .2370	.191 x .321
	-255	.2375 - .2550	.191 x .321
	-267	.2555 - .2670	.238 x .375
	-285	.2675 - .2850	.238 x .375
	-302	.2855 - .3020	.238 x .375
	-318	.3025 - .3180	.238 x .375
	-323	.3185 - .3230	.242 x .406
	-338	.3255 - .3380	.241 x .437
	-353	.3385 - .3530	.241 x .437
	-367	.3535 - .3670	.241 x .437
	-381	.3675 - .3810	.241 x .437
.750 19.05	3953-255	.2375 - .2550	.191 x .321
	-266	.2552 - .2660	.238 x .375
	-285	.2677 - .2850	.238 x .375
	-302	.2855 - .3020	.238 x .375
	-318	.3025 - .3180	.238 x .375
	-323	.3185 - .3230	.242 x .406
	-338	.3235 - .3380	.275 x .437
	-353	.3385 - .3530	.275 x .437
	-367	.3535 - .3670	.275 x .437
	-381	.3675 - .3810	.241 x .406
1.000 25.40	3954-323	.3050 - .3230	.242 x .406
	-337	.3235 - .3370	.275 x .437
	-352	.3375 - .3520	.275 x .437
	-367	.3525 - .3670	.275 x .437
	-375	.3675 - .3750	.241 x .406
	-381	.3755 - .3810	.241 x .406
	-397	.3815 - .3970	.322 x .500
	-413	.3975 - .4130	.322 x .500
	-429	4090 - .4290	.322 x .500
	-446	.4295 - .4460	.360 x .562
	-460	.4465 - .4600	.360 x .562
	-480	.4605 - .4800	.360 x .562
1.250 31.75	3955-367	.3430 - .3670	.242 x .437
	-388	.3675 - .3880	.322 x .500
	-409	.3885 - .4090	.322 x .500
	-429	.4095 - .4290	.322 x .500
	-446	.4295 - .4460	.360 x .562
	-463	.4465 - .4630	.360 x .562
	-480	.4635 - .4800	.360 x .562
	-500	.4805 - .5000	.406 x .625
	-521	.5005 - .5210	.406 x .625
	-542	.5215 - .5420	.406 x .625
	-566	.5425 - .5660	.442 x .683
	-590	.5665 - .5900	.442 x .683
	-610	.5905 - .6100	.489 x .718
	-631	.6105 - .6310	.489 x .718
	-652	.6315 - .6520	.489 x .718
	-672	.6525 - .6720	.523 x .750
	-697	.6725 - .6970	.523 x .750

5-C COLLET BLOCKS

To square small quantities of drills, use a square 5-C collet block, No. 12-707-178 BS on a surface grinder. For larger quantites, use a Zagar Collet Index Fixture, No. 707-150. Drill suppliers will also supply drills with square shanks to order.

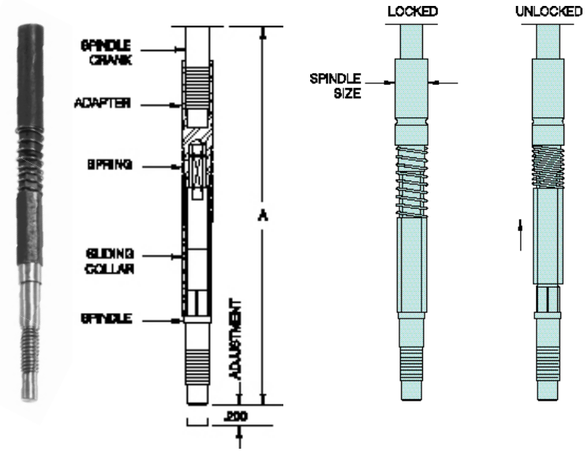
NOTE: Smaller numbers are metric conversions.

Spindle Accessories for Drilling

Spindle Size	Min. Length A	Assembly No.	Adjusting Spindle No.	Adapter No.	Collar	Collar Spring	Lock Pin Lock Ring
.187 4.75	3.00 76.20	708-2921-1	708-1859	708-1858	708-1860	708-1861	—
.218 5.54	3.00 76.20	708-2922-1	708-1863	708-1862	708-1864	708-1865	—
.250 6.35	3.50 88.90	D 708-2923-1 T 708-2923-2	D 708-1867 T 708-1868	708-1866	708-1869	708-1870 708-2036-2	708-2036-1
.312 7.92	3.50 88.90	D 708-2924-1 T 708-2924-2	D 708-1874 T 708-1875	708-1873	708-1876	708-1877	7081762-1 708-1763-2
		D Drilling	T Tapping				Tapping only

Zagar Multiple-Spindle Head complete with extension block and a Zagar Drill Fixture Assembly using Adjustable Adapter Tooling.

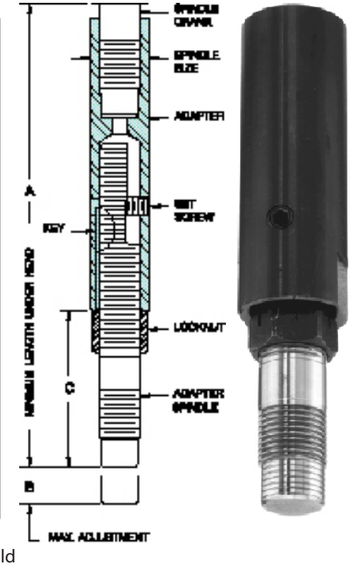
The quick lock Adjustable Adapter has design features suitable to very small spindles on minimum centers.



ADJUSTABLE ADAPTER - DRILLING

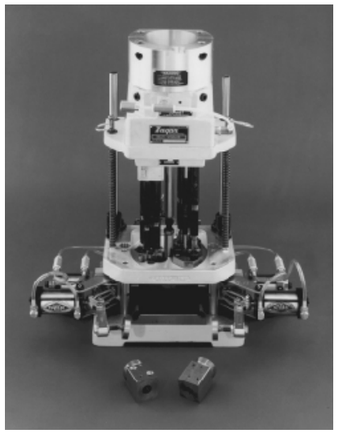
Spindle Size	A	B	C	Woodruff Key Size and A.N.S.I. No.	Adapter Assembly No	Spindle and Lock Nut Assembly No.	Adapter No.	Lock Nut No.
.375 9.53	3.50 88.90	.38 9.65	1.25 31.75	.062 x .312 202.5	708-2951	708-1737-1	708-1734-3	708-1736
.437 11.10	3.94 100.07	.50 12.70	1.19 30.22	.062 x .375 203	708-2954	708-1842-1	708-1841-3	708-1844
.500 12.70	3.94 100.07	.50 12.70	1.19 30.22		708-2957	708-1842-1	708-1845-3	708-1844
.562 14.27	4.88 123.95	.62 15.74	1.62 41.14	.093 x .500 304	708-2960	708-2651-1	708-2650-3	708-2654
.625 15.88	4.88 123.95	.62 15.74	1.62 41.14		708-2963	708-1849-1	708-1848-3	708-1893
.750 19.05	4.88 123.95	.62 15.74	1.62 41.14		708-2966	708-2463-1	708-2461-3	708-2464
*.750 19.05	4.88 123.95	.62 15.74	1.62 41.14		708-2967	708-2463-1	708-2465-3	708-2464
1.000 25.40	5.88 149.35	.62 15.74	2.12 53.84	.156 x .625 505	708-2972	708-2478-1	708-2477-3	708-2481
**1.000 25.40	5.88 149.35	.62 15.74	2.12 53.84		708-2973	708-2478-1	708-2476-3	708-2481

*Oversize .750 Assembly 1.000 Minimum Centers **Oversize 1.000 Assembly 1.250 Minimum Centers.



Adjustable Adapters provide the means for adjusting the tools to the proper working length to hold depth tolerances.

QUICK LOCK ADJUSTABLE ADAPTER



Zagar Multiple-Spindle Head complete with extension block and a Zagar Drill Fixture Assembly using Adjustable Adapter Tooling.

NOTE: Smaller numbers are metric conversions.

ADJUSTABLE ADAPTER with ASA M.T. ADAPTER

PART NUMBER EXPLANATION and ORDERING EXAMPLES

15- | 95-XXXX
Zagar No. | A.S.A. No.

To order Body Specify:
15-95-2631

To order Lock Nut Specify
15-95-2632

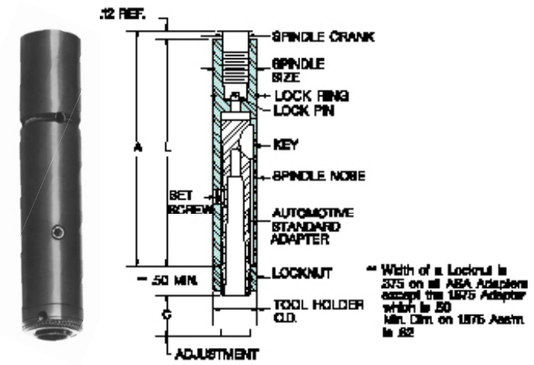
708- | XXXX | -XXXX | -X
Project No. | Ass'm No. | Length Col. A | Drilling or Tapping

Example: 708-3716-0400-1
TOOL HOLDER ASSEMBLY

INCLUDES THE FOLLOWING
Spindle Nose
A.S.A. Adapter
A.S.A. Locknut
Woodruff Key
Set Screw

Note 1
On .750 Spindle turn
Lock Nut #15-95-2622
Required for center
distance under .8

Eng. Ref 708-3706



Note: Metric bores available upon request.

Item No.	Adapter Body	Adapter Lock Nut	TOOL HOLDER Assembly No. Prefix No. 15-95 / Prefix No. 708-	Drilling	Tapping	Spindle Nose No. 708-	Drilling	Tapping	Spindle Size	Item Dia.	Spindle Shaft O.D.	Adapter A.S.A. O.D.	Adapter Morse Taper	TOOL HOLDER Tool Holder Head	A Length Under	C Adjustment Spindle Nose	L Actual Length of
1	2611	Note 1 2622	3716-0400	-1	-2	2191-0400	-3	-4	.625	1	.437 11.10	.500 12.70	0	.750 19.05	4.00 101.60	.90 22.86	3.88 98.55
2			3706-0400			2189-0400			.750	2	.562 14.27						
3	2612	2623	3714-0400			2190-0400				3	.625 15.88	.875 22.22	1	1.000 25.40			
4			3707-0450			2193-0450			1.000	4	.750 19.05				4.50 114.30		
5	2614	2625	3715-0525			2192-0525				5		.875 22.22	2		5.25 133.35	1.10 27.94	5.12 130.05
6	2613	2624	3815-0500			2211-0500				6		.750 19.05	1	1.250 31.75	5.00 127.00	.90 22.86	4.88 123.95
7	2614	2625	3708-0575			2194-0575			1.250	7	1.000 25.40	.875 22.22	2		5.75 146.05	1.10 27.94	5.62 142.75
8	2617	2627	3817-0575			2213-0575				8		1.062 26.97	1 2	1.562 39.67			
9	2631	2632	3803-0688			2199-0688				9		1.250 31.75	3	1.750 44.45	6.88 174.75		6.75 171.45
10	2615 2616	2626	3709-0600 3710-0600			2195-0600			1.500	10	1.125 28.58	1.000 25.40	1 2	1.500 38.10	6.00 152.40		5.88 149.35
11	2631	2632	3804-0712			2204-0712				11		1.250 31.75	3		7.12 180.85		7.00 177.8
12	2617 2618	2627	3711-0600 3712-0600			2196-0600				12		1.062 26.97	1 2	1.750 44.45	6.00 152.40		5.88 149.35
13	2631	2632	3713-0712			2197-0712			1.750	13	1.250 31.75	1.250 31.75	3		7.12 180.85	1.30 33.02	7.00 177.80
14	2621	2629	3807-0812			2221-0812				14		1.875 47.62	4	2.750 69.85	8.12 206.25	1.38 35.05	8.00 203.20

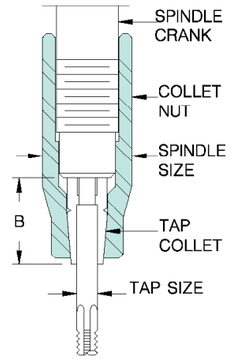
NOTE: Smaller numbers are metric conversions.

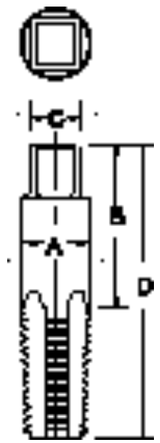
TAP COLLETS and NUTS

Spindle Size	B	Tap Size	Collet No.	Collet Nut No.	Wrench
.437 11.10 .500 12.70	.62 15.75	#0(.060) thru #10(.190)	708-1765	708-2007	708-2339
.562 14.27	.62 15.75	#0(.060) thru #10(.190)	708-1765	708-3031	708-2469
	.88 22.35	#12(.216) 1/4(.250)	708-1766	708-2307	
.625 15.88	.62 15.75	#0(.060) thru #10(.190)	708-1765	708-3032	708-2539
	.88 22.35	#12(.216) thru 1/4(.250)	708-1766	708-2307	
.750 19.05	.62 15.75	#0(.060) thru #10(.090)	708-1765	708-3033	708-3039
	.88 22.35	#12(.216) thru 1/4(.250)	708-1766	708-3034	
	1.00 25.40	5/16(.312) thru 1/2(.500)	708-1767	708-2507	
1.000 25.40	.88 22.35	#12(.216) thru 1/4 (.250)	708-1766	708-3035	708-3043
	1.00 25.40	5/16(.312) thru 1/2(.500)	708-1767	708-3036	
	1.38 35.05	9/16 (.562) thru 5/8(.625)	708-1768	708-3007	
1.250 31.75	1.00 25.40	5/16(.562) thru 1/2(.500)	708-1767	708-3037	
	1.38 35.05	9/16(.562) thru 5/8(.625)	708-1768	708-3038	
	1.56 39.62	3/4(.750) 1/4 N.P.T.	708-1769	708-4007	

NOTE: For Collet Nut dimensions see Page 16.

TAP COLLETS are used for convenience of change-over from drilling to tapping with the same spindle. Use tap collets when float on tap is undesirable.





Taper Pipe Tap Standards

Pipe Tap Size	Threads per inch	Shank Size A	Shank Length B	Size of Square C	Length Overall D	Tap Drill A.S.A.
1/16[.062]	27	.3125	1.437	.234	2.125	D(.246)
1/8[.125]	27	.3125	1.375	.234	2.125	R(.339)
1/8[.125]	27	.4375	1.375	.328	2.125	R(.339)
1/4[.250]	18	.5625	1.375	.421	2.437	7/16
3/8[.375]	18	.7000	1.500	.531	2.562	37/64
1/2[.500]	14	.6875	1.750	.515	3.125	45/64
3/4[.750]	14	.9063	1.875	.679	3.250	59/64
1.[1.000]	11.5	1.1250	2.000	.843	3.750	1-5/32
1-1/4[1.250]	11.5	1.3125	2.250	.984	4.000	1-1/2
1-1/2[1.500]	11.5	1.5000	2.500	1.125	4.250	1-47/64
2.[2.000]	11.5	1.8750	2.750	1.406	4.500	2-41/64

Metric Sizes are available upon request

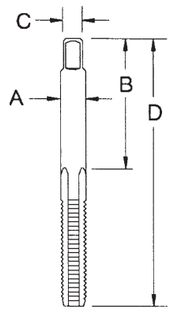
For Individual Lead Screw Tapping in one pass of various pitch threads, see Pages 31 thru 39.

NOTE: Smaller numbers are metric conversions.

Taps Standards and Dimensions

TAPS STANDARDS AND DIMENSIONS

A metric tap with an ANSI shank uses the same Z-Lock holder as an inch tap with the same shank diameter. To determine spindle size for application. Select spindle size at minimum centers or use the basic spindle size. (Ref. Pages 6-7.) Use the charts on this page and the following to specify the holder number.



Inch Series

Tap Size	Shank Dia. A (in.)	Shank Length B (in.)	Size of Square C (in.)	Overall Length D (in.)	Metric Tap Size w/ Inch Shank (mm)
#0-0(.047)					
#0 (.060)	.141	1.312	.110x.187	1.625	M1.6
#1 (.073)				1.687	M1.8
#2 (.086)				1.750	M2,M2.2
#3 (.099)				1.812	M2.5
#4 (.112)				1.875	
#5 (.125)				1.937	M3,M315
#6 (.138)	.141	1.312	.110	2.000	M3.5
#8 (.164)	.168	1.375	.131	2.125	M4
#10 (.190)	.194	1.500	.152	2.375	M4.5,M5
#12 (.216)	.220	1.438	.165	2.375	
1/4 (.250)	.255	1.500	.191	2.500	M6,M6.3
5/16 (.312)	.318	1.593	.238	2.718	M7,M8
3/8 (.375)	.381	1.687	.286	2.937	M10
7/16 (.437)	.323	1.720	.242	3.156	M10
1/2 (.500)	.367	1.720	.275	3.375	M12,M12.5
9/16 (.562)	.429	1.938	.322	3.594	M14
5/8 (.625)	.480	2.000	.360	3.812	M16
11/16 (.687)	.542	2.218	.406	4.031	M18
3/4 (.750)	.590	2.250	.442	4.250	
13/16 (.812)	.652	2.375	.489	4.500	M20
7/8 (.875)	.697	2.468	.523	4.688	M22
15/16 (.937)	.760	2.562	.570	4.875	M24
1 (1.000)	.800	2.625	.600	5.125	M25

Note: Customer to specify M10 shank dimensions.

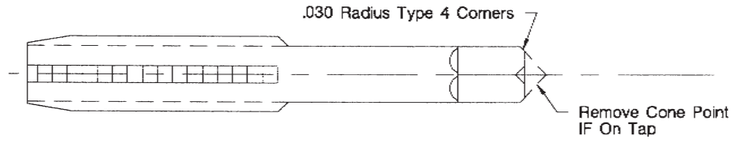
ISO Metric Series

Tap Size	Shank Dia. A	Shank Length B	Size of Square C	Overall Length D
M0.9	2.5 (.098")	17	2.1 x 5	25
M1		18		
M1.1				
M1.2		18		25
M1.4		21		28
M1.6		24		32
M1.7				
M1.8	2.5 (.098")	24		
M2	2.8 (.110")	23		
M2.2				
M2.3		23		32
M2.5		26		36
M2.6	2.8 (.110")	26	2.1 x 5	36
M3	3.5 (.138")	26	2.7 x 6	36
M3.5	4.0 (.157")	29	3.0 x 6	40
M4	4.5 (.177")	28	3.4 x 6	40
M4.5	6.0 (.236")	33	4.9 x 8	45
M5		31		45
M6		34		50
M7		34		50
M8	6.0 (.236")	38	4.9 x 8	56
M9	7.0 (.275")	38	5.5 x 8	56
M10	7.0 (.275")	43	5.5 x 8	63
M11	8.0 (.314")	41	6.2 x 9	63
M12	9.0 (.354")	48	7.0 x 10	70
M14	11.0 (.433")	45	9.0 x 12	70
M16	12.0 (.472")	42	9.0 x 12	70
M18	14.0 (.552")	48	11.0 x 14	80
M20	16.0 (.629")	48	12.0 x 15	80
M22	18.0 (.708")	58	14.5 x 17	90
M24	18.0 (.708")	68	14.5 x 17	100
M27	20.0 (.787")	64	16.0 x 19	100
M30	22.0 (.866")	70	18.0 x 21	110

PROCEDURE FOR GRINDING TAPS for ZLOCK AND SLIP LOCK TAP HOLDERS

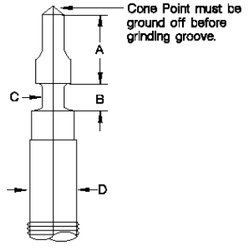
Before inserting taps into holders follow these steps:

(1) If taps have cone points on square, grind off flush with square.
(2) Hand grind and buff a .030 radius on the square end.
(3) Assemble taps into holder by twisting in counter-clockwise until square end engages square hole, then push straight in until tap bottoms.



TAP GROOVE DATA for Tension Tap Holder

Tap Sz.	#0 (.060) thru #6 (.138)	#8 (.164)	#10 (.190)	#12 (.216)	1/4 (.250)	5/16 (.312)	3/8 (.375)	7/16 (.437)	1/2 (.500)
A	.56 14.22	.56 14.22	.56 14.22	.69 17.53	.66 16.76	.66 16.76	.66 16.76	.66 16.76	.66 16.76
B	.16 4.06	.16 4.06	.16 4.06	.16 4.06	.19 4.83	.19 4.83	.19 4.83	.19 4.83	.19 4.83
C	.090 2.29 .080 2.03	.120 3.05 .110 2.79	.150 3.81 .140 3.56	.175 4.45 .165 4.19	.205 5.21 .195 4.95	.265 6.73 .255 6.48	.325 8.26 .315 8.00	.265 6.73 .255 6.48	.325 8.26 .315 8.00
D	.141 3.58	.168 4.26	.194 4.83	.220 5.59	.255 6.48	.318 8.08	.381 9.68	.323 8.20	.367 9.32

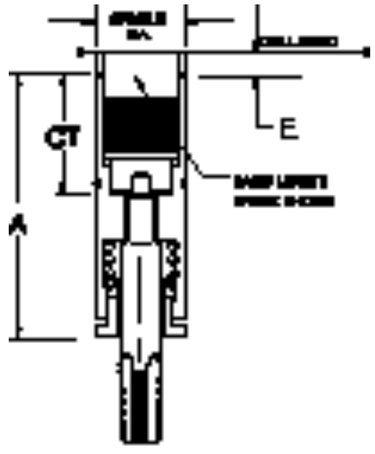


NOTE: Smaller numbers are metric conversions.

Z-Lock Tap Holders Style B

ISO Metric Series

Spindle Size	Tap Size	Assembly 708-	A	B	E
.250 (6.35mm)	M3	3946-138	1.52	.62	.32
.312 (7.92mm)	M3	3947-138	1.59	.69	.25
	M3.5	-157	1.59	.69	.25
.375 (9.53mm)	M3	3948-138	1.71	.81	.13
	M3.5	-157			
	M4	-177			
.437 (11.10mm)	M3	3949-138			
	M3.5	-157			
	M4	-177			
.500 (12.70mm)	M3	3950-138			
	M3.5	-157			
	M4	-177	1.71		
	M4.5, 5, 6, 7, 8	-236	1.87	.81	.13
.562 (14.27mm)	M3.5	3951-157	1.96	1.06	.13
	M4	-177	1.96		
	M4.5, 5, 6, 7, 8	-236	2.12		
.625 (15.88mm)	M4.5, 5, 6, 7, 8	3952-236			
	M9, 10	-275			
	M11	-314			
.750 (19.05mm)	M4.5, 5, 6, 7, 8	3953-236			
	M9, 10	-275			
	M11	-314	2.12		
	M12	-354	2.38	1.06	.13
1.000 (25.40mm)	M10	3954-275	2.45	1.38	.31
	M12	-354	2.70	1.38	.31
	M14	-433	2.83	1.38	.31
	M16	-472	2.83	1.38	.31
1.250 (31.75mm)	M14	3955-433	3.51	2.06	.13
	M16	-472	3.51		
	M18	-551	3.62		
	M20	-630	3.62		
	M22, 24	-708	3.81	2.06	.13



Note: A tap must be ground per Zagar drawing on Page 22.

Inch Series

Spindle Size	Inch Tap Size	Assembly 708-	A	B	E
.250(6.35mm)	#0(.060) thru #6(.138)	-3946-141	1.85	.62	.32
.312 (7.92mm)	#0(.060) thru #6(.138)	-3947-141		.69	.25
	#8(.164)	-168		.69	.25
.375 (9.53mm)	#0(.060) thru #6 (.138)	-3948-141		.81	.13
	#8 (.164)	-168			
	#10 (.190)	-194			
.437 (11.10mm)	#0 (.060) thru #6 (.138)	-3949-141			
	#8 (.164)	-168			
	#10 (.190)	-194			
.500 (12.70mm)	#0 (.060) thru #6 (.138)	-3950-141			
	#8 (.164)	-168			
	#10 (.190)	-194			
	# 12 (.216)	-220			
	1/4 (.250)	-255	1.85	.81	.13
.562 (14.27mm)	#0 (.060) thru #6 (.138)	-3951-141	2.10	1.06	.13
	#8 (.164)	-168	2.10		
	#10 (.190)	-194	2.10		
	#12 (.216)	-220	2.25		
	1/4 (.250)	-255	2.25		
	5/16 (.312)	-318	2.25		
.625 (15.88mm)	#0 (.060) thru #6 (.138)	-3952-141	2.00		
	#8 (.164)	-168	2.00		
	#10 (.190)	-194	2.00		
	#12 (.216)	-220	2.25		
	1/4 (.250)	-255			
	5/16 (.312)	-318			
	3/8 (.375)	-381			
	7/16 (.437)	-323			
.750 (19.05mm)	#12 (.216)	-3953-220			
	1/4 (.250)	-3953-255			
	5/16 (.312)	-318			
	3/8 (.375)	-381			
	7/16 (.437)	-323			
	1/2 (.500)	-367	2.25	1.06	.13
1.000 (25.40mm)	1/4 (.250)	-3954-255			
	5/16 (.312)	-3954-318			
	3/8 (.375)	-3954-381	2.75	1.38	.31
	7/16 (.437)	-323	2.75		
	1/2 (.500)	-367	2.75		
	9/16 (.562)	-429	3.07		
	5/8 (.625)	-480	3.07	1.38	.31
1.250 (31.75mm)	1/2 (.500)	-3955-367	3.38	2.06	.13
	9/16 (.562)	-429	3.64		
	5/8 (.625)	-480	3.64		
	11/16 (.687)	-542	3.89		
	3/4 (.750)	-590	3.89		
	13/16 (.812)	-652	3.89	2.06	.13
	7/8 (.875)	-697	3.89	2.06	.13

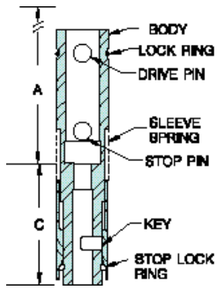
Pipe Tap

Spindle Size	Pipe Tap Size	Assembly 708-	A	B	E
.562 (14.27 mm)	1/16 [.062]	3951-312	2.25	1.06	.13
	1/8 [.125]	-312			
.625 (15.88 mm)	1/16 [.062]	3952-312			
	1/8 [.125]	-312			
.750 (19.05 mm)	1/16 [.062]	3953-312			
	1/8 [.125]	-437	2.25	1.06	.13
1.000 (25.40 mm)	1/8 [.125]	3954-437	2.57	1.38	.31
	1/4 [.250]	-562	2.57	1.38	.31
1.250 (31.75 mm)	1/8 [.125]	3955-437	3.25	2.06	.13
	1/4 [.250]	-562	3.25		
	3/8 [.375]	-700	3.31		
	1/2 [.500]	-687	3.56	2.06	
1.500 (38.10 mm)	3/8 [.375]	3956-700	3.56	2.31	
	1/2 [.500]	-687	3.81		
	3/4 [.750]	-906	3.93		
1.750 (44.45 mm)	3/8 [.375]	3957-700	3.56		
	1/2 [.500]	-687	3.81		
	3/4 [.750]	-906	3.93		
	1. [1.000]	-1125	4.06		
	1-1/4 [1.250]	-1312	4.31		
	1-1/2 [1.500]	-1500	4.31	2.31	
2.125 (53.98 mm)	2 (2.000)	3958-1875	5.06	2.81	.13

NOTE: Smaller numbers are metric conversions.

NOTE: ALL Part No.'s shown on this page have the Prefix 708-

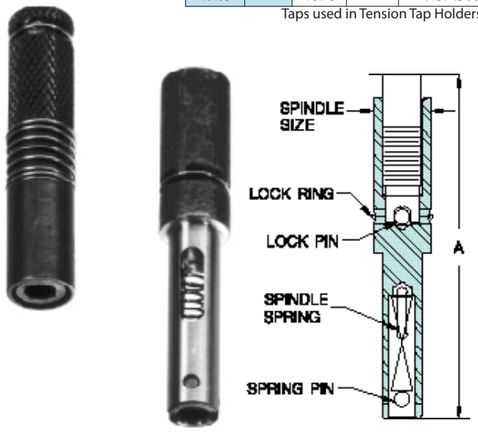
TENSION TAP HOLDER



Spindle Size	A	Stroke	C	Tap Range	Tap Holder Ass'm	Body	Sleeve	Sleeve Spring	Lock Ring	Stop Stop Pin	Lock Ring	Drive Pin	Use With: Adapter No.	Use With: Adj. Adapter No.	Key
.312 7.87	Use "A" Dim on Either Chart Below	.25 6.35	.88 22.36	#6(.138)	-3395	-1763	-2025	-2024-4	-2024-3	-1762-1	-1763-2	-1763-5	-2689	—	See Key Chart Below
.375 9.30			.88	#6 #8(.164)	-2984	-2067	-2028	-2026-4	-2026-3	-2067-6	-2067-2	-2067-5	-2690	-2953	
.437 & .500		.38 9.65	.88	#6 #8 #10(.190)	-2985	-2068	-2032	-2031-4	-2031-3	-2068-6	-2068-2	-2068-5	-2691	-2956	
.500 12.70			1.12 26.44	#12(.216) .250	-2987	-2071	-2038	-2033-4	-2037-3	-2069-6	-2069-2	-2069-5	-2709	-2959	
.562 14.22		.53 13.46	1.12	#6 #8 #10 #12 .250 .312	-2988	-2666	-2642	-2688-4	-2688-3	-2666-6	-2666-2	-2666-5	-2692	-2962	
.625 15.74			1.12	#6 #8 #10 #12 .250 .312 .375	-2989	-2073	-2044	-2040-4	-2043-3	-2072-6	-2072-2	-2072-5	-2693	-2965	
.750 19.05		.66 16.76	1.12	.312 .375 .437 .500	-2990	-2074	-2065	-2064-4	-2064-3	-2074-6	-2074-2	-2074-5	-2694	-2970 -2971	

Taps used in Tension Tap Holders must be grooved per dimensions on TAP GROOVE DATA CHART (see Page 22)

NOTE: Tension Tap Holders require the use of adapters.



TENSION TAP HOLDER ADAPTER

Spindle Size	A Ref.	Adapter Ass'm	Adapter	Lock Ring	Lock Pin	Spindle Spring	Spindle Spring Pin	Use With Tension Tap Holder No.
.312	2.19	-2689	-1762	-1763-2	-1762-1	-1762-8	-2036-1	-3395
.375	55.63	-2690	-2695	-2067-2	-2026-1	-2076-8	-2076-7	-2984
.437 & .500	2.44	-2691	-2696	-2068-2	-2031-1	-2077-8	-2026-1	-2985
.500	61.97	-2709	-2711	-2069-2	-1845-1	-2077-8	-2026-1	-2987
.562	2.94	-2692	-2697	-2666-2	-2688-1	-2653-8	-2031-1	-2988
.625	74.67	-2693	-2698	-2072-2	-1848-1	-2078-8	-1845-1	-2989
.750	3.19 81.02	-2694	-2699	-2074-2	-2461-1	-2079-8	-1848-1	-2990

NOTE: Smaller numbers are metric conversions.

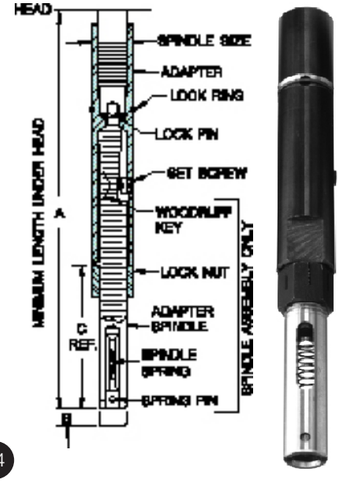
TAP RETENTION KEY CHART

Tension Tap Holder	Tap	Key
-3395	#6	-3418
-2984		-2863
	#8	-2864
-2985	#6	-2865
	#8	-2863
	#10	-2716

Tension Tap Holder	Tap	Key
-2987	#12	-2685
	.250	-2688
-2988	#6	-2867
	#8	-2868
	#10	-2869
	#12	-2870
	.250	-2871
	.312	-2866

Tension Tap Holder	Tap	Key
-2989	#6	-2872
	#8	-2873
	#10	-2867
	#12	-2868
	.250	-2874
	.312	-2871
	.375	-2875
-2990	.312	-2874
	.375	-2876
	.437	-2874
	.500	-2876

TENSION TAP HOLDER ADJUSTABLE ADAPTER



Spindle Size	A Ref.	B	C Ref.	Adjust-able Adapter Ass'm	Adapter	Spindle Ass'm	Spring Pin Spindle Spring	Lock Nut	Lock Ring Lock Pin	Use With Tension Tap Holder No.
.375	3.50 88.90	.38 9.65	1.25 31.75	-2953	-1734-4	-2076-1	-2076-7 -2076-8	-1736	-2067-2 -2026-1	-2984
.437	4.19 106.42	.50 12.70	1.44 36.57	-2956	-1841-4	-2077-1	-2026-1	-1844	-2068-2 -2031-1	-2985
.500				-2959	-1845-4		-2077-8	-1844	-2069-2 -1845-1	-2987
.562	5.12 130.04	.62 15.74	1.88 47.75	-2962	-2650-4	-2653-1	-2031-1 -2653-8	-2654	2666-2 -2688-1	-2988
.625				-2965	-1848-4	-2078-1	-1845-1 -2078-8	-1893	-2072-2 -1848-1	-1989
.750	5.38 136.65	.62	2.12 53.84	-2970	-2461-4	-2079-1	-1848-1	-2464	-2047-2 -2461-1	-2990
.750				-2971	-2465-4		-2079-8	-2464	-2465-2 -2477-2	

Heavy Duty .750 Ass'm - 1.00 Min Center

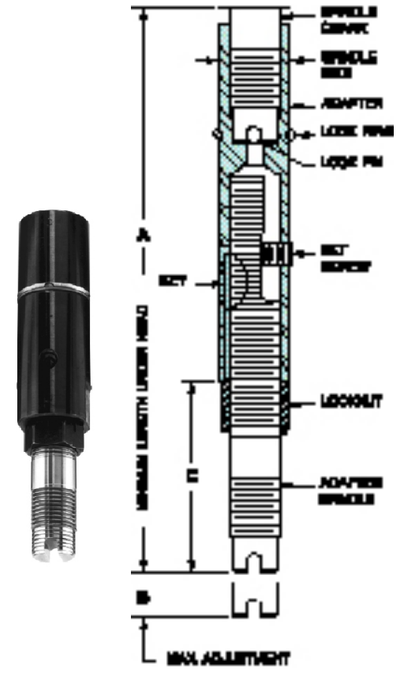
ADJUSTABLE ADAPTER

FOR TAP HOLDERS (Z-Lock Tap Holders) Spindle Size	A	B	C	Assembly No.	Spindle and Lock Nut Ass'm No.	FOR TAP COLLETS Assembly No.	Spindle and Lock Nut Ass'm No.	Adpater No. §
.375 9.53	3.50 88.90	.38 9.65	1.25 37.25	708-2952	708-2176-1	—	—	1734-4
.437 11.10	3.94 100.07	.50 12.70	1.19 30.22	708-2955	708-1296-1	708-3722	708-1842-1	1841-4
.500 12.70				708-2780	708-1296-1	708-3723	708-1842-1	1845-4
.562 14.27	4.88 123.95	.62 15.74	1.62 41.14	708-2961	708-2652-1	708-3724	708-2651-1	2650-4
.625 15.88				708-2781	708-2784-1	708-3725	708-1849-1	1848-4
.750 19.05				708-2782	708-2785-1	708-3726	708-2463-1	2461-4
*.750 19.05				708-2783	708-2785-1	708-3729	708-2463-1	2465-4
1.000 25.40	5.88 149.35	.62 15.74	2.12 53.85	708-2800	708-2802-1	708-3727	708-2478-1	2477-4
**1.000 25.40				708-2801		708-3728	708-2478-1	2476-4

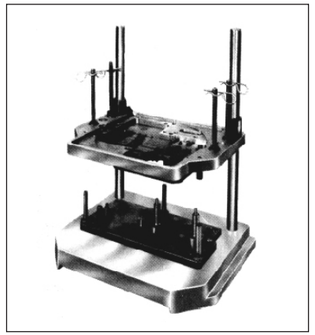
*Oversize .750 Assembly 1.000 Minimum Centers

**Oversize 1.000 Assembly 1.250 Minimum Centers

The Adapters are used with either Spindle or Lock Nut Assembly - Tap Holders or Tap Collets.



NOTE: Smaller numbers are metric conversions.



Complete
Fixtures completely assembled with Drill Bushings, Locators and Nesting Devices.

Partially Complete
Fixtures completely assembled with Bushing Plate bored and fitted with Drill Bushings. **Customer** supplies Locators and Nesting Devices.

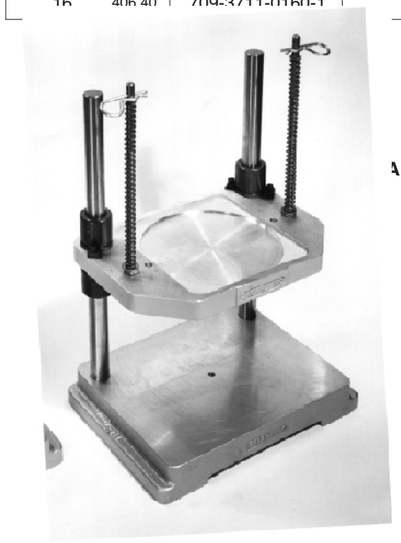
Blank Assemblies
Fixtures completely assembled but with **no boring. Customer** does own boring and supplies Drill Bushings, Locators, and Nesting Devices.

Individual Components
Order **any** fixture Component from Off-the-Shelf Standard Stock Parts. **Customer** assembles own fixture, supplies Boring, Bushings, Locators, and Nesting Devices.

SELF-CLAMPING DRILL FIXTURE ASSEMBLIES

FIXTURE SIZE		ORDERING NO. SQUARE WITH NO BORES	SQUARE WITH REAR GUIDE BORES	DIAGONAL WITH NO BORES	DIAGONAL WITH REAR GUIDE BORES
3	76.20	709-3711-0030-1	709-3711-0030-2	709-3716-0030-1	709-3716-0030-2
4.5	114.30	709-3711-0045-1	709-3711-0045-2	709-3716-0045-1	709-3716-0045-2
6	152.40	709-3711-0060-1	709-3711-0060-2	709-3716-0060-1	709-3716-0060-2
8	203.20	709-3711-0080-1	709-3711-0080-2	709-3716-0080-1	709-3716-0080-2
10	254.00	709-3711-0100-1	709-3711-0100-2	709-3716-0100-1	709-3716-0100-2
12	304.80	709-3711-0120-1	709-3711-0120-2	709-3716-0120-1	709-3716-0120-2
16	406.40	709-3711-0160-1	709-3711-0160-2	709-3716-0160-1	709-3716-0160-2

NOTE: Also available with Center Guide Bore design. Order #709-371X-SIZE-3

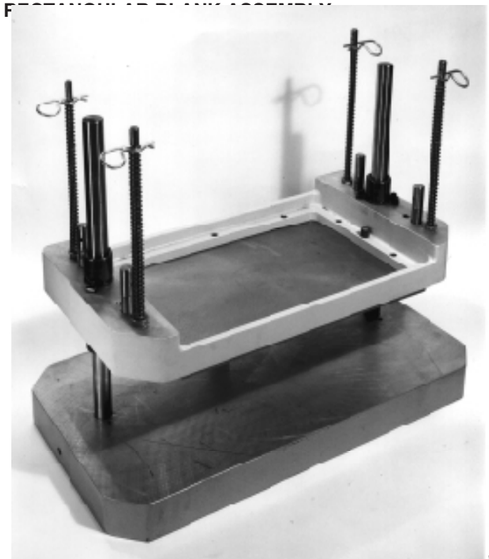


ARE BLANK ASSEMBLY

RECTANGULAR BLANK ASSEMBLY

FIXTURE SIZE		Ordering No.
5X10	127x54	709-3718-0510
8X12	203x305	709-3718-0812
8X16	203x405	709-3718-0816
10X15	254x381	709-3718-1015
10X20	254x508	709-3718-1020
12X18	203x457	709-3718-1218
12X24	203x610	709-3718-1224
16X16	406x406	709-3718-1616
16X24	406x610	709-3718-1624
16X32	406x813	709-3718-1632
20X20	508x508	709-3718-2020
20X30	508x762	709-3718-2030
20X40	508x1016	709-3718-2040
24X24	610x610	709-3718-2424
24x36	610x914	709-3718-2436
28X28	711x711	709-3718-2828
28X44	711x1118	709-3718-2842
32X32	813x813	709-3718-3232
36X36	914x914	709-3718-3636
32x60	813x1524	709-3718-3260

NOTE: Smaller numbers are metric conversions.



Ordering Information

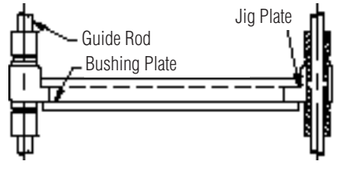
When ordering Individual Blank Fixture Components add -1 to Ordering Number. *Example 709-3718-1224-1*
When ordering Blank Fixture Assemblies with Guide Post in rear position add -2 to Ordering Number. *Example 709-3718-1224-2*
When ordering Blank Fixture Assemblies with Guide Post in center position add -3 to Ordering Number. *Example 709-3718-1224-3*

SQUARE BUSHING PLATE

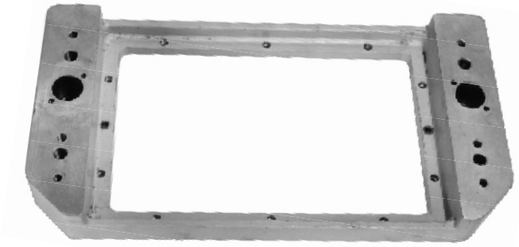
FIXTURE SIZE	BUSHING PLATE SPECIFICATIONS						
	A	B	C	D	E	F	G
3 76.2	1.0000 25.40	6.24 158.49	3.6 91.44	1.90 48.26	1.00 25.40	.42 10.66	4.7500 120.65
4.5 114.3	1.6870 42.85	8.00 203.20	5.00 127.00	2.62 66.55	1.00 25.40	.62 15.75	6.6250 168.28
6 152.40	2.5000 63.50	9.50 241.30	6.62 168.15	3.50 88.90	1.00 25.40	.62 15.75	8.2500 209.55
8 203.2	3.1250 79.38	12.12 307.85	8.12 206.25	4.12 104.65	1.00 25.40	.62 15.75	10.1250 257.18
10 254	3.8750 98.43	14.75 374.65	10.25 260.35	5.12 130.05	1.00 25.40	.62 15.75	12.3750 314.33
12 304.80	4.8750 123.83	16.75 425.45	12.25 311.12	6.12 155.45	1.00 25.40	.62 15,75	14.3750 365.13
16 406.4	6.8750 174.63	20.75 527.05	16.25 412.75	8.12 206.25	1.25 31.75	.75 19.05	18.3750 466.73

FIXTURE SIZE	ORDERING NUMBERS		
	BLANK BUSHING PLATE	BORED BUSHING PLATE	
		Guide Rod holes in standard rear position	Guide Rod Holes on horizontal centerline
3	709-3685	708-3685-2	709-3685-3
4.5	709-3672	709-3672-2	709-3672-3
6	709-3674	709-3674-2	709-3674-3
8	709-3675	709-3675-2	709-3675-3
10	709-3676	709-3676-2	709-3676-3
12	709-3677	709-3677-2	709-3677-3
16	709-3679	709-3679-2	709-3679-3

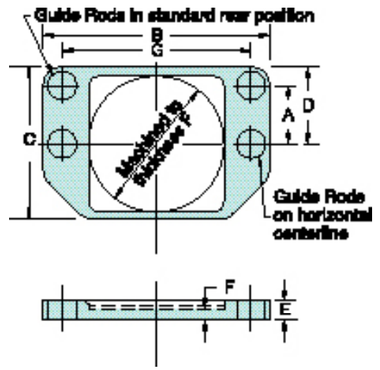
RECTANGULAR JIG PLATE



BUSHING PLATE
Used with Rectangular and Large Square Jig Plates
Bushing Plate mounts on Jig Plate



SQUARE BUSHING PLATE

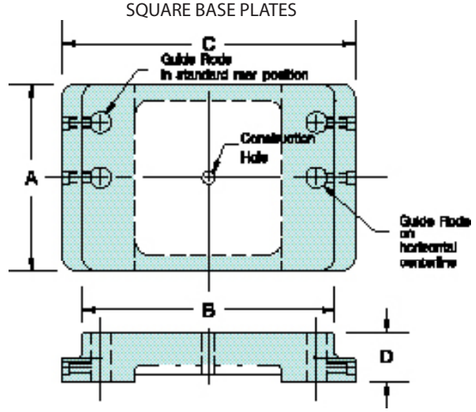


RECTANGULAR JIG PLATE AND BUSHING PLATE

JIG PLATE SIZE	Jig Pl. Or. No. 709	G	OPENING WIDTH	OPENING LENGTH	B. Pl. Or. No. 709
5X10 127x254	-3801	12.5000 317.5	3.00 76.2	8.00 203.2	-3721
8X12 203x305	-3802	14.5000 368.3	5.50 139.7	9.50 241.3	-3722
8X16 203x406	-3803	18.5000 469.9	5.50 138.7	13.50 342.9	-3723
10X15 254x381	-3804	17.5000 444.5	7.50 190.5	12.50 317.5	-3724
10X20 254x508	-531	22.5000 571.5	7.50 190.5	17.50 444.5	-3725
12X18 305x457	-3805	20.5000 520.7	9.50 241.3	15.50 393.7	-3726
12X24 305x610	-3806	26.5000 673.1	9.50 241.3	21.50 546.1	-3727
16X16 406x406	-3679	19.0000 482.6	13.50 342.9	13.50 342.9	-3728
16X24 406x610	-551	27.0000 685.8	13.50 342.9	21.50 546.1	-3729
16X32 406x813	-3809	35.0000 889	13.50 342.9	29.50 749.3	-3730
20X20 508x508	-3811	23.0000 584.2	17.50 444.5	17.50 698.5	-3731
20X30 508x762	-577	33.0000 584.2	17.50 444.5	27.50 444.5	-3732
20X40 508x1016	-3812	43.0000 1092.2	17.50 444.5	37.50 952.5	-3733
24X24 610x610	-519	27.0000 685.8	21.50 546.1	21.50 546.1	-3734
24X36 610x914	-506	39.0000 990.6	21.50 546.1	33.50 546.1	-3735
28X28 711x711	-526	31.0000 787.4	25.50 647.7	25.50 647.7	-3736
28X44 711x1118	-3813	47.0000 1193.8	25.50 647.7	39.50 1003.3	-3737
32X32 813x813	-3814	35.0000 889	39.50 1003.3	29.50 1003.3	-3738
36X36 914x914	-3636	39.0000 990.6	33.50 850.9	33.50 850.9	-3739
32X60 813x1524	-3260	63.0000 1600.2	28.30 718.82	56.30 1430.02	-3740

NOTE: Smaller numbers are metric conversions.

SQUARE BASE PLATES



RECTANGULAR & LARGE SQUARE BASE PLATES

Fixture Size	Order No. 709	A	B	D
5X10 127x254	-2621	11.00 279	14.50 368.3	2.00 50.8
8X12 203x305	-2625	13.00 330	16.50 419.1	2.00 50.8
8X16 203x406	-2639	17.00 431	20.50 520.7	2.50 63.5
10X15 254x381	-2639	17.00 431	20.50 520.7	2.50 63.5
10X20 254x508	-530	10.00 254	25.00 635	2.50 63.5
12X18 305x457	-3835	12.00 203	23.50 596.9	2.50 63.5
12X24 305x610	-3836	12.00 203	30.50 774.7	2.50 63.5
16X16 406x406	-3849	17.00 431	20.50 520.7	2.50 63.5
16X24 406x610	-550	16.00 406	30.50 774.7	2.50 63.5
16X32 406x813	-3839	16.00 406	38.50 977.9	2.50 63.5
20X20 508x508	-3847	20.00 508	26.50 927.1	2.50 63.5
20X30 508x762	-3841	20.00 508	36.50 927.1	2.50 63.5
20X40 508x1016	-528	20.00 508	46.50 1181.1	2.50 63.5
24X24 610x610	-518	24.00 610	30.50 774.7	2.50 63.5
24X36 610x914	-517	24.00 610	42.50 1079.5	2.50 63.5
28X28 711x711	-3842	28.00 711	34.50 876.4	2.50 63.5
28X44 711x1118	-3843	28.00 711	50.50 876.4	2.50 63.5
32X32 813x813	-3844	32.00 813	38.50 977.9	2.50 63.5
36X36 914x914	-3846	36.00 914	42.50 1079.50	2.50 63.5
32X60 813x1524	-3845	32.00 813	66.50 1689.1	2.50 63.5

Fixture Size

A	B	C	D
5.00 127	6.00 152.40	7.75 196.85	1.38 35.05
5.75 146.05	7.75 196.85	9.00 228.60	1.50 38.10
7.50 190.05	9.50 241.30	10.75 273.05	1.50 38.10
9.00 228.60	11.75 298.45	13.00 330.20	1.75 44.45
11.00 279.40	14.50 368.30	16.00 406.40	2.00 50.80
13.00 330.20	16.50 419.10	18.00 457.20	2.00 50.80
17.00 431.80	20.50 520.70	22.00 558.80	2.50 63.50

ORDERING NUMBERS

Fixture Size	BORED BASE PLATE		
	Blank Base Plate	Guide Rod Holes st'd rear position	Guide Rod Holes horiz. centerline
3 76.20			
4.5 114.30	709-2601	709-2601-2	709-2601-3
6 152.40	709-3671	709-3671-2	709-3671-3
8 203.20	709-3673	709-3673-2	709-3673-3
10 254.00	709-2617	709-2617-2	709-2617-3
12 304.80	709-2621	709-2621-2	709-2621-3
16 406.408	709-2625	709-2625-2	709-2625-3
	709-2639	709-2639-2	709-2635-3

BASE PLATES can be ordered BLANK, BORED OR COMPLETE.

BLANK Base Plates have no holes but are machine finished ready for boring. BORED base plates have a center construction hole and guide rod holes bored in the Standard Rear Position or on the Horizontal Centerline. (Can be bored to suit your individual requirements.)

The COMPLETE Base Plate has the above mentioned holes plus locators, nesting devices etc. per your tooling package requirements.

ORDERING INFORMATION

When ordering Blank Base Plates add -0 to the ordering no.

When ordering Bored Base Plates with Guide Rod Holes in the standard rear position, add -2 to the ordering no.

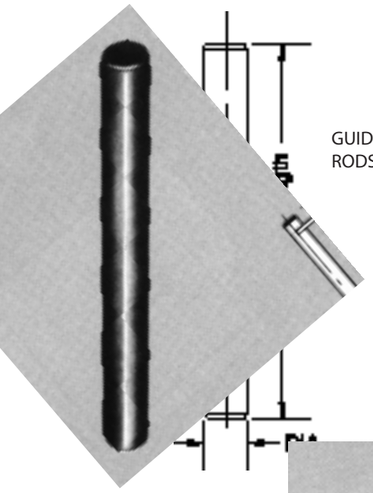
When ordering Bored Base Plates with Guide Rod Holes on the horizontal centerline, add -3 to the ordering no.

- Base Plates are Aluminum
  Available in Cast Iron on request.

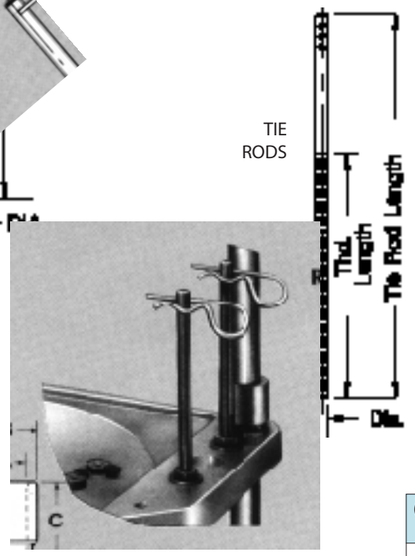
SQUARE BASE PLATE

NOTE: Smaller numbers are metric conversions.

Components *(for self-clamping drill fixtures)*



GUIDE RODS



TIE RODS

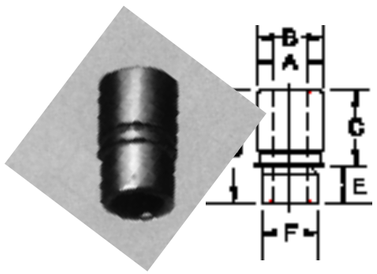
RODS

Guide Rod Diameter	Guide Rod Length	Guide Rod Ordering No.
.625	14.00	
15.88	356	
1.000	18.000	709-2664
25.40	457	
1.250	20.000	709-2665
31.75	508	
1.500	36.000	709-2666
38.10	914	
1.750	36.000	709-2667
44.45	914	

12-164

TIE RODS

Tie Rod Ordering No.	709-2672	709-2674
Tie Rod Diameter	.375	.500
	9.53	12.70
	11.000	14.000
Tie Rod Length	279	356
Thread Size	3/8(.375)-16	1/2(.500)-13
Thread Length	7.50	8.00
	190.50	203.20

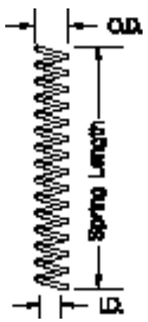


BUSHING COMPRESSION

BUSHINGS

A (Nom.)	Bushing Ordering No.	B	C	D	E	F
.625	12-100	1.18	1.50	2.12	.62	1.0000
15.88		29.97	38.10	53.84	15.75	.9996
1.000	12-101	1.68	1.75	2.62	.88	1.5000
25.40		42.67	44.45	66.55	22.35	1.4996
1.250	12-102	1.94	2.00	3.12	1.12	1.7500
31.75		49.28	50.80	79,25	28.45	1.7496
1.500	12-103	2.18	2.00	3.38	1.38	2.0000
38.10		55.37	50.80	85,85	35.05	1.9996
1.750	12-104	2.50	2.00	3.38	1.38	2.2500
44.45		63.50	50.80	85.85	35.05	2.2496

SPRING GUIDE



COMPRESSION SPRINGS

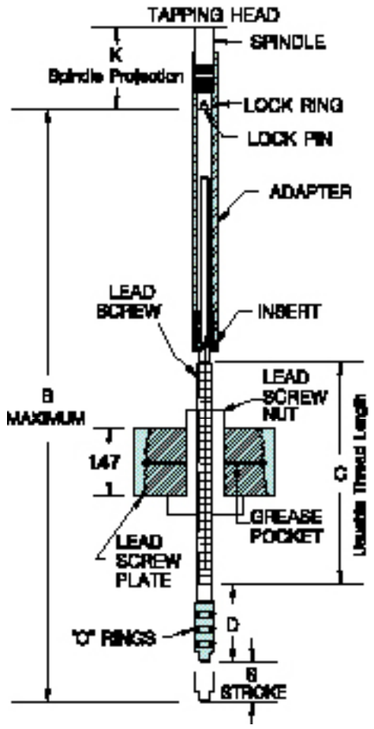
Spring I.D. (Rod Dia.)	Spring O.D. (Rod Dia.)	Spring Length	Spring Ordering No.
.375	.562	18.00	
9.53	14.27	457	12-168
.500	.687	9.00	
12.70	17.45	228	12-166
.625	.875	12.00	
15.88	21.44	305	12-165
1.000	1.312	18.00	
31.75	33.32	457	12-167
1.250	1.625	18.00	
25.40	41.14	457	

709-2662

NOTE: Smaller numbers are metric conversions.

Individual Lead Screw Tapping

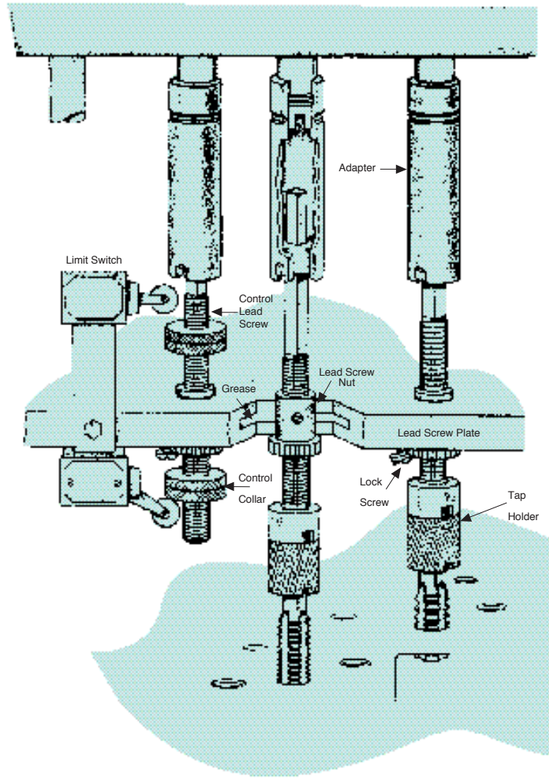
ZAGAR INDIVIDUAL LEAD SCREW TAPPING permits ONE PASS TAPPING of any quantity of holes, any pitch, any thread size, tapping plane or depth



Lead Screw Assembly No.	Spindle Size	SHORT STROKE S	SHORT STROKE B Max.	SHORT STROKE C	LONG STROKE S	LONG STROKE B Max.	LONG STROKE C	D	SPINDLE PROJECTION K Basic	SPINDLE PROJECTION K Max	SPINDLE PROJECTION In Steps
710-3240-250	.250	1.50	9.50	3.12	—	—	—	1.12	.94	2.94	.25
710-3240-250-3	.250	—	—	—	2.50	11.50	4.12	1.12	.94	2.94	.25
710-3240-312	.312	1.50	9.50	3.12	—	—	—	1.12	.94	2.94	.25
710-3240-312-3	.312	—	—	—	2.50	11.50	4.12	1.12	.94	2.94	.25
710-3240-375	.375	1.50	9.50	3.12	—	—	—	1.12	.94	3.44	.25
710-3240-375-3	.375	—	—	—	2.50	11.50	4.12	1.12	.94	3.44	.25
710-3240-437	.437	2.00	11.00	3.50	—	—	—	1.12	.94	3.69	.25
710-3240-437-3	.437	—	—	—	3.00	13.00	4.50	1.12	.94	3.69	.25
710-3240-500	.500	2.00	11.00	3.50	—	—	—	1.12	.94	3.69	.25
710-3240-500-3	.500	—	—	—	3.00	13.00	4.50	1.12	.94	3.69	.25
710-3240-625	.625	2.00	11.25	3.50	—	—	—	1.38	1.19	3.94	.25
710-3240-625-3	.625	—	—	—	3.00	13.25	4.50	1.38	1.19	3.94	.25
710-3240-750	.750	2.00	11.25	3.50	—	—	—	1.38	1.19	4.19	.50
710-3240-750-3	.750	—	—	—	3.00	13.25	4.50	1.38	1.19	4.19	.50
710-3240-1000	1.000	2.00	11.50	3.50	—	—	—	1.62	1.69	4.69	.50
710-3240-1000-3	1.000	—	—	—	3.00	13.50	4.50	1.62	1.69	4.69	.50
710-3240-1250	1.250	2.50	13.50	4.50	—	—	—	2.12	2.19	5.19	.50
710-3240-1250-3	1.250	—	—	—	3.50	16.50	5.50	2.12	2.19	5.19	.50

CONTROL LEAD SCREW

A multiple spindle Lead Screw Tapping Head showing the Control Lead Screw and many different tap sizes tapping at various levels and depths.



CONTROL LEAD SCREW ASSEMBLY

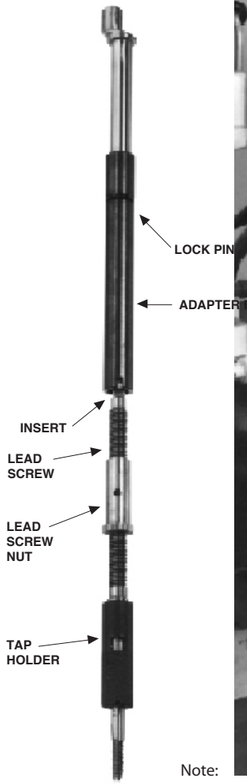
SPINDLE SERIES	SIZE	LENGTH	ORDERING NO.
200	.625	Short Stroke	710-3240-625-1
200	.625	Long Stroke	710-3240-625-2
400	.750	Short Stroke	710-3240-750-1
400	.750	Long Stroke	710-3240-750-2

ZAGAR LEAD SCREW ACCESSORIES are functionally designed and available from stock in a wide range of sizes to make your lead screw tapping operation more profitable with maximum performance.

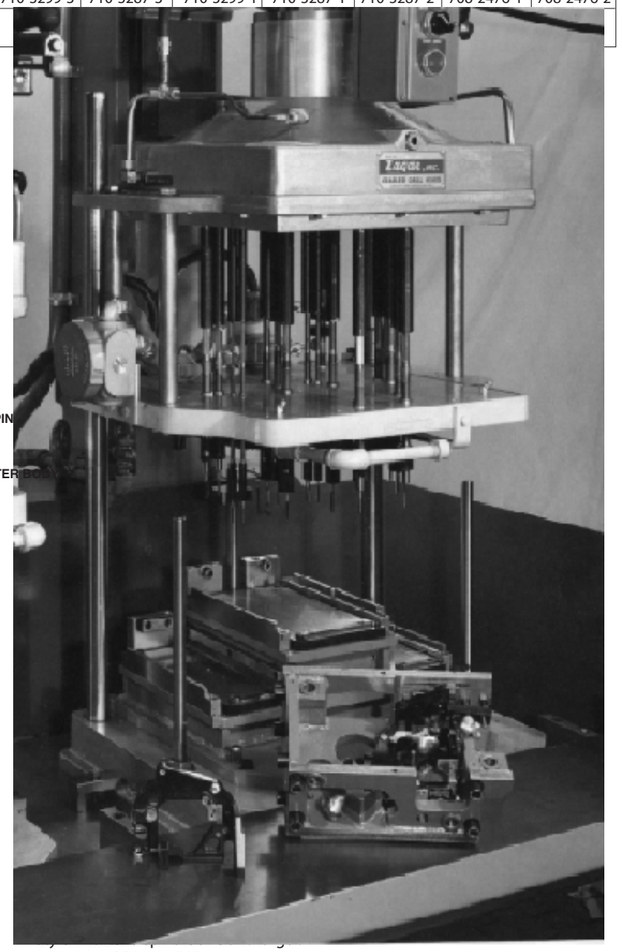
Spindle Size	Lead Screw		Lead	"O" Ring	
	Short Stroke	Long Stroke	Screw Nut	Part No.	Req.
.250 6.35	710-3247	—	710-3301	Threaded	
.312 7.93	710-3257	710-3258	710-3302	Threaded	
.375 9.53	710-3242	710-3243	710-3303	11-007	3
.437 11.10	710-3252	710-3253	710-3304	11-008	3
.500 12.70	710-3262	710-3263	710-3305	11-008	3
.625 15.88	710-3272	710-3273	710-3306	11-011	3
.750 19.05	710-3282	710-3283	710-3307	11-012	3
1.000 25.40	710-3292	710-3293	710-3308	11-113	2
1.250 31.75	710-3297	710-3298	710-3311	11-117	3

Spindle Size	Straight Pipe	Taper Pipe
.625 15.88	1/8(.125)-27 1/4(.250)-18	1/8 (.125)-27
.750 19.05	1/8(.125)-27 1/4(.250)-18 3/8(.375)-18	1/8(.125)-27 1/4(.250)-18
1.000 25.40	1/8(.125)-27 1/4(.250)-18 3/8(.375)-18 1/2(.500)-14	1/8(.125)-27 1/4(.250)-18 3/8(.375)-18
1.250 31.75	3/8(.375)-18 1/2(.500)-14	3/8(.375)-18

Spindle Size	National Coarse and National Fine
.250 6.35	#0(.060)-80 thru #6(.138)-32
.312 7.93	#0(.060)-80 thru #8(.164)-32
.375 9.53	#0(.060)-80 thru #10(.190)-24
.437 11.10	#0(.060)-80 thru #12(.216)-24
.500 12.70	#0(.060)-80 thru 1/4(.250)-20
.625 15.88	#0(.060)-80 thru 3/8(.375)-16
.750 19.05	#0(.060)-80 thru 1/2(.500)-13
1.000 25.40	5/16(.312)-18 thru 5/8(.625)-11
1.250 31.75	1/4(.250)-20 thru 1" (1.000)-8



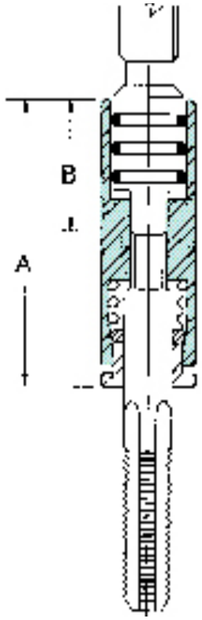
Spindle Size	Adapter Assembly Short Stroke	Adapter Assembly Long Stroke	Adapter Body Short Stroke	Adapter Body Long Stroke	Insert	Lock Pin	Lock Ring
.250	710-3249-3	—	710-3249-1	—	710-3249-2	708-2036-1	708-2036-2
6.35 .312	710-3259-3	710-3259-3	710-3259-1	710-3259-1	710-3244-2	708-1762-1	708-1763-2
7.93 .375	710-3244-3	710-3244-3	710-3244-1	710-3244-1	710-3244-2	708-2026-1	708-2067-2
9.53 .437	710-3254-3	710-3254-3	710-3254-1	710-3254-1	710-3254-2	708-2031-1	708-2068-2
11.10 .500	710-3264-3	710-3264-3	710-3264-1	710-3264-1	710-3264-2	708-1845-1	708-2069-2
12.70 .625	710-3274-3	710-3274-3	710-3274-1	710-3274-1	710-3274-2	708-1848-1	708-2072-2
15.84 .750	710-3284-3	710-3284-3	710-3284-1	710-3284-1	710-3284-2	708-2461-1	708-2074-2
19.05 1.000	710-3294-3	710-3294-3	710-3294-1	710-3294-1	710-3294-2	708-2477-1	708-2477-2
25.40 1.250	710-3299-3	710-3287-3	710-3299-1	710-3287-1	710-3287-2	708-2476-1	708-2476-2
31.75							



Note: [illegible] Style B for .250 and .312 spindle size.

NOTE: Smaller numbers are metric conversions.

STYLE "A" - Z-LOCK QUICK CHANGE TAP HOLDER FOR LEAD SCREW TAPPING



Note: When using a th
dle, see Page 2
Tap Holder Styl

Inch Series

Spindle Size	Inch Tap Size	Assembly 708-	B	A
.375 (9.53mm)	#0(.060) thru #6(.138)	-4061-141	.80	1.67
	#8 (.164)	-168	.80	1.67
	#10 (.190)	-194	.80	1.67
.437 (11.10mm)	#0(.060) thru #6(.138)	-4062-141	.81	1.69
	#8 (.164)	-168		
	#10 (.190)	-194		
.500 (12.70mm)	#0(.060) thru #6(.138)	-4063-141		
	#8 (.164)	-168		
	#10 (.190)	-194		
	# 12 (.216)	-220		
	1/4 (.250)	-255	.81	1.69
.625 (15.88mm)	#0(.060) thru #6(.138)	-4065-141	1.00	1.88
	#8 (.164)	-168		1.88
	#10 (.190)	-194		1.88
	#12 (.216)	-220		2.07
	1/4 (.250)	-255		
	5/16 (.312)	-318		
	3/8 (.375)	-381		
	7/16 (.437)	-323		2.07
.750 (19.05mm)	#12 (.216)	-4066-220		2.07
	1/4 (.250)	-255		2.08
	5/16 (.312)	-318		2.08
	3/8 (.375)	-381		2.33
	7/16 (.437)	-323		2.33
	1/2 (.500)	-367	1.00	2.33
1.000 (25.40mm)	1/4 (.250)	-4067-255	1.38	2.71
	5/16 (.312)	-318		2.71
	3/8 (.375)	-381		2.71
	7/16 (.437)	-323		2.71
	1/2 (.500)	-367		2.71
	9/16 (.562)	-429		2.96
	5/8 (.625)	-480	1.38	2.96
1.250 (31.75mm)	1/2 (.500)	-4068-367	1.75	3.08
	9/16 (.562)	-429		3.33
	5/8 (.625)	-480		3.33
	11/16 (.687)	-542		3.58
	3/4 (.750)	-4068-590		3.58
	13/16 (.812)	-4068-652		3.58
	7/8 (.875)	-4068-697	1.75	3.58

ISO Metric Series

Spindle Size	Metric Tap Size	Assembly 708-	B	A
.375 (9.53mm)	M3	4061-138	.80	1.69
	M3.5	-157		1.66
	M4	-177	.80	1.70
.437 (11.10mm)	M3	4062-138	.81	1.71
	M3.5	-157		1.67
	M4	-177		1.71
.500 (12.70mm)	M3	4063-138		1.71
	M3.5	-157		1.67
	M4	-177		1.71
	M4.5,5,6,7,8	-236	.81	1.88
.625 (15.88mm)	M4.5,5,6,7,8	4065-236	1.00	2.07
	M9,10	-275		2.07
	M11	-315		2.07
.750 (19.05mm)	M4.5,5,6,7,8	4066-236		2.07
	M9,10	-275		2.07
	M11	-315		2.07
	M12	-354	1.00	2.32
1.000 (25.40mm)	M14	4067-433	1.38	2.83
	M16	-472	1.38	2.83
1.250 (31.75mm)	M14	4068-433	1.75	3.20
	M16	-472		3.20
	M18	-551		3.31
	M20	-630		3.31
	M22 & M24	-708	1.75	3.53

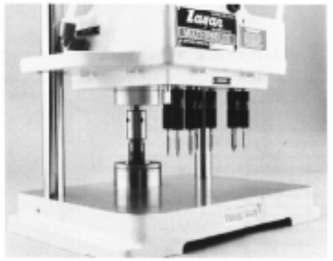
NOTE: Smaller numbers are metric conversions.

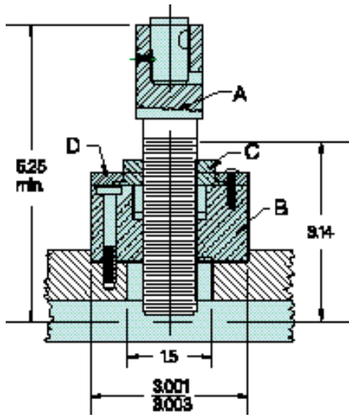
HEAD LEAD SCREW

The HEAD LEAD SCREW is designed for moving the part into the taps, or moving the taps into the part when all the threads are the same pitch.

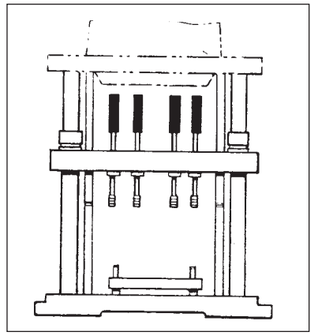
ASSEMBLY NO.	SPINDLE SERIES
710-0009-0002-0	200
710-0009-0004-0	400

	PART	ORDERING NO.
A	Lead Screw	710-10-(Pitch)
B	Lead Screw Nut	710-11-(Pitch)
C	Adjusting Nut	710-12-(Pitch)
D	Clamp Ring	710-3190



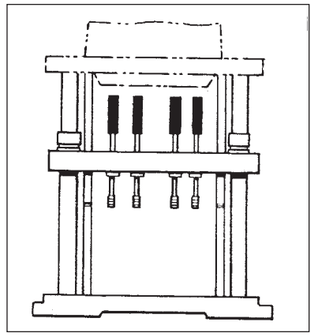


NOTE: Smaller numbers are metric conversions.



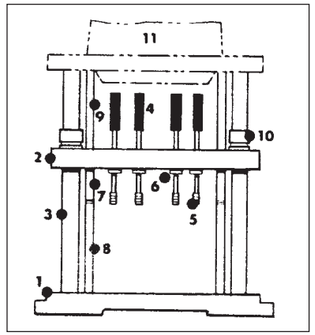
Complete

Fixtures completely assembled - Bored and fitted with Lead Screws, Lead Screw Nuts, Locators and Nesting Devices.



Partially Complete

Fixtures completely assembled and fitted with Lead Screws and Lead Screw Nuts. Customer supplies Locators and Nesting Devices.



ITEM

1. Base Plate
2. Lead Screw Plate
3. Guide Rod
4. Lead Screw Adapter
5. Lead Screw
6. Lead Screw Nut
7. Stop Rod
8. Support Rod
9. Spacer Rod
10. Bushing
11. Tapping Head (not included)

Individual Components

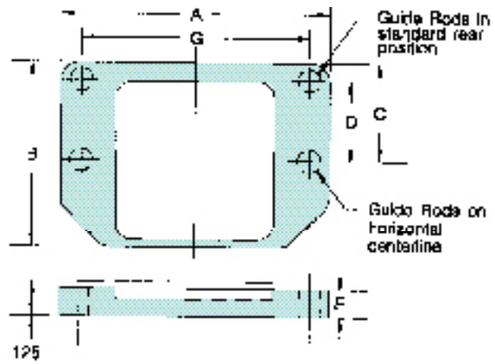
Order any Fixture Component separately, Lead Screw Plate and Base Plate can be ordered blank or completely bored. Lead Screws, Lead Screw Nuts . . .

Order any component for
Do-It-Yourself-Fixtures from
Off-The-Shelf Standard Stock Parts!

SQUARE LEAD SCREW PLATE

FIXTURE SIZE	A	B	C	D	E	G
4.5	8.00	5.00	2.68	1.6870	1.00	6.6250
114.3	203.20	127.00	73.15	42.85	25.40	168.28
6	9.50	6.62	3.75	2.5000	1.00	8.2500
152.4	241.30	168.15	95.25	63.50	25.40	209.55
8	12.12	8.12	4.38	3.1250	1.00	10.1250
203.2	307.85	206.25	111.25	79.38	25.40	257.18
10	14.75	10.25	5.38	3.8750	1.00	12.3750
254	374.65	260.35	136.65	98.43	25.40	314.33
12	16.75	12.25	6.38	4.8750	1.00	14.3750
304.8	425.45	311.12	162.05	123.83	25.40	365.13
16	20.75	16.25	8.38	6.8750	1.25	18.3750
406.40	527.05	412.75	212.85	174.63	25.40	466.73

SQUARE LEAD SCREW PLATE

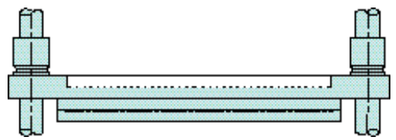


LEAD SCREW PLATE	4.5	6	8	10	12	16
	114.30	152.40	203.20	25.4.00	304.80	405.40
ORDER NO.	710-					
	3721	3722	3723	3724	3725	3727

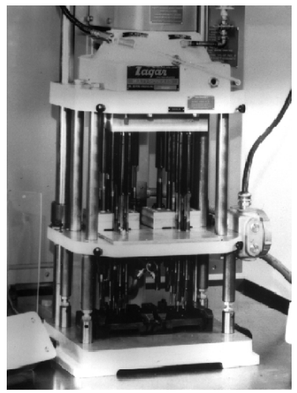
LEAD SCREW PLATE ASSEMBLIES

FIXTURE SIZE		ORDERING NO. SQUARE WITH BASE PLATE	SQUARE WITHOUT BASE PLATE	DIAGONAL WITH BASE PLATE	DIAGONAL WITHOUT BASE PLATE
4.5	114.30	710-3730-0045-0	710-3715-0045-0	710-3730-0045-1	710-3715-0045-1
6	152.40	710-3730-0060-0	710-3715-0060-0	710-3730-0060-1	710-3715-0060-1
8	203.20	710-3730-0080-0	710-3715-0080-0	710-3730-0080-1	710-3715-0080-1
10	254.00	710-3730-0100-0	710-3715-0100-0	710-3730-0100-1	710-3715-0100-1
12	304.80	710-3730-0120-0	710-3715-0120-0	710-3730-0120-1	710-3715-0120-1
16	406.40	710-3730-0160-0	710-3715-0160-0	710-3730-0160-1	710-3715-0160-1

RECTANGULAR AND LARGE SQUARE LEAD SCREW PLATE



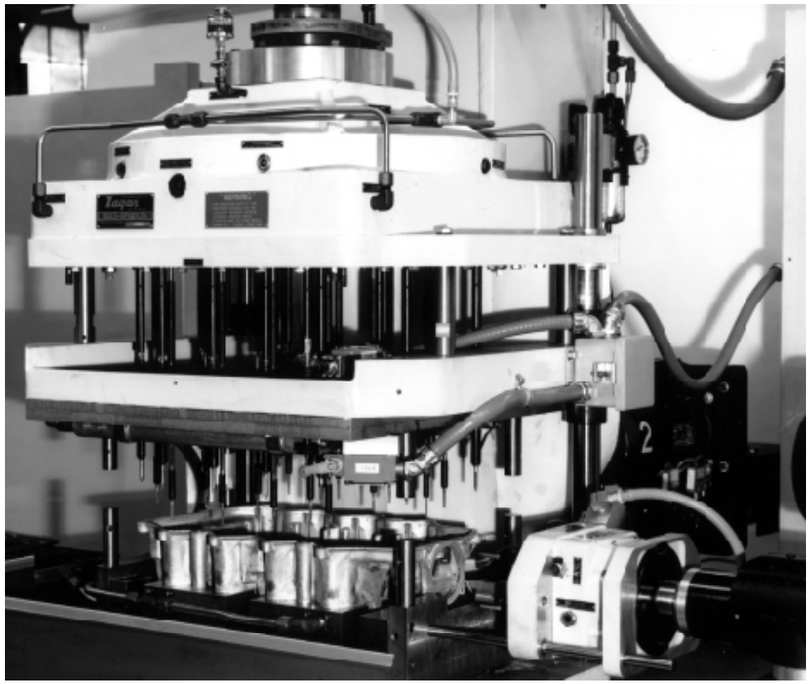
ZAGAR HEAD WITH INDIVIDUAL LEAD SCREW TAPPING FIXTURE



NOTE: Smaller numbers are metric conversions.

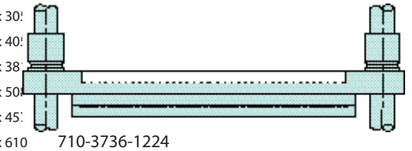
RECTANGULAR LEAD SCREW PLATE ASSEMBLIES

Fixture Size	Ordering No.



RECTANGULAR LEAD SCREW FIXTURE ASSEMBLIES

Fixture Size		Ordering No.
5x10	127 x 54	710-3780-510
8x12	203 x 305	710-3780-812
8x16	203 x 405	710-3780-816
10x15	254 x 381	710-3780-1015
10x20	254 x 508	710-3780-1020
12x18	203 x 457	710-3780-1218
12x24	203 x 610	710-3780-1224
16x16	406 x 406	710-3780-1616
16x24	406 x 610	710-3780-1624
16x32	406 x 813	710-3780-1632
20x20	508 x 508	710-3780-2020
20x30	508 x 762	710-3780-2030
20x40	508 x 1016	710-3780-2040
24x24	610 x 610	710-3780-2424
24x36	610 x 914	710-3780-2436
28x28	711 x 711	710-3780-2828
28x44	711 x 1118	710-3780-2844
32x32	813 x 813	710-3780-3232
36x36	914 x 914	710-3780-3636
32x60	813 x 1524	710-3780-3260



5x10	127 x 254	710-3736-510
8x12	203 x 30[illegible]	
8x16	203 x 40[illegible]	
10x15	254 x 38[illegible]	
10x20	254 x 50[illegible]	
12x18	203 x 45[illegible]	
12x24	203 x 610	710-3736-1224
16x16	406 x 406	710-3736-1616
16x24	406 x 610	710-3736-1624
16x32	406 x 813	710-3736-1632
20x20	508 x 508	710-3736-2020
20x30	508 x 762	710-3736-2030
20x40	508 x 1016	710-3736-2040
24x24	610 x 610	710-3736-2424

GUIDE RODS

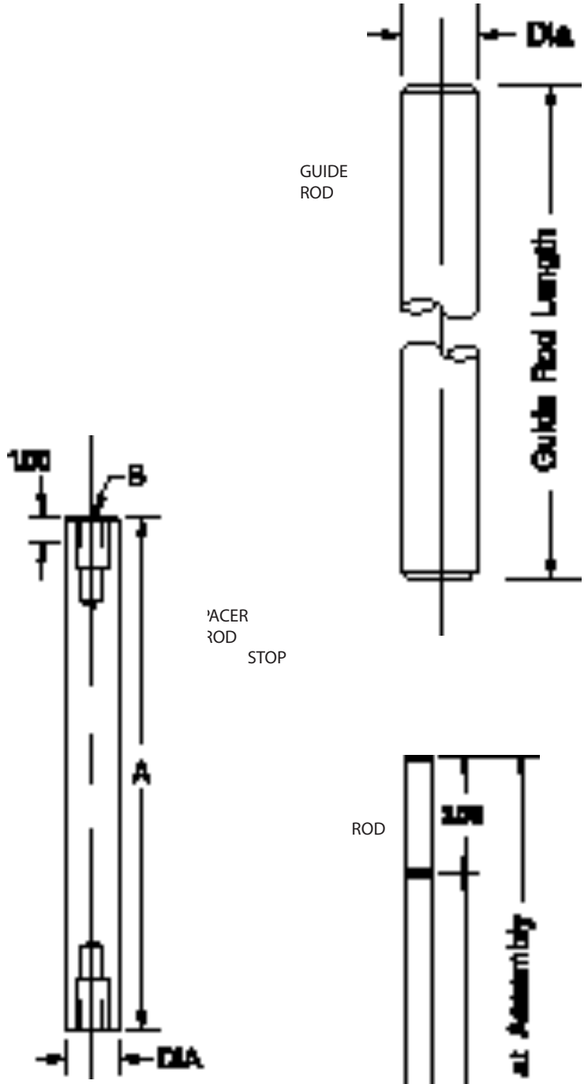
Diameter	Ordering No.	Length
.625 15.88	710-3179	36.00 91.40
1.000 25.40	710-3178	36.00 91.40
1.250 31.75	710-3177	36.00 91.40
1.500 38.10	709-2666	36.00 91.40
1.75 44.45	709-2667	36.00 91.40

SPACER RODS

Diameter	Ordering No.	Blank Length A	B
.625 15.88	710-3176	11.00 279.40	3/8-16
.750 19.05	710-3175	13.50 342.90	3/8-16
1.000 25.40	710-3174	13.50 342.90	1/2-13
1.250 31.75	710-0542	11.50 292.10	1/2-13

SUPPORT RODS AND STOP RODS

SUPPORT ROD		STOP ROD	
Dia.	Order No.	Dia.	Order No.
.750 19.05	710-3733	.750 19.05	710-3732
1.000 25.41	710-3735	1.000 25.41	710-3734



NOTE: Smaller numbers are metric conversions.

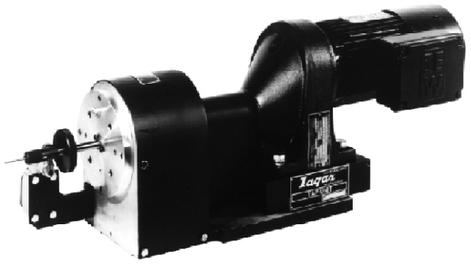
GEARMOTOR TAP UNITS

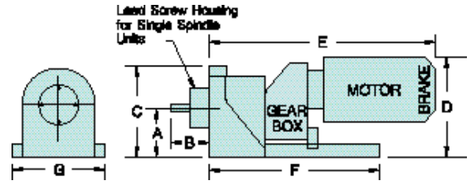
Zagar's Gearmotor Tap Units offer an inexpensive alternative to satisfying single or multiple hole tapping applications. Standard units are available for horizontal or vertical mounting.

For single spindle applications, a heavy duty gear motor with integral brake is used to drive a lead screw and nut assembly.

Multiple hole tapping is accomplished by using the same drive to power a Zagar multiple spindle head with individual lead screw/nut assemblies for each spindle. In this manner simultaneous tapping of different thread pitches is also possible.

The Single Spindle unit comes complete with gearmotor and mounting base, drive coupling, guard, one (1) lead screw and nut and two (2) limit switches for stroke controls are required.





Lead Screw Pitch and Projection Limits			
Spindle Lead Screw Size	Thread Pitch Limits	Stroke*	B Retracted
.750	13 to 80	1.50	2.88
1.000	10 to 40	1.50	3.12
**1.250	8 to 32	1.75	4.12
Multiple Spindle Heads	4 1/2" thru 16" Square Please refer to Page 10 & 31		

** Not available on 1 H.P.
* Longer strokes available.

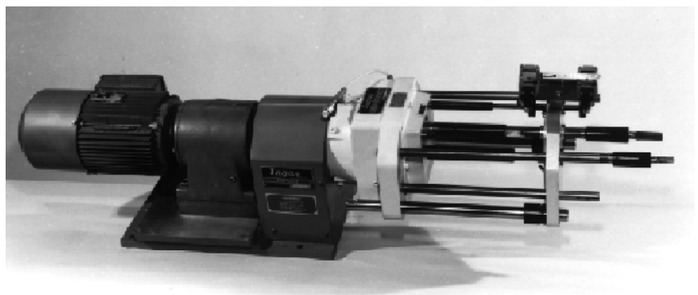
MODEL NO.	Motor	DIMENSIONS						
SINGLE SPINDLE	H.P.	A	B	C	D	E	F	G
746-2011	1	6.062	See lead screw	9.56	11.60	26.30	15.00	8.50
746-2032	2	6.062	pitch and pro-	9.56	11.60	29.63	15.00	8.50
746-2053	3	8.562	jection limits	12.18	12.50	38.59	20.00	13.00
MULTIPLE SPINDLE								
746-2001	1	6.062	See multiple	9.56	11.60	2.156	15.00	8.50
746-2022	2	6.062	Spindle head	9.56	11.60	23.21	15.00	8.50
746-2043	3	8.562	Data	12.18	15.00	28.23	20.00	13.00
746-2065	*5	8.562	Page 10	12.18	12.50	28.65	20.00	13.00

* Not available in single spindle

Output Shaft R.P.M.	Motor H.P.			
	1	2	3	5
	430	385	215	187
	471	435	306	241
	540	476	415	276
	614	546	523	387
	694	621	614	424
	794	702	694	490
	939	804	783	677
	1118	950	939	774
	—	1132	1118	944

HOW TO ORDER

- Specify Model Number
- Output R.P.M.
- Head Size
- Spindle Lead Screw
- Threads per inch
- Spindle Lead Screw Size



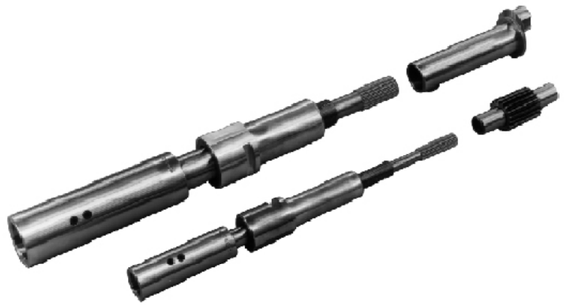
MULTIPLE SPINDLE UNIT
Gearmotor Tap Unit with multiple spindle head.

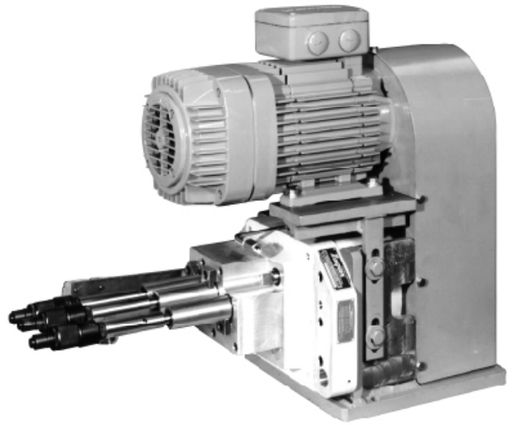
Lead Screw Tapping Units

CARTRIDGE LEAD SCREW

Zagar Cartridge type lead screw tapping heads provide an alternative to using a lead screw plate assembly for simultaneous tapping of different pitches.

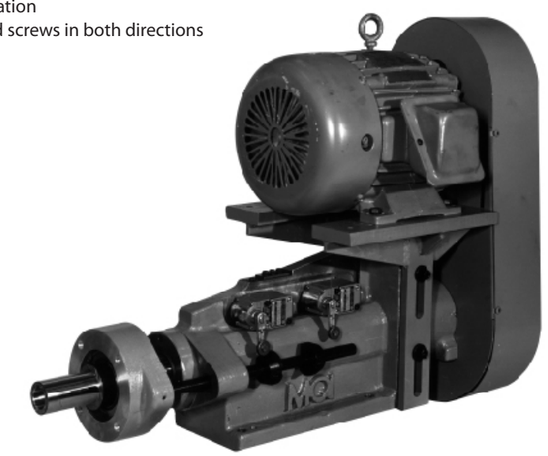
Gear driven spindles can be used in a gearless head when higher or lower spindle speeds are required.





ADVANTAGES

- No lead screw plates
- Compact self contained unit
- Rapid change of lead screw/nut assembly
- Brake motor sized per application
- Over travel protection of lead screws in both directions



MODEL LT 375 TAP UNIT

STANDARD FEATURES

The Model LT-375 Unit is our self-contained lead screw tapping unit with 3.75 inches of stroke and no rapid traverse.

Design features include:

- a hardened and ground lead screw operating in a bronze nut
- disengagement of the drive spline if over-travel occurs in either direction
- spring loaded lead nut on all single spindle applications for protection against broken drills
- commercial oil-tight limit switches
- machining of all adapter type spindles for quick-change over the spindle holders

The ease of accessibility to the lead screw and nut assembly, makes this unit ideally suited for applications that require frequent changing of the thread pitch.

The Unit comes complete with motor mounting brackets, two limit switches, sheaves and vee belts and enclosed belt guard.

Optional features include a four switch control assembly for safety overtravel in both directions.

Max. Spindle Speed	1,000 R.P.M.
Unit Stroke	3.75 inches
Spindle Nose	1 1/16 A.S.A. Bore
	1 3/8 A.S.A. Bore
	Flange mounts for
	Multiple Spindle Heads
Capacity	3/4-10 in Steel
	7/8-9 in Cast Iron
Thread Pitch	8 to 32 T.P.I.
Est. Weight	160 lbs. (less motor)

Note: Please refer to Zagar Feed Unit Catalog for additional information.

SPECIFICATIONS

Self Clamping Fixture

Drilling, Tapping and Reaming a part usually necessitates holding that part.

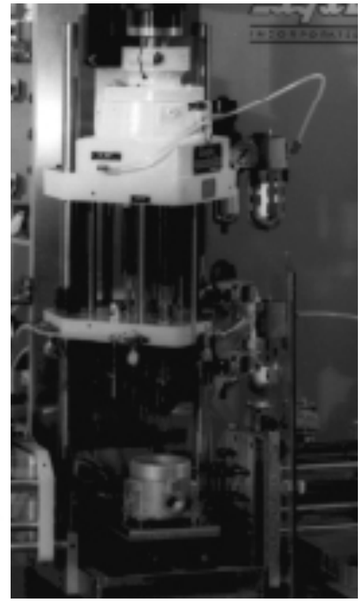
This is where a ZAGAR Self-Clamping FIXTURE is the key to successful clamping.

Zagar Fixtures take advantage of the natural downward movement of the Head and the Fixture automatically clamps the part. (In some applications this eliminates the need for additional clamping mechanisms.)

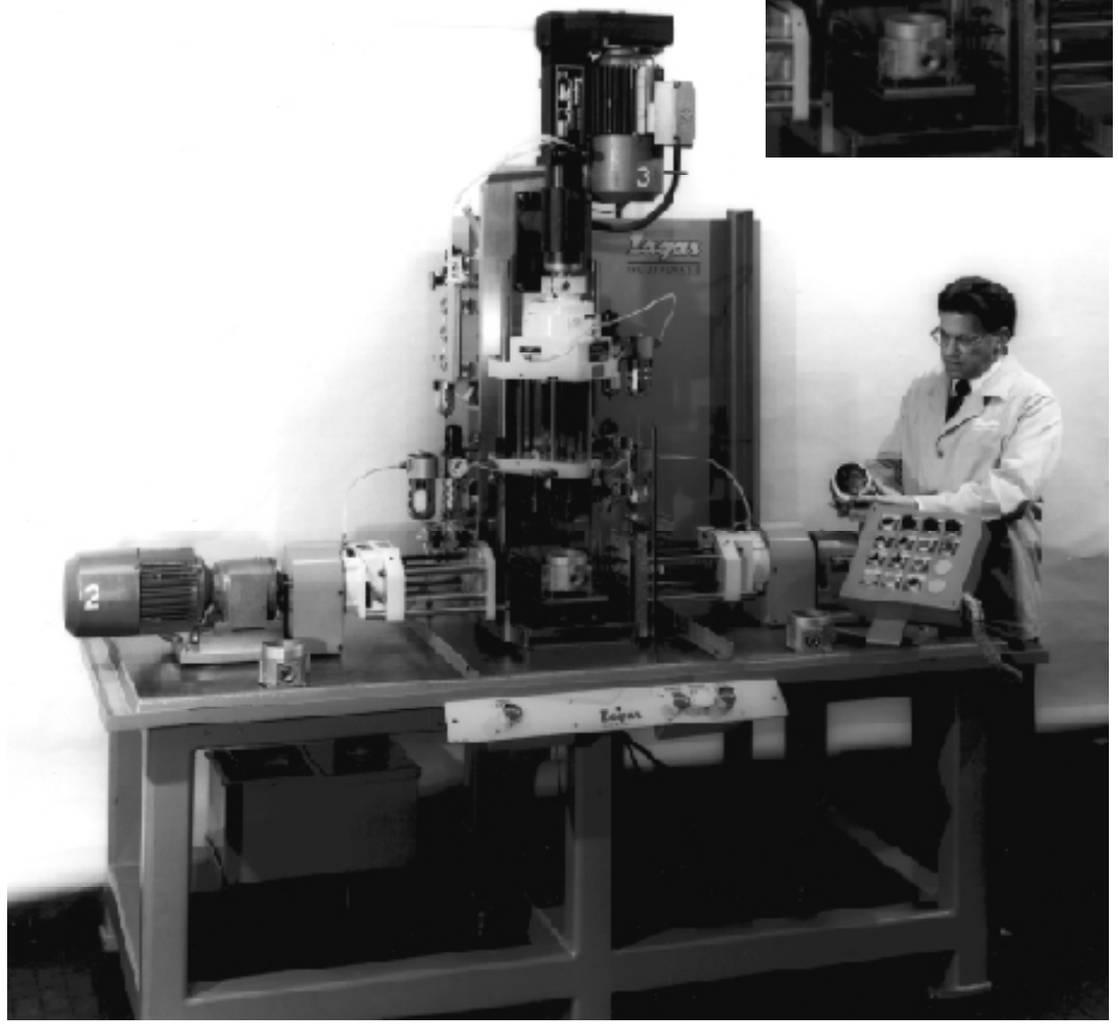
Naturally, the ideal combination is a ZAGAR HEAD and ZAGAR FIXTURE for maximum performance, but remember - a Zagar Fixture can be used with practically any type Head you may have.

Many years of experience in building Fixtures enables us to supply the Right Fixture to do the job right! There are countless ways and variations in which Zagar Fixtures and Fixture Components can be ordered, but we have found through experience that three basic ways will serve practically any situation that you may encounter.

Please see Pages 26-38, 49-54



Typical Applications of . . . SELF CLAMPING FIXTURES

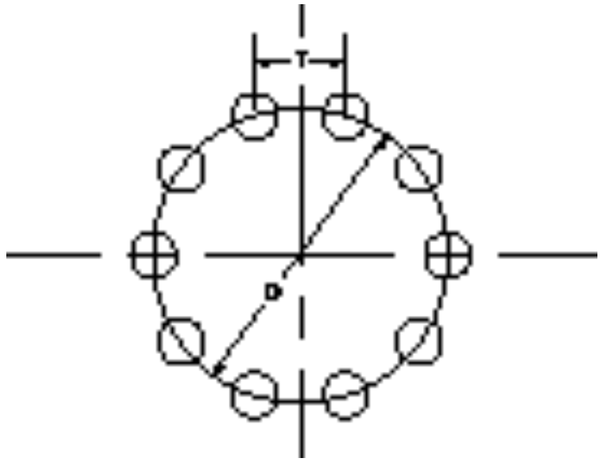


Bolt Circle Center Distance Formula

LENGTH OF CHORDS

T = length of chord
D = diameter of circle
C = constant for each No. of divisions N

To obtain length of chord T, multiply the diameter of D by the constant C.



T = DC

N	C	N	C	N	C	N	C
3	.86603	28	.11196	53	.05924	78	.04027
4	.70711	29	.10812	54	.05814	79	.03976
5	.58779	30	.10453	55	.05709	80	.03926
6	.50000	31	.10117	56	.05607	81	.03878
7	.43388	32	.09802	57	.05509	82	.03830
8	.38268	33	.09506	58	.05414	83	.03784
9	.34202	34	.09227	59	.05322	84	.03739
10	.30902	35	.08964	60	.05234	85	.03695
11	.28173	36	.08716	61	.05148	86	.03652
12	.25882	37	.08481	62	.05065	87	.03610
13	.23932	38	.08258	63	.04985	88	.03569
14	.22252	39	.08047	64	.04907	89	.03529
15	.20791	40	.07846	65	.04831	90	.03490
16	.19509	41	.07655	66	.04758	91	.03452
17	.18375	42	.07473	67	.04687	92	.03414
18	.17365	43	.07300	68	.04618	93	.03377
19	.16459	44	.07134	69	.04551	94	.03341
20	.15643	45	.06976	70	.04486	95	.03306
21	.14904	46	.06824	71	.04423	96	.03272
22	.14231	47	.06679	72	.04362	97	.03238
23	.13617	48	.06540	73	.04302	98	.03205
24	.13053	49	.06407	74	.04244	99	.03173
25	.12533	50	.06279	75	.04188	100	.03141
26	.12054	51	.06156	76	.04132	101	.03110
27	.11609	52	.06038	77	.04079	102	.03080

Gauging Feed Unit

Our applications engineering department evaluates production drilling and machining requirements and recommends the appropriate units for profitable operation. Sales engineers in major metalworking areas give you prompt, personal service without obligation.

Formulae are programmed into our computer. Send us data on your application for machining units for a free evaluation. Needed information includes: operations, S.A.E. equivalent of material and Brinell hardness (BHN) or Rockwell scale, depth and diameter of cut, and whether cutting tools are HSS or carbide.

The following procedures are recommended to determine specifications of machining unit.

I. Drill

Determine RPM, HP, Torque and Thrust as follows:

A. $\text{RPM} = \frac{3.82 \times \text{SFM}}{\text{O.D.}}$

B. Drill HP (cutting dia. up to 2 inches) = 1.5 x (actual feed) x drill dia. x SFM x MM (Table 4)

C. $\text{Torque (in. lbs.)} = \frac{\text{HP} \times 63{,}025}{\text{RPM}}$

D. Thrust = Thrust (Table 2) x $\frac{\text{Actual Feed Rate} \times \text{MM (Table 4)}}{\text{Feed Rate (Table 2)}}$

Note:

If the hole is pre-drilled (dead center removed), the thrust value is approximately one-half that of the drill from solid. For diameters larger than Table 2, drill thrusts can be obtained from graph (Figure 1) on Page 46. Multiply graph value by MM if other than 1.

E. Cycle time =

$$60 \times \left(\frac{\text{Length of Drill Point} + \text{clearance} + \text{Hole Depth}}{\text{Feed Rate} \times \text{Cutting Tool RPM}}\right) + \text{Rapid Approach + Rapid Retract Time}$$

II. Ream, Bore, Counterbore, Countersink, Hollow Mill, Trepan, and Core Drill

Determine RPM, HP, Torque and Thrust as follows:

A. $\text{RPM} = \frac{3.82 \times \text{SFM}}{\text{O.D.}}$

B. HP (cutting dia. up to 2 inches) = 1.5 x

$$\text{Feed Rate} \times \frac{(\text{Cutting O.D.}^2 - \text{Cutting I.D.}^2) \times \text{SFM} \times \text{MM}}{\text{Cutting O.D.}}$$

C. $\text{Torque (in. lbs.)} = \frac{\text{HP} \times 63{,}025}{\text{RPM}}$

D. Reamer Thrust = $\frac{\text{Thrust of Equiv. Drill}}{2} \times \frac{\text{Reamer Feed}}{\text{Equiv. Drill Feed}} \times \text{MM}$

Where equiv. drill = $\sqrt{\text{Reamer Dia.}^2 - \text{Rough Drill Dia.}^2}$
Thrust and feed of equiv. drill are taken from Table 2.

E. Unit cycle time =

$$60 \times \left(\frac{\text{Length of Drill Point} + \text{clearance} + \text{Hole Depth}}{\text{Feed Rate} \times \text{Cutting Tool RPM}}\right) + \text{Rapid Approach + Rapid Retract Time}$$

Horsepower Formula for Drilling, Reaming, Etc. Cutting Diameters of Two or More Inches.

For cutting operations that exceed two inches in diameter (solid or otherwise), calculate horsepower at the spindle based on one HP required to remove one cu. in. of average steel in one minute using applicable material factor "K":

HP = Area of metal removed x Feed Rate (in./min.) x K x 1.3 (30% dull tool factor)

Material Factor "K"

Aluminum	= .25	Iron Malleable	= .75
Bronze & Brass	= .25	Steel, Average	= 1.0
Iron, Cast	= .50	Steel, Hard	= 1.5

III. Tap

Determine RPM, HP and Torque; thrust is not a factor:

A. $\text{RPM} = \frac{3.82 \times \text{SFM}}{\text{O.D.}}$ $\qquad \text{SFM} = \frac{\text{RPM} \times \text{O.D.}}{3.82}$

B. For HP values of material with MM other than 1 and SFM other than 100, use the following formula: (Applicable for straight threads and pipe taps.)

$$\text{H.P. (Actual)} = \frac{\text{HP (Table 3)} \times \text{Actual SFM} \times \text{MM}}{100}$$

C. For torque values of material with MM other than 1, multiply Table 3 value by actual MM. (Applicable for straight or taper threads.)

D. For HP of thread sizes not shown on Table 3, the following general formula prevails (for straight threads only):

$$\text{HP} = \frac{2.34 \times \text{Major Dia.} - .646}{\text{Major Dia.} \times (\text{T.P.I.})^2} \times \text{SFM} \times \text{MM}$$

E. $\text{Torque (in. lbs.)} = \frac{\text{HP} \times 63{,}025}{\text{RPM}}$

Thrust is not a factor in tapping

F. $\text{Feed Rate} = \frac{1}{\text{T.P.I. of tap}}$

G. Unit cycle time =

$$\frac{120 \times (\text{Clearance} + \text{Hole Depth})}{\text{Feed Rate} \times \text{Tap RPM}} + \text{Rapid Approach + Rapid Retract Time}$$

Note:

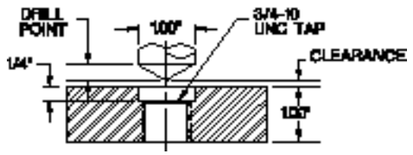
1. Feed rates are expressed in inches per revolution of the spindle. If necessary, convert this to inches per minute by multiplying the feed rate in inches per revolution by the RPM of the spindle.
2. Rapid approach and rapid retract rates are expressed in inches per minute. To determine the rapid approach time or rapid retract time when the length of these movements are known:

$$\text{R.R. Time (seconds)} = \frac{60 \times (\text{Length of R.A. or R.R.})}{\text{R.A. or R. R. Rate (IPM)}}$$

R.A. or

NOTE:
Power values are those required at the spindle of the machining unit for cutting metal. Additional horsepower must be allowed for actuation of the machining unit. Usually, air-hydraulic units require from 1/4 to 1 H.P.; mechanical units need from 1/2 to 5 H.P., depending upon the size of the unit, number of spindles, and the type of spindle gear reduction. Your Zagar sales engineer can advise you of the requirements.

EXAMPLE: 1020 carbon steel, 200 BHN hardness



I. Tap drill 21/32 inch diameter (.656) through:

1. SFM = 70 (Table No. 1 or other reference)
2. RPM = 409 (Table No. 6 or Formula IA.)
3. MM = 2.1 (Table No. 4)
4. Feed rate = .008 (Table No. 2 or other reference)
5. H.P. = 1.5 x .008 x .656 x 70 x 2.1 = 1.16 (Formula IB)
6. Torque = $\frac{1.16 \times 63{,}025}{409}$ = 178.5 in. lbs. (Formula IC)
7. Thrust = $\frac{597 \times .008 \times 2.1}{.009}$ = 1114 lbs. (Table No. 2, Formula ID)
8. Unit Cycle Time = $\frac{60 \times (.1972 + .062 + 1.000)}{.008 \times 409}$ + .5 sec. rapid approach
   +.5 sec. rapid retract = 24 seconds
   (Formula IE; approx. rapid approach and retract rates)

II. Countersink 1 inch diameter, 1/4 inch deep

1. SFM = 70 (Table No. 1 or other reference)
2. RPM = 268 (Table No. 6 or Formula IIA)
3. MM = 2.1 (Table No. 4)
4. Feed Rate = .012 (Table No. 2 or other reference)
5. H.P. = $\frac{1.5 \times .012 \times (1.000^2 - .656^2) \times 70 \times 2.1}{1.00}$ = 1.5 (Formula IIB)
6. Torque = $\frac{1.5 \times 63{,}025}{267}$ = 354 in. lbs. (Formula IIC)
7. Thrust = $\frac{750}{2} \times \frac{.012}{.010} \times 2.1$ = 945 lbs. (Formula IID)
8. Unit Cycle Time = $\frac{60 \times (.3005 + .062 + .250)}{.012 \times 267}$ + .5 sec. rapid approach
   +.5 sec. rapid retract = 12.5 seconds
   (Formula IIE approx. rapid approach and retract rates)

III. Tap 3/4* - 10 UNC through

1. SFM = 40 (Table No. 1 or other reference)
2. RPM = 203 (Table No. 6 or Formula IIIA)
3. MM = 2.1 (Table No. 4)
4. H.P. = 2.16 x $\frac{40}{100}$ x 2.1 = 1.8 (Formula IIIB)
5. Torque = 254.4 x 2.1 = 554 in. lbs. (Table No. 3; Formula IIIC)
6. Thrust is not a factor in tapping.
7. Feed Rate = 1/10 = .100 (Formula IIIF)
8. Unit Cycle Time = $\frac{120 \times (.125 + .750)}{.100 \times 203}$ + .5 sec. rapid approach
   +.5 sec. rapid retract = 6.14 seconds
   (Formula IIIG; approx. rapid approach and retract rates)

Cutting Tool Life
Use these formulas to calculate feeds and speeds as guidelines only. Test machine under production conditions to predict accurate tool life. Speeds and feeds shown are calculated on 60 minutes of actual cutting life for high speed steel tools; 45 minutes for re-usable carbide and 30 minutes for throw away carbide tools. Where a machine has an eight second cycle, 6 seconds is devoted to loading, transferring and unloading. Therefore, the tools are cutting for only two seconds per cycle or 15 minutes per hour. Thus, in the example, life of a high speed steel tool would be (4) hours of machine time.

Cutting Tool Failure
ZAGAR machining units help extend but do not control the life of the cutting tools. Excessive tool wear or breakage can usually be caused by one of the following:

1. Improper surface speed of tool.
2. Improper feed rates of tool
3. Improper cutting tool material
4. Excessively dull tools.
5. Hard spots; scale or sand in the materials.
6. Improper coolant or lubricants.
7. Lack of coolant or lubricant at the point of the cut.
8. No rigid tool guidance (overside drill bushings, guide rods, etc.)
9. Excessive deep cut and chip packing.
10. Improperly ground tools (clearance angles, rake angles, lip angles, rough finishes, etc.)

The above rates are recommendations only. The rate should be modified to best suite the machining environment.

Table No.1

MATERIAL	BRINELL (BHN)	DRILLS S.F.M.	TAPS - S.F.M. THREADS PER INCH 3-7 1/2	8-15	16-24	25 UP
Aluminum	99-101	200-250	50	100	150	200
Aluminum Bronze	170-187	60	12	25	45	60
Bakelite	—	80	50	100	150	200
Brass	192-202	200-250	50	100	150	200
Bronze, Common	166-183	200-250	40	80	100	150
Bronze, Phos.; 1/2 Hard	187-202	175-180	25	40	50	80
Bronze, Phos.; Soft	149-163	200-250	40	80	100	150
Celluloid	—	100	50	100	150	200
Copper	80-85	70	40	80	100	150
Copper, Mang.; 30% Min.	134	15	—	—	—	—
Duralumin	90-104	200	50	100	150	200
Everdur	179-207	60	20	30	40	50
Iron, Cast; Soft	126	140-150	30	60	90	140
Iron, Cast; Med. Soft	196	80-110	25	40	50	80
Iron, Cast; Hard	293-302	45-50	10	20	30	40
Iron, Cast; Chilled	402	15	5	5	10	10
Iron Malleable	112-126	85-90	20	30	40	50
Monel	149-170	50	8	10	15	20
Nickel, Pure	187-202	75	25	40	50	80
Nickel Steel; 3 1/2%	196-241	60	8	10	15	20
Rubber, Hard	—	100	50	100	150	200

Table No. 2

DRILL THRUST AND HORSEPOWER
MM of one (cast iron)

DRILL DIA.	DRILL POINT	FEED* IN./REV.	HP@ 100 S.F.M.	THRUST LBS.	TORQUE IN-LBS.
1/32	.009	.0008	.004	10	0.02
1/16	.019	.0015	.014	31	0.14
3/32	.028	.0020	.028	45	0.4
1/8	.037	.0025	.047	66	0.9
5/32	.047	.0035	.082	110	2.1
3/16	.056	.0040	.113	131	3.4
7/32	.066	.0045	.148	168	5.3
1/4	.075	.0050	.188	194	7.7
9/32	.084	.0050	.211	210	9.8
5/16	.094	.0050	.235	227	12.
11/32	.103	.0055	.284	261	16.
3/8	.113	.0060	.338	296	20.
13/32	.122	.0065	.396	333	26.
7/16	.131	.0070	.460	372	33.
15/32	.141	.0075	.526	413	40.
1/2	.150	.0080	.600	474	49.
17/32	.160	.0080	.637	503	56.
9/16	.169	.0080	.675	533	62.
19/32	.178	.0085	.757	569	74.
5/8	.188	.0090	.844	587	87.
21/32	.197	.0090	.885	597	96.
11/16	.206	.0090	.928	627	105.
23/32	.216	.0095	1.025	685	121.
3/4	.225	.0100	1.125	729	139.
25/32	.235	.0100	1.175	750	151.
13/16	.244	.0100	1.218	771	163.
27/32	.253	.0105	1.335	822	185.
7/8	.263	.0110	1.45	875	209.
29/32	.272	.0115	1.56	925	234.
15/16	.282	.0120	1.68	983	261.
31/32	.291	.0125	1.81	1.97	291.
1	.300	.013	1.96	1164	322.
1 1/16	.319	.013	2.13	1180	364.
1 1/8	.338	.014	2.37	1266	439.
1 3/16	.357	.014	2.50	1360	490.
1 1/4	.376	.015	2.64	1440	581.
1 5/16	.394	.015	2.70	1490	641.
1 3/8	.413	.015	3.04	1540	704.
1 7/16	.432	.015	3.23	1590	769.
1 1/2	.451	.015	3.37	1640	837.
1 9/16	.469	.016	3.78	1730	969.
1 5/8	.488	.016	3.94	1820	1048
1 11/16	.507	.016	4.07	1870	1131.
1 3/4	.526	.016	4.35	1915	1216.
1 13/16	.544	.016	4.50	2005	1304.
1 7/8	.563	.017	4.75	2115	1483
1 15/16	.582	.017	4.95	2165	1584.
2	.601	.017	5.12	2211	1688.

With carbide drills decrease feed rate 10% and double drill RPM and HP.

MATERIAL	BRINELL (BHN)	DRILLS S.F.M.	TAPS-S.F.M. THREADS PER INCH 3-7 1/2	8-15	16-24	25 UP
Screw Stock; C.R.	170-196	110	20	30	40	50
Steel, Carbon	175-225	70	30	40	50	50
Steel, Drop Forged	170-196	60	12	25	45	60
Steel, Machinery	170-196	110	35	50	60	85
Steel, Magnet; Soft	241-302	35-40	20	40	50	75
Steel, Magnet; Hard	321-512	15	5	10	15	25
Steel, Mang.; 7-13%	187-217	15	15	20	25	30
Steel, Mild; .20-.30C	170-202	110-120	40	55	70	90
Steel, Molybdenum	196-235	55	20	30	35	45
Steel, Spring	402	20	10	10	15	15
Steel, Stainless	150-225	50	8	10	15	20
Steel, Stainless	460-520	20	8	10	15	20
Steel .40-.50C	170-196	80	20	30	40	50
Steel, Structural; A-36	160	110	40	55	70	90
Steel, Tool; S.A.E. and Forging	149	75	25	35	45	55
Steel, Tool; S.A.E. and Forging	241	50	15	15	25	25
Steel, Tool; S.A.E. and Forging	402	15	8	10	15	20
Zinc, Alloy	112-126	200-250	50	100	150	200

NOTE: 1) HSS reaming tools should be at approximately 2/3 of Drill RPM.
2) Carbide tools should be at approximately double above values.

Table No. 3 - Tapping, MM of one (cast iron)

SIZE	SERIES	TAP DRILL 75%	RPM @ 100 S.F.M.	HP @ 100 S.F.M.	TORQUE IN-LBS.
6-32	UNC	.1077	2775	.19	4.4
6-40	UNF	.1138	2775	.12	2.9
8-32	UNC	.1337	2335	.2	5.4
8-36	UNF	.137	2335	.16	4.3
10-24	UNC	.149	2016	.35	10.9
10-32	UNF	.1597	2016	.2	6.4
12-24	UNC	.175	1773	.36	12.6
12-28	UNF	.1813	1773	.27	9.5
1/4-20	UNC	.2115	1532	.51	21
1/4-28	UNF	.2153	1532	.27	11
5/16-18	UNC	.2589	1226	.64	33
5/16-24	UNF	.2715	1226	.37	19.1
3/8-16	UNC	.3144	1021	.82	50
3/8-24	UNF	.334	1021	.38	23.3
7/16-14	UNC	.3681	875.5	1.1	77
7/16-20	UNF	.3890	875.5	.54	39
1/2-13	UNC	.4251	766	1.25	102.6
1/2-20	UNF	.4515	766	.55	45
9/16-12	UNC	.4817	681	1.5	136
9/16-18	UNF	.5089	681	.68	62.5
5/8-11	UNC	.5365	613	1.75	180
5/8-18	UNF	.5714	613	.68	70
3/4-10	UNC	.6562	511	2.1	264
3/4-16	UNF	.6894	511	.87	107
7/8-9	UNC	.7667	438	2.7	382
7/8-14	UNF	.8056	438	1.1	163
1"-8	UNC	.8781	383	3.4	553
1-12	UNF	.9192	383	1.5	253
1 1/8-7	UNC	.9857	340	4.4	812
1 1/8-12	UNF	1.0442	340	1.6	286
1 1/4-7	UNC	1.1107	306	4.4	910
1 1/4-12	UNF	1.1692	306	1.6	320
1 3/8-6	UNC	1.2125	279	6	1356
1 3/8-12	UNF	1.2942	279	1.6	353
1 1/2-6	UNC	1.3375	255	6	1489
1 1/2-12	UNF	1.4192	255	1.6	387
1 3/4-5	UNC	1.5552	219	8.7	2496
2"-4 1/2	UNC	1.7836	191	10.7	3530
2 1/4-4 1/2	UNC	2.0336	170	10.8	4005
2 1/2-4	UNC	2.2565	153	13.7	5628
2 3/4-4	UNC	2.5065	139	13.8	6230
3"-4	UNC	2.7565	127	13.8	6831
3 1/4-4	UNC	3.0065	118	13.9	7433
3 1/2-4	UNC	3.2565	109	13.95	8035
3 3/4-4	UNC	3.5065	102	14	8636
4"-4	UNC	3.7565	96	14	9238

PIPE TAPS (TAPER)

The following H.P. and Torque specs are based on tapered hole. If hole is straight, multiply by (3) three.

1/8-27	NPT	R	948	.54	36
1/4-18	NPT	7/16	706	1.17	103
3/8-18	NPT	37/64	565	1.69	133
1/2-14	NPT	23/32	455	2.00	277
3/4-14	NPT	59/64	364	2.06	356
1-11 1/2	NPT	1 5/32	291	3.07	663
1 1/4-11 1/2	NPT	1 1/2	231	3.48	950
1 1/2-11 1/2	NPT	1 47/64	201	4.08	1280

Conversion Charts

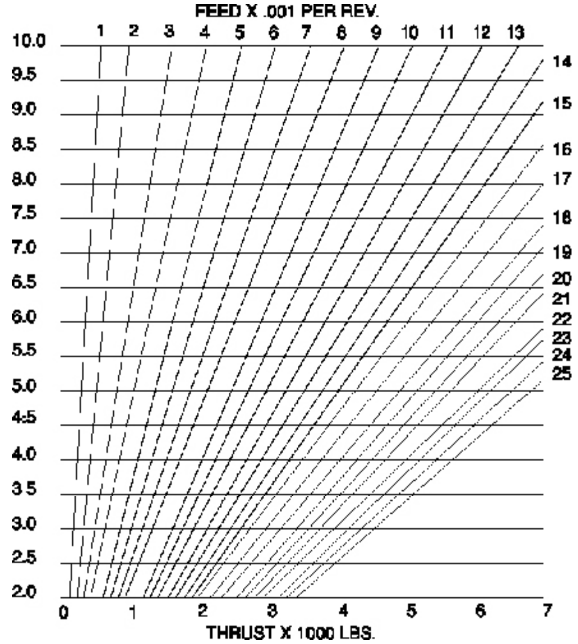
Table No. 4
MATERIAL MULTIPLIERS (MM)
RELATIVE MACHINABILITY BASED ON CAST IRON = 1

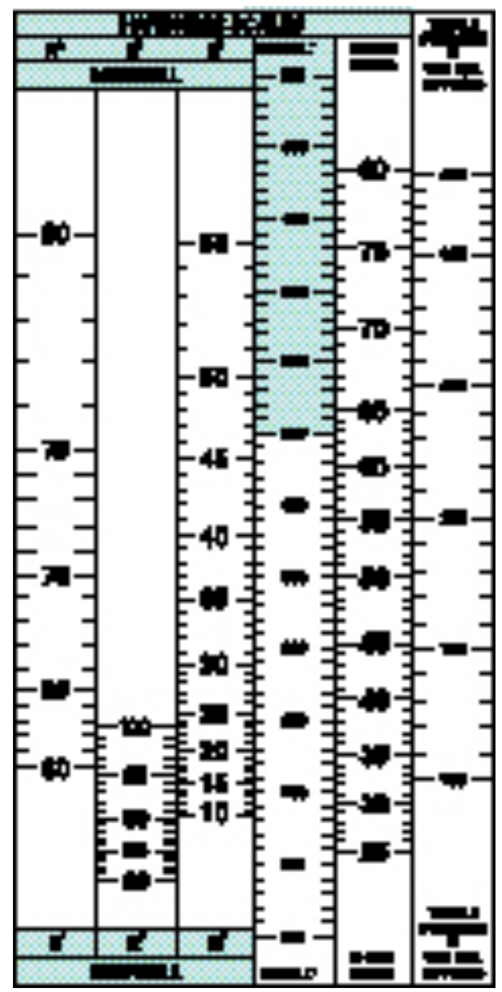
MATERIAL	BHN	MM	MATERIAL	BHN	MM
Aluminum		.38	Free Cutting (1111-1213)	140	1.10
Brass		.60	Alloy Steel(1330-8642)	175	1.50
Bronze		.60		190	1.60
Cast Iron		1.00		200	1.70
Copper		.72		203	1.80
Magnesium		.80		205	1.90
Malleable Iron		1.20		210	2.00
Stainless Steel		2.50		215	2.10
Titanium		2.25		220	2.20
Zinc		.60		230	2.30
Carbon Steel				240	2.40
(1008-1095)	90	1.60		250	2.50
	110	1.70		330	3.30
	140	1.80		390	3.90
	170	1.90		470	4.60
	190	2.00	Structural Steel (A-36)	160	1.50
	200	2.10			
	250	2.20			

Table No. 5

Hardness table compares the equivalent hardness of various scales. Brinell number 245 is equal to 62 Rockwell "A", 100 Rockwell "B", 23 Rockwell "C", 37 shore and tensile strength of approximately 120,000 PSI. Shaded area above 450 Brinell indicates that values vary slightly depending on the type of hardness tester.

DRILL THRUST; DIAMETERS OVER TWO INCHES
MM OF ONE (CAST IRON) 25% DULL DRILL FACTOR





SPINDLE RPM FOR VARIOUS CUTTING DIAMETERS WITH GIVEN SURFACE SPEED. (For higher speeds, multiply values by 10.)

SFM	10'	20'	30'	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'
DIAMETER INCHES	REVOLUTIONS PER MINUTE														
1/16	611	1222	1833	2445	3056	3667	4278	4889	5500	—	—	—	—	—	—
1/8	306	611	917	1222	1528	1833	2139	2445	2750	3056	3361	3667	3973	4278	4584
3/16	204	407	611	815	1019	1222	1426	1630	1833	2037	2241	2445	2648	2852	3056
1/4	153	306	458	611	764	917	1070	1222	1375	1528	1681	1833	1986	2139	2292
5/16	122	244	367	489	611	733	856	978	1100	1222	1345	1467	1589	1711	1833
3/8	102	204	306	407	509	611	713	815	917	1019	1120	1222	1324	1426	1528
7/16	87	175	262	349	437	524	611	698	786	873	960	1048	1135	1222	1310
1/2	76	153	229	306	382	458	535	611	688	764	840	917	993	1070	1146
5/8	61	122	183	244	306	367	428	489	550	611	672	733	794	856	917
3/4	51	102	153	203	255	306	357	407	458	509	560	611	662	713	764
7/8	44	87	131	175	218	262	306	349	393	436	480	524	568	611	655
1	38	76	115	153	191	229	267	306	344	382	420	458	497	535	573
1 1/8	34	68	102	136	170	204	238	272	306	340	373	407	441	475	509
1 1/4	31	61	92	122	153	183	214	244	275	306	336	367	397	428	458
1 3/8	28	56	83	111	139	167	194	222	250	278	306	333	361	389	417

HARDNESS CONVERSION

Suggested Drilling Feed Rates *(inches per rev.)*

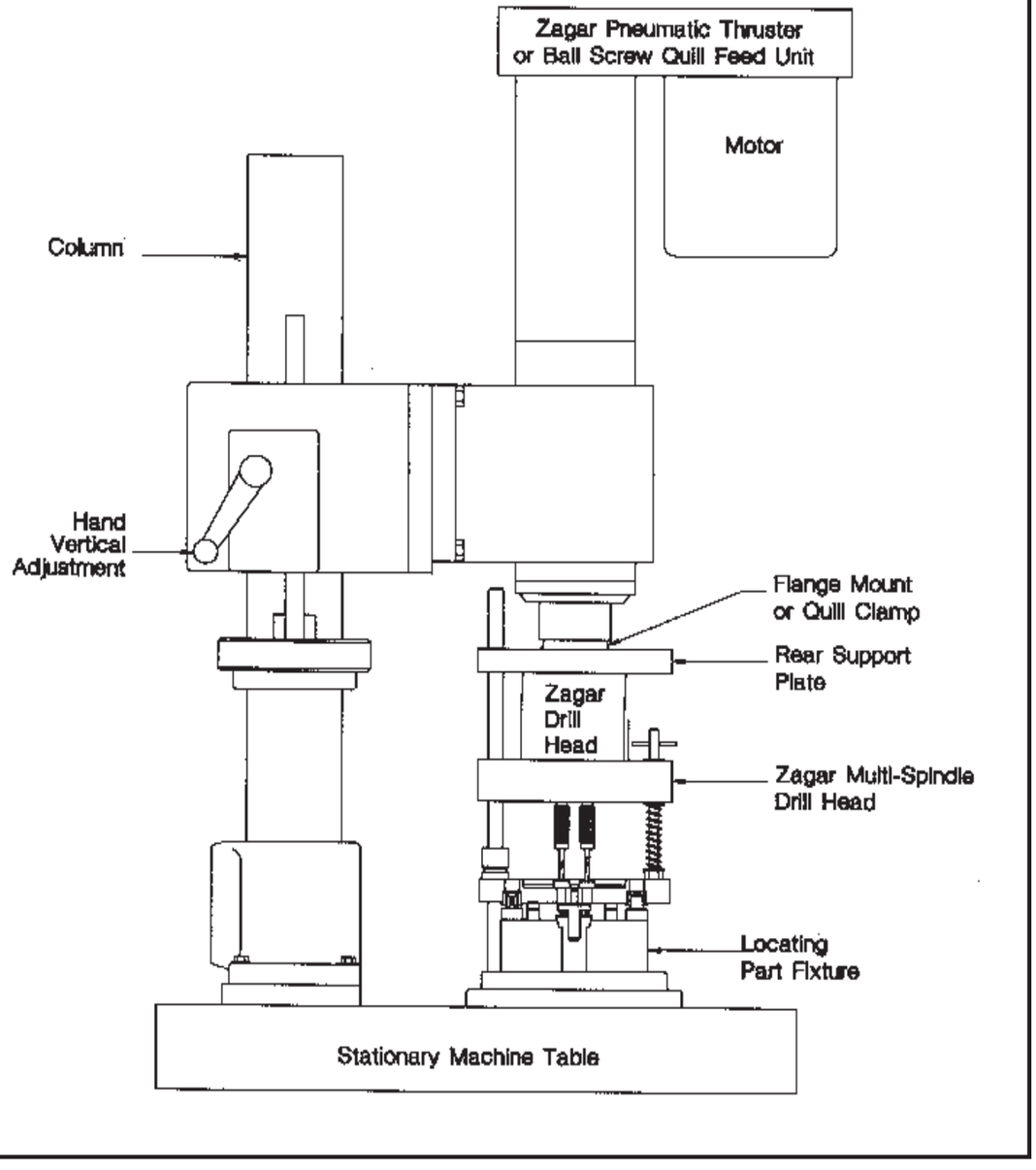
MATERIAL	BRINELL HARDNESS	HOLE DIAMETER							
		1/16"	1/8	1/4	1/2	3/4	1	1 1/2	2
Aluminum	99-101	.001	.003	.007	.012	.016	.020	.025	.030
Aluminum Bronze	170-187	.001	.003	.004	.008	.010	.012	.015	.020
Balkelite	- -	.002	.005	.006	.008	.010	.012	.015	.015
Brass	192-202	.001	.003	.004	.008	.012	.018	.020	.022
Bronze, Common	166-183	.001	.003	.004	.008	.012	.018	.020	.022
Bronze Phos.; 1/2 Hard	187-202	.001	.003	.004	.008	.010	.012	.015	.020
Bronze Phos.; Soft	149-163	.001	.003	.004	.008	.012	.018	.020	.022
Celluloid	—	.002	.004	.005	.006	.006	.008	.008	.010
Copper	80-85	.001	.003	.004	.008	.010	.012	.015	.020
Copper Mang.; 30% Mn	134	.001	.003	.005	.007	.009	.012	.014	.016
Duralumin	90-104	.001	.003	.005	.010	.015	.018	.020	.025
Iron, Cast; Med Soft	196	.001	.003	.005	.008	.010	.012	.014	.015
Iron, Cast; Hard	293-302	—	.001	.003	.005	.007	.009	.012	.012
Iron, Cast; Chilled	402	—	.001	.003	.005	.007	.009	.011	.011
Iron, Malleable	112-126	—	.002	.004	.007	.010	.012	.015	.018
Monel	149-170	—	.002	.003	.006	.008	.010	.012	.015
Nickel, Pure	187-202	—	.002	.003	.006	.008	.015	.018	.020
Nickel, Steel; 3 1/2%	196-241	—	.002	.003	.006	.008	.010	.012	.015
Rubber, Hard	—	.005	.010	.012	.015	.018	.020	.025	.030
Screw Stock, C.R.	170-196	.001	.003	.004	.007	.010	.012	.015	.018
Stl, Carbon	175-225	.001	.003	.004	.007	.010	.012	.015	.018
Stl, Drop Forged	170-196	.001	.002	.004	.007	.010	.012	.015	.018
Stl, Machinery	170-196	.001	.003	.005	.009	.012	.013	.018	.022
Stl, Magnet; Soft	241-302	—	.002	.003	.006	.008	.009	.010	.011
Stl, Magnet; Hard	321-512	—	.0005	.001	.002	.002	.003	.003	.004
Stl, Mang.; 7-13%	187-217	—	.0005	.001	.002	.002	.003	.003	.004
Stl, Mild; .20-.30C	170-202	.001	.003	.005	.010	.015	.018	.020	.025
Stl, Molybdenum	196-235	—	.002	.004	.006	.010	.012	.015	.018
Stl, Spring402	—	.002	.003	.005	.007	.009	.010	.010	
Stl, Stainless	150-225	.001	.002	.004	.006	.008	.011	.013	.016
Stl, Stainless	460-520	—	.0005	.001	.002	.002	.003	.003	.004
Stl, .40-.50c	170-196	.001	.002	.004	.007	.010	.012	.015	.018
Stl, Struct; A-36	160	.001	.003	.005	.010	.015	.018	.020	.025
Stl Tool; SAE, Forged	149	—	.002	.003	.006	.009	.011	.014	.016
Stl, Tool; SAE, Forged	402	—	.0005	.001	.002	.002	.003	.003	.004
Zinc, Alloy	112-126	.002	.003	.007	.012	.016	.018	.020	.025

Tap Holder Reference Chart

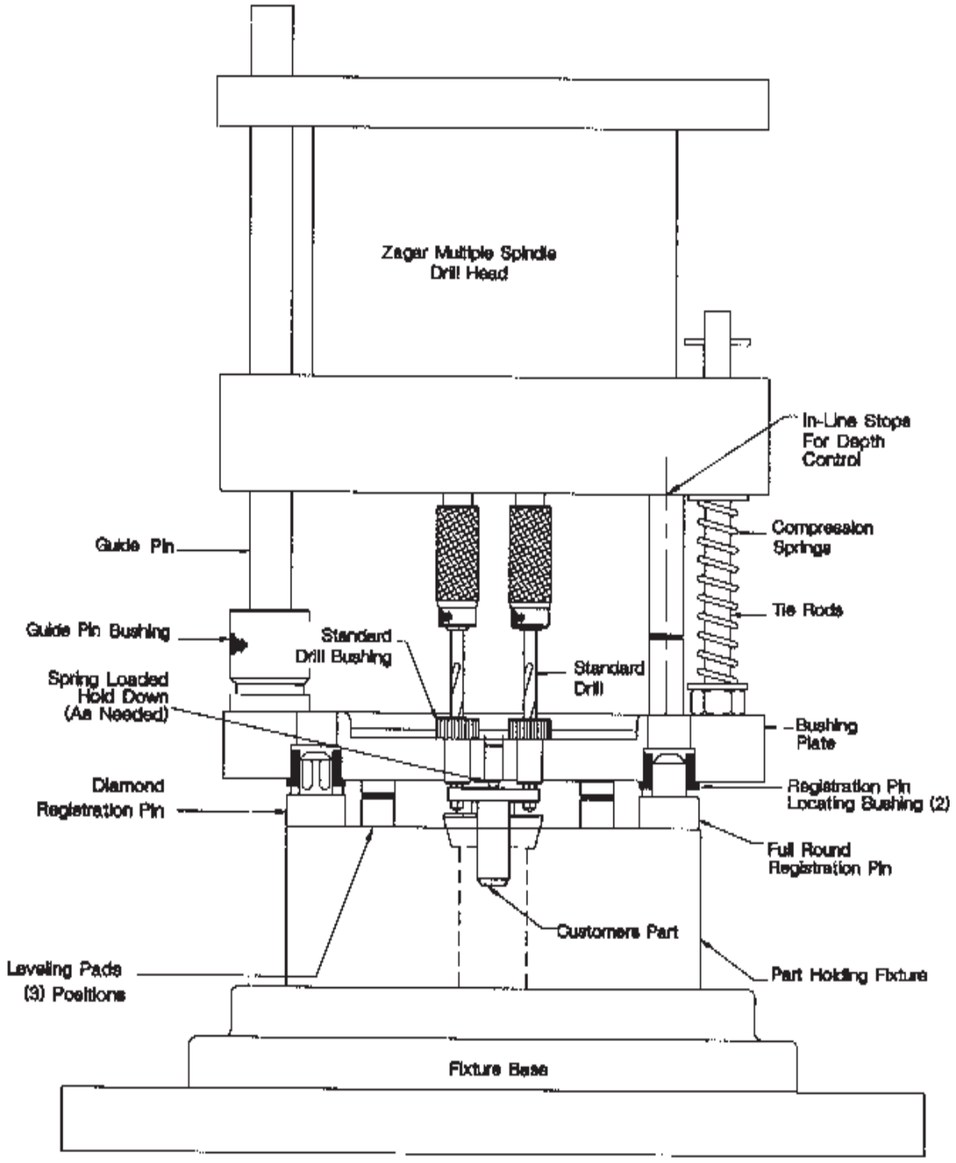
Tap Size	Decimal Equivalent	PITCH (threads per in.)	MM Per Thread	Threads per mm	Tap Size	Decimal Equivalent	Threads Per In.	PITCH (mm per thread)	Threads per mm
.90 mm	.0354				1/4"	.2500	24		
1.0 mm	.0393	101.60	.25	4.000	1/4"	.2500	28		
1.1 mm	.0433	101.60	.25	4.000	1/4"	.2500	32		
1.2 mm	.0472	101.60	.25	4.000	7.0 mm	.2755	25.4	1.00	1.00
1.4 mm	.0551	84.66	.30	3.333	5/16"	.3120	18		
#0	.0600	80			5/16"	.3120	24		
1/16"	.0625	64			8.0 mm	.3149	20.32	1.25	.800
1.7 mm	.0669	72.56	.35	2.857	9.0 mm	.3543	20.32	1.25	.800
1.8 mm	.0708	72.56	.35	2.857	3/8"	.3750	16		
#1	.0730	64			3/8"	.3750	24		
#1	.0730	72			10.0 mm	.3937	16.93	1.50	.666
2.0 mm	.0787	63.50	.40	2.500	11.0 mm	.4330	16.93	1.50	.666
#2	.0860	64			7/16"	.4370	14		
2.3 mm	.0905	63.50	.40	2.500	7/16"	.4370	20		
3/32"	.0625	64			12.0 mm	.4724	14.51	1.75	.571
#3	.0990	48			1/2"	.5000	13		
#3	.0990	56			1/2"	.5000	20		
2.6 mm	.1023	56.43	.45	2.222	14.0 mm	.5510	12.70	2.00	.500
1/8"	.1250	40			5/8"	.6250	11		
#4	.1120	32			5/8"	.6250	18		
#4	.1120	36			16.0 mm	.6299	12.70	2.00	.500
#4	.1120	40			11/16"	.6870	11		
#4	.1120	48			11/16"	.6870	16		
3.0 mm	.1181	50.80	.50	2.000	18.0 mm	.7086	10.16	2.50	.400
#5	.1250	40			3/4"	.7500	10		
#5	.1250	44			3/4"	.7500	16		
3.5 mm	.1378	42.33	.60	1.666	20.0 mm	.7870	10.16	2.50	.400
#6	.1380	32			13/16"	.8120	12		
#6	.1380	40			13/16"	.8120	16		
5/32"	.1562	32			13/16"	.8120	20		
5/32"	.1562	36			13/16"	.8120	28		
4.0 mm	.1574	36.28	.70	1.428	13/16"	.8120	32		
#8	.1640	32			22.0 mm	.8666	10.16	2.50	.400
#8	.1640	36			7/8"	.8750	9		
#8	.1640	40			7/8"	.8750	14		
4.5 mm	.1771	33.86	.75	1.333	15/16"	.9370	12		
3/16"	.1870	24			15/16"	.9370	16		
3/16"	.1870	32			15/16"	.9370	20		
#10	.1900	24			15/16"	.9370	28		
#10	.1900	32			15/16"	.9370	32		
#10	.1900	30			24.0 mm	.9448	8.46	3.00	.333
5.0 mm	.1980	31.75	.80	1.250	1.00"	1.0000	8		
#12	.2160	24			1.00"	1.0000	12		
#12	.2160	28			1.00"	1.0000	14		
#12	.2160	32			27.0 mm	1.0629	8.46	3.00	.333
7/32"	.2188	24			1-1/8"	1.1250	7		
7/32"	.2188	32			1-1/8"	1.1250	12		
6.0 mm	.2326	25.4	1.00	1.00	30.0 mm	1.1810	7.25	3.50	.285
#14	.2420	20			1-1/4"	1.2500	7		
#14	.2420	24			1-1/4"	1.2500	12		
1/4"	.2500	20			33.0 mm	1.2999	7.25	3.50	.285

Stationary Table Application *(Critical Fixture Components)*

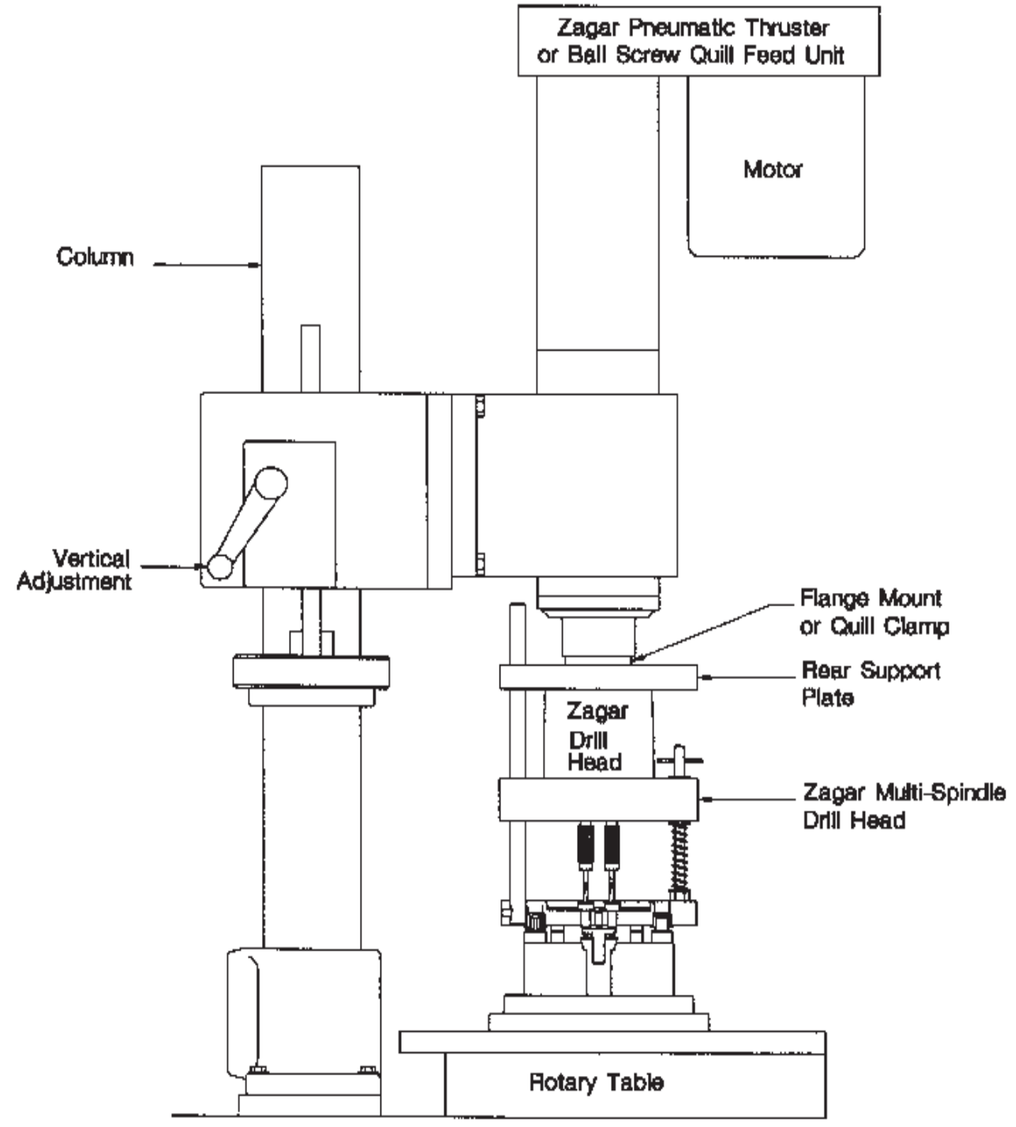
ZAGAR MULTIPLE SPINDLE DRILL HEAD
STATIONARY TABLE APPLICATION
CRITICAL COMPONENTS



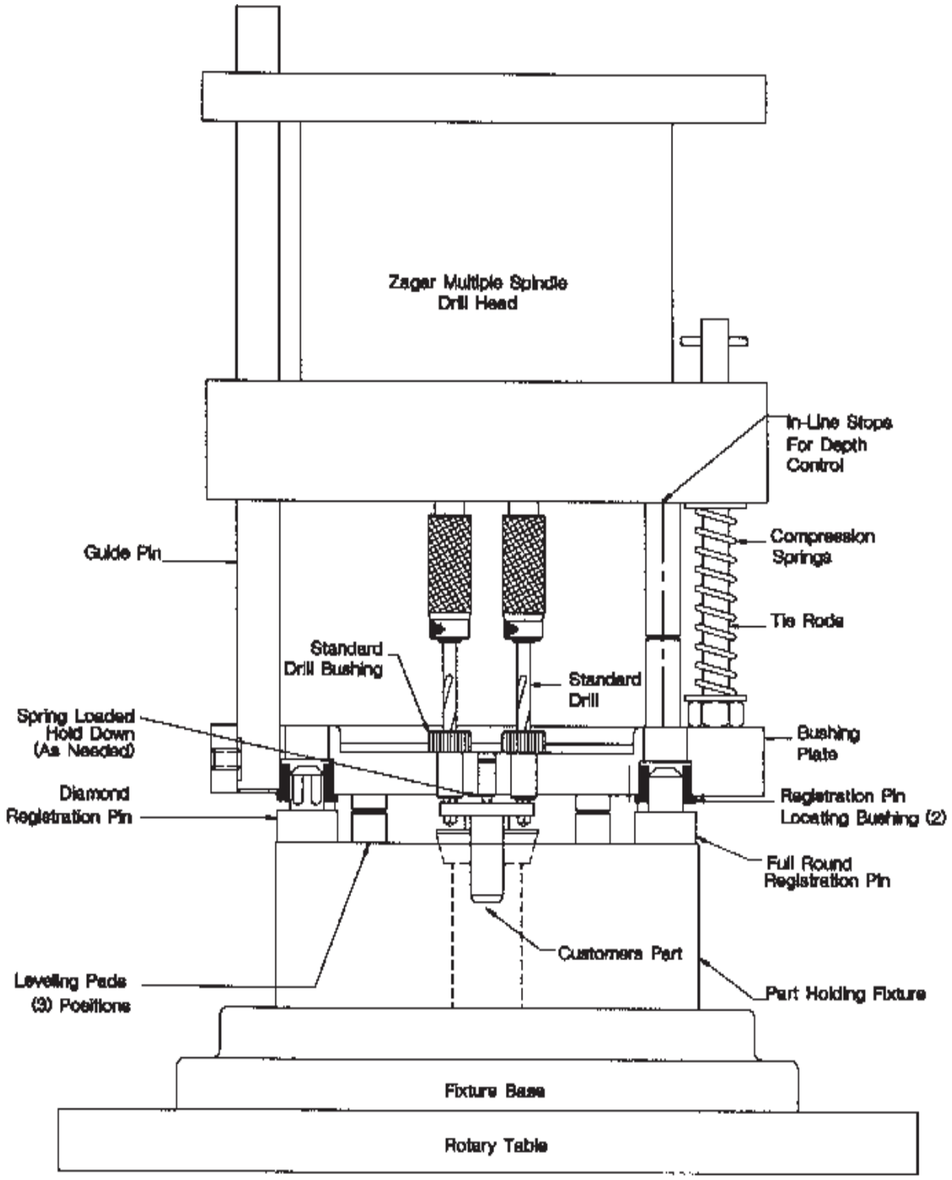
ZAGAR MULTIPLE SPINDLE DRILLING
STATIONARY TABLE APPLICATION
CRITICAL COMPONENTS



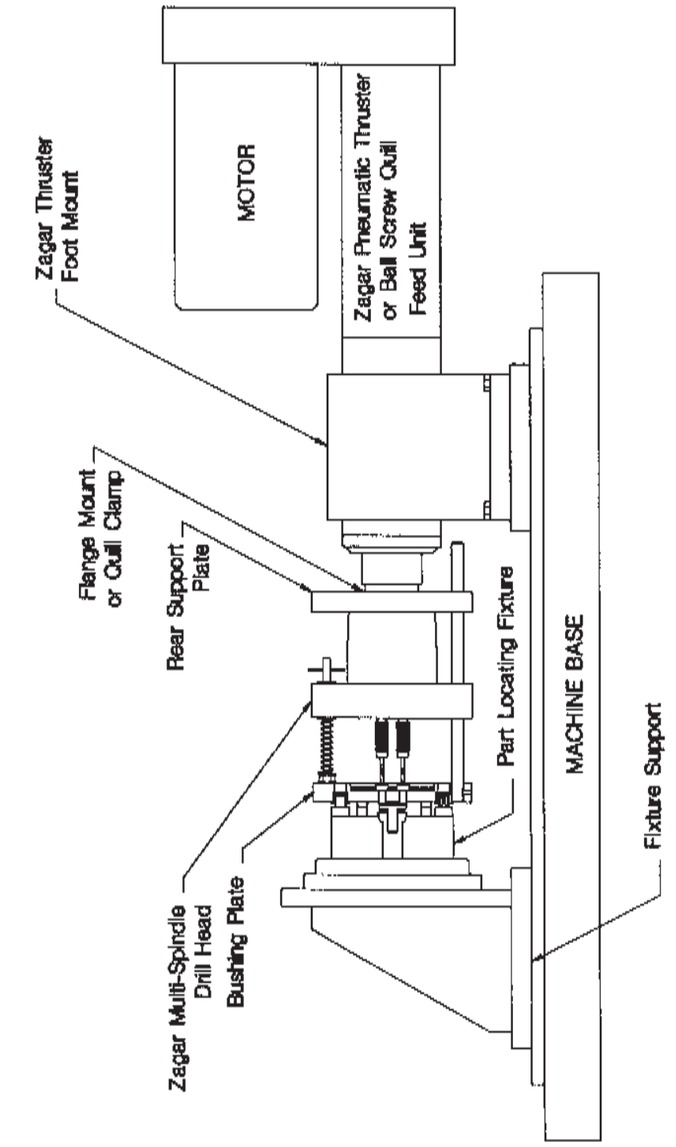
ZAGAR MULTIPLE SPINDLE DRILL HEAD
ROTARY TABLE APPLICATION
CRITICAL COMPONENTS



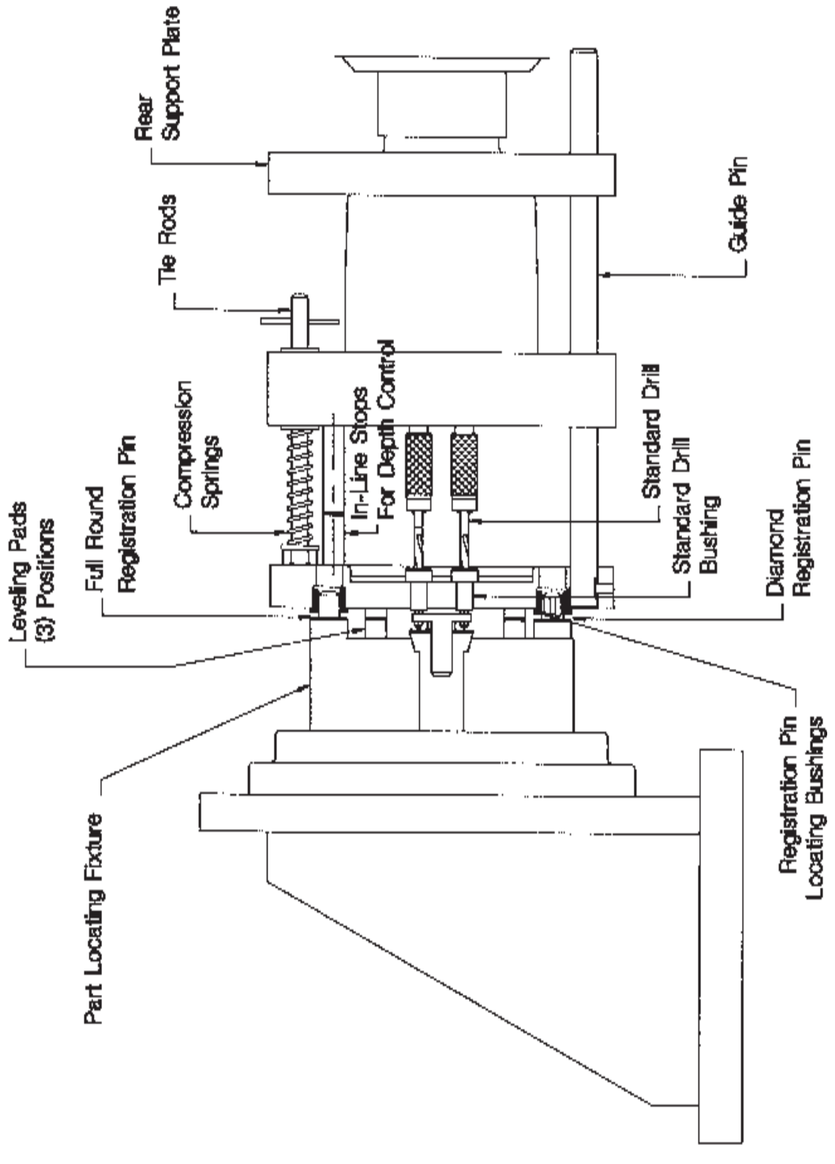
ZAGAR MULTIPLE SPINDLE DRILL HEAD
ROTARY TABLE APPLICATION
CRITICAL COMPONENTS



ZAGAR MULTIPLE SPINDLE DRILL HEAD
HORIZONTAL MACHINES
CRITICAL COMPONENTS



ZAGAR MULTIPLE SPINDLE DRILL HEAD
HORIZONTAL MACHINES
CRITICAL COMPONENTS



Drill Sizes in Decimal Equivalents

Inch	Decimal	Wire	mm	Inch	Decimal	Wire	mm	Inch	Decimal	Wire	mm	Inch	Decimal	Wire	mm	Inch	Decimal	Wire	mm	37/64	.5781		
1/64	.0156			1/16	.0625				.1339		3.40		.2165		5.50		.3248		8.25		.5906		15.0
	.0157		0.40		.0630		1.60		.1360	29		7/32	.2188				.3268		8.30				
	.0160	78			.0635	52			.1378		3.50		.2205		5.60	21/64	.3281			19/32	.5938		
	.0165		0.42		.0650		1.65		.1405	28			.2210	2			.3307		8.40	39/64	.6094		
	.0173		0.44		.0669		1.70	9/64	.1406				.2244		5.70		.3320	Q			.6102		15.5
	.0177		0.45		.0670	51			.1417		3.60		.2264		5.75		.3346		8.50	5/8	.6250		
	.0180	77			.0689		1.75		.1440	27			.2280	1			.3386		8.60		.6299		16.0
	.0181		0.46		.0700	50			.1457		3.70		.2283		5.80		.3390	R		41/64	.6406		
	.0189		0.48		.0709		1.80		.1470	26			.2323		5.90		.3425		8.70		.6496		16.5
	.0197		0.50		.0728		1.85		.1476		3.75		.2340	A		11/32	.3438			21/32	.6562		
	.0200	76			.0730	49			.1495	25		15/64	.2344				.3445		8.75		.6693		17.0
	.0210	75			.0748		1.90		.1496		3.80		.2362		6.00		.3465		8.80	43/64	.6719		
	.0217		0.55		.0760	48			.1520	24			.2380	B			.3480	S		11/16	.6875		
	.0225	74			.0768		1.95		.1535		3.90		.2402		6.10		.3504		8.90		.6890		17.5
	.0236		0.60	5/64	.0781				.1540	23			.2420	C			.3543		9.00	45/64	.7031		
	.0240	73			.0785	47		5/32	.1562				.2441		6.20		.3580	T			.7087		18.0
	.0250	72			.0787		2.00		.1570	22			.2460	D			.3583		9.10	23/32	.7188		
	.0256		0.65		.0807		2.05		.1575		4.00		.2461		6.25	23/64	.3594				.7283		18.5
	.0260	71			.0810	46			.1590	21			.2480		6.30		.3622		9.20	47/64	.7344		
	.0276		0.70		.0820	45			.1610	20		1/4	.2500	E			.3642		9.25		.7480		19.0
	.0280	70			.0827		2.10		.1614		4.10		.2520		6.40		.3661		9.30	3/4	.7500		
	.0292	69			.0846		2.15		.1654		4.20		.2559		6.50		.3680	U		49/64	.7656		
	.0295		0.75		.0860	44			.1660	19			.2570	F			.3701		9.40		.7677		19.5
	.0310	68			.0866		2.20		.1673		4.25		.2598		6.60		.3740		9.50	25/32	.7812		
1/32	.0312				.0886		2.25		.1693		4.30		.2610	G		3/8	.3750				.7874		20.0
	.0315		0.80		.0890	43			.1695	18			.2638		6.70		.3770	V		51/64	.7969		
	.0320	67			.0906		2.30	11/64	.1719			17/64	.2656				.3780		9.60		.8071		20.5
	.0330	66			.0925		2.35		.1730	17			.2657		6.75		.3819		9.70	13/16	.8125		
	.0335		0.85		.0935	42			.1732		4.40		.2660	H			.3839		9.75		.8268		21.0
	.0350	65		3/32	.0938				.1770	16			.2677		6.80		.3858		9.80	53/64	.8281		
	.0354		0.90		.0945		2.40		.1772		4.50		.2717		6.90		.3860	W		27/32	.8438		
	.0360	64			.0960	41			.1800	15			.2720	I			.3898		9.90		.8465		21.5
	.0370	63			.0965		2.45		.1811		4.60		.2756		7.00	25/64	.3906			55/64	.8594		
	.0374		0.95		.0980	40			.1820	14			.2770	J			.3937		10.0		.8661		22.0
	.0380	62			.0981		2.50		.1850	13			.2795		7.10		.3970	X		7/8	.8750		
	.0390	61			.0995	39			.1850		4.70		.2810	K			.4040	Y			.8858		22.5
	.0394		1.00		.1015	38			.1870		4.75	9/32	.2812			13/32	.4062			57/64	.8906		
	.0400	60			.1024		2.60	3/16	.1875				.2835		7.20		.4130	Z			.9055		23.0
	.0410	59			.1040	37			.1890		4.80		.2854		7.25		.4134		10.5	29/32	.9062		
	.0413		1.05		.1063		2.70		.1890	12			.2874		7.30	27/64	.4219			59/64	.8906		
	.0420	58			.1065	36			.1910	11			.2900	L			.4331		11.0		.9252		23.5
	.0430	57			.1083		2.75		.1929		4.90		.2913		7.40	7/16	.4375			15/16	.9375		
	.0433		1.10	7/64	.1094				.1935	10			.2950	M			.4528		11.5		.9445		24
	.0453		1.15		.1100	35			.1960	9			.2953		7.50	29/64	.4531			61/64	.9531		
	.0465	56			.1102		2.80		.1969		5.00	19/64	.2969			15/32	.4688				.9646		24.5
3/64	.0469				.1110	34			.1990	8			.2992		7.60		.4724		12.0	31/32	.9688		
	.0472		1.20		.1130	33			.2008		5.10		.3020	N		31/64	.4844				.9843		25.0
	.0492		1.25		.1142		2.90		.2010	7			.3031		7.70		.4921		12.5	63/64	.9844		
	.0512		1.30		.1160	32		13/64	.2031				.3051		7.75	1/2	.5000			1"	1.000		
	.0520	55			.1181		3.00		.2040	6			.3071		7.80		.5118		13.0				
	.0531		1.35		.1200	31			.2047		5.20		.3110		7.90	33/64	.5156						
	.0550	54			.1220		3.10		.2055	5		5/16	.3125			17/32	.5312						
	.0551		1.40	1/8	.1250				.2067		5.25		.3150		8.00		.5315		13.5				
	.0571		1.45		.1260		3.20		.2087		5.30		.3160	O		35/64	.5469						
	.0591		1.50		.1280		3.25		.2090	4			.3189		8.10		.5512		14.0				
	.0595	53			.1285	30			.2126		5.40		.3228		8.20	9/16	.5625						
	.0610		1.55		.1299		3.30		.2130	3			.3230	P			.5709		14.5				

Inch Decimal Wire mm

TAP DRILL SIZES FOR CUT AND FORMED THREADS

TAP SIZE	TAP DRILL SIZE				TAP SIZE	TAP DRILL SIZE				TAP SIZE	TAP DRILL SIZE			
	Cut Thread		Formed Thread			Cut Thread		Formed Thread			Cut Thread		Formed Thread	
0-80	3/64	.0469	54	.0545	8-32	29	.1360	25	.1495	7/16-14	U	.3680	13/32	.406
1-64	53	.0595	1.65 mm	.065	8-36	29	.1360	24	.1520	7/16-20	25/64	.3906	10.5 mm	.4134
1-72	53	.0595	1.7 mm	.0669	10-24	23	.1540	11/64	.1719	1/2-13	27/64	.4219	*	.466
2-56	50	.0700	5/64	.0781	10-32	20	.1610	16	.1770	1/2-20	29/64	.4531	*	.478
2-64	50	.0700	2 mm	.0787	12-24	15	.1800	5 mm	.1968	9/16-12	31/64	.4844	*	.525
3-48	46	.0810	43	.089	12-28	13	.1850	8	.1990	9/16-18	33/64	.5156	*	.538
3-56	45	.0820	2.3 mm	.0906	1/4-20	13/64	.2031	1	.2280	5/8-11	35/64	.5469	*	.584
4-40	43	.0890	39	.0995	1/4-28	7/32	.2187	A	.2340	5/8-18	37/64	.5781	*	.600
4-48	3/32	.0938	2.6 mm	.1024	5/16-18	G	.2610	7.3 mm	.2874	11/16-11	39/64	.6094	*	.646
5-40	38	.1015	33	.113	5/16-24	J	.2770	M	.2950	11/16-16	5/8	.6250	*	.660
5-44	37	.1040	2.9 mm	.1142	3/8-16	O	.3160	S	.3480	3/4-10	21/32	.6562	45/64	.7031
6-32	34	.1110	1/8	.125	3/8-24	R	.3390	T	.358	3/4-16	11/16	.6875	*	.722
6-40	32	.1160	3.2 mm	.1260										

NOTE: Cut thread tap drill sizes are for 2 B threads. Formed thread tap drill sizes are for approximately 65% thread. *Special drill sizes