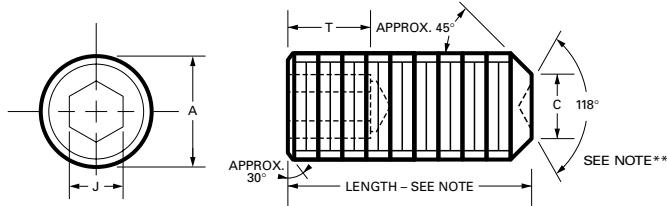
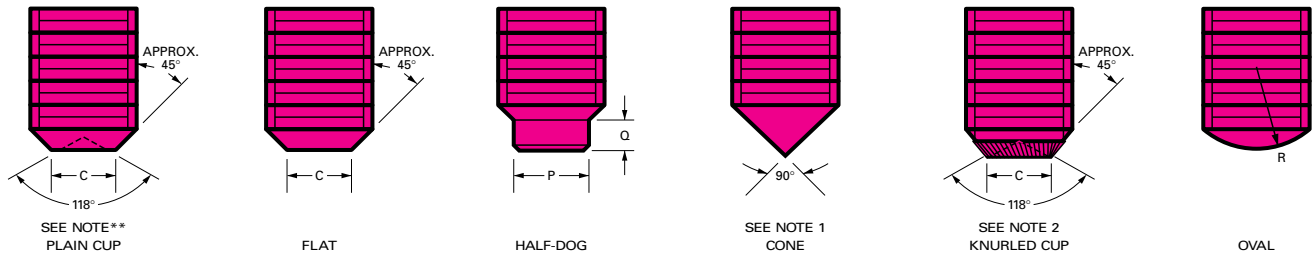


## SOCKET SET SCREWS ■ Dimensions ■ Application Data ■ Seating Torques



### LENGTH TOLERANCE

Diameter	.63 and under	over .63 to 2"	over 2" to 6"	over 6"
All	±.01	±.02	±.03	±.06



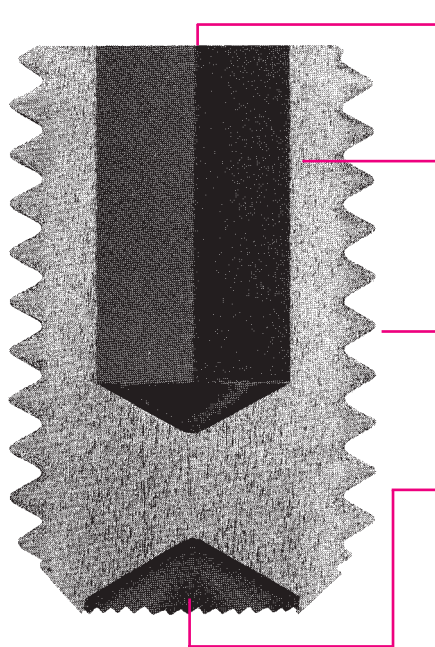
### DIMENSIONS

nom. size	basic screw diameter	threads per inch		A			C		P	
		UNRC	UNRF	max.	UNRC	UNRF	max.	min.	max.	min.
#0	.060	—	80	.0600	—	.0568	.033	.027	.040	.037
#1	.073	64	72	.0730	.0692	.0695	.040	.033	.049	.045
#2	.086	56	64	.0860	.0819	.0822	.047	.039	.057	.053
#3	.099	48	56	.0990	.0945	.0949	.054	.045	.066	.062
#4	.112	40	48	.1120	.1069	.1075	.061	.051	.075	.070
#5	.125	40	44	.1250	.1199	.1202	.067	.057	.083	.078
#6	.138	32	40	.1380	.1320	.1329	.074	.064	.092	.087
#8	.164	32	36	.1640	.1580	.1585	.087	.076	.109	.103
#10	.190	24	32	.1900	.1825	.1840	.102	.088	.127	.120
1/4	.250	20	28	.2500	.2419	.2435	.132	.118	.156	.149
5/16	.312	18	24	.3125	.3038	.3053	.172	.156	.203	.195
3/8	.375	16	24	.3750	.3656	.3678	.212	.194	.250	.241
7/16	.437	14	20	.4375	.4272	.4294	.252	.232	.297	.287
1/2	.500	13	20	.5000	.4891	.4919	.291	.207	.344	.334
9/16	.562	12	18	.5625	.5511	.5538	.332	.309	.390	.379
5/8	.625	11	18	.6250	.6129	.6163	.371	.347	.469	.456
3/4	.750	10	16	.7500	.7371	.7406	.450	.425	.562	.549
7/8	.875	9	14	.8750	.8611	.8647	.530	.502	.656	.642
1	1.000	8	12	1.0000	.9850	.9886	.609	.579	.750	.734
1 1/8	1.125	7	12	1.1250	1.1086	1.1136	.689	.655	.844	.826
1 1/4	1.250	7	12	1.2500	1.2336	1.2386	.767	.733	.938	.920
1 3/8	1.375	6	12	1.3750	1.3568	1.3636	.848	.808	1.031	1.011
1 1/2	1.500	6	12	1.5000	1.4818	1.4886	.926	.886	1.125	1.105

**NOTE:** Performance data listed are for standard production items only. Non-stock items may vary due to variables in methods of manufacture. It is suggested that the user verify performance on any non-standard parts for critical applications.

# SOCKET SET SCREWS

Dimensions ■ Application Data ■ Seating Torques



Deep socket – Key fits deeply into socket to provide extra wrenching area for tighter tightening without reaming the socket or rounding off corners of key

Continuous grain flow – Flow lines of rolled threads follow closely the contour of the screw

Fully formed threads – are rolled, not cut or ground. Metal is compressed, making it extra strong. Threads resist shearing, withstand higher tightening torques

Class 3A threads – Formed with closest interchangeable fit for maximum cross-section with smooth assembly. Assure better mating of parts

Counterbored knurled cup point

## NOTES

**Material:** ASTM F912 – alloy steel  
ASTM F880 – stainless steel

**Dimensions:** ASME/ANSI B18.3

**Hardness:** Rc 45-53 (alloy steel only),  
Rb 96-Rc 33 (stainless steel)

**Thread class:** 3A

1. When length equals nominal diameter or less, included angle is 118°. (#4 x 1/8 and #8 x 3/16 also have 118 angle)

2. When length equals nominal diameter or less, included angle is 130°.

## DIMENSIONS

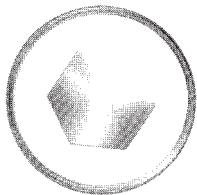
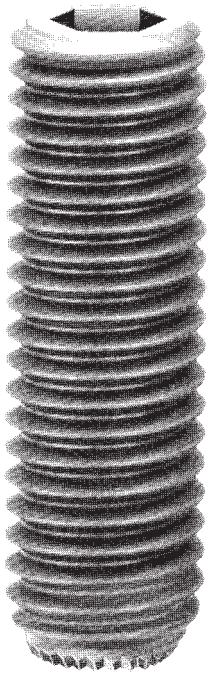
## RECOMMENDED SEATING TORQUES – INCH-LBS.\*\*

	Q		T*	J	R	Applicable only to nominal minimum lengths shown or longer			
	max.	min.				min.	nom.	basic	alloy steel
	.017	.013	.035	.028	.045	1.0	.4	3/32	.050
	.021	.017	.035	.035	.055	1.8	1.2	1/8	.060
	.024	.020	.035	.035	.064	1.8	1.2	1/8	.060
	.027	.023	.060	.050	.074	5	4	5/32	.070
	.030	.026	.075	.050	.084	5	4	5/32	.070
	.033	.027	.075	.0625	.094	10	7	5/32	.080
	.038	.032	.075	.0625	.104	10	7	3/16	.080
	.043	.037	.075	.0781	.123	20	16	3/16	.090
	.049	.041	.105	.0937	.142	36	26	3/16	.100
	.067	.059	.105	.125	.188	87	70	5/16	.125
	.082	.074	.140	.1562	.234	165	130	3/8	.156
	.099	.089	.140	.1875	.281	290	230	7/16	.188
	.114	.104	.190	.2187	.328	430	340	1/2	.219
	.130	.120	.210	.250	.375	620	500	9/16	.250
	.146	.136	.265	.250	.422	620	500	5/8	.250
	.164	.148	.265	.3125	.469	1,325	980	11/16	.312
	.196	.180	.330	.375	.562	2,400	1,700	3/4	.375
	.227	.211	.450	.500	.656	3,600	3,000	3/4	.500
	.260	.240	.550	.5625	.750	5,000	4,000	7/8	.562
	.291	.271	.650	.5625	.844	7,200	5,600	1	.562
	.323	.303	.700	.625	.938	9,600	7,700	1 1/8	.625
	.354	.334	.700	.625	1.031	9,600	7,700	1 1/4	.625
	.385	.365	.750	.750	1.125	11,320	9,100	1 1/4	.750

**\*CAUTION:** Values shown in column T are for minimum stock length cup point screws. Screws shorter than nominal minimum length shown do not have sockets deep enough to utilize full key capability which can result in failure of socket, key or mating threads.

\*\*See Note, page 1.

## SOCKET SET SCREWS ■ Point Selection According to Application



Socket set screws offer three types of holding power: torsional (resistance to rotation); axial (resistance to lateral movement); and vibrational.

**Size selection** is an important factor in holding power. The screw diameter should be roughly 1/2 that of the shaft as a rule-of-thumb. (For more specific size data see pages 18–19.) Additional design considerations appear below.

**Holding power** is almost directly proportional to seating torque in a cup, flat, and oval point screws. Holding power can be increased by increasing seating torque. Greater holding power reduces the number of screws required and the assembled cost of the application.

By its penetration, the set screw point can add as much as 15% to total holding power. Cone points, with

deepest penetration, give the greatest increase; oval points, with minimum penetration, the least. Making 1 the index for cup point, holding power values from tables on pages 22 and 23 can be multiplied by 1.07 for cone point, 0.92 for flat or dog points, and 0.90 for oval point.

**Relative hardness** between set screw and shaft is also a factor. A 10-point differential between the screw's normal Rockwell C 50 and shaft should be maintained for full holding power. As much as 15% loss in holding power can result from a lower differential.

**Vibration resistance** can be achieved by correct size and proper tightening. The UNBRAKO knurl cup set screw offers additional mechanical locking resistance when required.

### POINT SELECTION

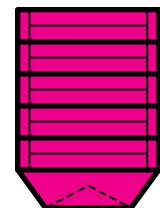
#### According to Application

Point selection is normally determined by the nature of the application – materials, their relative hardness, frequency of assembly and re-assembly and other factors. Reviewed here are standard point types, their general features and most frequent areas of application of each type.



#### knurled cup

For quick and permanent location of gears, collars, pulleys or knobs on shafts. Exclusive counterclockwise locking knurls resist screw loosening, even in poorly tapped holes. Resists most severe vibration.



#### plain cup

Use against hardened shafts, in zinc, die castings and other soft materials where high tightening torques are impractical.

# SOCKET SET SCREWS

## Point Selection According to Application

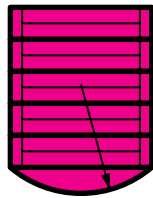
### STAINLESS STEEL ADVANTAGES

- Corrosion resistance, Wide temperature range ( $-300^{\circ}$  F to  $+800^{\circ}$  F), Freedom from scaling or oxidation.
- Non-magnetic, a valuable property in certain electrical and electronic applications. (Maximum permeability is 1.2 and can be reduced to 1.02 by bright annealing.) Corrosion-resistance useful where cleanliness is important.
- Standard processing of these socket set screws includes a passivation treatment which neutralizes surface contamination.



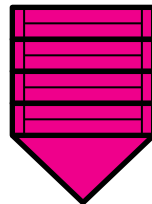
#### flat

Use where parts must be frequently re-set, as it causes little or no damage to part it bears against. Can be used against hardened shafts (usually with ground flat for better contact) and as adjusting screw. Preferred for thin wall thickness and on soft plugs.



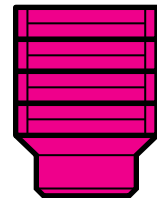
#### oval

Use for frequent adjustment without deformation of part it bears against, also for seating against an angular surface. Circular U-grooves or axial V-grooves sometimes put in shaft to permit rotational or longitudinal adjustment.



#### cone

For permanent location of parts. Deep penetration gives highest axial and holding power. In material over Rockwell C15 point is spotted to half its length to develop shear strength across point. Used for pivots and fine adjustment.



#### half dog

Used for permanent location of one part to another. Point is spotted in hole drilled in shaft or against flat (milled). Often replaces dowel pins. Works well against hardened members or hollow tubing.

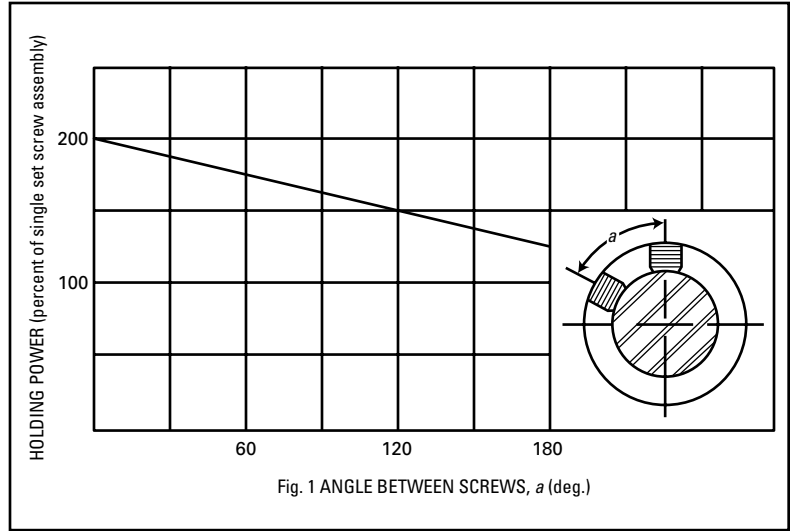
## SOCKET SET SCREWS ■ Torsional and Axial Holding Power

### SIZE SELECTION OF SOCKET SET SCREWS

The user of a set-screw-fastened assembly is primarily buying static holding power. The data in this chart offers a simplified means for selecting diameter and seating torque of a set screw on a given diameter shaft.

Torsional holding power in inch-pounds and axial holding power in pounds are tabulated for various cup point socket screws, seated at recommended installation torques. Shafting used was hardened to Rockwell C15. Test involved Class 3A screw threads in Class 2B tapped holes. Data was determined experimentally in a long series of tests in which holding power was defined as the minimum load to produce 0.010 inch relative movement of shaft and collar.

From this basic chart, values can be modified by percentage factors to yield suitable design data for almost any standard set screw application.



### NOTES

Tabulated axial and torsional holding powers are typical strengths and should be used accordingly, with specific safety factors appropriate to the given application and load conditions. Good results have been obtained with a factor of 1.5-2.0 under static load conditions (i.e., where a collar is supporting a vertical load on a post) and of 4.0-8.0 for various dynamic situations.

Values in bold type in the chart indicate recommended set screw sizes on the basis that screw diameter should be roughly one-half shaft diameter.

### TORSIONAL and AXIAL HOLDING POWER (Based on Recommended Seating Torques – Inch-Lbs.)

nom. size	seating torque inch-lbs.	axial holding power (pounds)	shaft diameter (shaft hardness Rc 15 to Rc 35)											
			1/16	3/32	1/8	5/32	3/16	7/32	1/4	5/16	3/8	7/16	1/2	9/16
			torsional holding power inch-lbs.											
#0	1.0	50	1.5	2.3	3.1	3.9	4.7	5.4	6.2					
#1	1.8	65	2.0	<b>3.0</b>	4.0	5.0	6.1	7.1	8.1	10.0				
#2	1.8	85	2.6	4.0	<b>5.3</b>	6.6	8.0	9.3	10.6	13.2	16.0			
#3	5	120	3.2	5.6	7.5	<b>9.3</b>	11.3	13.0	15.0	18.7	22.5	26.3		
#4	5	160		7.5	10.0	12.5	<b>15.0</b>	17.5	20.0	25.0	30.0	35.0	40.0	
#5	10	200			12.5	15.6	18.7	<b>21.8</b>	<b>25.0</b>	31.2	37.5	43.7	50.0	56.2
#6	10	250				19	23	27	31	<b>39</b>	47	55	62	70
#8	20	385				30	36	42	48	60	<b>72</b>	84	96	108
#10	36	540					51	59	68	84	101	<b>118</b>	135	152
1/4	87	1,000							125	156	187	218	<b>250</b>	<b>281</b>
5/16	165	1,500								234	280	327	375	421
3/8	290	2,000									375	437	500	562
7/16	430	2,500											545	625
1/2	620	3,000												750
9/16	620	3,500												702
5/8	1,325	4,000												843
3/4	2,400	5,000												985
7/8	3,600	5,600												
1	5,000	6,500												

# SOCKET SET SCREWS

## Torsional and Axial Holding Power

If you know set screws, you know that the tighter you can tighten them, the better they hold and the more they resist loosening from vibration. But there's a limit to how much you can tighten the average socket set screw. If you're not careful, you can ream or crack the socket, and in some cases, even strip the threads. So you're never quite sure whether or not it will actually stay tight.

With UNBRAKO set screws it's a different story. A unique combination of design and carefully controlled manufacturing and heat treating gives these screws extra strength that permits you to tighten them appreciably tighter than ordinary screws with minimal fear of reaming or cracking the socket. This extra strength represents a substantial bonus of extra holding power and the additional safety and reliability that goes with it.

**Design** – Deeper UNBRAKO sockets give more key engagement to let you seat the screws tighter. Corners are radiused to safeguard against reaming or cracking the socket when the extra tightening torque is applied. The sharp corners of other set screws create high stress concentrations and

can cause cracking, even at lower tightening torques. By eliminating the corners, the radii distribute tightening stresses to reduce the chance of splitting to a minimum.

**Controlled Manufacturing** – The fully-formed threads of UNBRAKO set screws are rolled under extreme pressure to minimize stripping and handle the higher tightening torques. Also, with rolled threads, tolerances can be more closely maintained. UNBRAKO set screws have Class 3A threads, closest interchangeable fit, giving maximum cross-section with smooth assembly. The thread form itself has the radiused root that increases the strength of the threads and resistance to shear.

**Controlled Heat Treatment** – This is the third element of the combination. Too little carbon in the furnace atmosphere (decarburization) makes screws soft, causing reamed sockets, stripped threads and sheared points when screws are tightened. Too much carbon (carburization) makes screws brittle and liable to crack or fracture. The heat treatment is literally tailored to each "heat" of UNBRAKO screws, maintaining the necessary controlled

Rc 45-53 hardness for maximum strength.

Finally, point style affects holding power. As much as 15% more can be contributed, depending on the depth of penetration. The cone point (when used without a spotting hole in the shaft) gives greatest increase because of its greater penetration. The oval point, with the least contact area, affords the least. The cup point lies in between, but is by far the most commonly used, because of the wide range of applications to which it is adaptable.

However, there is one cup point that can give you both a maximum of holding power and of resistance to vibration. It is the exclusive UNBRAKO knurled cup point, whose locking knurls bite into the shaft and resist the tendency of the screw to back out of the tapped hole. The chart on this page shows clearly how much better the UNBRAKO set screws resist vibration in comparison with plain cup point set screws. UNBRAKO knurled cup point self-locking set screws give you excellent performance under conditions of extreme vibration.

**UNBRAKO SOCKET SET SCREWS – UNRC or UNRF Thread – Seated Against Steel Shaft**

nom. size	seating torque inch-lbs.	axial holding power (pounds)	shaft diameter (shaft hardness Rc 15 to Rc 35)												
			5/8	3/4	7/8	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3	3 1/2	4	
			torsional holding power inch-lbs.												
#0	1.0	50													
#1	1.8	65													
#2	1.8	85													
#3	5	120													
#4	5	160													
#5	10	200	62												
#6	10	250	78	94	109										
#8	20	385	120	144	168	192									
#10	36	540	169	202	236	270	338								
1/4	87	1,000	312	357	437	500	625	750							
5/16	165	1,500	468	562	656	750	937	1125	1310	1500					
3/8	290	2,000	625	750	875	1000	1250	1500	1750	2000					
7/16	430	2,500	780	937	1095	1250	1560	1875	2210	2500	3125				
1/2	620	3,000	937	1125	1310	1500	1875	2250	2620	3000	3750	4500			
9/16	620	3,500	1090	1310	1530	1750	2190	2620	3030	3500	4370	5250	6120		
5/8	1,325	4,000	1250	1500	1750	2000	2500	3000	3750	4000	5000	6000	7000	8000	
3/4	2,400	5,000		1875	2190	2500	3125	3750	4500	5000	6250	7500	8750	10000	
7/8	3,600	5,600			2620	3000	3750	4500	5250	6000	7500	9000	10500	12000	
1	5,000	6,500				3500	4375	5250	6120	7000	8750	10500	12250	14000	