

SOCKET SET SCREWS

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 care-ful, 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 plain cup point 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 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.



SOCKET SET SCREWS



In contrast to other types of fasteners, set screws are primarily used in compression. They must hold fast against three types of forces, torsional (rotational), axial (lateral movement) and vibrational. To be effective, socket set screws should produce a strong clamping action which resists the relative motion between the assembled parts, because of the compression developed by tightening the set screw. Since holding power is proportional to seating torque, the tighter you can seat the screw, the higher the compression force will be.

But there is a limit to how much you can tighten the average set screw. If you're not careful, you'll ream or crack the socket, or strip the threads. So you're never sure if the screw is tight enough, and whether it will stay tight.

But you can be sure that Unbrako set screws will 'stay put' because you can tighten them until the key twists off, with no damage to the screws. Unbrako recommend tightening torques as much as 40% higher than other set screws, giving you extra holding power and additional safety and reliability. Unbrako socket set screws hold tighter because

they are stronger than other set screws. The superior strength and dimensional uniformity of Unbrako set screws permit use of consistently higher seating torques than with other set screws. Consequently you can often save money because you can reduce the size or the number of set screws you require in your assembly.

Here are some of the reasons why Unbrako set screws are so strong and stay tight. Unbrako set screws are made of high grade alloy steel and heat treated to a minimum hardness of Rc 45. Deep accurate sockets give more key engagement for extra wrenching areas. Radiused socket corners minimize points of weakness where cracks may start. Distribute stresses. Fully formed rolled threads provide greater strength and resistance to stripping. Controlled heat treatment assures uniform hardness without brittleness.

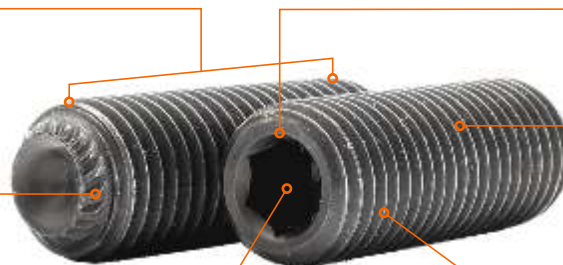
Unbrako socket set screws are available in knurled cup, cone, half dog, flat and plain cup point styles in plain or plated finishes. Stainless steel set screws are available in plain cup points only.

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

Radiused socket corners – Rounded corners resist cracking and allow UNBRAKO set screws to withstand high tightening torques

Counterbored knurled cup point – Exclusive UNBRAKO self-locking point provides 5 times greater vibrational holding power than other knurled points

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

Balanced heat treatment – It's customized to individual lots of screws for uniform hardness, assuring maximum strength without brittleness

Socket Set Screws

Knurled, Plain, Flat and Cone Point

Metric



Fasten collars, sheaves, gears, knobs on shafts. Locate machine parts. Self-locking knurled cup point is standard. Special Points like Flat, Dog, Cone & Plain Cup are also available.

Mechanical Properties

Unbrako High Grade Alloy Steel
Hardness: Rc 45 Minimum

Notes

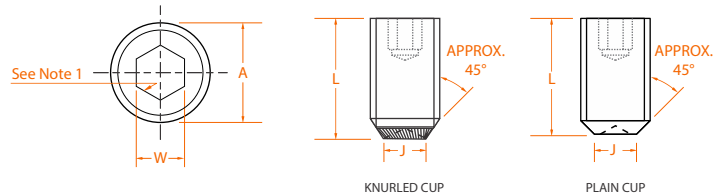
1. Corner of recess must have fillets to minimise stress concentrations.
2. Thread Class: 6g
3. Working Temperature: -50°C to +300°C
4. Angle: The cup angle is 135 max for screw lengths equal to or smaller than screw diameter. For longer lengths, the cup angle will be 124 max.
5. Torques calculated at 75% of the torsional shear strength of the respective Unbrako wrenches.

Maximum Tightening Torque

| Thread size | Nm | lbf.in. |
|-------------|--------|---------|
| M3 | 0.87 | 7.7 |
| M4 | 2.20 | 19.5 |
| M5 | 4.60 | 41.0 |
| M6 | 7.80 | 69.0 |
| M8 | 18.00 | 160.0 |
| M10 | 36.00 | 320.0 |
| M12 | 62.00 | 550.0 |
| (M14) | 62.00 | 550.0 |
| M16 | 150.00 | 1330.0 |
| (M18) | 290.00 | 2570.0 |
| M20 | 290.00 | 2570.0 |
| (M22) | 475.00 | 4200.0 |
| M24 | 475.00 | 4200.0 |

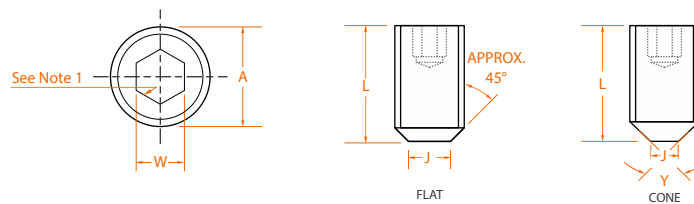
Length Tolerance

| Screws Over | Up to and including | Tolerance |
|-------------|---------------------|--------------|
| - | Screw Dia | +0.25 - 0.00 |
| Screw Dia | 50 | ±0.25 |
| 50 | 80 | ±0.50 |
| 80 | 120 | ±0.70 |
| 120 | 250 | ±0.80 |



Product Dimensions

| Thread size A nom. | Pitch | Hex Socket Size W nom. | Knurled Cup Point | | Plain Cup Point | |
|--------------------|-------|------------------------|-------------------|-------------------|-----------------|-------------------|
| | | | J max | L - min preferred | J max | L - min preferred |
| M2.5 | 0.45 | 1.27 | - | - | 1.2 | 3.0 |
| M3 | 0.50 | 1.5 | 1.30 | 3.0 | 1.4 | 3.0 |
| M4 | 0.70 | 2.0 | 2.10 | 3.0 | 2.0 | 3.0 |
| M5 | 0.80 | 2.5 | 2.40 | 4.0 | 2.5 | 4.0 |
| M6 | 1.00 | 3.0 | 3.30 | 5.0 | 3.0 | 4.0 |
| M8 | 1.25 | 4.0 | 4.30 | 6.0 | 5.0 | 5.0 |
| M10 | 1.50 | 5.0 | 5.25 | 8.0 | 6.0 | 6.0 |
| M12 | 1.75 | 6.0 | 6.60 | 10.0 | 8.0 | 8.0 |
| (M14) | 2.00 | 6.0 | 8.10 | 12.0 | 9.0 | 10.0 |
| M16 | 2.00 | 8.0 | 9.10 | 14.0 | 10.0 | 12.0 |
| (M18) | 2.50 | 10.0 | 10.30 | 16.0 | 12.0 | 14.0 |
| M20 | 2.50 | 10.0 | 11.50 | 18.0 | 14.0 | 16.0 |
| (M22) | 2.50 | 12.0 | 12.65 | 20.0 | 16.0 | 18.0 |
| M24 | 3.00 | 12.0 | 14.65 | 20.0 | 16.0 | 20.0 |



| Thread size A nom. | Pitch | Hex Socket Size W nom. | Flat Point | | Cone Point | | $y^{\circ} \pm 2^{\circ}$ 90° for these Lengths & Over; and 120° Under |
|--------------------|-------|------------------------|------------|-------------------|------------|-------------------|---|
| | | | J max. | L - min Preferred | J max. | L - min Preferred | |
| M3 | 0.50 | 1.5 | 2.0 | 3.0 | Sharp | 4.0 | 4.0 |
| M4 | 0.70 | 2.0 | 2.5 | 3.0 | Sharp | 4.0 | 5.0 |
| M5 | 0.80 | 2.5 | 3.5 | 4.0 | Sharp | 5.0 | 6.0 |
| M6 | 1.00 | 3.0 | 4.0 | 4.0 | 1.5 | 6.0 | 8.0 |
| M8 | 1.25 | 4.0 | 5.5 | 5.0 | 2.0 | 6.0 | 10.0 |
| M10 | 1.50 | 5.0 | 7.0 | 6.0 | 2.5 | 8.0 | 12.0 |
| M12 | 1.75 | 6.0 | 8.5 | 8.0 | 3.0 | 10.0 | 14.0 |
| (M14) | 2.00 | 6.0 | 10.0 | 10.0 | 4.0 | 12.0 | 14.0 |
| M16 | 2.00 | 8.0 | 12.0 | 12.0 | 4.0 | 14.0 | 18.0 |
| (M18) | 2.50 | 10.0 | 13.0 | 12.0 | 5.0 | 16.0 | 20.0 |
| M20 | 2.50 | 10.0 | 15.0 | 14.0 | 5.0 | 18.0 | 22.0 |
| (M22) | 2.50 | 12.0 | 17.0 | 16.0 | 6.0 | 20.0 | 28.0 |
| M24 | 3.00 | 12.0 | 18.0 | 20.0 | 6.0 | 20.0 | 28.0 |

All Dimensions In Millimetres.
Sizes In Brackets Are Non-preferred Standards.