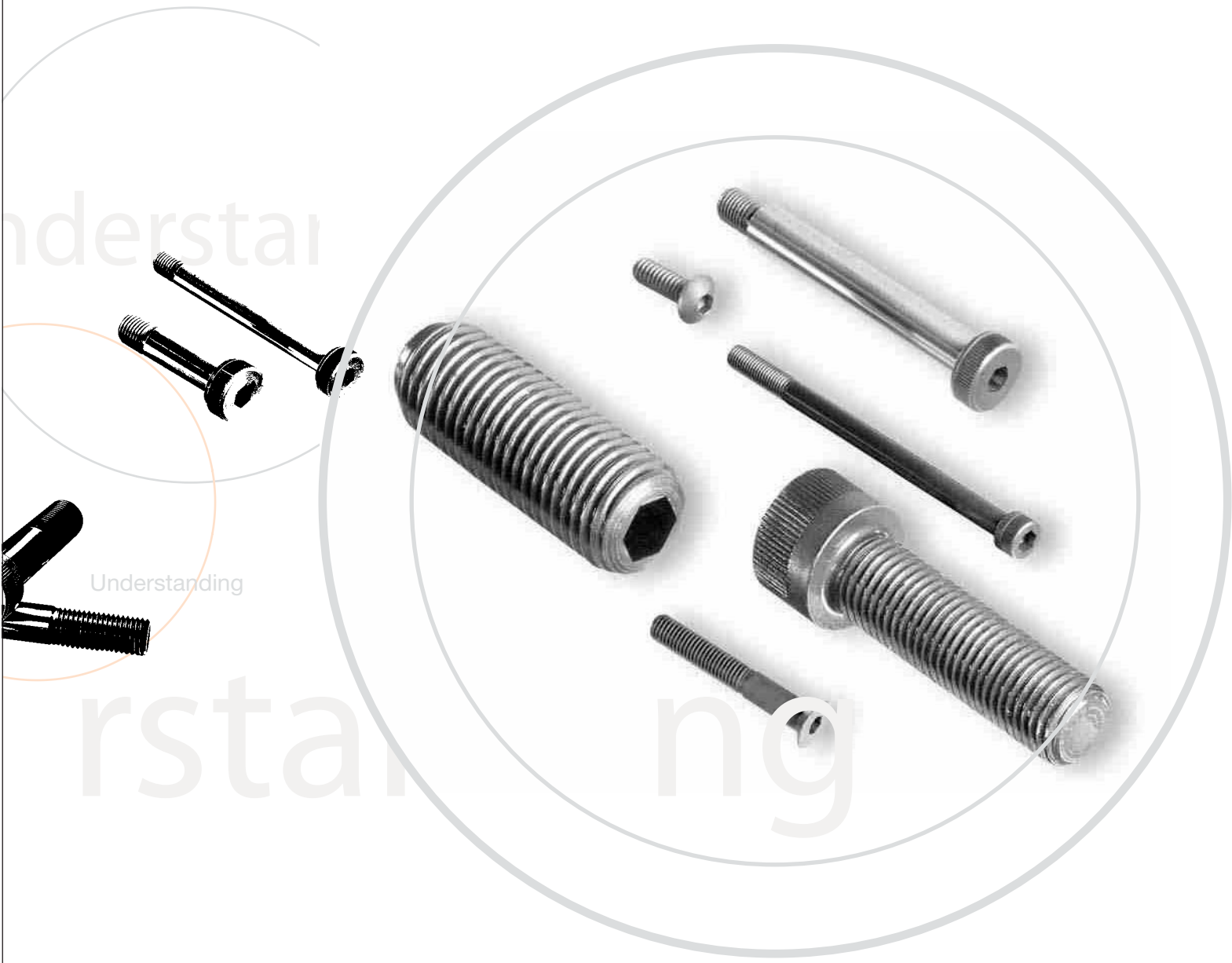


Understanding Unbrako

technical brochure



Understanding

Understanding

COMPANY BACKGROUND

UNBRAKO is the world's largest manufacturer of Precision Mechanical Fasteners and has earned a reputation for quality and performance in the production of Hexagon Socket Screws (and Allied Products), Aerospace and Automotive Fasteners. Special Hot and Cold Forged Components as well as significant business in Speciality and Exotic Alloy materials and magnetic products.

UNBRAKO employs over 4,000 people in 5 manufacturing plants and sales offices in 6 countries spread over 4 continents.

Since its founding in 1903, **UNBRAKO** has sought opportunities for growth through product innovation and technological advances. In pioneering work in metallurgy, testing, design and metal working, the company continues to develop unique capabilities for solving its customers industrial problems.

UNBRAKO is involved with quality control at its specialist steel suppliers, enabling **UNBRAKO** to control the production of high grade alloy steels with metallurgical and chemical characteristics specifically to suit **UNBRAKO** Fasteners. It also allows complete control of material from original steel melt to finished product ensuring ultimate fastener reliability.

UNBRAKO In addition to the well known hexagon socket product range (detailed in this catalogue), **UNBRAKO** also manufactures a wide range of custom designed fasteners for aerospace and other demanding applications. The wide range of Hexagon Wrenches and Wrench Sets are also available.

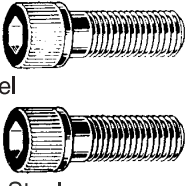
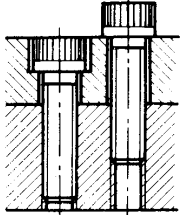
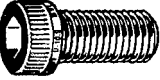
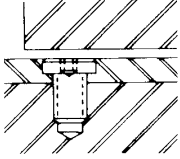
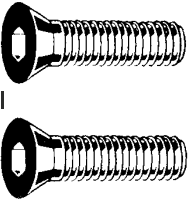
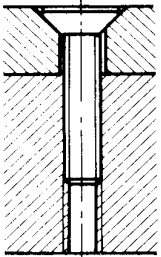
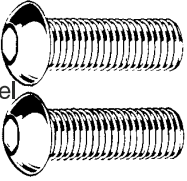
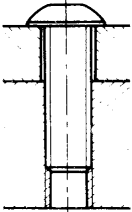
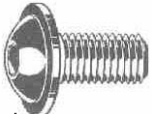
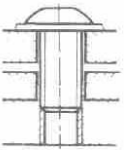
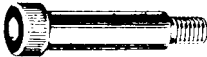
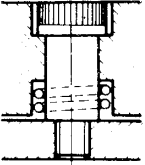
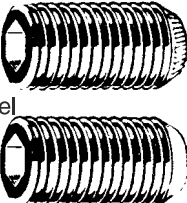
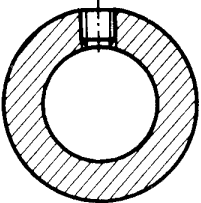
UNBRAKO standard fasteners-"The widest range in the world" are available from Distributors who have the support of trained sales and application engineers who will solve fastening problems in all types of industrial environments. If necessary **UNBRAKO** will design and develop fasteners to suit the specific requirements of any application.

Quick Selector Guide	2 & 3
Socket Head Cap Screws	
Introduction	4
Product Features	5
Applications	6
ISO Metric Threads	
- Dimensions & Tightening Torques	7
- Body and Grip length	8 & 9
- Micro Screw	10
- Low Head	11
1936 Series B BA BSW & BSF Threads	
- Dimensions & Tightening Torques	12
- Grip Lengths	14 & 15
1936 Series UNC & UNF Threads	
- Dimensions & Tightening Torques	13
- Grip Lengths	16 & 17
1960 Series UNC & UNF Threads	
- Dimensions & Tightening Torques	18
- Grip Lengths	16
Counter sunk Socket Head Screws	
Description	19
ISO Metric Threads	
- Dimensions & Tightening Torques	20
- Body & Grip Lengths	22 & 23
BA BSW & BSF Threads	
- Dimensions & Tightening Torques	21
- Body & Grip Lengths	24
UNC & UNF Threads	
- Dimensions & Tightening Torques	25
- Body & Grip Lengths	26
Button Head Socket Screws	
Description	27
ISO Metric Dimensions	28
BS, BSW and BSF Dimensions	29
UNC & UNF Dimensions	30
Flange Button Head Socket Screws	31
ISO Metric Dimensions	32
Socket Set Screws	
Description	33
Point Style	41
ISO Metric Threads	
- Dimensions & Tightening Torques	34 & 35
- Torsional Holding Power	38 & 39
- Microsize	40
UNC, UNF, BA, BSW, & BSF Threads	
- Dimensions & Tightening Torques	36 & 37
- Torsional Holding Power	38 & 39
Socket Shoulder Screws	
Applications	42
Description	43
ISO Metric Dimensions	44
UNC, UNF, BSW & BSF Dimensions	45

Due to a continuous policy of research and development Unbrako reserve the right to alter the specification of any product without prior notice.

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

QUICK SELECTION GUIDE

Type	Application	Features
<p>Socket Head Cap Screws</p>  <p>Alloy Steel</p> <p>Stainless Steel</p>		<p>Suitable for all high tensile applications. Use stainless for corrosive-cryogenic or elevated temperatures.</p>
<p>Socket Low Head Cap Screw</p>  <p>Alloy Steel</p>		<p>Suitable for use in parts too thin for std. SHCS; and for applications with limited clearances.</p>
<p>Countersunk Socket Head Screws</p>  <p>Alloy Steel</p> <p>Stainless Steel</p>		<p>Controlled angle under the head ensures maximum flushness and sidewall contact. Non-slip Hex socket prevents marring of material. Note: Inclined angle under the head varies as follows:</p> <p>BSW & BSF Threads - 90°C UNC & UNF Threads - 82°C Metric Threads - 90°C Above M20 - 60°C</p>
<p>Button Head Screws</p>  <p>Alloy Steel</p> <p>Stainless Steel</p>		<p>Low heads streamline design. Use them in materials too thin to countersink; also for non-critical loading requiring heat treated screws.</p>
<p>Flange Button Head Screw ws</p>  <p>Alloy Steel</p>		<p>Allows covering of large diameter holes in sheet metal. Can be used with softer materials.</p>
<p>Shoulder Screws</p>  <p>Alloy Steel</p>		<p>Replaces costly special parts - shafts, pivots, pins, guides, linkages and trunnion mountings. Also standard for tool and die industries.</p>
<p>Socket Set Screws</p>  <p>Alloy Steel</p> <p>Stainless Steel</p>		<p>Fasten collars, sleeves, gears, knobs on shafts. Locate machine parts</p> <p>Cone, half dog, oval, cup and self locking knurled cup points are standard.</p>

QUICK SELECTION GUIDE

Maximum Operating Temperature Unplated	Material	Corrosion Resistance	Magnetic or Non-Magnetic	Page
300°C	High Grade Unbrako Alloy Steel	Plating Optional	Magnetic	4 to 18
430°C	Austenitic Stainless Steel	Excellent	Non-Magnetic	
300°C	High Grade Unbrako Alloy Steel	Plating Optional	Magnetic	11
300°C	High Grade Unbrako Alloy Steel	Plating Optional	Magnetic	19 to 26
430°C	Austenitic Stainless Steel	Excellent	Non-Magnetic	
300°C	High Grade Unbrako Alloy Steel	Plating Optional	Magnetic	27 to 30
430°C	Austenitic Stainless Steel	Excellent	Non-Magnetic	
300°C	High Grade Unbrako Alloy Steel	Plating Optional	Magnetic	31 to 32
300°C	High Grade Unbrako Alloy Steel	Fair	Magnetic	41 to 44
300°C	High Grade Unbrako Alloy Steel	Plating Optional	Magnetic	31 to 39
430°C	Austenitic Stainless Steel	Excellent	Non-Magnetic	

SOCKET HEAD CAP SCREWS

If you use fasteners, you know their importance in today's technology. Higher pressures, higher stresses and higher speeds demand stronger, more reliable joints, and stronger, more reliable fasteners to hold them together. Parts must stay together. A single failure can destroy valuable equipment or stop an assembly line. Reliability must be total.

This is why industry is using more and more socket head cap screws, the strongest threaded fasteners you buy "off the shelf". They have the extra strength and fatigue resistance required for total reliability in high strength fastening.

Tensile and Fatigue Strength

Unbrako socket head cap screws have the highest levels of strength and fatigue resistance in the industry. They exceed all government and industry standards. Instead of the usual range of 1220 N/mm², minimum tensile strength levels of Unbrako cap screws are consistently 1300 N/mm². At the same time ductility and fatigue resistance are not sacrificed.

When you buy tension fasteners (which is what socket head cap screws basically are) you're buying clamping force - the ability to hold things together. The additional strength offered by Unbrako screws can save pounds, if you use the screws correctly.

The extra strength of Unbrako screws allows the use of either fewer fasteners of the same size, or the same number of smaller screws to achieve the same clamping force. With fewer fasteners you save on drilling and tapping and have fewer screws to buy and install. If you go the other way, smaller screws generally cost less and permit reduced assembly size, saving space, material and weight.

If you have dynamic stress or varying load conditions, the exceptional fatigue resistance of Unbrako screws gives you an additional bonus of built-in protection against fatigue failure.

Design

One of three major factors in the superiority of Unbrako socket head screws is design. For example, socket depth is carefully controlled. The socket is deep enough for full tightening without reaming and cracking, but not deep enough to weaken the head area and cause failure.

Inspired by our research and development of aerospace fasteners, another major feature on Unbrako socket screws is the Radiused-Root-Runout. The root of the thread runout is also radiused to eliminate the usual sharp 'V' - a major point of weakness in other threads. Fatigue life in this critical area is increased as much as 300% in certain sizes.

Class 4g 6g tolerances are standard, the closest without selective assembly. They combine maximum cross-section with smooth assembly, and assure better mating of parts.

The elliptical fillet at the juncture of head and shank is another aerospace-inspired Unbrako development. This compound curve more than doubles fatigue life in the head

area without reduction of critical bearing area. Discontinuity is minimised and stress concentrations are reduced, providing an added margin of safety. Heads are correctly proportioned to screw size, assuring full clamping force without indentation and loss of preload.

Properties

Second major factor in Unbrako socket screw superiority is their physical properties. These are no accident. Consistently higher stress levels are direct result of customised heat treatment. Carbon content of furnace atmospheres is closely controlled, since carburisation (too much carbon) makes screws brittle, while decarburisation (too little carbon) results in soft surface with poor strength and resistance to wear. Every melt of Unbrako steel is pre-tested and its treatment tailored to produce a consistent part.

Manufacturing Control

Closely controlled manufacturing is the third factor. Rigid control of every operation of a socket screw is necessary in order to guarantee performance.

Heads of standard Unbrako socket screws are forged, not machined. Machining cuts metal fibres, breaks flow lines, creates planes of weakness at stress points. Forging, on the other hand, forms metal, produces uniform grain flow, makes heads stronger by compressing the metal. Head bearing area is strictly perpendicular to screw body to avoid strains and misalignment. Fillet areas are precisely controlled, with fillets made glass smooth to eliminate surface irregularities where cracks can start.

Radiused threads of standard Unbrako screws are rolled, not ground or cut. Rolled threads are more uniform and closer tolerances can be maintained because Unbrako thread roll dies and rolling techniques produce smoother surfaces and more accurate size control. High points and planes of weakness are avoided.

Plating

Plating becomes more critical as the demand for plated screws increases. Unbrako socket screws that are to be plated are accurately controlled to be within tolerance after plating. Precision plating thickness brings screws to correct dimensions, while rigid control of the plating process guards against screw failure from hydrogen embrittlement. This is a brittle condition caused by hydrogen diffusing into the base material during cleaning and electroplating. It can cause screw failure long after the screw is tightened, but can be avoided by the extreme care Unbrako take in processing plated socket screws.

Unbrako Socket Screws pay off in Savings

You get extra safety and reliability in Unbrako socket screws, plus significant economies, both in the cost of the fasteners and the cost of their installation. Furthermore, they protect the reputation of your product, which can well depend on the fasteners that hold it together.

These are considerations too important to overlook as production costs continue to rise and reliability requirements become more exacting.

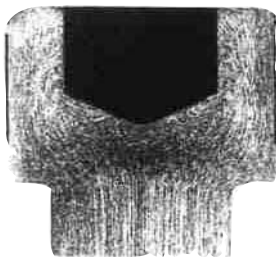
"YOU'RE SAFER WITH UNBRAKO"



HREAD
RUNOUT Note sharp angle at root where high stress concentration can develop cracks in the screw.

UNBRAKO RADIUS ROOT RUNOUT THREAD - Controlled radius of runout root provides a smooth form that distributes stress and increases fatigue life of fastener considerably.

Fully formed radiused threads rolled to maintain continuous grain flow for greater tensile and fatigue strength.
 Heat treatment in a controlled atmosphere for maximum uniform strength and surface integrity without brittleness or decarburisation.



Accurate control of socket depth gives more wrench engagement than other screws, permitting full tightening without cracking or reaming the socket, yet maintaining ample metal in the crucial fillet area for maximum head strength.



Controlled head forging forms uniform grain flow with unbroken flow lines, makes heads stronger, prevents failure in vital fillet area and adds to fatigue strength of the screw.

Cross-section of radiused fully formed threads. Contour following flow lines provide extra shear strength in threads, resist stripping and provide high fatigue resistance. Note the large root radius, an Unbrako socket screw development that increases fatigue life of the threads.