Stainless steel Mechanical properties

This section is not intended to be a beginners' course in metallurgy, far from it! Its purpose is to try to help to "demystify" the product with regard to its application on motorcycles and also to give the answers to frequently asked questions concerning the product Inox fasteners sell.
Please also bear in mind that stainless steel is a multi faceted subject. These pages deal with stainless fastener grades and their likely application on motorcycles - nothing else. These information pages contain the absolute minimum in terms of jargon and flowery language.
Any weird sounding terms are explained (hopefully) as they are written. If you are a Metallurgist you'll probably find it a bit beneath you!

The technical questions we are asked most by our customers often refer in some way to the mechanical properties of stainless steel, how strong is it? or is it suitable for x or y ?

When considering potential fastener replacement, many people still directly compare stainless steel with high tensile steel and immediately write off stainless as not strong enough, or "only suitable for mounting indicator stems"

Before reading on, please bear in mind that this section deals with the question of the strength of the material, there are of course other mechanical properties not dealt with here

Firstly, a word or two about tensile strength.....

When a load (stress) is applied to the fastener, the metal stretches slightly, (elastic deformation) Provided the load isn't too great, the fastener will return to its original size and shape once the stress has reduced, the metal is said to be "elastic" If the stress is too great (ie the fastener is over tightened) the metal will remain stretched or bent (plastic deformation or 'strained') but not necessarily broken.

Ultimate "Tensile Strength" (UTS) is the amount of longitudinal stress applied to the fastener to induce stretch narrowing (necking) Please remember that this point is way past that at which the fastener starts to suffer plastic deformation (strain). It is the point at which the fastener has effectively failed.

Specifiers of any metal of course are interested in it's tensile strength, but what is more important to them (as it is us) is the serviceable limit of the material, long before it fails. The value 0.2% Proof stress (Young's modulus) is the stress supported by the fastener to the point of strain by 0.2% of the fasteners original length. This is the figure that in practical terms should be considered!

The stress is expressed as tonf/in2 ton force per square inch or N/mm2, Newtons per square mm. A Newton is 1kg force.

"Shear stress" or "cross sectional strength" is another important factor. Basically the same elastic properties are sought but from a force exerted across the cross section or profile of the fastener. Shear strength is always directly related to tensile strength. Examples of longitudinal tensile stress are plentiful on any motorcycle an excellent example of shear strength is on rear suspension units bolted to the swinging arm.

Some figures;- for ALUMINIUM not the sort of structureless cast stuff the Japanese make fork yokes or brake calipers out of, but the bright, machinable, easily weldable, polishable and anodisable metal specified by engineers designing fork yokes multipot brake calipers and a variety of other products. The most common grade of material used for these applications is a grade known as 6082T651 or HE30TF

	6082T651	Class 70*	Class80*
0.2% Proof (Young's modulus)	240N/mm2	450N/mm2	600N/mm2
UTS (Ultimate tensile strength)	295N/mm2	700N/mm2	800N/mm2

*both classes 70 & 80 are sold by us, class 70 being the minimum quality we offer. Figures quoted for fasteners are minimum yields

We rarely stop to think about the material in which the fastener is to be fixed, when you consider that fork yokes, sliders, wheel hubs etc are produced from cast alloys which possess inherently poor ductile properties (ie very little in the way of intercrystalline structure) and then look at the table, the conclusion must be that the fasteners we sell will endure greater stress than the alloy you are fastening into. We own a Motorcycle with brake calipers and discs fastened with A2 bolts. The fasteners have been tested repeatedly on a daily basis with no problems whatsoever.

Class 70 fasteners sold by us possess a minimum 87.5% more stress bearing ability than the Aluminium rolled model demonstrated in the table above!

Shear resistance

Example below on the 'Kenny Roberts flat tracker' project run by Classic & Motorcycle mechanics a few years ago

Tensile strength

Almost everybody has heard of Harrison billet calipers. They are constructed using standard A2 fasteners

BEWARE;-
There is another class of stainless fastener, class 50, its elastic properties are about 30-40% less than class 70 - some of our competitors sell it because it is cheaper. Far be it for us to suggest that you don't buy it, but words like "safety margin" always seem to be the instinctive choice whenever class fifty is mentioned. Still they are cheap and you might even get a discount!

Note this technical information is supplied free of charge. If you require replacement fasteners yielding high tensile properties use original equipment.