

## How the world's strongest bolts were developed using Nobel Prize winning technology

**BUMAX® Ultra is now recognized as the strongest fastener in the world. It draws on Nobel Prize winning quasi-crystalline precipitate technology that fundamentally altered how chemists conceive of solid matter – and what engineers believe possible for stainless steel fasteners in demanding applications.**

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Pictures: BUMAX AB

▲ With development and manufacturing in central Sweden's historic steel belt, built on heritage from the 1600s and on collaboration with steel making companies such as Outokumpu and Sandvik, premium stainless steel fastener manufacturer BUMAX produces what is now widely known as the strongest fastener in the world. Far beyond standard, its super strong BUMAX Ultra bolt has proven itself in various highly-demanding critical fastener applications around the world – providing optimal safety and reliability where standard fasteners are simply inadequate.

BUMAX Ultra typically offers a yield strength of over 1,350 megapascals (MPa), which is three times the strength of standard stainless steel 'class 70' fasteners (450 MPa) and more than twice that of strong 'class 80' fasteners (600 MPa). The fact that BUMAX Ultra can handle more than double the load of a standard stainless steel fastener is a game changer for critical fastener applications by providing enhanced solutions that simply were not available a few years ago.

### Drawing on Nobel Prize winning technology

BUMAX has been manufacturing premium stainless steel bolts since 1926 – to provide customized fastener solutions for global clients with extremely demanding challenges. To develop the world's strongest fastener, the company capitalized on its own material technology knowledge and that of its premium stainless steel supplier, as well as its advanced manufacturing techniques.

BUMAX Ultra ensures ultra-high strength and good corrosion resistance by drawing on Nobel Prize winning quasi-crystalline precipitate technology. Materials Science Professor Dan She-

chtman won the 2011 Nobel Prize in Chemistry for his work with quasi-crystals, which fundamentally altered how chemists conceive of solid matter. The BUMAX technique uses strain hardening followed by precipitation hardening, which significantly increases the yield strength of the stainless steel by ensuring the crystal structure which reinforces the material.

### The strongest bolt in the world – and it's stainless

Stainless steel fasteners are often selected for their corrosion resistance properties, however reduced strength has historically been an accepted compromise of using stainless steel rather than carbon steel. BUMAX Ultra has changed all this by providing ground-breaking solutions for highly demanding applications. It far exceeds carbon steel in terms of yield strength.

"High-strength stainless fastener solutions ensure superior corrosion resistance, while exceeding the mechanical properties offered by carbon steel, standard stainless products and many



high alloy fasteners," explains Anders Söderman, BUMAX Technical Director. "Unique stainless steel fasteners such as BUMAX Ultra have revolutionized the fastener market by far exceeding carbon steel in terms of yield strength."

### Demanding applications – space, military and high pressure

Since its launch, the BUMAX Ultra range has proven that it is capable of exceeding yield strengths of over 1,350 MPa in various applications, with good corrosion resistance and an operating range between -50 and 400°C.

As BUMAX Ultra is designed for applications that require ultra-high strength



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combined with high ductility and fatigue resistance, applications include the most challenging imaginable – including security lock systems, aerospace systems, military applications, high pressure applications and the construction industry.

BUMAX Ultra has met all customer and end user expectations with excellent results. Lock companies value it for its excellent fatigue properties combined with strength, developers of aerospace systems appreciate its good fatigue, corrosion and strength properties as an alternative to titanium fasteners, and high-pressure applications welcome its high strength.

## **Replacing carbon steel fasteners in critical applications**

Custom-made BUMAX Ultra fasteners are increasingly used to replace high-strength carbon steel fasteners in critical applications with extreme requirements

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BUMAX AB is a part of Bufab Group. In addition to the Ultra grade, BUMAX AB produces high-Mo A4 fasteners with strength levels 88 and 109, duplex and super duplex with strength levels 109 and 129, which are stocked products. Other stainless steels grades are available on request, including super austenitic and high temperature grades.

on strength, ductility and fatigue resistance. The very high strength-to-weight ratio in combination with BUMAX Ultra's good formability and ductility also make it a cost-effective fastener alternative to lightweight materials such as titanium.

"BUMAX Ultra is an advanced engineering grade and we provide technical support for customer projects to develop

the optimal end solution for a particular application," says Elina Leivo, BUMAX Sales Manager in Finland. "Even yield strength exceeding 1,350 MPa is possible with BUMAX Ultra, together with good corrosion resistance, formability and ductility."

As a real-life example, a European lock manufacturer originally used a carbon steel screw for the critical latch screw. Following breakages that disabled the entire locking mechanism, the manufacturer tested various grades without solving the problem.

The manufacturer then fatigue-tested BUMAX Ultra, which survived 500,000 strokes without a single breakage – compared with high strength carbon steel screws that only lasted 10,000 strokes. Needless to say, BUMAX Ultra screws are now a critical lock component that helps ensure lock reliability.