



Bumax[®] Grades and Properties Data Sheet

BUMAX[®] GRADES Other special grades can be offered on request

BUMAX 88 offers better corrosion resistance than standard A4 due to higher molybdenum content. Bumax 88 is a very consistent material that offers higher yield strength and lower amount of inclusion than standard A4 fasteners, that gives superior mechanical properties and fatigue resistance. Bumax 88 fasteners are used in many applications that demands very low magnetic permeability, it has lower magnetic permeability and less variation from batch to batch compared to standard A4 fasteners.

BUMAX 109 is the strongest A4 bolt on the market. Same material as Bumax 88 but higher strength due to special manufacturing process.

BUMAX Nitro, austenitic stainless steel with high nitrogen content, characterized by very high strength and fatigue resistance, in combination with good corrosion resistance. Excellent material for marine application and can be supplied in strength class 12.9 up to M42.

BUMAX Super Austenite (SA), high-alloy austenitic stainless steel for seawater and other aggressive chloride bearing medias. Excellent resistance to general, crevice, pitting and stress corrosion.

BUMAX Lean Duplex (LDX) offers economical solution for high strength fasteners in medium corrosive environments.

BUMAX Duplex (DX) are characterized by excellent strength, ductility and fatigue resistance in combination with good general, pitting, crevice and stress corrosion properties.

BUMAX Super Duplex (SDX) are characterized by excellent mechanical properties and very good corrosion resistance. Excellent resistance to general crevice, pitting and stress corrosion in chloride bearing medias.

BUMAX Hyper Duplex (HDX), a groundbreaking alloy used in the most demanding applications. Suited for use in severe corrosive environments such as hot chlorinated sea-water and for aggressive acidic chloride containing media in chemical, oil/gas, marine and petrochemical industry.

BUMAX Ultra, a unique precipitation hardenable stainless steel that can be delivered in ultra high strength levels. Strongest stainless steel fastener on the market. Good corrosion resistance in chloride environments.

BUMAX Heat (HE), high temperature resistant material for applications requiring high strength and good oxidation resistance at temperatures up to 700°C. Can be precipitation hardened.

BUMAX Heat Plus (HEP), precipitation hardenable high temperature resistant material with excellent oxidation resistance and high tensile and creep properties at temperatures up to 815°C.

CHEMICAL COMPOSITION Nominal wt%

GRADE	EN	UNS	Microstructure	C max	Cr	Ni	Mo	Other	PRE ¹⁾
BUMAX 88	1.4432, 1.4436, 1.4435	S31603	Austenitic	0.03	17	11.5	2.7		27
BUMAX 109	1.4432, 1.4436, 1.4435	S31603	Austenitic	0.03	17	11.5	2.7		27
BUMAX Nitro		S31675	Austenitic	0.035	20.5	10	2.4	N 0.4	35
BUMAX SA	1.4547	S31254	Austenitic	0.01	20	18	6.2	N, Cu	43
BUMAX LDX ²⁾	1.4162	S32101	Ferrite-Austenitic		21.5	1.5	0.3	N 0.22, Mn 5	26
BUMAX DX	1.4462	S31803, S32205	Ferrite-Austenitic	0.03	22	5.2	3.2	N 0.18	36
BUMAX SDX	1.4410	S32750	Ferrite-Austenitic	0.03	25	7	4	N 0.3	42
BUMAX HDX	1.4658	S32707	Ferrite-Austenitic	0.03	27	6.5	4.8	N 0.4, Co	49
BUMAX Ultra		S46910	Martensitic	0.02	12	9	4	Al, Ti, Cu	25
BUMAX HE	1.4980	S66286	Austenitic	0.08	15	26	1.5	Ti, V	
BUMAX HEP	2.4952	N07080	Austenitic	0.10	19	>65	-	Al, Ti, Co	

¹⁾ PRE (Pitting Resistance Equivalent) number shows the pitting corrosion resistance of stainless steels. A higher PRE number indicates better corrosion resistance. The PRE is defined as, in weight-%: PRE = % Cr + 3.3 x % Mo + 16 x % N

²⁾ Standard offer for Bumax Lean Duplex is 1.4162 (PRE 26), but we have also the possibility to supply 1.4661 (PRE 33)

THE WORLD'S STRONGEST STAINLESS BOLT

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MECHANICAL PROPERTIES in as delivered condition

Grade	Dimension	Strength Class	Screws and stud bolts					Nuts	Washers		
			Tensile strength R_m , min		Yield strength $R_{p0.2}$, min		Elongation, min			Stress under proof load, min	Hardness, min
			MPa	ksi	MPa	ksi					
BUMAX 88	M3 - M36	88	800	116	640	92	0.3 d	800	200		
BUMAX 88, PED	M6 - M30	88	800	116	640	92	0.4 d	800	200		
BUMAX 109	M3 - M12 > M12	109 109	1000 1000	145 145	900 800	130 116	0.2 d	1000	300		
BUMAX Nitro	≤M42	109 129	1000 1200	145 174	900 1080	130 156	0.2 d	2)	2)		
BUMAX SA	≤ M42	88 109	800 1000	116 145	640 800	92 116	0.2 d	2)	2)		
BUMAX LDX	≤ M42	88 109 129	800 1000 1200	116 145 174	640 900 1080	92 130 156	0.3 d	2)	2)		
BUMAX DX	≤ M42	88 109 129	800 1000 1200	116 145 174	640 900 1080	92 130 156	0.3 d	2)	2)		
BUMAX SDX	≤ M42	88 109 129	800 1000 1200	116 145 174	640 900 1080	92 130 156	0.3 d	2)	2)		
BUMAX HDX	≤ M8	88 109 129	800 1000 1200	116 145 174	640 900 1080	92 130 156	0.3 d	2)	2)		
BUMAX Ultra ¹⁾	≤ M16	149 159 169	1400 1500 1600	203 217 232	1260 1350 1440	182 195 208	0.2 d	2)	2)		

¹⁾ Bumax Ultra is a grade that is tailor made to solve customer needs in regards of strength, ductility, fatigue and wear resistance. Values in the table are typical strength values, but even higher strength levels can be achieved on some designs and dimension, up to tensile strength levels of 2500 MPa.

²⁾ On request

The data shown in the table are typical and are representative for the majority of standard fasteners. May be subject to alterations, depending on size and design.

PROPERTIES AT LOW AND HIGH TEMPERATURES

It is important to understand what happens with the fastener material when operating at elevated temperatures for prolonged times. Properties such as thermal expansion, strength, ductility, corrosion resistance and fatigue resistance are affected by high temperatures and its effect on the jointed application must be considered from case to case. The diagram to the right shows typical yield strength losses that instantly occur in the material when exposed to high temperatures. Property changes during prolonged service at elevated temperature must also be considered. Gas corrosion at high temperature is totally different compared to wet corrosion at lower temperatures. Furthermore, changes in mechanical properties might gradually change over time due to ageing and creep deformation. Ageing that occurs in all stainless steel material over time is enhanced by high stresses in the material in combination with high temperature or temperature fluctuations, and can lead to ductility losses in the material. Creep deformation is a slow plastic deformation under the influence of mechanical stresses. It can occur as a result of long-term exposure to stresses that are still under the yield strength of the material and the effect increases at higher temperatures. Bumax HE and Bumax HEP are high temperature resistant grades optimized for high temperature conditions and are much more stable against ageing, gas oxidation, creeping and strength losses compared to regular stainless steels.

An increased brittleness at subzero and especially cryogenic temperatures is characteristic of all steels and metals in general. Some steel grades become more brittle than others at cryogenic temperatures below -150°C. This depends mainly on microstructure, chemical composition and internal stress. Austenitic stainless steels has generally better impact strength at very low temperatures than Duplex, Ferritic and Martensitic stainless steel.

To understand the environment and application requirements is therefore crucial. Your local Bumax sales representative will help you selecting the right material.

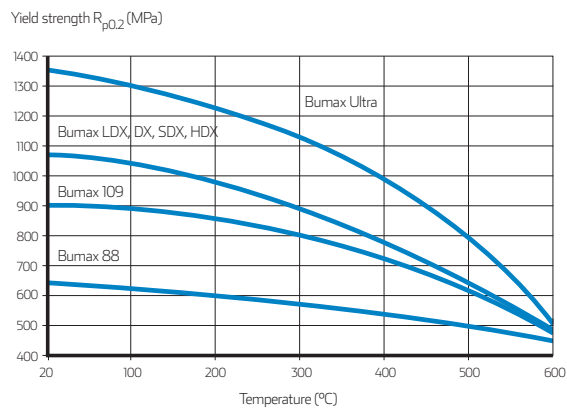


Fig 1. Typical yield strength losses at elevated temperature for stainless steel

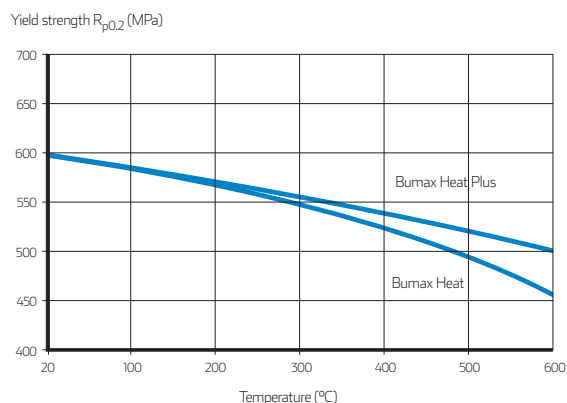


Fig 2. Typical yield strength losses at elevated for heat resistant grades



PHYSICAL PROPERTIES at 20°C, unless stated otherwise

Grade	Thermal expansion, mean values in temperature ranges (x10 ⁻⁶) per °C						Magnetic permeability
	20 to 100°C	20 to 200°C	20 to 300°C	20 to 400°C	20 to 500°C	20 to 600°C	
BUMAX 88	16.5	17	17.5	17.5	18	18	1.006
BUMAX 109	16.5	17	17.5	17.5	18	18	1.007
BUMAX Nitro	15	15.5	16	16.5	17	17	1.003
BUMAX SA	16	16	16.5	16.5	17	17	1.003
BUMAX LDX	12.5	13	13.5	13.5	14	14.5	100
BUMAX DX	12.5	13	13.5	13.5	14	14.5	100
BUMAX SDX	12.5	13	13.5	13.5	14	14.5	100
BUMAX HDX	12.5	13	13.5	13.5	14	14.5	100
BUMAX Ultra	11.5	12	12	12.5	12.5	13	1000
BUMAX HE	16.5	16.5	17	17	17.5	17.5	1.007
BUMAX HEP	12	13	13	13.5	13.5	14	1.001

CORROSION RESISTANCE

Grade	Urban	Marine, salt water		Hydrochloric acid (HCl) at 50°C				Sulphuric acid (H ₂ SO ₄) at 50°C		
	High	Low	High	0.1%	1%	2%	3%	1%	10%	30%
BUMAX 88, 109	☉	☉	☉	☉	●	●	●	☉	●	●
BUMAX Nitro	☉	☉	☉	☉	☉	●	●	☉	☉	☉
BUMAX SA	☉	☉	☉	☉	☉	☉	●	☉	☉	☉
BUMAX LDX	☉	☉	☉	☉	●	●	●	☉	☉	●
BUMAX DX	☉	☉	☉	☉	☉	●	●	☉	☉	●
BUMAX SDX	☉	☉	☉	☉	☉	☉	●	☉	☉	☉
BUMAX HDX	☉	☉	☉	☉	☉	☉	☉	☉	☉	☉
BUMAX Ultra	☉	☉	●	●	●	●	●	☉	●	●

☉ No corrosion under normal conditions ● Not suitable, corrosion is likely to occur
 ☉ Possible risk of corrosion, but the steel grade might be suitable depending on requirement, environment, design and maintenance.

Low: Mild condition, such as low concentrations at low temperatures. High: Severe condition, such as high concentrations at elevated temperatures.

PRELOAD AND TIGHTENING TORQUE

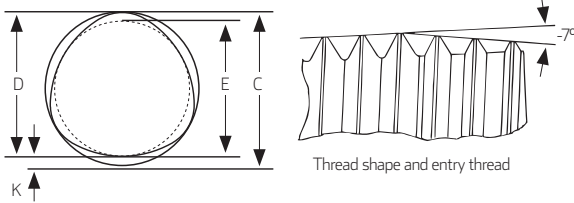
Preload is needed to keep the jointed part together and function correctly for long periods of time, resisting both static and dynamic loads.

The combined pretension in the joint should normally not exceed the yield strength of the fastener. In practical use can the recommended pretension vary between 50-80% of the yield strength R_{p0.2}. Tightening torque is needed to achieve the necessary preload. The recommended tightening torque depends on many parameters such as friction, fastener strength, thread diameter, screw type and tightening procedure. The recommendation used for Bumax products are based on a targeted preload of about 65-70% of the yield load and a friction coefficient of 0.14-0.16, which can only be obtained by a burr-free surface and using high quality lubrication. Recommended preload and tightening torque data can be found at www.bumax.se.

BUMAX® HARD TAPTITE THREAD-FORMING SCREW

Bumax Hard Taptite is a thread-forming screw which forms its own thread during assembly because of its trilobular shape, its conical entry thread and its excellent surface hardness. Bumax Hard Taptite is suitable for assembly in structural steel and cold rolled stainless steel with hardness up to 200 HV.

Taptite trilobular geometry



C=External circle diameter D=Trilobular diameter
E=Internal circle diameter K=Ovality

BUMAX® HARD SELF-TAPPING SHEET METAL SCREW (ST)

Bumax Hard self-tapping screw with ST thread is designed for use in structural steel and cold rolled stainless steel with a maximum hardness of approximately 200 HV.

All Bumax Hard products exhibits excellent surface hardness and are made with the same steel grade as Bumax 88. Bumax Hard is a great and cost-efficient solution for fitting to sheet metal and profiles.

BUMAX® LOCK

Bumax Lock is an all-metal lock nut made out of the same steel grade as Bumax 88. It is equipped with a specially designed thread profile that locks when it is tightened, distributing the stresses along the entire nut thread. This allows better load distribution which in turn produces greater gripping strength.

Tensile stress

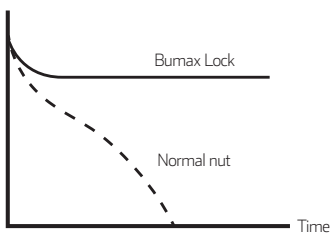
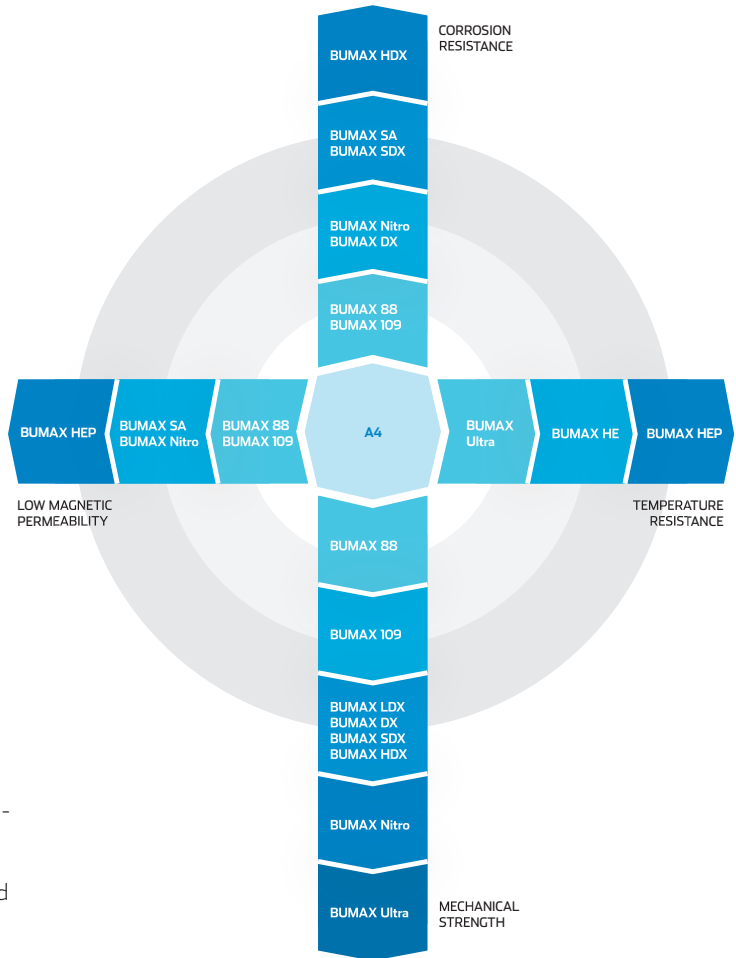


Fig 3. Residual stress

BUMAX® GRADE SELECTION CROSS



Stainless steel fasteners have properties which make them attractive choices for a wide range of applications. It is essential to consider the required properties such as corrosion resistance, temperature resistance, mechanical strength and magnetic permeability. Correctly chosen material will guarantee a trouble-free life time and low life cycle cost. Grade selection cross helps you select the best material suited for your needs.

For more information contact your local Bumax salesman or visit www.bumax.se.

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