

Engineering Services (Fasteners)

Information on Stainless Steel Fastener Grades

Introduction

Stainless steel fasteners are specified to BS EN ISO 3506. Part 1 covers bolts, screws and studs. Part 2 covers nuts. These specifications now replace BS 6105.

Chemical composition for austenitic stainless steel fasteners

The chemical compositions of austenitic stainless steel fasteners with the designations A1, A2 and A4 are shown in Table 1. This shows some of the grade designations which have been used in other British Standards.

Table 1 Chemical composition for austenitic stainless steel fasteners

Grade	Chemical Composition (% maxima unless stated)									BS Grades
	C	Si	Mn	S	P	Cr	Mo	Ni	Cu	
A1	0.12	1.0	2.0	0.15-0.35	0.20	17.0-19.0	0.6	8.0-10.0	1.75-2.25	303S31, 303S42
A2	0.08	1.0	2.0	0.03	0.05	17.0-20.0	(-)	8.0-14.0	4	304, 321, 347, 394S17 (BS 3111)
A4	0.08	1.0	2.0	0.03	0.05	16.0-18.0	2.0-3.0	10.0-14.0	1	316, 320 (316Ti)

Notes

1. Either sulphur or selenium (less common) is allowed in grade A1. These additions make the steel free machining for ease of manufacture but can reduce the corrosion resistance under certain conditions such as marine environments (chloride pitting attack risk).
2. Grade A2 does not specify molybdenum additions but allows these (normally the deliberate addition of molybdenum makes the grade A4).
3. Additions of titanium or niobium are allowed to both grades A2 and A4. Combinations of niobium and tantalum are also allowed in the range 10 x C to 1.0% max. There are, however, no such alloys in any British Standards and so this is less common.

Mechanical properties for austenitic stainless steel fasteners

Three 'property classes' are assigned to each of the austenitic stainless steel fastener grades. Table 2 shows the 0.2% proof stress, tensile strength and elongation values for each of these property classes.

Table 2 Mechanical properties for austenitic stainless steel bolts, screws, studs and nuts

Property class	Diameter range	Bolts, screws and studs			Nuts
		Tensile strength R_m N/mm ²	0.2% Proof stress $R_{p0.2}$ N/mm ²	Extension A (mm)	Proof load strength S_p N/mm ²
50	≤M39	500	210	0.6d	500
70	≤M24	700	450	0.4d	700
80	≤M24	800	600	0.3d	800

Notes

1. The mechanical property limits are minima.
2. Property class 50 represents the steel in the annealed condition.
3. The most common and readily available supply condition is property class 70, which represents a 'cold drawn' for the bar stock from which the fasteners are made.
4. Property class 80 is based on severely hard cold drawn bar.
5. For A2 and A4 fasteners with $d > 24$, the mechanical properties need to be agreed between user and manufacturer and marked with grade and property class according to this table.
6. All tensile stress values are calculated and reported in terms of the nominal tensile stress area of the thread.
7. The elongation measurement is determined on the actual bolt or screw length and not on a prepared test piece. It is expressed in millimetres (mm) of extension and not as percentage elongation, i.e. $A = (L_2 - L_1)$
(where L_1 = original length and L_2 = length after fracture)
 d = nominal diameter of bolt, screw or stud

[top](#)