Table 26 Bolt Types and Bolting Categories

	Details of bolt used					
Bolting Category	**Strength Grade**	**Minimum Tensile Strength (MPa)**	**Minimum Yield Strength (MPa)**	**Name**	**Australian Standard**	**Method of Tensioning Remarks**
4.6/S	4.6	400	240	Commercial	AS 1111	Use **S**nug tightened. Least costly and most commonly available 4.6 Grade bolt.
8.8/S	8.8	830	660	High Strength Structural	AS 1252	Bolts used are **S**nug tightened. The high strength structural has a large bolt head and nut because it is designed to withstand full tensioning (see 8.8T category description). However, it can also be used in a snug tight condition.
8.8/TF ↑ **8.8/T** ↓	8.8	830	660	High Strength Structural Bolt – Fully **T**ensioned **F**riction Type Joint	AS 1252	In both applications bolts are fully **T**ensioned to the requirements of AS4100. Cost of tensioning is an important consideration in the use of these bolting categories.
8.8/TB	8.8	830	660	High Strength Structural Bolt – Fully **T**ensioned **B**earing Type Joint		

Table 27 Design Shear and Tension Capacities – Strength Limit State
Commercial Bolts 4.6/S Bolting Category
(f_{uf} = 400 MPa) **Grade 4.6**

Bolt Size	Axial Tension ø N_{tf}	Shear Values (Single Shear)	
		Threads included in Shear Plane – N ø V_{fn}	Threads excluded from Shear Plane – X ø V_{fx}
	kN	kN	kN
M12	27.0	15.1	22.4
M16	50.2	28.6	39.9
M20	78.4	44.6	62.3
M24	113	64.3	89.7
M30	180	103	140
M36	261	151	202
	ø = 0.8	ø = 0.8	
		4.6N/S	4.6X/S

NOTE 1.
Bearing/Plate Tearout Design Capacity. For all reasonable combinations of ply thickness, bolt diameter and end distance, the design capacity for a ply in bearing (ØV_b) exceeds both ØV_{fn} and ØV_{fx}.

Table 28 Design Shear and Tension Capacities – Strength Limit State
High Strength Structural Bolts
8.8/S 8.8/TB 8.8/TF Bolting Categories
(f_{uf} = 400 MPa) **Grade 8.8**

Bolt Size	Axial Tension	Single Shear		Plate Tearout												Bearing		
		Threads included in Shear Plane	Threads excluded from Shear Plane	øV$_b$ for t_p & a_e of:												øV$_b$ for t_pf		
	øN$_{tf}$	øV$_{fn}$	øV$_{fx}$	t_p = 6			t_p = 8			t_p = 10			t_p = 12			6	8	10
	kN	kN	kN	35	40	45	35	40	45	35	40	45	35	40	45			
M16	104	59.3	82.7													113	151	189
M20	163	92.6	129	79	89	100	103	118	133	129	148	166	155	177	199	142	189	236
M24	234	133	186													170	227	283
M30	373	214	291													213	283	354
				$a_e < a_{emin} = 1.5\ d_f$														
	ø = 0.8	ø = 0.8		ø = 0.9												ø = 0.9		
		8.8N/S	8.8X/S	f_{up} = 410 MPa												f_{up}=410MPa		

Table 29 Reduction factor for lap connections (k_r)

Length	$L_j < 300$	$300 \le L_j \le 1300$	$L_j > 1300$
k_r	1.0	$1.075 - L_j/4000$	0.75

L_j = length of a bolted lap splice connection.

Table 30 Minimum bolt tension at installation

Nominal Diameter of Bolt	Minimum Bolt Tension kN
M16	95
M20	145
M24	210
M30	335
M36	490

NOTE: The minimum bolt tensions given in this Table are approximately equivalent to the minimum proof loads given in AS 1252.

Table 31 Summary of Slip Factors

Surface Treatment	Average Slip Factor
Uncoated	
Clean as-rolled	0.35
Flame cleaned	0.48
Abrasive blasted	0.53
Painted	
Red oxide zinc chromate	0.11
Inorganic zinc silicate	0.50
Hot-dip Galvanised	
Clean as-galvanised	0.18
Lightly abrasive blasted	0.30-0.40

Table 32 Design Shear Capacity – Serviceability Limit State
High Strength Structural Bolts 8.8/TF Bolting Category
($\mu = 0.35$ $n_{ei} = 1$ $\phi = 0.7$) **Grade 8.8**

Bolt Size	Bolt Tension at Installation	Design Capacity in Shear (ϕV_{sf}) for		
		$k_h = 1$	$k_h = 0.85$	$k_h = 0.7$
	kN	kN	kN	kN
M16	95	23.3	19.8	16.3
M20	145	35.5	30.2	24.9
M24	210	51.5	43.7	36.0
M30	335	82.1	69.8	57.5

Table 33a Minimum Pitch between Centres of Fastener Holes (Clause 9.6.1 of AS 4100-1990)

Bolt size	Minimum distance between centres of fastener holes mm
M12	30
M16	40
M20	50
M24	60
M30	75
M36	90

NOTE: The edge distance may also be affected by Clause 9.3.2.4 of AS 4100-1990

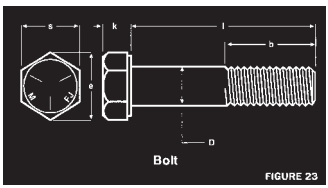
Table 33b Minimum Edge Distance (Clause 9.6.2 of AS 4100-1990)

Bolt Size	Sheared or Hand Flame Cut Edge (mm)	Rolled Plate; Machine Flame Cut Sawn or Planed Edge (mm)	Rolled Edge of a Rolled Section (mm)
M12	21	18	15
M16	28	24	20
M20	35	30	25
M24	42	36	30
M30	53	45	38
M36	63	54	45

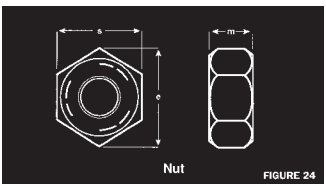
NOTE: The edge distance may also be affected by Clause 9.3.2.4 of AS 4100-1990

Blacks High Strength Structural Bolts

Property Class 8.8
Thread ISO Metric Coarse
Pitch Series
Dimensions to AS 1252



Bolt
FIGURE 23



Nut
FIGURE 24

Table 34

Bolt Dimensions									Nut Dimensions			
Size D	Pitch of Thread	Body Dia. D1		Width Across Flats s		Width Across Corners e	Head Thickness k		Width Across Flats s		Thickness m	
		Max.	Min.	Max.	Min.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
M16	2.0	16.70	15.30	27	26.16	29.56	10.75	9.25	27	26.16	17.1	16.0
M20	2.5	20.84	19.16	32	31.00	35.03	13.90	12.10	32	31.00	21.3	20.0
M24	3.0	24.84	23.16	41	40.00	45.20	15.90	14.10	41	40.00	25.3	24.0
M30	3.5	30.84	29.16	50	49.00	55.37	19.75	17.65	50	49.00	31.3	30.0
M36	4.0	37.00	35.00	60	58.80	66.44	23.55	21.45	60	58.80	37.6	36.0

All dimensions in millimetres.