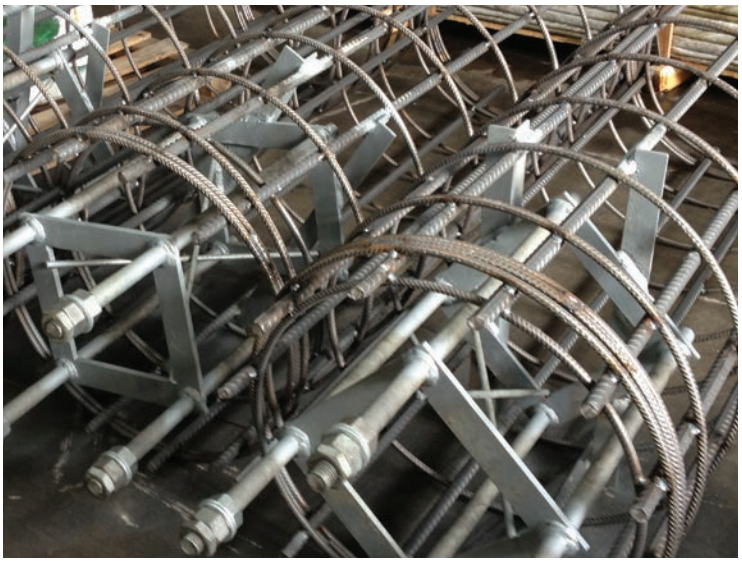
Steel Construction

Journal of the Australian Steel Institute

Volume 47 Number 1 – July 2014



Specification of threaded bar in structural applications

AUSTRALIAN STEEL INSTITUTE

ISSN 0049-2205 PRINT POST APPROVED PP255003/01614

STEEL CONSTRUCTION—EDITORIAL

This issue of Steel Construction contains a technical paper on threaded bar in structural applications prepared for the Australian Steel Institute by Prof. Saman Fernando from the Centre for Sustainable Infrastructure, Swinburne University of Technology. Its aim is to provide direction to structural engineers on the mechanical and dimensional properties of threaded bars.

Prof. Fernando has a BSc Eng (Hon) from the University of Peradeniya, Sri Lanka and a PhD in Aerodynamics and Thermodynamics from the University of British Columbia, Canada. Prof. Fernando is an internationally recognised fastener expert and innovator through his extensive research and publications in fastener and manufacturing engineering. He has authored over twenty patented products and processes. Before being appointed to Swinburne University of Technology in 2012, he worked as Engineering, Research, Development and Innovations Manager for Ajax Engineered Fasteners.

Dr Peter Key
National Technical Development Manager
Australian Steel Institute

AUSTRALIAN STEEL INSTITUTE

The Australian Steel Institute (ASI) seeks to achieve industry and professional development through regular technical seminars, publishing technical materials and making these available through its bookshop and online, and providing information through its web site www.steel.org.au.

It operates for its members the largest steel technical library in the Southern Hemisphere and provides lectures at colleges and universities as well as hosting a range of committees providing direction and assistance to ASI outputs.

Steel Construction is published by the ASI, Australia's premier technical marketing organisation representing companies and individuals involved in steel manufacture, distribution, fabrication, design, detailing and construction. Its mission is to promote the efficient and economical use of steel. Part of this work is to conduct technical seminars, educational lectures and publish and market technical design aids. Its services are available free of charge to financial corporate members. For details regarding ASI services, readers may contact the Institute's offices or visit the ASI website www.steel.org.au .

Contributions of original papers or reports on steel design, research and allied technical matters are invited from readers for possible publication. The views expressed in these papers are those of the authors and do not necessarily reflect the views of the ASI. Submissions should be in Microsoft Word including all diagrams and equations in full page format, using Arial font (size 10 point). A clean printout should also be forwarded.

SPECIFICATION OF THREADED BAR IN STRUCTURAL APPLICATIONS

by

Prof. Saman Fernando
Centre for Sustainable Infrastructure, Swinburne University of Technology

Summary

This technical note provides the information necessary for determining the mechanical and dimensional properties of threaded bars as well as the associated nuts and washers for structural applications and sets out the specific provisions that are required for ensuring that product is compliant with the nominated Standards.

1 INTRODUCTION

Threaded bar is becoming popular in the structural engineering industry. It is used as replacement for long bolts as well as concrete anchors. It is also known as thread bar, threaded rod, Sampson rod or All-thread. This product is not covered under Australian Standard AS 1252, 'High strength steel bolts with associated nuts and washers for structural engineering'. There is no clear direction to structural engineers on the mechanical and dimensional properties of threaded bars.

This technical note provides necessary information in order to determine the properties of threaded bars. As these may be used in safety critical applications and can be designed to carry high loads they should be selected and specified with sufficient understanding as for structural bolt and nut assemblies.

This technical note covers threaded bars and associated nuts and washers for structural engineering applications. However, it is limited to parts made from carbon/alloy steel and does not cover stainless steel.

2 IMPORTANT CONDITIONS

Threaded bar in its own right is not an ideal structural member. The threads act as notches and when subject to bending, material failure could occur at a lower load than that for a smooth bar due to stress concentrations associated with thread roots. The same reason makes threaded bars not suitable for dynamic load applications where they could be subject to premature fatigue failure. Furthermore, when the strength of the bar increases, its susceptibility to brittle fracture and fatigue failure also increases.

It is common practice that threaded bars are bent when used for anchorage into concrete. If the bar is of high tensile class and such bending is done on the hardened bar, micro-cracks may occur that could lead to premature failures. If the bending is done on an annealed threaded bar which is later heat-treated to achieve the necessary tensile properties this problem may be avoided. The creation of cracks is related to the radius of curvature. If the radius of curvature is large enough, such cracks may be avoided as a result of reduced stresses due to bending. The limiting radius of curvature is related to the bar strength as well as bar diameter.

Alternatively, there are threaded bars available in the market which are threaded at either end with the mid-section maintained unthreaded at the pitch diameter of the thread. If bending is required, it could be done in this unthreaded zone. It is better to avoid cold bending of even PC4.6 thread bars as it is very difficult to control the formation of micro-cracks.

High tensile threaded bars should not be heated beyond the transition temperature (in the order of 500°C) as it would reduce its strength due to annealing. Therefore welding should be totally avoided on high tensile threaded bars unless they are reheat-treated after welding.

High tensile threaded bars, Property Class 10.9 (PC10.9) and higher may also be subject to Stress Corrosion Cracking (SCC) and Hydrogen Embrittlement (HE). Therefore, the bar should not come in contact with acids and other acid forming substances that could increase the risk of SCC and HE. Generally, if the hardness is less than 34 HRC, such threaded bars are free from these issues. If the threaded bar goes through acid wash during its production, it should undergo an appropriate Hydrogen Embrittlement Relieve

(HER) process within a few minutes of coming in contact with acids. The specifier should ask for an HER certificate when purchasing plated threaded bars that are PC10.9 or higher.

There are certain proprietary coatings that may not use acid wash in the cleaning process. These coatings may not introduce HE on high tensile threaded rods. However, the performance of these coatings in terms of both the risk or HE and their corrosion protection should be verified by the user under field conditions prior to choosing these alternative coatings.

Galvanized threaded bar is made to standard thread tolerances and hot-dip galvanized (HDG) afterwards. Therefore, the thread of the galvanized threaded bar is larger in dimension than the standard uncoated threaded bar due to the coating thickness. For HDG threaded bars, oversize nuts manufactured to AS 1252 or EN 14399-3 could be used. As per these Standards it is necessary to use structural washers made to the same Standard with corresponding structural nuts.

Similar to bolts, threaded bars are best used in direct tension in a joint where a sufficient clamp force is provided. This clamping force helps reduce the share of the applied load on the threaded bar. Similar guidelines that are used in clamped bolted joints are therefore relevant to threaded bar.

Similar to tension bearing (TB) and tension friction (TF) bolted joints, clamp force is essential for the proper performance of PC8.8 and higher threaded bar joints intended for a similar function.

As the effective length of the threaded bar is not known accurately, the part-turn method in AS 4100 is not directly applicable to tightening joints with threaded bars. A suitable part-turn method may be devised through an appropriate calibration experiment on case by case basis. Unlike with bolts, when using part-turn method with threaded bars it should be kept in mind that either nut may rotate with respect to the bar, and therefore adequate precautions should be taken to account for these effects. Markings should be made on both ends and a combined rotation effect to be taken if both nuts rotate in the tightening process.

Alternatively, if the coating and thread dimensions of the threaded bars are well controlled, their friction characteristics become consistent. Then a laboratory test may provide a torque value that can be used with a calibrated batch of threaded bars. This has to be determined with sufficient data through a statistical analysis. EN 14399-2 specifies a test procedure incorporating both bolt washer and nut as an assembly in order to verify their torque vs tension characteristics. If the products are tested and supplied under such Standards, torque may be used as a tightening method as per the recommendations of the said Standard.

As AS 4100 does not allow torque as a tightening method, it is the responsibility of the engineer to conduct the necessary laboratory/field tests or to validate results produced under EN 14399-2, in order to substantiate the torque value on a case by case basis, as well as to assure that conditions simulated in the torque tests are maintained in the field application.

In accordance with AS 4100, other calibrated direct tension indicating (DTI) devices may be used for the tightening of the joints. In such cases the engineer should have all necessary supporting data and be assured of the performance of the used device.

When using part-turn method or DTIs, appropriate thread lubricants may be used to ease the tightening process. When using thread lubricants, the manufacturer's guidelines must be observed. If calibrated torque is used as the tightening method, then the thread conditions must be similar to the condition tested in the calibration process. The AS 4100 part-turn method should not be used in combination with DTIs on the same fastener. Torque method may be used in combination with DTIs.

3 IMPORTANT CONDITIONS

3.1 Relevant Standards

There are several Standards that are related to threaded bars. In Australia AS 2528-1982 is considered the most relevant to this product range. In Europe it is DIN 976-1 (2002-12) and in the USA it is ASTM A193/A193M. Some parts of EN 14399-3, EN 14399-5 and EN 14399-6 may also be applicable to this product range. The previous European Standard DIN 975 is now obsolete.

AS 2528 covers different types of stud bolts mainly for flanges and other high and low temperature applications, however, this only covers Property Classes PC4.6, PC8.8 and PC8.8. PC8.8 refers to bars manufactured out of lower carbon alloy steels. In addition, current industry uses Property Classes PC5.6 and PC5.8. For simplicity **only the information relevant to typical structural applications using these classes of materials** are presented in this technical note. While most of the information on dimensions,

material properties and test methods are from AS 1252, AS 4291.1 and/or ISO 898-1, where necessary, the relevant information from AS 2528 is also used. For all other requirements DIN 976-1 (2002-12) is used. Therefore, this technical note is generally in line with most applicable national and international standards.

The following sections provide requirements for metric series coarse thread threaded bars (threaded continuously), washers and nuts for diameters given in AS 1252 (M16, M20, (M22), M24, (M27), M30, M36) mainly intended for structural engineering applications in the temperature range -50^{0}C to +300^{0}C. Only Property Classes PC4.6, PC4.8, PC5.6, PC5.8, PC8.8 and PC8.8 are covered by this document.

3.2 Screw thread

Screw thread should be made in accordance with AS 1275/AS 1721 ISO coarse thread pitch series with a tolerance class of 6g. The thread pitch for each size is fixed and determined by this Standard. The thread should be formed by thread rolling (preferred) or thread cutting. Rolling after heat treatment is advisable if the thread is subject to significant dynamic (fatigue) loads. Cut thread may not perform as well as rolled thread in dynamic load applications.

(a) Machined thread (b) Rolled thread

FIGURE 1 COMPARISON OF MACROSTRUCTURES OF MACHINED AND ROLLED THREADS

As shown in Figure 1(a), macrostructure of a machined thread displays the grain flow that has been cut at the thread profile. This can be contrasted with a rolled thread (Figure 1(b)) where a continuous grain flow around the thread profile is shown. This effect, in combination with the cold working at the root of the thread, has been shown to significantly improve the fatigue and impact resistance of the rolled thread compared to the machined thread.

3.3 Shape and dimensions

The end of threaded bars should be chamfered at 45° to a depth exceeding the depth of the thread or as rolled condition as per DIN EN ISO 4753 to ensure easy engagement of the nut.

Limit deviations and geometrical tolerances should be as specified in Product Grade A of DIN EN ISO 4759-1. An extract of the applicable length tolerances are shown in the Table 1 below.

TABLE 1

LENGTH TOLERANCES FOR THREADED BAR

Length (mm)	Tolerance (mm)
35-50	+/- 0.5
55-80	+/- 0.6
85-120	+/- 0.7
130-180	+/- 0.8
190-240	+/- 0.925
260-300	+/- 1.05
320-400	+/- 01.15
420-500	+/- 01.25
1000-3000	+/- 4.5

3.4 Surface finish

The surface should be clean and free from cracks or thread laps that are detrimental to their performance. Small thread laps on the thread crests are acceptable on rolled thread. Threaded bars may be supplied without a coating, or hot-dip galvanized (HDG) or electroplated coating. If HDG coating or the electroplated coating is applied, it should be done in accordance with the relevant Standard as outlined in Table 2. Any other coatings may be used under special agreement between the supplier and the customer. These coatings should be checked for suitability for the exact field application. Some of the coatings are notorious for resulting in pitting corrosion if chloride ions are present in the atmosphere. Such pitting corrosion could lead to subsequent HE or SCC on PC10.9 rods due to acid build up in the pits.

TABLE 2

RELEVANT SURFACE FINISH STANDARDS FOR THREADED BAR

Surface finish	Relevant Standard
As processed	DIN 267-2 applies with regard to surface roughness
Electro-plating	AS 1897 or DIN EN ISO 4042
Zn flake coatings	DIN EN ISO 10683
Hot-dip galvanizing (HDG)	AS 1214 or DIN 267-10 or EN/ISO 10684

3.5 Chemical composition

The chemical composition of steel alloys used for manufacturing threaded bars should be within the limits given in Table 3.

TABLE 3

CHEMICAL COMPOSITION OF STEEL ALLOYS USED FOR MANUFACTURING THREADED BAR

Property Class	Material and heat treatment	Chemical composition %					Tempering temperature ^{o}C
		Carbon		Phosphorus	Sulphur	Boron	
		Min	Max	Max	Max	Max	
4.6	Carbon steel or carbon steel with additives	–	0.55	0.05	0.06	N/A	–
4.8		–	0.55	0.05	0.06	N/A	–
5.6		0.13	0.55	0.05	0.06	N/A	–
5.8		–	0.55	0.05	0.06	N/A	–
8.8	Low carbon steel with alloying elements (B, Mn, Cr etc.) quenched and tempered	0.15	0.40	0.025	0.025	0.003	425
8.8	Carbon steel quenched and tempered	0.25	0.55	0.025	0.025	N/A	450 (<M20) 425

Free cutting steels that are designed for machining purposes can be used only for PC4.6 and PC5.8 products. For free cutting steels the following limits apply: sulphur 0.35% max, phosphorous 0.11% max, lead 0.35% max. These products should not be used in temperatures above 200°C.

Some heat treatment may be required to achieve the required ductility of PC4.6 and PC5.6.

3.6 Mechanical properties

Mechanical properties for threaded bar are given in Table 4.

TABLE 4

MECHANICAL PROPERTIES FOR THREADED BAR

Mechanical property			Property Class					
			4.6	4.8	5.6	5.8	8.8 and 8.8	
							≤ M16	> M16
Tensile strength, R_m	Nom	MPa	400	400	500	500	800	800
	Min	MPa	400	420	500	520	800	830
Yield stress, R_{eL}	Nom	MPa	240	–	300	–	–	–
	Min	MPa	240	–	300	–	–	–
Stress under proof load, S_p	$S_p/R_{p\ 0.2}$		0.94	0.91	0.93	0.90	0.91	0.91
	Min	MPa	225	310	280	380	580	600
Stress at permanent set limit, $R_{p0.2}$	Nom	MPa	–	–	–	–	640	640
	Min	MPa	–	–	–	–	640	660
Brinell hardness	Min	HB	114	124	147	152	230	242
	Max	HB	209	209	209	209	306	319
Vickers hardness	Min	HV	120	130	155	160	242	255
	Max	HV	220	220	220	220	323	336
Rockwell hardness	Min	HR	B 67	B 71	B 79	B 82	C 21	C 23
	Max	HR	B 95	B 95	B 95	B 95	C 33	C 34
Elongation after fracture, A	Min	%	22	–	20	–	12	12
Impact strength @ -20^0C (K_v – Charpy V)	Min	J	–	–	27	–	27	27
Minimum height of non–carburized thread zone, h_d			–	–	–	–	0.5 thread height, h_s	
Maximum depth of complete decarburization			–	–	–	–	0.015 mm	

3.7 Tensile breaking and proof loads

Minimum tensile breaking and proof loads for metric threaded bars are given in Table 5.

TABLE 5

MINIMUM TENSILE BREAKING AND PROOF LOAD FOR METRIC THREADED BAR

Nominal diameter, D (mm)	Thread pitch p (mm)	Minor dia. area A_c (mm^2)	Tensile stress area, A_s (mm^2)	Breaking load (kN)					Proof load (kN)				
				Property Class					Property Class				
				4.6	4.8	5.6	5.8	8.8 and 8.8	4.6	4.8	5.6	5.8	8.8 and 8.8
16	2.0	138	157	62.8	65.9	78.5	81.6	125	35.3	48.7	44	59.7	91
20	2.5	217	245	98	103	122	127	203	55.1	76	68.6	93.1	147
(22)	2.5	272	303	121	127	152	158	252	68.2	93.9	84.8	115	182
24	3.0	313	353	141	148	176	184	293	79.4	109	98.8	134	212
(27)	3.0	414	459	184	193	230	239	381	103	142	128	174	275
30	3.5	503	561	224	236	280	292	466	126	174	157	213	337
36	4.0	738	817	327	343	408	425	678	184	253	229	310	490

3.8 Shear capacities of threaded bars

As threaded fasteners are meant for loading in tension, no requirements on the shear capacity of the bolts or threaded bars are specified in the relevant Standards except in AS 1559 for tower bolts. Therefore, no tests are conducted and no guarantees are given for the shear capacity of a structural bolt or a threaded bar by the manufacturer.

If the threaded bars need to be used in shear applications, guidance may be sought from other Standards such as AS 4100. This Standard uses the factor of 0.62 on the tensile capacity for the calculation of the shear capacity of a bolt. Using the same factor, the minimum breaking shear capacity of a certain size and property class thread bar (V_{fu}) may be calculated using the formula:

$$V_{fu} = 0.62 * R_m * A_c$$

where A_c is the minor diameter area of the thread as shown in Table 5, and R_m is the minimum ultimate tensile stress of the bolt as shown in Table 4.

Now by multiplying the breaking loads given in Table 5 by the factor of $0.62*A_c/A_s$ the corresponding minimum breaking single shear capacities may be estimated. Similarly, by multiplying the proof loads given in Table 5 by the factor of $0.62*A_c/A_s$ the corresponding proof single shear capacities may be estimated.

3.9 Acceptance tests for mechanical properties and inspection

The following minimum tests as shown in Table 6 are required for acceptance of threaded bars.

TABLE 6

ACCEPTANCE TESTS FOR THREADED BAR

Mechanical property	Test method	Test for Property Class	
		4.6, 4.8. 5.6, 5.8	8.8 and 8.8
Extension under proof load	Proof load test ISO 898-1/AS4291.1	Required	Required
Breaking load	Breaking load (wedge*) test ISO 898-1/AS4291.1	Required	Required
Decarburization	Decarburization test ISO 898-1/AS4291.1	–	Required

*- Threaded wedge with thread tolerance 4H is used. Wedge angle M16, 6^0, all other sizes 4°.

For threaded bar with diameter greater than M24, the additional acceptance tests as shown in Table 7 are recommended. For these tests, machined test pieces have to be used.

Acceptance inspection of this product should be done in accordance with DIN EN ISO 3269.

TABLE 7

ACCEPTANCE TESTS FOR THREADED BAR >M24

Mechanical property	Test method	Test for Property Class	
		4.6, 4.8, 5.6, 5.8	8.8 and 8.8
Tensile strength, R_m	Tensile test ISO 898-1/AS4291.1	Required	Required
Yield stress, R_{eL}	Tensile test ISO 898-1/AS4291.1	Required	–
Stress at permanent set limit, $R_{p,0.2}$	Tensile test ISO 898-1/AS4291.1	–	Required
% Elongation after fracture, A	Tensile test ISO 898-1/AS4291.1	Required	Required
Impact strength	Impact test ISO 898-1/AS4291.1	–	Required

3.10 Marking

Threaded bars greater than diameter M5 should be marked at one end with the symbol denoting the property class except for threaded bars of PC4.8. The 'dot' in property class may be omitted (e.g. 88 is acceptable for PC8.8). Alternatively, clock markings as per ISO 898-1 may also be used. Marking of the manufacturer symbol is not required.

The colour coding as shown in Table 8 is also acceptable. The markings should not impair proper use of the threaded bars.

TABLE 8

COLOUR CODING FOR STRENGTH IDENTIFICATION OF THREADED BAR

Property Class	Marking
PC4.6, 4.8	Not required
PC5.6	Brown, RAL 8015
PC5.8	Blue , RAL 5010
PC8.8	Yellow, RAL 1023
PC10.9	White, RAL 1013
PC12.9	Black, RAL 9017

In addition, the following information should be marked on the packaging:

a) General product description – threaded bar
b) The letter M indicating ISO metric coarse pitch thread
c) The nominal diameter in mm
d) The nominal length in mm
e) Property class
f) Coating applied (if present)

If the threaded bars are not marked, a suitable sample test is required to determine its property class. Also a verification of the chemical composition of the material is required in order to ascertain that it meets the specification in Table 3.

4 METRIC NUTS FOR THREADED BARS

There are various forms and classes of nuts available in the market that may fit the same size threaded bar. Therefore it is necessary to understand the differences between these nuts in order to select the appropriate nut.

The main Australian Standard specifying the geometry of nuts is AS 1112 which has four parts. Other than this Standard, AS 1252 also specifies a special nut for structural engineering applications. Table 9 summarizes the details of these Standards for steel nuts.

TABLE 9

A SUMMARY OF DIFFERENT NUT SPECIFICATIONS

	AS 1112.1/ ISO 4032	AS 1112.2/ ISO 4033	AS 1112.3/ ISO 4034	AS 1112.4/ ISO 4035	AS 1252	EN 14399-3
Title	ISO metric hexagon nuts: Style 1 – Product Grades A and B	ISO metric hexagon nuts: Style 2 – Product Grades A and B	ISO metric hexagon nuts: Product Grade C	ISO metric hexagon nuts: chamfered thin nuts – Product Grades A and B	High strength steel bolts with associated nuts and washers for structural engineering	High strength structural bolting assemblies for pre-loading – Part 3: System HR – Hexagon bolt and nut assemblies
Range covered	M1.6 to M64 d ≤ M16 Product Grade A. d > M16 Product Grade B.	M5 to M36 d ≤ M16 Product Grade A. d > M16 Product Grade B.	M5 to M64 Product Grade C.	M1.6 to M64 d ≤ M16 Product Grade A. d > M16 Product Grade B.	M16 to M36 Product grade designation does not apply.	M 12 to M36 Product grade designation does not apply.
Nominal nut thickness	Approximately 0.8 of d	Approximately 0.9 of d		Approximately 0.5 of d	Approximately d	Approximately 0.8 of d
Thread tolerance	6H	6H	7H	6H	6H – uncoated nut 6H + 0.4 – AS1214 Gal nut	6H – uncoated nut 6AZ – Gal nut
Property Class[a]	M39 < d < M3 as agreed M3 ≤ d ≤ M39 4, 5, 6, 8, 10, 12	8, 9 and 12	d ≤ M16; 5 M16 < d ≤ M39; 4, 5 d > M39 as agreed	M39 < d < M3 as agreed M3 ≤ d ≤ M39 04, 05	8 proof loads as per AS 1252	8 and 10 proof loads as per EN 14399-3
Finish and coating	Electroplated coatings AS 1897 or as agreed, hot-dip galvanized coatings AS 1214/EN 10684. Limits for surface discontinuities ISO 6157.2/EN 493					
Acceptability	Procedure of ISO 3269					
General comments	Most widely used nut in all mechanical applications. Thinner than Style 2 nut and AS 1252 nut but has a proof load sufficiently larger than the UTS of the bolt.	Thicker nut and has a proof load lower than Style 1 but still larger than the UTS of the bolt.	Has a wider tolerance on dimensions and are available only in Class 4 and 5. Proof load is slightly smaller than that of Product Grade A and B.	Thin nuts should not be high strength. They are only used as locknuts. Proof load is substantially lower than corresponding bolt UTS.	Larger nut in both height and width. Has a larger proof load than AS 1112. Galvanized nut has even larger proof load than the plain nut.	Nut has a wider across flats dimension similar to AS 1252 but the same height as the AS 1112.1 nut. Proof load lies between AS 1112.1 and AS 1252.

NOTE:
a - Other property classes refer to ISO 878.2.

4.1 Chemical composition for nuts

Nuts should be manufactured with steel conforming to the chemical composition as shown in Table 10.

TABLE 10

CHEMICAL COMPOSITION OF STEELS SUITABLE FOR MANUFACTURING NUTS FOR THREADED BAR

Property Class		Chemical composition limits %			
		C	Mn	P	S
		max	min	max	max
4[a], 5[a], 6[a]	–	0.50	-	0.060	0.150
8, 9	04	0.58	0.25	0.060	0.150
10[b]	05	0.58	0.30	0.048	0.058
12[b]	–	0.58	0.45	0.048	0.058

NOTES:
a – Nuts of these property classes may be made from free cutting steels unless otherwise agreed. In such cases the maximum of phosphorous 0.11%, sulphur 0.34% and lead 0.35% should be used.
b – Alloying elements may be added to achieve necessary mechanical properties.

4.2 Mechanical properties of nuts

4.2.1 Specified proof loads

Table 11 provides the proof loads for various coarse thread nuts in the diameter range M16 – M36 covered in AS 1252. These nuts are compatible with coarse thread, threaded bars.

TABLE 11

PROOF LOADS FOR VARIOUS COARSE THREAD NUTS

	Proof load (kN)*										
PC	8	10	4	5	8	10	8	9	12	AS 1252 Structural	
	EN 14399-3		Style 1 – AS 1112.1				Style 2 – AS 1112.2			HDG	Other
M16	157.0	182.1	80.0	96.0	138.0	165.0	–	149.0	186.0	183.0	168.0
M18	192.0	222.7	98.0	121.0	177.0	204.0	171.0	177.0	231.0	224.0	207.0
M20	245.0	284.2	125.0	154.0	225.0	259.0	218.0	225.0	294.0	285.0	263.0
M22	303.0	351.2	155.0	191.0	279.0	322.0	270.0	279.0	364.0	353.0	326.0
M24	353.0	409.5	180.0	222.0	324.0	374.0	314.0	324.0	423.0	411.0	379.0
M27	459.0	532.4	234.0	289.0	423.0	487.0	409.0	423.0	551.0	535.0	494.0
M30	561.0	650.8	286.0	353.0	516.0	594.0	499.0	516.0	673.0	653.0	603.0
M33	–	–	354.0	437.0	638.0	735.0	617.0	638.0	832.0	808.0	746.0
M36	817.0	947.7	417.0	515.0	751.0	866.0	727.0	751.0	980.0	951.0	878.0

NOTE:
*- Rounded off.

In general, the nuts used for structural engineering purposes have a proof load larger than that given in other Standards. As in most cases, structural nuts are tightened above the proof load of the bolt, this is necessary. However, AS 1252 specifies nut proof loads higher than the EN counterpart especially for HDG nuts. This is due to AS 1252 allowing larger oversize thread tapping tolerances than EN, as at the time of AS 1252, the local galvanizing industry was not developed enough to control the coating thickness. Since then, new technologies have been developed to tightly control the thickness of the galvanized coating. As such, the thread tolerance has been reduced in the later international standards.

It should be noted that even though EN nuts have a proof load lower than that of AS 1252 nuts, use of EN nuts will not compromise the joint integrity as the bolt will fail before reaching these proof load values.

4.2.2 Hardness

The proof load test is the ultimate deciding test for nuts if all geometric limitations are satisfied (i.e. Go/No go thread gauges and other critical dimensions). As the proof load test is quite cumbersome once proven, a hardness test may be used as a screening test in terms of determining the mechanical properties of a nut. Table 12 provides the Vickers Hardness (HV) specified for each type of nut. If the nuts are made in this hardness range and if all the other geometric and surface conditions are met then they will provide the adequate proof load. However, in case of a conflict, the hardness test is not a final test for the mechanical properties of a nut.

TABLE 12

VICKERS HARDNESS (HV) SPECIFIED FOR EACH TYPE OF NUT

	Vickers Hardness (HV)										
PC	8	10	4	5	8	10	8	9	12	AS 1252 Structural	
	EN 14399-3		Style 1 – AS1112.1				Style 2 – AS1112.2			HDG	Other
M16 –M36	EN 20898-2		117-302	146-302	233-353	272-353	180-302	188-302	272-353	260-353	188-353

Some practitioners weld hardened nuts in certain applications. This practice should be avoided as the material properties of a hardened nut would alter if the nut is heated beyond the transition temperature of the material which is in the order of 520^{0}C.

4.3 Acceptance tests for mechanical properties and inspection

The tests shown in Table 13 are required for acceptance of nuts for threaded bars.

TABLE 13

ACCEPTANCE TESTS FOR NUTS

Mechanical property	Test method	Applicability
Proof load	Proof load test ISO 898-1/AS 4291.1	Required*
Hardness	Hardness test ISO 898-1/AS 4291.1	Optional
Decarburization	Decarburization test ISO 898-1/AS 4291.1	Optional

NOTE:
* - May be replaced by a hardness test if all geometric and surface properties are met

In addition to these tests, there are some proprietary Standards that are devised by various companies and government authorities (e.g. TMR Qld. MRTS 78, RMS NSW, RMS B240) that may require assembly tests to full tightening (1.05 of proof load). These tests follow the guidelines of EN 14399-2 for assembly testing. When these tests are required in the purchase agreement, it is very important to select the appropriate nuts made to AS 1252/EN 14399-3, as some nuts made to AS 1112 may not consistently pass this test.

AS 1252 and AS 1112 bolts will not satisfy the torque vs tension relationship specified in the European Standard EN 14399-2 (k-factor values). If this requirement needs to be met, special friction controlled coatings may be required on threaded rod, the washer and the nut.

Acceptance inspection of this product should be done in accordance with DIN EN ISO 3269.

4.4 Markings

All nuts equal to or greater than M5 should be marked with the designation system specified in the relevant Standard. For AS 1112 nuts, the relevant Standard is ISO 898.2/AS 4291.2 and for structural nuts, it is AS 1252/EN 14399-3.

4.5 Rule of thumb for selection of nuts for threaded bars

It is good practice that for structural applications using PC8.8 galvanized threaded bars, galvanized nuts made to AS 1252/EN 14399-3 should be used. For uncoated threaded rod, AS 1252/EN 14399-3 uncoated nuts should be used.

For Property Class 4.6, 4.8, 5.6, 5.8 threaded bars, a nut of Class 5 made to AS 1112 should be used. For HDG threaded bar, a nut made to AS 1252/EN 14399-3 galvanized thread may be used. It is always acceptable to use a class equal or higher than the bolt property class for the nut (e.g. for a PC4.8 bolt, a nut of Class 4 or higher or for a PC8.8 bolt, a nut of Class 8 or higher may be used).

5 FLAT WASHERS

5.1 Mechanical properties for washers

Hardened flat washers made in accordance with AS 1252 should be used with AS 1252 nuts on high tensile threaded bars used for structural engineering applications. Hardness values for different types of washers are given in Table 14. If EN 14399-3 nuts are used, the corresponding washers from the same Standard should be used.

TABLE 14

HARDNESS SPECIFICATION FOR WASHERS FOR THREADED BAR

Washer type	Hardness range (HV)
HDG AS 1252 washer	270 – 445
Other than HDG AS 1252 washer	345 – 445
EN 14399-5, EN 14399-6	300 – 370
ASTM F436 – Plain and plated	370 – 445
ASTM F436 – HDG	270 – 445
Class HV 140 (ISO 7089)	140 – 200
Class HV 200 (ISO 7089)	200 – 300
Class HV 300 (ISO 7089/ISO 7415)	>300

Plain steel flat washers (DIN 7989A, ISO 7089, AS 1237) may be used with Property Class 4.6, 4.8, 5.6 and 5.8 threaded bars. Hardened steel flat washers (DIN 6340, ISO 7089, ISO 7415 Class HV 300) may also be used with PC8.8 threaded bars. It is important to use a washer that is harder than the nut in all applications.

Metric hardened flat washers should be marked in accordance with the relevant Standards as indicated in Table 14. Note that dimensions of washers given in ISO 7415 are larger than those of ISO 7089.

5.2 Acceptance tests for mechanical properties and inspection

The following tests are required for acceptance of hardened flat washers.

TABLE 15

ACCEPTANCE TESTS FOR WASHERS FOR THREADED BAR

Mechanical property	Test method	Applicability
Hardness	Vickers hardness test as per AS 1817.1 /ISO 6507.1	Required

Acceptance inspection of this product should be done in accordance with DIN EN ISO 3269. This Standard provides sampling schemes and acceptance criteria for batch inspection.

5.3 Marking

Hardened round flat washers made to AS1252 should have three nibs on the outer circumference at 120° intervals.

Hardened round flat washers made to EN 14399-5 or EN 14399-6 should have H marked on the washer surface with manufacturer identification.

AS 1237/ASTM F436/ISO 7089 do not specify any specific identification for plain steel flat washers. Some manufacturers include their identification and some mark the ISO 7089 Class but these are optional.

6 COMPLIANCE /CONFORMANCE CERTIFICATES

Amendment 1-2012 to AS 4100 requires a properly issued test certificate or a compliance certificate stating that the bolts, nuts and washers comply with all the provisions of the relevant Standard as sufficient evidence of compliance with the relevant Standard. Furthermore, this requires that the tests are carried out by an independent laboratory accredited by signatories to the International Laboratory Accreditation Corporation (Mutual Recognition Agreement) ILAC MRA on behalf of the supplier (manufacturer, importer) or customer. The compliance certificate is a letter or a certificate issued by the supplier taking responsibility for the product quality. By issuing these certificates, the supplier assures that the product is manufactured and performing in strict accordance with the relevant Standards specified in the certificate. Sufficient Factory Process Control (FPC) and sample testing need to be done on the particular batch of product in order to issue this certificate. This is an important legal document. If a false certificate is issued or if it is proven through adequate testing that the supplied certificate is false or misleading, the issuer of that certificate may be legally challenged.

As per HB 18.22 'Guidelines for third party certification and accreditation' the following information **must** be present in a valid compliance certificate or a letter of conformance:

- Date
- Name and address of the supplier
- Clear identification of the product with respective batch or purchase order number so that traceability to manufacturing process up to the stock material or material heat certificates can be made
- Identification of the relevant Standard or Standards
- Statement of Compliance or Conformance stating that the products as supplied fully comply with all the provisions of the relevant Standards
- Name, designation and signature of the issuing person

If this document does not refer to the particular batch of the product or the relevant Standards, it is not a valid document.

7 TEST CERTIFICATES

Test certificates contain more information than the compliance certificate. However, the statement of compliance as per compliance certificate must be present on the test certificate for it to be a valid test/compliance certificate as per AS 4100 requirements.

A valid test/compliance certificate must have the minimum of the following information:

- Date
- Name and address of the supplier
- Clear identification of the product with respective batch or purchase order number so that traceability to manufacturing process up to the stock material or material heat certificates can be made
- Identification of the relevant Standard or Standards
- Name and address of the test laboratory and their accreditation relating them to ILAC MRA
- List of tests conducted (with relevant Standards), test method used (with relevant Standards), specification based on the Standards, measured results:

- Threaded bars: Required acceptance tests as per Table 7 or as agreed with the customer
- Nuts: Required acceptance tests as per Table 13 or as agreed with the customer
- Washers: Required acceptance tests as per Table 15 or as agreed with the customer

- Statement of Compliance or Conformance stating that the products as supplied fully comply with all the provisions of the relevant Standards. This is the most important.
- Reference to a quality management system involved
- Name, designation and signature of the issuing person

A supplier may charge extra for providing a test certificate instead of a compliance certificate unless otherwise agreed at the ordering process. The organisation issuing the statement of compliance takes full responsibility for the compliance of the product to the relevant Standard. It is legally liable for this statement.

It is quite common that independent test laboratories undertaking contract testing for importers, issue test certificates that indicate that the product as tested meets with the requirements of the relevant Standards. This is not a valid compliance certificate as it only refers to the tested product. Unless the test laboratory has a full understanding of FPC and traceability of the product, they will not issue a compliance certificate. The importer or manufacturer has to take responsibility for the statement of compliance although it is issued with test data from an independent laboratory. In the statement of compliance, reference should be made to the supplied product with the particular batch identification.

If an engineer or a purchaser accepts an inadequate test/compliance certificate or statement of compliance it will not discharge him/her of the responsibility assigned by AS 4100. Therefore the responsible person must make sure the supplied test/compliance certificates are authentic and satisfy all the aforementioned requirements. It is good practice that these negotiations be held at the ordering process as there may be additional costs involved.

8 STORAGE

Threaded bars and nuts need to be stored in a way that it would prevent corrosion and potential thread damage of the bar and nuts. If stored in a wet or humid environment, independent of the coating applied, some corrosion may occur that will interfere with the performance of the product. Excessive corrosion may reduce the load-carrying capacities of the threaded bars.

Careful storage is absolutely essential if torque is used as a tightening method. Any difference to the surface condition from the calibrated condition may significantly impact the torque vs tension characteristics of the threaded bars. In this case the bars should be stored with the corresponding calibrated nuts in an environment that will not alter the surface characteristics of the products.

For higher strength threaded bars PC10.9 and higher there is an additional risk of Stress Corrosion Cracking (SCC) and Hydrogen Embrittlement (HE) if they come in contact with acids. SCC and HE could cause premature brittle failures of the stressed product. Therefore, they should not come in contact with acids or acid forming substances during the life time of the product. This danger is accentuated if the bar is heavily loaded.

APPENDIX A:

Checklist for a compliance certificate/letter of compliance

Parameter	Comment	Tick
Date	A date associated with the production, purchase order or the delivery note or in between	
Name and address of the supplier	Company name and ABN with a proper postal address. Company must have a responsible Australian entity	
Clear identification of the product with respective batch or purchase order number so that traceability to manufacturing process up to the stock material or material heat certificates can be made	Clear identification of the product	
	Production batch number or purchase order number	
	Reference to manufacturing quality system details (optional)	
Identification of the relevant Standard or Standards	Clear identification of relevant Standards; for an assembly not covered by one Standard, relevant Standard should be indicated for each component of the product.	
	The product should be actually covered in this Standard.	
Statement of compliance or conformance stating that the products as supplied fully comply with all the provisions of the relevant Standards	An appropriate statement wording would be: “The product xxxxxxxxx supplied under purchase order no./delivery docket no. xxxxxxxxx , as supplied is in full conformance with the relevant Standards xxxxxxx, xxxxxxx, xxxxxxx.” Note: Product identification, P.O./delivery docket no., relevant Standards etc. may be included in the document and referred to but not necessarily in the statement. If the statement states “The product as tested is in full conformance with the relevant Standards….”, it is not acceptable as a statement of conformance.	
Name, designation and signature of the issuing person	Should be the Quality Manager or the General Manager	

ASI STEEL DETAILER MEMBERS

NEW SOUTH WALES

CCD Drafting Services
Unit 4a
9-13 Winbourne Road
Brookvale NSW 2100 02 9938 3177

EDC
982 Hunter Street
Newcastle West NSW 2302 02 4927 6969

Elmasry Steel Design and Detailing
3/39 Stanley Street
Bankstown NSW 2200 02 9708 6500

Multicad
Shop 14 Annett's Arcade
9-11 Orient Street
Batemans Bay NSW 2536 02 4472 1611

QUEENSLAND

BDS Vircon
80 Tribune Street
South Brisbane QLD 4101 07 3503 5800

Brice Engineers
7-8 Brice Court
Mt Louisa QLD 4814 07 4774 8322

Complete Steel Detailing Pty Ltd
Unit 54, 139 Gooding Drive
Merrimac QLD 4226 07 5522 8604

Cubic Steel
Building 1
747 Lytton Road
Murarrie QLD 4172 07 3399 5164

Draftology
Suite 11, Level 3
445 Upper Edward Street
Spring Hill QLD 4004 07 3831 3775

Hempsall Steel Detailing
Unit 7, 16-22 Bremner Rd
Rothwell QLD 4022 07 3204 1054

JBD Steel Detailing
4/24 Hoopers Road
Kunda Park QLD 4556 0418 484 224

Murray Niebling
46 Berwick Street
Fortitude Valley QLD 4006 0427 968 437

Steelcad Drafting
Level 1, 375 Montague Road
West End QLD 4101 07 3844 3955

SOUTH AUSTRALIA

Australian Steel Detailers
3/ 147 Goodwood Road
Goodwood SA 5034 08 8271 6555

USDSA
16 Drury Terrace
Clovelly Park SA 5042 08 8374 4999

VICTORIA

Balpara
Unit 8, 104-106 Ferntree Gully Road
Oakleigh VIC 3166 03 9544 3877

Cadform Designs
13 Uganda Street
Burwood VIC 3125 0419 551 605

Engineering Design Resource
68 Hotham St
Traralgon VIC 3844 03 5173 7600

Fabcad Drafting
Suite 3
59 Church Street
Morwell VIC 3840 03 5133 0733

G.A.M. Steel
557 Mount Derrimut Road
Derrimut VIC 3030 03 8368 1555

Hybrid Steel Engineering Pty Ltd
48 Wilson Road
Melton VIC 3338 03 9746 9193

Ingen3D Steel & Façade Detailing Pty Ltd
Shop 3
83-85 Warren Road
Parkdale VIC 3195 03 9587 5051

WESTERN AUSTRALIA

BIM Drafting Services
Suite A7, 435 Roberts Road
Subiaco WA 6008 08 9363 7500

Cad Lab
Suite 1, 5/18 Griffin Drive
Dunsborough WA 6281 08 9759 1024

CADstruction Drafting
Suite 7
800 Albany Highway
East Victoria Park WA 6101 08 9472 7457

Goldfields Drafting
P.O. Box A309
Australind WA 6233 0419 904 672

Mechwest Design & Drafting
Suite 6
172 Scarborough Beach Road
Mount Hawthorn WA 6016 08 9444 7366

PDC Global
48 Kishorn Road
Applecross WA 6153 08 9315 6600

Universal Drafting
Suite 2, 8 Hasler Road
Osborne Park WA 6017 08 9242 8944

Westplan Drafting
Unit 3/11 Robinson Road
Rockingham WA 6168 08 9592 2499

NEW ZEALAND

Steel Pencil
554 Main Street
Palmerston North 4410 +64 6 356 8253

ASI STEEL MANUFACTURER, DISTRIBUTOR AND GALVANIZER MEMBERS

APC Group
www.apcgroup.com.au
Apex Building Products
www.apexsteel.com.au

Arrium Mining and Materials
www.arrium.com

Arrium Mining Consumables
www.arrium.com

ATB Morton
www.atbmorton.com.au

Australian Metal Processors (AMP)
www.amprocessors.com.au

Australian Reinforcing Company (ARC)
www.arcreo.com.au

Austube Mills
www.austubemills.com

Auszinc Metals & Alloys
www.auszinc.com.au

Bisalloy Steels
www.bisalloy.com.au

BlueScope Buildings Australia
www.bluescopebuildings.com.au

BlueScope Distribution
www.bluescopedistribution.com.au

BlueScope Sheet Metal Supplies
www.sheetmetalsupplies.com.au

BlueScope Steel Limited
www.bluescopesteel.com

BlueScope Water Australia
www.bluescopewater.com

Brice Metals
www.brice.com.au

Commercial Metals Pty Ltd
www.cmc.com

Commando
www.commando.com.au

Delta Galvanising Pty Ltd
www.delta.group.com.au

Dematic Pty Ltd
http://www.dematic.com/ap

Donhad
www.donhad.com.au

Ferrocut
www.ferrocut.com.au

Fielders
www.fielders.com.au

Fletcher Building Australia
www.fletcherbuilding.com

Fletcher Building Limited
www.fletcherbuilding.com

Fletcher Insulation Group
www.tasmaninsulation.com

GB Galvanizing Service Pty Ltd
www.gbgalv.com.au

Hartway Galvanizers
www.hartway.com.au

Horan Steel
www.horan.com.au
Hunter Galvanizing
www.huntergalvanizing.com.au

IG (Tasmania) Pty Ltd
http://ingal.com.au

Industrial Galvanizing Corporation
http://ingal.com.au

Ingal EPS
www.ingaleps.com.au

Kingfield Galvanising
www.kingfieldgalvanizing.com.au

Kingspan Insulated Panels
www.kingspan.com.au

Korvest Galvanisers
www.korvest.com.au

Lysaght
www.lysaght.com

Macrack
www.macrack.com.au

Menghello Galvanizing
www.meneghello.com

Metalcorp Steel
www.metalcorpsteel.com.au

Midalia Steel Pty Ltd
www.midaliasteel.com

National Galvanizing Industries
www.natgalv.com.au

Nepean Building & Infrastructure
www.nepean.com

OneSteel Distribution
www.onesteel.com

OneSteel Limited
www.onesteel.com

Onesteel Manufacturing
www.onesteel.com

OneSteel Metalcentre
www.onesteel.com

OneSteel Recycling
www.onesteel.com

Onesteel Reinforcing
www.onesteel.com

Orrcon
www.orrcon.com.au

Pacific Steel Group
www.pacificsteel.co.nz

RJE (Rigby Jones)
www.rigbyjones.com.au

Rondo Building Services
www.rondo.com.au

Southern Queensland Steel
www.sqsteel.com.au

Southern Sheet & Coil
www.southernsheetandcoil.com.au

Southern Steel Group
www.southernsteelgroup.com.au

Southern Steel Supplies
www.southernsteel.com.au

Southern Steel W.A
www.southernsteelwa.com.au

Statewide Office
www.statewideoffice.com.au

Stramit Building Products
www.stramit.com.au

Surdex Steel
www.surdexsteel.com.au

Vulcan Steel Pty Ltd
03 8792 9600
Webforge Australia Pty Ltd
www.webforge.com.au

Western Galvanizers
www.westgalv.net.au

ASI STEEL FABRICATOR MEMBERS

AUSTRALIAN CAPITAL TERRITORY

Baxter Engineering
177 Gladstone Street
Fyshwick ACT 2609 02 6280 5688

Oz Metalwork
11 Cheney Place
Mitchell ACT 2911 0458 080 887

NEW SOUTH WALES

7Steel Building Solutions
142 Magowar Road
Girraween NSW 2145 02 8071 4383

ACA-Ace Construction Australia
22 York Road
Ingleburn NSW 2565 02 9618 7874

ACT Steelworks
32 Faunce Street
Queanbeyan NSW 2620 02 6297 4611

Adua Engineering Aust.
25 – 27 Loftus Street
Riverstone NSW 2765 02 9627 2933

Algon Steel
7 Pippita Close
Beresfield NSW 2322 02 4966 8224

Align H
Lot 102 Lackey Road
Moss Vale NSW 2577 02 4869 1594

Aljen Welding & Engineering
17 Deering Street
Ulladulla NSW 2539 02 4455 7299

Allthread Industries
15 Bellona Avenue
Regents Park NSW 2143 02 9645 1122

Amarcon Group
18-20 Lucca Road
North Wyong NSW 2259 02 4352 2468

AWI Steel
36 Day Street
North Silverwater NSW 2128 02 9748 6730

Belmore Engineering
47 Showground Road
Tamworth NSW 2340 02 6765 9311

Bosmac Pty Ltd
64-68 Station Street
Parkes NSW 2870 02 6862 3699

C & V Engineering Services
23 Church Avenue
Mascot NSW 2020 02 9667 3933

Charles Heath Industries
18 Britton Street
Smithfield NSW 2164 02 9609 6000

Combell Steelfab
51 Jedda Road
Prestons NSW 2170 02 9607 3822

Coolamon Steelworks
81 Wade Street
Coolamon NSW 2701 02 6927 4000

Cosme-Australia Stainless Steel Fab
19 Lasscock Road
Griffith NSW 2680 02 6964 1155

Cullen Steel Fabrications
26 Williamson Road
Ingleburn NSW 2565 02 9605 4888

D.A.M. Structural Steel
65 Hartley Road
Smeaton Grange NSW 2567 02 4647 7481

D.M.E. Engineering Services
8 Dupas Street
Smithfield NSW 2164 02 9725 5720

Davebilt Industries
116 Showground Road
North Gosford NSW 2250 02 4325 7381

Designed Building Systems
144 Sackville Street
Fairfield NSW 2165 02 9727 0566

Edcon Steel
Unit 3a, 9-13 Winbourne Road
Brookvale NSW 2100 02 9938 8505

Fabinox
67 Melbourne Road
Riverstone NSW 2765 02 9627 6237

Ficogi Engineering
33 Liverpool Street
Ingleburn NSW 2565 02 9829 2711

Flame-Cut
68 Elizabeth Street
Wetherill Park NSW 2164 02 9609 3677

Forgacs Engineering
50 Fitzroy Street
Carrington NSW 2294 02 4978 9100

Halley and Mellowes
10 Hereford Street
Berkeley Vale NSW 2261 02 4389 6191

HF Hand Constructors
26-32 Akubra Place
South Kempsey NSW 2440 1300 434 263

Hutchins Bros
25-27 Driscoll Road
Narrandera NSW 2700 02 6959 2699

ILB NSW
24-28 Lords Place
Orange NSW 2800 02 6362 3100

In City Steel
21 Dampier Place
Prestons NSW 2170 02 8783 8831

Industrial Building Systems
9 Old Punt Road
Tomago NSW 2322 02 4961 6822

Kaydee Engineering
90 Toongabbie Road
Toongabbie NSW 2146 02 9631 3531

Mario & Sons Steel Fabrication
189- 193 Newton Road
Wetherill Park NSW 2164 02 9756 3400

Mecha Design & Fabrication
P.O. Box 477
Wyong NSW 2259 02 4351 1877

Morson Engineering
4 Lucca Road
Wyong NSW 2259 02 4352 2188

On Time Fabrication
2/300 Manns Road
West Gosford NSW 2250 02 4324 4467

Pacific Steel Constructions
Unit 1, 4 Maxim Place
St Marys NSW 2760 02 9623 5247

Piper & Harvey Steel Fabrications (Wagga)
51 Tasman Road
Wagga Wagga NSW 2650 02 6922 7527

Precision Oxycut
106 Long Street
Smithfield NSW 2164 02 9316 9933

Protective Fencing
16 Pile Road
Somersby NSW 2250 02 4340 4411

Rambler Welding Industries
39 Lewington Street
Wagga Wagga NSW 2650 02 6921 3062

Redispan Conveyors
15 Old Punt Road
Tomago NSW 2322 1300 131 370

Riton Engineering
101 Gavenlock Road
Tuggerah NSW 2259 02 4353 1688

S & L Steel Group
59 Glendenning Road
Rooty Hill NSW 2766 02 9832 3488

Saunders International
271 Edgar Street
Condell Park NSW 2200 02 9792 2444

Stronghold Fabrications
15 Homedale Road
Bankstown NSW 2200 02 9791 1886

Sydney Maintenance Services
7/173 Power Street
Glendenning NSW 2761 02 8678 0710

Tasman Tank Company
151 Glendenning Road
Glendenning NSW 2761 02 8887 5000

Tubular Steel Manufacturing
15 Johnson Street
Maitland NSW 2320 02 4932 8089

Universal Steel Construction (Australia)
52-54 Newton Road
Wetherill Park NSW 2164 02 9756 2555

W E Smith Engineering
Hamilton Drive
Boambee NSW 2450 02 6650 8888

Walpett Engineering
48 Hincksman Street
Queanbeyan NSW 2620 02 6297 1277

Weldcraft Engineering
79 Thuralilly Street
Queanbeyan NSW 2620 02 6297 1453

WGE
151-153 Five Islands Road
Cringila NSW 2502 02 4272 2200

QUEENSLAND

AG Rigging & Steel
207-217 McDougall Street
Toowoomba QLD 4350 07 4633 0244

Alltype Welding
55 Christensen Road
Stapylton QLD 4207 07 3807 1820

Austin Engineering
173 Cobalt Street
Carole Park QLD 4300 07 3271 2622

Austweld Engineering
77 Coleyville Road
Mutdapilly QLD 4307 07 5467 1122

Beenleigh Steel Fabrications
41 Magnesium Drive
Crestmead QLD 4132 07 3803 6033

Bend-Worx
1 Viking Drive
Wacol QLD 4076 07 3271 1377

Brezac Constructions
27-35 Calcium Court
Crestmead QLD 4132 07 3803 6188

Brown Steel
157 O'Mara Road
Charlton QLD 4350 07 4614 3901

Cairns Steel Fabricators
6 Walters Street
Portsmith QLD 4870 07 4035 1506

Casa Engineering
151 Tile Street
Wacol QLD 4076 07 3271 2300

Central Engineering
19 Traders Way
Currumbin QLD 4223 07 5534 3155

Compliant Steel
1294 Kingsthorpe-Haden Road
Boodua QLD 4401 07 4696 7665

DWW Engineering
53 Station Avenue
Darra QLD 4076 07 3375 5841

Gay Constructions
225 Queensport Road
Murarrie QLD 4172 07 3890 9500

Hosken Site Steel
228b Lavarack Avenue
Pinkenba QLD 4008 07 3260 2084

Idec Solutions
58 Anton Road
Hemmant QLD 4174 07 3908 9600

KG Fabrication
Unit 3/35 Sodium Street
Narangba QLD 4504 07 3888 4646

Lazco Fabrications
P.O. Box 884E
Earlville QLD 4870 07 4035 5211

Morton Steel
78 Freight Street
Lytton QLD 4178 07 3396 5322

Noosa Engineering & Crane Hire
9 Leo Ally Road
Noosaville QLD 4566 07 5449 7477

Pierce Engineering
48 Quinn Street
North Rockhampton QLD 4701 07 4927 5422

Quality Assured Bolt & Steel Fabrication
32 Andrew Campbell Drive
Narangba QLD 4504 07 3888 3888

SJC Engineering
Unit 2 / 11 Natasha Street
Capalaba QLD 4157 0403 178 424

Steel Fabrications Australia
Unit 12, 63 Burnside Road
Stapylton QLD 4207 07 3439 6126

Stewart & Sons Steel
11-17 Production Street
Bundaberg QLD 4670 07 4152 6311

Sun Engineering
113 Cobalt Street
Carole Park QLD 4300 07 3271 2988

Thomas Steel Fabrication
19 Hartley Street
Garbutt QLD 4812 07 4775 1266

Tobin Projects
47 Noble Avenue
Northgate QLD 4013 07 3260 5189

Vancisco Industries
1/162 Enterprise Drive
Beaudesert QLD 4285 07 5541 1115

W D T Engineers
124 Ingram Road
Acacia Ridge QLD 4110 07 3345 4000

Widgee Engineering
532 Upper Widgee Road
Widgee QLD 4570 07 5484 0109

SOUTH AUSTRALIA

Advanced Steel Fabrications
61-63 Kapara Road
Gillman SA 5013 08 8447 7100

Ahrens Group
Wilhelm Road
Kingsford SA 5118 08 8521 0000

BGI Building Group
21-23 Tanunda Road
Nuriootpa SA 5355 08 8562 2799

Bowhill Engineering
Lot 100, Weber Road
Bowhill SA 5238 08 8570 4208

Gadaleta Steel Fabrication
12 Wattle Street
Port Pirie SA 5540 08 8633 0996

Manuele Engineers
240-280 Morphett Road
North Plympton SA 5037 08 8414 2000

RC & ML Johnson
671 Magill Road
Magill SA 5072 08 8333 0188

SA Structural
9-11 Playford Cresent
Salisbury North SA 5108 08 8285 5111

Samaras Structural Engineers
96-106 Grand Trunkway
Gillman SA 5013 08 8447 7088

Tali Engineering
119 Bedford Street
Gillman SA 5013 08 8240 4711

Williams Metal Fabrication
181 Philip Highway
Elizabeth South SA 5112 08 8287 6489

TASMANIA

Haywards Steel Fabrication & Construction
160 Hobart Road
Launceston TAS 7249 03 6391 8508

VICTORIA

Apex Welding & Steel Fabrication
15 Centofanti Place
Thomastown VIC 3074 03 9466 4125

Aus Iron Industries
15-17 Galli Court
Dandenong South VIC 3175 03 9799 9922

Australian Engineering
176 Colchester Road
Bayswater VIC 3153 03 9728 5500

Bahcon Steel
549 Princes Drive
Morwell VIC 3840 03 5134 2877

Brunton Engineering & Construction
54-56 Freight Drive
Somerton VIC 3062 03 9303 7475

Geelong Fabrications
5-17 Madden Avenue
Geelong VIC 3214 03 5275 7255

GFC Industries
42 Glenbarry Road
Campbellfield VIC 3061 03 9357 9900

GVP Fabrications
25-35 Japaddy Street
Mordialloc VIC 3195 03 9587 2172

Keppel Prince Engineering
184 Darts Road
Portland VIC 3305 03 5523 8888

Kiewa Valley Engineering
34 Moloney Drive
Wodonga VIC 3690 02 6056 6271

Materials Fabrication/ Melbourne Facades
5/23 Bell Street
Preston VIC 3072 03 9480 6988

Metalform Structures
2 Zilla Court
Dandenong VIC 3175 03 9792 4666

Minos Structural Engineering
Building 3, 69 Dalton Road
Thomastown VIC 3074 03 9465 8665

Multicoat
7 Laser Drive
Rowville VIC 3178 03 9764 8188

P&T Weldings Vic
11 Davies Avenue
North Sunshine VIC 3020 03 9367 5957

Page Steel Fabrications
20 Fulton Drive
Derrimut VIC 3030 03 9931 1600

Riband Steel (Wangaratta)
69-81 Garden Road
Clayton VIC 3168 03 9547 9144

SGA Engineering (Aust)
1/67 High Street
Melton VIC 3337 03 9747 9600

Skrobar Engineering
34 Elliott Road
Dandenong South VIC 3175 03 9792 0655

Stilcon Holdings
37 Link Court
Brooklyn VIC 3012 03 9314 1611

Structural Challenge
63 Star Crescent
Hallam VIC 3803 03 8795 7111

Thornton Engineering Australia
370 Bacchus Marsh Road
Corio VIC 3214 03 5274 3180

Uptime Services Management
35-37 Hume Court Reserve
Bell Park VIC 3215 03 5277 2580

Wisteria Steel Constructions
12 Elite Way
Carrum Downs VIC 3201 03 9775 1983

WESTERN AUSTRALIA

Allstruct Engineering
16 Ryelane Street
Maddington WA 6109 08 9459 3823

Alltype Engineering
52 Hope Valley Road
Naval Base WA 6165 08 9410 5333

Arch Engineering
9 Rivers Street
Bibra Lake WA 6163 08 9418 5088

Austline Fabrications
181 Welshpool Road
Welshpool WA 6106 08 9451 7300

Bossong Engineering
189 Planet Street
Welshpool WA 6106 08 9212 2345

Cays Engineering
17 Thornborough Road
Greenfields WA 6210 08 9582 6611

Civmec Construction and Engineering
16 Nautical Drive
Henderson WA 6166 08 9437 6288

Complete Steel Projects
31 Cooper Road
Jandakot WA 6164 08 9414 8579

Dwyer Engineering and Construction
16-22 Spencer Street
Harvey WA 6220 08 9729 2922

EMICOL
First Floor, Ascot Place
226 Great Eastern Highway
Belmont WA 6104 08 9374 1142

Fitti Steel Fabrication
11 Erceg Road
Yangebup WA 6965 08 9434 1675

Fremantle Steel Fabrication Co.
Lot 600 Prinsep Road
Jandakot WA 6164 08 9417 9111

GF Engineering
39 Lionel Street
Naval Base WA 6165 08 9410 1615

Highline
8 Colin Jamieson Drive
Welshpool WA 6106 08 6454 4000

Inter-Steel
9 Ilda Road
Canning Vale WA 6155 08 9256 3311

Italsteel W.A.
1 Forge Street
Welshpool WA 6106 08 6254 9800

JV Engineering
100 Dowd Street
Welshpool WA 6106 08 6350 6400

Mentis Australia
34 Renewable Chase
Bibra Lake WA 6163 08 9434 1961

MetworkWA
57 Attwell Street
Landsdale WA 6065 08 9303 9996

Metro Lintels
2 Kalmia Road
Bibra Lake WA 6163 08 9434 1160

Mintrex
Level 3, 516 Hay Street
Subiaco WA 6008 08 9442 3333

National Lintels
11a Delawney Street
Balcatta WA 6021 08 9240 1666

Pacific Industrial Company
42 Hope Valley Road
Naval Base WA 6165 08 9410 2566

Park Engineers
388 Welshpool Road
Welshpool WA 6106 08 9451 7255

Scenna Constructions
43 Spencer Street
Jandakot WA 6164 08 9417 4447

Southern Steelworks
16-18 Hampton Street
Mandurah WA 6210 08 9581 6872

Uniweld Structural Co
10 Malcolm Road
Maddington WA 6109 08 9493 4411

ASI CONTACT DETAILS

Head Office
Level 13, 99 Mount Street
North Sydney NSW 2060
PO Box 6366
North Sydney NSW 2059
Telephone: (02) 9931 6666
Facsimile: (02) 9931 6633
Email: enquiries@steel.org.au
Website: http://steel.org.au

New South Wales & ACT
Phil Casey – State Manager
Level 13, 99 Mount Street
North Sydney NSW 2060
Telephone: (02) 9931 6605
Mobile: 0424 225 701
Facsimile: (02) 9931 6633
Email: philc@steel.org.au

Queensland & NT
John Gardner – State Manager
National Education Manager – Technical
Brisbane Technology Park
1 Clunies Ross Court
(off Miles Platting Road)
Eight Miles Plains QLD 4113
Telephone: (07) 3853 5320
Mobile: 0418 788 870
Facsimile: (07) 3219 9653
Email: johng@steel.org.au

South Australia
Sam Contouris – State Manager,
Mobile: 0425 121 670
Email: samc@steel.org.au

Western Australia
James England – State Manager
Suite 1, 2a Brodie Hall Drive
Bentley WA 6102
Telephone: (08) 9355 1544
Mobile: 0423 614 860
Facsimile: (08) 9355 1250
Email: jamese@steel.org.au

Victoria & Tasmania
Michael Simmons – State Manager
Redmon on York
68−72 York Street
South Melbourne VIC 3205
Telephone: (03) 9694 4499
Mobile: 0412 743 616
Facsimile: (03) 9694 4498
Email: michaels@steel.org.au