

HISTORY OF AUSTRALIAN REINFORCING BAR STANDARDS

Hot Rolled Plain Round Reinforcing Bars

Std No	Period	Sizes	Mechanical Properties	Chemistry	Identification	Comments
A.S. A.81 Grade designations were: Mild Structural Intermediate Hard	1958 - 1965	Not Stated	<p>Mild Grade Yield Strength: 205 MPa min Tensile Strength: 380 - 480 MPa Elongation: 20% on gauge length of 200mm, but less for bar diameters above and below ¾ inch</p> <p>Structural Grade Yield Strength: 230 MPa min Tensile Strength: 435 - 515 MPa Elongation: 20% on gauge length of 200mm but less for bar diameters above and below ¾ inch</p> <p>Intermediate Grade Yield Strength: 275 MPa min Tensile Strength: 480 - 620 MPa Elongation: 16% on gauge length of 200mm, but less for bar sizes above and below ¾ inch.</p> <p>Hard Grade Yield Strength: 345 MPa min Tensile Strength: 550 MPa min Elongation: 10% on gauge length of 200mm, but less for bar diameters above and below ¾ inch</p>	<p>Only requirements were: S: .06% max P: .06% max</p> <p>Mild and Structural grades could be assumed to have welding equivalents to structural steel (WTIA Group 4 Steel)</p> <p>Intermediate grade could be assumed equivalent to WTIA Group 5 Steels</p> <p>Hard Grade could be assumed equivalent to WTIA Group 6 steel</p>	On bundle tag only covering makers name, trade mark, grade of steel, and batch number	
A.S. A.81	1965 - 1973	Not stated, but generally in increments of 1/8 inch starting at 3/8 inch	Yield Strength: 230 MPa min Tensile Strength: 305 MPa Elongation: 22% min on 5d	<p>C: .30% max C + Mn/6: .45% max</p> <p>As produced by BHP, equivalent to WTIA Group 4 Steel</p>	On bundle tags only, covering heat/batch number and this Standard	

Std No	Period	Sizes	Mechanical Properties	Chemistry	Identification	Comments
AS 1302 - 230R	1973 - 1977	Range of diameters 10 - 50mm	Yield Strength: 230 MPa Min Tensile Strength: 430 MPa min Elongation: 22% min on 5d	Carbon: .30% max C + Mn/6: .45% max As produced by BHP, equivalent to WTIA Group 4 Steel	On bundle tag only covering heat / batch number and grade of steel	
AS 1302 - 230R	1977 - 1982	As above	Yield Strength: 230 MPa min Tensile Strength: 1.15xYS min Elongation: 22% min on 5d	As above	As above	
AS 1302 - 230R	1982 - 1991	Range of diameters 6.5 - 36mm	As above	As above	As above	
AS 1302 - 250R	1991 - 2001	As above	Yield Strength: 250 MPa min Tensile Strength: 1.10xYS Elongation: 22% on 5d	Carbon: .25% max Carbon Equivalent defined as: C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 = .43% max Equivalent to WTIA Group 4 Steel	On bundle tag only covering manufacturer, grade, this Standard, heat/batch number and mass	AS 3679 - 250 grade rounds are deemed to comply with this grade
AS 4671	2001 -	Not stated	Yield Strength: 300 MPa min Tensile Strength: 440 MPa min Elongation: 22% min on 5d	Carbon: .22% max Carbon Equivalent defined as: C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 = .43% max Equivalent to WTIA Group 4 Steel	As above	Supplied by OneSteel as 300PLUS (in accordance with AS/NZS 3679.1)

Hot Rolled Deformed Bar Reinforcing Steels

Std No	Period	Sizes	Mechanical Properties	Chemistry	Identification	Comments
A.S. A.92 Grade designations were: Mild Structural Intermediate Hard	1958 - 1965	Bar numbers 3 to 11 where each unit represents 1/8 inch. Effective range 10mm - 35mm	<p>Mild Grade Yield Strength: 205 MPa min Tensile Strength: 380 - 480 MPa Elongation: 20% on gauge length of 200mm, but less for bar diameters above and below 3/4 inch</p> <p>Structural Grade Yield Strength: 230 MPa min Tensile Strength: 435 - 515 MPa Elongation: 20% on gauge length of 200mm but less for bar diameters above and below 3/4 inch</p> <p>Intermediate Grade Yield Strength: 275 MPa min Tensile Strength: 480 - 620 MPa Elongation: 16% on gauge length of 200mm, but less for bar sizes above and below 3/4 inch.</p> <p>Hard Grade Yield Strength: 345 MPa min Tensile Strength: 550 MPa min Elongation: 10% on gauge length of 200mm, but less for bar diameters above and below 3/4 inch</p>	<p>Only requirements were: S: .06% max P: .06% max</p> <p>Mild and Structural grades could be assumed to have welding equivalents to structural steel (WTIA Group 4 Steel)</p> <p>Intermediate grade could be assumed equivalent to WTIA Group 5 Steels</p> <p>Hard Grade could be assumed equivalent to WTIA Group 6 steel</p>	On bundle tag only covering makers name, trade mark, grade of steel, and batch number	
A.S. A.92	1965 - 1973	As above	<p>Structural Grade Yield Strength: 230 MPa min Tensile Strength: 430 MPa min Elongation: 22% min on 5d</p> <p>Hard Grade Yield Strength: 345 MPa min Tensile Strength: 550 MPa Elongation: 14% min on 5d</p>	<p>C: .30% max C + Mn/6: .45% max</p> <p>As produced by BHP, equivalent to WTIA Group 4 Steel</p>	On bundle tags only, covering heat/batch number and this Standard. Hard grade to have identification marks at manufacturer's discretion on opposite sides of bar. This was typically an additional short longitudinal rib joining two transverse ribs	

Std No	Period	Sizes	Mechanical Properties	Chemistry	Identification	Comments
AS 1302 – 230S	1973 – 1977	Not stated	Yield Strength: 230 MPa min Tensile Strength: 430 MPa min Elongation: 22% on 5d	Carbon: .30% max C + Mn/6: .45% max As produced by BHP, equivalent to WTIA Group 4 steel	On bundle tags only, covering heat/batch number and grade.	
AS 1302	1977 - 1982	12mm to 36mm in 4mm increments. 40mm and 50mm subject to enquiry.	Grade 230S Yield Strength: 230 MPa min Tensile Strength: 1.15 x YS min Elongation: 22% on 5d Grade 410Y Yield Strength: 410 MPa min Tensile Strength: 1.15 x YS Elongation: 12% min on 5d	Grade 230S Carbon: .30 max C + Mn/6: .45% max As produced by BHP, equivalent to WTIA Group 4 Steel Grade 410Y Carbon: .35% max C + Mn/6 = .60% max As produced by BHP, equivalent to WTIA Group 4 Steel	On bundle tag covering manufacturer, grade, this Standard, heat/batch number and mass. For grade 410Y only, a continuous mark on diametrically opposite surfaces of the bar.	There was no large scale production of grade 410Y in this period
AS 1302	1982 - 1991	12mm to 36mm in 4mm increments. 40mm and 50mm subject to enquiry.	Grade 230S Yield Strength: 230 MPa min Tensile Strength: 1.15 x YS min Elongation: 22% on 5d Grade 410Y Yield Strength: 410 MPa min Tensile Strength: 1.05 x YS Elongation: 12% min on 5d	Grade 230S Carbon: .30 max C + Mn/6: .45% max Grade 410Y Carbon: .35% max C + Mn/6 = .60% max As produced by BHP, equivalent to WTIA Group 4 Steel	On bundle tag only covering heat / batch number and grade of steel.	This marked the introduction of TEMPCORE steel, and the rapid phasing out of cold twisted rebars

Std No	Period	Sizes	Mechanical Properties	Chemistry	Identification	Comments
AS 1302	Amdt 1983	As above	As above	Carbon: .22% max Carbon Equivalent defined as: $C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 =$.39% max	A distinctive deformation pattern or other markings to identify grade. This resulted in use of the still current crescent shaped transverse ribs and the name "TEMPCORE" on BHP bars. This was later modified to show individual producing mill ID marks.	
AS 1302	1991 - 2001	12mm to 36mm in 4mm increments. 40mm and 50mm subject to enquiry.	Grade 250S Yield Strength: 250 MPa min Tensile Strength: 1.10 x YS min Elongation: 22% on 5d Grade 400Y Yield Strength: 400 MPa min Tensile Strength: 1.10 x YS Elongation: 16% min on 5d	Grade 250S Carbon: .25% max Carbon Equivalent defined as: $C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 =$.43% max Equivalent to WTIA Group 4 Steel Grade 400Y Carbon: .22% max Carbon Equivalent defined as: $C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 =$.39% max	On bundle tag only covering manufacturer, grade, this Standard, heat/batch number and mass. Bar markings at manufacturers discretion to identify grade of steel and producing mill - see TEMPCORE information.	

Std No	Period	Sizes	Mechanical Properties	Chemistry	Identification	Comments
AS 4671	2001 -	12, 16, 20, 24, 32, 36mm 10mm also available in coil. 40mm also available in bar.	<p>Grade 250N Yield Strength: 250 MPa as lower characteristic value. Tensile Strength: 1.08 x YS Elongation at maximum force (Uniform elongation or Agt): 5%</p> <p>Grade 500N Yield Strength: 500 MPa as lower characteristic value. 650 MPa as upper characteristic value Tensile Strength: 1.08 x YS Elongation at maximum force (Uniform elongation or Agt): 5%</p>	<p>Grade 250N Carbon: .22% max Carbon Equivalent defined as: $C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 = .43\%$ max. Equivalent to WTIA Group 4 Steel</p> <p>Grade 500N Carbon: .22% max Carbon Equivalent defined as: $C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 = .44\%$ max. Equivalent to WTIA Group 4 Steel</p>	Two or more longitudinal marks in addition to longitudinal ribs, or a minimum of two short transverse markings, or alpha numeric characters indicating steel grade	

Cold Twisted Deformed Bar Reinforcing Steels

Standard	Period	Sizes	Mechanical Properties	Chemistry	Identification	Comments
A.S. A.83	1958 - 1966	Not Specified	For single bars > 10mm (3/8 inch) diameter. Proof Stress: 410 MPa Tensile Strength: 480 MPa Elongation: 14% min on 8d : 16% min on 4d For twin bars > 10mm (3/8 inch) twisted together: Proof Stress: 370 MPa Tensile Strength: 435 MPa Elongation: 14% min on 8d 16% min on 4d	Only requirements were: S: .06% max P: .06% max As produced by BHP, equivalent to WTIA Group 4 Steel	At manufacturer's discretion.	
AS A83	1966 - 1973	Not restricted but expressed in bar numbers where each unit represents 1/8 inch of diameter.	For bar sizes #3 and above (10mm and above) Proof Stress: 410 MPa Tensile Strength: 480 MPa Elongation: 14% min on 5d	C: .30% max C + Mn/6: .45% max As produced by BHP, equivalent to WTIA Group 4 Steel	Marked or tagged to identify conformance with this specification	Square twisted rebars also covered by this specification. This grade was sometimes referred to as "CW60" indicating cold twisted bar with 60 kips minimum yield strength
AS 1302	1973 - 1977	10mm and then in 4mm increments to 36mm.	Proof Stress: 410 MPa min Tensile Strength: 480 MPa min Elongation: 14% min on 5d	C: .30% max C + Mn/6: .45% max As produced by BHP, equivalent to WTIA Group 4 Steel	On bundle tag only covering heat / batch number and grade of steel	

Standard	Period	Sizes	Properties	Chemistry	Identification	Comments
AS 1302	1977 - 1982	12mm to 36mm in 4mm increments	Proof Stress: 410 MPa min Tensile Strength: 1.08 x PS Elongation: 12% min on 5d	C: .30% max C + Mn/6: .45% max As produced by BHP, equivalent to WTIA Group 4 Steel	Marked or tagged to identify conformance with this specification, and heat/batch number	
AS 1302	1982 - 1991	12mm to 36mm in 4mm increments	Proof Stress: 410 MPa min Tensile Strength: 1.05 x PS Elongation: 12% min on 5d	C: .30% max C + Mn/6: .45% max As produced by BHP, equivalent to WTIA Group 4 Steel	Marked or tagged to identify conformance with this specification, and heat/batch number	Cold twisted bars were not made in Australia beyond 1983

Deformation Requirements and Dimensions.

The basic requirements for rib design, spacing, height and coverage have remained essentially unaltered since 1958. These requirements are similar to those for other major international Reinforcing Bar Standards. The current standard (AS/NZS 4671:2001) includes a requirement to determine the specific projected area of ribs as a means of demonstrating that the required bond with concrete will be achieved.

Hard Drawn Wire and Mesh

The material properties of hard drawn wire, and reinforcing mesh made from this wire, remained basically unaltered from 1958 until the 1990's, being:

Proof Stress: 450 MPa min
Tensile Strength: 500 MPa min.

During the 1990's, higher strength deformed wires were produced with strengths of:

Proof Stress: 500 MPa min
Tensile Strength: 550 MPa min.

The nominal sizes of these higher strength wires were proportionally reduced in line with the increase in strength.

With the publication of AS/NZS 4671 in 2001, reinforcing wire and mesh must achieve a proof stress of 500 MPa as a lower characteristic value. In addition, these products must satisfy the following ductility measures:

Ratio (R_m/R_e): 1.03 min
Uniform Elongation (A_{gt}): 1.5 % min.

Material Identification

Should you need to identify reinforcing steels where the origin, grade and strength levels are unknown, we can provide a very accurate estimate of properties and likely specification. Simply cut a sample of length 25mm or greater. A longer sample would be preferable if heat (eg from oxy cutting of sample) has been applied. We will determine an estimate of properties based on our chemical analysis, microstructure assessment and hardness level in the sample provided.

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