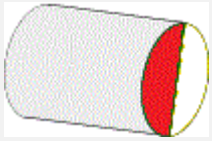
ENGINEERING STEELS + ALLOYS

4317 CASE HARDENING STEEL

4317 is a 1.8% chromium - nickel - molybdenum high hardenability, case hardening (carburizing) steel, generally supplied in the annealed condition with a maximum brinell hardness of 229 (Rc22).
Characterised by high core strength and toughness in medium to large sections with case hardness up to Rc62 when carburized, hardened and tempered.
4317 can also be used (uncarburised) as a high tensile steel, which when suitably hardened and tempered can be utilized for various applications requiring good tensile strength and toughness.
Pre hardened and tempered (uncarburized) 4317 can be further surface hardened by nitriding but will not respond satisfactorily to flame or induction hardening due to its low carbon content.
4317 (carburized) is used extensively by all industry sectors for components and shafts requiring high surface wear resistance, high core strength and impact properties.
Typical uses are: Heavy Duty Bushings and Bearings, Cam Followers, Clutch Dogs, Compressor Bolts, Extractors, Fan Shafts, Heavy Duty Gears, Pump Shafts, Sprockets, Tappets, Wear Pins, Wire Guides etc..

Colour Code	Stocked Sizes	
Red and White (Bar End) 	Rounds	24 mm to 660 mm Diameter
	Bar Finish	
	Peeled, Turned or Hot Rolled	

Related Specifications	
Australia	AS1444 - 1996 4317/4317H
Germany	W.Nr 1.6587 DIN 17210 17CrNiMo6 18CrNiMo 7-6
Great Britain	BS970: PART 3: 1991 820M17/822M17 BS970: 1955 - EN354/EN355
USA	SAE 4317 AISI 4317

Chemical Composition		
	Min. %	**Max. %**
Carbon	0.15	0.21
Silicon	0	0.40
Manganese	0.50	0.90
Nickel	1.40	1.70
Chromium	1.50	1.80
Molybdenum	0.25	0.35
Phosphorous	0	0.035
Sulphur	0	0.035

Mechanical Property Requirements	
Annealed Condition - Brinell Hardness 229 Maximum	
Typical Mechanical Properties - Annealed	
Tensile Strength Mpa	700
Yield Strength Mpa	520

Elongation on 5.65√S_0 %		23
Hardness	HB	200
	Rc	15

Typical Mechanical Properties - Water Quenched at 830°C and Tempered as Indicated *				
Section Size mm		11	30	63
Tensile Strength Mpa	Min	1180	1080	980
	Max	1420	1320	1270
Yield Strength Mpa	Min	835	785	685
Elongation on 5.65√S_0 %	Min	7	8	8
Impact Charpy J	Min	41	41	
Hardness	HB	350 - 415	320 - 385	290 - 375
	Rc	39 - 44	35 - 42	31 - 41

Forging

Heat to 1150°C and hold until temperature is uniform throughout the section. Soaking time at forging temperature should be as short as possible to avoid heavy scaling and excessive grain growth. This will vary depending on furnace conditions but 15 minutes per 25 mm of section may be used as a guide.
Do not forge below 850 °C.
Following completion of forging operation, work piece should be cooled as slowly as possible in sand or dry lime etc.
Note: Case hardening steels due to their low carbon content are less susceptable to cracking than medium or high carbon steels, and may therefore be heated and cooled more rapidly.

Heat Treatment

Annealing

Heat to 830°C - 850°C, hold until temperature is uniform throughout the section and cool in furnace.

Caburizing

Pack, salt or gas carburize at 900°C - 930°C, holding for sufficient time to develop the required case depth and carbon content, followed by a suitable hardening and tempering cycle to optimise case and core properties.

Hardening

Refer Refining & Hardening.

Nitriding

Not suitable for nitriding.

Normalizing

Heat to 860°C - 900°C, hold until temperature is uniform throughout the section. Soak for 10 - 15 minutes and cool in still air.

Refining & Hardening

Core Refine

Slow cool from carburizing temperature and re-heat to 840°C - 870°C, hold until temperature is uniform throughout the section, quench as required in warm water, oil or air cool. Alternatively quench in salt bath held at 150°C - 250°C, followed by air cool.

Case Refining

Following core refining, re-heat to 780°C - 820°C, hold until temperature is uniform throughout the section, and quench in oil.
Temper immediately while still hand warm.

Single Refine*

Direct Quench: Cool from carburizing temperature to 820 °C - 840 °C, hold until temperature is uniform throughout the section. Quench in oil.Temper immediately while still hand warm.
Or: Cool from carburizing temperature to room temperature, re-heat to 820 °C - 840 °C and hold until temperature is uniform throughout the section and quench in oil.
Temper immediately.
*Suitable for fine grained steels only.

Stress Relieving

Heat to 630°C - 650°C, hold until temperature is uniform throughout the section, soak for 1 hour per 25 mm section, and cool in still air.

Tempering

Heat to 150ºC - 200ºC as required, hold until temperature is uniform throughout the section, soak for 1 - 2 hours per 25 mm of section, and cool in still air. N.B. Tempering will improve the toughness of both case and core, with only a slight reduction in core strength and case hardness. It will also reduce the susceptibility of the case to grinding cracks.

Notes on Heat Treatment

Heating temperatures, rate of heating, cooling and soaking times will vary due to factors such as work piece size/shape also furnace type employed, quenching medium and work piece transfer facilities etc..Please consult your heat treater for best results.

Machining

4317 in the annealed as supplied condition has very good machinability and all operations such as turning, drilling,milling and tapping etc. can be carried out satisfactorily as per machine manufacturers recommendations for suitable tool type - feeds and speeds.

Welding

4317 is readily weldable in the annealed as supplied condition. Following welding, the work piece immediately upon cooling to hand warm should be stress relieved at 630ºC - 650ºC if possible. N.B. Welding in the carburized and heat treated condition is not recommended.

Welding Procedure

Welding of 4317 should always be carried out using low hydrogen electrodes - please consult your welding consumables supplier.

Suggested Pre-heat Temperature

Section	25mm	40mm	50mm	75mm	150mm
ºC	250	275	300	350	400

Post Welding

Maximum cooling rate 100ºC per hour down to 100ºC, followed by cooling in still air.
It is recommended that the work piece if possible is buried in sand or dry lime etc..