

655M13 – 3.25% Ni – Cr Case Hardening Steel

Related Specifications

BS970-1955 EN36B

UNS G93106

W.Nr. 1.5752

DIN 14NiCr4

655M13 is a 3.25% Nickel – Chromium high hardenability case hardening steel, characterised by high core strength, excellent toughness and fatigue resistance, with case hardnesses up to 62HRC when carburised, hardened and tempered. Material is usually supplied in the Annealed condition upto 255HB. Material can be used in the un-carburised condition as a high tensile steel, which, when suitably hardened & tempered can be used for various applications requiring good tensile strength and toughness. General applications include all industry sectors for applications requiring high surface wear resistance, high core strength & impact properties. Typical uses include Gears, King Pins, Sprockets, Shafts etc.

Typical Chemical composition (Values are maximums unless otherwise stated)

Carbon	0.15%
Silicon	0.25%
Manganese	0.50%
Phosphorous	<0.040%
Sulphur	<0.040%
Chromium	0.90%
Nickel	3.50%

Mechanical Property Requirements - Annealed condition

Yield	Tensile Strength	Elongation	Hardness
540 Mpa	700/770 Mpa	25%	255 HB Max

Mechanical Property Requirements – On Blank Carburised Test Piece – As required by BS970 Part 3 1991 655M13

Test Bar Diameter	Tensile Strength Mpa	Elongation %	Charpy Impact J	Izod Impact Ftlbs	Hardness HB
19mm	1000	9	40	35	255 Max

Typical Core Properties – Carburised and Oil Hardened at 830oC

Section Size	Yield Strength Mpa	Tensile Strength Mpa	Elongation %	Charpy Impact J	Hardness HB
11mm	1030/1320	835	9	55	300-385
30mm	930/1230	785	10	55	275-360
63mm	880/1180	735	10	-	260-350

NOTE: This material can be used in the hardened and tempered (Un-carburised) condition for heavy duty shock resisting shafts and parts requiring tensile strengths in excess of 1000Mpa in sections upto 200mm

Forging

Forging temperature for this material should be 850 – 1150oC. Soaking times should be kept to a minimum to avoid heavy scale and excessive grain growth, suggest 15minutes per inch (25mm) of ruling section

Heat Treatment

Annealing - Heat to 830 - 850oC ensuring sufficient time is allowed for the centre to achieve furnace temperature and hold for a time commensurate with the ruling section, followed by a slow furnace cool.

Carburizing - Pack, salt or gas carburizing at 900 - 950oC, hold for time commensurate with required case depth, followed by suitable hardening and tempering to optimise core properties.

Hardening - Heat to 830 - 880oC and hold for time commensurate with ruling section, quench as required in Water, Oil or Air. Salt bath quench held at 150 - 200oC followed by Air cooling could be used as an alternative

Note: This treatment is used for core refinement and should be followed by Tempering

Case Hardening - Following core refining above, re-heat to 760 - 800oC, hold for time commensurate vwith ruling section and quench in oil.

Note: Material should be tempered immediately whilst still hand warm.

Tempering - Heat to 150 - 200oC for sufficient time to allow centre to achieve furnace temperature, and hold for 2hrs minimum, cool in still air.

Machining

Material in the annealed condition is readily machinable by milling, drilling, turning, tapping etc as required

Welding

In the annealed condition the material is readily weldable using low hydrogen electrodes, however following cooling the material should be stress relieved at 600-650oC

Note: Welding in the carburized or Heat Treated condition is not recommended.