

STEEL



LIBERTY

AISI 4140 Modified

A low alloy Chromium Molybdenum
(CrMo) steel

AISI 4140 modified is a low alloy Chromium Molybdenum (CrMo) steel similar to 4140 but with enhanced levels of chromium and molybdenum for increased hardenability.

It is typically used for down hole drilling tools such as tool joints and shock subs.

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Scope

The specification defines the requirements for AISI 4140 modified hot rolled CrMo bars hardened and tempered to meet either 80ksi minimum yield, 22HRC maximum or 120ksi minimum yield, 40HRC maximum.

Steel manufacture

Steel is manufactured via Electric Arc Furnace, followed by Ladle Refining and Vacuum Degassing and is either cast into bottom-poured wide end up ingots, or Continually Cast.

Heat treatment

- Furnaces surveyed and calibrated per AMS 2750.
- Austenitised and liquid quenched.
- Tempered to meet selected strength variant.
- Supplied either stress free or stress relieved.

Chemical analysis

C	Si	Mn	P	S	Cr	Mo	Ni	Al
0.40	0.20	0.75	-	-	0.80	0.25	-	0.015
0.43	0.35	1.10	0.015	0.020	1.20	0.35	0.25	0.030

General delivery conditions

- Applicable bar diameters: 1-12".
- Surface conditions: Black/Peeled/Smooth/Turned.
- Straightness: 1mm in 500mm, 1/8 in 5'.
- Enhanced straightness may be available on request.

Mechanical properties

	80ksi Variant 1-10" (mid radial) 1-12" (1" below)			110ksi variant 1-10" (mid radial)			125ksi variant 1-7.5" (mid radial)	
	Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
0.2% Proof stress (ksi)	80			110			125	
UTS (ksi)	100			135			135	
% Elongation	20			13			13	
% reduction of area	45			40			40	
Hardness HRC	18	22		30	36		32	38
Hardness HBW	217	237		285	341		301	352
	Average	Min. Single		Average	Min. Single		Average	Min. Single
CVN @ 23°C (J)	80			60				
CVN @ -32°C (J)	55	40	CVN @ 0 °C (J)	30	22	CVN @ 0°C (J)	25	20
CVN @ -46°C (J)	42	33	CVN @ -20 °C (J)	27	20			

Tensile Strength as per ASTM A370, Charpy as per ASTM E23, HRC as per ASTM E18, HBW as per ASTM E10

Machining tolerances

For 'Machining Quality Bar' to ASTM A29 Tolerances the minimum machining allowance should be as follows:

Ordered Surface condition	Minimum stock removal
Peeled/Smooth Turned	1 % per side
Black	1.6 % per side

API 6A

Each bar length will be 100 % ultrasonically tested per ASTM A388, with acceptance criteria in accordance with API 6A PSL 3&4

Note: Above a rolled size 10.5" the central 20 % of the bar will be excluded from ultrasonic testing.

Reduction ratio

Reduction ratio will meet 4:1 as a minimum.

Structure

Grain size will be ASTM 5 or finer.

Technical Support

We have a comprehensive technical support team available to advise on grade selection and product range to achieve the maximum benefit. Customer Technical Support provide specialist advice and help with day-to-day problem solving.

Works based metallurgists and the full resources of our Steel Research and Development Laboratories are available to assist with longer-term developments.

For further information, enquiries or any technical guidance on our range of Oil & Gas products please contact the Commercial Department at the address below.

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