

STEEL



AISI 4145 Modified

A low alloy steel with increased
hardenability at larger diameters

AISI 4145 modified is a low alloy Chromium Molybdenum (CrMo) steel similar to 1440 but with amended analysis which contributes towards increased hardenability at larger diameters.

It is typically used for down hole drilling tools such as drill collars, stabilisers and whipstocks.

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Scope

The specification defines the requirements for AISI 4145 hot rolled CrMo bars hardened and tempered to meet either 110ksi, 120ksi or 125ksi minimum yield strength.

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.

Note: at larger sizes a normalising process may be required.

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.

Structure

Grain size will be ASTM 5 or finer.

Reduction ratio

Reduction ratio will meet 4:1 as a minimum.

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

Chemical analysis

C	Si	Mn	P	S	Cr	Mo	Ni	Al
0.43	0.15	0.95	-	-	0.9	0.25	-	0.015
0.49	0.35	1.15	0.015	0.02	1.2	0.35	0.25	0.03

AP 7-1

Ultrasonic and surface inspection for any orders $\leq 11"$ (280mm) diameter can be carried out to meet customer specifications.

Note: The test certificate will be endorsed with the following: 'Ultra Sonic Testing Satisfactory, Confirming capability to API 7-1'.

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.

Mechanical properties

	110ksi Variant 1-10" (Mid Radial) 10-12.5" (1" below)			120ksi variant 1-10" (Mid Radial) 10-12.5" (1" Below)			120ksi variant 1-10" (Mid Radial) 10-12.5" (1" Below)	
	Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
0.2 % Proof stress (ksi)	110			120			125	
UTS (ksi)	140			140			140	
% Elongation	14			14			14	
% reduction of area	45			45			45	
Hardness HRC	30	36		30	36		30	36
Hardness HBW	285	341		285	341		285	341
	Average	Min. Single		Average	Min. Single		Average	Min. Single
CVN @ 23°C (J)	65	65		54	54		54	54
CVN @ -32°C (J)	27	20	CVN @ -20 °C (J)	42	30	CVN @ -20°C (J)	30	20
			CVN @ -46 °C (J)	27	20	CVN @ -46 °C (J)	27	20

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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