AISI 4140, 110 KSI TUBING, FORGING/BARSTOCK, IMPACT REQUIREMENTS AT -20F AND -40F, STANDARD SERVICE

Rev	Reason of Change	Date	Made By	Reviewed By	Approved By	Status
0	Initial release	30-07-2018	MN	AS	KKD	Released
1	Quenching media temperature requirements amended & retention period added in clause 6.0 added as per API 6A 21st edition	03-10-2019	MN	USR	AS	Released

Summary:

This specification covers AISI 4140 tubing, forgings, forged or rolled bar stock with minimum yield strength of 110 ksi.

1.0 SCOPE

This specification covers AISI 4140 tubing, forgings, forged or rolled bar stock with minimum yield strength of 110 ksi.

2.0 Reference Specifications

Documents	Descriptions
AISI 4140	American Iron and Steel Institute Chemistry

3.0 Chemistry Requirements

The chemistry shall meet the requirements of Table 1.

Table 1: Required Chemistry. All are maximums unless otherwise noted.

Elements	Wt. Percentage (%)
Carbon	0.38 - 0.43
Manganese	0.75 - 1.00
Chromium	0.80 - 1.10
Molybdenum	0.15 - 0.25
Phosphorus	0.035
Sulfur	0.040
Silicon	0.15 - 0.35

4.0 Mechanical Properties

Test location, orientation and permitted QTC configurations are specified within an additional specification SES 26-590, SES 26-740 & SES 26-744. The material shall meet the mechanical requirements of the table 2

Table 2: Mechanical Properties. (All values are minimums unless otherwise noted.)

Tensile strength	130,000 psi (896 MPa)
Yield strength	110,000 psi (758 MPa)
Elongation in 2" or 4D	15%
Reduction in area	25% (Not required for tubing wall thickness of less than 7/8 inch.)
Brinell Hardness	241- 341 HBW

Charpy V-notch Impact Energy Values (10mm x 10mm specimens) at test temperature of -20ºF (-29ºC):
Min. average for a set of 3 specimens…….31 ft-lbf (42J)
Min. for each individual specimen ……23.6 ft-lbf (32J)
Lateral expansion, min. for each specimen……0.015 inches
Percent shear……...Report Actual Values

Charpy V-notch Impact Energy Values (10mm x 10mm specimens) at test temperature of -40ºF (-40ºC):
Min. average for a set of 3 specimens…….20 ft-lbf (27J)
Min. for each individual specimen ……15 ft-lbf (20J)
Lateral expansion, min. for each specimen…… Report Actual Values
Percent shear……...Report Actual Values

If material tested at -40ºF or colder has energy values which meet or exceed the values listed for -20ºF, the tests at -20ºF are not required. When the -20ºF test is not run, then the lateral expansion must meet the -20ºF value and the percent shear must be reported

5.0 Heat Treatment

PROCESS	ATMOSPHERE/MEDIA	TEMPERATURE	TIME AT TEMPERATURE
Normalized	Air	1600 ºF – 1700 ºF (870 ºC – 925 ºC)	30 Minutes / Inch of T, Minimum Time is 30 Minutes.
Still air cool to below 400 degrees F (204 degrees C) before further processing			
Austenitize	Air	1550 ºF - 1650 ºF (840 ºC – 900 ºC)	30 Minutes / Inch of T, Minimum Time is 30 Minutes.
Quench	Oil, Polymer	104 ºF (40 ºC) - 158 ºF (70 ºC)	
	Water	The temperature of quenching medium shall not exceed 100 °F (38 °C) at the start of the quench nor exceed 49°C (120°F) at any time during the quench cycle.	
Temper	Air	1000 ºF – 1300 ºF (540 ºC – 700 ºC)	1 hour per inch of maximum through thickness. One-hour Minimum.

Note: Maximum holding time shall not exceed Five times (5X) the maximum holding time. In all case, holding time shall not start until parts or materials have reached specified heat treatment temperature. The 5X rule does not apply to the separate QTC (e.g. ER 5").

6.0 Workmanship

Material shall be inspected in accordance with part report (DBI). Material shall be free of injurious defects that are detrimental to the integrity of the final product, such as laps, scabs, cracks and exogenous inclusions.
Suppliers shall retain heat treat charts in a secure area for a period of no less than 10 years (e.g. electronic or paper).