AISI 4140, 90 KSI (621 MPA), FORGING/BARSTOCK, SUBSEA COMPATIBLE

Rev	Reason of Change	Date	Made By	Reviewed By	Approved By	Status
0	Initial release	13-11-2017	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

1.0 Scope

This specification covers 4140 forgings, forged or rolled bar stock with minimum yield strength of 90 ksi (621 MPa). This material is for NON sour gas (H_2S) environment.

2.0 Reference Specifications

Documents	Descriptions
AISI 4140	American Iron and Steel Institute Chemistry
API 6A	Specification for Wellhead and Christmas Tree Equipment

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 - 00.43
Manganese	0.75 - 1.00
Chromium	0.80 - 1.10
Molybdenum	0.15 - 0.25
Phosphorus	0.035
Sulfur	0.040
Nickel	0.80
Silicon	0.15 - 0.35

4.0 Mechanical Properties

Mechanical property requirements are listed below. Each heat shall be tested and the listed mechanical properties shall be reported as per table 2.

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

Tensile strength	110,000 psi (758 MPa)
Yield strength	90,000 psi (621 MPa)
Elongation in 2" or 4D	17%
Reduction of area	35%
Brinell Hardness (raw)	235-302 HBW
Brinell Hardness (finish part)	229-302 HBW

5.0 Heat Treatment

PROCESS	ATMOSPHERE/MEDIA	TEMPERATURE	TIME AT TEMPERATURE
Normalized	Air or Nitrogen	1600 ºF – 1700 º (870 ºC – 925 ºC)	30 Minutes/inch of thickness. Minimum time 30 minute.
Still air cool to below 400 ºF (204 ºC) before further processing			
Austenitize	Air or Nitrogen	1550 ºF - 1650 ºF (840 ºC – 900 ºC)	30 Minutes/inch of thickness. Minimum time 30 minute.
Quench	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.	
	Polymer	50 ºF (10 ºC) minimum before quenching	
	Oil	----------	
Temper	Air or Nitrogen	1000 ºF – 1300 ºF (540 ºC – 700 ºC)	1 hour per inch of maximum through thickness. One hour Minimum.

Cooling after tempering shall be air cooling or faster (By Water). Furnace cooling is not permitted. For heavy cross sections, rapid cooling after tempering may improve impact properties. The minimum tempering temperatures must be met in all cases to ensure that later steps of manufacturing,

Note: Maximum holding time shall not exceed Five times (5X) the minimum 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").

Note 1: The short blasting shall be carried out after normalizing & Tempering if applicable.

Note 2: The austenitizing temperature shall be less than the normalizing temperature.

2.1 Continuous Heat Treatment

Screw, walking-beam, pusher furnaces, mesh or cast link type furnaces utilized for continuous heat treatment are permitted. Continuous induction, electrical resistance or infra-red heat treatment is not permitted. Times outside the specified ranges may be used, as long as the minimum time at temperature is 15 minutes per inch of thickness. Tempering temperature minimum shall be met. Other thermal operations may use temperatures outside the ranges specified. Mechanical properties shall be met on a prolongation or sacrificial part.

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).