SPECIFICATION FOR 17-4PH (105 KSI) STAINLESS STEEL BARS & TUBING -50F CHARPY IMPACTS

Rev	Reason of Change	Date	Made By	Reviewed By	Approved By	Status
0	Initial release	08-03-2018	MN	AS	KKD	Released

Summary: This specification covers 17-4PH (UNS S17400) precipitation-hardening stainless steel bars, shapes and tubing in the Double H1150 condition with minimum yield strength of 105,000 psi (725 MPa), and with -50ºF impact.

1.0 Scope

This specification covers 17-4PH (UNS S17400) precipitation-hardening stainless steel bars, shapes and tubing in the Double H1150 condition with -50ºF impact.

2.0 Reference Specifications

Documents	Descriptions
ASTM A564 GR 630	Standard Specification for Hot-Rolled and Cold- Finished Age-Hardening Stainless Steel Bars and Shapes
ASTM A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A484	Standard Specification for General Requirements for Stainless Steel Bards, Billets, and Forgings
ASTM A519	Standard Specification for Seamless Carbon and Alloy Steel Mechanical Tubing
NACE MR0175/ ISO 15156	Petroleum and natural gas industries - Materials for use in H2S-containing environments in oil and gas production
ASTM E23	Standard Test Methods for Notched Bar Impact Testing of Metallic Materials
ISO 148	Metallic Materials - Charpy Pendulum Impact Test

3.0 Chemical Requirements

The chemistry shall meet the requirements listed in Table 1.

Table 1: Chemical Requirements (All are maximums unless otherwise noted)

Elements	Wt. Percentage (%)
Carbon	0.07
Manganese	1.00
Phosphorus	0.040
Sulfur	0.030
Silicon	1.00
Chromium	15.00 - 17.50
Nickel	3.00 - 5.00
Copper	3.00 - 5.00
Niobium & Tantalum	0.15 - 0.45

4.0 Melting Practice

4.1 The supplier's melting practice shall utilize one of the following: electric-arc, induction or basic oxygen, with optional further refinement using vacuum degassing or AOD. Killed steel is required.

5.0 Hot Working

5.1 All hot working practices must be documented by the supplier utilizing one of the following processes: open die forging, close die forging, hot upset forging, roll type forging, or hot forming.

5.2 All material shall be formed using hot work practices that produce a wrought structure throughout.

5.3 A minimum forging/reduction ration of 3:1 shall apply. Minimum or actual forging/reduction ratio shall be reported on the MTR.

6.0 Heat Treatment

6.1 Bars, shapes, and tubes shall be solution treated and aged as follows.

6.1.1 Solution anneal at 1900°F (+/- 25°F) and air cool or suitable liquid quench to below 90°F before precipitation hardening.

6.1.2 Precipitation harden at 1150°F (+/- 25°F) for a minimum of 4 hours at temperature and air cool to below 90°F before the second precipitation hardening step.

6.1.3 Precipitation harden at 1150°F (+/- 25°F) for a minimum of 4 hours at temperature and air cool.

7.0 Mechanical Properties

The material shall meet the requirements of Table 2. Test specimens and test methods shall be per ASTM A370.

All the bars and tubing shall be checked for hardness.

Table 2: Mechanical Requirements (All are minimums unless otherwise noted)

Tensile Strength	125,000 psi (860 MPa)
Yield Strength	105,000 psi (725 MPa)
Elongation	16%
Reduction of Area	50%
Hardness	24-33 HRC (255-311 HBW)

The material shall meet the impact requirements of Table 3. Impact testing shall be in accordance with ASTM E23 or ISO 148. Charpy V Notch impact testing shall be performed in the longitudinal direction. In the event that the material diameter or thickness is too small to permit the smallest sub size charpy specimen listed in the above industry specifications, then the requirement shall be waived. An example would be that of a small diameter spring.

Table 3: Impact Property Requirements

Testing Temperature	-50°F (-46°C)
Average Impact energy, min (set of 3)	30 ft-lbs (41 J)
Single value Impact energy, min	20 ft-lbs (27 J).
No more than one of the three (3) test results may be below the required minimum average (transverse or longitudinal).	

8.0 Weld Repair

Weld repair is not permitted.

9.0 Workmanship

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.

10.0 Documentation

Material test reports (MTR's) shall be supplied to Stream-Flo for each heat. MTR's shall contain the following information:

- Chemical analysis
- Mechanical properties
- Impact values
- Hardness test results
- Heat treatment details
- Minimum or actual forging/reduction ratio
- Initial and final temperature for quench media
- Heat treatment lot identification