Sara Sae

Engineering Standards/Specifications

Procedure No.

SES 26-712

Title

MATERIAL SPEC, ALLOY STEEL FORGINGS AND ALLOY STEEL PLATE OF AISI 4130 FOR LOW TEMPERATURE SERVICE, API 6A, STANDARD AND H_2S SERVICE (HB 207-235) FOR VALVE GATES

V.P. of Manufacturing	V.P. of Engineering	V.P. of QA/QC	V.P. of Sales/ Marketing	Revision Description	Release Date	Rev. Ltr

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MATERIAL SPEC, ALLOY STEEL FORGINGS AND ALLOY STEEL PLATE OF AISI 4130 FOR LOW TEMPERATURE SERVICE, API 6A, STANDARD AND H_2S SERVICE (HB 207-235) FOR VALVE GATES

1.0 SCOPE

1.1 This Specification covers low alloy forgings and plates suitable for pressure containing and controlling parts, such as valve gates, for low temperature standard and H_2S Service in conformance with NACE MR0175 and API 6A. This material may have third party inspection requirements.

1.2 The material manufacturer or the forging/plate supplier shall document the hot working process, the heat treating procedure, the qualification of heat treating equipment, and shall maintain material traceability. Heat treatment certification shall be provided for time and temperature of the heat treated lot.

2.0 APPLICABLE REQUIREMENTS AND SPECIFICATIONS

2.1 Applicable Specifications

2.1.1 UNS G41300 and H41300

2.1.2 AISI 4130H and 4130

2.1.3 API Spec 6A

2.1.4 ASTM A29

2.1.5 NACE MR0175

3.0 BASIS OF PURCHASE

3.1 The material chemistry shall meet the requirements of Paragraph 4.1.

3.2 Purchase Order shall include the following:

3.2.1 SARA SAE Engineering Specification

3.2.2 SARA SAE part number

3.2.3 Dimensions: T x L x L

3.2.4 Heat Treating Condition Required:

a. Forged bars and hot rolled plates may be purchased in the slow cooled or normalized condition. If bought in the slow cooled condition, SARA SAE will normalize them prior to rough machining.

3.2.5 Certification requirements specified in Section 10.0.

3.2.6 Test temperature and V-notch Charpy values..

4.0 CHEMISTRY REQUIREMENTS

4.1 The AISI 4130 parts must conform to the requirements for the chemical composition for each grade specified and shall be within the limits specified **below** for each grade:

AISI Grade	4130	4130H
Carbon, %	.28 to .33	.27 to .33
Manganese, %	.40 to .60	.30 to .70
*Phosphorous, %	.025 max.	.025 max.
*Sulfur, %	.025 max.	.025 max.
Silicon, %	.15 to .35	.15 to .35
Chromium, %	.80 to 1.10	.75 to 1.20
Molybdenum, %	.15 to .25	.15 to .25
Nickel, %	.50 max.	.50 max.
Copper, % Residual	.30 max.	.30 max.

* Phosphorous and sulfur have maximum limitations which are different from the typical AISI chemistry.

5.0 MECHANICAL PROPERTIES

5.1 Mechanical properties can be obtained from a prolongation coupon or a test block which will represent the API QTC. This coupon or test block shall be from the same heat of steel, receive the same type of hot work and the same reduction or less, and shall have the equivalent heat treat cycle as the product per paragraph 6.0.

Tensile Strength, psi (min.) 85,000

Yield Strength, psi (min.)	60,000
Elongation, 2" gauge length, % (min.)	18
Reduction in area, % (min.)	35
Brinell Hardness, HB	207-235

5.2 Mechanical properties for plates can be taken from a test coupon removed from the plate. For plate thicknesses from 3/4" to 4", each side of the test coupon shall be equal to the plate thickness and the length equal to 6". For plate thicknesses over 4", the test coupon shall be removed and forged to 4" x 4" x 8" prior to heat treatment and heat treated per paragraph 6.0. The 6" or 8" dimension shall be in the direction of rolling (longitudinal).

5.2.1 Test results must meet the properties of paragraphs 5.1 and 5.3.1.

5.3 Impact Properties

5.3.1 Test temperature, V-notch Charpy values, and lateral expansion requirements are:

Temperature	Average of 3 Specimens	Minimum Requirements 1 Specimen Only	Lateral Expansion
-26°F (-32°C)	20 ft.-lbs.	13.3 ft.-lbs.	0.15" min.

5.3.2 The test specimens should be sampled from a ¼ location where "t" is the thickness of the test coupon.

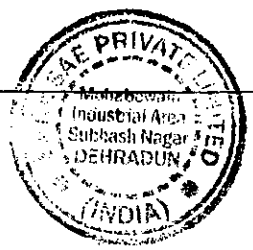
5.3.3 Unless otherwise specified, the Charpy V-Notch specimens are to be oriented in the longitudinal direction, with the notch machined such that it is perpendicular to the material surface from which t/4 is measured.

5.4 The hardness shall be taken at the surface of the test bar.

5.5 Chemical properties obtained from a mill qualification report representing the same heat are acceptable.

5.6 Chemical, mechanical and impact testing may be conducted on pieces cut from the forging/plate and subjected to the equivalent heat treatment as the component.

6.0 HEAT TREATMENT



6.1 Forgings and plates shall be supplied in the normalized (1600 - 1675°F) condition unless specified otherwise in the Purchase Order.

6.2 Gates made to this Specification shall be heat treated as follows after they have been sprayed and fused for hardfacing:

6.2.1 Preheat 700 - 800°F.

6.2.2 Austenitize at 1550 - 1600°F for 1/2 hour to 1 hour (0.5 – 1.0) per inch of maximum cross-section, or one (1) hour minimum.

6.2.3 Quench in 700 - 750°F liquid salt until temperature stabilizes, or one (1) hour minimum.

NOTE: Quenching may be done in Polymer, provided the QTC was quenched in Polymer.

6.2.4 Cool to room temperature and check hardness.

6.2.5 Temper to HB 207-235 (approximate temperature range 1050/1300°F).

7.0 MARKINGS

7.1 The wrought products shall be marked by steel stamping with the Purchase Order number, the alloy, mill heat number, and part number.

8.0 INSPECTION

8.1 The product shall be inspected for laps, seams, folds, and re-entry grains, and those defects shall be ground out.

8.2 When surface defects are removed by grinding and the thickness is not reduced below that specified on the Purchase Order, the defective areas may be blended smooth. Care should be taken to assure that all the defects have been removed by reinspecting the zone after grinding.

8.3 When surface grinding reduces the thickness below the specified minimum, the material shall be rejected. No welding is permitted for materials required by this Specification.

9.0 SPECIAL REQUIREMENTS

9.1 Cleanliness

9.1.1 SARA SAE has the option to perform a macro analysis of the forged bars, hot rolled plates, and other forgings to reveal the presence of segregation and non-metallic inclusions. The material shall show freedom from pipe, segregation, flaking, and injurious non-metallic inclusions.

9.2 Wroughtness

9.2.1 The forged bars and plates shall be mechanically hot worked by a press, hammer, or rolling mill to work the metal to produce uniform Wroughtness throughout the section thickness. The minimum reduction that the forging is subjected to shall exceed 3.0 to 1. The reduction can be calculated based on the original area to the final area of the part.

9.3 Melting Process

9.3.1 The steel shall be made by the basic electric furnace process in which the molten metal may be vacuum or AOD treated prior to or during the pouring of the ingot in order to remove objectionable gases, particularly hydrogen. Vacuum-arc remelting and electroslag remelting are also permissible melting processes. The material shall be treated to fine grain melting practice.

10.0 CERTIFICATION

10.1 A certification shall be provided to SARA SAE with each shipment. In addition, the original and a copy will be provided to the SARA SAE Purchasing Department.

10.2 The following information is mandatory on the certified record:

10.2.1 Purchase Order Number

10.2.2 Mill chemical analysis and heat number

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10.2.3 Statement of actual values of the mechanical properties to include Charpy V-Notch values, of the forged coupon or test block for each heat treatment specified in Section 5.0 and 6.0.

10.2.4 Certification of heat treatment to include time/temperature cycle and the surface hardness of the coupon or block test block (API QTC).

10.2.5 If material was purchased in the normalized condition, it must be reflected on the certification..

10.3 In the event of partial shipment or billing, each shipment shall be accompanied by a certification. Traceability of components is required as to heat lot, heat treatment, and mechanical properties.

11.0 DIMENSIONS

11.1 The wrought products shall conform to the dimensions and tolerances specified on the SARA SAE drawing and/or Purchase Order.

12.0 DEVIATION

12.1 Any deviation from this Specification shall be permitted only upon prior written approval from SARA SAE. SARA SAE Engineering shall be the final authority on any deviations.

12.2 Qualified suppliers will be notified of their acceptability to this Specification and any deviations will be so noted.

13.0 SERIALIZATION

13.1 Materials/parts ordered to this Specification will require serialization by SARA SAE Quality Control.