

		SARA SAE ENGINEERING SPECIFICATION	
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SPECIFICATION FOR GENERAL REQUIREMENTS OF HEAT TREATMENT OF ALLOY STEELS FOR USE IN WELL HEAD , CHRISTMAS TREE, MANIFOLD AND RELATED EQUIPMENT

1.0 PURPOSE

- 1.1 It is the purpose of this specification to list in a concise form the Heat Treatment of alloy Steels used in well head, Christmas Tree, Manifold and related equipment used oil field services.
- 1.2 This material specification is intended to aid the PPC / Product Manager/ purchasing department in out sourcing and the vendor to comply the requirements of heat treatment of a material which needs to meet its intended use, and the quality control department in the inspection and release of incoming material.

2.0 SCOPE

- 2.1 This specification covers requirements of heat treatment of alloy steels used for Well Head , Christmas Tree , Manifold and related equipment /die-forgings and ring rollings(where applicable) to meet requirements of the relevant specification.

3.0 APPLICABLE DOCUMENTS

- SARA SAE QA Sampling Plan SARA SAE/DOC/42 Rev'2'
- SES/QAD/MT-1/97 Rev'1' Test Method of MPI
- SES-26-701 Rev'0' Test Method of Liquid Penetrant Test
- SES-26-702 Rev'0' Ultra Sonic inspection, Steel, General.
- Material Spec as per Purchase Order
- Relevant Drawings / Specs

4.0 CONDITION

- 4.1 Heat Treated products shall be supplied clean, free from scale meeting the requirements of this specification, the purchase order and the relevant forging drawing.

5.0 VENDOR APPROVAL

- 5.1 Prior to outsourcing the process, prospective vendors shall be assessed for their capabilities for heat treatment.
- 5.2 Prior to HT of bulk the prospective vendor shall submit first off samples of the product duly Heat treated as per procedure for evaluation & approval.
- 5.3 After approval vendor shall make no changes in process without the written permission of SARA SAE and re-approval of first article sample, if desired by SARA SAE.



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6.0 GENERAL REQUIREMENTS

6.1 Spacing: Material to be heat treated should be racked / stacked such to allow circulation of heating and quenching media, to ensure all surfaces of the product are exposed to heating & quenching media and to minimize warpage during heating & quenching.

6.2 Carburization and Nitriding - The heating media in furnaces used for heating material shall be controlled to preclude carburization & nitriding.

6.3 Temperature Uniformity / Calibration of Furnace – The design and construction of the furnace(heat treatment equipment) shall be such that the temperature at any point in the furnace working zone or work load shall comply requirements of Appx 'P' of the 19th Edn of API 6A or AMSH – 6875.

7.0 HOLDING TIME

Table -1 : Holding Time for Annealing / Austenizing / Normalizing and tempering of Class A , B , C , and D Steels

Material	Annealing /Austenizing/Normalizing		Tempering & Aging Furnace or Contact Thermocouples
	Furnace Thermocouples	Contact Thermocouples	
Class A & B steels	30 minutes/ inch of T + one hour ; 1 hour min	15 minutes/ inch of T 15 minutes min	Matl upto 8" thickness --1 hr / inch min. + 30 min/ inch for additional T
Class C steels	As per table -		
Class D steels	As per table -		

1- These times are suitable for the simple solid shapes heated from -all-surfaces
2- For simple shapes, thickness 'T' shall be defined as follows:

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Billets for forgings may be heated by induction or electric or oil fired furnace

- 7.1.1 Heating shall not produce internal oxidation, sigma phase or grain growth exceeding Grain Size of 5 as per ASTM E112.
- 7.1.2 Billet pre-heat temperature shall depend upon the material used.
- 7.1.3 forgings shall be struck/ rolled so that the longitudinal axis of the starting billet coincides with the centerline of the forging / ring.
- 7.1.4 Finished forgings / rings shall be hot trimmed.
- 7.1.5 A min forging ratio of 3:1 shall be maintained for all die/free forgings and rings produced from bars/billets with predetermined forging ratio of min 3:1.

8.0 When specified on the PO, forgings shall be supplied in normalized or normalized and tempered condition as required.

9.0 FINISHED FORGING REQUIREMENTS

- 9.1 forgings shall conform to the dimensions and tolerances specified on the relevant drawing referenced on the purchase order.
- 9.2 Finished forgings shall be clean, scale free, free of laps, seams, cracks, fins, scabs, excessive flash or other surface / injurious defects.
- 9.3 Forging surfaces shall be capable of meeting the requirements of MPT / DPT as applicable.

10.0 ACCEPTANCE

- 10.1 A lot shall consist of one part number forgings produced from one heat of respective material and forged (heat treated, if require) in identical conditions.
- 10.2 SARA SAE may inspect random samples from each lot to verify any or all the above requirements.
- 10.3 An AQL of 4 with an acceptance / rejection number as per SARA SAE QA Plan SARA SAE /DOC/42 Rev'2' shall be used for lot acceptance. Any non-conforming lot shall be rejected.
- 10.4 Individual forgings may also be rejected for non-conformance if any.

11.0 PACKING

- 11.1 forgings shall be supplied in packages that protect against damages during shipment.

11.0 DOCUMENTATION REQUIRED

- 11.1 Each shipment shall be accompanied by material certifications for each lot of material, the certifications must be positively relatable to the lot of material represented.
 - a) Mill certificate of raw material.
 - b) Chemical certificate for each lot of forging.
- 11.2 Mechanical properties certification as per spec
- 11.3 Impact testing certification
- 11.4 Certification of heat treatment including cycle time, temperature, cooling media, hardness and graphs.
- 11.5 Calibration certificate of furnace.





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11.6 Ultrasonic test report -- certification of raw material.

12.0 TESTING TO BE CARRIED OUT BY SARA SAE

12.1 At the time of lifting forgings re-verification of chemical properties.

12.2 Recheck of tensile strength, yield strength, elongation, reduction in area, hardness, impact testing and UT testing as per applicable spec.

