ALLOY 625, 60 KSI (414 MPA), FORGINGS/MILL PRODUCTS, H2S COMPATIBLE

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0	Initial release	12-12-2016	MN	AS	KKD	Released

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1.0 Scope

This specification covers Alloy 625 (UNS N06625) forgings, bar, and mill products with SMYS of 60 ksi (414 MPa).

This material is compatible with H2S with no environmental limitations when in the annealed/ solution annealed heat treatment condition.

2.0 Reference Specifications

Documents	Descriptions
ASTM B443	Standard Specification for Ni-Cr-Mo-Cb Alloy (UNS N06625) and Ni-Cr-Mo-Si Alloy (UNS N06219) Plate, Sheet, and Strip
ASTM B444	Standard Specification for Ni-Cr-Mo-Cb Alloys (UNS N06625 and UNS N06852) and Ni-Cr-Mo-Si Alloy (UNS N06219) Pipe and Tube
ASTM B446	Standard Specification for Ni-Cr-Mo-Cb Alloy (UNS N06625) and Ni-Cr-Mo-Si Alloy (UNS N06219), and Ni-Cr-Mo-W Alloy (UNS N06650) Rod and Bar
ASTM B564	Standard Specification for Nickel Alloy Forgings
ASTM B705	Standard Specification for Nickel-Alloy (UNS N06625, N06219 and N08825) Welded Pipe
ASTM B829	Standard Specification for General Requirements for Nickel and Nickel Alloys Seamless Pipe and Tube
ASTM E213	Standard Practice for Ultrasonic Testing of Metal Pipe and Tubing
ASTM E426	Standard Practice for Electromagnetic (Eddy-Current) Examination of Seamless and Welded Tubular Products, Titanium, Austenitic Stainless Steel and Similar Alloys
ASTM E571	Standard Practice for Electromagnetic (Eddy-Current) Examination of Nickel and Nickel Alloy Tubular Product

3.0 Melting

The material shall be melted by electric furnace or vacuum induction melting (VIM), followed by vacuum arc remelting (VAR) or electroslag remelting (ESR). Melting practices shall facilitate production of homogenous ingot with minimal non-metallic inclusions, banding, flake, pipe or other defects.

4.0 Chemistry Requirements

The chemistry shall meet the requirements listed in Table 1.

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

Elements	Wt. Percentage (%)
Nickel[1]	58.0 Minimum
Chromium	20.0 - 23.0
Iron	5.0
Molybdenum	8.0 - 10.0
Cb + Ta	3.15 - 4.15
Carbon	0.10
Manganese	0.50
Silicon	0.50
Phosphorus	0.015
Sulfur	0.015
Aluminum	0.40
Titanium	0.40
Cobalt (reporting not required)	1.0
[1]Element may be determined arithmetically by difference.	

5.0 Mechanical Testing

5.1 Forgings

The material shall be hot worked, sufficient to produce a desired shape with 100% wrought structure, according to the parameters established by the manufacturer in a written procedure.

Forged and rolled bar are not considered 'shaped forgings' for the purposes of this specification and shall have a minimum reduction ratio of 4:1.

Shaped forgings and rolled rings shall have a minimum reduction ratio of 4:1, with the following considerations:

- The initial free upsetting operations of the as cast ingot shall not be considered as part of the final reduction ratio.
- Upsetting following cogging or drawing may be considered as part of the overall reduction ratio. If upsetting following cogging or drawing is to be considered, the overall forging reduction ratio shall be 6:1.

5.2 Mill Products

Samples for production testing shall realistically reflect the properties in the actual component, and shall be performed according to the associated ASTM(s) for each product form.

5.3 Mechanical Properties

The material shall meet the mechanical requirements of Table 2.

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

Tensile strength	120 ksi (827 MPa)
Yield strength	60 ksi (414 MPa)
Elongation in 2"	18%
Reduction of Area	35%
Hardness[1]	Report
[1]Hardness testing is not required for mill products	

6.0 Heat Treatment

6.1 Forgings

Heat treatment shall be in accordance with the requirements listed herein. Time and temperatures for heat treatment shall be as listed in Table 3.

Table 3: Heat Treatment Parameters

Process	Temperature	Time
Anneal/ Solution Anneal	1600-2125°F (871-1163°C) followed by air cooling or quicker	½ hour per inch of maximum through Thickness. One hour minimum
Hot Finish	1600-2125°F (871-1163°C) followed by air cooling or quicker	

6.2 Mill Products

Material shall be supplied in the annealed/ solution annealed condition at 1600°F minimum per the applicable ASTM specification or Table 3.

7.0 Non Destructive Evaluation

7.1 Forgings

Nondestructive inspection of forgings shall be performed in accordance with the specification on the DBI (part report).

7.2 Mill Products

The following NDE methods are required by the associated ASTM specifications. A separate report containing the results of this NDE is not required. Any additional NDE shall be performed in accordance with the part report and results shall be submitted as applicable.

Table 4: NDE required by the associated ASTM

ASTM	Product Form	NDE required
B705[1]	Welded Pipe	Hydrostatic testing or pneumatic leak test (air underwater) or eddy current testing or UT
B444	Pipe and Tube	Hydro Test and Nondestructive Electric Test[2]
B443	Plate	Per Part Report
B446	Bar and Shapes	Per Part Report
B564	Forgings	Per Part Report

[1]Welded pipe according to B705: All welds shall be 100% radio graphically examined to give a joint factor of 1.0.

[2]ASTM B829 (ref. by B444) defines this as UT (E213) or Eddy Current (E426 or E571)

8.0 Repair

Repair by welding is not acceptable.

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