

Age-hardened Nickel-based Alloys for Oil and Gas Drilling and Production Equipment

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Introduction

This standard for Age-Hardened Nickel-Based Alloys was formulated by the API Committee on Standardization of Oilfield Equipment and Materials (CSOEM), Subcommittee on Valves and Wellhead Equipment (SC6), Materials Task Group. It is based on the conclusions of a task group evaluation of requirements needed for Age-Hardened Nickel-Based Alloys to supplement the existing requirements of API Specification 6A, Specification for Wellhead and Tree Equipment.

NOTE Age-hardened and precipitation-hardened terms are interchangeably used in international standards

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Age-hardened Nickel-based Alloys for Oil and Gas Drilling and Production Equipment

1 Scope

1.1 Purpose

This document provides material requirements, including acceptable microstructures, for age-hardened nickel-based alloys used in the manufacture of solid or hollow wrought raw materials for API 6A equipment, and other equipment where specified by the applicable Standard or Specification.

The process controls and tests requirements contained in this standard assist in achieving adequate performance in a variety of environments. These requirements have been applied since 2004 for UNS N07718 120K via API 6A718 (which was superseded by this Standard).

WARNING—Failures attributed to hydrogen-induced stress cracking (HISC) have been reported in production equipment and early in the life of subsea equipment made from age-hardened nickel-based alloys. Some age-hardened nickel-based alloys that meet the requirements of ANSI/NACE MR0175/ISO 15156 and API 6ACRA may be susceptible to HISC. Sources of hydrogen charging include but are not limited to galvanic coupling to a more active material, direct exposure to seawater with cathodic protection (CP), and decomposition of brines. The industry is evaluating alternate test methods and/or acceptance criteria to identify material with susceptibility to HISC.

1.2 Applicability

This standard is intended to apply to raw materials used in the manufacture of pressure-containing and pressure-controlling components as defined in API 6A. Requirements of this standard may be applied by voluntary conformance by a manufacturer, normative reference in API 6A or other product specification(s), or by contractual agreement.

Thermal post-processing of API 6ACRA material designations, after the applicable final aging heat treatment specified in this standard, is outside the scope of this standard.

NOTE Examples of thermal post-processing and thermochemical surface treatments (e.g. chemical vapor deposition) and/or thermal diffusion treatments (e.g. boronizing, nitriding, nitrocarburizing), welding, and brazing.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API Specification 6A, *Specification for Wellhead and Tree Equipment*

ASTM A370¹, *Test Methods and Definitions for Mechanical Testing of Steel Products*

ASTM A604, *Standard Practice for Macroetch Testing of Consumable Electrode Remelted Steel Bars and Billets*

ASTM B880, *Standard Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys and Cobalt Alloys*

ASTM E8, *Standard Test Methods for Tension Testing of Metallic Materials*

¹ ASTM International, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428-2959. www.astm.org.