Materials and Fabrication of $1^{1}/_{4}$Cr-$^{1}/_{2}$Mo Steel Heavy Wall Pressure Vessels for High-pressure Hydrogen Service Operating at or Below 825 °F (440 °C)

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Suggested revisions are invited and should be submitted to the Standards Department, API, 200 Massachusetts Avenue, NW, Suite 1100, Washington, DC 20001, standards@api.org.

Contents

Introduction

This recommended practice (RP) applies to new fabrication of heavy wall pressure vessels in petroleum refining, petrochemical and chemical facilities in which hydrogen or hydrogen-containing fluids are processed at elevated temperature and pressure. It is based on decades of industry operating experience and the results of experimentation and testing conducted by independent manufacturers, fabricators, and purchasers of heavy wall pressure vessels for this service.

Licensors and owners of process units in which these heavy wall pressure vessels are to be used may modify and/or supplement this recommended practice with additional proprietary requirements.

Materials and Fabrication of 1 1/4Cr-1/2 Mo Steel Heavy Wall Pressure Vessels for High-pressure Hydrogen Service Operating at or Below 825 °F (440 °C)

1 Scope

This recommended practice (RP) covers materials and fabrication requirements for new $1^1/_4$Cr-$^1/_2$Mo steel heavy wall pressure vessels and heat exchangers for high-temperature, high-pressure hydrogen service. It applies to vessels that are designed, fabricated, certified, and documented in accordance with ASME Section VIII, Division 1 or Division 2. This document may also be used as a resource for equipment fabricated of 1Cr-$^1/_2$Mo Steel.

This document may also be used as a resource when planning to modify an existing heavy wall pressure vessel.

The interior surfaces of these heavy wall pressure vessels may have an austenitic stainless steel or ferritic stainless steel weld overlay or cladding to provide additional corrosion resistance.

For this recommended practice, “heavy wall” is defined as a shell thickness 2 in. (50 mm) or greater, but less than or equal to 4 in. (100 mm) at the time of mill heat treatment. At shell or head thicknesses greater than 4 in. (100 mm), $1^1/_4$Cr-$^1/_2$Mo plates and forgings have been shown to have difficulty meeting the toughness requirements given in this document. Thick $1^1/_4$Cr-$^1/_2$Mo forgings, such as integrally reinforced nozzles, flanges, tube sheets, channel covers, etc., can especially have difficulty meeting specified properties. $2^1/_4$Cr-1Mo plates and forgings can be used as an alternative to ensure properties are met. Although outside of its scope, this document can be used as a resource for vessels down to 1 in. (25 mm) or lower in shell thickness, with changes defined by the purchaser.

Multilayer vessels are outside the scope of this document.

This recommended practice is not intended for use for equipment operating above 825 °F (440 °C) or in the creep range. API RP 934-E covers these higher-temperature applications.

2 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any addenda) applies.

API Recommended Practice 582, *Welding Guidelines for the Chemical, Oil, and Gas Industries*

API Recommended Practice 934-A, *Materials and Fabrication of $2^1/_4$Cr-1Mo, $2^1/_4$Cr-1Mo-$^1/_4$V, 3Cr-1Mo, and 3Cr-1Mo-$^1/_4$V Steel Heavy Wall Pressure Vessels for High-temperature, High-pressure Hydrogen Service*

API Recommended Practice 934-E, *Recommended Practice for Materials and Fabrication of $1^1/_4$Cr-$^1/_2$Mo Steel Pressure Vessels for Service above 825 °F (440 °C)*

ASME [1] *Boiler and Pressure Vessel Code, Section II-Materials; Part A-Ferrous Material Specifications; Part C, Specification for Welding Rods, Electrodes and Filler Metals; Part D-Properties*

ASME *Boiler and Pressure Vessel Code*, *Section V-Nondestructive Examination*

ASME *Boiler and Pressure Vessel Code*, *Section VIII-Rules for Construction of Pressure Vessels, Division 1*

[1] ASME International, 3 Park Avenue, New York, New York 10016, www.asme.org.