International Standard

ISO 18742

Ship and marine technology — High-manganese austenitic steel — Specification for high-manganese austenitic steel welded fittings for cryogenic temperature

Navires et technologie maritime — Acier austénitique à haute teneur en manganèse — Spécification pour les raccords soudés en acier austénitique à haute teneur en manganèse pour température cryogénique

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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This document was prepared by Technical Committee TC 8, *Ships and marine technology*, Subcommittee SC 4, *Outfitting and deck machinery*.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

The aim of this document is to provide a set of common requirements for metallic materials used in cryogenic applications, in alignment with the IGC Code[1] and IGF Code[2] adopted by the International Maritime Organization (IMO).

The newly developed, high-manganese austenitic steel is expected to possess mechanical properties including Charpy impact energy values comparable to those materials for cryogenic service listed in both the IGC Code and IGF Code. Consequently, high-manganese steel is intended to satisfy the strength requirements of the structure of cargo tanks, fuel tanks and piping systems.

In addition, upon agreement with a purchaser, this document can be applied to piping systems for liquefied hydrogen.

This document provides a standard specification of high-manganese austenitic steel welded fittings for material suppliers, ship owners, ship yards, manufacturers and shipping companies with regard to producing, purchasing and using such materials.

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Ship and marine technology — High-manganese austenitic steel — Specification for high-manganese austenitic steel welded fittings for cryogenic temperature

1 Scope

This document provides requirements for wrought high-manganese austenitic steel welded fittings used for pressure piping at cryogenic temperature.

The specification of high-manganese austenitic steel welded fittings is applicable to all pressure retaining components and any non-pressure retaining components used in hull systems for marine technology and in onshore projects.

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 amendments) applies.

ISO 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 2566-1, *Steel — Conversion of elongation values — Part 1: Carbon and low-alloy steels*

ISO 2566-2, *Steel — Conversion of elongation values — Part 2: Austenitic steels*

ISO 3452-1, *Non-destructive testing — Penetrant testing — Part 1: General principles*

ISO 4136, *Destructive tests on welds in metallic materials — Transverse tensile test*

ISO 5173, *Destructive tests on welds in metallic materials — Bend tests*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 9606-1, *Qualification testing of welders — Fusion welding — Part 1: Steels*

ISO 9712, *Non-destructive testing — Qualification and certification of NDT personnel*

ISO 10474, *Steel and steel products — Inspection documents*

ISO 15609-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding*

ISO 15614-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys*

ISO 18265, *Metallic materials — Conversion of hardness values*

ASME B16.28, *Wrought Steel Butt-Welding Short Radius Elbows and Returns*

ASME B16.9, *Factory-Made Wrought Buttwelding Fittings*

ASME B31.3, *Process Piping*

ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, 2023, *Rules for Construction of Pressure Vessels*

ASTM A960/960M, *Standard Specification for Common Requirements for Wrought Steel Piping Fittings*

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3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
cryogenic service
service environment in which the minimum *design temperature* (3.2) is lower than –104 °C

3.2
design temperature
minimum temperature for selection of materials at which cargo or fuel can be loaded or transported in the cargo or fuel tanks

3.3
heat
molten metal poured from a single melting furnace or all the molten metal from two or more furnaces poured into a single ladle

3.4
high-manganese austenitic steel
steel with high amount of manganese to retain austenitic as its primary phase at atmospheric and service temperature

3.5
leak testing
hydrostatic leak test
pneumatic leak test
application of a pressure load, greater than the design load, to demonstrate the integrity of a pressure system to safely withstand the design load

Note 1 to entry: ASME B31.3 uses the terms *hydrostatic leak test*, *pneumatic leak test*, or a combination of both methods, such as a hydro-pneumatic test.

3.6
lot
fitting which is manufactured by the same manufacturer process, same heat number (same chemical composition), same heat treatment and same welding procedure specification

3.7
manufacturer
organization, including subcontractors, which carries out operations (e.g. forming, heat treatment) that affect the material properties of the finished product

3.8
purchaser
owner or another party acting on their behalf, who is responsible for procuring materials, components or services intended for the design, construction or modification of fittings

3.9
test specimen
part that is subject to mechanical testing

3.10
starting material
material used as the initial input for the forging operation, such as a billet, bloom, or cast preform

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3.11
under match
condition where the tensile strength of the weld metal is lower than that of the base metal

4 Abbreviated terms

For the purposes of this document, the following abbreviated terms are used.

ACCP	ASNT Central Certification Program
AOD	Argon oxygen decarburization
API	American Petroleum Institute
ASNT	American Society for Non-destructive Testing
BPVC	Boiler and Pressure Vessel Code
HAZ	Heat-affected zone
NDT	Non-destructive testing
PT	Penetrant testing
RT	Radiographic testing
SMAW	Shielded-metal arc welding
SMYS	Specified minimum yield strength
UT	Ultrasonic testing
VT	Visual testing

5 Health, safety and quality requirements

5.1 Health and safety requirements

Each manufacturer is expected to operate in accordance with all relevant statutory health and safety legislation pertaining to the location where manufacturing, testing and inspection take place.

At least, the following safety equipment and systems shall be provided:

a) ventilation and extraction facilities for welding-related activities or work in a confined space;

b) personal protective equipment including eye, breathing and hearing protection;

c) access/scaffolding/working platforms and fall-arrest protective equipment for working at height;

d) access and secure temporary formwork for working below product;

e) protective systems to prevent electric shock and build-up, or discharge, of static electricity.

Each manufacturer shall manage all work undertaken during manufacturing, including cleaning, flushing, and leak testing activities.

5.2 Quality requirements

The manufacturer is responsible for implementing effective quality, process, production controls according to manufacturing specifications.

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