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

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Abbreviated terms **3**
5 Health, safety and quality requirements **3**
5.1 Health and safety requirements 3
5.2 Quality requirements 3
6 Material designation **4**
7 Manufacture **4**
7.1 Steel making 4
7.2 Forging 4
8 Chemical composition **4**
9 Heat treatment **5**
10 Mechanical properties **6**
10.1 Preparation of test specimens 6
10.2 Extent of testing 6
10.3 Mechanical properties 7
10.3.1 General 7
10.3.2 Tensile testing 7
10.3.3 Impact testing 7
10.4 Retesting 8
11 Inspection **8**
11.1 General requirements 8
11.2 Visual inspection 8
11.3 Liquid penetrant inspection 9
11.4 Ultrasonic inspection 9
11.5 Hydrostatic testing 9
12 Repairs **10**
13 Dimension **10**
14 Traceability, handling and packing **10**
15 Documentation **10**
Bibliography **12**

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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 system for liquefied hydrogen.

This document provides a standard specification of high-manganese austenitic steel castings 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 forgings for cryogenic temperature

1 Scope

This document specifies minimum requirements for high-manganese austenitic steel forgings for valves, flanges, fittings and other pressure-containing components used at cryogenic temperature.

The specification of high-manganese austenitic steel forgings can be applicable to all pressure retaining components and any non-pressure retaining component.

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 5208, *Industrial valves — Pressure testing of metallic valves*

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

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

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

ASME B31.3, *Process Piping*

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

ASTM A370, *Standard test methods and definitions for mechanical testing of steel products*

ASTM A388, *Standard Practice for Ultrasonic Examination of Heavy Steel Forgings*

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

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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
end user
entity responsible for the operation of an installation/facility and its component

3.4
heat
molten metal poured from a single melting furnace or all the molten metal from two or more furnaces poured into a single ladle

3.5
high-manganese austenitic steel
steel with a high amount of manganese to retain austenitic as its primary phase at atmospheric and service temperature

3.6
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.

3.7
lot
two or more products with the same chemical composition (same melt of material), same heat treated in a same heat treatment furnace, same thickness (within ±20 %, maximum thickness base), and same product type

3.8
manufacturer
organization, including subcontractors, which carries out operations (e.g. forging, heat treatment) that affect the material properties of the finished product

3.9
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 forging

3.10
set temperature
target holding temperature for heat treatment

3.11
test coupon
part from which the *test specimens* (3.12) will be extracted

3.12
test specimen
part that is subject to mechanical testing

3.13
starting material
material used as the initial input for the forging operation, such as a billet, bloom, or cast preform

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3.14
calibration notch
artificial notch used to calibrate ultrasonic testing equipment

4 Abbreviated terms

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

ACCP	ASNT Central Certification Program
AOD	Argon oxygen decarburization
ASNT	American Society for Non-destructive Testing
BPVC	Boiler and pressure vessel code
NDT	Non-destructive testing
PT	Penetrant testing
QMS	Quality management system
RT	Radiographic testing
SMYS	Specified minimum yield strength
UT	Ultrasonic 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 carrying out effective quality, process and production controls according to the manufacturing specifications.

The manufacturer shall establish and maintain documented procedures for all critical manufacturing processes.

High-manganese austenitic steel forgings shall meet the chemical composition requirements specified in Clause 8 and the mechanical property requirements specified in Clause 10.

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