SLOVENSKI STANDARD
oSIST prEN ISO 17781:2016

01-julij-2016

Petrokemična industrija ter industrija za predelavo nafte in zemeljskega plina - Preskusne metode za kontrolo kakovosti mikrostrukture avstenitno-feritnega (dupleksnega) nerjavnega jekla (ISO/DIS 17781:2016)

Petroleum, petrochemical and natural gas industries - Test methods for quality control of microstructure of austenitic/ferritic (duplex) stainless steel (ISO/DIS 17781:2016)

Erdöl-, petrochemische und Erdgasindustrie - Werkstofftestanforderungen für nichtrostenden Duplexstahl (ISO/DIS 17781:2016)

Industries du pétrole, de la pétrochimie et du gaz naturel - Méthodes d'essai de contrôle de la qualité de la microstructure des aciers inoxydables (duplex) austénitiques/ferritiques (ISO/DIS 17781:2016)

Ta slovenski standard je istoveten z: prEN ISO 17781

ICS:

75.180.01	Oprema za industrijo nafte in zemeljskega plina na splošno	Equipment for petroleum and natural gas industries in general
77.140.20	Visokokakovostna jekla	Stainless steels

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DRAFT INTERNATIONAL STANDARD
ISO/DIS 17781.2

ISO/TC **67** Secretariat: **NEN**

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Petroleum, petrochemical and natural gas industries — Test methods for quality control of microstructure of ferritic/ austenitic (duplex) stainless steels

Industries du pétrole, de la pétrochimie et du gaz naturel — Méthodes d'essai de contrôle de la qualité de la microstructure des aciers inoxydables (duplex) austénitiques/ferritiques

ICS: 75.180.01

ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*.

Introduction

The aim of this International Standard is to establish common test methods for quality control of microstructure of ferritic/austenitic (duplex) stainless steels for the oil and gas industry, enabling the manufacturers to apply the same test procedures for their clients.

Duplex stainless steels have a dual phase microstructure consisting of ferrite and austenite. Ideally, these phases are present in equal proportions although in commercial alloys the ferrite phase volume fraction may vary between 35 % and 65 % for products in the solution annealed condition. They are characterized by high chromium (19 % to 33 %) and low nickel contents compared with austenitic stainless steels.

Some duplex stainless steels are prone to precipitation of intermetallic phases and nitrides possibly causing embrittlement and reduced corrosion resistance. The formation of intermetallic phases such as Sigma and Chi occurs depending on exposure time in the approximate temperature range 590 °C to 1000 °C (1 094 °F to 1 832 °F) and decomposition of ferrite to Alpha Prime occurs in the range 300 °C to 540 °C (572 °F to 1 004 °F).

The microstructure of components or fabrication welds is affected by amongst others the thermal-mechanical history associated with hot working, solution annealing and with subsequent forming and welding. The destructive test methods with acceptance criteria specified herein are considered relevant to verify that exposure time at above stated temperature ranges have been within acceptable limits and to ensure that desired corrosion resistance and mechanical properties are obtained in final products.

Petroleum, petrochemical and natural gas industries — Test methods for quality control of microstructure of ferritic/ austenitic (duplex) stainless steels

1 Scope

This International Standard specifies quality control testing methods and test conditions for the characterization of microstructure in relation to relevant properties in ferritic/austenitic (duplex) stainless steel components supplied in the solution annealed condition and fabrication welds in the as welded condition.

This International Standard supplements the relevant product and fabrication standards with respect to destructive testing methods including sampling of test specimens, test conditions and test acceptance criteria to show freedom from deleterious intermetallic phases and precipitates in duplex stainless steels. In addition this International Standard specifies how testing and test results shall be documented by the testing laboratory.

NOTE 1 This International Standard is based upon experience with duplex stainless steels in offshore oil and gas industry applications including topside and subsea hydrocarbon service, sea water service as well as structural use.

NOTE 2 The austenite spacing is relevant to the susceptibility of duplex stainless steels to hydrogen induced stress cracking (HISC) in subsea applications where cathodic protection is applied. This falls outside the scope of this International Standard. Reference is made to DNV/GL RP-F112 [6].

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.

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

ISO 15614-1[2)], *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*)

ASTM A 1084, *Standard test method for detecting detrimental phases in lean duplex austenitic/ferritic stainless steels*

ASTM E 3, *Standard practice for preparation of metallographic specimens*

ASTM E 562, *Standard test method for determining volume fraction by systematic manual point count*

ASTM E 1245, *Standard practice for determining the inclusion or second-phase constituent content of metals by automatic image analysis*

ASTM G 48, *Standard test methods for pitting and crevice corrosion resistance of stainless steels and related alloys by use of ferric chloride solution*

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1)) For the purpose of this International Standard, the following documents are considered equivalent:— ASTM A 370, *Standard test methods and definitions for mechanical testing of steel products*— ASTM A 1058, *Standard test methods and definitions for mechanical testing of steel products – Metric*

2)) For the purpose of this International Standard, the following documents are considered equivalent:— ASME Boiler and pressure vessel code, section IX Welding and brazing qualifications

3 Terms, definitions and abbreviations

For limitations in chemical composition of each specific material grade of duplex stainless steel reference is made to the appropriate product standards or UNS number. For nominal chemical composition of duplex stainless steels and grouping of different types, used within this International Standard, reference is made to Annex A.

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

3.1 Terms and definitions

3.1.1
centreline intermetallic stringer
group of intermetallic phases aligned within the mid-thickness area due to alloy segregation

Note 1 to entry: They can be observed as both continuous and discontinuous precipitates.

3.1.2
fabrication
building of structures or equipment by cutting, bending, and assembling processes such as welding, riveting, threaded fasteners or other joining methods

3.1.3
ferritic/austenitic (duplex) steel
stainless steel with a high chromium mass fraction (19 % to 33 %) with or without molybdenum additions up to 5 %, and a nickel mass fraction intermediate to those of ferritic and austenitic stainless steels

3.1.4
intermetallic phase
solid-state compounds, containing two or more metallic elements, whose ordered structure differs from that of its constituents

Note 1 to entry: In duplex stainless steel the relevant phases are identified as σ-phase, χ-phase and R-phase.

3.1.5
pitting resistance equivalent number
PREN
number indicating the resistance of stainless steel to pitting corrosion related to chemical composition and derived from one of the equations PREN = % Cr + 3,3 % Mo + 16 % N or PREN = % Cr + 3,3 × % (Mo + 0,5W) + 16 × % N (mass fraction)

Note 1 to entry: All PREN limits are absolute limits based upon the heat analysis. The calculated value is not to be rounded.

3.1.6
precipitate
solid-state compounds, containing two or more elements, whose ordered structure differs from that of its constituents

Note 1 to entry: In duplex stainless steel the relevant precipitates are chromium carbides and nitrides.

3.1.7
stainless steel
steel with at least 10,5 % mass fraction or more chromium, possibly with other elements added to secure special properties

3.1.8
type 20Cr duplex Group A
ferritic/austenitic stainless steel alloys with 24,0 ≤ PREN < 28,0

