

Cast structural steel

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Foreword

The NORSOK standards are developed by the Norwegian petroleum industry to ensure adequate safety, value adding and cost effectiveness for existing and future petroleum industry developments.

The NORSOK standards are prepared to complement available international standards and fill the broad needs of the Norwegian petroleum industry. Where relevant NORSOK standards will be used to provide the Norwegian industry input to the international standardisation process. Subject to development and publication of international standards, the relevant NORSOK standard will be withdrawn.

These standards are developed according to the consensus principle generally applicable for most standards work and according to established procedures defined in NORSOK A-001

The preparation and publication of the NORSOK standards is supported by OLF (The Norwegian Oil Industry Association) and TBL (Federation of Norwegian Manufacturing Industries). NORSOK standards are administered and issued by NTS (Norwegian Technology Centre).

Introduction

This standard is based on former company specifications and experience from deliveries and operation.

1 Scope

This Standard defines the requirements for qualification of foundries and the technical delivery requirements for cast structural steel for use in offshore structures where Steel Quality Level I or II is required.

2 Normative references

The following standards include provisions which, through reference in this text, constitute provisions of this NORSOK standard. Latest issue of the references shall be used unless otherwise agreed. Other recognised standards may be used provided it can be shown that they meet or exceed the requirements of the standards referenced below.

ASME V Article 3	Radiographic Examination
ASME V, Article 5	Ultrasonic Examination Methods For Materials And Fabrication
ASME V, Article 7	Magnetic Particle Examination
ASME IX	Welding and Brazing Qualifications
ASTM A 609	Standard Practice For Castings, Carbon, Low-Alloy And Martensitic Stainless Steel, Ultrasonic Examination Thereof
ASTM E 112	Standard Test Method for Determining Average Grain Size
ASTM E 125 - 80	Standard Reference Photographs For Magnetic Particle Indications On Ferrous Castings
ASTM E 446	Reference Radiographs For Steel Castings Up To 51 mm In Thickness
ASTM E 186	Reference Radiographs For Heavy-Walled (51 to 112 mm) Steel Castings
ASTM E 280	Reference Radiographs For Heavy-Walled (112 to 305 mm) Steel Castings
ASTM E 709	Standard Practice For Magnetic Particle Examination
BS 7448	Fracture mechanics toughness tests
Bureau de Normalisation des Industries de la Fonderie (BNIF)	Technical Recommendation No. 341-02, "Characterisation Of Surface Condition Of Steel Castings"
EN 287	Approval testing of welders – Fusion welding
EN 288	Specification and approval of welding procedures for metallic materials
EN 473/Nordtest/ASNT	Qualification of NDT operators
EN 10204	Metallic products – Types of inspection documents
ISO 148	Steel – Charpy impact test (V-notch)
ISO 2632 / III	Roughness Comparison Specimens, Cast Surfaces
ISO 6892	Metallic material – Tensile testing at ambient temperature
ISO 8062	Castings – System of dimensional tolerances and machining allowances
ISO 9001	Quality management systems – Requirements
MSS-SP 55	Visual Inspection Guide For Steel Castings
EN 10225 (Aug. 2001)	Weldable structural steels for fixed offshore structures – Technical delivery conditions

3 Abbreviations

AOD	Argon Oxygen Decarburisation
CTOD	Crack Tip Opening Displacement
FATT	Fracture Appearance Transition Temperatures
NDT	Non Destructive Testing
PWHT	Post Weld Heat Treatment
VODC	Vacuum Oxygen Decarburisation Converter
VAD	Vacuum Argon Decarburisation

4 Qualification

The purchaser may accept the foundry's qualification based on general information described in 4.1 combined with a verification or audit at the foundry.

However, depending on the criticality and complexity of the casting and the experience of the foundry, the purchaser may require the foundry to perform a qualification as described in 4.2.

4.1 General

4.1.1 Basis for qualification of steel foundries

The basis for qualification:

- Documented knowledge and previous experience with the material and the manufacturing.
- Manufacturing facilities and equipment.
- Established manufacturing procedures covering all important manufacturing steps from melting to finished products.
- Manufacturers quality system, which shall fulfil the requirements related to product realization in ISO 9001 or equivalent.
- Results of testing in compliance with this standard.

Prior to qualification a complete report, with information and results of testing as required by this standard shall be available for review.

4.1.2 General requirements

The manufacturer shall have knowledge and experience within relevant metallurgical aspects of the applicable steel grades including welding, heat treatment parameters, etc. as applicable for his manufacturing process.

Experience should be supported by statistical data or relevant test records for the size range to be qualified. The steel shall have been produced to manufacturing procedures and with equipment intended used for the actual manufacturing.

Facilities and equipment shall be fit for purpose, regularly maintained and calibrated as required. The assessment shall concentrate on facilities and equipment for moulding, melting, refining, welding, heat treatment, etc.

Foundries shall have heat treatment facilities on their own premises or such facilities shall be located in their close vicinity.

If parts of the production is carried out at a sub-supplier, the manufacturer is responsible for ensuring that the sub-supplier meets the requirements of this standard for the manufacturing steps that he is performing.

4.1.3 Manufacturing

The manufacturer shall have a Manufacturing Summary for each production route. The Manufacturing Summary shall describe, step by step in a logical and correct sequence all important manufacturing activities with reference to detailed procedures. A short description and the main parameters for each activity shall be included. The production route shall be illustrated with a flow chart. The scope of the manufacturing summary shall be clearly defined:

- Name and address of manufacturer.
- Grade of material with reference to standard.
- Type and size range of products for which the manufacturing summary applies.
- Identification of the manufacturing process.

The manufacturing summary shall include procedures for:

- Moulding method, type of sand, binding agent and method of casting.