

Qualification of manufacturers of special materials

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Standards Norway
Strandveien 18, P.O. Box 242
N-1326 Lysaker
NORWAY

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Telephone: + 47 67 83 86 00
Fax: + 47 67 83 86 01
Email: petroleum@standard.no
Website: www.standard.no/petroleum



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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 petroleum industry developments and operations. Furthermore, NORSOK standards are as far as possible intended to replace oil company specifications and serve as references in the authorities' regulations.

The NORSOK standards are normally based on recognised international standards, adding the provisions deemed necessary to 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 Subject to development and publication of international standards, the relevant NORSOK standard will be withdrawn.

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

The NORSOK standards are prepared and published with support by The Norwegian Oil Industry Association (OLF) and Federation of Norwegian Manufacturing Industries (TBL).

NORSOK standards are administered and published by Standards Norway.

Annexes B and C are normative, whilst Annex A is for information only.

Introduction

This revision replaces NORSOK M-650, Rev. 2.

The main changes made are related to the following items:

- Validity of the Qualification Test Record (QTR).
- Changes in essential variables of the qualification test.
- Additional extent of testing for section thickness above 60 mm and 120 mm.
- Additional requirements to the content of the Qualification Test Record (QTR).
- Third party witnessing is required for qualification tests, EN 10204 Type 3.1C certificate to be issued.
- Introduction of Qualification Test Record (QTR) front page, see Annex C.

This NORSOK standard is published without marking of changes, compared to Rev. 2, as the modifications are considerable.

1 Scope

This NORSOK standard establishes a set of qualification requirements to verify that the manufacturer has sufficient competence and experience of the relevant material grades, and necessary facilities and equipment to produce these in the required shapes and sizes with acceptable properties.

The following materials grades are included:

- Duplex SS: all grades, product forms and dimensions
- High alloyed austenitic SS: all product forms and dimensions
- Nickel base alloys: castings
- Titanium and its alloys: castings

This NORSOK standard may also be considered for critical components or product forms in other materials) and for special manufacturing/fabrication processes, e.g. induction and cold bending.

Structural steels are not included.

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 recognized standards may be used provided it can be shown that they meet or exceed the requirements of the standards referenced below.

ASTM A 703	Steel Castings, General Requirements, for Pressure-Containing Parts
ASTM A 991	Standard test method for conducting temperature uniformity surveys of furnaces used to heat treat steel products
EN 10204:1991	Metallic products – Types of inspection documents including EN 10204:1991/A1:1995
ISO 9001	Quality Management Systems – Requirements
NORSOK M-630	Material Data Sheet for Piping

3 Terms, definitions and abbreviations

For the purposes of this NORSOK standard, the following terms, definitions and abbreviations apply.

3.1 Terms and definitions

3.1.1

can

verbal form used for statements of possibility and capability, whether material, physical or casual

3.1.2

company

operator of a development/project

NOTE: This is normally an oil company.

3.1.3

high alloyed austenitic SS

austenitic SS with $PRE \geq 40$ or $Ni + 2 \times Mo > 30$ ($Mo > 2$)

EXAMPLES: SS type 6Mo, UNS S31266, UNS S32654, UNS S34565, UNS J95370

3.1.4

main contractor

contractor holding an engineering and procurement contract or an engineering, procurement and construction contract

3.1.5**manufacturer**

manufacturer including sub-vendors carrying out the operations affecting the material properties

3.1.6**may**

verbal form used to indicate a course of action permissible within the limits of the standard

3.1.7**pitting resistance equivalent****PRE**

$PRE = \%Cr + 3.3 \times \%Mo + 16 \times \%N$

3.1.8**purchaser**

body that purchase a product from a manufacturer

3.1.9**shall**

verbal form used to indicate requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted, unless accepted by all involved parties

3.1.10**should**

verbal form used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required

3.1.11**SS type 22Cr duplex**

ferritic/austenitic stainless steel alloys with 22 % Cr

EXAMPLES: UNS S31803 and UNS S32205

3.1.12**SS type 25Cr duplex**

ferritic/austenitic stainless steel alloys with 25 % Cr and $PRE \geq 40$

NOTE: Often referred to as "super duplex".

EXAMPLES: UNS S32550, UNS S32750, UNS S32760 and UNS S329274.

3.1.13**SS type 6Mo**

austenitic stainless steel alloys with 6 % Mo and $PRE \geq 40$

EXAMPLES: UNS S31254, UNS N08367 and UNS N08926.

3.2 Abbreviations

HIP	hot isostatic pressed
MDS	material data sheet
NDE	non-destructive examination
PRE	pitting resistance equivalent
QTR	qualification test record
PWHT	post weld heat treatment.
SS	stainless steel
WPQR	welding procedure qualification record
WPS	welding procedure specification

4 Responsibilities

The purchaser is responsible for ensuring that his manufacturers are qualified within the essential variables within this NORSOK standard. Acceptance of a manufacturer is at the discretion and determination of the purchaser.

The qualification exercise itself should be carried out in co-operation with company or its main contractors.

5 Basis for qualification of manufacturers

The basis for qualification of manufacturers shall be

- knowledge and relevant manufacturing experience with the type of material to be qualified (see clause 6),
- acceptable manufacturing facilities and equipment (see clause 6),
- established manufacturing summary (procedure) covering all manufacturing steps from melting or semi product to finished products (see clause 7),
- manufacturers quality system, which shall fulfill the requirements of ISO 9001 or equivalent,
- results of testing in compliance with this NORSOK standard (see clause 8).

Prior to qualification a complete QTR (see clause 9) with information and results of testing as required by this NORSOK standard shall be available for review.

6 General requirements

6.1 Knowledge and relevant experience

The manufacturer shall have knowledge of relevant metallurgical aspects of the applicable alloys including precipitation diagrams, effect of hot forming, welding, and heat treatment parameters, etc. as applicable for his manufacturing process.

The manufacturer shall have relevant experience with manufacture of the type of material to be qualified. Relevant experience should be supported by statistical data or relevant test records from the last 2 years to 3 years production for the product, material and the range of size to be qualified. The material shall have been produced to manufacturing procedures and with equipment intended used for manufacturing to the relevant requirements.

6.2 Manufacturing facilities and equipment

Facilities and equipment shall be fit for purpose, regularly maintained and calibrated as required.

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

Calibration of the quality heat treatment furnaces shall be made in accordance with ASTM A 991 and additional requirements given in Annex B or equivalent. The calibration shall be carried out with maximum workload, see ASTM A 991 para 6.1.2. This is to demonstrate that the required temperature uniformity and the maximum temperature specified can be reached. The subsequent annual calibrations may be carried out with empty furnace according to the standard.

The equipment shall be capable of transferring materials from heat treatment furnace into quenching bath within maximum 60 s for alloys requiring water quenching unless specifically qualified for the applicable material, product and size.

Quenching baths shall have satisfactory circulation and cooling facilities and shall be capable to keep the water temperature below 50 °C after completion of any quenching operation. The bath should be equipped with temperature monitoring/recording devices.

6.3 Sub-suppliers

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