

**Date: 31.07.2015**

**NORSOK Standard M-650 Edition 4**  
**Qualification of manufacturers of special materials**

**Group A: Frequently asked questions – FAQ**

**Group B: Clarification and comment list**

## INTRODUCTION

NORSOK standard M-650 Edition 4 was issued in September 2011. The standard is used worldwide by many organizations and persons. Questions are being brought up both with respect to use of the standard and to the various requirements and sections in the standard.

The aim of this document is to ensure uniform practicing of the standard. It is the intention to update this document on an annual basis.

The document has been split in two groups:

### **Group A: Frequently asked questions – FAQ**

This group addresses questions of a more general nature.

### **Group B: Clarification and comment list**

This group provides guidance, clarifications and comments to the specific sections and paragraphs in the standard. In some cases guidance are given for subjects, which were not originally covered in Edition 4. An example is for strain hardened products.

## REVISIONS

This edition of NORSOK M650 Ed. 4 FAQ and clarification list dated 31.07.2015 replaces the previous edition dated 2014-05-30.

- There are no changes to the FAQs.
- New clarifications are designated; year of revision –sequence No., e.g. 2015 – x1. Revised clarifications are identified with a prefix R, e.g. R2014 - xx.

The updates of the clarifications include:

- R2014-28: Sect. 10.3.2.2, Table 2, Annex 3; Qualification testing HIP – Selection of components for qualification
- R2014-29: Sect. 10.3.2.2 Table 2; Qualification testing – Sleeves, nozzles and similar products.
- 2015-1: Sect. 6.1; Validity of a QTR after renewal according to 6.2.
- 2015-2: Sect. 6.2; Renewal of an expired QTR.
- 2015-3: Sect. 8.2.2.6; Type of start material to be used
- 2015-4: Sect. 10.2..2, Table 1; Qualified thickness for bolting
- 2015-5: Sect. 10.2.4; Melting in induction furnaces without subsequent secondary refining used in foundries
- 2015-6: Sect. 10.2.5; Shall the listing also include bars?
- 2015-7: Sect. 10.2.5; Change in start material manufacturer
- 2015-8: Sect. 10.3.2.2, Table 2; Qualification of bar

## **Group A: Frequently asked questions – FAQ**

### **1. For whom is a qualification valid?**

It is the intention that a qualification carried out for one customer shall be valid also for other customers within the essential variables in Sect. 10.2 of the standard.

### **2. Requirements to be fulfilled**

NORSOK standard M-630, “Material Data Sheet for Piping” is the basis for the requirements to be fulfilled and the tests to be carried out in NORSOK standard M650. Fulfilling these requirements is commonly expressed as being “NORSOK qualified”.

NORSOK standard M-650 may also be used for the qualification of manufacturers of various materials, product forms and manufacturing processes according to other specifications or standards when specified by the Purchaser. In such cases shall this be highlighted onto the QTR Front Page.

### **3. Is there any listing of qualified (accepted) manufacturers according to NORSOK standard M650?**

There is no official listing in the name of NORSOK of manufacturers, which have been evaluated to fulfill the requirements of and have carried out the qualification tests according to NORSOK standard M-650.

### **4. How to obtain a confirmation of having fulfilled the requirements of NORSOK standard M-650?**

The confirmation of having fulfilled the requirements of NORSOK standard M-650 is the properly filled in and signed QTR Front Page (Annex D in the standard). Both Manufacturer and Qualifying Company, who has verified the qualification exercise, shall sign off QTR Front Page.

The QTR Front Page shall only be signed off when *all* requirements in NORSOK standard M-650 are fulfilled.

### **5. How to get qualified?**

To get qualified a Qualifying Company must be engaged.

A Qualifying Company may in first hand be engaged through projects and/or frame agreement holders to Companies or Main Contractors.

There is neither any system nor any body within NORSOK for getting pre-qualified according to the standard. In such cases a Qualifying Company known in the market should be contacted.

There is no existing list of Qualifying Companies.

### **6. Who can be the Qualifying Company?**

The definition of who can be the Qualifying Company is stated in M-650 Ed. 4, Sect. 3.1.12, and is hereby emphasized:

“The Qualifying Company can be the Company, the main contractor, the purchaser or a party *authorized* to act on their behalf. Qualifying Company shall be independent of the manufacturer.”

In cases where a third party is used as Qualifying Company, the Company, main contractor or the purchaser, who has given the authorization, should co-sign the QTR Front Page.

It should be noted that experience with third party bodies or others without responsibility for products or their use acting as Qualifying Company is variable. Experience has shown that they at several occasions have an inadequate understanding of the NORSOK M-650 standard and the qualification process resulting in incomplete and/or unacceptable QTR's leading to rejection as a consequence.

Nobody should act as Qualifying Company without prior experience with the M-650 standard or without guidance/supervision from a person with previous experience from M-650 qualifications.

### **7. What is the responsibility of Purchaser?**

Purchaser is responsible for ensuring that the manufacturers engaged are qualified within the essential variables of this standard. It is recommended that existing QTRs, accepted by Qualifying Companies unknown to Purchaser, are reviewed for compliance with this standard. Manufacturers unknown to him should in addition be visited.

It is emphasized that Purchaser is not exempted from his responsibility of following-up his subcontractors even if these are fulfilling the NORSOK standard M-650 requirements.

### **8. Are deviations to NORSOK standard M-650 acceptable?**

There is no such thing as deviations to NORSOK standard M-650 with respect to being qualified. The only way of being qualified is to fulfill the requirements of the standard. Only when *all* requirements are fulfilled shall the QTR Front Page be signed off.

A manufacturer may be acceptable for deliveries to a specific customer or delivery without fulfilling the requirements of the standard. This has to be clarified with the specific customer in each case and is outside the scope of NORSOK standard M-650.

### **9. Language**

The language to be used in documents included in a QTR and essential procedures referred to in a QTR shall be English. Documents may also be established as bilingual documents.

### **10. Who to contact if questions to NORSOK standard M-650?**

Questions about NORSOK standard M-650 should be directed to the following mail address: [petroleum@standard.no](mailto:petroleum@standard.no)

**Group B: Clarification and comment list**

Number	M-650 section	Question/Topic	Comment and/or clarification
2014-1	1	<p>Does lean duplex need to be qualified?</p> <p>Qualification of other grades of materials not included in NORSOK M630.</p>	<p>NORSOK M650 was in fist hand established for qualification of the grades of materials standardised in NORSOK standard M630, which does not include lean duplex SS.</p> <p>The second paragraph may be read to understand that all grades of duplex SS, including lean duplex and hyper duplex, should be qualified. That seems also to be the practise today. This is, however, to be agreed in each case between Purchaser and Manufacturer. In such case a specification for the applicable material must be established and agreed, which shall be the basis for the type of tests to be carried out and requirements to be fulfilled. The established specification must be stated onto the QTR Front Page and an explanation included in the "Other Comment" row.</p> <p>NORSOK M650, being a system standard, may be used for qualification of any material applying the principles above.</p>
2014-2	3.1.11 & 4.1	Who is Purchaser?	Company (end user), Main Contractor and Buyer are Purchaser's in the sense used in this section of the standard.
2014-3	6.1	Validity of qualifications.	<p>A signed and stamped QTR is generally valid for 5 years within the essential variables of the standard.</p> <p>Whether a qualification to an obsolete edition of the standard will be acceptable is solely at Purchasers discretion. Usually qualification to the newest edition of the standard will be required. It should be noted that there are main changes between Edition 4 of M650 and the previous revision of the standard as listed under Introduction to Edition 4.</p>

NORSOK Standard M-650 Edition 4: Comment & clarification list

Number	M-650 section	Question/Topic	Comment and/or clarification
2014-4	6.1	Expiring date onto the QTR Front Page?	<p>Expiring date should be described by date/month/year or month/year. Stating 5 years only is not acceptable.</p> <p>The expiring date shall not be changed if the QTR is given a new revision number due to, e.g. changes in the Manufacturing Summary or other documents included in the QTR. It is only after new qualification testing or renewal of an existing qualification according to Section 6.2 in the standard that the expiring date shall be changed.</p>
2015-1	6.1	Validity of a QTR after renewal according to 6.2	<p>Validity of a QTR after renewal according to 6.2 starts from <i>the date of signing the renewal QTR Front Page</i>.</p> <p>Qualifying Company may restrict the validity to less than 5 years.</p>
2015-2	6.2	Renewal of an expired QTR	<p>A renewal according to 6.2 must be initiated <u>prior</u> to expiring date of the existing QTR.</p> <p>If this is not the case a complete new qualification must be carried out.</p> <p>If the renewal cannot be completed prior to the expiring date a statement shall be put on the original QTR Front Page.</p>
2014-5	7.4.1	Assessment of test laboratories	<p>Laboratories that do not hold an ISO 17025 accreditation may be evaluated for acceptance. In such cases the laboratory should fill in the form in Annex 1 for Qualifying Company's evaluation. The final decision about acceptability is at the discretion of Qualifying Company.</p>
2014-6	8.1	Numbering of Manufacturing Summary	<p>Each Manufacturing Summary shall be designated with document number and revision number as shown in Annex A of the standard.</p>

## NORSOK Standard M-650 Edition 4: Comment & clarification list

Number	M-650 section	Question/Topic	Comment and/or clarification
2014-7	8.2.2.1	Straightening of bars, profiles, tubes and pipes	Possible straightening operation(s) of bars, profiles, tubes and pipes should be described as separate activities in the Manufacturing Summary.
2014-8	8.2.2.1	Certification requirements	As an own activity should the type of certificate to be issued, content of certificate (ref. the applicable MDS's) and the requirement to identification of the QTR and/or Manufacturing Summary used for the manufacture in the certificate be stated.
2014-9	8.2.2.5	Castings	In addition to the listed items also the following information should be stated, <ul style="list-style-type: none"> <li>• Knock-out practice</li> <li>• Possible intermediate heat treatments</li> <li>• Sampling for chemical composition</li> </ul>
2015-3	8.2.2.6	Type of start material to be used	Type of start material (cast, forged, wrought, etc.) shall be defined in the purchasing specification and in the MS. Note: Change from forge to cast should be considered an essential variable.
2014-10	8.2.2.7	Heat treatment	Para a): "Set" temperature in the sense used means the soaking (material) temperature. If the furnace set temperature is different from the soaking (material) temperature should this be stated. In addition also the maximum allowable transfer time should be stated, ref. Sect. 9.1.7.
2014-11	8.2.2.12	Non Destructive Examination	The extent of Non Destructive Examination should be stated together with the acceptance criteria.

NORSOK Standard M-650 Edition 4: Comment & clarification list

Number	M-650 section	Question/Topic	Comment and/or clarification
2014-12	8.2.2.13	Production testing	Extent of production tests together with acceptance criteria for each test to be carried out should be included in the Manufacturing Summary.
2014-13	8.2.2.13 d)	Microstructure Examination Procedure	<p>The procedure for microstructure examination should include,</p> <ul style="list-style-type: none"> <li>a) Test sampling if not specified in the test sampling sketch(es) included in the MS.</li> <li>b) Preparation of specimens</li> <li>c) Type of etchant(s) to be used</li> <li>d) Areas on test specimen to be examined</li> <li>e) How examination for intermetallic phases and precipitates are carried out and documented</li> <li>f) Measuring of ferrite content, e.g. location and number of fields to be examined, method, grid size to be used, calculation of ferrite content and how it will be reported.</li> </ul>
2014-14	8.2.2.15	List of procedures	<p>The list of procedures shall also include revision number of each document. To avoid unnecessary revision of the MS and QTR the following note may be included at the bottom of the list.</p> <p>“This qualification is based on the stated revision of the procedures in the list. The listed procedures may be revised without the Manufacturing Summary or the QTR being revised provided the essential variables in M-650 Ed. 4, Sect. 10.2, and other specified requirements are not infringed on.”</p>



NORSOK Standard M-650 Edition 4: Comment & clarification list

Number	M-650 section	Question/Topic	Comment and/or clarification
2014-15	9.1.3 & 9.3	Difference between “temperature uniformity survey” and “verification of heat treatment procedure”?	<p>The uniformity survey is requirements to be fulfilled for the heat treatment furnaces.</p> <p>The verification of the heat treatment procedure shall demonstrate that the specified soaking conditions are fulfilled.</p>
2014-16	9.1.4	Calibration of temperature controlling- and recording instruments	<p>Temperature controlling and –recording instruments shall be calibrated each third month. See API 6A, Annex M.4.3 and ASTM A991, Sect. 5.2.2. This includes also the thermocouples.</p>
2014-17	9.2.2	Calibration of temperature controlling- and recording instruments	<p>The procedure should also describe the frequency and how the temperature controlling and recording instruments are calibrated. This includes also the thermocouples.</p>
2014-18	9.2.4	Heat treatment parameters	<p>Para a): “Set” temperature in the sense used means the soaking (material) temperature. In addition to the listed items also the following information shall be specified,</p> <ul style="list-style-type: none"> <li>• Furnace set temperature and soaking temperature if different.</li> <li>• What trigger off the start of the holding time?</li> </ul>

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Number	M-650 section	Question/Topic	Comment and/or clarification
2014-19	9.2.4	Induction heat treatment	Para c): In addition to the listed parameters shall type and size of induction coils together with the current to be used as function of the size of the component(s) to be heat treated be stated, normally in a table. In addition must it be described how the temperature measurements are being carried out to ensure that the specified soaking temperature and the minimum soaking time is achieved.
2014-20	9.2.4	Seamless pipes and tubes directly quenched from hot forming temperature	Only acceptable when specifically stated in the relevant ASTM standard. The heat treatment procedure must describe how the specified soaking temperature is obtained and kept for the minimum specified soaking time together with how this is measured and documented.
2014-21	9.3.2	Heat treatment verification parameters	<p>Para a): The "...specified set temperature..." means the "...specified soaking (material) temperature..".</p> <p>Para b): "...minimum heat treatment temperature.." means the "...nominal soaking temperature with the specified minus tolerance subtracted..". E.g. specified soaking temperature is 1110 °C +30/-10 °C. In this case the minimum soaking temperature is 1100 °C. See Annex 2.</p>
2014-22	9.3.3	Maximum furnace load	<p>Is the weight of the load used for heat treatment verification governing for determining the maximum load of the furnace?</p> <p>Answer: Yes.</p>
2014-23	9.3.3	Extent of verification	<p>Is the verification required for each quality heat treatment furnace?</p> <p>Answer: Yes.</p>

## NORSOK Standard M-650 Edition 4: Comment & clarification list

Number	M-650 section	Question/Topic	Comment and/or clarification
2014-24	9.3.4	Verification using induction furnaces of tubing and pipes	Preferably thermocouples attached to the inside diameter of the tube/pipe should be used for verification of the soaking temperature. Other methods, e.g. use of pyrometers, may be used as agreed between manufacturer and Qualifying Company.
2014-25	9.3.4	When is verification with thermocouple in the mid-thickness required?	It is recommended that mid-thickness measurements of the temperature should be carried out whenever it is possible to locate the thermocouples. Normally this will be for thicknesses exceeding, e.g. 15mm.
2014-26	9.3.5	Heat treatment verification report	The report shall include a separate section "Conclusions" with clear statements whether the heat treatment procedure is considered satisfactory or needs/recommends to be revised. Achieved and minimum specified equalization time should be stated.
2015-4	10.2..2 Table 1	Qualified thickness for bolting	<ul style="list-style-type: none"> <li>a) Solution annealed bolting. As for bars.</li> <li>b) Strain hardened bolting up to maximum tested diameter.</li> </ul>
2015-5	10.2.4	Melting in induction furnaces without subsequent secondary refining used in foundries	For foundries it is considered acceptable to carry out melting in induction furnaces without secondary refining provided certified AOD or equally refined scrap only is used. Use of return scrap should in such cases be limited.
2015-6	10.2.5	Shall the listing also include bars?	Yes.

## NORSOK Standard M-650 Edition 4: Comment & clarification list

Number	M-650 section	Question/Topic	Comment and/or clarification
2015-7	10.2.5	Change in start material manufacturer	<p>A change in start material manufacturer requires that new qualifications are carried out for each grade of material affected by the change with the exceptions stated in a) and b) in the section.</p> <p>Sub-clause b) To be documented by the manufacturer to be qualified</p>
2014-27	10.3.1	Condition of qualification test components	<p>Components for qualification testing shall be tested in their final delivery condition except that machining, as applicable, does not need to be carried out.</p> <p>This means that operations as, e.g. strain ageing, etc., shall be carried out before testing of the components.</p>
R2014-28	10.3.2.2 Table 2	Qualification testing HIP – Selection of components for qualification	<p>According to Sect. 10.3.1 shall components for qualification be “representative in geometry of what actually shall be manufactured”. Flanges require a separate qualification according to Table 2. To avoid numerous qualifications it is recommended to carry out the qualification on a flanged component as shown in Annex 3. This geometry should cover most of the applicable geometries including flanges.</p>
R2014-29	10.3.2.2 Table 2	Qualification testing – Sleeves, nozzles and similar products	<p>The qualification tests should be carried out on a component with the heaviest WT and smallest ID.</p> <p>As a guidance components with bore, <math>ID \leq 70\text{mm}</math> and length <math>L &gt; 3 \times ID</math>, should be considered as solid with respect to qualified WT.</p>
2014-30	10.3.2.2 Table 2	Qualification testing pipes and tubes – Testing of thin and thick pipes and tubes	<p>For pipes and tubes manufactured according to the same MS only a tube or pipe in the upper thickness range specified in the MS, see Table 1, need to be tested for qualification. The combination of small diameters and heavy wall thicknesses may represent a challenge with respect to achieving sufficient cooling. In such cases additional testing may be required at the discretion of Qualifying Company.</p>

NORSOK Standard M-650 Edition 4: Comment & clarification list

Number	M-650 section	Question/Topic	Comment and/or clarification
2014-31	10.3.2.2 Table 2	Qualification testing – Strip and coils	For qualification <i>both</i> ends of a strip or coil should be tested according to Table 2.
2014-32	10.3.2.2 Table 2	Qualification testing – Wrought fittings	Qualification on a welded fitting may also qualify for a seamless fittings manufactured according to the same forming method and parameters.
2014-33	10.3.2.2 Table 2	Qualification testing – Strained hardened products including bolts	<p>Sample for production testing shall be taken from the overlength of the strain hardened mother bar or from a sacrificial part. Testing shall be as specified by the established specification. For bolting NORSOK MDS D59 applies.</p> <p>Qualification testing shall be as specified for rolled and forged bars in Table 2. In addition it is recommended to include the following tests,</p> <ul style="list-style-type: none"> <li>a) hardness tests of the cross-sections using HV10 with 2 mm spacing;</li> <li>b) for materials requiring impact testing with diameter <math>\geq 25\text{mm}</math> (1”) one set of impact tests located as close to the surface as possible</li> </ul>

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Number	M-650 section	Question/Topic	Comment and/or clarification
2015-8	10.3.2.2 Table 2	Qualification of bar	<p>Qualification of bars, OD ≥ 100mm, ref. MDS D47, D57 , R17 and R27 all Rev. 5.</p> <p>A) Impact test requirements to be fulfilled for duplex SS, MDS D47 and D57,</p> <ol style="list-style-type: none"> <li>1. Bars not qualified for machining of components,               <ol style="list-style-type: none"> <li>a) KV ¼ D longitudinal: 45J/35J + 20J</li> <li>b) KV ½ D transverse: 27/20J</li> <li>c) KV ½ D longitudinal: 27/20J</li> </ol> </li> <li>2. Bars qualified for machining of components,               <ol style="list-style-type: none"> <li>a) As A1 with addition of KV ¼ D transverse                   <ul style="list-style-type: none"> <li>• Components with welding ends: 45J/35J + 20J</li> <li>• Components without welding ends: 27J/20J + 20J</li> </ul> </li> </ol> </li> </ol> <p>B) Bars qualified for machining of components,</p> <p>On the QTR Front Page in the row "Products and Manufacturing Process(es)" the product designation should be, "Bars for machining of components with respectively with or without welding ends (note different requirements in this respect).</p>
2014-34	11.1	QTR	<p>One QTR shall be established for each production route, type of product, grade of material and size range if not otherwise agreed with Qualifying Company.</p>

NORSOK Standard M-650 Edition 4: Comment & clarification list

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Number	M-650 section	Question/Topic	Comment and/or clarification
2014-35	11.2	Content of QTR	<p>The following should be included into the QTR under the respective sections:</p> <p><i>Sect. 2:</i> The procedure for microstructure examination, ref. M650 Ed. 4, Sect.8.2.2.13 d), should be enclosed the Manufacturing Summary.</p> <p><i>Sect. 6:</i> Statistical data as required in M650 Ed. 4, Sect. 7.1.2.</p> <p><i>Sect. 7:</i> For laboratories ISO/IEC 17025 certificate and/or national accreditation certificate, as applicable.</p>

**ANNEX 1: ISO 17025 Assessment of testing laboratories**

ISO 17025 clause	Requirement	Compliance (Yes / No)	Comments
1	<i>General</i>		
	Is the laboratory included in the ISO 9001 certification?		
4.1	<i>Organization</i>		
	Does the laboratory operate independently from the production organization?		
4.2	<i>Management requirements</i>		
	Does the laboratory have a dedicated manager and operate to a quality management system?		
4.3	<i>Document control</i>		
	Are specific procedures giving requirements to testing and reporting available?		
4.5	<i>Subcontractors and calibration</i>		
	Does the laboratory have a list of approved subcontractors and certificates proving their accreditation?		
4.9	<i>Control of none conforming work</i>		
	Does the laboratory have a procedure for stopping ongoing work or release of data in case of a test failure?		
4.10	<i>Corrective actions</i>		
	What measures are put in place in order to prevent re-occurrence of failed tests?		
4.11	<i>Preventive actions</i>		



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ISO 17025 clause	Requirement	Compliance (Yes / No)	Comments
	Do you track trends in test data in order to respond to a drop in quality before it reaches unacceptable levels?		
4.12	<i>Records</i>		
	Does the test report enable it to identify the procedure, name of operator, equipment and calibration records for the testing?		
4.14, 4.15	<i>Internal Audits</i>		
	Is regular audits performed of the procedures, personnel and equipment?		
5.2	<i>Personnel</i>		
	What measures are put in place to ensure that testing personnel have got the adequate qualification and experience to perform the work?		
5.3	<i>Traceability</i>		
	How does the laboratory maintain traceability through the testing activity?		
5.4, 5.9	<i>Test, calibration methods, validation and Quality Control</i>		
	What types of internal calibration is performed and is the material used for calibration traceable to certified references?		
5.4.7	<i>Control of data and data integrity</i>		
	Is transfer of data subject to checks?		

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ISO 17025 clause	Requirement	Compliance (Yes / No)	Comments
5.5, 5.6	<i>Equipment, calibration and traceability</i>		
	Is all calibrated equipment labeled and traceable to calibration records?		
5.8	<i>Handling of test and calibration items</i>		
	Is there a system of identifying samples through the laboratory?		
5.10	<i>Reporting</i>		
	How is the tests reported to include job reference, calibration records and operator identification?		
	Is the test requirements included in the test report?		
M650 Ed.4 8.2.2.13	<i>Micro structural and ferrite content examination duplex SS</i>		
Micro-structure	Is there a procedure for preparation of specimens, etching, examination and reporting of microstructure?		
	How is the test specimen for micro structure examination taken and prepared?		
	What type of etchant is used for check of intermetallic and nitride precipitations? Ref. etchants listed in ASTM E407.		
	What are the acceptance criteria for microstructure examination?		
	Do you have micrographs of specimens showing unacceptable microstructure?		

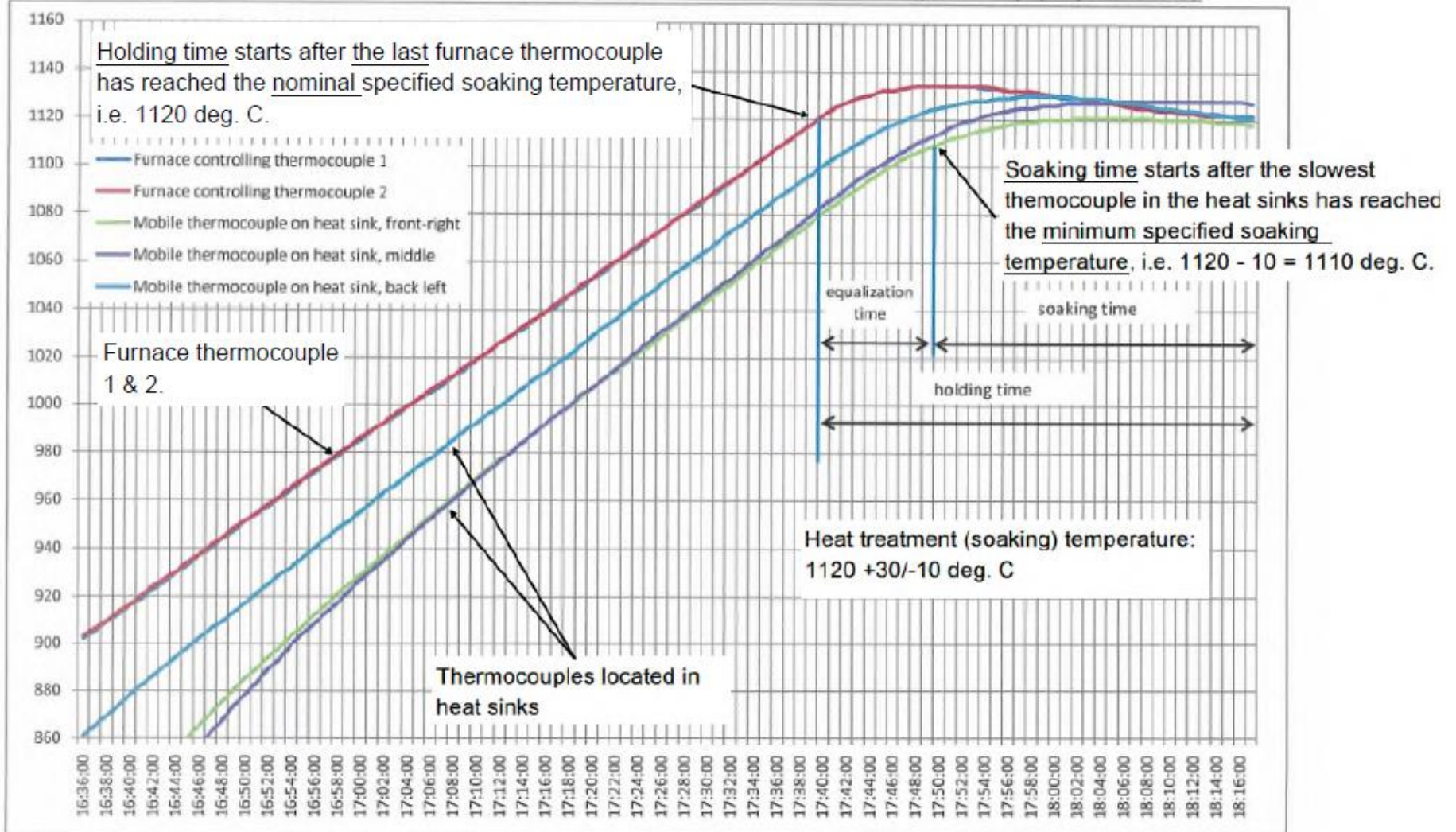
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ISO 17025 clause	Requirement	Compliance (Yes / No)	Comments
	How do you report microstructural examinations?		
Ferrite content	Is there a procedure for preparation of specimens, etching, examination and reporting of ferrite content?		
	What type of etchant is used for check of intermetallic and nitride precipitations? Ref. etchants listed in ASTM E407.		
	Which method of testing is used? E 526 or E1245?		
	Which size of grid is used?		
	How many fields of view used to determine the ferrite content?		
	What are the acceptance criteria for ferrite content?		
	How do you report ferrite content?		
General	What is the personnel knowledge and qualifications for micro examination?		

**Annex 2:**  
**NORSOK standard M-650 Edition 4 Sect. 9.3.2:**  
**Start of holding time and soaking time during verification of heat treatment procedures**

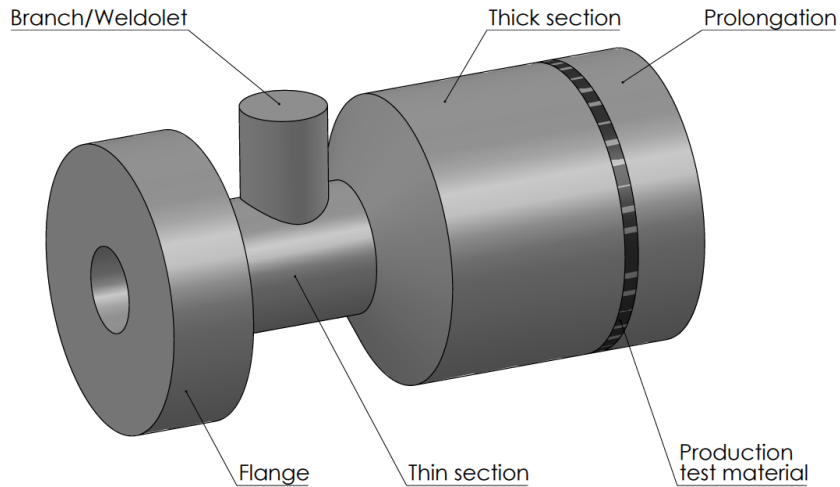
Chart of the superimposing time and temperature curves for the three mobile thermocouples and furnace controlling thermocouple(temperature in °C):



**Annex 3:**

**NORSOK Standard M-650 Edition 4 Sect. 10.3.1:**

**Example of a HIP – component intended to qualify all geometries including flanges.**



See also CL R2014-29

