

Technical Requirements Specification

Steel EN 1.4980 (660) for non-DT in-vessel usage

This specification covers the supply of Grade EN 1.4980 (660) steel for non-DT in-vessel usage.

Approval Process			
	Name	Action	Job Title / Affiliation
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<i>Change Log</i>			
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v1.2	Approved	03 Mar 2026	Update scope for non DT in-vessel usage (VQC-1B application)
v1.3	Signed	13 Apr 2026	Add impurity requirements for Co, Ta and Nb in Table 1 Chemical Composition
v1.4	Signed	22 Apr 2026	implementing QARO's comments.
v1.5	Signed	22 Apr 2026	Typo correction
v1.6	Approved	23 Apr 2026	Incorporating QARO's comments on Quality Assurance Requirements

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1 Scope

This specification covers grade **X6NiCrTiMoVB25-15-2 (No. 1.4980) (which is European analogue of ASTM steel 660, UNS Number S66286)** structural hardening austenitic stainless steel hot rolled or forged bars with diameter not greater than 160 mm for non DT in-vessel usage (VQC-1B application as per ITER Vacuum Handbook, [ITER_D_2EZ9UM](#)). The products are intended for bolting.

This specification is based on the European Standard EN 10269:2013 and includes some additional requirements established for the ITER application.

The amount of the steel bars to be procured shall be specified in the purchase order and shall include appropriate contingency to face unexpected difficulties, to remake rejected parts and to repair parts with insufficient quality.

The supply covers the following items:

- Manufacture of the total quantity of stainless steel bar grade X6NiCrTiMoVB25-15-2 (No. 1.4980).
- Organization of quality at works.
- Elaboration of all procedures required for the manufacturing, inspection (including analyses), packaging, storage and delivery.
- Time schedules and documentation.
- To perform all the inspections and tests during and after manufacturing envisaged in this specification.
- Storage, packaging and delivery.

2 Referenced documents

The following Codes and Standards shall be referred to in this specification (latest editions of standards shall be used):

- EN 10269:2013 Steel and Nickel Alloys for Fasteners with specified elevated and/or low temperature properties.
- EN ISO 6892-1, Metallic materials — Tensile testing — Part 1: Method of test at room temperature
- EN ISO 6892-2, Metallic materials — Tensile testing — Part 2: Method of test at elevated temperature
- EN ISO 148-1, Metallic materials — Charpy pendulum impact test — Part 1: Test method
- EN 10221:1995 Surface quality classes for hot-rolled bars and rods –Technical delivery conditions.
- EN 10060, Hot rolled round steel bars for general purposes — Dimensions and tolerances on shape and dimensions
- EN 10204: 2004 Metallic products: Type of inspection documents.
- EN ISO 377: 2013 Steel and steel products – Location and preparation of samples and test pieces for mechanical testing.
- EN ISO 14284: 2002 Sampling and preparation of samples for the determination of chemical composition.
- EN 10228-4: 2016 Non-destructive testing of steel forgings, Part 4: Ultrasonic testing of austenitic and austenitic-ferritic stainless steel forgings.
- EN 13018:2016 Non-destructive testing - Visual testing - General principles

- EN ISO 9712: 2012 Non-destructive testing. Qualification and certification of NDT personnel
- ASTM A342/A342M-14 Standard test methods for permeability of weakly magnetic materials

In case of change of edition year or issuing standard which supersede above mentioned, the use of new standards is allowed only in case of demonstration of equivalency with prior written IO approval.

Other equivalent national or international standards and codes proposed by the Manufacturer may be acceptable with prior written IO approval, provided conformity assessment to all criteria is satisfied.

Following documents are applicable for implementation of the contract:

- [ITER_D_82MXQK – General Management Specification for Service and Supply](#)
- [ITER_D_22MFG4 – Quality Requirements for IO Performers](#)
- [ITER_D_2LZJHB – Procedure for the management of Deviation Request](#)
- [ITER_D_22F53X – MQP L2 Procedure for Management of Nonconformities](#)

3 Information to be presented by the purchaser

Mandatory information is presented in Chapter 7.1 of EN 10269:2013.

Additional requirements are presented in this specification.

The nominal dimensions and tolerances on dimensions shall be in accordance with the relevant dimensional standards listed in EN 10269. The surface condition shall be defined in the purchase order. The purchaser shall specify a surface quality class in accordance with EN 10221.

The weight of batch/lot shall be limited by 1000 kg.

4 Melting process

The steel shall be made using electric furnace or by any other technically equivalent process and shall be vacuum-remelted or electro slag remelted.

5 Delivery conditions

The purchaser shall specify in his enquiry and order the delivery condition required.

Final components in design shall be in solution annealed and precipitation treated condition.

Purchaser may select material only in solution treated condition, but it shall be demonstrated that after final precipitation treatment mechanical properties of material in accordance with this specification will be met.

The heat treatments for mechanical properties are given in Table 4 (+AT+P) and in Table B1 of the standard EN 10269 for grade X6NiCrTiMoVB25-15-2.

- Solution treatment - 970 to 990°C, hold 2 h, oil or water quench;
- Precipitation hardening treatment - 710 to 730°C, the minimum time for precipitation hardening shall be 16 hours.

The bars shall be machined to its as-delivered profile.

6 Chemical composition

The Steelmaker shall supply a ladle analysis certified by the Mill Manager or his duly accredited representative. The chemical composition determined by ladle and product analyses, shall comply with the requirements given in Table 1.

The product analysis shall not deviate from the specified values of the cast analysis as specified in EN 10269. For the product analysis one sample per cast (heat) shall be taken for determining the elements indicated with numerical values in Table 1.

Table 1 Chemical Composition

Element	Alloying elements and impurities, wt. %	
	Min	Max
Fe	balance	
C	0.030	0.080
Si		1.00
Mn	1.00	2.00
P		0.025
S		0.015
Cr	13.50	16.00
Mo	1.00	1.50
Ni	24.00	27.00
Ti	1.90	2.30
V	0.10	0.50
B	0.003	0.010
Al		0.35
Co*		0.2
Ta*		0.1
Nb*		0.1

* Radioprotection requirement

7 Magnetic permeability

The relative magnetic permeability of the finished tubes shall be measured at room temperature after solution annealing. The value measured shall be lower than or equal to 1.03. Test shall be performed as per ASTM A342. One test per batch is required.

Alternatively, it is allowed to use permeability-meter apparatus (Foerster, Ferromaster, etc.). The type, trademark and copy of its calibration certificate shall be provided with the material certificate.

8 Mechanical properties

8.1 Required values

The material shall conform to the mechanical property requirements specified in Table 2 after applying the heat treatments for mechanical properties given in Table 4 (+A+P) and in Table B1 of the standard EN 10269: solution annealing and precipitation hardening.

Table 2 Mechanical properties

	Tensile properties			
Test Temp. (°C)	Tensile Strength, (Rm) (MPa)	Yield Strength (Rp0.2%) min (MPa)	Elongation A, (5d) min (%)	Impact energy (ISO-V) (J) min
Room	900 - 1150	600	15	50
250	Min. 792	550	Information	-

The yield strength at 1% offset (at RT and elevated temperature) shall be recorded for information purposes.

8.2 Sampling

Sampling and sample preparation shall be in accordance with the requirements of standard EN 10269: EN ISO 14284:2002 (chemical composition) and EN ISO 377:2013 (mechanical tests). If the product is not delivered in the solution annealed and precipitation hardened condition, the samples shall be treated.

Round test pieces shall be prepared for the tensile test at room temperature in accordance with EN ISO 6892-1 and for the tensile test at elevated temperature in accordance with EN ISO 6892-2.

Three longitudinal V-notched test pieces in accordance EN 10269 and in accordance with EN ISO 148-1 shall be prepared for the impact test.

8.3 Test methods

The test shall be performed on specimens taken from samples subjected to no heat treatment after sampling.

Frequency of testing

For the product analysis one sample per cast shall be taken for determining the elements indicated within the numerical values of Table 1.

The test unit for the other tests shall be the batch of products or part thereof coming from the same cast and having been treated in the same batch and in the same heat treatment facility.

Refer to Table 12 of EN 10269:2013 for the quantity of test samples and test pieces depending on batch size.

Test methods – for details refer to requirements of EN 10269 (chapter 11) and the following standards:

- EN ISO 6892-1, Metallic materials — Tensile testing — Part 1: Method of test at room temperature
- EN ISO 6892-2, Metallic materials — Tensile testing — Part 2: Method of test at elevated temperature
- EN ISO 148-1, Metallic materials — Charpy pendulum impact test — Part 1: Test method

9 Non-destructive Examination

The testing and inspection personnel as well as their supervisors shall be qualified and certified in accordance with EN ISO 9712. Certificates of Inspectors shall be provided together with the material certificate.

9.1 Visual examination

All surfaces shall be thoroughly examined during all phases of production and machining to check the soundness of metal.

100% of the surface of each plate shall be visually examined as per EN 13018.

The bars shall be sound and free of scale, strings, tears, nicks or other injurious defects (class E as per EN 10221:1995).

9.2 Ultrasonic examination

The ranges considered and the acceptance criteria which depend on thickness of the part examined, shall be those defined by the standard EN 10228-4:2016 for normal probe. The quality class 2 shall be adopted.

Ultrasonic testing shall be performed in accordance with an approved written procedure. A detailed description of the Ultrasonic Testing calibration blocks (including types, location sizes and depths of reference reflectors placed in each of the blocks including a sketch) to ensure the detection levels compliant with the minimum acceptable flaw shall be included in the procedure.

10 Dimensional check

The dimensions and tolerances shall be checked in accordance with the requirements of purchase order.

The main dimensions shall be recorded.

11 Marking

The Manufacturer shall specify the identification and marking method used, in compliance Chapter 12 of EN 10269:2013.

Marking shall include:

- Manufacturer name or symbol.
- Steel name or number.
- Type of finish.
- Identification number related to quality history (including traceability if the cast number).
- Nominal diameter.
- Customer's order number.

Markings or codes which provide clear reference to documents containing the information required for production control will always be acceptable.

Samples delivered with the part shall be marked in accordance with provisions of the purchaser order.

12 Cleanliness-packaging-transportation

Requirements are specified in the purchase order.

13 Acceptance

Material Test Report and certificate have to be provided to the Purchaser prior to delivery. Material and certification shall be in compliance with this specification. Material cannot be accepted if it does not comply with this specification.

Certification

A certificate, that the material was manufactured, sampled, tested and inspected in accordance with requirements of the material specification and has been found to meet those requirements shall be supplied to the purchaser.

14 Documentation and test report

The Manufacturer shall provide the Inspection Certificate type 3.1 in accordance with EN 10204:2004. The inspection certificate 3.1 shall include, in accordance with EN 10168, the codes described in EN 10269.

The following reports shall be drawn up by the Manufacturer after each individual test and prior to the delivery of the part:

- Ladle and product analyses.
- Melting process method.
- Results of mechanical property tests.
- Non-destructive examination.
- Dimensional check.

These reports shall include:

- Material designation and marking.
- The heat number and part reference number.
- Identification of the Manufacturer.
- Identification of the purchase order number.
- Test and retest results together with required values.

All documents shall be in the English language and all measures shall be given in the metric system SI. Each document shall be provided as an electronic file in PDF format.

15 Quality system requirements

The Quality class under this contract is QC2.

The Manufacturer shall have either an ITER Organization (IO) approved QA Program or an ISO 9001 certified Quality Management System.

The Manufacturer shall ensure that the quality of supply meets the requirements. In case of any questions, the Manufacturer shall seek clarification from the Purchaser prior to proceeding with the work.

The Manufacturer shall submit the reports according to chapter 14, including all required information.

For materials that are custom-made for this contract, i.e. materials that are not off-the-shelf, the Manufacturer shall also comply with the IO quality requirements specified in Table 3, including the following:

- submission of the Quality Plan (QP), describing the implementation of IO requirements, the Manufacturing and Inspection Plan (MIP), and the reports containing all required information for IO approval;
- conduct of the Manufacturing Readiness Review (MRR) as a gate review, and obtaining authorization for the manufacture of such materials prior to the start of manufacturing.

Table 3 IO Quality requirements

IO Quality Requirements	Associated IO Quality Documents
Overall quality requirements applicable throughout the implementation of the contract	<ul style="list-style-type: none"> ▪ Chapter 8 of “General Management Specification for Service and Supply” (ITER_D_82MXQK)
Prior to contract implementation: <ul style="list-style-type: none"> ▪ Obtain IO acceptance of a dedicated Quality Plan 	<ul style="list-style-type: none"> ▪ “Quality Requirements for IO Performers” (ITER_D_22MFG4)
Prior to start of manufacturing: <ul style="list-style-type: none"> ▪ Obtain IO acceptance and mark up of an Manufacturing and Inspection Plan (MIP) ▪ Complete MRR Gate review 	<ul style="list-style-type: none"> ▪ “Quality Requirements for IO Performers” (ITER_D_22MFG4), ▪ “Working Instruction for Manufacturing Readiness Review” (ITER_D_44SZYP) ▪ “Inspection Plan Template” (ITER_D_QV7GQF).
During manufacture: <ul style="list-style-type: none"> ▪ Notify IO representatives of any Inspection Points as marked up in the MIP ▪ Complete the relevant entries in the MIP as work progresses. 	<ul style="list-style-type: none"> ▪ “Quality Requirements for IO Performers” (ITER_D_22MFG4),
During contract implementation – issue as necessary: <ul style="list-style-type: none"> ▪ Deviation Request (DR) ▪ Non-Conformance Reports (NCR) 	<ul style="list-style-type: none"> ▪ “Procedure for the management of Deviation Request” (ITER_D_2LZJHB). ▪ “Procedure for Management of Nonconformities” (ITER_D_22F53X).
Contractor release note (CRN)	<ul style="list-style-type: none"> ▪ “Quality Requirements for IO Performers” (ITER_D_22MFG4)

The Manufacturer shall implement, in compliance with its Quality Management System, the monitoring activities including the quality audits and any inspections to verify the compliance with the requirements.

The IO reserves the right to perform the visits to any premises where the IO related work is being performed.

Documentation developed as the result of this supply shall be retained by the Contractor for a minimum of 5 years from the completion of this supply.