

THE ENGINEERING EQUIPMENT AND MATERIALS USERS ASSOCIATION

SPECIFICATION FOR STRUCTURAL CASTINGS FOR USE OFFSHORE

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THE ENGINEERING EQUIPMENT AND MATERIALS USERS ASSOCIATION

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FOREWORD

This Specification has been prepared by the EEMUA Materials for Offshore Service Technical Committee as a joint Supplier-Purchaser document for the procurement of carbon-manganese steel castings for use as structural members of offshore platforms for location in the North Sea. The Specification may also be used at the discretion of purchasers of castings for application in other geographic areas, but it would be necessary in such circumstances to take into account any alternative and/or supplementary requirements of local statutory regulations and authorities.

In the United Kingdom, the legislation governing the design and manufacture of structural castings for use in offshore installations in UK waters is contained in the 'Offshore Installations' regulations issued by the Health and safety Commission under the Health and Safety at Work etc. Act 1974 (see 2.1). The attention of Purchasers and Suppliers of structural castings intended for such use is drawn to those legislative requirements.

Use of Language and Definitions

In this document the words 'will', 'may', 'should', 'shall' and 'must', when used in the context of actions by the purchaser or others, have specific meanings as follows:

- i) 'Will' is used normally in connection with an action by the purchaser, rather than by a manufacturer or supplier.
- ii) 'May' is used to indicate that the manufacturer or supplier is permitted to do something, or the purchaser reserves the right to do something, according to context.
- iii) 'Should' is used where a provision is preferred.
- iv) 'Shall' is used where a provision is mandatory.
- v) 'Must' is used only where a provision is a statutory requirement.

'Purchaser' means the owner of the installation(s) of which the structural castings will form part, and/or his appointed agent.

'Supplier' means the person or organisation contracted or sub-contracted to supply structural castings to the Purchaser.

List of Abbreviations Used in the Text

AC	Alternating current
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BS	British Standard
CE	Carbon equivalent
CTI	Castings Technology International
CTOD	Crack tip opening displacement
DAC	Distance amplitude correction

ECA	Engineering critical assessment
FEA	Finite element analysis
HAZ	Heat affected zone
Hv	Vickers hardness
MPI	Magnetic particle inspection
NDT	Non-destructive testing
PCN	PCN Certification Services (of the British Institute of NDT)
PQR	(Welding) procedure qualification record
PWHT	Post-weld heat treatment
YS	Yield stress

1. SCOPE

This EEMUA Specification defines the requirements for the design, manufacture and testing of carbon-manganese steel castings for use as structural members of offshore platforms in the North Sea. It sets out the separate responsibilities of the Purchaser and the Supplier for meeting the requirements of the Specification.

Chemical and mechanical properties are specified together with the requirements for fracture toughness and non-destructive testing. Requirements for weldability testing are also specified where such testing is considered necessary.

2. LEGISLATION AND STANDARDS REFERENCED IN THE TEXT

2.1 UK Legislative Requirements

Health and Safety Commission:

Offshore Installations and Wells (Design and Construction, etc) Regulations 1996

2.2 Codes and Standards

The latest editions operative at the time of purchase order placement shall be used in all instances, unless otherwise agreed with the Purchaser.

2.2.1 American Standards

ASME Boiler and Pressure Vessel Code

Sec V Nondestructive Examination

Sec VIII Pressure Vessels

Sec IX Welding & Brazing Qualifications

ASTM A 609 Practice for Castings, Carbon, Low-Alloy, and Martensitic Stainless Steel, Ultrasonic Examination Thereof

ASTM E 125 Reference Photographs for Magnetic Particle Indications on Ferrous Castings

ASTM E 186 Reference Radiographs for Heavy-Walled (2 to 4½-in. (51 to 114-mm)) Steel Castings

ASTM E 280 Reference Radiographs for Heavy-Walled (4½ to 12-in. (114 to 305-mm)) Steel Castings

ASTM E 446 Reference Radiographs for Steel Castings Up to 2 in. (51 mm) in Thickness

2.2.2 British Standards (including adopted European (EN) and International (ISO) standards)

BS 709 Methods of Destructive [sic] Testing Fusion Welded Joints and Weld Metal in Steel

BS 3100 Specification for Steel Castings for General Engineering Purposes

BS 6072 Method for Magnetic Particle Flaw Detection

BS 6208 Method for Ultrasonic Testing of Ferritic Steel Castings Including Quality Levels

BS 7191 Specification for Weldable Structural Steels for Fixed Offshore Structures

BS 7448 Fracture Mechanics Toughness Tests

BS EN ISO 9000-9004 (Various quality standards commonly collectively referred to as the '9000 series')

BS EN 287 Approval Testing of Welders for Fusion Welding

BS EN 288-3 Specification and Approval of Welding Procedures for Metallic Materials—Welding Procedure Tests for the Arc Welding of Steels

BS EN 462-1	Non-destructive Testing. Image quality of Radiographs—Image Quality Indicators (Wire Type). Determination of Image Quality Value
BS EN 462-3	<i>Ibid.</i> —Image Quality Classes for Ferrous Metals
BS EN 499	Welding Consumables. Covered Electrodes for Manual Metal Arc Welding of Non-Alloy and Fine Grain Steels

Destructive Tests on Welds in Metallic Materials:

BS EN 875	Impact Tests. Test Specimen Location, Notch Orientation and Examination
BS EN 876	Longitudinal Tensile Test on Weld Metal in Fusion Welded Joints
BS EN 895	Transverse Tensile Test
BS EN 1043-1	Hardness Test on Arc Welded Joints
BS EN 1321	Macroscopic and Microscopic Examination of Welds
BS EN 10002-1	Tensile Testing of Metallic Materials—Method of Test at Ambient Temperature
BS EN 10045-1	Charpy Impact Test on Metallic Materials—Test Method (V- and U-notches)
PD 6493	Guidance on Methods for Assessing the Acceptability of Flaws in Fusion Welded Structures (<i>Due to be superseded by BS 7910: Guide on Methods for Assessing the Acceptability of Flaws in Structures</i>)
PD 6513	Magnetic Particle Flaw Detection. A Guide to the Principles and Practice of Applying Magnetic Particle Flaw Detection in accordance with BS 6072

2.2.3 Other Codes/Standards

CTI	Comparators for the Definition of Surface Quality of Steel Castings
EEMUA Pub. 158	Construction Specification for Fixed Offshore Structures in the North Sea
PCN	General Requirements for the Qualification and Certification of NDT Personnel

3. QUALITY ASSURANCE

The Supplier shall establish and maintain a quality assurance system in accordance with the applicable standard(s) in the BS EN ISO '9000 series', or an approved equivalent, to ensure that the castings supplied comply in all respects with the requirements of this Specification. The Supplier shall submit a specific quality plan to the Purchaser for approval.

The Purchaser shall have the right to conduct audits of the Supplier's quality system, and to undertake inspection and/or testing of the castings during any stage of their manufacture at which their quality may be affected.

4. DESIGN REQUIREMENTS

4.1 General

Based upon this Specification, the scope of work document, the structural design brief and the accompanying structural drawings, the responsibility for design of all cast items lies with the Supplier.

The Supplier shall include with his quotation a design brief. In this design brief all intended verification principles shall be outlined.

The Supplier shall not proceed with casting manufacture until the final design calculations and detailed drawings are approved and the casting configuration is agreed with the Purchaser.

The structural drawings will show the type and grade of steel used in the parts of the structure to which the casting will be joined.

The Supplier shall demonstrate that all joints between the casting and its connecting members are capable of withstanding the design forces and moments. He shall also demonstrate the weldability of the material to be cast, in accordance with the requirements of Appendix A.

4.2 Yield Strength

The casting shall be designed based on the guaranteed minimum yield strength for the casting material, as per 7.2.1 of this Specification.

If the guaranteed yield strength values of the casting used in the calculations are dependent on section thickness, these values, complete with supporting historical data, shall be clearly presented and submitted with the Supplier's quotation for review and approval by the Purchaser.

4.3 Calculation Techniques

Verification of the integrity of the cast steel items shall be by a combination of finite element analysis (FEA) and 'hand' calculations. For bid purposes hand calculations shall normally be sufficient, but a full FEA shall be provided by the Supplier within the time limit agreed for data submission following purchase order placement.

The FEA, limiting stress criteria and safety factors shall meet the requirements of the structural design brief, and shall be compatible with the requirements of the code of practice adopted for the steel member design and with the criticality rating of the item to be cast (in terms of structural redundancy, fatigue life etc.). Table 4 of EEMUA 158 may be used for guidance on categorising the structural criticality rating for the item to be cast.

Certain special additions to the FEA computer model may be required in order to adequately analyse all critical areas of the casting.

Sufficient hand calculations shall be prepared to justify the casting arrangement chosen, and returned with the quotation. These calculations shall be clear, concise, expressed in English, and shall have been checked.