



GS 136-2

**STRUCTURAL STEEL MATERIALS FOR USE IN
THE FABRICATION OF FIXED OFFSHORE
STEEL STRUCTURES**

(Requirements Supplementary to EEMUA Publ. 150)

April 1997

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BP GROUP RECOMMENDED PRACTICES AND SPECIFICATIONS FOR ENGINEERING											
Doc. No. GS 136-2		Issue Date April 1997	Latest Amendment Date								
Document Title STRUCTURAL STEEL MATERIALS FOR USE IN THE FABRICATION OF FIXED OFFSHORE STEEL STRUCTURES (Requirements Supplementary to EEMUA Publ. 150)											
APPLICABILITY Regional Applicability: International											
SCOPE AND PURPOSE This BP Group RPSE supplements EEMUA Publ. 150 to specify all BP general requirements for structural steel materials for use in the fabrication of fixed offshore steel structures, and is for use with a supplementary specification to adapt it for each specific application.											
AMENDMENTS <table border="0" style="width: 100%;"> <tr> <td style="width: 15%;">Amd</td> <td style="width: 20%;">Date</td> <td style="width: 20%;">Page(s)</td> <td style="width: 45%;">Description</td> </tr> <tr> <td colspan="4"> </td> </tr> </table>				Amd	Date	Page(s)	Description				
Amd	Date	Page(s)	Description								
CUSTODIAN (See Quarterly Status List for Contact) Electrical Engineering											
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FOREWORD

Introduction to BP Group Recommended Practices and Specifications for Engineering

The Introductory Volume contains a series of documents that provide an introduction to the BP Group Recommended Practices and Specifications for Engineering (RPSEs). In particular, the 'General Foreword' sets out the philosophy of the RPSEs. Other documents in the Introductory Volume provide general guidance on using the RPSEs and background information to Engineering Standards in BP. There are also recommendations for specific definitions and requirements.

Value of this Guidance for Specification

This Guidance for Specification, originally issued in October 1986, has been completely revised and updated following the issue of [EEMUA Publication 150](#) in 1987. It supplements EEMUA Publ. 150 to specify all BP general requirements for structural steel materials for use in the fabrication of fixed offshore steel structures, and is for use with a supplementary specification to adapt it for each specific application.

This Guidance for Specification is based upon an industry specification.

The value of this Guidance for Specification to its users will be significantly enhanced by their regular participation in its improvement and updating. For this reason, users are urged to inform BP of their experiences in all aspects of its application.

Application

This Guidance for Specification is intended to guide the purchaser in the use or creation of a fit-for-purpose specification for enquiry or purchasing activity.

Text in italics is Commentary. Commentary provides background information which supports the requirements of the Specification, and may discuss alternative options. It also gives guidance on the implementation of any “Specification” or “Approval” actions; specific actions are indicated by an asterisk (*) preceding a paragraph number.

This document may refer to certain local, national or international regulations but the responsibility to ensure compliance with legislation and any other statutory requirements lies with the user. The user should adapt or supplement this document to ensure compliance for the specific application.



Principal Changes from Previous Editions

This document is an update of BP Standard 109 (August 1988). No technical changes have been made, the update comprises only re-formatting into the Guidance for Specification (GS) style. Users should be aware that this document retains the prescriptive requirements of BP Standard 109.

Feedback and Further Information

Users are invited to feed back any comments and to detail experiences in the application of BP RPSE's, to assist in the process of their continuous improvement.

For feedback and further information, please contact Standards Group, BP International or the Custodian. See Quarterly Status List for contacts.



SECTION 1 GENERAL

1. SCOPE

1.1 General Applicability

This BP Group RPSE specifies general requirements supplementary to [EEMUA Publication No. 150](#):1987, for the supply of weldable structural steels to be used in fixed offshore steel structures.

To apply this Standard, supplementary specification and approval actions by BP are required to adapt it to each specific project application.

The titles and numbering of the text of this BP Group RPSE follow those of [EEMUA Publication No. 150](#). As a result of this, gaps in numbering may occur. All text is cross referenced to [EEMUA Publication No. 150](#), and qualifies, substitutes, modifies or adds to its requirements.

Where additional text is to be read as an extension of the text of [EEMUA Publication No. 150](#), the text numbering of [EEMUA Publication No. 150](#) has been extended accordingly.

(Addition to EEMUA 1.1)

* 1.4 Duties of the Supplier and Manufacturer

The manufacturer shall supply a quality manual which shall be submitted to BP with the tender documents. The manual shall include provisions for the quality assurance of all raw material, production processes and final inspection.

The quality assurance organisation and procedures will be monitored by BP, and may be audited by BP at any time following an agreed period of notice.

Following an order and approval of any manufacturing procedure (refer to 4.3), the manufacturer shall submit a quality plan which shall be subject to approval by BP.

(Addition to EEMUA 1.4)



4. INFORMATION TO BE SUPPLIED BY AND TO THE PURCHASER

*** 4.3 Details of Manufacturing Procedures to be Supplied by the Manufacturer for all Modified Grades**

Having studied the requirements of the appropriate sections of the EEMUA Specification as supplemented by BP Group RPSE 136-2, the manufacturer shall submit, with his tender, details of his manufacturing procedure for all Modified Grade materials, for approval by BP. This shall include completion of the questionnaire in Appendix E. (EEMUA Appendix H). Additional documentation shall be submitted to cover any points remaining of those listed below:-

(Substitution for 1st sentence of EEMUA 4.3)

4.4 Production Records

- (1) The manufacturer shall maintain histograms of mechanical and chemical test results from production for the order. These shall be made available to BP, and submitted with the final documentation.
- (2) For Modified Grades, the manufacturer shall submit early production data to BP for all testing required by this Standard, e.g. mechanical, chemical analysis, weldability, non-destructive testing, and inspection.

(Addition to EEMUA 4)

7. CHEMICAL COMPOSITION AND MECHANICAL PROPERTIES

7.2 Product Analysis

For all grades, the maximum permitted carbon equivalent value shall be 0.43% (product analysis).

(Modification to Table 1 of EEMUA 7.2)



8. WELDABILITY REQUIREMENTS FOR MODIFIED GRADES

8.2 Alternative Weldability Tests

8.2.1 Selection of Weldability Test(s)

Any requirement for weldability testing in accordance with Appendix C (EEMUA appendix F) will be specified by BP.

Weldability tests in accordance with Appendix D (EEMUA Appendix G) shall be performed on each heat of steel.

(Addition to EEMUA 8.2.1)

9. QUALITY OF FINISHED STEEL

9.1 Plates

9.1.1 Surface Condition

Testing and inspection shall be under the survey of the third party inspectorate. Any material that is rejected, and the cause for rejection, shall be reported to BP.

(Addition to EEMUA 9.1.1)

9.4 Ultrasonic and Magnetic Particle Inspection Procedures

Ultrasonic inspection procedures shall also include details of scanning speed.

(Addition to EEMUA 9.4)

11. MARKING

11.1 Die Stamp and Paint Marking

Die Stamp

- plate/section/tube number;

(Substitution for second line of list
in EEMUA 11.1 (Die Stamp))



Paint Marking

- plate/section/tube number;

(Substitution for fifth line of list
in EEMUA 11.1 (Paint Marking))

The manufacturer's plate, section or tube number shall be the same for Die Stamp, Paint Marking, and for the plate, section or tube number in 12.1(1). The number shall distinguish a plate, section or tube from all others made from the same heat of steel.

(Addition to EEMUA 11.1)

12. TEST CERTIFICATES

12.1 Manufacturer's Supply

(1) Identification

- plate/section/tube number;

(Substitution for fifth and sixth line of
list in EEMUA 12.1(1))

SECTION THREE: SPECIFIC REQUIREMENTS FOR TESTING

21. TENSILE TEST

21.1 General

The yield strength, R_e , for 275 and 355 Grades shall not exceed 450 N/mm². For 450 Grades it shall not exceed 600 N/mm².

(Addition to EEMUA 21.1)

26. THROUGH-THICKNESS TESTING FOR Z GRADES

Routine through-thickness testing of grades of steel having enhanced through-thickness properties is not normally required, provided that the manufacturer can provide suitable data demonstrating the ability to meet the necessary requirements.

(Addition to EEMUA 26)



28. RETESTS

28.3 Re-heat Treatment

Any such re-heat treatment and retesting shall be permitted only when BP is satisfied with the explanation for the failure of the original incorrect heat treatment.

(Addition to EEMUA 28.3)



DEFINITIONS AND ABBREVIATIONS

Definitions

Standardised definitions may be found in the BP Group RPSEs Introductory volume.

Abbreviations

CTOD	Crack-tip opening displacement
EEMUA	Engineering Equipment and Materials Users Association
HAZ	Heat affected zone
HV	Vickers hardness
PWHT	Post-weld heat treatment
SI	Système International d'Unités



LIST OF REFERENCED DOCUMENTS

A reference invokes the latest published issue or amendment unless stated otherwise.

Referenced standards may be replaced by equivalent standards that are internationally or otherwise recognised provided that it can be shown to the satisfaction of the purchaser's professional engineer that they meet or exceed the requirements of the referenced standards.

Industry Publications

EEMUA Publication No. 150	Steel Specification for Fixed Offshore Structures (Adapted for Offshore from BS 4360: 1986)
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APPENDIX C (EEMUA APPENDIX F)

WELDABILITY TESTING FOR MODIFIED GRADES - MECHANICAL TESTING OF BUTT WELDS

F.1 OBJECTIVE

Testing of non-Z grades is also required when these exceed the thickness of the Z quality plate ordered, or where no Z quality plate is included in the order.

(Addition to EEMUA F.1)

F.4 MECHANICAL TESTING

CTOD tests on the weld and HAZ are not required.

(Modification to EEMUA F.4)



APPENDIX D (EEMUA APPENDIX G)

WELDABILITY TESTING FOR MODIFIED GRADES - BEAD-ON-PLATE TESTING

G.1 OBJECTIVE

The Thickness of the plate tested need not exceed 40 mm

(Modification to EEMUA G.1)

G.3 WELDING METHOD

For steels with carbon equivalent limits other than the 0.43% assumed in Table G1, alternative preheat conditions will be defined by BP.

(Qualification of EEMUA G.3)

G.5 SPECIFIC TEST REQUIREMENTS

G.5.2 Test Results

Acceptance Criteria - For normalised steels, the maximum permissible hardness shall be 376 HV 10.

(Addition to 1st paragraph of EEMUA G.5.2)



MANUFACTURING PROCEDURE SPECIFICATION QUESTIONNAIRE FOR STRUCTURAL PLATE

Manufacturers tendering are required to complete this questionnaire form and return it with their tender, together with any additional information which they consider will assist in evaluation of their tender.

Some parts of the questionnaire ask for ranges (e.g. of temperature or of chemical analysis) to be given. The answers will be contractually binding on the successful tenderer, since they form part of the manufacturing procedure being offered, but relatively wide ranges will be interpreted by BP as evidence of a lack of control over the process.

Where the overall range is wide because the answers vary with size, or with steelmill, the values for each mill or size should be given on an attachment. Where a temperature range will be changed according to the actual heat analysis, an attachment to the questionnaire should explain the basis for such changes, and the questionnaire should give the range for a typical heat of steel.

Where a nominal value is asked for, a single value is acceptable.

1. What is the name of the steelmaker?
 2. How many steel plants will be used?
 3. What are the locations of the steel making plants?
.....
 4. Will the iron be de-sulphurised before steelmaking?
If so, what will be added as a de-sulphuriser?
 5. What will be the nominal sulphur level before steelmaking?%
 6. Which steelmaking process will be used?
 7. What will be the nominal weight of each heat of steeltonnes
 8. What is the maximum level of scrap in the charge?%
 9. Will the steel be de-sulphurised in the ladle?
If so, what will be added as a de-sulphuriser?
- Manufacturer tendering Steel Grade



10. Will the steel be calcium treated for sulphide shape control?
If so, at which stage
11. Please tabulate below, the limits on alloying element ranges which will be applied to heat and product analysis. If any of the elements listed will not be added deliberately, please give 0% as the minimum. If any other alloying elements are proposed, detail these in an attachment.

Element	Product Minimum	Heat Minimum	Heat Maximum	Product Maximum
Carbon	%	%	%	%
Manganese	%	%	%	%
Silicon	%	%	%	%
Aluminium	%	%	%	%
Niobium	%	%	%	%
Vanadium	%	%	%	%
Titanium	%	%	%	%
Nickel	%	%	%	%
Copper	%	%	%	%

12. Please tabulate below, the limits on residual element levels which will be applied to heat and product analysis. If any of the elements listed will be added deliberately, please state a minimum as well as maximum.

Element	Typical	Heat Maximum	Product Maximum
Sulphur	%	%	%
Phosphorus	%	%	%
Chromium	%	%	%
Molybdenum	%	%	%

Manufacture Tendering.....

Steel Grade.....



Nitrogen	%	%	%
Calcium	%	%	%
Boron	%	%	%
(Carbon Equivalent	%	%	%)

13. Which other elements will be subject to analysis on every heat?
.....
14. Where will the majority of alloying additions be made?
15. Where will the 'trimming' alloying additions be made?
16. Will the steel be vacuum degassed before casting?
If so, which degassing process will be used?
17. What will be the maximum hydrogen level at casting?
18. What will be the maximum oxygen level at casting?
19. How many samples will be taken for ladle analysis?
20. Where will the ladle analysis sample be taken?
21. What will be the steel temperature range at casting?.....°C
22. Will any steel be continuously cast?
If so:- (a) How will the pouring stream be protected?.....
 - (i) Between ladle and tundish?.....
 - (ii) Between tundish and mould?.....
- (b) Will electromagnetic stirring be used?
If so, what proportion of the section will be liquid during
electromagnetic stirring?.....%

Manufacturing tendering.....

Steel Grade.....



(c) Will centreline segregation be monitored?

If so:-

(i) Will monitoring be carried out on slab or plate?

(ii) Will monitoring be by sulphur print or macro-etch?

(iii) Please attach a photocopy of the lowest grading which would be offered

(d) Will slabs containing two heats of steel be offered?

If so, which heat number will apply?

(e) What is the maximum number of heats in a casting sequence?

(f) What will be the maximum thickness of plate rolled from continuously cast slab?mm

(g) What will be the minimum reduction ratio?:1

(h) Please attach the minimum slab dimensions for each plate thickness.

23. Will any steel be cast in ingots?

If so:- (a) What is the maximum thickness of plate which will normally be produced from ingot steel?mm

(b) What will be the maximum ingot weight available tonnes

(c) What will be the nominal ingot-to-plate weight ratio? :1

(d) What will be the minimum ingot-to-plate thickness ratio?...:1

(e) At which mill will the ingot be rolled to slab?

Manufacturer tendering.....

Steel Grade.....



24. Will any surfaces of the slab or ingot be 100% scarfed?
 If so:- (a) Which surfaces will be 100% scarfed?
 (b) What is the nominal steel temperature during scarfing?°C
 (c) What will be the nominal depth of scarfing?mm
25. At which mill(s) will the slab be rolled to plate?
26. In what range will the slab be soaked before rolling?°C
 Manufacturer tendering Steel Grade
27. How will thickness be monitored during rolling?
28. How will thickness be verified after rolling?
29. Above what temperature will rolling be completed?°C
30. Please attach details of any intermediate holding, cooling or re-heating.
31. Will the plate be cooled in still air?
 If not:- (a) How will it be cooled?
 (b) What controls will be applied to the cooling rate?

32. What de-hydrogenation treatment (if any) will be applied to the slab or rolled plate?

33. What heat treatment will the plate receive after rolling?

34. What is the normalising/re-austenitising furnace atmosphere?
35. Will plate ultrasonic testing be manual or automatic?
 If automatic, is scanning longitudinal or transverse to rolling
 direction?

Manufacturer tendering.....

Steel Grade.....



36. After what length of soaking time at $600\text{ }^{\circ}\text{C} \pm 20\text{ }^{\circ}\text{C}$ would mechanical tests on the plate be unlikely to meet the requirements of BP Group RPSE GS 136-2.
..... hours
37. Above what level of strain would strain-aged Charpy tests be unlikely to meet the requirements of BP Group RPSE GS 136-2:-
- (a) Cold formed and aged?%
 - (b) Cold formed, aged and heat treated?%
What heat treatment?
 - (c) Hot-formed, heat treated and aged?%
What forming temperature range? $^{\circ}\text{C}$
What post-forming heat treatment?
38. Above what level of welding heat input would HAZ Charpy tests be unlikely to meet a requirement at $-40\text{ }^{\circ}\text{C}$ of 35 J average for Grade 355, 45 J average for Grade 450?:-
- (a) In the as-welded condition?kJ/mm
 - (b) Post-weld heat treated at $600^{\circ}\text{C} \pm 20^{\circ}\text{C}$?kJ/mm
39. Is a post-weld heat treatment temperature other than $600^{\circ}\text{C} \pm 20^{\circ}\text{C}$ recommended?
.....
- If so:- (a) What is the recommended PWHT temperature range?.....
- (b) Which properties would be adversely affected by PWHT at $600^{\circ}\text{C} \pm 20^{\circ}\text{C}$?
40. For plate manufactured in accordance with BP Group RPSE GS 136-2, what are the limiting overall dimensions for finished plate?
- (a) Thicknessmm
 - (b) Lengthmm
 - (c) Widthmm
 - (d) Weighttonnes
 - (e) Which aspects of the manufacturing route defines this limit on weight
.....

Manufacturer tendering

Steel Grade

