



GS 118-1

FABRICATION OF FIXED OFFSHORE STEEL STRUCTURES TO EEMUA 158

June 1992

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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 clarifies certain of the [EEMUA Publication 158](#) requirements and lists those additional BP requirements, i.e. not fully detailed in EEMUA Publication 158.

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. 'Specification' or 'Approval' actions are indicated by an asterisk (*) preceding a paragraph number.

This Guidance for Specification is based upon an industry specification and 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 application of this Guidance for Specification to other sea areas or for other structures may also be appropriate, depending on the design philosophy selected and the sea areas. BP will specify when this specification is to be used for these other sea areas or other structures. The user should adapt or supplement this document to ensure compliance for the specific application.

Specification Ready for Application

A Specification (BP Spec 118-1) is available which may be suitable for enquiry or purchasing without modification. It is derived from this BP Group Guidance for Specification by retaining the technical body unaltered but omitting all commentary, omitting the data page and inserting a modified Foreword.



Principal Changes from Previous Edition

BP Engineering Standard 111, originally issued in December 1985, has been completely revised and re-issued as this BP Group Guidance for Specification following the issue of [EEMUA Publication 158](#) in 1989.

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 Engineering or the Custodian. See Quarterly Status List for contacts.



1. INTRODUCTION

1.1 Scope

This BP Specification specifies general requirements supplementary to [EEMUA Publication No. 158:1989](#), for the construction of fixed offshore steel structures in the North Sea and is for use with a supplementary specification to adapt it for each specific application.

Pipeline risers and any other pipework supplied integrally with the structure are not covered by this Specification.

The titles and numbering of the text of this BP Specification follow those of [EEMUA Publication No. 158](#). As a result of this, gaps in numbering may occur. All text is cross referenced to [EEMUA Publication No. 158](#), 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. 158](#), the text numbering of [EEMUA Publication No. 158](#) has been extended accordingly.

(Addition to [EEMUA 158 1.1](#))

*2. QUALITY ASSURANCE

The Contractor shall supply a quality manual which shall be submitted to BP with the tender documents.

Following an order the contractor shall submit a quality plan which shall be subject to approval by BP.

The Contractor shall ensure that the quality requirements are applied to the materials, equipment and services provided by sub-contractors.

(Addition to [EEMUA 158 2](#))

2.1 Documentation

* 2.1.1 General

The contractor's quality assurance system shall ensure that all documentation specified in 2.1.2 of this specification is presented to BP, and any regulatory authority.

The method of indexing and collating all documentation shall be agreed between BP and the contractor within an agreed period after contract



award, and shall be subject to final approval by BP before the commencement of fabrication. BP will specify those documents that are required prior to and during the progress of the work only, and those that are required for permanent record.

(Additional to [EEMUA 158 2](#))

2.1.2 Project Documentation

The documents required for any particular project shall include, but not necessarily be limited to those covered by 2.1.2 and 2.1.3 of this specification.

Prior to the commencement of each part of the fabrication, the following documentation may be subject to approval by BP:-

- (a) Fabrication sequences, welding procedures, forming procedures and erection sequence.
- (b) Fabrication drawings including identification of material grades, weld details and NDT requirements; plate seam arrangements drawings; plate cutting drawings.
- (c) Drawings and calculations of temporary works, inclusive of support points, jacking points and sling points, approved by a professionally qualified engineer in the contractor's employ.
- (d) List of proposed welding procedures and their areas of application.
- (e) Qualified welding procedures and weld-repair procedures in accordance with this Specification for both permanent work and temporary attachments.
- (f) Certificates of welders, welding operators, arc/ air gougers and tackers, qualified in accordance with this Specification.

Additionally, documents detailing qualifications and experience of engineers and all QA and QC personnel.

- (g) Material identification and control procedures.

Additionally, certificates for material supplied by the contractor.

- (h) Key plans showing an unambiguous member identification and weld marking scheme.



- (i) Detailed procedures for non-destructive testing and inspection, and the format of the NDT certificates.
- (j) Contractor's in-house procedures for the control of fabrication drawings and their revisions.
- (k) Procedures for control of tolerances during fabrication.
- (l) PWHT procedures.
- (m) Leak test procedures.
- (n) Coating and coating repair procedures.

(Addition to [EEMUA 158 2](#))

* 2.1.3 Following completion of any part of the work the contractor shall submit copies of the following documentation for approval by BP:

- (a) Tolerance-drawing records which shall be updated continually and issued at least every month.
- (b) Plans marked to relate certificate references for all materials to their final position in the structure.
- (c) Weld plans showing unique weld-seam references and a list of weld procedure numbers used for each individual weld.
- (d) PWHT reports.
- (e) NDT test reports and key plans showing final identification numbering, test report numbers and the results.
- (f) Production mechanical test records if required and leak test reports for all items tested.
- (g) As-built drawings and specifications showing in detail the manner in which the work was performed and all changes, additions, corrections or revisions made during the course of fabrication. These drawings shall also indicate the number of the welding procedure specification used for each weld.
- (h) On final completion, a line drawing shall be produced detailing and numbering the layout of all node joints. The numbering system used shall be indexed against all inspection/NDT reports. This is to facilitate ease of node identification and



correlated NDT during in-service sub-sea and topside inspections.

(Addition to EEMUA 158 2)

3. MATERIALS

3.1 Weldable Structural Materials

Steel plate, tubulars and sections shall be in accordance with BP Group GS 136-2.

(Substitution for EEMUA 158 3.1)

3.2 Welding Consumables

BP may require supplementary batch testing of welding consumables. Evidence is also required to confirm that the consumables will produce satisfactory CTOD results after PWHT.

(Addition to EEMUA 158 3.2)

Batch definition which limit a batch number to a single dry blend of flux and/or a single heat of filler are normally considered acceptable and no additional batch testing is required. The exception being when BP are still not convinced that all batches of the consumables would pass the welding procedure qualification tests. Additional batch testing could be waived, however, if the contractor also achieves the required weld metal charpy energy in additional tests from each procedure plate at a temperature 10 below the specified temperature. In cases where BP is not satisfied with the batch definition the contractor shall propose a batch testing programme for BP approval.

3.3 Miscellaneous Materials

3.3.1 Bolts, Nuts and Washers

Mild steel bolts and nuts shall be to BS 4190 Grade 4.6 and washers to BS 4320. Mild steel stud bolts and washers shall be to BS 4882. All threaded connections shall have a suitable locking device so that they are incapable of becoming undone. However, locking welds shall not be used on nuts and bolts to BS 4882 and free machining nuts and bolts to BS 4190 Grade 4.6. In a torqued connection, the tensioned length of the bolt shall be at least 5 diameters long and the torque requirement shall be specified on the drawing.

For subsea applications high strength bolts, nuts and washers shall be to BS 3692 Grade 8.8 with Chemical Composition as per BS 4882 Grade L7. These Bolts shall be heat-treated and charpy toughness following thread rolling to achieve an hardness of not more than 300Hv or shall



have machined threads. All bolts, nuts and washers shall be Cadmium plated and dehydrogenated to [BS 3382](#): Part 7: 1966.

Bolting materials for the splash zone shall be manufactured from MARINEL cupro-nickel alloy.

(Modification to [EEMUA 158 3.3.1](#))

3.5 Material Handling

3.5.2 Maintenance of Identity

Dot matrix stamps are an acceptable alternative to round nosed stamps.

(Addition to [EEMUA 158 3.5.2](#))

3.5.4 Storage Conditions

Damage to any part of the steelwork either before, during or after erection shall immediately be brought to the notice of BP.

(Addition to [EEMUA 158 3.5.4](#))

4. QUALIFICATION OF WELDING PROCEDURES AND PERSONNEL

4.2 Approval Process for Welding Procedures

4.2.1(d) Initial Submission

To comply with the essential variables, some extra SWIS information will be necessary.

For SMAW : the stub length assumed for the run-out lengths quoted.

For SAW : the number and orientation of wires.

For SSFCAW : the polarity.

4.3 Restrictions on Welding Practices

A questionnaire (Attachment 1) has been prepared which addresses each of the points listed in [EEMUA 158](#) Clause 4.3. This should be returned with the tender.

(Addition to [EEMUA 158 4.3](#))

[EEMUA 158](#) Clause 4.3 does not prohibit the practices listed, it merely warns the contractor of some which concern BP. If a contractor has background data which convinces BP that it is sensible to permit one or other of these practices, then



approval may be given. To ensure that any such proposals are made clearly in the tender, and that appropriate background data are submitted with the tender, a questionnaire (Attachment 1) has been prepared which addresses each of the points listed in this clause. This should be returned with the tender.

- 4.3(b) SMAW bead widths exceeding the lesser of 16 mm or four times the core wire diameter.

(Modification to [EEMUA 158 4.3\(b\)](#))

The BP supplementary requirements are simply to correct errors in [EEMUA 158](#)

- 4.3(h) SSFCAW for heat inputs exceeding 1.5 KJ/M for all welding passes other than the root pass.

(Modification to [EEMUA 158 4.3\(h\)](#))

The BP supplementary requirements are simply to correct errors in [EEMUA 158](#)

- 4.3(k) SSFCAW followed by any other process, including the mixing of weld metal at weld intersections.

(Modification to [EEMUA 158 4.3\(k\)](#))

Past experience has shown that there can be a substantial reduction in weld metal toughness when SSFCAW is followed by other welding processes. This is equally true for individual butt welds and at the intersection of welds, where the first joint involves SSFCAW and the second any other welding process. BP will require detailed, assurance testing before this 'mixing' of weld metal is allowed to proceed.

- 4.3(l) Heat inputs exceeding 3KJ/mm for grade 450 material and 3.5 KJ/mm for grade 355 material.

(Modification to [EEMUA 158 4.3\(l\)](#))

- 4.3(n) Butt welds where both edges are square and are greater than 8 mm thick and T butt welds without a bevel where the thickness of the incoming member is greater than 8 mm.

(Modification to [EEMUA 158 4.3\(n\)](#))

The BP supplementary requirements are simply to correct errors in [EEMUA 158](#)

- 4.3(o) Included angles of bevelled welds below 45 degrees (except as covered by 4.5.2(g)).

(Modification to [EEMUA 158 4.3\(o\)](#))

The BP supplementary requirements are simply to correct errors in [EEMUA 158](#)



- 4.3(r) Use of any welding technique in which the welder is not permitted to put the final capping pass adjacent to the plate.

(Modification to [EEMUA 158 \(4.3\(r\)\)](#))

'Temper bead' means any welding technique in which the welder is not permitted to put the final capping pass adjacent to the plate, regardless of the stated objective for this restriction. The acceptability of such a technique will depend on the tenderer's ability to show that the technique has no effect on hardness. Alternatively, if there is a hardness effect, the tenderer will need to control bead placement so as to guarantee compliance with the specified hardness limit.

- 4.3(t) Single-pass fillet welds (other than by submerged arc) with a design leg length greater than 6 mm.

(Modification to [EEMUA 158 4.3\(t\)](#))

The BP supplementary requirements are simply to correct errors in [EEMUA 158](#)

- 4.3(w) SSFCAW without a split second layer.

(Addition to [EEMUA 158 4.3](#))

Problems have been experienced on past projects with poor toughness in the root area of SSFCAW Welds. The problem was solved by ensuring a small bead size and adequate interrun tempering. Splitting the second layer of weld metal was found to be particularly effective.

- 4.3(x) Use of single bevel or K weld preparations for in-plane butt welds.

(Addition to [EEMUA 158 4.3](#))

It is very difficult to detect defects on the sidewall of square edge preparations. Special ultrasonic techniques e.g. tandem probe are effective but they are time consuming and expensive.

4.4 Welding Procedure Qualification Tests

4.4.1 General Requirements

When rolled steel sections have been purchased with transverse Charpy properties, testing in the HAZ shall also be transverse.

(Addition to [EEMUA 158 4.4.1](#))



For fillet weld tests, the root gap shall be set at 2 mm with the two plates fully restrained. The fillet weld leg length qualified by this test is the actual leg length minus the 2 mm gap. Only consumables which have been qualified on butt welds may be used.

(Modification to [EEMUA 158 4.4.1](#))

It is assumed that all fabricators will take advantage of the opportunity to qualify T-butt welds using plate butt (with single bevel or K preparations). For stub to barrel welds however, the test 4.4.2.3(b) is required in addition.

The PWHT soak time of 4 hours minimum may not qualify the procedure for the possibility of a repeat PWHT. The Contractor may wish to cover this eventually by testing at longer soak times.

Although 30 mm plates are required for fillet weld procedure qualification, and the preheat in the test will therefore be the one appropriate to the 90 mm combined thickness, this is not the minimum preheat permitted for fillet welds. The ruling clause is 4.5.4(b), which will permit the same reduction for lesser combined thickness as [BS 5135](#) will permit.

4.4.2 Types of Test Weld

4.4.2.3 Single Tests and Demonstrations

4.4.2.3(a) Mechanical tests shall be taken to evaluate both sides of the repair. The requirement for PWHT or CTOD test depends on the plate thickness not on the repair weld depth.

(Addition to [EEMUA 158 4.4.2.3\(a\)](#))

4.4.2.3(b) The internal weld shall not be undertaken until the single-sided weld root has been fully visually inspected.

(Addition to [EEMUA 158 4.4.2.3\(b\)](#))

4.4.2.3(c) The maximum root gap which will be permitted in this test is the 12 mm limit from section 5.2.7.

(Addition to [EEMUA 158 4.4.2.3\(c\)](#))

4.4.2.3(d) Visual examination shall also include a measurement of bead width.

(Addition to [EEMUA 158 4.4.2.3\(d\)](#))



4.4.3 Inspection and NDT Requirements and Acceptance Criteria

4.4.3(b) Non-destructive Testing

Welding procedure qualification tests shall be inspected against the Table 3 requirements of Category I for butt welds and Category V for fillet welds.

(Addition to EEMUA 158 4.4.3(b))

Reference here, and in 4.4.1 and 7.2.3 of EEMUA 158 to the 'third day after the completion of welding' result from the practice of certain fabricators of recording only the day on which welding or NDT took place. Where the Contractor's system includes a record of the time at which welding was completed, or PWHT or NDT was started, then this delay time may be taken to mean 48 hours, since this is the minimum period guaranteed by the 'third day' wording.

4.4.4 Mechanical Test Requirements and Acceptance Criteria

Where dissimilar material welds involve a thickness transition to compensate for a difference in strengths, the requirements for the stronger material shall apply.

(Addition to EEMUA 158 4.4.4)

4.4.4(d) Hardness Survey

Individual hardness figures in the weld, or in the HAZ of the quench and tempered grade 450 steel, shall not exceed 325 HV10.

(Addition to EEMUA 158 4.4.4(d))

It is recognised that existing procedure qualifications are unlikely to comply precisely with the hardness survey defined here. Qualifications using a similar approach (i.e. using surveys down the HAZ rather than parallel to the plate surface) will normally be acceptable, but the old-fashioned 'parallel' surveys may have conditions attached to their acceptance since they are less searching - e.g. the acceptance level for such surveys may be set 25 HV lower than for the 'correct' survey.

4.4.4(e) Charpy Tests

Charpy test on single bevel or K weld preparations shall be taken from the bevelled edge. Tests from the square edge are not required.

The root weld centreline charpy notch for the punch- through technique shall be at the intersection of the columnar grains of the punch-through bead.

(Addition to EEMUA 158 4.4.4(e))

- * 4.4.4(f) Unless approved otherwise by BP the weld metal CTOD requirement is 0.25 mm at a test temperature of 0°C for piles and -10°C in all other cases.

The consumable that is proposed for use on node stub to can welds shall require CTOD testing in the weld metal where the stub (brace) is over 40 mm thickness. This is intended as a mandatory consumable verification test and shall be conducted after PWHT unless specified otherwise by BP.

HAZ CTOD tests are not required unless specified otherwise by BP.

(Addition to EEMUA 158 4.4.4(f))

4.4.5 Failed Procedures

Additional retests may be permitted when the cause of failure was a machining or testing error, rather than any fault with the weld.

(Modification to EEMUA 158 4.4.5)

4.5 Essential Variables

4.5.1 Materials Related Variables

- 4.5.1(a) Procedures for castings shall require qualification using cast steel base material.

(Addition to EEMUA 158 4.5.1(a))

- 4.5.1(h) If the thickness of the protective finish applied to the weld bevel is greater than that used for the procedure qualification tests.

(Modification to EEMUA 158 4.5.1(h))

4.5.2 Weld Geometry Related Variables

- 4.5.2(i) The qualified root gap for double sided welds is limited to a maximum of 6 mm.

(Modification to EEMUA 158 4.5.2(i))

- 4.5.2(e) *In certain circumstances BP may be able to offer a relaxation on the requirement for qualification in all of the 4 positions. As a minimum, however, the highest and lowest heat input positions will be qualified for the range of thickness using the same fundamental procedure. In addition a single additional test will be required, on the thickest material, in each of the remaining two positions.*

(Additional commentary, to EEMUA clause only)



4.5.4 Procedural Variables

- 4.5.4(c) *The simplest way of complying with this clause is to allow the test plate to cool to the minimum specified preheat before starting each pass of the cap. If this has not been done with existing qualifications, then the measured interpass temperature in the cap becomes the minimum 'preheat' for capping.*

(Additional commentary, to EEMUA clause only)

- 4.5.4(e) *Where existing procedure qualifications are being offered, the depth of gouging may not have been measured during all relevant test welds. In such a case, the contractor may provide a single 3G demonstration plate - or 1G for any SAW procedure involved - of the greatest thickness covered by the appropriate procedure. In this demonstration, the backgouging should taper from nil to 10 mm over a distance not less than 500 mm. Charpy tests should then be taken from the bottom of the first side welded; at locations representing 1 mm steps of backgouging depth. The minimum permissible backgouging depth will then be set 2 mm deeper than the depth beyond which all of the Charpy tests meet the normal root Charpy test requirements.*

(Additional commentary, to EEMUA clause only)

- 4.5.4(f) Backgouging beyond the 10 mm limit will be permitted where the ligament after gouging still exceeds either 10 mm or the ligament which remained after backgouging the appropriate procedure qualification test.

(Modification to [EEMUA 158 4.5.4\(f\)](#))

4.5.5 Welding Parameter Variables

- 4.5.5(b) *Where existing procedure qualifications are being offered, it is unlikely that all runs with a particular size of electrode will have been controlled within this tolerance on the mean value although this would be mandatory for procedures run especially for EEMUA fabrication. If examination of the 'as run' sheet shows that the standard deviation of the actual run lengths for fill and cap passes exceeds 10% of the mean for that electrode diameter, then that existing qualification is unlikely to be accepted.*

(Additional commentary, to EEMUA clause only)

- 4.5.5(f) The maximum heat input during production welding is limited to the lesser of 10% or 0.2 KJ/mm greater than that used during procedure qualification.

(Modification to [EEMUA 158 4.5.5\(f\)](#))



- 4.5.5(g) If the equipment used for SAW SSFCAW or GSFCAW does not indicate wire feed speed but does indicate current, then the 5% tolerance will apply to the current.

(Modification to [EEMUA 158 4.5.5.\(g\)](#))

- 4.5.5(i, k, l) *If existing procedure qualifications are being offered and these parameters have not been measured during procedure qualification BP may still be able to accept these procedures subject to the acceptance of additional verification tests.*

(Additional commentary, to EEMUA clause only)

5. CONSTRUCTION

5.2 Preparation and Assembly

5.2.3 Spacing of Seams and Splices.

- 5.2.3(b) This restriction is not mandatory for castings.

(Clarification to [EEMUA 158 5.2.3 \(b\)](#))

- * 5.2.7 Alignment and Fit Up of Welding Joints

The contractor must seek BP approval in writing before attempting to weld single sided closure butt welds with a root gap exceeding that permitted by 4.5.2(h). A single qualification test (4.4.2.3 c) is required at 12 mm gap.

(Addition to [EEMUA 158 4.5.2\(h\)](#))

Effort should be made to ensure that the number of wide gap closure welds within the structure are kept to a minimum. Wide gaps require a higher degree of welder skill and they are more prone to weld root defects, poor toughness and cracking.

5.3 Control of Production Welding

5.3.2 Welding Consumables and Equipment

The Storage and control of welding consumables shall comply with BP Group [GS 118-4](#).

Before the start of production BP may require the Contractor to have the SAW flux control system audited by the consumable manufacturer and an audit report shall be made available to BP.

(Addition to [EEMUA 158 5.3.2](#))



5.3.5 Weld Execution

Ultrasonic inspectors for single-sided closure welds shall perform a pre-weld survey of the joint fit-up. Scribed lines shall be drawn 100 mm away from the root face on either side of the weld to assist ultrasonic examination of the completed weld.

(Addition to EEMUA 158 5.3.5)

5.3.7 Weld Repairs

The minimum toe-to-toe separation of weld repairs shall be 75 mm.

(Modification to EEMUA 158 5.3.7)

5.3.9 Weld Profile and Surface Finish

Toe grinding shall not be less than 0.5 mm or more than 1.5 mm penetration into the base metal and shall extend 0.5 mm below visible undercut. Profile requirements for TKY joints within jackets are shown in Fig. 5 of EEMUA 158. BP may specify additional requirements for certain joints and this will be shown on the design drawings.

(Modification to EEMUA 158 5.3.9)

5.3.11 Production Controls

The Contractors production monitoring system should incorporate the use of portable arc monitoring equipment.

(Addition to EEMUA 158 5.3.11)

5.4 Post-Weld Heat Treatment

* 5.4.1 Welds Requiring PWHT

PWHT shall only be repeated with BP approval.

Even where the Drawing defines an as welded joint thicker than these rules, a CTOD tested procedure is still required.

(Addition to EEMUA 158 5.4.1)

5.4.2 PWHT Procedures

Based on the steel makers recommendations BP may define different soaking temperature for grade 450 material and castings.

(Modification to EEMUA 158 5.4.2)



*** 5.5 Bolted Connections**

Bolting procedures shall be submitted to BP for approval.

Bolted connections shall comply with the following unless otherwise specified on the Drawings:

When not specifically indicated on the Drawings, holes for bolted connections shall have a diameter 1.5 mm larger than the bolt size. Holes shall be made only by drilling, or subdrilling and reaming.

Where close tolerance bolts are required the hole shall be made to within +0.5 mm and -0 mm of the specified bolt diameter.

Bolt heads and nuts shall be drawn tight against the work by a method acceptable to BP. Bolt heads shall be tapped with a hammer while the nut is being tightened. Having been finally tightened, the nuts shall be locked. All high strength bolts shall be pretensioned to the proper proof stress or shall have the torque level specified. All such bolting details shall be subject to prior review by BP.

Where surfaces joined by bolting have a slope greater than 1:20 with respect to the plane normal to the bolt axis, suitable tapered washers shall be used.

All bolts shall be provided with either a lock nut, a locking washer, or an alternative locking device. All bolt locking devices shall be subject to prior review by BP.

Bolts shall be threaded to such a length that not more than one thread will be within the grip of the structural members.

Bolts shall be of a length that will extend entirely through the nut, but not more than 10 mm beyond.

(Addition to [EEMUA 158](#))

7. INSPECTION AND NON-DESTRUCTIVE TESTING

7.3 Qualification of Inspection and NDT Procedures and Personnel

7.3.1 Non-Destructive Testing Procedures

Procedures shall be prepared and qualified in accordance with BP Group [GS 132-2](#).

(Addition to [EEMUA 158 7.3.1](#))



7.3.2 Qualification of Inspection and NDT Personnel

The qualification and reporting relationships of Inspection and NDT personnel are specified in BP Group [GS 132-2](#).

(Addition to [EEMUA 158 7.3.2](#))

7.4 Non Destructive Testing Techniques

7.4.1 Visual Inspection

The requirement of BP Group [GS 132-2](#) shall also apply. Internal visual examination of single-sided closure welds roots shall be carried out using a high intensity light source.

(Addition to [EEMUA 158 7.4.1](#))

7.4.2 Ultrasonic Testing

The requirements of BP Group [GS 132-2](#) shall also apply.

(Addition to [EEMUA 158 7.4.2](#))

7.4.3 Radiography

The requirements of BP Group [GS 132-2](#) shall also apply.

(Addition to [EEMUA 158 7.4.3](#))

7.4.4 Magnetic Particle Inspection

The requirements of BP Group [GS 132-2](#) shall also apply.

(Addition to [EEMUA 158 7.4.4](#))



TABLE 2

- (b) The requirements for Castings are the same as for grade 355 steel)

(Modification to [EEMUA Table 2 \(b\)](#))

TABLE 3

- (d) Alternative inspection requirements may also be specified for critical partial penetration welds.

(Addition to [EEMUA Table 3 \(d\)](#))

- (f) For nodes where scanning from internal surfaces is not possible, examination shall be to the Purchaser's approval ([BS 3923](#) Level 4).

(Addition to [EEMUA 158 Table 3](#))

- (g) The option given in Table 5 of [BS 3923](#) to delete inspection from the lower surfaces for plate and pipe butt welds below 35 mm shall not apply.

(Addition to [EEMUA 158 Table 3](#))

- (h) A chevron cracking check is required for Inspection Categories I to IV on submerged-arc welds 25 mm thick or above.

(Addition to [EEMUA 158 Table 3](#))

TABLE 5

This should read table 6.

The acceptance levels for lack of fusion defects do not apply. Lack of fusion defects are not acceptable.

(Modification to [EEMUA 158 Table 5](#))

TABLE 6

This should read table 5.

Undercut shall not exceed 0.25 mm for all welds in jacket structures and piles.

(Modification to [EEMUA 158 Table 6](#))



TABLES 5 & 6

EEMUA 158 was published with these tables incorrectly numbered and wrongly positioned. Table 5 on page 119 should be table 6 on page 120 and table 6 on page 120 should be table 5 on page 119.



QUESTIONNAIRE ON PROPOSALS FOR WELDING PRACTICES

Clause 4.3 of [EEMUA 158](#) defines restrictions on a variety of welding practices, making their use subject to the specific approval of the purchaser. Any decision on approval would be based on an assessment of the background data submitted by the tenderer.

To ensure an equitable assessment of tenders, BP requires tenderers to nominate their intentions in these areas at the time of tender.

Tenderers are required to answer YES or NO to the questions on the list which follows covering all of the relevant topics. This requirement has been made to encourage tenderers to be open about their intentions prior to contract.

A 'Yes' response must be supported by data submitted with the tender that demonstrates to the satisfaction of BP's Professional Engineer that use of the practice will provide the required welding quality.

A 'No' response means that the practice is not proposed. BP reserve the right to hold the Contractor to this response, and to reject any subsequent request for approval, without explanation.

Tenderers shall also include details of the definition of a batch or lot used by the chosen welding consumables manufacturers, and of the testing carried out by the manufacturer on each batch or lot, as required by Clause 3.2 of [EEMUA 158](#).



Are any of the following practices proposed for this enquiry?	Answer (YES/NO)
(1) SMAW for heat inputs exceeding 3 kJ/mm	_____
(2) SMAW bead widths exceeding either of 16 mm or four times the core wire diameter	_____
(3) SMAW vertical down	_____
(4) GMAW (except for the root pass in double-sided SAW welds)	_____
(5) SSFCAW without the voltage and wire-feed speed set and locked	_____
(6) SSFCAW for heat inputs exceeding 1.5 kJ/mm (except for root passes)	_____
(7) SSFCAW with weave beads	_____
(8) SSFCAW vertical up (except for root run)	_____
(9) SSFCAW in combination with another process	_____
(10) Heat input exceeding 3 kJ/mm for grade 450 or 3.5 kJ/mm for grade 355 material	_____
(11) Welding on materials less than 30 mm thick with a heat input exceeding 3.5 kJ/mm	_____
(12) Square edge butt and T butt welds greater than 8 mm thick	_____
(13) Included angles of bevelled welds below 45 degrees (except for tubular intersections)	_____
(14) Included angles below 60 degrees for closing welds in tubulars above 40 mm thick	_____
(15) Welding on the second side of a joint without back gouging, except for SAW procedures using the 'punch-through' technique	_____
(16) Use of a 'temper bead' technique	_____
(17) Maximum interpass temperature exceeding 250°C	_____



- (18) Single-pass fillet welds (other than by SAW) with a design leg length greater than 6 mm _____
- (19) Use of backing strips _____
- (20) Use of ceramic inserts _____
- (21) Use of single bevel or K weld preparation for in plane butt welds _____



DEFINITIONS

Definitions

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

certifying authority: an independent agency which, for UK waters, certifies the design and/or fabrication of an offshore structure for statutory purposes.

third party inspectorate: an impartial body, independent of, but appointed by, BP.

Note: Any specific application of the terms and the responsibilities of the parties defined above is a matter for the relevant Conditions of Contract.

single sided weld: applies to joints welded from one side only.

double sided weld: applies to joints welded from both sides regardless of weld preparation.



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.

Documents already referenced in EEMUA 158 are not included here.

EEMUA Publ. No 158	Construction specification for fixed offshore structures in the North Sea Available from:- The Engineering Equipment and Materials Users Association 14-15 Belgrave Square LONDON SW1W 8PS
BS 3382	Specification for electroplated coatings on threaded components:- Part 7:1966 Thicker platings for threaded components
BS 3692	Specification for ISO metric precision hexagon bolts, screws and nuts. Metric units
BS 3923	Methods for ultrasonic examination of welds
BS 4190	Specification for ISO metric black hexagon bolts, screws and nuts
BS 4320	Specification for metal washers for general engineering purposes. Metric series
BS 4882	Specification for bolting for flanges and pressure containing purposes
BP Group GS 118-4	Storage and control of welding consumables (was BP Std 165)
BP Group GS 132-2	Non-destructive testing of welds for offshore application (was BP Std 188)
BP Group GS 136-2	Structural steel materials for use in the fabrication of fixed offshore steel structures (was BP Std 109)



SUPPLEMENTARY COMMENTARY

DESIGN DRAWINGS - POINTS FOR CONSIDERATION BY THE DESIGN CONTRACTOR

EEMUA Publication 158 clarifies a number of points for consideration by the design contractor(s). In particular the following should be reflected on the design drawings by the design contractor:-

Node Stub Geometry

Clause 5.2.3(e) of EEMUA 158 defined a minimum perpendicular clearance between node barrels and the brace/stub weld. This should be reflected on the drawings.

Welding from One Side Only (single-sided welding)

Clause 5.2.4 of EEMUA 158 suggests that this should be any tubular weld where the internal diameter is less than 600 mm. Any restrictions on the locations of closure welds in larger members should be defined on the drawings.

Closure Weld Radiography

Clause 5.3.5 of EEMUA 158 identifies the possibility that some critical closure welds (normally those with uncomfortably low fatigue lives) will receive early radiography in addition to the final ultrasonic and magnetic particle examination. These welds should be identified on the drawings.

Welds Requiring/Not Requiring PWHT

Clause 5.4.1 of EEMUA 158 provides a general definition, then leaves the designer free to indicate exceptions. It may be preferable to indicate on the drawings all nodes (and other welds) which require PWHT.

Dimensional Tolerances

Clause 6.1 of EEMUA 158 states that the 158 tolerances only apply if the drawings do not specify alternatives, and *clause 6.2.2.3 of EEMUA 158* specifically requires the drawings to define skid beam tolerances.

Extent of Inspection and NDT

Clause 7.2.2.4 of EEMUA 158 requires that each weld be allocated a category from Table 3. This should be designated on the design drawings.

Leak Testing

Clause 7.4.5 offers the option for components other than buoyancy tubes and jacket leg sections to be leak tested; these should be designated on the drawings.



Weld Profiles

Although Figure 5 of EEMUA 158 defines the requirements for tubular intersections, clause 7.5.2 of EEMUA 158 implies that the requirements for other welds will be stated on the drawings.

Joint Details

Joint details for welds between materials of different strengths (e.g. between Grade 450 and Grade 355 or castings) should be shown on the drawings.

Primary Structure

EEMUA 158 defines the requirements for fabrication work on primary structures of offshore installations. It is important that there is a clear definition of primary structure. This should be in the form of a single list or alternatively the design drawings should indicate the boundaries between primary and non-primary structure.

A separate specification would be issued to cover fabrication of non-primary structure.

Risers

Risers are excluded from 158; a further revision of BP Group GS 118-10 'Welding of Transmission Pipelines; will deal with riser fabrication and installations. Until this is available additional requirements for risers e.g. a specification for bolting and hydrostatic testing should be indicated on the drawings.

