

DEP SPECIFICATION

OFFSHORE TOPSIDES STRUCTURES

(AMENDMENTS/SUPPLEMENTS TO ISO 19901-3:2010)

DEP 37.19.00.12-Gen.

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DESIGN AND ENGINEERING PRACTICE

DEM1



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PART I INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the structural design, fabrication, installation, modification and structural integrity management of offshore topsides structures for the petroleum and natural gas industries.

This DEP is based on ISO 19901-3:2010. Part III of this DEP amends, supplements and replaces various clauses of ISO 19901-3. Part III follows the clause numbering of ISO 19901-3 for easy reference.

All clauses of ISO 19901-3 not modified by this DEP remain valid as written.

This DEP contains mandatory requirements to mitigate process safety risks in accordance with Design Engineering Manual (DEM) 1 – Application of Technical Standards.

This is a revision of the DEP of the same number dated September 2013; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorization to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to offshore oil and gas production. This DEP may also be applied in other similar facilities.

This DEP is intended for use by the Principal and by design Contractors working on behalf of the Principal. The DEP shall be used in conjunction with ISO 19901-3:2010 and other relevant national and international standards, codes of practice on structural design and pertinent HS&E legislation and shall take precedence except where design requirements in the latter standards are more stringent or onerous or where deviations are approved.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The capitalised term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

The word **may** indicates a permitted option.

1.3.2 Specific definitions

Term	Definition
ALS	Accidental limit states
FLS	fatigue limit states
SLS	serviceability limit states
ULS	ultimate limit states

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets (). Other documents referenced by this DEP are listed in (Part IV).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a minor revision of the DEP of the same number dated September 2013. The following are the main, non-editorial changes.

Section/Clause	Change
Part II	Old part II deleted and renumbered Part III as Part II
All	Restructured and clarified requirements, enforced shall/should.
7.10.1	Restructured and updated SHALL [PS] statements
15	Restructured and updated SHALL [PS] statement

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://swwww.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

PART II AMENDMENTS/SUPPLEMENTS TO ISO 19901-3:2010

4 Symbols and abbreviated terms

4.2 Abbreviated terms

Add new terms:

COG	centre of gravity
DLB	ductility level blast
EEMUA	Engineering Equipment & Material Users Association
FE	finite element
GRP	glass-reinforced plastic
HAZID	hazard identification
MTO	material take-off
NLFEA	non-linear finite element analysis
QRA	quantitative risk assessment
RMP	Run and Maintenance Practice
SLB	strength level blast
TEMPSC	totally enclosed motor propelled survival craft
TR	temporary refuge

Delete existing terms:

DLB	ductile level explosion
SLB	strength level explosion

5 Overall considerations

5.1 Design situations

Add to the end of this clause:

For requirements pertaining to topsides layout, refer to DEP 80.00.10.12-Gen.

5.2 Codes and standards

5.2.1 Limit state and allowable stress design philosophies

Add to this clause:

In certain situations (e.g., where extensive good historical performance is known), topsides structures may be designed using WSD, subject to approval by the Principal.

5.2.2 Use of national codes and standards

Add the following after the 3rd paragraph of this clause:

1. The governing design code for proportioning members and joints of new topsides or the modification of existing topsides shall be agreed with the Principal
2. The applicable design codes shall be consistent with regional requirements.
 - a. For example, for platforms located within Europe the Eurocodes should be used.
 - b. For America ANSI/AISC 360-10 should be used.
3. The standards used for fabrication should be consistent with and compatible with those agreed for design.

5.3 Deck elevation and green water

Add to first paragraph of this clause:

1. The durability, corrosion protection and fatigue characteristics of topsides structure or equipment and support members, shall be incorporated in design.

Add at the end of this clause:

2. For a structure with exposure level L1 (manned non-evacuated or high consequence, refer ISO 19902, Table 6.6.1), the abnormal water level should have a return period of 10000 years
 - a. The abnormal water level should incorporate the following:
 - i. associated storm surge and astronomical tide;
 - ii. allowances for water depth uncertainty, seabed penetration and subsidence.
3. For a structure with exposure level L2 (manned evacuated or unmanned and medium consequence, refer ISO 19902, Table 6.6.1) the abnormal water level should have a return period of 1000 years
 - a. The abnormal water level should incorporate the following:
 - i. associated storm surge and astronomical tide;
 - ii. allowances for water depth uncertainty, seabed penetration and subsidence.

5.4 Exposure level

Add at the end of this clause:

1. The target reliability level associated with the defined platform exposure level shall be the same as the support structure (ref. DEP 37.19.00.30-Gen.).

5.6 Selecting the design environmental conditions

Add at the end of this clause:

For the design environmental conditions, refer to DEP 37.00.10.10-Gen.

5.9 Modifications and refurbishment

Add at the end of this clause:

For the assessment of an existing topsides structure and any planned modifications, refer to requirements specified in ISO 19902, Clause 24.

6 Design requirements

6.2 Materials selection

Add at the end of this clause:

For requirements pertaining to Carbon steel, refer to DEP 37.19.10.30-Gen.

6.5 Design for serviceability limit states (SLS)

6.5.3 Deflections

Add at the end of this clause:

During lift and installation of an integrated deck or module, deck deflections may be larger due to the different support configuration compared to the operating case.

1. The effect of deck deflections on piping, at nozzle connections to vessels and other sensitive equipment, should be evaluated in the design.
2. Where required, corrective measures should be taken to ensure the integrity of piping and nozzle connections against deck deflection for the lift and installation cases.

6.7 Design for fatigue limit states (FLS)

Add at the end of this clause:

1. The fatigue performance of secondary structural items located above water and within the splash zone that are considered critical to safety shall be assessed.

6.9 Robustness

Add at the end of this clause:

1. Non-linear finite element analysis (NLFEA) should be used during the design stage to assess and confirm the robustness of the topsides primary structure and safety critical barriers.

NLFEA is especially important for manned; high consequence platforms (refer ISO 19902, Clause 6.6).

6.11 Design for fabrication and inspection

Add after first paragraph of this clause:

1. The manufacturing and fabrication tolerances accounted for in the design (e.g., member out of straightness, plate thickness mismatch, pre-camber tolerances) shall not be less than those achievable during construction.
 - a. EEMUA 158 or another fabrication specification approved by the Principal may be used to specify fabrication tolerances.
 - b. Where the design recommends tighter fabrication tolerances than specified in EEMUA 158, agreement of the Principal should be first obtained before use.
 - c. The Contractor shall conform to all the design requirements during construction.
 - d. Variances from the design intent (if any) should be resolved without compromising structural integrity.
2. The method and arrangement of supports during construction prior to the erection of pipework and vessels should ensure minimal residual stresses remain in pipework and vessel attachments for the in-service condition from the fabrication phase.
3. The structure should be supported on the in-place (stab-in) support points.

Add to the end of third paragraph of this clause:

4. For in-service inspection requirements, refer to RMP 37.19.60.50-Gen.

Add at the beginning of the last paragraph of this clause:

5. A risk based approach to weld inspection shall be adopted.
6. The Contractor should define the extent, type and acceptance criteria for all NDE in accordance with EEMUA 158 or the design class and inspection categories defined in ISO 19902.

7 Actions

7.2 In-place actions

Add to the end of this clause:

1. During the design and fabrication (construction and erection), regular weight reports shall be produced to monitor and control weights (and COG) for use in the analysis of temporary and permanent phases (load-out, transportation, lift and in-place conditions).
 - a. Total structural weight and COG shall be determined from a material take-off (MTO) with allowance and contingencies added for inaccuracies and changes during design and fabrication in accordance with ISO 19901-5.
 - b. Topsides weight and COG should be continuously controlled and monitored throughout the operational phase.
 - c. A computerised database system should be used to record the weight information.
 - d. A weight audit should be periodically conducted to confirm the accuracy of the permanent and variable actions.
2. Topsides load plans shall be produced during design and maintained throughout the operational phase.
 - a. The load plan should show the topsides weight and COG and clearly define the maximum carrying capacity of areas used for storage, access and maintenance.

7.3 Action factors

7.3.3 Design action for in-place situations due to extreme environmental actions

Add to the end of this clause:

Further guidance on selection of partial action factors for the environmental action can be found in EP 97-5050.

7.5 Deformations

Add after the 2nd paragraph of this clause:

1. The possibility of uneven module seating resulting in redistribution of support reactions and the consequent effect of loads in deck members or primary framing shall be evaluated.

7.6 Wave and current actions

Replace second sentence in the first paragraph with:

1. All wave and current effects on the supporting structure, appurtenances (e.g., conductors, caissons, etc.) and the topsides shall be included in the calculation of the environmental actions on the topsides, including those listed below.