

DEP SPECIFICATION

**OFFSHORE CONSTRUCTION SPECIFICATION FOR
DEEPWATER PIPELINES, FLOWLINES AND RISERS**

DEP 37.81.41.33-Gen.

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DESIGN AND ENGINEERING PRACTICE



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The information set forth in these publications is provided to Shell companies for their consideration and decision to implement. This is of particular importance where DEPs may not cover every requirement or diversity of condition at each locality. The system of DEPs is expected to be sufficiently flexible to allow individual Operating Units to adapt the information set forth in DEPs to their own environment and requirements.

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- 3) Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) or 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

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All administrative queries should be directed to the DEP Administrator in Shell GSI.

TABLE OF CONTENTS

1.	INTRODUCTION	5
1.1	SCOPE	5
1.2	DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS	5
1.3	DEFINITIONS	6
1.4	CROSS-REFERENCES	7
1.5	SUMMARY OF MAIN CHANGES.....	7
1.6	COMMENTS ON THIS DEP	8
1.7	DUAL UNITS.....	8
1.8	NON NORMATIVE TEXT (COMMENTARY).....	8
2.	GENERAL	9
2.1	REVIEW OF PROJECT PLANS, PROCEDURES AND CALCULATIONS	9
2.2	MARINE VESSEL AUDITS AND COMPLIANCE	13
3.	ONSHORE FABRICATION AND HANDLING OF MATERIALS AND LOAD-OUT	13
3.1	ONSHORE FABRICATION OF PIPE AND RELATED APPURTENANCES.....	13
3.3	LOAD-OUT AND OFFSHORE SUPPLY	14
3.4	RETURN OF MATERIALS	14
4.	PIPELINE CONSTRUCTION	15
4.1	ATMOSPHERIC WELDING AND NDE	15
4.2	FIELD JOINT COATING	15
4.3	CATHODIC PROTECTION SYSTEMS	15
4.4	MARINE PAINTING	15
4.5	ALLOWABLE STRESSES AND STRAINS DURING CONSTRUCTION	15
4.6	PIPELAY MONITORING AND MAJOR EQUIPMENT CONTROLS	16
4.7	PRE-MOBILIZATION TESTS	18
4.8	REELED FLOWLINES AND PIPELINES	22
4.9	BOLTED CONNECTIONS.....	23
4.10	PULL-TUBE RISER INSTALLATION	25
4.11	CONVENTIONAL RISER INSTALLATION.....	25
4.12	INITIATION FROM EXISTING PLATFORMS	26
4.13	INSTALLATION OF DEEPWATER RISERS	26
4.14	FLEXIBLE PIPE INSTALLATION	28
4.15	PIPE-IN-PIPE INSTALLATION.....	28
4.16	ELECTRICALLY HEATED PIPE	29
4.17	FLOWLINE SLED (PLET) INSTALLATION	29
4.18	UTILITY AND PIPELINE CROSSINGS	30
4.19	TRENCHING.....	30
4.20	ANCHORING OPERATIONS	31
4.21	SURVEY AND POSITIONING	31
4.22	REMOTE COMMUNICATIONS WITH PLATFORMS	32
4.23	LIFTS AND LOWERING OF PIPELINES, RISERS, AND EQUIPMENT	32
4.24	DEMOBILIZATION.....	33
5.	SUBSEA HOT-TAP CONNECTIONS	33
6.	HYDROSTATIC PRESSURE TESTING AND PRE-COMMISSIONING.....	33
7.	REQUIREMENTS FOR REMOTE OPERATED VEHICLE (ROV) OPERATIONS	33
8.	REQUIREMENTS FOR DIVING OPERATIONS	33
9.	REQUIREMENTS FOR DYNAMICALLY POSITIONED (DP) VESSELS	34
9.1	GENERAL REQUIREMENTS.....	34
9.2	DP DOCUMENTATION REQUIREMENTS	34
9.3	PRE-FIELD ARRIVAL TESTS	34
9.4	ADDITIONAL NAVIGATION EQUIPMENT	34

10. AS-BUILT DOCUMENTATION 35

11. REFERENCES 36

1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for offshore construction of deepwater pipelines, flowlines and risers, and related hardware and appurtenances, including but not limited to pipeline end manifolds PLETs (pipeline end termination) (sleds), in-line sleds, jumpers, and spool pieces. "Deep Water" is generally defined as water depth in which diver access is not possible or impractical. For general purposes this depth is approximately 300 m (985 ft.).

This DEP may be applied to shallow water construction of pipelines, flowlines and risers, if so specified by the Principal. All requirements of this DEP apply, unless a deviation for shallow water construction is specifically identified by the Principal. Where appropriate, the adjective "deepwater" can then be removed from the specific language in the specifications.

This DEP covers the following main topics:

- requirements for installation engineering and installation procedures;
- onshore pipe handling;
- offshore installation activities.

This is a revision of the DEP of the same number dated February 2015; 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 authorisation to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil and gas production on deepwater pipeline, flowline, and riser projects. This DEP may also be applied in other similar facilities.

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 word **should** indicates a recommendation.

The word **may** is an option to be confirmed with the Principal.

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

1.3.2 Specific definitions

Term	Definition
Work	Define the work to be executed by the Contractor as defined in the Invitation to Tender or Contract Scope of Work.



1.3.3 Abbreviations

Term	Definition
A&R	Abandonment and Recovery
AFC	Approved For Construction
ASOG	Activity Specific Operating Guidelines
DP	Dynamic Positioning
ECA	Engineering Critical Assessment
FAT	Factory Acceptance Testing
FEA	Finite Element Analysis
FMEA	Failure Mode and Effects Analysis
HSSE	Health, Safety, Security and Environment
MOC	Management of Change
NDE	Non Destructive Examination
PLET	Pipeline End Termination
RAO	Response Amplitude Operator
ROV	Remotely Operated Vehicle
ROW	Right of Way
SCR	Steel Catenary Riser
VIV	Vortex Induced Vibration

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section or clause number is shown in brackets (). Other documents referenced by this DEP are listed in (11).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a full revision of the DEP of the same number dated February 2015. The following are the main, non-editorial changes.

Section/Clause	Change
All	Restructured and clarified requirements, enforced shall/should.

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.

2. GENERAL

2.1 REVIEW OF PROJECT PLANS, PROCEDURES AND CALCULATIONS

1. The Contractor shall perform and submit to the Principle for approval all analyses, calculations, drawings and procedures for the design, fabrication, and installation of all components included in the Work.

(e.g., pipelines, risers, PLETs, manifolds, abandonment and recovery [A&R] heads, lifting analyses).

2.1.1 Design

1. The Contractor shall submit engineering calculations and drawings of those components for which the Contractor has design responsibility in order to demonstrate that such components meet the Principle's requirements and standards.

2.1.2 Fabrication

1. The Contractor shall submit engineering calculations, drawings, and procedures of those components for which the Contractor has fabrication responsibility in order to demonstrate that such components meet the Principle's requirements and standards.

2.1.3 Installation engineering

1. The Contractor shall submit engineering calculations, drawings, analyses, and procedures necessary to demonstrate that pipeline installation operations and other construction that is part of the Work can be safely executed with the procedures and methods selected.
 - a. This shall include applicable static analyses of the suspended pipe span for nominal pipelay conditions, upset conditions (DP drift off), fatigue of the upper end and sagbend of the suspended pipe span under adverse weather conditions.
 - i. The result of the analyses shall be used to define limiting operating conditions and guidelines.
 - ii. The Contractor shall use the results of the aforementioned analyses to develop a set of graphs for use offshore by pipelay vessel operators and field engineers to allow them to determine quickly if measured pipelay parameters are within allowable ranges or require corrective action (i.e., change in vessel position, change in tension or ramp angle, etc.).
2. The Contractor shall prepare a set of vessel watch circle graphs for the entire route, which depicts maximum allowable vessel excursion under different operating conditions (currents, waves and wind), such that allowable bending strains are not exceeded and pipeline is installed within the specified right-of-way.
 - a. The Principal may elect to perform analyses similar to those performed by the Contractor.
 - i. The Contractor shall make the required input data, such as lay vessel response amplitude operators (RAOs), available to the Principal for comparison analyses to Principals own data when requested.

The results of the analyses will be compared as a quality assurance step.
 - ii. The reason for any differences from the comparison shall be submitted to the Principal for agreement and approval before the installation procedures are finalized.
3. The Contractor shall be responsible for the design, installation and ultimate removal of all installation aids and rigging.
 - a. Design for installation aids that will place a load on the existing structures shall be submitted to the Principal for review and approval prior to submission of the installation procedures.
 - b. Upon completion of the installation activities, these aids shall be removed by the Contractor and any damage to existing surfaces or coatings repaired with approved procedures at the Contractor's cost.

2.1.5 Installation procedures and manuals

1. The Contractor shall present written specific detailed project plans and procedures, including e.g., calculations and drawings of the proposed installation to the Principal for review and approval, before any construction commences.
 - a. This shall include mobilization and demobilization procedures (e.g., load out and deck layout).
 - b. These procedures shall cover the full range of water depths for the proposed work.
2. The Contractor shall submit an installation manual for the Principal's review and approval which will include all of these procedures and analyses prior to mobilization as required by the Contract.
 - a. The Contractor shall submit for the Principle's approval a proposed table of contents for the installation manual.
 - b. The installation manual shall contain those procedures and analyses as required within the Contract or as agreed by the Principle for the mobilization and offshore installation.

Project management documents and shore based fabrication documents are not typically included in the installation manual. Upon approval the installation manual becomes AFC.
3. The AFC Installation Manual shall be provided prior to the scheduled start of offshore work as described in the Contract.
 - a. After approval each subsequent revision to the AFC Installation Manual shall require approval of the Principal in writing.
 - i. The Contractor shall ensure that the AFC Installation Manual and each revision thereof has been reviewed and approved by the vessel captain and project superintendent prior to submittal to the Principal.
4. The Installation Manual shall contain the following detailed procedures and analysis:
 - a. pipe transportation, transfer, storage, and tallying procedures;
 - i. Contractors who propose the use of semi-submersible vessels shall submit detailed procedures for positioning cargo vessels alongside the vessel.
 - b. welding and non-destructive examination procedures;
 - i. These procedures shall be completed no later than 60 days prior to the start of mobilization or first construction welding of pipe (if multiple jointing takes place prior to offshore work).
 - ii. Welder qualification shall be completed no later than 30 days prior to scheduled start of mobilization, or first construction welding of pipe whichever comes first.
 - iii. A welding procedure and NDE procedure summary table shall be submitted four (4) months prior to start of mobilization or first construction welding of pipe.
 - iv. Procedure qualification includes successful completion of any reeling or fatigue testing qualification.
 - c. pipelay analysis results and procedures for pipelay tension control, operation, and monitoring, and relative sequence of pipe joint welding, pipe joint pay out and vessel movement;
 - i. This shall include copies of "computer analysis" for the Principal to review.

- d. installation of vortex induced vibration (VIV) suppression devices;
 - i. If VIV suppression make contact with any pipelay equipment, such as stinger rollers, the Contractor shall demonstrate by actual testing that this contact will not damage the VIV suppression devices.
- e. installation of buoyancy devices;
- f. pipeline crossing procedures;
- g. pipelay initiation and termination procedures - including handling of all PLETs (sleds) and manifolds and contingency procedures for recovery of a PLET (sled) when the pipe is flooded;
- h. riser installation procedures - including go-no-go philosophy;
- i. installation procedures for subsea hardware - including PLETs (sleds), manifolds, foundation piles, jumpers, if part of the Scope of Work;
- j. ROV operating procedures;
- k. vessel Positioning and Surveying Procedures - including detailed vessel positioning procedures for each incremental water depth of 60 m (200 ft.) increments maximum;
- l. abandonment and Recovery (A&R) procedures;
 - i. The Contractor shall have a qualified A&R winch operator on board at all times who is designated to operate the A&R winch(es) and is thoroughly familiar with the working of the winch(es).
- m. accidental flooding of the suspended pipe procedures;
- n. pipelay fatigue analyses during construction;
 - i. As a minimum this shall include fatigue analysis as specified in DEP 37.81.40.31-Gen.
 - ii. Unless otherwise specified by the Principal, the allowable fatigue budget for weld fatigue damage during installation shall not exceed 7.5% of the BS 7608-F2 curve on the outside diameter of the pipe, with a safety factor of 5 (i.e., factored allowable fatigue damage is 1.5% of BS 7608-F2).
- o. contingency procedure for dry or wet buckle recovery - including vessel stability analysis in case of a suddenly released load (cable break or dropped pipeline), stinger deballasting operations, tensioner operations, pipe cutting, dewatering, pig stopping, lifting, recovery head installation and A&R cable handling;
- p. the Contractor shall be capable of handling accidentally flooded pipe and be able to safely abandon a buckled pipe on seafloor with damage to pipelay equipment;
- q. pipe transportation and movement of pipe from pipe supply barge to lay barge - In the case of reel-lay pipelay installation method, this shall include details of the pipe assembly and spooling procedures;
- r. stinger installation, operation (including ballasting/deballasting if appropriate) and monitoring procedures;
 - i. Analysis performed to analyze stinger ballasting/de-ballasting procedures shall be provided to the Principal for review.
 - ii. Stinger settings plan shall be provided to the Principle for review.
- s. emergency response procedures - including evacuation of injured or sick personnel, and procedures for response to severe weather, including tropical storms;
- t. authority notification procedures for offshore incidents - such as spills, accidents, etc.