

DEP SPECIFICATION

UMBILICAL TRANSPORTATION AND INSTALLATION (AMENDMENTS/SUPPLEMENTS TO ISO 13628-5: 2002)

DEP 37.80.03.30-Gen.

September 2011

(DEP Circular 55/12 has been incorporated)

ECCN EAR99

DESIGN AND ENGINEERING PRACTICE



© 2011 Shell Group of companies

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, published or transmitted, in any form or by any means, without the prior written permission of the copyright owner or Shell Global Solutions International BV.

This document contains information that is classified as EAR99 and, as a consequence, can neither be exported nor re-exported to any country which is under an embargo of the U.S. government pursuant to Part 746 of the Export Administration Regulations (15 C.F.R. Parts 746) nor can be made available to any national of such country. In addition, the information in this document cannot be exported nor re-exported to an end-user or for an end-use that is prohibited by Part 744 of the Export Administration Regulations (15 C.F.R. Parts 744).

PREFACE

DEP (Design and Engineering Practice) publications reflect the views, at the time of publication, of Shell Global Solutions International B.V. (Shell GSI) and, in some cases, of other Shell Companies.

These views are based on the experience acquired during involvement with the design, construction, operation and maintenance of processing units and facilities. Where deemed appropriate DEPs are based on, or reference international, regional, national and industry standards.

The objective is to set the recommended standard for good design and engineering practice to be applied by Shell companies in oil and gas production, oil refining, gas handling, gasification, chemical processing, or any other such facility, and thereby to help achieve maximum technical and economic benefit from standardization.

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.

When Contractors or Manufacturers/Suppliers use DEPs, they shall be solely responsible for such use, including the quality of their work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will typically expect them to follow those design and engineering practices that will achieve at least the same level of integrity as reflected in the DEPs. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal.

The right to obtain and to use DEPs is restricted, and is typically granted by Shell GSI (and in some cases by other Shell Companies) under a Service Agreement or a License Agreement. This right is granted primarily to Shell companies and other companies receiving technical advice and services from Shell GSI or another Shell Company. Consequently, three categories of users of DEPs can be distinguished:

- 1) Operating Units having a Service Agreement with Shell GSI or another Shell Company. The use of DEPs by these Operating Units is subject in all respects to the terms and conditions of the relevant Service Agreement.
- 2) Other parties who are authorised to use DEPs subject to appropriate contractual arrangements (whether as part of a Service Agreement or otherwise).
- 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.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, Shell GSI disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any DEP, combination of DEPs or any part thereof, even if it is wholly or partly caused by negligence on the part of Shell GSI or other Shell Company. The benefit of this disclaimer shall inure in all respects to Shell GSI and/or any Shell Company, or companies affiliated to these companies, that may issue DEPs or advise or require the use of DEPs.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, DEPs shall not, without the prior written consent of Shell GSI, be disclosed by users to any company or person whomsoever and the DEPs shall be used exclusively for the purpose for which they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of Shell GSI. The copyright of DEPs vests in Shell Group of companies. Users shall arrange for DEPs to be held in safe custody and Shell GSI may at any time require information satisfactory to them in order to ascertain how users implement this requirement.

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

TABLE OF CONTENTS

PART I	INTRODUCTION	5
1.1	SCOPE.....	5
1.2	DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS	5
1.3	DEFINITIONS	5
1.4	ABBREVIATIONS	6
1.5	CROSS-REFERENCES	7
1.6	COMMENTS ON THIS DEP	7
1.7	DUAL UNITS.....	7
2.	GENERAL.....	8
2.1	PROJECT DOCUMENTATION	8
PART II	TUBE AND UMBILICAL TRANSPORTATION REQUIREMENTS.....	9
1.	UMBILICAL TRANSPORTATION	9
1.1	UMBILICAL TRANSPORTATION ON REELS	9
1.2	COORDINATION	11
PART III	AMENDMENTS/SUPPLEMENTS TO ISO 13628-5:2002	12
1.	UMBILICAL INSTALLATION.....	12
1.1	PRINCIPAL OVERLAY TO ISO 13628-5:2002	12
5.0	QUALITY ASSURANCE	12
6	DESIGN REQUIREMENTS	13
6.3	ANALYSIS.....	13
10	UMBILICAL MANUFACTURE AND TEST	14
10.2	VERIFICATION TESTS	14
13	PRE-INSTALLATION ACTIVITY	16
13.1	UMBILICAL INFORMATION.....	16
13.2	ROUTE INFORMATION	16
13.3	TERMINATIONS AND ANCILLARY EQUIPMENT INFORMATION	16
13.4	HOST FACILITY INFORMATION	16
13.5	SUBSEA STRUCTURE INFORMATION	16
13.6	HOST FACILITY VISIT	16
14	LOAD-OUT	17
14.2	TECHNICAL AUDIT OF LOAD-OUT FACILITIES.....	17
14.3	LOAD-OUT PROCEDURE	17
14.5	PRE-LOAD-OUT TESTS	18
14.6	LOAD-OUT OPERATION	18
14.7	STARTING AND STOPPING THE LOAD-OUT.....	19
14.8	HANDLING OF THE UMBILICAL	19
14.9	LOAD-OUT MONITORING.....	20
14.10	LOAD-OUT ON A REEL OR CAROUSEL.....	21
14.11	POST LOAD-OUT TESTS	21
15	INSTALLATION OPERATIONS.....	22
15.1	GENERAL.....	22
15.2	REQUIREMENTS FOR VESSEL AND EQUIPMENT	22
15.3	PRE-INSTALLATION SURVEY	25
15.4	I/J-TUBE PULL-IN OPERATIONS.....	25
15.5	LAY-DOWN OF SUBSEA TERMINATION	26
15.6	LAY ROUTE.....	26
15.7	HANDLING REQUIREMENTS FOR THE MAIN LAY	27
15.8	VESSEL POSITIONING TO ACHIEVE REQUIRED TOUCH-DOWN.....	27
15.9	CONTROL AND MONITORING OF LENGTH LAID	27
15.10	INTEGRITY MONITORING DURING LAY	27
15.11	BURIAL OPERATIONS	28
15.12	APPROACH TO SUBSEA TERMINATION POSITION (SECOND END)	29

15.13 LAYDOWN OF SUBSEA TERMINATION 29

15.15 PIPELINE CROSSINGS 29

15.16 ARMING OF WEAK LINK 30

15.19 POST PULL-IN TEST 30

15.20 POST HOOK-UP TEST 30

15.22 CONTINGENCIES 30

15.23 REPAIRS 31

15.24 POST INSTALLATION SURVEY 31

PART IV REFERENCES 33

PART I INTRODUCTION

1.1 SCOPE

This new DEP specifies requirements for umbilical transportation and installation, and its intended use is for deepwater subsea applications.

This document is written in four (4) parts. Part I specifies the minimum Principal requirements for project administration for the duration of the Purchase Order. Part II outlines Principal's minimum tube and umbilical transportation requirements.

Part III amends, supplements, and deletes various clause of ISO 13628-5:2002. Wherever reference is made to ISO 13628-5, it shall be understood to mean ISO 13628-5 as amended/supplemented by this DEP. For ease of reference, the clause numbering of ISO 13628-5 has been used throughout Part III of this DEP. Clauses in ISO 13628-5 which are not mentioned in this DEP, shall remain valid as written.

Part IV and V include a list of references and a bibliography, respectively.

This is the first revision of this DEP; however, it is an update of the following Company standards in whole or part:

- SDS-US-07, Revision 3, Umbilical Transportation and Installation Specification
- SDS-US-19, Revision 2, Tube and Umbilical Transportation Specification

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 oil refineries, chemical plants, gas plants, exploration and production facilities and supply/distribution installations. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process should 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.

1.3.2 Specific definitions

Term	Definition
Purchase Order	Defines equipment or contract requirements to Contractor for a specific Project Scope of Work
Design Working Pressure	Equivalent to the maximum allowable operating pressure as defined in API 17E/ISO 13628-5:2002 Section 3.1.13
Weld Procedure Specification	Defines and records all the different elements, variables, and factors that are involved in producing a specific weld or weldment
Procedure Qualification Record	Documents the qualification on a specific weld procedure specification
Welder Performance Qualification	Documents the individual qualification of each welder for a specific weld procedure specification

1.4 ABBREVIATIONS

A&R	Abandonment and Recovery
ADC	American Diving Contractor
API	American Petroleum Institute
ASOG	Activity Specific Operating Guideline
CoC	Certificate of Conformance
CoG	Centre of Gravity
CR	Conductor Resistance
DCC	Distance Cross Course
DP	Dynamic Positioning
DPO	Dynamic Positioning Operator
DWP	Design Working Pressure
EP	Extended Play
ETA	Estimated Time of Arrival
H	Hold
HDPE	High Density Polyethylene
IMCA	International Marine Contractor's Organization
IR	Insulation Resistance
ISO	International Standards Organization
ITP	Inspection and Test Plan
LBL	Long Base Line
MAOP	Maximum Allowable Operating Pressure
MBR	Minimum Bend Radius
NDE	Non Destructive Examination
OD	Outer Diameter
OSHA	Occupational Safety and Health Administration
PE	Professional Engineer
QP	Quality Plan
ROV	Remotely Operated Vehicle
ROW	Right of Way
SDH	Subsea Distribution Hardware

S&HO	Stab and Hinge Over
SWL	Safe Working Load
UTA-MM	Umbilical Termination Assembly Mudmat
UTH	Umbilical Termination Head
VIV	Vortex Induced Vibrations
W	Witness
WLL	Working Load Limit

1.5 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).

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be sent to the Administrator at standards@shell.com, using the DEP Feedback Form. The DEP Feedback Form can be found on the main page of "DEPs on the Web", available through the Global Technical Standards web portal <http://www.shell.com/standards> and on the main page of the DEPs DVD-ROM.

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.

2. GENERAL

Project specific variables shall be specified in the Project Scope of Work for umbilical installation and transportation Contractor.

Any concessions agreed upon between the Manufacturer/Supplier and Principal during tender negotiations shall be listed as technical clarifications to this DEP and included in any contract. Requests for concessions thereafter shall be in the form of a Technical Deviation Request, submitted in writing to and approved by the Principal.

2.1 PROJECT DOCUMENTATION

2.1.1 Contractor supplied documents

The Contractor shall prepare a Project Document Register that shall include the documents and drawings for all elements of scope awarded to the Contractor in the Project Scope of Work.

2.1.2 Principal supplied documents

The Principal shall provide the necessary information to support the Contractor's installation procedure.

The Principal shall provide location and route information in drawings provided in agreement.

The Contractor shall review the Principal's detailed design information to ensure that the Contractor's equipment, rigging, and procedures interface properly with hardware provided by the Principal.

The Principal shall provide the necessary host interface data to support the Contractor's installation procedure.

The Principal shall provide the necessary interface information relating to existing or future subsea structures and equipment at the subsea location to support the Contractor's installation procedure.

PART II TUBE AND UMBILICAL TRANSPORTATION REQUIREMENTS

1. UMBILICAL TRANSPORTATION

This section specifies the Principal's minimum requirements for handling and shipping of umbilical bundles on a reel or carousel.

The umbilical Manufacturer and Installation Contractor (referred hereafter as Contractor) shall address methods of handling, lifting, and moving tube reels and umbilical reels in their Quality Plans (QP) for any related scope of work in their Purchase Orders.

All reel movements, on Contractor's premises or "transportation" by land or sea are governed by (Part II).

1.1 UMBILICAL TRANSPORTATION ON REELS

1.1.1 Reel design and quality assurance

Reels shall be manufactured to a drawing approved by a professional engineer (PE) or Journeyed Engineer that includes the maximum tube (or product) and lift weights. Reel design shall address loads (longitudinal, transverse, and vertical) imposed by the anticipated transport methods including trucks, ships, and barges. The following information shall be stated on the reel drawing:

- Maximum tube (or product) weight
- Maximum lift weight
- Anticipated longitudinal, transverse, and vertical loads

The empty weight of the reel (tare) shall be measured and stencilled or marked with weld bead in contrasting paint on each flange. Reels shall be uniquely marked so that the reel can be traced to owner, fabricator, and fabrication date.

Installation reels shall be designed for installation and reeling loads as required by the Principal. During transport and while in rotating operation, the rims of the installation reel flanges shall be designed to operate under the full design load of the reel (i.e., while the drive system is rotating the reel) and not locally buckle. The reel shall be designed to rotate smoothly and evenly under full design load. Full design load shall consider umbilical, terminations, any installed accessories and any fluid contents.

Installation reels shall be coated for offshore operation in accordance with DEP 30.48.00.32-DWP.

Reel flanges shall be in good condition and free from missing pieces or other damage that could potentially harm the umbilical while loading onto the reel or during transportation.

The inside facing of the reel flanges shall be fully plated to prevent point loading umbilical damage during transportation and trans-spooling operations. The exterior structural design of the reel shall include "weep holes" as needed to allow for drainage of seawater/rainwater and prevent the formation of ice packs on the reel.

The reel shall have suitably located doubler plates to permit welding/cutting of seafastenings and support cradles without causing structural damage.

The reel supplier shall furnish a Certificate of Conformance (CoC) regarding the condition of the reel. Reels supplied for the project (rental or purchase) are subject to Principal inspection and approval.

To facilitate decisions for modifications to the reel during any emergency, the Principal shall be provided with as-built drawings and design specifications for any reel supplied by the Contractor.

1.1.2 Packing

The reel hub shall be manufactured as a fully plated circumferential cylinder. The reel hub radius shall be sized based on the strain of the single umbilical tubes in the bundle under

no tension. Maximum plastic strain of the governing single tube shall not exceed 0.5 %. If the reel hub requires being "built-out" for the project, the method and materials are subject to the Principal's approval.

The umbilical shall be spooled so that the wraps are evenly distributed across the reel.

In order to perform any post load-out testing and/or integrity monitoring during transportation, both terminations of the umbilical shall be easily and safely accessible.

Nothing shall extend beyond the outer diameter (OD) of the reel flange, unless approved by the Principal (e.g. for a bend stiffener that has an MBR preventing storage wholly within the reel volume envelope).

Umbilicals with pressure containing plugs/valves or threaded fittings, as appropriate, shall be accompanied at load-out with test plates for outboard connections to the umbilical tubing head (UTH) and electrical test caps. Test accessories furnished by the Principal are listed in the Project Scope of Work.

1.1.3 Marking

Reel gross weight [reel weight + tube weight + contents+ packing materials (if applicable)], with and without support cradles, shall be marked on each flange.

1.1.4 Accompanying documentation

Accompanying documentation shall be agreed to between the Principal and Contractor.

1.1.5 Lifting

The Contractor shall comply with the OGP Lifting and Hoisting Recommended Practices Report Number 376.

The reel shall only be lifted with a spreader bar. Spreader bar length shall be greater than the width of the reel.

All lifting equipment shall be rated appropriately, stamped, and certified. Certification papers shall be made available to the Principal. All rigging below the crane hook (wire, shackles, spreaderbar, etc.) shall have been load tested and certified for safe working load (SWL) or working load limit (WLL) within one year.

The Contractor shall develop a detailed lift plan specifying all equipment to be used during the lift and a step-by-step procedure. All equipment certification shall be available for the Principal to review prior to the lift.

All weights shall be accurately monitored and recorded during lifting. If the reel is on a drive mechanism, the mechanism shall be locked to prevent movement of the reel during lifting.

1.1.6 Cradles

Cradles shall incorporate doubler plates to permit welding and cutting for seafastening without causing structural damage to the cradle. Single cradles are preferred so to reduce access and interference problems on the deck of transit and installation vessels. If cross bracing is required between cradles, bracing shall be detachable and not welded in position.

Support cradles shall be marked on each side with weight and shall feature lifting padeyes marked with SWL.

1.1.7 Marine transportation

The reel shall be located on the vessel as close to the Centre of Gravity (CoG) and centreline as possible to minimize motion during transit. Risks associated with lifting of other cargo over the reel should also be considered and minimized.