

DEP SPECIFICATION

DEEPWATER UMBILICAL MANUFACTURING (AMENDMENTS/SUPPLEMENTS TO ISO 13628-5:2009)

DEP 37.80.02.36-Gen.

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DESIGN AND ENGINEERING PRACTICE



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PART I INTRODUCTION

1.1 SCOPE

This DEP specifies the requirements and give recommendations for manufacture of steel tube umbilicals for subsea applications.

This DEP is based on ISO 13628-5:2009. Part III of this DEP amends, supplements and deletes various clauses of ISO 13628-5:2009. Part III follows the clause numbering of ISO 13628-5 for easy reference.

All clauses of ISO 13628-5 not modified by this DEP remain valid as written.

Transportation and installation of umbilicals are not covered in this DEP; refer to DEP 37.80.03.30-Gen.

This is a revision of the DEP of the same number dated September 2011; 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.

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.

NOTE: In ISO 13628-5:2009, the term Customer is used. In this DEP, the term Customer shall be understood to mean the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Abbreviations

Term	Definition
BR	Bend Restrictor
BS	Bend Stiffener
CoC	Certificate of Conformance
CR	Conductor Resistance
DWP	Design Working Pressure
ETA	Estimated Time of Arrival
FAT	Factory Acceptance Test
GA	General Assembly
IR	Insulation Resistance
ISO	International Organization for Standardization
LV	Low Voltage
MBR	Minimum Bend Radius
MPS	Manufacturing Procedures and Specifications
MRB	Manufacturing Record Book
OD	Outer Diameter
PE	Polyethylene
RDS	Reel Drive System
QA	Quality Assurance
QP	Quality Plan
SFL	Steel Flying Lead
SWL	Safe Working Load
VIV	Vortex Induced Vibration
WPQ	Welding Operator Performance Qualification
WPQR	Welding Procedure Qualification Record
WPS	Weld Procedure Specification

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 revision of the DEP of the same number dated September 2011.

The basic purpose of this revision was to incorporate reference to the 2009 version of ISO 13628-5.

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.

PART II GENERAL REQUIREMENTS

1. GENERAL

ISO 13628-5:2009, Subsea Control Umbilicals, as modified by this DEP, shall be the basis for the specification. In all cases, this DEP shall govern over any ambiguities with the text of ISO 13628-5.

Part III of this DEP is written as amendments and supplements to ISO 13628-5:2009. Wherever reference is made to ISO 13628-5, it shall be understood to mean ISO 13628-5:2009 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.

Functional/project specific requirements shall be specified in the Project Scope of Work.

Any concessions agreed upon between the Manufacturer/Supplier and the 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. PROJECT DOCUMENTATION

2.1 MANUFACTURER/SUPPLIER SUPPLIED DOCUMENTS

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

2.2 PRINCIPAL SUPPLIED DOCUMENTS

The Principal shall provide the necessary information to support the Manufacturer/Supplier's design. The Manufacturer/Supplier shall review the Principal's detailed design information to ensure that the Manufacturer/Supplier's supplied equipment interfaces properly with hardware provided by the Principal. The Principal shall provide the necessary host interface data to support the Manufacturer/Supplier's end termination and riser design.

3. UMBILICAL REEL DESIGN AND MANUFACTURE

3.1 GENERAL

This Section identifies functional and physical information to be used in the design and manufacture of reels used for transportation, storage, and/or installation of umbilicals.

3.2 DESIGN CONSIDERATIONS

This Section provides a preliminary list of considerations for umbilical reel design.

3.2.1 General

The capacity of the reel is defined by the combination of the volume and the total weight the reel is designed to handle. Typical industry standard reel dimensions and capacity are shown in Table 2. Higher capacity reels are available in the market and may be utilized as required by the project with approval from the Principal. Capacity of standard reels may also be improved through structural strengthening.

Table 1 Standard dimension and capacity of reels

Parameter	86-44-50	92-44-50	106-44-50* Special Size
Outside Flange Diameter	8.6 m (28.2 ft)	9.2 m (30.2 ft)	10.6 m (37.8 ft)
Total Width	5.0 m (16.4 ft)	5.0 m (16.4 ft)	5.0 m (16.4 ft)
Drum Diameter	4.4 m (14.4)	4.4 m (14.4)	4.4 m (14.4)
Empty Weight	35 t (38.5 T)	44 t (48.5 T)	
Total Weight Limit Driven by reel structure, handling units, and lift capacity	250 t (275.6 T)	300 t (330.7 T)	350 t (385.8 T)

3.2.2 Reel design

The reel shall be manufactured to a drawing approved by a professionally qualified engineer or registered engineer. The maximum weight capacity (or product) and maximum total lift weight shall be noted on the drawing. Reel design shall address loads (longitudinal, transverse, and vertical) imposed by the anticipated transport methods including trucks, ships, and barges. The design criteria shall be stated on the reel drawing.

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 reel flanges shall be designed to support and not locally buckle under the full design load of the reel, i.e., while the drive system is rotating the reel. The reel shall be designed to rotate smoothly and evenly under the full design load. Full design load shall consider umbilical, terminations, any installed accessories, and any fluid contents.

Reel design shall work efficiently in two drive system configurations:

- Concentric Hub Interface – Two drive elements in horizontal plane driving the reel by the hubs located on the central axis of the side flanges
- Under-Roller Interface – Multiple drive rollers in horizontal plane driving the reel by the outer rim of both side flanges below the central axis

The reel shall have suitably located double-plated features or any Principal-approved alternative that permits welding/cutting of sea-fastenings and support cradles without causing structural damage.

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

Reel assembly and flanges shall be in good condition and free from missing pieces or other damage that could potentially damage the umbilical while loading onto the reel or during transportation and installation. All reel features and details shall be designed and fabricated to be free of all sharp edges and fouling points to allow for safe and smooth transfer of product on or off. The inside facing of the reel flanges shall be fully plated with Delrin (or similar HDPE) in a smooth and continuous manner to prevent point loading umbilical damage during transportation and trans-spooling operations. This plating shall be securely fastened with a system that does not allow hardware or components (secured or failed) to come in contact or damage the umbilical or product. All fixtures for the plating shall be fully recessed.

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.

Reel design shall include provisions/multiple handling points to ensure that the reel and its contents can be moved easily and safely from any position.

Reel partitions or features located 180° apart on opposite sides may be required to securely isolate two umbilical terminations from movement or damage. The size and complexity of these features shall account for required packing space for product, MBR, handling points and minimum envelope size that the termination shall pass through.

Any component of the assembly that is not welded and requires fastening shall be securely fastened with a system that does not allow hardware or components, secured or failed to come in contact or damage the umbilical or product during any operations.

Reels shall incorporate a lifting arrangement that allows it to be easily installed and removed from a drive system. A spreader bar shall be used to prevent side loading the flange.

Reels shall include lashing eyes equally spaced around reel flanges with capacity in tonnes shown.

3.2.3 Cradles

Cradles shall incorporate doubler plates to permit welding and cutting for seafastening without causing structural damage. Single cradles are preferred 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 be welded in position. Support cradles shall be marked on each side with weight and shall feature lifting padeyes marked with SWL.

3.2.4 Configuration and Packing

The reel hub shall be manufactured as a fully plated circumferential cylinder. The reel hub radius shall be sized based on the maximum allowable strain experienced in the largest single umbilical tube in the bundle while the umbilical is under the nominal tension required for spooling. This hub diameter size shall conform to the specified MBR of the umbilical bundle. The 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 material are subject to Principal approval.

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

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

Nothing shall extend beyond the 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).

Test plates for outboard connections to the Umbilical Termination Head (UTH), as well as electrical test caps, shall accompany the umbilical at load out with pressure-containing plugs/valves or threaded fitting as appropriate. Test accessories furnished by the Principal are listed in the Project Scope of Work.

On the outer wrap, the product shall be secured according to the packing drawing issued by the umbilical Manufacturer. The securing method/details are subject to Principal approval.

Umbilical manufacturing and installation operations require design applied tension values as agreed between the Principal and the Manufacturer/Supplier and documented in the reel design basis. The force is directed so to react against the "direction of pull" of the umbilical. This tension provides control of the product for maximum loading efficiency and protects from "free-spooling" or loss of control during unloading.

Anchor points (or alternative features) are required to secure the tension on the umbilical within 60 m (200 ft) of the free ends, from that point tension is minimized to permit safe handling operations.

Any load applied to an umbilical shall be reviewed and approved by the Principal prior to being implemented.

3.2.5 Transportation requirement

If included within the Project Scope of Work for the umbilical Manufacturer, transportation of the finished umbilical will be subject to the following:

- a) Marine Transport: Reel mounted umbilicals shall be located on the vessel as close to the Centre of Gravity (CoG) and centreline as possible to minimize motions during transit. Risks associated with lifting of other cargo over the reel shall also be considered and avoided where practical.
- b) Reels shall be secured, as a minimum, in accordance with applicable government and agency regulations. The Manufacturer/Supplier shall inform the Principal of the regulations that are being applied.
- c) At the Principal's discretion, sea fastening and loading shall be subject to inspection and approval by a qualified Marine Surveyor acting on behalf of the Principal.
- d) The transportation vessel shall be a self-powered vessel designed for blue water transport, i.e., a tug and barge arrangement is not acceptable for open water transport. Commercial shipping of reeled product is acceptable with Principal approval of shipping plan.
- e) The Manufacturer/Supplier shall nominate a responsible party to prepare and transmit a Vessel Daily Report to the Principal during the transit, including location, distance over the last 24 hours, ETA at intermediate and final locations, current weather, summary weather forecast, incidents, and any areas of concern.
- f) The Principal shall be notified within 24 hours of any events during transportation that could have potentially damaged the umbilical.
- g) Land transport: The umbilical reel shall be designed with overall dimensions that allow for ground transportation to the destination ports without the use of special permits. Designs that cannot meet this requirement may be granted concessions; however, the design shall be submitted to the Principal along with a fabrication plan, transportation plan, and load out plan and shall be subject to Principal approval.

3.2.6 Hub drive aspects for Reel Drive System (RDS)

The installation Manufacturer/Supplier shall supply detailed drawings and specifications for the hub interface of the RDS to the reel if the reel is to be used during installation.

3.3 ASPECTS FOR UNDER ROLLER DRIVE SYSTEM

An under roller drive system is suitable for onshore spooling operations only.

Size and weight limitations for under roller use shall be checked against a fully loaded reel to determine suitability.

Flanges need to be in-plane and parallel and at a true right angle to the reel hub. Flange thickness needs to be verified for loading. Outer surface of flange shall be smooth and free from defects which may prevent proper operation of under roller system.

At the Principal's request, reel flanges shall be surveyed by a third party at Manufacturer/Supplier's cost and shall be rectified to structurally adequate and smooth for under roller use at Manufacturer/Supplier's cost before use with the Principal product.

3.4 LIFTING AND HANDLING

All lifting and hoisting of umbilical reel(s) shall be performed in accordance with OGP Report No. 376.

The reel shall only be lifted with its designated spreader bar. The rigging assembly (spreader bar, associated slings and hardware) shall be designed to allow optional configurations. Slings will not be permanently attached and all components shall be tested and certified separately and as an assembly. Testing and certification of the rigging assembly shall be within 1 year of the date of lift.

All lifting equipment shall be rated appropriately, stamped, and certified. Certification papers shall be made available to the Principal prior to delivery.

The Manufacturer/Supplier 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 Principal review prior to the lift.

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

3.5 SURFACE PROTECTION

Reels shall be coated for offshore operation in accordance with project specifications.

3.6 SUITABILITY FOR WORKING ENVIRONMENT

The umbilical reel shall be designed for operation in the following environmental conditions:

- a) Ambient temperature range:
- b) Operation temperature shall be -17.78 °C to 48.89 °C (0 °F to 120 °F)
- c) Storage temperature shall be -17.78 °C to 60 °C (0 °F to 140 °F)
- d) Humidity may be as high as 100 %, salt-laden spray
- e) Roll loads not to exceed 0.55 G
- f) Pitch loads not to exceed 0.35 G
- g) Heave loads not to exceed 1.5 G
- h) Roll angle not to exceed $\pm 15^\circ$
- i) Pitch angle not to exceed $\pm 10^\circ$
- j) Heave not to exceed 1.2 G

3.7 LABELLING AND SHIPPING DOCUMENTS

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.

Each flange will be marked with the following:

- a) Reel gross weight (reel weight + tube weight + contents, if applicable + packing materials) with and without support cradles
- b) Project name
- c) Umbilical identifier
- d) Principal name
- e) Date

Shipping documents as specified and agreed to by the Principal shall accompany the reels at time of shipment.