

DEP SPECIFICATION

DEEPWATER SUBSEA DISTRIBUTION HARDWARE INSTALLATION

DEP 37.80.03.31-Gen.

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DESIGN AND ENGINEERING PRACTICE



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1. INTRODUCTION

1.1 SCOPE

This new DEP specifies requirements and gives recommendations for load out, transportation, and installation of Subsea Distribution Hardware (SDH) for deepwater subsea systems. These include diverless, guidelineless systems with a clustered, non-template architecture and without trolling or fishing protection. It covers guidelines for the subsea deployment and activities during each of the components' installation.

This is the first version of this DEP; however, it is an update of, and replaces the following Company standards:

SDS-US-11	rev 2	Subsea Distribution Hardware Installation Specification
SDS-US-12	rev 1	Subsea Distribution Hardware Installation Vessel 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 exploration and production. 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.

1.4 ABBREVIATIONS

Term	Definition
A&R	Abandonment and Recovery
DGPS	Deferential Global Positioning System
DP	Dynamic Positioning
EDM	Electrical Distribution Manifold
EFL	Electrical Flying Lead
ESFL	Electrical Steel Flying Lead
FLOT	Flying Lead Orientation Tool
HDM	Hydraulic Distribution Manifold
HFL	Hydraulic Flying Lead
MBR	Minimum Bend Radius
MQC	Multiple Quick Connection
ROV	Remotely Operated Vehicle
SDH	Subsea Distribution Hardware
SFL	Steel Flying Lead
UTAJ	Umbilical Termination Assembly Jumper
UTA-MM	Umbilical Termination Assembly – Mudmat

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 (12).

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 SDH Contractor.

The purpose of this DEP is to define the operational guidelines and equipment required to install individual SDH components and MQC-mounted SDH components. The component specifications, auxiliary equipment, and their associated rigging are defined in DEP 30.80.02.37-Gen.

SDH components include:

- a) Steel Flying Lead (SFL)
- b) Electrical Flying Lead (ESFL)
- c) Parking Frame
- d) Installation Frame
- e) Hydraulic Distribution Manifold (HDM)
- f) Electric Distribution Manifold (EDM)
- g) Hydraulic Flying Lead (HFL)
- h) Electrical Flying Lead (EFL)
- i) Umbilical Termination Assembly Jumper (UTAJ)

All of the MQC-mounted SDH components shall be deployed on a parking frame or else by reel or carousel. These components include:

- Logic Caps (LCs)
- Commissioning Caps
- Intermediate Logic Caps (ILCs)
- Test caps, electrical test connectors, dust covers, and protection caps

Individual SDH components shall be supplied by Principal and shall be configured or assembled by Contractor after load out and prior to deployment as needed. Contractor shall provide labour, equipment, safe work area, utilities, and craneage to prepare equipment for deployment and subsequent installation.

Principal shall supply the component installation location as well as the parking frame/deployment frame locations. Depending on the weight of the individual component, buoyancy modules may be necessary.

MQC-mounted SDS component installation locations shall require the removal of a protective cap, dust cover, or other SDH before the MQC-mounted SDH component can be installed. All removed components shall be re-installed or recovered to the surface.

This DEP is meant to provide guidelines for the subsea deployment and activities during each of the components' installation. These guidelines shall not relieve Contractor of its responsibility for providing full comprehensive procedures for subsea deployment and installation.

2.1 PROJECT DOCUMENTS

2.1.1 Contractor supplied documents

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

2.1.2 Principal supplied documents

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

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

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

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

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

3. INSTALLATION MANAGEMENT

3.1 PROJECT PLANS AND PROCEDURES

Contractor shall present detailed project plans and procedures for the proposed installation to Principal for review and approval prior to mobilization and as per the submittal schedule in the Project Scope of Work. The offshore procedures shall cover the full range of water depths for the project.

In particular, Contractor shall conduct a positioning analysis for the installation vessel throughout the incremental water depths to identify a safe working window for construction operations for all relevant weather headings and moderate or poor weather conditions.

Contractor shall not alter or deviate from these written procedures during construction unless previously approved by Principal's Representative through a documented Management of Change Process.

As a minimum, project plans and procedures shall include:

- a) Contractor's plans for receiving, storing, and handling Principal supplied items
- b) Plans for vessel rig-up and equipment layout
- c) Load out or transfer of SDH, deployment frames, and any other Principal free issued materials
- d) Transit plan
- e) Local mobilization plan
- f) Any intermediate spooling activities
- g) Tension, departure angle, and lay control procedures
- h) Survey and positioning procedures and LBL array, if specified in Project Scope of Work
- i) Deployment, positioning, and recovery procedures for the SDH
- j) Surface handling and subsea installation procedures for all SDH
- k) Monitoring during the lay and post installation tests
- l) Contingency plans for installation phases as specified in Project Scope of Work

3.2 QUALITY ASSURANCE

3.2.1 Project quality plan

Contractor shall supply a project quality plan in accordance with project specifications that include all equipment certifications, witness and hold points, and internal process audits.

3.2.2 Calibration of equipment

Prior to mobilization, Contractor shall ensure equipment is fit for its intended purpose and is calibrated and verified against known standards and where applicable the accuracy shall be traced back to international standards. Applicable test and measuring equipment shall be calibrated over full range (100% of measuring scale). Calibration certificates shall list the last and next calibration dates and shall be checked for validity before equipment use. Calibration records shall be available for checking at mobilization. Examples include the remotely operated vehicle (ROV) torque tool calibration tool, pressure test equipment, ROV bathymetry unit, vessel gyros, etc.

All instrumentation/measuring devices to be utilized during execution of the project shall be listed on a register with unique tag number and calibration status and submitted to the Principal's representative.

The tolerances for all electrical and mechanical instrumentation used to measure or monitor criteria stated in the inspection and test plan.

3.3 INSTALLATION ANALYSIS

All installation phases shall be analyzed and conclusions reported regarding operational and weather limitations in addition to other critical parameters. Sequence may be flipped and/or switched if applicable but the following phases shall be studied in the analysis as the basis for the Installation Procedures and Contingency Procedures:

- a) Overboarding of SDH
- b) Transfer of SDH from overboarding cranes or A-frames to downlines
- c) Installation of SDH
- d) Recovery of SDH
- e) Emergency abandonment and recovery (A&R) – dynamic analysis for worst case weather scenario and maximum service water depth
- f) Installation or recovery with restricted direct vertical access due to host or rig interference

Restrictions in vessel heading and limits in weather conditions for each heading shall be identified to determine the safe working window and layback range for each phase of the work. Specific parameters to consider in the analysis shall include:

- a) Significant wave height
- b) Wave period
- c) Currents
- d) Vessel offset range from existing surface or subsea structures
- e) Layback range for SDH
- f) Touchdown tension
- g) Curvature/bending radius
- h) Tension and compression in the SDH
- i) Departure angle from chute or from moonpool (if applicable)
- j) Contact angle or minimum clearance in moonpool envelope (if applicable)
- k) Layable curve limit
- l) Safe overboarding zones

The installation analysis shall also quantify the maximum and minimum steel flying lead/electrical steel flying lead/hydraulic flying lead/electrical flying lead (SFL/ESFL/HFL/EFL) loading such that when installing, abandoning, or recovering the flying leads, the load remains within elastic stress limits and the tension and bending radius at locations of controlled bending (e.g. lay chute or installation reel) remain within the limits set out in the Project Scope of Work. The loading constraints shall be listed in the appropriate installation and contingency procedures. The procedures shall ensure that the installation occurs within the operating limits of the equipment.

Contractor shall demonstrate that Contractor's cable (or down line) is suitably rated in accordance with Principal's lifting specification per the loading conditions in the analysis and Project Scope of Work. Contractor's cable shall be load tested prior to mobilizing for the work. Load test record from the start of the season is not acceptable.

4. INSTALLATION VESSEL REQUIREMENTS

The installation vessel shall be in compliance with DEP 37.90.10.32-Gen. The vessel must be of sufficient size [60 m (200 ft) minimum] to support all required equipment and personnel during continuous 24-hour operations for the entire length of the project.

The vessel shall comply with all governmental codes and regulations. Manufacturer/Supplier shall furnish the proper documentation of certification for the proposed vessel.

Specifications, deck plans, and photograph(s) of proposed vessel shall be submitted for Principal review.

Re-supply of food, fuel/lube, water and all items necessary for the efficient and continuous operation of the vessel shall be the sole responsibility of the Contractor.

Detailed anchoring and anchor movement procedures, including "Safe Anchoring" drawings for congested areas or near host/rigs, shall be developed for Principal approval.

The Principal shall survey the Contractor's proposed vessel prior to acceptance. This shall be to verify that Contractor's vessel is adequate to act as the project support vessel in regards to dynamic positioning (DP) capability, available mooring line, safety, and life saving equipment. Principal reserves the right to reject any vessel and/or vessel equipment deemed inappropriate for the project.

4.1 DYNAMIC POSITIONING SYSTEM REQUIREMENTS

The vessel shall be equipped with a fully redundant dynamic positioning system capable of continuous operation. See DEP 37.90.10.32-Gen. Additionally, the DP system must have the capability to track an ROV and continuously update the vessels position relative to the ROV.

4.2 SURVEY CAPABILITIES AND REQUIREMENTS

The installation vessel shall have, at a minimum, the following surveying capabilities:

- a) Contractor shall supply all surveying services associated with SDH installation.
- b) The positioning system shall be calibrated before use offshore. Calibration documentation shall be submitted for the Principal's review and approval prior to commencing work activities.
- c) Contractor shall supply beacons to track all items deployed subsea. Survey system must be capable of tracking beacons.
- d) When working close to drill rig or platform structure, survey shall position off (using) seafloor transponders, fan beam reflectors, or other means approved by Principal.
- e) It is the Contractor's responsibility to locate all existing pipelines, cables and other seafloor objects in the area of construction operations.
- f) Contractor shall provide a continuous CRT two monitor display of the vessel, umbilical route (proposed and actual), and vessel movement. The display shall also display the planned or existing locations for other flowlines or umbilicals in the corridor.
- g) If anchoring is utilized in any stage of the project, no anchor shall be placed closer than 300 m (1000 ft) from an existing pipeline or cable.
- h) If anchoring is utilized in any stage of the project and the mooring cable crosses the pipeline, no anchor shall be placed closer than 150 m (500 ft) from an existing pipeline or cable.

Pre-Installation survey requirements, as a minimum, shall include the following:

- a) Locate and identify existing Principal subsea equipment
- b) Identify x-y coordinate locations
- c) Visual survey of routes between equipment
- d) Verify clear area for landing equipment
- e) Define landing zones of frames and mudmats

The base case for all underwater positioning requirements shall be USBL, but Principal may opt for LBL positioning if specified in Project Scope of Work.

4.3 DECK EQUIPMENT REQUIREMENTS

The Contractor shall supply all A&R and deployment winches, deck tuggers, deployment chutes, reel units, swivels, auxiliary rigging, and cranes necessary to complete the installation work scope. All equipment shall be designed according to the loading conditions listed in the Project Scope of Work and per the analysis of this document (3.3). All lifting equipment and wire used on the winches, tuggers, and cranes shall be certified for the loading conditions and be designed with safety factors according to Principal's lifting specifications.

Contractor's winch and level winder shall be tested at dockside prior to mobilization. The winch wire shall be spooled on to the drum under tension and the winch spread shall be load tested prior to mobilizing for the work. A load test shall be performed for a load 1.25 times the maximum anticipated value for the work. Load gauges and payout gauges shall be re-calibrated and tested against a standard unless Contractor can demonstrate instruments have been calibrated and certified within the previous six months.

All down lines used to deploy SDH components shall require the use of a swivel. All mudmats, parking frames, and deployment frames shall use special designed bolt-type shackles that are ROV operable to ensure that the rigging maintains connection to the down line and load during deployment. ROV hooks shall not be used to deploy or retrieve any mudmat, parking frame, or deployment frame.

Contractor shall take all necessary precautions when handling the SDH to prevent damage of any sort. Lay chute, guide chutes, and rollers in contact with SDH during load out or laying operations shall be coated with a minimum thickness of 25 mm (1 in) of High-Density Polyethylene (HDPE) or approved equivalent. The SDH shall not be allowed to drag across unprotected metal surfaces. Bolts or fixtures shall be recessed and inspected regularly. Alternatively, metal surfaces shall be in good condition (smooth with no protrusions, exposed weld beads, etc.) and lubricated with water or approved fluid.

For SDH specific operations, additional surface handling equipment shall be provided by Contractor and, as a minimum, shall consist of the following unless specifically specified in the Project Scope of Work:

- a) Carousel/reel drive system (RDS) capable of interfacing with Principal provided carousel/reels, controlled payout/retrieval and back tension control.
- b) If product is to be transpoiled onto vessel/installation equipment then carousel/reel shall be capable of storage at specified minimum bend radius (MBR), controlled payout and retrieval, and back tension control.
- c) Overboarding chute with MBR specified in the Project Scope of Work.
- d) Vessel crane suitable for offshore use and handling of flying leads during transpooling, initiation, and abandonment activities.
- e) Deepwater winch suitable for project depths and anticipated loads.
- f) Deck space to accommodate SDH and any other tooling supplied by Principal or otherwise required to complete the Project Scope of Work.