

DEP SPECIFICATION

DEEPWATER JUMPER DESIGN, MEASUREMENT, FABRICATION AND TESTING

DEP 37.80.00.38-Gen.

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DESIGN AND ENGINEERING PRACTICE



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

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1. INTRODUCTION

1.1 SCOPE

This new DEP specifies minimum requirements for the design, fabrication, and testing of a deepwater subsea jumper system, used to make subsea connections establishing a flow-path between trees, manifolds, and/or flow-lines. It also specifies minimum requirements for making the measurements subsea and onshore required for jumper fabrication.

This DEP supersedes and is a combination of three previous Deepwater standards:

- Deepwater Subsea Well Jumper System, DEP 37.80.00.38 DWP;
- Subsea Jumper Fabrication and Testing, DEP 37.81.42.33-EPP, and;
- Jumper Metrology Surveys, DEP 37.81.40.37-EPP.

Refer to (1.5) for the main 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 subsea oil and gas production. Application in other facilities may also apply.

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 may 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 regard 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
Metrology	The measurement process to define the spatial relationship between two subsea connector hubs that are to be joined by a jumper.

1.3.3 Abbreviations

Term	Definition
AFC	Approved for Construction
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
AWS	American Welding Society
FAT	Factory Acceptance Test
FEA	Finite Element Analysis
ISO	International Organization for Standardization
JSA	Job Safety Analysis
MAOP	Maximum Allowable Operating Pressure
NDE	Non Destructive Examination
PLET	Pipeline End Termination
ROV	Remote Operated Vehicle
SIT	System Integration Test
VIV	Vortex Induced Vibration

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 (7).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a combination and update of three previous Deepwater standards:

- Deepwater Subsea Well Jumper System, DEP 37.80.00.38 DWP;
- Subsea Jumper Fabrication and Testing, DEP 37.81.42.33-EPP; and
- Jumper Metrology Surveys, DEP 37.81.40.37-EPP.

As such, it is not practical to list all of the changes with reference to the various parent documents. The following provides a brief description of only major changes with respect to the previous documents.

Major changes from DEP 37.80.00.38 DWP:

1. Connector related content is not included in this DEP. Instead, the new DEP 37.81.40.35-Gen. is referenced.
2. Jumper welding requirements to conform to DEP 37.81.40.31-Gen. for fatigue design were added.
3. Jumper length requirements changed.
4. Scope is expanded to include all jumpers, not only well jumpers.
5. Loads for dropped object (2.2) changed from 15kJ to 10kJ, subject to project requirements, and snag load from 45kN to 25kN, subject to project requirements.

Major changes from DEP 37.81.40.37-EPP:

1. The measurement document content becomes a section of this new DEP rather than a stand-alone document.
2. Detailed reporting and documentation requirements for metrology were added in (3.2.4) and (3.3.4).
3. Provision was added in (3.2.3.5) for alternate survey methods to take account of advances in technology.

Major changes from DEP 37.81.42.33-EPP:

1. An extensive section on jumper design (4.) is now included
2. Measurement and verification information superseded by the measurement information in (3) incorporated from DEP 37.81.40.37-EPP and updated.
3. A section on jumper testing, including FAT and SIT, is broken out separately as (5.4).
4. Section (6), covering documentation requirements was added

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.

2. GENERAL AND FUNCTIONAL REQUIREMENTS

2.1 GENERAL REQUIREMENTS

The Contractor shall have responsibility for ensuring that the jumper system meets the minimum requirements as set forth in this DEP. In particular, the Contractor shall:

NOTE There are various contracting and execution strategies that the Principal may choose in allocating the work associated with jumper design, fabrication, and testing. This section is written for the case of an overall jumper system Contractor responsible for all aspects of the jumper system. In other scenarios, there may be multiple Contractors involved, or the Principal may assume some of the work. Contractor responsibility for the items below will depend on the scope of work as defined in the contract.

1. Perform the appropriate engineering, design, and analysis of the jumper system to meet the requirements of this specification. This is to include structural analysis, piping analysis, a complete stack-up tolerance analysis, and an ROV access analysis.
2. Prepare all fabrication and assembly drawings, bills of materials, specifications (materials, welding, heat treatment, etc.), assembly and test instructions, and installation and operation & maintenance (O&M) procedures.
3. Procure all materials, parts, and sub-assemblies, and provide all labor, tools, and equipment required for fabrication, assembly and testing of the jumper system.
4. Perform testing of the jumper system, including Factory Acceptance Testing (FAT), and System Integration Testing (SIT) as required.
5. Prepare the jumper system for shipment. This is to include necessary clean up and refurbishment of the equipment after the FAT and SIT, including preservation fluids, coatings, handling, and interim storage.
6. Consider all interfaces and coordinate all interface information concerning the jumper system. The jumper system shall work in conjunction with, and interface with, other, mating equipment systems, installation equipment, and vessels.

2.2 FUNCTIONAL REQUIREMENTS

The jumper system shall be lowered to the connection points on the seafloor, and used to make permanent metal-to-metal sealed subsea connections between flow-lines, trees, and/or manifolds. The jumper system may include rigid pipe sections, pipe bends, forged components such as elbows or block tees, and/or flexible pipe sections. The jumper system shall include end connectors in accordance with DEP 37.81.40.35-Gen. The male connector hubs shall be located on subsea infrastructure connection points, while the female connector assembly half shall be part of the jumper spool.

The jumper shall meet the following functional requirements:

1. Provide the means to connect production, gas or water injection wells, flow-lines, gas lift lines, manifolds or PLET's as required by project field architecture, based on measurements taken of the subsea tie-in points, as described in (3.2).
2. Be capable of accommodating all applicable design loads, including those resulting from initial misalignment of the tie-in points and subsequent settlement and operational movement of the tie-in points.
3. Be capable of retrieval with the relevant "worst case" loads and misalignments applied.
4. Convey process fluids as appropriate, including all relevant chemicals and produced solids.
5. Production well or flowline jumper assemblies shall be provided with the required level of thermal insulation necessary to achieve the specified cool down period as defined in the Project Basis of Design document or data sheet.
6. Be suitable for remote guideline-less ROV assisted installation and retrieval.
7. Provide for sufficient structural strength and appropriate protection for sensitive

components to avoid damage from handling or impact loads.

8. All ROV landing and attachment points shall be designed in accordance with ISO 13628-8, to withstand all the forces developed by ROVs in the course of their installation or intervention operations.
9. All equipment installed on the seabed shall be suitable for the specified operating life without the need for planned maintenance, including any non-metallic components and anodes.
10. Size and weight of the jumper system shall be minimized to allow conventional installation techniques to be used from an ROV/light construction vessel, and to minimize hydrodynamic forces on the system as it is installed through the splash zone and on bottom where current effects are a concern.
11. Potential snagging points on the structure shall be minimized. The jumper system shall be designed to withstand snagging loads of up to 25kN applied in any direction, unless otherwise specified by the project documentation.
12. The jumper system shall be designed to withstand impact from an ROV travelling at 1 m/s, or a dropped object impact of 10kj over a circular area of 10 cm (4 in) diameter, unless otherwise specified by the project documentation.

2.3 LOAD CRITERIA

Analysis of the jumper system is required. Factors applied to the basic loads shall be in accordance with the requirements of the applicable design codes and regulations specified by Principal for use on the project. Contractor shall submit to Principal for review and approval a list of load criteria and design cases to be used for all the equipment within his scope of supply, which at a minimum shall include:

1. Maximum Allowable Operating Pressure (MAOP)
2. Maximum hydrostatic test pressure
3. Bending load profile
4. Torsion load profile
5. ROV and intervention loads
6. Snag loads
7. Maximum and minimum operating temperatures
8. Cyclic loads
9. Loads due to measurement and fabrication tolerances

2.4 CORROSION PROTECTION

A corrosion protection system shall be required for any jumper system component which is intended to remain subsea. A corrosion protection system based on a combination of materials selection, surface coating, and cathodic protection shall be included in the design, including ROV accessible cathodic protection inspection points for verification of performance during operation. The corrosion protection system shall be in accordance with DEP 30.10.73.32-Gen. Refer to (5.3.4) and (5.3.5) for requirements relating to coating and insulation.

All external materials shall be compatible with cathodic protection (i.e., not susceptible to hydrogen embrittlement) including welded components.

Anodes for cathodic protection may be supplied as part of the jumper system, or protection may be provided by anodes located on PLETs, trees, or manifolds that connect to the jumpers. Anodes shall be flush-mounted style, stand-off style, or both. Anodes shall be placed so that they do not prevent ROV access, and center of gravity is maintained. Anode design shall not snag ROV tethers.