Execution Plan

Statoil Frame Agreement

Subsea Rock Installation Services

Revision	Document Status	Date	Prepared by Project Engineer	Checked by Project Manager	Approved by Operations Manager
04	Re-issued for installation	17-03-2016	[redacted]		

Client	Statoil AS
Contractor	Van Oord Norway AS

Revision record

Revision Number	Description	Date
A	Issue for Review	13-05-2011
01	Re-issue for Installation. Fig 1.3.1. updated. Reference to Loading Plan Stornes added.	15-08-2011
02	Re-issued for Installation. - VOMS updated.	07-01-2014
03	Re-issued for installation - Deleted references to FFPV Tertnes	20-01-2014
04	Re-issue for installation -Updated reference documents	17-03-2016

Reference documents

Document Name	Revision	Date
Van Oord Management System (VOMS-GEN-03)	3	31 Aug 2015
Van Oord QHSE Policy (VOMS - PO-01)		01 Mar 2013
VOMS-PR2.04-OFF-IN-01 SRI instruction project data between office and vessel	4	15 Aug 2013
Van Oord Offshore QA/QC Instruction Specified Rock Grades for Subsea Rock Installation	5	20-01-2015

Related documents

Document Number	Document Name	Revision
105221-PRO.RPT-5.1-001	Project Plan	
105221-PRO.RPT-5.2-006	QHSE Management Plan	
105221-PRO.RPT-5.2-007	Emergency Preparedness Plan	
105221-PRO.RPT-5.2-008	Emergency Notification Flowchart	
105221-SAF.FOR-11.1-001	Risk Assessment Report	
105221-PRO.RPT-5.2-009	Construction Data Sheet	
105221-PRO.RPT-5.2-005	Survey Plan	
105221-PRO.RPT-5.2-004	Loading Plan Stornes	
105221-PRO.RPT-5.2-003	Loading Plan Nordnes	

Distribution list

Draft:	
Contractor Representatieve Van Oord Offshore	Original
Company Representative Statoil	1 Copy
For construction:	
Contractor Representatieve Van Oord Offshore	Original
Company Representative Statoil	2 Copies
Offshore Construction Manager	1 Copy

The Project Manager is responsible for logging and distribution of controlled and uncontrolled copies of the original project plan's various sections.

For practical reasons any amendment to these operations can be enforced by mutual agreement between Statoil and Van Oord Representatives, confirmed in writing either by e-mail, letter or memo. The Representatives are responsible for informing their personnel regarding any agreed amendment.

Table of contents

Abbreviations and definitions

Abbreviations

CDS	:	Construction Data Sheet
DP	:	Dynamic Positioning
DTM	:	Digital Terrain Model
ETA	:	Estimated Time of Arrival
FPROV	:	Fall Pipe Remote Operated Vehicle
FPSO	:	Floating Production Storing and Offloading unit
KP	:	Kilometre Point
MBE	:	Multi Beam
OCM	:	Offshore Construction Manager
ROV	:	Remote Operated Vehicle
UTM	:	Universal Transverse Mercator
VOO	:	Van Oord Offshore

Definitions

- Pipeline or Cable crossing — A pipeline or cable crossing will occur when two or more pipeline/cable routes have a point of intersection. This point of intersection is solved by constructing a ramp. This ramp will change the elevation of the new pipeline or cable, thus making a crossing possible and providing the minimum separation between existing and new pipeline/cable.
- Ramp — A Ramp is a rockfilled body providing support to the pipeline or cable. This support brings the pipeline or cable to another elevation required for crossing. This ramp is constructed prior to pipe/cable laying (Pre-lay rock installation).
- Pipeline/cable cover — A pipeline/cable cover is a rockfilled body constructed on top of the ramp and pipeline or cable. This pipeline cover may serve for various reasons (e.g. Stabilisation, impact protection, fishing protection, upheaval buckling, insulation) (Post-lay Rock Installation)
- Pre-lay Rock Installation — Pre-lay Rock Installation means Rock Installation before the new pipeline or cable is installed.
- Post-lay Rock Installation — Post-lay rock installation means Rock Installation after the new pipeline or cable is installed
- Benchmark — A Benchmark is a natural or artificial subsea feature with known horizontal and vertical position which will be used for comparisons of surveys and position checks.
- Reference heap — A Reference heap is a circular shaped benchmark consisting of rock material.
- Trench — An artificial ditch to lower the pipe below seabed level.
- Backfilling — After trenching of a pipeline or cable or cable the trench may be filled either with natural seabed material or with a finer grading of sand or gravel. Backfilling may be performed by the trencher or by means of a flexible fallpipe.

• Continuous pipeline or cable cover	A continuous pipeline or cable cover is a rockfilled body constructed on top of the pipeline or cable and immediately adjacent to it. This rockfilled body provides extra stability to the pipeline or cable after laying.
• Freespan	A freespan is the distance defined by the pipeline or cable over a length where it is not supported by the seabed or a support. When Pipeline or Cable Covering is required over this distance continuous sand and/or gravel fill will be incorporated. This continuous sand and/or gravel fill will provide the basis for the Pipeline or Cable Covering.
• Uplift Prevention	Rock installation to avoid upheaval buckling of the expanding pipeline. The height of the construction will be specified to a certain level above the pipeline.
• Axial Locking	In areas where the temperature of the pipeline changes with the operational conditions, the maximum feed-in length to buckled areas is controlled by axial locking of the pipeline within certain intervals. The height of the construction will be specified to a certain level above the pipeline.
• Buckling	Buckling is the displacement of a pipeline in lateral directions caused by the expansion characteristics of the pipeline.
• Benchmark	A Benchmark is a natural or artificial subsea feature with known horizontal and vertical position which will be used for comparisons of surveys and position checks.

1 Introduction

1.1 General

Van Oord aims to perform the scope of work as safe as possible. Therefore Van Oord complies with all applicable legal standards for QHSE Management and safe work.
Van Oord strives to reduce the number of lost time incidents to zero and to keep risks to personnel and the environment at a level as low as reasonably practicable.

1.2 Description of project

The Contract is entered into between Statoil (Client) on the one part and Van Oord Norway AS (Contractor) on the other part.

The main objective of the Frame Agreement under the Contract is to achieve a performance of the services in a manner which will satisfy both the requirements of the Client and the Authorities during the Frame Agreement.

The Work to be performed by Contractor comprises the performance of all activities necessary to complete Subsea Rock Installation, based on Client provided engineering.

Under the Frame Agreement several Projects can be appointed to Contractor. The projects can contain one or more typical activities of the following services:

- Axial locking (AL)
- Free span mitigation (FS)
- Pipeline Crossing (PC)
- Pipeline Protection – Jetted Trench (JT)
- Pipeline Protection, pipeline on seabed (PP)
- Pipeline Protection – Ploughed Trench (PT)
- Rock Carpet (RC)
- Uplift prevention (UP)
- Rock foundation (RF)
- GRP Cover (GC)

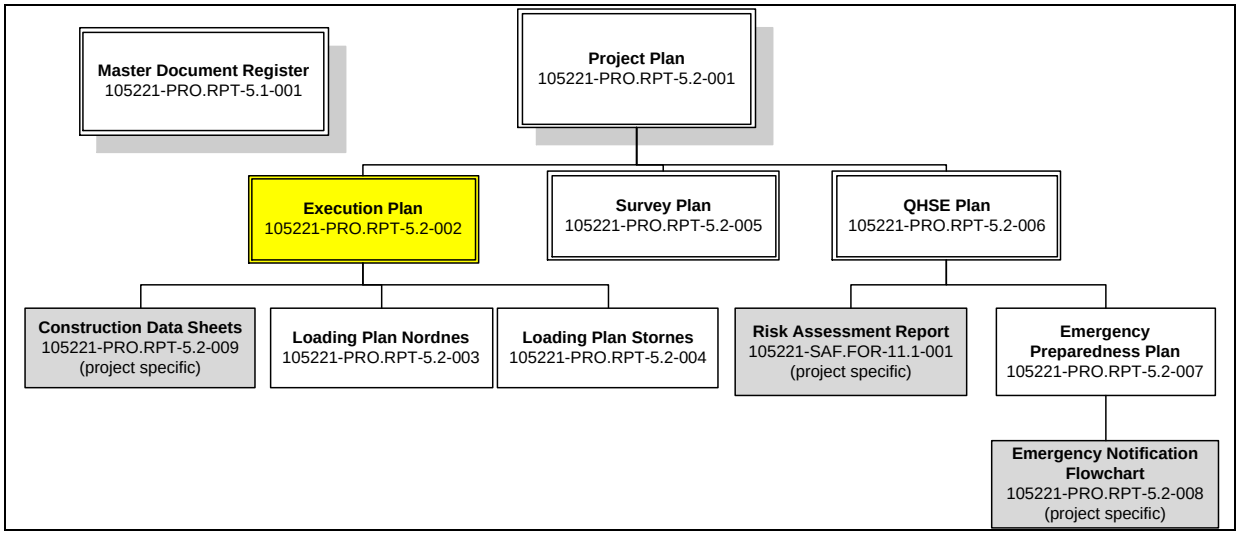
For project specific Scope descriptions reference is made to the project specific “Construction Data Sheets”.

1.3 Objective

The purpose of this execution plan is to describe the rock installation process of the Flexible Fall Pipe Vessel from loading the rock to performing the Post survey. This document should be read in conjunction with the Project Plan.

1.4 Scope

This document is part of the “umbrella” document: The Project Plan. The figure below shows the structure of the SRI Project Plan and all the related documentation. In yellow is the Execution Plan.



2 Scope of work

The Work to be performed by Contractor comprises the performance of all activities necessary to complete Subsea Rock Installation, based on Client provided engineering.

Under the Frame Agreement several Projects can be appointed to Contractor. The projects can contain one or more typical activities of the following services:

- Axial locking (AL)
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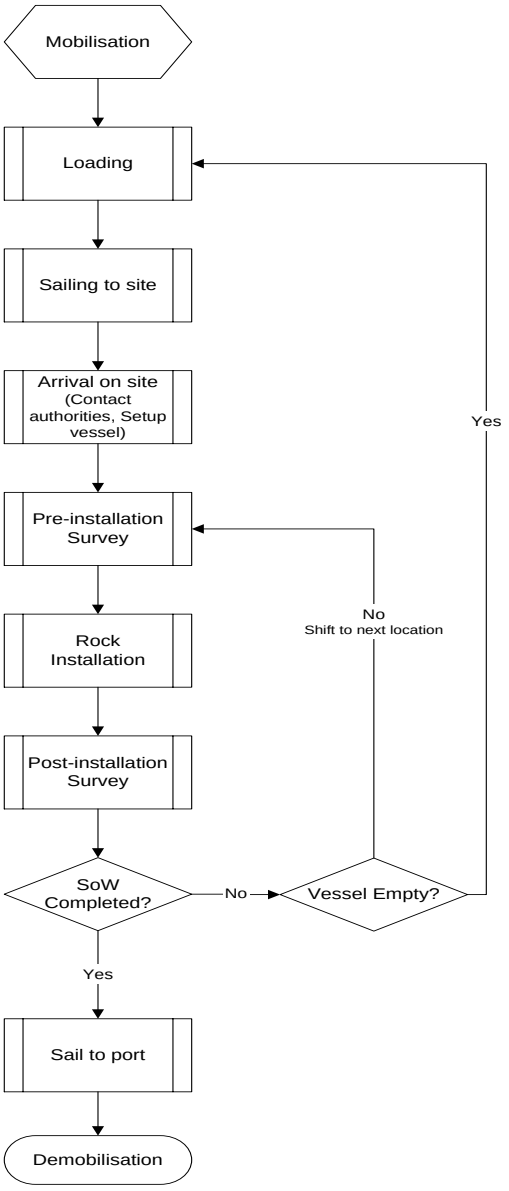
- Pipeline Crossing (PC)
- Pipeline Protection – Jetted Trench (JT)
- Pipeline Protection, pipeline on seabed (PP)
- Pipeline Protection – Ploughed Trench (PT)
- Rock Carpet (RC)
- Uplift prevention (UP)
- Rock foundation (RF)
- GRP Cover (GC)

For project specific Scope descriptions reference is made to the project specific “Construction Data Sheets”.

3 Method Statement

The scope of this chapter is to describe how the overall installation operations are carried out during project activities onboard. The process which VOO carries out to execute subsea rock installation is depicted in the flow chart below.



3.1 Mobilisation Vessel

Mobilisation of the vessel will take place at the port of loading. The representative(s) is (are) requested to embark the vessel at the port of loading.
The Project Manager will give client sufficient notice of vessel's ETA at the loading site.
The Project Plan, Drawings, Specifications and other relevant documentation will be sent to the vessel for attention of the OCM.

3.1.1 Loading

Where the vessel will load will differ per project under the Frame Agreement and will be specified in the project specific CDS. The SRI project team will determine where the vessel will load prior to execution of the project. A list of possible quarries to use can be found in the Project plan section 2.2.3.
The OCM will notify the quarry/loading contractor and the Vessels Agent for the latest update on the ETA of the vessel at the quarry, in order to be sure that the loading of the vessel can start without delays.
The rock is tested prior to loading of the vessel and the test results (grading curves) shall be presented to the Client representatives *(See detail of rock testing in section 5.2).* Before and after loading the Chief Officer will make a draft survey in order to calculate the quantity of material loaded.

For the Loading plan of FFPV Nordnes, reference is made to 'Loading Plan Nordnes' (105221-PRO.RPT-5.2 LPN)
For the Loading plan of FFPV Stornes, reference is made to 'Loading Plan Stornes' (105221-PRO.RPT-5.2 LPS)

On completion of the loading the vessel will sail to location.

3.1.2 Positioning and Survey Equipment

The vessel is in an operating mode continuously and regular calibrations and field checks of positioning and survey equipment are executed. All calibration and field check reports on board the vessel are available to the Client/Main Contractor representatives for inspection.
For more details on the calibrations, field checks and the geodetic parameters reference is made to the Survey Plan (105221-PRO.RPT-5.2 SUP).

3.2 Rock Installation Operations

3.2.1 Arrival on site

The following main activities will be carried out upon arrival on location:

- Contact authorities;
- Navigation comparison checks;
- DP set-up;
- Deck and pre-dive checks
- Launching of fall pipe ROV minimum 75 meter away from any underwater structure, pipeline, cable or safety zone.
- Launch of the FFP may take place during survey operations.

3.2.2 Pre-Installation survey

A pre-installation survey is carried out to obtain reference and initial seabed profile prior to the rock installation operations. If necessary, the pre-survey data can be used to establish a line database in case client supplied line database is significant different from the actual as-found situation. The DTM survey will be executed using the multi beam echo sounder (MBE) equipment on the FPROV.
For more details on the pre-installation survey reference is made to the Survey Plan (105221-PRO.RPT-5.2 SUP)

3.2.3 Subsea Rock Installation

SRI will generally be performed with the vessel in auto track mode at a constant speed. The position of subsea asset relative to the FPROV which is found mainly with the MBE will be based on the established database.

The FPROV pilot may make small lateral corrections to keep the FPROV above its intended track. During rock installation operations, information of the achieved profiles will be obtained from the profilers, situated 4.0 m from the centre of the FPROV. The actual achieved profile is checked against the required profile and corrective actions can be taken by changing the feeder output or the tracking speed of the vessel.
The build-up of the rock berm depends on the actual material flow (tons/hour) in combination with the tracking speed of the vessel (centimetres/second). The quantities installed will be calculated / monitored by means of a weighing device in combination with a speed sensor under the conveyor belt.
All installation processes will be monitored by performing check surveys during installation operations. The OCM is responsible for obtaining high standard rock installation results.

3.2.4 Post-installation survey

After rock installation, a post DTM survey of the top of the rock berm will be executed. The post-survey will be matched and compared with the corresponding pre-survey to measure the rock berm build-up over the target subsea asset. The post survey will validate the post installation result with the design of the rock berm.
For more details on the post-installation survey reference is made to the Survey Plan (105221-PRO.RPT-5.2 SUP)

3.2.5 Video Survey

In general a continuous video survey can be recorded during the pre- and post survey when specifically required. The video survey shows date-time-KP and UTM co ordinates. This will be logged in the video log. The video survey is subjected to visibility.

3.2.6 Quantity Measurement

To measure and quantify the practical material quantity installed the following two methods shall be used on board the vessel:

a. Draft survey before and after a trip
The Chief Officer shall execute draft surveys before and after loading to calculate the exact quantity of rock material loaded.
When a Trip is completed, whether before a reload or before demobilization, the Chief Officer will execute an end of trip draft survey to calculate the exact installed quantity of rock material.
When the vessel is empty upon completion of the trip the installed tons are equal to the loaded tons.

b. Measurement of installed quantities on board by using the belt's weighing device
Measurements to quantify the quantity of rock material used during the project shall be compiled by reading the belt's weighing device (Ramsey) continuously. This instrument shall record constantly the quantity of rock installed.
In the Daily Progress Report the weighed quantity of installed rock material will be noted for each location as estimated tons.
After the end of trip survey, the estimated quantity can be corrected to the actual quantity if the tons displayed on the weighing device (an indication) are not equal to the actual loaded tons as calculated by the draft surveys.
In this manner the measured tons on board are corrected linear to the actual tons for each location and so noted in the Daily Progress Report as actual tons.
The Ramsey belt's weighing device consists of a load sensor device integrated into the frame of the belt conveyor and a processor/display unit. The technology is based on a belt speed sensor, a load cell and a microprocessor. The Ramsey belt's weighing device accuracy is verified periodically.

4 Rock Installation Procedure

This chapter will describe the outlines of construction procedure to build up the rock berm.
Details for construction of individual projects under the Frame Agreement will be described in a Construction Data Sheet (CDS). The construction procedure in the CDS shall be read in conjunction with this chapter unless specifically written. A CDS contains information regarding:

- Rock berm geometry
- Rock installation locations
- Seabed characteristics
- Survey and Positioning
- Construction Method
- Tolerances
- Rock specification

4.1 Construction Pre-lay supports

This section outlines the general aspects applicable to all pre-lay supports.
All installation processes will be monitored by performing check surveys during rock installation operations. A check survey will be made after completion of each phase in order to establish the performance and to be able to monitor the settlement behaviour before next construction stages are started.

4.1.1 Counterfill

The installation of the Counterfill will be executed together with the start of the Main fill. Generally the Counterfill consists of rock blanket which will be installed by means of repetitive berms adjacent to and on top of each other. These berms will be oriented as much as possible parallel to the depth contours of the seabed.

4.1.2 Main fill

The installation of the body of the support will be carried out in the main fill area up to the topping-up level, which below the target level. The vertical build up will consist of horizontal rock layers, with a thickness as indicated on the CDS. Each rock layer will be installed by means of repetitive berms adjacent to and on top of each other. These berms will be oriented as much as possible parallel to the depth contours of the seabed and the start will be made at the deepest part of the area to be rock-filled.

4.1.3 Topping-up

The Topping-up comprises accurate rock installation on top of the Main-fill up to the target elevation. The vertical build-up to the final level will be carried out by thin rock layers, as indicated on the Datasheets, within the applicable tolerances. The Rock Installation direction is the free choice of the Superintendent. After the Topping-up a post-survey will be made to verify the geometry of the Rock Supports.

In a later stage, an additional Topping-up phase may be necessary prior to the pipe-lay in case of an update of the design target elevation, unexpected settlement or otherwise.

4.1.4 Rock Carpets

For the construction of Rock Carpets the multiple layer method will be used. The Multiple Layer method is applicable when the size of the Rock Carpet is of a significant size. Each rock layer will be installed by means of repetitive berms, adjacent to and on top of each other if not mentioned in the construction data sheet. Dump directions are free to be chosen by the OCM but are generally parallel or perpendicular to the pipeline.

4.2 Construction Post-lay supports

This section outlines the general aspects applicable to all pre-lay supports.
All installation processes will be monitored by performing check surveys during rock installation operations. A check survey will be made after completion of each phase in order to establish the performance and to be able to monitor the settlement behaviour before next construction stages are started.

4.2.1 Main fill

Different methods for the construction of Pre- and Post-lay Rock Supports can be used. The method to be used depends on the height of the Freespan correction and the size of the Rock Support. For detailed information of the specific Rock Support reference is made to the applicable Datasheet. The method to be used is decided upon the results of the Pre-rock Installation survey. The following construction methods for the main fill can be applied.

- **Spotdump method**
  The Spotdump method will be executed when the height of the Freespan correction is minimal and the size of the Rock Support is not sufficient for Rock Installation repetitive berms. When using the Spotdump method the natural slope of the spotdump will extend under the pipeline, providing the support required for the pipespan rectification in case of Post-lay installation.
- **Multiple Layer method**
  The Multiple Layer method is applicable when the size of the Rock Support is of a significant size. In this case free span correction will be established by constructing a Rock Support with a vertical build-up of horizontal rock layers. Each rock layer will be installed by means of repetitive berms, adjacent to and on top of each other if not mentioned in the construction data sheet. Dump directions will be identified in the Construction datasheets

4.2.2 Counter fill filling construction

The installation of the counterfill, if applicable will be executed together with the main fill. Generally the Counterfill consists of rock blanket which will be installed by means of repetitive berms adjacent to and on top of each other. These berms will be oriented as much as possible parallel to the depth contours of the seabed. Rock installation will commence at the deepest part of the area to be rock-filled.

4.3 Pipeline or Cable Crossings

Constructing pipeline or cable crossings may be executed in two stages. These construction stages are:

4.3.1 Pre-lay construction stage

Pre-lay construction works involves constructing the continuous ramp required for changing the elevation of the pipeline or cable and to provide the minimum required separation between the existing and the new line. This ramp will be typically constructed by using the Multiple Pass Method. The number of passes needed for constructing the required ramp depends on the height of the pipeline or cable crossing and size of the area to be rock filled. Reference is made to the applicable Construction Datasheets.

The Multiple Pass method consists of the vertical build-up of horizontal rocklayers. Each rocklayer will be installed by means of repetitive berms near and on top of each other. Rock installation will be started at the lowest part of the ramp and end near the pipeline. Second and repetitive layers will be started closer to the pipeline thus creating a slope required for the pipeline or cable crossing. Installation directions are perpendicular or at an oblique angle to the pipeline or cable to be crossed.

4.3.2 Post-lay construction stage

The Post-lay intervention works consists of the installation of rock required for pipeline or cable covering.

4.4 Pipeline or Cable Covering

Different construction methods are possible, depending on the height and size of the area to be rock installed. Reference is made to the applicable datasheets. The use of the Single Pass Method or Multi- Pass Method is decided upon the results of the post-lay survey. The following construction methods for the Pipeline or Cable Covering can be applied.

- **Single Pass method**

For the Single Pass Method rock installation will be carried out in one single run. The vessel will be tracked along a pre-determined route, maintaining speed and installation rate for achieving the designed profile.

- **Multiple Pass method**

The Multiple Pass method is applicable when the required profile is of significant size. Pipeline or Cable Covering can be performed by the vertical build-up of horizontal rock layers. Each rock layer will be installed by means of repetitive berms near and on top of each other. The slope of the first strings (side strings) will extend under the pipeline or cable, thus providing the required rock filling for Pipeline or Cable Covering. The final cover of the pipeline or cable may be obtained by installing over the centre of the pipeline or cable. Installation directions are parallel to the pipeline or cable.

5 Rock Procurement

5.1 Material Specification

The rock material be used will differ per project under the Frame Agreement and will be specified in the CDS. In average the material will have a specific density of 2.6 t/m^3 and a grading similar to the following:

1"- 3" (22/90 mm)			
	Target	Min	Max
D_{max}	--	--	125 mm
D_{90}	75 mm	60 mm	90 mm
D_{50}	50 mm	40 mm	60 mm
D_5	22 mm	16 mm	32 mm

1"- 4"			
	Target	Min	Max
D_{max}	--	--	125 mm
D_{90}	100 mm	90 mm	115 mm
D_{50}	60 mm	50 mm	70 mm
D_5	22 mm	16 mm	32 mm

1"- 5" (22/125 mm)			
	Target	Min	Max
D_{max}	--	--	150 mm
D_{90}	125 mm	110 mm	135 mm
D_{50}	75 mm	60 mm	90 mm
D_5	22 mm	16 mm	32 mm

The grading shall be maintained through loading, transport and unloading.

Bulk Densities of Proposed Quarries
Hereunder an overview is given of the approximate average bulk density values for the proposed quarries:

- Norstone AS 1.55 t/m³
- Norock & Co 1.72 t/m³
- Halsvik Aggregates AS 1.55 t/m³
- Norstone AS 1.55 t/m³
- Bremanger A/S 1.55 t/m³
- Gunnar Holth A/S 1.55 t/m³
- AquaRock AS 1.55 t/m³
- Stema Shipping AS 1.55 t/m³
- Kvantum AS 1.55 t/m³

5.2 Material Testing

5.2.1 Rock testing procedures, Verification test prior to loading

Grading curve
The verification tests will be performed by an independent laboratory.
The grain size distribution is tested prior to the loading operations at the source of the rock material.
At least one representative sample will be taken from the stockpile before loading of the vessel.
The grain size analysis will be done as follows. A sample will be taken with a weight of a couple of hundred kilograms. The grading of the rock will be determined by weighing the amounts of rock that are retained on the different sieves. The cumulative percentages of material passing the different sieves are calculated and plotted. If the actual grading curve lies within the specified envelope the test has passed.
The grading curve will be made available to Van Oord, Client and the vessel prior to loading. Copies of the grading curves will be incorporated in the As-Built Report.

Specific gravity
The grain specific gravity is determined using standard tests which measure weight and volume of individual stones.

5.2.2 Inspection during production

It is specified that the grain size distribution shall be tested at regular intervals during the material production, with a minimum of one sample every five thousand (5000) tonnes.

This testing will be done by the quarry as part of the production control. At least every 5000 tons a sample will be taken from the production line with a weight of a couple of hundred kilograms.
The test results (grading curves) obtained during production of the rock material will be sent to Van Oord for internal quality control.

6 Appendices

Appendix 1 Specimen Construction Data Sheet

Van Oord
Marine ingenuity

APPENDIX 1

Specimen Construction Data Sheet

Construction Data Sheet

Toll P12 Post-lay campaign 1

A	For review	03-05-2011	BMU	RBB
Revision	Document Status	Date	Prepared by Project Engineer	Approved by Project Manager

Client	Statoil
SRI Contractor	Van Oord Offshore

Revision record

Revision Number	Description	Date
A	For review	03-05-2011

Reference documents

Document Name	Revision	Date
Van Oord Management System		August 2009
Vessel Specific Manual Nordnes (VOMS-PR.2.04-OFF-OD-03)	4	01-09-2010
Construction Procedures (OS-CON-00XX)	4	01-11-2009
TR 1370 Technical and professional requirements Statoil	02	19-05-2009

Related documents

Document Number	Document Name
PM-VAN-SBI-00001	Project Manual
SRI-VAN-SBI-00001	SRI Manual
SM-VAN-SBI-00001	Survey Manual
SEM-VAN-SBI-00001	Survey equipment manual
QHSE-VAN-SBI-00001	QHSE Manual

Distribution list

Project Manager Van Oord Offshore
Client Representative
Offshore Client Representative
Offshore Superintendent

CONTENTS

Abbreviations and definitions

Abbreviations

DGPS	Differential Global Positioning System
FFPV	Flexible Fall Pipe Vessel
FPROV	Fallpipe ROV
HiPAP	High Precision Acoustic Positioning
KP	Kilometre Point
MSBL	Mean Seabed Level
MSL	Mean Sea Level
N/A	Not Applicable
PC	Pipeline crossing
PP	Pipeline Protection, line on seabed
ROV	Remotely Operated Vehicle
SRI	Subsea Rock Installation
TBA	To be advised
TOP	Top of Pipe
COP	Centre of Pipe

Definitions

Axial locking	In areas where the temperature of the pipeline changes with the operational conditions, the maximum feed-in length to buckled areas is controlled by axial locking of the pipeline within certain intervals. The height of the construction will be specified to a certain level above the pipeline
Counterfill	A counterfill is a rock fill blanket draped (partly) around the main fill of a support thus securing the geotechnical stability of the support by means of counter weighing.
Free span	A free span is defined as the distance of the pipeline which is not supported by the seabed or a support.
Free span mitigation	Seabed rectification to mitigate pipeline free spans. Also ensure sufficient lateral pipeline stability during installation in curves.
Main fill	The main fill is the rock fill heap that forms the body of the support
Pipeline/cable cover	A pipeline/cable cover is a rock-filled body constructed on top of pipeline or cable. This cover may serve for various reasons e.g. stabilisation, impact protection, fishing activities protection, upheaval buckling, insulation.
Pipeline/Cable crossing	Preparations for crossing of existing pipeline or cable. Certain rock thickness is required for minimum vertical separation between existing and new lines.
Rock carpet	A rock carpet is installed to control lateral friction in an area where the pipeline is expected to move laterally due to pipeline expansion
Uplift prevention	Rock installation to avoid upheaval buckling of the expanding pipeline. The height of the construction will be specified to a certain level above the pipeline.

1 INTRODUCTION

1.1 DESCRIPTION OF PROJECT

Due to the anticipated decrease in reservoir pressure, a new 36" pipeline is planned in order to maintain the gas quantity transported from the Troll gas field to Kollsnes. The new pipeline, denoted P12, is to be installed along the common Troll corridor, except for the last section approaching the existing subsea riser termination.

1.2 OBJECTIVE

The purpose of this Construction Data Sheet is to provide the details for the execution of the Subsea Rock Installation works on Troll P12 Post-lay.
This document is not a stand alone document and should be read in conjunction with the following documents:

- PM-VAN-SBI-0001_rev2 Project Manual, providing Vessel and Rock Installation Equipment Descriptions.
- SRI-VAN-SBI-0001_rev1 Rock Installation Manual, which provides Construction Procedures, Vessel Handling Procedures, and Rock Quality Procedures. A Construction Procedure describes the typical features of its subject activity with emphasis on the actual construction/installation activities, irrespective of its exact location. For instance the typical Rock Installation sequence and the interaction with the survey activities are included in these procedures.
- SM-VAN-SBI-0001_rev2 Survey Manual, providing the Survey Operations Procedures with the FPROV, including calibrations, field checks, processing, etc.
- SEM-VOO-SBI-0001_rev2 Survey Equipment Manual, which provides detailed Equipment Descriptions of the survey and positioning equipment.
- LP-VAN-SBI-0001_rev1 Loading procedures
- EPM-VAN-SBI-0001_rev1 Emergency preparedness Manual
- QHSE-VAN-SBI-0001_rev1 QHSE Manual
- RMP-VAN-SBI-0001_rev1 Risk management procedures
- Construction Drawings.

Risks of the operations shall be assessed in accordance with the procedures referred to in the Offshore QHSE Manual and Risk management procedures.

2 SCOPE OF WORK

2.1 GENERAL DESCRIPTION

The scope for this campaign is part of the complete Troll P12 Post-lay scope for 2011. The complete Scope of Work list for Troll P12 Post-lay can be found in Appendix 1. The scope to be executed this campaign is marked in yellow. The total volume of the marked scope is 9,355 M^3.
For a field lay-out of the design Troll P12 area, reference is made to Appendix 2.

2.2 THEORETICAL BERM GEOMETRY

The scope consists of post-lay SRI for crossings (CR) and 3 of them include Counterfills (CF). All the specifications regarding berm geometry can be found in the Scope of Work list.
The side slope requirement is 1:2.5. The slope of the topplane will follow the slope of the seabed. The topplane width will be 2 meter.

The locations where counterfills are required are the following:
2-OFF-2200-CR
2-OFF-2220-CR
2-OFF-2250-CR

3 start and end-KP's are given in the scope list for these locations. The complete berms for these locations are split in 3:
- 2 berms with a height of 'Centre of Pipe' (at the start and at the end of the complete berm).
- 1 berm with a height of 'TOP + 0.5' (in the middle).

2.3 DRAWING REFERENCE

None

2.4 STATOIL PROJECT IDENTIFICATION NUMBER

Project identification number is ST11811

The coding to be used for as-built charts: start from C030-ZX-P12-FB-134-01
up to max C030-ZX-P12-FB-199-01

3 SEABED CHARACTERISTICS

- Water depth: between 295 – 350 meter
- The seabed comprises very soft clay. The undrained shear strength is 2 kPa increasing with depth.

4 SURVEY AND POSITIONING SYSTEMS

For details survey procedures and survey equipment on Nordnes reference is made to:

- SM-VAN-SBI-0001_rev2 Survey Manual, providing the Survey Operations Procedures with the FPROV, including calibrations, field checks, processing, etc.
- SEM-VOO-SBI-0001_rev2 Survey Equipment Manual, which provides detailed Equipment Descriptions of the survey and positioning equipment.

There are no additional survey requirements to this project.

4.1 SURVEY PARAMETERS

Transformations between WGS84 and ED50 shall be in accordance with the Guidance Note Number 10, April 2001, Geodetic Transformations Offshore Norway, paragraph 14.

▪ Satellite datum and spheroid	:	WGS84, WGS84
▪ Survey datum and spheroid	:	ED50, International 1924
▪ Projection	:	Universal Transverse Mercator
▪ UTM Zone	:	31
▪ Datumshift parameters from WGS 84 to ED 50 South of 62o North	:	dX = +90.365m dY = +101.130m dZ = +123.384m rX= -1.614µrad (-0.333sec) rY = -0.373µrad (-0.077sec) rZ = -4.334µrad (-0.894sec) Scale = -1.994ppm
▪ Vertical datum	:	MSL

Transformation method: Position Vector, 7-parameter transformation

The reverse transformation (ED50 to WGS84) is code 1613 in the EPSG geodetic parameter database.

4.2 POSITION CHECK

Prior to starting the SRI the Nordnes will test its positioning equipment by performing a position check. The position check will be done on a feature on the seabed with a known position in the vicinity of the work. Features with known locations might be looked op in the client provided event listing.

5 CONSTRUCTION METHOD

For detailed construction method descriptions reference is made to the Construction Procedures, also summarized in the SRI Manual.

For the Reinertsen construction method description and installation tolerances reference is made to Appendix 3, 'guideline for Installation of Post-lay supports'.

5.1 TOLERANCES

Standard tolerances for main supports:
Vertically: -0.0 /+ 0.4 m
Horizontally for main support: -0.0 / upper limit given implicitly by the vertical tolerance in the side slope

Standard tolerances for the counterfills are:
Vertically: -0.0 /+ 0.4 m
Horizontally: -0.0 / no upper limit given (for stability reasons)

6 ROCK MATERIAL

6.1 SPECIFICATIONS

The rock to be used shall have an average specific density no less than 2.65 Te/m3.

The preferred grading used for the Gas export pipeline is 1-3 inch where 1-5 inch is also allowed as alternative.

Rock Grading	1" – 3"
D_{10}	16 – 35 mm
D_{50}	35 – 60 mm
D_{90}	60 – 85 mm

Rock Grading	1" – 5"
D_{10}	16 – 40 mm
D_{50}	60 – 100 mm
D_{90}	105 – 125 mm

7 QHSE

7.1 RISK ASSESSMENT REPORT

For the risk Assessment report reference is made to Appendix 4

7.2 EMERGENCY NOTIFICATION FLOWCHART

For the Emergency Notification Flowchart (ENF) reference is made to Appendix 5

8 APPENDICES

Appendix 1 Scope of Work list
Appendix 2 Field lay-out
Appendix 3 Reinertsen guidline for installation of post-lay supports
Appendix 4 Risk assessment report
Appendix 5 Emergency notification Flowchart

APPENDIX 1:

Scope of Work list

APPENDIX 2:

Field Lay-out

APPENDIX 3:

Reinertsen guidline for installation of post-lay supports

APPENDIX 4:

Risk assessment report

APPENDIX 5:

Emergency notification Flowchart