	Company Document ID	Sheet of Sheets 1 / 91	
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LBA CCS TRANSPORT AND STORAGE PROJECT

DOUGLAS SUBSEA

CABLE INSTALLATION AND MARINE OPERATIONS OUTLINE PROCEDURE

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1.0 INTRODUCTION

1.1 Project Overview

Eni's Liverpool Bay CCS Transport & Storage Project (LBA CCS T&S Project) is being developed in parallel with and as a key part of the HyNet Northwest full-chain hydrogen and CCS industrial decarbonisation project (the HyNet Project, see Figure 1-1), which is designed to transform a region of the UK into the world's first low carbon industrial cluster by 2030. The HyNet Project was conceived in 2016 with the objective of decarbonising the entire industrial cluster to Net Zero. The HyNet Project is being developed on a phased approach based on CO_2 emissions capture from existing industrial facilities, alongside capture from new-build hydrogen generation facilities. While industrial decarbonisation is the anchor, the HyNet Project builds the infrastructure backbone for a full regional hydrogen economy and leverages the opportunity to repurpose for future CCS service the existing oil and gas facilities at Point of Ayr and offshore in Liverpool Bay. CO_2 storage is provided in well-known gas fields that are owned and operated by Eni UK.

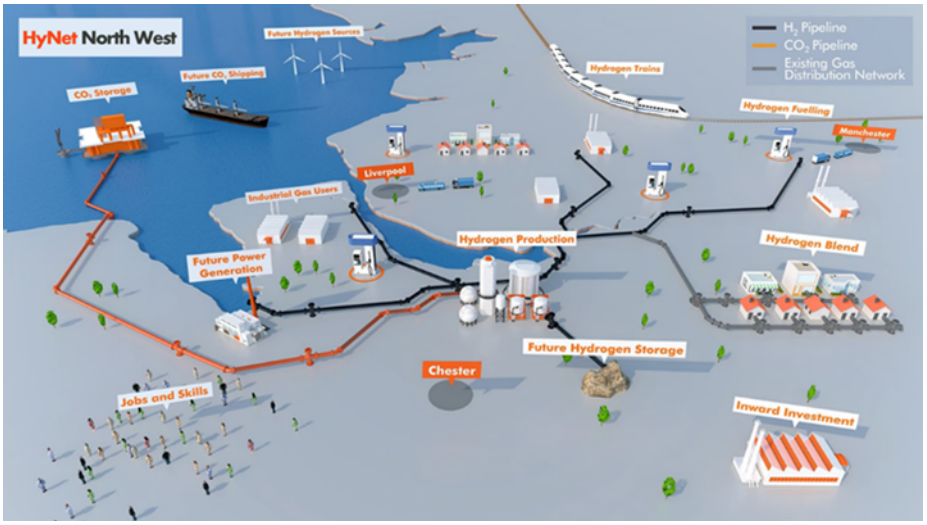


Figure 1-1 Hynet Project North West Project Overview

As part of Onshore Scope, CO_2 emissions from these sources will be transported along a new-build pipeline which will connect Ince AGI (Above Ground Installation) with Stanlow AGI and then run from Stanlow AGI to the south of Chester, and then on to the Flint AGI located in the vicinity of Connah's Quay power station which is the termination point of the existing pipeline (P852). At the Flint AGI the new-build pipeline will connect to the existing pipeline (owned and operated by Eni). The existing onshore natural gas import pipeline will be re-purposed to become a CO_2 export pipeline and will transport the CO_2 to the existing Point of Ayr (PoA) gas terminal.

As part of Offshore Scope, the existing offshore natural gas import pipeline from PoA gas terminal will be re-purposed to become a CO_2 export pipeline and will transport the CO_2 to the New Douglas Platform. From the New Douglas, CO_2 will be transported along re-purposed natural gas pipelines to the Hamilton platform for injection into the Hamilton reservoir, to the Hamilton North platform for injection into the Hamilton North reservoir, to the Lennox platform for injection into the Lennox reservoir.

The present document defines indicative key project data and criteria to be used for Offshore Project Scope (PoA, New Douglas & Satellite platforms).

2.0 PURPOSE OF DOCUMENT

The purpose of this document is to describe the marine operation outline procedure for installation of five (5) new power cables that run from Point of Ayr to New Douglas Platform and from Douglas Platform to Hamilton Main, Hamilton North, and Lennox Platform and to enable relevant Contractors to develop their own proposals for executing the works.

The document purpose is to highlight major installation characteristics such as cable lay, crossing and J-Tube pull-in procedure and providing the relevant data /information in order to ensure a safe and efficient installation of power cables.

The outline procedure shall be updated during the next design phase considering criteria, methods, information reported in this document and according to Company specifications and project actual information/data (e.g., transportation and installation marine spread characteristics, load-out and transportation analyses results, construction yard facilities and quay characteristics, etc.). Based on updated procedures, the relevant Contractors Shall then develop detailed Installation, Load-out, Transportation Manual, including relevant contingency plans, defining methods and resources that they intend to employ for the execution of the marine operation activities. Contractor procedures for onshore preparatory works, installation, load-out and transportation Shall comply with Company Specifications and with MWS criteria/requirements.

3.0 DEFINITION AND ABBREVIATION

3.1 Definition

Term	Definition
Company	The party that initiates the project and ultimately pays for its design and construction i.e., Eni UK. COMPANY will generally specify technical requirements. The term “COMPANY” also includes agents or consultants authorised to act for, and on behalf of, COMPANY.
Contract	An acceptance of legal relations between two or more parties for the transfer of goods or services for value.
Subcontractor	Any business which has agreed to carry out construction operations for another business or body which is a contractor or deemed contractor
Contractor	A person or organisation that undertakes responsibility for the execution of a contract.
Supplier	The party (Manufacturer or Vendor) that manufactures or supplies equipment or services to perform the duties specified by the Company or Contractor
Shall	A mandatory provision
Should	An advisory provision

3.2 Abbreviations

AHT	Anchor Handling Tug
BCE	Bow Cable Engine
BEIS	Department of Business, Energy, and Industrial Strategy
CCS	Carbon Capture and Storage
CLV	Cable Laying Vessel
CO_2	Carbon Dioxide
CoG	Centre of Gravity
DA	Douglas Accommodation Platform
DAF	Dynamic Amplification Factor
DCC	Direct Cable Connection
DD	Douglas Production Platform
DGPS	Differential Global Positioning System
DMA	Dead Man Anchor
DP	Dynamic Positioning
DPO	Dynamic Positioning Officer
DPR	Daily Progress Report
DW	Douglas Wellhead Platform
FCG	Flushing, Cleaning and Gauging
FEED	Front End Engineering and Design
FOC	Fibre Optic Cable
HAT	High Astronomical Tide
HAZID	Hazard Identification Study
HAZOP	Hazard Operability Analysis
HH	Hamilton Main Platform
HMPE	High Modulus Polyethylene
HN	Hamilton North Platform
Hs	Significant Wave Height
HWM	High Water Mark
H_2S	Hydrogen Sulphide
ICPC	International Cable Protection Committee
JSA	Job Safety Analysis
KP	Kilometre Point
LAT	Lowest Astronomical Tide
LBA	Liverpool Bay Area
LD	Lennox Platform
MARPOL	The International Convention for the Prevention of Pollution from Ships
MBL	Minimum Breaking Load
MBR	Maximum Bending Radius
MOC	Management of Change
MSL	Mean Sea Level
MSV	Multi-Purpose Support Vessel
MT	Metric Tonne
MWS	Marine Warranty Surveyor
OD	Outside Diameter
OCM	Offshore Construction Manager
OGA	Oil and Gas Authorities
OSI	Oil Storage Installation
PTW	Permit to Work
RAT	Rope Access Team
RFHU	Ready for Hook Up
RIB	Rigid Inflatable Boat
ROV	Remote Operated Vehicle

PoA	Point of Ayr
PTW	Permit to Work
SWL	Safe Working Load
SoW	Scope of Work
TBC	To Be Confirmed
TCPA	Town and Country Planning Association
TDM	Touch Down Monitoring
TDP	Touch Down Point
TOC	Top of Cable
TOP	Top of Pipe
TSV	Trenching Support Vessel
UKCS	UK Continental Shelf
USBL	Ultra Short Baseline
WD	Water Depth
WoW	Waiting on Weather
WT	Wall Thickness

4.0 REFERENCES

4.1 Company Standard

[Ref 1] Eni Doc. Nr. 08832.ENG.MME.SDS, "General Specification – Offshore Steel Structures", Rev. 9, Dec 2020.
[Ref 2] Eni Doc. Nr. 08833.ENG.MME.SDS, "General Specification – Offshore Platforms – Offshore Structures Construction", Rev. 7, Dec 2019.
[Ref 3] Eni Doc. Nr. 23001.ENG.MET.PRG, "Design of Fixed Offshore Structures", Rev. 2, Dec 2020.
[Ref 4] Eni Doc. Nr. 23002.ENG.MET.ORG, "Functional Specification – Fixed Offshore Structures", Rev. 1, March 2009.
[Ref 5] Eni Doc. Nr. 20225.ENG.ELE.STD, "Transport and Laying of Submarine Electric Cables – Rev.03 – March 2012"
[Ref 6] Eni Doc. Nr. 193130BGPU01587, "List of Applicable Codes and Standards".
[Ref 7] Eni Doc. Nr. 23006.SLI.OFF.FUN, "Functional Specification for Positioning".
[Ref 8] Eni Doc. Nr. 23027.STR.NAV.FUN, "Installation of Offshore Structures".
[Ref 9] Eni Doc. Nr. 23015.SLI.OFF.FUN, "Pre-Construction Marine Surveys".
[Ref 10] Eni Doc. Nr. 23016.SLI.OFF.FUN, "Functional Specification for As-Laid and As-Built Surveys".
[Ref 11] Eni Doc. Nr. ENI E&P Standard 1.3.3.27, "Minimum Safety Standard for protecting against Hydrogen Sulphide (H2S).
[Ref 12] Eni Doc. Nr. 27953.ENG.SAF.STD, "Mechanical Isolation Philosophy and Procedures".

4.2 International Codes and Standard

[Ref 13] API RP 2A-WSD, "Planning, Designing and Constructing Fixed Offshore Platforms – Working Stress Design", 22nd Ed. November 2014.
[Ref 14] AISC 335-89, "Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design", 9th Ed. June 1989.
[Ref 15] ISO 19902, "Petroleum and natural gas industries — Fixed steel offshore structures"
[Ref 16] ISO 19901, "Petroleum and natural gas industries — Specific requirements for offshore structures.
[Ref 17] DNV-ST-F101, "Submarine Pipeline Systems, latest edition"
[Ref 18] DNV Rules for Classification of Ships, Part 3, Chapter 1, 2012.
[Ref 19] Code of Practice for temporary works, procedures, and the permissible stress design of false work BS 5975, 2008.
[Ref 20] DNV-ST-N001: 2020, "Noble Denton Marine Services Warranty Standard".
[Ref 21] DNV-RP-F105, "Free Spanning Pipelines"
[Ref 22] EN 10025, "Hot rolled Products of structural Steels".
[Ref 23] EN 10204, "Metallic products – types of inspection documents".
[Ref 24] ISO 2768, "General Tolerances", 1989.
[Ref 25] ISO 13920, "Welding — General tolerances for welded constructions — Dimensions for lengths and angles — Shape and position", 1996.
[Ref 26] AWS D1.1, "Structural Welding Code – Steel", 2015.
[Ref 27] IMCA M179, "Guidance on Use of Cable-Laid Slings and Grommets".
[Ref 28] BEIS Guidance Notes, "Decommissioning of Offshore Oil and Gas Installations and Pipelines".
[Ref 29] UK Petroleum Act 1998.
[Ref 30] Pipeline Safety Regulations 1996.
[Ref 31] (OIS) 4/2013, Health and Safety Executive Offshore Information Sheet.

4.3 Project Documents

[Ref 32] 1025H0BGRB09002 "Basis of Design Offshore 4.5 Mtpa (Gas Phase) – Feed & 10 Mtpa (Dense Phase) – Feasibility".
[Ref 33] 1025H0BGES09003 "LBA CCS Transport & Storage Project, Project List of Applicable Standard".
[Ref 34] 1025H0BGRV09098 "Design of New Facilities and Replacement of Existing Facilities".
[Ref 35] 1025H0BFRB09501 "HSE Design Philosophy".
[Ref 36] 1025H0BGEX09006 "Project Assumption Register".
[Ref 37] 1025H0BGQB09801 "Project Quality Plan".
[Ref 38] 1025H0BFRB09510 "PoA & Offshore HAZID Report".
[Ref 39] 1025H0BFRV09511 "PoA & Offshore ENVID Report".
[Ref 40] 1025HTBOSC89010 "Site Survey Report Point of Ayr Terminal".
[Ref 41] 1023DSBNDN85018 "Cable Installation and Marine Operations Drawings".
[Ref 42] 1025H0BJRV09235 "Constructability Report - Point of Ayr and Foreshore".
[Ref 43] 1025HTBNMI85019 "Nearshore Cable Marine Operations Outline Procedure".
[Ref 44] 1025H0BEST40801 "Technical Specification for Submarine Cable".
[Ref 45] 1025H0BSDG84100 "New Offshore Power Cable and Fibre Optic Field Layout (Onshore Section).
[Ref 46] 1025H0BSDG84104 "New Offshore Power Cable and Fibre Optic Field Layout (Offshore Section)".
[Ref 47] 1025H0BSRA84106 "Offshore Subsea Cable Stability Study".
[Ref 48] 1025H0BSRV84107 "Offshore Subsea Cable Protection Requirement".
[Ref 49] 1025H0BSSA84108 "Power Cable Installation Specification".
[Ref 50] 1025H0BSSA84109 "Offshore Power Cable Trenching and Backfilling Specification".
[Ref 51] 1025H0BSDG84110 "Offshore Power Cable No.1 PoA to Douglas Alignment Sheet".
[Ref 52] 1025H0BSDG84141 "Offshore Power Cable -No.2 PoA to Douglas Alignment Sheet."
[Ref 53] 1025DSBSDG84142 "Offshore Power Cable Douglas to Hamilton North Alignment Sheet
[Ref 54] 1025DSBSDG84143 "Offshore Power Cable Douglas to Lennox Alignment Sheet".
[Ref 55] 1025DSBSDG84144 "Offshore Power Cable Douglas to Hamilton Main Alignment Sheet".
[Ref 56] 1025HTBLDL80026 "Onshore Power Cable Power 1 Alignment Sheet - Point Of Ayr to Junction Box".
[Ref 57] 1025HTBLDL80027 "Onshore Power Cable Power 2 Alignment Sheet - Point Of Ayr To Junction Box".
[Ref 58] 1025H0BSDN84112 "Offshore Power Cable - Approach Drawings".
[Ref 59] 1025H0BLDG84145 "P908 Beach and Point of Ayr Approach Drawing".
[Ref 60] 1023DSBSRV84183 "Offshore Cable Preliminary Routing Report".
[Ref 61] 1025DSBSCZ84173 "Offshore Cables Preliminary Crossing Report".
[Ref 62] 1025H0BNSC85022 "Marine Warranty Surveyor Scope of Work".
[Ref 63] L-700-SB-006 "Metocean Criteria for Lennox Platform Vol.1.".
[Ref 64] L-700-SB-007 "Metocean Criteria for Lennox Platform Vol.2.".
[Ref 65] L-700-SB-008 "Metocean Criteria for Lennox Platform Vol.3.".
[Ref 66] H-800-SB-002 "Metocean Criteria for Hamilton East Platform Vol.1."
[Ref 67] H-800-SB-003 "Metocean Criteria for Hamilton North Platform Vol.1."
[Ref 68] H-800-SB-004 "Metocean Criteria for Hamilton Platform Vol.1."
[Ref 69] H-800-SB-006 "Metocean Criteria for Hamilton Platform Vol.2."
[Ref 70] H-800-SB-007 "Metocean Criteria for Hamilton Platform Vol.3."

[Ref 71] D-500-SB-002 "Metocean Criteria for Douglas Platform Vol.1– Design Criteria".
[Ref 72] D-500-SB-003 "Metocean Criteria for Douglas Platform Vol.2 – Operational Presentation".
[Ref 73] D-500-SB-004 "Metocean Criteria for Douglas Platform Vol.3 – Supporting Information."
[Ref 74] D-520-PP-001 "Douglas Production Platform Plot Plan - Weather Deck".
[Ref 75] D-520-PP-002 "Douglas Production Platform Plot Plan – Mezzanine Deck".
[Ref 76] D-520-PP-003 "Douglas Production Platform Plot Plan– Cellar Deck".
[Ref 77] D-520-PP-004 "Douglas Production Platform Plot Plan – Under Deck".
[Ref 78] 1023DDBODE89804 "Jacket J-Tube Assembly and Details - Douglas".
[Ref 79] 1023DDBODE89820 "Deck Extensions /Modifications Elevation and Plan Drawings Douglas".
[Ref 80] 1023DDBODE89821 "Deck Extensions /Modifications Section and Details Drawings Douglas.
[Ref 81] Report No. 91/2126-1 Rev 3 Feb 92 Hamilton Field Landfall and Terminal Facilities, Volume 1: Factual Data.
[Ref 82] Report No. 91/2126-2 Rev 1 Feb 92 Hamilton Field Landfall and Terminal Facilities, Volume 2: Interpretive Analysis.
[Ref 83] Report No. 9212622 May 92 "Hamilton Field Terminal Facilities.
[Ref 84] 1025H0BGRV09407 "Ground Investigations Factual Laboratory Report".
[Ref 85] 1025H0BGRV09408 "Ground Investigations Interim Interpretative Report".
[Ref 86] 2018_021_AL_PL1030_01_1000 "PL1030 Alignment Chart - Sheet 1 OF 20 KP 0.000 TO KP 1.713".
[Ref 87] 2018_021_AL_PL1030_02_1000 "PL1030 Alignment Chart - Sheet 2 OF 20 KP 1.663 TO KP 3.451".
[Ref 88] 2018_021_AL_PL1030_02_1000 "PL1030 Alignment Chart - Sheet 3 OF 20 KP 3.401 TO KP 5.042".
[Ref 89] H-000-QR-025 "Pipelines Annual Report 2017.
[Ref 90] H-000-QR-026 "Pipelines Annual Report 2018.
[Ref 91] H-000-QR-027 " Pipelines Annual Report 2019.
[Ref 92] H-000-QR-028 "Pipelines Annual Report 2020.
[Ref 93] 1023DSBSDG84181 "Typical Power Cable Crossing Existing Cable Buried".
[Ref 94] 1023DSBSDG84180 "Typical Power Cable Crossing Existing Cable on Seabed".
[Ref 95] 1023DSBSDG84179 "Typical Power Cable Crossing Existing Pipeline Buried".
[Ref 96] 1023DSBSDG84178 "Typical Power Cable Crossing Existing Pipeline on Seabed".
[Ref 97] 102100BJRV09201 "Constructability Report New Onshore Pipelines"
[Ref 98] 1023D0BSDG84169 "Preliminary Subsea Removal Around Platform – Douglas

5.0 DESIGN DATA

Two power cables will be installed from the Point of Ayr to the New Douglas Platform. The 2nd cable mentioned here and in Table 5-1 is an option for possible installation in future.
Further Cable properties will be provided in detail design. For more information refer to [Ref 45] to [Ref 59].

5.1 Cable properties

Following cables properties are considered:

NEW POWER CABLES				
FROM	**TO**	**Type**	**Approx. Length (m)**	**Diameter**
Cable No.1 Point of Ayr	New Douglas Platform	3-core 33 kV armoured with bundled FOC	34310(1)	6" (1)
Cable No.2 Point of Ayr	New Douglas Platform		34370(1)	6" (1)
New Douglas Platform	Lennox Platform		32340(1)	6" (1)
New Douglas Platform	Hamilton North Platform		14890(1)	6" (1)
New Douglas Platform	Hamilton Main Platform		10860(1)	6" (1)

Table 5-1: New Cables Routes and estimated Lengths

Note (1): To Be Confirmed during the detailed design.

Preliminary cable properties that shall be defined and confirmed during detailed design phase are presented in Table 5-2. For details refer to cable data sheet in Section 12.1.

Outside Diameter	156mm
Weight per meter in air	47 kg/m
Weight per meter in water	30 kg/m
Min. Bending Radius, installation	2.4m
Min. Bending Radius Coiling	1.3m
Max. Linear Tension during cable pull-in	TBC during detail design
Total Weight Cable No. 1	1597.5 tonne
Total Weight Cable No. 2	1595.7 tonne

Table 5-2: Cables Properties (to be Defined During the Detail Design Phase)

5.2 Field Layout

Following cable field layout can be found in Figure 5-1 bellow. For details refer to Section 12.3 and [Ref 46] - 1025H0BSDG84104 “New Offshore Power Cable and Fibre Optic Field Layout (Offshore Section)”.

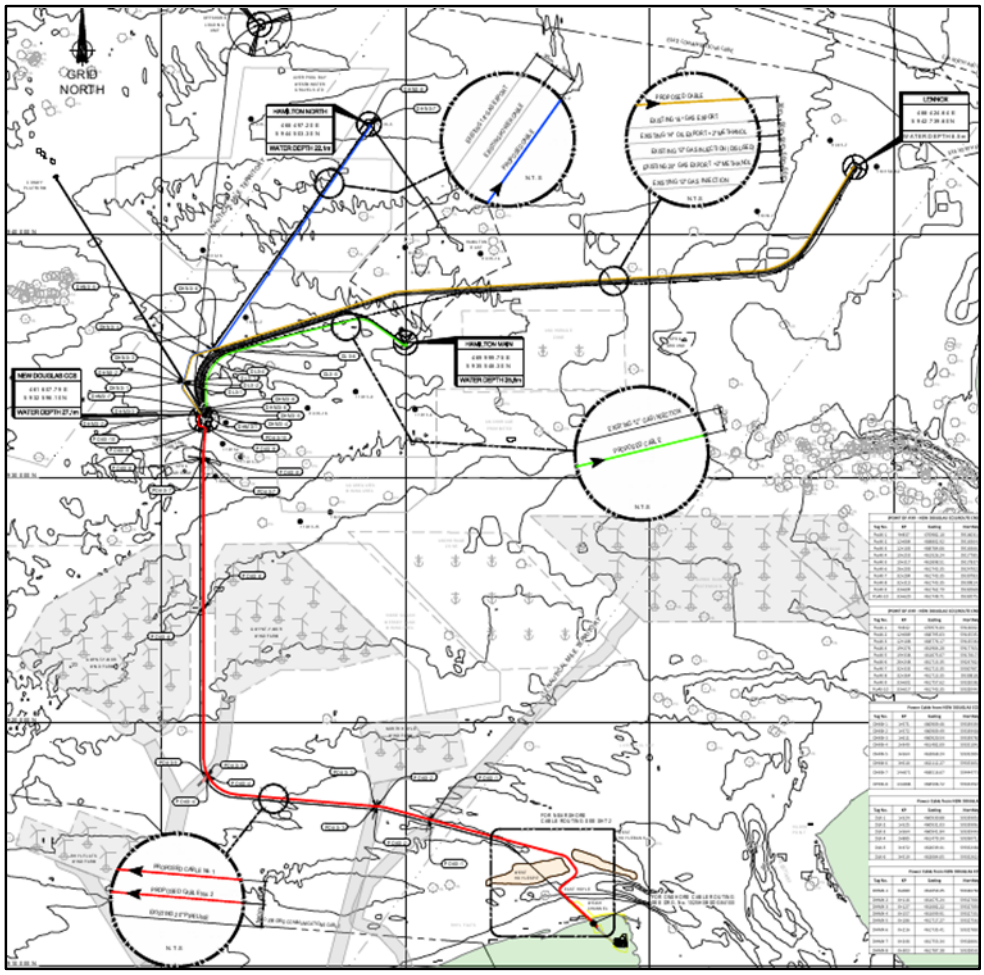


Figure 5-1 Proposed Cables Field Layout

Nearshore section and cable shore pull up to 4500m from beach (High Water Mark) is described in 1025HTBNMI85019 - Nearshore Cable Marine Operations Outline Procedure (see [Ref 43]).

This document reflects cable laying from KP4500m towards New Douglas Platform and is considering that nearshore pull-in operation is completed.

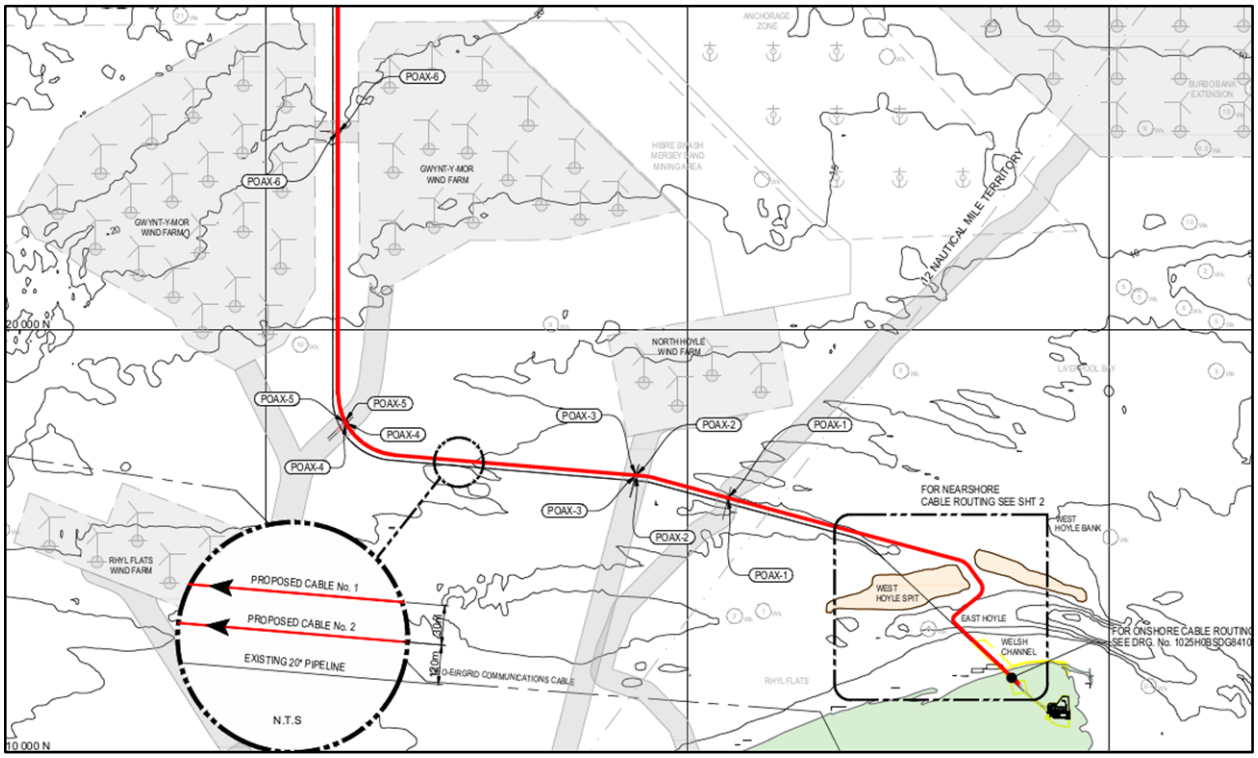


Figure 5-2 Plain View on Offshore Cable Routing (Offshore and Nearshore Section Battery Limit)

5.3 Cable Approach at Platforms

Cable approach is shown for New Douglas, Hamilton Main, Hamilton North and Lennox on figures bellow and in detail defined in [Ref 46]1025H0BSDG84104 "New Offshore Power Cable and Fibre Optic Field Layout (Offshore Section)".

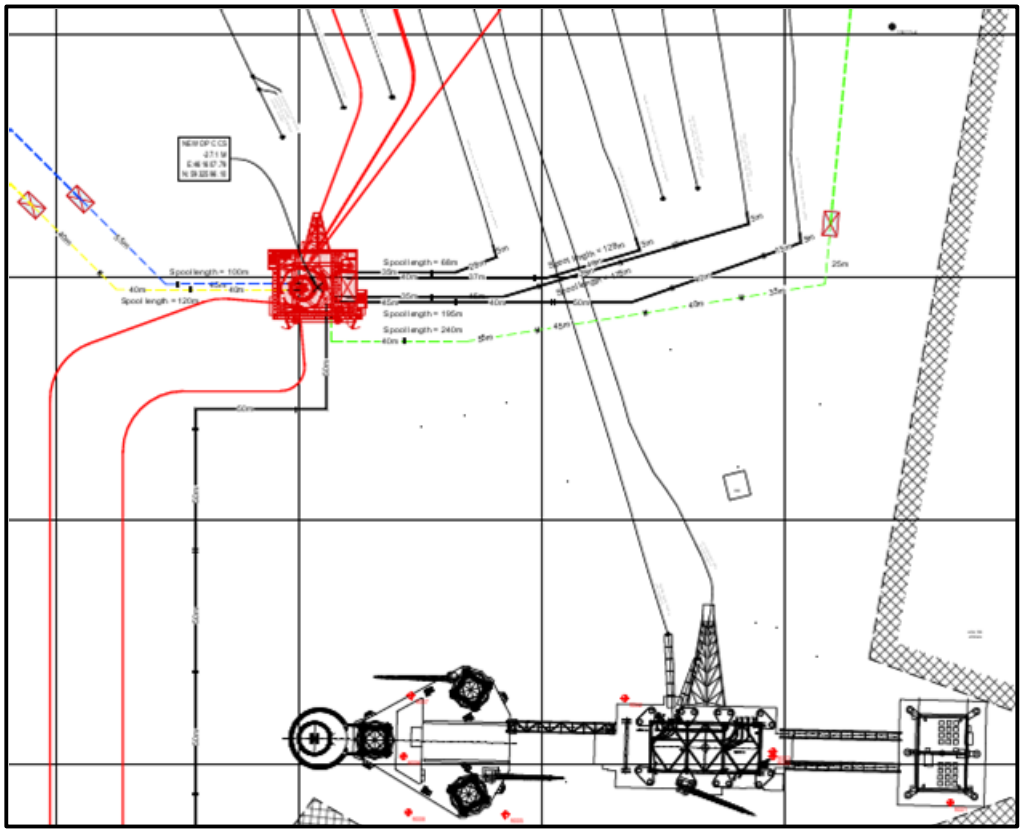


Figure 5-3 Cables Approach at New Douglas Production Platform

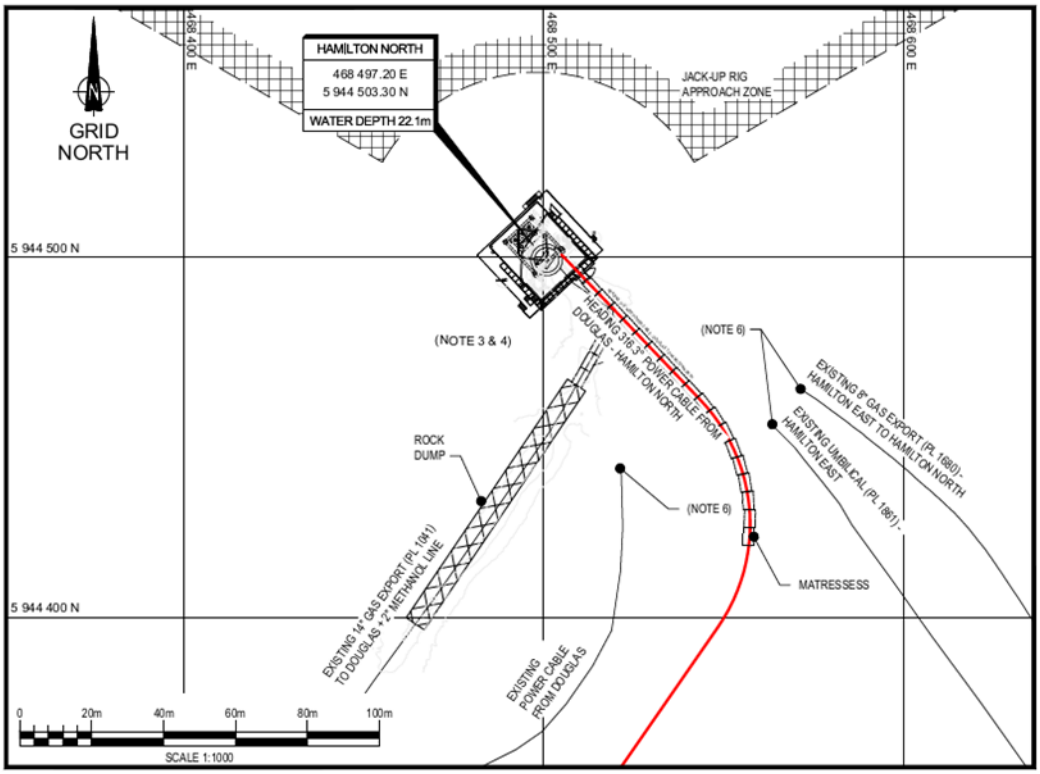


Figure 5-4 Cable Approach at Hamilton North (HN)

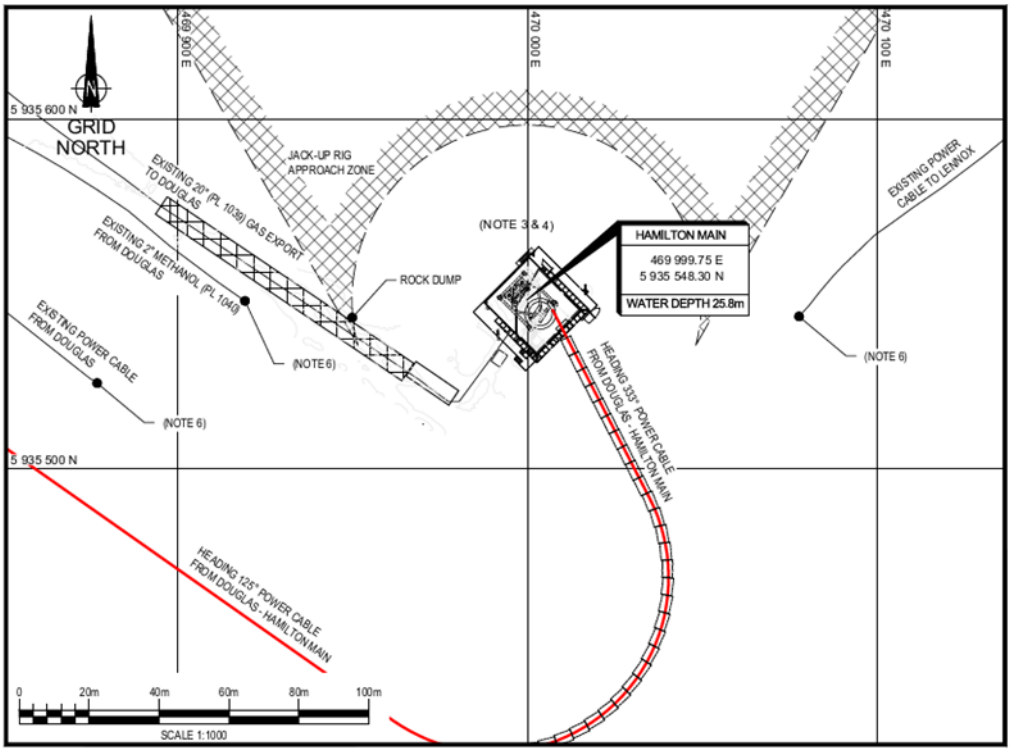


Figure 5-5 Cable Approach at Hamilton Main (HH)

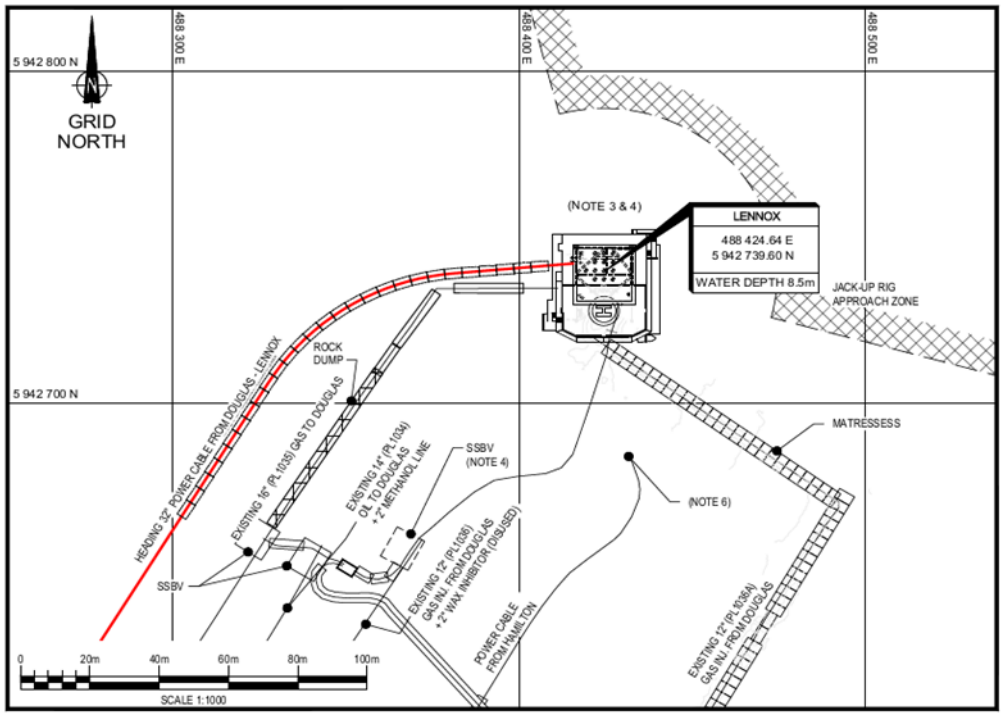


Figure 5-6 Cable Approach at Lennox (LD)

5.4 Potential Temporary Wet Storage of Cables Ends before Platform Pull-In

If platform pull-in operation is impacted by other work fronts on platforms (such as hook-up activities, Topside installation etc.) Contractor can perform temporary wet storage of cable Ends. If such option is envisaged Contractor Shall consider a marine license to be obtained for such operation.
Note: depending on the estimated wet storage duration, Contractor to decide using some means of protection for the cable Ends such as Cable End wet storage stand or blast matts to rest the Cable End on and for longer duration, protection can be provided by means of shroud being wrapped around the Cable End.
Following wet storage areas are shown on Figure 5-7, Figure 5-8, Figure 5-9 and Figure 5-10 bellow:

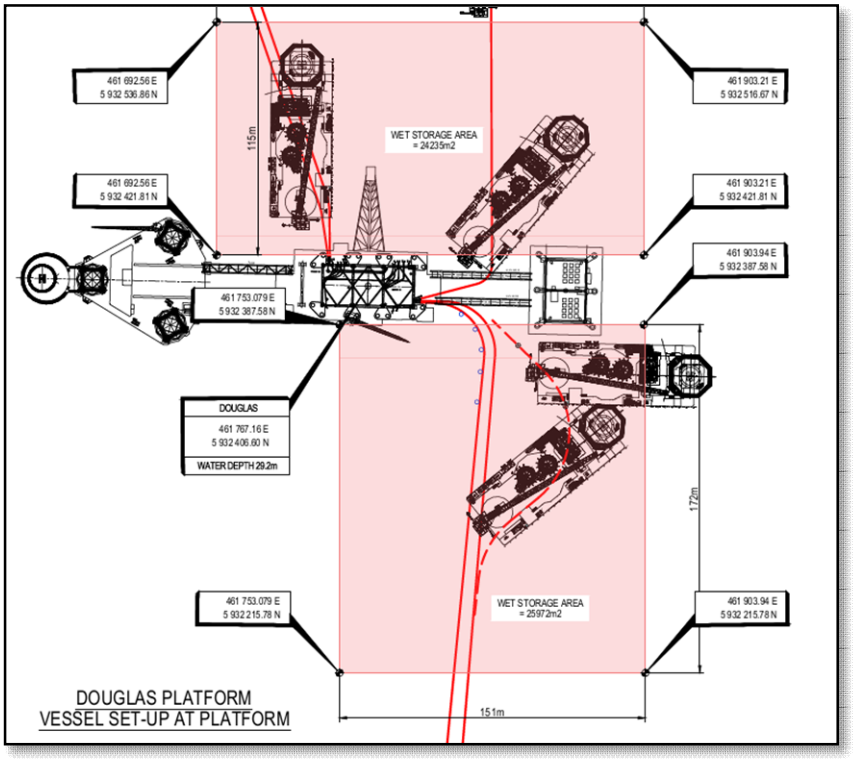


Figure 5-7 Potential Cable Wet Storage Area – New Douglas

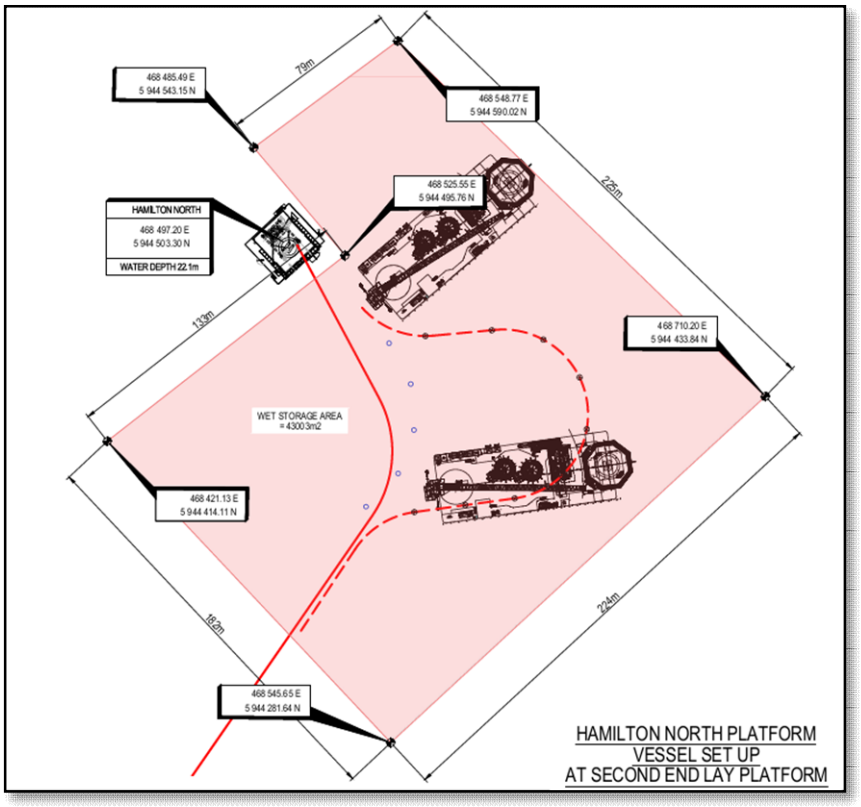


Figure 5-8 Potential Cable Wet Storage Area - Hamilton North

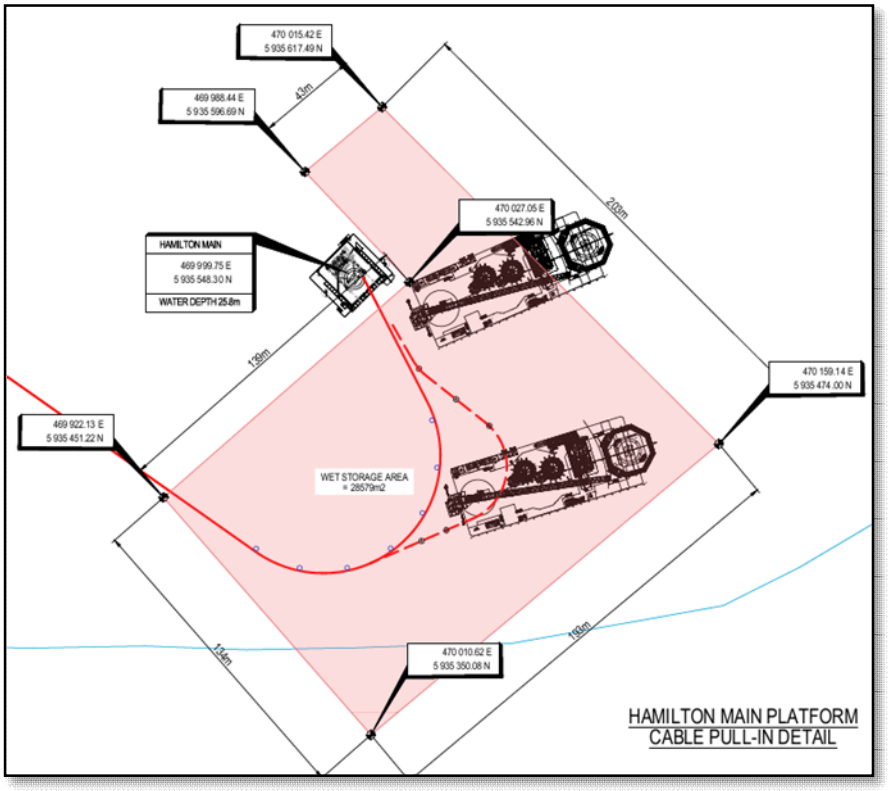


Figure 5-9 Potential Cable Wet Storage Area - Hamilton Main

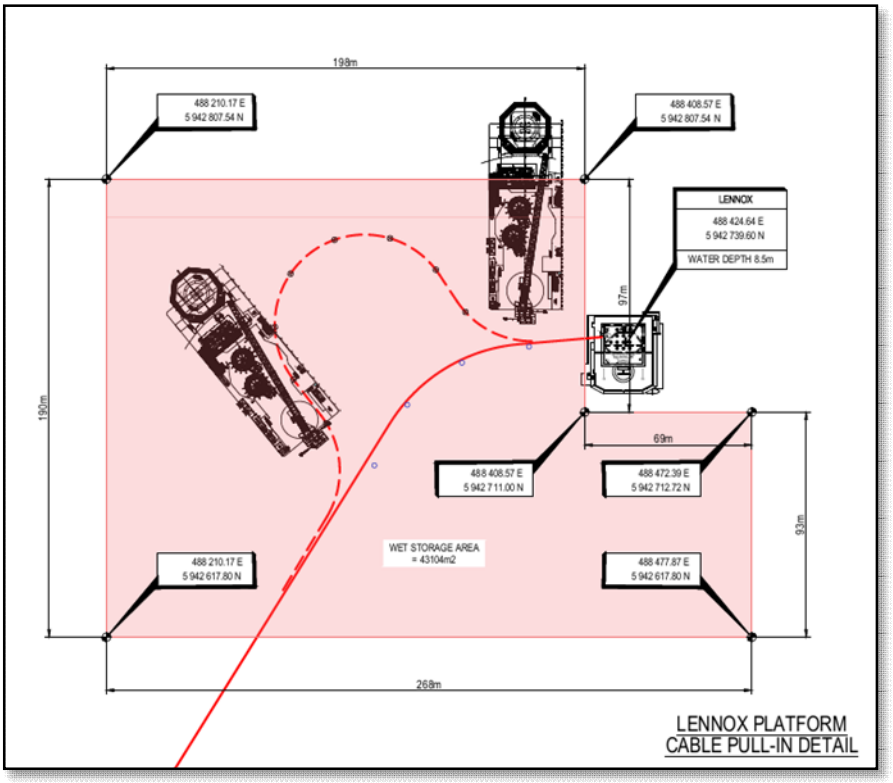


Figure 5-10 Potential Cable Wet Storage Area – Lennox

5.5 Crossings

Typical Crossing Details are presented in Table 5-3.

PoA to Douglas Route Crossing Cable #1				
Tag Number	**KP**	**Easting**	**Northing**	**Description Of Crossing**
PoA X-1	8 + 431	470982.1	5916031.5	BURBO Bank Wind Farm
PoA X-2	10 + 677	468802.92	5916564.54	North Hoyle Wind Farm (Export Cable)
PoA X-3	10 + 696	468784.06	5916566.12	North Hoyle Wind Farm (Export Cable)
PoA X-4	17 + 849	461926.24	5917785.34	GWYNT Y MOR Wind Farm (Export Cable)
PoA X-5	17 + 908	461898.51	5917837.67	GWYNT Y MOR Wind Farm (Export Cable)
PoA X-6	24 + 797	461743.35	5924702.5	GWYNT Y MOR Wind Farm (Inter Array Cable)
PoA X-7	30 + 878	461743.35	5930783.12	Western Link HVDC Cable – Pole 1
PoA X-8	30 + 909	461743.35	5930814.39	Western Link HVDC Cable – Pole 2
PoA to Douglas Route Crossing Cable #2				
Tag Number	**KP**	**Easting**	**Northing**	**Description Of Crossing**
PoA X-1	8 + 436	470974.84	5916002.39	BURBO Bank Wind Farm
PoA X-2	10 + 683	468795.03	5916535.1	North Hoyle Wind Farm (Export Cable)
PoA X-3	10 + 702	468776.17	5916536.68	North Hoyle Wind Farm (Export Cable)
PoA X-4	17 + 875	461897.1	5917756.2	GWYNT Y MOR Wind Farm (Export Cable)
PoA X-5	17 + 936	461868.2	5917810.7	GWYNT Y MOR Wind Farm (Export Cable)
PoA X-6	24 + 852	461713.35	5924702.5	GWYNT Y MOR Wind Farm (Inter Array Cable)
PoA X-7	30 + 937	461713.35	5930787.1	Western Link HVDC Cable – Pole 1
PoA X-8	30 + 968	461713.35	5930818.38	Western Link HVDC Cable – Pole 2

Power Cable from Douglas to Hamilton North				
Tag Number	**KP**	**Easting**	**Northing**	**Description Of Crossing**
PLX - 1	0 + 010	461745.98	5932430.88	2” Methanol (PL1042) from Hamilton North
PLX - 2	0 + 012	461745.70	5932432.72	14” Gas Export (PL1041) from Hamilton North
PLX - 3	0 + 196	461682.60	5932604.01	14” Gas Export (PL1041) + 2” Methanol (PL1042) from Hamilton North
PLX - 4	0 + 223	461659.73	5932617.80	14” Oil Export (PL1031) to OLU
PLX - 5	3 + 137	461482.09	5935104.25	14” Oil Export (PL1031) to OLU
PLX - 6	3 + 751	462068.24	5935289.42	14” Gas Export (PL1041) + 2” Methanol (PL1042) from Hamilton North
FOX - 1	3 +797	462112.27	5935303.33	Existing Power Cable to Hamilton
PLX - 7	15 + 060	468516.67	5944477.68	14” Gas Export (PL1041) + 2” Methanol (PL1042) from Hamilton North
PLX - 8	15 + 077	468508.72	5944492.55	14” Gas Export (PL1041) + 2” Methanol (PL1042) from Hamilton North
Power Cable from Douglas to Lennox				
Tag Number	**KP**	**Easting**	**Northing**	**Description Of Crossing**
PLX - 1	0 + 010	461748.23	5932431.09	2” Methanol (PL1042) from Hamilton North
PLX - 2	0 + 011	461748.22	5932432.34	14” Gas Export (PL1041) from Hamilton North
PLX - 3	0 + 206	461680.47	5392611.14	14” Gas Export (PL1041) + 2” Methanol (PL1042) from Hamilton North
PLX - 4	1 + 085	461392.86	5933434.15	14” Oil Export (PL1031) to OLU
PLX - 5	3 + 090	461479.34	5935071.92	14” Oil Export (PL1031) to OLU
PLX - 6	3 + 678	462039.41	5935248.85	14” Gas Export (PL1041) + 2” Methanol (PL1042) from Hamilton North
FOX - 1	3 + 724	462084.05	5935262.96	Existing Power Cable to Hamilton

Table 5-3: List of Cable Crossing

Where the route of the cable crosses existing cables or pipelines or other subsea asset, will not be possible to bury without interruption. Buried in-service cables shall be located by use of tone detection equipment or other applicable detection equipment. If necessary, this may be followed by careful excavation with diver’s jetting/ROV tools to allow verification and identification. The burial machine shall be raised and lowered either side of the intersection (creating a “plough skip” or interruption in the burial alignment). This may be done 100-500 meters either side of the intersection, the margin of safety depends on factors like crossing angles, complexity of the seabed installations, etc. Alternative means must be used to achieve cable burial at and around crossing points to avoid any risk of damage to in-situ infrastructure while ensuring that the new cable is also protected.

Divers or ROV then perform the cable burial precisely around the intersection using jetting or other tools. The proposed installation method shall be in line with ICPC guidelines. Highly accurate (GPS) positioning systems shall be used to navigate the main-lay vessel and burial equipment to provide a guarantee that all vessel and burial machine positions are known at all times better than +/- 10m accuracy, and so the exclusion zone from the crossed cable is sufficient to guarantee the safety of all cable crossings.

Contractor Shall follow International Cable Protection Committee guidelines intended to assist the cable and pipeline industries to adopt harmonised approach in relation to crossings and attempts to observe these wherever possible

Contractor shall seek a “no objection” or “agreement to cross” from the owners of the crossed cable. This process will involve provision by the crossing power cable owner of details of the crossing point location, the physical characteristics of the power cable, details of how the cable is armoured, buried, or otherwise protected and an explanation of the methods by which the power cable owner proposes to install the power cable at and around the crossing point.

5.6 Soils Property

Historical Geotechnical data and recommendations for PoA on foundation types, concrete mixes, etc. can be found in the following reports:

- Report No. 91/2126-1 Rev 3 Feb 92: Hamilton Field Landfall and Terminal Facilities, Volume 1: Factual Data [Ref 81].
- Report No. 91/2126-2 Rev 1 Feb 92, Hamilton Field Landfall and Terminal Facilities, Volume 2: Interpretive Analysis [Ref 82].
- Report No. 92/2622-1 Geotechnical Report May 92 Hamilton Field Terminal Facilities [Ref 83].

In addition to the above, two deep boreholes were performed at PoA in 2022 and are referenced 1025H0BGRV09407 [Ref 84] and 1025H0BGRV0940 [Ref 85], which are the Laboratory and Geotechnical Interpretative Reports respectively from a detailed site investigation performed in 2021 and 2022.

5.7 Environmental Limits/ Criteria

Contractor Shall provide during execution phase a full list of limiting sea states for whole spread involved in Cable Laying and Cable Platform pull-in, including but not limited to:

- Cable Lay Vessel equipped with DP II as a minimum;
- Multicats;
- Jack-up;
- Anchor Handling;
- Cargo Barge Mooring;
- Operations with work boat;
- Diving Operations;
- Personnel Transfer by Man Basket.

5.8 Cable Installation Analysis

Contractor Shall perform an installation analysis to support their installation methodology, this includes but not limited to the followings:

- Lifting Ops by Cable Lay/DSV crane;
- Platform Pull-in Ops (1st and 2nd End and shore pull-ins);
- Mattress or any means of asset protection and or stabilisation installation;
- Trenching operations;
- Back filling operations;
- Protective equipment installation (e.g., URADUCT)during lay/crossing over other assets;
- Lay Ops.

The vessel's dynamic responses to wave induced shall be described through a set of Response Amplitude Operators (RAOs). The dynamic response of the cables shall be assessed in time domain by providing environmental parameters in accordance with the met-ocean report and using adequate wave spectrum simulations as per [Ref 20], DNV-ST-N001: 2020, "Noble Denton Marine Services Warranty Standard". and [Ref 18], DNV Rules for Classification of Ships, Part 3, Chapter 1, 2012.
Note: All dynamic analysis shall be carried out using an agreed and well-established dynamic analysis software.

5.9 Tidal Range

Liverpool Bay Area is characterised by a significant astronomical tide excursion with difference between HAT and LAT in excess of 9m. For tide range refer to [Ref 32], 1025H0BGRB09002 "Basis of Design Offshore 4.5 Mtpa (Gas Phase) – Feed & 10 Mtpa (Dense Phase) – Feasibility". Values of maximum and minimum still

sea water level are also strongly dependent on water depth, thus extreme values relevant to the different sites for different return periods are reported in Table 5-4, Table 5-5 and Table 5-6.

Return Period	Tidal Levels Rel. LAT (*m*)	Surge Displacement Rel. MSL (*m*)	Still Water Level Rel. LAT (*m*)	Still Water Depth Rel. Sea Bed (*m*)
Positive				
10,000-Years		3.73	10.24	39.4
1,000-Years		2.67	9.86	39.1
100-Years		1.91	9.43	38.6
50-Years		1.73	9.34	38.5
10-Years		1.37	9.10	38.3
1-Year		0.98	8.76	38.0
HAT	9.20		9.20	38.4
MHWS	8.17		8.17	37.4
MHWN	6.53		6.53	35.7
MSL	4.56		4.56	33.8
MLWN	2.66		2.66	31.9
MLWS	0.95		0.95	30.1
LAT	0.00		0.00	29.2
Negative				
1-Year		-0.79	0.62	29.8
10-Years		-1.09	0.31	29.5
50-Years		-1.38	0.09	29.3
100-Years		-1.53	0.00	29.2
1,000-Years		-2.13	-0.40	28.8
10,000-Year		-2.98	-0.76	28.4

Table 5-4: Astronomical Tides, Surge and Maximum Still Water Depth – Douglas Field

Return Period	Tidal Levels Rel. LAT (*m*)	Surge Displacement Rel. MSL (*m*)	Still Water Level Rel. LAT (*m*)	Still Water Depth Rel. Sea Bed (*m*)
Positive				
10,000-Years		3.86	10.54	36.34
1,000-Years		2.76	10.14	35.94
100-Years		1.98	9.70	35.50
50-Years		1.79	9.60	35.40
10-Years		1.42	9.36	35.16
1-Year		1.02	9.01	34.81
HAT	9.46		9.46	35.26
MHWS	8.40		8.40	34.20
MHWN	6.72		6.72	32.52
MSL	4.68		4.68	30.48
MLWN	2.74		2.74	28.54
MLWS	0.97		0.97	26.77
LAT	0.00		0.00	25.80
Negative				
1-Year		-0.81	0.63	26.43
10-Years		-1.12	0.31	26.11
50-Years		-1.42	0.08	25.88
100-Years		-1.58	-0.01	25.79
1,000-Years		-2.19	-0.42	25.38
10,000-Years		-3.07	-0.79	25.01

Table 5-5: Astronomical Tides, Surge and Maximum Still Water Depth – Hamilton Field

Return Period	Tidal Levels Rel. LAT (*m*)	Surge Displacement Rel. MSL (*m*)	Still Water Level Rel. LAT (*m*)	Still Water Depth Rel. Sea Bed (*m*)
Positive				
10,000-Years		3.82	10.50	32.60
1,000-Years		2.73	10.11	32.21
100-Years		1.96	9.67	31.77
50-Years		1.77	9.57	31.67
10-Years		1.40	9.33	31.43
1-Year		1.01	8.98	31.08
HAT	9.43		9.43	31.53
MHWS	8.37		8.37	30.47
MHWN	6.70		6.70	28.80
MSL	4.67		4.67	26.77
MLWN	2.73		2.73	24.83
MLWS	0.97		0.97	23.07
LAT	0.00		0.00	22.10
Negative				
1-Year		-0.81	0.64	22.74
10-Years		-1.12	0.32	22.42
50-Years		-1.41	0.09	22.19
100-Years		-1.57	0.00	22.10
1,000-Years		-2.18	-0.41	21.69
10,000-Years		-3.06	-0.78	21.32

Table 5-6: Astronomical Tides, Surge and Maximum Still Water Depth – Hamilton North Field

5.10 Unit System

Unless otherwise indicated, the units used in the analysis are:

Length:	[m]
Force:	[kN]
Stress:	[MPa]
Mass:	[Metric Tons] (equivalent to Mg in S.I.)
Acceleration of gravity	9.81 [m/s^2]
Sea water density	1025 [kg/m^3]

5.11 Environmental Data

Environmental data are reported from [Ref 63] to [Ref 65] where the descriptions and main characteristics of the following data and relevant document references are reported:

- Meteorological Characterisation;
- Wind conditions;
- Wave conditions;
- Current conditions;
- Sea surface variability;
- Marine growth;
- Hydrology.

5.12 Weather Forecasting

Contractor will use the weather forecasting provided by two independent and dedicated forecast service and monitor the weather at 12-hour intervals. The forecasting will commence one (1) week prior to the proposed mobilisation date. As a minimum, the forecasts shall comply with the Weather Forecast Levels defined in DNVGL-ST-N001, “General guidelines for marine projects”, [Ref 20].

These forecasts will be received two (2) times daily, six (6) days ahead.

The above forecast will be relevant to a location determined from the last reported position of the vessel and will contain but not limited to the following information:

- Meteorological situation;
- Warnings section;
- Weather summary;
- Tabular representation of forecast winds and weather at three (3) hourly intervals;
- Graphical representation of forecast winds and weather at three (3) hourly intervals.

In addition to the above detailed forecast, twenty-four (24) hour weather consultation by telephone Shall be available.

Above weather forecasts may be used for decision making by Contractor to alter course to avoid storms or high seas.

5.13 Operational Criteria

Operational limitations for some operations are dependent on the installation vessel heading relative to the seas swell and current.

For each phase of the installation a dedicated weather window needs to be agreed for a safe and continuous operation. The following operational criteria are typical for the standard power cable installation operations and Shall be updated and provided by Contractor during tender phase in depth during detailed design phase.

Operations	Weather limitations
Vessel's crane operations	25 knots (12.8 m/s) max. wind speed, combined sea/swell 1.5-meter Hs
Zodiac Operations	Combined sea/swell 1.5-meter Hs
First/Second End pull-in operations	20 knots (10.28m/s) max wind speed, combined sea/swell 1.5-meter Hs, current 2 knots
Work class ROV operations	24 knots (12.35 m/s) max. wind speed, combined sea/swell 1.5-meter Hs, currents 1.5 knot (0.76 m/s)
Normal cable laying	20 knots (10.28m/s) abeam max. wind speed, sea/swell 2-meter Hs, current 2 knots

Table 5-7: Operational criteria – typical (to be updated during tender phase)

6.0 NEARSHORE CABLE PULL IN OPERATIONAL REQUIREMENTS

The below is the planned and expected equipment to be utilised for the shore pull-in operation.

6.1 Marine Spread

Contractor Shall present their own marine spread and prove feasibility of cable shore pull during tender phase. Marine spread considered in this study are the following:

- 1x Cable Laying Vessel (CLV) which is main cable installation vessel;
- 1 x RIB work boats for assisting cable pull-in operation at platform side.

6.2 Cable Laying Equipment

Typical Deck Layout is presented in Figure 6-1 Typical Deck Layout bellow:

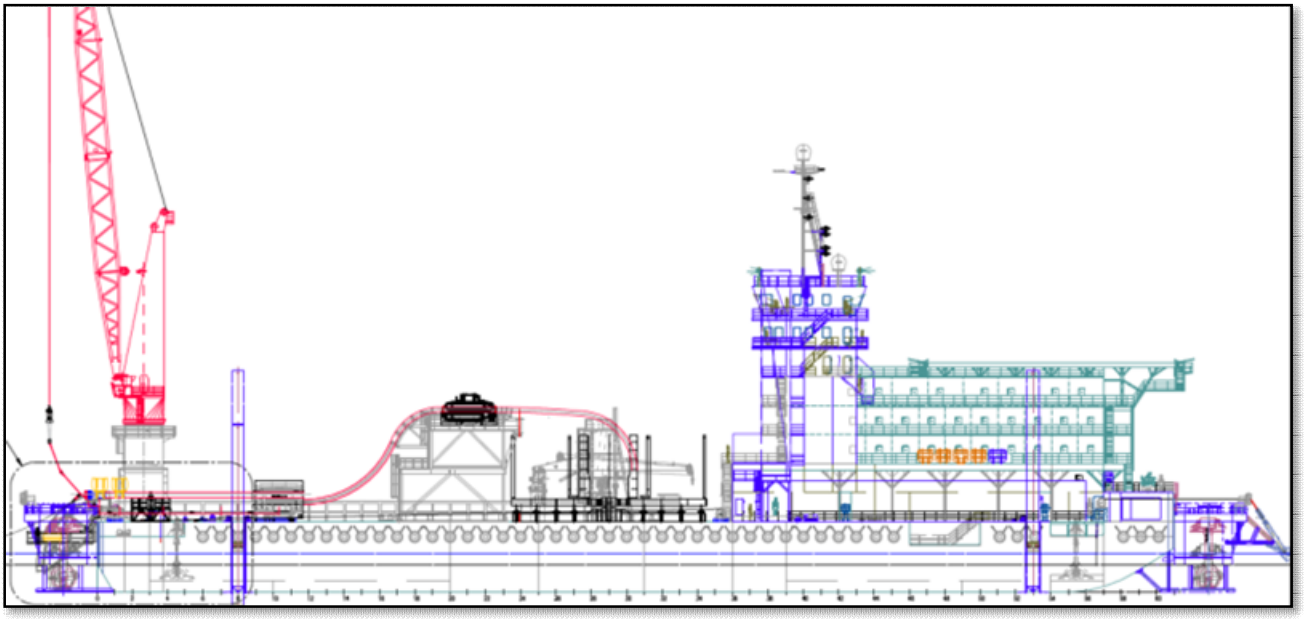


Figure 6-1 Typical Deck Layout

Equipment and materials that are typical for power cable installation but not limited to are presented bellow in Table 6-1: Equipment and Material List - typical. Contractor Shall update material list during detailed design phase. Furthermore, power cable/s to be installed from PoA to New Douglas platform shall be done by a CLV able to beach during the low tide for the near shore cable pull-in, the below list will have to be updated accordingly.

Item	Description	Unit	Quantity	Reference
1.	Lock-A-Loy 16MT SWL	ea	5	Installation aids
2.	12.5 MT Load cell	ea	2	Installation aids
3.	Seabed buoyancy unit (3 EA hard float c/w ø4 mm steel wire, 2 EA 1.5 MT shackles both ends)	ea	150	Installation aids
4.	Swivel, Y-link 8.5MT SWL	ea	2	Installation aids

Item	Description	Unit	Quantity	Reference
5.	5.4 MT WLL ROV hook (long shank)	ea	4	Installation aids
6.	11.5 MT WLL ROV hook (long shank)	ea	2	Installation aids
7.	11 MT Master link	ea	2	Installation aids
8.	17 MT Master link	ea	2	Installation aids
9.	Bull dog grip ø 19mm wire rope	ea	20	Installation aids
10.	12 MT SWL snatch block (suit to ø19mm wire)	ea	4	Installation aids
11.	8-12 MT SWL load cells	ea	2	Installation aids
12.	12 MT SWL bolt shackles	ea	7	Installation aids
13.	8 MT SWL bolt shackles	ea	7	Installation aids
14.	4.75 MT SWL bolt shackles	ea	7	Installation aids
15.	5 Te x 2 m flat sling	ea	3	Installation aids
16.	5 Te x 3 m flat sling	ea	3	Installation aids
17.	5 Te x 5 m flat sling	ea	3	Installation aids
18.	3 Te x 3 m Polyester round sling	ea	4	Installation aids
19.	5 Te x 5 m Polyester round sling (for bell mouth cover recovery)	ea	2	Installation aids
20.	5 MT WLL Tirfor	set	1	Installation aids
21.	2 MT WLL Tirfor	set	2	Installation aids
22.	3.2 MT WLL Pneumatic Tirfor	set	3	Installation aids
23.	2 Te Lever hoist	ea	4	Installation aids
24.	5 Te Chain block	ea	3	Installation aids
25.	Air/Pneumatic tugger winch SWL 7 MT, cable dia 21mm x 220m long	ea	2	Installation aids
26.	J-Tube pull in quadrant (for 12- ¾" J-Tube)	ea	3	Installation aids
27.	J-Tube temporary hang-off (for 12- ¾" J-Tube)	ea	3	Installation aids
28.	Static Cable Tank	ea	1	Existing on-board
29.	Gooseneck	ea	1	Existing on-board
30.	5 MT Linear Cable Engine with Cable Counter	ea	1	Existing on-board
31.	URADUCT assembly table	ea	2	Installation aids
32.	3m Radius Overboarding chute	ea	1	Existing on-board
33.	1" air hose c/w whip check/ whip stopper	m	120	Installation aids
34.	Ø18 - 20mm polypropylene rope	roll	10	Installation aids
35.	Pulling grip Chinese finger suitable for Cable diameter	ea	6	Installation aids

Item	Description	Unit	Quantity	Reference
36.	Pneumatic Torque tool for URADUCT (Free Issue)	ea	3	Installation aids
37.	Manual Torque tool for URADUCT (Free Issue)	ea	1	Installation aids
38.	Hand Crimping tool for URADUCT (Free Issue)	ea	1	Installation aids
39.	12" hack saw c/w spare saw blades	ea	2	Installation aids
40.	Ball hammer	ea	2	Installation aids
41.	Drilling hammer	ea	2	Installation aids
42.	Adjustable wrench 12"	ea	2	Installation aids
43.	18" pipe wrench	ea	3	Installation aids
44.	Pliers	ea	2	Installation aids
45.	2" duct tape	ea	20	Installation aids
46.	2" waterproof tape	ea	20	Installation aids
47.	Pipe tread tape	box	1	Installation aids
48.	Wire cutter	ea	2	Installation aids
49.	17 mm Allen key	ea	2	Installation aids
50.	19 mm Allen key	ea	2	Installation aids
51.	Cutter	ea	2	Installation aids
52.	Air heat gun	ea	2	Installation aids
53.	12 mm strap ribbon (stainless steel)	roll	1	Installation aids
54.	12 mm metal seal (stainless steel)	ea	100	Installation aids
55.	12 mm strap tensioner	ea	1	Installation aids
56.	12 mm steel strap sealer	ea	1	Installation aids
57.	Degreaser (spray can)	ea	12	Installation aids
58.	2 Te Ratchet straps	set	5	Installation aids
59.	5 Te Ratchet straps	set	5	Installation aids
60.	10 Te Ratchet straps	set	5	Installation aids
61.	5 Te Chain ratchet tool	set	2	Installation aids
62.	5 ltr. Mix bucket	ea	2	Installation aids
63.	Screwdriver	ea	2	Installation aids
64.	13mm combination spanner	ea	2	Installation aids
65.	17mm combination spanner	ea	2	Installation aids
66.	22mm combination spanner	ea	2	Installation aids
67.	24mm combination spanner	ea	2	Installation aids

Item	Description	Unit	Quantity	Reference
68.	Torque wrench 100 Nm (1/2" drive)	ea	2	Installation aids
69.	18" ratchet wrench (1/2" drive)	ea	2	Installation aids
70.	13mm long socket 1/2" drive	ea	2	Installation aids
71.	17mm long socket 1/2" drive	ea	2	Installation aids
72.	22mm long socket 1/2" drive	ea	2	Installation aids
73.	24mm long socket 1/2" drive	ea	2	Installation aids
74.	Diver glow stick	ea	100	Installation aids
75.	1Te Turning bollard / Sandbags	ea	30	Installation aids
76.	Loctite 577	ea	10	Installation aids
77.	Portable Lighting for Platform	ea	1	Installation aids
78.	Torque Wrench (for 20-50Nm)	ea	1	Installation aids
79.	Torque Wrench (for 50-110 Nm)	ea	1	Installation aids
80.	Torque Wrench (for 200-220Nm)	ea	1	Installation aids
81.	Portable propane gas with blow torch	ea	6	Installation aids
82.	Tarpaulin sleeves	m	200	Installation aids

Table 6-1: Equipment and Material List - typical for cable laying and J-Tube Pull-In

6.3 Major Installation Aids

List of major installations aids is presented bellow but not limited to:

6.3.1 Gooseneck

A Gooseneck is used to guide the cable from the vertical orientation (exit of cable basket) to horizontal (in line with tensioner entry). The minimum radius of the cable path shall be determined during the detailed design phase.

6.3.2 Cable Tensioner

A vessel shall be equipped with suitable sized tensioners which will be used for installation purpose and to apply pre-determined squeeze and tension suitable to the cable's characteristics, water depth as well as considerations taken into account for the environmental characteristics i.e., Wave, Wind and Current.

Figure 6-2 Tensioning Unit (Track Tensioner- typical)

6.3.3 Over-boarding Chute

The over boarding chute guides the cable over the stern of the vessel, ensuring cable MBR is maintained. The chute has an adequate radius, and the exit of the chute needs to be extended to flare 30deg in all directions to allow the cable to be laid in any direction with respect to the vessel.

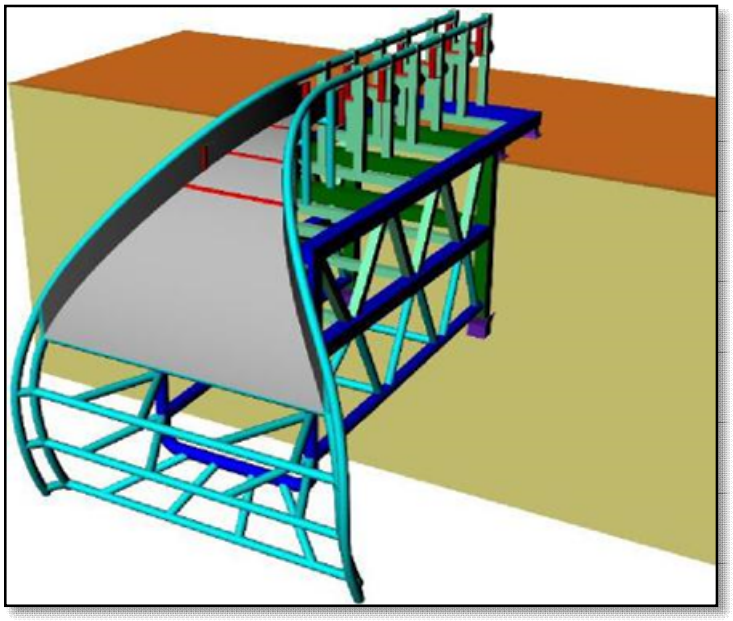


Figure 6-3 Over-boarding Chute Model (typical)

Figure 6-4 Over-boarding Chute (typical, for reference only)

6.3.4 Pulling Heads

The Contractor Shall utilise manufacturer supplied cable pulling heads which will be used to initiate, deploy and pull through the cable Ends at J-Tube locations and in case of emergency. Typical drawing is presented on Figure 6-5 bellow.

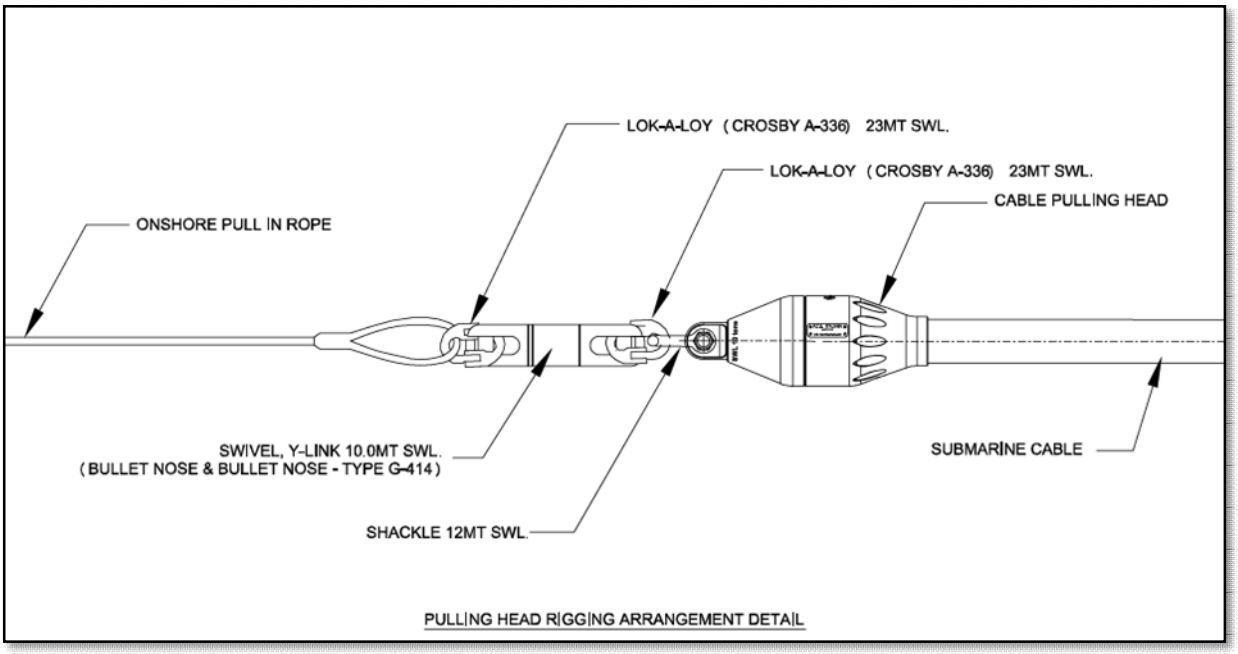


Figure 6-5 Pulling Head Arrangements (Typical)

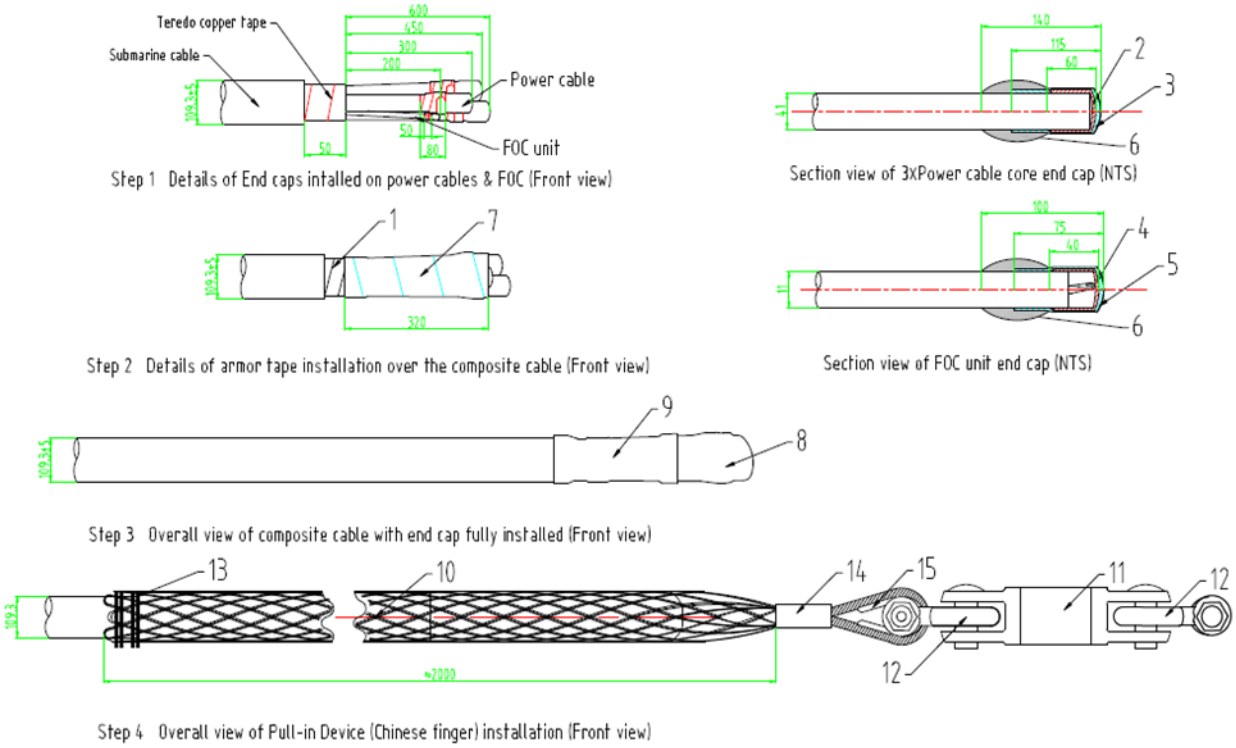


Figure 6-6 Pulling Head Arrangements for 2nd End (Typical)

6.3.5 Pull-In Rope

The J-Tube pull-in rope shall be designed as per Contractor's applied methodology, pull-in analysis and manufacturers standard. The rope considered should be designed as minimum HMPE braided rope which has the required durability and strength for the pull-in ops. It is made from first class, ultra-high tenacity Polyethylene raw materials covered with Exsil or similar coating to reduce abrasion.

6.3.6 Cable Carousel/Basket

The cables will be stored inside rotating cable basket (carousel) or non-rotating cable basket on the back deck of the CLV (as per Contractor decision and vessel capacity).

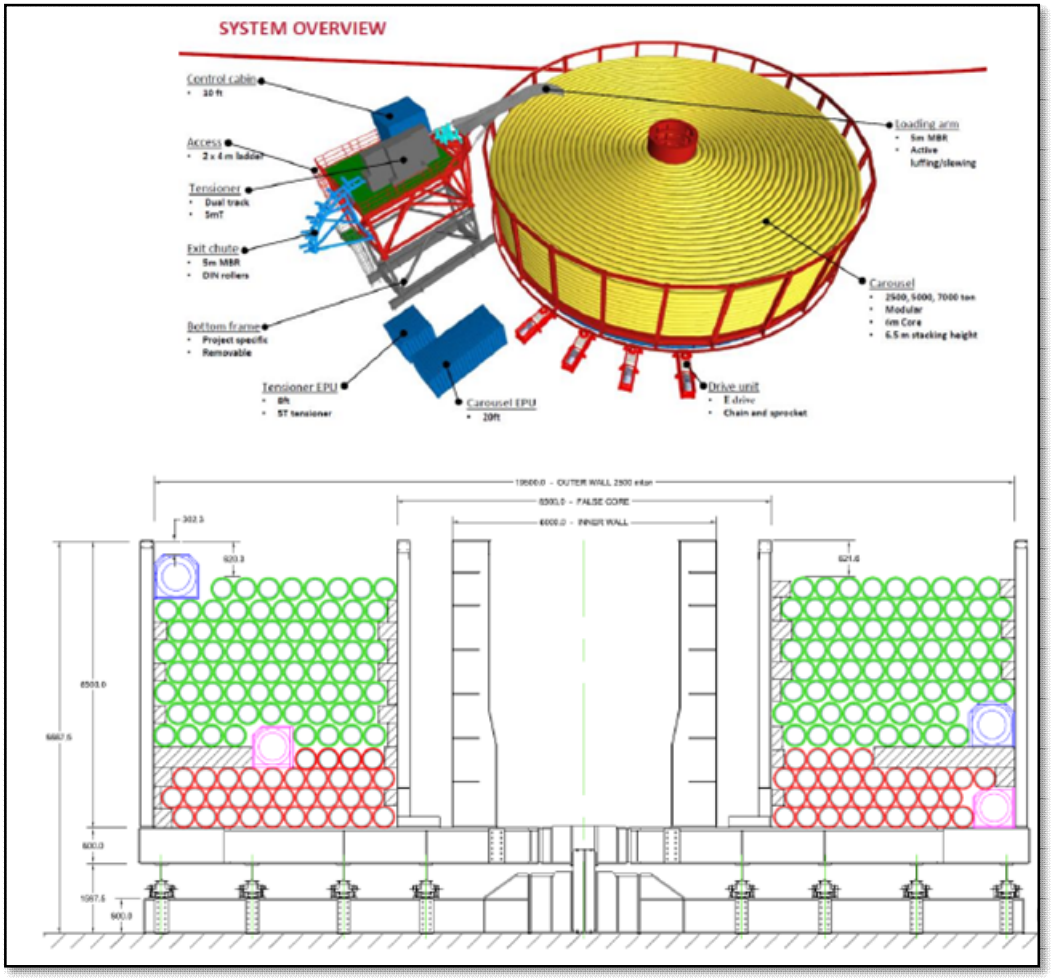


Figure 6-7 Carousel (Turn Table) Typical Configuration

6.3.7 Cable Burial Requirements and Marine Spread

The cable burial equipment shall be capable of performing the trenching/backfilling operations without causing any damage to the power cable.

It shall be capable of operating in all existing soil conditions within the project area and shall be capable of forming a smooth profile at the ends of buried sections to ensure that the cables will not be subjected to spanning or profile irregularities beyond allowable limits.

Contractor Shall demonstrate by means of calculation that the trench slopes created by the trenching equipment shall remain stable during cable trenching and backfilling operations. The trenching equipment monitoring system shall be calibrated and include devices to measure depth of cable.

The trenching equipment shall be of a type that does not place significant loads on the cable. The only contact between the trenching equipment and the cable shall be guidance controls, position monitors, monitoring equipment to achieve the required trench depth and position tolerance and, if applicable, the roller supports on the trenching equipment.

Trenching equipment shall be equipped with sufficient instrumentation to ensure any damage and excessive cable contact is avoided.

Cable burial requirements are presented in Table 6-2 and in [Ref 32], [Ref 44], [Ref 47], [Ref 48], [Ref 49],[Ref 50].

Parameter	Location		Unit	Value
Minimum Target Cable Burial Depth (Top of Cable)	Main cable route		m	2.0 Note 2
Minimum Target Cable Burial Depth (Top of Cable)	Landfall area	West Hoyle Spit	m	3.0 Note 1,2,
		Welsh Channel		3.0 Note 1,2
		Inter-tidal Beach Crossing		3.0 Note 1,2

Note 1: Increase burial depth to account for changing seabed topography at this location Reference is made to Pipelines Annual Report (Ref. [Ref 89] to [Ref 92]).

Note 2: Burial depth shall be confirmed once the following studies are completed and available

- Anchoring Study Reports;
- Fishing and Shipping Study Report;
- Fishing and Maritime Traffic Report;
- Quantitative Risk Assessment Report;
- Sediment Seabed Mobility Assessment;
- Construction Method Statements & Methodology.

Table 6-2: Power Cable Burial Requirements TOC

Suitable Cable Burial spread is presented bellow and in the **Section 12.0** Attachment and it's only for indicative purposes. Burial spread and methodology shall take into account beach environmentally protective areas and therefore suitable burial spread shall be utilised to minimise operational impact. Therefore, plough methodology is advised and presented indicatively bellow on Figure 6-8, Figure 6-9 and 6-10. Contractor Shall propose their own trenching/backfilling spread considering all design and operational requirements.

More detailed Trenching Equipment requirement has been provided in document [Ref 50].
1025H0BSSA84109 "Offshore Power Cable Trenching and Backfilling Specification".

Figure 6-8 Power Cable Plough (Typical)

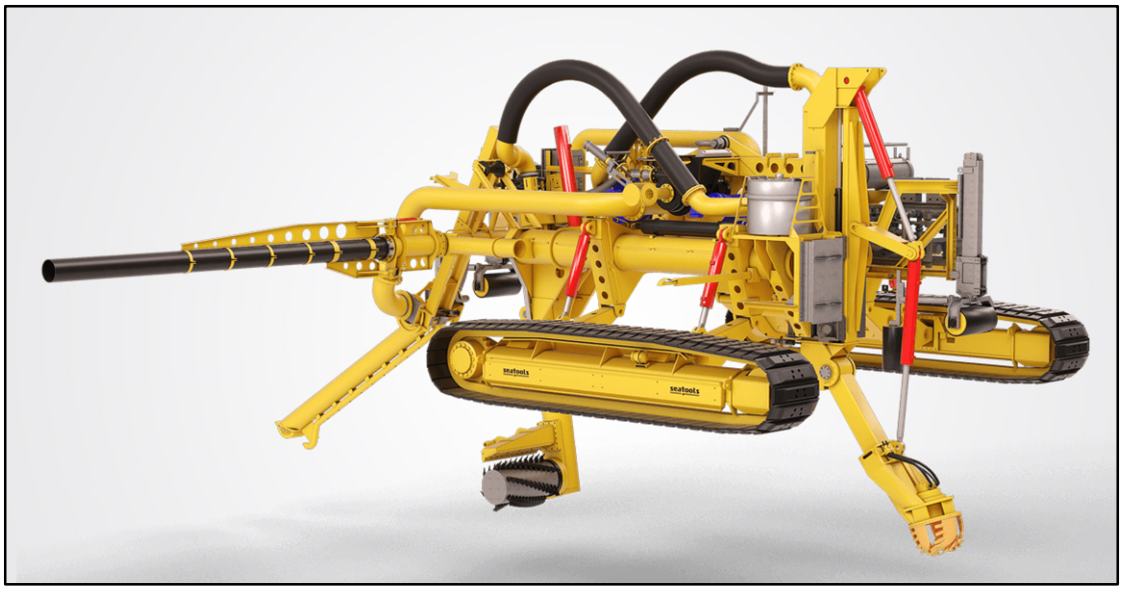


Figure 6-9 Self-propelling Mechanical Trencher (typical)

Figure 6-10 Trencher with Jetted swords (typical)

7.0 NORMAL CABLE LAY OPERATION

This section shall be read in conjunction with the following documents:

- 1025H0BJRV09235 "Constructability Report Point of Ayr and Foreshore", [Ref 42];
- 1025H0BSDG84100 "New Offshore Power Cable and Fibre Optic Field Layout; (Onshore Section), [Ref 45];
- 1025H0BSDG84104 "New Offshore Power Cable and Fibre Optic Field Layout (Offshore Section)", [Ref 46];
- 1025H0BSRV84107 "Offshore Subsea Cable Protection Requirement", [Ref 48];
- 1025H0BSDG84110 "Offshore Power Cable Power Cable - Alignment Sheet – PoA to Douglas (Cable #1)", [Ref 51];
- 1025H0BSDG84141 "Offshore Power Cable Power Cable - Alignment Sheet - PoA to Douglas (Cable #2)", [Ref 52].

Note: There shall be a set of HAZID/HAZOP reviews prior to execution phase in order to make sure risks and hazards are As Low As Reasonably Practicable (ALARP).
Note: Furthermore, CLV and associated lay equipment require going under audits such as Offshore Vessel Inspection Data (OVID).

7.1 Installation Preparations

All equipment as required for installation of the cables on the installation vessel shall undergo a typical pre-arrival check before arrival of the cable installation vessel at the installation site as per approved procedures and quality plans. A pre-lay survey Shall be conducted by Contractor along the cable route to confirm and ensure no unexpected features/debris/boulders or crossings are along the planned cable routes.

7.2 Cable Loading

Power cables shall be transpooled into cable tank or carousel onboard the CLV as per approved Cable Transpooling Procedure. Cable loading/transpooling location shall be determined and provided by Contractor.

All mobilisation works/activities Shall remain under Contractor's responsibility. Detailed description and methodology and or mobilisation procedure Shall be provided by Contractor. The Contractor Shall be responsible for supplying all necessary equipment and aids for execution of cable transpooling onto vessel.
Contractors/Cable manufacturers and suppliers Shall follow COMPANY standards; however, this Shall be monitored by the Contractor.

7.3 Cable Lay Parameters Monitoring and Control

The cable will be laid along the designated route in the specified lay corridor in accordance with the contractual requirements and Company procedures.

In line with the cable specification and the route layout, a cable catenary calculation shall be prepared detailing maximum allowable cable tension, cable touchdown allowable tension, departure angle, as well as suspended cable length. The cable catenary calculation shall be detailed in cable laying analysis document.

Above catenary calculation shall be used as a guideline during the installation Works and will be counter checked during installation by touch-down monitoring. Fatigue management shall be considered during the design phase in case of stoppage of laying operation if and when the stoppage of laying is more than the recommended period.
The CLV's position and cable route shall be displayed on the monitor of the remote survey computer located at tension control and at the DP control desk.

Typical tension monitoring values from the cable engines, cable counter, water depth and touch-down point shall be displayed by the computer/monitor in the control cabin for the tensioner operators (or as per Contractor vessel arrangement).

During the cable installation operations, the minimum allowable bending radius in the sag bend shall be controlled by applying the associated minimum lay tension at the tensioner. On the other hand, it should also ensure that the maximum tensile load is never exceeded the allowable tension.
The required tension level for the cable shall be displayed and recorded on the monitor of the remote/slave computer at the tension control position. By observing the displayed pre-determined value of the tension on the display, the cable engine/tensioner operator can adjust the required tension to the cable engines on board the CLV. Cable lay tension log recording will be submitted to Company after completion of campaign upon request.

The integrity of the cable shall be ensured during installation by controlling installation parameters such as cable tension, and departure angle and touchdown point.

The following monitoring and control equipment will be used on-board the CLV:

- The cable touchdown location will always be monitored using a ROV at Touchdown point on the seabed during the cable lay along the installation route to maintain positioning within the defined corridor;
- The cable departure angle will be monitored at the chute by visual means of on-board personnel. This method will be backed up with camera images sent to the bridge. This video will be recorded/logged to hard disk drive;
- Once the TDP is established, the departure angle is set and will remain the same as long as water depth is constant, and the vessel speed and cable pay out speed remain constant;
- If the water depth decreases or increases, the departure angle can be adjusted as necessary to ensure the desired distance of the touchdown point on the seabed determined by the ROV;
- The cable counter continuously measures the laid length so an accurate distance can be monitored, cable laid length against positional KP shown on the survey suite is to ensure the cable is not laid at a higher than allowable tension, which could induce free span or too much slack that could cause the cable to deform on the seabed;
- The ROV positioning at TDP is crucial if the cable starts to move to one side of the line due to current and if this happens the vessel can be manoeuvred to counteract this sideways movement.

Note: In case of shallow water installation, the trencher shall be equipped with cameras to fulfil the first bullet point requirement above.

The below data shall be recorded during cable installation:

- Time and date;
- Reference number navigational fix;
- Co-ordinates of the over boarding point;
- Co-ordinates of touch down point;
- Distance along the route (KP);
- Equipment reading of cable length measurement;
- Cable length since last calculation;
- Cumulative length;
- Distance to end of lay;
- Length of cable left on board;
- Cable lay tension log;
- Water depth (by Echo-sounder);
- Any fixes taken by surveyors during the lay ops.

Submarine cable tension and departure angle shall be recorded during the entire laying operation. Accuracy of the tension measurement shall be within ±500 kg. Accuracy of the departure angle measurement shall be within ±1 degree. The submarine cable tension shall be recorded on a continuous chart recording complete with time scale or other method.

7.4 Touchdown Monitoring

The ROV operated from the CLV providing TDM of Cable Lay Operations will be positioned using Sonardyne's Ranger USBL or any other equivalent USBL equipment. TD position accuracy from taken ROV Sonar ranges will be of meter accuracy.

The ROV will monitor and assist the cable laying operations by monitoring the cable position and integrity at or close to the TDP. The ROV will locate the cable on the seabed behind the lay vessel and move slowly towards it until the TDP is located.

The ROV position at touchdown will then be used to calculate the DCC of the cable relative to the proposed route. Throughout cable laying operations, the online surveyor will monitor the cable length. The surveyor will highlight any concern regarding the remaining cable length to the shift supervisor; the remaining cable length should always be longer than the remaining route distance.

The data received from the ROV during cable laying will be used as-laid survey data for preparation of the as-built report. All survey images & Videos that will be recorded onto DVD/HDD shall be provided to Company on completion of the campaign/upon request from Company.

7.5 Records of Installation Operation

The TDP data received from the ROV during cable lay shall be used for preparation of the As-Built report. Cable lay will be recorded on Video with commentary and made available on completion of the work.

During the Cable lay operation, Contractor to provide the following reports:

- Engineering/Plans to recover delays/non compliances, if any;
- As-laid video survey report after cable pull-in operations are complete;
- DPRs indicating;
    - ✓ Any HSE related incident/accident/near miss occurred in the last 24 hrs,
    - ✓ Summary of the Works performed,
    - ✓ Summary of the Works planned for the next 24 hrs,
    - ✓ Equipment/Spread downtime,
    - ✓ Vessel stand-by or downtime due to weather,
    - ✓ Equipment downtime,
    - ✓ Personnel/ Equipment/Spread on site, shipped back, arriving,
    - ✓ Shipping traffic, offshore activities including fishing activities, any activity that may be and/or become a hazard to the installation observed as well as received by radio.

At the completion of the Work, Contractor Shall provide a Final Report including the followings:

- Description of the Work and of discrepancies with the agreed scope of work/methods, if any;
- As-built project schedule showing the agreed baseline;
- As-built survey charts;
- Installation coordinates and As-built field charts;
- As-built drawings of mechanical protections used, if any;
- Collection of DPRs;
- Summary of 3rd Parties activities/potential hazards to the pipeline observed in the area;
- Interim Certificate;

- Provisional Acceptance Certificate.

All significant documents shall be approved, and counter signed by Company.

7.6 Installation Operations

Prior to the commencement of the offshore cable installation operations, the proposed route will be identified and analysed. The required tensions for the entire cable route, thereby taking water depth and installation tolerances into consideration shall be calculated. With the off-line tension calculation an analysis can be made where (abrupt) changes in tension levels are expected, however these shall not exceed the allowable tension on the cable during the lay.

The cable tension and departure angle as well as lay back distance and allowable free span during installation phase shall be detailed in dedicated installation analysis. These factors are critical and shall always be monitored and adhered to so as to maintain the integrity of the cable during installation.

At bidding stage, Contractor Shall demonstrate it is feasible and safe to perform cable shore pull-in as per requirements in DNVGL-ST-N001, [Ref 20]. Contractor Shall detail the operation in dedicated procedures and supported by the engineering analysis. This shall include the following:

- Demonstrate capability of the proposed marine spread versus project requirements and characteristics in all the installation phases;
- Track record of previous similar project done;
- To demonstrate trough calculation that maximum obtained values for cable pulling tension are compatible, and far below, with the product and the installation equipment;
- Installation procedure, sequence and complete set of sketches/drawings/storyboards showing an in-place efficient set-up, synchronisation, controlling and monitoring procedures for the entire operation, including a fail-safe automated emergency stop system to prevent failure of the cable;
- Plan and elevations for all item shifting and approaching to existing facilities, lowering, and docking; rigging-down. All sketches/drawings/storyboards shall be provided with dimension and shall be scaled;
- Completion works to achieve the RFHU milestones;
- Workability analysis (time stand-by estimate).

At project execution stage, Contractor Shall submit the below documents, but it is not limited to:

- Procedures with detailed marine and onshore works sequence;
- Associated Risk Assessment;
- Cable J-Tube pull-in Analysis;
- Cable Crossing Design, Analysis and Drawings;
- Cable Protection Procedures and Drawings;
- Applicable Structural Analysis;
- Cable rigging design and calculation notes;
- Vessel approaches drawings;
- Vessel operational limits for each activity;
- Cable burial procedures, analysis and drawings;
- Deck Layouts, Hold Back rigging arrangements for J-Tube winches and pull-in arrangement;
- Design and calculation of pulling head;
- Installation aids, storyboard, anchor pattern drawings;
- CLV, Installation Aids (Sea Serpent, Buoys etc.);
- Major Equipment and Cable data specification;
- Operation schedule, including weather stand-by;
- Transportation engineering;

- Dropped object study, mitigation measures to minimise any dropped object during removal, barriers in place (no lifting above subsea assets);
- Contingency Plan Procedures;
- Abandonment and Recovery Procedure.

7.7 Cable Testing

All power cable testing shall be conducted by qualified and skilled technicians preferably from the manufacturer personnel, as per approved procedure and test monitoring procedure. Contractor Shall detail cable testing during detailed design phase.

7.8 Field Preparatory Works

A crossing shall be prepared using concrete mattresses to cover the existing pipeline /cables prior to the power cable laying ops. For details of crossing refer to [Ref 46], [Ref 47], [Ref 48], [Ref 49], [Ref 50], [Ref 51], [Ref 52], [Ref 93], [Ref 94], [Ref 95] and [Ref 96].

7.9 J-Tube Centraliser and Bend Restrictor Assembly

J-Tube Centraliser and Bend Restrictor shall be installed to power cable at J-Tube bell mouth location.
J-Tube centraliser and Bend Restrictor shall be designed accordingly during detailed design phase. See bellow typical assembly (indicative) in Figure 7-1 and Figure 7-2.

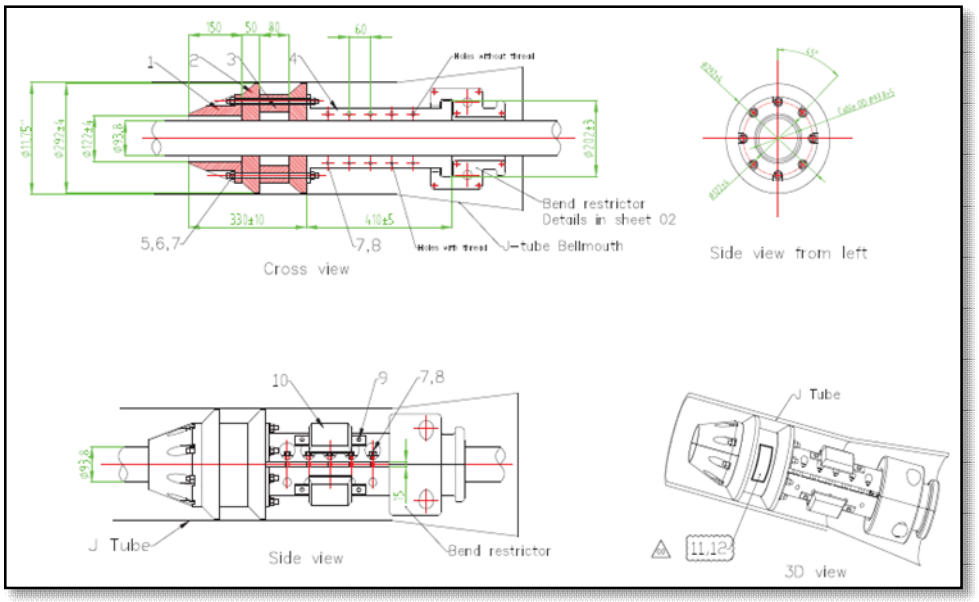


Figure 7-1 J-Tube Centraliser (Typical)

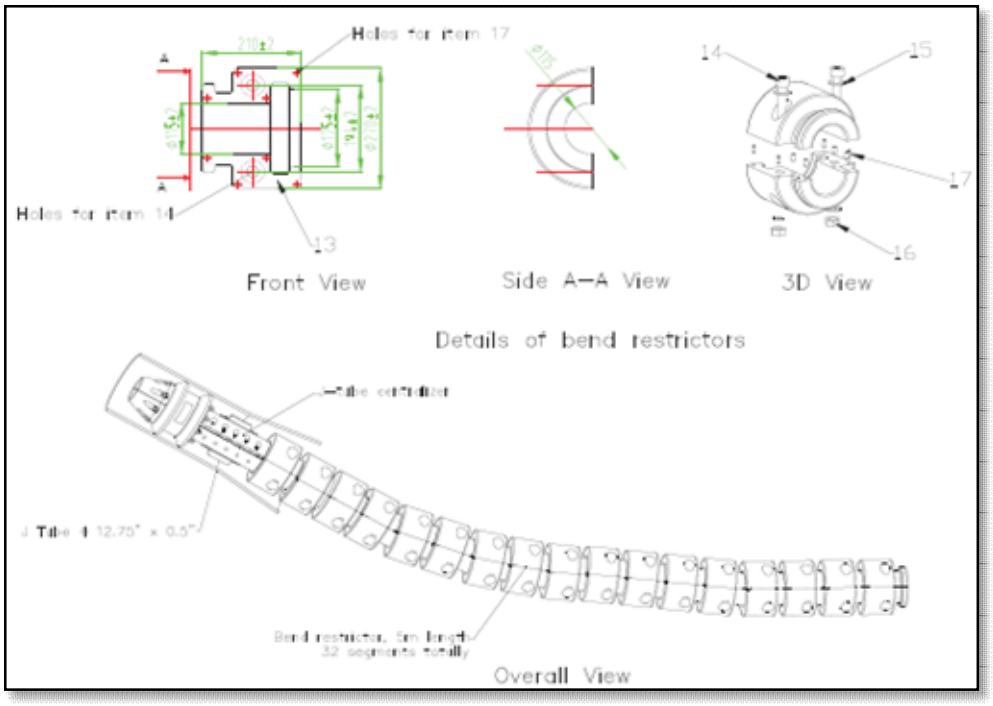


Figure 7-2 Bend Restrictor Assembly (Typical)

7.10 Cable Protection

Power cable shall be protected by URADUCT or any other means of required protection in the vicinity of structure(s) and at crossing location as specified in [Ref 48],
1025H0BSRV84107 "Offshore Subsea Cable Protection Requirement".

7.11 Contingency Procedures

Contractor Shall develop contingency procedures to cover all aspects of the cable lay and cable pull-in at platform operation including but not limited to:

- Adverse Weather;
- Obstruction on lay route / debris / boulder removal (minor and major debris);
- DP failure;
- ROV System Failure;
- Tensioner Failure;
- A&R Winch Failure;
- Crane Failure;
- Cable Outer Sheet Damage;
- Sliding OD Cable;
- Abandonment and Recovery procedure.

Detailed description and methodology Shall be provided by Contractor.

7.12 Cable Lay Positioning/Mooring

Once in field and prior to shore pull initiation, the CLV will be positioned according to approved positioning\mooring plan; the position of CLV whether on DP or on its anchors, if any, will be controlled by using a suitable positioning system. The exact position of the vessel crane will be determined by the CLV vessel Superintendent after review of the prevailing conditions and weather forecast.

Actual installation layout shall consider the actual CLV characteristics and the site environmental conditions at all times.

An appropriate positioning\anchoring sequence and procedure shall be chosen, taking into account the actual prevailing environmental conditions and the presence of underwater sealines. The characteristics of such mooring system will be defined by the Contractor. A pre-deployment underwater survey of the removal area, if necessary, will be carried out. In addition, laying through existing wind farms field, Contractor Shall acquire permission from field owner to approach and lay with suitable cable lay spread (anchor or DP).

7.13 Transportation and Sea-fastening Manual

A transportation & sea-fastening manual shall be developed and submitted to Company and MWS for approval. This Manual shall include description of, but not limited to:

- Schedule of the preparatory works before sail away;
- Schedule of the voyage to and from site as well as interim transitions between platforms;
- Organisation and communication (incl. responsibility matrix);
- General arrangement during transportation;
- Object/s to be transported;
- Barge structure, including internal and external barge reinforcement if any;
- Grillage and sea-fastening, (Class DNV or Lloyds Register approval of the sea-fastening report, whichever the vessel is classed with);
- Detailed tow route;
- Environmental conditions for the voyage;
- Barge/CLV ballast condition;
- Barge/CLV stability report (intact and damage);
- Extreme motions and accelerations expected during the voyage (shall be part of the sea-fastening report);
- Bollard pull calculation (if required);
- Preparatory works before sail away;
- Check lists;
- Utility requirements, workforce, consumables, electrical power, cooling water for preparatory works before sail away;
- Risk analysis report;
- Associated calculation notes, as needed in sections above;
- Associated drawings.

Note: The transportation and sea-fastening manual shall include the necessary calculation notes to document all above items. Contractor is required to prepare the transportation and sea-fastening manual in connection with the load-out/load-in manual and to check compatibility between the loadout arrangement (skid ways, skid shoes, skid beams, etc.), the transportation arrangement (barge grillage, sea-fastening, etc.).

7.14 Towing Manual

A towing manual (in case a barge is utilised) shall be developed and submitted to Company and MWS for approval. This Manual shall include description of, but not limited to:

- Organisation and communication (incl. responsibility matrix);
- Barge;
- Tow vessels;
- Towing equipment;
- Towing arrangement;
- Object/s to be transported;
- Transportation route;
- Schedule of the voyage;

- Ports / Place of refuge;
- Bunkering;
- Weather forecasting;
- Weather routing;
- Preparatory works and check lists;
- Reporting;
- Contingencies;
- Emergency procedure;
- Procedures for departure, for passages, for arrival on site.

Note: The towing manual shall include the necessary drawings/sketches/storyboards and calculation notes to document the bollard pull calculation and towing engineering.

7.15 Load-out Manual

A loadout procedure shall be developed and submitted to Company and MWS for approval. This Procedure shall include description of, but not limited to:

- Loadout method: skidding, trailers, lifting, etc.;
- Schedule;
- Organisation and communication (incl. responsibility matrix);
- General arrangement;
- Items to be loaded;
- Site and quay;
- Skid ways, skid beams, skid shoes, link beams;
- Barge, grillage, and sea-fastening;
- Loadout equipment and its spares, such as: trailers, winch systems, jacking systems, crane, lift rigging details, ballast pumps & arrangement;
- Mooring arrangements before, during and after the loadout;
- Fender details;
- Tide tables;
- Ballast procedure;
- Weather forecast;
- Loadout limitations such as environmental operation criteria, settlements /deflections /displacements, harbour traffic, etc.;
- Recording and monitoring procedure (barge draft, trim, heel, object advancement, etc.).
- Check lists;
- Videography of all basic stages to be documented.

Utility requirements, manpower, consumables, electrical power, cooling water, etc.

- Contingency plans;
- Emergency procedures;
- Associated calculation notes, as needed in sections above;
- Associated drawings.

Note: The loadout manual shall include the necessary calculation notes to document all above items, their strength, the clearances, the specific tolerances.

8.0 J-TUBE PLATFORM PULL-IN OPERATION

8.1 Pre-Lay and 1st End Preparatory Works

Prior to operations any Permit to Work (PTW) in accordance with the established Company procedures shall be in place. Only when the PTW has been issued the vessel will proceed with operations. Following preparatory work will be executed prior to cable pull-in operations commencement.

- Pre-lay survey;
- Placement of pre-lay concrete mattresses at the crossing locations along the lay route;
- Placement of turning bollards at 2nd End platform approach to accommodate temporary cable over-length storage “omega” on seabed;
- Placement of pull-in equipment and materials on the 1st End platform (for PoA-New Douglas cable coming from shore, pull-in equipment shall be placed before nearshore cable shore pull-in operation);
- Local circumstances may cause slight alterations to the intended layouts. The sheave block arrangement shall be secured to strong points of the Jacket structure as per Contractor drawings;
- The A&R winch wire will be connected to the Platform pull-in Tirfor wire on seabed in preparation for cross-hauling pull-in Tirfor wire to CLV.

Personnel will transfer to the platform. The crew will prepare the equipment on platforms prior to the start of the actual J-Tube pull-in. The scope of the platform support should be based on both scenarios, without and with Topsides (for Hamilton Main, Hamilton North and Lennox) and with Topsides being in place for Douglas and will consist of:

- Transit to Field;
- Vessel DP & Field Entry Trials;
- Installation of pneumatic Tirfor;
- Scaffolding Setup at Platforms (if required);
- Installation rigging and sheave blocks;
- Air supply to Tirfor;
- Tirfor and pull-in arrangement load test;
- Operation of the pneumatic Tirfor during J-Tube pull-in operations;
- Controlling of pulling force during J-Tube pull-in operations;
- Removal of Tirfors and other equipment after completion of cable installation;
- Post pull-in cable test and installation of temporary clamp (if required);
- Securing the cable over-length on the platform in such a way the cable(s) coming out of the J-Tube(s) MBR is within Contractor/Supplier specification and the secured cable over-length forms no obstruction when Topside(s) are placed. Cable to be rested on Sacrificial Quadrants at Platforms to maintain the MBR of the Cable. At Platforms/ Jackets, Cable Quadrant will be positioned to prevent clash/ obstruction during deck Installation;
- With the CLV, the necessary installation aids/rigging/Tirfor will be lifted on the respective Jackets/Topsides. Subsequently the Tirfor will be secured to the platform and further required rigging installed.

Prior to any cable pull-in, a visual inspection of bell mouths will be carried out by the ROV to check the condition of the bell mouth, and to identify any possible debris or obstacles in the vicinity of the bell mouth. A position check shall be done to compare actual position to designed position for later calculation of the “cut off” length.

After these checks the bell-mouth cover will be removed, in case of bellmouth’s cover is bolt type, Diver with spanner will be deployed to assist the removal. The 1st End messenger line will be recovered to the CLV directly at the start of pull-in operations. The 2nd End messenger wire will be prepared and positioned on the seabed, the position logged on the survey screen for later recovery and transfer of pull-in Tirfor wire.

For the 1st End J-Tube pull, the cable will run straight from the CLV and pulled into the platform through a pre-installed J-Tube by a temporary platform-based pull-in system where the cable will be run to the top of the J-Tube and the over-length is pulled onto the platform to be secured on the cable Quadrant.

At the 2nd End of the cable, the required amount of cable will be calculated on board the CLV and cut to length which is provide for options to complete pull-in at a stage through the respective J-Tubes at the New Douglas and Satellite Platforms (HH, HN, and LN).

The ROV will disconnect the A&R winch wire from deployment rigging then recover the A&R winch wire on deck. The cable to be wet stored at the proposed temporary lay route and the Cable End secured with deployment rigging on seabed.

ID	Procedural step description
Preparatory Works Prior to CLV Entering 500m zone	
1.	Initial Status • Risk Assessment review has been conducted and approved; • Toolbox talk has been conducted with all personnel involved in the operation; • All required survey data is displayed on the ships Navigation screen; • Weather suitable for operations; • A Communication protocol has been established.
2.	Client Representative to give the host platform sufficient notice of the CLV arriving in the field and ensure all work permits are/being prepared.
3.	Prior to CLV arrival on location and during the CLV operations, confirm weather forecast is available and ensure thereafter updated at regular intervals.
4.	Vessel to transit and set-up outside the platform 500m Zone and perform DP trails. On arrival in the field, radio-working channels shall be established with the control centre of the Host platform in the absence of a Clients Representative performing this role, the CLV Master should assume the responsibility for this communication. CLV Bridge and Deck team radios shall be set and tested on the established working channels that will be monitored throughout the operation.
5.	CLV deck crew to prepare the following equipment, ensuring it is ready for transferring from CLV to the platform.

ID	Procedural step description

Description	Unit	Qty
J-Tube Pull-In quadrant	ea	2
Master Link - 8 Te SWL	ea	2
½"Air Hoses	m	50
3.2 Te pneumatic Tirfor winch	ea	2
Manual Tirfor Winch 2 Te SWL	ea	2
Beam Clamp 8 Te SWL (To Suit Beam W24x55)	ea	2
Snatch Block - 8 Te SWL	ea	2
Lever Hoist 3 Te SWL	ea	1
Lever Hoist 1.5 Te SWL	ea	1
Chain Block 5 Te SWL	ea	2
Shackle 12 Te SWL	ea	4
Shackle 8 Te SWL	ea	4
Tension Load Cell-12 T SWL	ea	2
Round sling, 5 Te x 4.0m - hold back Chinese finger	ea	2
Round sling, 5 Te x 1.0m - for winch load test	ea	2
Round sling, 5 Te x 3.0m	ea	2
Round sling, 3 Te x3.0m	ea	2
Cargo Straps - (5 Te x10.0m) - Hold Back	ea	10
Spanner size 1 1/4" (32mm equivalent)	ea	4
J-Tube temporary hang-off (for 12- ¾" J-Tube)	ea	1

Note:

- Pull-in equipment to be transferred from CLV to platform crane landing area;
- Taglines on equipment and materials are required to be pre-installed;
- Full HSE controls to be applied under JSA and in line with PTW system;
- VHF communication to be established.

6.	Project Engineer to witness function the platform dedicated equipment and confirm it is ready for transfer.
7.	Test primary and secondary means of communication and ensure all personnel are aware of the **ALL STOP** signal in the event of a communications failure. **Note**: The use of Maritime Radio within the field and for the purpose of construction works has to be limited to the essential necessary use by vessels. No persons shall communicate on the marine radio channels for any other reason than essential shipboard operations in the case of emergency; any person is allowed to use the maritime radio, if necessary. All VHF/UHF handheld radios must be intrinsically safe.
Preparatory Works Within 500m Zone	
8.	Prior to the commencement of, and regularly throughout work scope activities the prevailing and forecast environmental conditions should be examined and monitored by: • CLV Master; • DPO's. It will be determined if the proposed operation will be carried out with the CLV in a "Blow on" or "Blow off" condition and the possibility of that criterion changing due to forecasted wind

ID	Procedural step description
	shifts.
9.	Confirm that “field services” has issued a valid PTW.
10.	DPO to obtain permission from Company to enter 500m zone of the platform. **Note**: Prior to approaching the platform, the CLV Master / OCM should satisfy themselves that all parties engaged in the operation are aware of their allocated duties and responsibilities. An escape route is to be determined by considering present and forecasted environmental conditions in relation to the platform. The escape route chosen is to be plotted and clearly displayed by the most effective means to enable DPO to maintain a safe horizontal clearance of the platform in the event of having to move away in manual control.
11.	DPO to set-up the CLV on DP at a suitable position to allow for personnel transfers to the platform. If required – ROV to assist for placement of Beacon, taut wire, and any related assistance/monitoring during set-up. Relevant reference systems to be checked and shall be operational. **Note**: Minimum stand off for CLV is 10m from the platform superstructure.
12.	Prior to personnel transfer, transfer information will be passed to the Company REP.
13.	Prior to conducting personnel transfer to the platform, Vessel master to review whether it is safe to transfer personnel. Consideration should be given to the pitch, heave, roll and yaw of the vessels. Weather conditions (visibility, wind, and sea states) are major factors that influence personnel transfer and shall be taken into account upon all transfers.
14.	Commence personnel transfer by RIB. **Note**: It is imperative that all baggage, equipment, and stores are transferred separately, and personnel should not attempt to transfer whilst carrying any items.
Platform Equipment Preparatory Works	
15.	Details of platform team are the following: • 1 x Supervisor; • 3 x RAT(s). Once platform team has boarded the platform, platform team to locate to the Jacket walkway deck and familiarise themselves with the layout. **Note**: Test primary and secondary means of communication once on location and ensure all personnel are aware of the **ALL STOP** signal in the event of a communications failure.
16.	Platform team to positively identify the allocated J-Tube for the subject cable that is being prepared for J-Tube pull operations. Conduct general survey of J-Tube top flange and local vicinity and access installation requirements for pull-in quadrant and rigging.
17.	Platform team to conduct general survey of leg and local vicinity and access installation requirements for hold back rigging. Platform team to assess for any risk hazard and obstructions. Paying particular attention to the following: • Handrails;

ID	Procedural step description
	• Walkway kick plates, trip hazards; • Floor grating.
18.	Platform team to relocate and positively identify the proposed tugger winch location as Contractor drawing.
19.	On CLV deck, Crew to prepare the equipment in preparation for transferring to Platform. Contractor Project Engineer to inspect all equipment prior to transfer and confirm satisfaction with condition and assembly. • Check general condition of each individual item; • Check assembly and orientation of components, alongside relevant drawings.
20.	DPO to set-up the CLV on DP at a suitable position to allow transfer of equipment to the platform. **Note**: Minimum stand off for vessel is 10m from the platform superstructure.
21.	Prevailing conditions and latest forecast shall have been reviewed and a suitable weather window identified for the particular activity (transferring project equipment).
22.	Deck Foreman / Deck Supervisor to review Lift Plan, and Risk Assessment for this task.
23.	Ensure lift route is suitably cordoned off and access to work area restricted to essential personnel involved in the lift operations.
24.	The cargo / project materials to be lifted from CLV to crane landing area by vessel crane then platform team to transfer from dropped location to working location on sea deck by manual handling. **Safety note for cargo transfer;** Tag lines to be attached on lifted objects to control the lift at take-off and landing.
25.	Platform team to locate the walkway deck and positivity identify the hold back structure member adjacent to main structural leg. Review access around the structural member for the installation of the pull-in rigging.
26.	Platform team to install pull-in Tirfor and preparation for rigging load test and pull-in cable.
27.	Platform team to locate the J-Tube and prepare for installation of the pull-in quadrant.
28.	Platform team to review access around the J-Tube.
29.	Platform team to install double wrap and choke a 5 Te x 1m round sling around the walkway outer tubular, which positioned adjacent to the J-Tube.
Platform Tirfor Load Test	
30.	Platform project team foreman/ Project Engineer to carry out visual inspection of all pull-in riggings (snatch block, round sling etc.).
31.	Platform team to flake-out air hose between pull-in pneumatic Tirfor and Air compressor. Ensure suitable hold backs and whip checks are installed. **Safety Note**: • Hydraulic and or pneumatic hoses shall have whip restrains; • Personnel to be aware of the tensioned winch lines at all times.

ID	Procedural step description
32.	Prior to conducting pneumatic Tirfor load test, winch operator to conduct a full function test and shall be monitored / audited. • Operate the pull-in Tirfor for the full travel of the operating lever; • Check for excessive noise; • Check for excessive vibration; • Check the operation of the hoist brake and condition of any brake linings /discs; • Verify that emergency stop fitted to Tirfor operates correctly; • Confirm stall settings; • Confirm pull-in Tirfor operates smoothly; • Visually check Tirfor wire.
33.	Pay-out on Tirfor wire and run the wire through snatch block in preparation for load testing platform Tirfor.
34.	Connect Tirfor wire to temporary load test rigging adjacent to 12 ¾" J-Tube utilising a 12 Te safety bow shackle.
35.	Platform team foreman to ensure load cell readout is set to zero.
36.	Prior to conducting pull-in Tirfor load test, ensure area is suitably cordoned off and access to work area is restricted to essential personnel involved in the pull test operations. **Note**: Test primary and secondary means of communication between load testing personnel and ensure all personnel are aware of the **ALL STOP** signal in the event of a communications failure.
37.	Provided that the Tirfor have passed the visual inspection and function test, a load test will be conducted and witnessed: • Load test the rigging to 2 Te; • Operate through entire range of movements to expose all components to test conditions; • Confirm that the brake holds the load; • Confirm that the Tirfor operates smoothly. **Note**: Load tests to be in accordance with class DNV/Lloyds Register (duration of the test)
38.	On completion, inspect the rigging for any damage or deformity.
39.	Platform team to remove the J–Tube load cell and temporary pull test hold back sling.
40.	Platform team to remove the J-Tube cover plate. Install lift rigging to assist with removal. **Note:** J-Tube temporary cover plate is connected to a messenger wire.
41.	Once the J-Tube temporary cover has been raised to allow access to the messenger wire 3/4"Ø shackle (4.75 Te SWL) Platform project team to connect the pull-in Tirfor wire to the messenger wire at the sling eye utilising 3/4"Ø shackle and disconnect and remove the temporary cover. **Note**: Ensure safety bow shackle is correctly connected and R-clip / Split pin is installed.
42.	Manoeuvre Quadrant into position and install to J–Tube**.**

ID	Procedural step description
43.	Platform team to conduct visual survey of the cable laydown (over-pull) area. Ensure floor grating and kickboard are protected with wood or similar product. This is required to protect the cable during over-pull operations.
44.	Task Completed.

Table 8-1: 1st End Preparatory Works Steps Description (typical)

8.2 Pre-Lay Concrete Mattresses Installation

Contractor Shall pre-install concrete mattresses before initiation of cable lay. Exact quantity and position will be determined during detailed design phase. For purpose of this document refer to [Ref 46], [Ref 51], [Ref 52] and [Ref 58]. Typical installation steps description is provided in bellow Table 8-2.

ID	Procedural Step Description
1.	Initial Status • Risk Assessment review has been conducted and approved; • Toolbox talk has been conducted with all personnel involved in the operation; • All required survey data is displayed on the ships Navigation screen; • Weather suitable for operations; • A Communication protocol has been established.
2.	Prior to CLV arrival on location and during the CLV operations, confirm weather forecast is available and ensure thereafter updated at regular intervals.
3.	CLV moves to pre-lay mattress installation location (if required).
4.	Deploy ROV to perform as-found survey.
5.	ROV to indicate the crossing position at existing pipeline/cable and surveyor to take a fix Table 5-3: List of Cable Crossing.
6.	Pre-determine target box/es for the mattress positions and safe zone for deployment shall be plotted on the navigation screen.
7.	CLV positions itself in the safe deployment zone.
8.	Rig up concrete mattress lifting frame to crane with concrete mattress attached to the frame. **Note:** rigging up shall be carried out in parallel with other activities where possible.
9.	Beacons will be fitted for positioning accuracy at both sides of the lifting frame.
10.	Tag lines will be fitted to control lifting and deployment.
11.	All rigging attached to deployment frames shall be fit for purpose and certified with the certificates sighted in the lifting register by the shift supervisor.
12.	To assist the ROV pilot with identification and positioning and provide greater protection against chafing damage, the long webbing slings between the installation frame and the concrete mattress may be tagged with different colours (i.e., one side of the frame red and the other yellow) and protected by a plastic sheathing.
13.	During installation the use of long webbing slings allows the load to be landed and detached from the rigging whilst still maintaining the installation frame high enough above the ROV during any periods of vessel motion to avoid ROV damage.
14.	Commence lift and slew overboard and deploy.
15.	When the mattress enters the water at the surface the line out meter for crane wire should be reset to zero to ensure accuracy on depth as the mattress descends. **Note:** Lowering through splash zone protocol to be followed.
16.	Lower down concrete mattress to approx. 5m above seabed in the safe deployment zone. ROV keep monitoring at a safe distance. **Note**: deployment of the mattress shall not be plumed on the subsea assets and at 5m or 2m (depending on the water depth and at the discretion of the deck leader) above seabed, vessel

ID	Procedural Step Description
	can move towards the target box for landing.
17.	Upon confirmation of its location and heading, lower down concrete mattress to seabed.
18.	Once deemed satisfactory by client representative, release the concrete mattress by pulling the quick-release handle using the ROV. Once released the crane can pick up the mattress lifting frame slowly to about 5m from seabed with the ROV monitoring the load and to ensure all hooks/riggings are disconnected from the mattress.
19.	Once confirmed all clear the mattress lifting frame can be recovered back to CLV deck.
20.	All rigging, handling lines, positioning equipment and installation aids will be recovered to the surface along with mattress lifting frame.
21.	ROV take fix at the four corners of concrete mattress and record location.
22.	ROV commence as-built survey, Continue to next crossing location
23.	Task Complete

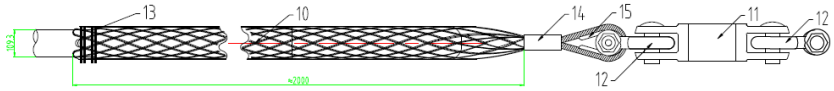
Table 8-2: Concrete Mattresses Installation Steps (typical)

8.3 1st End J-Tube Pull-In

The first end J-Tube pull-in operation will commence after the 1st End platform preparatory work has been completed, at this stage the CLV is manoeuvred on DP at the platform. For any circumstance that requires the CLV to transit out of 500m zone, the DP trial shall be performed prior to re-commencing the J-Tube pull-in operation. Typical installation steps are provided in Table 8-3 below:

ID	Procedural Step Description
1.	Initial Status • Risk Assessment review has been conducted and approved; • Toolbox talk has been conducted with all personnel involved in the operation; • All required survey data is displayed on the ships Navigation screen; • Weather suitable for operations; • A Communication protocol has been established; • Platform preparation works have been completed.
2.	Prior to CLV conducting cable pull-in operation, weather forecast shall be reviewed and ensure thereafter updated at regular intervals as per DNV-ST-N001: 2020, “Noble Denton Marine Services Warranty Standard”.[Ref 20].
3.	Radio-working channels shall be established with the control centre of the Host platform. In the absence of a Clients Representative performing this role, the CLV Master should assume the responsibility for this communication. CLV Bridge and Deck team radios shall be set and tested on the established working channels that will be monitored throughout the operation.
4.	Test primary and secondary means of communication and ensure all personnel are aware of the **ALL STOP** signal in the event of a communications failure. **Note**: The use of Maritime Radio within the field and for the purpose of construction works must be limited to the essential necessary use by vessels. No persons shall communicate on the marine radio channels for any other reason than essential shipboard operations, in the case of emergency; any person can use the maritime radio, if necessary. All VHF/UHF

ID	Procedural Step Description
	handheld radios must be intrinsically safe.
5.	Confirm that field services have issued a valid PTW.
6.	DPO to set-up the CLV on DP at a suitable position at the J-Tube face of the platform. Due consideration to be given to prevailing weather conditions. The seabed is heavily congested with assets. DPO to select suitable clear area for taut wire clump weights to be deployed. ROV to spot/monitor deployment of taut wire clump weights. If required - ROV to assist placement of Beacon, taut wire, and any related assistance/monitoring during set-up. Relevant reference systems to be checked and operational. **Note**: Minimum stand off for CLV is 10m from the platform superstructure. **Note**: An escape route is to be determined by considering present and forecasted environmental conditions in relation to the platform. The escape route chosen is to be plotted and clearly displayed by the most effective means to enable DPOs to maintain a safe horizontal clearance of the platform in the event of having to move clear in manual control.
7.	ROV to commence as-found survey at J-Tube and appurtenances. Identify any hazards that may affect ROV, cable lay operations and plot any obstructions on survey Video. ROV to pay particular attention to the following areas: • J-Tube; • J-Tube Bell mouth; • 150m along proposed lay route. **Note**: Any items identified as potentially hazardous to be highlighted to the Project Engineer and OCM for assessment. If possible, the ROV shall resolve / 'make safe' the worksite by removing or securing the debris. Should this be required then the MOC process shall control this operation. To be recorded on video with suitable commentary.
8.	Upon completion of ROV as-found surveys, Project Engineer, OCM & Client Rep to review. All parties (OCM, Project Engineer and Client Representative) to confirm satisfaction of the as- found survey.
9.	DPO to set-up the CLV on DP at a suitable heading on the J-Tube face of the platform to commence cable pull-in operations. Due consideration to be given to prevailing weather conditions **Note**: Vessel must always maintain a minimum 10m stand-off from platform superstructure.
10.	Deploy ROV to worksite and locate the J-Tube and positively identify the J-Tube bell month.
11.	CLV deck crew to prepare A&R winch wire.
12.	Cable lay supervisor is to inform CLV deck crew and platform team to commence messenger wire recovery to CLV.
13.	Prior to conducting operations test primary and secondary means of communication and ensure all personnel are aware of the **ALL STOP** signal in the event of a communications failure. Platform team have confirmed Topside pull-in equipment when fully operational and winch is connected to J-Tube messenger wire. CLV DPO/Master to ensure vessel is on the correct heading and offset distance.
14.	ROV to remove J-Tube bellmouth cover and connect to CLV A/R-winch wire

ID	Procedural Step Description
15.	ROV to position itself to allow for full overview of the bellmouth.
16.	On instruction from CLV Cable Lay supervisor, Platform operator to pay-out on platform wire. CLV A&R winch operator to pay-in on CLV A&R winch. ROV to monitor messenger wire & A&R wire catenary as well as the exit at the Bell mouth. Recover messenger wire to CLV deck.
17.	On confirmation that the messenger wire / platform winch wire has been recovered to the CLV. A&R winch operator to stop paying–in and Platform Tirfor operator to stop paying out. Deck crew to connect cable pull-in grip and secondary double eyes Chinese finger to platform Tirfor wire. 
18.	Set cable engine's/tensioner cable counter to zero (0) at Cable End.
19.	CLV to pay-out cable (ensure tensioner is on the correct set and constantly monitored), lower cable through the tensioner, chute and splash zone, Platform winch operator to pay-in on platform winch. ROV to monitor cable catenary as well as the entry at the Bell mouth. **Note:** Vessel to ensure heading and position is constantly monitored and maintained.
20.	Continue to pay-out cable and pull-in on the Platform, ensure vessel maintains offset distance and its position is maintained.
21.	On instruction from CLV shift supervisor. Stop at pre-determined cable count to install heat shrink tape, J-Tube centraliser or other means of cable protection. **Note:** • Apply Heat shrink tape from top of J-Tube flange to LAT -5m; • Ensure that cable counter figures/readings are checked against cable markings, so centraliser is installed properly; • Install specified cable protections means in a radius of 100m of platform approach (if required). Once centraliser / URADUCT are installed, CLV continue with lay.
22.	Continue cable pay-out, maintaining horizontal entry into bell mouth. ROV to monitor cable catenary as well as the entry at the Bell mouth.
23.	ROV to inform CLV & Platform crews when pull-in head is at the bell mouth.
24.	Adjust speed as necessary to allow clear entrance of cable into bellmouth. ROV to monitor cable catenary as well as the entry at the bellmouth. Continue cable pay-out / pay-in.
25.	During this process, cable pay-out will continue step by step to allow the safe application of URADUCT. Throughout this operation, the tension will be measured and controlled from the platform mounted winch, whereby the maximum allowable tension shall not exceed the maximum allowable cable tension.
26.	The cable will be pulled through the J-Tube to the snatch block. The cable will be temporary stopped off utilising temporary hang–off rigging. Tirfor wire will then be disconnected from pull-in head and removed from the snatch block and re-routed, then re-connected to the cable pulling head in preparation to conduct over pull operations.
27.	The platform team to pay-out on temporary rigging and transfer the load to the pull-in Tirfor.
28.	Under instruction from platform team foreman continue with pull-in, while CLV pays out on cable. Continue until the sufficient length is pulled to the Topside; over pull required.

ID	Procedural Step Description
29.	Platform crew to inform CLV to stop pay-out when maximum pull length has been achieved and centraliser has been located within the bellmouth.
30.	On completion the cable has been over pulled and cable centraliser has been positioned within bellmouth. The cable will be secured with static rigging.
31.	Platform crew to prepare temporary hang-off clamp to install at the top of the J-Tube.
32.	Cable shall be rested on cable quadrant and secured against railing at Cable End.
33.	ROV to conduct survey and pay particular attention to the following: • Bellmouth; • Cable catenary; • J-Tube centraliser; • To be recorded on video with suitable commentary. **Note:** Cables shall not deviate from the proposed route drawings at the platform approaches unless it is within the lay tolerance specified.
34.	This now completes the cable pull-in operations. Prior to conducting lay-away operations, cable to be tested by Contractor/cable manufacturer personnel as per approved testing procedure. Pull-in quadrant shall be left for supporting the cable until completion of cable termination by Contractor/ cable manufacturer personnel.
35.	Task completed.

Table 8-3: 1st End J-Tube Pull-In (typical)

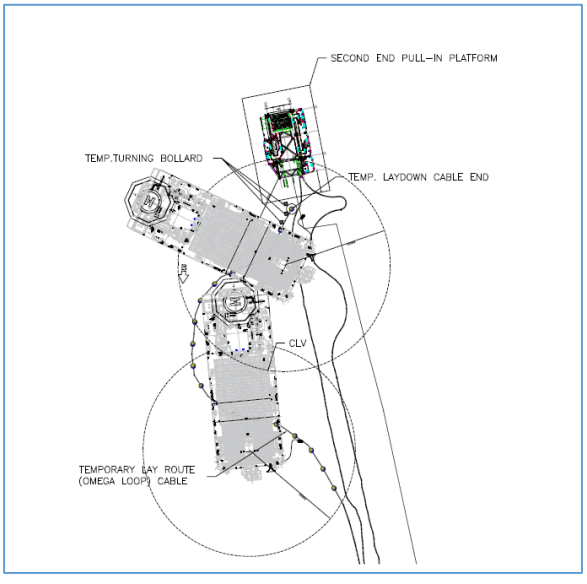
8.4 2nd End Preparatory Works

The CLV will be first positioned at the 2nd End pull-in platform to commence the subsea preparatory work at the 2nd End platform's location, when the subsea preparatory work at 2nd End completed, CLV will perform a pre lay survey and transit to First End pull-in location to commence 1st End pull-in and lay operation. As soon as the CLV arrival at 2nd End platform the 2nd End of each cable shall be wet stored as the proposed temporary lay rote (omega loop) on the seabed.
Note: Deployment of DMA and any survey beacons on the seabed shall be performed during this time.

8.5 2nd End Deployment

The CLV will be first positioned at 2nd End of cable. Typical installation steps for 2nd End deployment is presented in Table 8-4 bellow:

ID	Procedural Step Description for 2nd End Deployment
1.	Initial Status • Risk Assessment review has been conducted and approved; • Toolbox talk has been conducted with all personnel involved in the operation; • All required survey data is displayed on the ships Navigation screen;

ID	Procedural Step Description for 2nd End Deployment
	• Weather is suitable for operations; • A Communication protocol has been established; • Platform preparation works have been completed.
2.	Prior to CLV conducting cable deployment operation, weather forecast shall be reviewed and ensure thereafter it's updated at regular intervals. Test primary and secondary means of communication and ensure all personnel are aware of the **ALL STOP** signal in the event of a communications failure. **Note**: Radio-working channels shall be established with the control centre of the Host platform. CLV Bridge, RIB, Tension control, CLV deck team and Platform pull-in team radios shall be set and tested on the established working channels that will be monitored throughout the operation.
3.	The CLV will continue laying towards the temporary laydown's location. At a predetermined distance from the temporary laydown End (150m), meter marks will be applied to the cable. The position of the meter marks will be fixed at touchdown point using the ROV. Design KP´s, actual KP´s, cable counts and bell mouth survey values will be used to correct any calculated length to actual length. Knowing the calculated offset between cable counter readings and actual cable touchdown KP's the installation of defined cable means will commence at the calculated counter reading.
4.	DPO to deviate from planned route at a predetermined point taking into account heading, current and weather conditions. 
5.	At the 2nd End of cable, pull-in cable length and J-Tube length will be calculated.
6.	At a predetermined point, deck crew to attach cable protection means (as defined in detailed design).
7.	CLV will continue installing cable protection means whilst laying cable in small steps towards the platform along the temporary lay-route.

ID	Procedural Step Description for 2nd End Deployment
	Addition/apply heat shrink tape from top of J-Tube flange to LAT -5m.
8.	During final approach, OCM, and Project Engineer will check cable counts and KP´s to determine J-Tube centraliser and cable cut positions. Prior to conducting cable cutting, (as well as cable protection means and J-Tube centraliser installation), CLV project team to calculate and confirm position calculations which will be made based on following factors: • Cable Counter Readings; • KP distance from last cable mark to J-Tube KP along the route line (route distance), • J-Tube length; • Topside allowance; • Plus, an agreed additional length for contingency; • Allocated length for Primary & Secondary Chinese Finger.
9.	On instruction from CLV shift supervisor. Stop at predetermined cable count to install cable J-Tube centraliser. **Note:** • Ensure that cable counter values is checked against cable markings, so J-Tube centraliser is installed properly; • CLV deck crew to install cable protection means and J-Tube centraliser, refer to manufactures installation procedure. Once J -Tube centraliser has been installed, remove hold backs and continue with lay.
10.	At the agreed calculated position, stop paying out on cable. Deck crew to install temporary holdback (stopper) to the cable, onboard the CLV. Once temporary hold back cable installed. Deck crew to remove cable from the cable engine in preparation to cut cable. **Note**: Ensure prior to cutting, all calculations have been double checked and agreed.
11.	Cable to be tested prior to final cut and will be sealed by Contractor hired Personnel after which pulling grip has been installed. **Note**: End cap seals installation and pull-in grip installation will be carried out according to approved procedure.
12.	On confirmation cable pulling grip and secondary double eyes Chinese finger has been correctly installed, prior to deploying the Cable End, a temporary cable deployment arrangement will be attached to the Cable End.

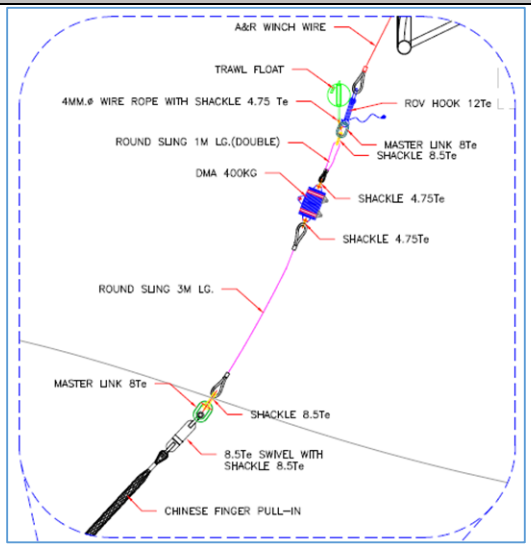
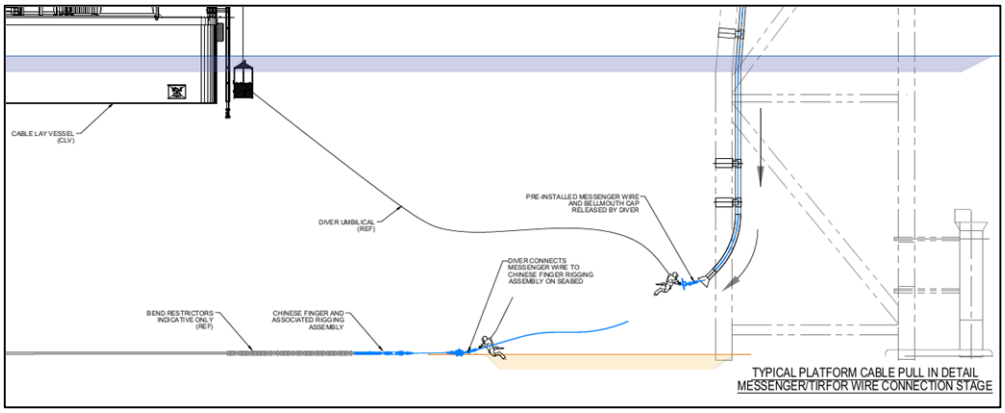
ID	Procedural Step Description for 2nd End Deployment
	
13.	Deploy the Cable End to seabed by A&R winch. Vessel move in small steps ahead until Cable End is laid on seabed, while ROV monitoring the touch down points of the cable at the seabed, in order to maintain catenaries / lay-back, departure angles and tension.
14.	ROV takes position fix on the temporary cable deployment arrangement for Cable End.
15.	ROV disconnect A&R winch from temporary cable deployment and recover A&R winch on deck then the CLV will be freed from the cable.
16.	CLV is positioning overturning bollard's locations to recover all of the turning bollards.
17.	ROV to conduct survey and pay particular attention to the following: • Temporary laydown end; • J-Tube centraliser & Bend restrictor; • URADUCT; • Inspection along the cable route line; 📽 To be recorded on video with suitable commentary. **Note:** Cables shall not deviate from the proposed temporary lay route (Omega loop) drawings.
18.	Repeat task step for other cable (if required).
19.	Task completed.

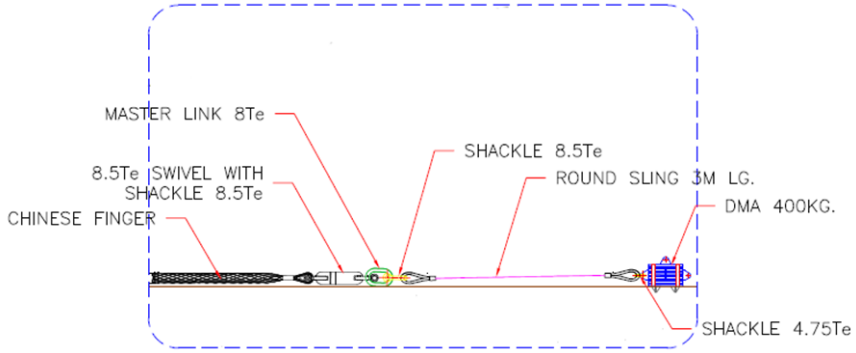
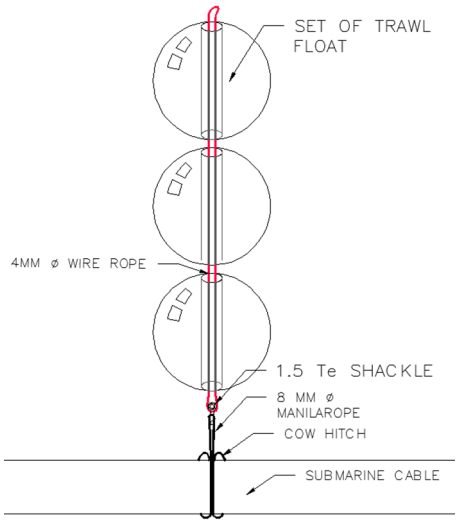
Table 8-4: 2nd End Deployment (typical)

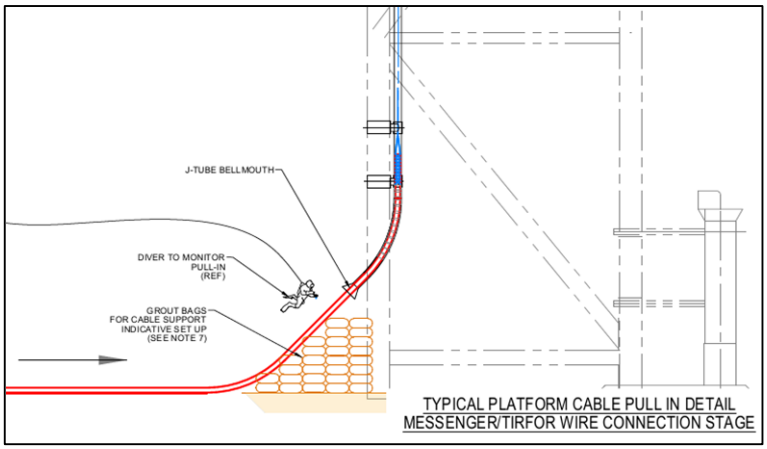
8.6 2nd End J-Tube Pull-In

The 2nd End J-Tube pull-in operation will commence after the platform preparatory work has been completed, at this stage the CLV is manoeuvred on DP at the platform. For any circumstance that requires the CLV to transit out of 500m zone, the DP trial shall be performed prior to re-commencing the J-Tube pull-in operation. Typical 2nd End J-Tube pull-in installation steps are presented in Table 8-5 bellow:

ID	Procedural Step Description
1.	Initial Status • Risk Assessment review has been conducted and approved; • Toolbox talk has been conducted with all personnel involved in the operation, • All required survey data is displayed on the ships Navigation screen, • Weather suitable for operations, • A Communication protocol has been established, • Platform preparation works have been completed.
2.	Prior to CLV conducting cable pull-in operation, weather forecast shall be reviewed and ensure thereafter updated at regular intervals **Note**: Weather forecast will be issued as per [Ref 20], DNV-ST-N001: 2020, "Noble Denton Marine Services Warranty Standard".
3.	Radio-working channels shall be established with the control centre of the Host platform. In the absence of a Clients Representative performing this role, the CLV Master should assume the responsibility for this communication. CLV Bridge and Deck team radios shall be set and tested on the established working channels that will be monitored throughout the operation.
4.	Test primary and secondary means of communication and ensure all personnel are aware of the **ALL STOP** signal in the event of a communications failure. **Note**: The use of Maritime Radio within the field and for the purpose of construction works has to be limited to the essential necessary use by vessels. No persons shall communicate on the marine radio channels for any other reason than essential shipboard operations In the case of emergency; any person is allowed to use the maritime radio, if necessary. All VHF/UHF handheld radios must be intrinsically safe.
5.	Confirm that field services has issued a valid PTW.
6.	DPO to set-up the CLV on DP at a suitable position at the J-Tube face of the platform. Due consideration to be given to prevailing weather conditions. The seabed is heavily congested with assets. DPO to select suitable clear area for taut wire clump weights to be deployed. ROV to spot/monitor deployment of taut wire clump weights. If required - ROV to assist for placement of Beacon, taut wire and any related assistance/monitoring during set-up. Relevant reference systems to be checked and operational. **Note**: Minimum stand off for CLV is 10m from the platform superstructure. **Note**: An escape route is to be determined by considering present and forecasted environmental conditions in relation to the platform. The escape route chosen is to be plotted and clearly displayed by the most effective means to enable DPOs to maintain a safe horizontal clearance of the platform in the event of having to move clear in manual control.
7.	ROV to commence as-found survey at J-Tube and appurtenances. Identify any hazards that may affect ROV, cable lay operations and plot any obstructions on survey Video. ROV to pay particular attention to the following areas: • J-Tube; • J-Tube bellmouth;

ID	Procedural Step Description
	• Temporary laydown end; • 150m along proposed lay route. **Note**: Any items identified as potentially hazardous to be highlighted to the Project Engineer and OCM for assessment. If possible, the ROV shall resolve / 'make safe' the worksite by removing or securing debris. Should this be required then the MOC process shall control this operation. To be recorded on video with suitable commentary.
8.	Upon completion of ROV as-found surveys, Project Engineer, OCM & Company Rep to review. All parties (OCM, Project Engineer and Company Representative) to confirm satisfied of the as-found survey.
9.	DPO to set-up the CLV on DP at a suitable heading on the J-Tube face of the platform to commence cable pull-in operations. Due consideration to be given to prevailing weather conditions **Note**: Vessel must always maintain a minimum 10m from platform superstructure.
10.	Deploy ROV / Diver to worksite and locate the J-Tube and positively identify the J-Tube bellmouth. 
11.	CLV deck crew to prepare A&R winch wire.
12.	Cable Installation supervisor is to inform CLV deck crew and platform team to commence messenger wire recovery to CLV.
13.	Prior to conducting operations, test primary and secondary means of communication and ensure all personnel are aware of the **ALL STOP** signal in the event of a communications failure. Platform team have confirmed Topside pull-in equipment if fully operational and Tirfor wire is connected to J-Tube messenger wire. CLV DPO/Master to ensure vessel is on the correct heading and offset distance.
14.	Diver/ROV to position itself to allow for full overview of the bellmouth.
15.	On instruction from CLV Cable Installation supervisor, Platform operator to pay out on platform Tirfor wire. CLV A&R winch operator to pay-in on CLV A&R winch. ROV/Diver to monitor messenger wire & A&R wire catenary as well as the entry at the bellmouth. Once the 1st End of Tirfor wire on seabed (close to temporary laydown end) then Diver/ROV to disconnect the messenger wire from Tirfor wire and recover messenger wire onto CLV deck.
16.	Diver / ROV to disconnect the DMA at temporary deployment rigging then recover on the CLV deck.

ID	Procedural Step Description
	
17.	On confirmation that the DMA has been recovered to the CLV. Diver/ROV to connect the cable laydown pull-in head to the Tirfor wire.
18.	Deck Crew to connect 4 sets of Atlantis Trawl floats (3 floats) to DMA 400kg then lift / lower to subsea locations by vessel crane. The DMA shall be relocated to the attach locations then diver to disconnect the Atlantis Trawl floats and attach to the cable. Repeat this step for other locations. Diver/ROV to attach Atlantis Trawl floats (3 floats) to the cable utilising 8mm manila rope choked c/w 1.5Te safety bow shackle. **Note:** • Lower buoy shall have a minimum of 800mm pennant (8mm manila rope) – this is to ensure avoidance of any entangled during pull-in. • Float Net buoyancy 17.6kg each. • Set buoy capacity = 50kg/set • Buoy interval = 5.0m (correct intervals at the discretion of the deck leader and according to water depth) • Combined weight of Power cable and Buoy in the water = 11.9kg/m  **Note**: • The trawl floats shall be installed in 5m intervals beginning at cable pulling head to the

ID	Procedural Step Description
	end of URADUCT, • The Diver shall strip out buried cable from the mud if the cable is buried, • On confirmation that all the trawl floats already attached to the cable as designed locations then diver back to the surface.
19.	Platform Tirfor operator to pay-in on platform Tirfor (take up the slack only). ROV to monitor cable moving into J-Tube. **Note**: Vessel to ensure heading and position is constantly monitored and maintained.
20.	RIB master to position itself in preparation for subsea floats recovery. **Note:** RIB to stay away from float surfacing area so floats do not hit the RIB when arriving on surface.
21.	ROV to set up in position to monitor cable during pull-in operations and ensure ROV has the correct shear cutter installed to release subsea floats.
22.	On confirmation that ROV, RIB, Platform team and CLV teams are in position and communications protocol has been checked and confirmed. CLV shift supervisor to instruct Platform Tirfor operator to pay-in on Platform Tirfor. ROV to monitor cable entry into bellmouth.
23.	Once cable pulling head approaches bellmouth, ROV to position itself to allow for cutting Atlantic trawl floats.
24.	Just before the cable reaches the bellmouth, the first float will be cut away by the ROV. **Note**: The exact timing and distance being dependent on the angle of approach to protect the Cable's MBR. The surfacing hard floats will be recovered by a RIB with 2 persons on board. When RIB is full the floats will be brought to CLV meanwhile ROV stops cutting off floats.
25.	As the pull-in continues, subsequent floats will be cut away at the bellmouth and the floats recovered by the RIB. **Note**: The speed of the pull-in will be dependent on the tension limits at the Tirfor and the entry angle of the cable into the bellmouth. Once the cable has exited the top of the J-Tube and sufficient length is pulled Topside an **ALL STOP** will be called.
26.	The Cable will be pulled through the J-Tube over the pull-in Support bow. The cable will be stopped off and platform project team to install 2nd (open) fleeter if a staged pull is required.
27.	Platform crew to stop pull-in when maximum pull length has been achieved and centraliser has been located and or locked in within the bellmouth.
28.	ROV / Diver shall verify that there are no excess loops left on the seabed at platform approach after cable pull-in and the cable is left within the platform width corridor to the south. Any loops outside this corridor shall be rectified in by Contractor with the applicable task plans and risk assessments. 

ID	Procedural Step Description
	Grout bags can be utilised to give support to the cable in case bend restrictors are not enough or not present.
29.	The cable over length above J-Tube flange will be stored on the pull-in quadrant until completion of cable termination by Contractor.
30.	Platform crew to prepare temporary hang-off clamp to install and secure the cable at the top of the J-Tube.
31.	Secure over length cable to pull-in quadrant.
32.	ROV to conduct survey and pay particular attention to the following: • Bellmouth; • J-Tube centraliser and bend restrictors; • Inspection of cable route line after trawl float removed. To be recorded on video with suitable commentary. **Note:** Cables shall not deviate from the proposed route drawings at the platform approaches unless it is within the lay tolerance specified.
33.	Testing of the cable shall be conducted by Contractor and or cable manufacturer personnel.
34.	This now completes the cable pull-in operations. Platform deck crew to remove equipment / materials and recovery to CLV. In addition, platform project team to re-instate walkway grating and construct temporary handrails utilising scaffolding as required.
35.	Project Engineer and Company Rep to conduct as-left survey of the areas where intervention (platform) has been conducted and confirm area(s) are left in a suitable condition.
36.	Repeat task steps for other cable.
37.	Task completed.

Table 8-5: 2nd J-Tube Pull-In Operation (typical)

8.7 Survey Operations for Cable Installation

During Cable Lay Operations the CLV will be positioned using DGPS to meet specified installation corridor requirements as defined in the Lay Route Drawings. Surveyor Shall mark the location of existing pipelines, cables, and other structures in critical areas and identify any pipeline or cable crossings and plot into survey navigational screen. Surveyor to ensure that crossing supports, and the like are installed within the approved tolerances.
The submarine cable shall be closely monitored as it is being laid for any out-of-corridor tolerance or for any damage. The monitoring shall be undertaken using ROV at all bends, crossings, corridor spools and during J-Tube pulls. The ROV operated from the CLV providing TDM of Cable Lay Operations will be positioned using Ultra Short Baseline (USBL).
After the 2nd End pull is completed, separate as-built survey to be performed. The logged data will be used to generate the preliminary As-built report.

The As-Built report will include:

- Summary of the results;
- Personnel and equipment used;
- Geodetic and navigation parameters;
- Daily Progress Report;

- As Laid Route Map;
- Survey charts.

8.8 Contingency Operations

Contractor Shall develop procedures to be followed in the event of contingencies that may occur during the submarine cable installation operation. The following contingency procedures, but not limited to, shall be provided during details design phase.

- Cable Damage and Repair;
- Weather Contingency;
- Tensioner break down;
- DP run-off (in DP mode);
- “Heaving to”;
- Currents;
- Fishing gear or fishing nets;
- ROV breakdown;
- Abandonment;
- Recovery;
- Contingency Procedures for ROV Operations;
- Fatigue Management.

9.0 MARINE SPREAD

Contractor Shall provide Cable Laying Vessel (CLV) able to safely perform the works and provide feasibility study including concept drawings and preliminary installation analysis and demonstrate feasibility of operation. All vessels shall conform to MARPOL, including:

- General requirements over the control of waste oil, engine oil discharges and grey and black wastewater discharges;
- Prevention of pollution by garbage from ships and prevention of air pollution;
- and maintain operating procedures for dealing with incidents such as oil and waste spillages that potentially may threaten the marine environment.

9.1 CLV Mubarak Supporter

For the purpose of this study, multipurpose shallow draft spud pontoon type of vessel with both DP and anchor capabilities has been chosen (MSV Mubarak Supporter). Vessel is only indicative; Contractor shall propose its own Cable Lay Vessel to accommodate all project and marine requirements.

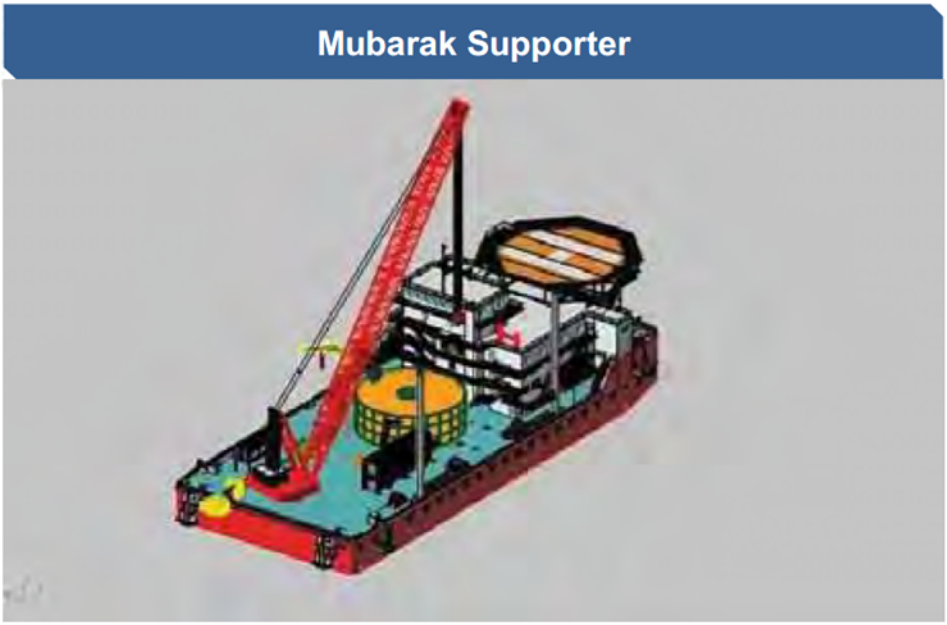


Figure 9-1 CLV Basic View

SELF PROPELLED DPII, 8-POINT MOORING, 206 PERSONS WORK ACCOMMODATION BARGE CAN BE CONFIGURED FOR CABLE LAYING. OFFSHORE CONSTRUCTION / HOOK UP AND DEEP SEA DIVE and ROV SUPPORT OPERATIONS

Marine Technology, Bridge Mate, ABS, PAS, DPS-2, HAB (WB), UWILD,HELIDK, Unrestricted Services, x2 DGPS, x1 HPR, x1 taut Wire, x1 laser Scan, x3 Gyro compasses, x2 wind sensors, x1 independent back-up joy stick system

DIMENSIONS

Length Overall	77.50 m
Breadth Moulded	30.00 m
Depth Moulded	5.5 m
Minimum Draft	2.4 m with 15days consumables
Maximum Draft	3.9 m
GRT	4836 MT
NRT	1451 MT

MACHINERY

Main Generator	3x Guascor 1115kW = 3345kW with Leroy Sommer Alternator Aux. Generator: 2 x Guascor 866kw = 1732Kw Hydraulic Power Pack, 2 x Caterpillar diesel 750kW = 1500kW
Emerg. Generator	1x Guascor · 422kW
Total Power	6999 kW
PMS	1 x Terasaki (60Hz)
OWS	1 x 0.5m3/h , 15ppm
Fresh Water Maker	3 x 30t/day = 90t/day Production
Sewage Plant	2x Manipur, Germany Membrane (Black & Gray Water) type with UV Sterilization system

CLEAR DECK AREA

Work Deck Area	1303 m2
Deck Strength	10 t/m2- with capacity for 4,000t Carousel

CAPACITY

Fuel Oil	561 m3
Fresh Water	1616 m3
BFW	1979 m3
Freezer Room	138 m3
Chiller Room	108 m3
AC unit	2 x 133 T = 266 TONS of Screw Type for Chilled Water System with Independent Room Temperature Control

REGISTRATION

Year of Built	2013
Builder	Dubai Ship Building & Engineering LLC
Flag	U.A.E
Class	American Bureau of Shipping
Class No.	YY242127
Port of Registry	Dubai, UAE
Owner	Mubarak Marine LLC

PROPULSION SYSTEM & DP THRUSTERS

Propulsion	4 x Verhaar Omega – water jet type Thruster Model 31140 rated 550kw @ 1800R 4 x Hydraulic driven retractable Thrusters of 750 kW each
DP	DP II, Joystick controlled w/ independent thruster control

DECK EQUIPMENT

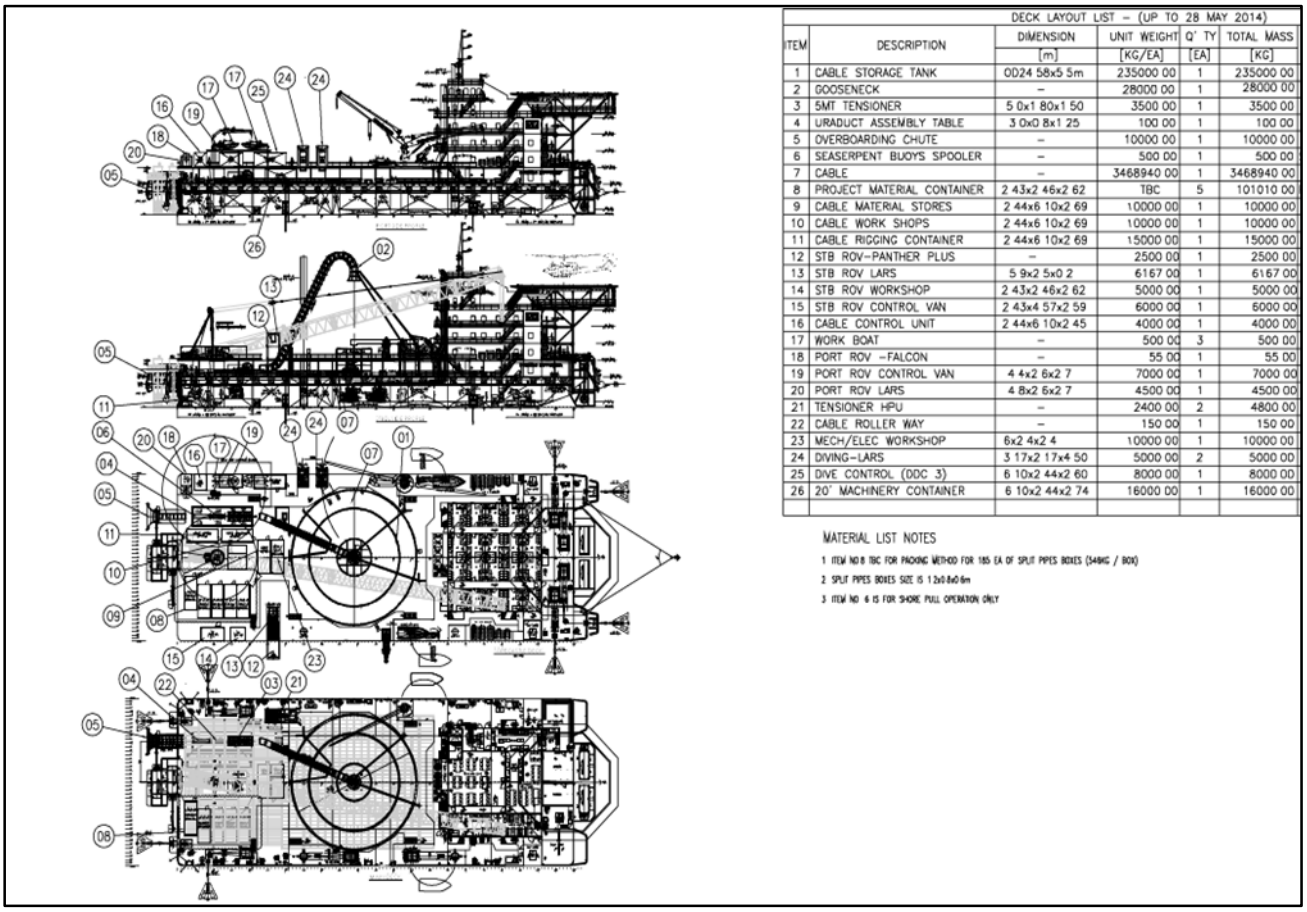
Main Crane	1 x Pedestal Mounted Manitowoc Crane of 250t Lifting Capacity Model 2250 Series 1
Auxiliary Crane	1 x Electro Hydraulic Cranev12t – 200m Hook Reach
Mooring Winch	8 x 40t pull, 100t break holding power
Mooring Wire	Length 1000m of Dia 42mm wire
Spud Legs	Length 27m of Dia 1200mm
Spud Winches	2 x 30 t pull, Electric winches
Anchors	8 x 7T Delta Flipper Anchors

HELIDECK Designed for Bell 412&212 for Helicopters with D" value up to 22.2m

WORKSHOP FACILITY

64 m2 Mechanical/Fabrication/Welding Shop located on Main Deck/Winch Room. Equipment with Work Bench, Drill, Vice, Grinding Machine, Welding & Fabrication Equipment & 2nos

Figure 9-2 CLV Basic Specification



DECK LAYOUT LIST – (UP TO 28 MAY 2014)

ITEM	DESCRIPTION	DIMENSION [m]	UNIT WEIGHT [KG/EA]	Q'TY [EA]	TOTAL MASS [KG]
1	CABLE STORAGE TANK	0024 58x5 5m	235000 00	1	235000 00
2	GOOSENECK	–	28000 00	1	28000 00
3	5MT TENSIONER	5 0x1 80x1 50	3500 00	1	3500 00
4	URADUCT ASSEMBLY TABLE	3 0x0 8x1 25	100 00	1	100 00
5	OVERBOARDING CHUTE	–	10000 00	1	10000 00
6	SEASERPENT BUOYS SPOOLER	–	500 00	1	500 00
7	CABLE	–	3468940 00	1	3468940 00
8	PROJECT MATERIAL CONTAINER	2 43x2 46x2 62	TBC	5	101010 00
9	CABLE MATERIAL STORES	2 44x6 10x2 69	10000 00	1	10000 00
10	CABLE WORK SHOPS	2 44x6 10x2 69	10000 00	1	10000 00
11	CABLE RIGGING CONTAINER	2 44x6 10x2 69	15000 00	1	15000 00
12	STB ROV–PANTHER PLUS	–	2500 00	1	2500 00
13	STB ROV LARS	5 9x2 5x0 2	6167 00	1	6167 00
14	STB ROV WORKSHOP	2 43x2 46x2 62	5000 00	1	5000 00
15	STB ROV CONTROL VAN	2 43x4 57x2 59	6000 00	1	6000 00
16	CABLE CONTROL UNIT	2 44x6 10x2 45	4000 00	1	4000 00
17	WORK BOAT	–	500 00	3	500 00
18	PORT ROV –FALCON	–	55 00	1	55 00
19	PORT ROV CONTROL VAN	4 4x2 6x2 7	7000 00	1	7000 00
20	PORT ROV LARS	4 8x2 6x2 7	4500 00	1	4500 00
21	TENSIONER HPU	–	2400 00	2	4800 00
22	CABLE ROLLER WAY	–	150 00	1	150 00
23	MECH/ELEC WORKSHOP	6x2 4x2 4	10000 00	1	10000 00
24	DIVING–LARS	3 17x2 17x4 50	5000 00	2	5000 00
25	DIVE CONTROL (DDC 3)	6 10x2 44x2 60	8000 00	1	8000 00
26	20' MACHINERY CONTAINER	6 10x2 44x2 74	16000 00	1	16000 00

MATERIAL LIST NOTES

1 ITEM NO 8 TBC FOR PACKING METHOD FOR 185 EA OF SPLIT PIPES BOXES (348KG / BOX)

2 SPLIT PIPES BOXES SIZE IS 1 2x0 8x0 6m

3 ITEM NO 6 IS FOR SHORE PULL OPERATION ONLY

Figure 9-3 CLV Typical Deck Layout for Cable Lay

9.2 Rigid Inflatable Boats (RIB)

RIB shall be used to control horizontal movement of cable during pull-in, to assist with Sea Serpent installation and removal, for initiation of messenger wire and cable wire pull to winch position.

Figure 9-4 RIB (Typical)

10.0 INSTALLATION DURATIONS

Detail of allocated working activity duration for the Cable Lay SoW is presented on Figure 10-1 as an indicative schedule of works.

Following conservative assumptions were considered:

- Cable Lay Rate 6000m/day;
- WoW 30% Net of total duration;
- Platform Preparation Works Included Intervention Works.

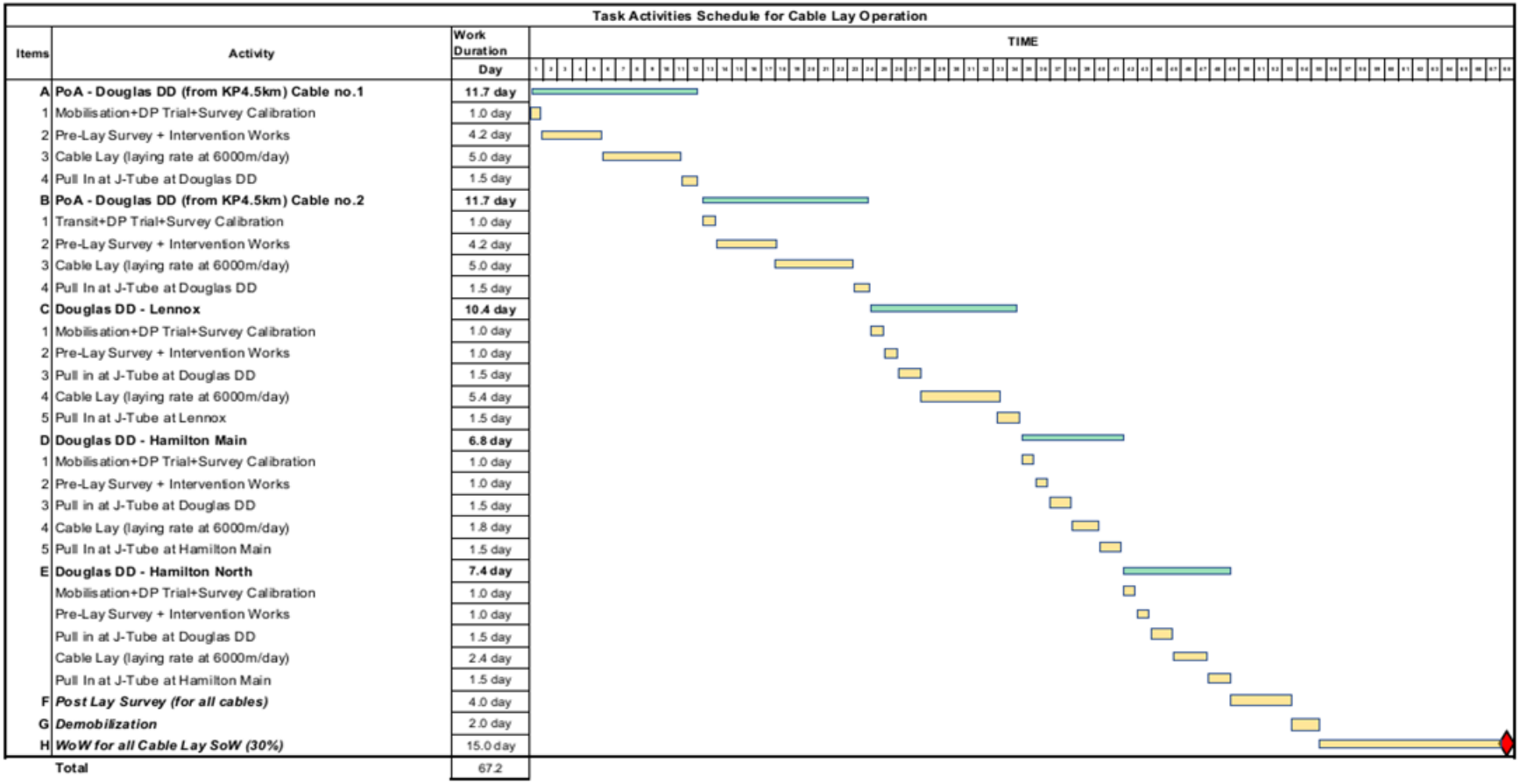


Figure 10-1 Operation Duration for Cable Lay

11.0 AREAS OF CONCERN

This section is intended to identify those areas of challenge, address the related concerns and to discuss in detail their impact on the success of the project.

The following areas of challenge have been identified that will be discussed in detail in the next sub-sections:

11.1 West Hoyle Spit and Length of Cable Shore Pull-In

As presented in document, current methodology is based on requirement of having one single continues laying cable campaign from PoA to Douglas with no splicing of cable along the route. Very shallow water depth with significant tide level is present in Liverpool Bay. In addition, there is presence of West Hoyle Spit, an elevated shore area during lower tide conditions. This impacts the vessel approach and length of cable nearshore pull-in. Significant sediment movement is also present which impact alternative route without proper survey done ahead and as well presence of environmentally protected areas (around dunes and beach areas). Contractor Shall organise and develop their installation strategy taking into consideration all complexities of shore approach. Contractor must ensure that all risks are mitigated, and proper actions are taken.

11.2 Cable Laying Route Through Existing Wind Farm

Along current cable route existing wind farm (Gwynt Y Mor) is present. Cable Laying Vessel shall be equipped with DP system as running of anchors through wind farm is not verified in FEED phase. Therefore, a dedicated CLV vessel must comply with further requirements and to be capable of shallow water approach and have DP capabilities. Contractor to evaluate operability of their vessel in shallow water and choose adequate Cable Laying Vessel for cable nearshore approach and installation.

11.3 Synergy with Existing and New Platform (Topsides) with new J-Tubes Installation

Contractor Shall organise and develop their installation strategy based on that installation of new J-Tubes on existing Jackets are in conjunction with removal of existing Topsides. Contractor shall provide detailed removal and installation methodology to demonstrate their capability to remove structures without impacting future installation of new structures such as J-Tubes and new Topside.

11.4 Operational Weather Window

Contractor must minimise downtime for cable laying activities by choosing the most adequate weather window during the year (even in the wintertime) where operation can be carried out in a safe and efficient manner. Contractor must provide a detailed offshore construction schedule, including any downtime (weather, etc.) at tender and detailed engineering phase to demonstrate their capability to install cables without impacting overall project schedule. Downtime shall be highlighted in the provided schedule.

11.5 Requirements for Consultation

For decommissioning of oil and gas assets in the UK, there is a statutory requirement for Operators to consult with stakeholders who may be affected by decommissioning proposals under Section 29(3) of the UK Petroleum Act 1998 [Ref 29]. This ensures information is made public and provides various stakeholders with the opportunity to deliberate in input and decision-making in the execution of the project.

11.6 Statutory Consultees (UKCS)

As part of stakeholder consultation, Annex H of the BEIS Guidance Notes [Ref 28] stipulates organisations that should be contacted for decommissioning.

Government departments with relevant roles to whom a draft Decommissioning Programme must be sent are identified in Annex E of the Guidance Notes[Ref 28].

As decommissioning program of existing structures is directly corelated with installation of new structures, Contractor shall take into consideration the UKCS in their overall execution programme.

11.7 Consultation Process

When UKCS statutory consultation starts that is when the draft Decommissioning Programme is submitted to BEIS/OGA which is when, within brief period thereafter, a public notice is made for the decommissioning proposals. The outcome of the consultation process is reported in the Decommissioning Programme prior to final submission. As decommissioning program of existing structures is directly corelated with installation of new structure, Contractor shall take into consideration the Consultation Process in his overall execution programme.

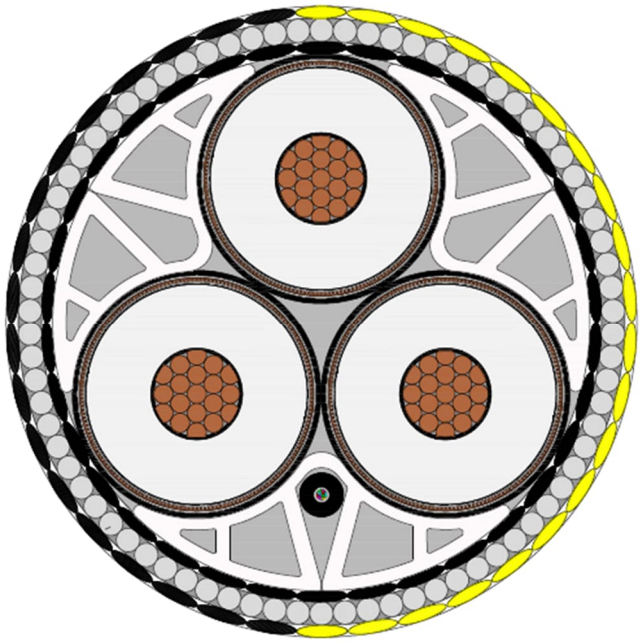
12.0 ATTACHMENTS

12.1 Cable Data Sheet

General DataSheet

Single Armoured Submarine Cable.

Copper conductor + XLPE + Copper Wires+ Copper foil bonded to the PE sheath



Drawing for indication only.

Rated voltage $U_0/U(U_m)$: 18/30(36)kV or 19/33(36)kV

Cable cross sections:

3 x 240 mm²	3 x 500 mm²
3 x 300 mm²	3 x 630 mm²
3 x 400 mm²	

Governing Standards

Construction:	IEC 60502-2 IEC 60228 EN 10257-2 EN 10244-2
Current Ratings:	IEC 60287-1-1 IEC 60287-2-1 IEC 60949

J-tube Rating:

R. A. Hartlein, Z. Black "Ampacity of Electric Power Cables in Vertical Protective Risers" IEEE 1983

Anders G. "Rating of cables on riser poles" Jicable 1995

S.L. Cress, J. Motlis "Temperature rise of submarine cable on riser poles" IEEE 1991

Type tests (+preconditioning)	**: IEC 60502-2** **Cigré 171**

Design

Conductor	Stranded round compacted copper conductors class 2, longitudinally water blocked
Conductor screen	Extruded semi conductive compound
Insulation	XLPE (Cross Linked Polyethylene)
Insulation screen	Extruded semi conductive compound
Water penetration protection	Water Swellable Tape
Screen	Individual Cu-wires screen on each phase
Water penetration protection	Water Swellable Tape
Radial Water Barrier	Cu foil bonded to the PE sheath
Power core sheath	Extruded Polyethylene Sheath (HDPE)*
Fibre optic unit	Up to 3 FO units with metal tube (FIMT)
Lay up	Three power cables laid up with extruded fillers or polypropylene yarns.
Armour Bedding	Polypropylene Yarns
Armouring	One layer of galvanized steel wires, filled with Bitumen.
Outer protection	Polypropylene Yarns in customisable colours.

Other materials, designs and cross sections are available, for more information contact Prysmian.

General DataSheet

DIMENSIONS

Conductor cross section area [mm²]	Conductor diameter [mm]	Conductor Screen Thickness [mm]	Insulation Thickness [mm]	Insulation Screen Thickness [mm]	Metallic Cu wires screen area [mm²]	PE sheath Thickness [mm]	Diameter Core [mm]	Armour wires diameter approx. [mm]	Outer serving PPY Thickness [mm]	Outer cable dia. [mm]
3 x 240	18,55	1,0	8,0	1,0	25	2,8	48	5	3,0	124
3 x 300	21,10	1,0	8,0	1,0	25	2,8	51	5	3,0	130
3 x 400	23,75	1,0	8,0	1,0	35	2,8	54	5	3,0	137
3 x 500	26,60	1,0	8,0	1,0	35	2,8	57	5	3,0	143
3 x 630	30,25	1,25	8,0	1,0	35	2,8	63	5	3,0	156

Dimensions are approximated and for information only.

MECHANICAL DATA

Conductor cross section area [mm²]	MBR [m] Submarine cable		MBR [m] Single core		Weight, approx. [kg/m]	
	Installation	Permanent	Handling	Permanent	In air	In water
3 x 240	1,9	1,9	1,0	1,0	26	16
3 x 300	2,0	2,0	1,0	1,0	29	18
3 x 400	2,1	2,1	1,1	1,1	33	21
3 x 500	2,2	2,2	1,1	1,1	40	26
3 x 630	2,4	2,4	1,3	1,3	47	30

All values are for guidance only.

General DataSheet

ELECTRICAL DATA

Conductor cross section area [mm²]	Conductor resistance DC 20°C [Ω/km]	Conductor resistance AC 90°C [Ω/km]	Capacitance per phase [μF/km]	Inductance per phase [mH/km]	Positive Sequence Impedance [Ω/km]	Charging current [A/km]	Short Circuit Current
							Conductor [kA/1s]
3 x 240	0,0754	0,098	0,232	0,362	0.098+j0.114	1,39	34,8
3 x 300	0,0601	0,079	0,253	0,348	0.079+j0.109	1,52	43,4
3 x 400	0,0470	0,063	0,276	0,332	0.063+j0.104	1,65	57,7
3 x 500	0,0366	0,050	0,300	0,321	0.050+j0.101	1,80	72,1
3 x 630	0,0283	0,040	0,353	0,316	0.040+j0.099	2,12	90,8

All values are for guidance only.

Calculation parameters

General:

Voltage level 18/30(36) kV
Frequency 50 Hz
Steady state
Non-adiabatic conditions

Short circuit considered temperatures:

- Conductor: 90ºC initial temperature
  250ºC max temperature

General DataSheet

Cable current rating and losses in some typical installation conditions

Conductor cross section area [mm²]	Current rating [A] 1)				Losses6) [kW/km]			
	Buried in seabed (1m) 2)	Buried in seabed (2m) 3)	Air 4)	J-tube5)	Load 25%	Load 50%	Load 75%	Load 100%
3 x 240	555	525	570	520	6	25	60	115
3 x 300	615	585	640	585	6	26	62	119
3 x 400	680	640	715	655	7	28	66	125
3 x 500	745	705	800	735	8	30	70	131
3 x 630	825	770	910	830	9	35	79	140

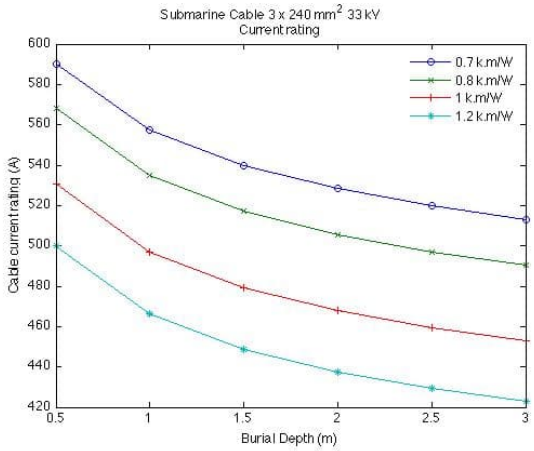
All values are for guidance.

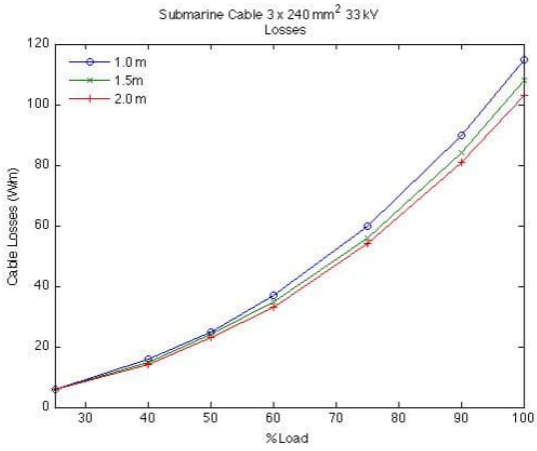
Calculation parameters

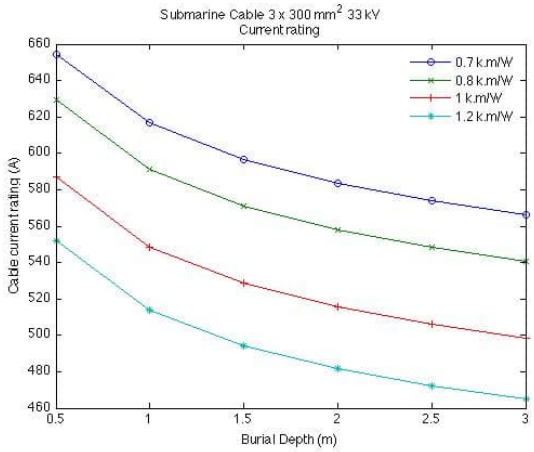
1) General:
   Voltage level: 18/30(36) kV
   Frequency: 50 Hz
   Steady state
2) Assumption: Soil temperature 15°C
   Soil thermal resistivity 0,7 K·m/W
   Burial depth 1,0 m from the top of the cable (TOC)
3) Assumption: Soil temperature 15°C
   Soil thermal resistivity 0,7 K·m/W
   Burial depth 2,0 m TOC
4) Assumption: Air temperature 30°C
   No exposure to solar radiation
   e.g J-tubeless solution inside a monopile
5) Assumption: External steel yellow J-Tube, directly exposed to sun
   Ambient temperature outside J-Tube 30°C
   Solar Radiation 725 W/m²
   J-Tube inner diameter 2,5 x D_{cable} mm
   Maximum J Tube length in air 10 m
   Wind speed 9 m/s
6) Calculated with the conditions considered in 2).
7) Assumption: Soil temperature 15°C
8) Assumption: Soil temperature 15°C
   Soil thermal resistivity 0,7 K·m/W

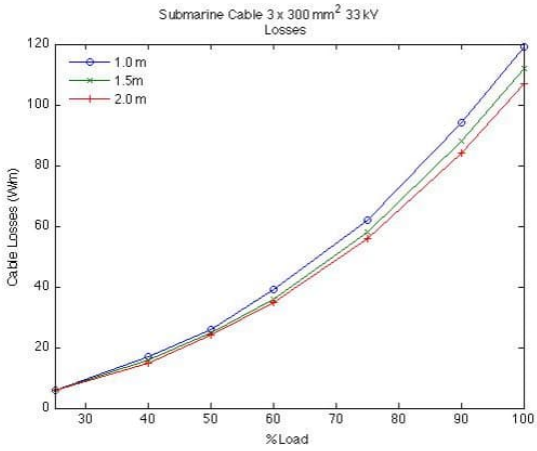
General DataSheet

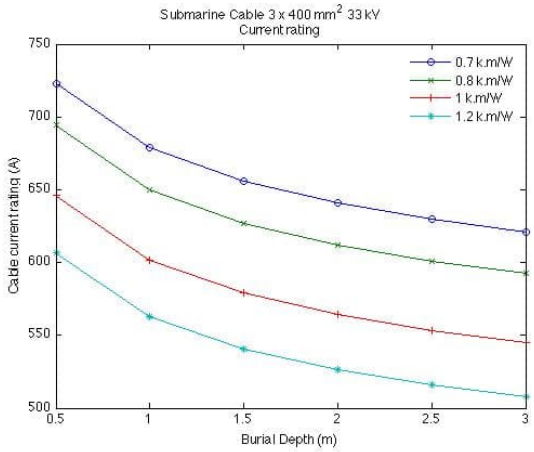
Cable current rating[7)] and losses[8)] as a function of soil thermal resistivity and burial depth

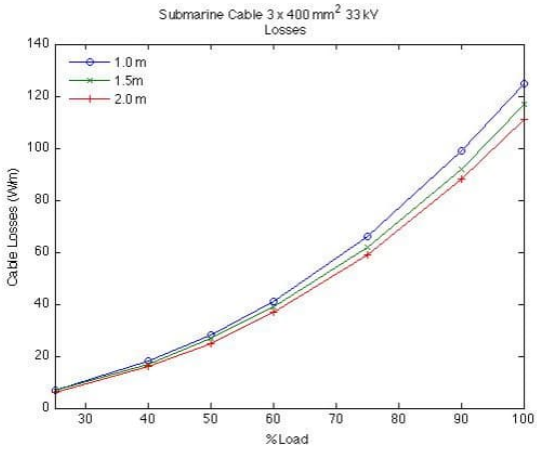




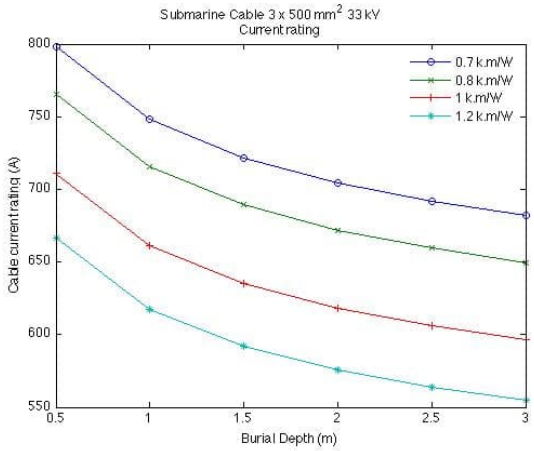


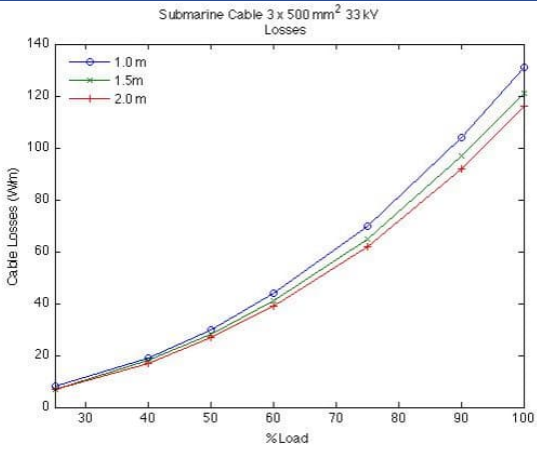


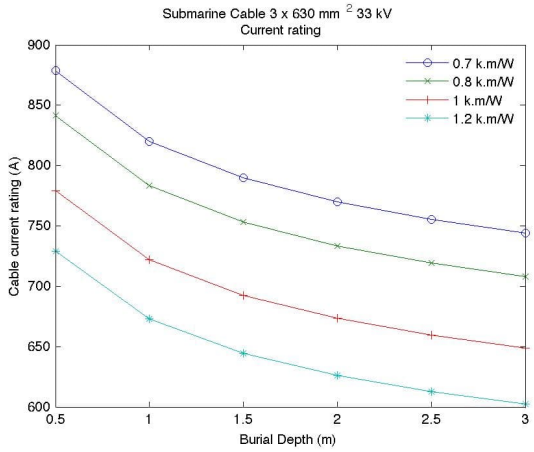


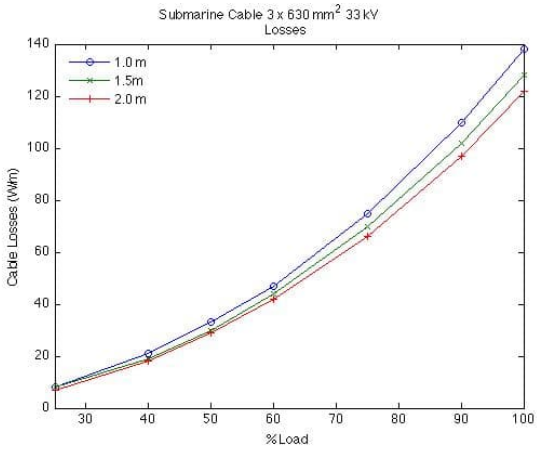


General DataSheet









12.2 Cable Lay Vessel

Mermaid
SUBSEA SERVICES

IMCA

SUBTECH New look. New name. Still Subtech.

MUBARAK SUPPORTER

SELF PROPELLED, 206 PERSONS "DP2"
ACCOMMODATION WORK BARGE

CONTACT US

Tel: + 974 4442 8230 | Fax: +974 4442 8236
www.mermaidsubsea.com | info@mermaidsubsea.com

3rd Floor, Sh. Jassim Bin Jaber Al-Thani Building,
Abdullah Bin Jassim Street, Doha, Qatar

P.O. Box 11575 Doha, Qatar

MERMAID SUPPORTER

AIR & MIX GAS DIVING SUPPORT

MERMAID SUPPORTER

AIR & MIX GAS DIVING SUPPORT

MERMAID SUPPORTER

AIR & MIX GAS DIVING SUPPORT

DIMENSIONS

Length Overall	77.50 m
Breadth Moulded	30.00 m
Depth Moulded	5.5 m
Minimum Draft	2.4 m with 15days consumables
Maximum Draft	3.9 m
GRT	4836 MT
NRT	1451 MT

MACHINERY

Main Generator	3x Guascor 1115kW = 3345kW with Leroy Sommer Alternator Aux. Generator: 2 x Guascor 866kw = 1732Kw Hydraulic Power Pack, 2 x Caterpillar diesel 750kW = 1500kW
Emerg. Generator	1x Guascor @ 422kW
Total Power	6999 kW
PMS	1 x Terasaki (60Hz)
OWS	1 x 0.5m3/h , 15ppm
Fresh Water Maker	3 x 30t/day = 90t/day Production
Sewage Plant	2x Manipur, Germany Membrane (Black & Gray Water) type with UV Sterilization system

CLEAR DECK AREA

Work Deck Area	1303 m2
Deck Strength	10 t/m2- with capacity for 4,000t Carousel

CAPACITY

Fuel Oil	561 m3
Fresh Water	1616 m3
BFW	1979 m3
Freezer Room	138 m3
Chiller Room	108 m3
AC unit	2 x 133 T = 266 TONS of Screw Type for Chilled Water System with Independent Room Temperature Control

FIRE FIGHTING EQUIPMENT

Fire pump	2 nos. & 1 x Emergency Fire Pump
Fire Detection	Smoke &Heat Detection System
Sprinkle System	Covering all areas of Barge
Gas Detection	H2S & LEL detection
Mist System	Covering all machinery spaces Equipped with latest CO2extinguishers & FiFi equipment Barge conforms to all SOLAS requirements

LIFE SAVING EQUIPMENT

Life raft	26 x 25persons= 650persons
Rescue Boat	2 x 18persons with Diesel Driven Jet Propulsion, Launchable by Slewing Davit
Life buoy	12 x with Smoke signals; 20nos 20 x Fitted with 30m Lifelines
Life jacket	350 nos.

BARGE ACCOMMODATION FACILITIES

SBC	2 Nos with Bath & Toilet
DBC	26 Nos with Bath & Toilet
FBC	38 Nos with Bath & Toilet
Client Office	3rd Deck
Meeting Room	2nd Deck
Lounge	2nd Deck
Prayer Room	Main Deck
Mess Room	Main Deck, 100 persons seating
Galley	Main Deck, Fully equipped Refrigerator Storage With Dry and Refrigerated Storage

REGISTRATION

Year of Built	2013
Builder	Dubai Ship Building & Engineering LLC
Flag	U.A.E
Class	American Bureau of Shipping
Class No.	YY242127
Port of Registry	Dubai, UAE
Owner	Mubarak Marine LLC

PROPULSION SYSTEM & DP THRUSTERS

Propulsion	4 x Verhaar Omega – water jet type Thruster Model 31140 rated 550kw @ 1800R 4 x Hydraulic driven retractable Thrusters of 750 kW each
DP	DP II, Joystick controlled w/ independent thruster control

DECK EQUIPMENT

Main Crane	1 x Pedestal Mounted Manitowoc Crane of 250t Lifting Capacity Model 2250 Series 1
Auxiliary Crane	1 x Electro Hydraulic Cranev12t – 200m Hook Reach
Mooring Winch	8 x 40t pull, 100t break holding power
Mooring Wire	Length 1000m of Dia 42mm wire
Spud Legs	Length 27m of Dia 1200mm
Spud Winches	2 x 30 t pull, Electric winches
Anchors	8 x 7T Delta Flipper Anchors

HELIDECK

Designed for Bell 412&212 for Helicopters with D" value up to 22.2m

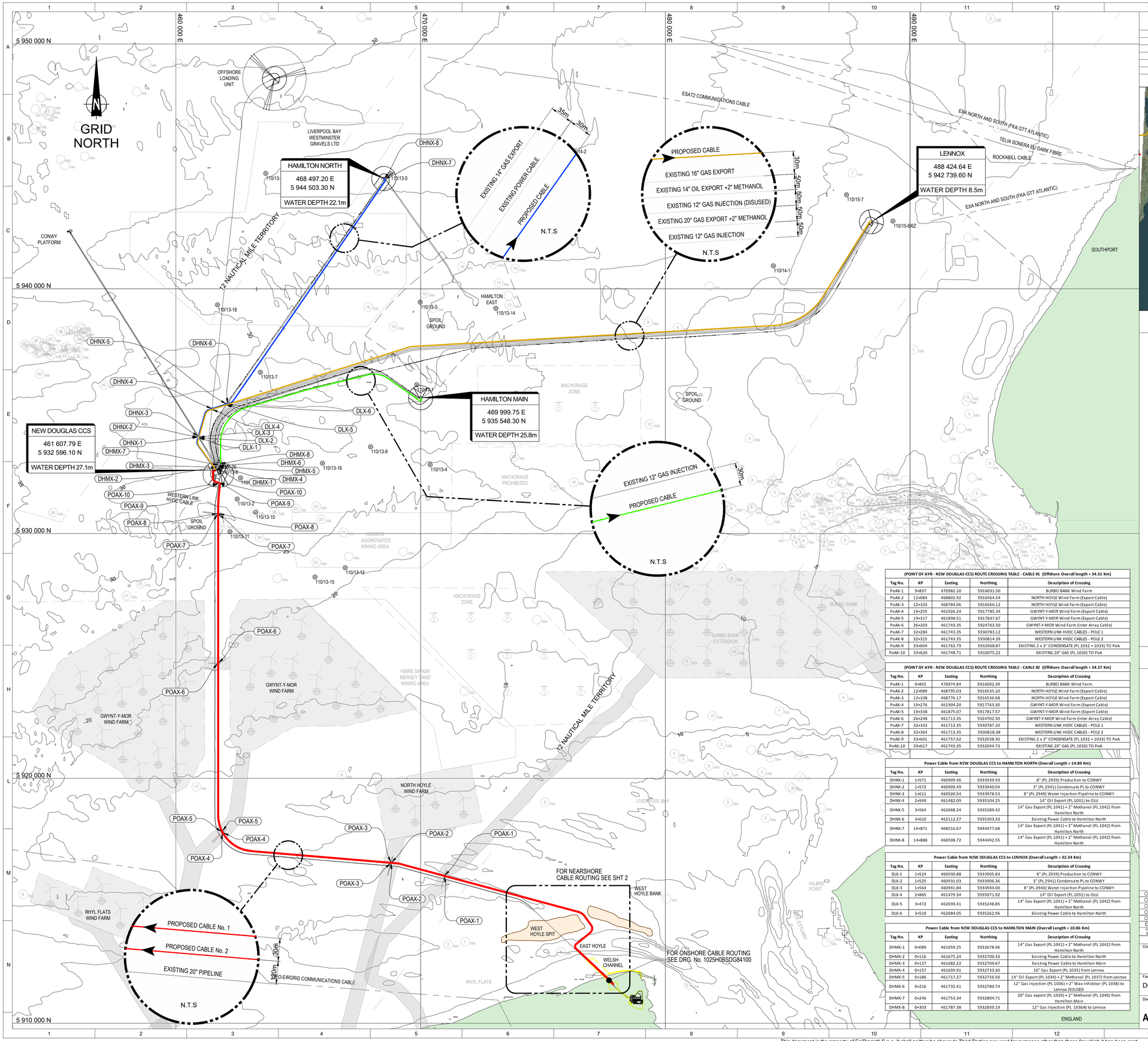
WORKSHOP FACILITY

64 m2 Mechanical/Fabrication/Welding Shop located on Main Deck/Winch Room. Equipment with Work Bench, Drill, Vice, Grinding Machine, Welding & Fabrication Equipment & 2nos Welding Rectifiers.

NAVIGATION AND COMMUNICATION EQUIPMENT

Wind Indicator	2 x Walker & Company 2020
Gyro Compass	3 x Sperry Marine Navigate MK1
Echo Sounder	1 x KODEN
Radar	2 x Sperry Marine
GPS	3 x Veripos DGPS / DGNSS
Fixed	VHF 3 x Sailor RT2048
Portable VHF	6 x Standard Horizon HX370S
Satellite Phone	1 x INMARSAT Phone 1xThuraya Sat.
Satellite TV	1 x Seatel
SSB Radio	1x JRC JSB-196
PABX Phone	1 x NEC Exchange; Covering all cabins
Recreation/TV Room	1 Nos, Fully equipped
Library	1 Nos
Gymnasium	Fully equipped
Game Room	Table Tennis & Pool
Laundry Room	Fully equipped with washers & dryers
Change Room	1 Nos
Deck Toilet	1 Nos
Clinic	1xDouble Berth with Bath& Toilet on Main Deck with attached Paramedic Room

12.3 Field Layout



(POINT OF AYR - NEW DOUGLAS CCS) ROUTE CROSSING TABLE - CABLE #1 (Offshore Overall length = 34.31 Km)

Tag No.	KP	Easting	Northing	Description of Crossing
PoAX-1	9+837	470982.10	5916031.50	BURBO BANK Wind Farm
PoAX-2	12+084	468802.92	5916564.54	NORTH HOYLE Wind Farm (Export Cable)
PoAX-3	12+103	468784.06	5916566.12	NORTH HOYLE Wind Farm (Export Cable)
PoAX-4	19+255	461926.24	5917785.34	GWYNT-Y-MOR Wind Farm (Export Cable)
PoAX-5	19+317	461898.51	5917837.67	GWYNT-Y-MOR Wind Farm (Export Cable)
PoAX-6	26+203	461743.35	5924702.50	GWYNT-Y-MOR Wind Farm (Inter Array Cable)
PoAX-7	32+284	461743.35	5930783.12	WESTERN LINK HVDC CABLES - POLE 1
PoAX-8	32+315	461743.35	5930814.39	WESTERN LINK HVDC CABLES - POLE 2
PoAX-9	33+604	461762.79	5932068.87	EXISTING 2 x 3" CONDENSATE (PL 1032 + 1033) TO PoA
PoAX-10	33+620	461748.71	5932075.22	EXISTING 20" GAS (PL 1030) TO PoA

(POINT OF AYR - NEW DOUGLAS CCS) ROUTE CROSSING TABLE - CABLE #2 (Offshore Overall length = 34.37 Km)

Tag No.	KP	Easting	Northing	Description of Crossing
PoAX-1	9+842	470974.84	5916002.39	BURBO BANK Wind Farm
PoAX-2	12+089	468795.03	5916535.10	NORTH HOYLE Wind Farm (Export Cable)
PoAX-3	12+108	468776.17	5916536.68	NORTH HOYLE Wind Farm (Export Cable)
PoAX-4	19+276	461904.20	5917763.30	GWYNT-Y-MOR Wind Farm (Export Cable)
PoAX-5	19+338	461875.07	5917817.57	GWYNT-Y-MOR Wind Farm (Export Cable)
PoAX-6	26+248	461713.35	5924702.50	GWYNT-Y-MOR Wind Farm (Inter Array Cable)
PoAX-7	32+333	461713.35	5930787.10	WESTERN LINK HVDC CABLES - POLE 1
PoAX-8	32+364	461713.35	5930818.38	WESTERN LINK HVDC CABLES - POLE 2
PoAX-9	33+601	461757.62	5932038.30	EXISTING 2 x 3" CONDENSATE (PL 1032 + 1033) TO PoA
PoAX-10	33+617	461743.35	5932044.73	EXISTING 20" GAS (PL 1030) TO PoA

Power Cable from NEW DOUGLAS CCS to HAMILTON NORTH (Overall Length = 14.89 Km)

Tag No.	KP	Easting	Northing	Description of Crossing
DHNX-1	1+571	460909.46	5933939.93	8" (PL 2939) Production to CONWY
DHNX-2	1+572	460909.49	5933940.04	3" (PL 2941) Condensate PL to CONWY
DHNX-3	1+611	460920.54	5933978.53	8" (PL 2940) Water Injection Pipeline to CONWY
DHNX-4	2+949	461482.09	5935104.25	14" Oil Export (PL 1031) to OLU
DHNX-5	3+564	462068.24	5935289.42	14" Gas Export (PL 1041) + 2" Methanol (PL 1042) from Hamilton North
DHNX-6	3+610	462112.27	5935303.33	Existing Power Cable to Hamilton North
DHNX-7	14+871	468516.67	5944477.68	14" Gas Export (PL 1041) + 2" Methanol (PL 1042) from Hamilton North
DHNX-8	14+888	468508.72	5944492.55	14" Gas Export (PL 1041) + 2" Methanol (PL 1042) from Hamilton North

Power Cable from NEW DOUGLAS CCS to LENNOX (Overall Length = 32.34 Km)

Tag No.	KP	Easting	Northing	Description of Crossing
DLX-1	1+524	460930.88	5933905.83	8" (PL 2939) Production to CONWY
DLX-2	1+525	460931.03	5933906.36	3" (PL 2941) Condensate PL to CONWY
DLX-3	1+564	460941.84	5933944.00	8" (PL 2940) Water Injection Pipeline to CONWY
DLX-4	2+885	461479.34	5935071.92	14" Oil Export (PL 1031) to OLU
DLX-5	3+472	462039.41	5935248.85	14" Gas Export (PL 1041) + 2" Methanol (PL 1042) from Hamilton North
DLX-6	3+519	462084.05	5935262.96	Existing Power Cable to Hamilton North

Power Cable from NEW DOUGLAS CCS to HAMILTON MAIN (Overall Length = 10.86 Km)

Tag No.	KP	Easting	Northing	Description of Crossing
DHMX-1	0+089	461659.25	5932678.96	14" Gas Export (PL 1041) + 2" Methanol (PL 1042) from Hamilton North
DHMX-2	0+116	461675.24	5932700.33	Existing Power Cable to Hamilton North
DHMX-3	0+127	461682.22	5932709.67	Existing Power Cable to Hamilton Main
DHMX-4	0+157	461699.91	5932733.30	16" Gas Export (PL 1035) from Lennox
DHMX-5	0+186	461717.27	5932756.50	14" Oil Export (PL 1034) + 2" Methanol (PL 1037) from Lennox
DHMX-6	0+216	461735.41	5932780.74	12" Gas Injection (PL 1036) + 2" Wax Inhibitor (PL 1038) to Lennox DISUSED
DHMX-7	0+246	461753.34	5932804.71	20" Gas export (PL 1039) + 2" Methanol (PL 1040) from Hamilton Main
DHMX-8	0+303	461787.38	5932850.19	12" Gas Injection (PL 1036A) to Lennox

REFERENCE DOCUMENTS

NUMBER	TITLE
1025H0BSDG84100	NEW OFFSHORE POWER CABLE AND FIBRE OPTIC FIELD LAYOUT (ONSHORE SECTION)
1025H0BGRV09422	PIPELINE / CABLE ROUTE ENGINEERING GEOLOGICAL GROUND MODEL
1025H0BGRV09420	PHASE 2C NEARSHORE ENGINEERING GEOLOGICAL GROUND MODEL
1023DSBNDN85018	CABLE INSTALLATION AND MARINE OPERATIONS DRAWINGS
1025HTBNDN85020	NEARSHORE CABLE MARINE OPERATIONS DRAWINGS

KEY PLAN

GENERAL NOTES

1. ALL DIMENSIONS AND COORDINATES ARE IN METRES UNLESS NOTED OTHERWISE.
2. GLOBAL COORDINATE REFERENCE SYSTEM: European Datum 1950 UTM Zone 30N (EPSG: 23030)

PROJECTED COORDINATE SYSTEM	European Datum 1950 UTM Zone 30N
PROJECTION	TRANSVERSE MERCATOR
LINEAR UNIT	METERS (1.0)
FALSE EASTING	500000.0
FALSE NORTHING	0.0
CENTRAL MERIDIAN	-3.0
SCALE FACTOR	0.9996
LATITUDE OF ORIGIN	0.0
GEOGRAPHIC COORDINATE SYSTEM	European Datum 1950
ANGULAR UNIT	DEGREE (0.0174532925199433)
PRIME MERIDIAN	GREENWICH (0.0)
DATUM	European 1950
SPHEROID	International 1924
SEMIMAJOR AXIS	6378388.0
SEMIMINOR AXIS	6356911.946127946
INVERSE FLATTENING	297

3. CABLE ROUTING AND CROSSINGS ARE PRELIMINARY AND SUBJECT TO CHANGE BASED ON SURVEY INFORMATION.
4. WATER DEPTHS AND SHIPWRECKS (WK) ARE GIVEN FOR INFORMATION ONLY.
5. LAYOUT IS COMPILED FROM VARIOUS SOURCES AND THEREFORE IS SUBJECT TO CONFIRMATION.
6. PRELIMINARY ROUTING BASED ON EXISTING SEABED ARCHITECTURE AROUND EACH PLATFORM.
7. DELETED.
8. CABLE APPROACH TO EACH PLATFORM TO BE CONFIRMED.
9. FIELD LAYOUT BASED ON THE PRELIMINARY LOCATION OF NEW J-TUBES AT EXISTING PLATFORMS (HAMILTON MAIN, HAMILTON NORTH, LENNOX) AND NEW DOUGLAS CCS PLATFORM.
10. FINAL LOCATION OF J-TUBES AT NEW DOUGLAS CCS PLATFORM TO BE CONFIRMED DURING FEED.
11. DRILLING JACK-UP CORRIDOR AND FOOTPRINT AROUND PLATFORMS TO BE CONFIRMED.
12. FIELD LAYOUT TO BE REVIEWED AGAINST THE DECOMMISSIONING SCOPE FOR THE PROJECT.
13. FOR ONSHORE CABLE ROUTING REFER TO DRAWING No. 1025H0BSDG84100.
14. FOR POWER CABLE ALIGNMENT SHEETS SEE:

OFFSHORE POWER CABLE - PoA TO DOUGLAS (CABLE No. 1)	- 1025HOBSDG84110
OFFSHORE POWER CABLE - PoA TO DOUGLAS (CABLE No. 2)	- 1025HOBSDG84141
OFFSHORE POWER CABLE - DOUGLAS TO HAMILTON NORTH	- 1025DSBSDG84142
OFFSHORE POWER CABLE - DOUGLAS TO LENNOX	- 1025DSBSDG84143
OFFSHORE POWER CABLE - DOUGLAS TO HAMILTON MAIN	- 1025DSBSDG84144
ONSHORE POWER CABLE - PoA TO JUNCTION BOX	- 1025HTBLDL80026
ONSHORE POWER CABLE - PoA TO JUNCTION BOX	- 1025HTBLDL80027

LEGEND

- PROPOSED CABLE (2 OFF) ROUTE (POINT OF AYR - DOUGLAS) - 34 Km
- PROPOSED CABLE ROUTE (DOUGLAS - HAMILTON) - 11 Km
- PROPOSED CABLE ROUTE (DOUGLAS - HAMILTON NORTH) 15 Km
- PROPOSED CABLE ROUTE (DOUGLAS - LENNOX) 32 Km
- EXISTING POWER CABLES
- EXISTING PIPELINES / UMBILICALS
- AREA LIMITS
- XX Wk — SHIPWRECK LOCATION
- 110/XX-XX — ABANDONED WELL LOCATION AND IDENT
- WIND TURBINE (NOT INDICATIVE OF LOCATION)
- OFFSHORE WIND FARM POWER CABLE CORRIDORS

Validity Status	Rev. Number	Date	Description	Prepared	Checked	Approved	Approved Eni UK
CD-FE	07	29.03.2023	RE ISSUED FOR COMMENT	N.Z	E.R	S.G	
CD-FE	06	14.02.2023	RE FINAL ISSUE	N.Z	E.R	S.G	
CD-FE	05	14.10.2022	RE FINAL ISSUE	N.Z	S.R	S.G	
CD-FE	04	15.08.2022	FINAL ISSUE	N.Z	S.G	M.S	
CD-FE	03	02.08.2022	RE-ISSUED FOR COMMENT	N.Z	S.G	M.S	
CD-FE	02	25.05.2022	RE-ISSUED FOR COMMENT	N.Z	S.G	M.S	

Revision index

Company logo and business name: eni uk — eni progetti

Company Document ID: 1025H0BSDG84104

Job. N. JA0614

Facility and Sub Facility Name	Project Name	Scale	Sheet of Sheets
DOUGLAS SUBSEA	LBA CCS Transport and Storage	1:75k @A1	1 / 2

Document Title

NEW OFFSHORE POWER CABLE AND FIBRE OPTIC FIELD LAYOUT (OFFSHORE SECTION)

Supersedes N.

Superseded by N.

Plant Area	Plant Unit
N/A	N/A

Software:AutoCad

Filename.1025H0BSDG84104_CDFE07_01_02.DWG

A1 (841 x 594)

12.4 Cable Lay Installation Sequence

For Cable Lay Installation Sequence refer to [Ref 41], 1023DSBNDN85018 "Cable Installation and Marine Operations Drawings".

12.5 Cable Alignment Sheets

For Cable Alignment Sheets refer from References [Ref 51] to [Ref 57].