

OFFSHORE HOOK-UP SUPERVISOR GUIDE

GUS OFFSHORE HOOK-UP GUIDE



GUS OFFSHORE HOOK-UP BASE SCOPE OF WORK

WP-HU-1	Ballasting and de-ballasting operations during towing for Suez Crossing
WP-HU-2	Mooring Hook-Up
WP-HU-3	Flare deployment
WP-HU-4	Riser protectors' installation
WP-HU-5	Riser Spools / ESDV / PLR Installation
WP-HU-6	SWLP Installation
WP-HU-7	Umbilical Tie-In



WORK PACK WPHU01 TOWING / BALLASTING

WP-HU-1: Ballast/De-ballast



WP-HU-1: Ballast/de-ballast during towing for Suez bridge crossing

A temporary ballasting system shall be installed prior towing phase to fill the central cargo tanks (COT) with Sea water. This will allow to increase the draft of the FPSO up to 19m and pass under Suez Canal bridge. Complementary ballast water will be used in ballast tanks that will be filled and emptied with the FPSO normal ballasting system.

The temporary ballasting uses one fire water pump and its main ring. Distribution pipes are provided close to the COT manhole. Temporary hoses will be connected from the FW ring flanges to the COTs.

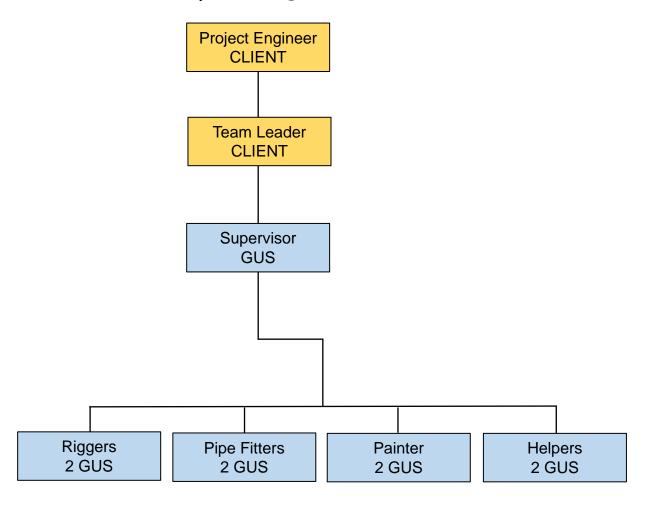
The Subcontractor shall cover all handling, piping and hose connection/reconnection works to perform the ballast / de-ballast operation and to remove the temporary ballasting system that will have been put in place at Singapore yard before FPSO sail away.

Job cars description will be provided by CONTRACTOR and Job Cards shall be completed by SUBCONTRACTOR to cover the above.

Organization Chart (Day & Night Shift)

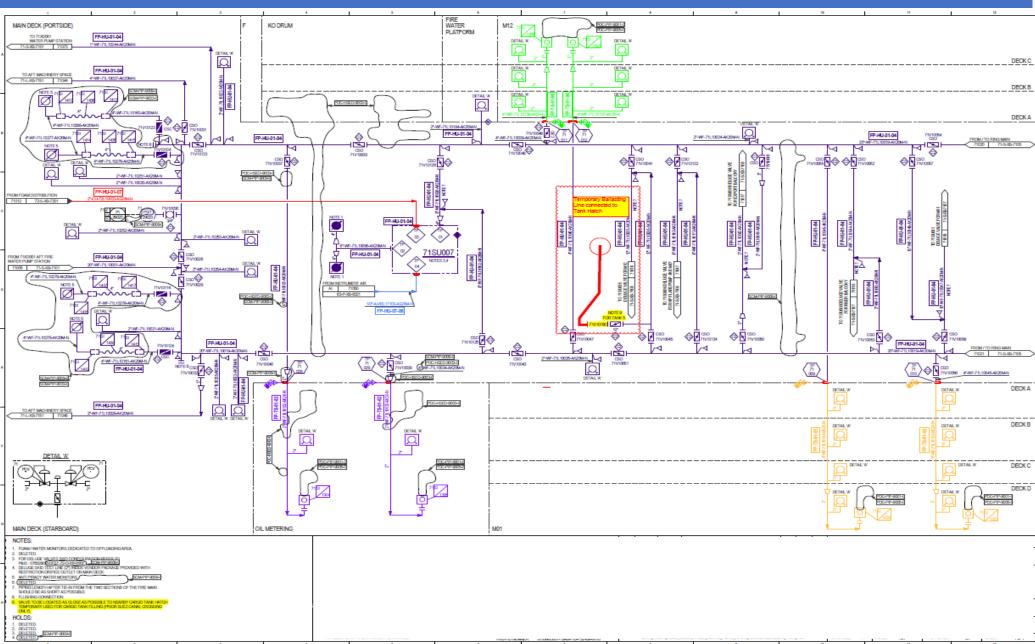


Day Shift Night Shift



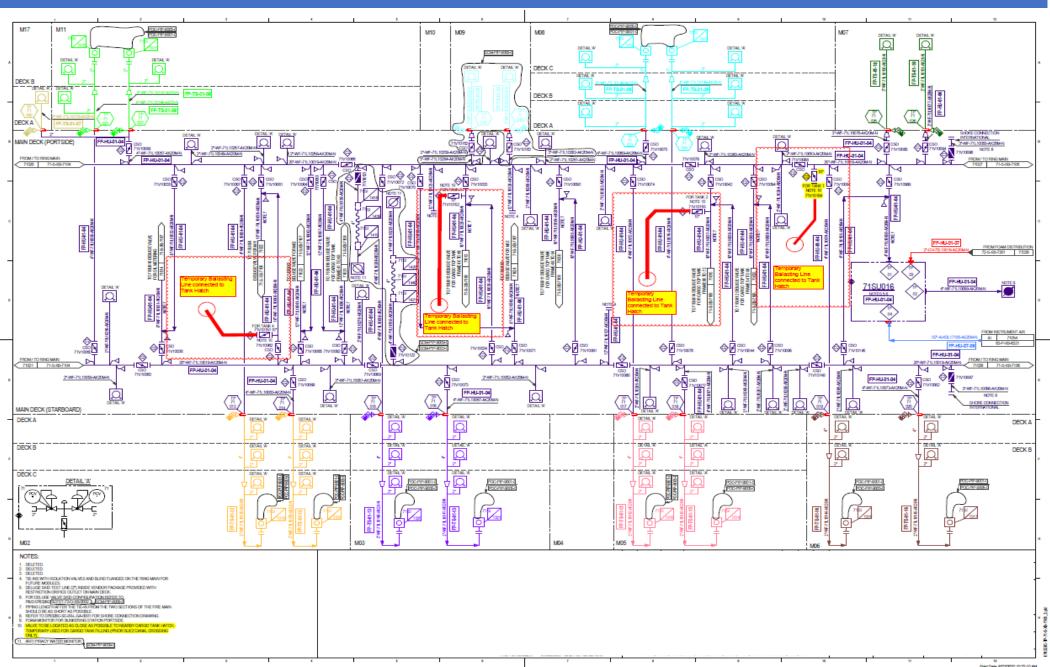
Temp Ballast Lines





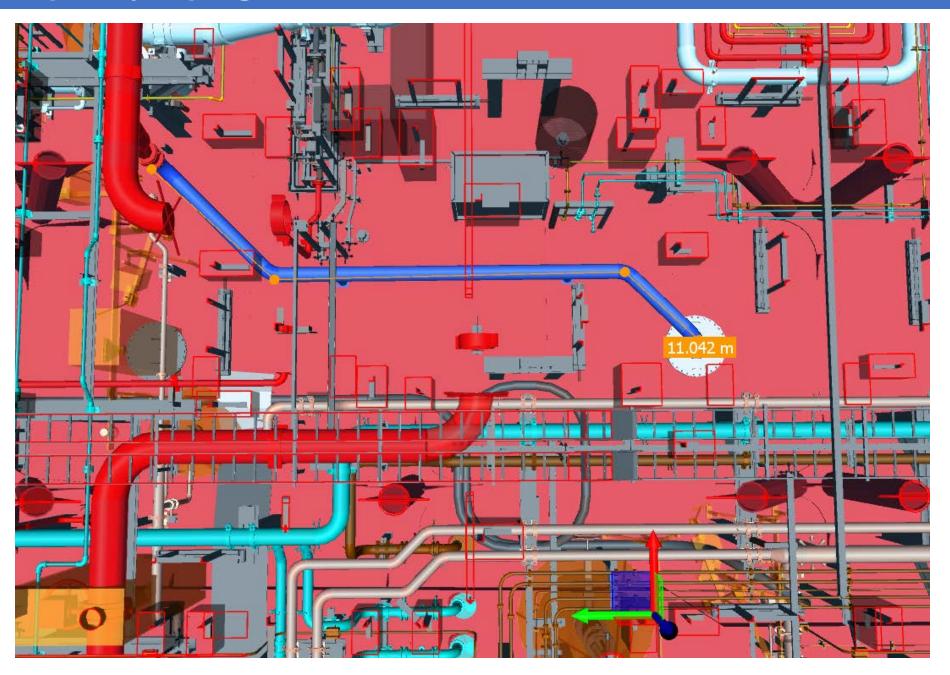
Temp Ballast Lines





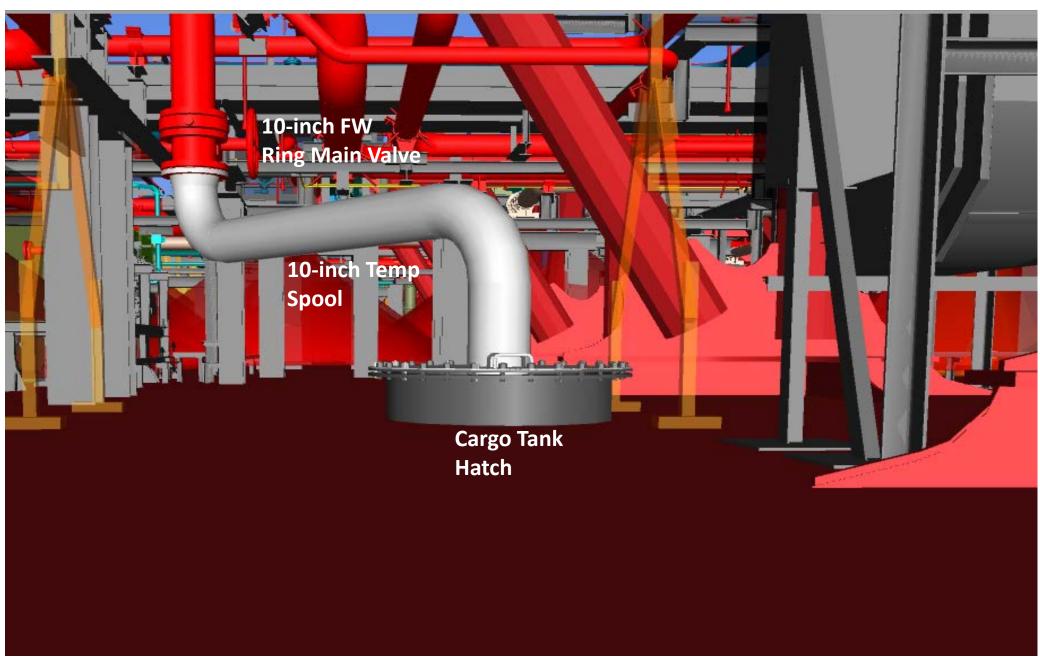
Typical Temporary Piping Connections





Typical Temporary Piping Connections





Work Completion



Once the Ballast operation has been completed:

- 1. Close all fire water ring main valves and isolate
- 2. Remove all temporary spools and flexible hoses
- 3. Reinstate tank top hatch covers
- 4. Touch-up painting of covers and deck area affected



WORK PACK WPHU02 MOORING HOOK-UP

WP-HU-2: Mooring Hook up



WP-HU-2: Mooring hook up

FPSO is moored with 14 lines in 1700 m of WD.

Mooring system uses 4 sets of moveable equipment, i.e one each cluster, for the Hook-up and tensioning activities. This includes moveable sheaves to be used in conjunction with a wire winch, and a Moveable Chain Tensioner (MCT chain jack system) to perform chain tensioning. Two HPU provide hydraulic power for the winches and MCT. CONTRACTOR and mooring Vendor will provide resources to manage the whole operation and run the mooring equipment (MCT Winches, HPU).

SUBCONTRACTOR shall provide resources to perform the Handling and bolting activities associated to mooring equipment, wire or chain handling, including chain cutting activities. A gantry is available at each cluster to perform handling of the main equipment.

SUBCONTRACTOR shall provide experienced personnel:

mooring lines handlings

bolting tensioner skill

Chain cutting skills

The equipment used for bolting and chain cutting shall be submit together with SUBCONTRACTOR method statement and detailed Job cards for approval CONTRACTOR. Efficiency and safety are key factors.

Scope of Work



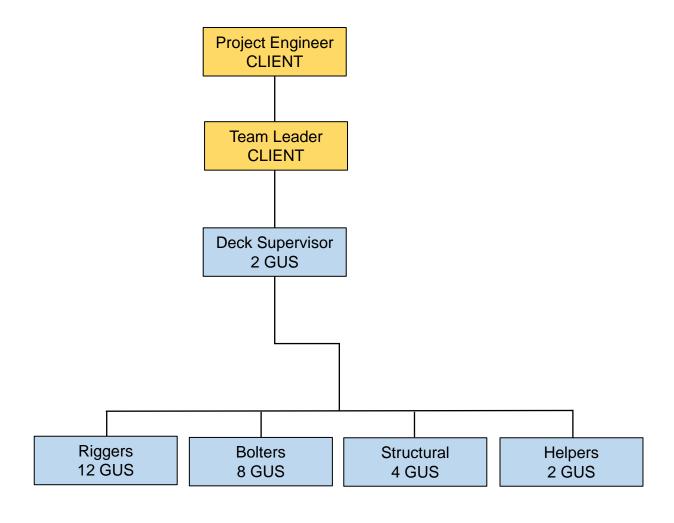
Document Title **Method Statement Hook-up and Tensioning**Document Number **076328C-0000-MS-3847-0310/A**

Scope of work will be to provide manpower, rigging equipment and cutting equipment for the chain installation, tensioning and cutting off excess chain lengths once the FPSO is in the final position with all 14 chains tensioned.

Mooring operations and tensioning work will be carried out by the mooring contractor. Method statement for Hook-up and Tensioning on board the FPSO

Organization Chart (Day & Night Shift)





CLIENT

GUS

Manpower



The Following manpower will be required to assist with the mooring operations working 2 x 12-hour shifts.

Deck Supervisor

Riggers (to assist with rigging and handling of sheaves, chains, tensioners

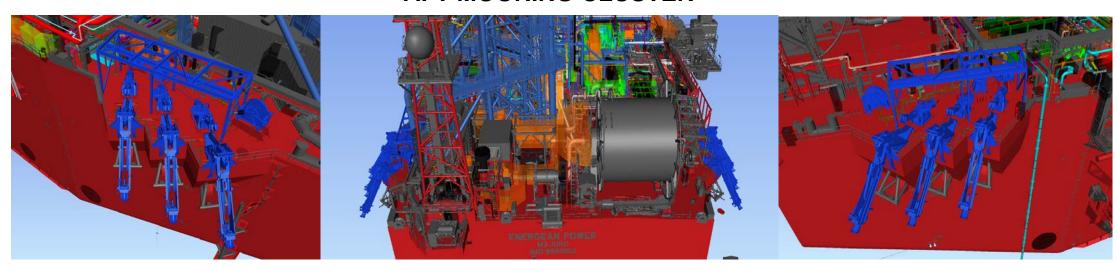
Bolters (Bolt Tightening of sheave bolts 75mm AF, 3200Nm)

Structural Fitter (Chain Cutting using Size 1/8 Cutting Tip, 1100mm Torch)

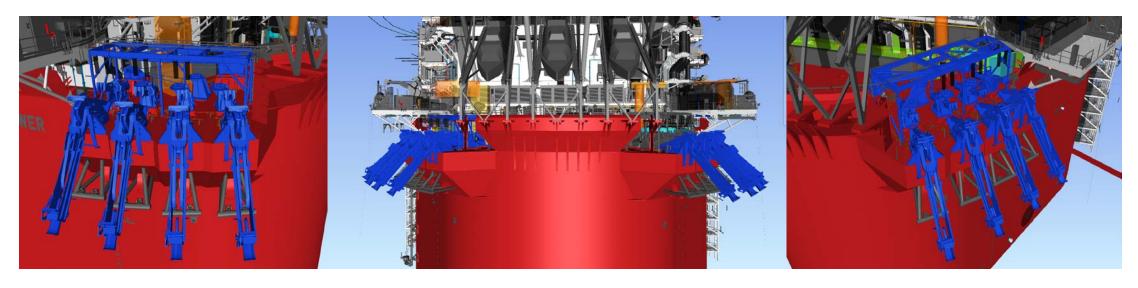
Helper (fire watch with 5kg Fire Extinguishers)



AFT MOORING CLUSTER

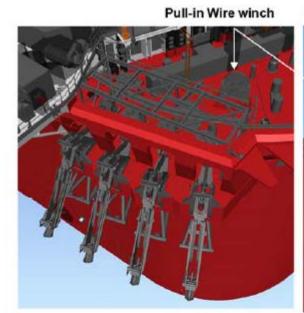


FORWARD MOORING CLUSTER

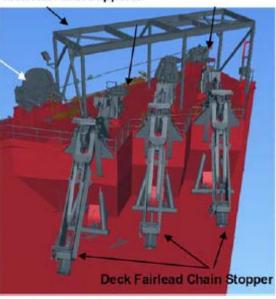


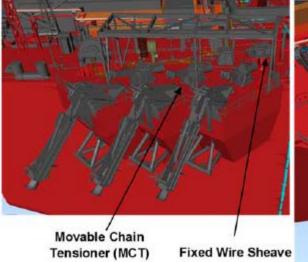
Pull-In Arrangement

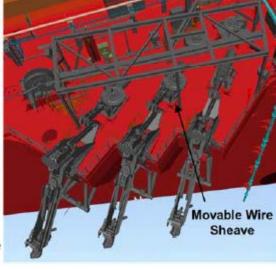




Monorail with supports





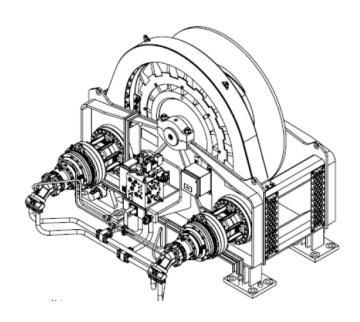


For each cluster is equipped with the following items

- ✓ One Fixed wire sheave
- ✓ One Movable wire sheave
- ✓ One Monorail with supports
- ✓ One Pull-in Winch
- ✓ One Movable Chain tensioner
- ✓ Three or Four Deck fairlead chain stopper including Chute (it depends on the cluster)

Note:

✓ Two HPUs are installed on board, one for the forward clusters (Portside and starboard side) and one for the aft clusters (portside and starboard side)



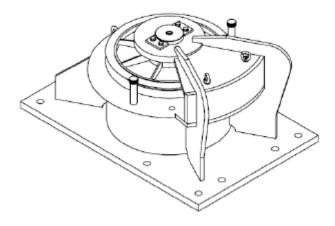
Movable Sheaves & Tensioning Equip.



5.5.2 Fixed Wire Sheave

There is a total of four fixed wire sheave on deck, one on each cluster.

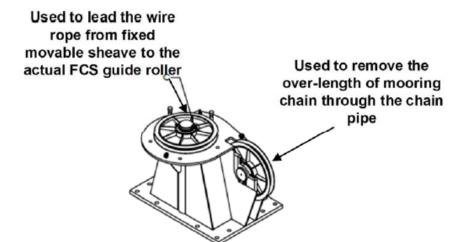
The isometric view is given here under:



5.5.3 Movable Wire sheave

There is a total of four movable wire sheave on deck, one on each cluster.

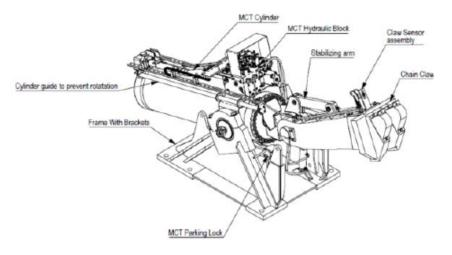
The isometric view is given here under:

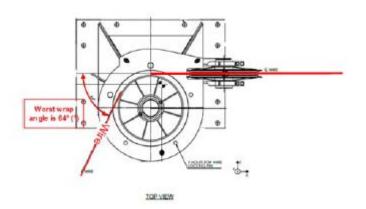


5.5.5 Movable Chain Tensioner (MCT)

There is a total of four Movable Chain Tensioner on deck, one on each cluster. One MCT is used to serve all adjacent mooring lines within each cluster. The MCT is moved from one mooring line to another using a lifting yoke suspended in the Monorail (§ 5.5.4) using a headroom hoist with geared trolley and swivel hook 10t.

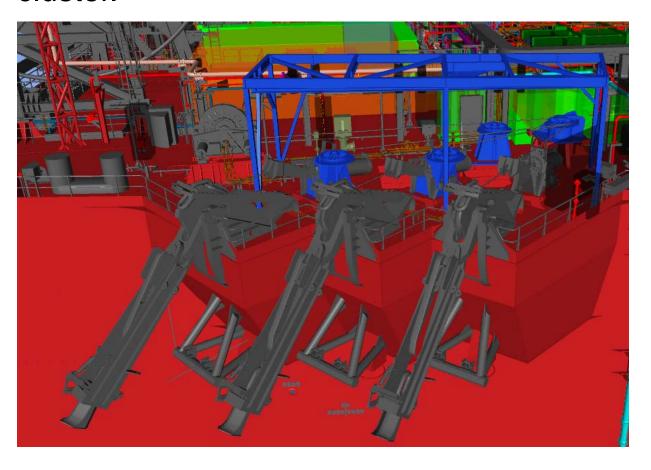
The isometric view is given here under:







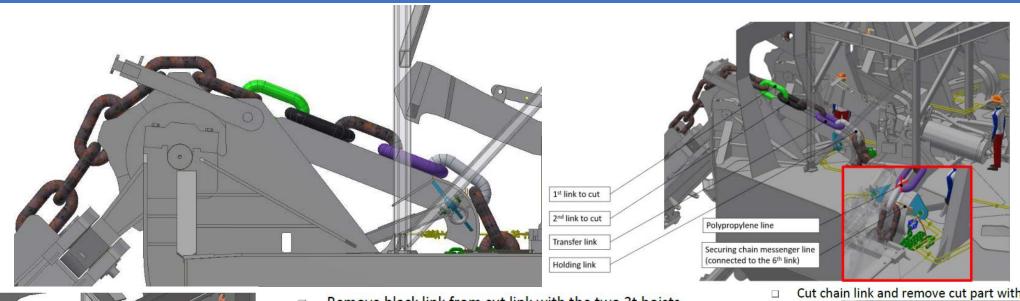
The Following tools, equipment and consumables will be used to for the mooring operations and placed at each cluster.

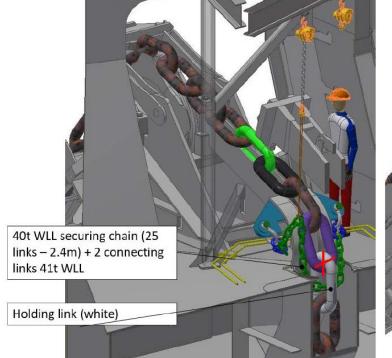


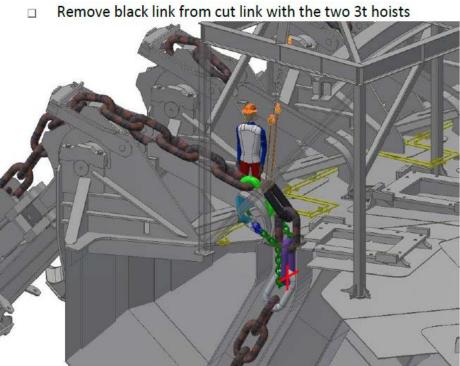
- a) 5 Ton Movable Trolley
- b) 10 Ton Movable Trolley
- c) 5 Ton Chain Hoist (5meter chain)
- d) 5 Ton Chain Block with 4-meter chain
- e) 10 Ton Chain Block with 4-meter chain
- f) 5 Ton Belt Slings (3meter)
- g) 10 Ton Belt Slings (3meter)
- h) 5 Ton Shackles
- i) 10 Ton Shackles
- j) 75mm Sockets (1 1/2 drive)
- k) 75mm Combination Spanners
- l) 5kg hammer
- m) 3200Nm 5ITB Raytorc Hydraulic Torque Wrench
- n) Gas Cutting Torch 36 inch
- o) Gas & Oxygen Regulators ,Hoses
- p) Cutting Oxygen & Acetylene Gas

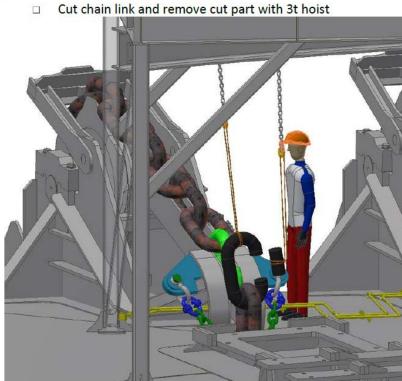
Tensioning and Chain Cutting













WORK PACK WPHU03 FLARE DEPLOYMENT

WP-HU-3: Flare Deployment



WP-HU-3: Flare deployment:

The Flare of the FPSO is a telescopic Flare composed of 2 elements, a fixe lower part and a mobile upper one. The erection is done by means of strand jack operated by Vendor with SUBCONTRACTOR support for the installation.

The flare deployment operation is divided in 4 steps:

Flare tip installation,

Flare deployment set-up/preparation,

Flare deployment

Flare completion (welding, piping, E&I)

The flare tip is installed before flare deployment by means of a A-frame that is installed and operated by a CONTRACTOR Vendor. A davit is installed by Vendor on the top of fixe flare for all further lifting within a max capacity of 1t.

All rigging, scaffolding, structural welding, piping fitting and welding, handling, Dimensional control, NDT including golden welds (radio), EICT, painting shall be performed by SUBCONTRACTOR

SUBCONTRACTOR shall consider that some of the scaffolding to be used offshore for the flare operation will be pre-installed at yard in Singapore and used during the flare deployment test. This scaffolding (type, status, readiness) will have to be fully surveyed and corrected as required by

SUBCONTRACTOR to be reused offshore after towing and arrival at offshore site in Israel.

Scope of Work



Document Title Flare deployment method statement Document Number 587C-0000-MS-0180-0001/0

Work plan 10 – Preparation for offshore works

Work plan 11 – Flare tip installation

Work plan 12 – Flare deployment preparation

Work plan 13 – Flare deployment operation

Work plan 14 – Flare deployment completion

Recourses



Position	Number	Working time /Shift		
Project engineer (PE)	1 day shift + 1 night shift	12h/ shift		
HSE rep	1	part time		
Inspection NDT	1	Part time		
Foreman	1 day shift + 1 night shift	12h/ shift		
Riggers	6 day shift + 3 night shift	12h/ shift		
Welders	6 day shift + 3 night shift	12h/ shift		
Scaffolders	2 day shift + 2 night shift	12h/ shift		

SUBCONTRACTOR ALE manpower

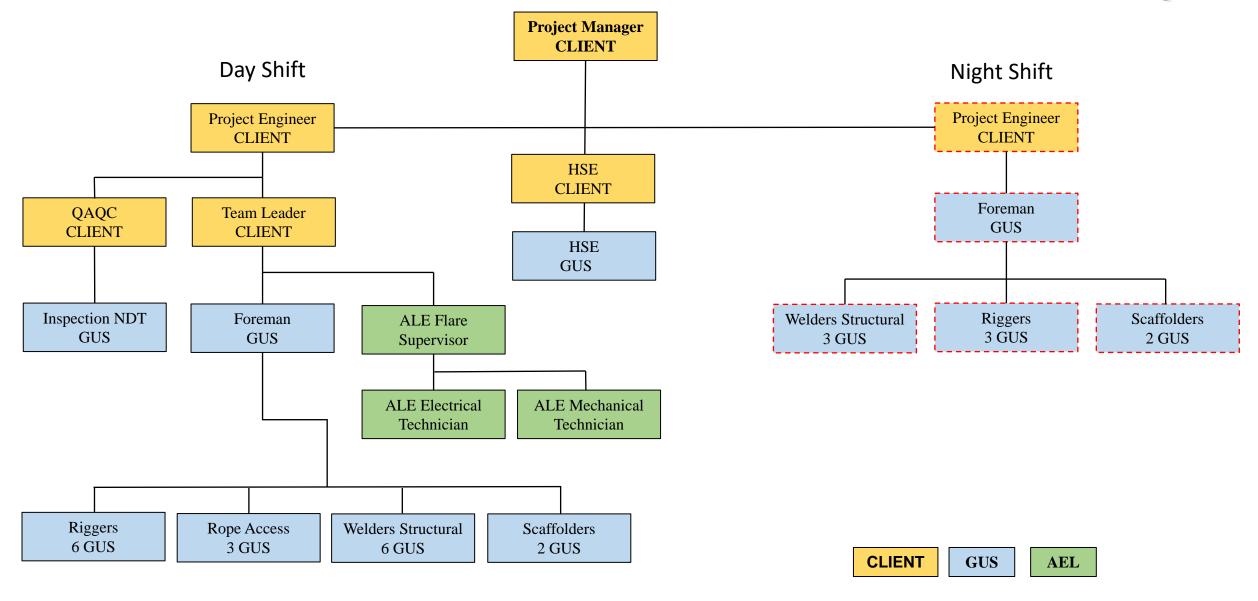
Position	Number	Worting time /Shift
CTR Flare supervisorervisor/Operator (SUB SUP)	1	12h day shift
Electrical Technician	1	12h day shift
Mechanical Technician	1	12h day shift

SUBCONTRACTOR CONBIT offshore manpower

Position	Number	Worting time /Shift		
Team Leader (SUB SUP)	1	12h day shift		
Rope access rigger	3	12h day shift		

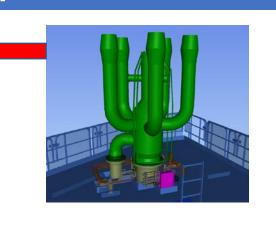
Organization Chart (Day & Night Shift)





Snapshot of Scope Overview





Sequence 1. Flare Tip will installation will be carried out once vessel arrives in Israel before redeployment of the structure.

- . Bolt Torqueing of Flare Tip Flanges and pilot gas lines
- 2. Connection of ignitor and thermocouple cables



Sequence 2. Flare structure redeployment will be carried out once the vessel has been moored into the final position.

- Tools / equipment preparations
- 2. Remove Sea fastening
- 3. Deploy flare structure (strand Jacking)
- 4. Final Hight position
- 5. Install Girder Boxes in position
- 6. Lower structure onto Girder Boxes and align
- 7. Welding of Girder Boxes and structure
- 8. 14 & 24 inch Piping Installation and Welding
- 9. 1 inch gas line installation and welding
- 10. Cable Hook-up/termination/testing
- 11. Testing of Ignitors/thermocouples/NAV lighting
- 12. Final Touch-up painting

Flare Structural & Piping Welding Summary



Туре	Element	Nbre of elements	Item	Material	number of weld	thickness (mm)	L (mm)	total /item	Total /element	Type of weld
Structure	top sea fastening	8	sea fastening plate dia 300mm tube closing	S355	1	15	942	942	7540	fillet 10mm
Structure	Girder box	12	triangular gusset one year uplift	S355	1	40	245	245	2940	full pen
Structure	Girder box	12	Rectangular shape permanent uplift	S355	1	25	1660	1660	19920	full pen
Structure	Girder box	6	C plates	S355	2	20	400	800	4800	full pen
Structure	Girder box	3	Flange outline sealing fillet weld	S355	1	50	6605	6605	19815	fillet 35mm (0,7X50)
Structure	Chord base	2	leg 2&3 onto box girder one year condition	S355	2	15	2199	4398	8796	full pen
Structure	Chord base	1	leg 1 onto box girder one year condition	S355	1	15	2199	2199	2199	full pen
Structure	Chord base	2	leg 2&3 onto girder box final	S355	2	20	2199	4398	8796	full pen
Structure	Chord base	1	leg 1 onto girder box final	S355	1	20	2199	2199	2199	full pen
Structure	Upper guide	3	Fixed flare to skiding plate	S355	1	30	940	940	2820	full pen
Structure	Upper guide	3	skiding plate to mobile flare	S355	1	30	1200	1200	3600	full pen

Element	Line Number	Piping Class	Material	Number of Weld	Wall Thickness (mm)	Weld Length (mm)	Total Length (mm)
14" spool	VF-43L10401	AC21	CS ASTM A106 Gr.B	3	8	1117	3351
24" spool	VF-43L10301	AS20	SS ASTM A358 Gr.316/316L	3	6.35	1915	5745
1" spool	GF-43L10007	AS20	SS ASTM A312 Gr.316/316L	2	4.55	80	160
1" spool	GF-43L10006	AS20	SS ASTM A312 Gr.316/316L	2	4.55	80	160
1" spool	GF-43L10001	AS20	SS ASTM A312 Gr.316/316L	2	4.55	80	160
1" spool	GF-43L10002	AS20	SS ASTM A312 Gr.316/316L	2	4.55	80	160

Shipped Loose Items stored at (LEVEL 5)





SHIP LOOSE PARTS FOR FLARE REDEPLOYMENT WILL BE STAMPED / MARKED AND PACKED IN WOODEN BOXES

- 1. HAND RAILS AND GRATING
- 2. SHIM PLATES 1MM TO 20MM
- 3. BEARING PLATES AND STUDBOLTS FO UPPER STOPS
- 4. 1/2 ROUND ANTI UP-LIFT PLATES AND CLOSING PLATES
- 5. SQUARE PLATE ANTI UP-LIFT PLATES
- 6. UPPER STOPS
- 7. UPPER SEA FASTENING CLOSURE PLATES (3PCS)

REFERENCE DRAWING 076328C-TP-90-N-XG-1402 SHEET 1 TO 15







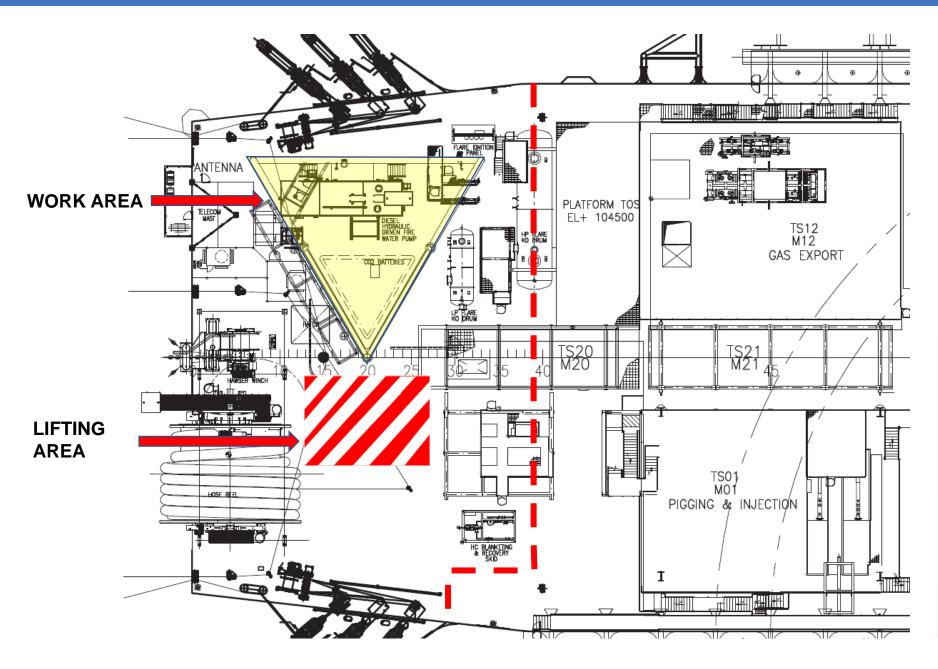






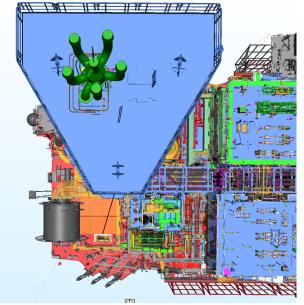
Pre-Sail Away Preparation





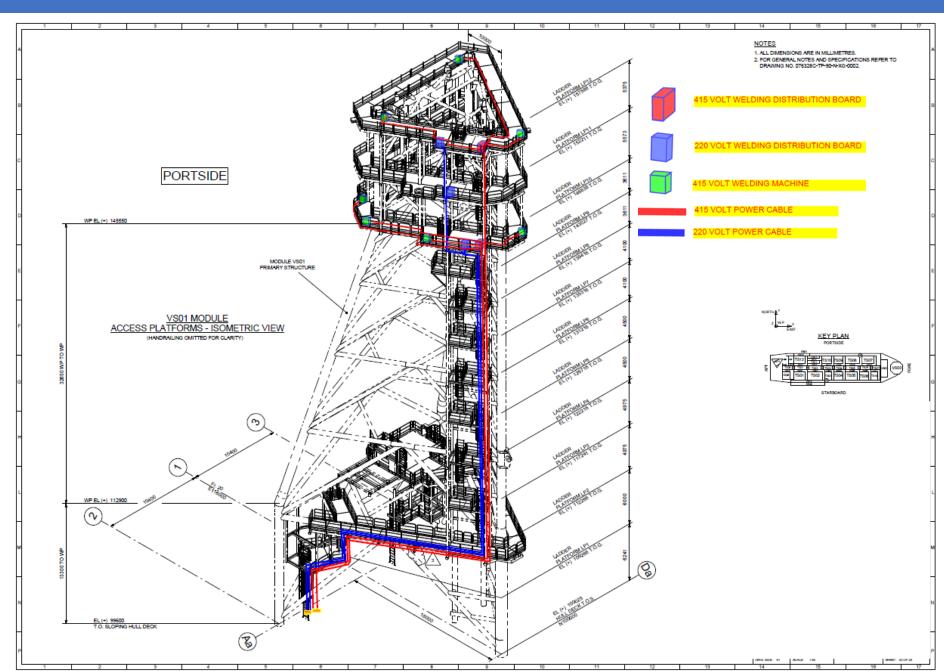
The lifting winch will be temporarily placed on the main deck where it will be secured and fastened to existing structures with 5 ton rigging.

All materials including removal of strand jacks (1.5t each) and wires will be removed from the flare and lowered to the main deck lifting area.



POWER SUPPLY 220V / 415V WELDING SUPPLIES





Temporary Power Supplies will be installed at the shipyard.

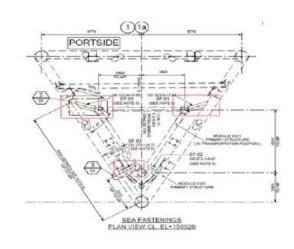
After the flare work is completed offshore, all the power supplies will be removed from the Flare Structure and put back into the GUS container and sent back to Singapore

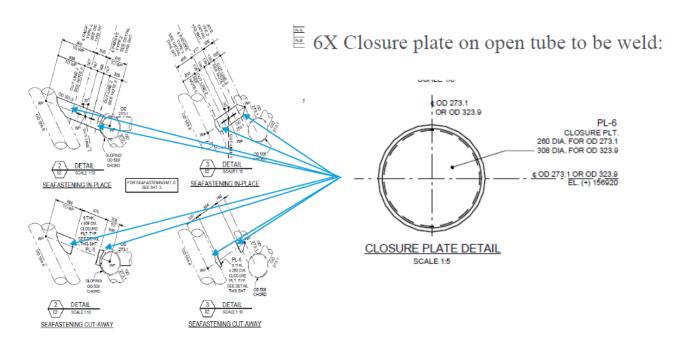
REMOVAL OF UPPER SEAFASTENING X 3

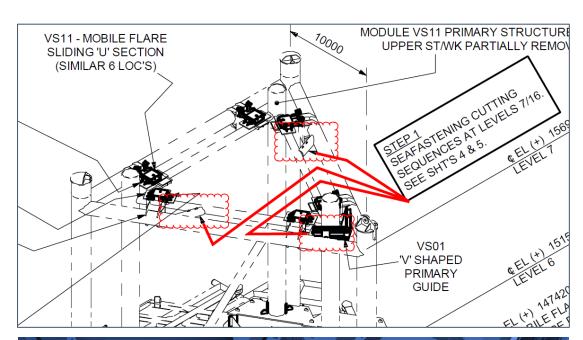


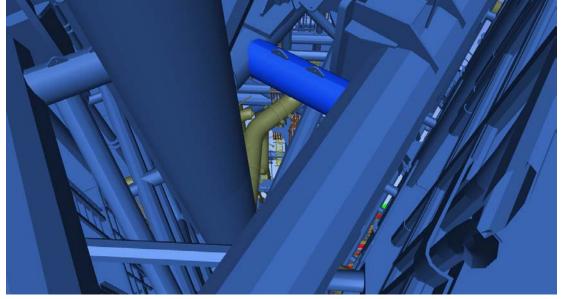
Cutting off 3 x sea fastening using oxy cutting torch 1/16 size tip.

After Cutting, clean ends and weld 6 closure before lifting the flare and paint.



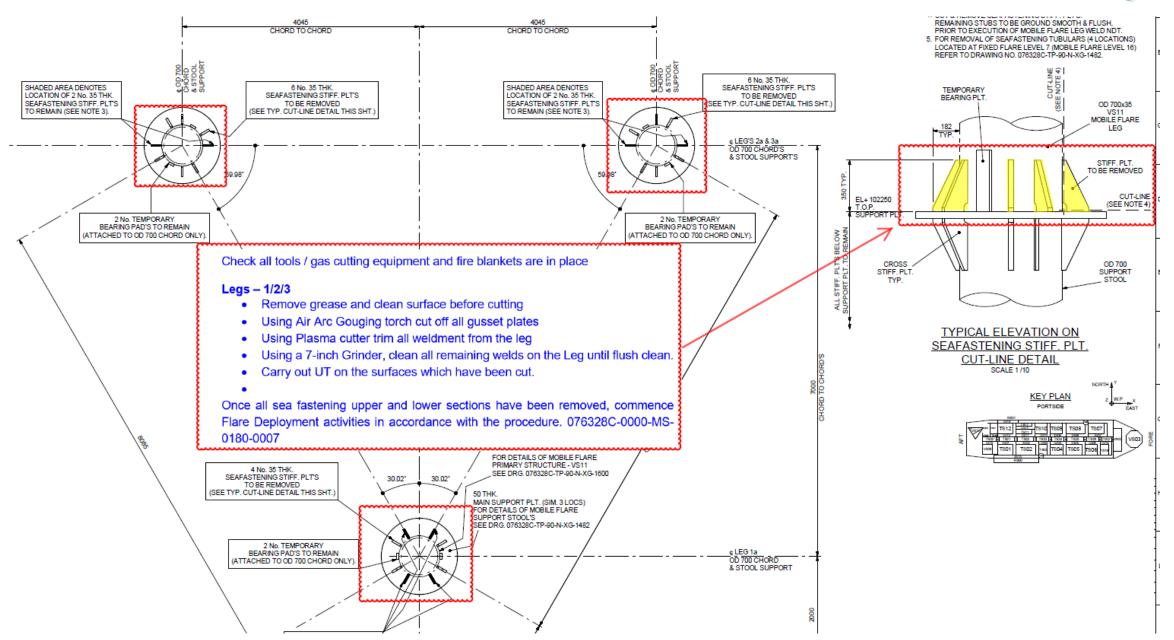






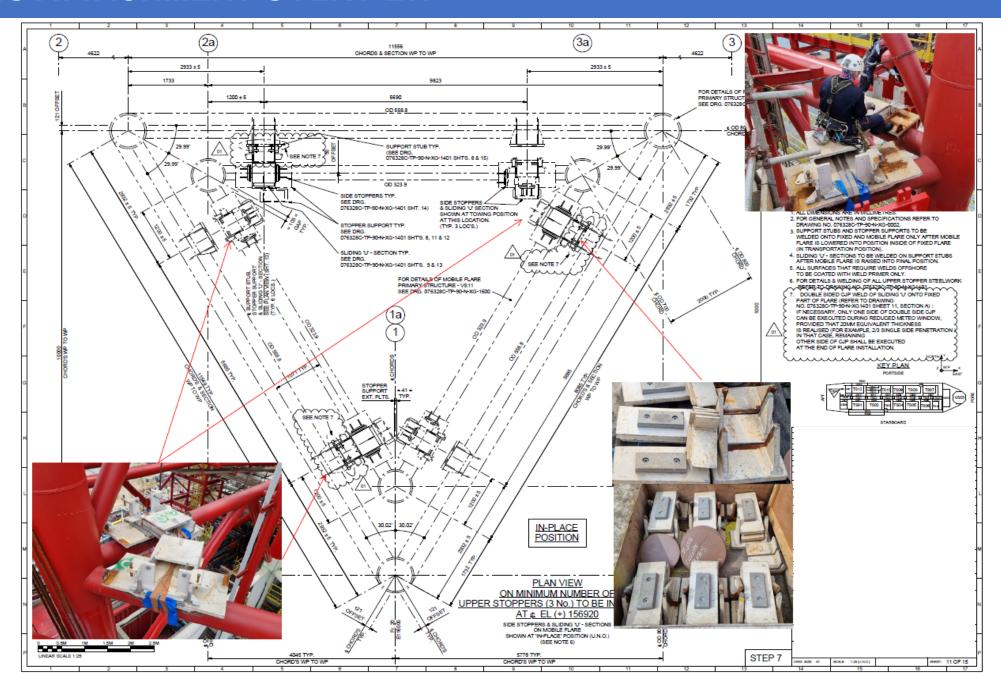
REMOVAL OF LOWER SEAFASTENING X 3





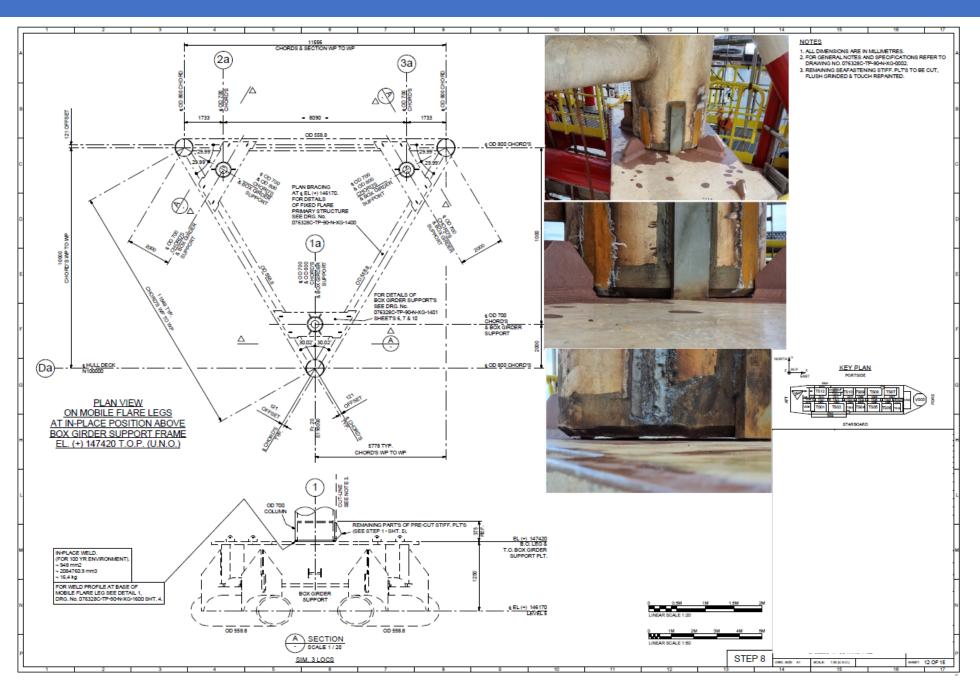
WELDING ATTACHMENT OVERVIEW





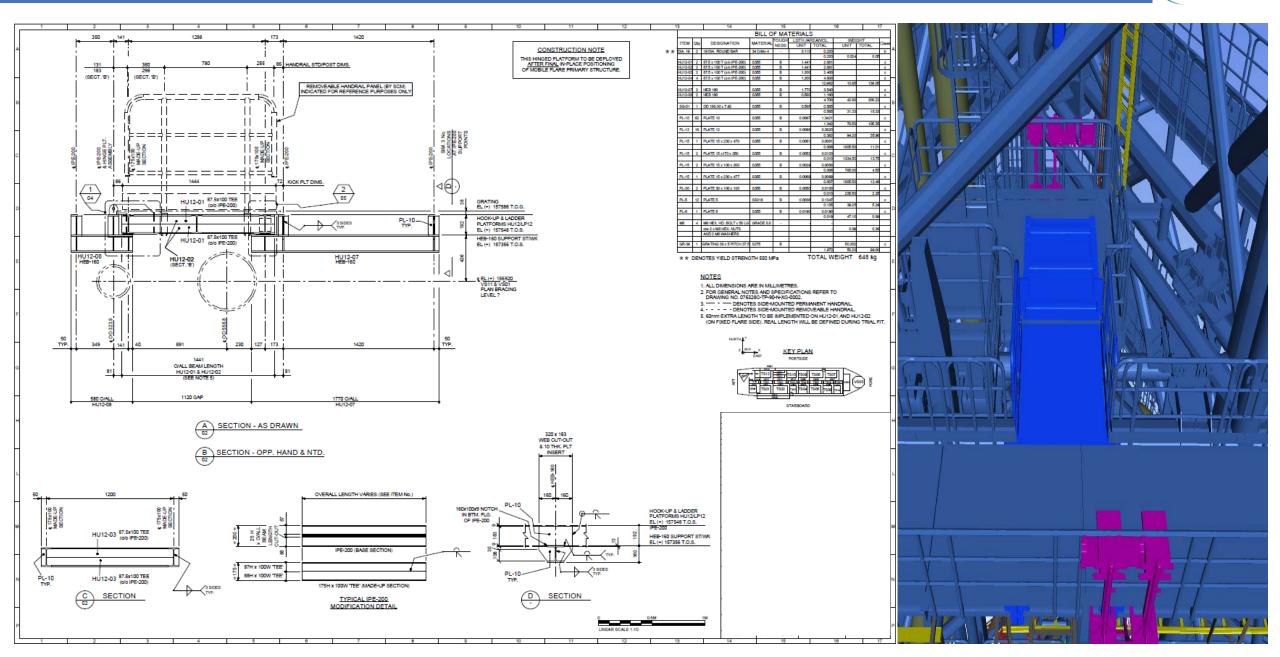
WELDING ATTACHMENT OVERVIEW





INSTALLATION OF ACCESS PLATFORM LEVEL 7

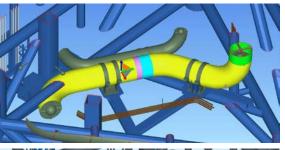




Welding of 14 & 24 inch Tie-in spools (TIG & SMAW)

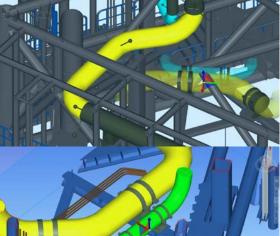


24" Stainless Steel line #150 Line Number: VF-43L10301 14" Carbon Steel line #150 Line Number: VF-43L10401



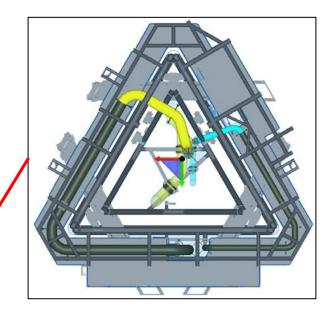


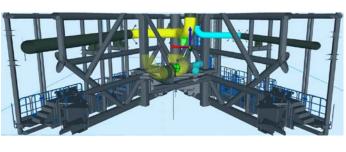




- Scaffold Platform will be inspected and recertified
- Prepare TIG welding and FCW machines
- Prepare 14 & 24 Pipe Cutting/Beveling machines
- Set up fire blankets and tarpaulins
- Prepare all tools
- Prepare all pipe rigging equipment
- 24 inch Dimension checks of tie-in points
- Machine 24 inch line, fit, clamp, tack weld
- Complete welding of 24 inch spool
- 10. NDT
- 11. 14 inch Dimension checks of tie-in points
- 12. Machine 14 inch line, fit, clamp, tack weld
- 13. Complete welding of 14 inch spool
- 14. NDT
- 15. Painting, Inspection
- 16. Demob tools, equipment, scaffold
- 17. MC Complete









Completion of Work



- 1. Complete all Work Scopes for Flare Redeployment
- 2. Complete all Structural Job Cards and sign off MC
- 3. Complete all Welding Job Cards and sign off MC
- 4. Complete all Piping Job Cards and sign off MC
- 5. Complete all Painting Job Cards and sign off MC
- 6. Complete all Electrical Job Cards and sign off MC
- 7. Complete all Instrument Job Cards and sign off MC
- 8. Compile Handover Dossier
 - Structural Fit-Up Reports / Welding Reports / NDT Report
 - Piping Fit-Up Reports / Welding Reports / NDT Report
 - Piping Hydrotest Reports (4 x 1 inch Gas Lines)
 - Painting Reports
 - Electrical Inspection / Ex Reports
 - Instrument Inspection / Ex Reports



WORK PACK WPHU04 16INCH RISER (ESDVs)

WP-HU-4: Riser spool/ESDV/PLR installation



WP-HU-4: Riser spool/ESDV/PLR installation

FPSO will recover the production from the wells with 2 production risers 10" located on starboard side. Gas export is made through 1 export riser 16" located on portside.

Recovery of prelaid risers and hook-uk to the riser receptacles will be performed by SURF CONTRACTOR. A single riser pulling system (RPS) is used sequentially on each side of the FPSO to perform the riser HU. The transfer of the RPS from one vessel side to the other is performed by CONTRACTOR.

Once a riser head is in its final position on the riser head receptacle, a riser spool, ESDV and pig launcher shall be installed. After pigging of the riser lines, the final spools shall be installed.

SUBCONTRACTOR shall cover piping, rigging, lifting and handling activities to:

1. Install the riser spool in its final position and allow CONTRACTOR's riser RATS to bolt the bottom spool flange to the riser head flange

Install the ESDV on top of the spool

Install the temporary PLR on top to ESDV

Removal of pigging lines

Installation of final production/export spools.

Hydrotest will be performed by CONTRACTOR (SURF).

After Riser commissioning has been completed by CONTRACTOR, SUBCONTRACTOR shall cover all the piping, rigging, lifting, handling activities associated to the removal and storage of the temporary PLR, and installation of the final spool between ESDV and process modules.

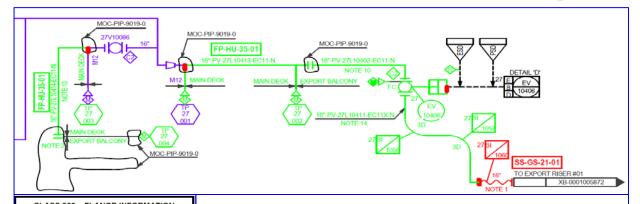
Piping Installation Overview



Piping installation will be carried out by experienced pipe fitters and supervision.

Scope:

- 1. Prepare Job Cards and PTW
- 2. Prepare Piping Tools, Equipment
- 3. Prepare & inspect piping materials, gaskets
- 4. Prepare piping torque values for RTJs
- 5. Prepare and grease all bolts MolyKote 1000
- 6. Prepare & inspect KAMOS Gaskets
- 7. Prepare & inspect KAMOS hand pump
- 8. Clean and Inspect all flange joint sealing faces
- 9. Witness Joint, Install gaskets and connect flange
- 10. Carry out controlled bolt tightening all joints
- 11. Complete Flange Management Report (QC)
- 12. Tighten all pipe supports
- 13. Touch-up Painting
- 14. Complete Piping Test Pack Report(QC)
- 15. Release for Dewatering & Leak Testing



			Torque Ibf.ft (Nm)	
Nom. Flg. Size Ins. (mm)	Bolting No. x Dia. ins	A/F Ins.	Bolt Lubricant Copperslip (µ=0.1)	Bolt Lubricant Molycote 1000 (µ=0.13)
1/2 (15)	4 x 3/4	1-1/4	65 (90)	80 (110)
3/4 (20)	4 x 3/4	1-1/4	85 (115)	105 (145)
1 (25)	4 x 7/8	1-7/16	140 (190)	175 (240)
1-1/2 (40)	4 x 1	1-5/8	225 (305)	285 (390)
2 (50)	8 x 7/8	1-7/16	150 (205)	190 (260)
3 (80)	8 x 7/8	1-7/16	195 (265)	245 (335)
4 (100)	8 x 1-1/8	1-13/16	375 (505)	470 (635)
6 (150)	12 x 1-1/8	1-13/16	415 (560)	525 (710)
8 (200)	12 x 1-3/8	2-3/16	675 (915)	860 (1165)
10 (250)	16 x 1-3/8	2-3/16	675 (915)	860 (1165)
12 (300)	20 x 1-3/8	2-3/16	735 (995)	930 (1260)
14 (350)	20 x 1-1/2	2-3/8	935 (1265)	1185 (1605)
16 (400)	20 x 1-5/8	2-9/16	1295 (1755)	1645 (2230)
18 (450)	20 x 1-7/8	2-15/16	1850 (2505)	2360 (3200)
20 (500)	20 x 2	3-1/8	2245 (3040)	2865 (3885)
24 (600)	20 x 2-1/2	3-7/8	4190 (5680)	5370 (7280)
30 (750)	20 x 3	4-5/8	7070 (9585)	9085 (12315)
36 (900)	20 x 3-1/2	5-3/8	10935 (14825)	14085 (19070)

Flange Materials: ASTM A105, Class 900
Flange Materials: ASTM A105, ASTM A182 grades F80 and F81, ASTM A360 grades LF2 and LF3, ASTM A664 grades F82 and F80.
Botting Materials: ASTM A103 grades B7 and B7M, ASTM A320 grades 17, 17M and 143.

Sasket Type: Spiral Wound and Ring Joint

Service Temperature Range: Minus 101 thru' plus 400°C (F Piping Class)

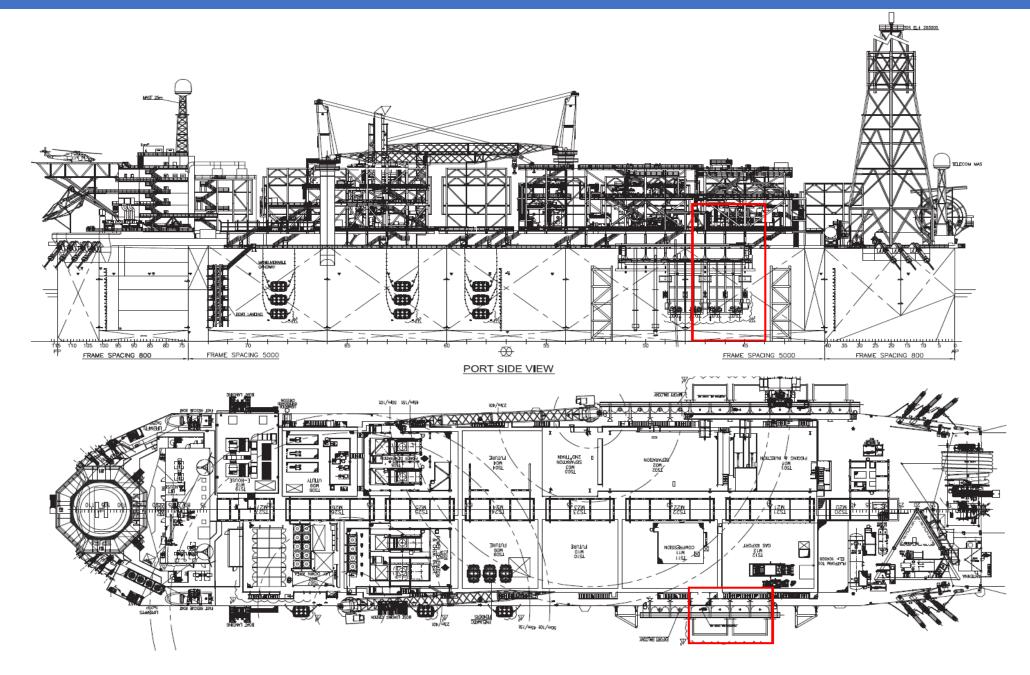






Work Location





Scope of Work



Document Title ESDV & Riser Spool & Pig Launcher Receiver Portside Installation Procedure COMPANY Doc / Rev No 076328C-0000-PP-0975

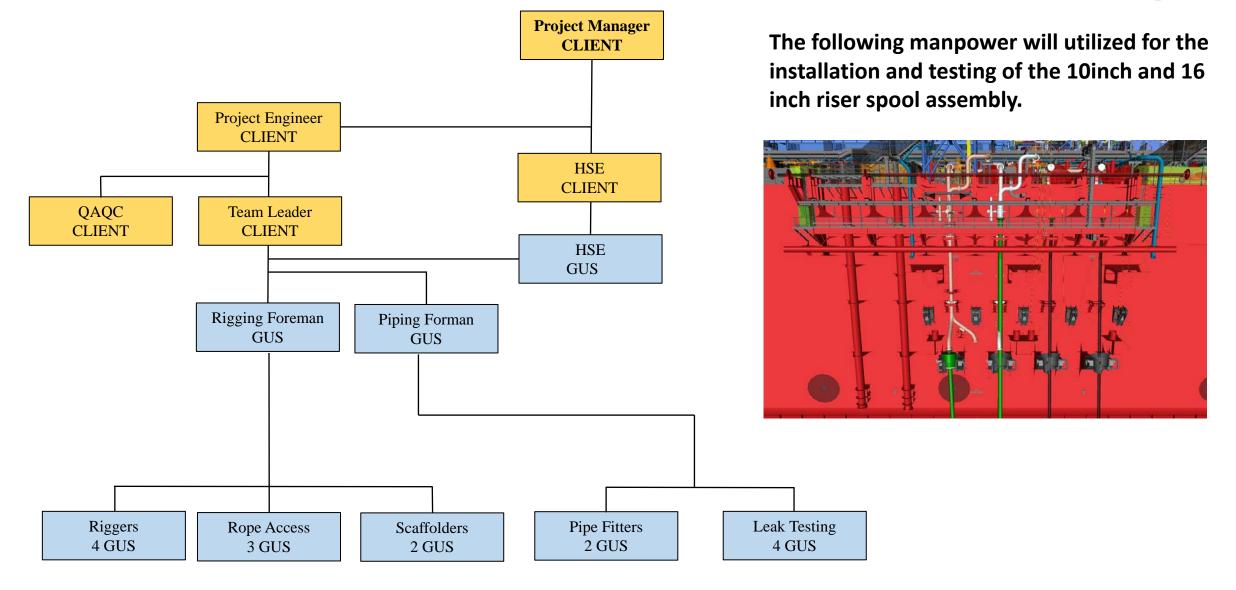
Document Title ESDV & Riser Spool & Pig Launcher Receiver Portside Installation Lift Plan COMPANY Doc / Rev No: 076328C-0000-PP-0978

ESDV & Riser Spool & Pig Launcher Receiver Portside Installation Procedure

ESDV & Riser Spool & Pig Launcher Receiver Portside Installation Lift Plan

Organization Chart / Man Power



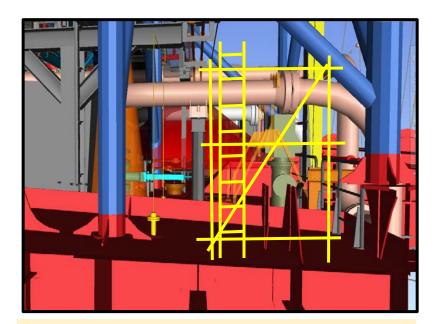


Scaffold and Access Requirements

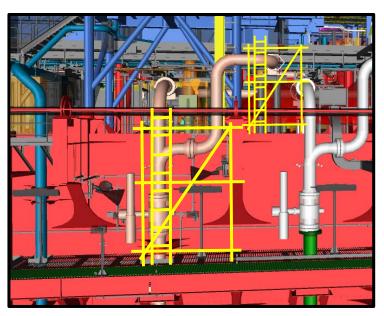


During the detail planning and Job Card preparation, the scaffold and rope access requirements be identified to calculate the required scaffold material to be erected for the duration of the work scope. Typically, the scaffold will be dismantled when Leak Testing has been complete and touch-up painting.

All scaffold material is to BS/EU Standards. All scaffolders will be qualified and experience offshore scaffolders. Rope access personnel will be IRATA qualified.



2m x 2m x 3m Tower Scaffold for flange alignment, flange management and leak testing.



3m x 3m x 4m Tower Scaffold for Spool installation & alignment, flange management, instrument Hook-up for ESD valve and leak testing.



2m x 2m Platform Scaffold for flange inspection, alignment, flange management, leak testing and coating application.

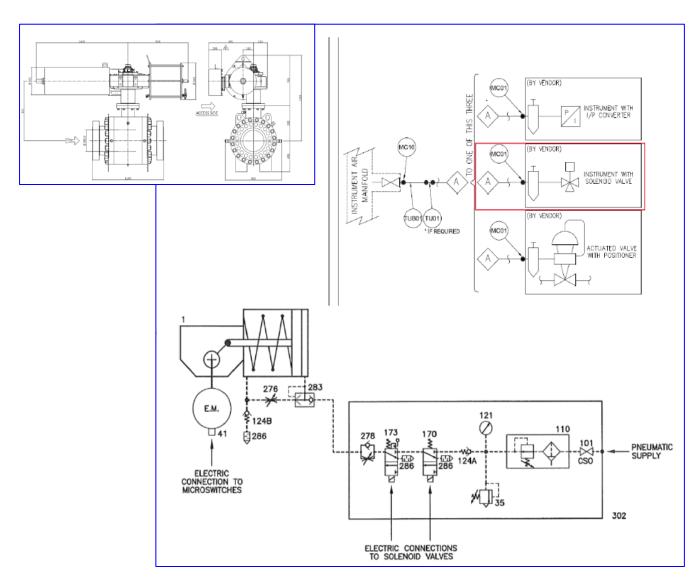
Instrument Installation



Instrument installation will take place when the ESD valve has been installed.

Scope:

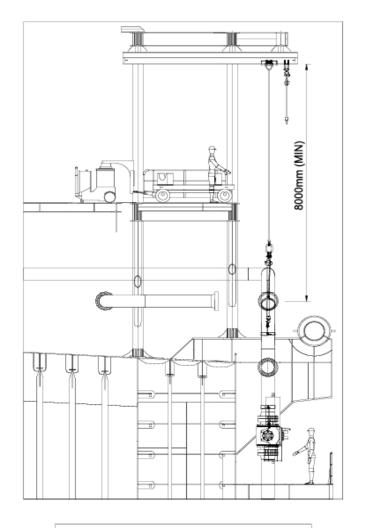
- Prepare Job Cards and PTW
- 2. Prepare Instrument Tools & Test Equipment
- 3. Prepare & inspect all materials
- 4. Connect instrument tubing to ESD valve
- 5. Gland and terminate Inst. cables to ESD valve
- 6. Secure and support tubing and cables
- 7. Carry out service test of instrument air tubing
- 8. Carry out function test of ESD valve
- 9. Complete Instrument Test Pack Report (QC)
- 10. Complete Ex Test Report (QC)
- 11. Complete Instrument Dossier
- 12. Release for Loop Checking & Commissioning

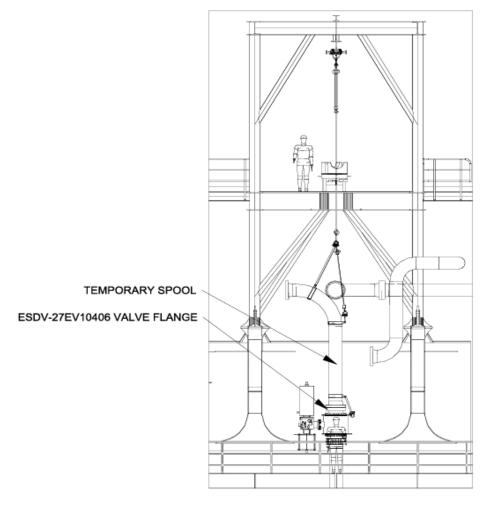


16 INCH RISER SPOOL INSTALLATION



STEP-4 (ALIGN TEMPORARY PIGGING SPOOL WITH ESDV-27EV10406 VALVE FLANGE)





VIEW LOOKING WEST

VIEW LOOKING SOUTH

SIT Photos (SDV INSTALLATION)





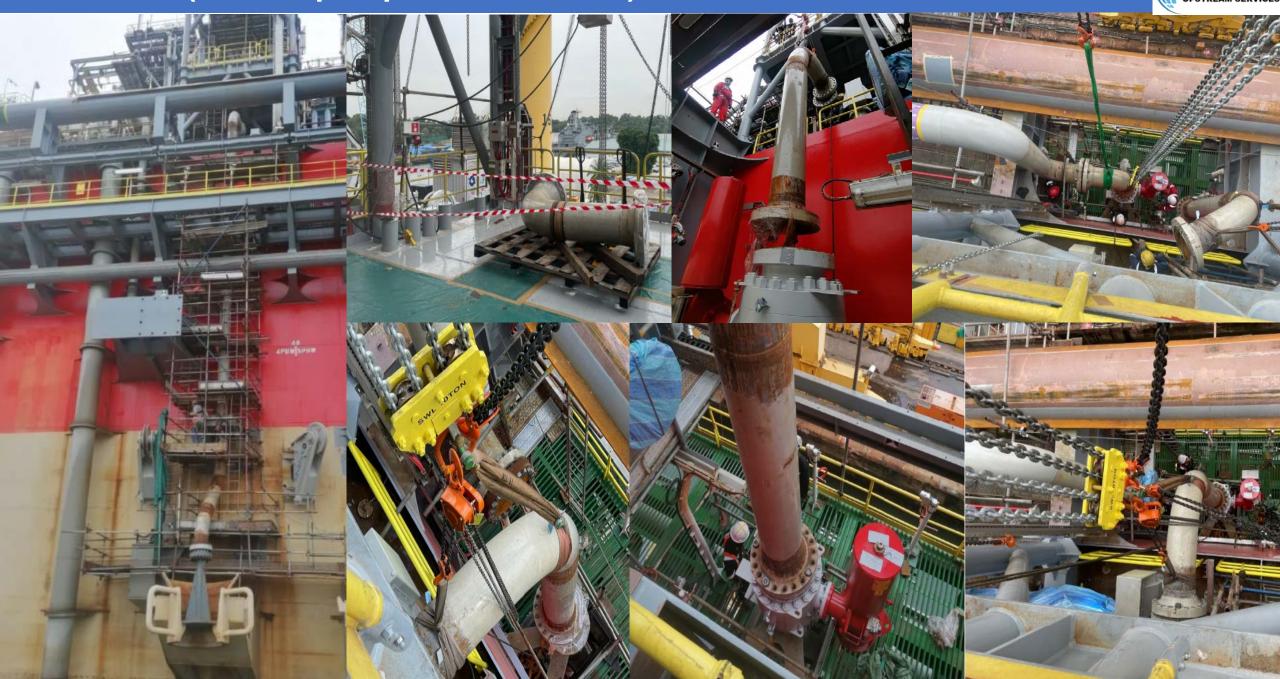






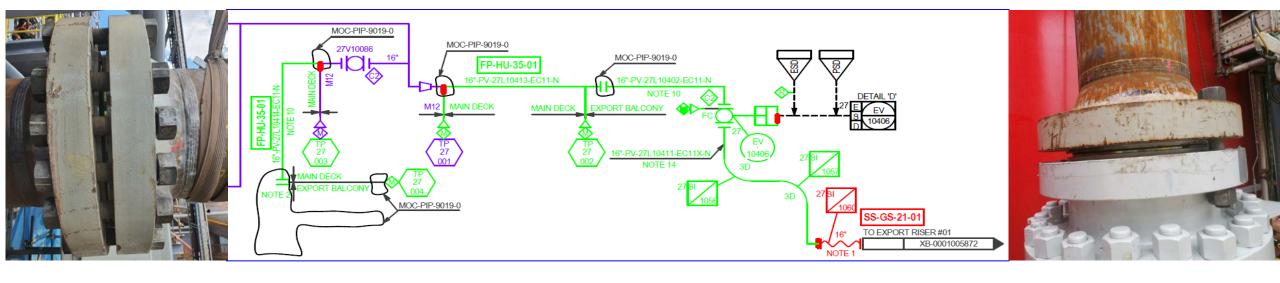
SIT Photos (Riser Pipe Spool Installation)





Piping Leak Testing





- ✓ Leak Testing of the system will be carried out by an experience and reputable N2He leak Testing Company.
- ✓ The leak testing company selected will prepare all the tools and equipment to carry out the leak testing offshore under the supervision of GUS and T.EN.
- ✓ Where KAMOS Gaskets have been installed and joints tested, the N2He leak testing boundary will be reduced to take in consideration that the KAMOS joints have been tested and LEAK FREE.
- ✓ Leak Test Packs will be prepared for each system that requires Leak Testing offshore.

Completion of Work



- 1. Complete all Work Scope as per method statement / installation sequence
- 2. Complete all Structural Job Cards and sign off MC
- 3. Complete all Piping Job Cards and sign off MC
- 4. Complete all Painting Job Cards and sign off MC
- 5. Complete all Instrument Job Cards and sign off MC
- 6. Compile Handover Dossier
 - Structural Reports
 - Piping Flange Management Reports
 - Piping Leak Testing Reports
 - Painting Reports
 - Ex Reports
 - Instrument Inspection / Ex Reports

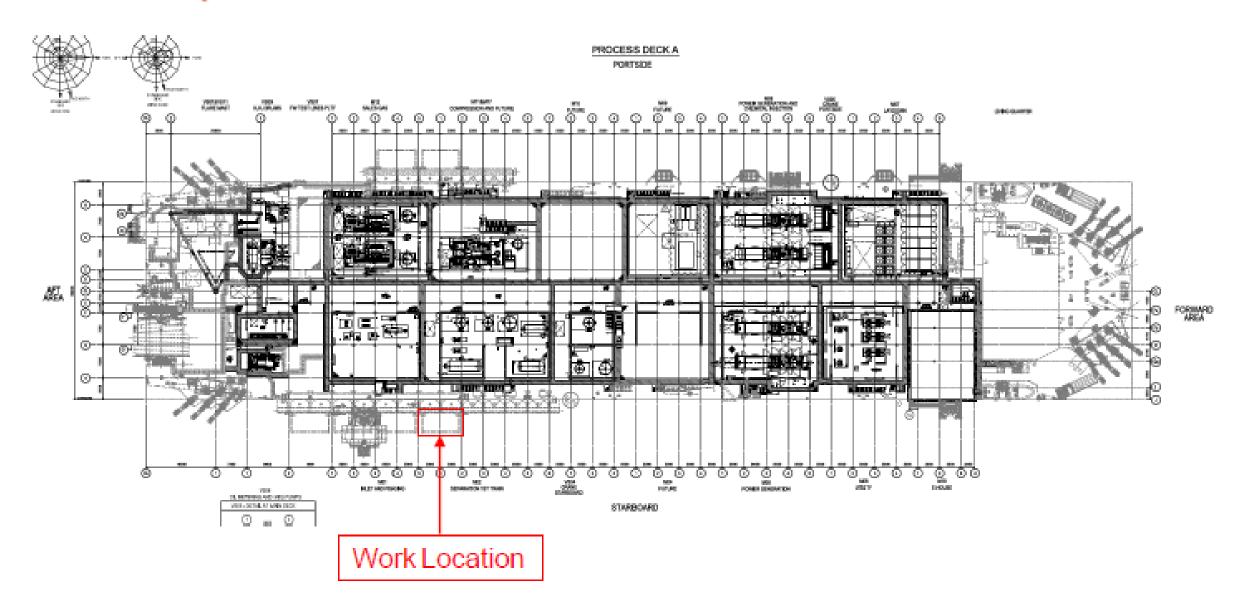


WORK PACK WPHU04 10INCH AND RISERS (ESDVs)

WP-HU-4: Riser spool/ESDV/PLR installation (10inch)



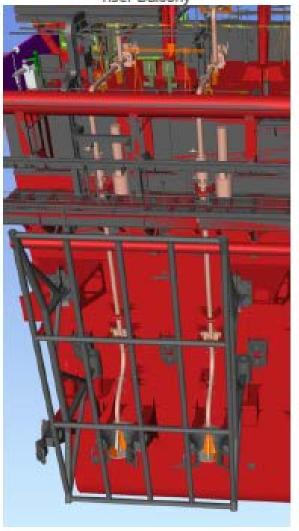
Overview: Layout



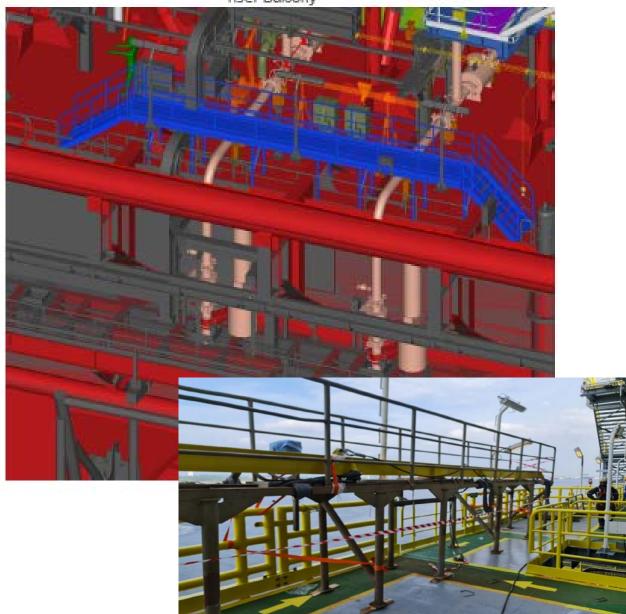


Overview

Overview without Removable Platform above riser Balcony

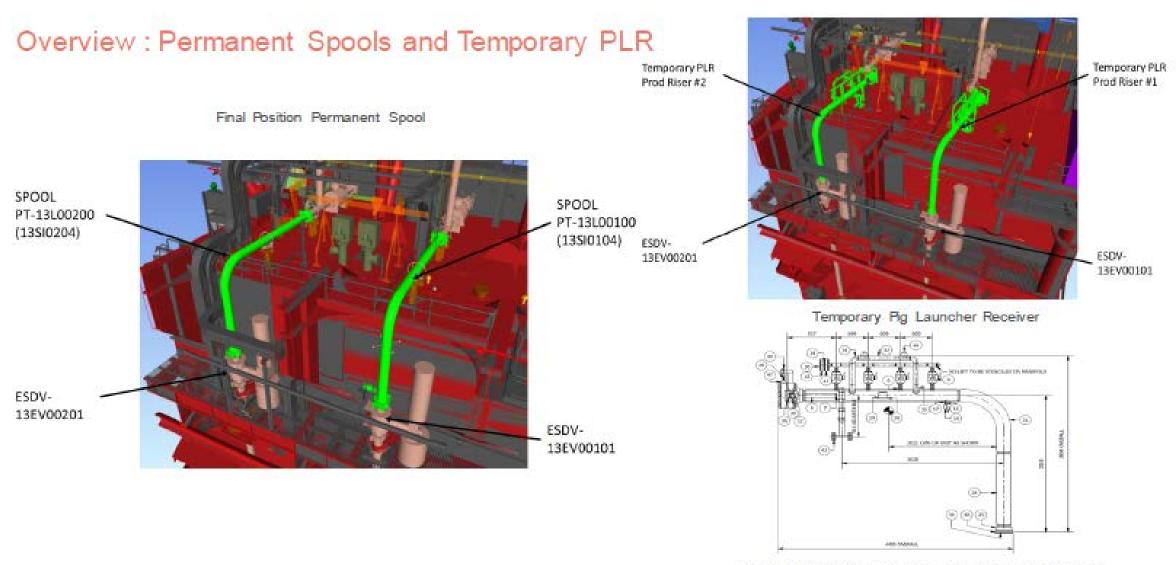


Overview with Removable Platform above riser Balcony





View with the PLR Installed

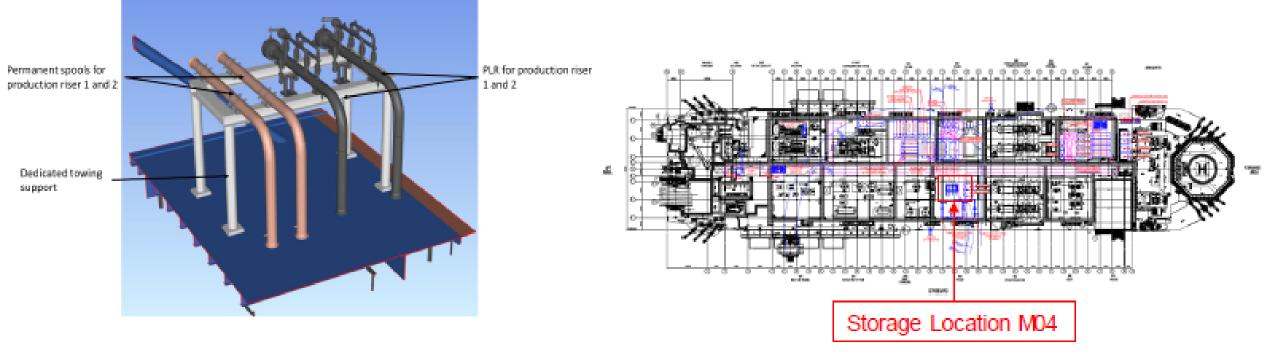


ESDV & Riser Spool & Pig Launcher Receiver Starboard Installation-Constructability Review



Prior to Start Installation: Pig Launcher Receiver and Permanent Riser Spool

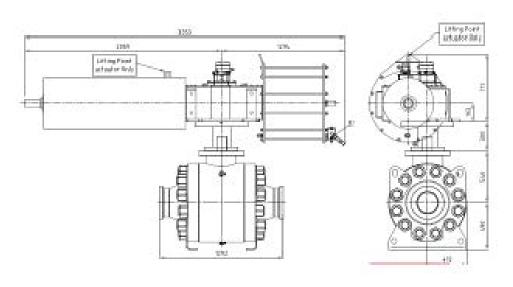
- Pig Launcher Receiver for Production Riser will be stored on temporary support on M04
- Permanent Spools Installed and Preserved with Platic end cap near PLR

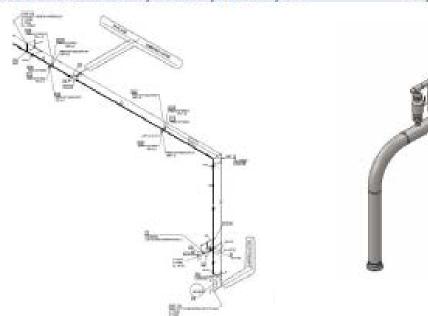




Prior to Start Installation: ESDV & Shipped Loose

LINE (SPECIAL ITEM)	DESCRIPTION	MAIN DIMENSIONS	GROSS WEIGHT
ESDV-13EV00101	ESDV - 10" - 2500#	3,3m x 1 m x 2,4m	5,3 tons
ESDV-13EV00101	ESDV - 10" - 2500#	3,3m x 1 m x 2,4m	5,3 tons
PT-13L00100 (13SI0104)	Permanent production riser #1 3d bend spool		1,7 tons
PT-13L00200 (13Sl0204)	Permanent production riser #2 3d bend spool	4,8m x 2,7m x 0,7m	1,7 tons
PV-27L10412-SPOOL1	Temporary PLR Riser Prod #1	4,4m x 3,8m x 0,7m	1,9 tons
PV-27L10412-SPOOL2	Temporary PLR Riser Prod #2	4,4m x 3,8m x 0,7m	1,9 tons





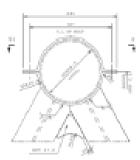




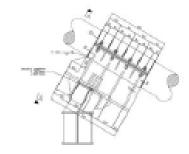
Job Sequence: De-seafastening Riser Spool # 2

- De-seafastening Activities :
 - Start by Riser Spool # 2 due to Seafastening Configuration
 - 2 Off Clamps spool to be free of movement
 - Remove RB00-SPS-002 and 004
 - Unbolt RB00-SPS-0010
 - Note: Design Modification of Permanent Support is on going





Clamp supports



RB00-SPS-0010 - Bottom temporary support

Clamp supports

Rotationnal guiding purpose.

Permanent support

Configuration : RB00-SPS-001 for Operation RB00-SPS-002 for towing

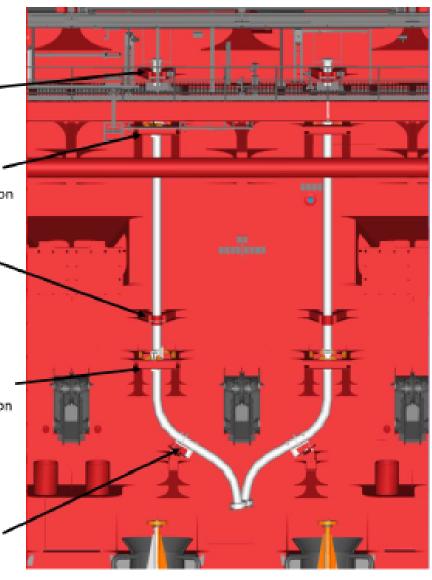
Clamp supports

Rotationnal guiding purpose.

Permanent support

Configuration : RB00-SPS-003 for Operation RB00-SPS-004 for towing

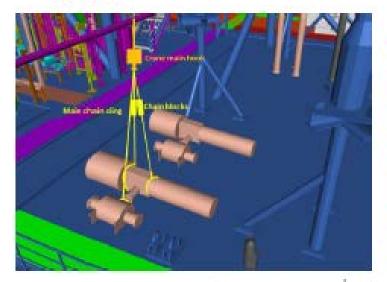
Temporary support RB00-SPS-0010 – For towing only





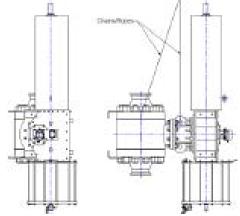
Job Sequence: Installation of the ESDV

 Upending and transfer overboard using FPSO Starboard Crane

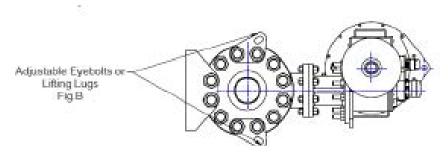








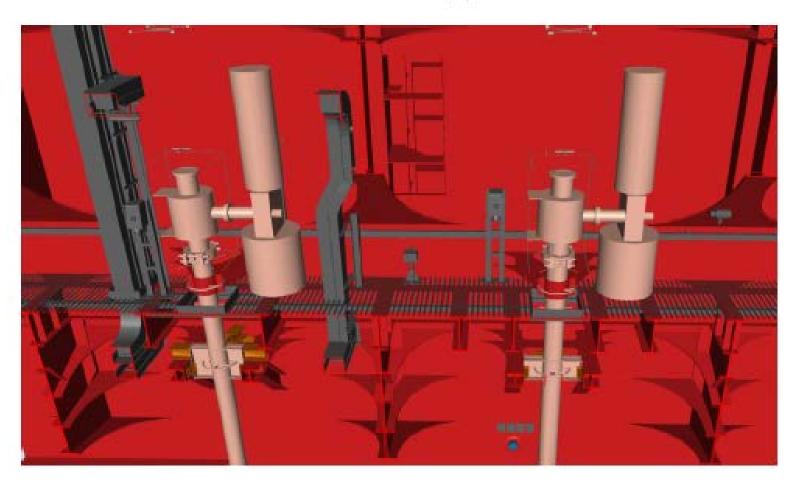






Job Sequence: Installation of the ESDV 13EV00101 & ESDV 13EV00201

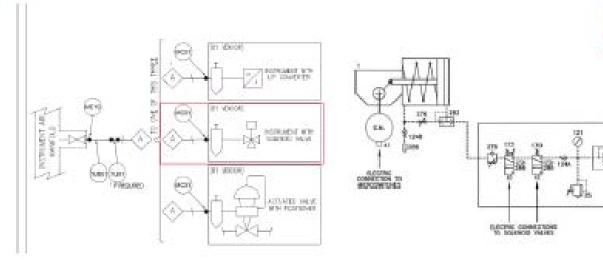
ESDV Installed on their Closing Spool



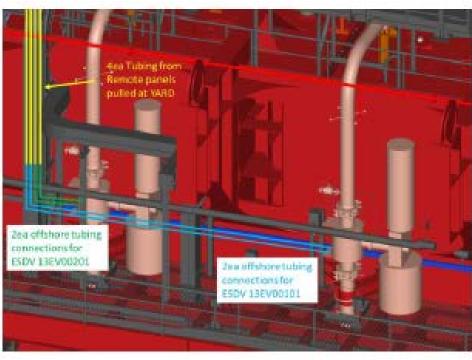


Job Sequence: ESDV connections and start-up

- Tubing connection for Actuator Air Supply
 - Approximately 5meter of 12mm OD 316SS
- 3ea instrumentation cables for Solenoid valves and Microswitches
 - Cables will be coiled and connected on one side by the YARD
- Start-up of the ESDV by PCC



Tubing Roorting

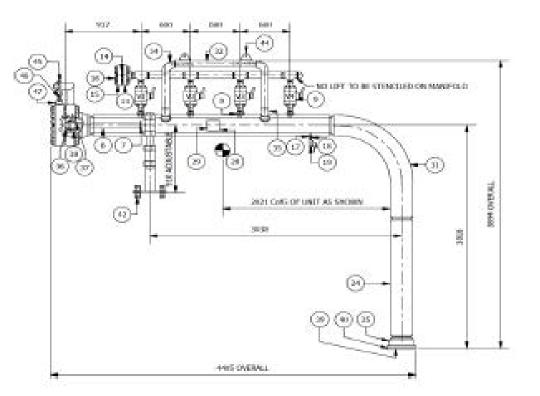




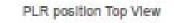
Job Sequence: PLR Installation Riser #1 and Riser #2

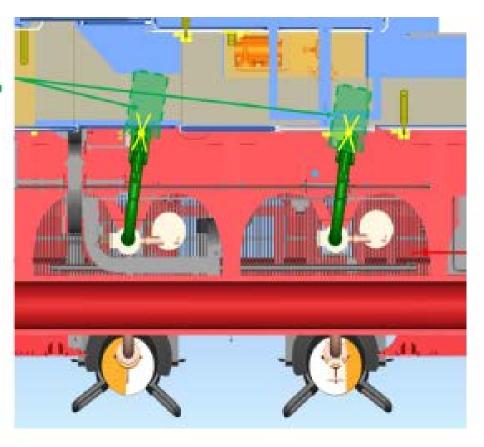
Prerequisite

 Free Area between the Top of ESDV flange and the Riser Balcony



Shadow of the part of the PLR under the FPSO bridge

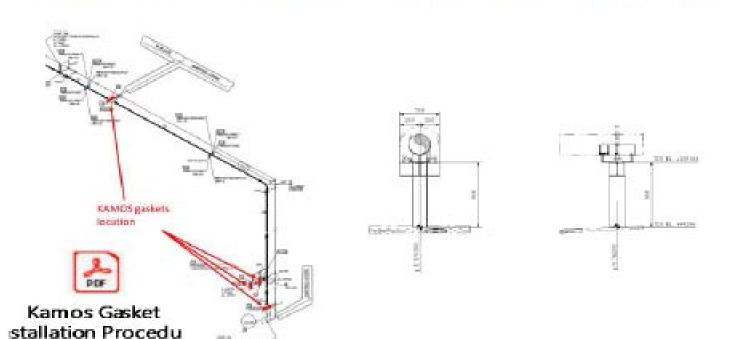


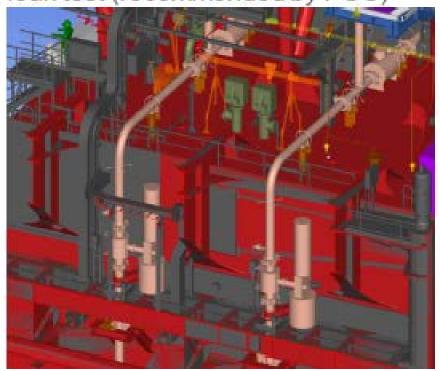




Job Sequence: Connection of the permanent spool Riser Prod #1 and #2

- Installation Sequences :
 - Deseafastening the Permanent Spool and Remove temporary blind flange on the process line
 - Permanent riser spool lifted from M04 using lifting devices and FPSO Starboard Crane
 - Flange connection with KaMos gaskets in order to avoid an other leak test (recommended by PCC)





SIT Photos (10 ESDV Installation)





10 INCH RISER SPOOL INSTALLATION PHOTOS



Main Deck Access Platform Reinstatement





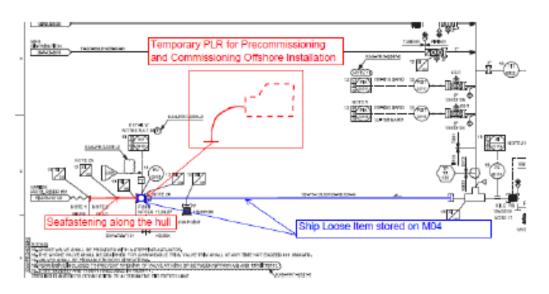
Re-installation of access platform stored on Module 2 back to existing location.

- 1. Reinstate all electrical lighting cables.
- 2. Touch-up painting of structure and deck plate

Piping Leak Testing



Starboard Production Riser 1



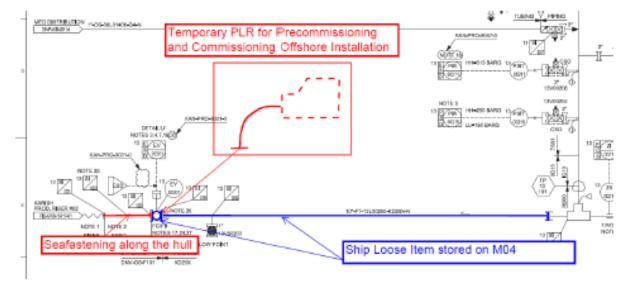


Leak Testing of the system will be carried out by an experience and reputable N2He leak Testing Company.



Where KAMOS Gaskets have been installed and joints tested, the N2He leak testing boundary will be reduced to take in consideration that the KAMOS joints have been tested and LEAK FREE.

Starboard Production Riser 2





The leak testing company selected will prepare all the tools and equipment to carry out the leak testing offshore under the supervision of GUS and T.EN.



Leak Test Packs will be prepared for each system that requires Leak Testing offshore.

Completion of Work



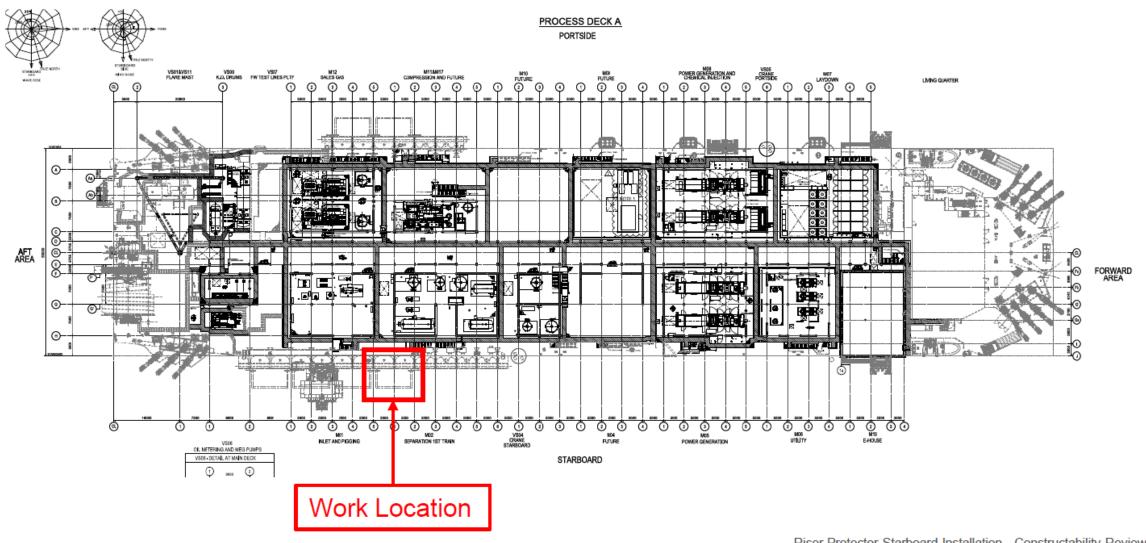
- 1. Complete all Work Scope as per method statement / installation sequence
- 2. Complete all Structural Job Cards and sign off MC
- 3. Complete all Piping Job Cards and sign off MC
- 4. Complete all Painting Job Cards and sign off MC
- 5. Complete all Instrument Job Cards and sign off MC
- 6. Compile Handover Dossier
 - Structural Reports
 - Piping Flange Management Reports
 - Piping Leak Testing Reports
 - Painting Reports
 - Ex Reports
 - Instrument Inspection / Ex Reports



WORK PACK WPHU05 RISER PROTECTORS



Overview: Layout





Procedure and Lift plan documents issuance

- Installation procedure 076328C-TP-13-J-KA-0983
- Lift plan 076328C-TP-13-J-KA-0985

Jobcard and Permit to Work: Preparation

- Jobcard is prepared
- Jobcard includes :
 - Activities Sequences
 - Manpower and Hours
 - Material and Tools
 - Documents
 - Lift plan

- Preparation Work Permit
 - T.EN will follow the Permit to Work procedure from CPY
 - Issue of PTW when Jobcard Submitted and Approved

Started by T.EN ———— Reviewed Completed by



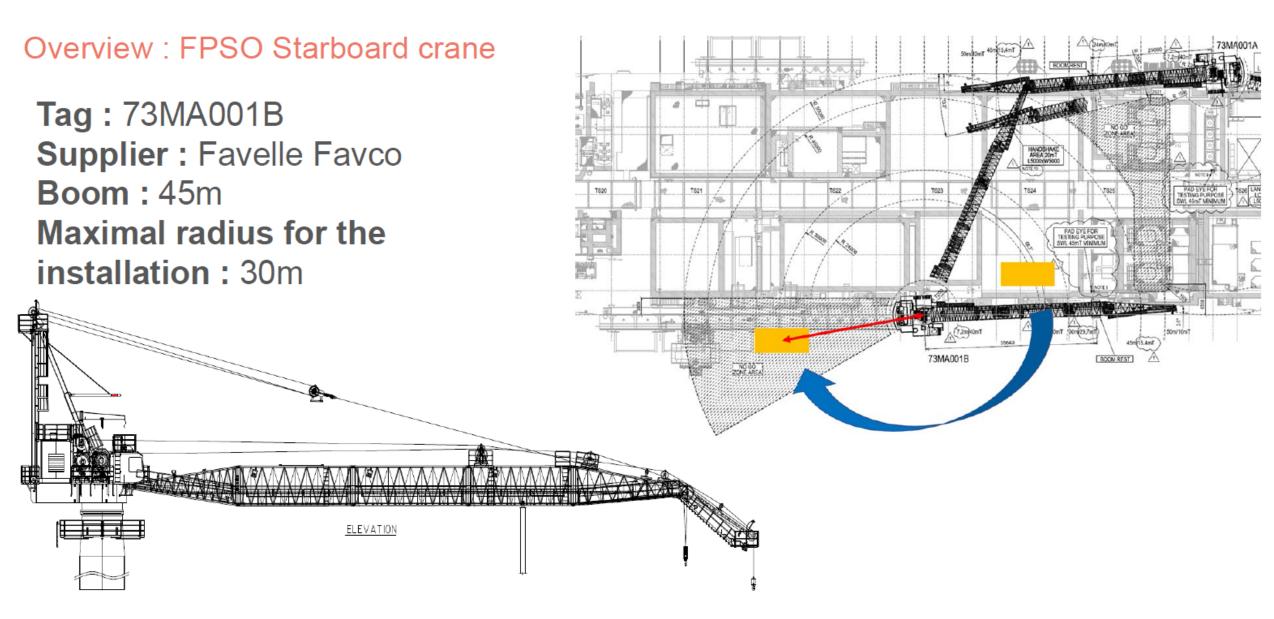
Resources

- Deck Superintendent + Rigging Supervisor
- POB: 9 PAX Rigger Foreman + Riggers + RAT (Rope Access Technician)
- Crane operator

Sequence

- Review of the procedure / Lift plan / Job Safety Analysis / TBT
- 2. Preparation of the lifting sets
 - Inspection of the main lifting set
 - Installation of the upper/lower lines
- 3. Deseafastening / Lifting / Final approach
- 4. Bolting



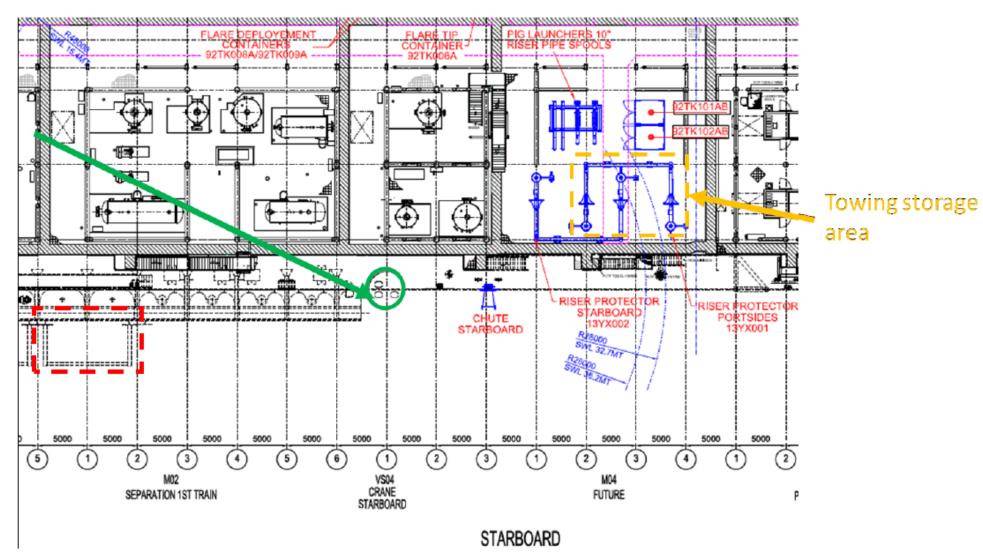




Overview: Layout

Starboard Crane pedestal

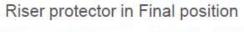
Riser protector installation area

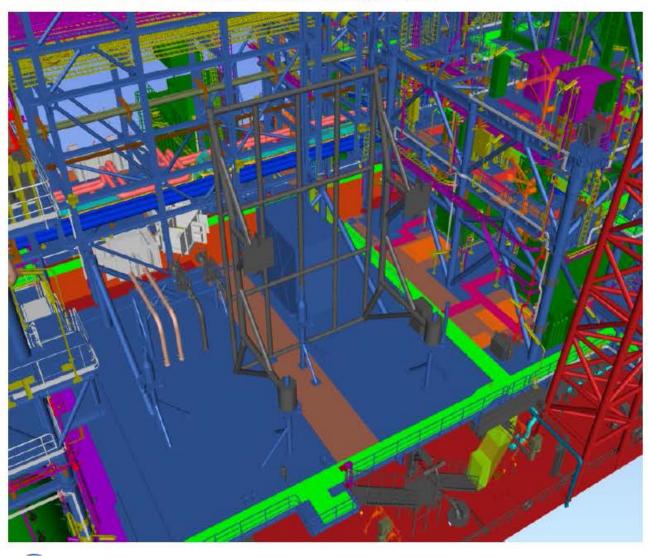


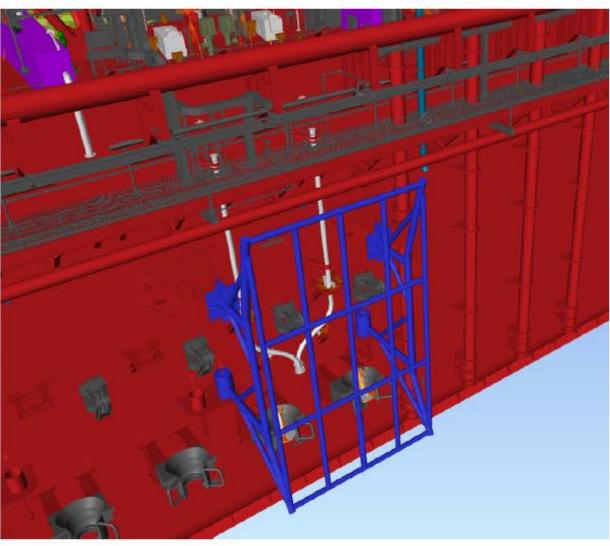


Overview

Riser protector in Towing position

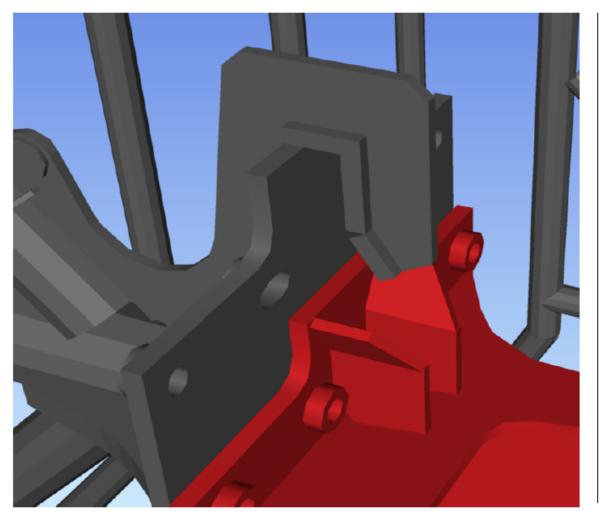


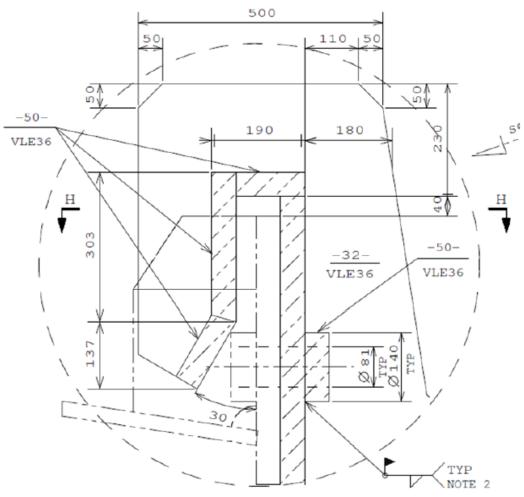






Overview – Flange connections with hook

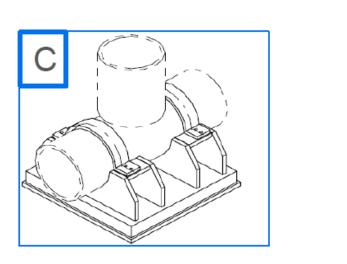


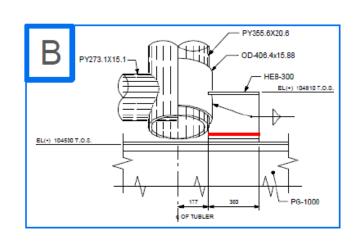




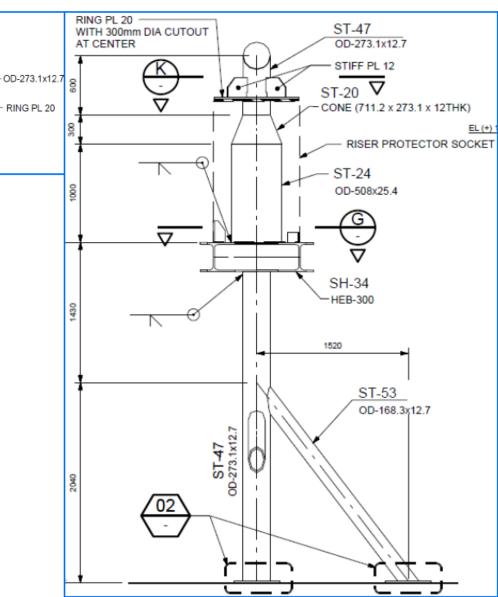
Riser Protector seafastening details.

- 2ea towing frames with pins and anti-uplift rings
- 2ea longitudinal stoppers at deck level (half tube)
- 2ea bolted clamp supports at deck level





PL-12

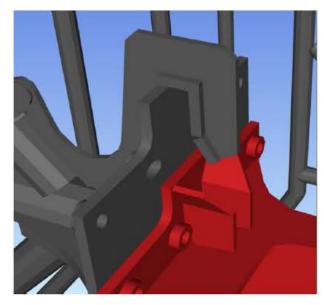


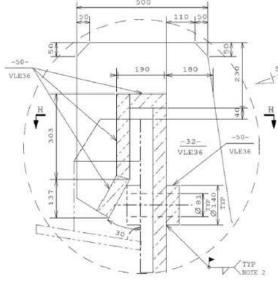


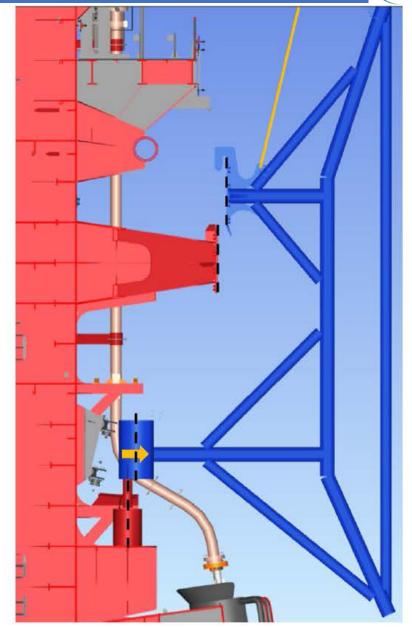
04 – Installation steps

Step 05 - Hooks positioning

- When the flanges are starting to face, move the load back towards the FPSO to have a flange contact.
- Align the hooks with their guides.
- Lower down the load smoothly until it fully rest on its supports.





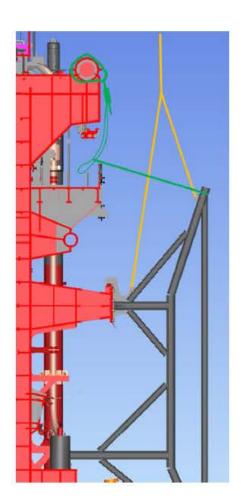


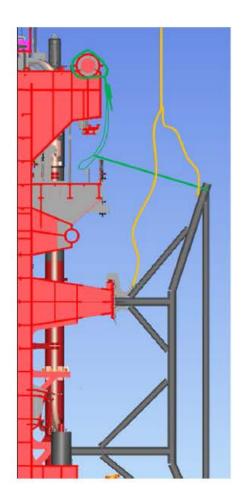


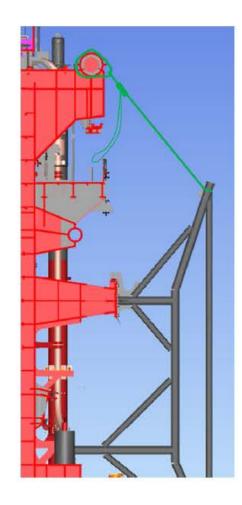
Step 06 – Main lifting sets disconnection

- Untension the lifting set
- RAT to disconnect the shackles from the padeyes
- If needed, use the 15tons
 SWL soft slings and chain
 block to keep a flange contact
 to ease the next step.





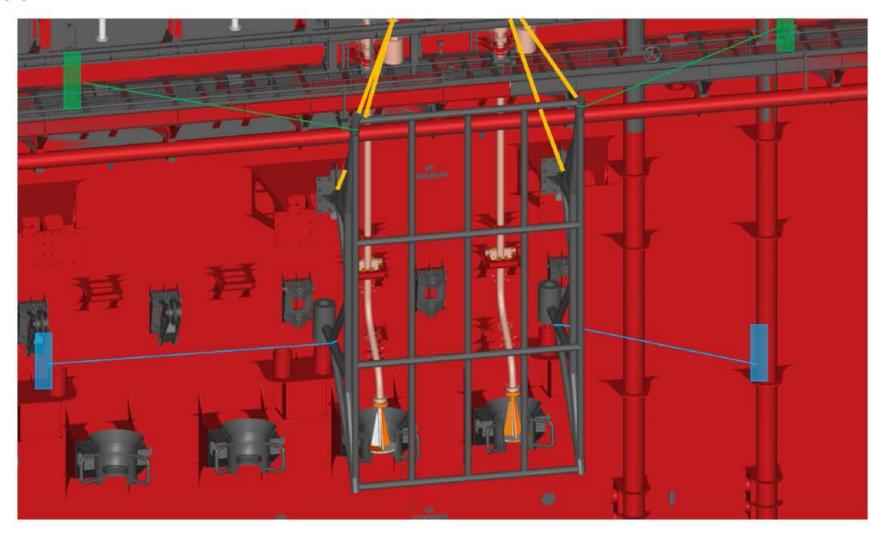






Step 03 – Installation area approach

- Upper lines to be used on the Riser Balcony as tag lines to control the load rotation
- Lower lines to be passed at flexible joint level and to be manipulated by RAT as tag lines as well.

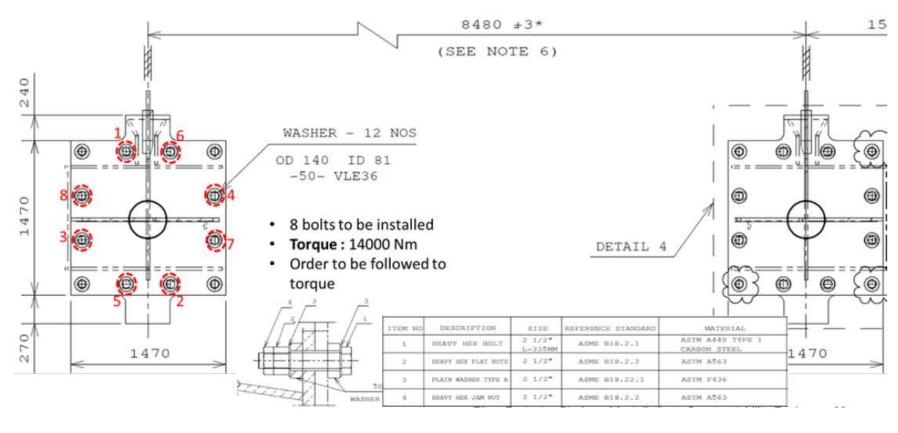




Step 06 – Upper line tensioning

- RAT to bolt up the flanges with hand torque.
- Torque the bolts with Hydraulic torque wrench EDGE - 12.







WORK PACK WPHU06 SEAWATER LIFT PUMP



WP-HU-6: Seawater lift pump (SWLP)

Sea water is lifted to the FPSO through three sea water lift pumps (SWLP – 50PS001 A/B/C) to be installed inside dedicated caissons integrated into the hull. Each vertical pumps will be fitted with a sea water intake riser head (SWIR Head) which will allow to pump sea water at colder temperatures in future phase. At least, one of the pump will be installed at YARD (50PS001A) without SWIR Head while other caissons will remain empty.

Offshore scope will be to:

Install SWIR Head B and install pump B (Mechanical / Piping / EIT)

Install SWIR Head C and install pump C (Mechanical / Piping / EIT)

Disconnect all spools, remove pump A and install the SWIR Head

Reinstall pump A (mechanical assembly, lowering, piping connections, power cables etc.)

Support PCC activities until start-up

SUBCONTRACTOR will be in charge to provide competent manpower and perform the overall installation until mechanical completion including: handling, rigging, assembly, bolting, pipe fitting, cables connections, oil filling, flushing) The pumps installation will be supervised by VENDOR (1x supervisor).

Man Power Requirements



Constructability review

Resources

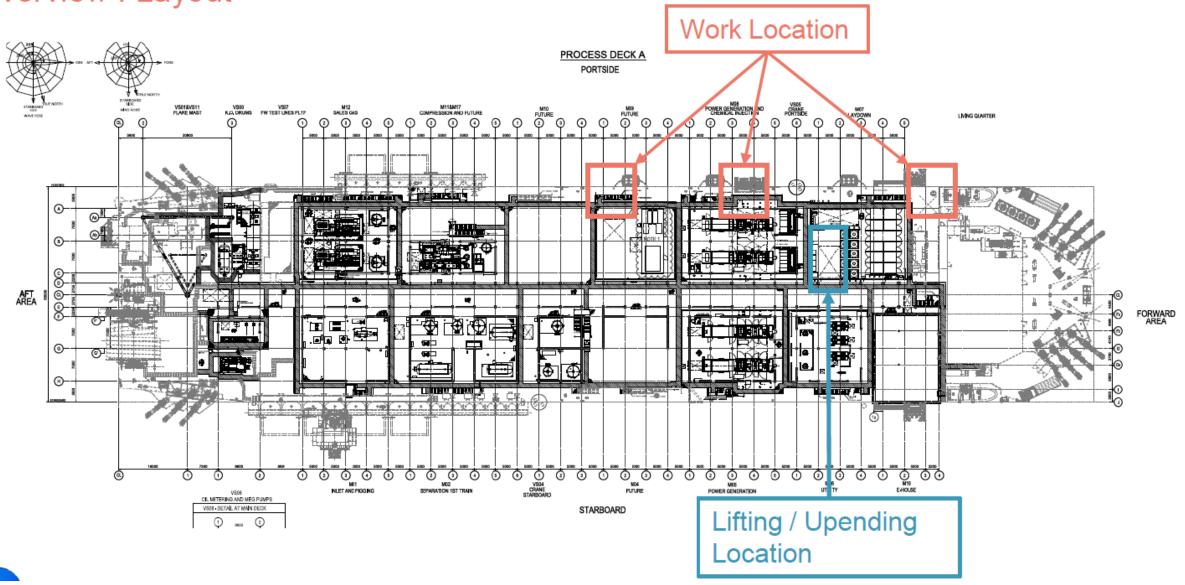
- Framo vendor
- Deck Superintendent + Rigging Supervisor + Mechanical Supervisor
- POB: 13 max PAX Riggers + Mechanical/Electrical/ Piping workers + 1 RAT
- Crane operator

Sequence

Task Plan 1	Preparatory Works		
Task Plan 2	SWIR Installation		
Sub-Task 2.1	Grapnel Installation and SWIR upending.		
Sub-Task 2.2	SWIR lifting and HCL line connection		
Sub-Task 2.3	2.3 Final installation		
Task Plan 3	SWLP installation		
Sub-Task 3.1	Pump Motor installation into the caisson		
Sub-Task 3.2	Stacks installation		
Sub-Task 3.3	Top Bend installation		
Sub-Task 3.4	Piping connections		
Sub-Task 3.5	Electrical connections		
Sub-Task 3.6	OCU Lube Oil top up		

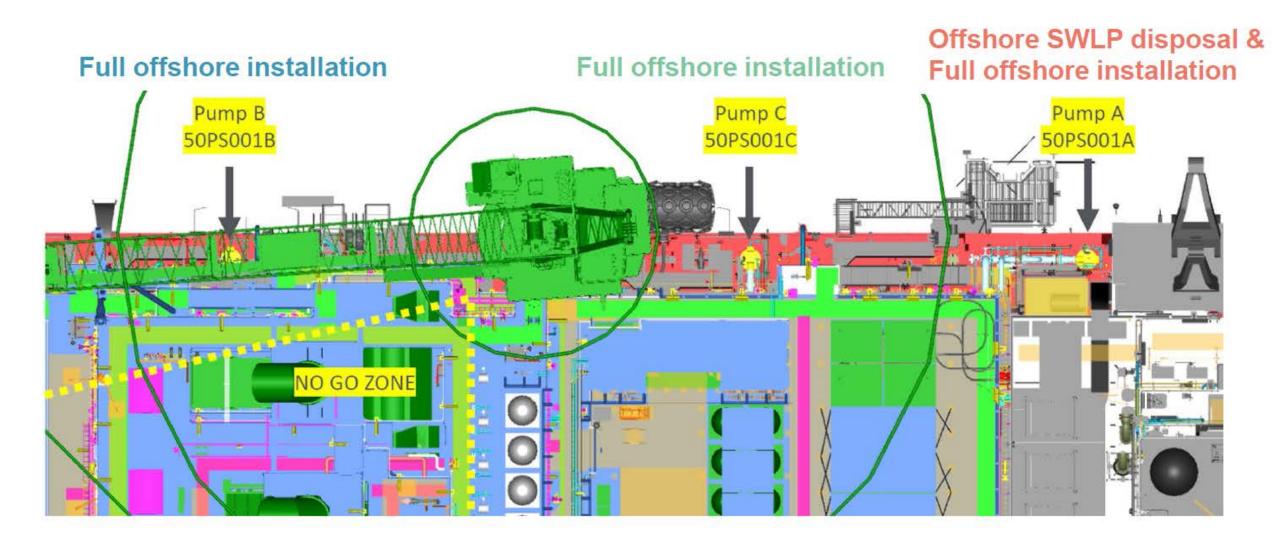


Overview: Layout

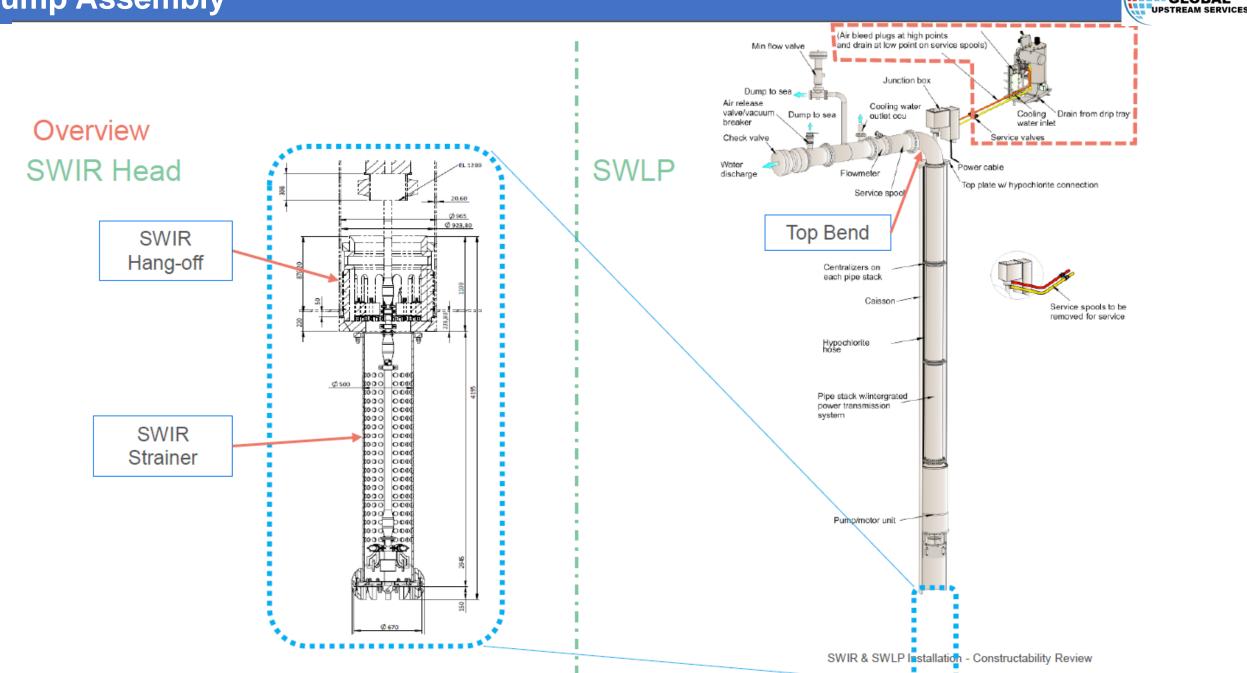




Overview: Layout



Pump Assembly

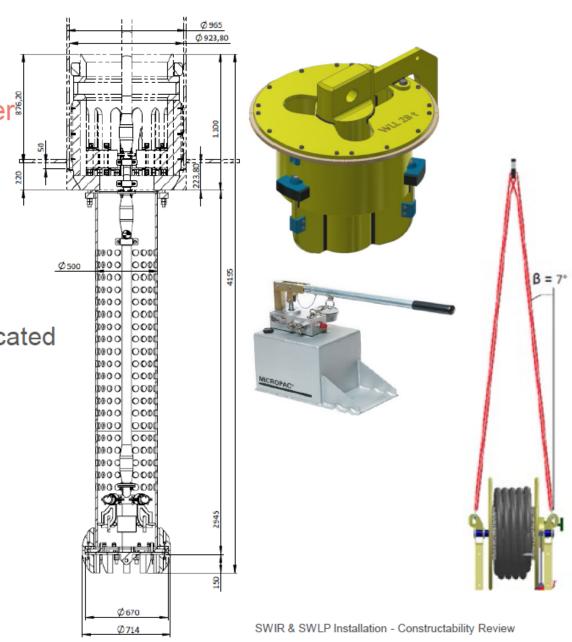


GLOBAL



Overview – SWIR Hang-off & SWIR Strainer

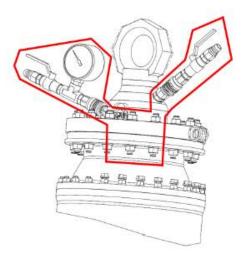
- Weight Overall dimensions
 - 2 tons (1159kg + 802kg)
 - L = 4195 mm
 - OD = 903.8mm (min OD 500mm)
- One SWIR by pump
- Delivered offshore in one piece with its dedicated lifting tool called "Grapnel"
 - Weight 530kg
 - WLL 28tons
 - Delivered with manual hydraulic pump and hose
- 3x 27m 2in HCL hose c/w one hose drum
- Supplier BARDOT Group



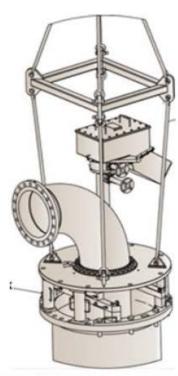


Overview - SWLP package

- Main component :
 - Submerged Pump (Electrical motor with blades)
 - Pipe stacks x 4 per pump 6m long 431kg
 - Top bend and top plate (delivered assembled) 1435kg
- Delivered with dedicated lifting tools :
 - Lifting frame WLL 19500kg
 - Lifting lug
 - Pressure purging tool
- Supplier FRAMO









SWIR & SWLP Installation - Constructability Review



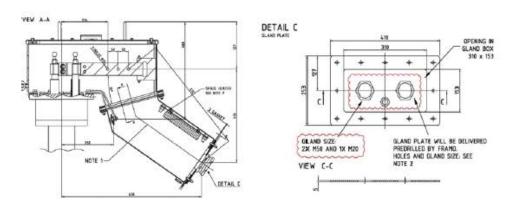
Overview – SWLP package – Interconnection

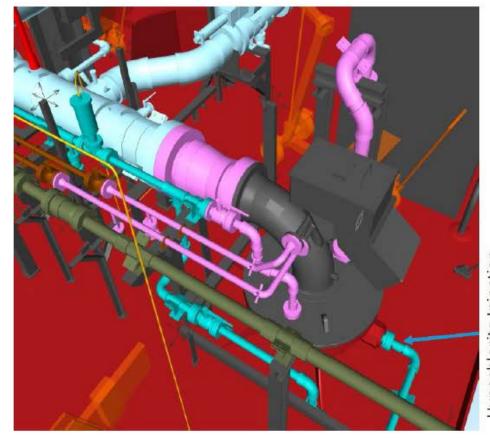
6ea piping connections

- 16" Service/Main discharge line GRE
- 4" Vent line GRE
- 2ea 1,5" Inlet/Outlet Oil lines
- 2ea 2" HCL lines for SWIR and SWLP

3ea cables connections

- 2ea Main Power cables M50
- 1ea Power cables for Heat Exchanger M20





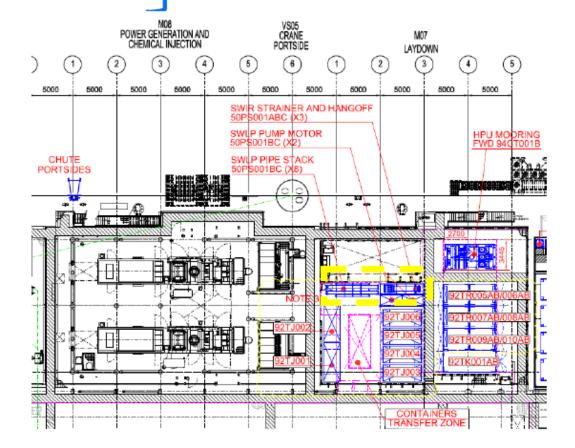
Hypochlorite Injectio [SWIR]

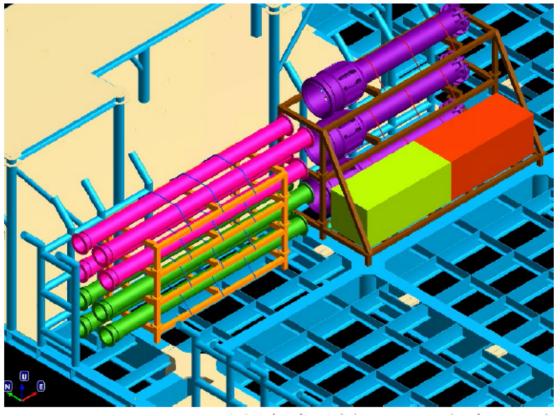


Material storage

- 8ea pipestacks
- 2ea SWLP
- 3ea SWIR

Stacked on dedicated seafastening bolted frames. Details drawing under issuance





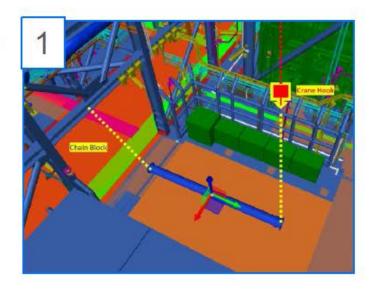


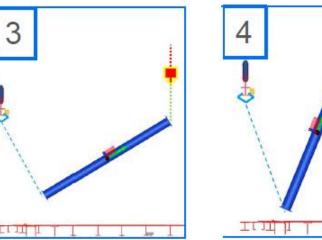
04 - Task plan - SWIR installation

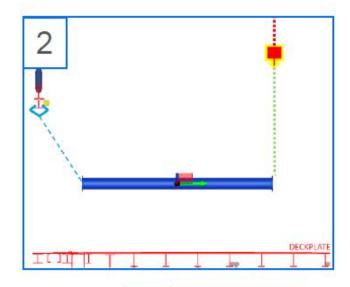
Subtask 2.1 – Grapnel Installation in Hang-off spool and SWIR upending

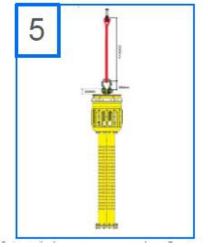
- Perform the upending following these 5 steps.
- Piperack beam equipped with padeye and chain block.
- Crane hook equipped with pennant.

Note – This steps are similar for the pump motor and the pipestack.







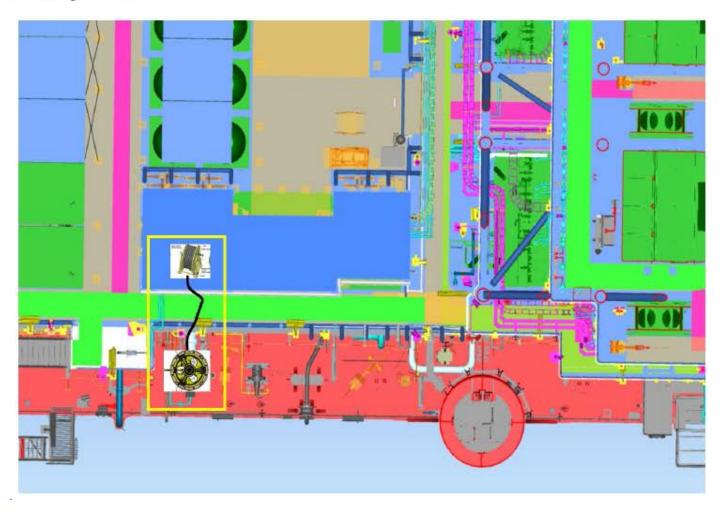


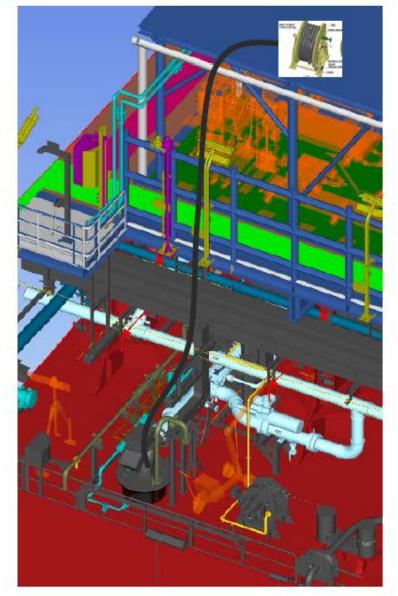


04 - Task plan 2 - SWIR installation

Subtask 2.2 - SWIR lifting and HCL line connection

• Pump C:



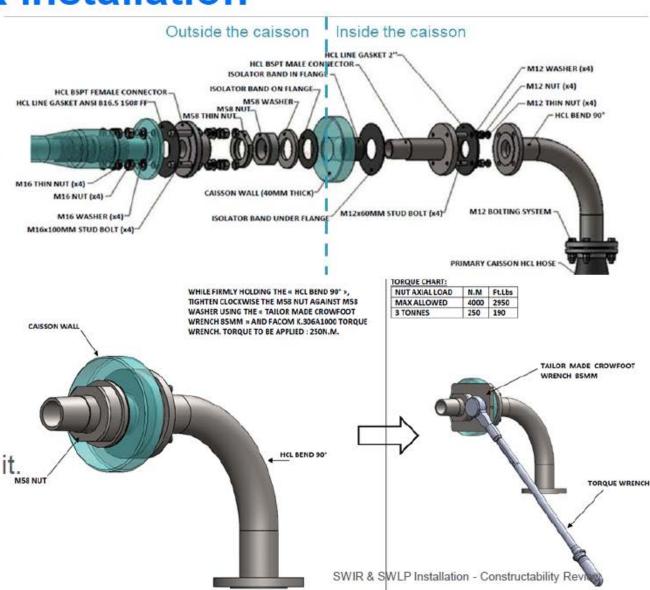




04 - Task plan 2 – SWIR installation

Subtask 2.3 – SWIR final installation

- Mount the inside parts together.
- RAT to access into the caisson.
 - Connect the HCL hose flange to the bend
 - Pass it though the opening.
- Install (from outside) the following pieces:
 - Isolator
 - M58 washer and nut
- Torque with titanium special tool Crowfoot wrench.
 - Torque 250N.m
- Install the M58 counter nut and torque it.

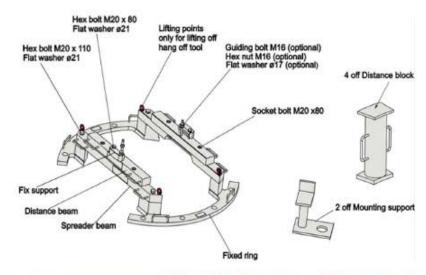


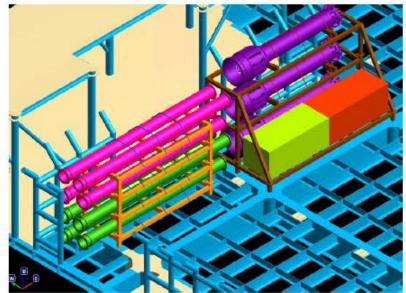


05 - Task plan 3 - SWLP installation

Subtask 3.1 – Pump Motor installation

- Discharge the pump from its support and prepare it for upending.
- Materials to be checked :
 - Hang off tool and other special tools
 - Strainers and anodes
 - Centralizers
- OCUs are running, filled up with clean oil.









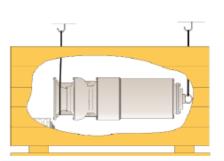


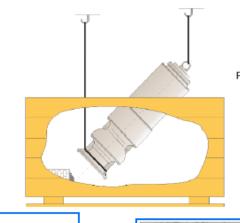
05 - Task plan 3 – SWLP installation

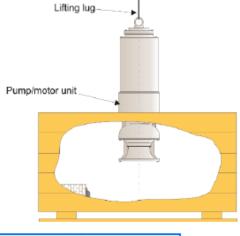
Subtask 3.1 – Pump Motor installation

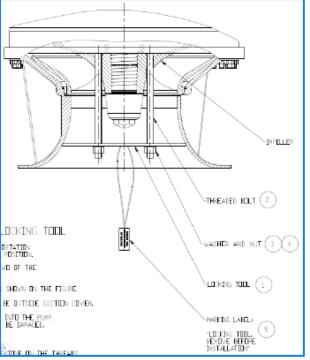
Remove the shock log with caution

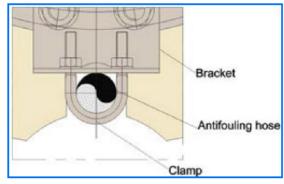
- Perform the upending
- Remove the locking device
- Assemble the HCL pump hose with U-bolts on the pump

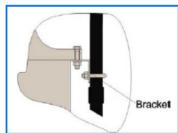










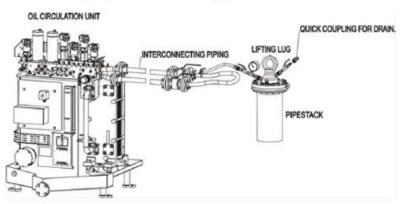


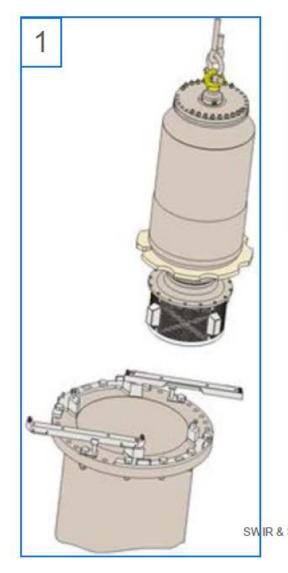


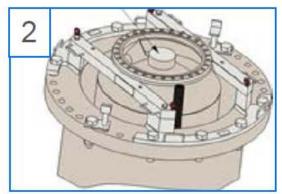
05 - Task plan 3 – SWLP installation

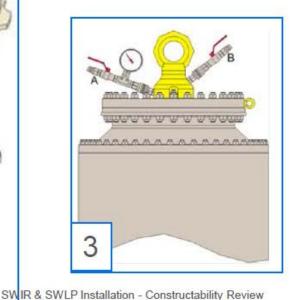
Subtask 3.1 – Pump Motor installation

- Install the hang off tool on the caisson's top flange in open position
- Engage the pump into the caisson
- Close the hang-off tool and make the pump resting on it
- Disconnect the crane
- Mount the quick couplings on the lifting lugs and test the pump with the OCU.
 (7bars – 15min < 0.1bar)







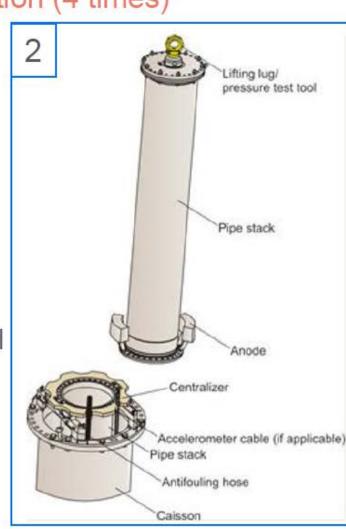


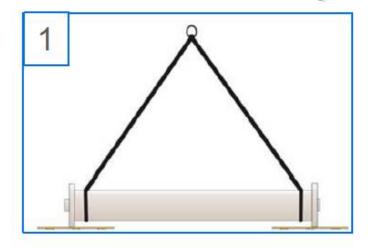


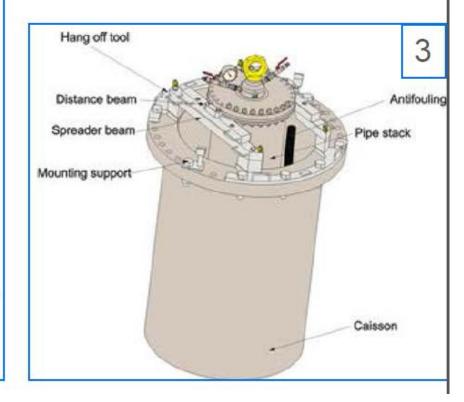
05 - Task plan 3 - SWLP installation

Subtask 3.2 – Pipestack installation (4 times)

- Pipestack retrieval
- Remove oil cap protections and install O-rings
- Install the lifting lug
- Upending
- Flange connection to the pump/pipestacks
- Lift up and open the hang off tool
- Lift down and rest on the hang off tool.
- Oil pressure test
- Install centralizer





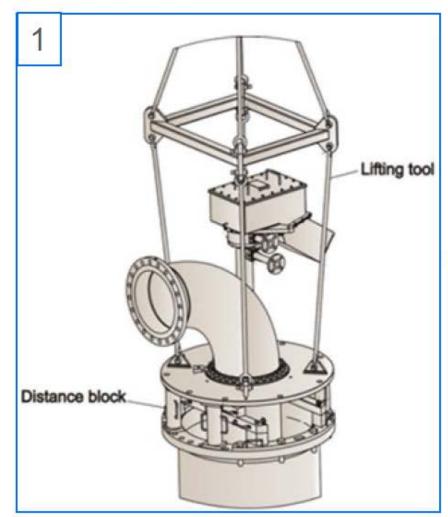


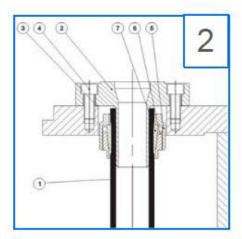


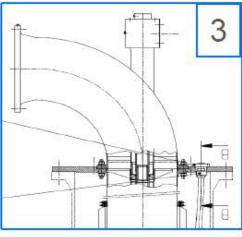
05 - Task plan 3 – SWLP installation

Subtask 3.3 – Top bend installation

- Install the top bend onto the pipestack flange
- Pull the HCL hose through the top plate, cut it and terminate it on the plate.
- Lift-up the full assembly
- Remove the hang off tool and distance blocks
- Align the discharge pipe with the FPSO pipe
- Bolt up the top plate to the caisson









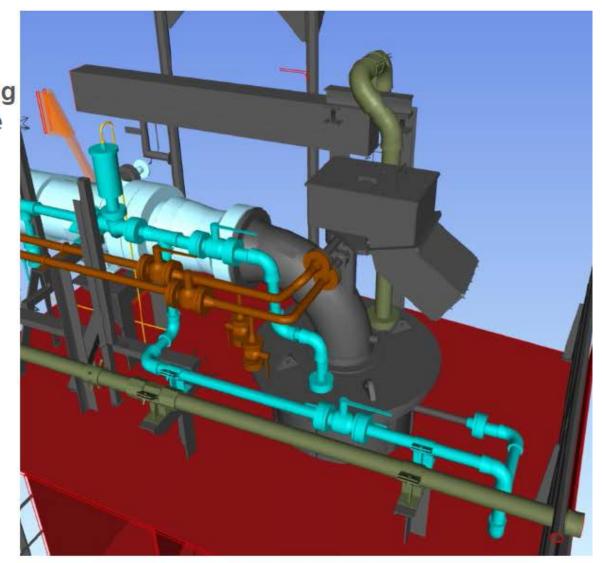
05 - Task plan 3 - SWLP installation

Subtask 3.4 – Piping installation

IMPORTANT

Cleanliness must be always the main concern during the spool's installation. Spool blind flanges must be kept until last moment in place.

- 16" Service/Main discharge line GRE
 - ~ 80kg
- 4" Vent line GRE
 - ~ 25kg
- 2ea 1,5" Inlet/Outlet Oil lines
- 2ea 2" HCL lines for SWIR and SWLP
- Depending the pump, some 2" manual valves must be installed due to some clashes.

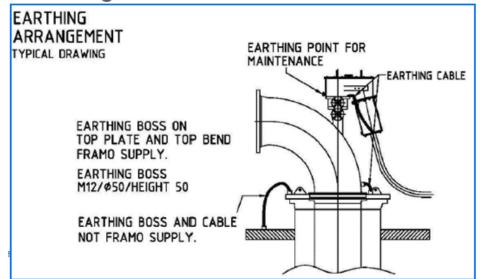


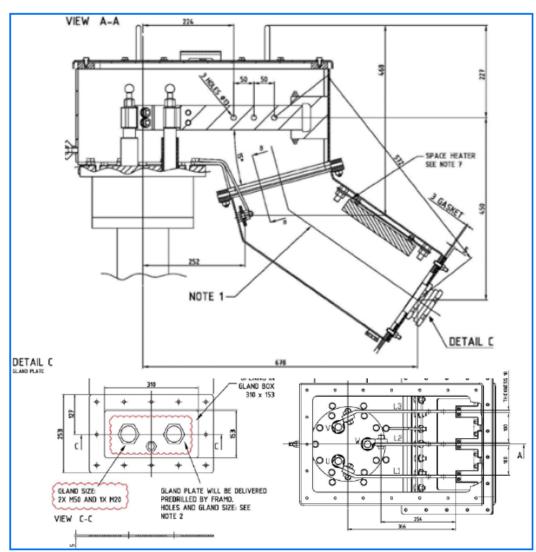


05 - Task plan 3 – SWLP installation

Subtask 3.5 – Electrical cable installation

- 2ea Main Power cables M50
 - Coiled until final location with overlength
 - To be cut and terminated
- 1ea Power cables for Heat Exchanger M20
 - Coiled until final location with overlength
 - To be cut and terminated
- Several earthing cables to be installed







WORK PACK WPHU07 UMBILICALS (PORT & STBD)

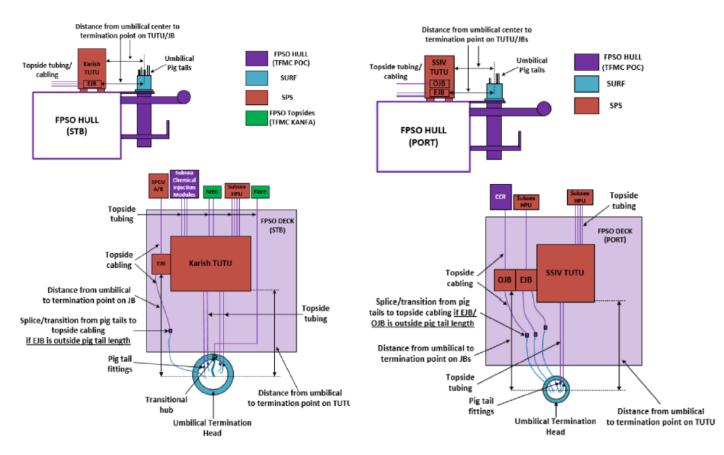
WP-HU-7: Umbilical / TUTU Tie in



WP-HU-7: Umbilical / TUTU tie in

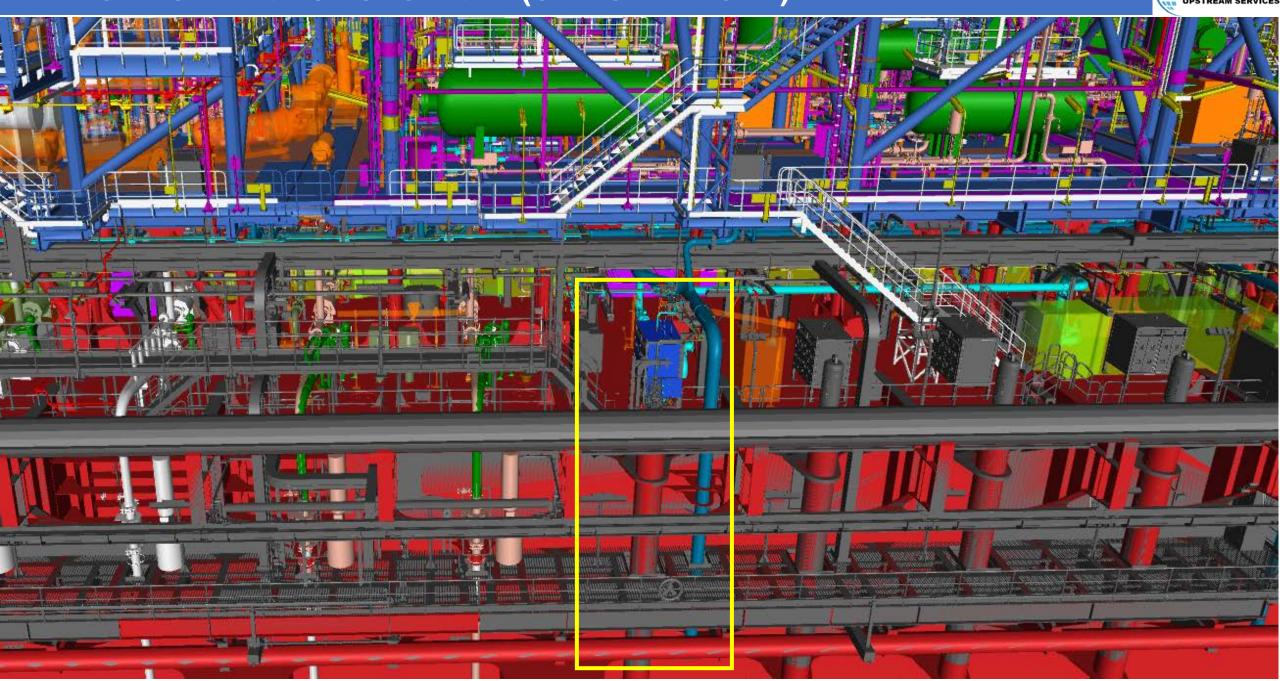
A total of two Topside Umbilical Termination Units will be installed at YARD (TUTU): one on starboard side and the other one on portside. After pulling activities completion, umbilical's will be connected to each TUTU. For starboard, SUBCONTRACTOR will be responsible to perform the tubing connection from the umbilical termination head to the FPSO TUTU & flare and cabling connection. Pulling and termination from the TUTU to the Topsides is performed at YARD.

For Portside, SUBCONTRACTOR will be responsible to perform the tubing hook-up (installation, testing, cleaning - Umbilical to TUTU) and cable pulling and termination (Umbilical Pig Tails Fittings to JB) including proper supporting on field (tubing tray, cable tray etc.) until mechanical completion of the systems is achieved.



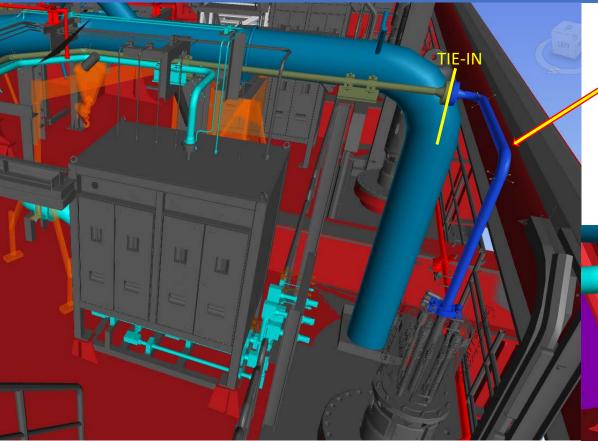
WP-HU-7: Umbilical / TUTU Tie in (STB UMBILICAL)





WP-HU-7: Umbilical/TUTU Tie in (STB UMBILICAL)

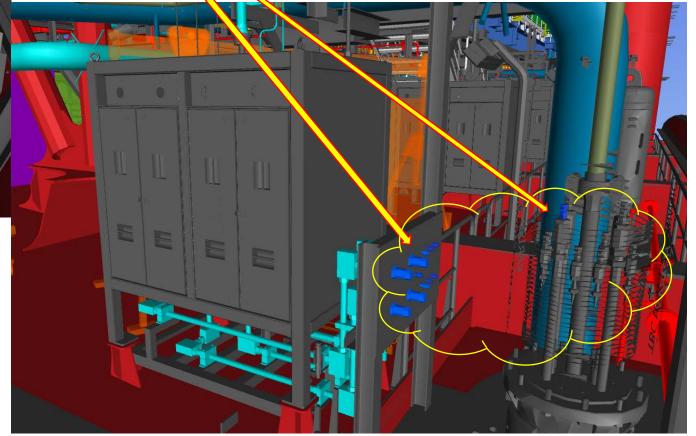




Installation and welding of 2inch Duplex (ASTM A790 UNS \$31803 line VF-43L01352 from Tie-In Flange to Umbilical G-Lock Clamp. (TIG Welding)

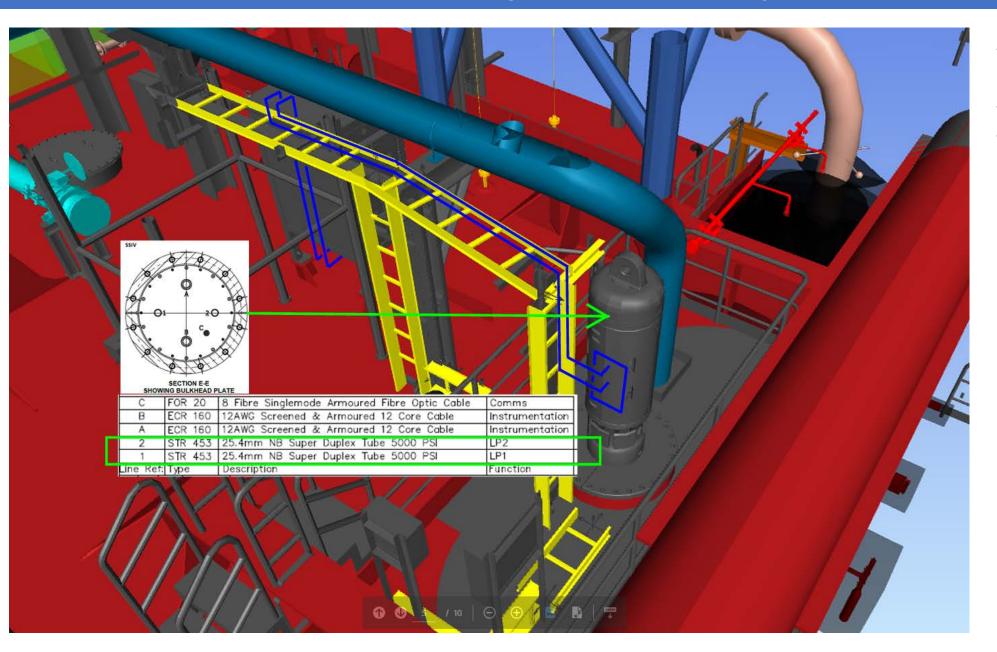
Tie-in of Flexibles and cable connections from TUTU to Umbilical Terminations.

All Hook-up materials are identified on the Job cards and bagged and tagged.



WP-HU-7: Umbilical/TUTU Tie in (STB UMBILICAL)

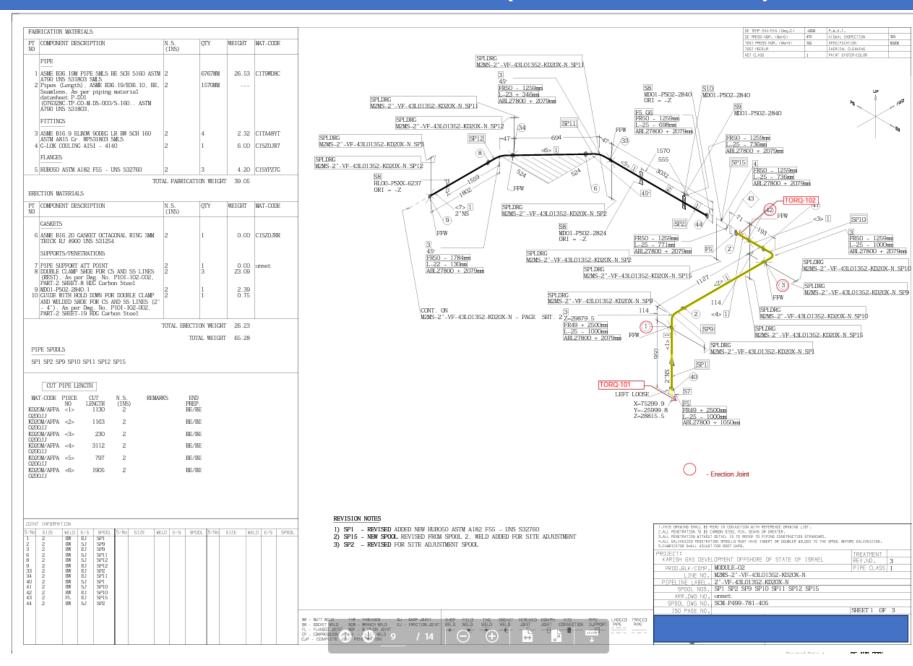




Tie-in of Flexibles and cable connections from TUTU to Umbilical Terminations.

WP-HU-7: Umbilical/TUTU Tie in (STB UMBILICAL)





Installation and welding of 2inch Duplex (ASTM A790 UNS S31803) line No. VF-43L01352 from Tie-In Flange to Umbilical G-Lock Clamp. (TIG Welding)

Hydrotest Pressure 587.5bar

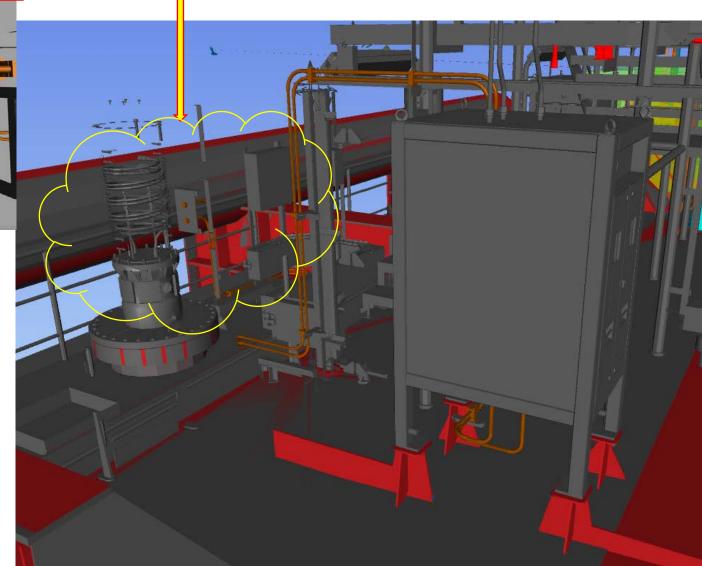
GLOBAL UPSTREAM SERVICES WP-HU-7: Umbilical / TUTU Tie in (PORT UMBILICAL)

WP-HU-7: Umbilical/TUTU Tie in (PORT UMBILICAL)





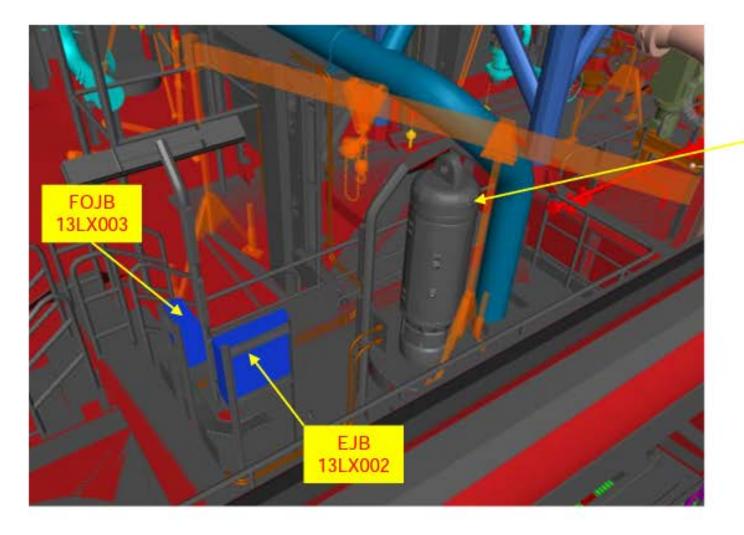
Tie-in of Flexibles and cable connections from TUTU to Umbilical Terminations.

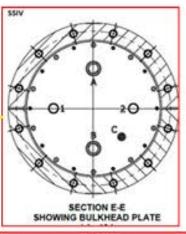


All Hook-up materials are identified on the Job cards and bagged and tagged.

WP-HU-7: Umbilical/TUTU Tie in (PORT UMBILICAL)







Ċ	FOR 20	8 Fibre Singlemode Armoured Fibre Optic Cable	Comms
В	ECR 160	12AWG Screened & Armoured 12 Core Coble	Instrumentation
A	ECR 160	12AWG Screened & Armoured 12 Core Cable	Instrumentation
2	STR 453	25.4mm NB Super Duplex Tube 5000 PSI	LP2
1	STR 453	25.4mm NB Super Duplex Tube 5000 PSI	LP1
Line Ref.	Type	Description	Function



UEN NO. 2021413790M | 320 SERANGOON ROAD, #13-05 CENTRIUM SQUARE, SINGAPORE 218108 ©2018 King Energy