



Engineering 'Lunch & Learn' Series

*What are PLETs
and
How are they installed ??*

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Principal Consultant
Submarine Pipelines Consulting Engineers*



Agenda



What is a PLET ?

Components of typical PLET

PLET Objective & Challenges

PLET Installation by S-mode

PLET Installation by J-mode

Agenda

What is a PLET ?

- Components of typical PLET
- PLET Objective & Challenges
- PLET Installation by S-mode
- PLET Installation by J-mode

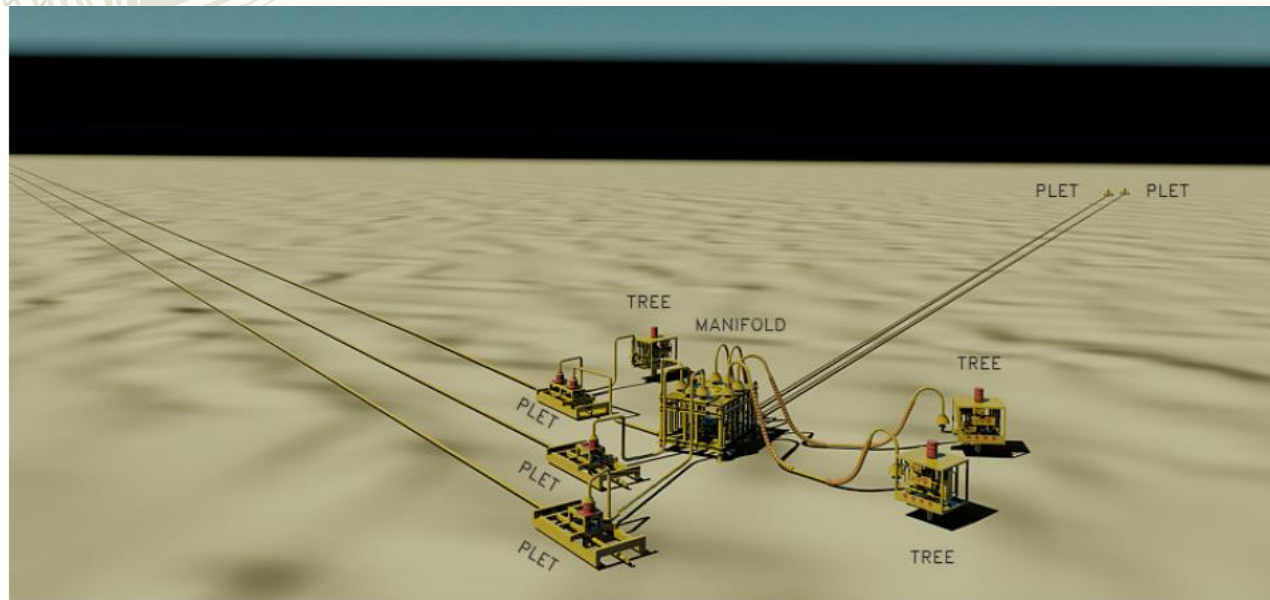
What is a PLET and what is difference between PLEM & PLET

PLET – Pipeline End Termination

A system of piping and valves, generally integral to the pipeline, used to make a subsea connection at the end of a pipeline. Typically has only one subsea connection.

PLEM – Pipeline End Manifold

A system of headers, piping and valves, generally integral to the pipeline, used to gather produced fluids or to distribute injected fluids in subsea production systems. Typically has more than one subsea connection.



Typical Structures – PLETs, Trees, Manifolds

Agenda

○ What is a PLET ?

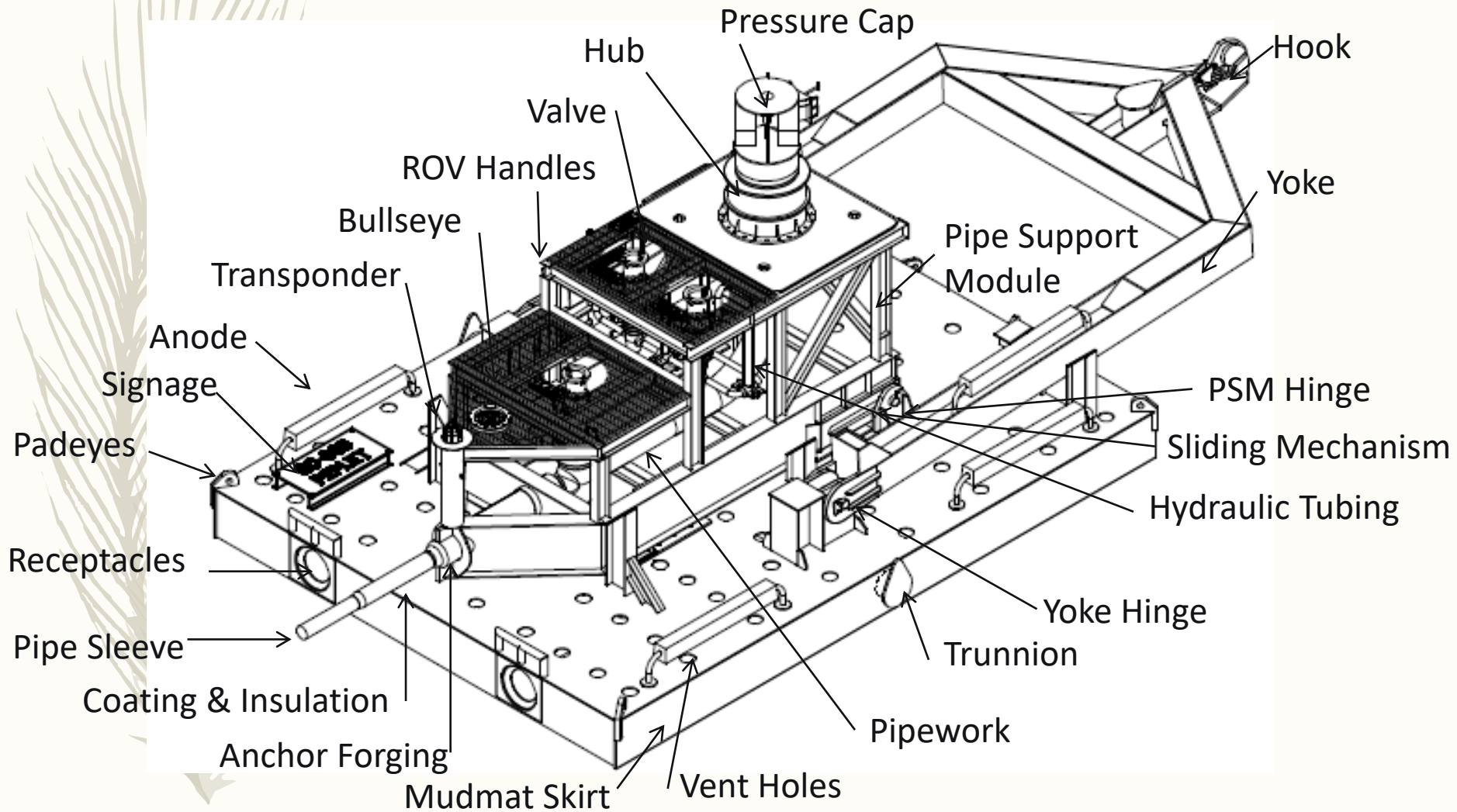
● **Components of typical PLET**

○ PLET Objective & Challenges

○ PLET Installation by S-mode

○ PLET Installation by J-mode

PLET Components



Valves (typical)

- Corrosion resistant overlay
- Inconel cladding on internal seats
- Gate valves
- Metal to Metal seals
- Carbide coat on gate
- Indicators
- Block and bleed (needle valves and hot stabs)



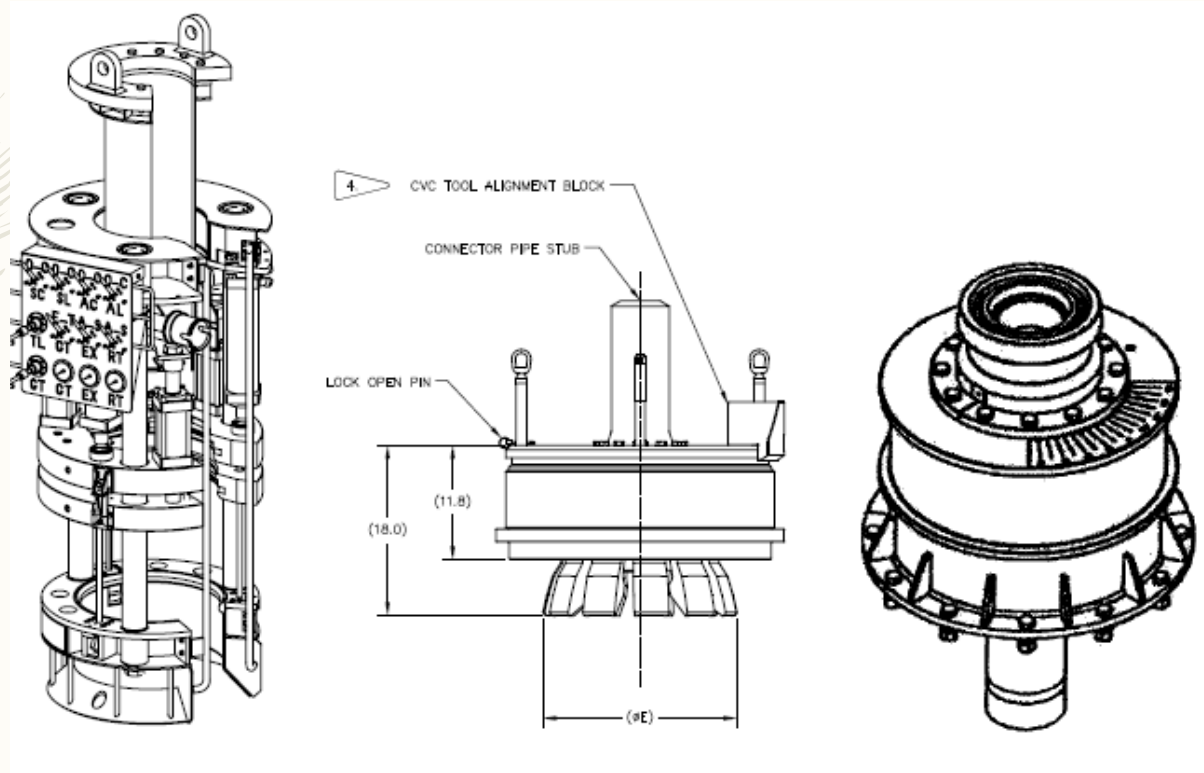
***Cameron Subsea
Hydraulic
Actuated Gate Valve
(9in, 15,000psi)***



***ATV Subsea Through
Conduit Slab Gate Valves***

Hubs, Connectors, Pressure Caps

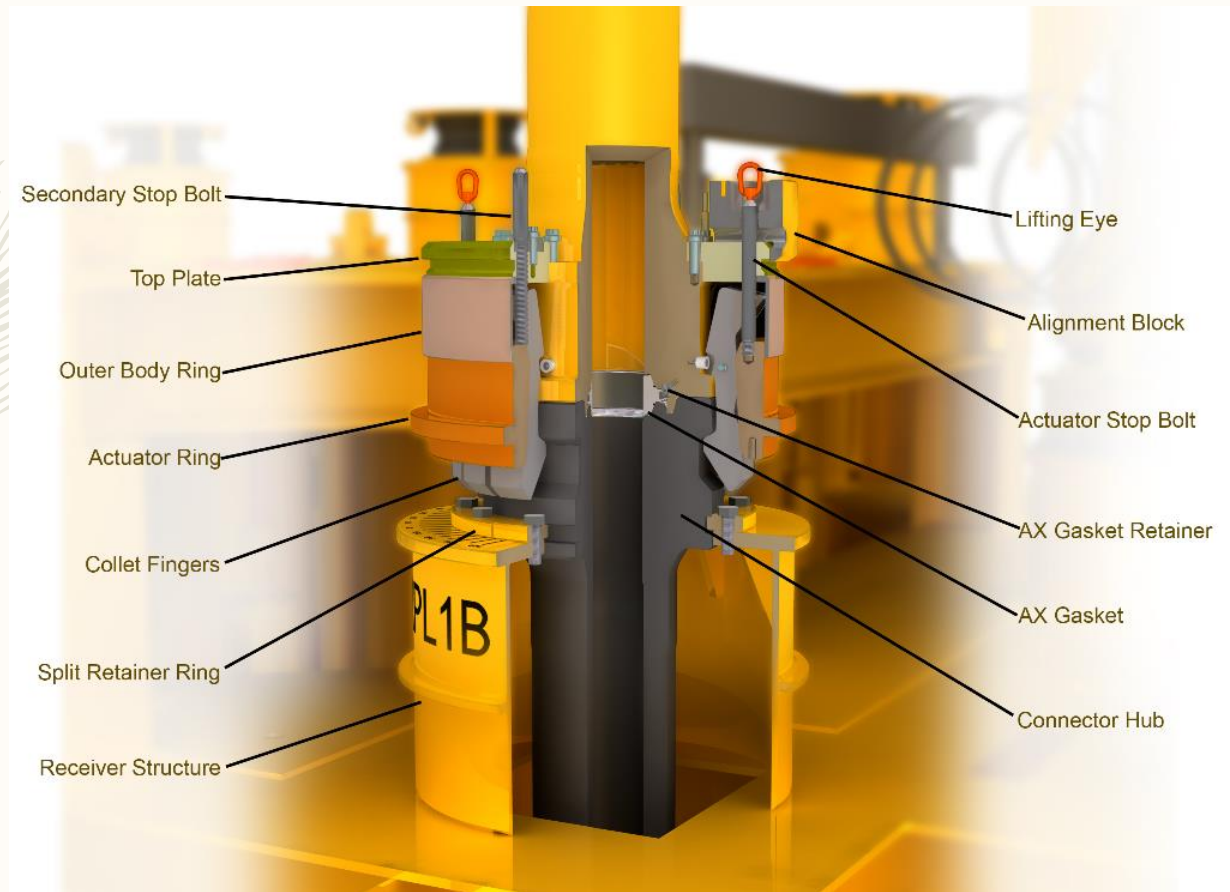
- Any size or weight
- Min clearance between hubs
- Between closest item
- Compatible / consistent materials (pups)
- 360deg sight access
- Windows
- Vertical connections



CVC Running Tool, Connector, Hub Receiver

Hubs, Connectors, Pressure Caps

- Any size or weight
- Min clearance between hubs
- Between closest item
- Compatible / consistent materials (pups)
- 360deg sight access
- Windows
- Vertical connections



CVC Connector

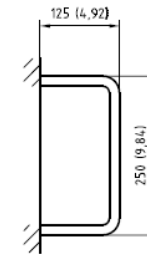
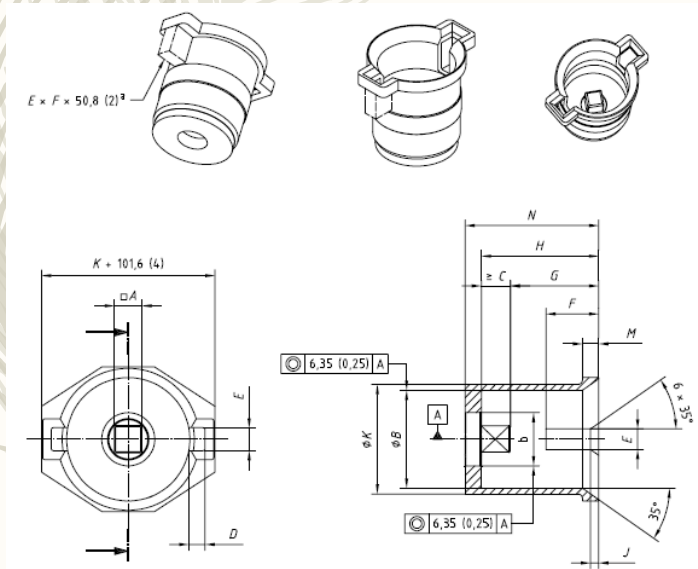
ROV Interfaces

- Handles, hotstabs, locking pins, etc.
- Min height above seabed – 6ft
- Almost neutrally buoyant

★ ***Integrate ROV interfaces where possible to reduce removal time subsea***

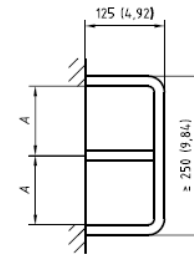


Hercules Workclass ROV (8' x 6' x 7')



Bar diameter = 20 mm (0,75 in)
Tensile strength = 450 N/mm² (65 kip/in²)

a) Type A



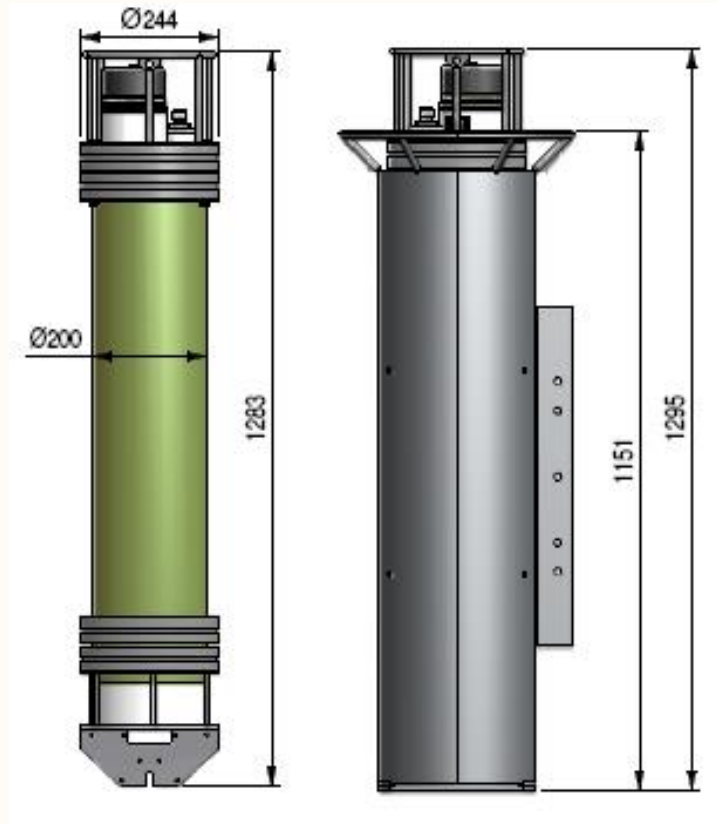
Bar diameter = 51 mm (2 in) or 20 mm (0,75 in)
Tensile strength = 450 N/mm² (65 kip/in²)

b) Type B

Transponder

Facilitate positioning & orientation of PLET

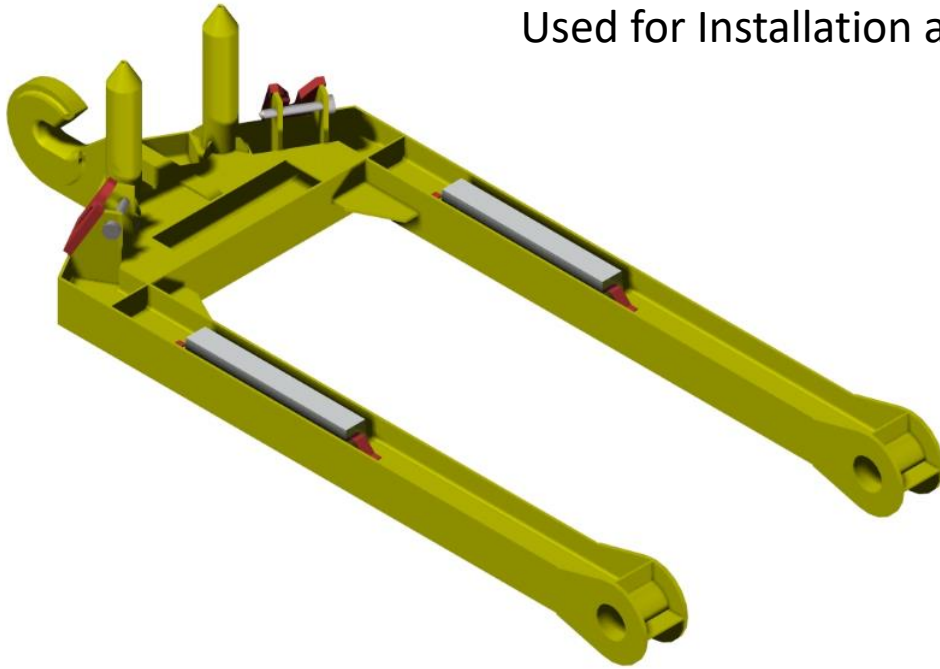
- High up and as far away from the structure as possible
- Clear line of sight to the vessel
- No clashing



Transponder and Bucket

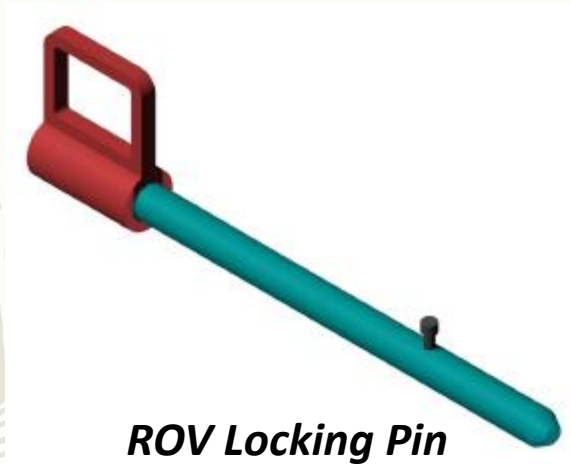
Yoke

Used for Installation and recovery



Locking Pins

- Type of ROV manipulator
- Fishtail handle
- Lanyards
- Funnel
- Chamfer pin end



ROV Locking Pin



Fishtail Interfaces

Padeyes / Trunnions and Rigging

- Standard shackles
- No out of plane loads
- Fully integrated into structure



PLET Lift

Lift Rigging

- 4 part lift
- Wire rope
- 5:1 Safety factor
- Rigging heights, angles (min 60deg)
- Spreader
- Protective cage



***PLET Lift
(Protective Cage Shown)***

Vessel Interfaces

- Offshore rated, active heave compensated crane with adequate capacities at the required working radius.
- DP (dynamic positioning) II
- Target box +/-5ft.
- Deck space and capacity
- Grillage
- Pallet



Buoyancy

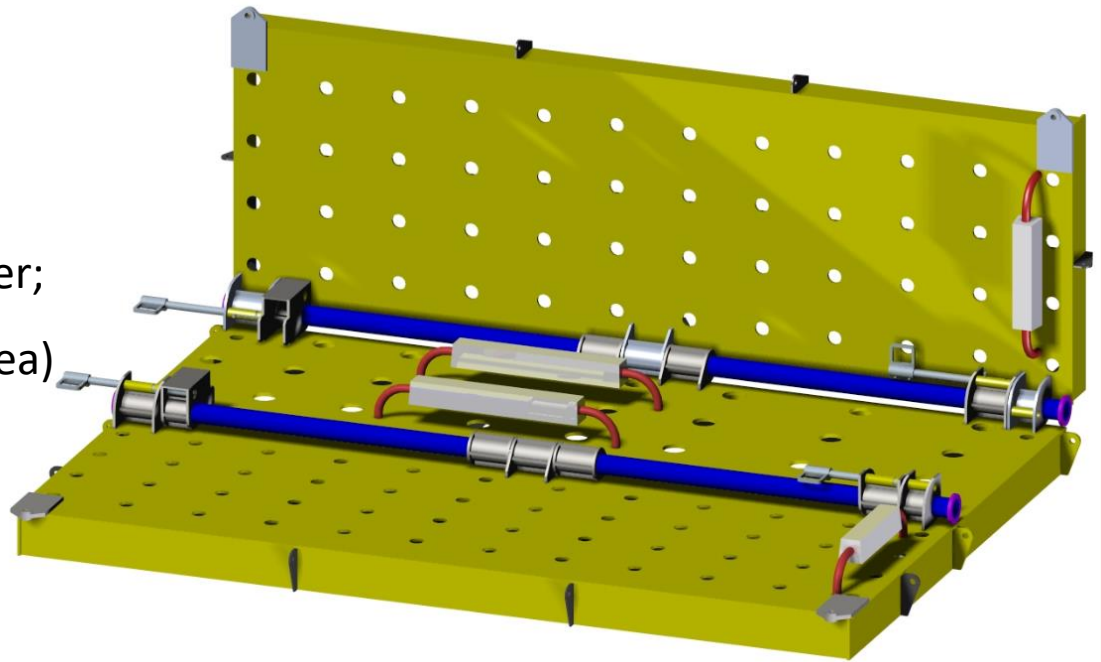
- Stability during installation
- Reduction in pipe stress
- Syntactic foam



Dynamic Buoyancy Module

Foundation

- Mudmat or Pile
- Vertical, lateral, overturning, torsion
- Skirts
- Min thickness
- Plate construction
- Vent holes (max 4" diameter;
2%-4% of total mudmat area)
- Wings (opened at 100m
from surface of water)
- Sacrificial straps
- Locking pins



★ *Minimize plate thickness for significant weight savings but not too thin*

Hinged Mudmat Foundation

Agenda



What is a PLET ?

Components of typical PLET

PLET Objective & Challenges

PLET Installation by S-mode

PLET Installation by J-mode

PLET Objectives & Challenges

1. Functional

- Pressure/Temperature
- ROV interfaces
- Insulation/Corrosion
- Efficient design

2. Installable & Recoverable

- Vessel (PHS and Workstation, lay settings)
- Pipe torsion
- Buoyancy

3. Fabricate-able

- Material sourcing and substitutions
- Tolerances
- Fabrication sequence
- Material cost

4. Client Agree-able

- Definition of Design Basis (what we will do and how we will do it)
- Definition of soil strength
- Definition of loads (jumpers, expansion)



Agenda



What is a PLET ?

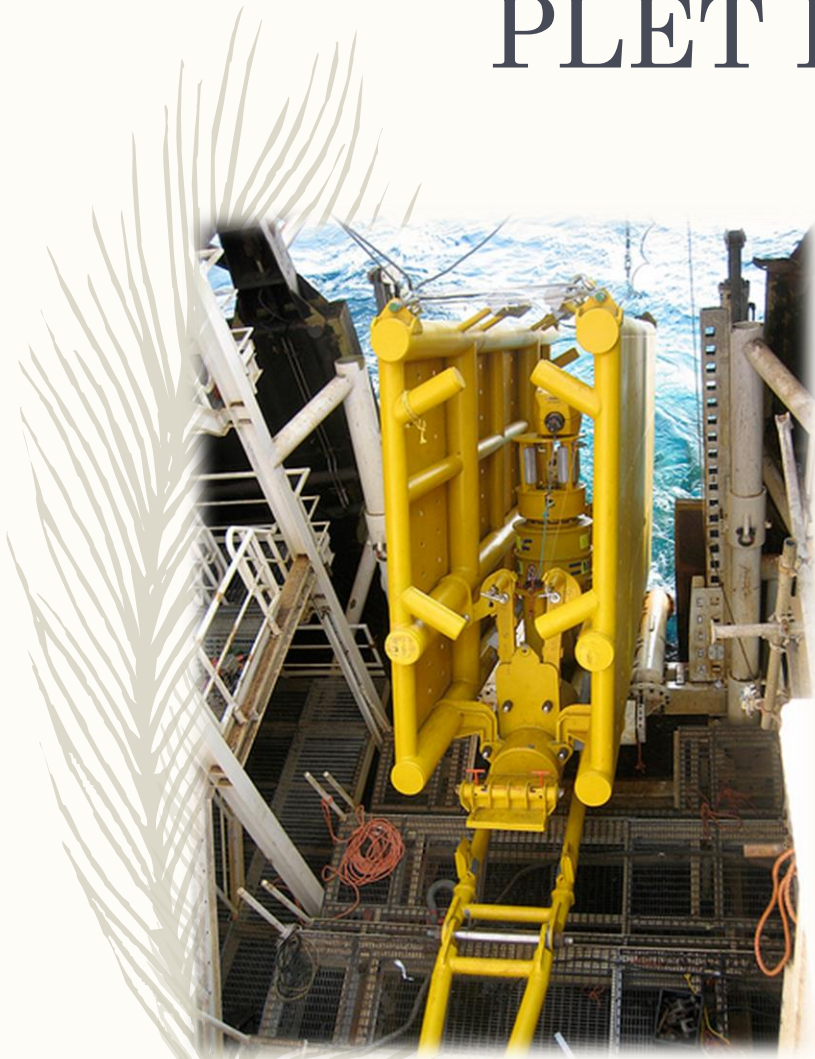
Components of typical PLET

PLET Objective & Challenges

PLET Installation by S-mode

PLET Installation by J-mode

PLET Installation



PLET Installed by S-mode
(Picture Courtesy of Allseas)



PLET Installed by J-mode

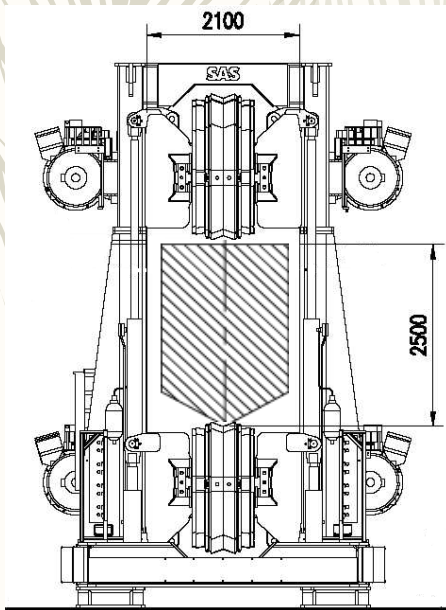
PLET Design for S-mode

Critical Issue:

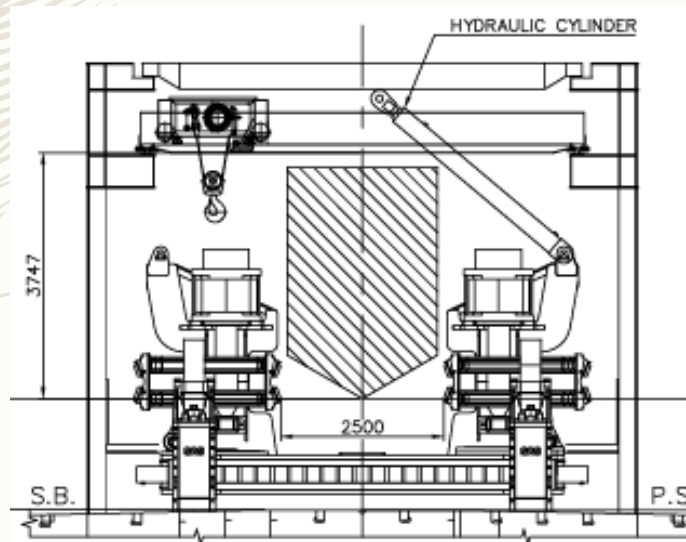
Safe Passage through Pipelay Vessel's Firing Line and Stinger.

PLET Dimension Limitation

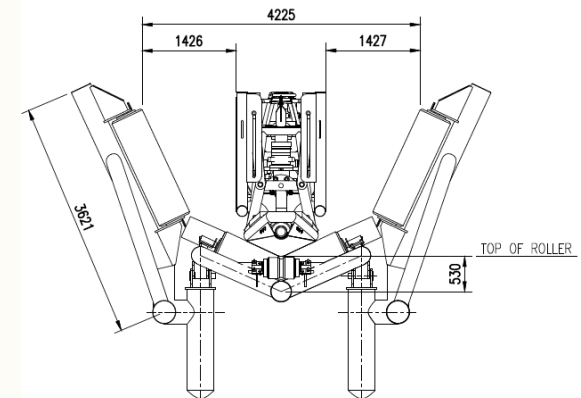
No Pipeline Over-Strain



Typical Clearance @ Vertical Tensioner



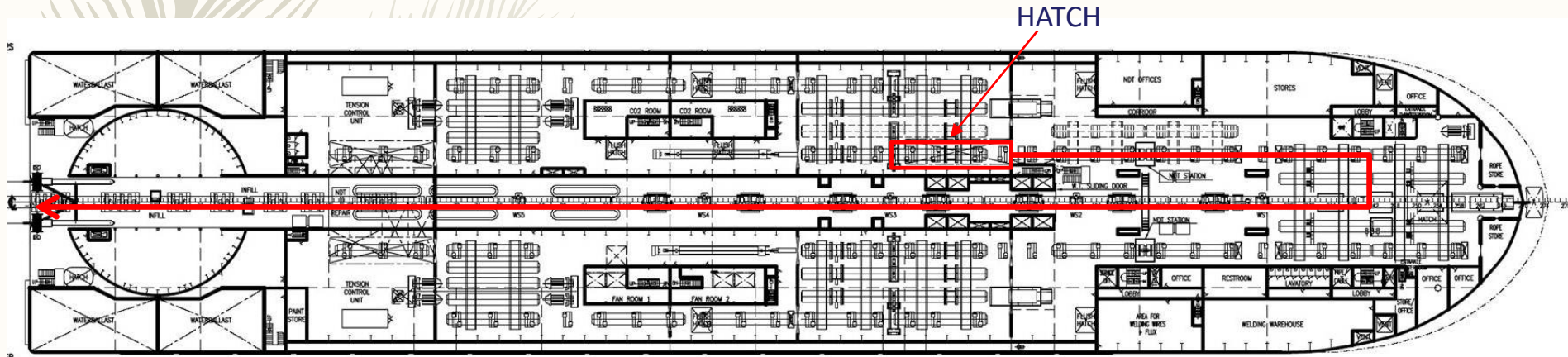
Typical Clearance @ Horizontal Tensioner



PLET on Stinger Roller

Main Preparatory Work

- Ensure access to the firing line
- Make sure all the obstructions have been temporarily removed if any, from the entrance to stern in firing line;
- If necessary, mock-up test is required;



PLETs arriving on Material Barge;

Subsequently, loaded to the
installation vessel



PLET Passing Firing Line

- PLET's passage with the assistance of the powered conveyers, gantries or winches;



PLET @ 1st Station



PLET @ Tensioners

PLET at Stern

- The PLET accessories e.g. Mudmats, Pressure caps, Transponders, Yoke will be assembled to the PLET main structure after tensioners.



PLET in Firing Line w/o Mudmat



2nd station

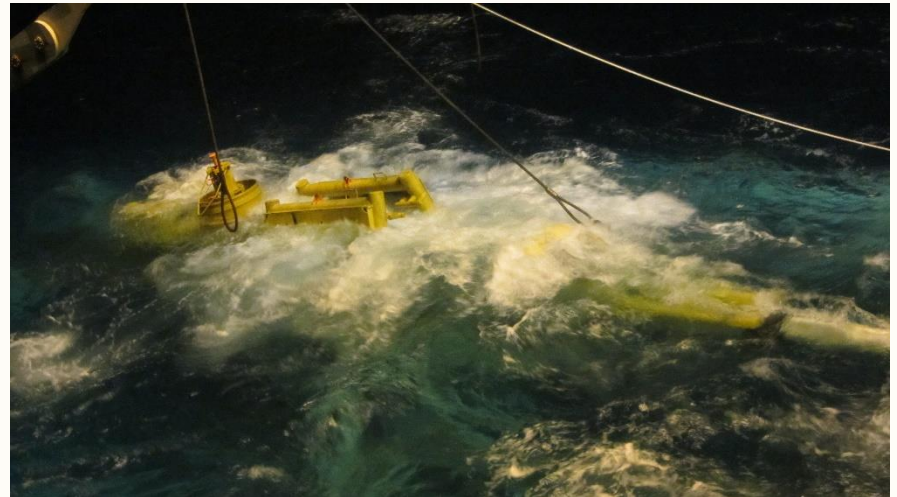


At stern



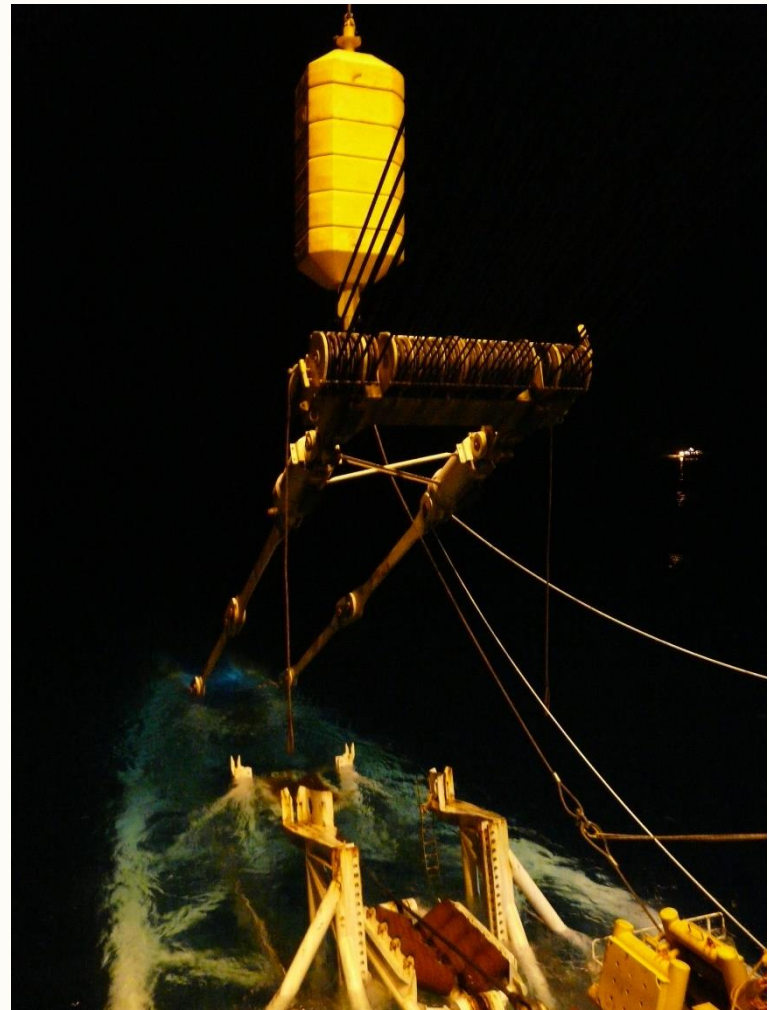
PLET at Stern with Folded Mudmat

PLET entering the stinger and into the sea



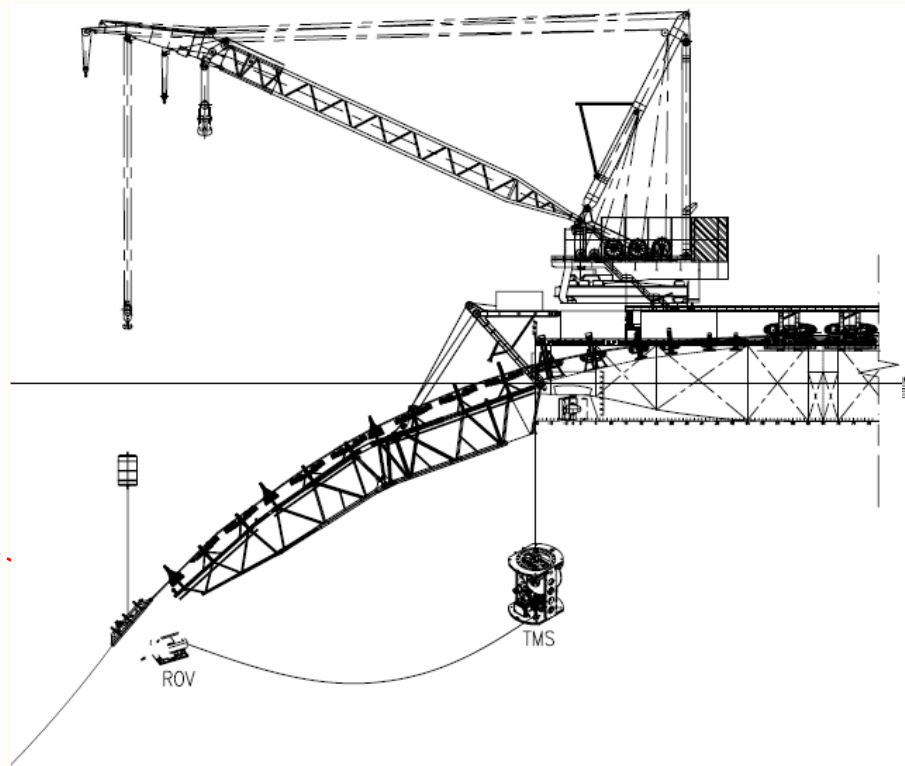
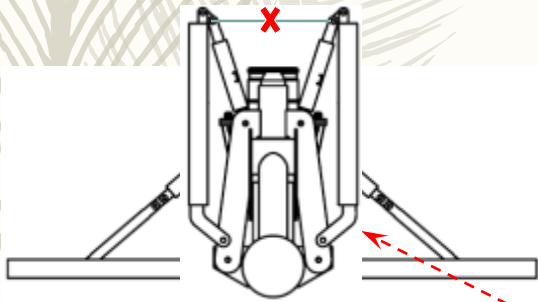
Buoyancy Modular Installation

- Buoyancy Modular handled by main crane and connected to yoke at stern;



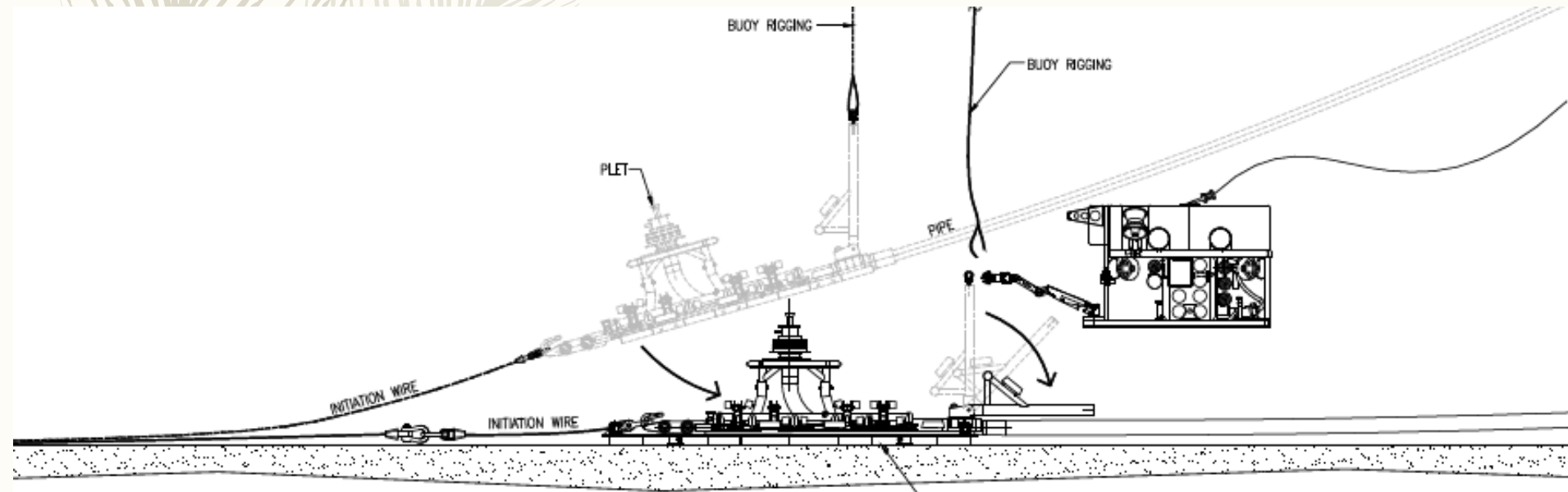
When PLET Past Stinger

- Open mudmat by ROV to cut the retaining rope;
- Release main crane from buoyancy.



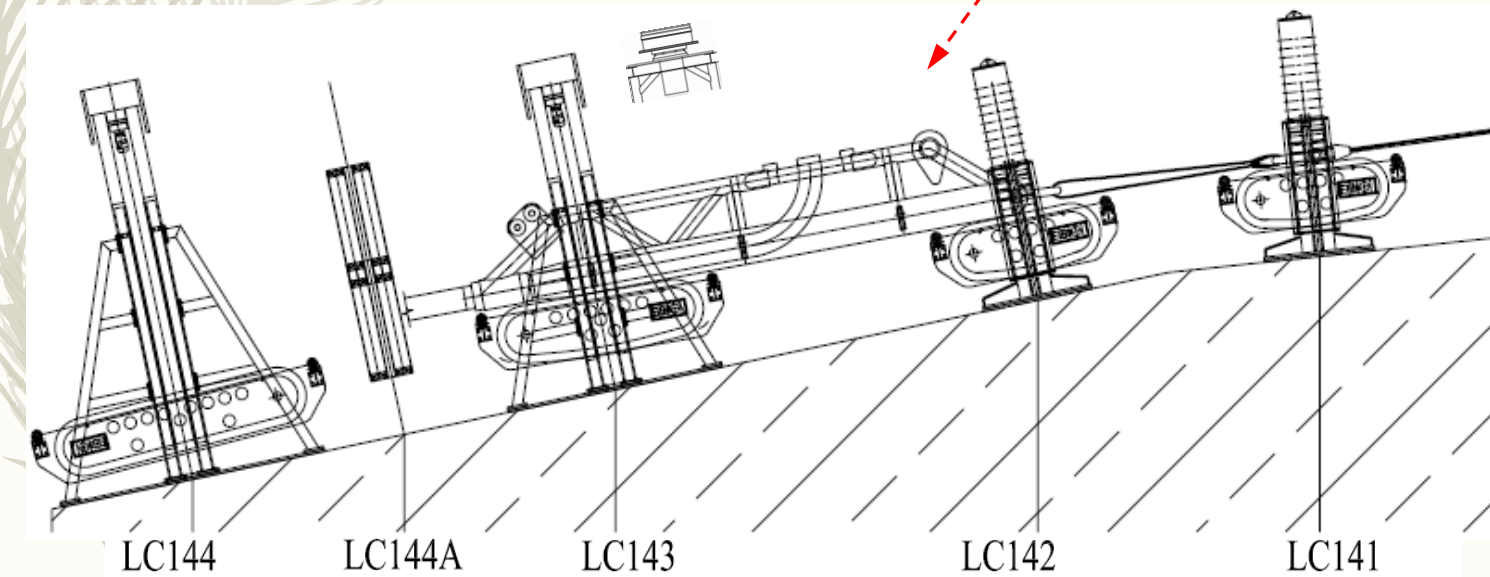
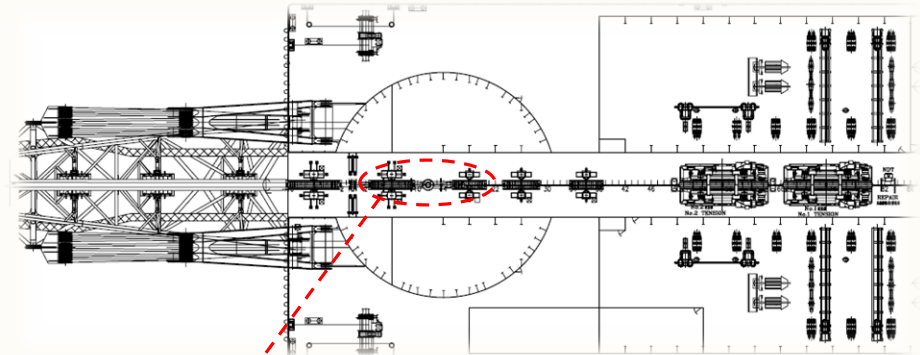
PLET Landing on Seabed

- When PLET rests on seabed, survey the position to make sure it is within target box;
- Release buoyancy modular.



Oversized PLET/ILT Installed by S-mode

- In some unique cases, 18"/22" PIP PLET installation in 300m W.D. for example, which is difficult for either S-mode or J-mode, the hub may be welded onto PLET at barge ramp.



Agenda



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Components of typical PLET

PLET Objective & Challenges

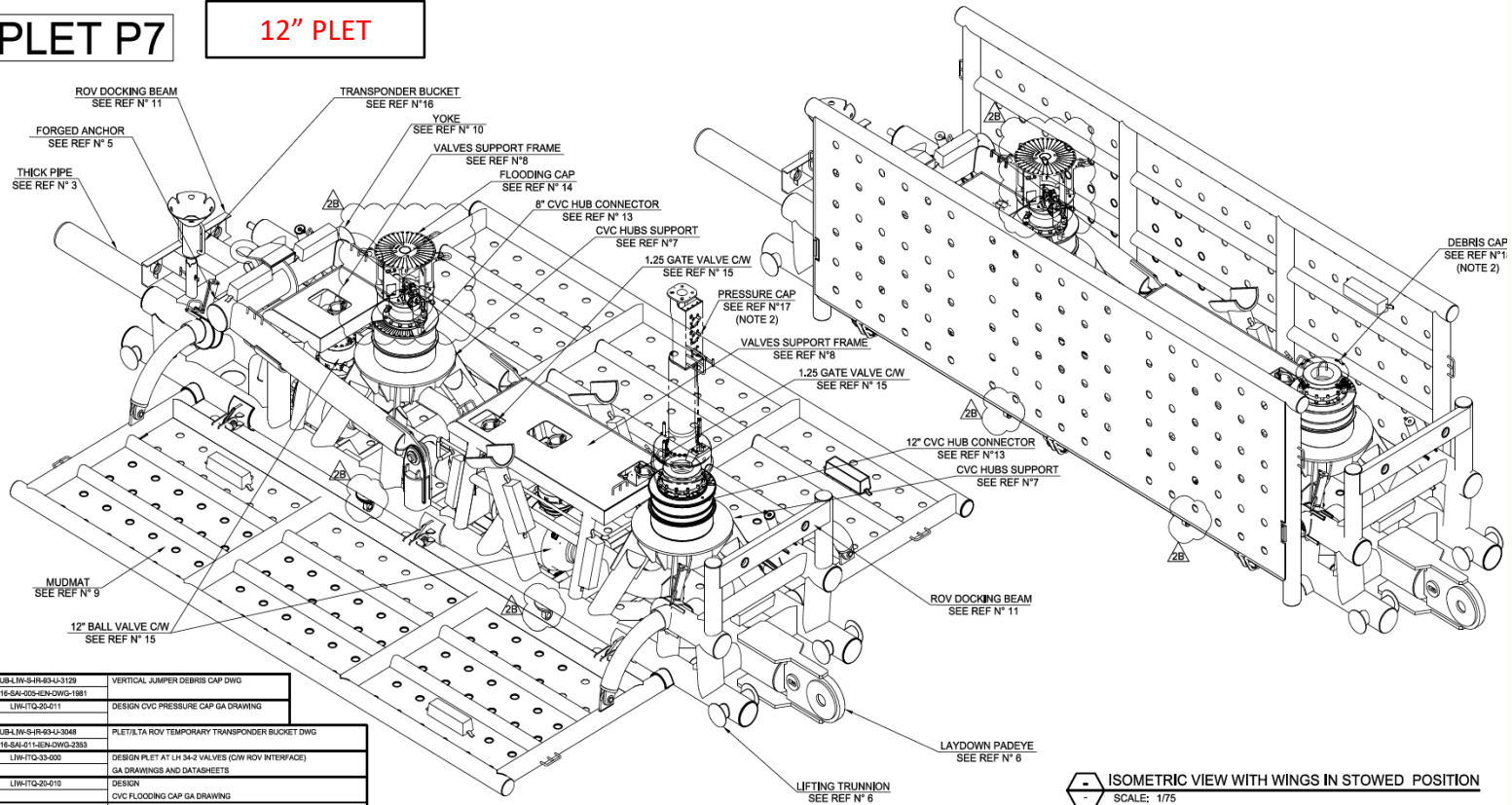
PLET Installation by S-mode

PLET Installation by J-mode

12" PLET Details

PLET P7

12" PLET



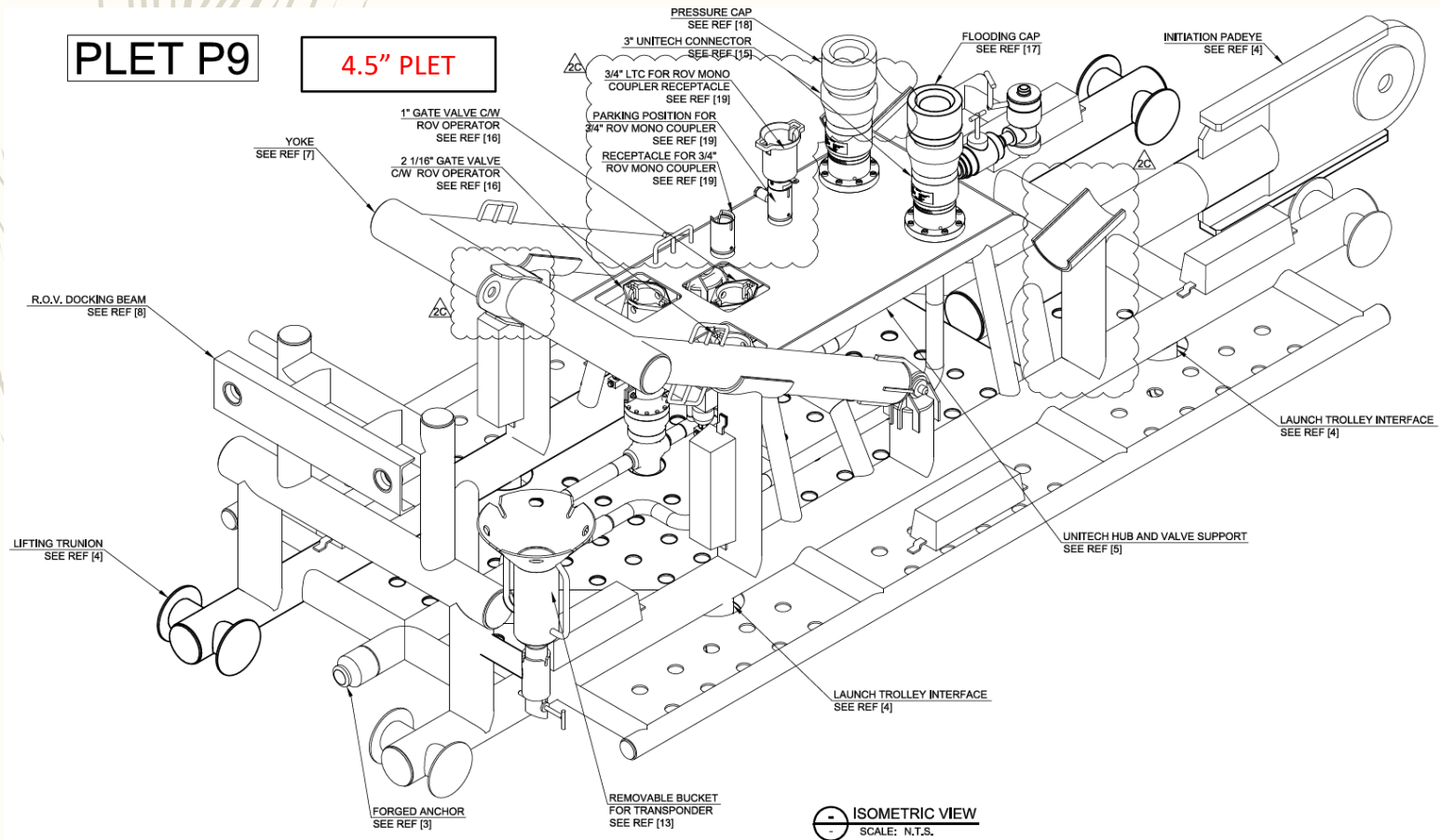
1	SUB4.IW-SR-63-U-1129	VERTICAL JUMPER DEBRIS CAP DWG
2	F12416-SAI-005-62N-DWG-1981	
3	LIW-ITQ-20-011	DESIGN CVC PRESSURE CAP GA DRAWING
4	SUB4.IW-SR-63-U-3048	PLET/LTA ROV TEMPORARY TRANSDUCER BUCKET DWG
5	F12416-SAI-011-63N-DWG-2393	
6	LIW-ITQ-33-000	DESIGN PLET AT LH 34-2 VALVES (CW ROV INTERFACE) GA DRAWINGS AND DATASHEETS
7	LIW-ITQ-20-010	DESIGN CVC FLOODING CAP GA DRAWING

ISOMETRIC VIEW WITH WINGS IN STOWED POSITION
SCALE: 1/75

4.5" PLET Details

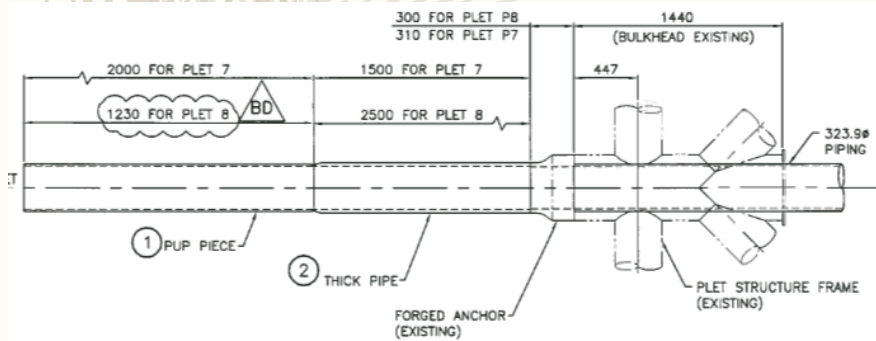
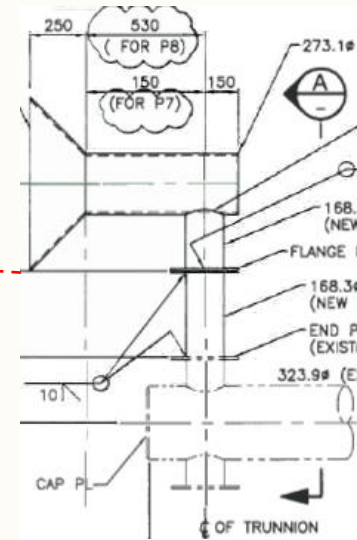
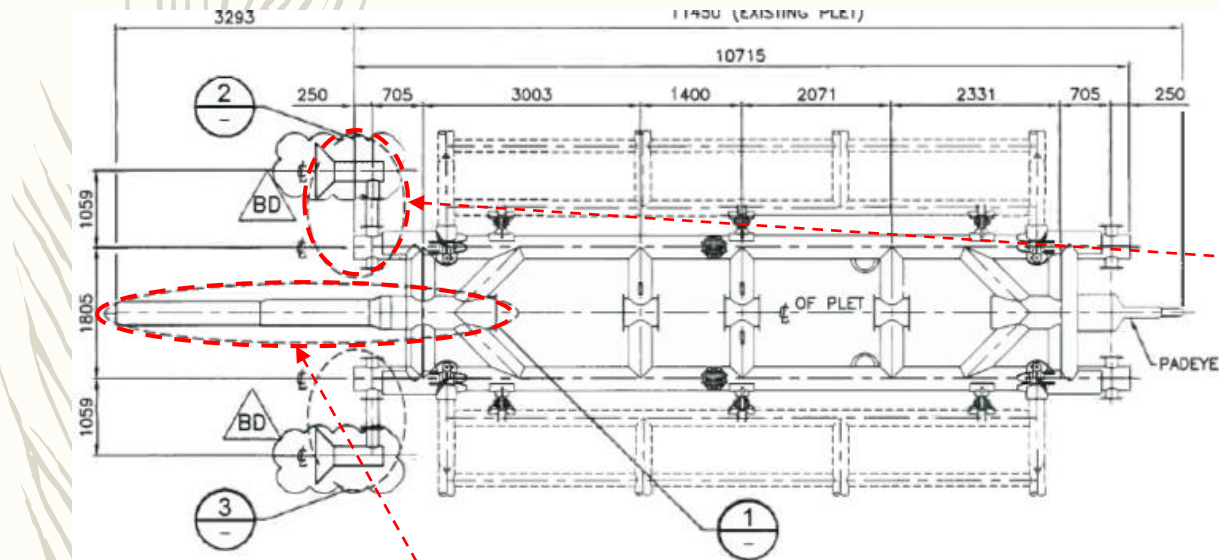
PLET P9

4.5" PLET



ISOMETRIC VIEW
SCALE: N.T.S.

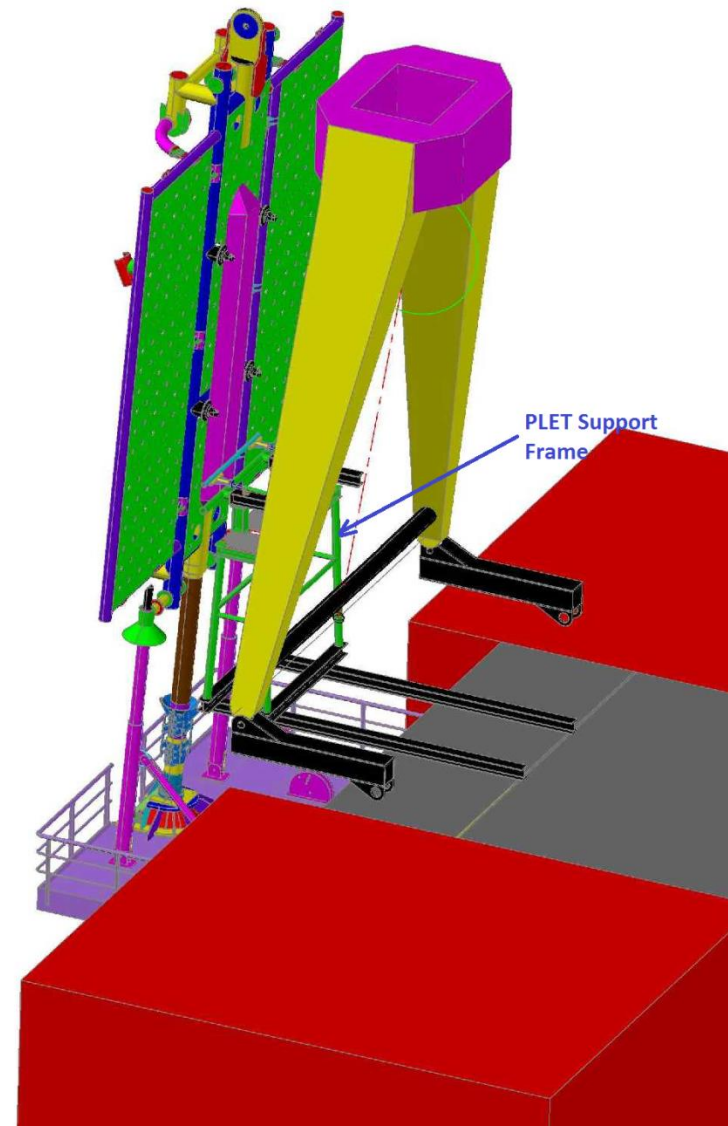
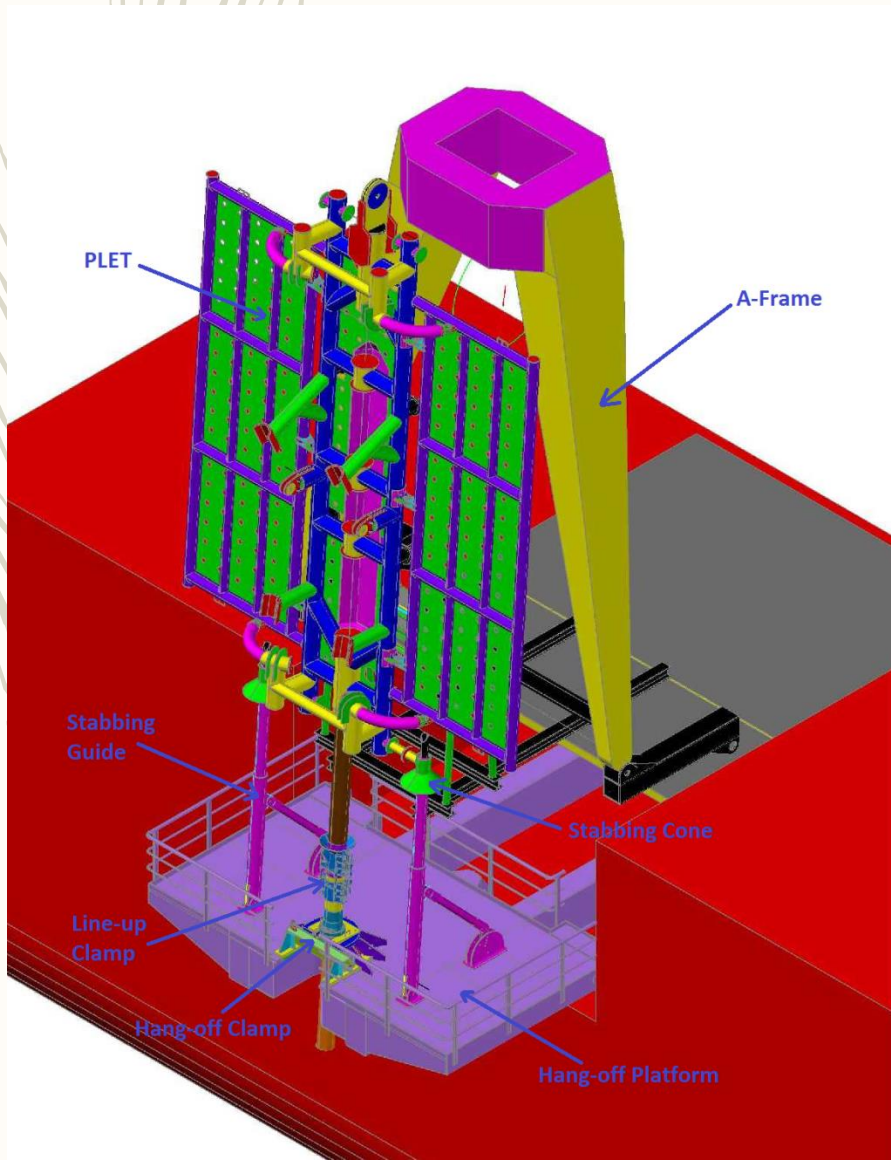
PLET Modification



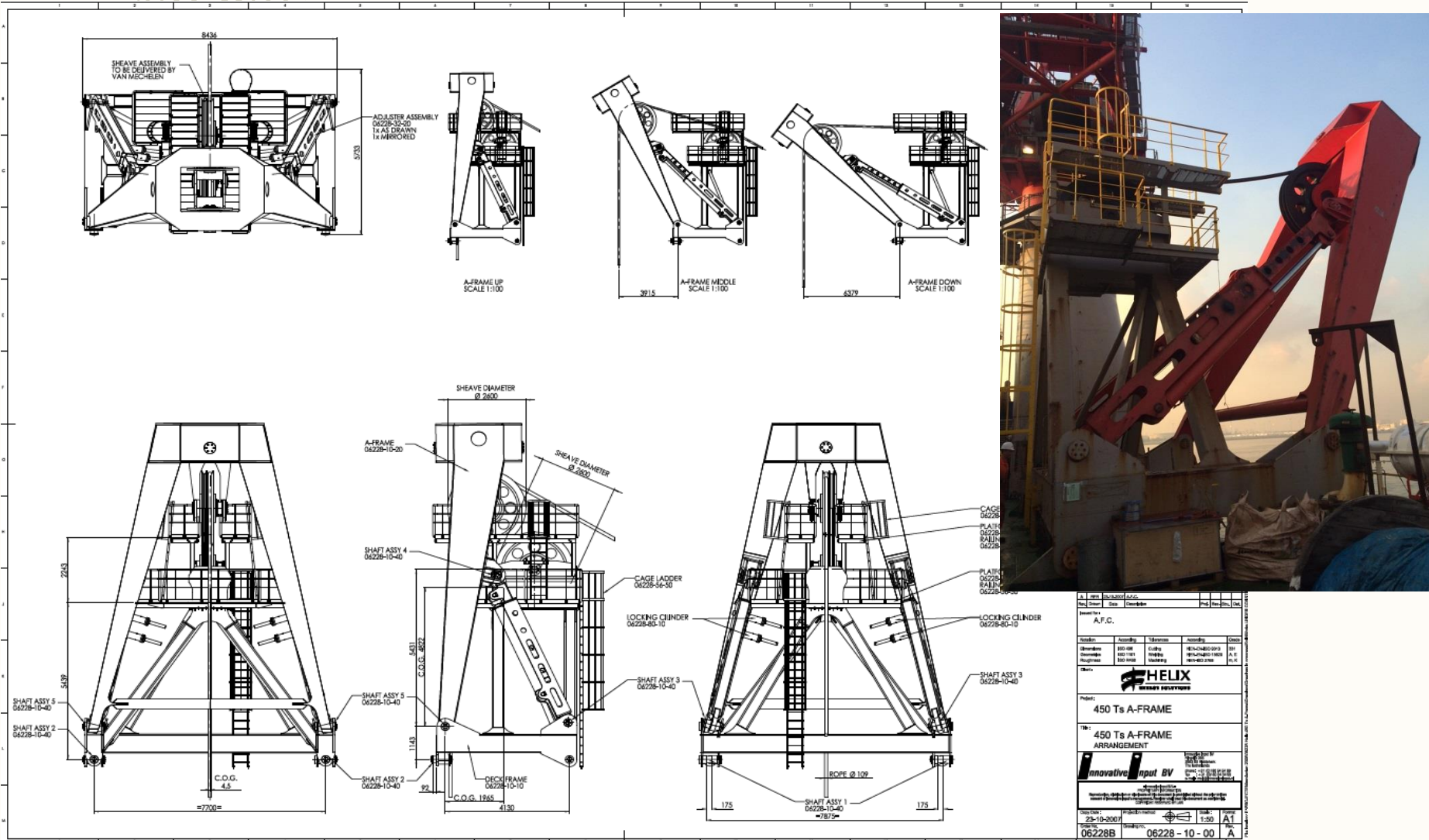
Pup Piece



LCE PLET J-Mode Installation System

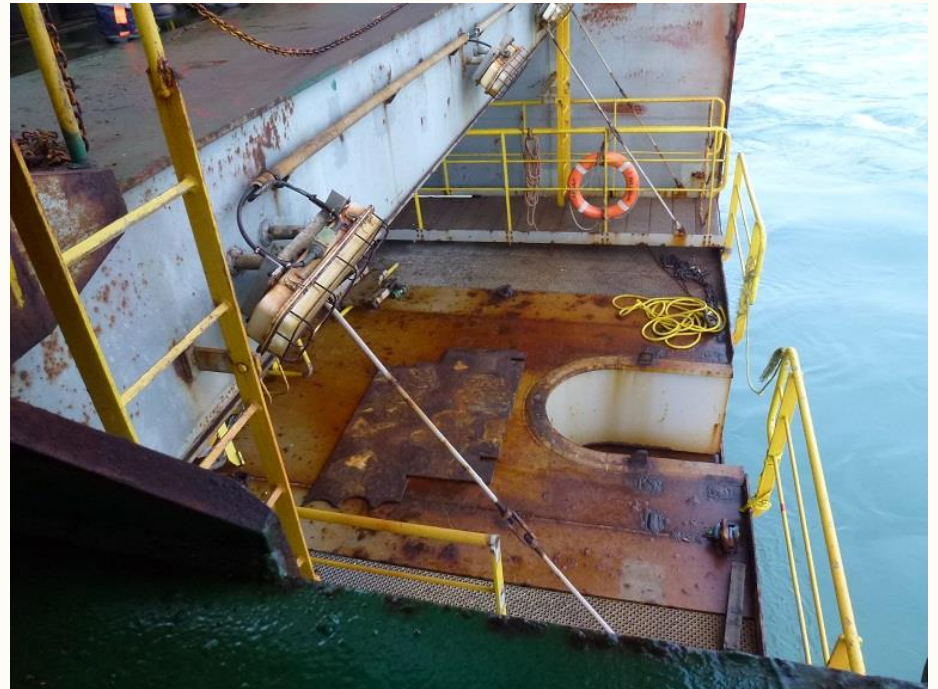
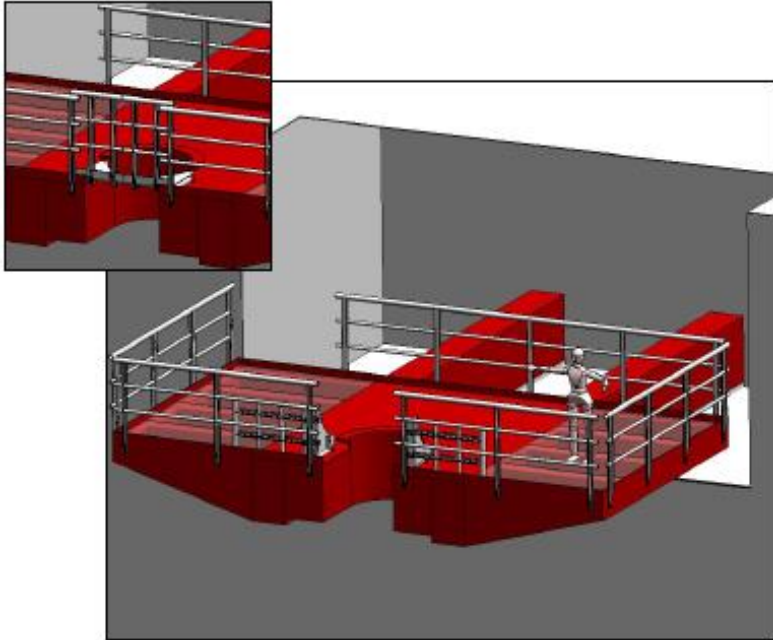


PLET Installation Equipment – A-Frame

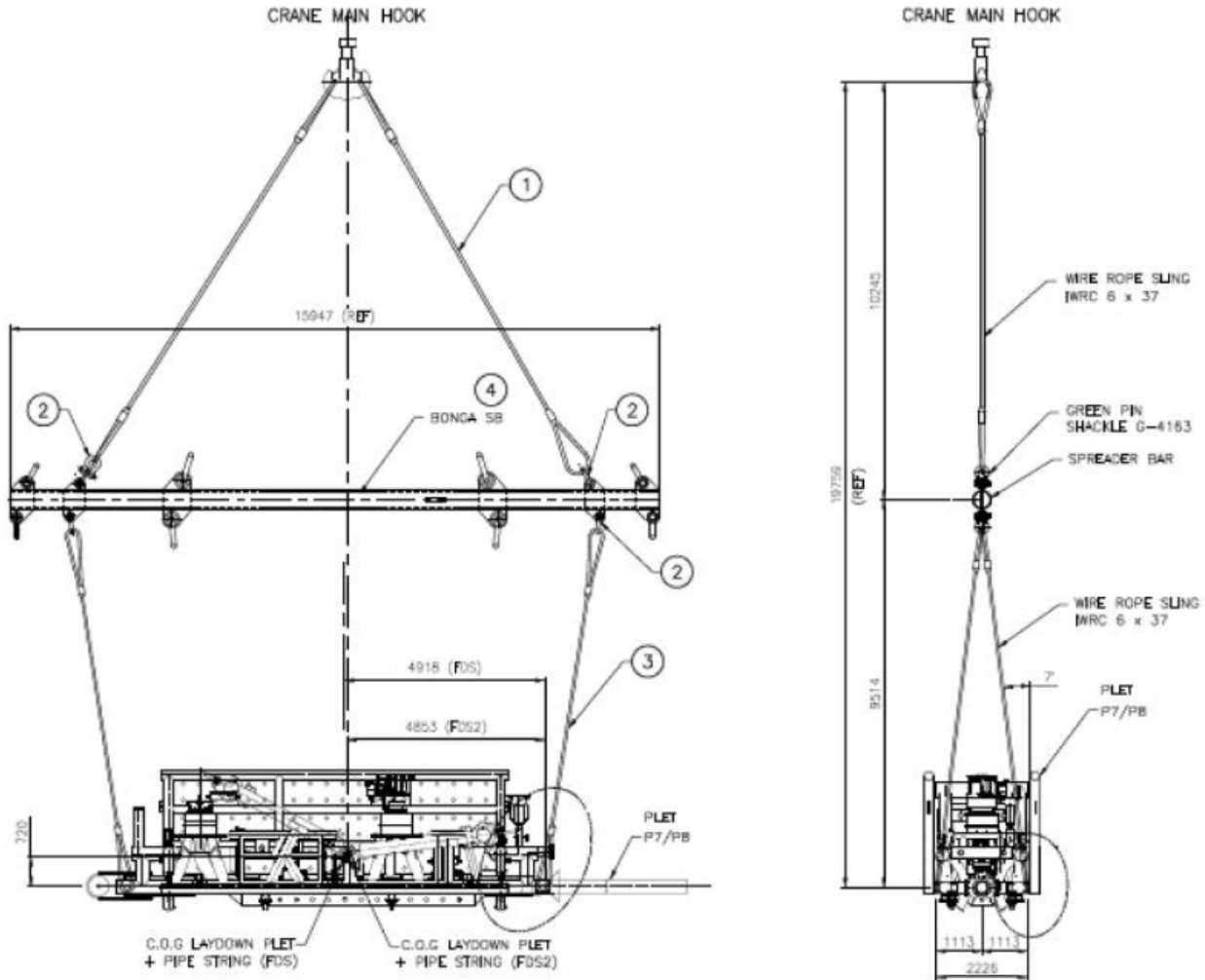


Rev	Revised	Scale	1:50	Drawn	Rev
1		1:50			
Project: A.F.C.					
Revision	Quantity	Volume	Assembly	Code	
06228	100	100	100	100	
06228	100	100	100	100	
06228	100	100	100	100	
Product: 450 Ts A-FRAME					
Title: 450 Ts A-FRAME ARRANGEMENT					
Helix is a registered trademark of Helix Group. All rights reserved.					
Drawn	Checked	Released	Scale	Rev	Appr
06228	06228	06228	1:50	1	A
06228B 06228-10-00 A					

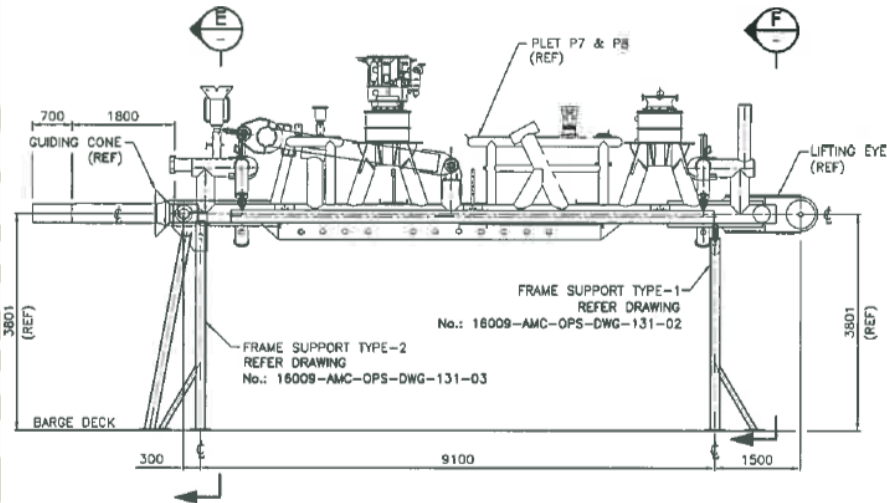
PLET Installation Equipment – Hang-Off Platform



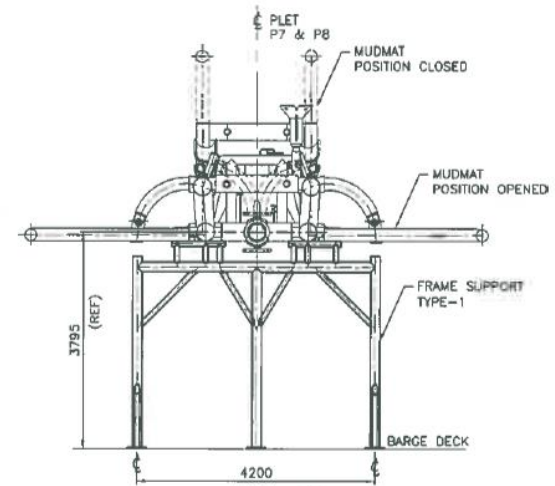
PLET Horizontal Lifting Rigging



PLET Upending Platform



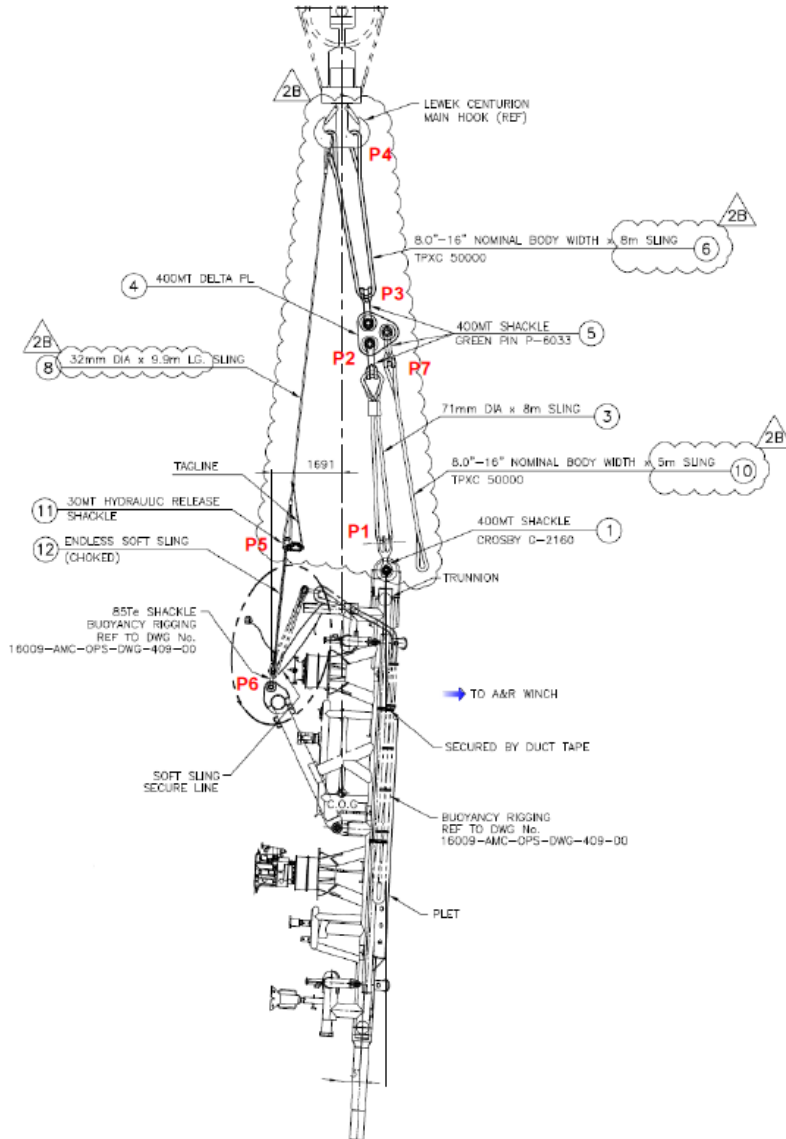
VIEW **B** PLET P7&P8
SCALE = 1:50



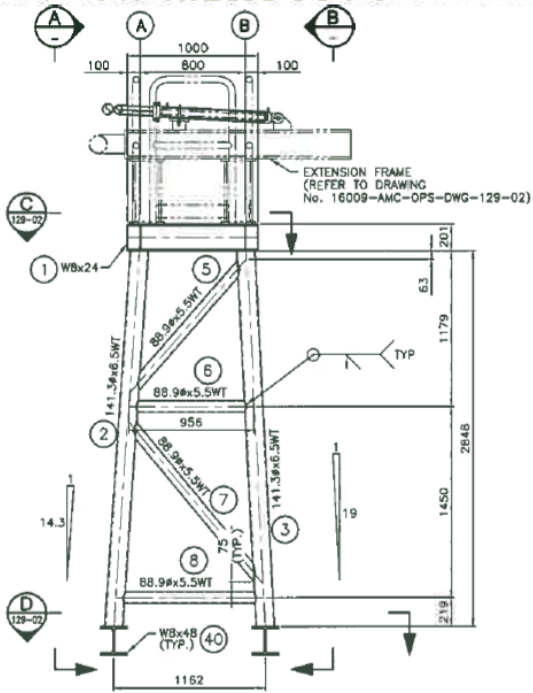
SECTION **E**
SCALE = 1:50



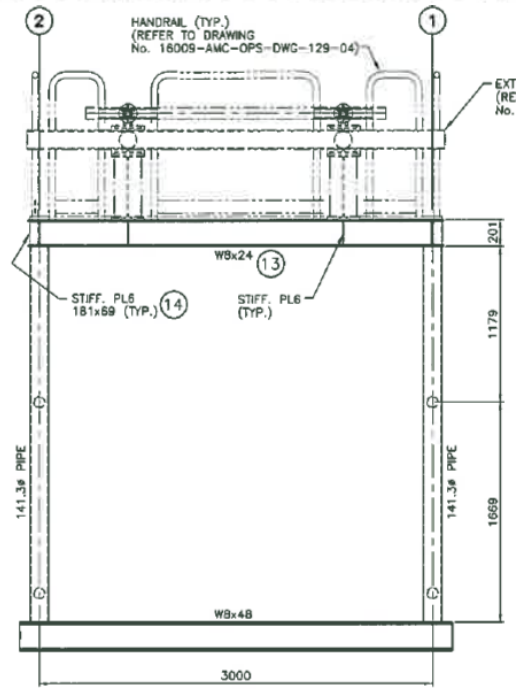
PLET Upending / Vertical Lifting Rigging



PLET Support Frame



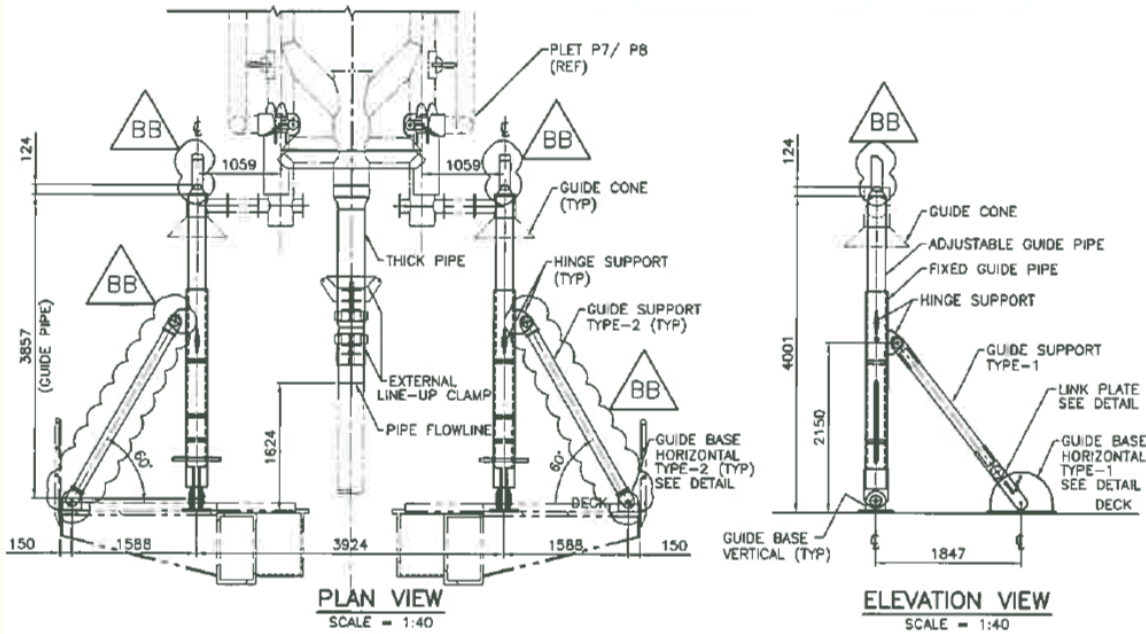
ELEVATION VIEW AT ROW 1 & 2
SCALE = 1:20



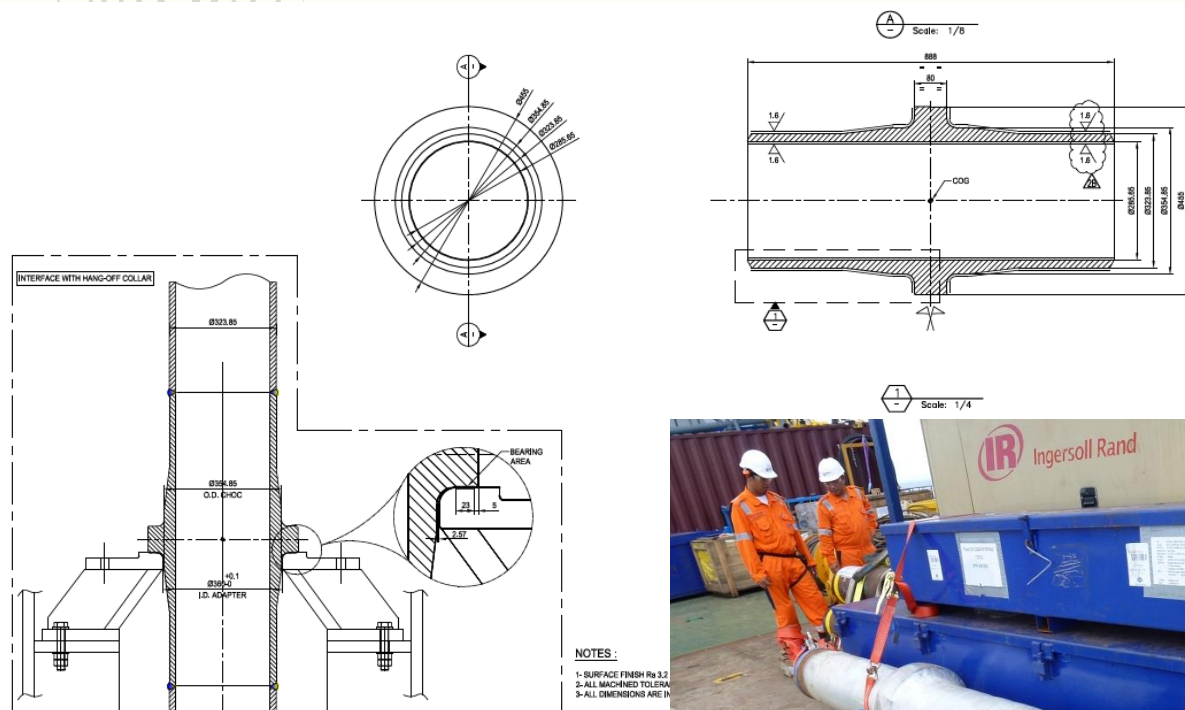
VIEW A
SCALE = 1:20



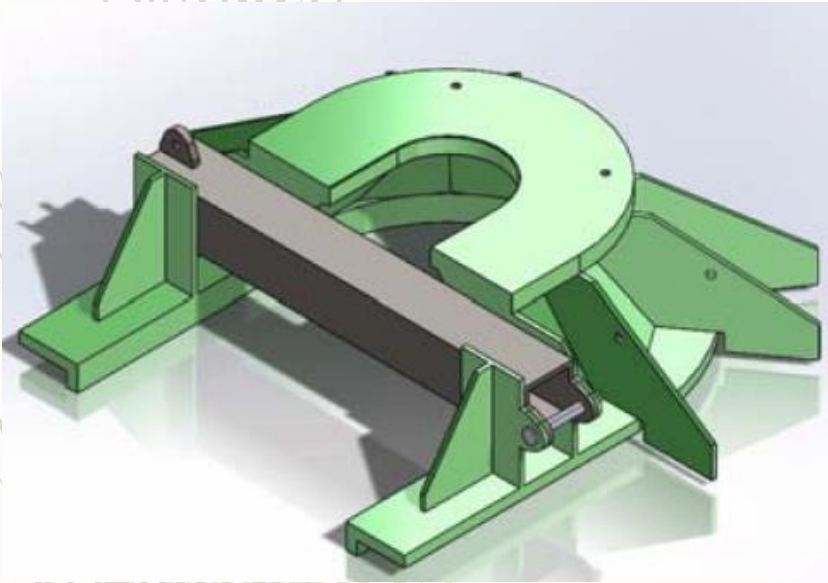
PLET Stabbing Guide



Pipeline Hang-off Collar



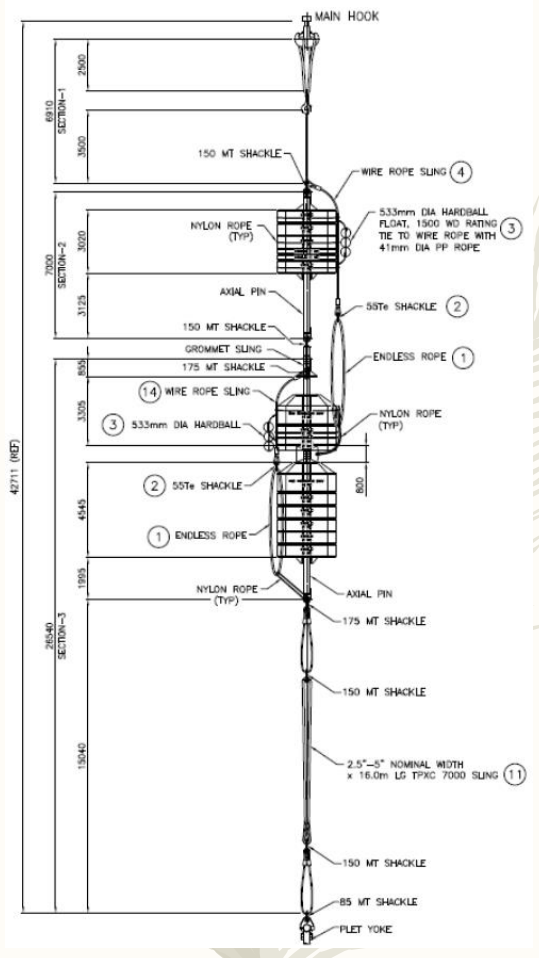
Pipeline Hang-off Clamp



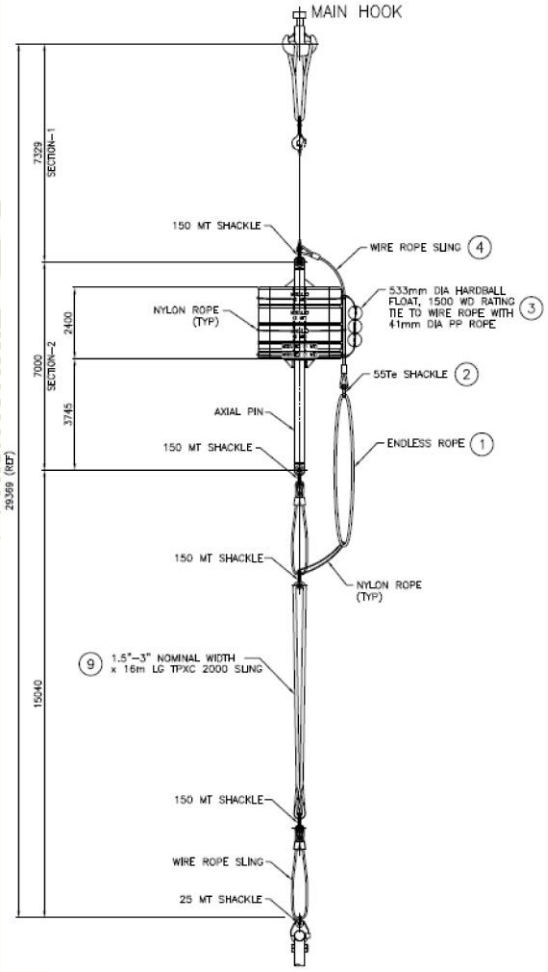
Pipeline / PLET Line-up Clamp



PLET Buoyancy Modular and Riggings



12" PLET (27 mT Net Buoyancy)



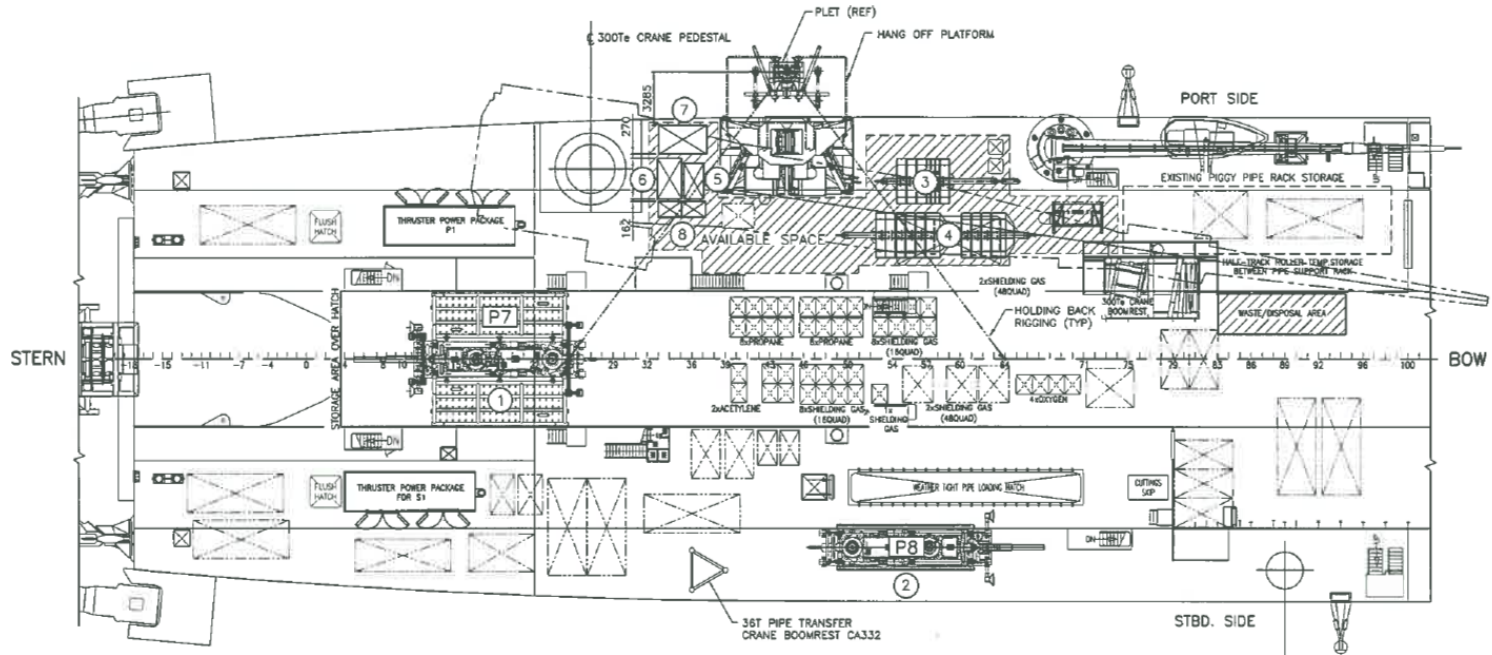
4.5" PLET (5.5 mT Net Buoyancy)



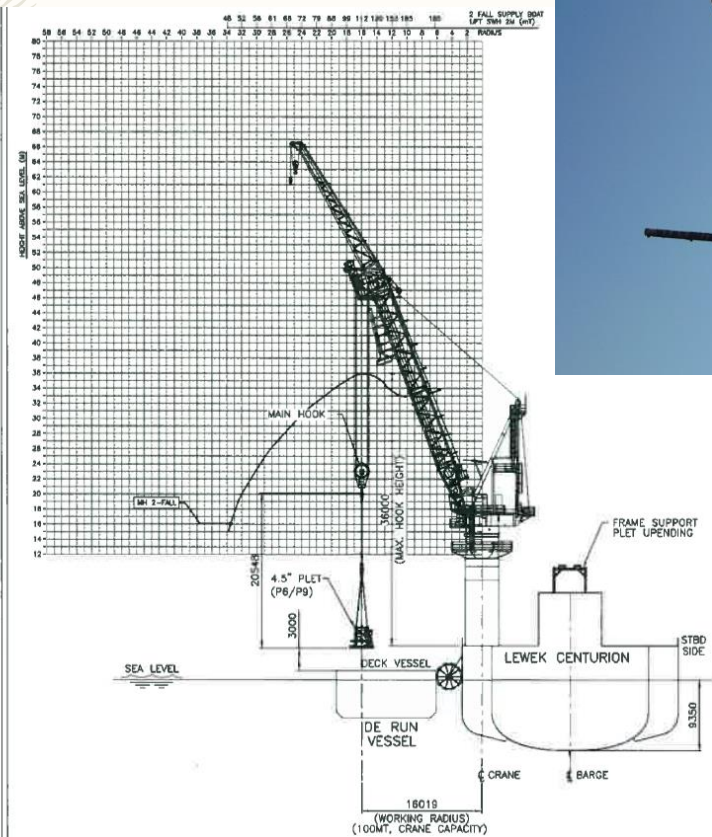
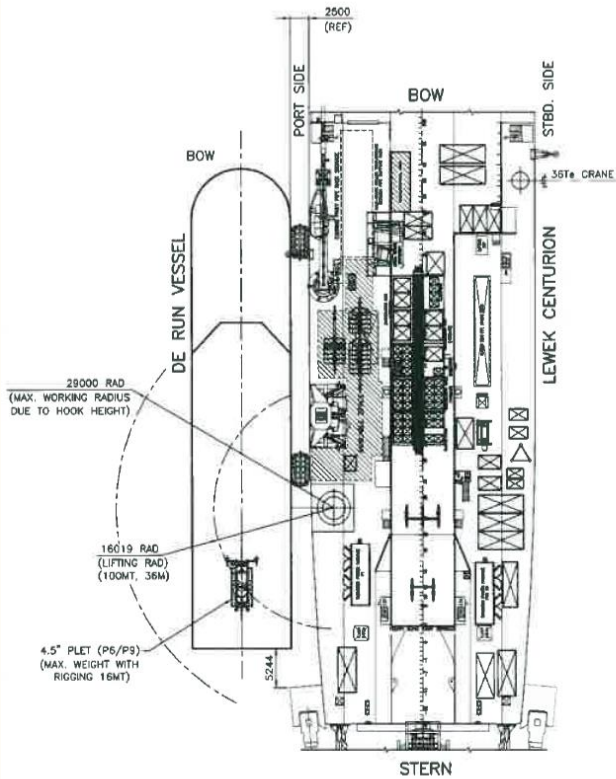
Executive Summary for PLET Installation

- Step 0 : LCE Deck Readiness for PLET Installation
- Step 1 : PLET lifting from Supply Boat
- Step 2 : J-Mode Pipeline Recovery to Surface with A-Frame
- Step 3 : Load Transfer from A-Frame to Main Crane
- Step 4 : Hang-off Pipeline onto HOP
- Step 5 : PLET up-righting and lifting
- Step 6 : PLET Stabbing & Aligning to Pipeline Top, Welding, NDT & FJC
- Step 7 : Disconnection PLET Tilt Sling
- Step 8 : Lift PLET + Pipeline off from HOP & Disengage Collar Stopper
- Step 9 : Load Transfer from Main Crane to A-Frame
- Step 10 : Buoyancy Module Installation to PLET Yoke
- Step 11 : Lower PLET to 150m or deeper and Release Main Crane Hook
- Step 12 : Continue Lower PLET close to Seabed
- Step 13 : Land PLET to the Seabed and Release Buoyancy Module and A&R cable

Step 0 : LCE Deck Readiness for PLET Installation

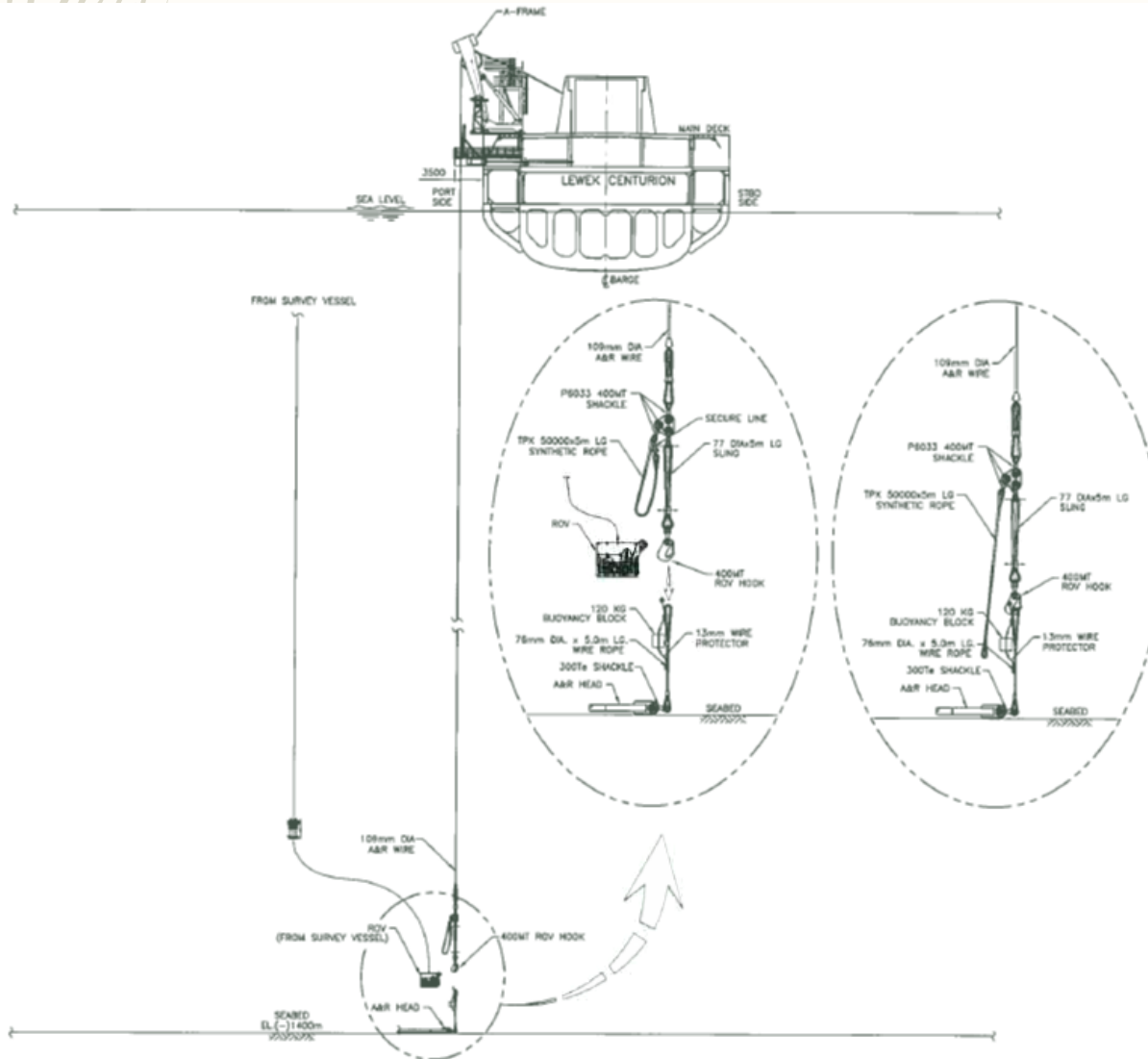


Step 1 : PLET Lifting from Supply Boat



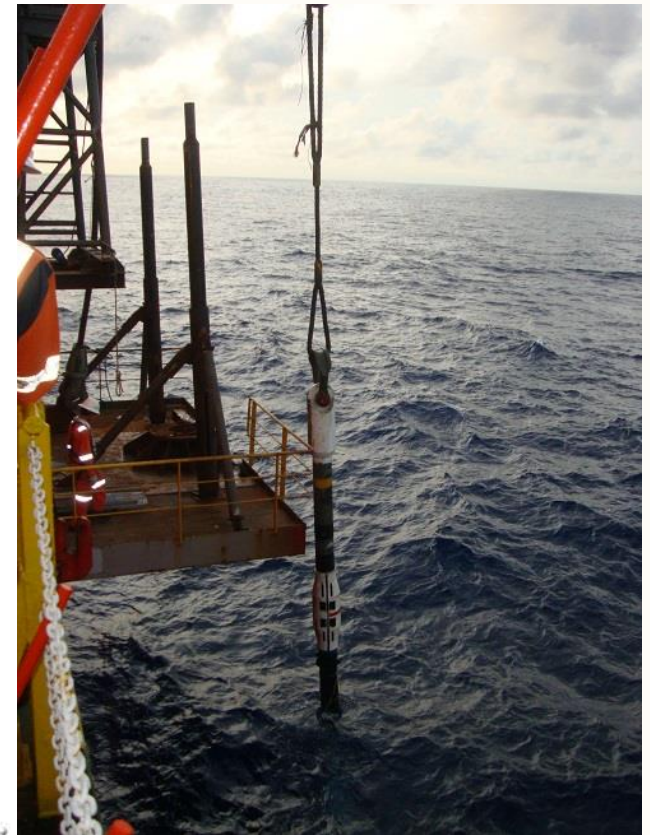
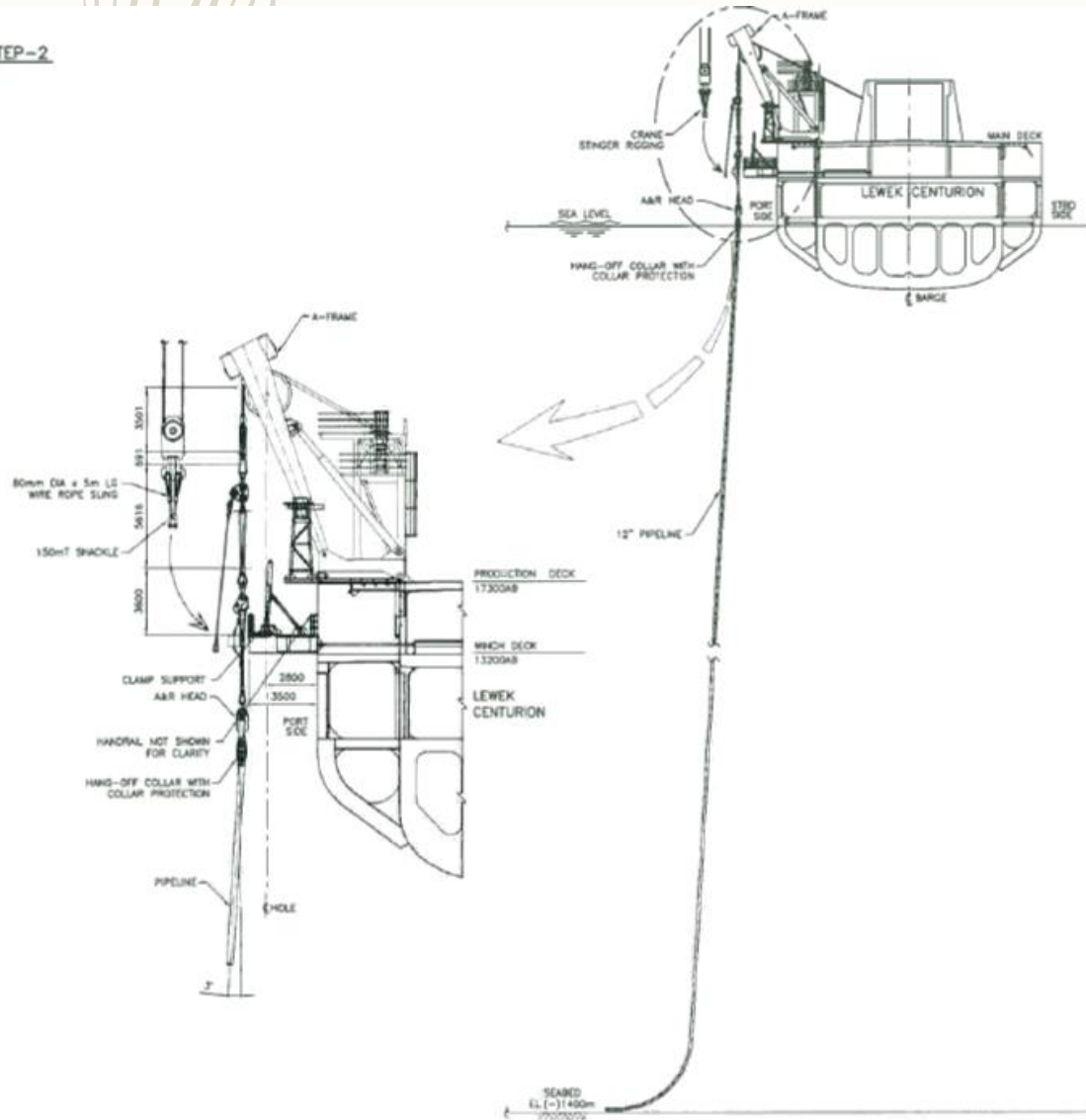
Step 2 : J-mode Pipeline Recovery to Surface

STEP-1

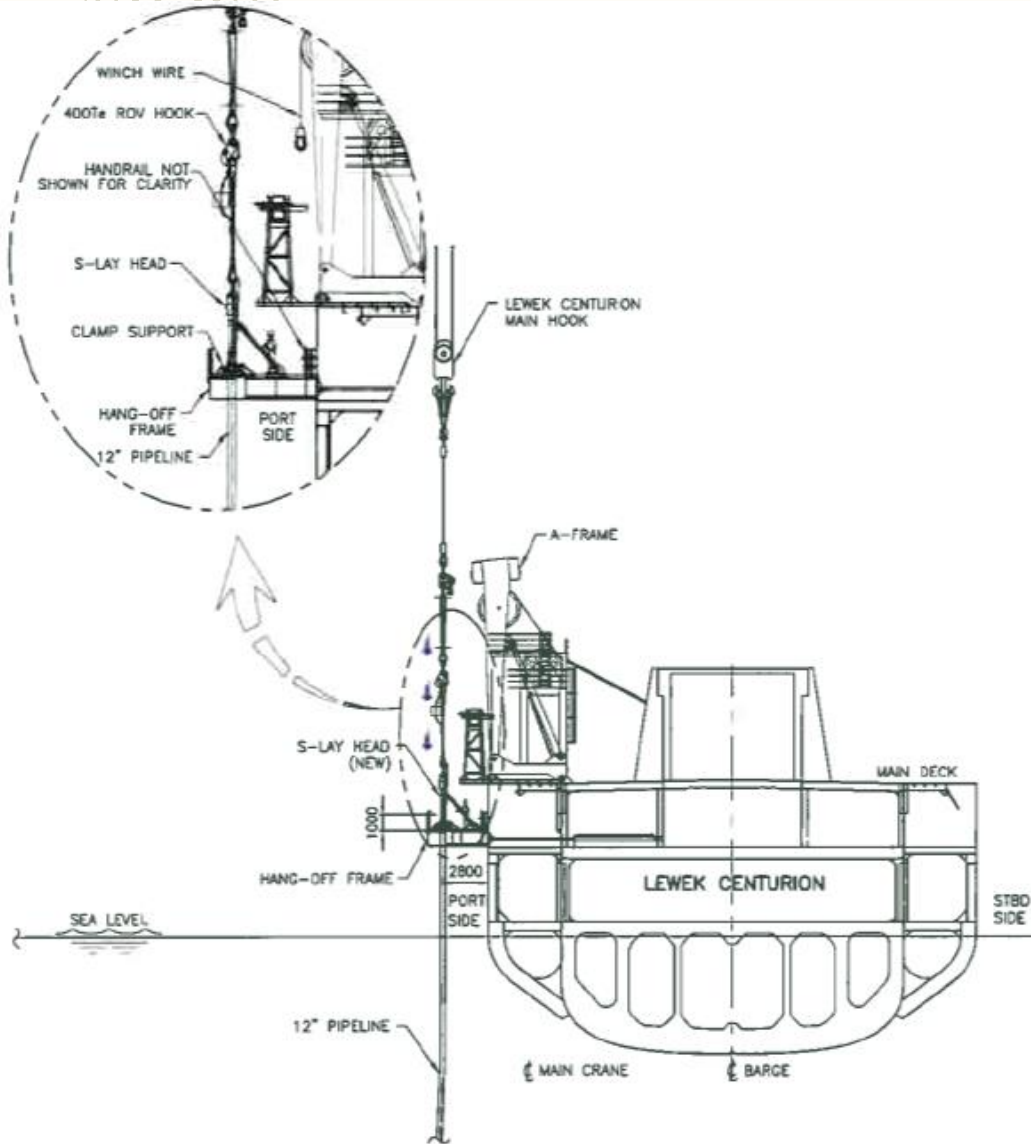


Step 3 : Load Transfer From A-Frame to Main Crane

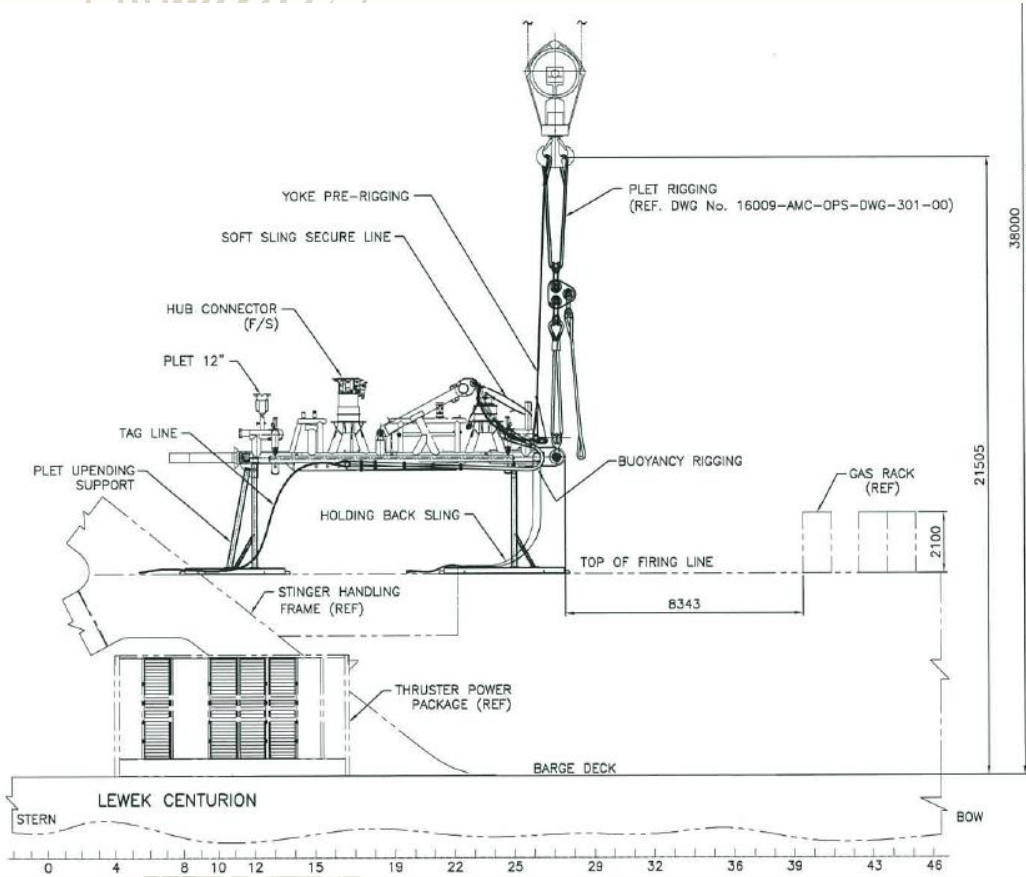
STEP-2



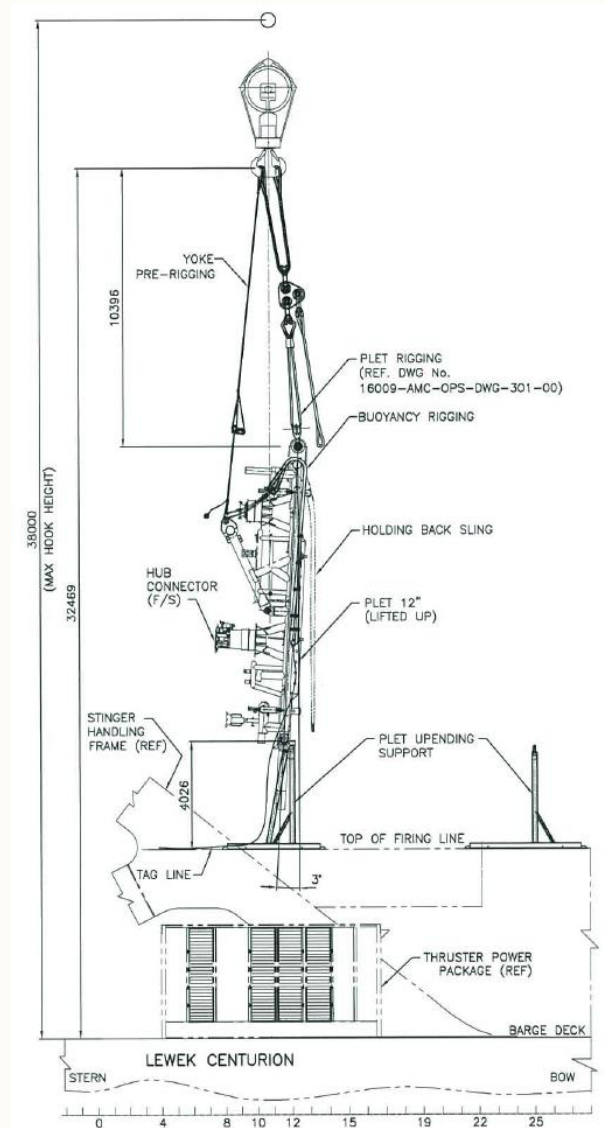
Step 4 : Hang-off Pipeline to HOP



Step 5 : PLET Upending and Lifting

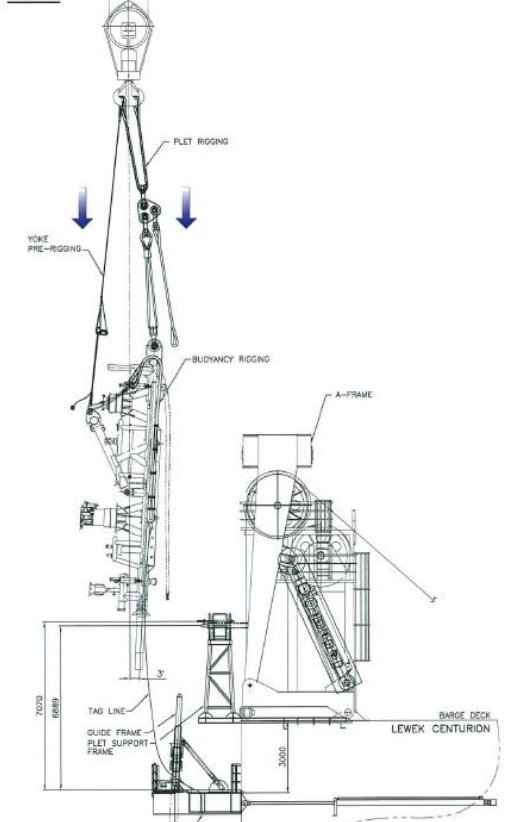


PLET Upending

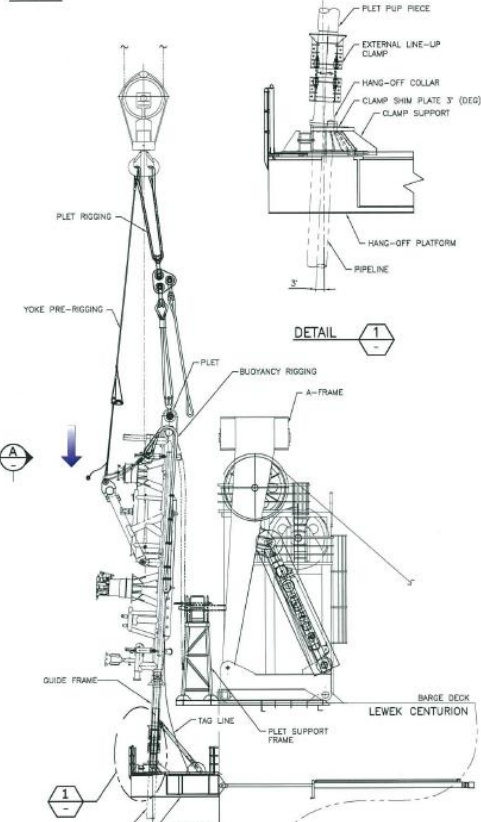


Step 6-1 : PLET Stabbing and Final Fit-up, Welding NDT & FJC

STEP 5

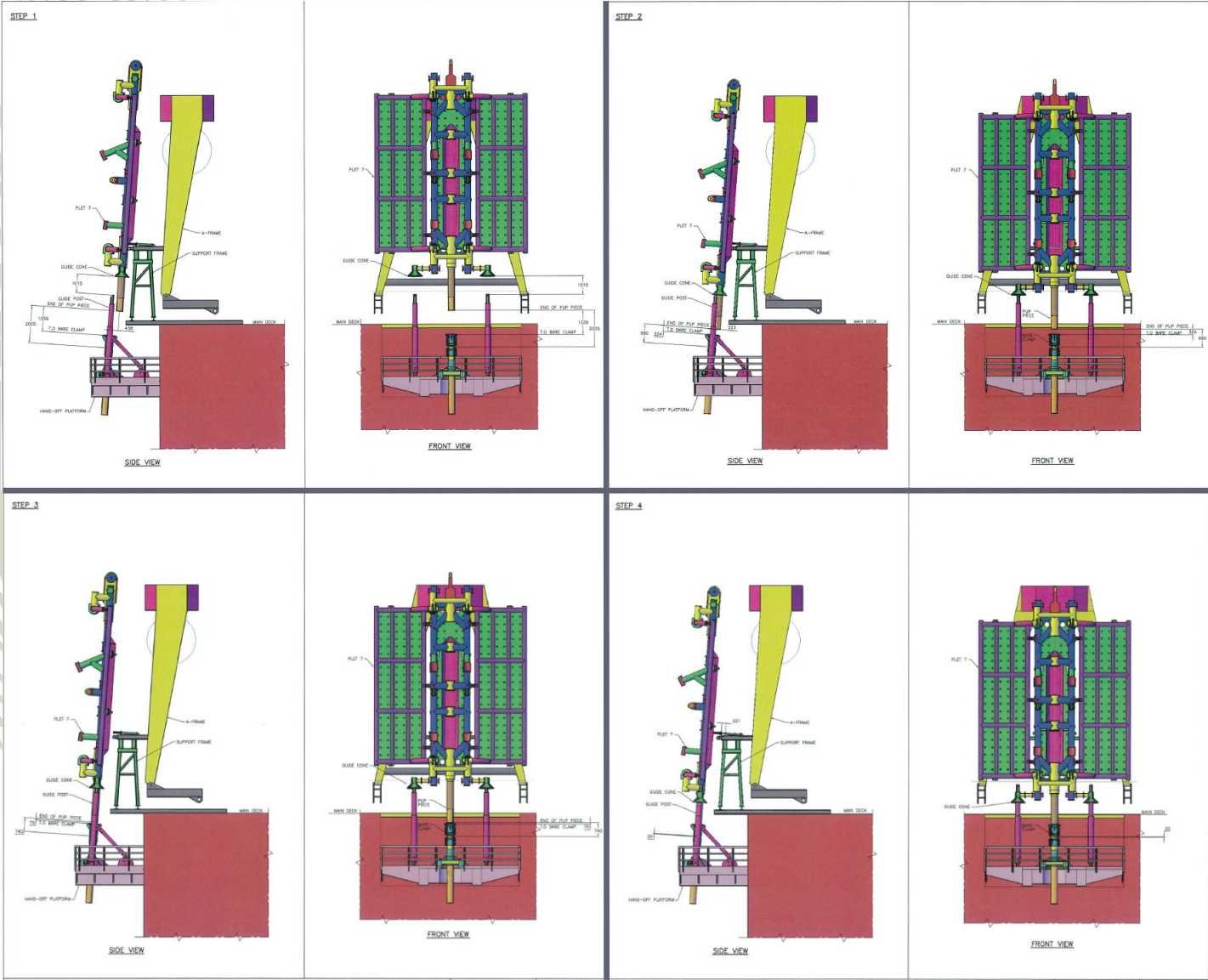


STEP 6

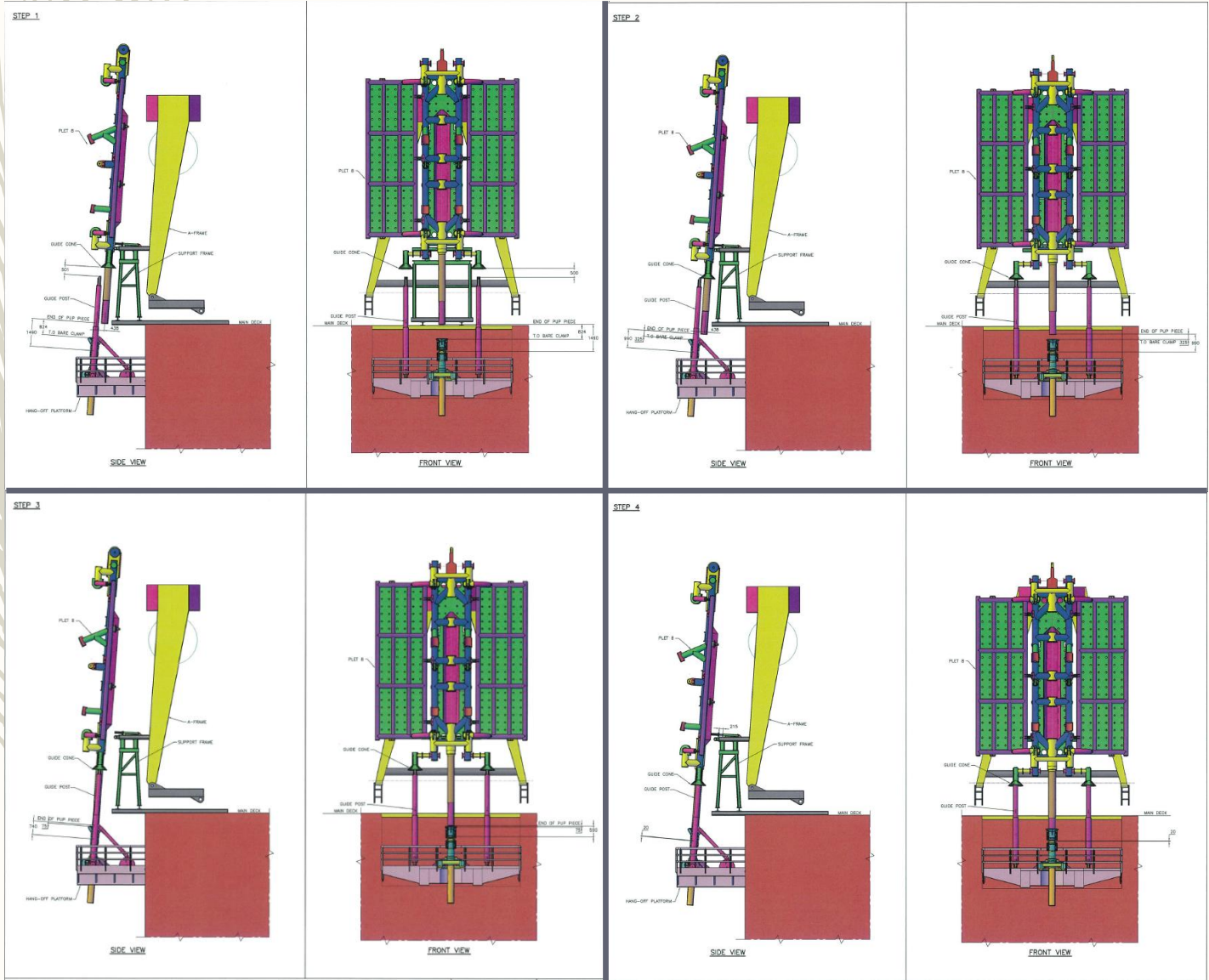


[PLET Stabbing Progress](#)

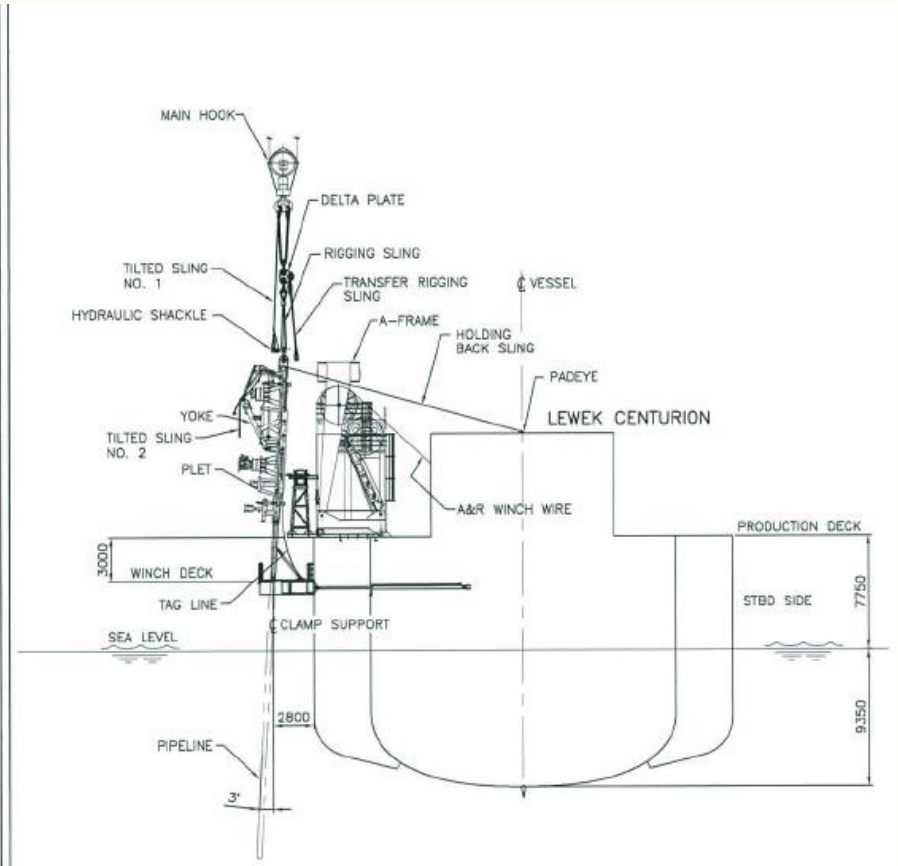
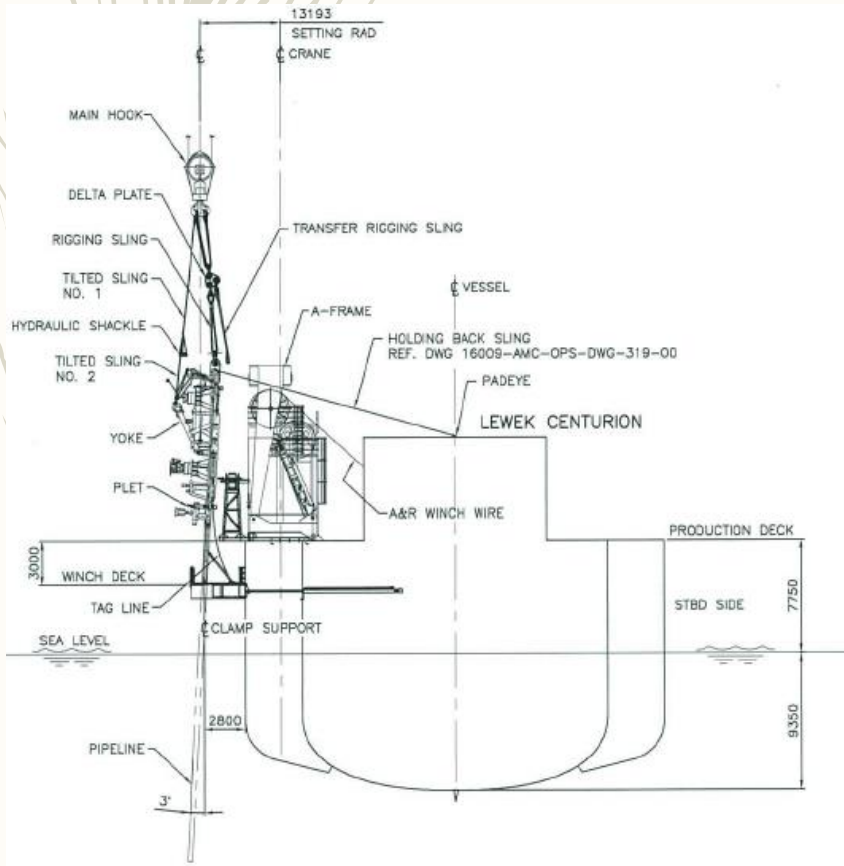
Step 6-2 : Detailed Check for PLET Stabbing



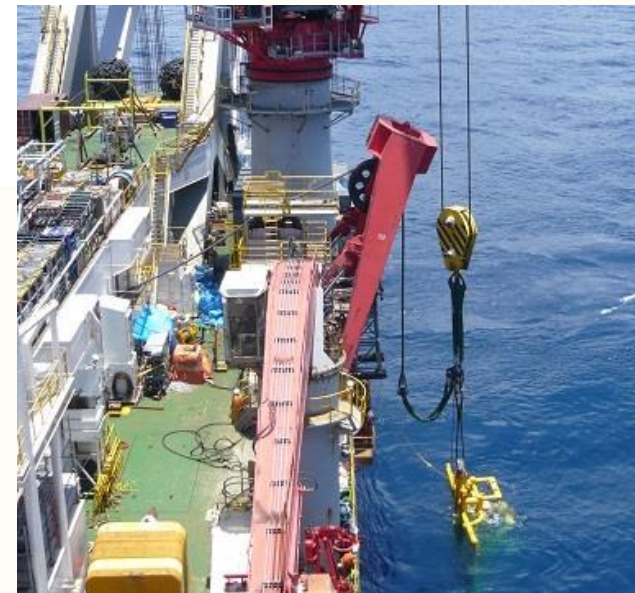
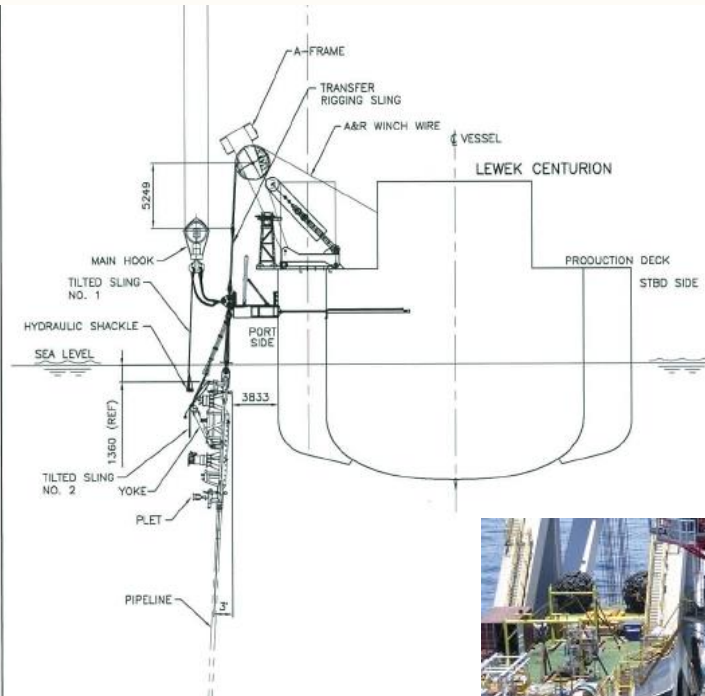
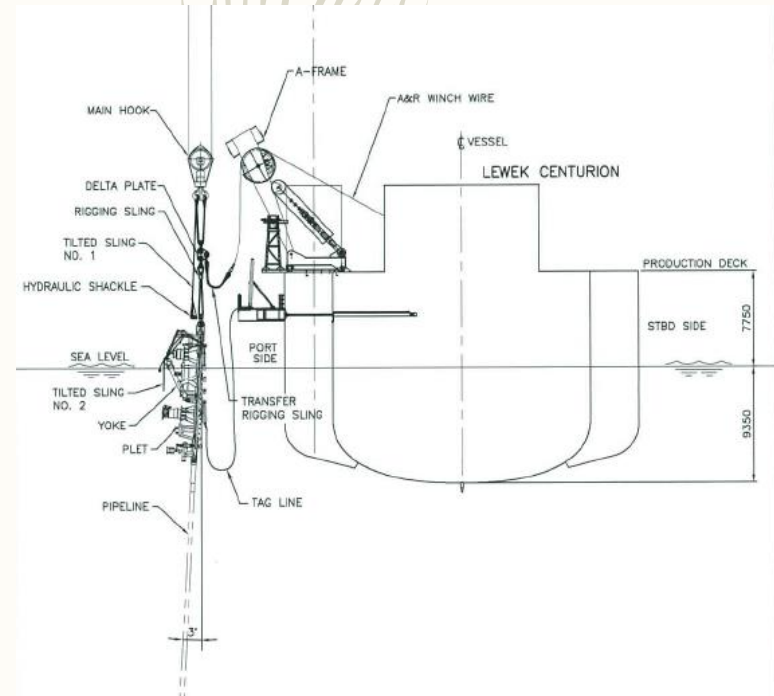
Step 6-3 : Detailed Check for PLET Stabbing (Continue)



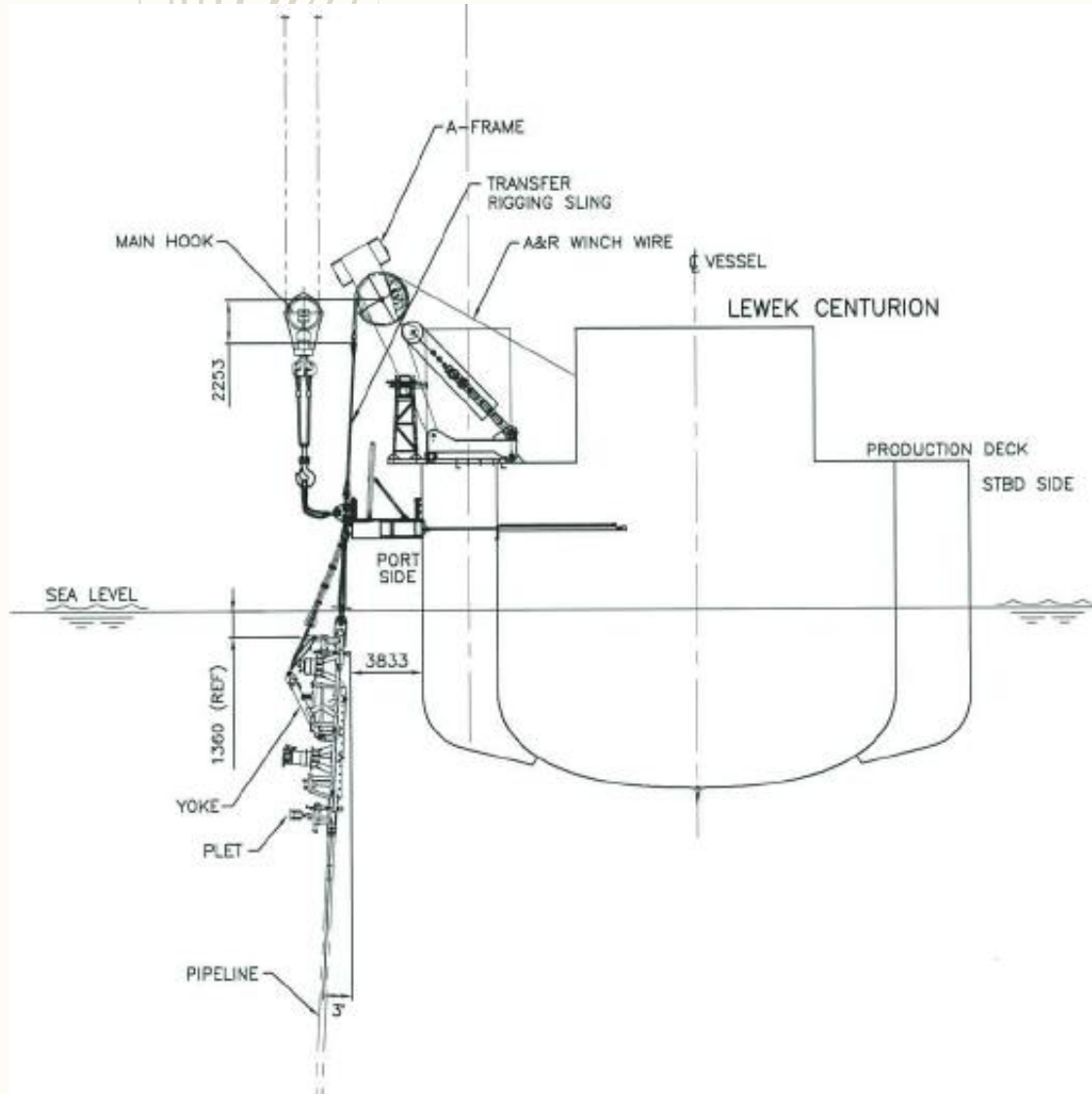
Step 7 : Disconnection PLET Tilt Sling



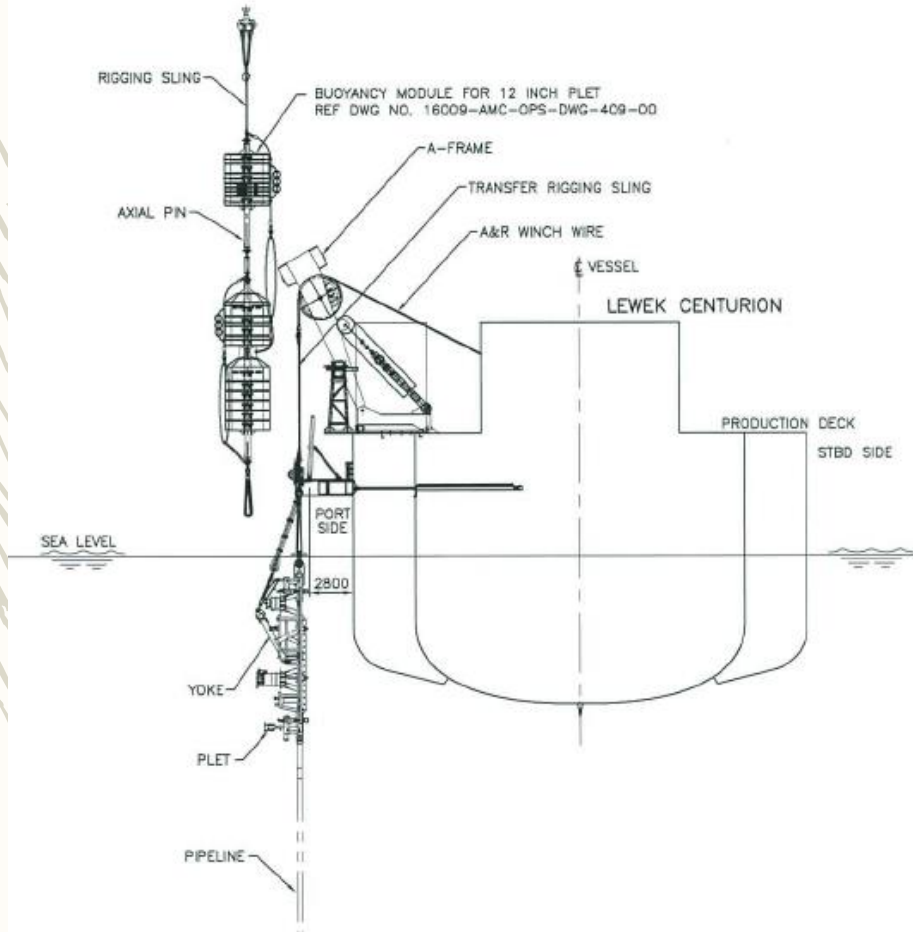
Step 8 : Lift PLET + Pipeline from HOP



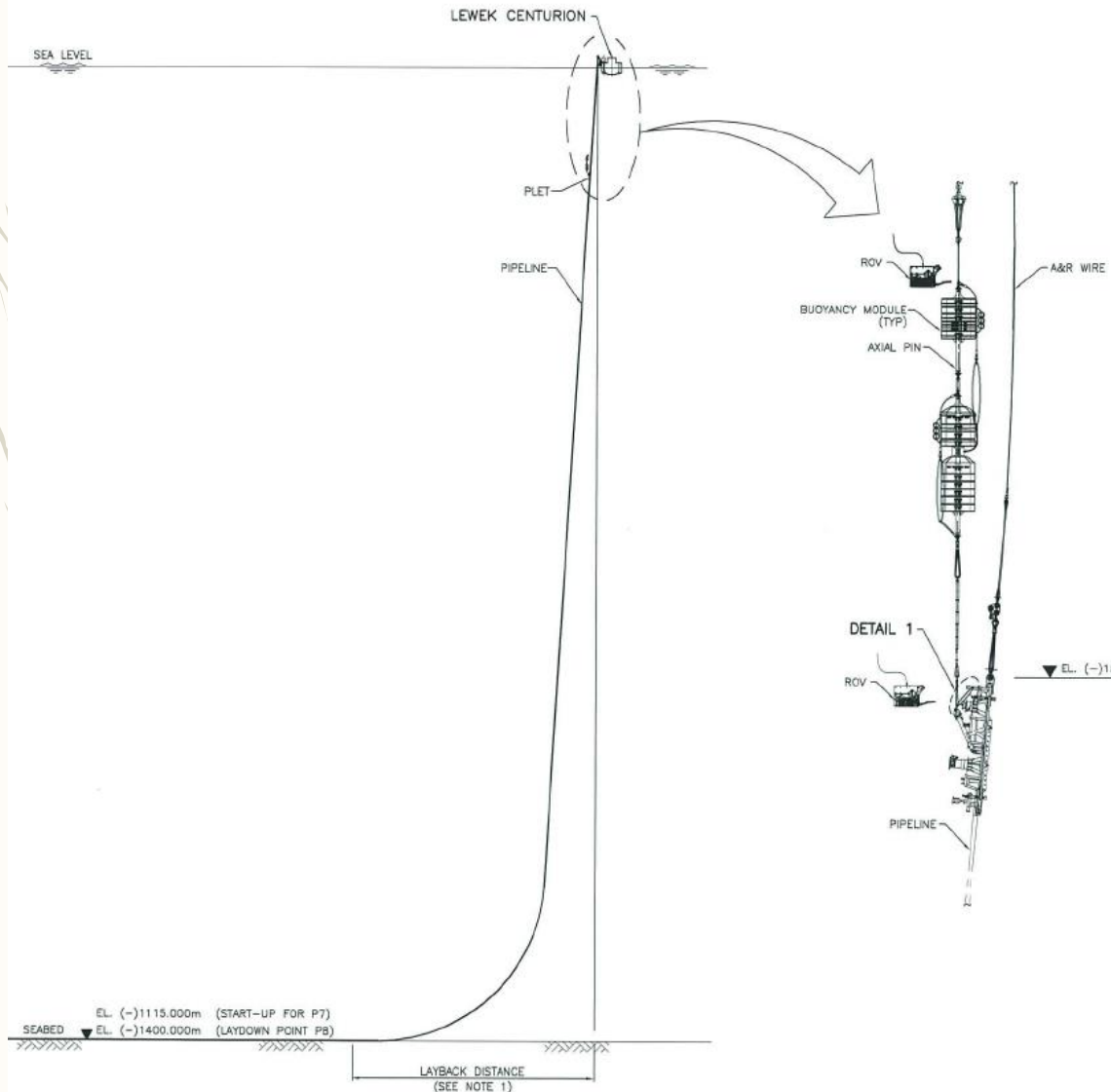
Step 9 : Load Transfer from Main Crane to A-Frame Crane



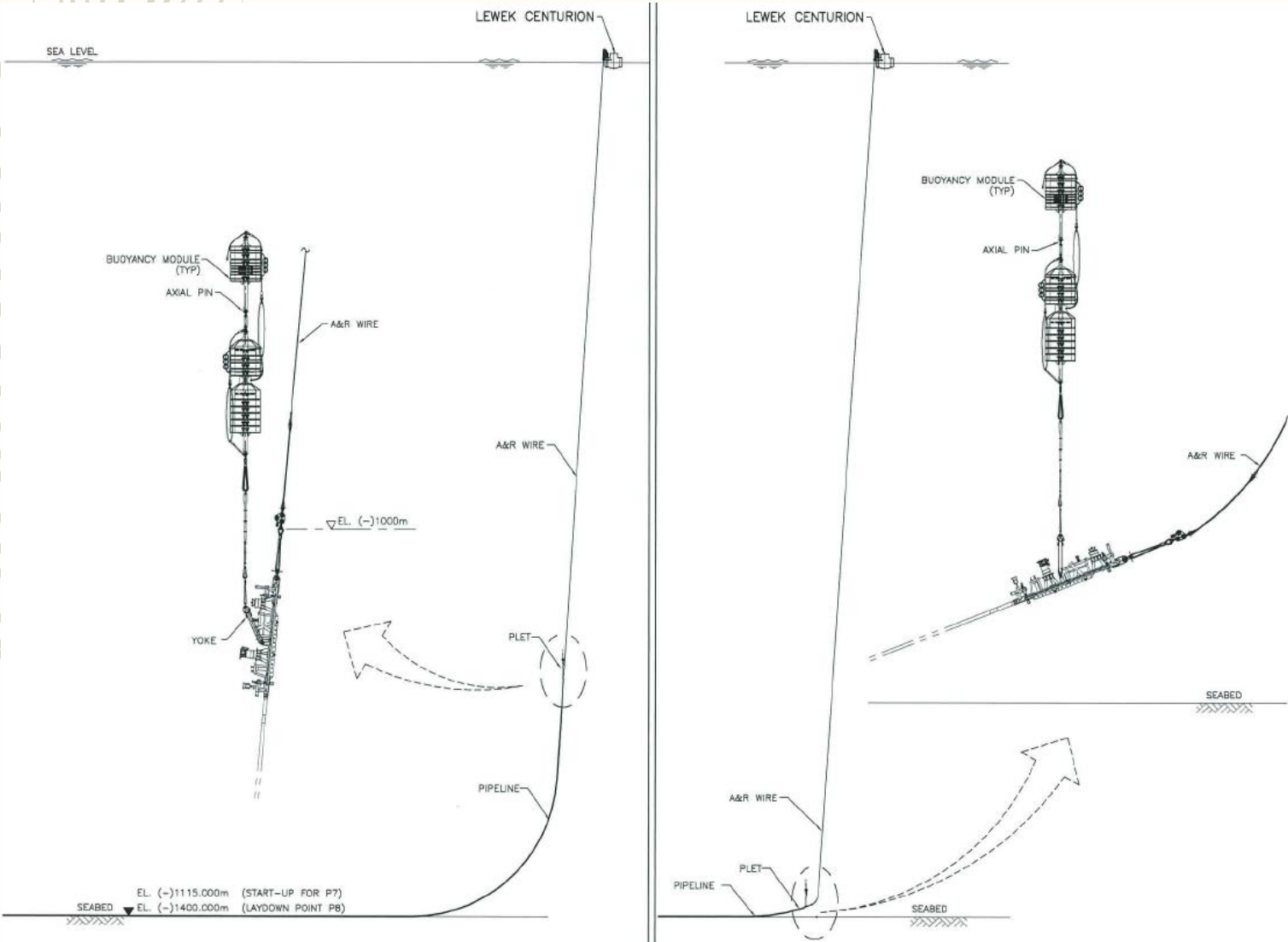
Step 10 : Buoyancy Module Installation to PLET Yoke



Step 11 : Lower PLET to 150m or Deeper (to prevent PLET rotation and Buoy Clash with A&R)



Step 12 : PLET Lowering



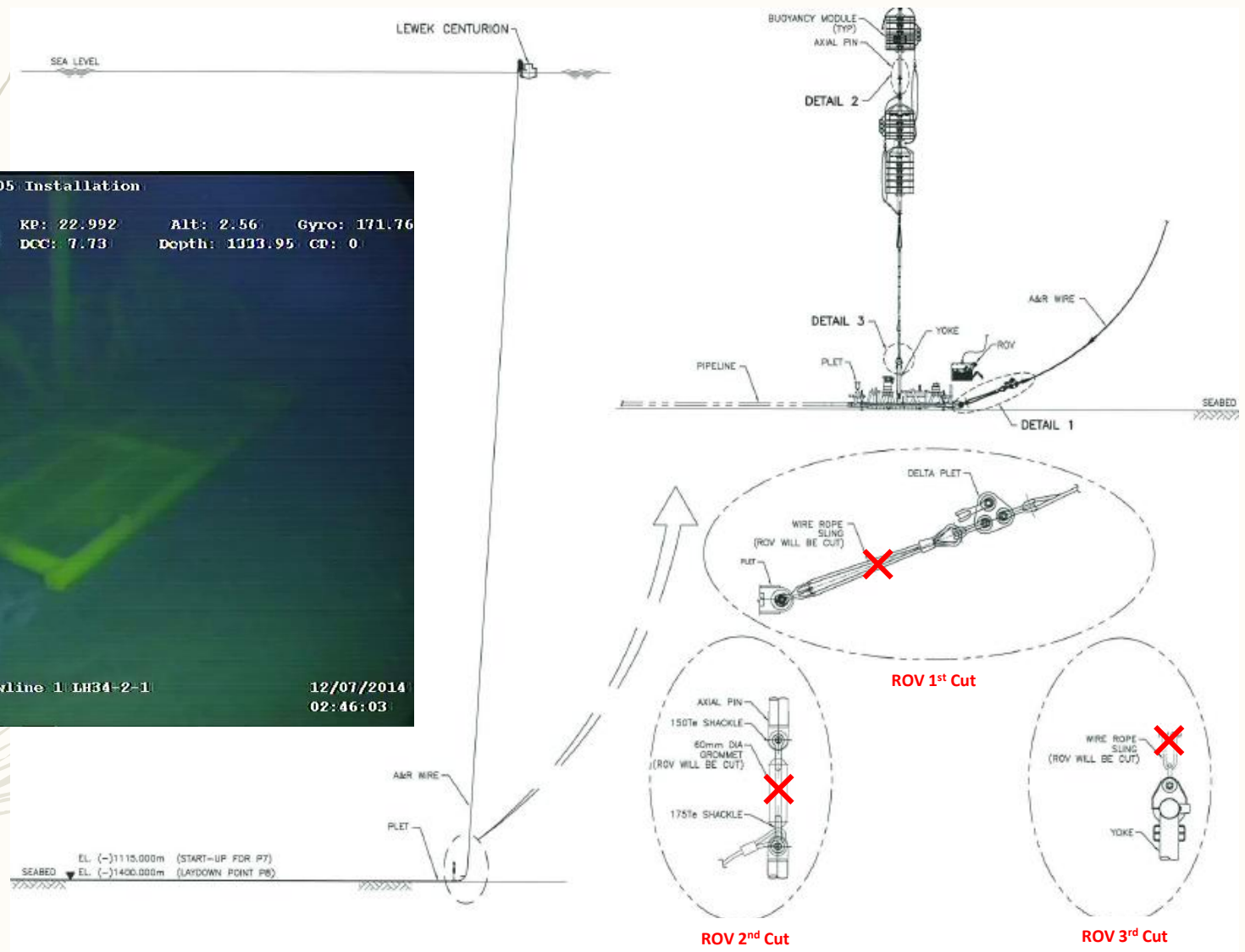
Step 13 : Land PLET to the Seabed and Retrieve Buoyancy Module and A&R Cable

Task: 12inch IF-1 EM-PLT-05 Installation
 Dive: 078
 ROV Laser E: 337753.46 KP: 22.992 Alt: 2.56 Gyro: 171.76
 N: 2205900.63 DCC: 7.73 Depth: 1333.95 CP: 0



Runline: 12in Infield Flowline 1 LH34-2-1
 Vehicle: Installer

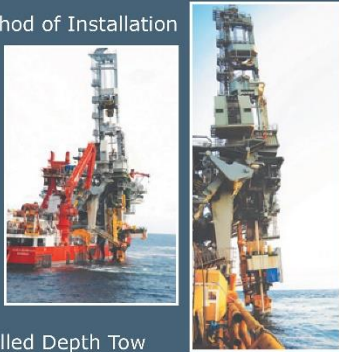
12/07/2014
 02:46:03



For more details on PLET installation or other methods of rigid pipeline installation, refer to my book:

“Subsea Rigid Pipelines – Methods of Installation”

J-lay Method of Installation



Controlled Depth Tow Method of Installation



Surface-tow Method of Installation



SUBSEA RIGID PIPELINES
— Methods of Installation

By Eng-Bin Ng



SUBSEA RIGID PIPELINES

— Methods of Installation

By Eng-Bin Ng



S-lay Method of Installation



Reel-lay Method of Installation



Stalk-on Method of Riser Installation





QUESTIONS ?????