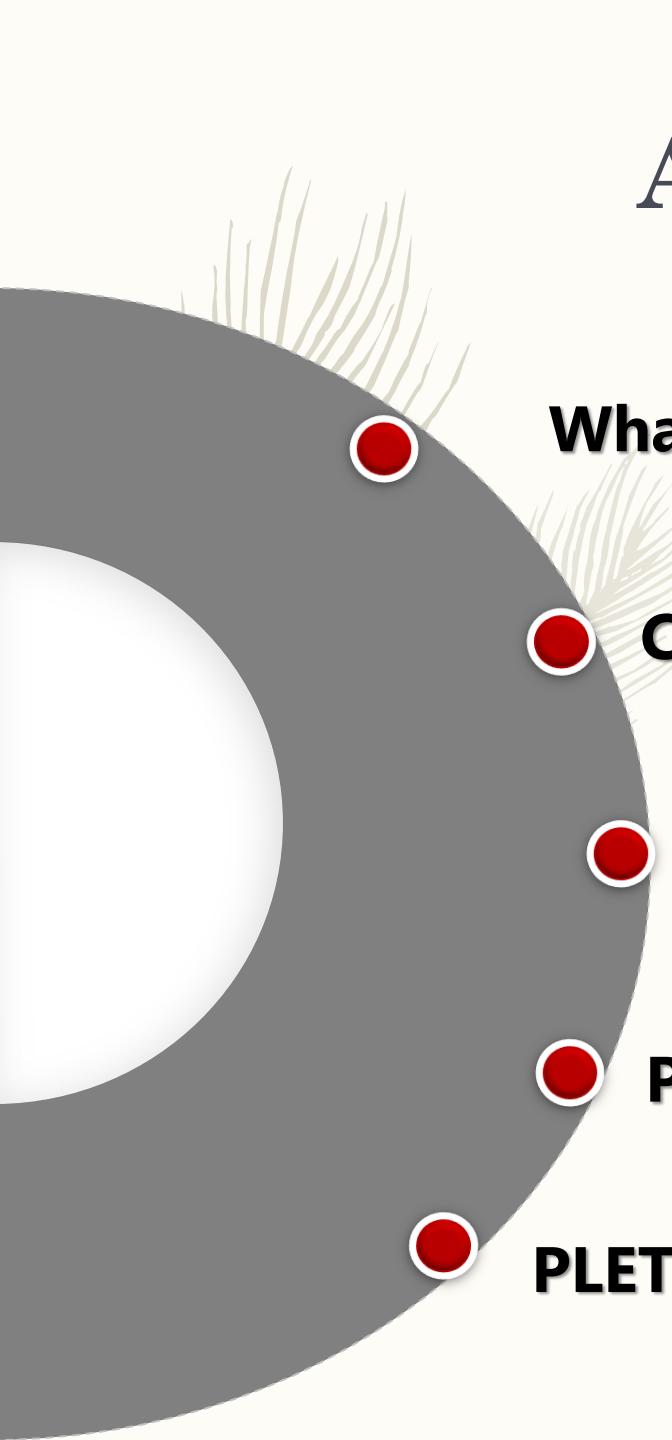


# *Engineering ‘Lunch & Learn’ Series*

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

*By: Ng Eng Bin  
Principal Consultant  
Submarine Pipelines Consulting Engineers*





# Agenda

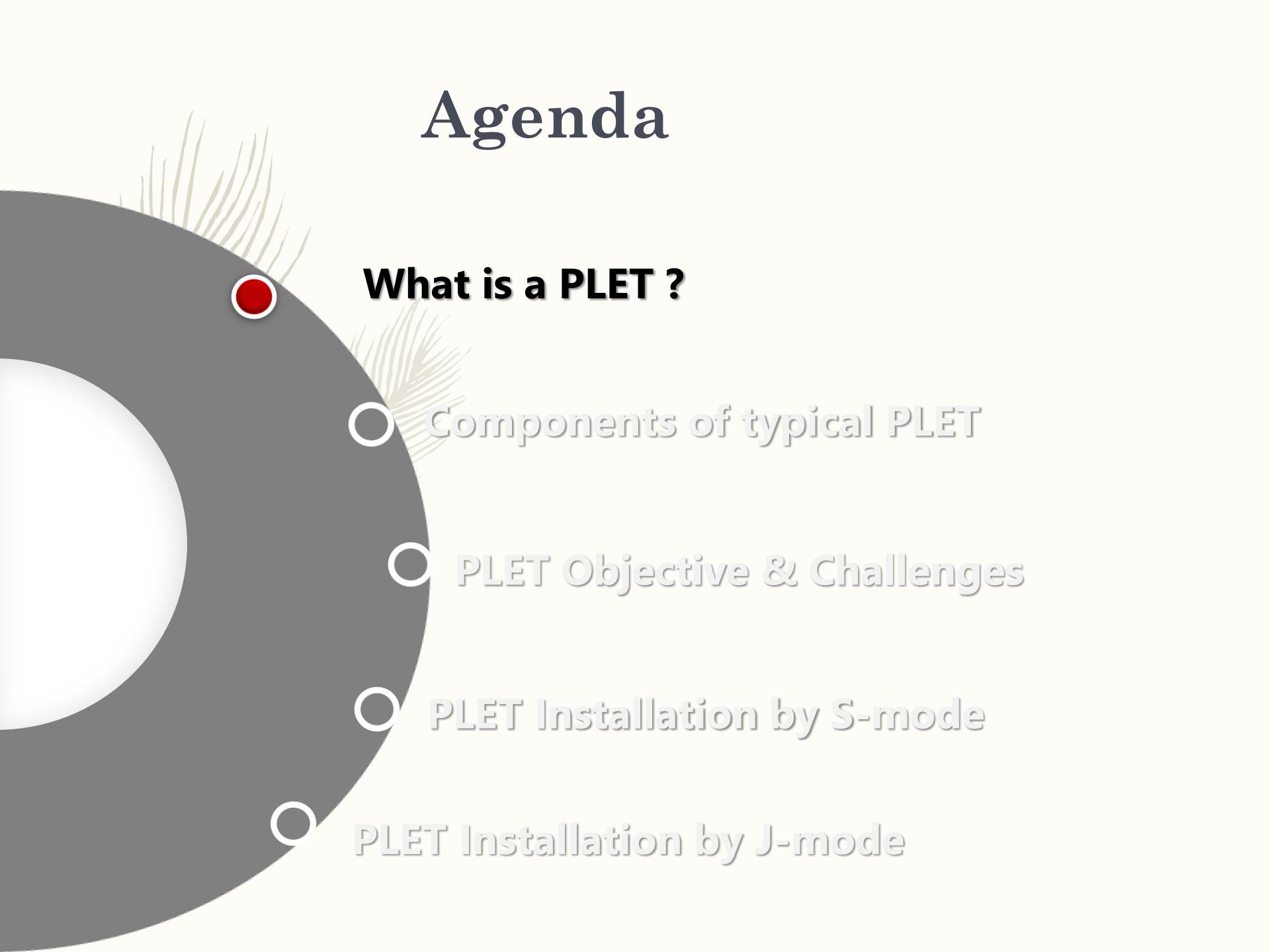
**What is a PLET ?**

**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

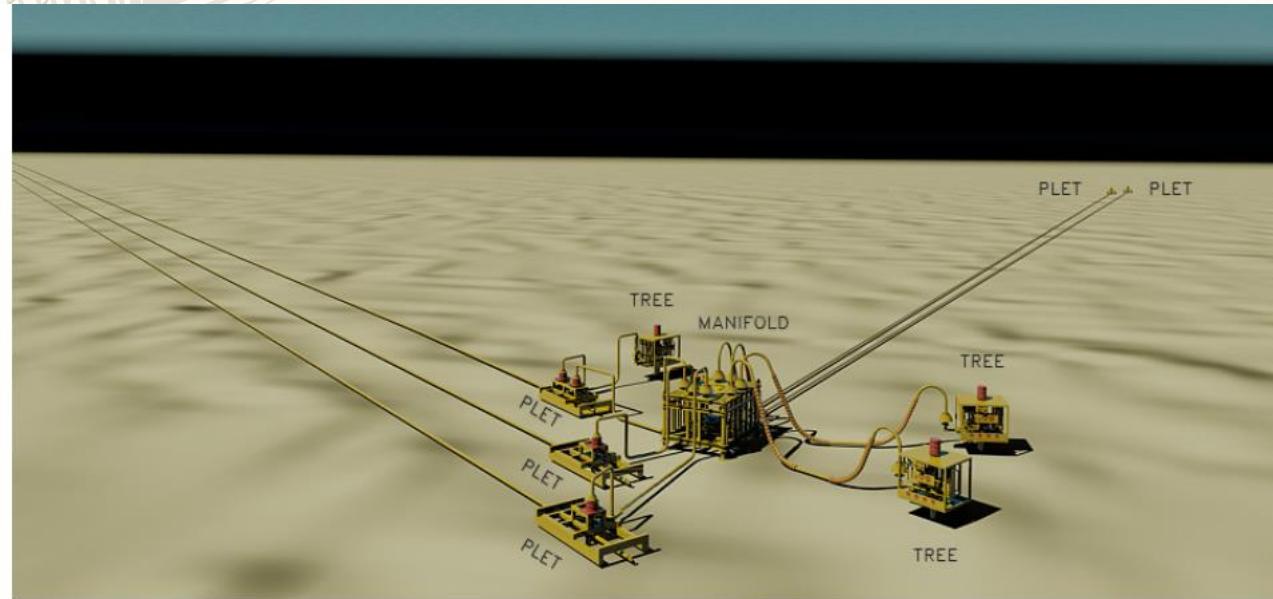
# What is a PLET and what is difference between PLEM & PLET

## 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.*

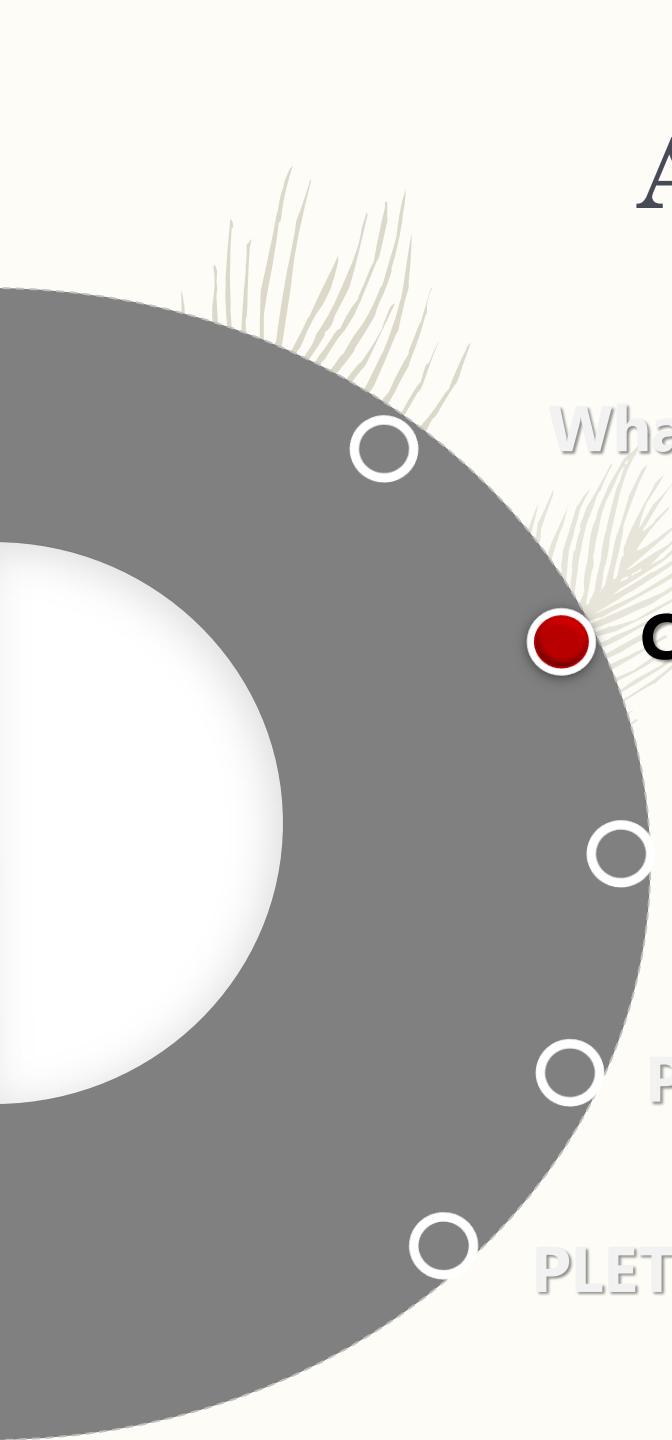
## PLEM – Pipeline End Manifold

*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.*

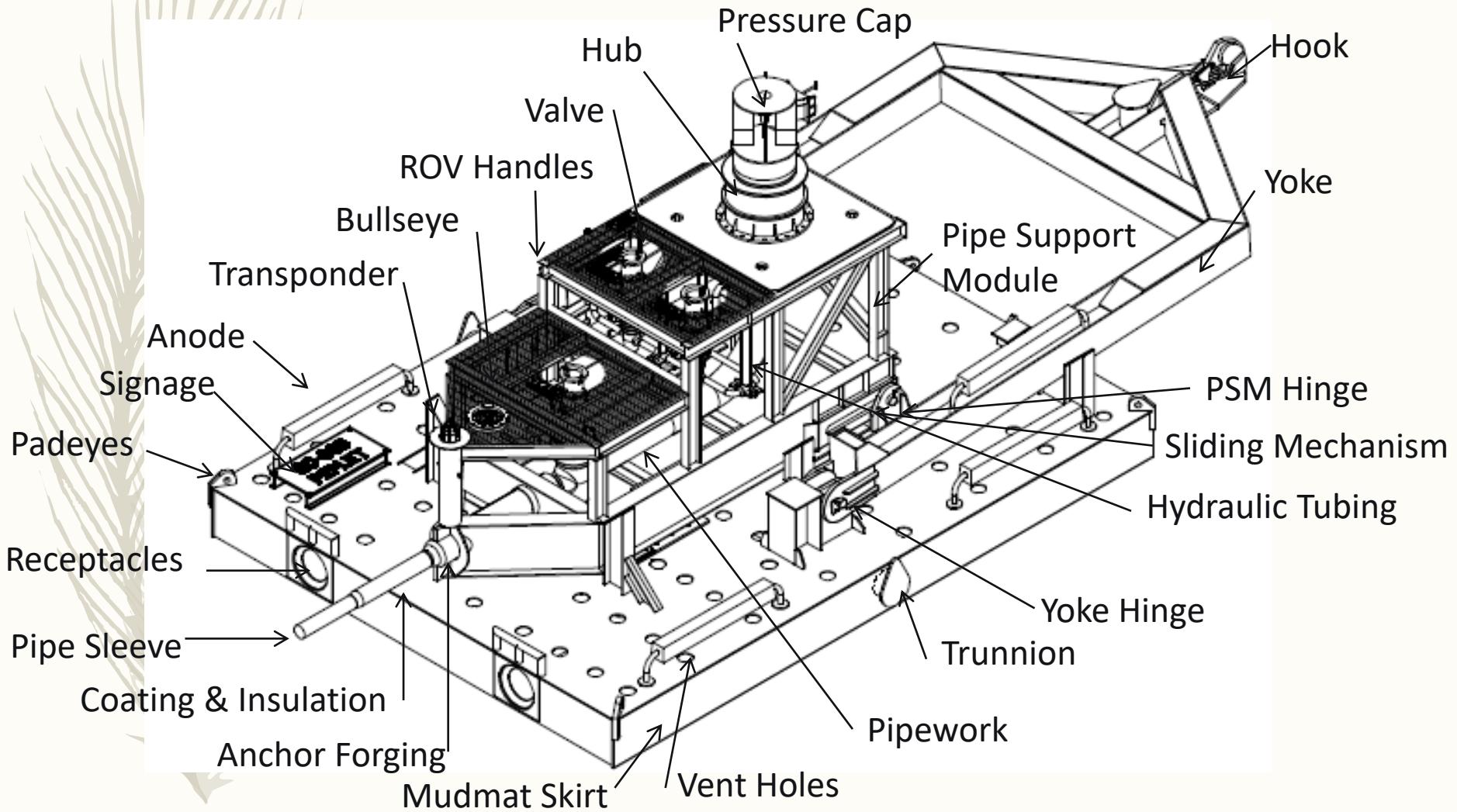


***Typical Structures – PLETs, Trees, Manifolds***

# 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)



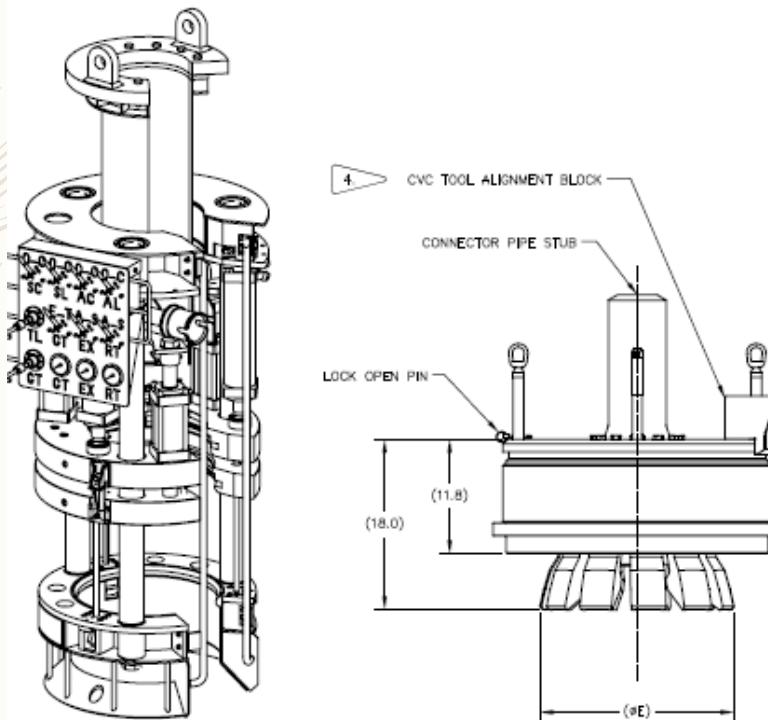
***Cameron Subsea  
Hydraulic  
Actuated Gate Valve  
(9in, 15,000psi)***



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

# Hubs, Connectors, Pressure Caps

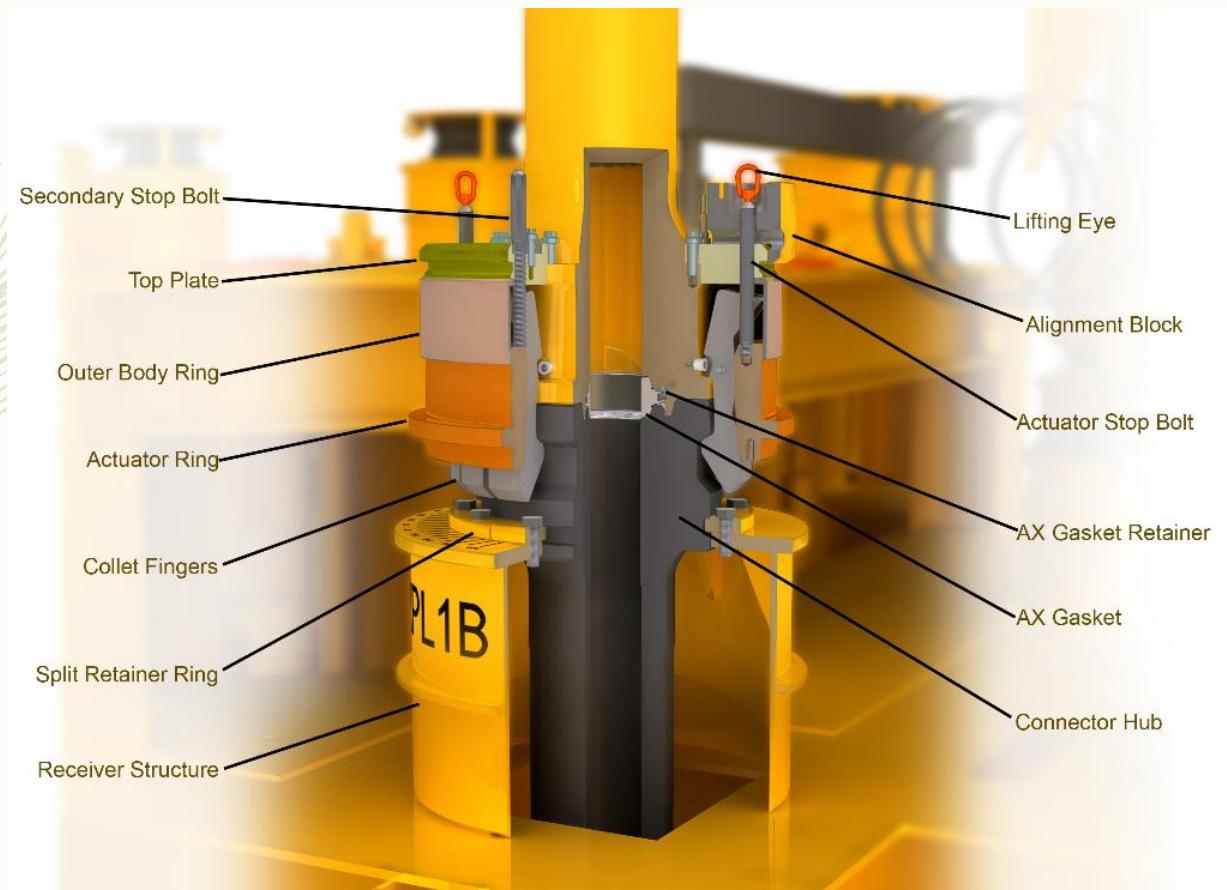
- Any size or weight
- Min clearance between hubs
- Between closest item
- Compatible / consistent materials (pups)
- 360deg sight access
- Windows
- Vertical connections



***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

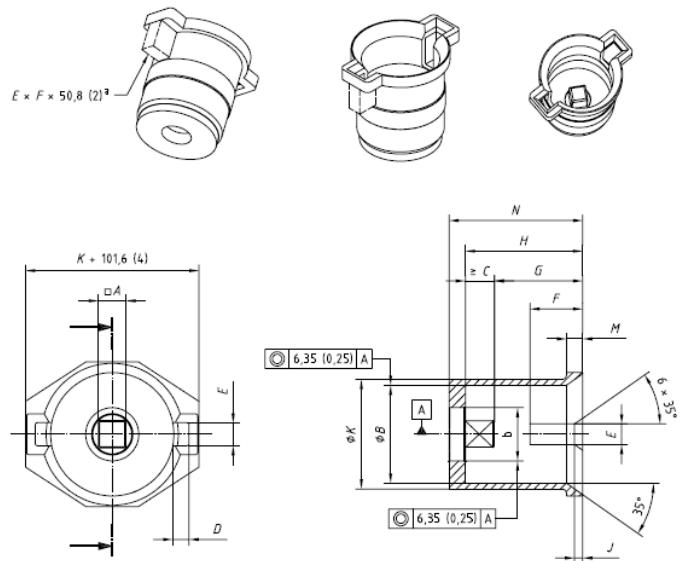


**CVC Connector**

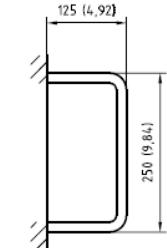
# ROV Interfaces

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

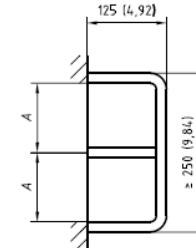
★ *Integrate ROV interfaces where possible  
to reduce removal time subsea*



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



Bar diameter = 20 mm (0,75 in)  
Tensile strength = 450 N/mm<sup>2</sup> (65 kip/in<sup>2</sup>)  
a) Type A

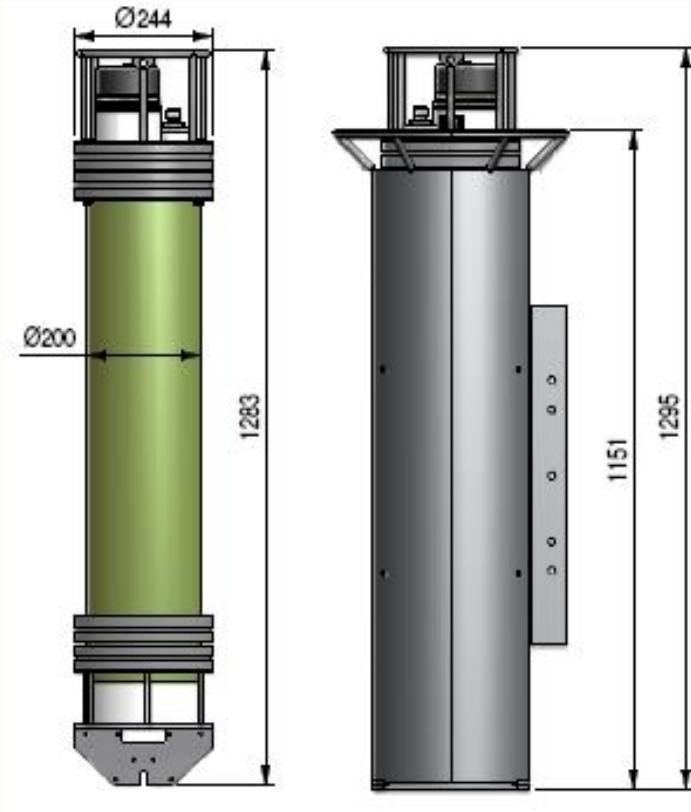


Bar diameter = 51 mm (2 in) or 20 mm (0,75 in)  
Tensile strength = 450 N/mm<sup>2</sup> (65 kip/in<sup>2</sup>)  
b) Type B

# Transponder

Facilitate positioning & orientation of PLET

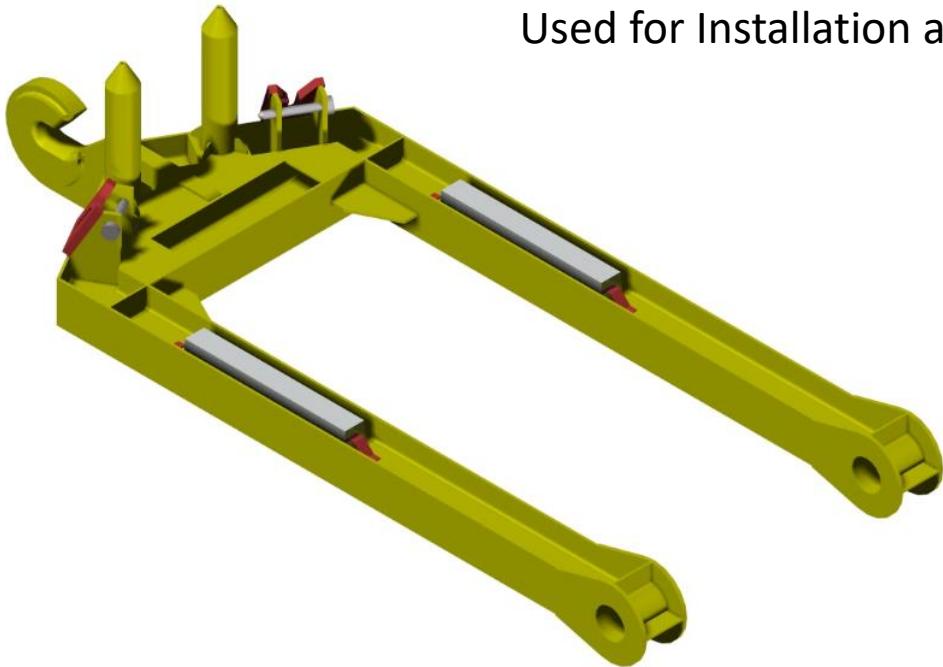
- High up and as far away from the structure as possible
- Clear line of sight to the vessel
- No clashing



*Transponder and Bucket*

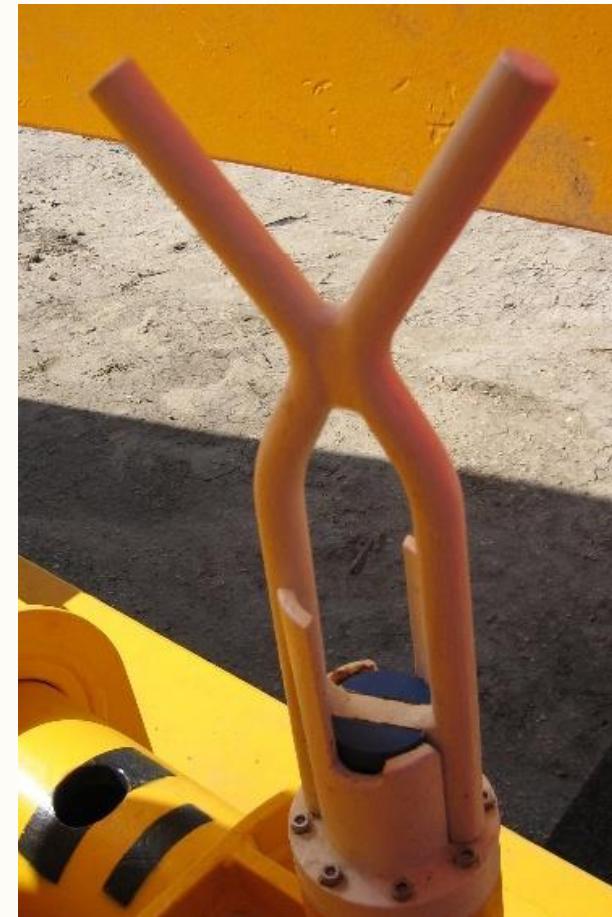
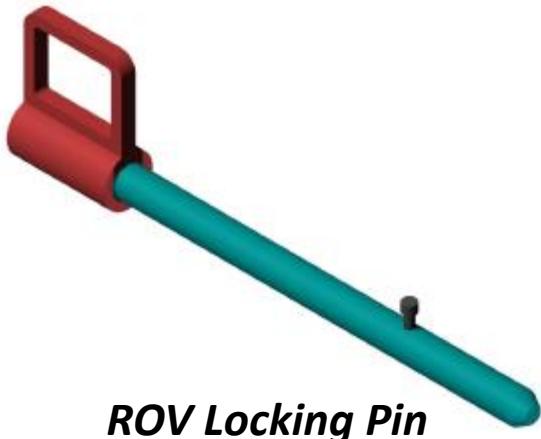
# Yoke

Used for Installation and recovery



# Locking Pins

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



*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

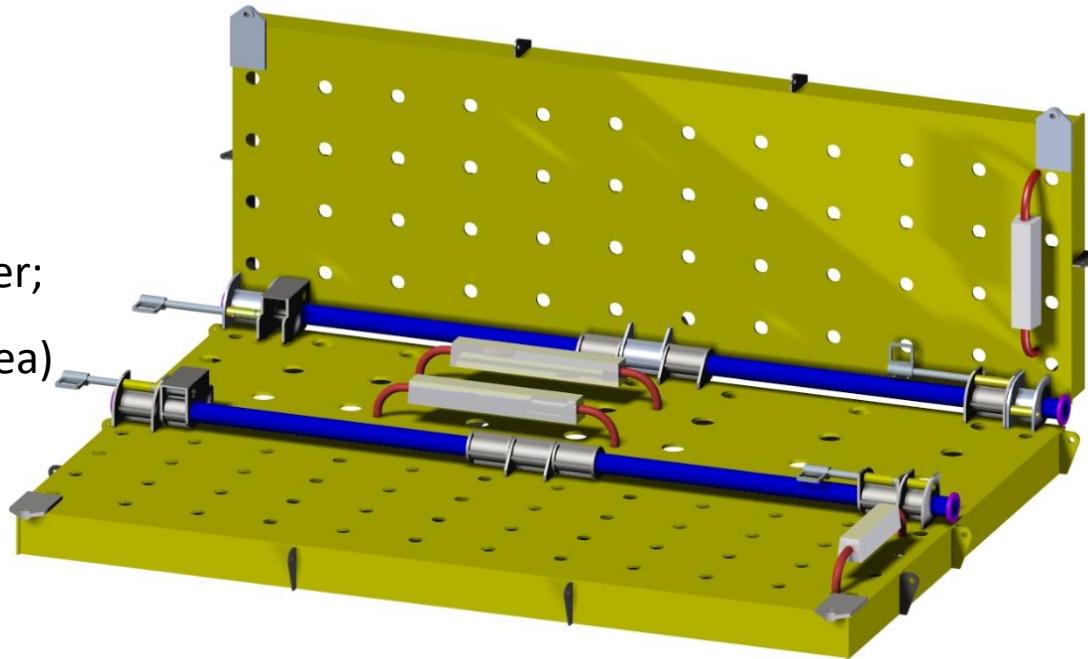
- Stability during installation
- Reduction in pipe stress
- Syntactic foam



***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

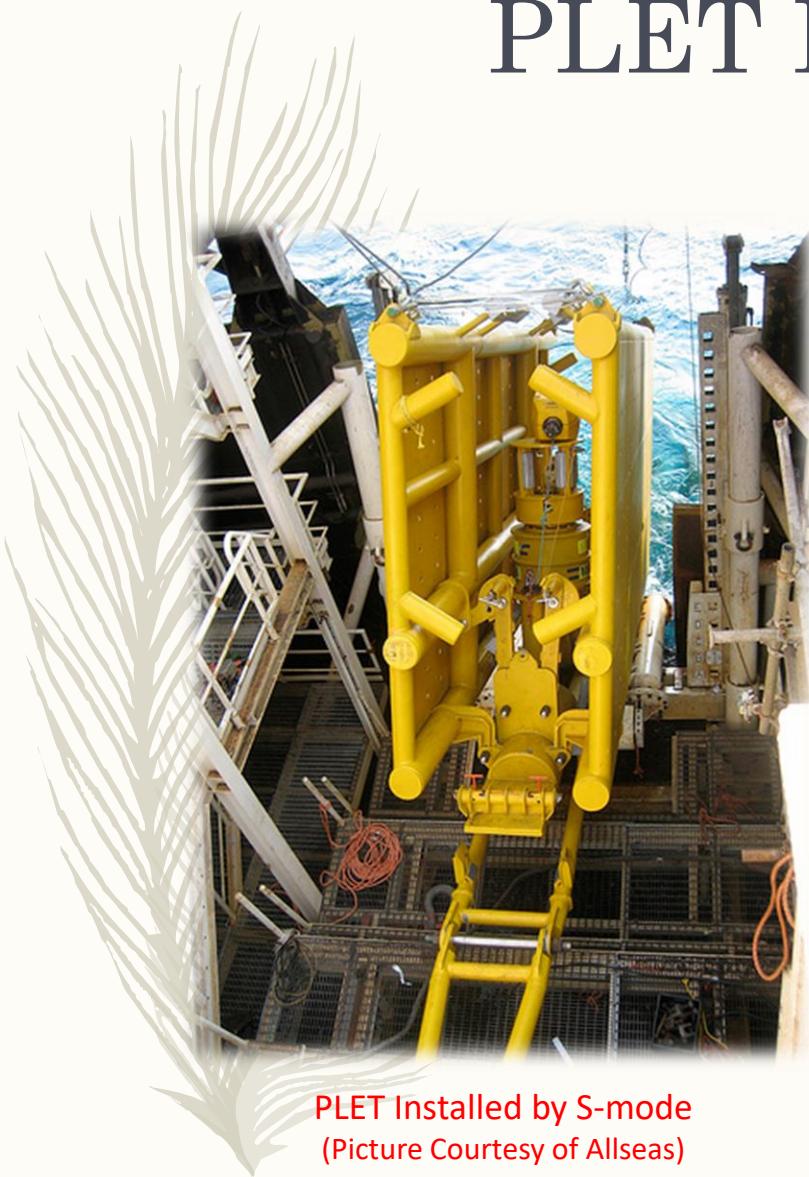
- Definition of Design Basis (what we will do and how we will do it)
- Definition of soil strength
- Definition of loads (jumpers, expansion)



# 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

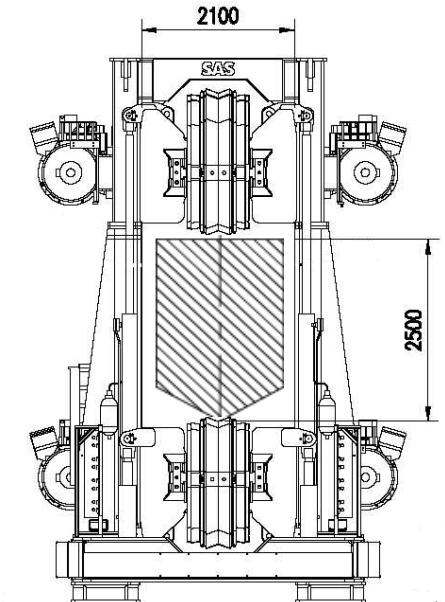
# PLET Design for S-mode

Critical Issue:

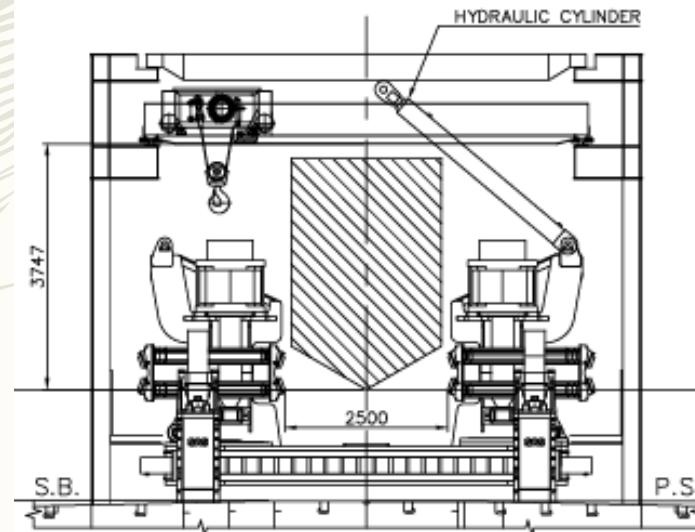
Safe Passage through Pipelay Vessel's  
Firing Line and Stinger.

PLET Dimension Limitation

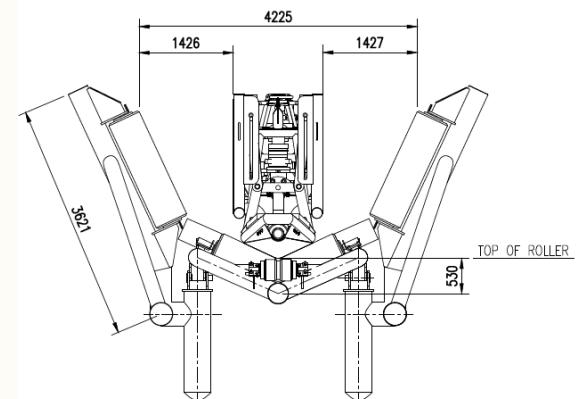
No Pipeline Over-Strain



Typical Clearance @  
Vertical Tensioner



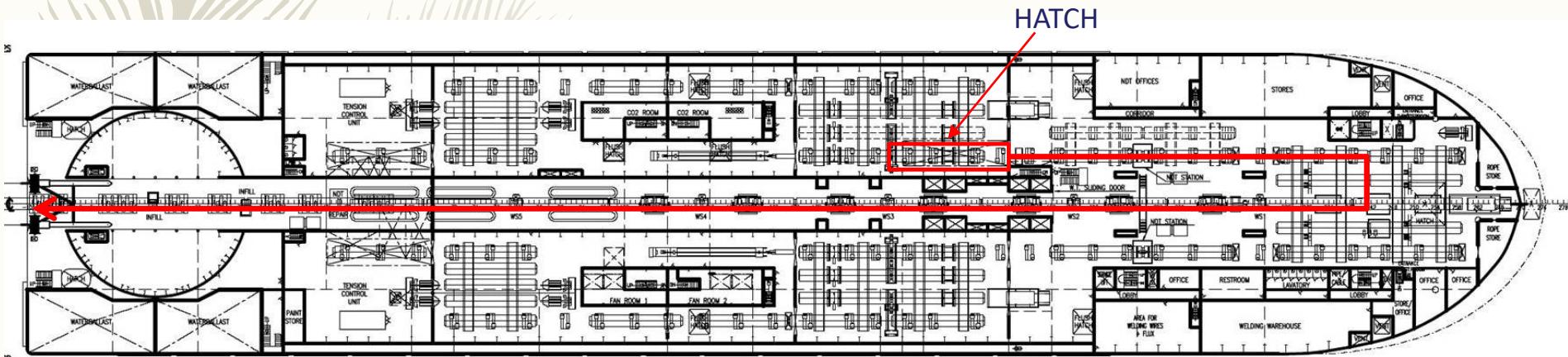
Typical Clearance @  
Horizontal Tensioner



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 conveyors, gantries or winches;



PLET @ 1<sup>st</sup> 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



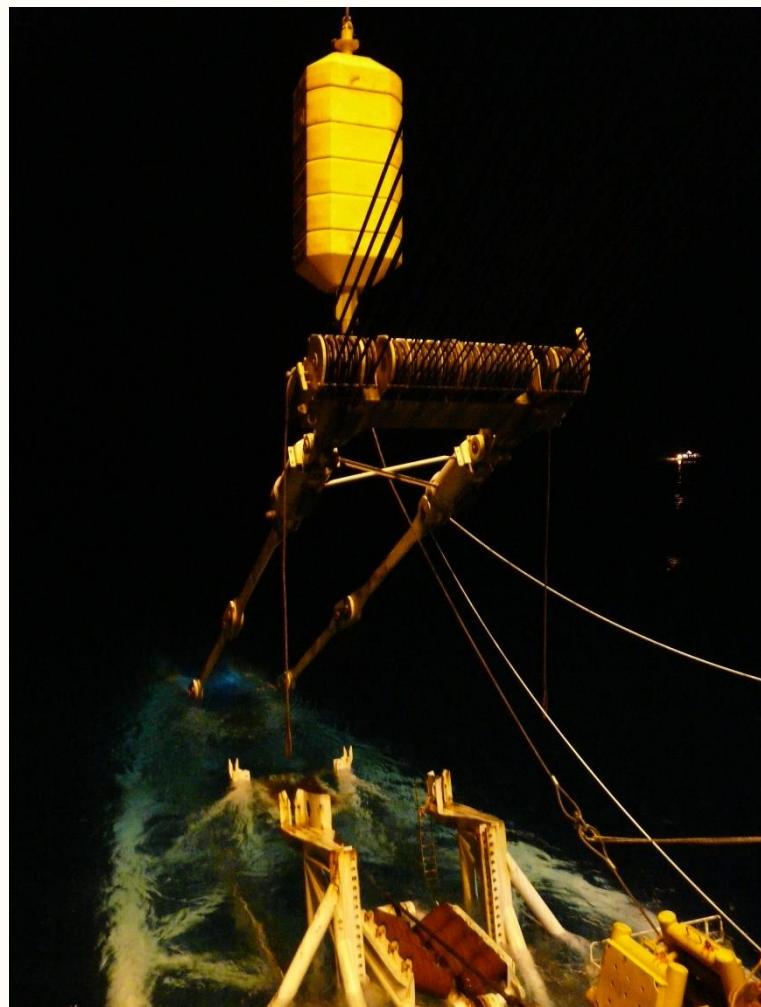
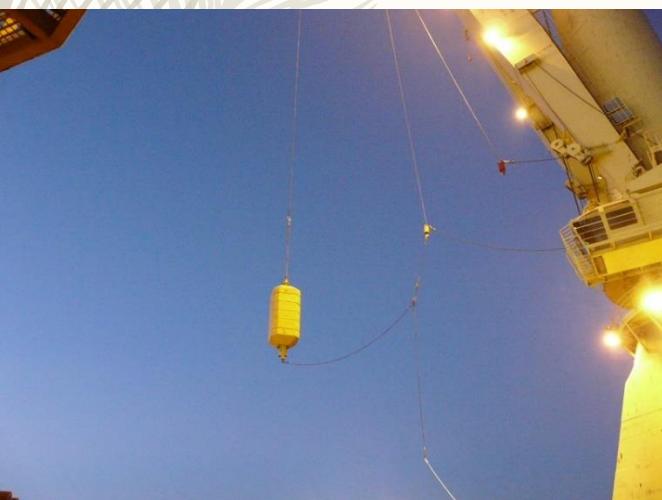
PLET at Stern with Folded  
Mudmat

# PLET entering the stinger and into the sea



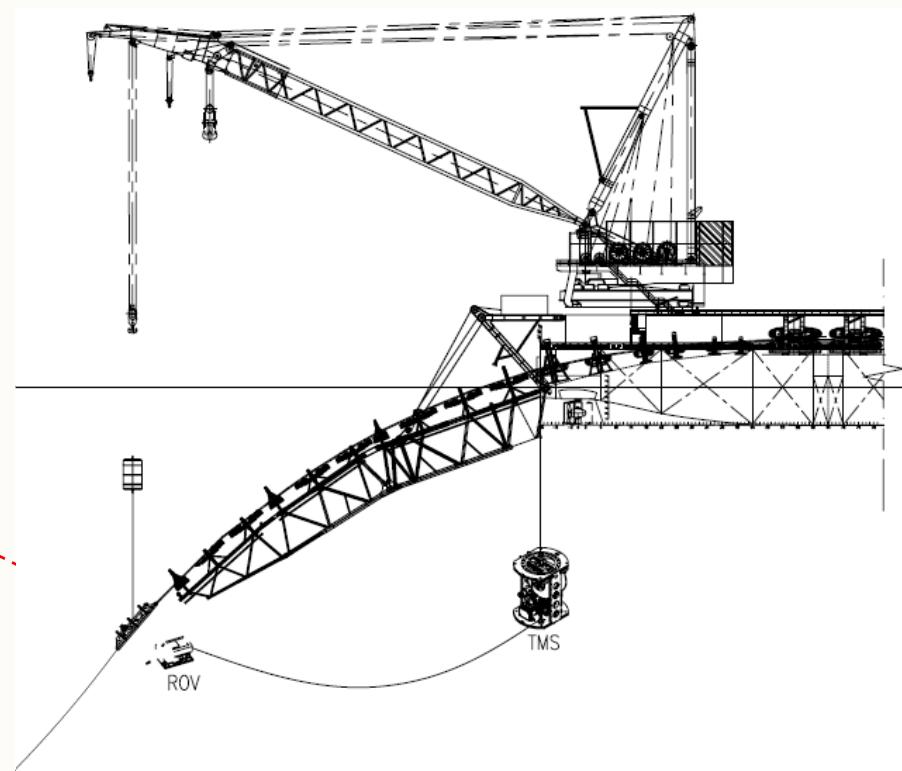
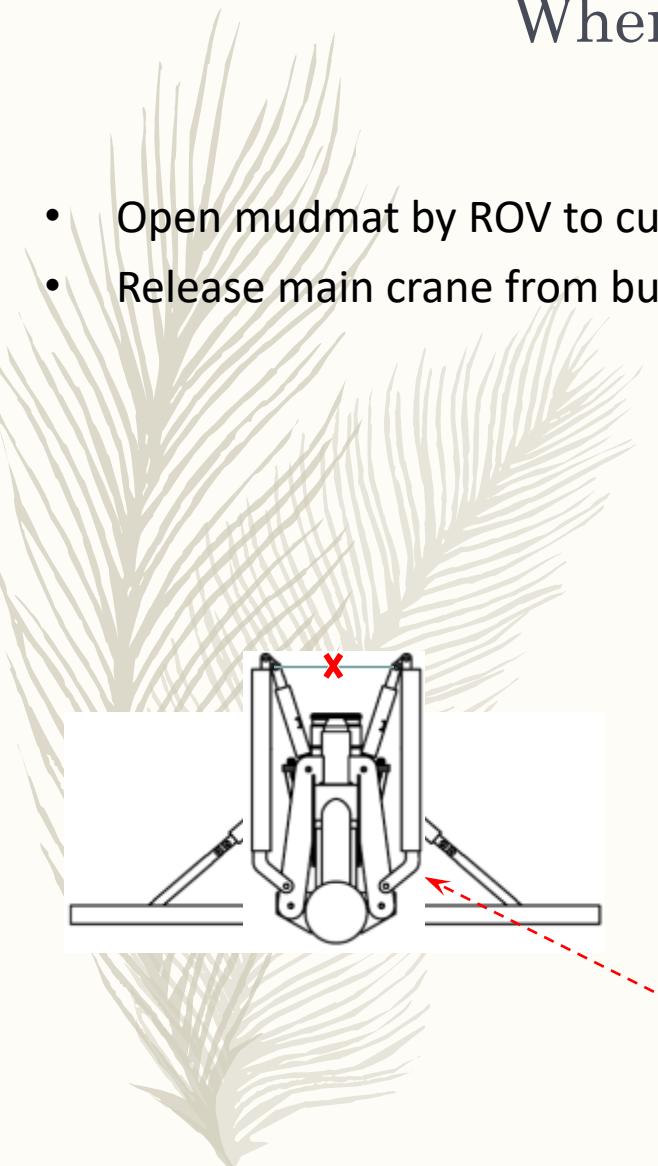
# Buoyancy Modular Installation

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



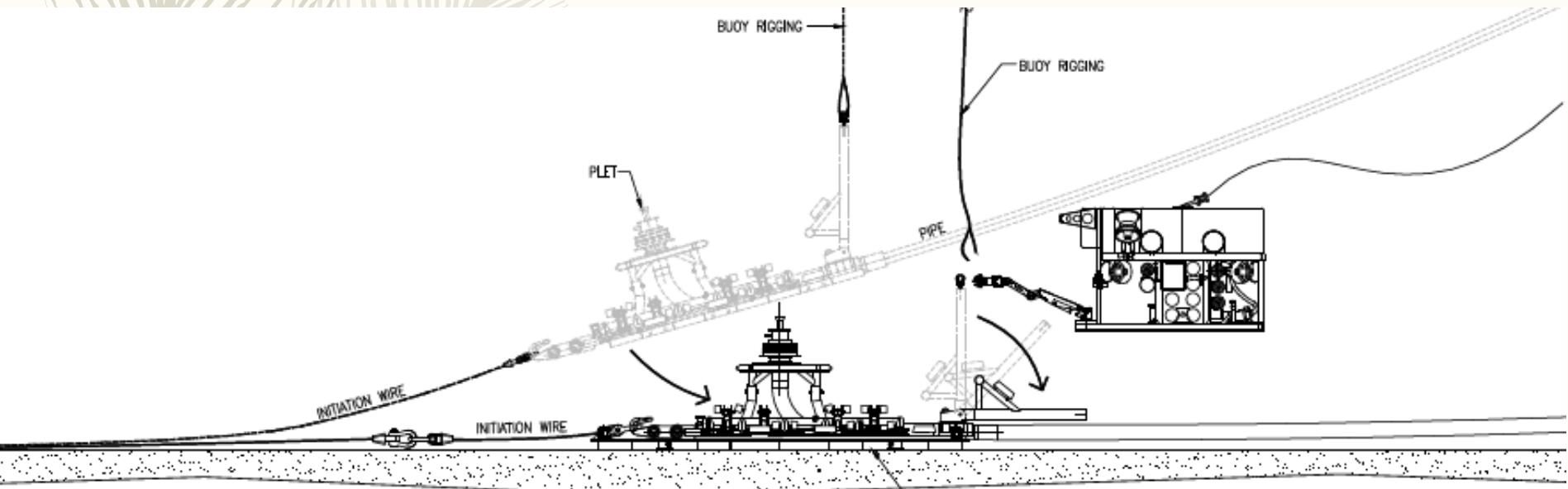
# When PLET Past Stinger

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



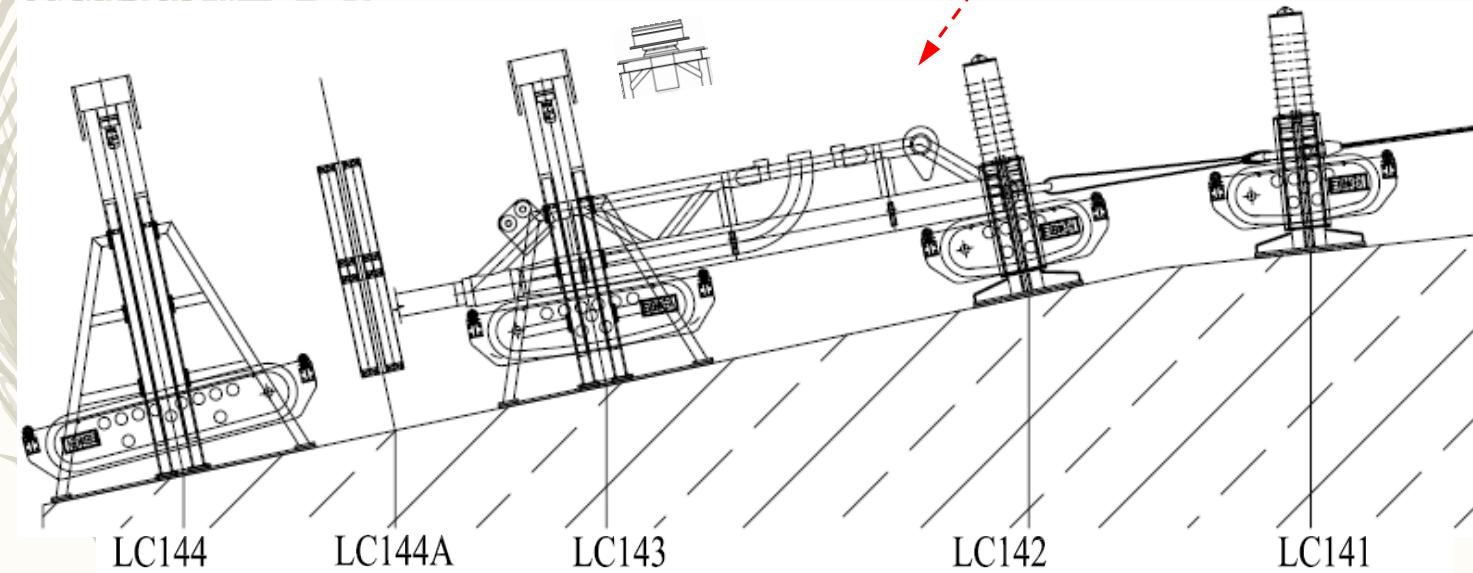
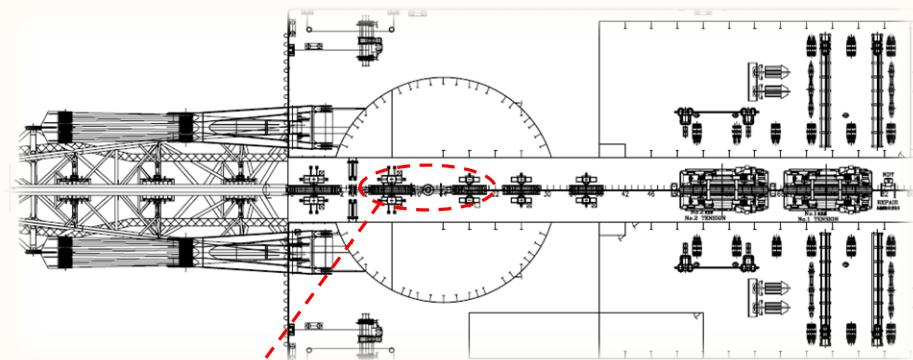
# PLET Landing on Seabed

- 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.



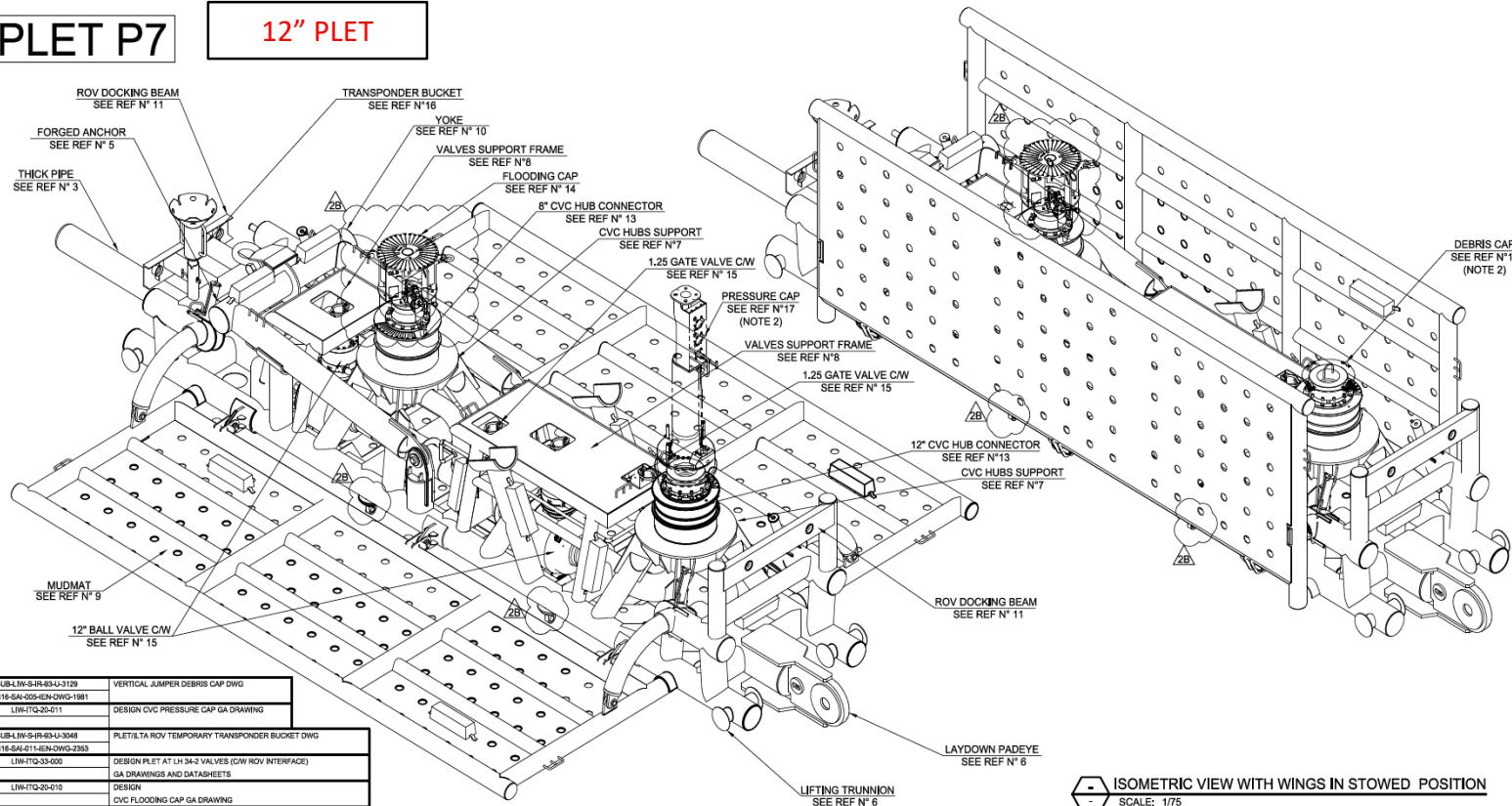
# Agenda

- What is a PLET ?
- Components of typical PLET
- PLET Objective & Challenges
- PLET Installation by S-mode
- **PLET Installation by J-mode**

# 12" PLET Details

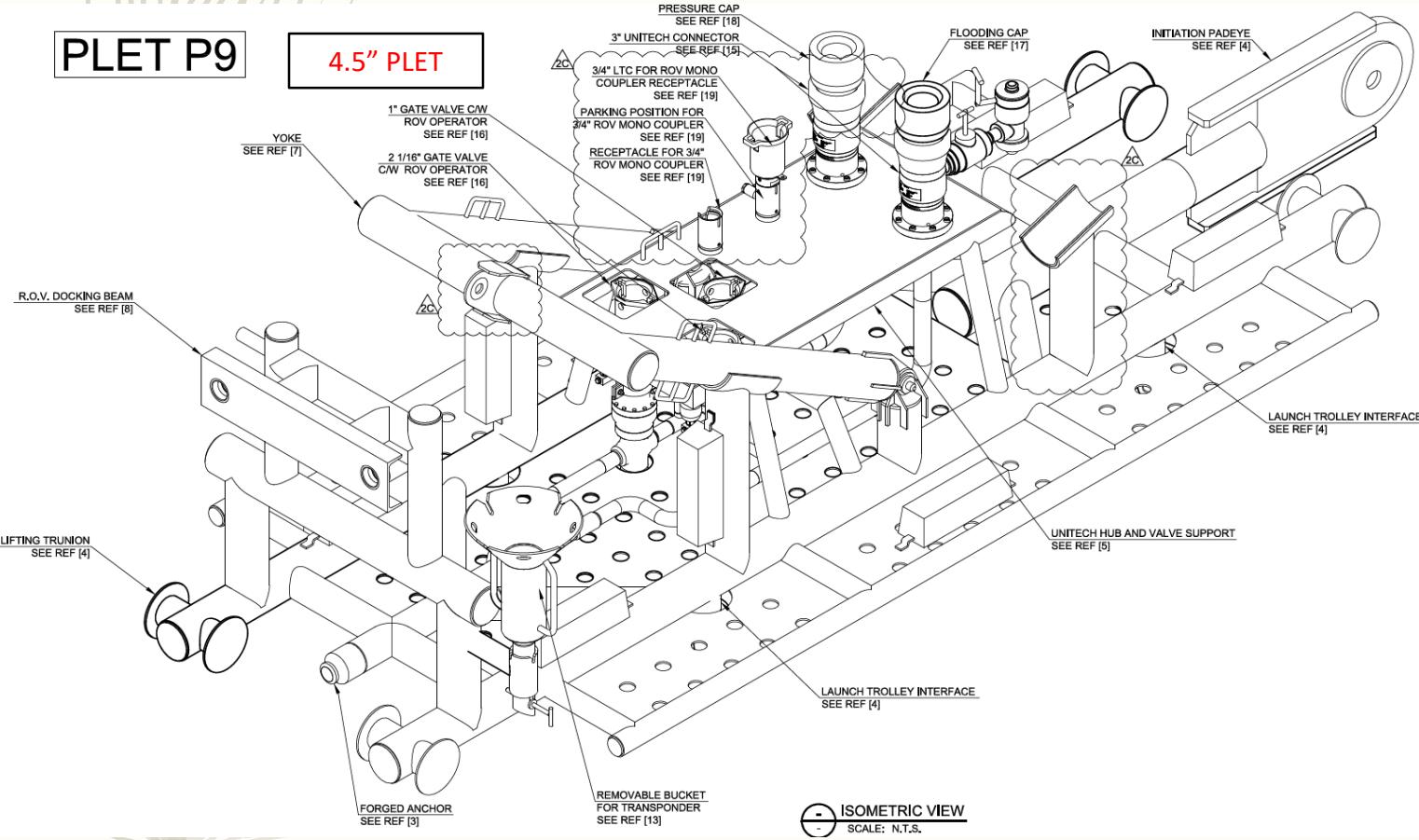
**PLET P7**

**12" PLET**

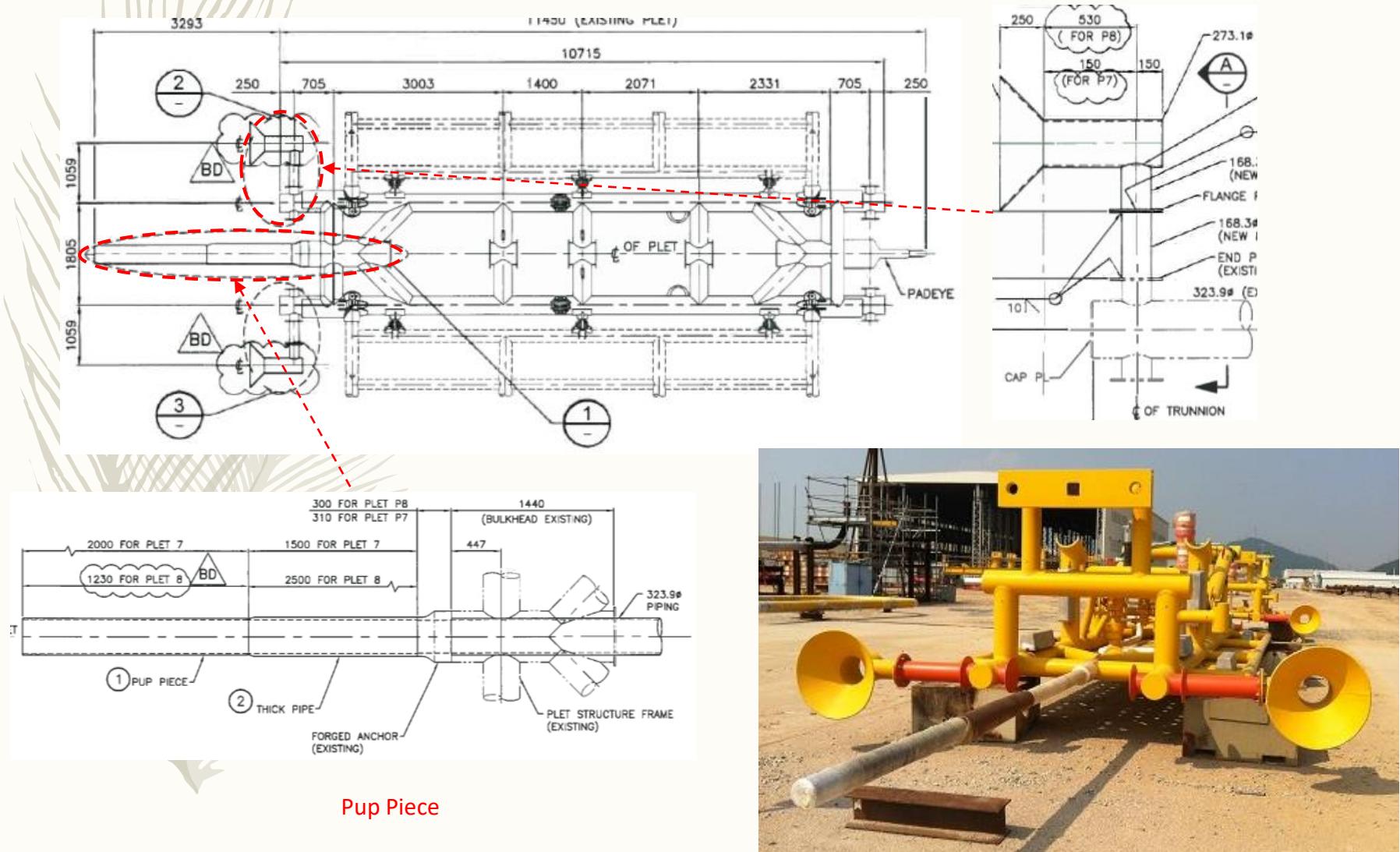


SUB4-IV-S-IR-03-U-3129	VERTICAL JUMPER DEBRIS CAP DWG
F12416-SA-005-EN-DWG-1981	
LIW-TQ-20-011	DESIGN CVC PRESSURE CAP GA DRAWING
SUB4-IV-S-IR-03-U-3048	PLET/ITA ROV TEMPORARY TRANSPODNER BUCKET DWG
F12416-SA-011-EN-DWG-2353	
LIW-TQ-33-000	DESIGN PLET AT LH 34-2 VALVES (C/W ROV INTERFACE) GA DRAWINGS AND DATASHEETS
LIW-TQ-20-010	DESIGN CVC FLOODING CAP GA DRAWING

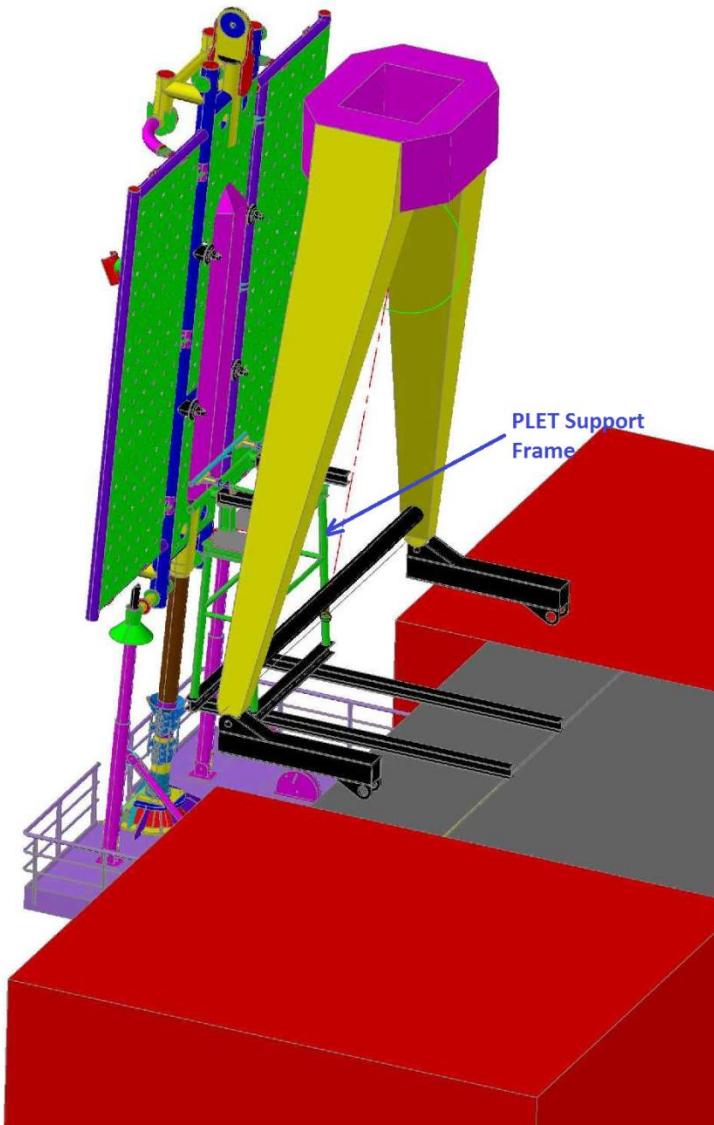
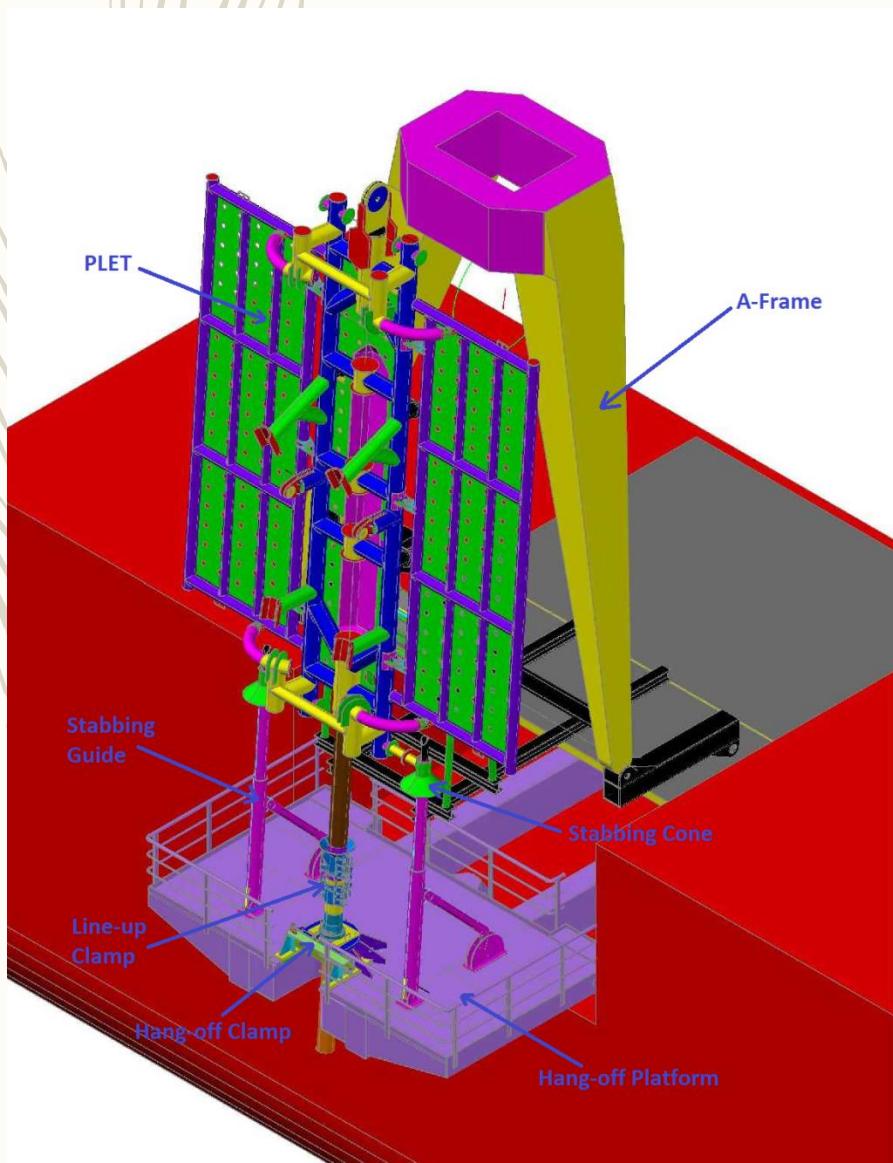
# 4.5" PLET Details



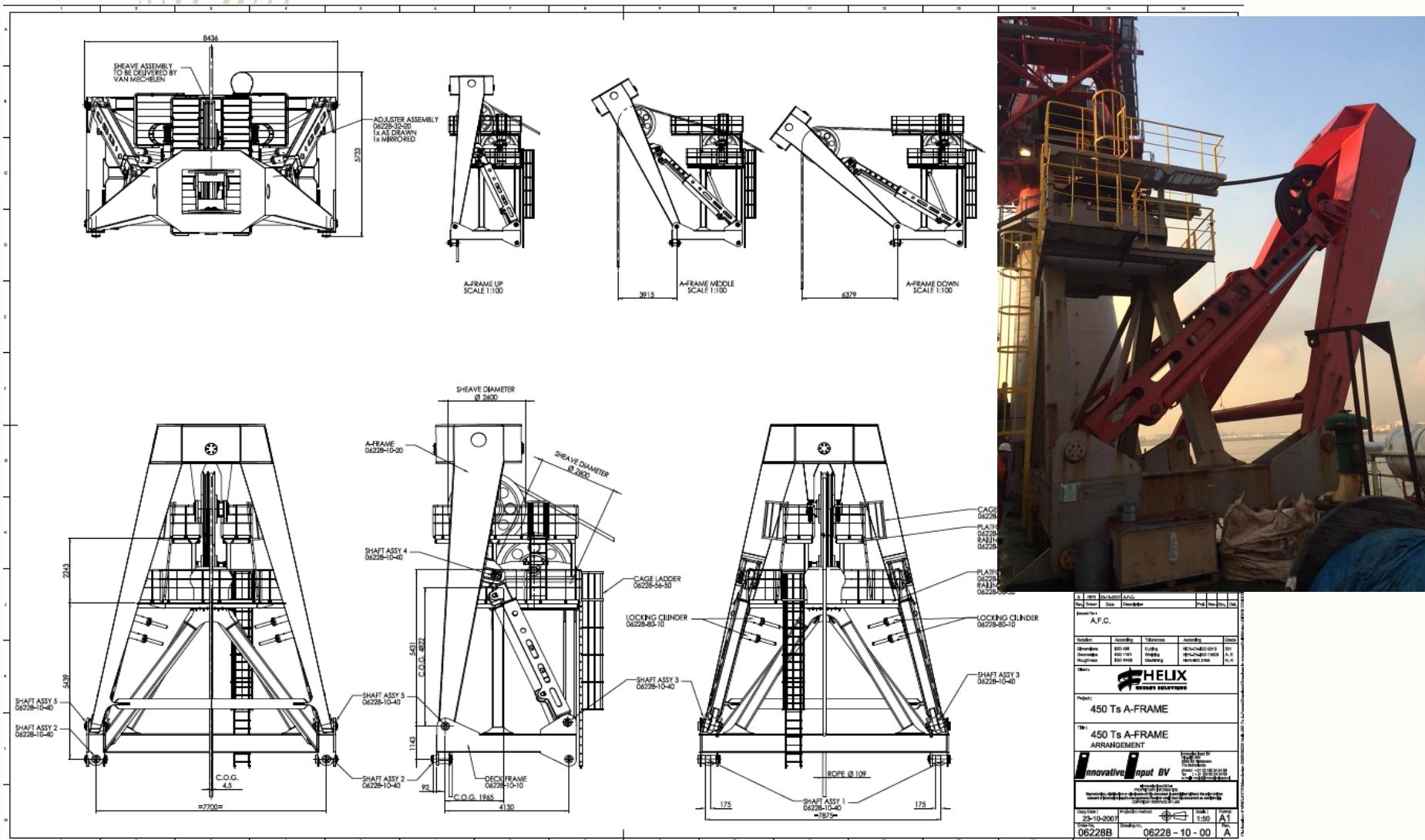
# PLET Modification



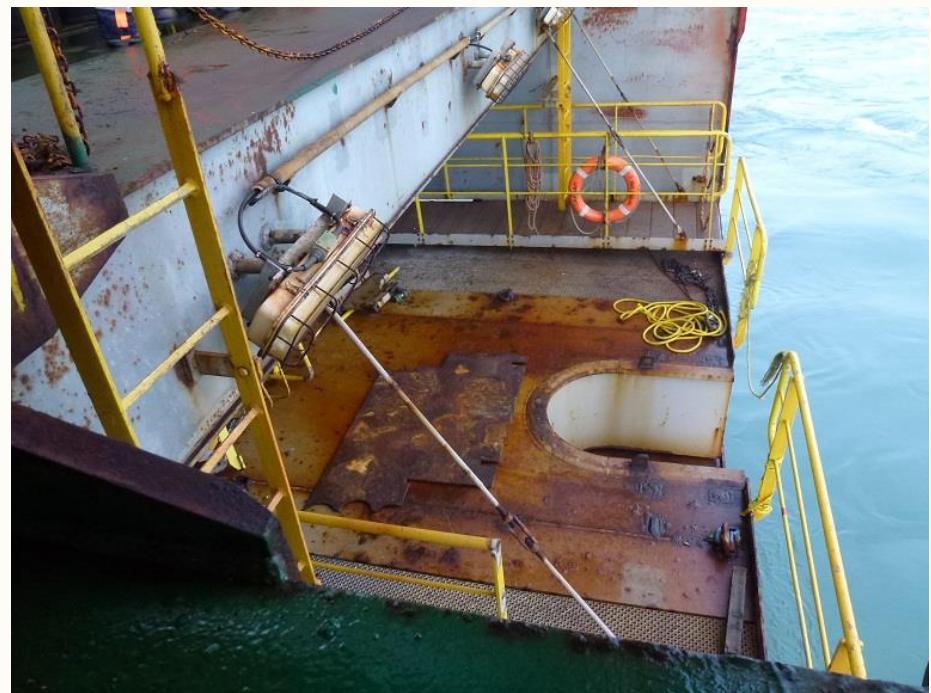
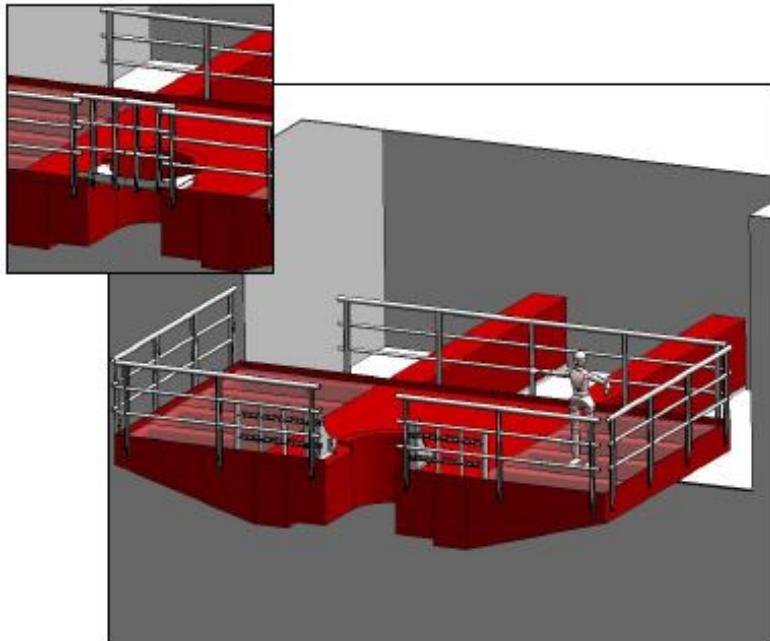
# LCE PLET J-Mode Installation System



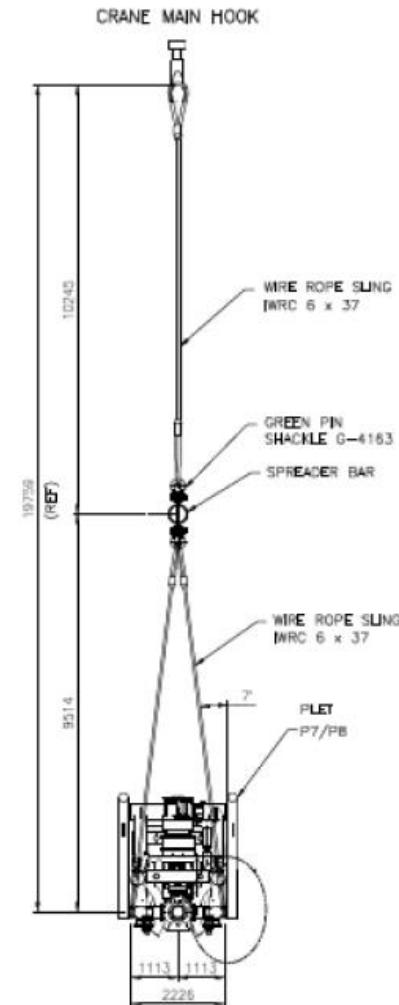
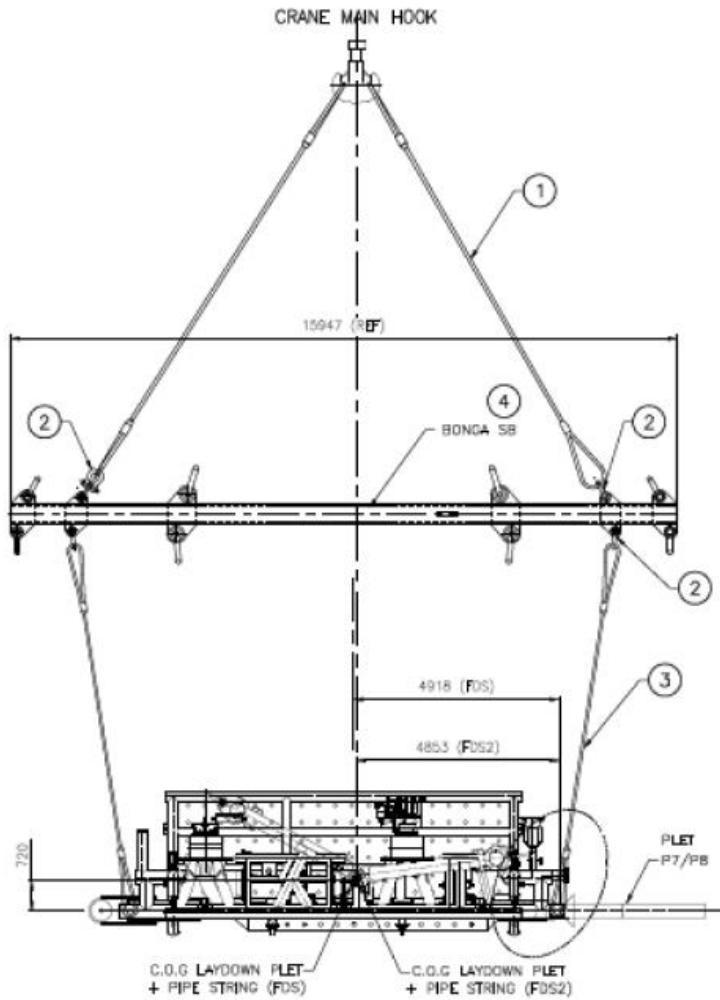
# PLET Installation Equipment – A-Frame



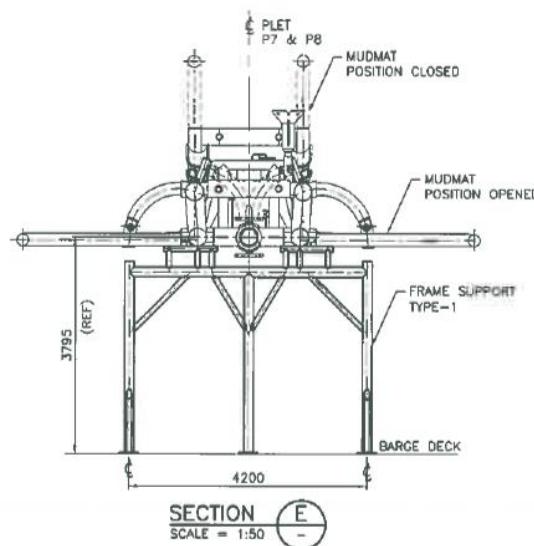
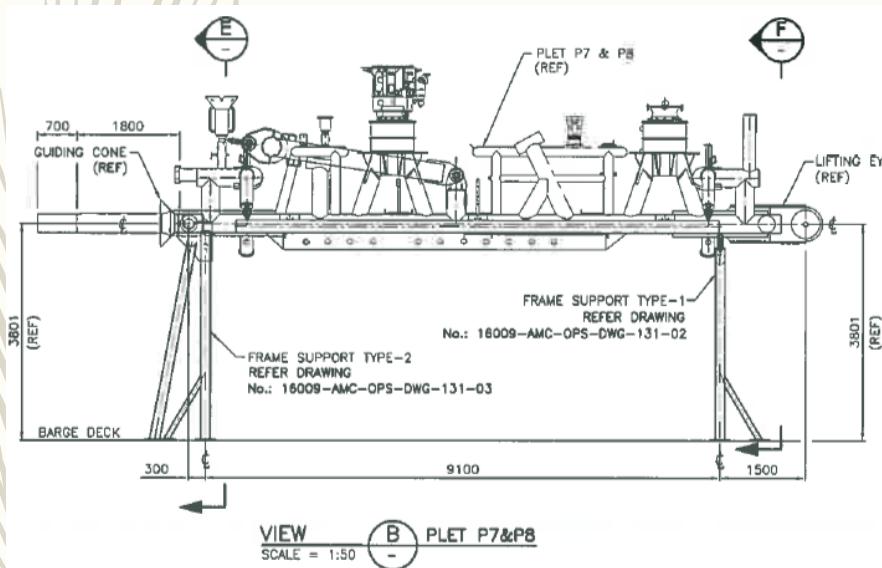
# PLET Installation Equipment – Hang-Off Platform



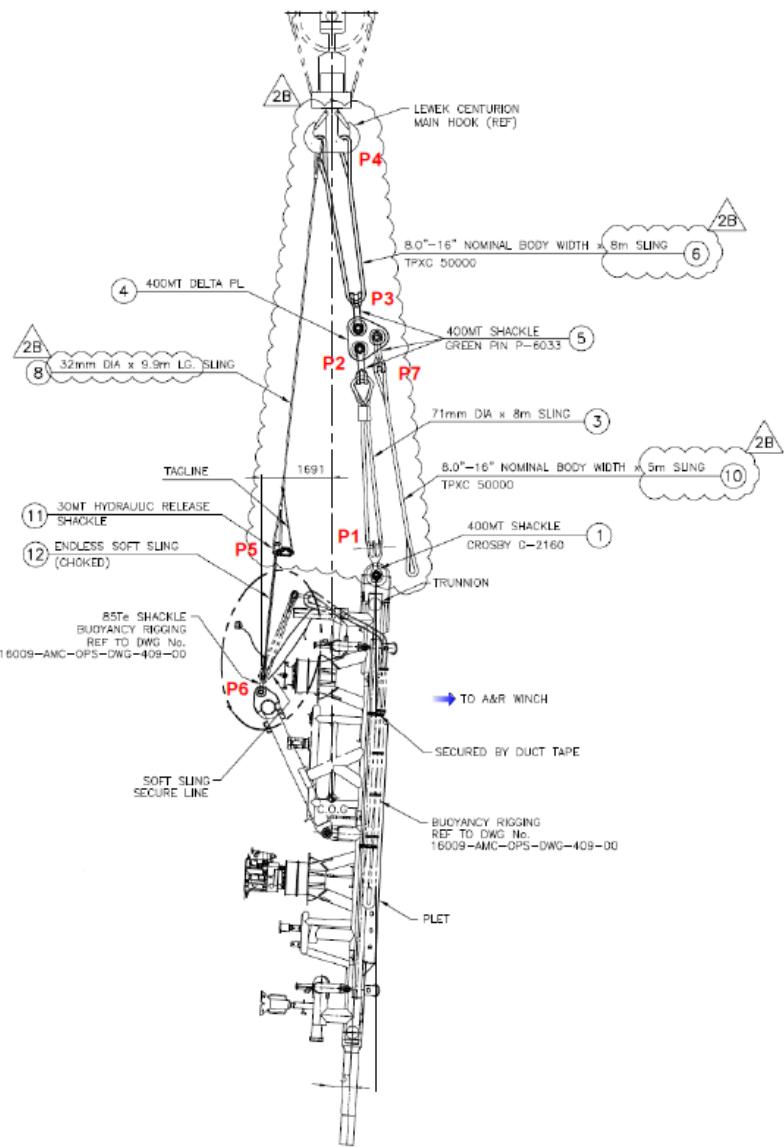
# PLET Horizontal Lifting Rigging



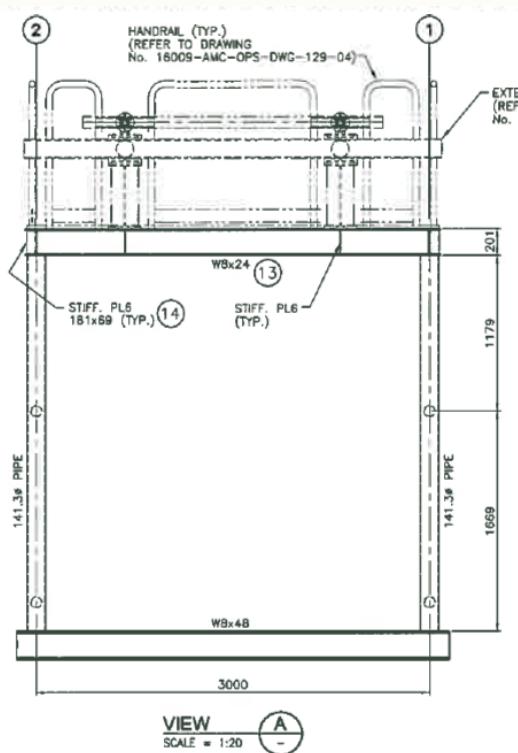
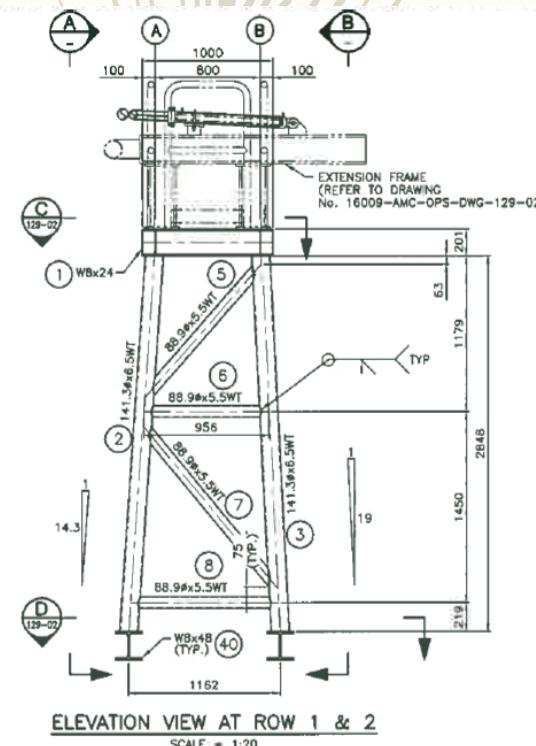
# PLET Upending Platform



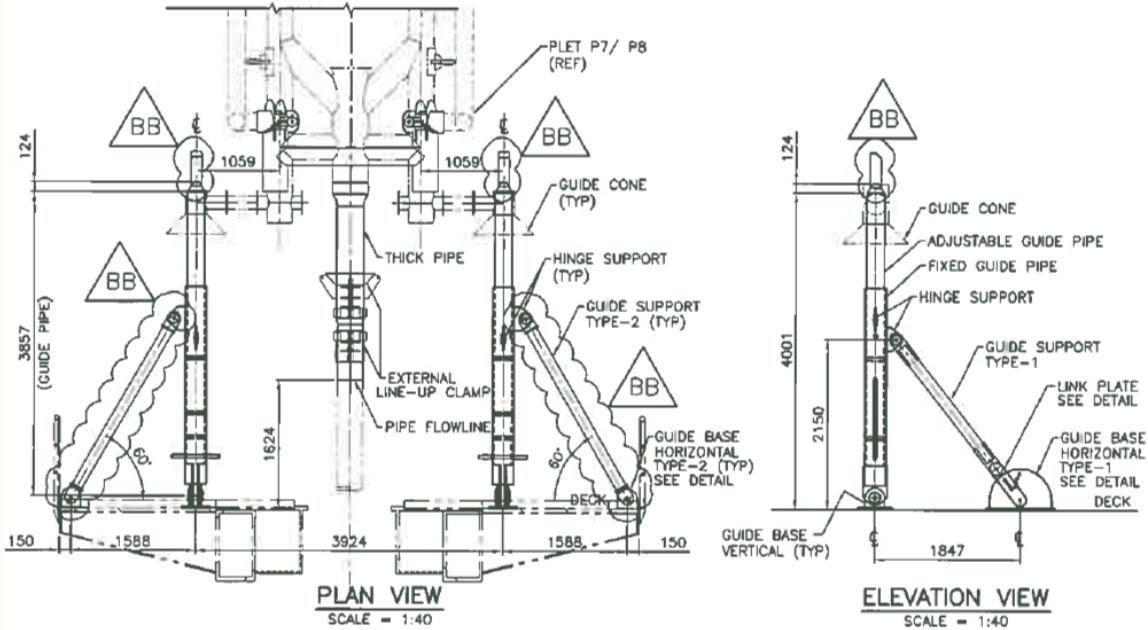
# PLET Upending / Vertical Lifting Rigging



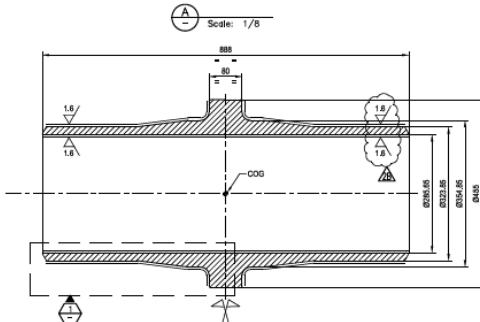
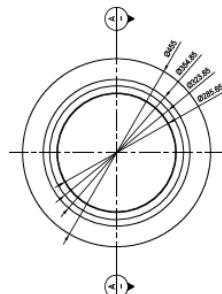
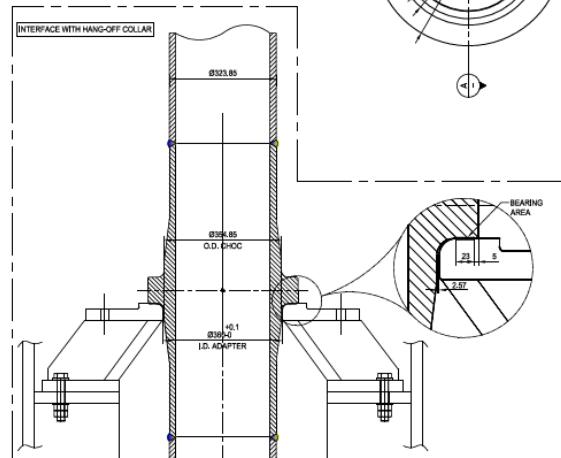
# PLET Support Frame



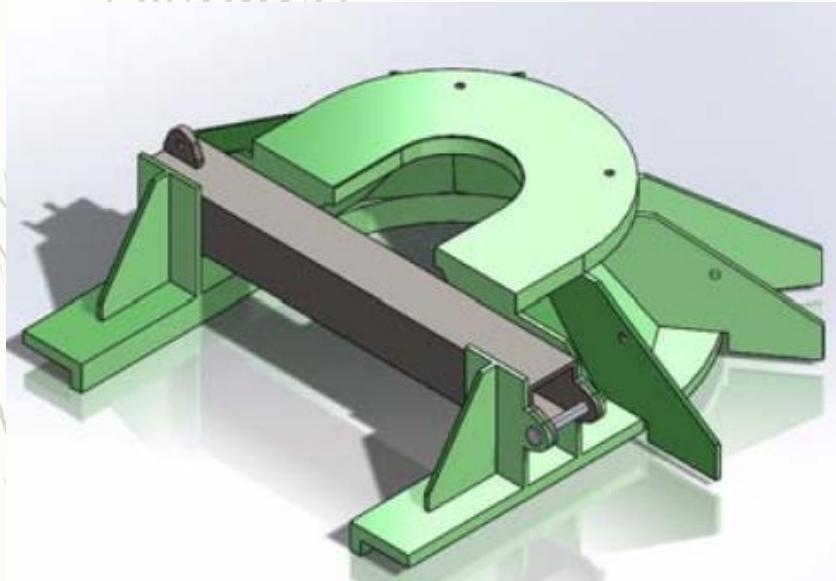
# PLET Stabbing Guide



# Pipeline Hang-off Collar



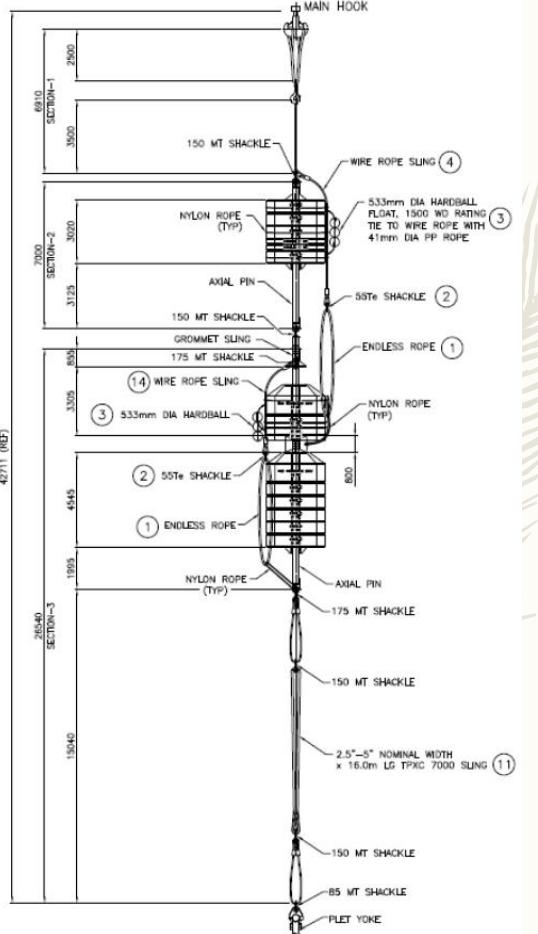
# Pipeline Hang-off Clamp



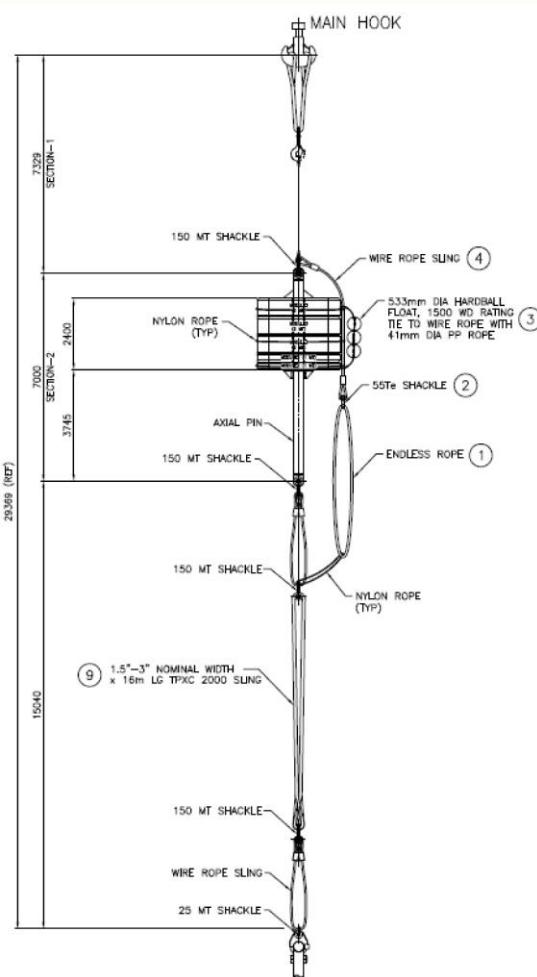
# Pipeline / PLET Line-up Clamp



# PLET Buoyancy Modular and Riggings



12" PLET (27 mT Net Buoyancy)



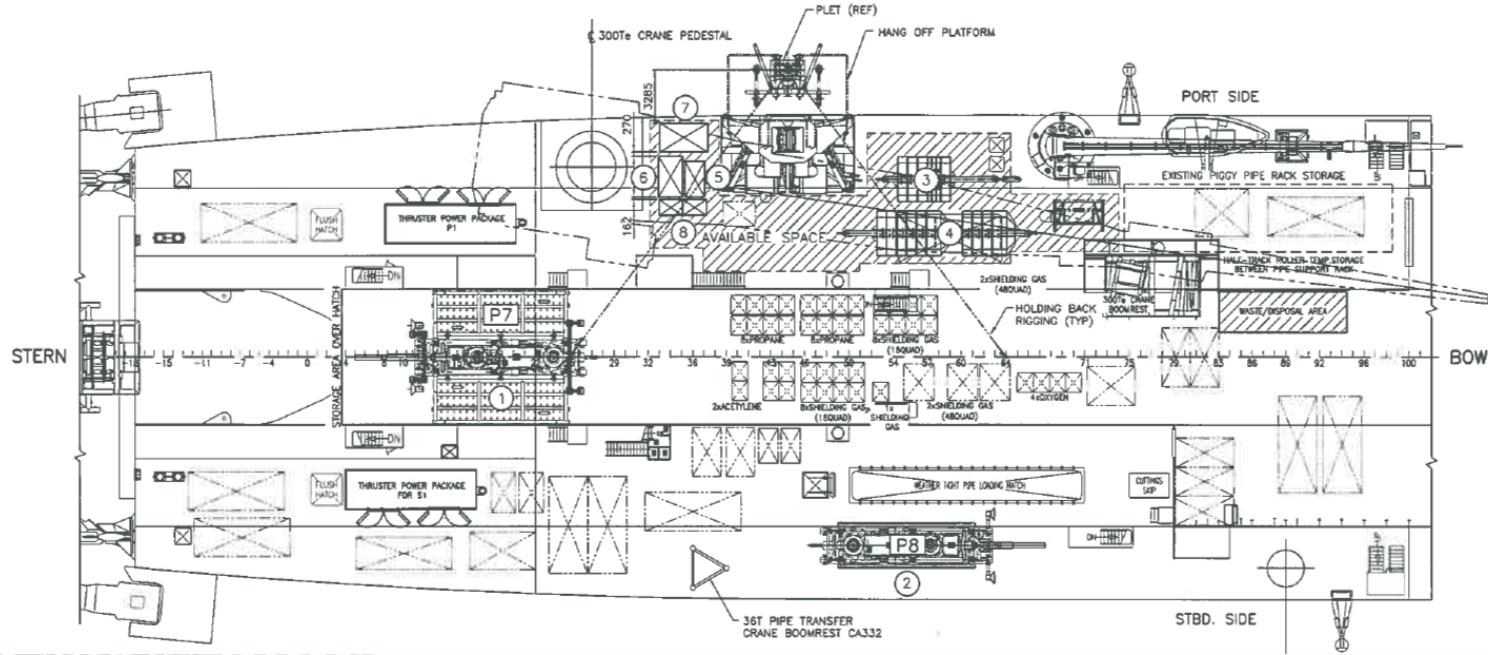
4.5" PLET (5.5 mT Net Buoyancy)



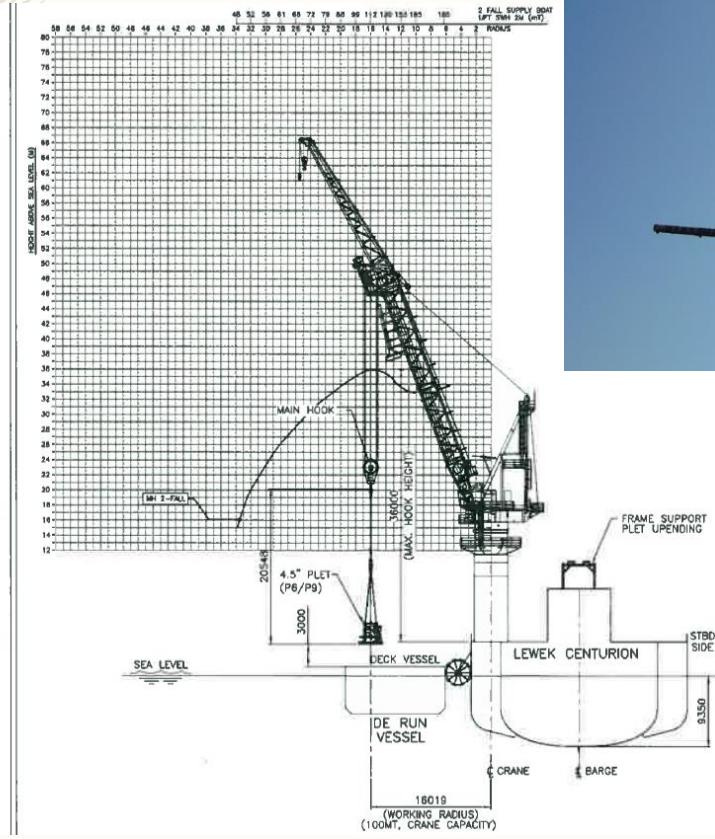
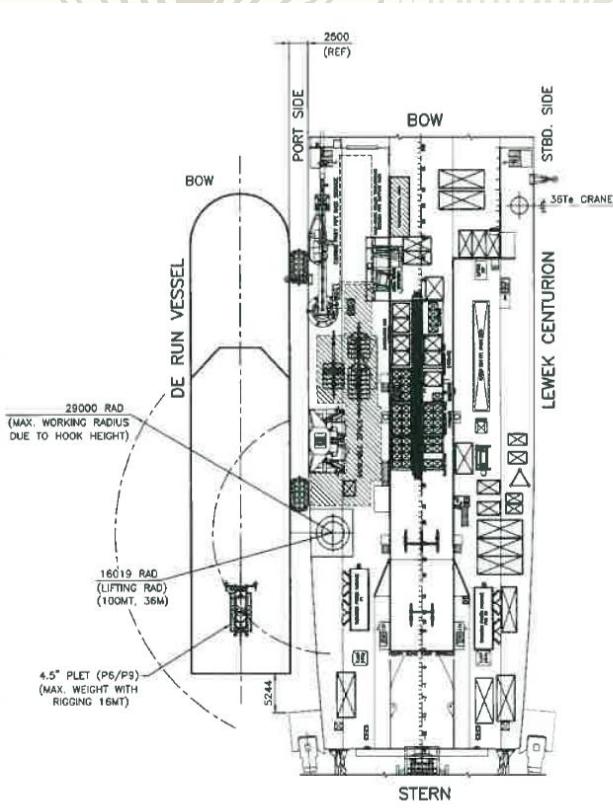
# Executive Summary for PLET Installation

- 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

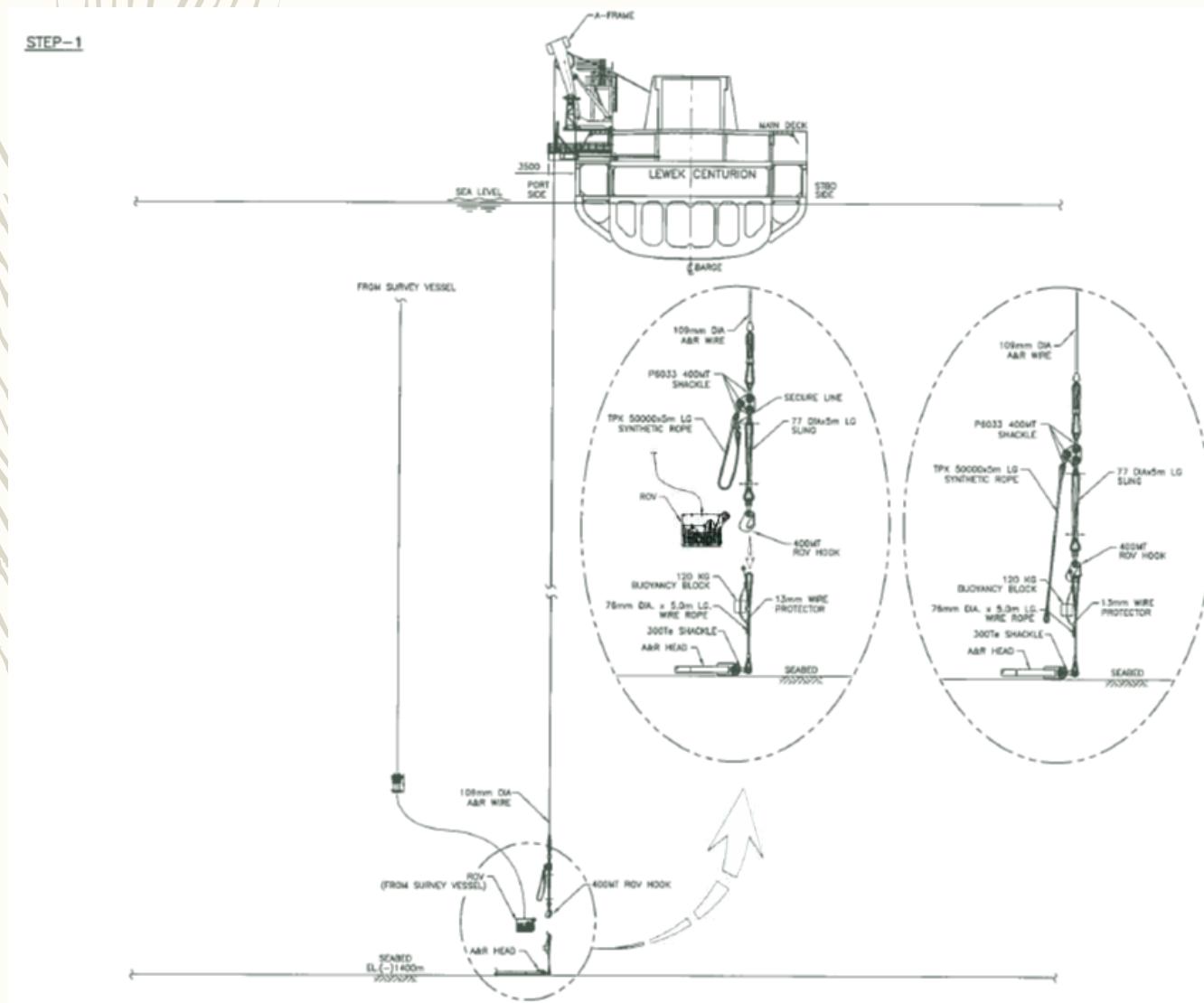
# Step 0 : LCE Deck Readiness for PLET Installation



# Step 1 : PLET Lifting from Supply Boat

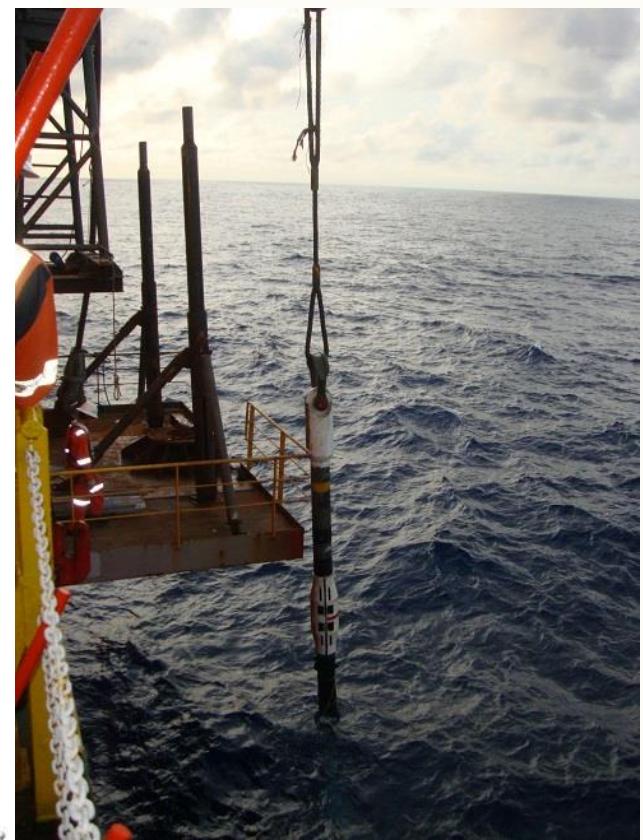
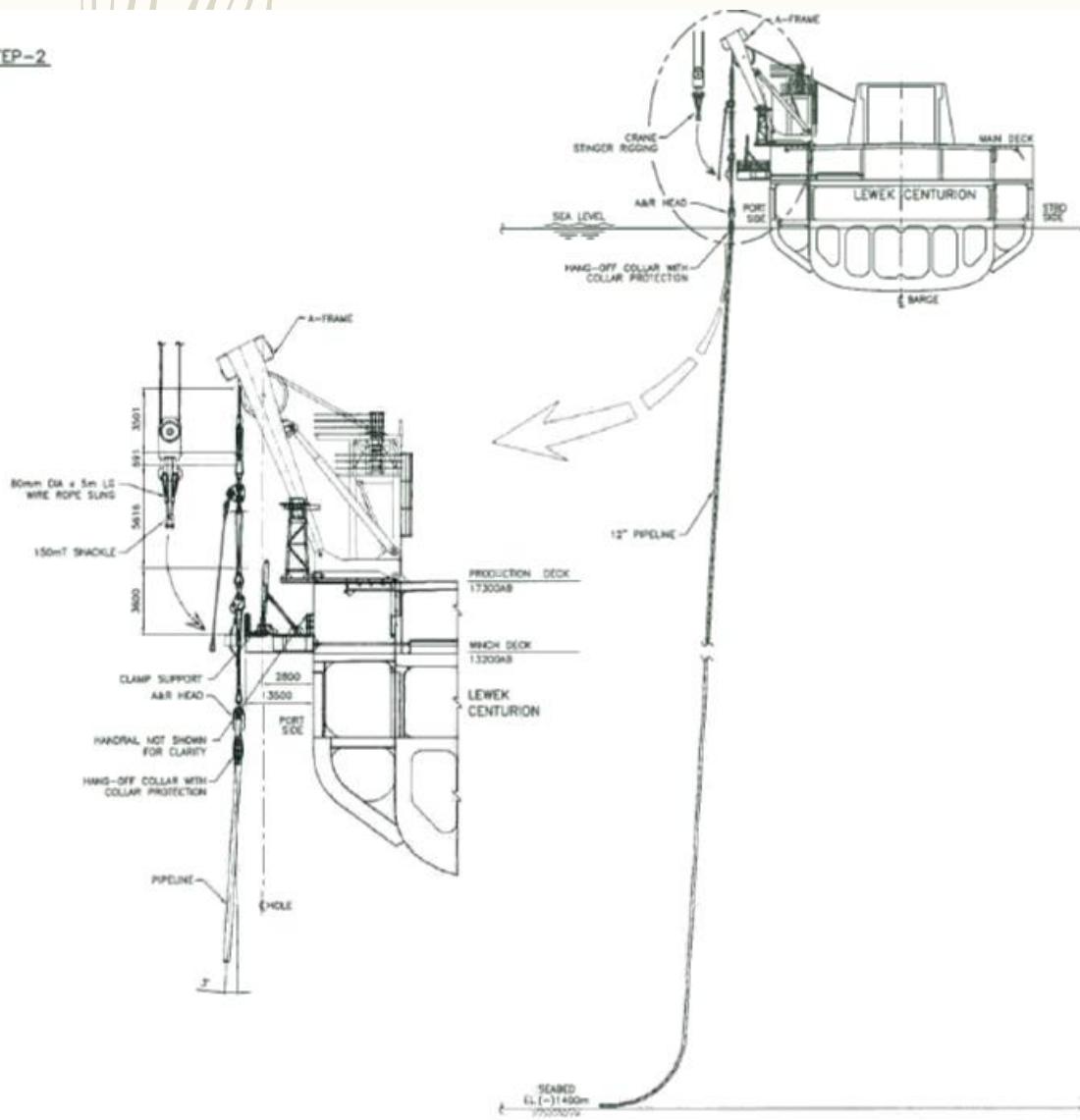


## Step 2 : J-mode Pipeline Recovery to Surface

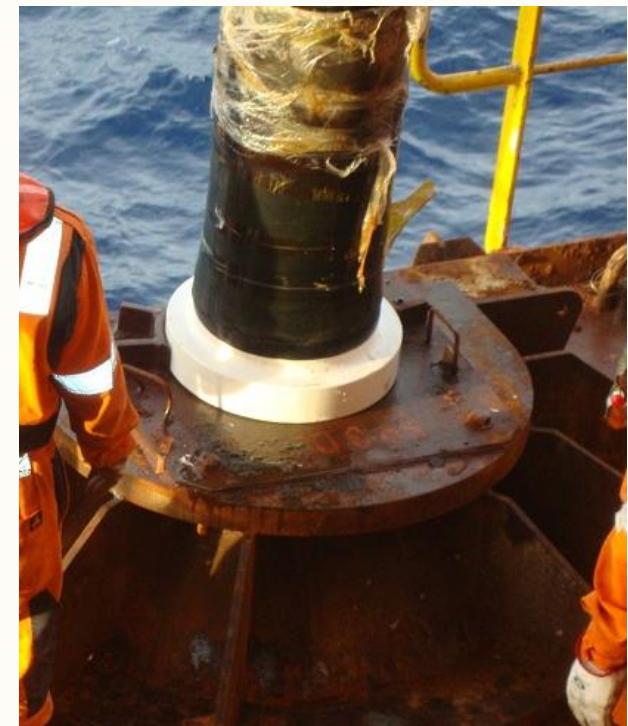
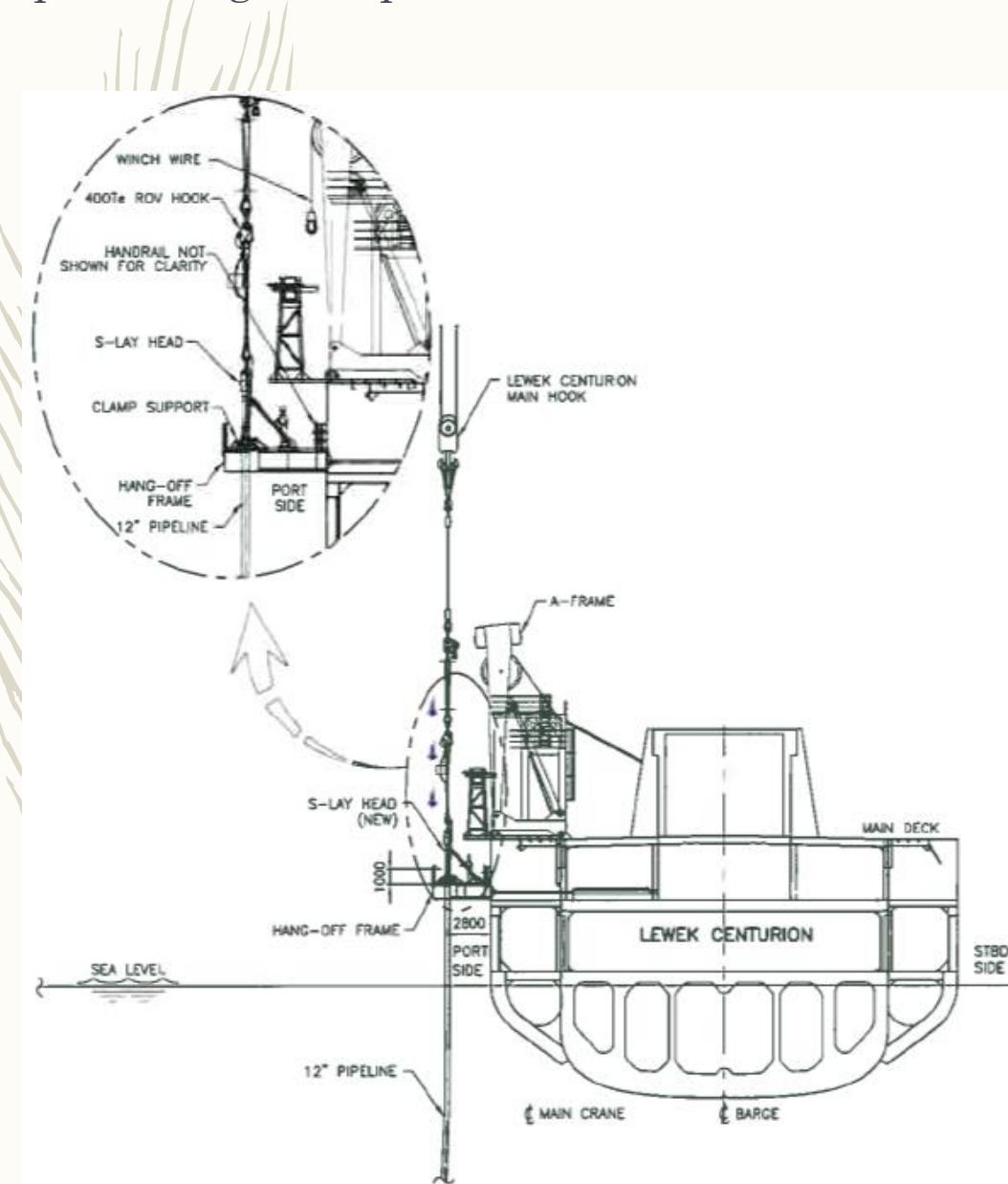


## Step 3 : Load Transfer From A-Frame to Main Crane

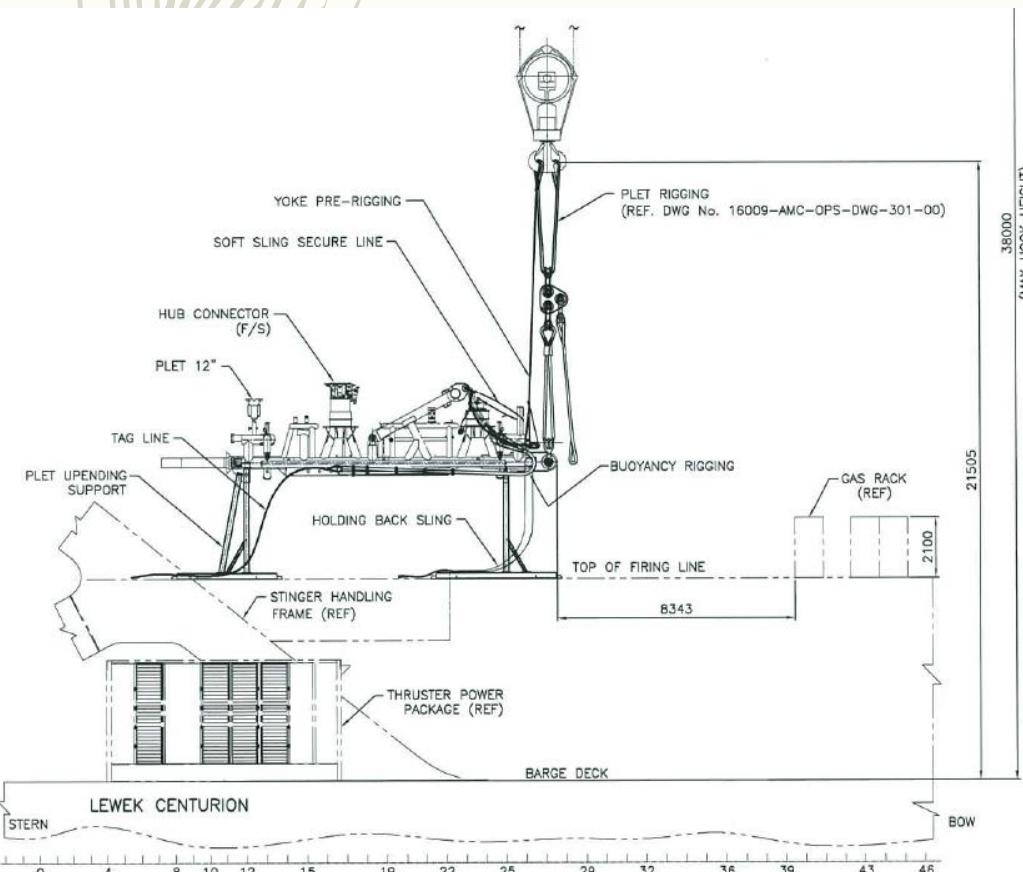
STEP-2



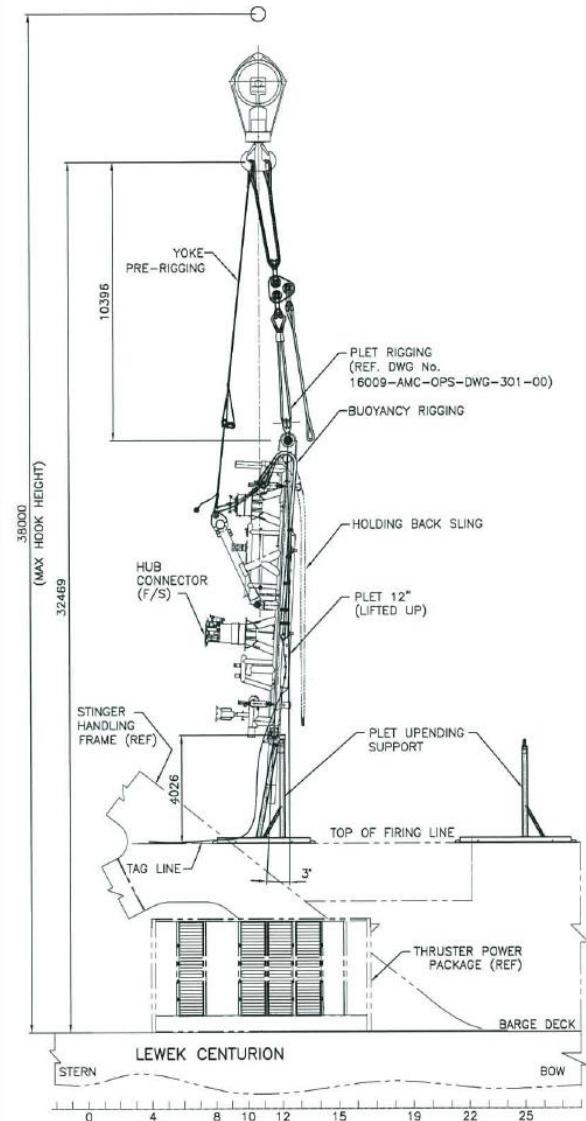
## Step 4 : Hang-off Pipeline to HOP



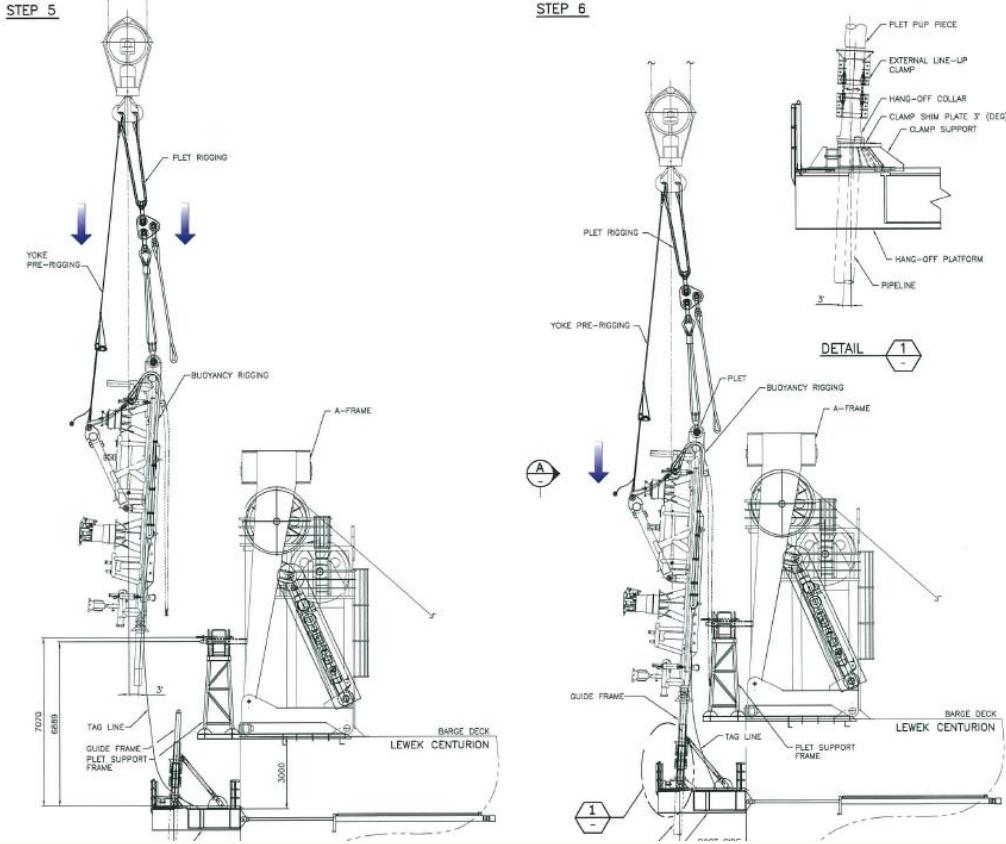
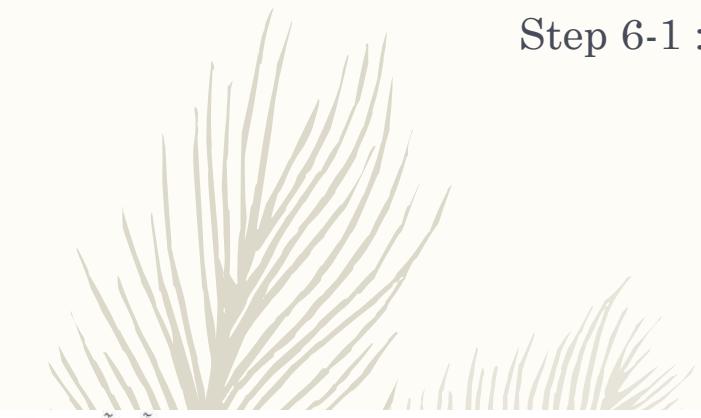
## Step 5 : PLET Upending and Lifting



PLET Upending

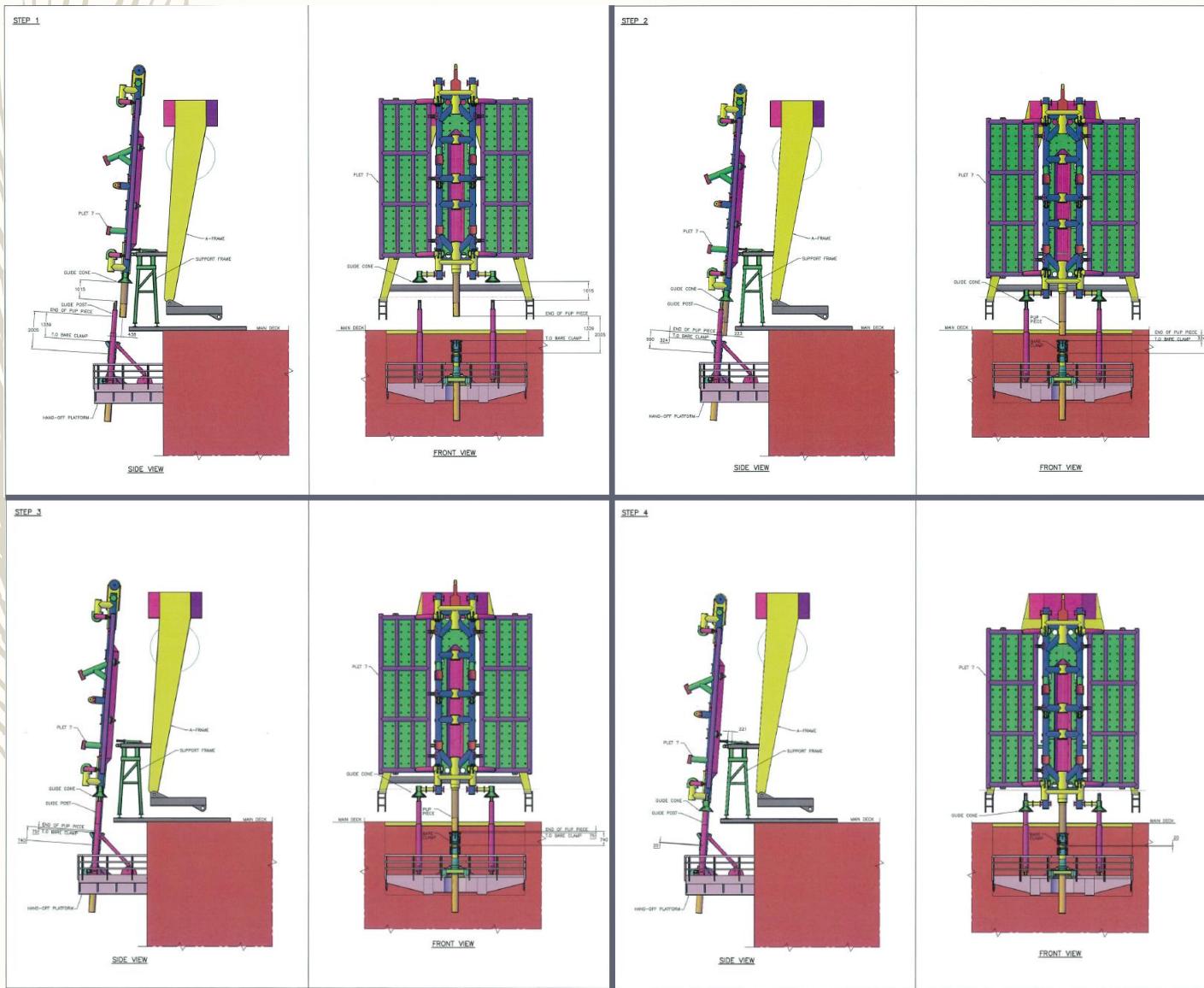


# Step 6-1 : PLET Stabbing and Final Fit-up, Welding NDT & FJC

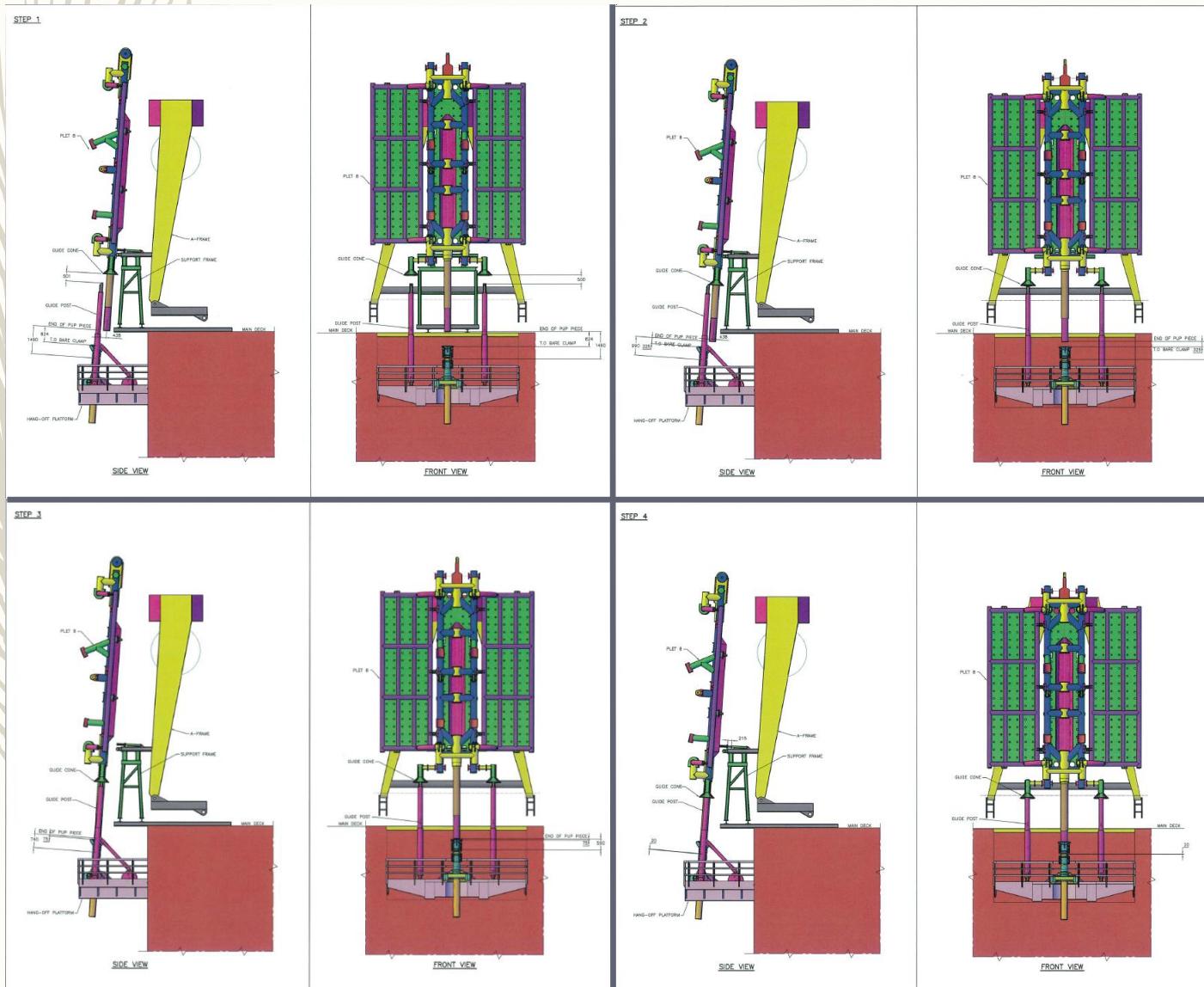


[PLET Stabbing Progress](#)

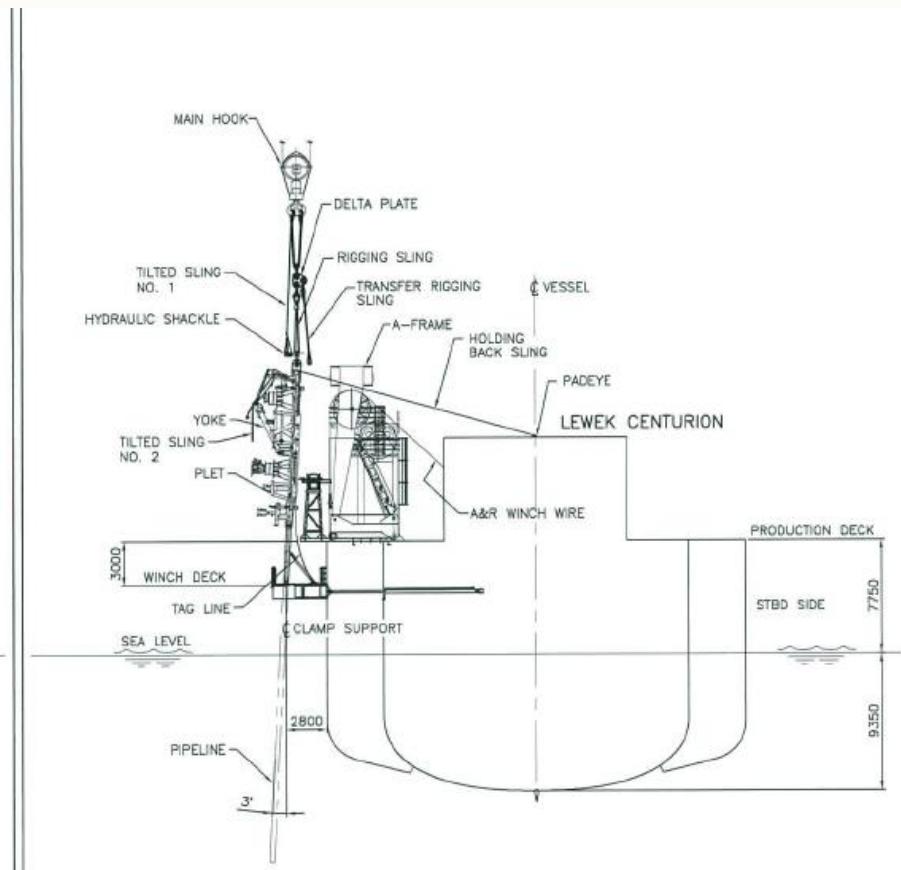
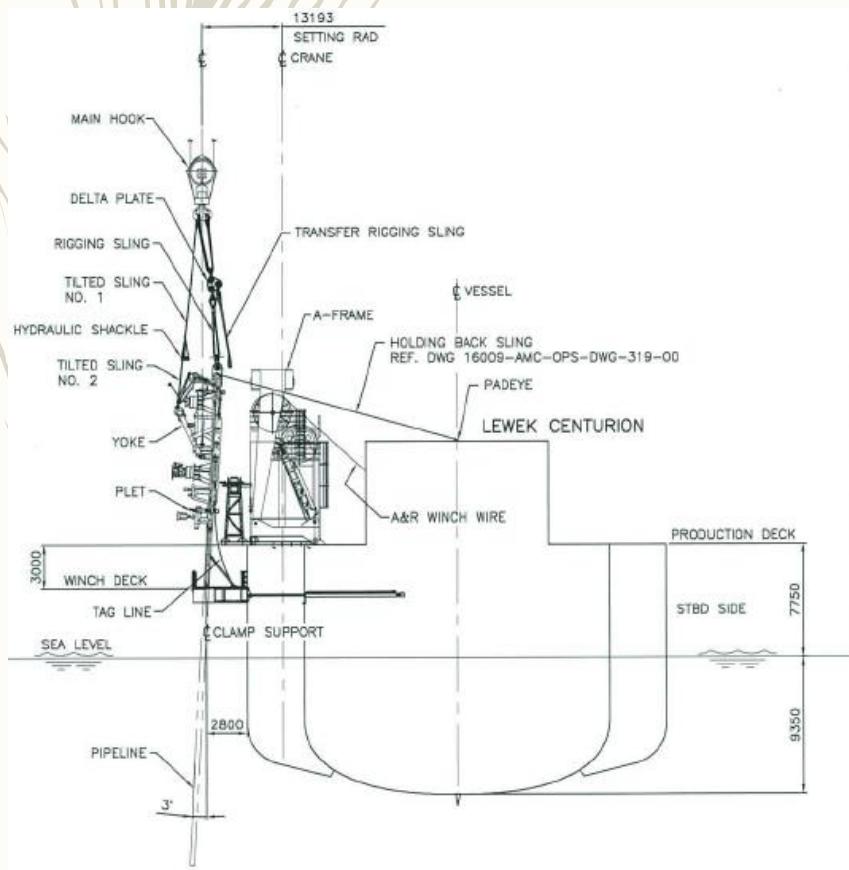
## Step 6-2 : Detailed Check for PLET Stabbing



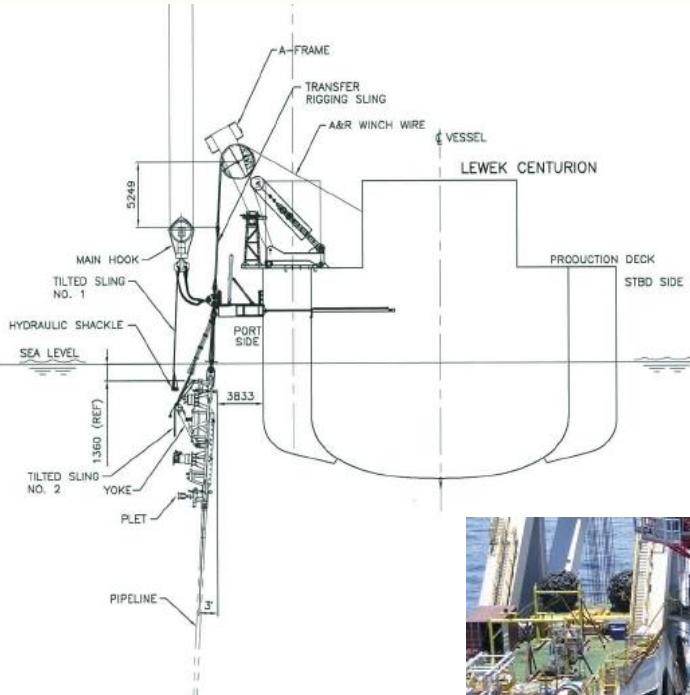
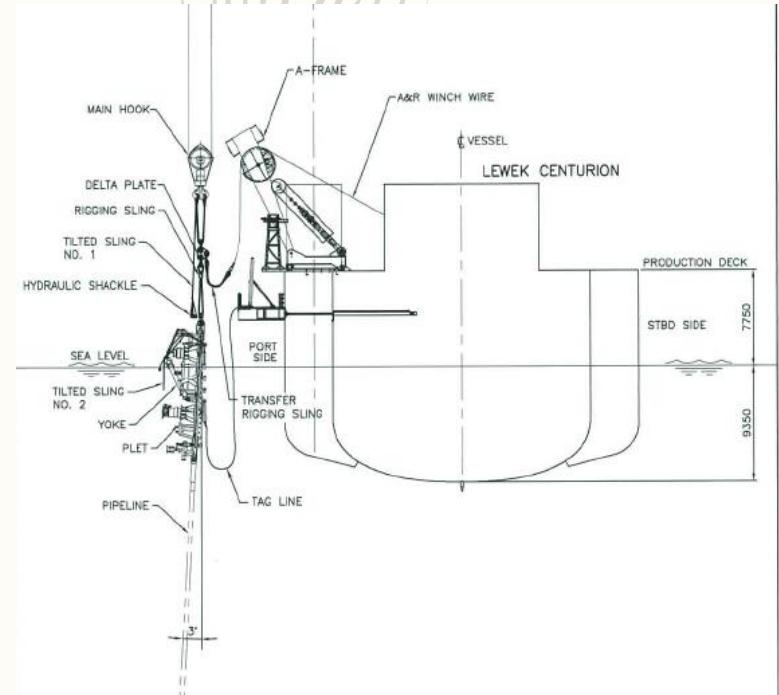
## Step 6-3 : Detailed Check for PLET Stabbing (Continue)



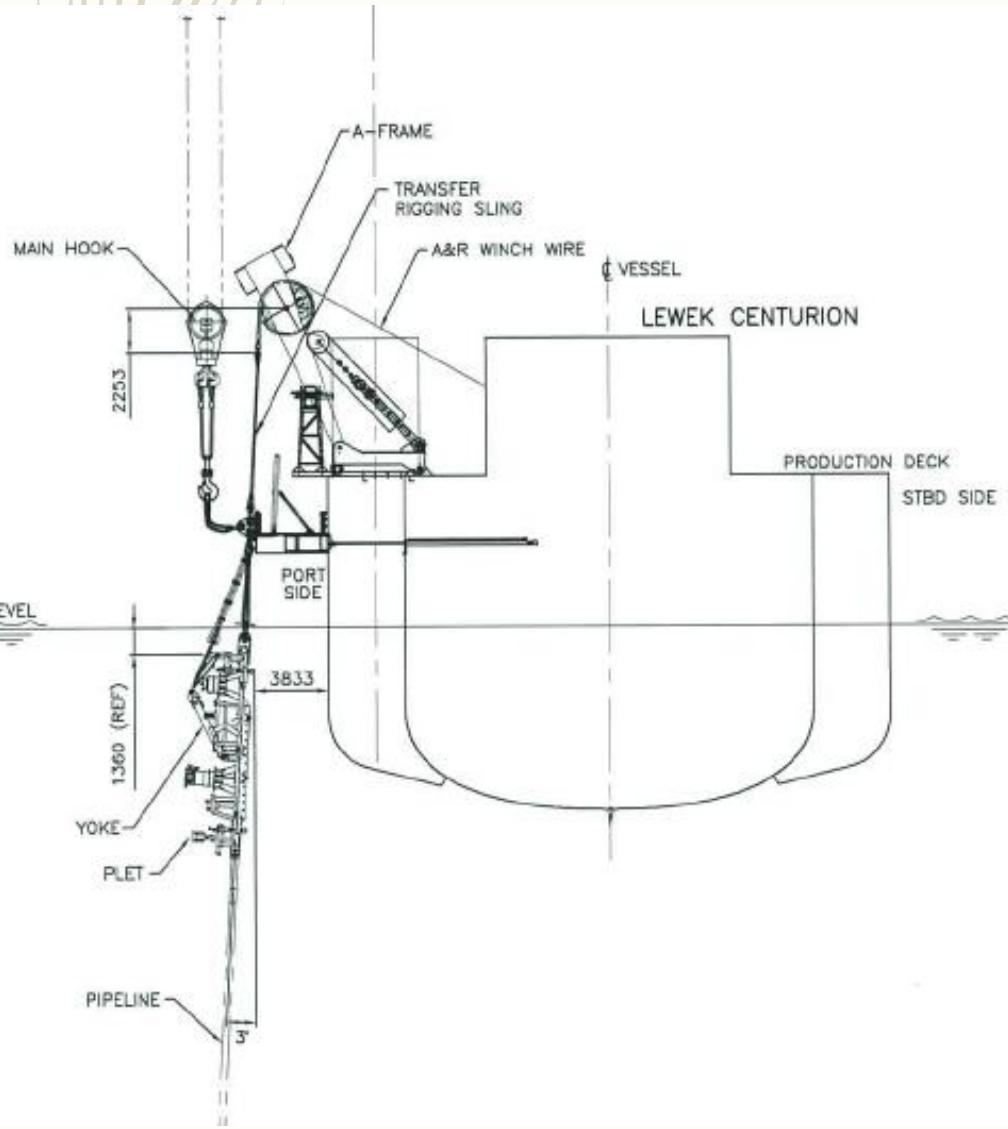
## Step 7 : Disconnection PLET Tilt Sling



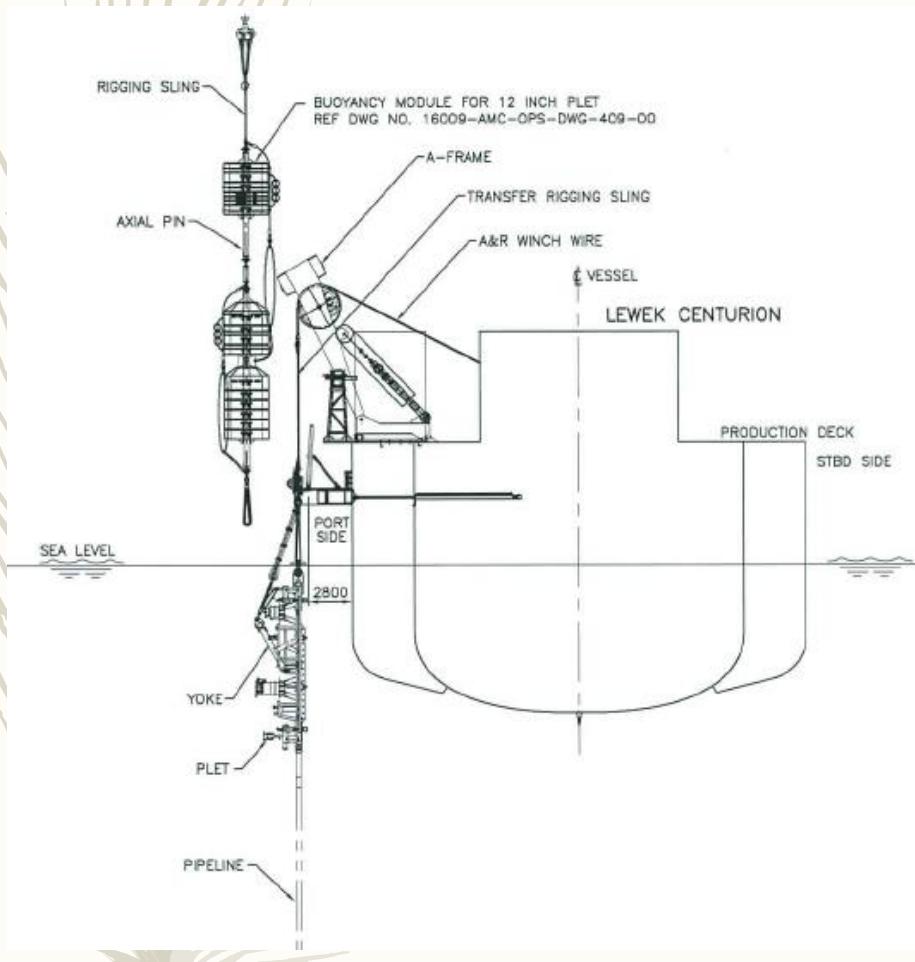
## Step 8 : Lift PLET + Pipeline from HOP



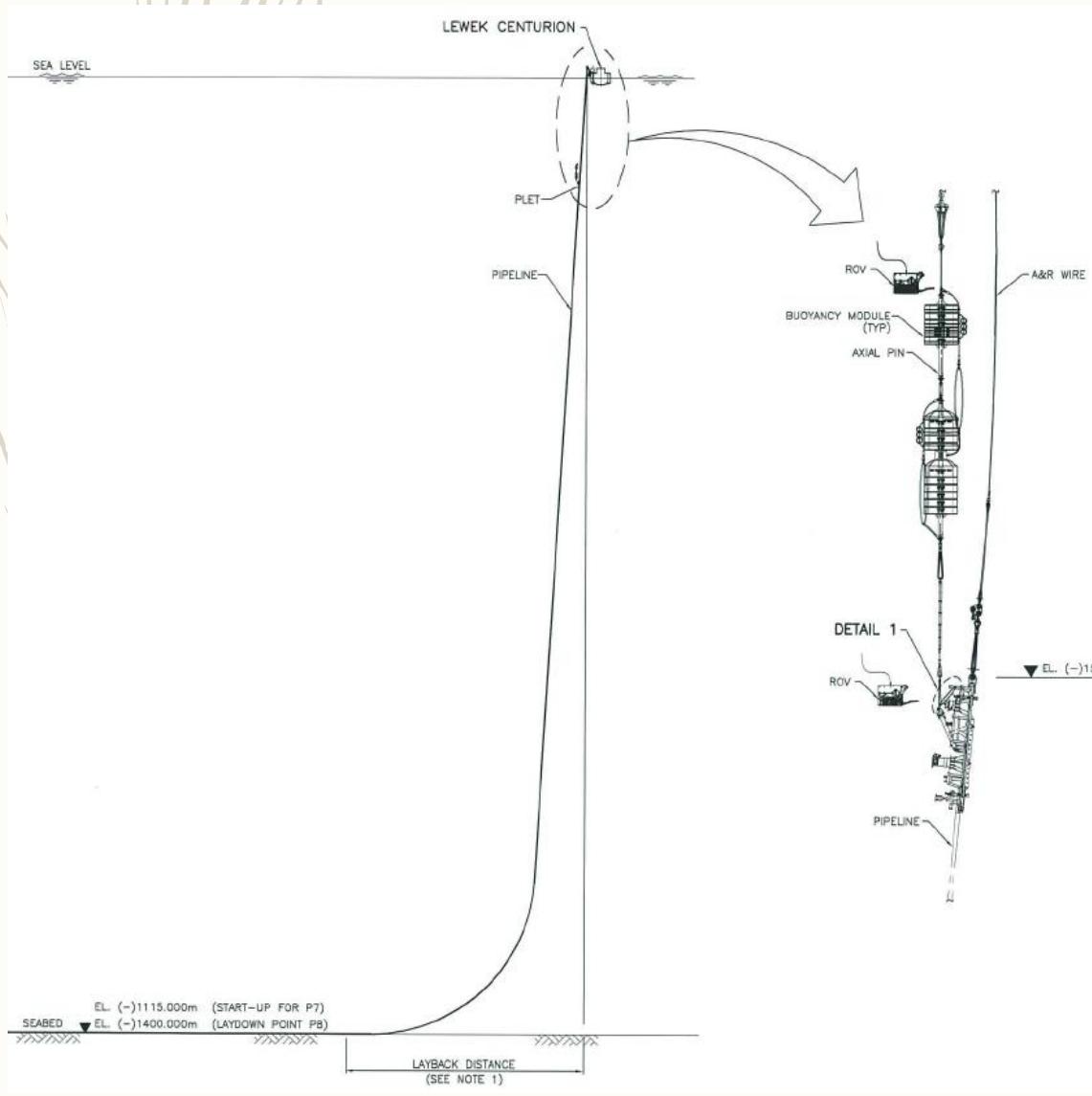
## Step 9 : Load Transfer from Main Crane to A-Frame Crane



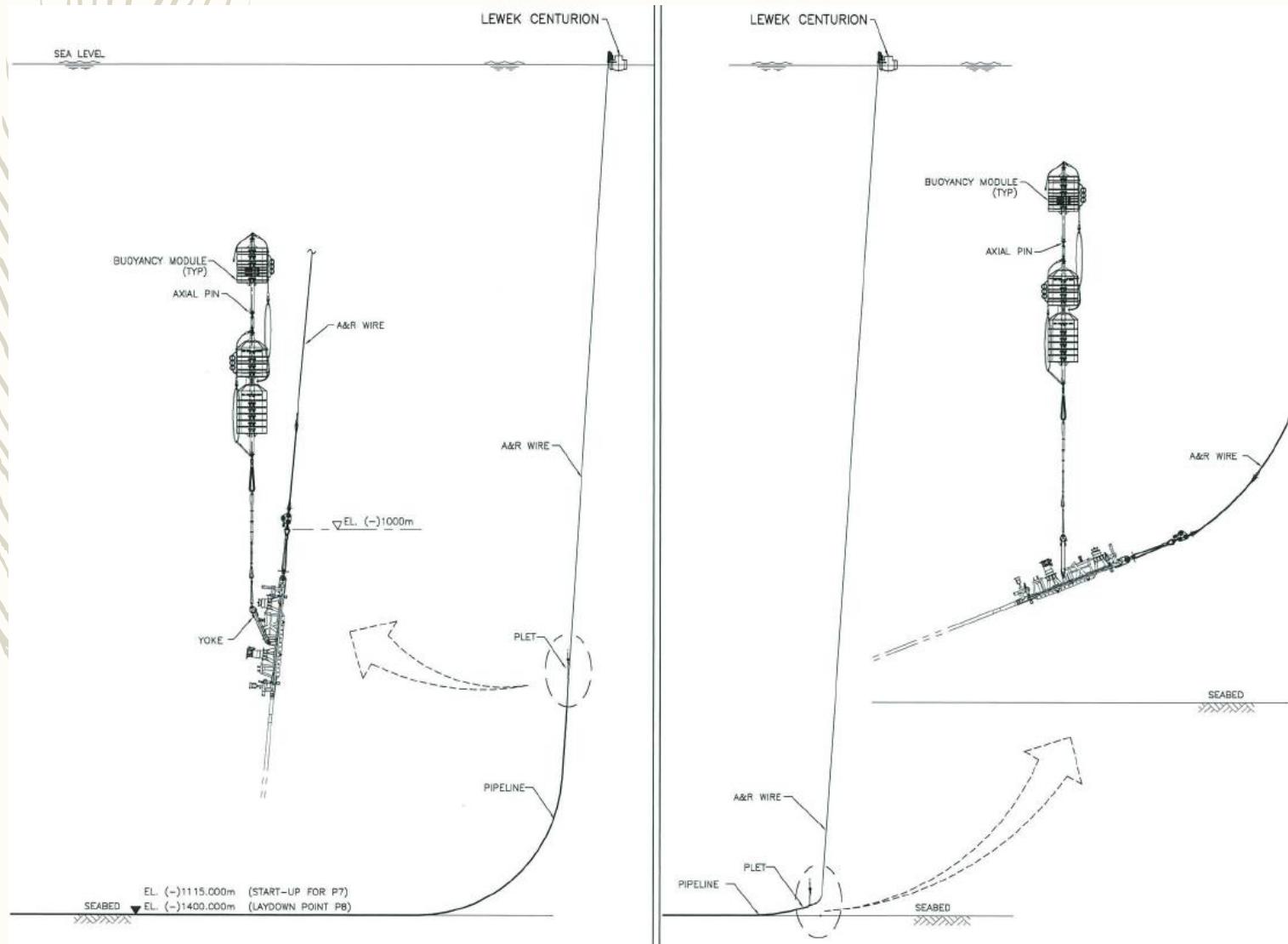
## Step 10 : Buoyancy Module Installation to PLET Yoke



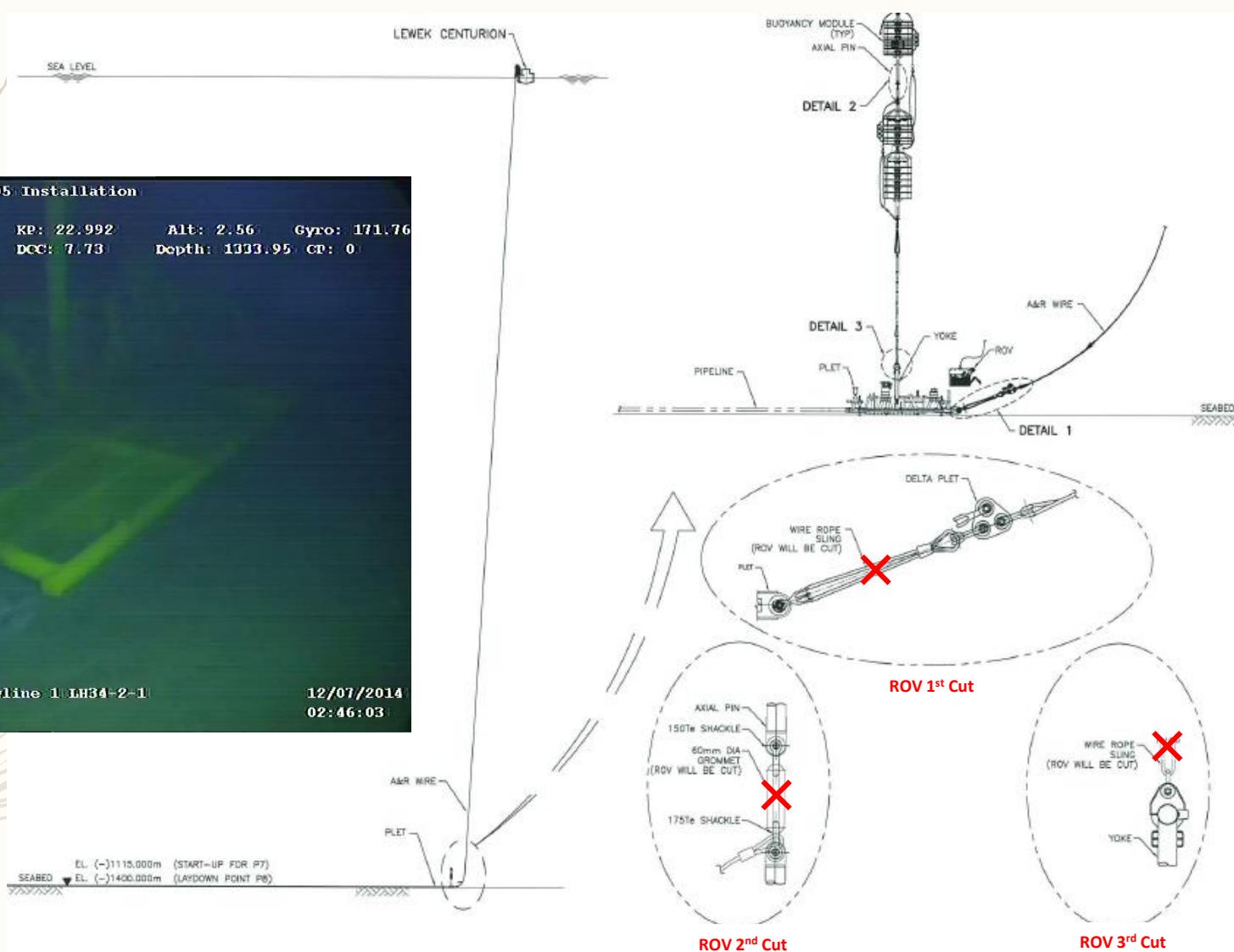
## Step 11 : Lower PLET to 150m or Deeper (to prevent PLET rotation and Buoy Clash with A&R)



## Step 12 : PLET Lowering



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



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 ???***