		Jerry Brennan					
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COURSEULLES

-- Offshore Monopiles Foundations --

Services Contract

Employer :

Parc éolien en mer du Calvados

Document number: (ACONEX)	COU	FOU	SAI	31173		2.0	EQP	PLA
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IFI	DM ASSEMBLY PLAN	FUS
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Subcontractor

Confidentiality : Restricted Confidential	

REVISION RECORD SHEET

Revision	Status	Description of Updated/Modified Sections (if any)
1.0	FUS	FIRST ISSUE
2.0	FUS	SECOND ISSUE

DM Assembly Plan

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1 Abbreviations

Acronym	Definition
LDD	Large Diameter Drilling
COU	Courseulles-Sur-Mer
OWF	Offshore Wind Farm
km	Kilometers
DM	Drilling Machine
DWG	Drawing
EQP	Equipment
SHS	Spoil Handling System
L	Length
W	Width
H	Height
QTY	Quantity
Kg	Kilogram
BHA	Bore Hole Assembly
te	tonne
UK	United Kingdom

2 Reference Documents

The philosophy has been developed in accordance with the following project documentation.

Document Number	Title
Manufacturing and assembly of components and machinery	FM EG 47
Drill bit assembly drawing and Bill of Materials	F10372-LDD-EQP-DWG-31441
Drilling Machine Shroud Assembly Drawings and Bill of Material	F10372-LDD-EQP-DWG-31442
Drilling Machine Kelly and Kelly Extensions Assembly Drawings and Bill of Material	F10372-LDD-EQP-DWG-31443
Drilling Machine Swivel Assembly Drawings and Bill of Material	F10372-LDD-EQP-DWG-31444
Drilling Machine Rotary Table Assembly Drawings and Bill of Material	F10372-LDD-EQP-DWG-31445
Drilling Machine Slip Table Assembly Drawings and Bill of Material	F10372-LDD-EQP-DWG-31446
DM Upending Frame Assembly Drawings and Bill of Material	F10372-LDD-EQP-DWG-31447

3 Project Summary

Large Diameter Drilling hereinafter referred to as LDD, are contracted to Saipem S. A to supply and operate drilling equipment, for the upcoming Courseulles-Sur-Mer (COU) wind farm development project.

The Offshore Wind Farm (OWF) will be located approximately 15km north of the city of Courseulles-Sur-Mer in the Bay of the Seine, off the Coast of Normandy.

The drilling system will be used to drill a socket into the seabed that will subsequently allow for the installation of a monopile on each wind turbine foundation.

The system designed to achieve this will comprise of the following:

- **1 No. Drilling Leader Tower (DLT) to locate and secure the drilling machine over the socket location.**
- **1No. Drilling machine (DM) to drill the required socket in the seabed.**
- **1No. Spoil Handling System (SHS) to remove, treat and re-distribute spoil from the drill face, back to the seabed at a pre-determined position.**

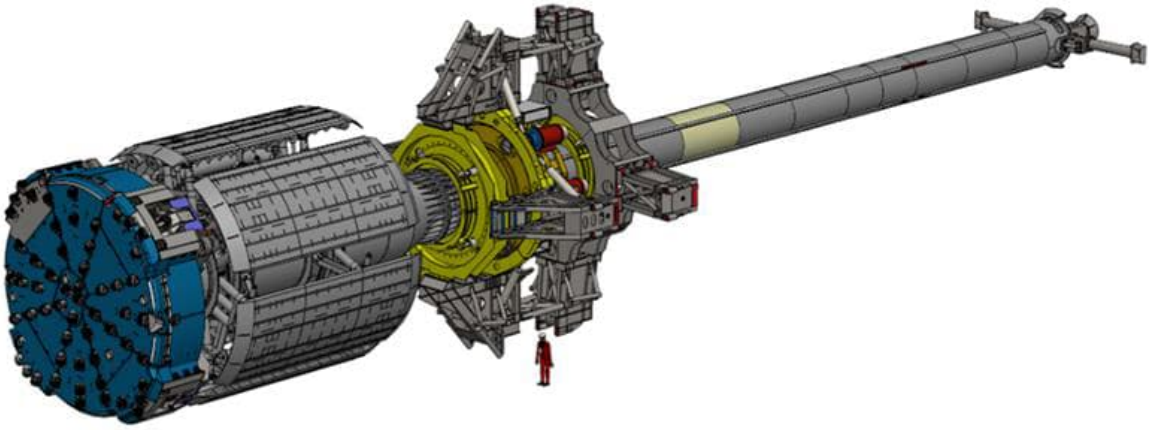
4 Scope of Document

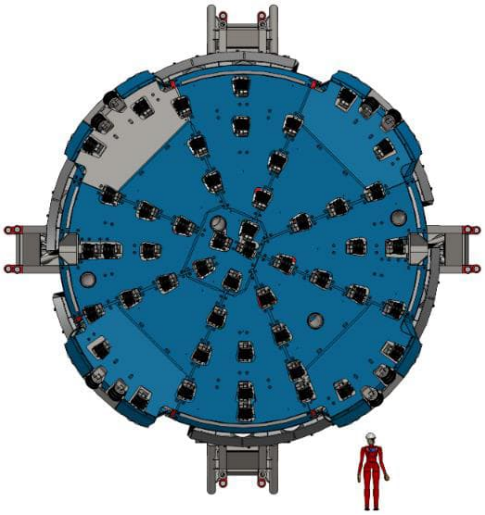
The purpose of this document is to outline the steps taken in the assembly of the Drilling Machine (DM), that will be supplied to Saipem as part of the drilling equipment to be used on the upcoming Courseulles-Sur-Mer (COU) wind farm development project.

In the preparation and distribution of this document, it is LDD's intention to have every part of the equipment understood as thoroughly as possible, to ensure safe and successful setup of the DM.

The DM will be assembled in the three phases as follows:

- **Black Build phase at CTL Site in Sheffield UK.**
- **Paint and assembly phase at Texo facility in Port of Blyth UK.**
- **Commissioning phase at Texo facility in Port of Blyth UK.**





5 Quality, Health, Safety and Environment

Prior to any work being undertaken, all personnel will undergo the following minimum training.

1. **Site risk assessment.**
2. **Site Induction**
3. **Equipment operation and safe handling. .**
4. **Familiarity with assembly, testing and operational procedures.**

All personnel identified as key personnel must be familiar with the set-up, testing and operational procedures of the equipment covered by this document.

5.1 Personel Protective Equipment

The following PPE is provided as standard issue/practice to undertake normal assembly, operations:

1. **Hard hat**
2. **Coveralls**
3. **Safety boots**
4. **Gloves**
5. **Ear-defenders**
6. **Safety Glasses**

5.2 First Aid Measures

Subject to the equipment layout provided, a First Aid Box and Eye Wash Station are provided in the Workshop, where initial treatment may be provided prior to seeking the next first aid measure.

5.3 Types of activity

Types of activity to be expected during assembly phase are as follows:

- **Overhead and mobile crane operation**
- **Hot Works**
- **Bolt tensioning**
- **Working at height**
- **Mobile plant operation**
- **Hydraulic fit out and operation**
- **Pressure Testing**
- **Survey**
- **Fit Out**
- **Commissioning**

6 DM Black Build

LDD will perform a black build of the various sub-assemblies comprising of:

- **Drill Bit (DB) – F10372-LDD-EQP-DWG-31441**
- **Shroud - F10372 - LDD-EQP-DWG-31442**
- **Kelly - F10372-LDD-EQP-DWG-31443**
- **Rotary Table (including Slips Unit and Rotary Drive Unit) - F10372-LDD-EQP-DWG-31445**
- **Slip Table (including Slips Unit) - F10372-LDD-EQP-DWG-31446**
- **Motor Cradles and Carriages - F10372-LDD-EQP-DWG-31488, F10372-LDD-EQP-DWG-31488**
- **Spoil Swivel - F10372-LDD-EQP-DWG-31344**
- **Upending Frame - F10372-LDD-EQP-DWG-31447**

The black build will comprise of a partial mechanical fit up of fabricated and free-issue items prior to painting of the Drill Machine sub-assemblies to confirm that all critical interfaces are compatible; that any moving parts are able to travel to the full extent of their designed working envelope and to confirm that the critical items of the DM can be integrated once the paint process is complete. This will not include a full mechanical fit up of the DM.

The sub-assemblies will then be shipped to the pre-Com Site for strip down and paint in advance of the Sub-assemblies being reassembled of which will undergo a test/QA procedure prior to integration into the complete DM.

This document will capture the testing procedure for the post-paint assembly of the Motor Cradle's. This document will also act as a means for recording the results of those tests.

During each assembly phase the following sub vendors will complete the work scopes as listed in the table below:

Sub-Vendor Work Scopes	
Sub Vendor Name	**Work scope**
GS hydro	Hydraulic Pipework Install
Ocean hydraulics	PHPU install
Texo	Disassemble, Paint, Assemble and Testing support
Batenburg	Cable Install
Mammoet	Lifting
Emsley	Lifting
CTL Seal	Fabrication and Assembly
DEPE	Pinion and Bearing Assembly

7 Description of Equipment

The DM and associated assemblies will undergo a phased sequence of assembly and testing, which will include but is not limited to:

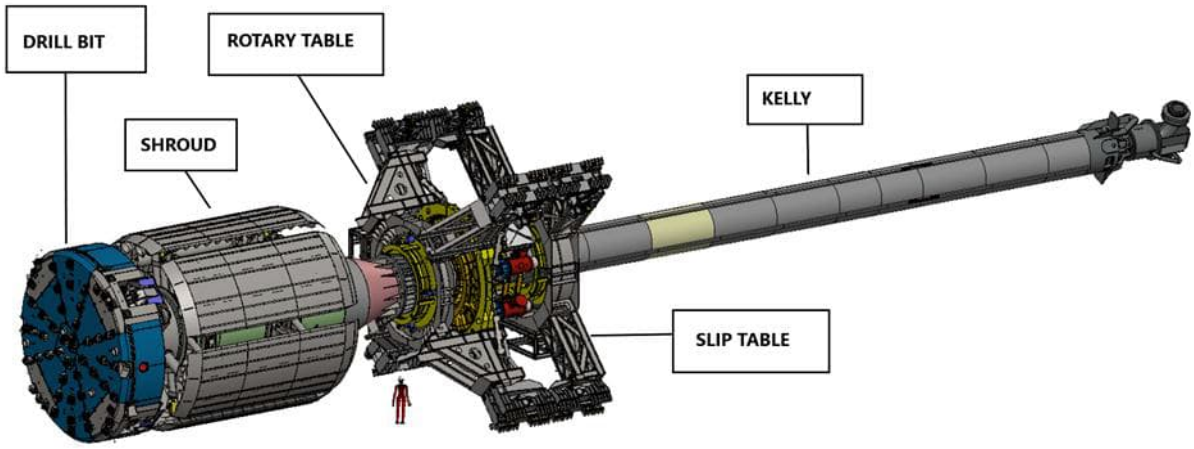
- **Interface checks/black build assembly**
- **Final painting**
- **Reassembly and testing**
- **Survey**

Upon completion of the black build activities, the DM will be disassembled into smaller sub-assemblies for transport by road to the Pre-Com site. Here each item will be fully disassembled and undergo a paint phase.

Post painting, the DM parts will be assembled by TEXO for final assembly and testing. Onsite facilities will include fabrication, shot blasting and painting to minimise further transportation requirements of the DM. Once Assembly is complete Dimcon Survey will be completed for the fully assembled drilling machine.

The Drilling machine assembly will comprise of the following sub-assemblies:

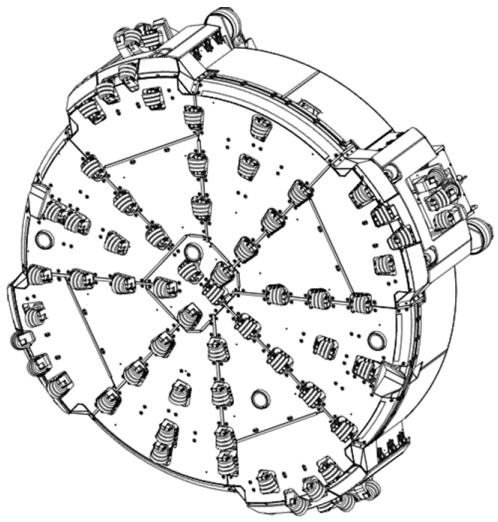
- **Drill bit**
- **Shroud**
- **Rotary table**
- **Slip table**
- **Kelly**
- **Lift-sub**



7.1 DM Components

7.1.1 Drill Bit

Drill Bit Specifications			
Diameter (m)	**Height (m)**	**Weight (kg)**	**Associated Bill of Materials and Assembly Drawings**
8.0 – 9.51	3.5	95,000	See Document COU-FOU-SAI-31441

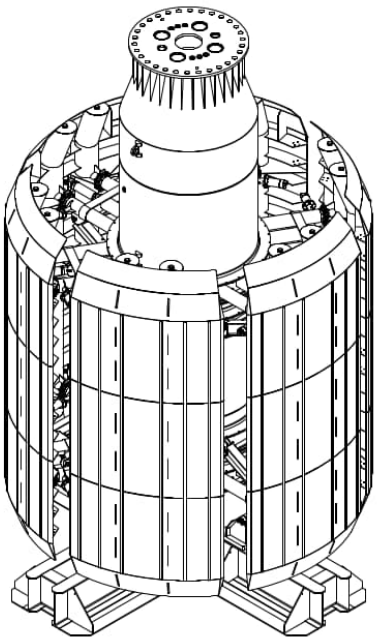


Assembly Work Scope

- **Perform mechanical assembly**
- **Perform 3D laser scan survey at each diameter's configuration (8m-8.76m, 8.5m-9.26m, 8.75-9.51m)**
- **Fit test hydraulic pipework and components.**
- **Perform test routine.**
- **Weight Verification**
- **Load out for paint.**

7.1.2 Shroud

Shroud Specifications			
Diameter (m)	**Height (m)**	**Weight (kg)**	**Associated Bill of Materials and Assembly Drawings**
8.0 – 8.75	121	117,000	See Document COU-FOU-SAI-31442

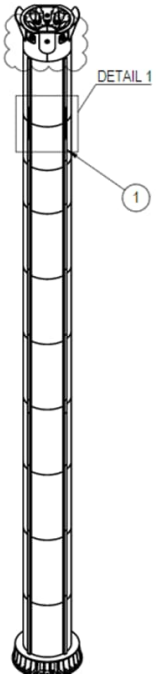


Assembly Work Scope

- **Assemble the shroud.**
- **Test wing function.**
- **Set wings to 3 different configurations.**
- **Perform 3D survey and test routine**
- **Weight Verification**
- **Disassemble**
- **Load out for paint**

7.1.3 Kelly

Kelly Specifications				
Kelly Type	**Diameter (m)**	**Height (m)**	**Weight (kg)**	**Associated Bill of Materials and Assembly Drawings**
1	2.6	25.06	62,000	F10372-LDD-EQP-DWG-31443
2	2.4	10	27,000	
4	2.4	5	15,000	



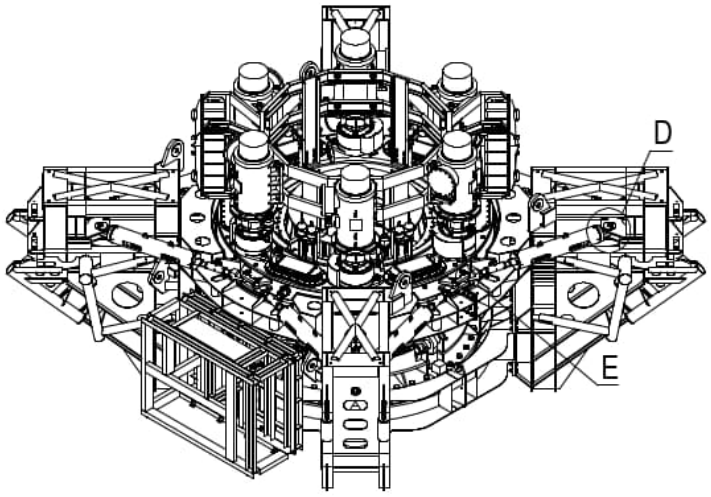
Assembly Work Scope

- Interface checks:
  - ✓ **Kelly Short Extension**
  - ✓ **Kelly Long Extension**
  - ✓ **Lift sub**

- ✓ **Spoil swivel**
- **Perform 3D survey and test routine**
- **Weight Verification**
- **Disassemble**
- **Load out**

7.1.4 Rotary Table

Rotary Table Specifications			
Length x Width (m)	**Height (m)**	**Weight (kg)**	**Associated Bill of Materials and Assembly Drawings**
8.58 x 8.58	5.6	127,000	F10372-LDD-EQP-DWG-31714

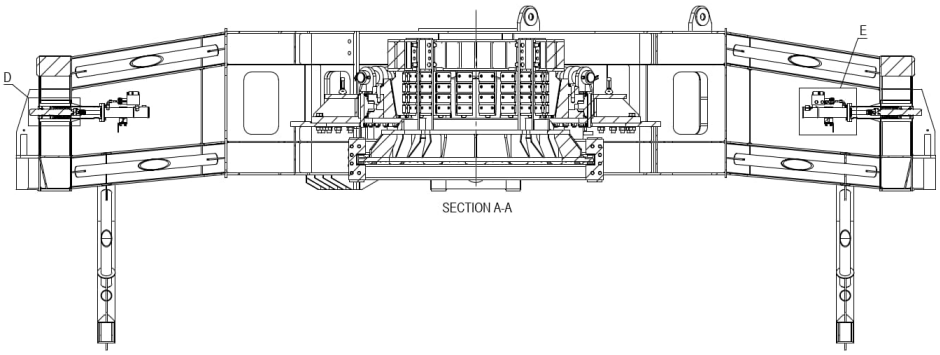


Assembly Work Scope

- **Perform partial mechanical assembly to confirm critical interfaces (seals not used)**
- **Fit test hydraulic pipework and components.**
- **Perform 3D survey and test routine**
- **Weight Verification**
- **Disassemble for road transport**
- **Load out for paint**
- **Rotary drive unit only to return for full assembly**

7.1.5 Slip Table

Slip Table Specifications			
Length x Width (m)	**Height (m)**	**Weight (kg)**	**Associated Bill of Materials and Assembly Drawings**
9.28 x 9.28	2.2 (Without Legs)	62,000	F10372-LDD-EQP-DWG- 31714

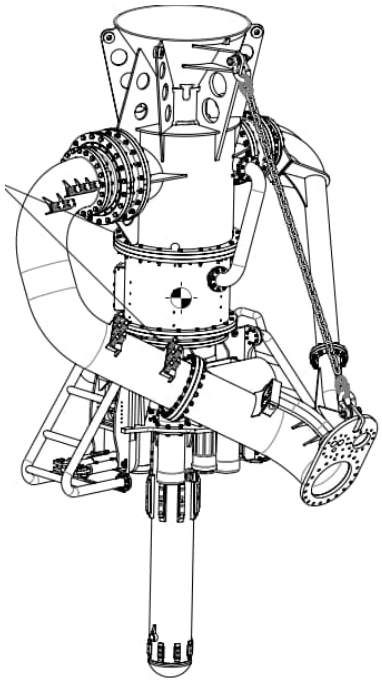


Assembly Work Scope

- **Perform partial mechanical assembly to confirm critical interfaces (seals not used)**
- **Fit test hydraulic pipework and components.**
- **Perform 3D survey and test routine**
- **Weight Verification**
- **Disassemble for road transport**
- **Load out**

7.1.6 Spoil Swivel

Spoil Swivel Specifications			
Length x Width (m)	**Height (m)**	**Weight (kg)**	**Associated Bill of Materials and Assembly Drawings**
4.25 x 4.92	8.17	25,000	F10372-LDD-EQP-DWG-31344

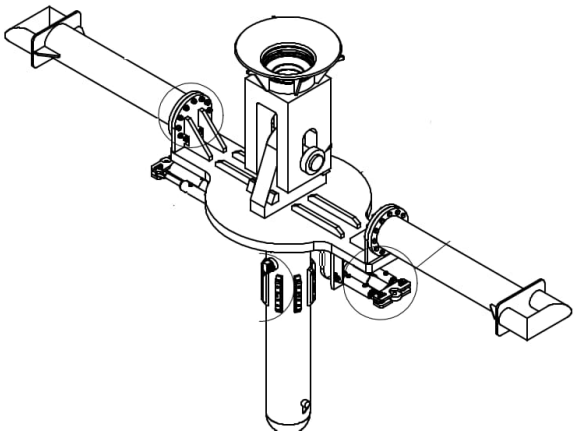


Assembly Work Scope

- **Perform partial mechanical assembly to confirm critical interfaces (seals not used)**
- **Fit test hydraulic pipework and components.**
- **Weight Verification**
- **Perform 3D survey and test routine**
- **Disassemble for road transport**
- **Load out for paint**
- **Return for full assembly**

7.1.7 Lift Sub

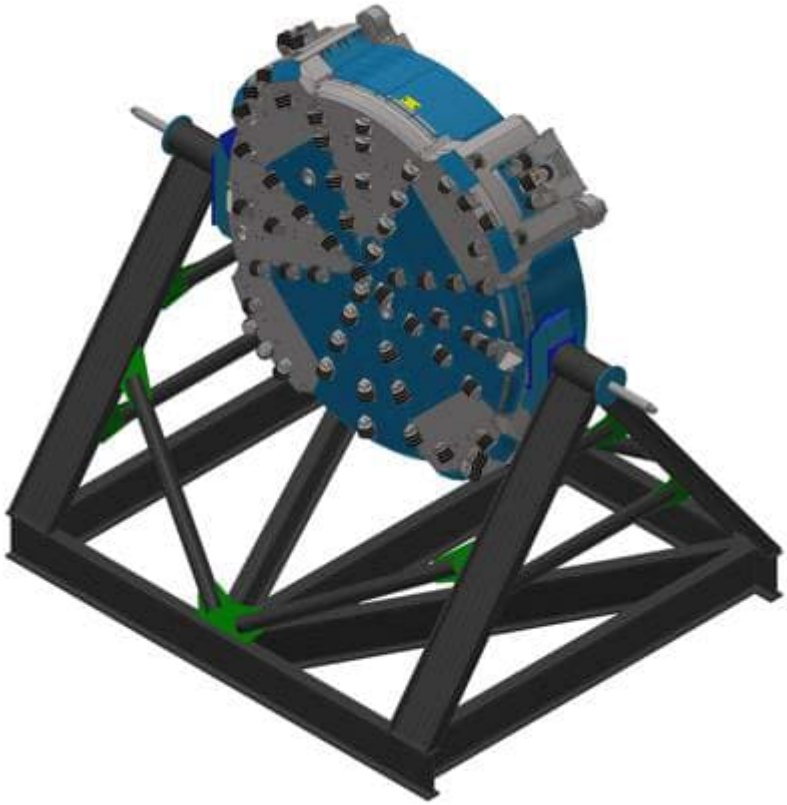
Slip Table Specifications			
Length x Width (m)	**Height (m)**	**Weight (kg)**	**Associated Bill of Materials and Assembly Drawings**
4.25 x 4.92	8.17	25,000	F10372-LDD-EQP-DWG-31431



Assembly Work Scope

- **Perform full mechanical assembly to confirm critical interface (seals not used)**
- **Install in Kelly short and long extensions to perform interface checks with pinions and carriages**
- **Weight Verification**
- **Perform test routine.**
- **Load out for paint**

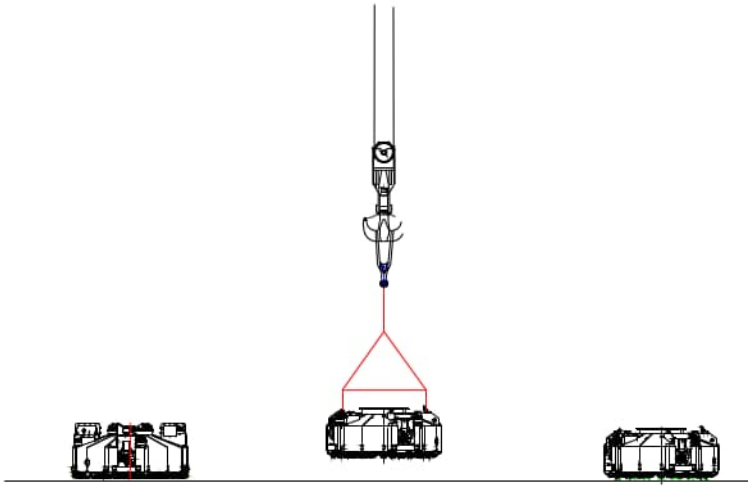
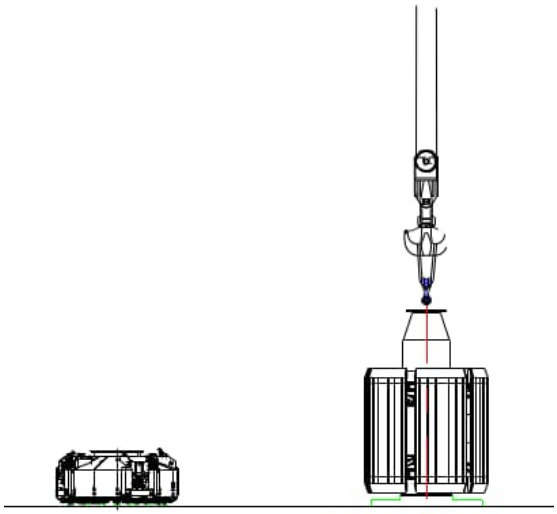
7.1.8 Upending Frame

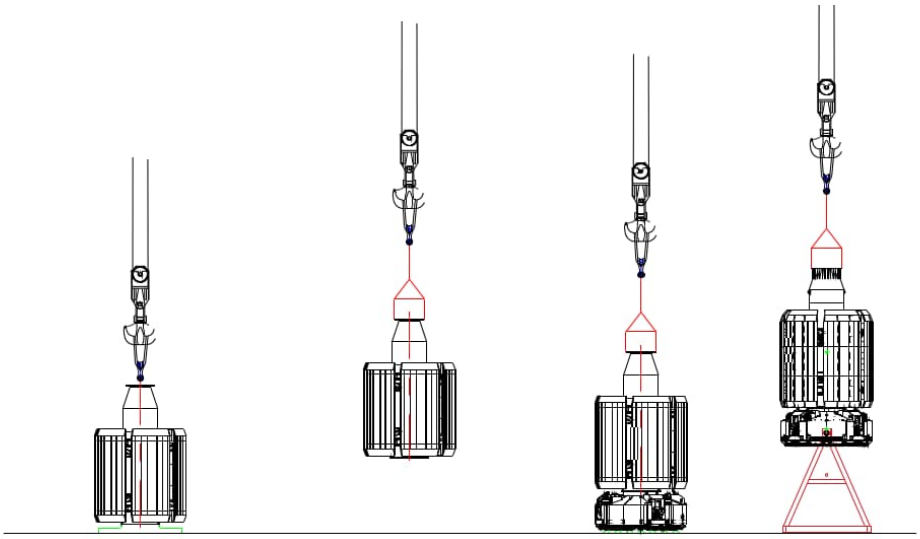
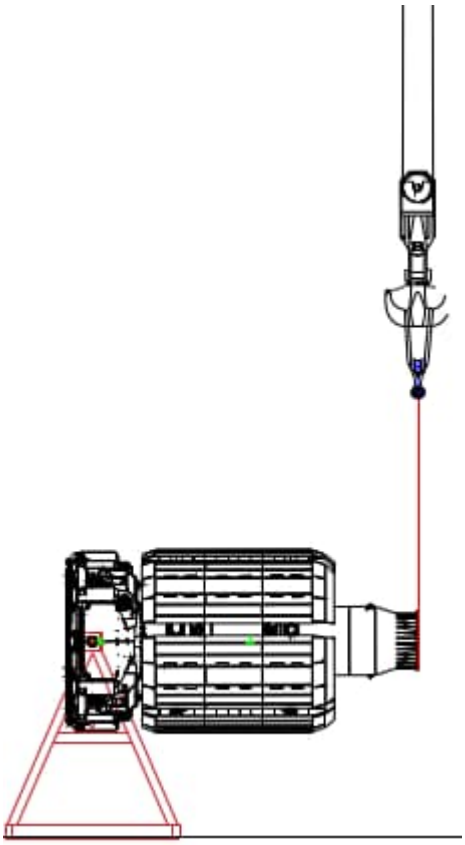


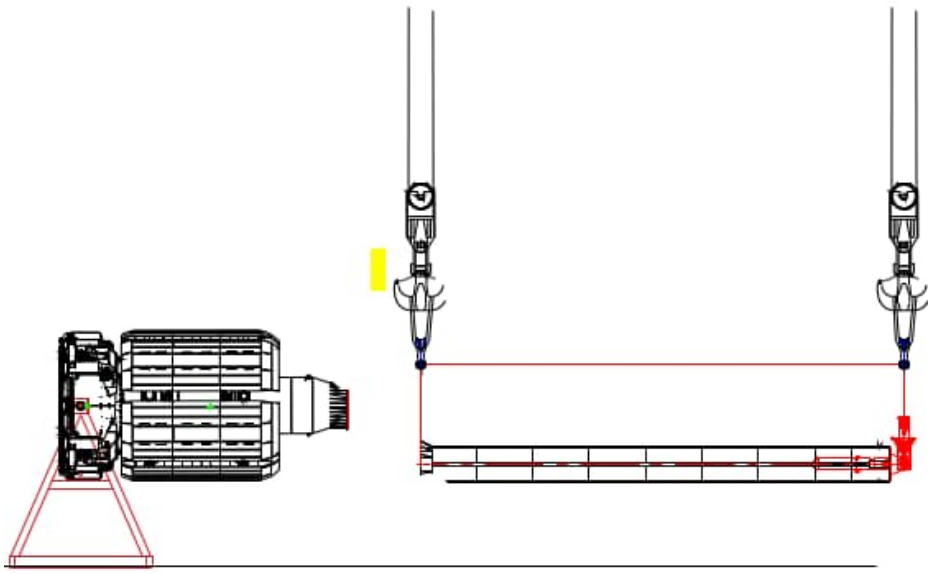
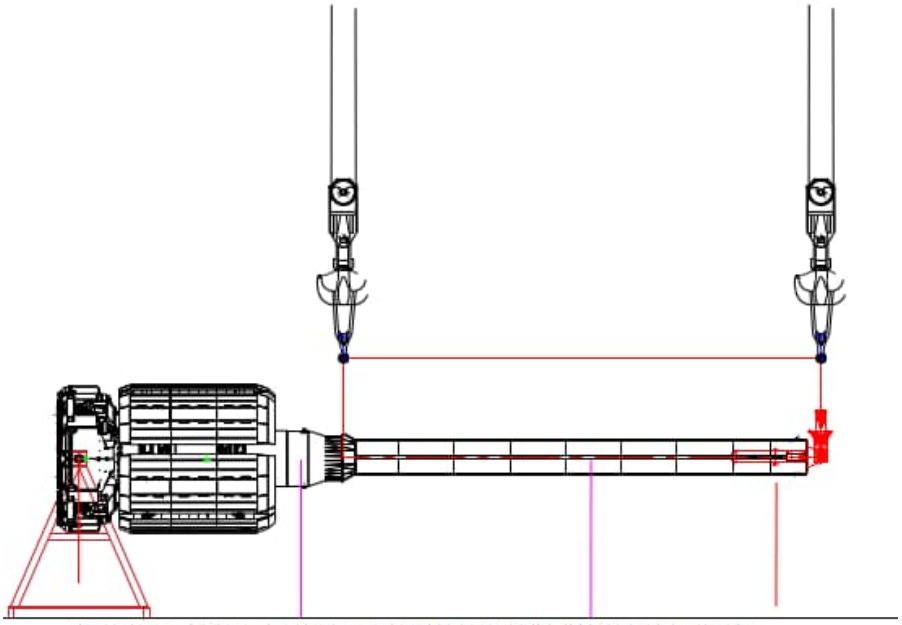
Assembly Work Scope

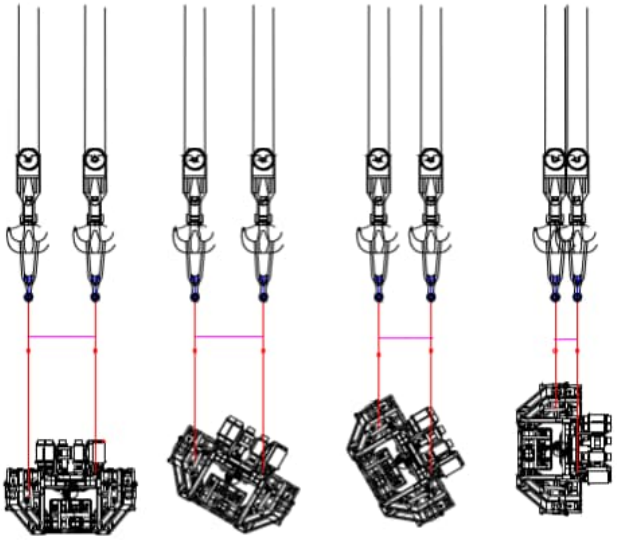
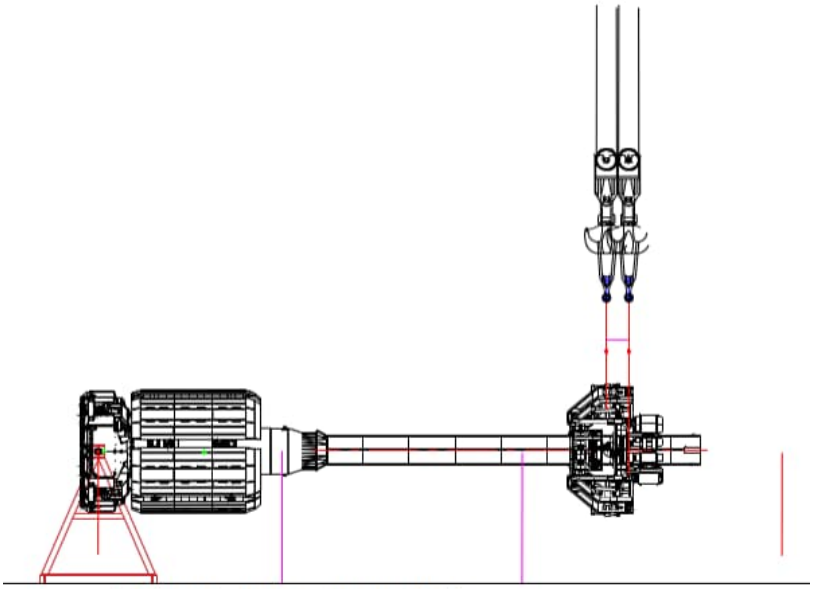
- **Perform full mechanical assembly to confirm critical interface (seals not used)**
- **Install drill bit**
- **Perform test routine.**
- **Weight Verification**
- **Load out for paint**

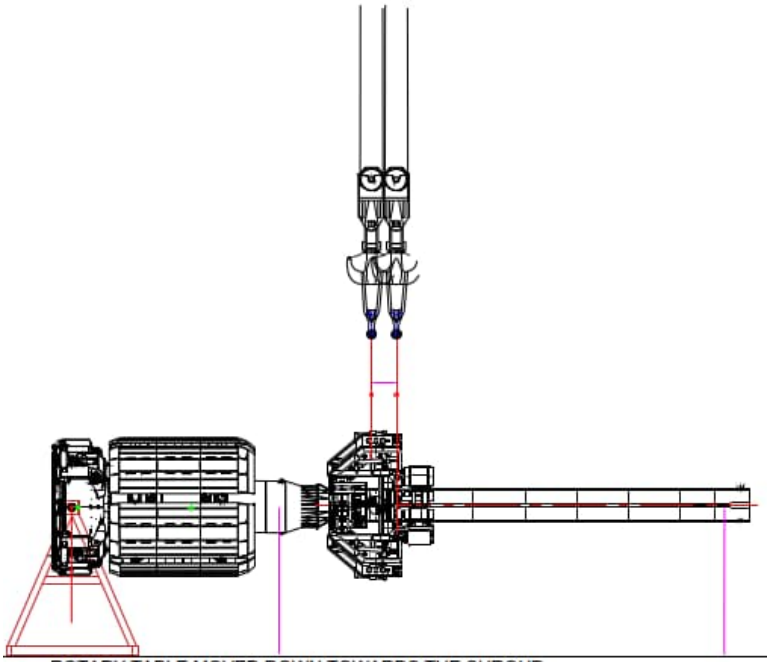
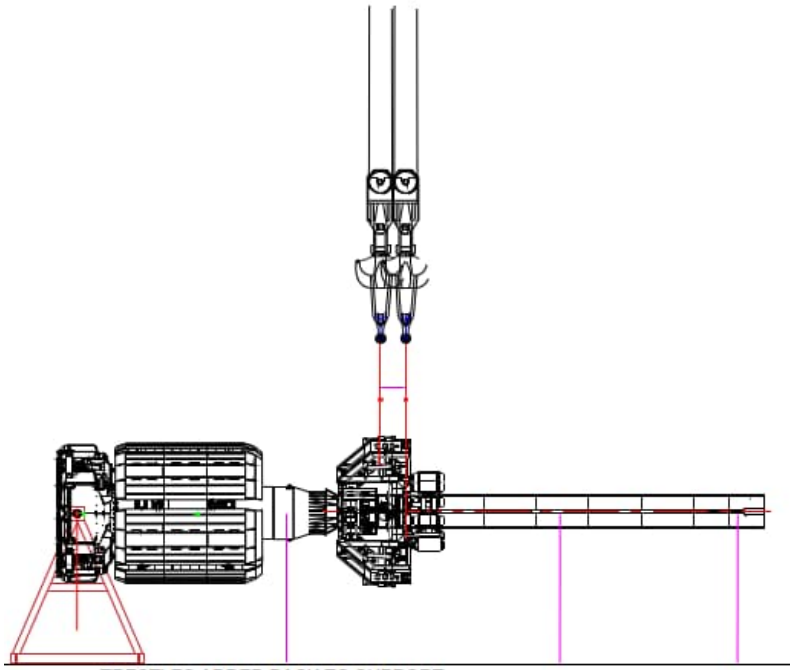
8 Equipment Setup Procedure

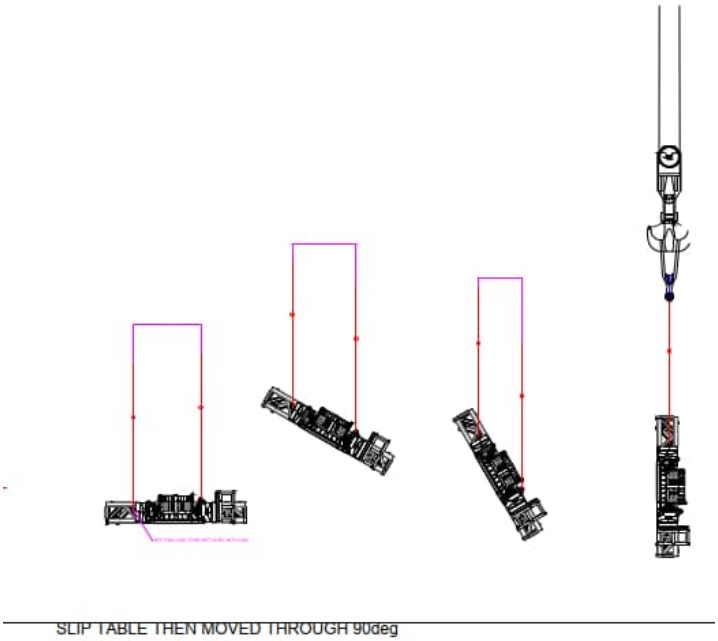
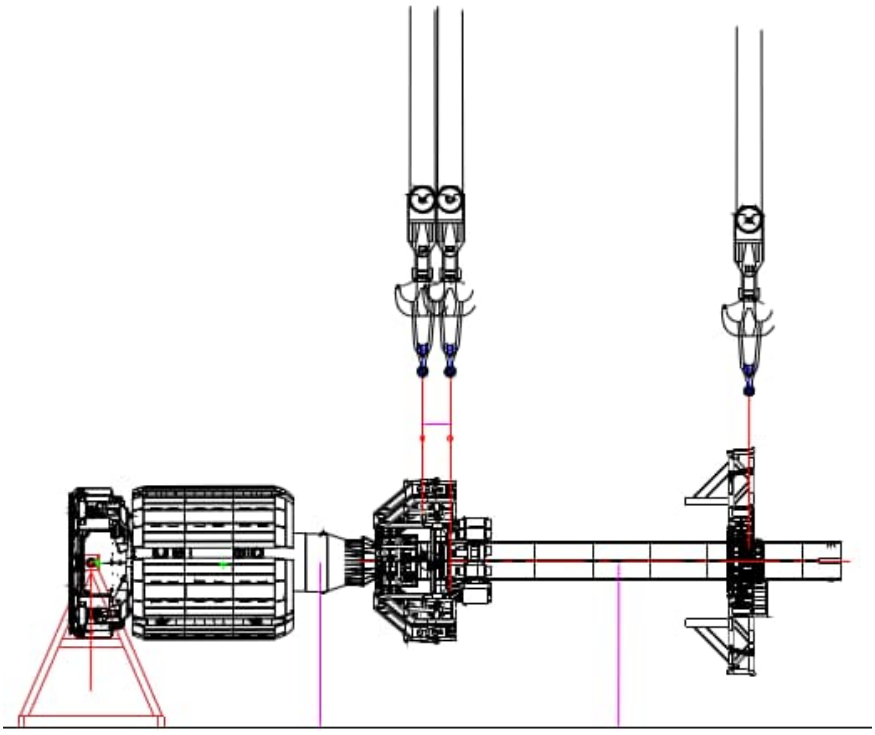
Positioning of DLTB	
Step	**Task Description**
1.	• **Setup of Drill Bit on Stand.** 
2.	• **Build up of Shroud Assembly on Stand** 

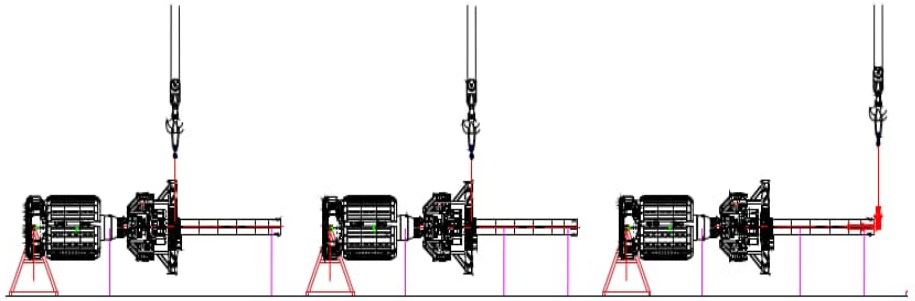
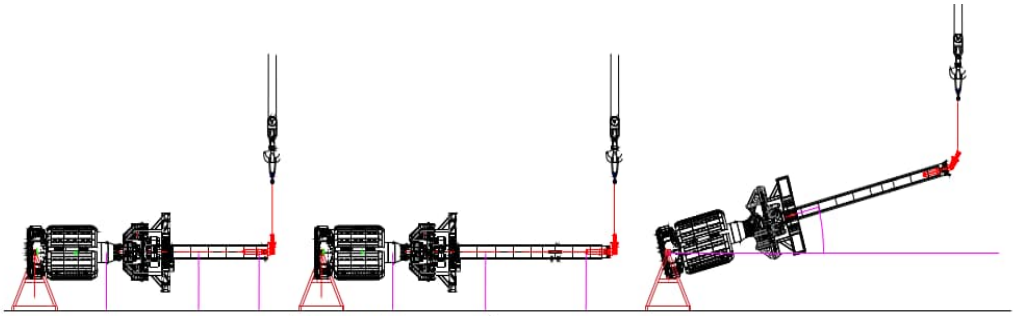
3.	• **Once built, the shroud should be lifted and placed on top of the drill head.** • **Shroud and drill bit are then bolted together to from the BHA Assembly.** • **The BHA Assembly is then fixed to the upending frame.** 
4.	• **BHA Assembly is then rotated 90 degrees and a trestle added to give support.** 

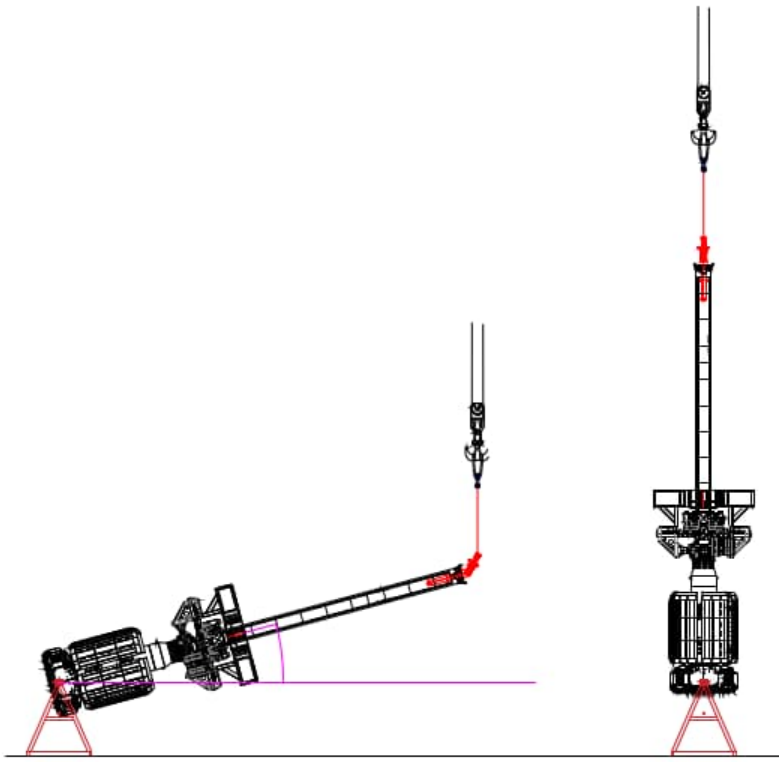
5.	• **Kelly is positioned ready for mounting to the BHA.**   TRESTLES ADDED TO SUPPORT KELLY AND DRILL IN UPENDING FRAME. KELLY BOLTED TO SHROUD.

6.	• **Rotary Table is upended and made ready to assemble to the BHA.**   ROTARY TABLE ADDED TO THE DRILL STRING TRESTLES MOVED TO AID THE INSERTION

7.	 ROTARY TABLE MOVED DOWN TOWARDS THE SHROUD. TRESTELS MOVED  TRESTLES ADDED BACK TO SUPPORT

8.	 SLIP TABLE THEN MOVED THROUGH 90deg ADDED TO TYHE END OF THE KELLY. TRESTLES MOVED FOR ACSSES 

9.	 SLIP TABLE MOVED INTO POSITION AND TRESTLES ADDED BACK FOR SUPPORT KELLY ILT ADDEED  DRILL STRING THEN MOVED THOUGH 90deg. •

10.	
Task Completed	