# PILE REMEDIAL REFUSAL SERVICES

# PRE-QUALIFICATION DOCUMENT

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## 1.0 INTRODUCTION

Offshore Construction Specialists (OCS) was formed in 2007 from a core group of experienced marine construction engineers with an extensive track record working with major contractors.

The company provides construction management, engineering and strategic support equipment services primarily to the offshore oil and gas sector focusing on the installation of pipelines, platforms, tanker moorings and related facilities. In addition to engineering, OCS also provides turnkey services for pipeline burial, pipeline pre-commissioning & drying, pile refusal remedial services, flexible flow line installation and umbilical installation on a subcontract basis to marine contractors.

The company has grown steadily since incorporation and now employs 60 personnel of whom over 30 are civil / structural and mechanical engineers along with an equipment group comprising of mechanics and technicians to operate in-house developed equipment. The engineers and technician work hand in hand to ensure all projects are properly engineered and operationally practical

OCS maintains a suite of jetting, airlift and drilling equipment designed to remove the soil plug in order to advance piling in the event of premature refusal during installation of an offshore substructure. OCS suite of reverse circulation drilling equipment is a highly effective solution for drilling deep and large diameter foundations in hard rock and mixed formation.

Drilling off the boom (DOTB) is the primary drilling technique proposed by OCS. The reverse circulation drilling operations is very suitable for offshore installation as it can be performed independently of caisson drilling. OCS main drill string for the DOTB is 13-3/8" H490 Hughes Pin-Box Drill Pipe which comes in 15ft drill pipe sections where the required drill pipe length is made up on the DOTB make-up frame. These threaded drill pipes extends from the Wirth reverse circulation power swivel to the Bottom Hole Assembly. During DOTB, the power swivel is connected to the crane with a DOTB frame complete with DOTB outrigger for the tugger control points.

It is common practice for platform owners to require that installation contractors carry this equipment to deal with the refusal contingency during platform installations. OCS provide both jet / airlift spread and an "off the boom" drilling spread for rental along with experienced operational personnel.

Our equipment is managed and operated by personnel who come from the same background as the main marine contractor. We help the major marine contractor plan the work such that the remedial activity has the least impact on operations. We are proactive in highlighting potential issues and ensuring both parties win. OCS understands the importance of getting the job done safely and efficiently to minimise operational costs for all concerned.

## 1.1 PILE REFUSAL AND REMEDIAL EXPERIENCE

OCS had been contracted the following remedial projects;

i. Shell Brunei / Bulan Bulan Development Project – Foundation Pile Size 54". Main Contractor is Swiber Offshore.

ii. Furie Alaska – Kitchen Lights Project – Monopod Platform Installation – Foundation Pile Size 42". Main Contractor Crowley Marine Services.

iii. Repsol – Pan Malaysia Transportation and Installation of Offshore Facilities Project – Foundation Pile Size 60". Main Contractor Sapura Kencana.

OCS in-house equipment spread is described in detail in this document. OCS has the full suite of jetting and drilling equipment including trained personnel to perform the remedial works. During tender stage, OCS in house engineering will review the pile data including the soil parameterss and advise the suitable equipment either jetting or drilling off the boom to perform the remediation work effectively. Upon award, OCS will configure the Jet String / BHA to suit the project pile size.

The make up frame for assembling the jet/ drill strings at the side of the barge will be designed by OCS inhouse engineering to suit the installation vessel. This includes any installation aids that is required to be design and fabricated for the project.

OCS is equipped to handle large projects or discrete project elements depending on the specific needs of the customer. For regional shallow water projects, OCS has a shallow water work barge "Miss Pennie" which can be readily kitted up with the jetting / drilling equipment, make up frames and all ancillaries to perform the remediation work or relief drilling. Miss Pennie comes with 3 x spud piles and eight point mooring. The barge would be kitted up in Batam / Singapore and tow to regional sites with OCS tow tug "Miss Bee" to perform the remediation/ relief drilling works.

During the preparation for remedial works or any offshore work the safety of personnel, equipment and environment plays a vital role in the success of a project and as such, HAZID's shall be conducted prior to any operations. These meetings are attended by key engineers and supervisors and all potential risks are identified and mitigation measures put in place to ensure they are as low as reasonably practicable.

## 2.0 ORGANISATION CHART

### KEY PERSONNEL CONTACTS

| | | |
|---|---|---|
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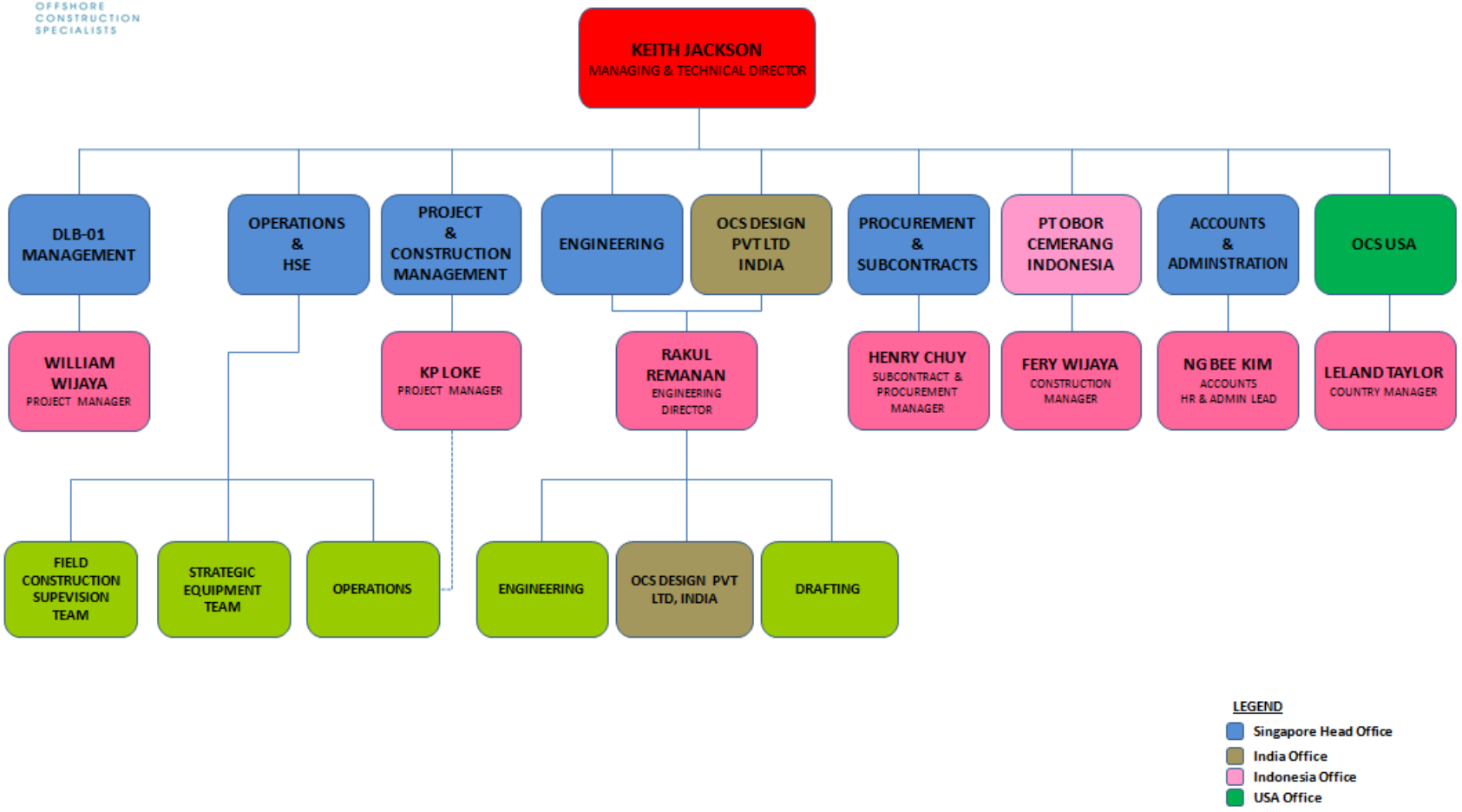
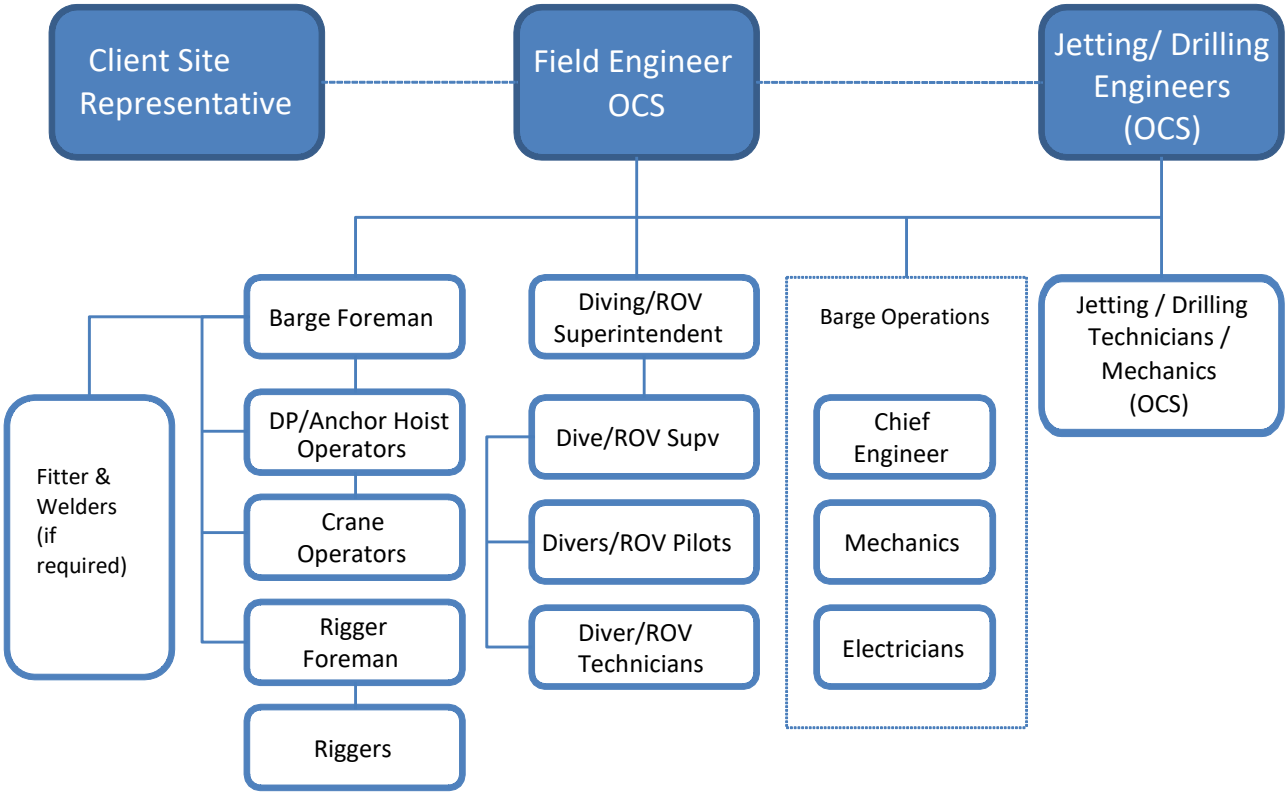
Refer to the next page for OCS Organisation Chart

## LIST OF KEY OF PERSONNEL



## 3.0 TYPICAL PILE REFUSAL REMEDIAL ORGANISATION CHART

**OCS PILE REFUSAL REMEDIAL OFFSHORE TEAM**




Personnel requirements for 24hour operations specifically for operating the refusal remedial equipment spread are as follows:

- 1 x Field Engineer
- 1 X Jetting / Drilling Engineer.
- 4 x Technicians/Mechanic (2 per shift)

Craneage, rigging and welding support along with key subcontract support including diving / ROV and survey services are usually provided by the vessel operator or main contractor. OCS can provide additional personnel as required.

Where specifically required, OCS can provide an option for provision of the entire support vessel. Customer requirements for this option can be discussed on a case by case basis.

## 4.0 PILE REFUSAL REMEDIAL METHODOLOGY OVERVIEW

In the event pile refusal or related foundation problem is encountered the circumstances related to the refusal must be reviewed and a strategy formulated for remediation best suited to the circumstances developed.

The following provides an overview of both methodology whereby Jetting and Airlift is more suited for clay formation utilizing high pressure water to jet the soil plug which will then be airlifted to the surface. The reverse circulation drilling technique is employed when internal plug is harder material which requires the rotating bit to cut and break the soil plug followed by airlift to surface. The drilling technique is also utilized when is pilot hole is required to drill ahead of the pile advancement.

As soon as refusal is encountered, the location of the soil plug must be measured to assess the depth of the soil plug in relation to the tip of the pile. Driving records must also be consulted to assess the hardness of the formation through which the pile has been driven.

Once the length of the soil plug is known and the driving records are assessed a decision can be made to perform remedial works. The general description of the both methods are described below.

**Jetting and Airlift**

This method uses high pressure water and impact to break up the soil plug and an airlift to remove the cuttings. The equipment spread include a high pressure Jet pump, Feed pump and hoses, air compressor and hoses and a string make up comprising Jetting head, intermediate make up sections and a top hang off section for connection off the crane and the Jetting and Airlifting hoses.

The assembly is connected to the vessel crane which controls the string as the soil plug is removed by airlifting the cuttings to the surface. In the case of Jetting and Airlifting the string is static and does not rotate. The method relies on high pressure water from the tip of the Jetting head to break up the formation. Strings are assembled on deck and hung off over the side in an assembly frame designed to accommodate jetting and airlifting string components.

Principle equipment employed for Jetting and Airlifting:

- Jetting / Airlifting String
- Water winning and pressure pumps.
- Air compressors
- Miscellaneous hoses and fittings.
- Jet String make up rack.
- Access platform on the top of the pile.

**Drilling**

Drilling can be either ‘Pile top drilling’ or ‘drilling off the boom’. OCS drilling off the boom method uses a drilling power swivel and drill string connected to the vessel crane. Equipment includes a hydraulic power pack and hoses, a drilling power swivel, Reverse Circulation (RC) drilling string

with centralizers and a drill bit and Bottom Hole Assembly (BHA). The rotating drill bit at the bottom of the drilling strings breaks up the soil plug and the cuttings are airlifted to the surface. This string rotates and uses roller cutters on the drill bit to break up the formation.

The key working principal for 'drilling off the boom' comprises of:

- Drilling assembly rigged up onto the vessel crane and lowered into the pile top.
- The Bottom hole assembly rotating bit cuts and breaks up the soil plug formation.
- Cuttings from the formation is airlifted to the surface.

Principal equipment for drilling:

- Power Swivel and Hydraulic power pack.
- Drill String, Bottom hole assembly centralisers, roller cutters.
- Drill string make up frames.
- Access platform on top of the pile (if required)

## 5.0 PLANNING AND EXECUTION

OCS will cover the following scope areas during planning and execution of Refusal Remedial projects.

### 5.1 Scope of Work Review

For a particular pile refusal remedial of work, OCS will review the scope of work taking particular note of the following:

- Jacket and Pile pertinent data
- Pile dimensions, pile make up and required pile penetration depth
- Seabed material properties and subsurface soil properties.
- Operating water depth and environmental conditions
- Supporting equipment requirement, eg Type of vessel to be used, deck peripheral equipment etc.
- Preparation of project specific Refusal Remedial Procedure
- Mobilization Interfaces

### 5.2 Equipment Assignment and Layout

Based on a review of the scope of work and the other critical parameters listed in 5.1 above OCS will assign the most appropriate equipment for the work.

Based on the assessment of equipment required OCS will also provided a layout the barge/vessel assigned by the client.

### 5.3 Execution Procedures

OCS will provide project specific execution procedures for every project which address all elements of the project. These procedures must be approved by the client. OCS will ensure that the procedures addresses all constraints posed by individual project site conditions and the specific scope of work.

### 5.4 Equipment Testing

OCS will ensure that all equipment is fully tested before leaving the OCS facility. Client representatives will be invited to witness the testing programme. For more difficult jobs, further specific testing may be required which will be determined on a case by case basis.

### 5.5 HAZID

Specific Hazid and risk identification sessions will be conducted to identify and propose mitigation measures for site hazards which may be posed by operations.

### 5.6 Equipment Mobilisation and Demobilisation

OCS will provide a procedure for equipment mobilization and demobilisation which will be in accordance with client requirements. The procedure will ensure the right equipment, properly prepared is in the right place at the right time.

Its is common practice for remedial equipment to be mobilized as part of the main contract project scope needs. In this case, OCS will liaise with the client to mobilize the equipment to the client designated marine base storage area.

### 5.7 Personnel

OCS will provide a team of qualified personnel to co-ordinate and operate the equipment on a 24-hour basis. The OCS proposed organization chart is in section 3.

### 5.8 Jetting and Airlift Procedures

Details procedures will be developed based on the scope of work provided by the client and approved prior work commencement. Refer following steps for jetting and airlift general operating procedure:

| No. | Description | Ref Doc |
|---|---|---|
| 1. | **Status:**<br><br>**In the event of a pile refusal, the following steps to be undertaken:**<br><br>☐ Confirmation of Pile tip location:<br>Mark chaser pile location with datum to top of Template Can. Measure chaser pile marked point to Chaser Pile and Main Pile bearing interface. Add up the chaser pile measured distance to the known driven pile length to confirm the pile tip location with respect to top of Template can.<br>☐ All concerned management parties to assess the situation and come to a written agreement on the best way forward and required remedial procedures. | |
| 2. | **Status:**<br><br>**In the event jetting and airlift is to be employed as the refusal remedial operations, the following preparation works to be completed prior to jetting;**<br><br>☐ Mobilize jet string equipment to offshore.<br>☐ Derig Chaser Pile and Hammer from crane and stow on deck.<br>☐ Measure soil plug location with respect to top of Template can.<br>☐ Make ready jet string hang-off beam and set close to refused pile location on Template walkway.<br>☐ Clear installation vessel deck area for jetting spread set-up and for jet string make up. | |

| No. | Description | Ref Doc |
|---|---|---|
| | ☐ Set-up jetting spread on installation vessel deck.<br>☐ Confirm jetting depth requirement and mark relevant depth markings on the jet strings.<br>☐ Make ready gaskets, studbolts and all flange fitting tools for jet string flanges. To place required amount on deck and at the refused pile location on template.<br>☐ Make ready 2-1/2" jet and airlift pipings. To place required amount on deck and at the refused pile location on template.<br>☐ Make ready welding labour, equipment and consumables for cutting and welding of 2-1/2" jet and airlift pipings. To place required amount on deck and at the refused pile location on template.<br>☐ Make ready 2 units air tuggers and cables for maintaining orientation of the jet string.<br>☐ Make ready jet string deployment rigging.<br>☐ Confirm jetting procedures is understood with all working personnel. Perform Tool Box talk and sign off on JSA.<br>☐ PTW to be in place. | |
| 3. | **Jet String Assembly for 1st Stage Jetting and Airlift**<br>☐ Make-up double string sections "Stab 1" (24m nominal length) on installation vessel deck.<br>☐ Make-up double string sections "Stab 2" (24m nominal length) c/w jet string top manifold on installation vessel deck.<br>☐ Make-up double string sections "Stab 4" (24m nominal length) on installation vessel deck.<br>☐ Connect jetting and airlift pipings by welding on pre-cut 2-1/2" diameter x 1100mm long collars on the pre-strung sections.<br>☐ Install lifting flange, lift and stab "Stab 1" into the Template can. Derig lifting flange after weight of "Stab 1" is fully supported by the hang-off beams.<br>☐ Install the lifting flange, lift and stab "Stab 2" onto "Stab 1".<br>☐ Connect jetting and airlift pipings by welding on pre-cut 2-1/2" diameter x 1100mm long collars.<br>☐ Lift "Stab 1" + "Stab 2" assembly, clear hang-off beam and lower the assembly into the Template can. Stopper of "Stab 2" to be hang off. Derig lifting flange after weight of the assembly is fully supported by the Hang-off Beams.<br>☐ Connect 2 x 2" water hoses and 1 x 2" air hose to jet string top manifold. Lift off "Stab 4" with the aid of hoses handling saddle and stab onto "Stab 2".<br>☐ Connect jetting and airlift pipings by welding on pre-cut 2-1/2" diameter x 1100mm long collars.<br>Note:<br>Actual required Stab-on sections to be finalized at site based on pile tip depth assessment, confirmation of jetting depth and project location water depth. | |

| No. | Description | Ref Doc |
|---|---|---|
| 4. | **Jetting and Airlift 1st Stage**<br><br>☐ Prepare to start jetting.<br>☐ Lower jetting assembly to seabed.<br>☐ Start jetting pump and air compressor<br>☐ Open jetting valve and air valve to jetting/ airlifting string and break circulation<br>☐ Once circulation is established, lower slowly to seabed<br>☐ During jetting, the following to be monitored:<br>- Jet pump discharge.<br>- Weight on jetting/ airlift string | |
| 5. | **At the end of 1st Stage Jetting and Airlift;**<br><br>☐ Stop jetting pump and air compressor and allow to depressurize.<br>☐ Reinstate hang off beam and hang off the jet string assembly until assembly is fully supported by the hang-off beams<br>☐ Cut connecting 2-1/2" jetting and airlift piping and disconnect jet string top manifold. Prepare cut off section ready to receive the next section. | |
| 6. | **Jet String Assembly for 2nd Stage and subsequent Jetting and Airlift operations**<br><br>☐ Continue add on sections and perform the jetting operations as above sequence until required plug removal depth. | |
| 7. | All concerned parties to sign off for acceptance. | |

## 5.9 Drilling off the Boom Procedures

Details procedures will be developed based on the scope of work provided by the client and approved prior work commencement. Refer following steps for drilling off the boom general operating procedure:

| No. | Description | Ref Doc |
|---|---|---|
| 1. | **Status:**<br><br>**In the event of a pile refusal, the following steps to be undertaken:**<br><br>☐ Confirmation of Pile tip location:<br>Mark chaser pile location with datum to top of Template Can. Measure chaser pile marked point to Chaser Pile and Main Pile bearing interface. Add up the chaser pile measured distance to the known driven pile length to confirm the pile tip location with respect to top of Template can.<br>☐ All concerned management parties to assess the situation and | |

| No. | Description | Ref Doc |
|---|---|---|
| | come to a written agreement on the best way forward and required remedial procedures. | |
| 2. | **Status:**<br><br>**In the event drilling is to be employed as the refusal remedial operations, the following preparation works to be completed prior to drilling;**<br><br>☐ Mobilize drilling equipment to offshore.<br>☐ Derig Chaser Pile and Hammer from crane and stow on deck.<br>☐ Measure soil plug location with respect to top of Template can.<br>☐ Clear installation vessel deck area for drilling spread set-up.<br>☐ Set-up drilling spread on installation vessel deck.<br>☐ Set-up drill string make up frame on the side of the vessel close to the refused pile location or the open pile/ chaser pile top.<br>☐ Set-up “pre-made” drill string hang off frame on the side of the vessel to hang off “pre-made” up drill strings.<br>☐ Confirm drilling depth requirement and mark relevant depth markings on the drill string.<br>☐ Make ready all tools including tongs supports and slips for drill string make up.<br>☐ Make ready 2 unit air tuggers and cables for maintaining orientation of the jet string.<br>☐ Make ready drill strings deployment rigging.<br>☐ Confirm drilling procedures is understood with all working personnel. Perform Tool Box talk and sign off on JSA.<br>☐ PTW to be in place. | |
| 3. | **Drill String Assembly**<br><br>☐ Pre-make-up double or triple string sections torque tightened with the power swivel and tongs (refer following steps for drill string make up).<br>☐ Rig-up power swivel and connect to the pre-made up drill string on the hang off frame.<br>☐ Lift the first drill string (DS-1) with the power swivel and connect to the bottom hole assembly (BHA). Torque tighten the connection using power swivel and thongs.<br>☐ Lift and lower BHA + DS-1 to hang off for next drill string assembly.<br>☐ Disconnect power swivel from DS-1.<br>☐ Connect power swivel to subsequent pre-made-up drill strings and lower drill strings as its made up until required drill string length is achieved.<br>☐ Lower drill string assembly and stab into the pile until BHA reaches the soil plug elevation.<br>☐ Establish control tugger lines to the power swivel. | |

| No. | Description | Ref Doc |
|---|---|---|
| | Note:<br>Actual required drill strings sections to be finalized at site based on pile tip depth assessment, confirmation of drilling depth and project location water depth. | |
| 4. | **Drilling operations**<br>☐ Prepare to start drilling.<br>☐ Start the air compressor<br>☐ Open air valve to drill string and break circulation<br>☐ Once circulation is established, lower slowly to seabed<br>☐ Lift bit off bottom and start rotating at approximately 10 RPM<br>☐ Lower drill string and maintaining a nominal weight of the bit.<br>☐ Monitor circulation. If circulation drops off, raise drill string and let cuttings clear from reverse circulation drill bit. When circulation returns to normal, recommence drilling. Pay close attention to torque fluctuations.<br>☐ Increase RPM progressively after 1m of hole as been made.<br>☐ During drilling, the following to be monitored:<br>- Circulation rate through discharge<br>- Airlift air pressure<br>- Torque<br>- Weight on Bit<br>- Penetration rate by ROV (if possible)<br>- RPM | |
| 5. | **At the end of 1st Stage Drilling;**<br>☐ Drill to the extent of the crane travel and recover drill string to hang off on the drill string make up frame.<br>☐ Stop air compressor and vent off pressure.<br>☐ Disconnect the power swivel from the drill pipe and connect to next section of drill string and torque tighten to make up the tool joint.<br>☐ Open the air valve to commence circulation<br>☐ Once circulation is established, commence drilling again.<br>☐ Continue add on sections and perform the drilling operations as above sequence until required plug removal depth. | |
| 6. | All concerned parties to sign off for acceptance upon drilling completion. | |

## 5.10 On Shore Preparation / Trial

Prior to any mobilization of the refusal and remedial spread the system are tested at OCS's onshore facilities at Batam and/or Singapore. The purpose is to ensure the soundness of the equipment i.e.:

i) Pressure and flow volume of the jetting pump.

ii) Jacks and Tongs testing for the drill strings make up
iii) Drilling Power Swivel testing

At the request of client, OCS can perform a mock set-up and perform a full circulation trial of the system.

### 5.11 Lifting Equipment Certification

All OCS owned equipment's including the lifting racks, containers and pumps skid have been designed for lifting in accordance with DNV lifting codes for offshore packages. The rigging points will be NDT (MPI) and lift riggings will be certified prior mobilization.

## 6.0 OCS CLIENT BASE

OCS has built up a significant customer base during twelve (12) years of operations. OCS past and present clients are listed below. References can be provided on request:

| NO | CLIENT NAME |
|---|---|
| 1 | Asia Petroleum Developments / Salamander Energy (Indonesia) [*] |
| 2 | Bumi Amarda |
| 3 | Chevron (Thailand) |
| 4 | Clough Sapura JV (Australia) [*] |
| 5 | DOF Subsea. |
| 6 | EMAS (Singapore) |
| 7 | Franklin Offshore (Singapore) |
| 8 | Galoc ( Philippines) |
| 9 | GFI (Thailand) |
| 10 | Global Industries (Malaysia)/Technip (M) |
| 11 | Hako Offshore (Singapore) |
| 12 | Heerema (Netherlands) |
| 13 | HESS (Indonesia) [*] |
| 14 | Kangean Energy (Indonesia) |
| 15 | Larsen & Toubro (Malaysia/ India) |
| 16 | M3 Energy (Malaysia) |
| 17 | McConnell Dowell CCC JV (Australia) |
| 18 | MRTS Engineering Ltd (Russia) |
| 19 | Newfield Peninsula Malaysia (Malaysia) |
| 20 | Nippon Steel (Indonesia) |
| 21 | NorCE (Singapore) |
| 22 | NuCoastal (Thailand) |
| 23 | Offshore Marine Contractors |

| | |
|---|---|
| 24 | Origin Energy (Australia) |
| 25 | PT Timas Suplindo (Indonesia) |
| 26 | Sapura Acergy (Malaysia) |
| 27 | Sarku (Malaysia) |
| 28 | Sea Drill (Singapore) |
| 29 | Star Petroleum (Indonesia) |
| 30 | Swiber (Singapore) |
| 31 | TLO Sapura Crest (Malaysia) |
| 32 | Vietsovpetro (VSP) (Vietnam) |
| 33 | PTSC (Vietnam) |
| 34 | Shelf Subsea (Singapore) |

## 7.0 EQUIPMENT GENERAL DESCRIPTION

OCS operates a complete set of refusal and remedial equipment. Each piece of equipment has its own equipment passport which is maintained from project to project. This helps to ensure that only appropriately maintained equipment is supplied to projects.

The key equipment components of our refusal remedial spread are as follows:

### 7.1 Jetting and Airlift Spread

**i) 40ft Open Top Container consists of:**

a) 10” Pipe Flanged strings (fitted with 2 x 2” Water Jet pipe & 1 x 2” Compressed air line)
- 40ft LG x 10” dia Jetting Head Section (Type 4) 01 ea
- 40ft LG x 10” dia Jetting Intermediate Section (Type 2) 03 ea
- 40ft LG x 10” dia Jetting Intermediate Section (Type 3) 13 ea
- 40ft LG x 10” dia Top Section (Type 1) 01 ea
- Lifting Cap for jetting and airlift string 03 ea
- Centralizers 04 ea

b) 2” dia x 500 psi Jetty Hose in 200 ft LG04 ea

**ii) B. 20ft High Cube Container consists of:**

a) Centralizers
b) Neoprene Rubber, 5mm WT x 508mm OD x 280mm ID
c) Pipe sleeve, 2-1/2" dia x 5mm WT x 1000mm LG
d) 6” dia to 2” dia Water Distribution Manifold
e) 8” ANSI 150lb Foot Valve Cast Iron

f) Misc Hose Assembly
g) Venture System Device
h) 8" dia to 6" dia reducer (#300 rating)
i) 8” dia x 1ft LG pup piece
j) Water Filled Pressure Gauge (500 Psi)
k) 6” dia x 1ft LG pup piece

**iii) Jetting Pump**

- Engine Make : Detroit Diesel 8V-92TA 450BHP
- Pump Make : SLD 280-43 3 Stage
- Capacity : 320 Cu.m / Hr
- Maximum Head :171 meters

## 7.2 Drilling off the Boom (DOTB) Spread

**i) The DOTB assembly consists of:**

a) Power Swivel
OCS reversed circulation (air lift) Wirth KDK 3-5 Power Swivel is suitable for soil plug removal and pilot hole drilling. Reverse circulation drilling is a highly effective solution for drilling deep and large diameter foundations in hard rock and mixed formations. The power swivel has a torque capacity of 66kNm and reverse circular rotation of 9.4 to 22.4rpm. The power swivel is suitable for NW 150 drill pipe.

The power swivel comes with a DOTB frame for lifting by the crane and outriggers for the tugger wire orientation control.

b) The cross over from the power swivel to drill pipes consists of a bespoke NW150 to 13-3/8 H490 pin with integrated air lines.

c) Drill Pipes
OCS Hughes 13 – 3/8 H490 pin box drill pipes which comes with the wash pipe assembly. The drill pipes come in nominal length of 15’ and the sections are made up on the DOTB make up frame torque tightened with power swivel and tongs.

d) Cross over 13 – 3/8 H490 drill pipe to the Bottom Hole Assembly

e) Bottom Hole Assembly and the Drill Collar
The drill collar and the stabilizers on the BHA will be designed and fabricated specifically to suit the pile internal dimensions and depth of insert/ penetration.

f) Drill Bit (Roller Cutter)

OCS designs and fabricates the drill bits to suit project specific requirements. The cutters are exchangeable on the drill bit body according to geological formation but generally milled tooth roller cutter bits are preferred.

### ii) Hydraulic Power Pack

The hydraulic power swivel will be driven by OCS owned 230kW HPU which has 350 L/m at 1500rpm. The HPU is capable of operating up to 210bar pressure.

### iii) DOTB Tool Make up System

The tool make up jacking system comprises of a make up frame integrated with the hydraulic jack. The make up frame would be designed to suit the installation vessel. OCS will design the make up frame and provide the design to the client to fabricate and install on the vessel.

OCS uses HT100 Tongs to make up or break the 13-3/8 H490 connections. The tong is pulled via the jacks from the make up frame.

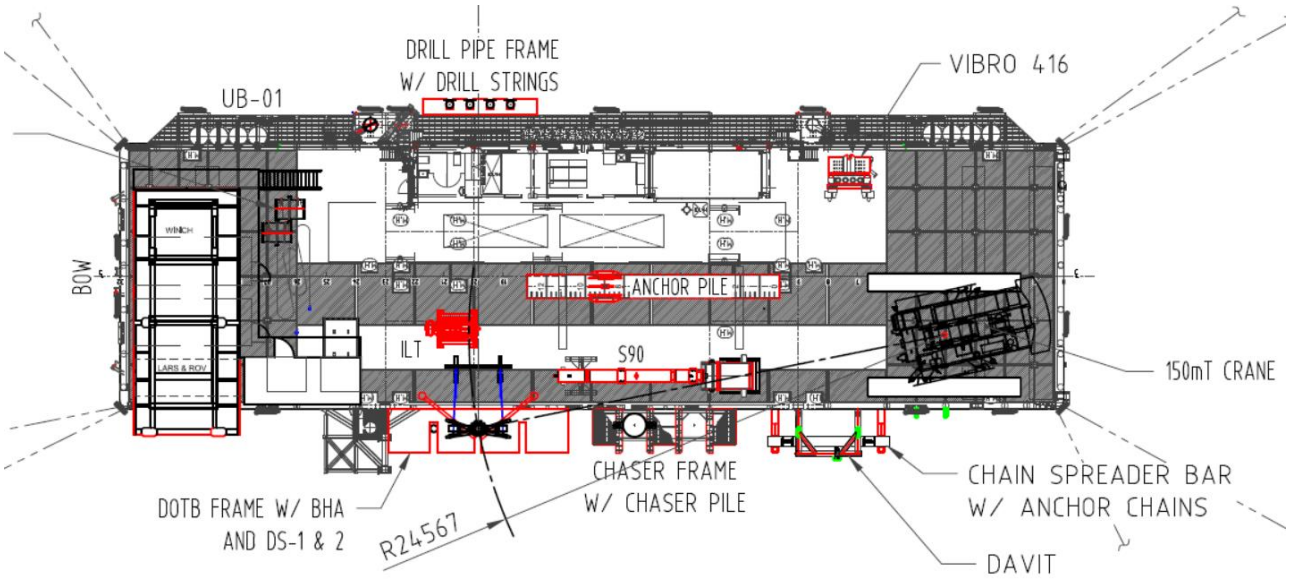
Summarizing the tool make up system:

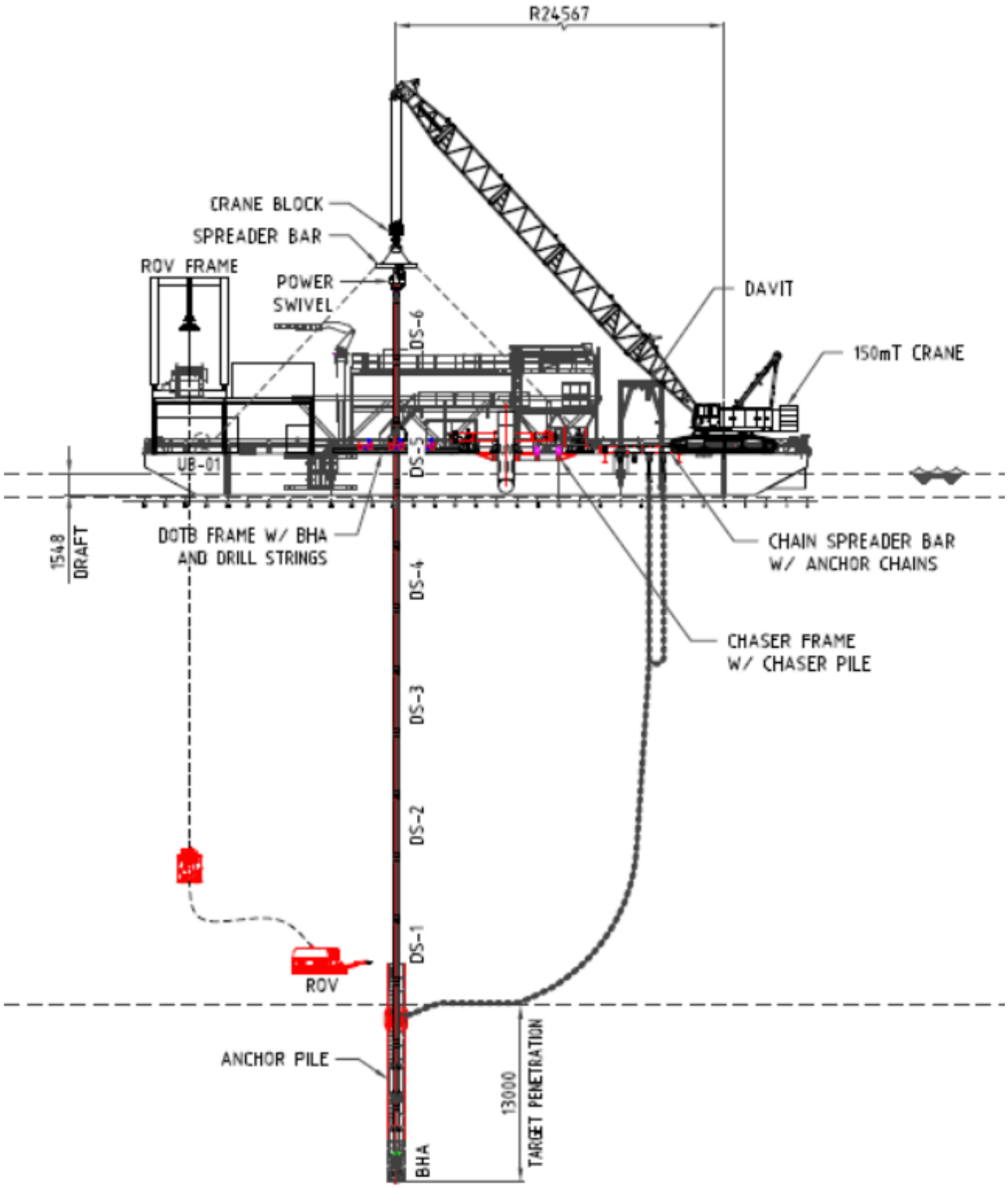
a) DOTB Make up Frame aka DOTB Work Deck - Designed by OCS, fabricate and installed by Client
b) Hydraulic Jacks
c) HT100 Tongs

### iv) Air Lift System

## 7.3 Typical Layout of Equipment on vessel

A typical layout of the DOTB in operations is shown below.






ELEVATION VIEW
SCALE 1 : 500

## 8.0 JETTING AND AIRLIFT PRINCIPAL EQUIPMENT DATA SHEETS

### JETTING AND AIRLIFT STRING


### TECHNICAL SPECIFICATIONS:

| | |
|---|---|
| Pipe Nominal Size | 10” |
| Water Jet Line | 2 x 2” |
| Compressed Air Line | 1 x 2” |
| Jetting Head Section (Type 4) | 40ft Lg x 10” dia x 01 ea |
| Jetting Intermediate Section (Type 2) | 40ft Lg x 10” dia x 03 ea |
| Jetting Intermediate Section (Type 3) | 40ft Lg x 10” dia x 13 ea |
| Top Section (Type 1) | 40ft Lg x 10” dia x 01 ea |
| Lifting Cap for Jetting and Airlift String | 03 ea |
| Centralizers | 04 ea |

## JETTING PUMP

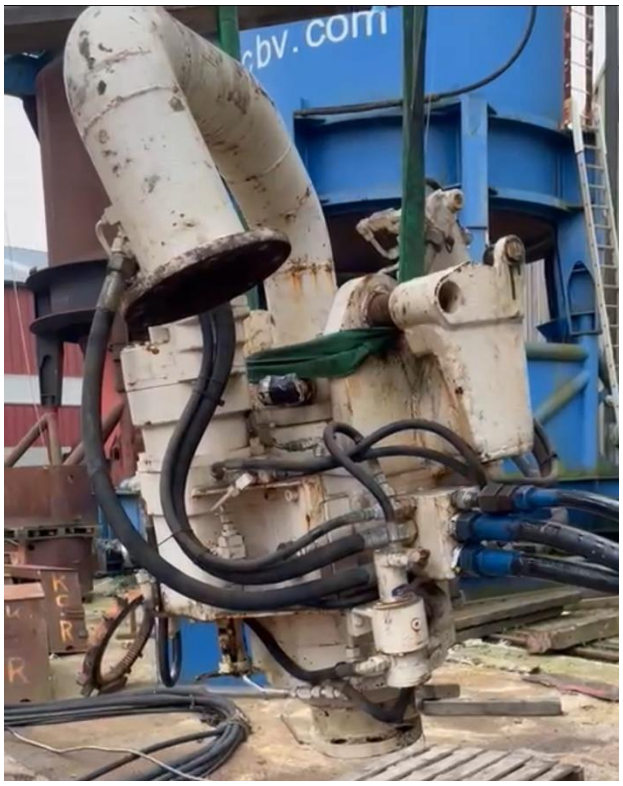

### TECHNICAL SPECIFICATIONS:

| | |
|---|---|
| Pump | 3-Stage Centrifugal Diesel Driven Pump |
| Fluid End | 200SLD280-43x3 |
| Flow Rating | 320m3/ hr (1409 Us Gallon) |
| Head | 171m (248psi) |
| Suction Inlet | 8” – 150# |
| Discharge Outlet | 8” – 150# |
| Engine | GM 8V92TA 2 Stroke Diesel Engine |
| Power Output | 450 bhp (336 kW) @ 2100 rpm |
| Peak Torque | 1250 lb-ft (1695 N.m) @1300rpm |
| Skid frame | 3800 x 1500x 2380 |
| Weight of Unit | 6mt |

## 9.0 DOTB PRINCIPAL EQUIPMENT DATA SHEETS

### 9.1 Wirth KDK 3-5 Power Swivel

**WIRTH KDK 3-5 POWER SWIVEL**



**TECHNICAL SPECIFICATIONS:**

| | |
|---|---|
| Make | Wirth |
| Model | KDK 3-5 Reversed Circulation Airlift Powerswivel |
| Suitability | Soil Plug Removal and Pilot Hole Drilling in Hard Rock formation |
| For Drillpipe | NW 150 |
| Torque | 66 kNm |
| Rotation | 9.4 to 22.4 rpm |
| Hydraulic Power Requirement | Hydraulic Pressure: 200bar<br>Hydraulic Flow: 375 l/min<br>(HPU Engine Power approximately 170 kW) |

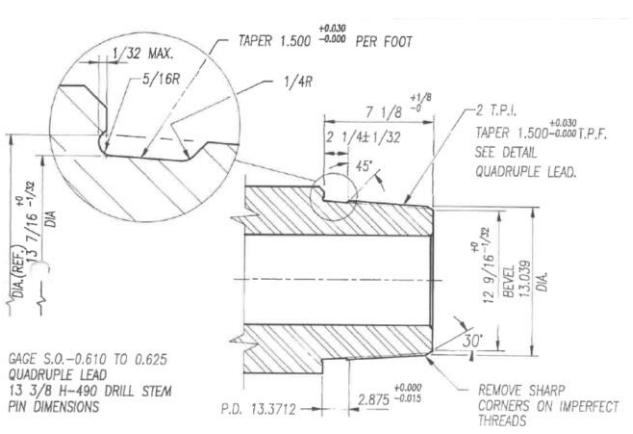
## 9.2 13-3/8 H490 Drill Pipes

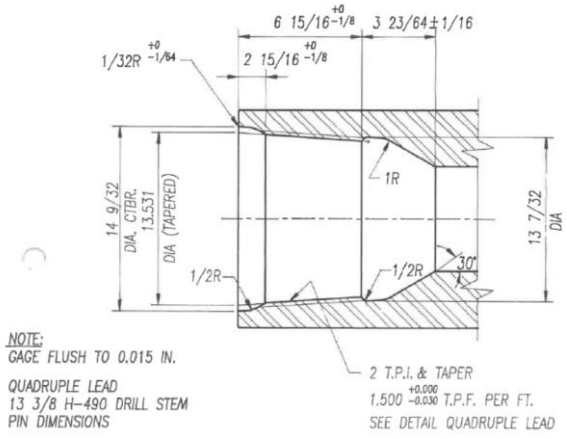
### 13-3/8 H490 Drill Pipes

### TECHNICAL SPECIFICATIONS:

| | |
|---|---|
| Make | Hughes |
| Pipe Details | 15ft 13-3/8” H490 |

### H490 PIN AND BOX CONNECTION DETAILS:



## 9.3 230kW Hydraulic Power Pack

### 230kW HYDRAULIC POWER PACK


### 230KW DIESEL ENGINE HYDRAULIC POWER PACK SPECIFICATIONS

| | |
|---|---|
| Engine | NISSAN Diesel RF8 |
| Power & Speed | 230kW @ 1500 rpm |
| Hydraulic Piston Pump | A11VO260LRDS/11R-NZD 12N00<br>(1 x 350L/min) |
| Pressure Setting | 230 Bar |
| Working Pressure | 210 Bar |
| Air Cooler | OK-ELD6H/3.1/24V/1/S |
| Hydraulic Oil Tank Capacity | 1125L |
| Diesel Oil Tank Capacity | 400L |
| Engine Fuel Consumption | 80L/h |
| Dimensions | 3.8 x 1.8 x 2 (m) |
| Weight | 5.5 Ton |
| No of Units | 1 |

## 9.4 HT100 Tong

**HT100 TONG**

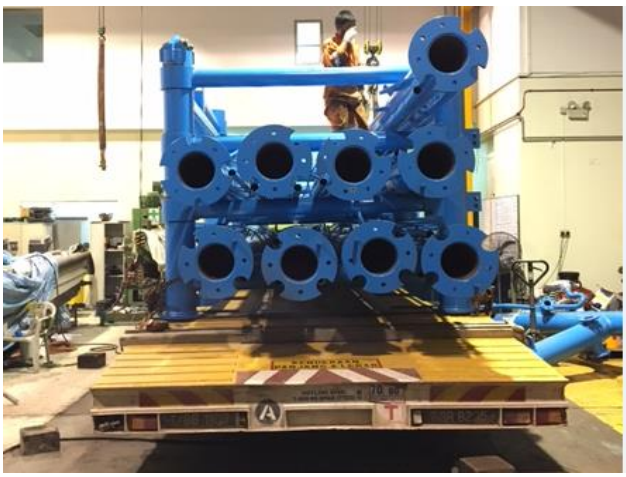

OCS HT100 Tong is of 15 ¾" type with 60,000 lb-ft (8,295 kg-m) Torque capacity
Moment Arm = 5ft (1.53m)

## 9.5 Roller Cutter

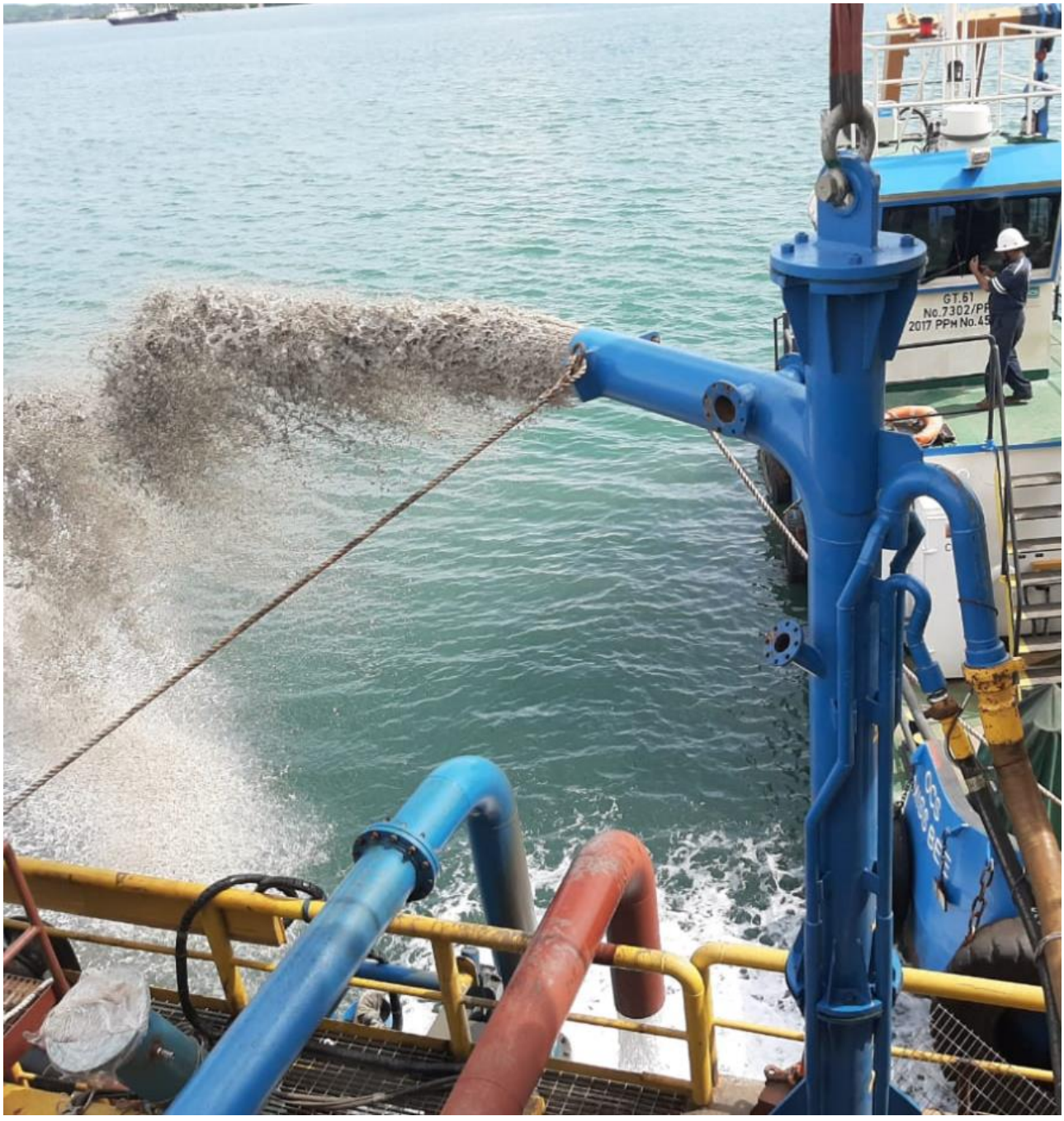
**ROLLER CUTTER**


## 10.0 PICTURES – JETTING AND AIRLIFT

### JETTING AND AIRLIFTING STRINGS MOBILIZED IN LIFTING RACKS



## JETTING AND AIRLIFTING STRINGS DURING JETTING OPERATIONS



## 11.0 PICTURES – DRILLING OFF THE BOOM OPERATIONS

**DRILLING OFF THE BOOM OPERATIONS**

## 12.0 ISO CERTIFICATION

# Certificate of Registration

This certificate has been awarded to

**Offshore Construction Specialists Pte Ltd**

36 Kian Teck Road, Singapore 628781, Singapore

in recognition of the organization's Quality Management System which complies with

**ISO 9001:2015**

The scope of activities covered by this certificate is defined below

**Provision of Project Management and Consultancy Services for Oil and Gas Construction Facilities**

| Certificate Number: | Date of Issue: (Original) | Date of Issue: |
|---|---|---|
| 41578/B/0001/SA/En | 04 November 2016 | 04 November 2019 |
| **Issue No:** | **Expiry Date:** | |
| 2 | 03 November 2022 | |

Issued by: *On behalf of the Director*

Accredited Certification Body
SAC
QS-2014-24

## 13.0 NATA CERTIFICATION

ACCREDITED LABORATORY

NATA
WORLD RECOGNISED ACCREDITATION

ilac-MRA

NATIONAL ASSOCIATION OF TESTING AUTHORITIES, AUSTRALIA

has accredited:

Offshore Construction Specialists Pte Ltd

Singapore

Following demonstration of its technical competence to operate in accordance with:

ISO/IEC 17025

This facility is accredited for the tests shown on the Scope of Accreditation issued by NATA.

Jennifer Evans
Chief Executive Officer, NATA

Date of issue: 28 January 2022 | Date of Accreditation:15 July 2013 | Accreditation number: 19122 | Site number: 21585

The Commonwealth recognises NATA as the national authority for accreditation of laboratories, and a leader in accreditation internationally. NATA is a signatory to the mutual recognition arrangements of the International Laboratory Accreditation Cooperation (ILAC) and the Asia Pacific Accreditation Cooperation (APAC). (ABN 59 004 379 748) Limited by guarantee
AP6-1-9 / Issue 6 / October 2021

## 14.0 BCA CERTIFICATION

Serial No : C2108038

Building and Construction Authority

# CERTIFICATE OF LICENCE

This is to certify that

**OFFSHORE CONSTRUCTION SPECIALISTS PTE LTD**

(Unique Entity Number / ACRA Registration Number : 200720801G )

is licensed as a

General Builder Class 1
(24 Aug 2021 to 24 Aug 2024)

under Part VA of the Building Control Act and Building Control (Licensing of Builders) Regulations 2008

Commissioner of Building Control
Singapore

Date: 25 Aug 2021