## PIPELINE POST-TRENCHING
### PRE-QUALIFICATION DOCUMENT

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</table>
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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, 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 has invested considerably in water distribution systems and in pipeline post trenching burial equipment. The water distribution systems provide a high volume/pressure water supply that is used to facilitate the Company’s pipeline post trenching, pipeline flooding, cleaning and gauging and pile remediation operations.

The company has constructed two jet sleds together with a sled deployment A frame and jet hose spooling equipment. A further jet sled configuration is available for extreme shallow water operations.

Maximum jetting pressures/volumes are in the range of 550 psi at 478 m³ per hour. OCS has 3 jet pumps that deliver at this capacity giving a system capacity of over 1400 m³ per hour. The jet pumps are fed by high volume electric (1500 m³ per hour at 50 psi) and diesel (1500 m³ per hour at 50 psi) pumps to enhance pump efficiency. In very hard materials higher pressures are possible by using smaller nozzle sizes and pumps of higher pressure capability.

To manage the supply of water to the jet sled OCS has developed a unique bespoke design water distribution manifold that takes the water from the feed pumps and diverts it through the pressure pumps before sending the pressurised water to the jet sled. The manifold pipe work has been built into a 20 ft container frame work to enhance portability and ease of set up.

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 post-trenching 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 PIPE BURIAL EXPERIENCE

OCS has undertaken seven (07) major post-trenching projects for different customers:

- APD/Salamander (Serica Kambuna Development project) 2009/10, 14" CWC pipeline x 13,000 km burial distance, 2.0m TOP cover. Nearshore north of Medan, Sumatra, Indonesia;
- HESS Indonesia (Ujung Pangkah Phase 1) 2010, 6" CWC, 12" CWC & 16" CWC pipelines x 5,500 km burial distance each line, 2.0m TOP cover. Nearshore north of Gresik/Surabaya, East Java, Indonesia;
- CSJV/Chevron Australia (DOMGAS 20" pipeline project) 2012, 20" CWC pipeline x 25km burial distance (in combination with intermittent rock bolting), 0.5/1.0m TOP cover. Karratha, Western Australia, Australia.
- Pertamina EP MOL 12" Pipeline near Cirebon in Central Java Indonesia. Pipeline was buried 2.0 metre TOP in highly cohesive clay for the most part in a single pass.
- Ketapang Petronas offshore Gresik in Surabaya, post trenching of 27km of 12" pipeline to 2m TOP.
- Thai Binh for PVGAS, post trenching of 10km length of 12" pipeline for the gas distribution project, in Vietnam. Main contractor is Sapura Kencana.
- Jankrik for ENI. Burial of 32 km of 24" / 4" Piggy back to varying TOP from 0.5 metres to 2.0 metres using a pontoon articulated arm jet sled.

Our in-house equipment spread is described in detail in this document. OCS is equipped to handle the full range of post-trenching activities with depth of cover ranges from one (1) to three (3) metres on pipeline diameters up to 48". Additionally the jet sled unit can be modified to further suit more demanding or special project requirements with sufficient planning. Our high pressure high flow rate centrifugal pump spread is suitable for material up to 200kPa with the correct nozzle configuration, however the most efficient burial operations are conducted where the seabed material is less than 40kPa. For harder formations a separate jetting arm and ultra high pressure pump can be incorporated.

Furthermore where water depths are shallow (less than 2m) and vessel access is restricted an alternative jet sled configuration (Articulated Jet Sled, AJS) is available that can be floated into position and ballasted over the pipeline. This sled was used on the Jangkrik Piggy back pipeline mentioned above.

OCS is equipped to handle large projects or discrete project elements depending on the specific needs of the customer. During the preparation for pipe burial 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

2.1 KEY PERSONNEL CONTACTS

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Refer to the next page for OCS Organisation Chart
3.0 TYPICAL POST-TRENCHING ORGANISATION CHART

Personnel requirements for 24 hour operations specifically for operating the pipe burial equipment spread are as follows:

- 1 x Jetting Supervisor/Superintendent
- 1 X Jetting Engineer.
- 4 x Technicians/Mechanic (2 per shift)
- 4 x Winch Operator / General Helpers(2 per shift)

OCS normally provides personnel specifically associated with the operation of the jet sled and associated water distribution systems only.

Craneage, rigging and welding support along with key subcontract support including diving 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 PLANNING AND EXECUTION

OCS will cover the following scope areas during planning and execution of post trenching projects.

4.1 Pipeline Burial Scope

OCS will review the scope of work taking particular note of the following:

- Pipeline outside diameter inclusive of all coating/s;
- Burial depth (coverage) required with reference to top-of-pipe (TOP);
- Burial distance required, inclusive of transition zones
- Seabed material properties, and seabed bathymetry/features
- Operating water depth, inclusive of tidal considerations
- Supporting equipment requirement

4.2 Equipment Assignment and Layout

Based on a review of the scope of work and the other critical parameters listed in 4.1 above OCS will assign the most appropriate equipment spread to the work. If there is hard material in some locations, consideration will be given to the mobilisation of dedicated super high pressure pumps and high pressure jetting arms specifically to deal with these areas and or to provide a suite of smaller nozzles to direct more pressure to the hand material. Jetting nozzles sizes and configurations will be determined such that they are specific to the nature of the seabed material to be jetted. The operating draft of the assigned support vessel and the operating water depth are also considerations. If the water is particularly shallow in close proximity to the beach, OCS will provide a specific sled that can be floated into position and ballasted down onto the pipe with extension hoses used to provide water and air to the spread.

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

In certain cases OCS can provide the operating vessel on which to base the equipment depending on the specific needs of the client although it is our experience that it is most cost effective to use a vessel that is already engaged in other areas of the project.

4.3 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 address all constraints posed by individual project site conditions and the specific scope of work.

4.4 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.
4.5 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.

4.6 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.

4.7 Personnel

OCS will provide a team of qualified personnel to co-ordinate and operate the equipment on a 24 hour basis. Key personnel will be the same as those who tested and mobilized the equipment. The OCS proposed organization chart is in section 2.

4.8 Site Operations

Typical procedures for site operations are included in this document. OCS will work closely with the client to ensure post trenching activities are closely coordinated with other activities on the project.

4.9 Surveys

Typically an surface air diving spread is utilised with regular trench profile checks behind the jet sled, particularly upon start up until jetting parameters are optimised to complete the required pipe burial depth in one pass (where possible).

On completion of burial operations the pipeline will be surveyed using client approved equipment and procedure such as side scan survey and sub-bottom profiling. Any anomalies or deficiencies in meeting the required pipeline burial depth will be corrected in an expedient manner.
5.0 OCS CLIENT BASE

OCS has built up a significant customer base during eight (8) years of operations. OCS past and present clients are listed below. References can be provided on request:

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<thead>
<tr>
<th>NO</th>
<th>CLIENT NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Asia Petroleum Developments / Salamander Energy (Indonesia) [*]</td>
</tr>
<tr>
<td>2</td>
<td>Bumi Amarda</td>
</tr>
<tr>
<td>3</td>
<td>Chevron (Thailand)</td>
</tr>
<tr>
<td>4</td>
<td>Clough Sapura JV (Australia) [*]</td>
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<tr>
<td>5</td>
<td>DOF Subsea.</td>
</tr>
<tr>
<td>6</td>
<td>EMAS (Singapore)</td>
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<td>7</td>
<td>Franklin Offshore (Singapore)</td>
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<td>8</td>
<td>Galoc (Philippines)</td>
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<td>9</td>
<td>GFI (Thailand)</td>
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<td>10</td>
<td>Global Industries (Malaysia)/Technip</td>
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<td>11</td>
<td>Hako Offshore (Singapore)</td>
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<tr>
<td>12</td>
<td>Heerema (Netherlands)</td>
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<tr>
<td>13</td>
<td>HESS (Indonesia) [*]</td>
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<td>14</td>
<td>Kangean Energy (Indonesia)</td>
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<td>15</td>
<td>Larsen &amp; Toubro (Malaysia/India)</td>
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<td>16</td>
<td>M3 Energy (Malaysia)</td>
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<td>17</td>
<td>McConnell Dowell CCC JV (Australia)</td>
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<td>MRTS Engineering Ltd (Russia)</td>
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<td>Star Petroleum (Indonesia)</td>
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<td>Swiber (Singapore)</td>
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<td>31</td>
<td>TLO Sapura Crest (Malaysia)</td>
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<tr>
<td>32</td>
<td>Vietsovpetro (VSP) (Vietnam)</td>
</tr>
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</table>
6.0 PIPE BURIAL - TRACK RECORD

<table>
<thead>
<tr>
<th>YEAR</th>
<th>PROJECT</th>
<th>CLIENT / OPERATOR</th>
<th>SCOPE OF WORK</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>JANGKRIK (ENI INDONESIA)</td>
<td>CLIENT : PT TIMAS SUPLINDO (sub contractor)</td>
<td>Technip was contracted by ENI Muara Bakau, Indonesia for the EPCI for the subsea package for Jangkrik project for installation of 24&quot;/4&quot; piggy back x 72km pipeline in water depths up to of 430m. PT Timas was subcontracted to perform the pipe laying at the shallow section between KP61.3 and KP 37.79 to water depths up to 30m. Part of the requirement for pipelay at the shallow water depth includes the post trenching of ~32km with a trench depth ranging from 0.5m to 2m T.O.P, from water depth ranges from less than 2m to 30m. OCS’s Pontoon Articulated Arm Jet Sled (PAAJS) is used due to the piggy back pipeline configuration to avoid contact during post trenching operation</td>
</tr>
<tr>
<td>2015</td>
<td>THAI BINH (VIETNAM)</td>
<td>CLIENT: SAPURA KENCANA</td>
<td>OCS was contracted by SAPURA KENCANA for the provision of post trenching support on board SK vessel. A total of 10km of pipeline was post trench to 1m BOP mostly performed in a single pass</td>
</tr>
<tr>
<td>2014</td>
<td>PETRONAS KETAPANG (INDONESIA)</td>
<td>CLIENT : PT TIMAS SUPLINDO</td>
<td>OCS was contracted by PT Timas to post trench 27 km of 12” pipe to be buried to 2.0 metres TOP from the beach area till offshore. The pipeline length is 110km. 2 passes were required at most section of the route. The work was completed in 2014</td>
</tr>
<tr>
<td>2013</td>
<td>PERTAMINA MOL PIPELINE (INDONESIA)</td>
<td>CLIENT: LEIGHTON OFFSHORE.</td>
<td>8.5 km of 12” pipeline buried 2.0 metres TOP in highly cohesive clay. Trench completed mostly in one pass. Progress average 1.0 km per day.</td>
</tr>
<tr>
<td>2012</td>
<td>GORGON DOMGAS 20IN PIPELINE</td>
<td>CLIENT: CLOUGH SAPURA JV (Australia)</td>
<td>CSJV was contracted by Chevron Australia Pty Ltd for the installation of the 20” x 59.4 km long offshore DOMGAS pipeline from Barrow Island to mainland Australia for the Gorgon Upstream Project. In order to achieve required permanent stability of the DOMGAS 20in pipeline, a combination of pre/post pipelay trenching and rock bolting were deployed. OCS was contracted by CSJV to perform post pipelay trenching for specific sections which were carried out in two phases; trenching between KP18.200-34.300 (with DLB Java Constructor), and post trenching between KP 48.414-57.014 (with...</td>
</tr>
<tr>
<td>YEAR</td>
<td>PROJECT</td>
<td>CLIENT / OPERATOR</td>
<td>SCOPE OF WORK</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
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<td>---------------</td>
</tr>
</tbody>
</table>
| 2010 | UJUNG PANGKAH PHASE 1 | CLIENT: PT TIMAS OPERATOR: HESS INDONESIA | SWLB Geocen Kalinda).  
• Seabed: Coarse calcareous sand (semi-compact)  
• Progress: 1000m per day, dual pass  
  • PMT for T&I for P1 development consisting of 3ea x infield pipelines and 1ea x WHP  
  • Detail engineering for three (3) infield lines, 16in Gas, 12in Liquid, and 6in Gas Lift. 5500m each from WHP-A (existing) to new WHP-B  
  • Linepipe coating - AE, CWC, FBE, neoprene  
  • Installation engineering for the T&I scope  
  • Transport and install WHP-B; 370t 8-leg jacket, piles (3 section), and 1500MT topside  
  • Transport and install of three (3) infield pipelines (inclusive of expansion spools and risers)  
  • Pipeline pre-commissioning (flood, pig, testing)  
  • Pipe burial of all three (3) infield pipelines to 2.0m TOP coverage up to 13m LAT water depth. Total burial distance - 15.5km  
  • Seabed: Soft silt, varying to soft green clay  
  • Progress: 1500m per day single pass |
| 2009 | SERICA KAMBUNA FIELD DEVELOPMENT | CLIENT: PT TIMAS OPERATOR: ASIA PETROLEUM DEVELOPMENT (APD) SALAMANDER ENERGY |  
• 14” x 39.0 km pipeline, including 5500m beach pull section for nearshore approach  
• Super duplex pipeline section, expansion spool and riser in the platform approach area (400m)  
• Unmanned 150MT topside onto existing tripod jacket with live conductor well assemblies with hook-up completions  
• Pipeline pre-commissioning (flood, pig, testing)  
• Pre-trenching and pipe burial (jet) for 13.0 km section of 14” pipeline, 2.0m TOP cover  
• Seabed: Black stiff consolidated silt clay  
• Progress: 500-800m per day |
8.0 EQUIPMENT GENERAL DESCRIPTION

OCS operates a comprehensive range of post trenching 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 post trenching are as follows:

i) Suction Feeder Pumps

These pumps provide high volumes of water at a positive head to the pressure pumps. This water supply ensures the pressure pumps work at optimal efficiency giving maximum jetting nozzle pressure and volume output.

OCS stocks both electric and diesel driven suction feeder pumps, Diesel units produce 1500 m³ per hour at 50 psi. Submersible pumps produce 6000 m³ per hour at 50 psi.

ii) Jet Pumps

Three (3) units available. High pressure high flow rate multistage centrifugal pumps with reliable turbocharged diesel prime movers for continuous operation. Total combined output is 6000GPM (550psig maximum)

iii) Super High Pressure Jet Pump/s (Optional for harder material <200kPa)

For hard seabed material formations, a positive piston displacement triplex-type pump can be used to provide approximately 250GPM at 2000psig, requires dedicated jetting arm and hose umbilical. This system assembly is can be used on harder outcrops where the water delivery from the standard jet pumps is not sufficient. Suitable for consolidated stiff clays, and compacted sands.

iv) Jet Hose and spooler unit

A hydraulically powered hose spooler unit equipped with a pressure rated chiksan swivel joint is used for hose deployment and control. Purpose built heavy 8” water jetting hose is used for water supply to the jet sled. The spooler ensures that the optimum amount of hose only is deployed.

v) Jet Sled A-frame

Where the jet sled is deployed at the side of the barge an A-frame is used to deploy and recover the unit, freeing up the crane for other operations.

vi) Jet Sleds (3 units)

Pipe riding and rotating arm sleds are supplied. Two pipe riding sleds are used for smaller and larger pipelines. The rotating arm sled can be floated into shallow water and ballasted down in cases where the barge cannot get back far enough.
vii) Jet Piping Manifold

This unit is a bespoke design that contains control piping valves for all feed and jet pumps. Feed water is routed through the manifold and in and out of the jet pumps before being delivered to hose spooler and jets sled. The unit facilitates the adaption of OCS jetting equipment to any vessel with a minimum of rig up. Pumps can be installed and plumbed in to the manifold with a minimum of effort.

viii) Pontoon / Articulated Arm Jet Sled (PAAJS)

The PAAJS is a new OCS asset more recently added to the OCS equipment inventory. This jet sled has been designed, fabricated and tested completely at the OCS KTR facility in Singapore under the close supervision of the OCS engineering team.

OCS existing pipe riding jet sleds are very efficient but have some drawbacks in that they must be supported by an A frame during trenching operations with consequent limitations on operations in extreme shallow water. A new proposed Articulated Jet Sled (AJS) does not ride on the pipeline but it is supported on either side on buoyancy tank skids while a rotating arm is fitted that is equipped with jetting nozzles and an educting/air lifting facility to remove jetted spoil.

The OCS PAAJS is equipped with ballastable pontoons and floats in sea water. The unit can be floated into shallow water before being ballasted over the pipe for trenching operations. In this way the entire tidal zone can be covered by the sled where necessary.

This design of sled does not make hard contact with the pipeline being trenched and can thus be used on piggy back pipelines configurations such as on the Jangkrik Project (24”/4”) to avoid damage to the piggy back pipeline.

Specific unique features of the PAAJS are summarized as follows:

- The PAAJS is designed to be used in all depths of water but is particularly relevant for extreme shallow water in areas which are not accessible by the attendant barge due to draft limitations.
- The PAAJS does not make hard contact with the pipe so can be utilized on piggy back pipelines avoiding damage to the pipelines and associated blocks used for tie in.
- PAAJS is designed to be transportable in two x 20 ft open top containers and 1 x 20 ft open top half height container and as such can be transported by conventional commercial freight to the location of operations avoiding excessive handling costs.
- PAAJS is designed to be floated with minimum draft into very shallow water. It is then ballasted down over the pipe.
- In very shallow water, the whole sled and pontoon arrangement is maneuvered by winches on the beach and on the mother barge.

Handling of the Articulated Jet SLED shown suspended from OCS A frame. Note the A frame is not required for extreme shallow water operations.
Articulated Jet Sled in operation mode
### 9.0 EQUIPMENT SPECIFIC DESCRIPTION

The following is a general description of the equipment supplied by OCS for pipeline post burial:

<table>
<thead>
<tr>
<th>NO</th>
<th>DESCRIPTION</th>
<th>CAPACITY / DIMENSION (mm)</th>
<th>WEIGHT</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>01A</td>
<td>SUCTION FEEDER PUMP DIESEL (complete with suction piping, foot valve and strainer assembly)</td>
<td>1500 m³ / hr at 50psi 4500L x 1600W x 2400H</td>
<td>7.000 MT</td>
<td>02 EA</td>
</tr>
<tr>
<td>01B</td>
<td>SUCTION FEEDER PUMP ELECTRIC (complete with Switch board for powering by a 75 kVA x 380Volt generator)</td>
<td>6000 m³ / hour at 50 psi. 4500L x 1600W x 2400H</td>
<td>2 MT</td>
<td>02 EA</td>
</tr>
<tr>
<td>02</td>
<td>JET PUMPS</td>
<td>2000 USGPM (600psig) 6100L x 2450W x 2650H</td>
<td>18.000 MT</td>
<td>03 EA</td>
</tr>
<tr>
<td>02A</td>
<td>JET PUMP - Spare fluid end</td>
<td>2000 USGPM/ 600psi 4150L x 1780W x 1400H (package)</td>
<td>2.500 MT</td>
<td>01 EA</td>
</tr>
<tr>
<td>04</td>
<td>JET PUMP - Super high pressure (triplex type)</td>
<td>250 USGPM (2000psig max) TBA Dimensions</td>
<td>~12.500 MT</td>
<td>01 EA</td>
</tr>
<tr>
<td>05</td>
<td>JET SLED 001 - Pipe-rider (configured for specific seabed material)</td>
<td>Configured for 12-48in pipelines 5500L x 2000W x 4500H</td>
<td>12.000 MT</td>
<td>01 EA</td>
</tr>
<tr>
<td>06</td>
<td>JET SLED 002 - Pipe-rider (configured for specific seabed material)</td>
<td>Configured for 6-16in pipelines 3500L x 1800W x 3000H</td>
<td>4.500 MT</td>
<td>01 EA</td>
</tr>
<tr>
<td>07</td>
<td>JET SLED 003 – Pontoon Articulated Arm (PAAJS) (configured for specific seabed mat'l)</td>
<td>Configured for 12-48in pipelines 11400L x 9310 x 2545 (assembled dimension) Transportable in 2 x 20' Open Top Containers and 1 x 20’ Open top Half height container</td>
<td>18 mT</td>
<td>01 EA</td>
</tr>
<tr>
<td>08</td>
<td>JET SLED Support/Transport frame</td>
<td>1500L x 2000W x 1500H</td>
<td>2.500 MT</td>
<td>01 EA</td>
</tr>
<tr>
<td>09</td>
<td>JET SLED Deployment A-Frame (Hydraulic operated)</td>
<td>8000L x 6000W x 10000H</td>
<td>15.000 MT</td>
<td>01 EA</td>
</tr>
<tr>
<td>10</td>
<td>JET HOSE Spooler unit (8&quot; &amp; 2&quot;)</td>
<td>5000L x 3000W x 3500H</td>
<td>5.000 MT</td>
<td>01 EA</td>
</tr>
<tr>
<td>11</td>
<td>JET HOSE Ø8in x 100ft c/w rated ends</td>
<td>n/a</td>
<td>2.300 MT</td>
<td>02 LGT</td>
</tr>
<tr>
<td>12</td>
<td>AIR HOSE Ø2in x 100ft c/w rated ends</td>
<td>n/a</td>
<td>0.400 KG</td>
<td>02 LGT</td>
</tr>
<tr>
<td>13</td>
<td>Air Volume Tank c/w rated ports</td>
<td>4000L x 1200W x 1400H</td>
<td>3.300 MT</td>
<td>01 EA</td>
</tr>
<tr>
<td>14</td>
<td>Half Height Container (misc. rigging, hoses, fittings, pipe sections)</td>
<td>Various</td>
<td>N/A</td>
<td>02 EA</td>
</tr>
<tr>
<td>15</td>
<td>Towing Outrigger</td>
<td>4500L x 2500W x 0.400H</td>
<td>0.250 MT</td>
<td>01 EA</td>
</tr>
<tr>
<td>16</td>
<td>Hydraulic Power Unit - complete with control valve (66kW)</td>
<td>Powers tugger winches, spooler and A-frame</td>
<td>3.500 MT</td>
<td>02 EA</td>
</tr>
<tr>
<td>17</td>
<td>Hydraulic Tugger Winch (10MT)</td>
<td>Complete with 28mm wire</td>
<td>4.100MT</td>
<td>02 EA</td>
</tr>
<tr>
<td>18</td>
<td>JET piping manifold (skid)</td>
<td>6100L x 2400W x 2400H</td>
<td>20.000 MT</td>
<td>01 EA</td>
</tr>
<tr>
<td>19</td>
<td>Workshop Container (20ft sea type)</td>
<td>Complete with tooling, spares 6100L x 2450W x 2550H</td>
<td>10.000 MT</td>
<td>01 EA</td>
</tr>
</tbody>
</table>
10.0 PRINCIPAL EQUIPMENT DATA SHEETS

9.1 JET SLED-001

Pipe-rider type, suitable for 12-48in pipeline sizes.
9.2 Suction Feeder Pumps

<table>
<thead>
<tr>
<th>FLOODING PUMP</th>
<th>- 02 Nos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>1590 Cu.m / Hr (7000 US GPM)</td>
</tr>
<tr>
<td>Maximum Head</td>
<td>25 meters</td>
</tr>
<tr>
<td>Engine Make</td>
<td>Detroit Diesel 8V-92TA 450BHP</td>
</tr>
<tr>
<td>Pump Make</td>
<td>SLOW350-380B</td>
</tr>
</tbody>
</table>
### 水泵检测数据表

#### (PUMP INSPECTION REPORT)

<table>
<thead>
<tr>
<th>序号NO</th>
<th>流量 Capacity (m³/h)</th>
<th>扬程 Head (m)</th>
<th>功率 Driver Shaft Power (kW)</th>
<th>泵效 Pump Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.0</td>
<td>29.91</td>
<td>100.48</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>792.5</td>
<td>28.46</td>
<td>114.24</td>
<td>53.8</td>
</tr>
<tr>
<td>3</td>
<td>1316.6</td>
<td>26.81</td>
<td>135.05</td>
<td>72.7</td>
</tr>
<tr>
<td>4</td>
<td>1592.2</td>
<td>25.22</td>
<td>145.58</td>
<td>78.1</td>
</tr>
<tr>
<td>5</td>
<td>1905.2</td>
<td>22.05</td>
<td>158.28</td>
<td>72.3</td>
</tr>
</tbody>
</table>

### 性能曲线

#### (Performance curve)

- $H(m)$
- $Q(m^3/h)$
- $P(kW), N(\%)$

### 结论

合 格

Conclusion: conformity
testing: HXG
date: Jan/10
9.3 Jet Pumps

<table>
<thead>
<tr>
<th>FLOODING PUMP</th>
<th>- 02 Nos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>513Cu.m / Hr (2257 US GPM)</td>
</tr>
<tr>
<td>Maximum Head</td>
<td>367 meters (532 psi)</td>
</tr>
<tr>
<td>Engine Make</td>
<td>Detroit Diesel 12V-149TI 1130BHP</td>
</tr>
<tr>
<td>Pump Make</td>
<td>250SLD 450-60 4</td>
</tr>
</tbody>
</table>

![Jet Pump Image]

![Engine Performance Curve Image]
## 水泵检测数据表 (PUMP INSPECTION REPORT)

<table>
<thead>
<tr>
<th>序号 NO</th>
<th>水泵型号 Type of pump</th>
<th>流量 (m³/h) Capacity</th>
<th>扬程 (m) Head</th>
<th>功率 (kW) Power</th>
<th>转速 (r/min) Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>250SLD450-60x4</td>
<td>429</td>
<td>420</td>
<td>843</td>
<td>1900</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>72.0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>501.95</td>
<td>477.06</td>
<td>533.17</td>
<td>52.3</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>363.83</td>
<td>449.74</td>
<td>631.76</td>
<td>70.5</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>429.29</td>
<td>420.91</td>
<td>679.87</td>
<td>72.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>513.83</td>
<td>367.60</td>
<td>739.81</td>
<td>69.5</td>
</tr>
</tbody>
</table>

### 性能曲线 (Performance curve)

- 扬程 H (m)
- 轴功率 P (kW)
- 效率 N (%)

### 结论: 合格

Conclusion: conformity

测试: 胡学刚  
Testing: HXG

日期: 2010年1月  
Date: Jan/10
9.4 Jet Hose Spooler unit

OCS’s hydraulically powered hose spoolers are an important part of the jetting spread as it houses the 8” water supply hose (fed from the jet pump) & 4” air-hose, configured in a chiksan such that the water/air supply are continuous as the spooler reeles out the hoses. The water supply hose is of high strength anti-kink type where it is durable and prevents kinking/collapse during operation. In order to keep less tension on the hose and protect the hose, the deployment and recovery should be assisted by deck crane. A pressure gauge is installed on the inlet of the spooler to obtain the direct pressure reading before the water enters the jet sled.

The specification of the Hose spooler employed in OCS’s post trenching spread is as follows:

<table>
<thead>
<tr>
<th>Hose Spooler Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Hose</td>
</tr>
<tr>
<td>Air Hose</td>
</tr>
<tr>
<td>Water suction/Discharge</td>
</tr>
<tr>
<td>Air suction/Discharge</td>
</tr>
<tr>
<td>Dimensions</td>
</tr>
</tbody>
</table>

Spooler General View/Arrangement
Spooler with 8” water and 4” air hose laid out
Layout of Spooler and other equipment on Jetting Barge (DOMGAS Project - Western Australia 2012)
9.5 JETTING SLED HANDLING A-Frame

**Hydraulically controlled Jet SLED Lifting A-Frame – 40T capacity**

- **Dimension:**
  - Height = 12 m
  - Width = 6 m
  - Length = 8 m

- **Weight:**
  - Base frame = 7 mT
  - A-Frame = 7 mT

![A-Frame folded for transport](image1)

A-Frame set up and load test

Lifting A-Frame

A-Frame boom out/set up over side of barge with spooler

![A-Frame set up and load test](image2)

![A-Frame boom out/set up over side of barge with spooler](image3)
9.6 HYDRAULIC SLED HANDLING WINCH

**90 hp Power Pack**

Dimension:
Length: 2520mm  
Width: 1200mm  
Height: 2040mm  

Weight:
Approx. 3.0 ton (dry)  
Approx. 3.5 ton (filled)  

**10 mT Hydraulic Winch**

Dimension:
Length: 2100mm  
Width: 1470mm  
Height: 1322mm  

Weight:
Approx. 2.5 tons (no rope)  
Approx. 4.1 tons (with 32mm x 360m rope)
9.7 JET PIPING MANIFOLD (SKID)

**Dimension:**
- **Length:** 6058mm Approx. 20 ton (dry)
- **Width:** 2438mm Approx. 22.5 ton (filled)
- **Height:** 2890mm

**Weight:**
- Approx. 20 ton (dry)
- Approx. 22.5 ton (filled)
## 9.8 ARTICULATED JET SLED

<table>
<thead>
<tr>
<th><strong>General Dimension</strong></th>
<th><strong>Overview</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>11400L x 9310 x 2545 (assembled dimension)</td>
<td>Specification of the OCS Articulated jet sled are as follows:</td>
</tr>
<tr>
<td></td>
<td>Jetting Nozzles - 322 nos</td>
</tr>
<tr>
<td></td>
<td>Jetting Nozzle Dia - 5/16&quot; – 3/8&quot; (7.93 – 25mm)</td>
</tr>
<tr>
<td></td>
<td>Nozzle Pattern - Vertical axis along the front of jetting arms</td>
</tr>
<tr>
<td></td>
<td>Flow Rate - 1550 – 1650m³ / hr</td>
</tr>
<tr>
<td></td>
<td>Eductors (Rear) - 10” x 2nos</td>
</tr>
<tr>
<td></td>
<td>Trench Depth - Maximum 2.5m based on jetting arms adjustment</td>
</tr>
<tr>
<td></td>
<td>No of Units - 1</td>
</tr>
<tr>
<td>Transportable in 2 x 20’ open top containers and 1 x 20’ open top Half height container</td>
<td>Container 1</td>
</tr>
</tbody>
</table>

Specification of the OCS Articulated jet sled are as follows:
- **Jetting Nozzles:** 322 nos
- **Jetting Nozzle Dia:** 5/16" – 3/8" (7.93 – 25mm)
- **Nozzle Pattern:** Vertical axis along the front of jetting arms
- **Flow Rate:** 1550 – 1650m³ / hr
- **Eductors (Rear):** 10” x 2nos
- **Trench Depth:** Maximum 2.5m based on jetting arms adjustment
- **No of Units:** 1

<table>
<thead>
<tr>
<th>Container 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Diagram of Container 1" /></td>
</tr>
</tbody>
</table>
9.9 PICTURES - JETTING OPERATIONS

- Setting SLED onto pipeline
- Jetting in operation -1
- Jetting in operation -2
- Jetting in operation -3
9.10  PICTURES - WATER PUMPING AND DISTRIBUTION SYSTEMS
11.0 ISO CERTIFICATION

Certificate of Registration

This certificate has been awarded to

Offshore Construction Specialists Pte Ltd
38 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: 451288/0031/SA/Es
Issue No: 1

Date of Issue: 06 November 2018

Expiry Date: 05 November 2018

Issued by: On behalf of the Director

[Certificate seal and logos]
Certificate of Registration

This certificate has been awarded to

Offshore Construction Specialists Pte Ltd
36 Kian Teck Road, Singapore 623781, 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: 41678/CD381/LM/En
Date of Issue: 06 November 2016
Date of Issue: 01 April 2017

Issue No: 2
Expiry Date: 06 November 2016

Issued by: 

On behalf of the Qualified Manager:
12.0 NATA CERTIFICATION

NATA ACCREDITED LABORATORY

National Association of Testing Authorities, Australia
(ABN 59 004 379 748)
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 in the field of
MECHANICAL TESTING
for the tests, calibrations and measurements shown on the Scope of Accreditation
issued by NATA

Jennifer Evans
Chief Executive Officer

Date of issue: 25 August 2016
Date of accreditation: 15 July 2013
Accreditation number: 19122

NATA is Australia’s government-endorsed accreditor of laboratories, and a leader in accreditation internationally. NATA is a signatory to the international mutual recognition arrangements of the International Laboratory Accreditation Cooperation (ILAC) and the Asia Pacific Laboratory Accreditation Cooperation (APLAC).