Huisman offers complete drilling packages and is dedicated to explore and realise new solutions to improve drilling operations. Our projects are typically complex and innovative, requiring solution-aimed thinking, technical excellence and partnerships with our clients. This has already resulted in a number of new value-adding solutions and orders for innovative and technically challenging drilling equipment sets.

The unique combination of our in-house design and engineering expertise, production facilities, testing capacity and installation location enables us to deliver custom-made, state of the art equipment on a turnkey basis: in time with fully operational equipment from day one. All Huisman products are designed and built in accordance with the international standards and certified by recognised authorities such as ABS, API and DNV.
DESCRIPTION

Introduction
The oil and gas exploration and production industry is being challenged to meet safety targets and environmental regulations in a cost constrained and competitive environment, while at the same time exploiting reserves from more and more remote or difficult to access locations.

The demand for fast operation, flexibility, safety, and quicker rig moves to global locations triggered the development of the LOC 400. The LOC 400 was designed to take advantage of advanced equipment automation and integrated 3rd party services into the rig design in order to reduce the time, hazards and costs of drilling a well. Flat time while drilling a well and in between wells is also reduced through offline activities and quick rig moves.

The LOC 400 is Huisman’s drilling solution designed to offer Lower Operating Costs.

MAIN ADVANTAGES OF THE LOC 400

- Modular containerized design
- Highly automated
- Integrated Design
- Safety through design
- Other benefits include:
  - 6 mt service crane with man riding basket  - Safety
  - Power unit designed to work with gen-sets or local grid - Efficiency
  - Offline BOP testing - Efficiency
  - Efficient Autodriller - Efficiency
  - Craneless rig moves - Safety, Efficiency
  - On board casing running tools - Safety, Efficiency
The modular design allows flexibility in laying out the rig so that it can suit odd sized locations.

Quick and safe rig moves

The rig is designed to move quickly and safely. Cranes are not required to rig-up or down. Working at heights is reduced as much as possible through the use of hydraulic actuated pins, installation work at ground level, swing out cable trays, and even using an iron roughneck and top drive that don’t need to be rigged down for rig moves.
AUTOMATED DRILLING

Pipe Handling
The LOC 400 is equipped with an automatic pipe handler enabling highly efficient and safe handling of both casing and drill pipe. The pipe handler picks up both casing and drill pipe from the horizontal pipe rack and places them vertically - directly over the well centre - where the top drive takes over. The top drive or the power tongs are used to spin in the tubulars and to torque-up the connections. Automated power slips are integrated into the rotary table and are used for making up casing.

The LOC 400 is capable of tripping 35 joints of Range 3 pipe an hour which equates to almost 1600 ft/hr. The entire tripping and pipe make-up process is controlled either fully automatically or by one single person from the driller’s cabin, making personnel on the drill floor unnecessary. As casing handling is identical to drill pipe handling and as the rig comes equipped with casing running tools, the drilling crew can carry out both tasks eliminating the need for casing crews.

Autodriller
The autodriller is used to keep a constant Weight on Bit (WOB) and/or a constant Standpipe Pressure. The measurement of the hook load is not done at the dead end as on conventional rigs, but in the connection pins of the lower block, eliminating friction and hysteresis in the measured load signal. The control of the drawworks is extremely accurate with exact speed control – even down to zero speed – without using mechanical brakes. This results in an improved drilling performance.

ADVANTAGES OF AUTOMATION:

- Automated pipe handling and automated power tongs:
  - Remove people from drill floor
  - No casing crews required
  - Automated handling of tubulars
    - Safety
    - Efficiency

- Autodriller:
  - Can keep constant Weight on Bit or constant Standpipe Pressure
  - Load measurement on block, not at dead end
  - Improved drilling performance
  - Optimized bit performance and life
    - Efficiency
INTEGRATED DESIGN

Most conventional rigs are combinations of components and systems that are developed and maintained by different suppliers. The LOC 400, however, is a fully integrated drilling rig that is offered as one complete package. All components, including the drawworks, top drive, mud pumps, power unit, mud treatment system, pipe handling, and BOP, are tested prior to delivery to ensure trouble free operations. All systems are combined into a fully integrated control and monitoring system. This means full control of all equipment from a single control desk made by one single supplier.

The monitoring system is prepared for satellite/linked remote diagnosis, which enables Huisman engineers to help solve customer’s specific needs.

As all sensors come with the rig, the need for third party sensors to be rigged up and down on a regular basis and paid extra is no longer required.

ADVANTAGES OF INTEGRATED DESIGN:
- One single control system from one single supplier
- Equipment outfitted with local backup controls
- Remote access and troubleshooting
- All sensors are installed and included with rig, no third party sensors required
- All systems are fully tested and commissioned prior to delivery

PERFORMANCE

Splittable Blocks
Most rigs are designed for the heaviest lift that the rig must carry. The LOC 400 comes with splittable blocks which allow push-button re-reeving of the blocks. This enables the rig to run most of the time on 8 falls (max 250 sht) at 50% higher block speed. In the case very heavy loads are required the rig can work at 12 falls at nominal speed.

Offline BOP testing
To reduce non-productive time, BOP’s can be pressure tested offline on a dedicated test stump that also serves as a mouse hole. The control hoses do not have to be disconnected after testing to move the BOP onto the wellhead. The BOP container is used to transfer the BOP from the test stump onto the well head.

Emergency Backup Systems
Even the most reliable systems can encounter interruptions. Thus all vital systems on the rig have a back-up. The drawworks and top drive can be controlled manually from a separate diesel driven hydraulic power unit. This can prevent stuck pipe and can save the well should power be interrupted while drilling.

Most equipment is designed fully redundantly either by design or provision of extra items. This means that even if key components are down, the rig can still be operated.

Casing While Drilling
Casing While Drilling (CWD) technology enables the simultaneous drilling and casing a well. The LOC 400 can be delivered equipped for all manners of casing drilling and can include an integrated wire line winch and casing drilling tools.

The CWD process eliminates tripping and its associated risks. A top drive system is used to rotate the casing, which remains in the hole at all times. The casing remains on bottom, at all times and is eventually cemented in place once the casing depth is reached. Using CWD can often eliminate a casing string from the well design.
**SAFETY AND ENERGY EFFICIENCY**

**Safety**
The LOC 400 is designed with safety in mind. The fully automated pipe handling including an automated pipe stabber removes all people from the drill floor for most operations. As the rig uses super singles drill pipe, no derrickman is required and there is reduced working at height. On board casing running tools remove the need for casing crews and reduce the number of people on site. Further, the rig move procedure is designed to not require cranes for rig moves. Fold out bridges for cables and hoses further remove overhead lifts and loads.

**Energy**
The LOC 400 has a significantly lower adverse impact on the environment compared with traditional rigs. Through intelligent design, drilling a well with the LOC 400 requires less fuel than typical rigs.

The footprint of the LOC, at 1200 m², is much smaller then the footprint required by a traditional rig of the same capabilities.
The modular rig is rated for 16,000 [ft]. The rig consists of 17 ISO containers loads – 12 x 40’ and 5 x 20’ containers. Some loads for loose items are not included. Main power consumers are electrically AC driven. Auxiliary functions are AC and hydraulically driven.

### GENERAL

<table>
<thead>
<tr>
<th>Substructure</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Height drill floor above ground level</td>
<td>8.0 [m]</td>
<td>26 [ft]</td>
</tr>
</tbody>
</table>

### Mast

| Static rated load (API 4F) | 360 [mt] | 400 [sht] |
| Clear height, drill floor to bottom water table | 27.8 [m] | 90 [ft] |
| Total height from ground level | 38.1 [m] | 125 [ft] |

### HOISTING

#### Service crane

| Maximum capacity, at max. 6 [m] radius | 6000 [kg] | 13200 [lbs] |

#### Drawworks with Autodriller

| Block speed at full load, 12 falls | 11 [m/min] | 36 [ft/min] |
| Block speed at red. Load, 12 falls | 44 [m/min] | 144 [ft/min] |
| Block speed at full load, 8 falls | 16 [m/min] | 54 [ft/min] |
| Block speed at red. load, 8 falls | 66 [m/min] | 216 [ft/min] |

### Travelling block

6/4 sheave assembly. Split blocks with room for wire line passage in the centre line. Thread saver cylinders incorporated.

| Block capacity (under top drive), 12 falls | 317 [mt] | 350 [sht] |
| Block capacity (under top drive), 8 falls | 227 [mt] | 250 [sht] |

### ROTATING EQUIPMENT

#### Top drive

Integrated swivel. Extend – Retract function for working over well and mouse hole. Link-tilt function for P/U tubulars.

| Max. capacity (excl. dyn factor) | 454 [mt] | 500 [sht] |
| Max. torque (Break-out) | 94000 [Nm] | 61000 [ft*lbs] |
| Max. speed | 220 [rpm] |

External/internal casing drive assemblies and drill pipe drive assembly available

#### Rotary Table

Power slips inside the rotary table, a standard API master bushing can be inserted

| Hang of capacity | 317 [mt] | 350 [sht] |
| Table opening (slips removed) | 953 [mm] | 37.5 [inch] |
| Power slips maximum size | 340 [mm] | 13 3/8 [inch] |
**Pipe Handling**

**Automatic pipe handler**
- Max. weight of tubular: 3.0 [mt] 3.3 [sht]
- Max. length of tubular: 14.3 [m] 47 [ft]

**Power tong, Canrig**
- Minimum pipe size: 60 [mm] 2 3/8 [inch]
- Maximum pipe size: 215 [mm] 8 1/2 [inch]
- Maximum torque: 100000 [Nm] 80000 [ft*lbs]

**Casing Drive Assemblies**
- Tubular sizes (casing): 4 1/2 [inch] 13 3/8 [inch]

**Pipe Rack**
- Automatic indexing arm incorporated
- Capacity of 7” casing joints (2 racks): 60 [-]

**Mud System – Active System**

- Huisman design
- Mud tank capacity (approx.)
  - Mud treatment container: 41.3 [m³] 255 [Bbls]
  - Active mud container: 54 [m³] 340 [Bbls]
  - Mud mix container: 41.3 [m³] 255 [Bbls]
  - Trip tank: 5 [m³] 35 [Bbls]
- TOTAL CAPACITY: 140 [m³] 872 [Bbls]
- All tanks (except sand trap) are fitted with electric driven agitators
- All tanks (except sand trap) are fitted with level transducers
- 1 Centrifugal degasser
- 3 Electric driven shakers, MI-SWACO or client specific
- 3 centrifugal pumps mud transfer, mud mixing, or charging mud pumps

**Mud System – Mud Pumps**
- Standard delivery: 3x or 4x
- Model: Triplex HHF-800 AC driven, Independent drive gearbox, lube pump, wash pump
- Rated power: 600 [kW] 800 [HP]
- Maximum strokes per minute: 160 [spm]
- Strokes: 228.6 [mm] 9 [inch]
- Liner sizes: 101.6–158.75 [mm] 4–6¾ [inch]
- Maximum output pressure (4” liner): 345 [bar] 5000 [psi]

**Output with nominal speed and maximum pressure (1 mud pump)**

<table>
<thead>
<tr>
<th>Liner size</th>
<th>4</th>
<th>5</th>
<th>5.5</th>
<th>6</th>
<th>6.5</th>
<th>6.75</th>
<th>[inch]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum pressure</td>
<td>345</td>
<td>220</td>
<td>180</td>
<td>152</td>
<td>129</td>
<td>121</td>
<td>[Bar]</td>
</tr>
<tr>
<td>Flow</td>
<td>666</td>
<td>1041</td>
<td>1261</td>
<td>1503</td>
<td>1760</td>
<td>1900</td>
<td>[l/min]</td>
</tr>
<tr>
<td></td>
<td>176</td>
<td>275</td>
<td>333</td>
<td>397</td>
<td>465</td>
<td>502</td>
<td>[Gpm]</td>
</tr>
</tbody>
</table>

**Output with maximum speed and reduced pressure (1 mud pump)**

<table>
<thead>
<tr>
<th>Liner size</th>
<th>4</th>
<th>5</th>
<th>5.5</th>
<th>6</th>
<th>6.5</th>
<th>6.75</th>
<th>[inch]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum pressure</td>
<td>276</td>
<td>176</td>
<td>144</td>
<td>122</td>
<td>103</td>
<td>97</td>
<td>[Bar]</td>
</tr>
<tr>
<td>Flow</td>
<td>832</td>
<td>1300</td>
<td>1576</td>
<td>1875</td>
<td>2200</td>
<td>2374</td>
<td>[l/min]</td>
</tr>
<tr>
<td></td>
<td>220</td>
<td>344</td>
<td>417</td>
<td>496</td>
<td>582</td>
<td>627</td>
<td>[Gpm]</td>
</tr>
</tbody>
</table>
**WELL CONTROL**

Blow Out Preventer

BOP can be controlled from the drillers cabin, tool pushers office, or from the BOP control unit

8 station BOP control unit included, remote controlled

<table>
<thead>
<tr>
<th>Bore size</th>
<th>13 5/8 [inch]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure (single and double rams)</td>
<td>690 [bar] 10000 [psi]</td>
</tr>
<tr>
<td>Pressure (annular)</td>
<td>345 [bar]   5000 [psi]</td>
</tr>
</tbody>
</table>

**POWER**

**RIG POWER CONSUMPTION**

Electric power system

Main consumers (mud pumps, draw works, top drive): electrical inverter controlled

Centrifugal pumps, shakers, agitators, BOP control unit, etc.: electrical

Required power, standard delivery

<table>
<thead>
<tr>
<th>Power source</th>
<th>2000 [kW] 3737 [HP]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>480 [V] 60 [Hz]</td>
</tr>
</tbody>
</table>

**HYDRAULIC POWER SYSTEM**

Auxiliary consumers (Rotary table, small cylinders etc.) hydraulic

Required electric power for HPU

<table>
<thead>
<tr>
<th>Power source</th>
<th>220 [kW] 300 [HP]</th>
</tr>
</thead>
</table>

Volume tank hydraulic oil

| Volume       | 2000 [l] 527 [USG] |

**OPTIONAL ITEMS**

**CASING WHILE DRILLING PACKAGE**

Wire line hoist winch

Capacity at surface

<table>
<thead>
<tr>
<th>Capacity</th>
<th>Approx. 15.3 [mt] 16.8 [sht]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoisting speed at reduced load &lt;= 6 [mt]</td>
<td>70 [m/min] 230 [ft/min]</td>
</tr>
<tr>
<td>Max. depth below surface</td>
<td>Approx. 6000 [m] 20000 [sht]</td>
</tr>
</tbody>
</table>