



LOC 400 DRILLING RIG

HUISMAN PRODUCT BROCHURE

DRILLING

GENERAL INTRODUCTION

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.



LOC 400

DRILLING RIG



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*



RIG MOVES

Modular Design

Two of the most important features of the LOC 400 are its compact size and the possibility to break down the entire rig into 17 main modules. Within 48 hours including limited transportation time, a crew can rig-down the entire rig and rebuild it at another location.

As the standard ISO containers can be transported quickly and economically by any container ship, train, or truck, the LOC 400 can be used to efficiently drill wells anywhere in the world. Transportation costs between worldwide locations are no longer an issue.



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.



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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.

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LOC 400 PERFORMANCE ADVANTAGES:

Automation

- Quicker drilling and pipe handling without tiring crews
- Safer operations

Splittable blocks

- Quicker block speed at lower loads
- Optimized use of drawworks power

Offline BOP testing using an integrated test stump

- Reduces 3rd party services and number of people required

Redundancy

- Back-up hydraulic power system powers top drive and drawworks in case rig power is lost
- Ring network design

Casing While Drilling

- Less tripping:
Reduced flat time and reduced risks of kicks and blow-outs
- Casing is always on bottom:
Improved stability and reduced risks of kicks and blow-outs
- Improved mud circulation leading to a reduction in the required pump power:
Lower noise, Lower fuel consumption, Less mud consumption.
- Tools can be delivered with the rig

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 foot print of the LOC, at 1200 m², is much smaller than the footprint required by a traditional rig of the same capabilities.

Service Crane

A service crane capable of lifting 6 mt is mounted on the crown. Any operations or maintenance requiring work above the drill floor can be done using the crane and a man riding basket. The crane can also be used to help lift heavy items to the drill floor and for lifting heavy tubulars.

SAFETY AND ENVIRONMENTAL ADVANTAGES:

Automation

- Safer operations by removing people from drill floor
- Zone management system

Integrated design

- Casing crews not required reducing people from drill floor
- No Derrickman required
- Lower overall human exposure

Rig moves

- Safe crane-less rig up and down procedure
- Less work at heights
- Engineered rig move procedure

Service crane

- No man riding
- Safe lifting of heavy loads

Environmental advantages

- Smaller footprint
- Lower fuel use
- Smaller rig (out of sight)
- Low noise

SPECIFICATIONS

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

Substructure

Height drill floor above ground level	8.0 [m]	26 [ft]
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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]
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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]



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PIPE HANDLING

Automatic pipe handler

Max. weight of tubular	3.0 [mt]	3.3 [sh]
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]
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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] 4–6 3/4 [inch]

Maximum output
pressure (4" liner)

345 [bar] 5000 [psi]

OUTPUT with nominal speed and maximum pressure (1 mud pump)

Number of strokes (approx.) 120 [spm]

Liner size	4	5	5.5	6	6.5	6.75	[inch]
Maximum pressure	345	220	180	152	129	121	[Bar]
	5000	3190	2610	2204	1878	1750	[Psi]
Flow	666	1041	1261	1503	1760	1900	[l/min]
	176	275	333	397	465	502	[Gpm]

OUTPUT with maximum speed and reduced pressure (1 mud pump)

Number of strokes (approx.) 150 [spm]

Liner size	4	5	5.5	6	6.5	6.75	[inch]
Maximum pressure	276	176	144	122	103	97	[Bar]
	4000	2550	2087	1768	1493	1400	[Psi]
Flow	832	1300	1576	1875	2200	2374	[l/min]
	220	344	417	496	582	627	[Gpm]



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

Bore size	13 5/8 [inch]	
Pressure (single and double rams)	690 [bar]	10000 [psi]
Pressure (annular)	345 [bar]	5000 [psi]

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 2000 [kW] 3737 [HP]

Power source 480 [V] 60 [Hz]

HYDRAULIC POWER SYSTEM

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

Required electric power for HPU 220 [kW] 300 [HP]

Volume tank hydraulic oil 2000 [l] 527 [USG]

OPTIONAL ITEMS

CASING WHILE DRILLING PACKAGE

Wire line hoist winch

Capacity at surface Approx. 15.3 [mt] 16.8 [sht]

Hoisting speed at reduced load <= 6 [mt] 70 [m/min] 230 [ft/min]

Max. depth below surface Approx.6000 [m] 20000 [sht]



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