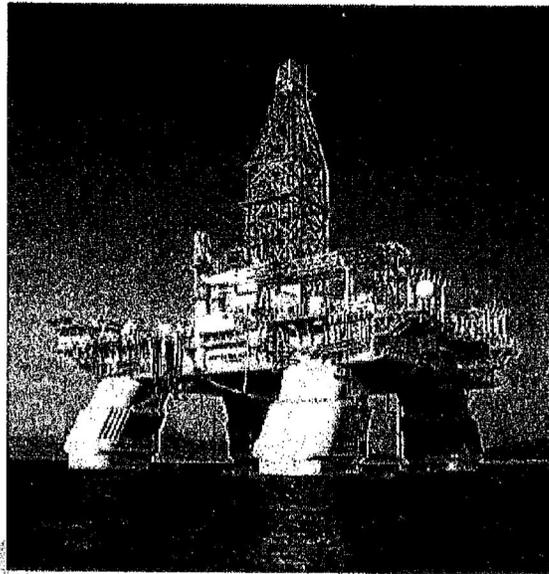


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**Deepwater Horizon – 5<sup>th</sup> Generation DP Semi-Submersible**

0	Preliminary Draft	18 APR 2010	Jerry Levine	
<b>Revision</b>	<b>Description</b>	<b>Date</b>	<b>Author</b>	<b>Reviewed</b>

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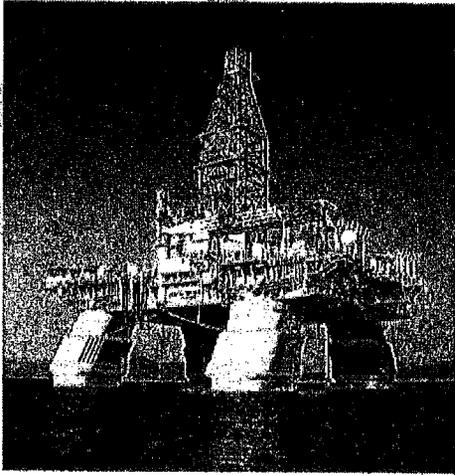
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## Introduction

### Rig Data

#### General Description

The DEEPWATER HORIZON is a Reading & Bates RBS-8D design semi-submersible drilling unit capable of operating in harsh environment and water depths up to 8,000 ft (upgradeable to 10,000 ft) using 18-3/4" 15,000 psi BOP and 21" OD marine riser.

Rig Type	5th Generation Deepwater	
Design	Reading & Bates Falcon RBS-8D	
Builder	Hyundai Heavy Industries	
Year Built	2000	
Classification	+A1, +AMS, Column Stabilized Drilling Unit, +CDS, +DPS-3, +ACCU	
Flag	Marshall Island	
Accommodation	146	
Helideck	72.8 ft x 72.8 ft. Sized for Sikorsky Model S-61N and Super Puma Helicopters	
Moonpool	21 ft x 93 ft	
Station Keeping	Dynamically Positioned	
Max Drill Depth	8144 m / 30000 ft	
Max Water Depth	2438 m / 8000 ft	
Operating Conditions	Wave 26 ft @ 14 Sec; Wind 60 Knots; Surface Current 3 Knots	
Storm Conditions	Wave 41 ft @ 14 Sec; Wind 103 Knots; Surface Current 1 Knot	

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#### Technical Dimensions

Length	369 ft	112 m
Breadth	256 ft	78 m
Depth	136 ft	41 m

#### Assessment Team

Jerry Levine, Assessment Team Leader (*Transocean*)  
 J.R. Kilcrease, Marine Surveyor (*ModuSpec*)  
 John Kingsland, Mechanical Surveyor (*ModuSpec*)  
 Alan Schneider, Electrical Surveyor (*ModuSpec*)  
 Victor Martinez, Well Control Surveyor (*ModuSpec*)  
 Kris Millsap, Well Control Surveyor (*ModuSpec*)

#### Assessment Scope of Work

The scope of work was to complete a hardware assessment of the rig, with particular emphasis on critical drilling and well control equipment. Safety procedures and equipment normally audited by HSE were purposely not included in this assessment. It should also be noted that the inspection of individual items of equipment was subject to operational and time constraints.

Over the course of the assessment and while in machinery spaces and on deck areas, associated hull and structural items were given detailed visual inspections.

#### Applicable Standards and Guidelines

- HSE Rig Condition Assessment Recommended Practices
- Transocean Maintenance Manual.
- Original Equipment Manufacturers maintenance and operating specifications.
- Accepted oilfield operating and safety practices.
- Transocean Standard Maintenance Tasks.

#### Objectives

The objective of the rig assessment is to provide Transocean Management with an unbiased, comprehensive, and fair evaluation of the condition of the rig and its equipment.

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**Report of Survey**

**Executive Summary**

The Deepwater Horizon is a 5<sup>th</sup> Generation Dynamically Position Semi-Submersible built in 2000. At the time of the assessment time, the rig was drilling for BP Exploration in Mississippi Canyon Block 252, Gulf of Mexico.

The overall condition of the rig and equipment was fair; details are listed below in the Equipment Condition section and in the ModuSpec final report. The housekeeping on the rig during the RCA was found to be good.

Cross head slide clearances were high on Mud Pump Nos. 1, 2 and 3, and the slides were severely worn on Mud Pump Nos. 2 and 3. As air filters have not been fitted to any of the AC drive motors, several of the motors were coated internally with dirt and grease.

Many of the sheaves on both Deck Cranes were worn on the sides and the bearings and have cable prints. The boom walk-way going down the outside of the boom was only 10 to 12 inches wide and unsafe and the winches, hydraulic pumps and motors have never been overhauled or replaced. The crane engines did not meet EPA emission standards and a new engines were on order to be installed at nearest opportunity. The Stbd crane, which is primarily used, suffered a fire in 2005 and has experienced numerous faults since. The load cell located on the dead-man cable end was bent and worn severely and the boom camera bracket and safety cable were corroded. The Stbd crane gear box was leaking, frequently requiring additional oil.

None of the Ex. electrical equipment as been tagged with an ID number and there is no Hazardous Area Electrical Register on this rig.

Several of the original grooved riser tensioner rods have been replaced and the new rods are not compatible with the transducers that indicate the rod position. This has rendered the Riser Recoil System inoperable in automatic mode.

The rotary table power skid controls had been removed from the rig for repair and the rotary table was not operational.

One chain is missing from the pipe skate, the carriage chains are in poor condition and the track is damaged where the skate has jumped off the rails.

The horizontal to vertical casing rotator lower clamp jacking motor was not operable and the hydraulic lines were plugged off. Many of the hydraulic hose connections on the casing rotator and under the control console are corroding. Additionally, most of the casing rotator control console gauges were damaged and require replacement.

The sea water pipes throughout the rig were corroded with leaks occurring daily. The sea water valves going to all the main engine coolers leaked and were hard to function. There were unpainted spools and piping at the sea water service pump in Thruster Room No. 8.

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The fresh water cooling pipe work for the main engine heat exchangers was thin with leaks occurring often. During the assessment there was a leak in the piping at the connection to the heat exchanger for Main Engine No. 1. Corrosion was present on the piping and several valves were leaking an/or difficult to operate.

While removed from the elevator shaft to facilitate rigging equipment to/from the pontoon, the Stbd Fwd personnel elevator was damaged and has been removed from the rig for repair.

Sewage treatment system is severely corroded with wastage. One of the overboard discharge pumps has been removed and both air compressors have also been taken off the plant; regulated rig air is now used to supply air to the tank diffuser system.

**Marine Integrity**

On visual inspection, the rig appeared to be in fair condition for marine integrity. Several salt water and fresh water pipes were severely corroded and numerous valves were corroded, difficult to function and leaking. In review of the history reports and past inspections, it was noted the ballast pipes, and sea water pipes were in bad condition and in need of being replaced.

Hydraulic unit relays for the ballast system in all four columns were overheating while opening or closing the ballast valves. History revealed the relays have been frequently replaced. Currently the relay panels and all relays are in need of replacement.

The rig had two of the hydraulic doors out of service and not working correctly, on the 28 ½ meter deck level and also on the 24 meter deck level, that have to be manually opened and closed. The STBD forward elevator was out of service and had been sent in for repairs.

The escape routes below the rig on all four columns were in bad condition and in need of repairs or replacement.

**Maintenance System Condition**

The Deepwater Horizon has been using RMS since July 2009. While the crew has been adapting well to the system, the overall condition of RMS was considered poor due to several issues.

Major equipment, to include deck cranes, drawworks, rotary table, air compressors and generators are not identified by the proper manufacturer and model. Checks and measurements are not assigned to most PMs. Inaccuracies in the asset hierarchy exist: child tags have been assigned to incorrect parents and parent/child tag relationships have not been established in accordance with the RMS Floater DP Single tag template. Looking ahead, there are several spikes in PM work load which should be adjusted. The rig crew has submitted over 1400 change requests in the past 8 months to address these and other issues. A review of the morning report for 01 April 2010 indicated that there were 32 bulletins not closed out, and 6 overdue equipment certifications. There are 2 high priority and 2 medium priority jobs overdue by more than 150 days and awaiting parts. As well as 176 unacknowledged equipment alarms.

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and 7 Job Deferral Requests requiring action. Out of service equipment is not tracked in the morning report. These statistics indicate that the morning report is in overall fair condition.

The central library is considered to be in fair condition. While it appears to be complete, due to limited size it is extremely cluttered with boxes of documents stacked on the deck throughout the space making efficient organization and access difficult. Most documents have been labeled per a legacy filing system, but a cross reference to RMS Tag Numbers as described in the Maintenance Procedures Manual has not been established.

**Equipment Condition**

**1. HULL & STRUCTURE**

**Manual Watertight Doors & Hatches (WTD WTDR)**

These structural items are considered to be in fair condition. The gasket to the main hatch in the welding area was hard due to age resulting in a poor seal when the hatch is closed and should be replaced. The hand winch for raising the hatch cover had severely worn gear teeth as well as a missing safety cover. The teeth on the winch for sack room hatch cover were also worn.

**Recommendations:**

- Replace the gasket for the main hatch in the welding area.
- Repair or replace the hand operated winch for the main hatch in the welding area.
- Repair or replace the hand operated winch for the sack room hatch.

**2. NAVIGATION / DP / PROPULSION / BALLAST / BILGE**

**Navigation Equipment (V-INST)**

This equipment is considered to be in fair condition. The starboard forward aircraft warning lights in the derrick as well as several 10 mile obstruction lights were not working. Wind speed indicator above the crown is not working.

**Recommendations:**

- Repair or replace the starboard forward aircraft warning lights in the derrick.
- Repair or replace any non-functional 10 mile obstruction lights.
- Repair/replace wind speed indicator.

**Thrusters (PROP THR)**

This equipment is considered to be in fair condition. Thruster No. 2 was out of service due to a flashover in the windings of the AC drive motor. It was also noted that both main junction boxes for this motor have suffered water ingress and are severely corroded.

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Hoses were dry cracked and hard on all thrusters.

Oil samples indicate that all the thrusters have water in the gear unit oil due to leaking seals. This was noted to be particularly high in Thruster No. 3. There was a hydraulic fluid leak at the inside shaft seal of Thruster No. 8 due to a poorly positioned oil seal rubber that was raised up on the shaft.

The cooling heat exchanger units were in bad condition due to age and have to be cleaned more often than normal. The water pipes of the cooling units were leaking at the flange connections on all of the units. The fresh water radiator unit for Thruster No. 3 was not operational.

**Recommendations:**

- Replace all shaft seals on all eight thrusters at nearest opportunity.
- Replace all cracked and hard hydraulic hoses on the thrusters as needed.
- Replace Thruster No. 2 AC drive motor and main junction boxes.
- Replace Thruster No. 3 fresh water radiator unit.
- Replace all thruster heat exchangers as needed.

**Ballast Piping and Valves (BLST)**

This equipment is considered to be in fair condition.

120V relays in the HPU's shared by the bilge and ballast systems in all four columns were overheating and failing while opening or closing the ballast valves and the HPU's had small leaks around the hose connections and the pumps.

**Recommendations:**

- Investigate and implement a solution where the relays do not overheat.
- Repair leaks around hose connections and pumps.

**Bilge System (BILG)**

This equipment is considered to be in fair condition.

120V relays in the HPU's shared by the bilge and ballast systems in all four columns were overheating and failing while opening or closing the ballast valves. Additionally, the HPU's had small leaks around the hose connections and the pumps.

The bilge pumps were not holding a prime at times and the crew would use the priming units that were on the rig to re-prime the pumps.

**Recommendations:**

- Repair the problem of the pumps losing prime. Investigate replacing the pump impellers or pumps.

**3. HOISTING / ROTATING EQUIPMENT**

**Auxiliary Drawworks / Hoist (DRHS DWKS)**

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**This equipment is considered to be in fair condition.**  
Auxiliary Drawworks is mounted on the roof of the BOP house and is used to handle casing in the moon pool area. The level wind hydraulic cylinder was disconnected, due to a hydraulic leak, and was not operational.

Corrosion was present on the auxiliary drawworks air receiver.

**Recommendations:**

- Install replacement cylinder when it arrives.
- Remove the corrosion from the air receiver and repaint.

**Main Drawworks Unit (DRHS DWKS)**

**This equipment is considered to be in fair condition.**  
Vibration was observed during operations in the AC motors, this is a common fault on active heave drawworks, being usually attributed to alignment or encoder feedback issues, when the motors are not running in synchronization. Drawworks Motor No. 2 air supply ductwork has been cracked, possibly as a result of this vibration.

Since OEM realignment of drive motors using the teeth contact method, the motor drive shafts are no longer centered in the gear case covers and the seals are leaking. Slight oil leaks were also present at the main drive shaft oil seals.

Drawworks AC motor No. 5 earth bond resistance was 1.15 MΩ, lower than the minimum allowable 2 MΩ.

Drawworks AC motor No. 3 was not operational as the buss assembly had been removed from Drawworks AC motor No. 3 VFD and installed in the Top Drive VFD.

Review of PM records indicated the brake disc springs have not been replaced in the last year as recommended by the OEM.

**Recommendations:**

- Verify motor alignment and encoder feedback. Repair as necessary.
- Repair cracked motor ductwork; consider fitting flex couplings in ductwork.
- Investigate if a redesigned motor shaft seal is available or other remedy from the OEM for leaking motor shaft seals.
- Repair leaking main drive shaft oil seals.
- Troubleshoot and repair the low earth bond resistance reading on Drawworks AC motor No. 5.
- As planned replace the missing buss assembly on Drawworks AC motor No. 3 VFD.
- Replace the brake caliper springs yearly as specified in the OEM service manual.

**Rotary Table (DSRT ROT)**

● **This equipment is considered to be in bad condition.**  
The rotary table power controls had been removed from the rig for repair and the rotary table was not operational.

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**Recommendations:**

- When returned to the rig, install power skid controls and make rotary table operational.

**Derrick (DRHS DERK)**

**This equipment is considered to be in fair condition.**

The derrick is galvanized, with the exception of the water table and crown which is painted. The paint has broken down and much of the structure, including the grating at the crown level, is corroded.

Crown bumper wood has now rotted out and only the steel mesh is holding what is left of the wood in place. Additionally, two horizontal beams below the monkey board level have wood bolted to their sides as some sort of beam protection device; this wood is now rotted out and is a potential dropped object.

Under the crown block assembly various pad eyes are attached to the main beams, these are fitted with shackles and attached to snatch blocks, while the snatch blocks are all correctly fitted with safety lines the cotter pins retaining the shackles are undersize and in some cases "R" snap pins are used instead of cotter pins.

Below the monkey board level, a horizontal beam has been damaged by stands of pipe falling across the derrick. Also, on the port side adjacent the derrick access ladder, two bolts are not flush with the derrick girts.

The port fwd air winch wire was found rubbing on a steel plate on the lower derrick level.

Various safety slings are corroded throughout the derrick and two block hang off lines, one short and the other long, are poorly secured with soft line. The shorter line is no longer used.

Drain holes clogged and standing water is present in the lower diagonal sections of the derrick. Also, at various levels in the derrick, pieces of the plastic coating from the drill line has collected.

**Recommendations:**

- Address corrosion on top painted section of derrick.
- Replace corroded grating at the crown level with galvanized steel grating.
- Replace rotted wood bumpers at the crown, or investigate if the wooden blocks can be replaced with neoprene bumper blocks.
- Fit the correct size cotter pins to all shackles.
- Remove or replace damaged horizontal beam below monkey board level.
- Check two bolts not flush with derrick girt, secure if necessary.
- Investigate if plate can be removed or if this is not possible, install a roller guide to prevent any further damage to the derrick structure.
- Replace corroded safety slings throughout derrick.
- Secure block hang off lines with wire slings.
- Remove short block hang off line if no longer required.
- Remove plastic drill line coating debris throughout derrick.

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- Clean out lower section of diagonal beams in derrick to remove standing water and debris.

**Crown Block (DRHS CROW)**

**This equipment is considered to be in fair condition.**

Crown sheaves grease hoses in poor condition, several of the hoses were damaged and leaking grease. There was no evidence of grease reaching the fast line or main block clusters.

**Recommendations:**

- Replace grease line hoses or as the access is good around sheaves, install grease zerks directly in sheave pins and grease the sheaves directly.

**4. MUD / CEMENT STORAGE**

**Mud Pit Agitators, Guns, Valves (MDS)**

**This equipment is considered to be in fair condition.**

All five mud guns in the pit room were seized and one mud pit valve handle was missing with the valve being operated with a pipe wrench. Additionally, several mud agitator motors were corroded and in poor condition.

**Recommendations:**

- Refit missing valve handle.
- Free off seized mud guns.
- Motors should be overhauled or replaced.

**5. MUD PROCESS**

**Mud Pumps (HPMS MP)**

• **This equipment is considered to be in bad condition.**

All the covers and inspection hatches on all the mud pumps had been sealed using silicone sealant or RTV, this has the potential to cause pump bearing failure as pieces of the silicone contaminates the lube oil system and becomes plugged off in various grease lines and oil passageways throughout the pump.

An additional unutilized fluid end lubrication pump is fitted to each mud pump; we were informed by the rig crew this is not required.

Air intake filters were not fitted on any of the AC motors and the air vents were covered with oil and dust. Filters will reduce the amount of dust and grease entering the motors, increasing their service life.

The belt guards on Mud Pumps Nos. 1 and 4 do not fully cover the pinion shaft drive hub on the inside of the belt guard, this exposed rotating hub is a potential hazard to personnel.

**Mud Pump No. 1:**

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The crosshead slide clearances were excessive, the left slide being the highest.

The belt guard on Mud Pump No. 1A AC Motor was damaged.

The motor winding on Mud Pump Nos. 1A and 1B AC Motors are coated in grease and dust.

**Mud Pump No. 2:**

The cross head lower slides were found badly scuffed and there was no trace of any smooth bearing surface left. As the slides are damaged we would also expect the lower crosshead surface to also be scored. Additionally, left and center crosshead clearances were high.

A hydraulic hose, which was hard and brittle, was used as a substitute for copper tubing as originally equipped, supplying oil to the left main bearing. Other internal lubrication lines were found either loosely clamped or not supported.

This pump has several oil leaks, including pinion shaft oil seals, main bearing covers and cross head covers.

The motor winding on Mud Pump Nos. 2A and 2B AC Motors are coated in grease and dust.

**Mud Pump No. 3:**

Center crosshead bearing clearance was found to have a lift of 0.010". While this is within the OEM acceptable limits, there was also evidence of damage to the lower slide, which could be caused by bearing material falling onto the lower slide. A small amount of metal was also visible in the oil pump suction strainers and on the magnetic strips installed inside the crankcase.

Three hydraulic hoses were being used inside the crankcase. These have become hard and brittle and should be replaced with original OEM copper tubing.

The oil pump packing gland was found to be loose as the bolts had backed off and were running on the pump coupling. Also, the oil pressure gauge was still reading pressure with the pump stopped.

Slight oil leaks were present at the rod drain box valve and the top inspection hatches.

The motor winding on Mud Pump No. 3A AC Motor is coated in grease and dust.

**Mud Pump No. 4:**

A small amount of metal particles were present on the magnetic strips.

The motor winding on Mud Pump Nos. 4A and 4B AC Motors are covered in dust.

The cable entry point for one of the pump proximity heads is vertically positioned making the attached cable susceptible to damage during pump maintenance.

**Recommendations:**

- If not required remove fluid end lube system pumps.
- During next PM intervals remove silicone sealant from all covers and hatches and install OEM gaskets on all mud pumps.
- Check all internal lube oil pipework and oil passageways for silicone sealant blockage.
- Install air intake filters on the AC motors.

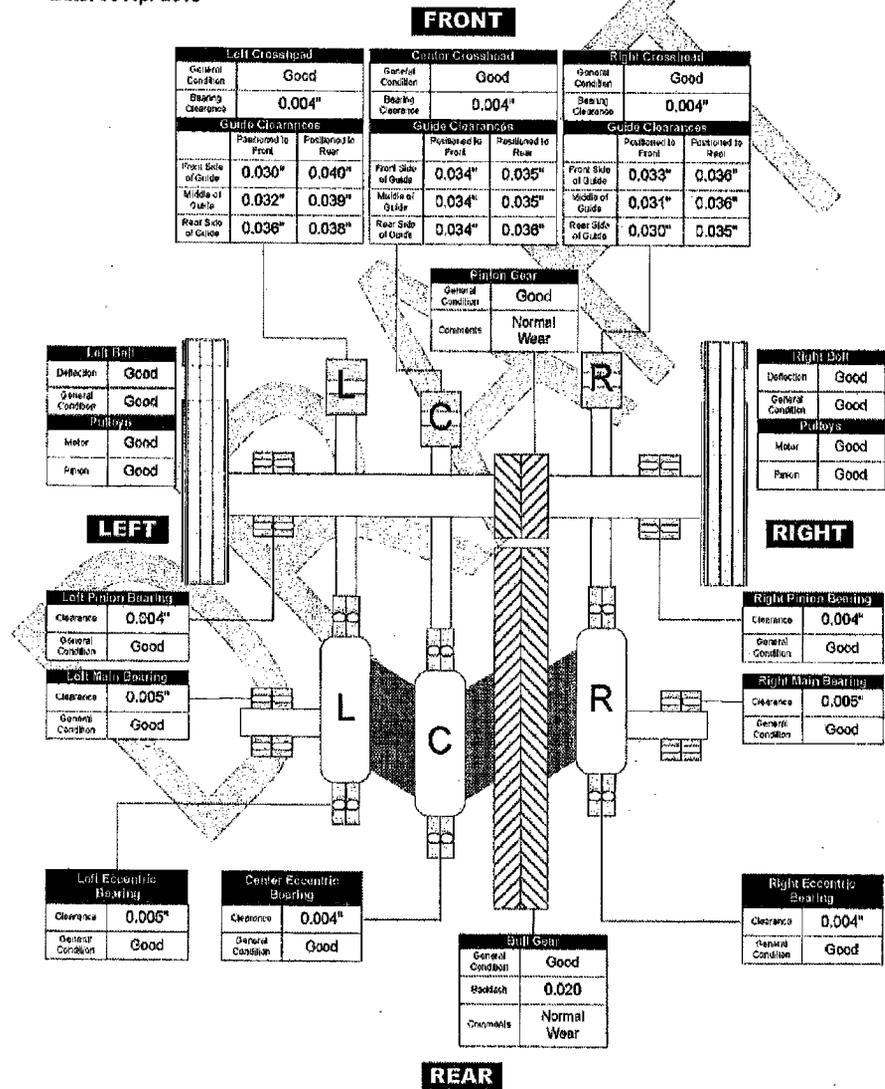
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- Remove air vents and clean.
- Extend belt guards on Mud Pumps Nos. 1 and 4 to cover exposed rotating machinery on the inside of the belt guard. (Pinion shaft drive hub).
- **Mud Pump No. 1:**
  - Adjust crossheads to reduce clearances below 0.030"
  - Repair or replace the belt guard on Mud Pump No. 1A AC Motor.
  - Repair or replace Mud Pump Nos. 1A and 1B AC Motors.
- **Mud Pump No. 2:**
  - Replace lower crosshead slides and crossheads and crosshead bearings.
  - Adjust left and center crosshead clearances to below 0.030".
  - Replace hard and brittle hydraulic hose used on oil supply to main bearing with copper piping.
  - Secure internal lubrication lines in power end.
  - Repair or replace Mud Pump Nos. 2A and 2B AC Motors.
- **Mud Pump No. 3:**
  - Replace center crosshead bearing, slide and crosshead.
  - Replace hard and brittle hoses installed inside power end with original OEM copper tubing.
  - Secure gland packing retainer and bolts on oil pump.
  - Replace oil pressure gauge.
  - Repair or replace Mud Pump No. 3A AC Motor.
- **Mud Pump No. 4:**
  - Check condition of magnetic strips in power end at next PM interval.
  - Reposition cable junction box to prevent any further cable damage occurring.
  - Clean Mud Pump Nos. 4A and 4B AC Motors with dry air.

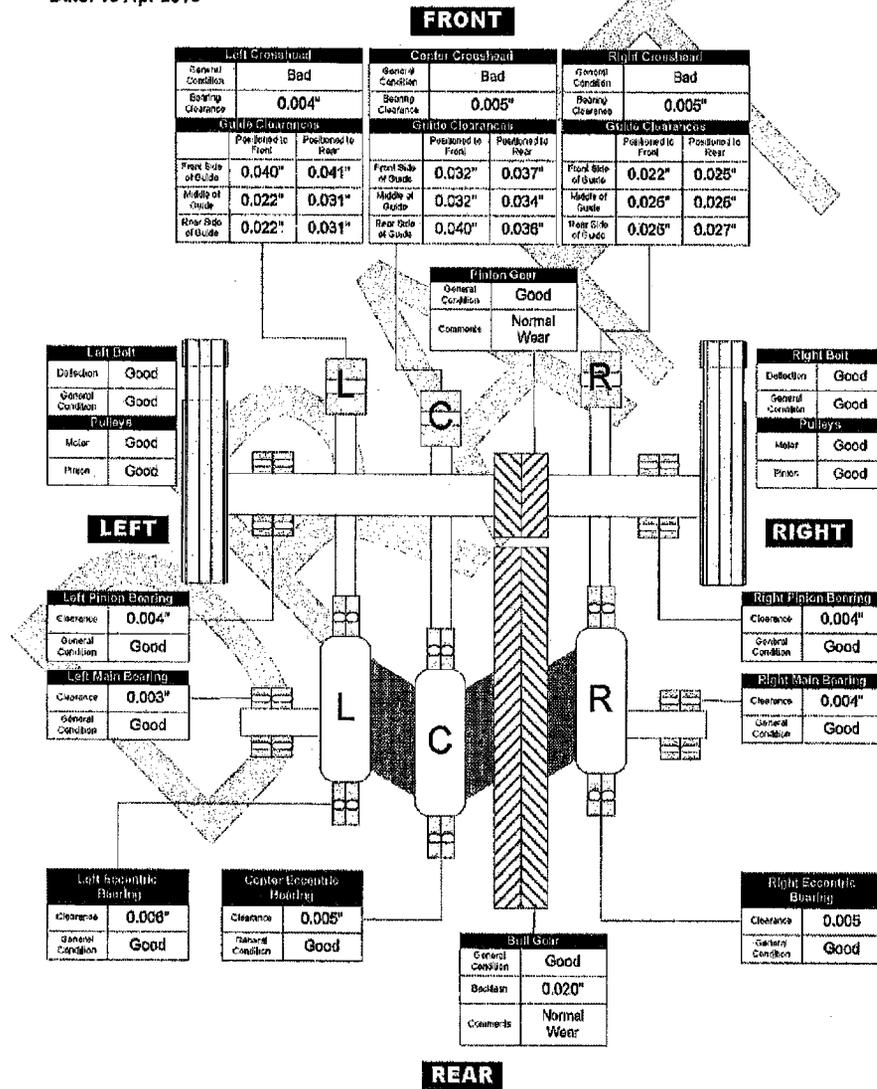
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**Rig Name:** Deepwater Horizon  
**Mud Pump: #** 1  
**Manufacturer:** Continental Enasco  
**Model:** FC-2200  
**Inspected By:** John Kingsland  
**Date:** 06 Apr 2010



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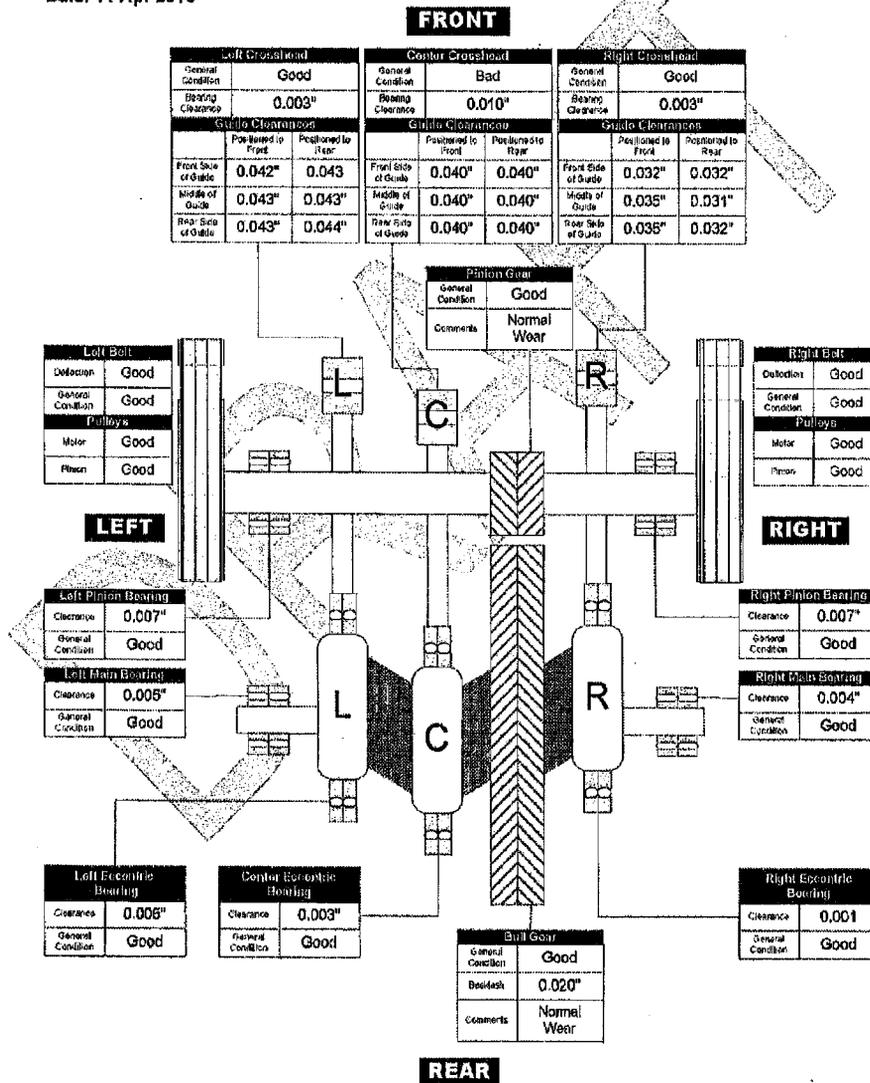
**Rig Name:** Deepwater Horizon  
**Mud Pump: # 2**  
**Manufacturer:** Continental Enasco  
**Model:** FC-2200  
**Inspected By:** John Kingsland  
**Date:** 10 Apr 2010



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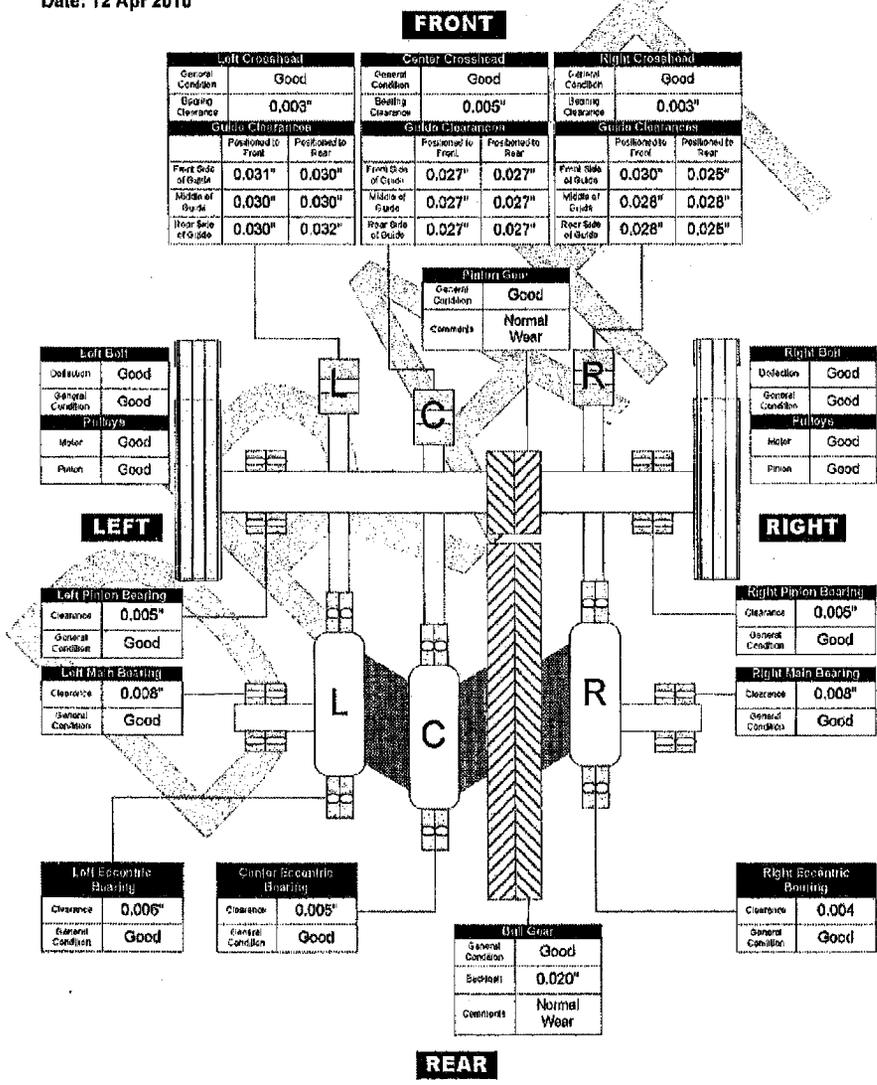
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Rig Name: Deepwater Horizon  
 Mud Pump: # 3  
 Manufacturer: Continental Enasco  
 Model: FC-2200  
 Inspected By: John Kingsland  
 Date: 11 Apr 2010



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**Rig Name:** Deepwater Horizon  
**Mud Pump: #** 4  
**Manufacturer:** Continental Enasco  
**Model:** FC-2200  
**Inspected By:** John Kingsland  
**Date:** 12 Apr 2010



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<b>6. DRILLING INSTRUMENTATION</b>
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**Drilling Control / Monitoring Systems - V-ICIS, etc. (DIST INST)**

**This equipment is considered to be in fair condition.**

Interviews with the rig crew indicated that several items on the rig floor including the PRS, iron roughneck and zone management system will not operate in automatic mode due to various issues with sensor alignment and tracking. During the assessment, rig floor equipment was only operated manual mode.

**Recommendations:**

- Investigate the issues and repair as necessary.

<b>7. RISER / BOP &amp; WELL CONTROL EQUIPMENT</b>
--

**Riser Tensioners (RTS HCYL)**

**This equipment is considered to be in fair condition.**

Protective coating on all riser tensioners was flaking and there were no records available of NDT inspections for the tensioners or support structure. Riser Tensioner No. 5 HP air supply hose is was damaged on the outer sheathing and Riser Tensioner No. 2 was not in service due to a leaking rod end seal.

All 30 APV pressure gauges were damaged with the glass broken on the majority and not visible on others. Furthermore, the discharge lines on all the bottles face a walkway.

There are two handles missing on the main isolation ball valves in the bank of 5 for Tensioner No. 6 that needs to be installed. The flanged connection from one of the standby bottles on the e stbd side end to the isolation ball valve before the main manifold for the standby bottles was severely corroded.

**Recommendations:**

- Perform protective coating maintenance on the riser tensioner cylinders.
- Perform NDT inspection of Riser Tensioners, and support structure to determine the need for repairs and/or replacements.
- Replace the Riser Tensioner No. 5 HP air supply hose as planned.
- Repair the leaking rod end seal on Riser Tensioner No. 2.
- Replace gauges with new calibrated gauges.
- Reroute discharge lines away from walkways
- Perform protective coating maintenance on corroded flanged connection or replace necessary.

**Riser Recoil System (RTS CTRU)**

**• This equipment is considered to be in bad condition.**

The Riser Recoil System is a critical system used for slowing the ascent of the Riser and LMRP, preventing, damage to the Rig, Riser, and LMRP in the event of an emergency disconnect

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situation. Several of the original grooved tensioner rods have been replaced and the new rods are not compatible with the transducers that indicate the rod position. This has rendered the Riser Recoil System inoperable in automatic mode.

**Recommendations:**

- Restore Riser Recoil system to operate as designed.

**BOP Control Panels (WCS CTRU)**

**This equipment is considered to be in fair condition.**

During the functioning of the Tool Pushers Panel on Yellow Side, the Pod Mismatch light was on with the error message: "Valve Mismatch (50)" and the surface flow meter light blinks intermittently when the stand pipe hole fill valve is closed.

The Drillers Panel door seal is leaking and the purge pump needs a new diaphragm.

**Recommendations:**

- Investigate why Pod Mismatch is happening and correct "Valve Mismatch (50)" error.
- Investigate which card needs to be replaced to fix the surface flow meter light and install in the panel.
- Replace the diaphragm on the purge pump and replace the door seal.

**BOP Cranes / Hoists / Handling / Transport (BOPH)**

**This equipment is considered to be in fair condition.**

Due to limited space for the water bags, the BOP Crane has not been load tested and is overdue. Of the two remote controllers for the crane, one has been removed from the rig for repair and the other is not designed for simultaneous operation of the main winches and is obsolete.

The majority of the motor and gear box mounting hardware on the Lower Stack Gripper as well as some nuts and bolts on the track were heavily corroded.

**Recommendations:**

- Load test the BOP Crane.
- Install new controller once arrived as planned.
- Address corrosion and replace track bolts and nuts as necessary.

**8. TUBULAR / PIPE HANDLING**

**Varco PRS (PH PHM)**

**This equipment is considered to be in fair condition.**

The steel track in the rig floor was replaced six months ago and is showing signs of premature wear. The Aft PRS cable tensioning system was leaking oil. Due to issues addressed in the Drilling Instrumentation section of this report, automatic mode has been disabled on the PRS and it is only operated in manual.

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**Recommendations:**

- Replace track, preferably with harder material and change 4 wheel carriage with 8 wheel carriage as planned to displace the load.
- Repair hydraulic leak.

**Pipe Skate (RISH BOPC)**

● **This equipment is considered to be in bad condition.**  
 One chain is missing from the skate, the carriage chains are in poor condition and the track is damaged where the skate has jumped off the rails.

**Recommendations:**

- Replace missing skate chain.
- Replace worn carriage chains.
- Repair skate cart track.

**Offline Casing Equipment (PH PHM)**

● **This equipment is considered to be in bad condition.**  
 The horizontal to vertical casing rotator lower clamp jacking motor was not operable and the hydraulic lines were plugged off. Many of the hydraulic hose connections on the casing rotator and under the control console are corroding. Additionally, most of the casing rotator control console gauges were damaged and require replacement.

**Recommendations:**

- Fit replacement hydraulic motor.
- Clean corrosion from hose connections and wrap with Denso tape.
- Replace hydraulic gauges.

**9. POWER GENERATION**

All equipment in this section is in good condition.

**10. AIR SYSTEMS**

All equipment in this section is in good condition.

**11. COOLING WATER / FUEL / LUBE OIL / OILY WATER**

**Salt Water Lines / Related Equipment (SEA PIPE)**

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● **This equipment is considered to be in bad condition.**

The sea water pipes throughout the rig were corroded with leaks occurring daily. The sea water valves going to all the main engine coolers leaked and were hard to function. There were unpainted spools and piping at the sea water service pump in Thruster Room No. 8.

**Recommendations:**

- Replace all corroded sea water piping as needed.
- Replace all sea water valves as needed for the engine coolers.
- Put protective coating on all piping and spools as needed in Thruster Room No. 8.

**Fresh Water Lines / Related Equipment (TFS PIPE)**

● **This equipment is considered to be in bad condition.**

The fresh water cooling pipe work for the main engine heat exchangers was thin with leaks occurring often. During the assessment there was a leak in the piping at the connection to the heat exchanger for Main Engine No. 1. The main water line going down through the deck next to TFW Cooling System Heat Exchanger #2 Port was severely corroded.

The discharge pressure gauge on TFW Cooling System Pump No. 1 Port and the suction pressure gauge on TFW Cooling System Pump No. 2 Stbd were broken.

The butterfly valve located next to TFW Cooling System Pump No. 1 Port was leaking and difficult to operate. Additionally, the valve at TFW Cooling System Heat Exchanger #2 Port was corroded and leaking.

**Recommendations:**

- Replace all pipe work as needed for all 6 heat exchangers for the engines at nearest opportunity.
- Replace the main water line going through the deck next to #2 fresh water heat exchange on the port side of the rig in #1 engine room.
- Replace the discharge pressure gauge on TFW Cooling System Pump No. 1 Port.
- Replace the suction gauge on TFW Cooling System Pump No. 2 Stbd.
- Repair or replace the butterfly valve at TFW Cooling System Pump No. 1 Port.
- Repair or replace the valve at TFW Cooling System Heat Exchanger No. 2 Port.

**Drill Water Lines / Related Equipment (DRLW PIPE)**

**This equipment is considered to be in fair condition.**

The drill water pumps on the port side of the rig were worn and leaking.

Some of the drill water valves in the mud pit room were leaking by when closed.

**Recommendations:**

- Repair or replace drill water pumps as needed.
- Repair or replace the drill water valves in the mud pit room as needed.

**Oily Water Treatment System (BILG SEP)**

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**This equipment is considered to be in fair condition.**  
The pumps and pressure relief valves on both oily water separators are leaking and the tanks are severely corroded.  
The piping for the drain going to the relief valve on Oily Water Separator No.1 was apart at the flange connection.

**Recommendations:**

- Repair or replace the pump and pressure relief valve on both oily water separators.
- Replace both oily water separators.
- Repair the piping going from the relief valve to the drain.

**12. LIFTING EQUIPMENT**

**Deck Cranes (MTHL CRN)**

● **This equipment is considered to be in bad condition.**

**Port Crane:**

The main block sheaves were severely worn and the sheaves had no grease point for lubrication of the sheaves or pin. The sheaves at the boom tip had cable prints in the sheaves and were showing signs of wear. The whip line sheaves at the boom tip were also worn.

The sewing bolts were severely corroded. The radiator louvers and housing around the fan guard were corroded. The housing bolt holes were severely corroded.

The boom walk-way going down the outside of the boom was only 10 to 12 inches wide and unsafe. The tie off cable was not safe for using as a tie off point as well.

The hoses for the oil cooler mounted in the radiator system were hard and cracked due to age. In review of the history, it was noted most of the hydraulic hoses had not been replaced during the life of the crane. The hydraulic hoses going to all of the winches have not been replaced as well.

The winches have not been reworked or replaced for the life of the crane. No records were provided to indicate the hydraulic motors or pumps were ever reworked or replaced on the winches.

The crane engine did not meet EPA emission standards and a new engine was on order for the crane to be installed at nearest opportunity.

**STBD Crane:**

The main block sheaves were severely worn and the sheaves had no grease point for lubrication of the sheaves or pin. The sheaves at the boom tip had cable prints in the sheaves and were showing signs of wear. The whip line sheaves at the boom tip were also worn.

The boom section bolts were severely corroded at each section of the boom where they join. The sewing bolts were severely corroded. The radiator housing was corroded around the fan guard. The housing bolt holes were severely corroded.

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The boom walk-way going down the outside of the boom was only 10 to 12 inches wide and unsafe. The tie off cable was not safe for using as a tie off point as well.

The hoses for the oil cooler mounted in the radiator system were hard and cracked due to age. In review of the history, it was noted most of the hydraulic hoses had not been replaced during the life of the crane. The hydraulic hoses going to all of the winches have not been replaced as well.

The load cell located on the dead-man cable end was bent and worn severely. Also, the boom camera bracket and safety cable were corroded.

The winches have not been reworked or replaced for the life of the crane. No records were provided to indicate the hydraulic motors or pumps were ever reworked or replaced on the winches.

The main gear box for the crane was leaking, frequently requiring additional oil.

A review of equipment history and interviews with the crew indicate that, since suffering a fire in 2005, the crane has experienced numerous faults.

The crane engine did not meet EPA emission standards and a new engine was on order for the crane to be installed at nearest opportunity.

**Knuckle Boom Crane:**

The crane had not been overhauled during the life of the crane. The hydraulic motors had not been overhauled or replaced. The hydraulic hoses were hard and stiff while some of the hose connections for the grippers had small leaks at the connections.

**Recommendations:**

- **Port Crane:**
  - Replace the main block or have completely reworked and NDT test done.
  - Replace the boom tip sheaves as needed.
  - Replace the dead-man sheave and housing block. Replace all pins for the housing block as well.
  - Replace all (3) three whip line sheaves at boom tip at nearest opportunity.
  - Replace all sewing bolts on the port crane.
  - Replace the radiator, radiator housing and louvers on crane as needed. Replace the fans and fan guards as for the radiator and cooler as needed.
  - Replace the walk-way going down the side of the boom with a wider walk way and replace the tie off cable. As a suggestion, install the walk-way on the inside of the boom and install a walkway at the boom sheaves for safe working when performing maintenance to the sheaves.
  - Replace all hard and cracked hydraulic hoses on crane as needed.
  - Replace or rework all winches on the crane at next available opportunity.
  - Replace or rework all hydraulic motors on the crane at next available opportunity.
  - Replace the crane engine as planned.
  
- **STBD Crane:**
  - Replace the main block or have completely reworked and NDT test done.

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- Replace the boom tip sheaves as needed.
- Replace the dead-man sheave and housing block. Replace all pins for the housing block as well.
- Replace all (3) three whip line sheaves at boom tip at nearest opportunity.
- Replace all sewing bolts on the port crane.
- Replace the radiator, radiator housing and louvers on crane as needed. Replace the fans and fan guards as for the radiator and cooler as needed.
- Replace the walk-way going down the side of the boom with a wider walk way and replace the tie off cable. As a suggestion, install the walk-way on the inside of the boom and install a walkway at the boom sheaves for safe working when performing maintenance to the sheaves.
- Replace all hard and cracked hydraulic hoses on crane as needed.
- Replace the load cell and pin for the load-cell; the load-cell and indicator must be calibrated when replaced.
- Repair/replace the boom camera mounting bracket and replace the safety cable for the camera.
- Replace or rework all winches on the crane at next available opportunity.
- Replace or rework all hydraulic motors on the crane at next available opportunity.
- Repair the leak on the main gear box as needed. Replace the crane engine as planned.
- **Knuckle Boom Crane:**
  - Overhaul the knuckle boom crane.
  - Overhaul or replace the knuckle boom crane hydraulic motors.
  - Replace all hydraulic hoses.
  - Repair all leaking hose connections on the grippers.

**Gantry Cranes – Excluding BOP Cranes (MTHL OCRN)**

**This equipment is considered to be in fair condition.**

During travel of the hoist back and forth #1 hoist would move more slower the #2 hoist. The limit sensors were out of sink and should be replaced if the speed of the hoist cannot be set the same on both hoists. Before moving the crane to the Port Side, the operator was having to move the unit to the STBD side first (for about a foot), to keep the crane from hanging up due to the FWD end moving faster than the AFT end, if not the unit would not travel to the Port.

**Recommendations:**

- Replace/repair the limit sensors for the hoist travel speed.
- Repair the problem with the crane not moving to the Port without moving the unit to the STBD first. The crane should travel both ways with out problems.

**Air Hoists – Man Riding (PHL MWIN)**

**This equipment is considered to be in fair condition.**

The Moonpool Port Fwd manriding winch is suffering from advances corrosion, including the hoisting wire.

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**Recommendations:**

- Remove winch from service carry out overhaul, remove corrosion and paint.
- Replace wire.

**Air Hoists – Non Man Riding (PH UWIN)**

This equipment is considered to be in fair condition. Both utility winches at the auxiliary derrick are blowing oil from the exhausts and the remote control panel backing plate has corroded. Isolation valve for all utility winches used for manriding are not within easy reach of the operator. Port Fwd rig floor utility winch air supply hose damaged.

**Recommendations:**

- Repair or replace auxiliary derrick utility winches.
- Replace auxiliary derrick utility winches control panel backing plate.
- Fit isolation valves next to winch controls.
- Replace damaged Port Fwd rig floor utility winch air supply hose.

**Personnel Elevators (PHL MELV)**

• This equipment is considered to be in bad condition. While removed from the elevator shaft to facilitate rigging equipment to/from the pontoon, the Stbd Fwd personnel elevator was damaged and has been removed from the rig for repair.

**Recommendations:**

- Return the elevator to the rig, reinstall and recertify prior to returning to service.

**13. COMMUNICATIONS / DATA PROCESSING**

**PA, PABX, Talk Back and Telephone Systems (COMM)**

• This equipment is considered to be in bad condition. The PA rack amplifiers are obsolete and no longer supported by the OEM.

**Recommendations:**

- As planned replace the PA system.

**14. ACCOMMODATIONS**

**Galley Refrigeration Equipment (ACOM GEQT)**

This equipment is considered to be in fair condition. Review of equipment history and crew interviews revealed that the main dishwasher is unreliable and constantly breaking down. The steam table would not heat up to temperature and the food mixer was not working.

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Many of the cabinets in the galley were damaged.

**Recommendations:**

- Replace the food mixer, steam table and the dish washer.
- Replace the damaged galley cabinets.

**Living Quarters / Rooms (ACOM ACM)**

**This equipment is considered to be in fair condition.**  
Several areas of the floors were damaged including the mess room and hole or dent in the deck outside room 330.

The majority of carpets in the rooms are stained and must be replaced.

**Recommendations:**

- Repair flooring as necessary.
- Replace the stained carpets.

**15. RIG UTILITIES**

**Ventilation Systems (HVAC)**

**This equipment is considered to be in fair condition.**  
Several tubes in the cooling system are plugged.  
Switchroom 5 A/C unit was not working due to a faulty expansion joint and the condenser unit for the bridge is wasted and non-operational.  
The ducting was corroded in the port 3<sup>rd</sup> deck AHC room.

**Recommendations:**

- Repair the expansion joint as planned.
- Replace the A/C condenser unit on the bridge.
- Repair the plugged tubes in the cooling system.
- Replace the corroded ducting in the AHC room port side 3rd deck.

**Watermakers (POTW WTMK)**

**This equipment is considered to be in fair condition.**  
The fresh water lines going to all six water makers were also corroded with small leaks in several places around the connection flanges at the water makers.  
Main salt water line to Watermaker No. 5 were corroded and leaking at the flange A soft patch was installed on the piping.  
Main salt water line to Watermaker No. 6 was leaking at the flange.

**Recommendations:**

- Replace all corroded fresh water piping going to the water makers as needed.

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- Install new pipe on Watermaker No. 5 as needed.
- Replace the bad main salt water line going to Watermaker No. 5 and replace/repair the flange at the top of the unit as needed.
- Repair or replace the flange connection at the top of Watermaker No. 6.

**Sewage Treatment Plant (EVNS SWGE)**

● **This equipment is considered to be in fair condition.**  
Sewage treatment system is severely corroded with wastage. One of the overboard discharge pumps has been removed and both air compressors have also been taken off the plant; regulated rig air is now used to supply air to the tank diffuser system.

**Recommendations:**

Replace the sewage treatment plant.

**Hazardous Area Electrical Equipment (ELPD HAZA)**

● **This equipment is considered to be in bad condition.**  
None of the Ex electrical equipment has been tagged with an ID number and there is no HAER on this rig.

**Recommendations:**

- Conduct a Hazardous Area Electrical Survey and establish a Hazardous Area Electrical Register as per HQS-OPS-EST-694-01.

**16. SAFETY & FIRE FIGHTING**

**Hydraulic Watertight Doors & Hatches (WTD WTDR)**

**This equipment is considered to be in fair condition.**  
Hydraulically operated doors in the Starboard columns at the 24m and 28 ½m levels were not working and had to be opened and closed with the manual pump.

Three hydraulically operated doors in the Port Aft column are dragging on the bottom track.

**Recommendations:**

- Repair the hydraulic problem with the door at the 24m level.
- Repair the hydraulic problem with the door at the 28 ½m level.
- Adjust dragging doors in the Port Aft column.

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### Attachments

- Rig Condition Scorecard
- Rig Assessment Definitions
- Corrective Opportunities
- Maintenance Issues
- Improvement Opportunities
- ABS Status Report
- Oily Water Separators (Marpol)
- ABB Thruster Motor No. 2 Failure Report

DRAFT

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