Rig Inspection Workshop

Floating Rigs

Workbook 2.1

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Drilling equipment

1 Drawworks

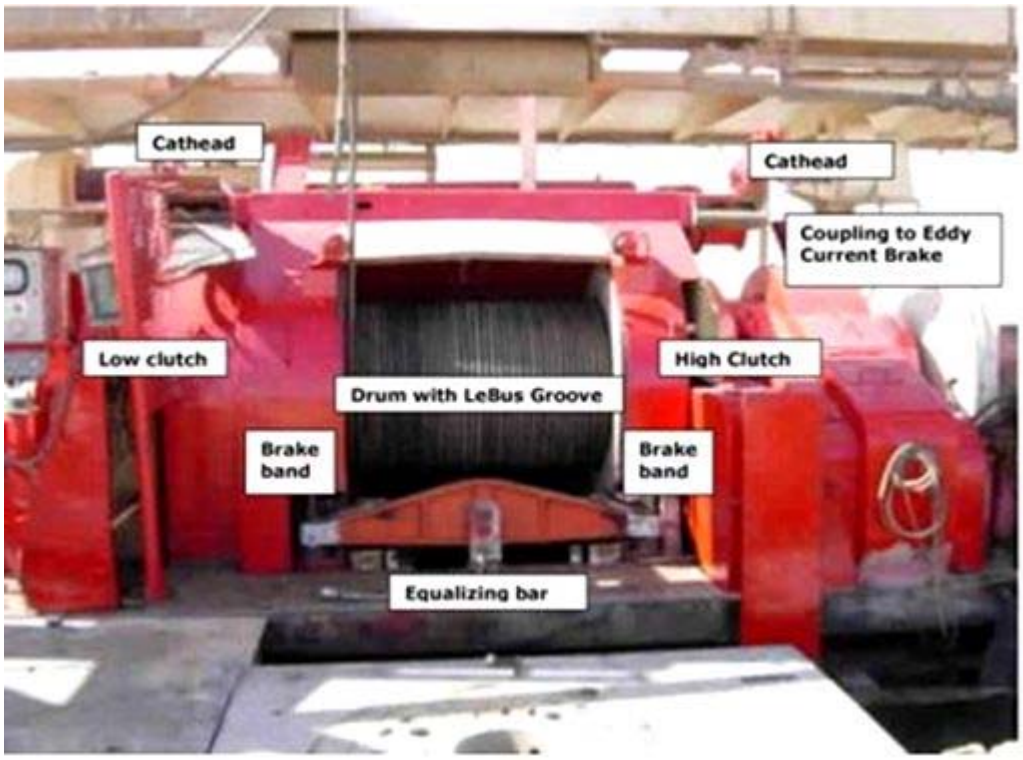


Figure 1 - Drawworks.

1.1 Drawworks checklist

- Record the date of the last overhaul (API RP 7L section 4.2) [Drawworks inspection].
- Check NDT inspection reports for the brake bands, linkage and equalizer bar.
- Check the wear reports for brake bands, brake pads and brake rims (IADC Drilling Manual Chapter F) [drawworks brake rim measurement].
- Check the wear on the brake linkage and look for kicking brakes.
- Check the wear on drill line and Lebus groove.
- Ensure that there are at least twelve wraps on brake drum (with the travelling block in the lowest position).
- Check the drill line clamp on the dead end of wire behind the brake rim flange.
- Is there enough spare drill line for the contract?
- Check the kickback roller setting (¼-inch play).
- Carry out a cathead pull test: make-up 7,000 lbs minimum and break-out cathead 14,000 lbs minimum.
- Check the condition of the break-out line.
- Check the condition of the make-up chain (max. link wear 10%).
- Check the operation of the oil pressure gauge (pressure 20/50 psi on National drawworks).
- Check for monthly oil samples analyses.
- Check that the oil sprayer nozzles are not blocked.
- Check if silicone sealant is used as gasket material on covers.

- Check the chain stretch: 3% maximum stretch over five links (API Spec 7F A.3.5) [chain stretch and sprockets].
- Check for wear on the sprockets (API Spec 7F A.3.4 and A.3.6).
- Carry out a function test of the Crown-O-Matic or equivalent system.
- Check the disc brakes for wear and cracks, and check the manual for wear rates.
- Check the disc brake hydraulic system and check the manual for correct operating pressures.
- Check the brake pads on the emergency brake, parking brake and main brake.
- Check the EX rating of the DC electric motors inside hazardous areas.
- Check the electric cables (API RP 14F section 12.1.2); check that the cable support and junction boxes are EX.
- Is there sufficient cooling-water capacity for the brake bands and eddy current brake (150 US gallons per minute = 570 litres per minute).
- Check that there is sufficient cooling water for disc brakes (195 gallons per minute = 740 litres per minute). (*)

1.2 Drawworks notes

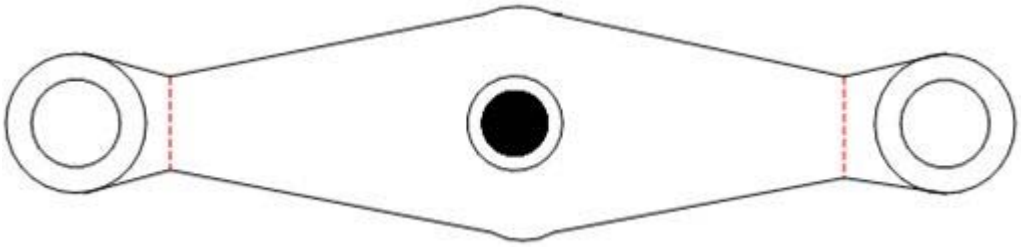


Figure 2 - Equalizing bar inspection points.

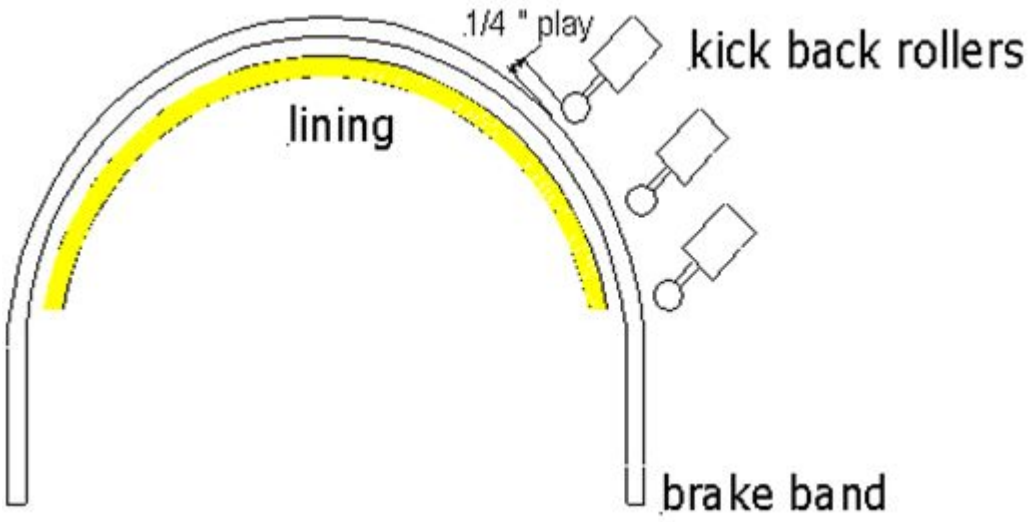


Figure 3 - Correct setting of kickback rollers.

Figure 4 - Kickback roller.

Figure 5 – Chain-driven oil pump.

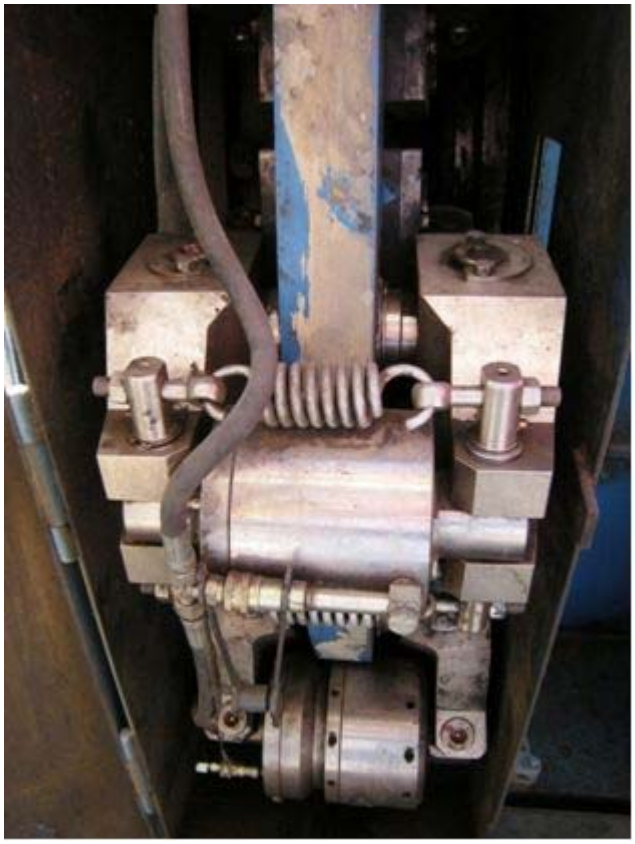


Figure 6 - Disc brake calliper.

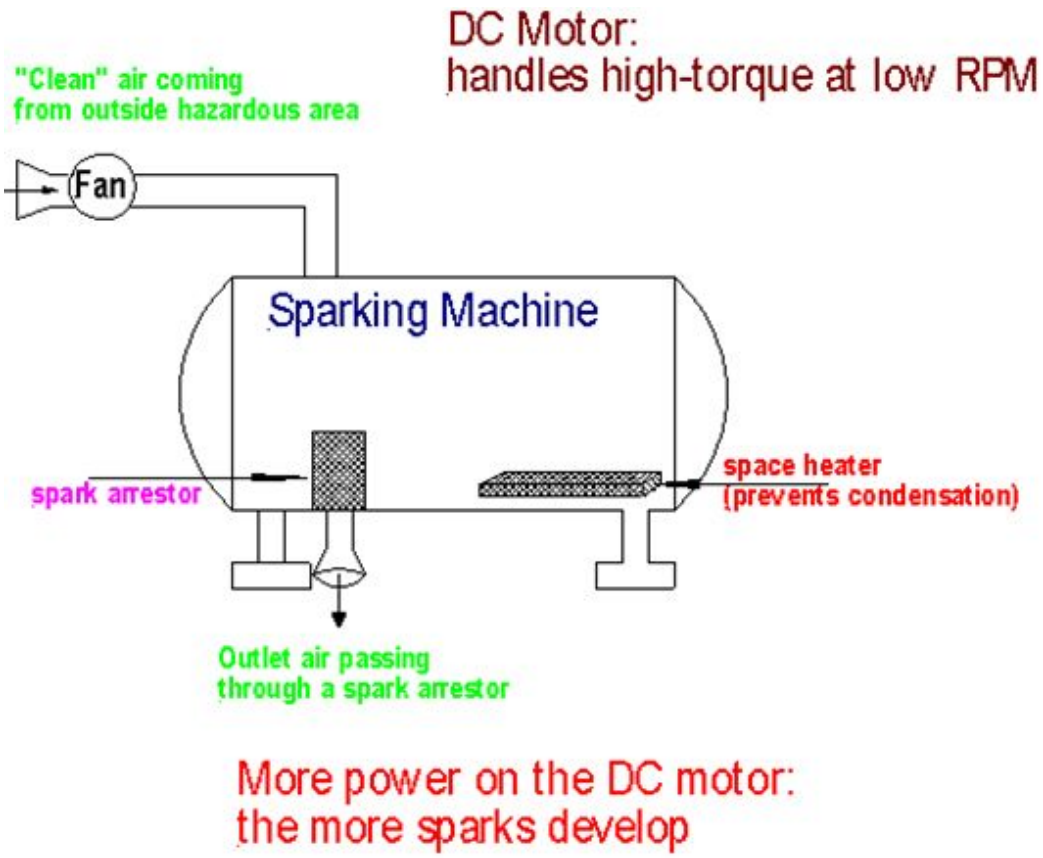


Figure 7 - DC motor in hazardous area.

2 Rotary table

Figure 8 - Rotary table.

2.1 Rotary table checklist

- Take out a permit to work (PTW) and isolate.
- Check the condition of the brake housing (2.1).
- Check the condition of the chain and sprockets. The maximum chain stretch is 3% (API RP 7F).
- Check that the electrical cables and junction boxes are EX.
- Check the condition of the gearbox.
- Check the oil analysis frequency.
- Check the records of backlash measurements.
- Run the rotary table and check noise and vibration levels.
- Check the condition of the main bearing.
- Ensure that the DC motors draw cooling air from outside the hazardous areas and that there are spark arrestor fitted on the discharge side.
- Check that there is safety matting around rotary table.
- Check for wear on the master bushings and inserts, note position drill pipe in slips (2.2).
- Test the manual locking system.
- Function-test at 120 rpm for 30 minutes in right-hand rotation.
- Function-test the left-hand rotation at low speed (*).

2.2 Rotary table notes

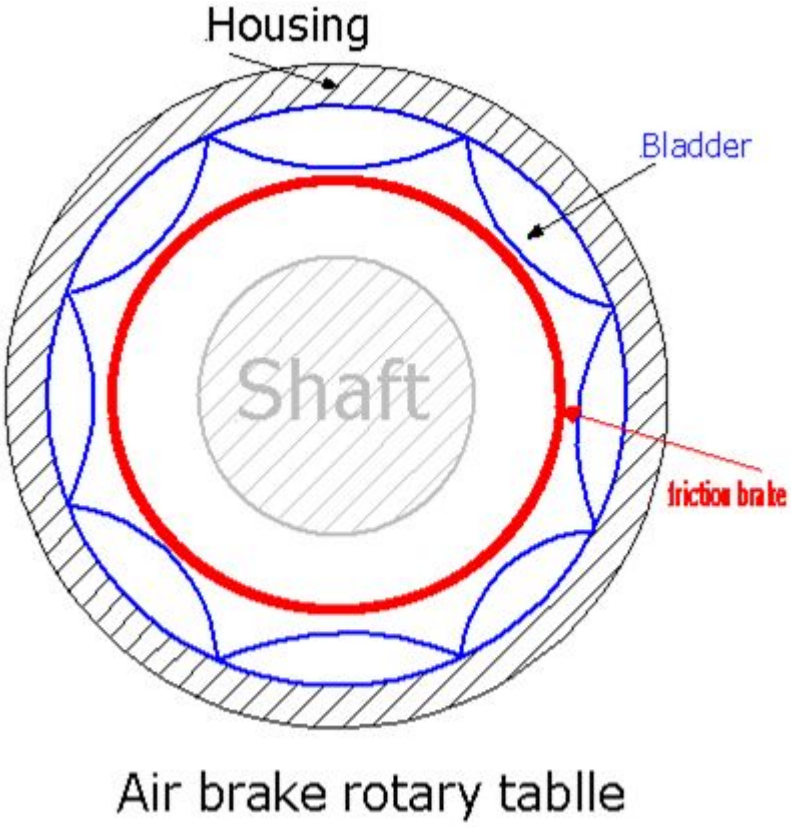


Figure 9 - Cross-sectional diagram of rotary table air brake.

Tapered bowls rotary table

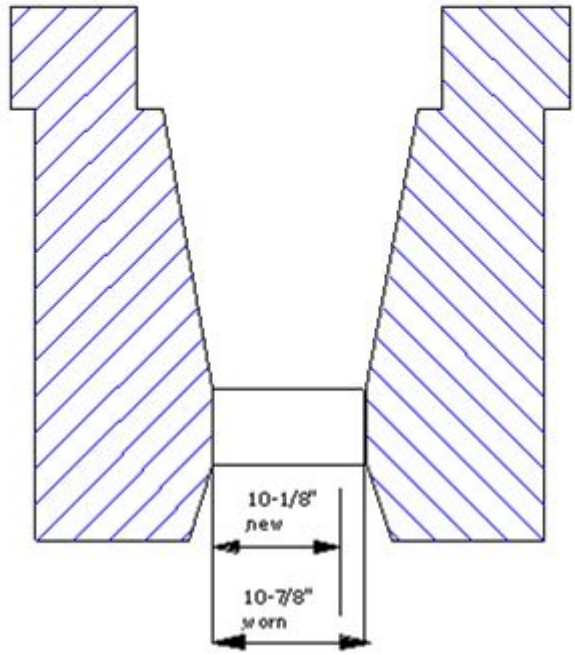


Figure 10 - Example of wear limit on tapered bowls.

Figure 11 - Anti-slip mats.

Figure 12 - Rotary table and master bushing.

3 Top drive

Figure 13 - Top drive.

3.1 Top drive checklist

- Check the last overhaul data (API RP 7L section 4.2 and OEM recommendations).
- Check that safety clamps are installed on the mud hose (API Spec 7K section 9.10.4 Table 8 Figure 10, and IADC Safety Alert 00-24).
- Check that the inspection intervals of the mud hoses are as per OEM recommendations.
- Check if there is any exposure of wire banding under the outer rubber of hose (ISS-059 inspection guidelines for high-pressure hoses) (ISS-059).
- Check the condition of the service loop in the derrick.
- Check for oil leakage.
- Check the frequency of the oil sampling and analysis.
- Check the protection frame (secured connections).
- Check that there is a spare service loop available.
- Check the condition of the wash pipe swivel and spare wash pipe.
- Check the condition of the DC motor and verify if it is high-torque-rated.
- Check the condition of the spare DC motor (DC motor with special hub and bearings).
- Check the AC motors for top drives with a VFD system.
- Check that there is a spare mud hose installed in the derrick.
- Check the NDT data of the pipe handler, main shaft/load collar (load collar), IBOP and elevator links.
- Check the condition and operation of the link-tilt assembly.
- Check that electric cables and J-boxes are EX.

- Check that dolly wheel catchers are installed.
- Check when the latest Varco upgrades have been installed.
- Check the clearance of the swivel bearing and check whether the swivel is integrated with the top drive bearings.
- Check that dropped-objects and post-spud procedures are in place. (*)

Figure 14 - Link-tilt assembly.

3.2 Topdrive notes

4 Swivel

- Check records and frequency of oil analyses.
- Check records of grease sampling and analysis.
- Check for oil leaks from the lower seal.
- Check thrust bearing clearance records (use a dial indicator) (API RP 8B section 6.2 and ISO 13534).
- Check that NDT inspections are carried out on all load-bearing areas (API RP 8B and ISO 13534).
- Check that NDT inspection records are as per API RP 7G section 13.2 on drill pipe connection.
- Check wall thickness inspection records for the gooseneck (API RP 574 table 1 for original pipe wall thickness).
- Ensure that a connection for wire line operations is installed on the gooseneck.
- Check that a spare wash pipe fully dressed with the correct seals is available.
- Check if an upgraded wash pipe has been installed.
- Ensure that unused/stored swivels are stored in a vertical position.
- Ensure that special seals have been fitted if they are used for high-temperature operations (*).

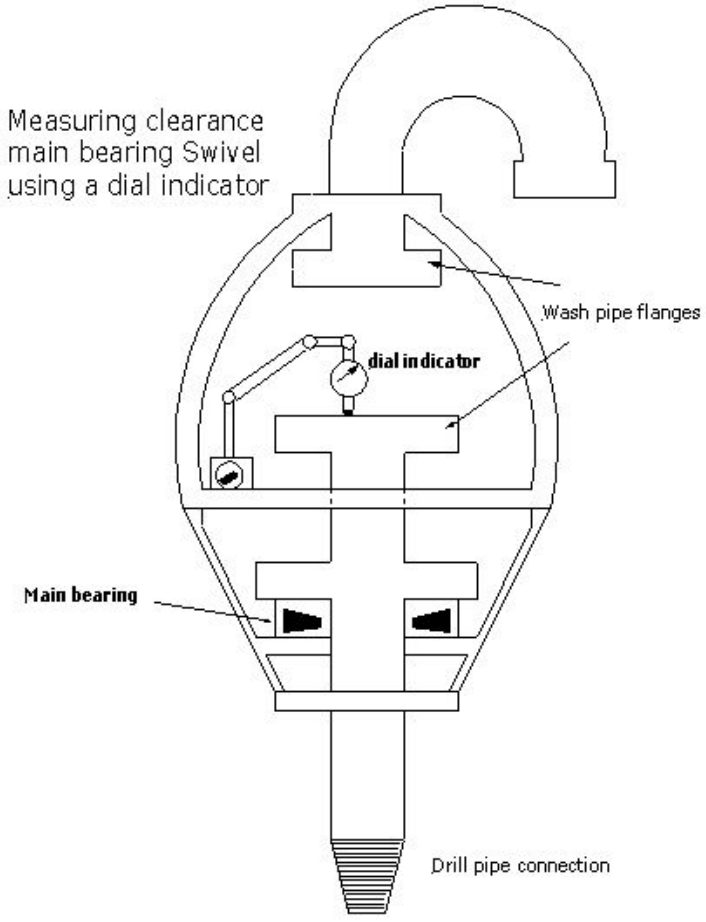


Figure 15 - Checking the wear of the main bearing on the swivel.

Figure 16 - Swivel with kelly spinner.

Figure 17 - Measuring the bearing clearance.

Figure 18 - Swivel stripped for API Category IV inspection.

Figure 19 - Swivel in long-term storage.

5 Crown block

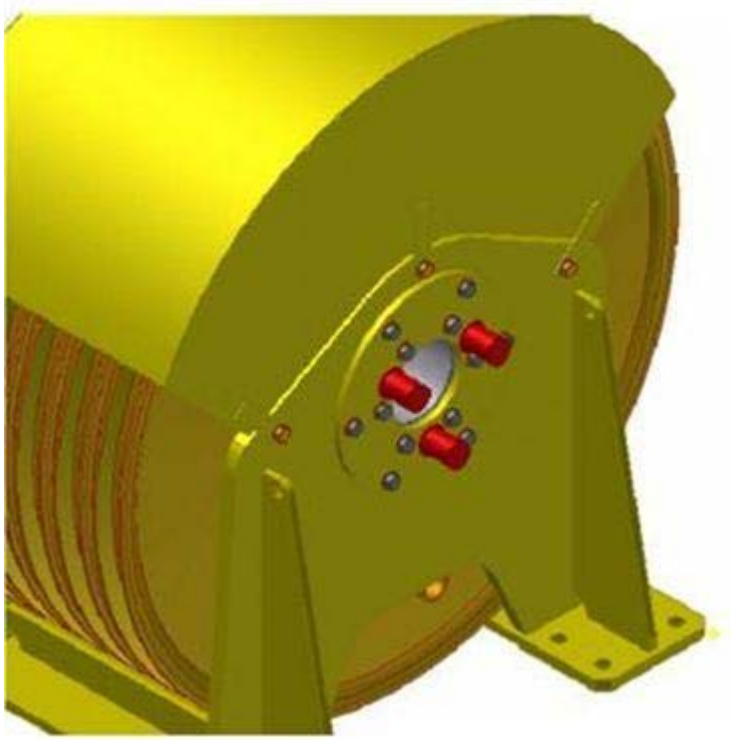


Figure 20 - Crown block.

5.1 Crown block checklist

- Take out a permit to work (PTW).
- Hang off the blocks prior to inspection, and isolate the drawworks SCRs/ VFDs.
- Use sheave gauges to check sheave profile.
- Ensure the five-yearly NDT and disassembly are as per API RP 8B and ISO 13534 (or acceptable other).
- Carry out a wobble test with a small crowbar to check the wear on the sheave boss and bearings.
- Check the NDT inspection reports for the support frame.
- Check that the grease lines and nipples are in good condition.
- Check the condition of the omni-directional aircraft-warning light.
- Ensure that the crown platform entrance has a self-closing door or barrier fitted.
- Check that (three) jumper bars are installed over the sheave cluster.
- Ensure that excessive grease/tar build-up is removed from the sheaves.
- Ensure that wooden bumper blocks are covered with heavy-duty wire mesh (*).

5.2 Crown block notes

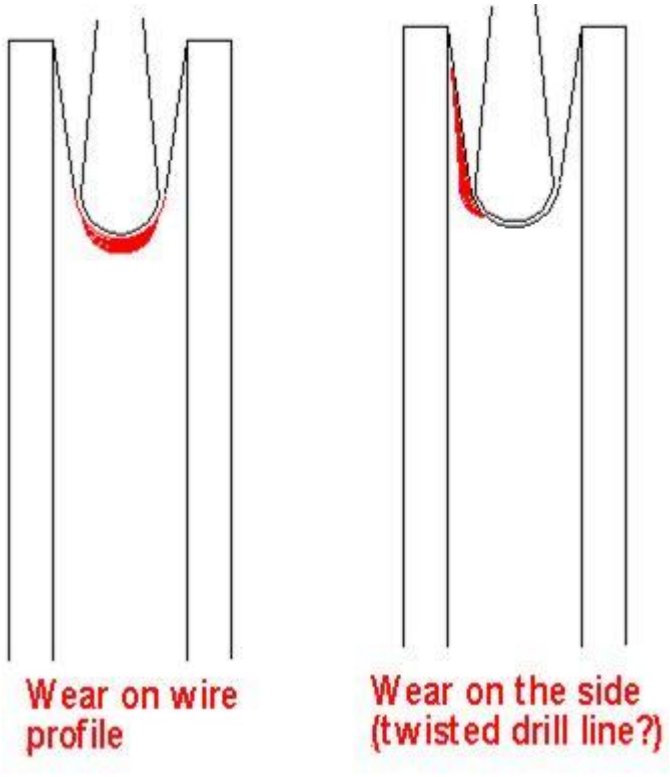


Figure 21 - Wear patterns on sheaves.

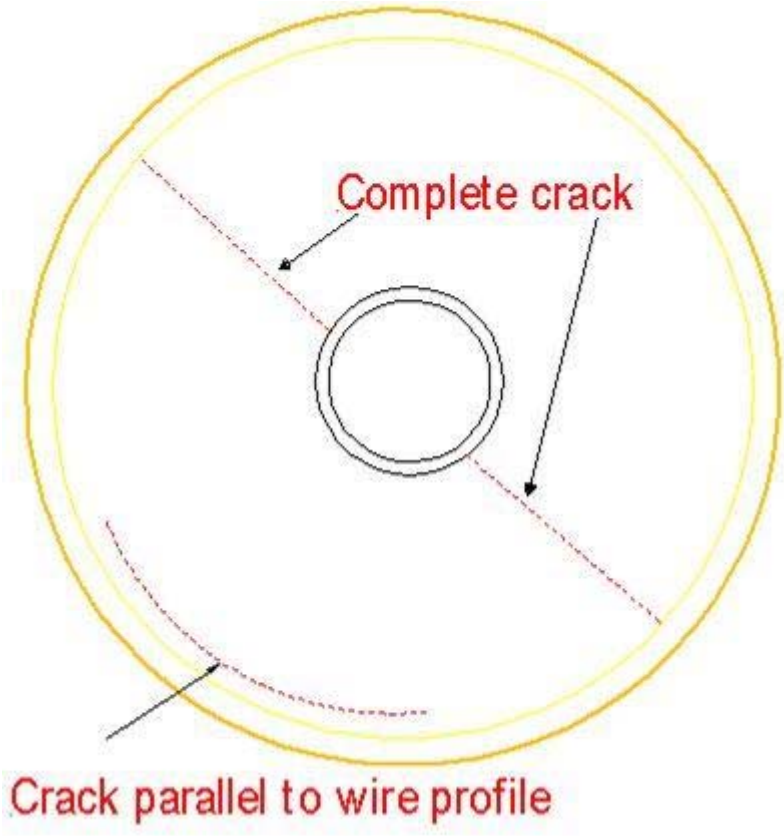


Figure 22 - Crack areas on sheaves.

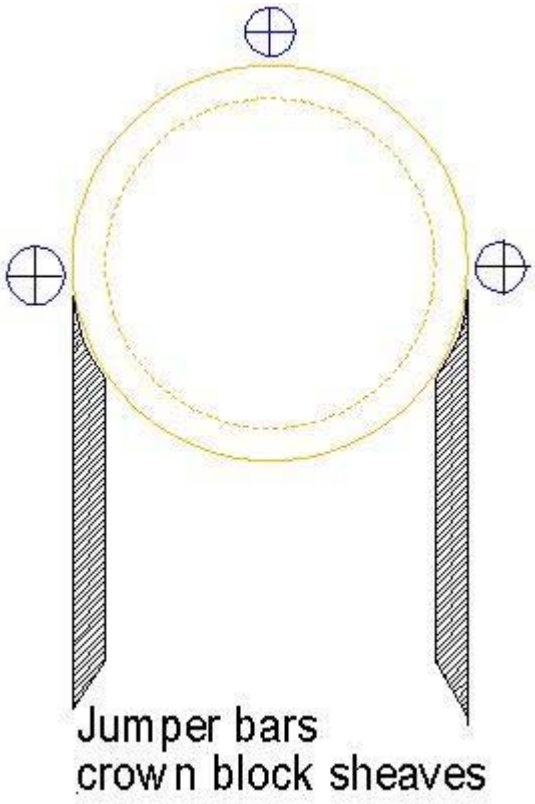


Figure 23 - Position of jumper bars.

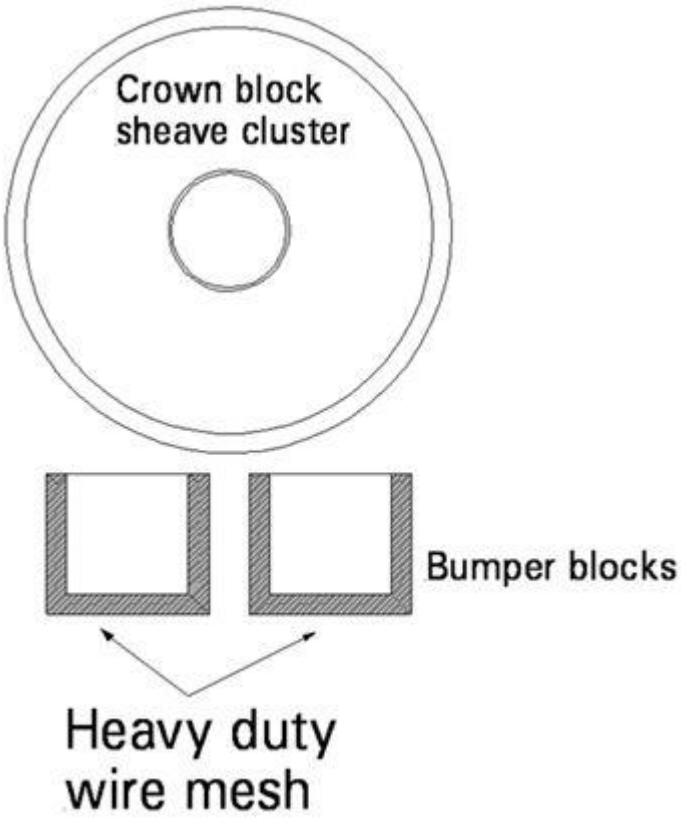


Figure 24 - Position of bumper blocks.

Figure 25 - Measuring the sheave wear.

Figure 26 - Simple self-closing gate.

Figure 27 - This is what is meant by substantial wire mesh.

6 Travelling block

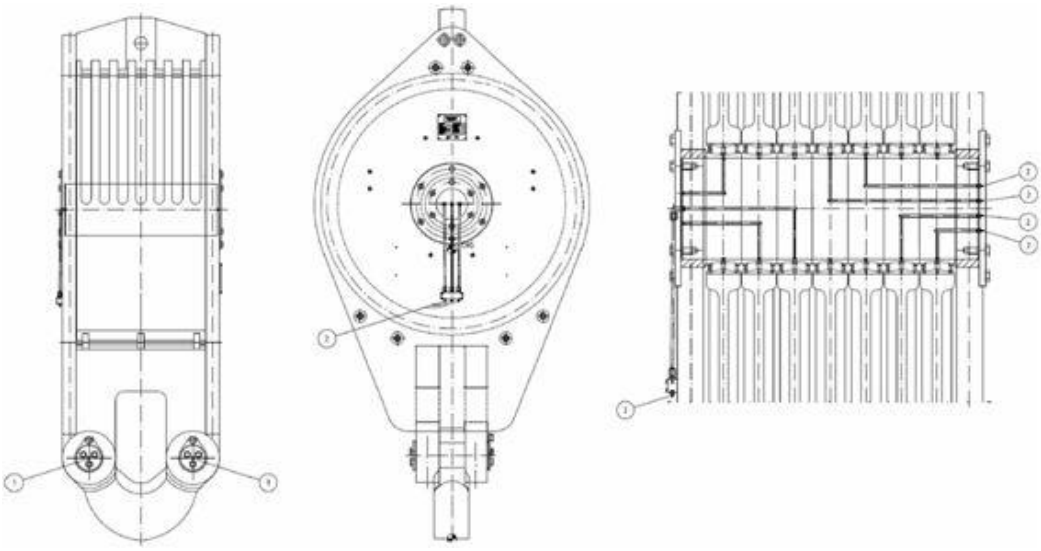


Figure 28 - Schematic of travelling block.

6.1 Travelling block checklist

- Take out a permit to work.
- Hang off the travelling block prior to inspection, and isolate the SCRs/ VFDs for the drawworks.
- Check that the NDT inspection and five-yearly disassembly are as per API RP 8B and ISO 13534 or an acceptable alternative.
- Carry out a wobble test on the sheaves by using a small crowbar.
- Check the records and/or measure the sheaves by using sheave gauge.
- Check that the grease nipples are in good working condition.
- Ensure that a certified hang-off line, pad eye and shackles are used (API RP 9A and API RP 9B).
- Check for damage on the sheave covers due to twisted drill line or too high a fleet angle on the drill line (twisted wire rope).
- Ensure that unused blocks in long-term storage are placed in a vertical position (*).

6.2 Travelling block notes

7 Driller's console

Figure 29 - Driller's console (Cyber Chair).

7.1 Driller's console checklist

- All gauges working; last calibration and tested every three years to 1% of full scale (API RP 53 section 12.5.3.g).
- Permanent warning lights.
- Purge air system EXp (API RP 14F sections 3.2.3 and 4.3.1.2).
- Last recorded purge air alarm test (visual and audible).
- View of driller of derrick stabbing board.
- View of driller of casing stabbing board.
- Load limiter or load management system for generators.
- Communication with monkeyboard and casing stabbing board.
- Electrical cables and J-boxes EX.
- Safety glass used for windows.
- Lamp test operational.
- Properly engraved signs (no graffiti on panels).
- Condition of mud pit indicators (API RP 53 section 15.7) (*).

Driller's console notes

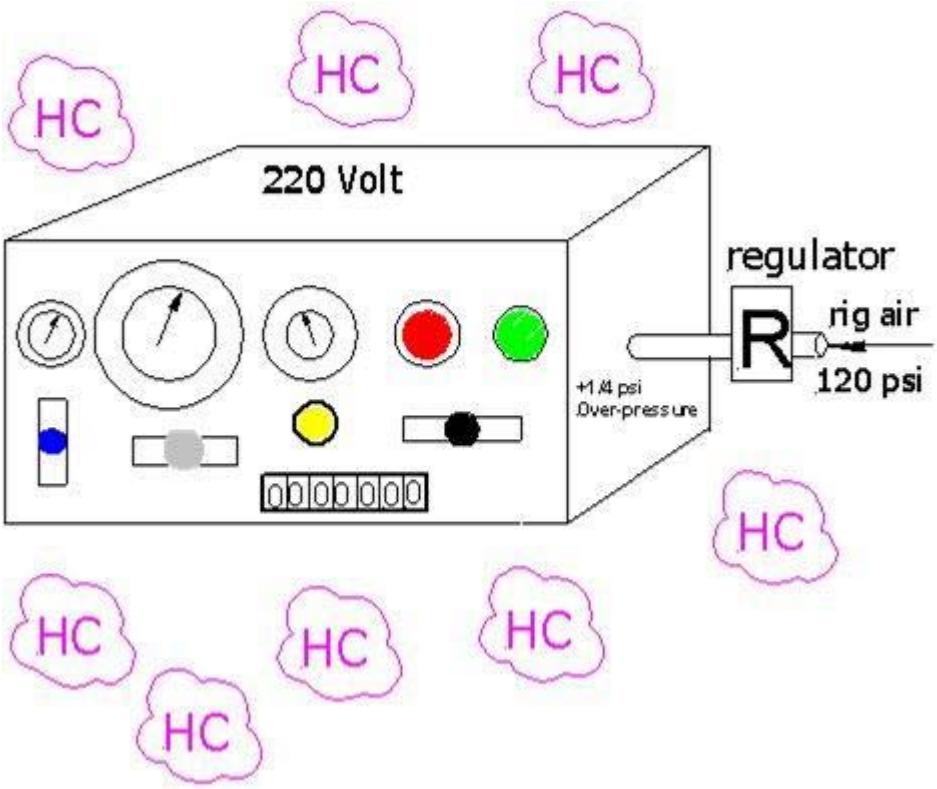


Figure 30 - EXp purge air protection.

8 Derrick

Figure 31 - Derrick structure.

8.1 Derrick checklist

- When was the last category IV derrick inspection (API RP 4G sections 4.2.5 and 6.3)?
- What is the load rating of the derrick (API RP 4G section 9.2.1)?
- Is there an inspection programme in place?
- Check for bent or damaged beams and cross-members (API RP 4G section 6).
- Check the NDT inspection reports for the fingerboard.
- Check that the fingers are fitted with acceptable safety chains, wire slings or wire rope.
- Ensure that air hoist cables are not rubbing against any beams or fingers.
- Check that the illumination in the derrick leaves no dark spots.
- Ensure that all light fittings have secondary retention.
- Is there a dropped-objects procedure in place?
- Is the derrickman correctly secured when working on the monkeyboard?
- Check the condition of the derrick ladders and platforms, self-closing barriers, handrails and back-scratchers (API RP 54 section 9.3.17).
- Are suitable toe boards installed (API RP 54 section 9.3.19)?
- Check the condition of the omni-directional aircraft-warning lights.

- Check the condition of the travelling-block hang-off lines and shackles (API RP 9B).
- Are wooden bumper blocks covered with a heavy-duty wire mesh (API RP 54 section 9.2.16)?
- Are all hinged parts in the derrick secured with safety chains?
- Ensure snatch block safety wires have a SWL which is at least two times the SWL of hoist wires (dynamic impact) (*).

8.2 Derrick notes

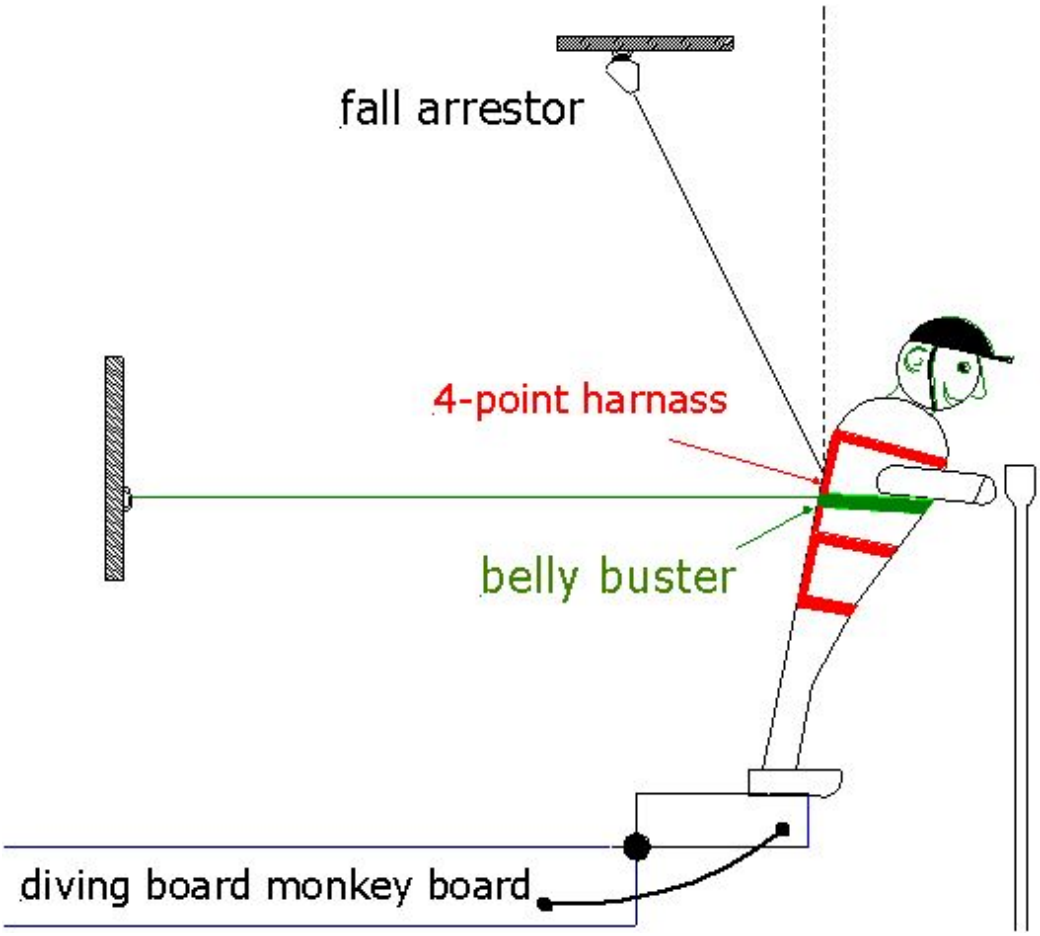


Figure 32 - Securing the derrickman.

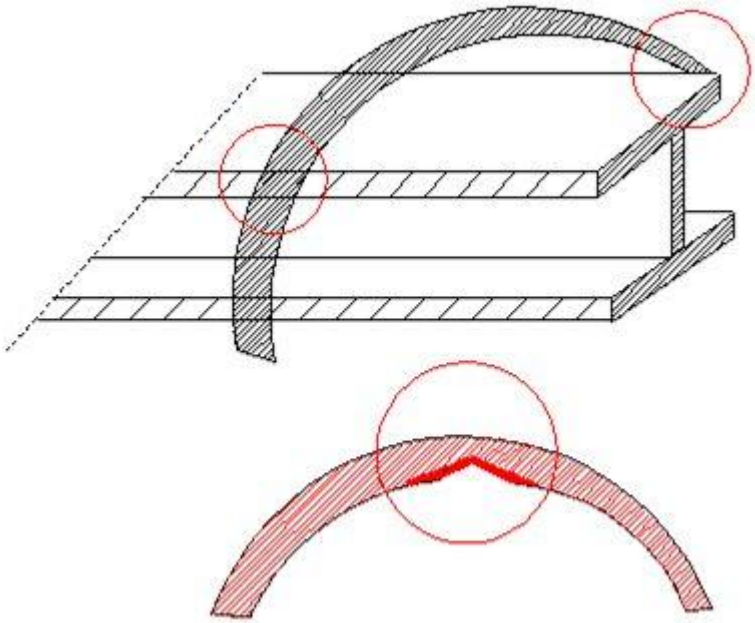


Figure 33 - A damaged wire rope sling provides a false sense of security.

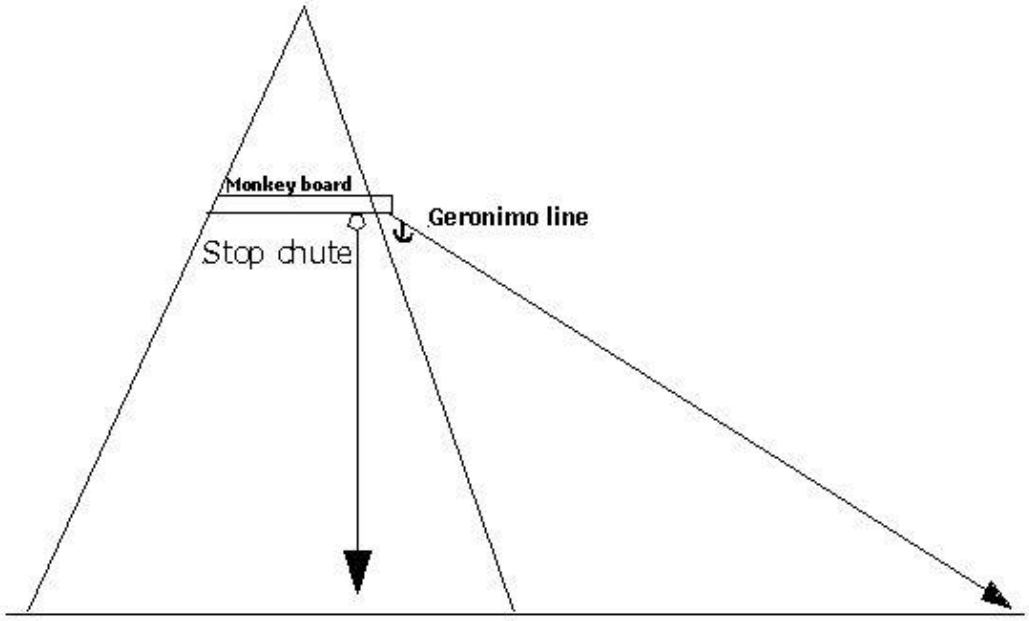


Figure 34 - Derrickman's escape devices.

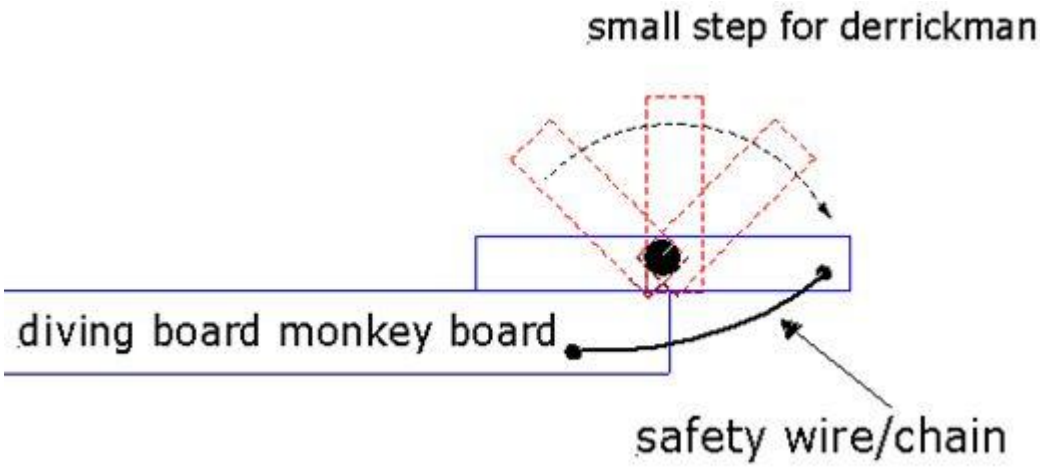


Figure 35 - All hinged parts in the derrick must be secured with a safety wire, a chain or a wire rope.

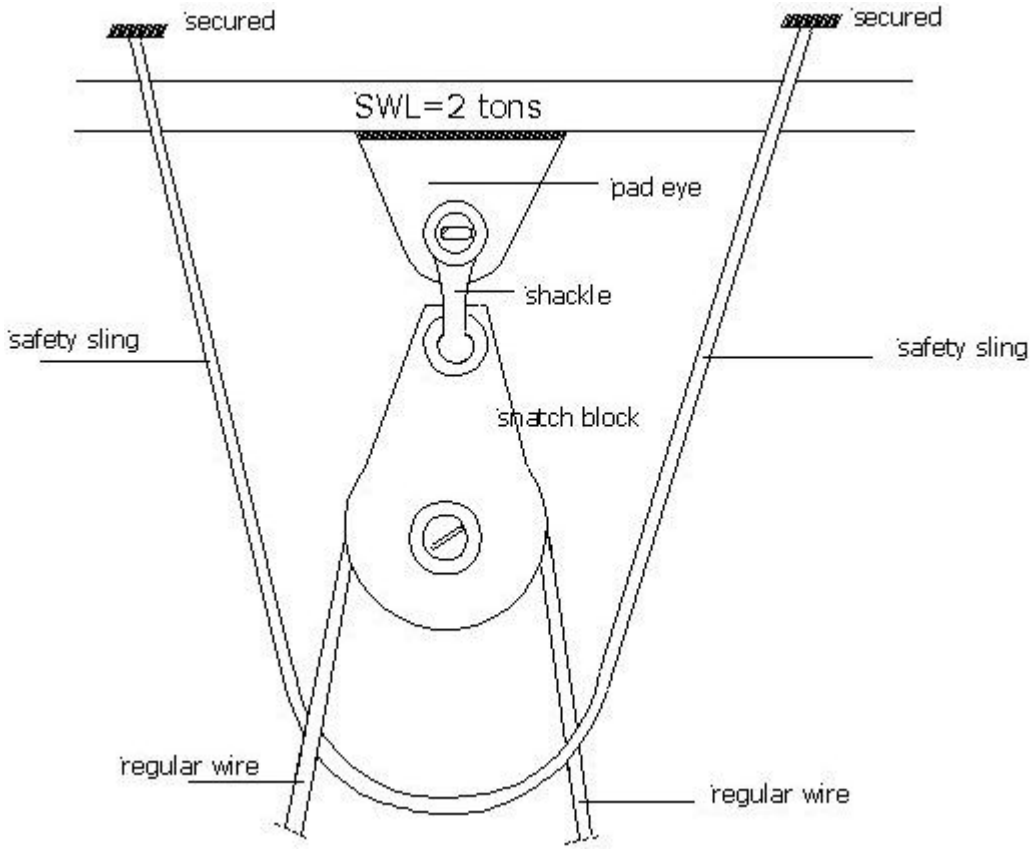


Figure 36 - Installation of snatch block safety line.

Figure 37 - New raising-line sheave.

Figure 38 – Platform with safety wire across the hinge.

Figure 39 - Aircraft-warning light.

9 Air winches

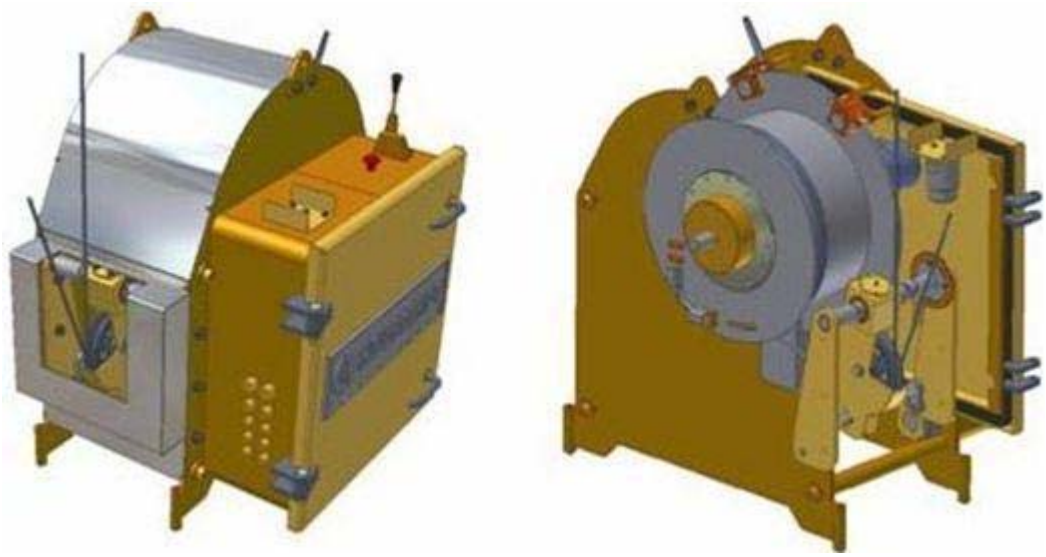


Figure 40 - Air winches.

9.1 Air winches checklist

- Check the condition of the brake lining (no oil contamination is allowed).
- Ensure that the brake linkage system and adjustment is correct.
- Check that a ball valve is used on the air supply line and that the handle is within easy reach of the operator.
- Ensure that the free-fall handles on the hoist winches have been disabled or removed.
- Check for oil leaks and air leaks.
- Check the condition of the wire end termination.
- Check that the winch control handle returns back to neutral when released.
- Ensure that a safe working load (SWL) sign is displayed.
- Ensure that a protective cage is fitted.
- Ensure that a spooling device is fitted.
- Ensure that the controls correctly indicate the UP and DOWN functions.
- Check the condition of the winch foundation and foundation bolts and any NDT inspection records.
- Check that an exhaust noise suppressor is fitted.
- Check the condition of snatch-blocks and their inspection reports (10.1).
- Ensure that the sheave snatch block is at least eighteen (18) times the diameter of the wire in use.
- Check the condition of the wire (API RP 9B).
- Ensure that man-riding winches are fitted with automatic and manual brakes.
- Ensure that man-riding winches have non-rotating wire installed.
- Ensure that no rubber hoses are fitted in the man-riding winch air supply line.
- Check maximum pull/speed adjustment on the man-riding winches.

- Ensure that dedicated man-riding winches are installed in their area of operation.
- Check if there is an accumulator system for man-riding winches (*).

Figure 41 - Free-fall handle needs to be locked.

Figure 42 - Sheave undergoing inspection.

Figure 43 - Cable secured with a Wedgelock.

Figure 44 - Poorly fitted man-riding winch.

Figure 45 - Modern man-riding winch.

10 Lifting and handling equipment

Figure 46 - Elevator inspection.

10.1 Lifting and handling equipment checklist

- Check that all drilling lifting equipment is NDT-inspected as per API RP 8B Category I and II, and visually inspected before use.
- Check that all drilling lifting equipment is NDT-inspected as per API RP 8B Category III every six months.
- Check that all chain hoists are inspected on a six-monthly basis and before use.
- Check that sheaves are removed from the derrick and inspected on a regular basis.
- Check that all the elevator IDs are measured every six months.
- Check that the elevator links/bails are measured every six working months.
- Check that the slips, master bushings and safety clamps are inspected every six working months.
- Check the last inspection of all drilling tubulars and what criteria were used (minimum API RP 7G).
- When was the last inspection of drilling subs and fishing tools?
- Are the generally preferred four-part shackles in use in the derrick?
- Check that shackles and slings are inspected every six months.
- Check if the rig uses a colour code that is changed on a six-monthly rotation.
- Check that the pad eyes are tested and inspected as part of the six-monthly programme.
- Ensure that no homemade spliced slings are used on the rig.
- Ensure that no homemade lifting eyes or drill pipe lifting subs are in use (*).

Figure 47 - On-site NDT inspections of lifting gear.

Figure 48 - Lifting gear under inspection.

Figure 49 - Measuring the elevator bails / links.

Chapter 02

Mud-processing equipment

1 Mud pumps

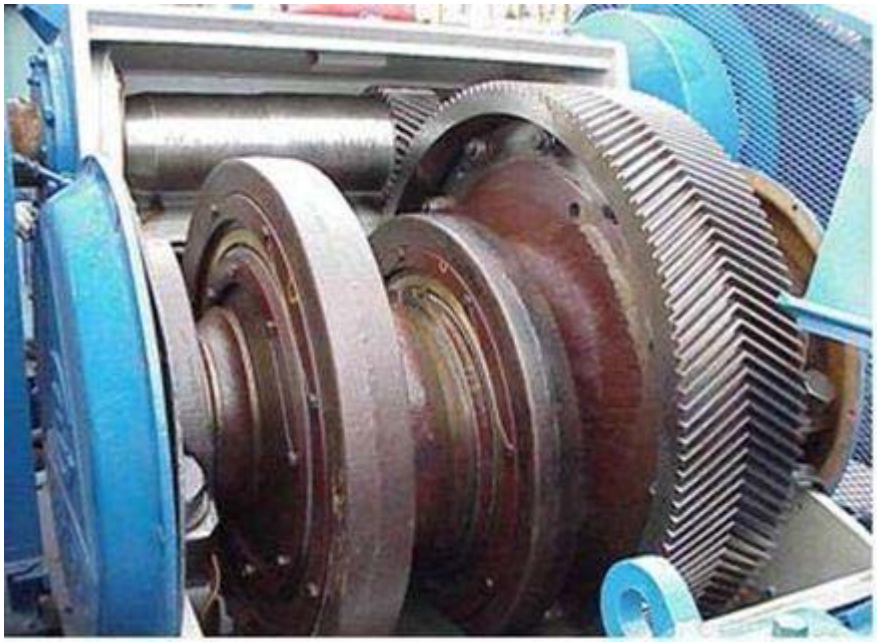


Figure 1 - Mud pump power end.

1.1 Mud pumps checklist

- Check the condition of the drive chains and sprockets or belts and pulleys.
- Check the operation of the VFD AC driven pumps.
- Check and record the main and pinion shaft bearing clearances (i.e. maximum clearance 0.016"/0.40 mm).
- Visually inspect the bronze covers on the main shaft eccentric bearings for cracks or loose pins.
- Check and record the crosshead slide clearances (top clearance between 0.015"/0.38 mm and 0.025"/0.63 mm on National pumps).
- Check oil analysis frequency and records.
- Ensure that pressure relief valves exhaust lines slope downwards at least 2 degrees or ½ inch per foot (API RP 54 section 9.13.7).
- Check the location of the relief valve on the discharge manifold.
- Ensure the discharge pulsation dampener installed is correctly charged.
- Check the condition of the discharge strainer.
- Check the suction and discharge the valves and seats
- Ensure that with 3,000-psi (200-bar) systems there are no NPT-threaded fittings (for 2-inch or larger connections) (API RP 53 sections 8.2.b and 10.2.1b).
- Check the suction pulsation dampener pressure and gas.
- Check the suction strainer condition.
- Check if they NDT pony rods in between wells.
- Do they inspect the discharge manifold studs (cycle 10% per year)?
- Check the condition of the manifold high-pressure valves.

- Check the wall thickness inspection records for high-pressure lines (minimum 87.5% of the original wall thickness left).
- Check the condition of DC motors and AC motors and last overhaul records.
- Check the condition of electrical cables and junction boxes.
- Ensure they do not use silicone sealant as gaskets on main covers.
- Check the condition of the pony rods and seals, wear scores, pitting (*).

1.2 Mud pumps notes

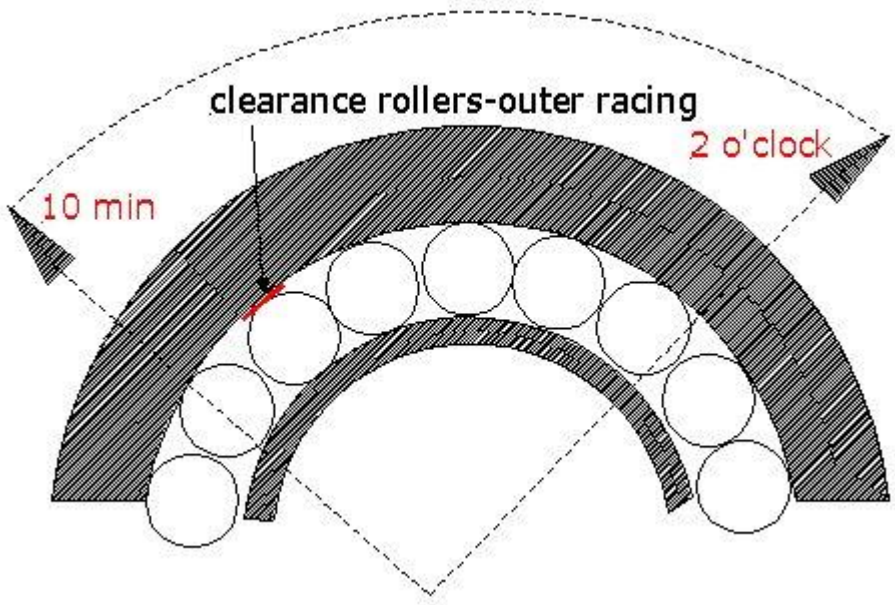


Figure 2 - Mud pump bearing measurement.

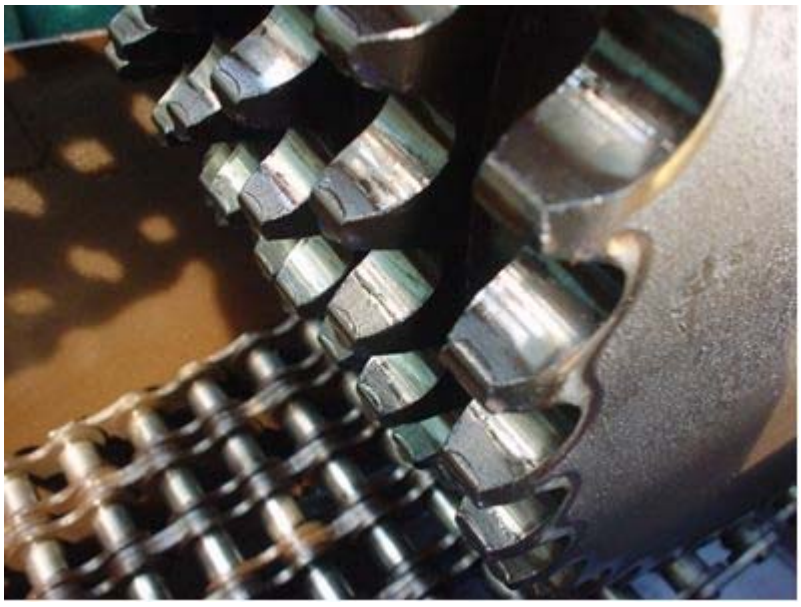


Figure 3 - Worn and damaged sprocket teeth.

Figure 4 - Mud cross with strainer, pulsation dampener and relief valve.

Figure 5 - Typical suction strainer.

Figure 6 - Fluid-end studs should be inspected regularly.

Figure 7 - Typical wiper seal.

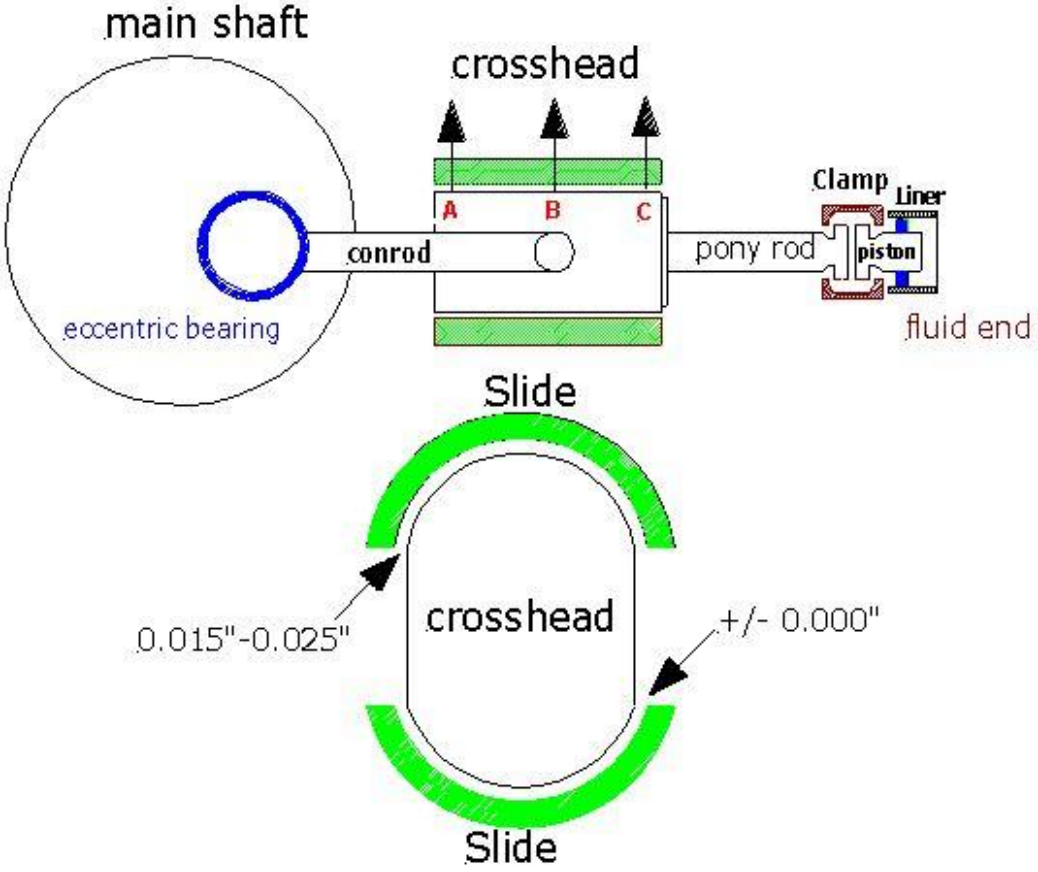


Figure 8 - Measurement of crosshead slides clearance.

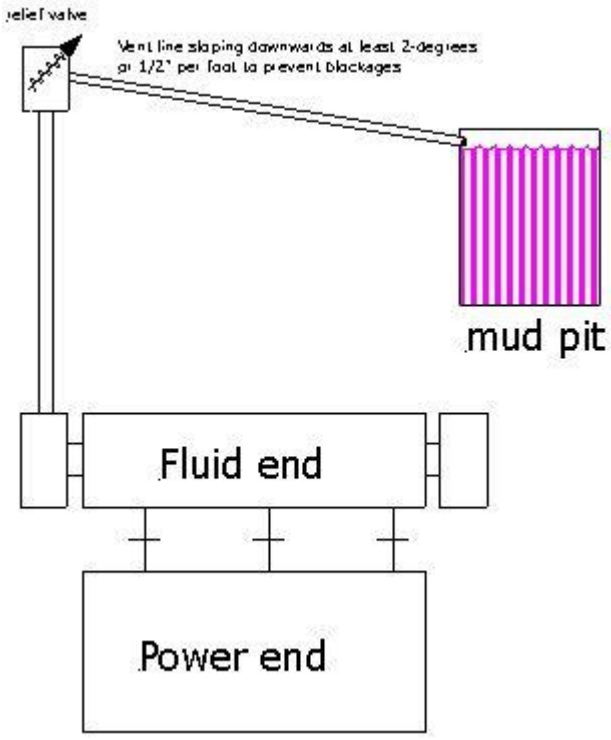


Figure 9 - Vent line sloping downwards.

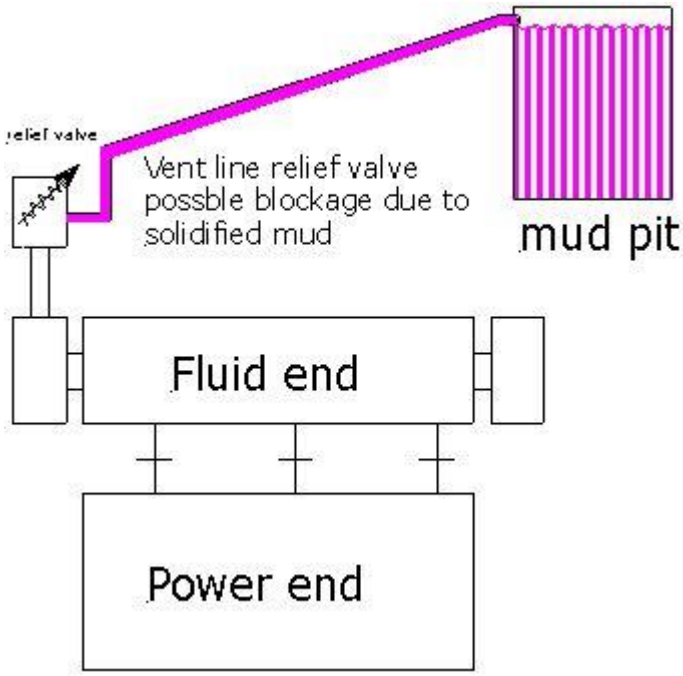


Figure 10 - Vent line flowing uphill.

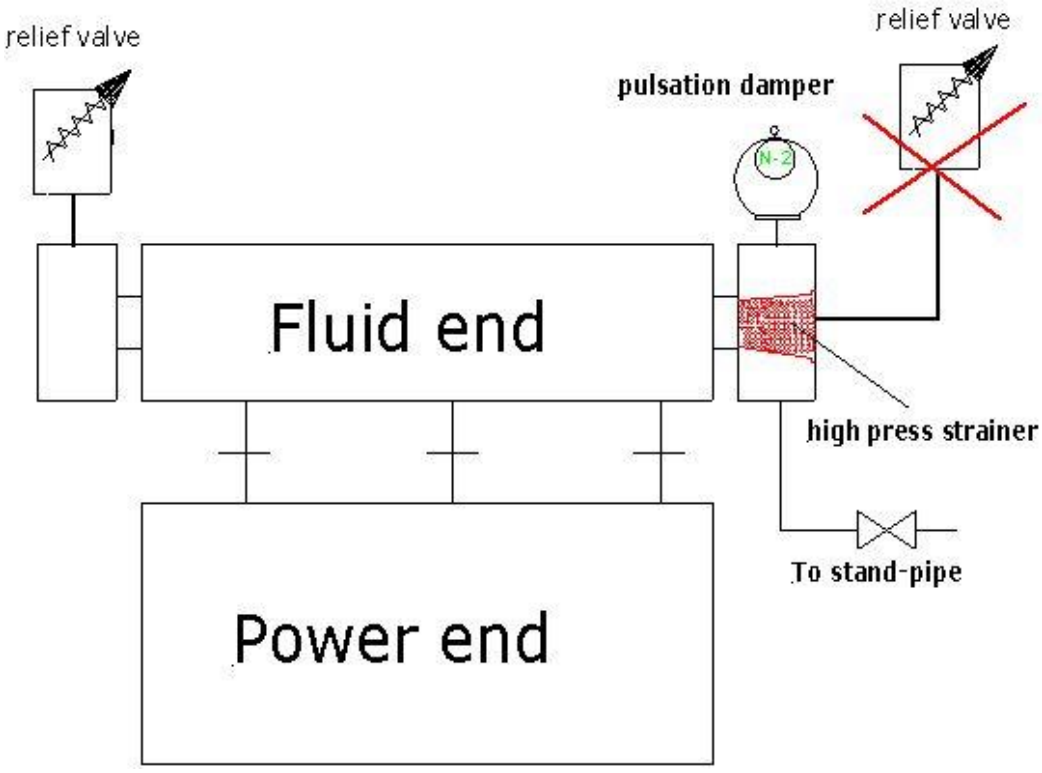


Figure 11 - Correct position of pressure relief valve.

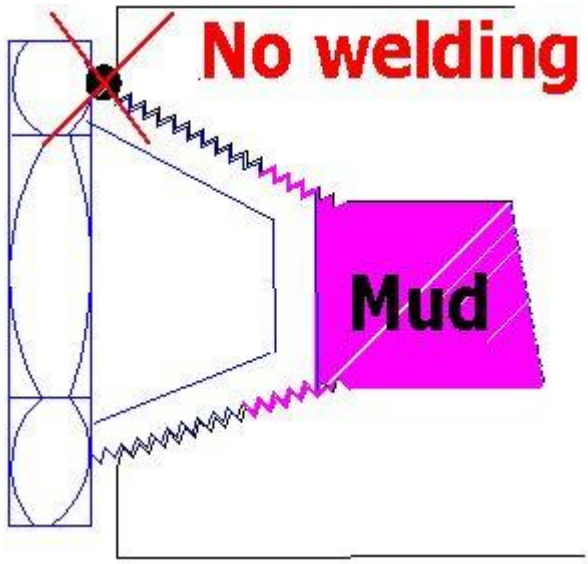


Figure 12 - NPT fitting seals on the thread: direct contact between the threads and the (aggressive) mud.

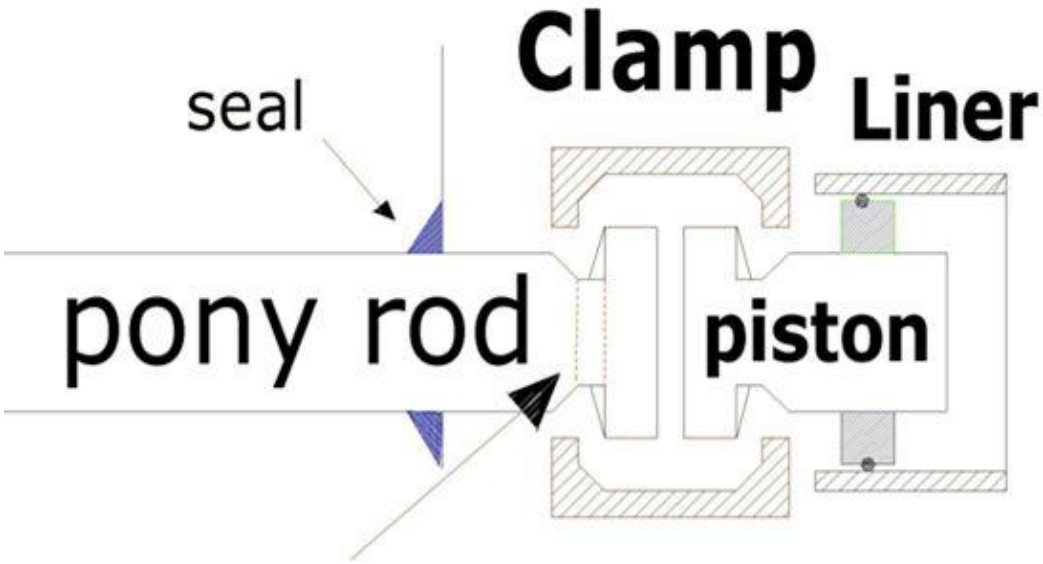


Figure 13 - Cracks at the hub end of the pony rod.

2 Standpipe manifold

Figure 14 - Standpipe manifold.

2.1 Standpipe manifold checklist:

- Ensure there are spare connections for sensors (MWD).
- Ensure there are no NPT-threaded connections over 2 inches fitted in systems with a pressure of more than 3,000 psi (200 bars) (API RP 53 section 8.2.b and 10.2.1b).
- Check the certification of all mud hoses used (API RP 7L).
- Is there a spare mud hose available, is it in the derrick?
- Check recent wall thickness measurements (minimum 87.5% of original wall thickness remaining).
- Is the Preventive Maintenance (PM) on the valves up to date?
- Are the pressure gauges recalibrated (tested every three years to 1% full scale) (API RP 53 section 12.5.3.g)?
- Ensure all valve handles are fitted.
- If connected to the choke manifold, there must be two isolation valves installed between the choke and standpipe manifold.
- Are the valve handles colour-coded (drilling mode one colour)?
- Are the valves numbered?
- Check the condition of the flanged pressure gauge.
- Carry out pressure tests: low pressure at 250 psi (17 bars) and then to full working pressure.
- Check chiksan condition; no threaded chiksans are allowed. All chiksans need safety clamps and safety wire/chains. Note: Check this with the service company policy, as some companies do not install safety wires.
- Be careful with 602 and 1502 couplings; if connected, they do NOT hold pressure but appear to "match". Note: This has accounted for at least two known fatalities.
- Ensure there is a schematic drawing available in driller's doghouse (*).

2.2 Standpipe manifold notes

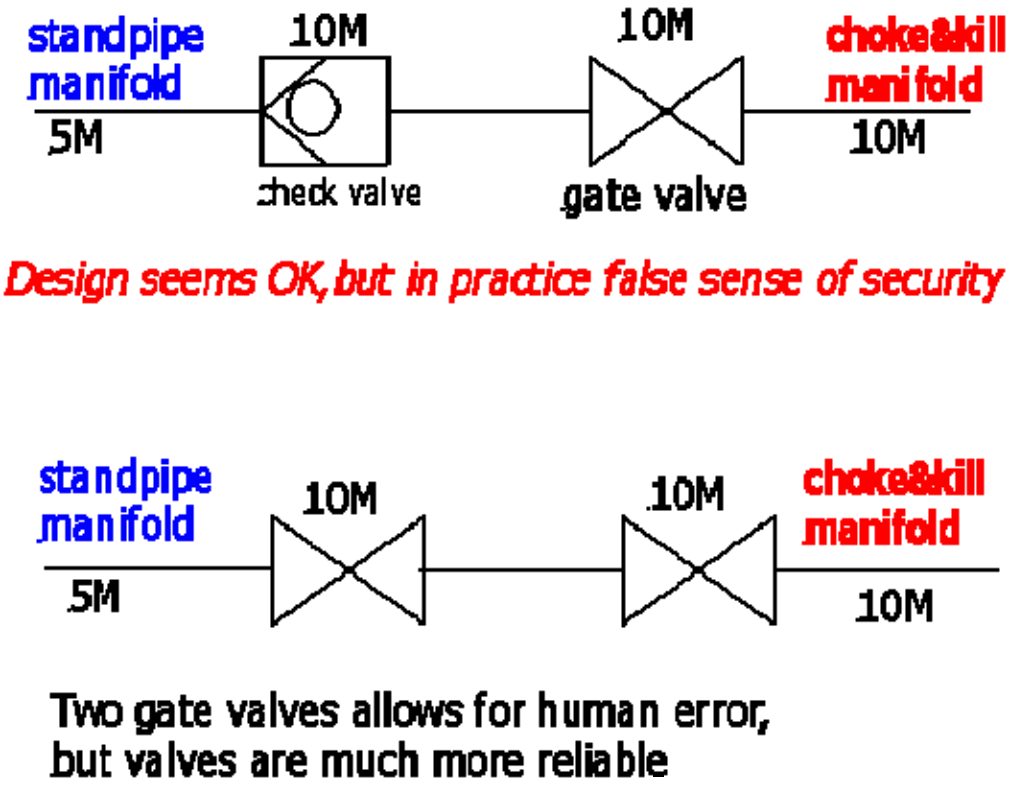


Figure 15 - Design of standpipe manifold.

Figure 16 - Corrosion is not just an internal problem.

Figure 17 - Spare hose in derrick.

Figure 18 - Numbered ground manifold.

Figure 19 - Chiksan union without safety sling.

3 Centrifugal pumps

Figure 20 - Centrifugal pump: gland packing.

3.1 Centrifugal pumps checklist

- Check for any seriously leaking gland packing.
- Check if efficiency testing is performed on a regular basis.
- Check electrical cables and junction boxes.
- Check for excessive vibration.
- Check the correct alignment between pump and motor.
- Check the condition of flexible couplings.
- Check for heat development in the bearing pedestal.
- Check for excessive noises.
- Check for missing coupling covers.
- Ensure mechanical seals are used for oil-based mud applications.
- Check complete spare pumps are available.
- Check the condition of pressure gauges.

- Does each mud cleaning system have its own dedicated pump (*)?

Figure 21 - Overfilling is as bad as underfilling.

3.2 Centrifugal pumps notes

4 Mud-mixing system

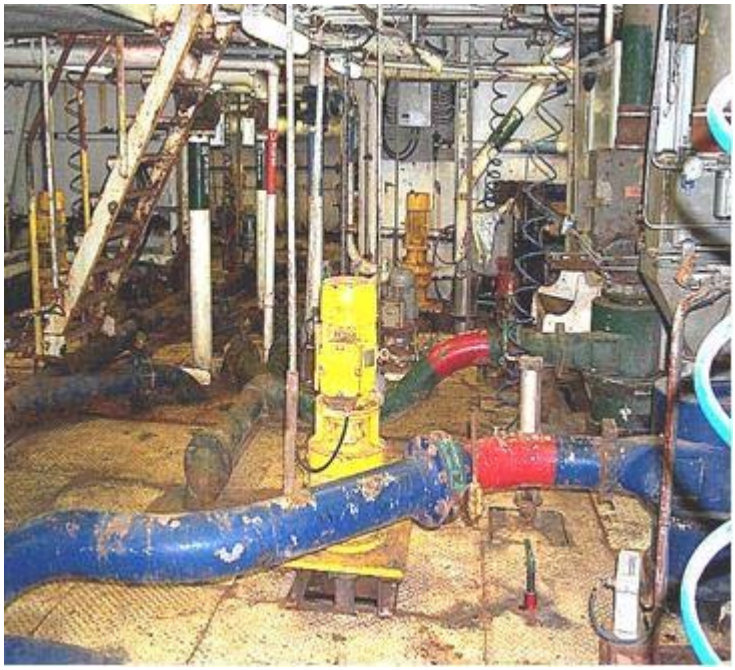


Figure 22 - Mud-mixing equipment layout.

4.1 Mud-mixing system checklist

- Is the ventilation adequate? For indoor mixing systems: Is the noise level acceptable?
- Is the lighting adequate?
- Are the electrical cables and junction boxes suitable?
- Check any pressurized alarms.
- Check the standard of housekeeping.
- Check handrails and stairs for damage.
- Check the condition of any dump valves.
- Check the condition of the mud agitators for noise and vibration.
- Check the condition of the mud guns.
- Check the condition of any butterfly valves.
- Check the operation of the pit level indicators.
- Check that there are no damaged/unsecured gratings and other tripping hazards.
- Is the trip tank design acceptable (max. 1 barrel for 1 inch in height).
- Check the condition of the desilter, desander and mud cleaners.
- Check the condition of the vacuum degasser.
- Check the condition of the mud pits.
- Check the suction height of the mud pits.
- Are the mud pits suitable for HP/HT applications?
- Ensure all AC motors are EX and certified (API RP 14F section 4).
- Check any fixed fire-fighting system.

- Check all personal protective equipment (PPE), such as long-sleeved rubber gloves, rubber aprons, goggles and/or face masks, eyewash station, shower, first-aid safety sheet of chemicals in use, and earplugs.
- Is there a high-quality PPE box available?
- Check the corrosion levels of the hopper funnel and piping.
- Check the operation of the hopper venturi arrangement and the eductors in the vacuum mixing system.
- Check the condition of surge tanks for cement and barite.
- Is there a working mud-weighing system present?
- Check if communication between the hoppers and the driller's doghouse is possible.
- Ensure that a first-aid treatment sheet (MSDS) detailing the particular types of chemicals is in use (*).

4.2 Mud-mixing system notes

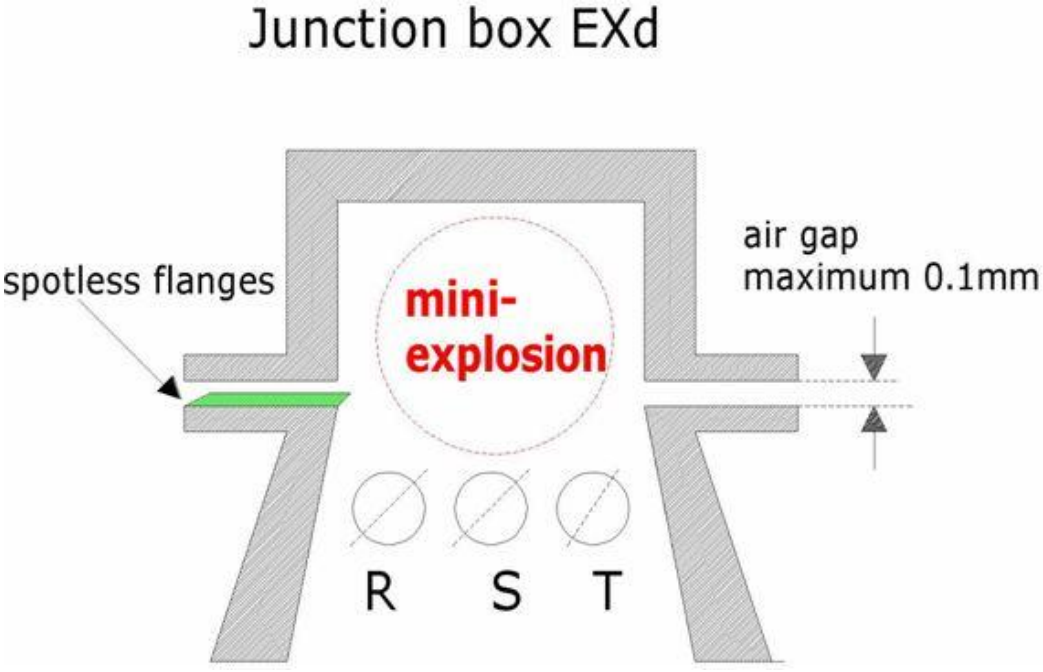


Figure 23 - Small air gap allows expansion (temperature drop); the air gap and spotless flange provides the flame path.

Ensure that all the studs are installed on the covers.

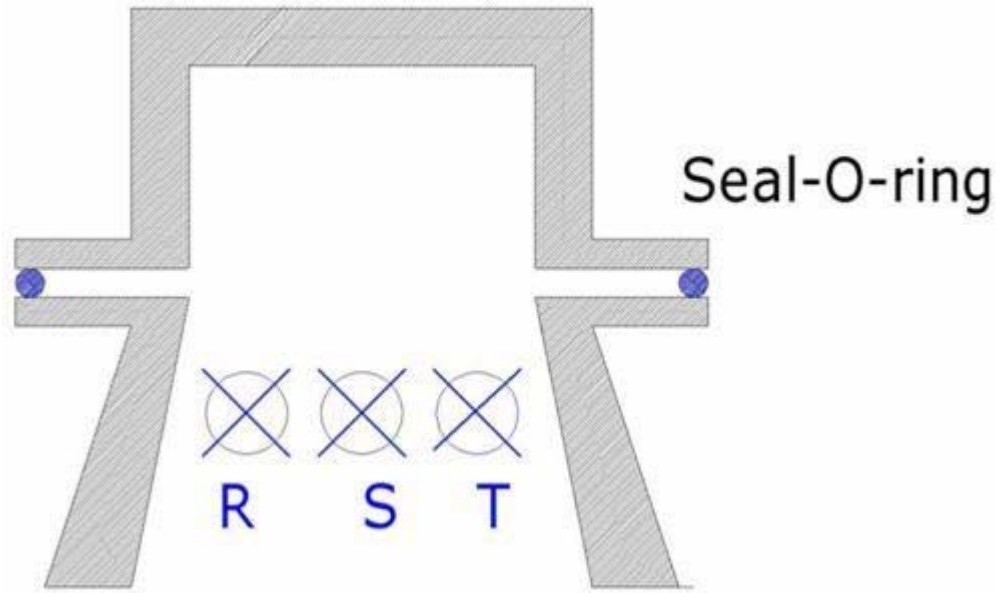
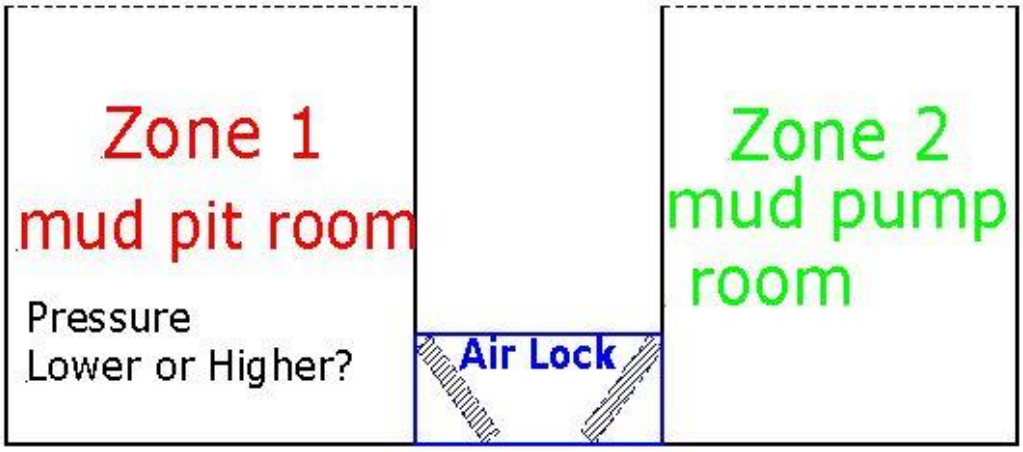


Figure 24 - EXe junction box, double-secured cable connections and an O-ring seal installed.



To be able to maintain zone 2 for mud pump room:
a) 2 self-closing gas-tight doors
b) an air lock with an alarm (time delayed)

Figure 25 - Installation of an air lock.

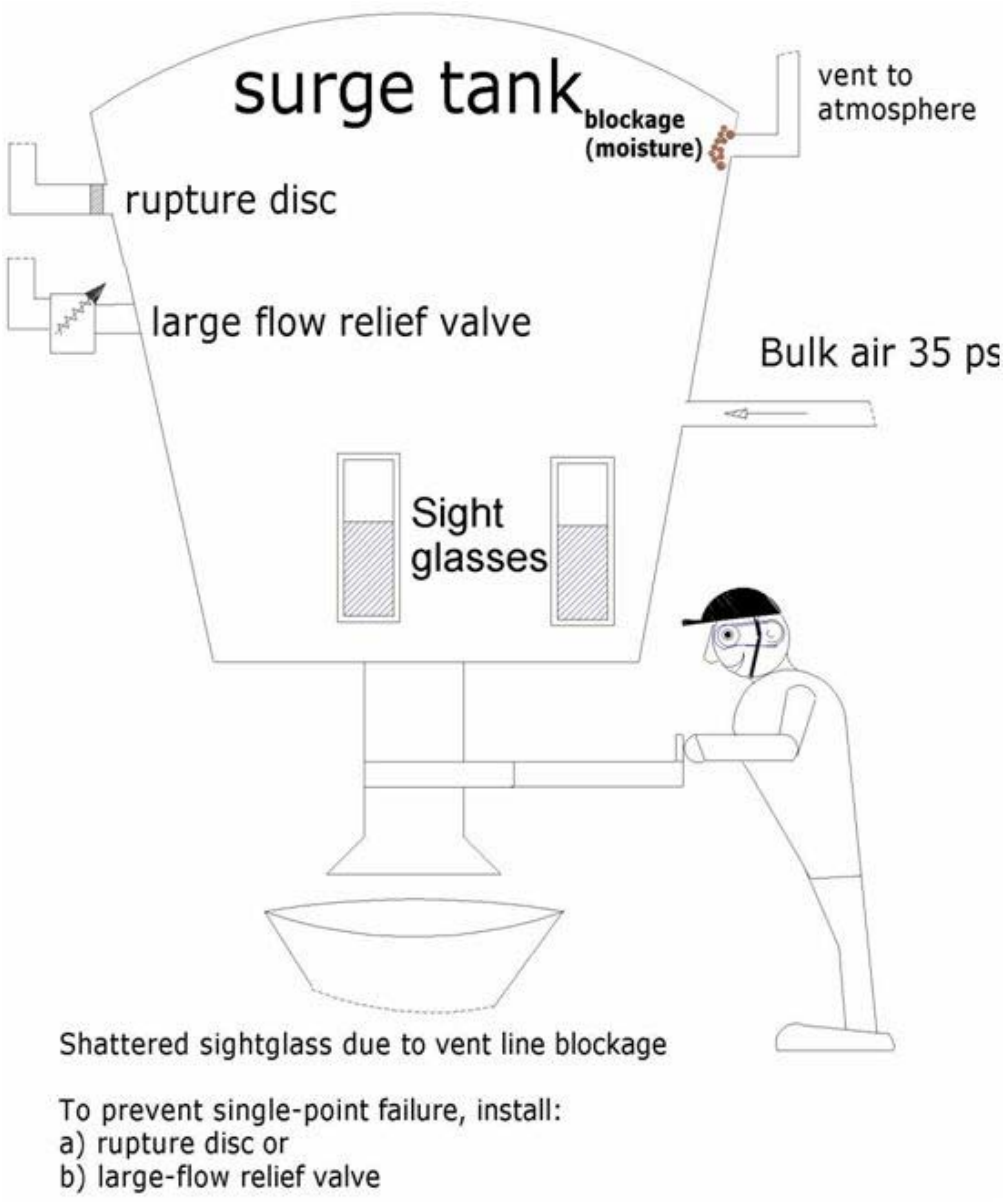


Figure 26 - Surge tank layout.

Figure 27 - Typical mud cleaner unit.

Figure 28 - Badly corroded mud pit walls.

Figure 29 - Typical eyewash station.

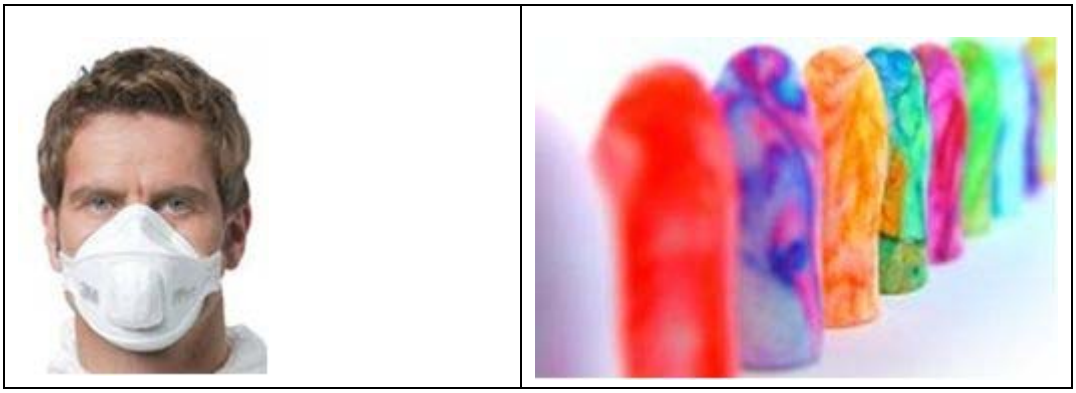


Figure 30 - Masks and earplugs must be available.

Figure 31 - Typical mixing hoppers.

Figure 32 - Safety signs are important.

Chapter 03

Engine room and power plant

1 Diesel engines

Figure 1 - Diesel engines.

1.1 Diesel engines checklist

- Ensure there are sufficient engines and power available for the drilling programme.
- Check for oil, air, gas and water leaks.
- Check the date of the last major overhaul (for example the last 20,000-rhr service). Check the OEM service manual.
- Check the date of the planned major overhaul.
- Verify that the oil consumption is according to OEM specifications.
- Verify that the engine safety devices are tested (API RP 7C section 11F and API RP 14F section 5.2.5.1). Note: Typical safety devices are low lubrication oil pressure, high cooling-water temperature, overspeed and crankcase pressure.
- Verify that overspeed tests are recorded (110% of speed).
- Verify that the engine exhaust lines are insulated (mandatory for marine engines).
- Verify the presence of CO_2 or foam fixed fire protection.
- Verify that crankcase overpressure safety devices are installed on the crankcase doors (for engines with a bore larger than 200 mm).
- Check the fitting and operation of inlet air safety devices (rig saver valves).
- Verify that suitable cooling-water treatment is in use (API RP 7C-11F section 2.8).
- Check electrical cables and junction boxes.

- Check the exhaust gas colour indication (API RP 7C-11F section 9).
- Check the frequency of oil sampling/analysis.
- Check the condition of pressure gauges and temperature sensors.
- Check the operation of the turbochargers and the presence of spare turbochargers.
- Verify that suitable spark arrestors are installed (API RP 7C-11F sections A.3.e and A.1).
- Check the condition of all starting motors and the presence of a spare (API RP 7C-11F section 6.3.4). (*)

Figure 2 - Example of a clean and tidy engine space.

Figure 3 - Example of good exhaust insulation.

Figure 4 - Starter and crankcase relief valve.

Figure 5 - Example of a rig saver valve.

Figure 6 - Example of a spark arrestor.

1.2 Diesel engines notes

2 Emergency generator

Figure 7 - Emergency generator engine

2.1 Emergency generator checklist

- Check the presence of power indication (in kW) on the switchboard.
- Ensure the engine is designed to start during a total black-out.
- Check for fuel, oil, air and water leaks.
- Check the condition of the fan, belt and radiator.
- Check the gauges and their calibration.
- Verify that weekly tests are conducted (including an automatic start).
- Ensure there is no dirt and oil lying underneath the engine (fire hazard).
- Check there are two independent ways of starting the engine.
- Check the layout of emergency switchboard.
- Ensure that (on MODUs) the emergency generator room is located above the waterline.
- Check the condition of the electrical cables and junction boxes.
- Verify the installation of a spark arrestor.
- Verify the installation of a rig saver valve.
- Verify the presence of a pre-heating system for the engine.
- Carry out a test run on maximum load for at least 30 minutes.
- Check that there is adequate ventilation.
- Verify that the fuel tank sight-glasses are protected.
- Check the remote operation of the fuel tank valve.
- Check the condition of the starting batteries and battery charger. (*)

2.2 Emergency generator notes

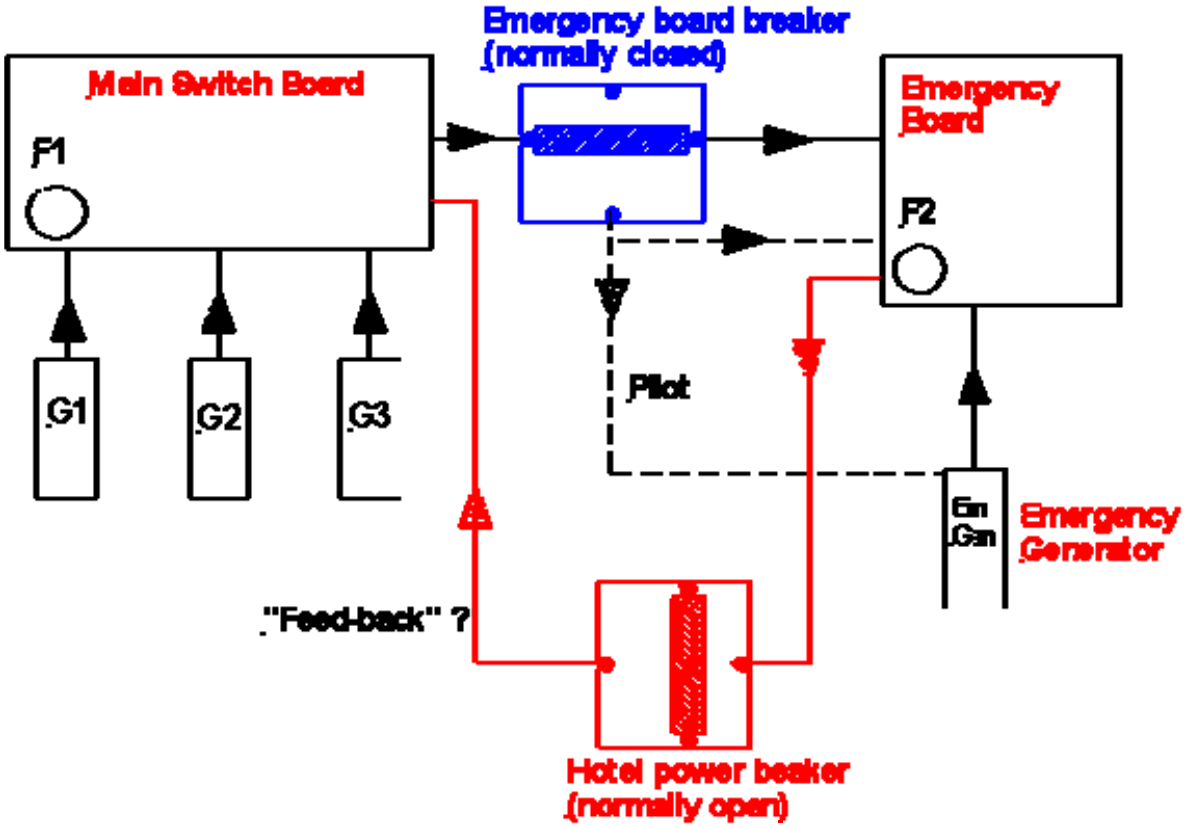


Figure 8 - Schematic of emergency power system.

Figure 9 - Fuel leaks under the generator constitute a fire hazard.

Figure 10 - Fuel tank with self-closing valve; however, the sight-glass needs protection.

Figure 11 - Neglected starting batteries; these must be kept in good condition.

3 Air compressors

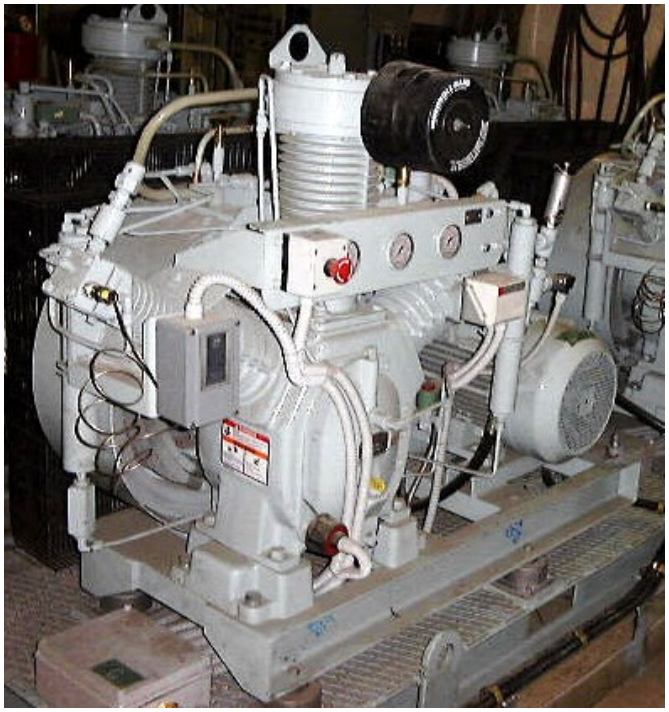


Figure 12 - Reciprocating air compressor.

3.1 Air compressors checklist

- Record the number of air compressors and the capacity of rig air and bulk air.
- Check for the presence of a separate bulk air compressor present.
- If there is no independent bulk compressor, check that there are two reducing valves fitted to supply bulk air.
- Ensure that there are at least three rig air compressors if no bulk air compressor is available (on offshore drilling rigs).
- Check that the air dryer outlet air temperature is +4ºC.
- Check that the electrical cables and junction boxes are EX.
- Check the emergency air compressor (diesel-driven cold-start compressor).
- Verify that all relief valve vents are routed towards a safe area by means of rigid piping.
- Check that the air receivers are purpose-built and certified.
- Verify that the air receivers are hydrostatically tested every 10 years (API 510 chapter 6).
- Verify that the relief valves are recertified every 2 years.
- Check that the relief valve sizes are compatible with the pressure vessel size.
- Check the frequency of the oil sampling and analysis.
- Verify that wall thickness measurements on bulk silos and piping are conducted (as a standard, 87.5% of original must be remaining).
- Check that the high-temperature air shutdown is tested on all screw-type compressors. (*)

Figure 13 - Bulk air reducing station.

Figure 14 - Typical modern air compressor.

Figure 15 - The size of the relief valve is important.

Figure 16 - Typical air receiver.

3.2 Air compressors: notes

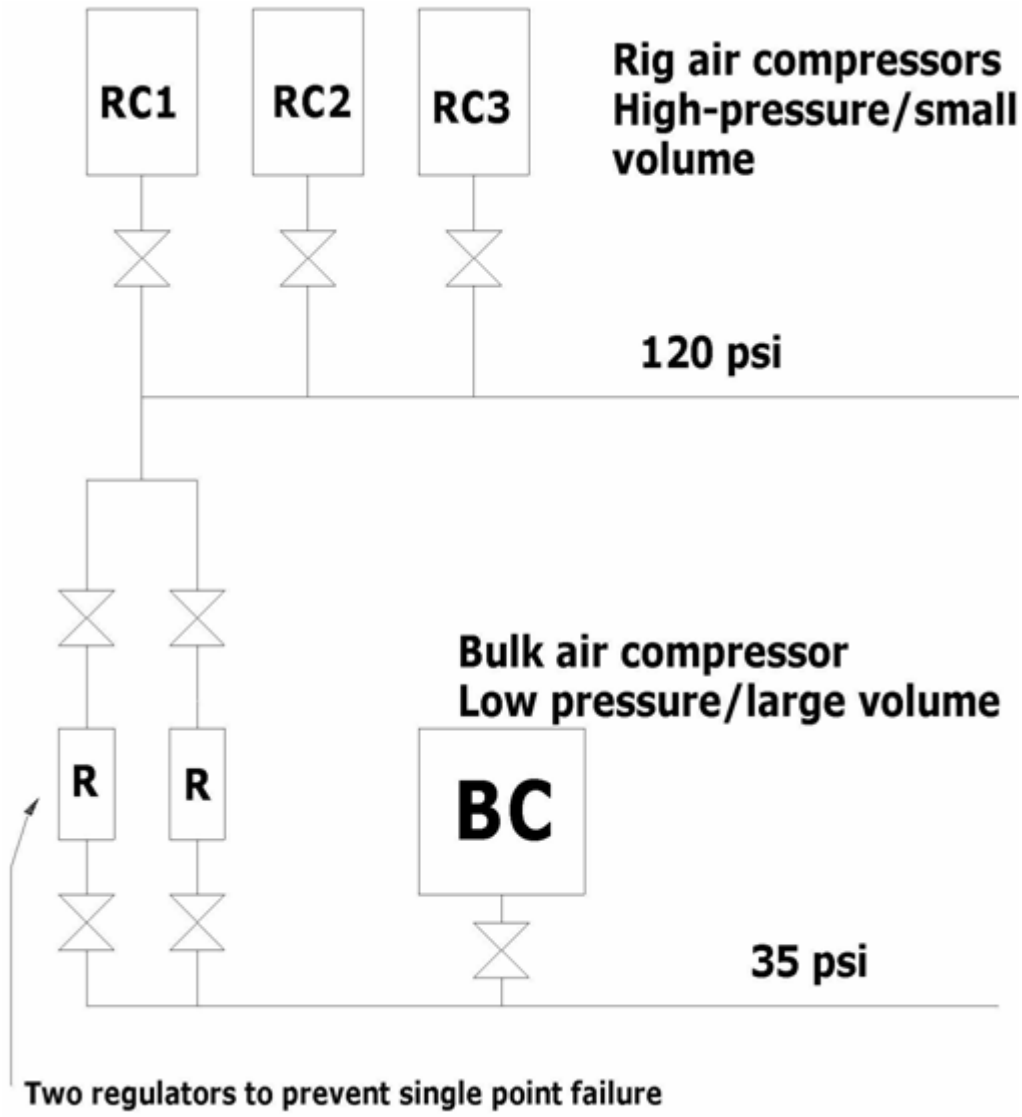


Figure 17 - Bulk air compressor layout.

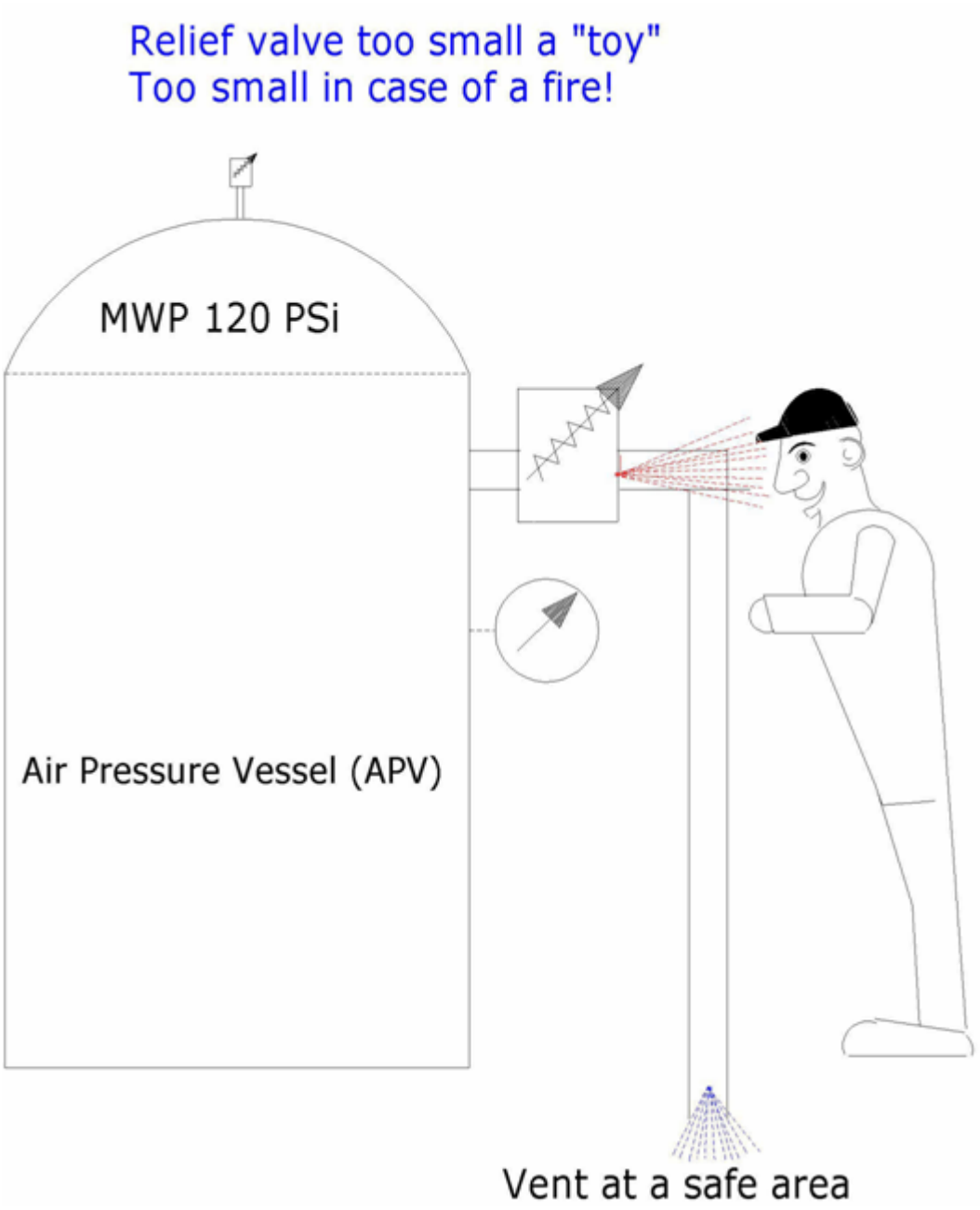


Figure 18 - Safe operation of rig air vessels: the relief valve exhaust line must vent into a safe area.

4 Marine cranes

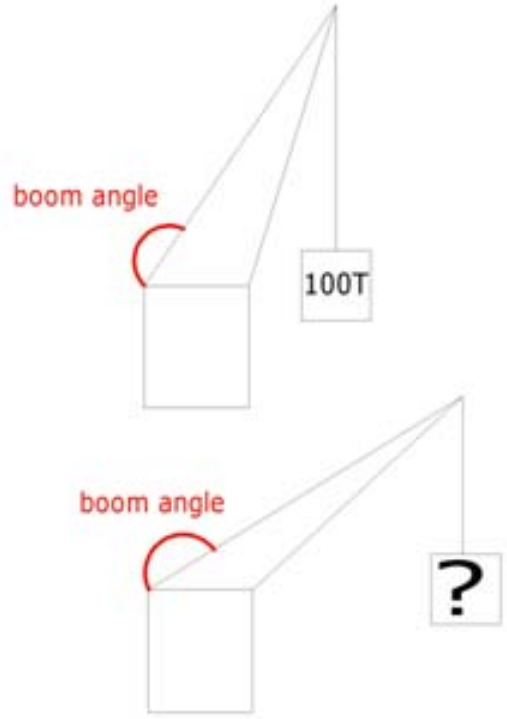
Figure 19 - Offshore pedestal crane.

4.1 Marine cranes checklist

- Record the date of the last crane engine overhaul.
- Check the date of the last slew brake test.
- Verify that aircraft-warning lights in the boom and A-frame are working.
- Ensure that there is a windsock fitted.
- Check the condition of the A-frame ladders.
- Check the certification of wires: boom, main and whip.
- Check and record the date of the last load test (Classification Societies Lloyds, ABS, DNV).
- Check that the following tests are conducted:
  - SWL up to 20 tons: + 25%
  - SWL between 20 and 50 tons: + 5 tons
  - SWL above 50 tons: + 10%
- Ensure that load cell management and radius/weight alarms are installed and working.
- Check that NDT of the pedestal, crane boom and blocks is part of the lifting-gear surveys.
- Check that 4-yearly NDT of slew bearing bolts is carried out (both internal and external).
- Function-test the high-/low-limit switches of the main, whip and boom lines (API RP 2D app C section 4.1.2.d).
- Ensure that safety glass is used for the crane cabin windows (API RP 2C section 12.2).

- Check the records of boom pin inspection and NDT (API RP 2D Appendix C).
- Ensure that crane control handles return to the centre position when released (API RP 2C section 11.1.2).
- Check the operation of wire drum braking systems (API RP 2C section 8).
- Ensure that friction brakes are fitted with rain guards (API RP 2C section 13.3).
- Ensure that the sheave sizes are no less than 18 times diameter of the wire rope (API Spec 2C section 7.4.1.1).
- Ensure that there is a load chart in the crane cabin (API RP 2C section 4.2).
- Ensure that a working emergency stop for the crane engine is available in the crane cabin.
- Ensure that a life vest is available in the crane cabin.
- Check the wedge socket and end termination for correct installation (API RP 2C section 7.3.3).
- For land rigs: Check that the rig cranes only lift when the support legs are extended and secure.
- For land rigs: Verify that there is a procedure to ensure that the rig cranes are not allowed to move while there is a lift in the crane. (*)

4.2 Marine crane notes



Direct relation between boom angle and maximum load

Figure 20 - Direct relation between boom angle and maximum load.

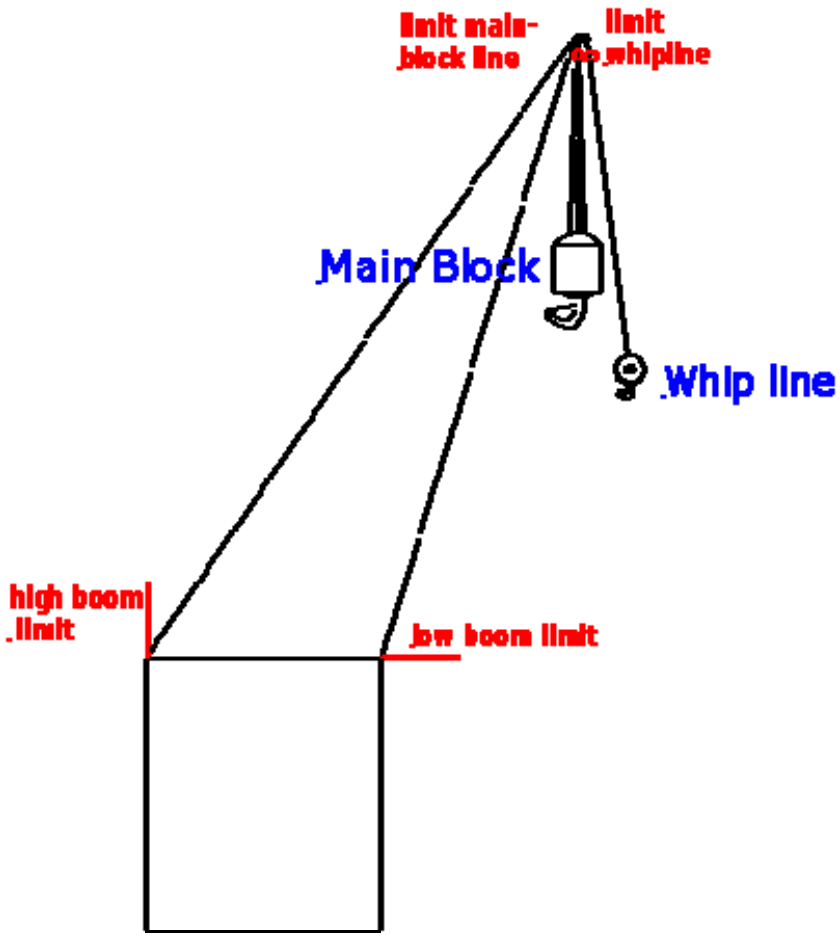


Figure 21 - Limit switches and/or anti-two blocking system.

Figure 22 - Whip line sheave.

Figure 23 - Correctly labelled hook.

Figure 24 - Typical crane cabin.

Figure 25 - Well secured Wedgelock.

Figure 26 - Mobile crane ready to lift.

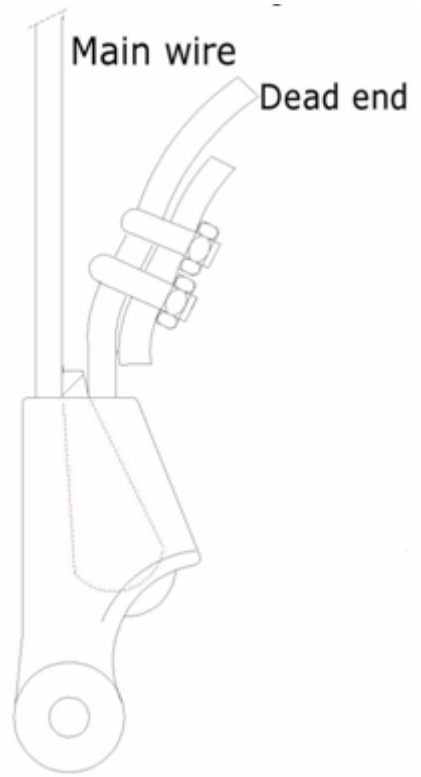


Figure 27 - Wedge socket termination as per API Spec 2C section 5.7.

Chapter 04

Electrical equipment

1 Eddy current brake

Figure 1 - Auxiliary electric brake.

1.1 Eddy current brake checklist

- When was the last disassembly of the brake and bearing replacement?
- Check the condition of the spline coupling and its alignment.
- Does it discharge through a cooling-water funnel?
- Does the control handle switch to off when released?
- Check that the electric cables and junction boxes are EX.
- Record the air gap measurements. For instance, for the Baylor 7838 brake this is 0.055" (1.4 mm) when new; maximum-allowed wear is 0.080" (2 mm); gives only 50% efficiency.
- Record the last reading of the individual coil resistance (11-14 ohms at 20^{o}C) and the insulation values (minimum 5 Mom for the coils).
- Ensure that the breathers are not plugged and the float is still present. These are EX fittings and must be kept clean with Kerosene every month.
- Check that there are flow and temperature alarms (both audible and visible).
- Record the date of the last battery back-up system drain test (must hold for at least three minutes).
- Is cooling-water treatment used to prevent scale from blocking the lines and to preserve adequate heat transfer?
- Is there a fault-monitoring system installed?
- Is the spline coupling release handle adequately secured? (*)

1.2 Eddy current brake notes

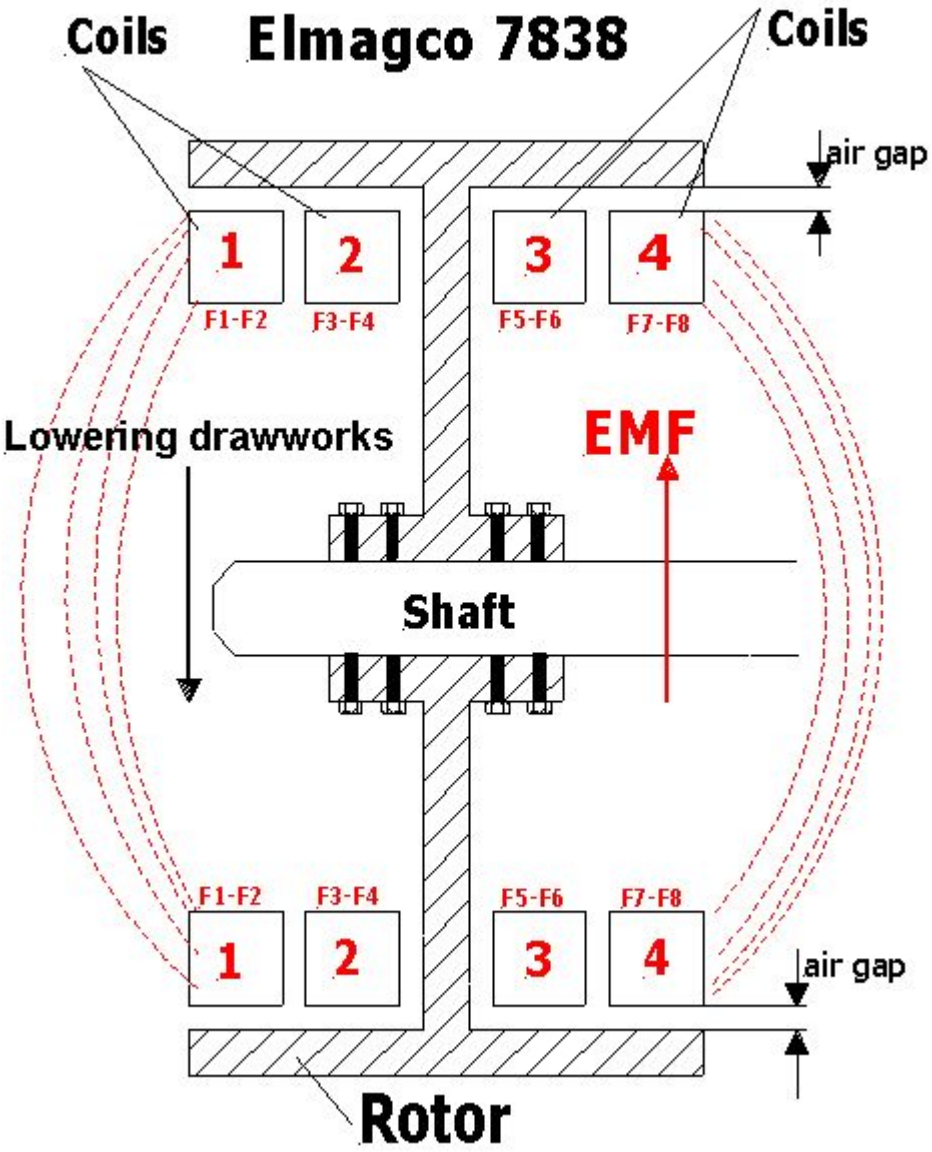


Figure 2 - Cross-section of eddy current brake and principle of operation.

Figure 3 - Air gap between coil and rotor.

Figure 4 - Aligning the coupling.

Figure 5 - Coil breather element.

Figure 6 - Flow and temperature sensors.

1.3 Elmagco brake notes

2 Electrical safety equipment

Figure 7 - Electrical ground system.

2.1 Electrical safety equipment checklist

- Verify that the rig zones are clearly defined on the rig and that a hazardous-area drawing is available.
- Verify that there are proper signs indicating the zones on the rig?
- Verify the electricians have attended an EX equipment training course.
- Check that certified cables and EX cable fittings are fitted.
- Check that all AC and DC motors are properly grounded with an external ground wire.
- Check that ground measurements of AC and DC motors are performed every month.
- Ensure that the maximum resistance of ground wires is 1 ohm.
- Check that only correctly sized copper ground wires are used.
- Ensure that vibrating equipment (shakers) uses a braided-style ground wire and ground matting.
- In case of a looped system, ensure that it is double-looped to prevent single-point failures.
- Ensure that flame-path maintenance is carried out on all EXd boxes.
- Ensure that all EXd boxes are fitted with securing bolts.
- Ensure that silicone sealant is not used as gasket material on EXd boxes.
- Check the resistance of all DC motors (2 Mohm).
- Ensure that spark arrestors are installed on DC motors used in hazardous areas.
- Ensure that DC motors used in hazardous areas draw their cooling air from outside hazardous areas.
- Check that DC motor space heaters have an EX rating.
- Test all the loss-of-purge-air alarms installed.
- Ensure that the electrical safety in the accommodation is adequate.

- Ensure that the electric cables are adequately supported in dedicated cable trays.
- Ensure that the electrical cables in the derrick are secured with rubber-coated steel tie-wraps.
- Ensure that AC motors in hazardous areas have an EX certification.
- Record the date of the last infrared survey performed on the electric busbars.
- Ensure that rubber safety matting is present in front of all motor control centres (MCCs).
- Verify that there is an insulated grab hook present in the MCCs and in the main switchgear room.

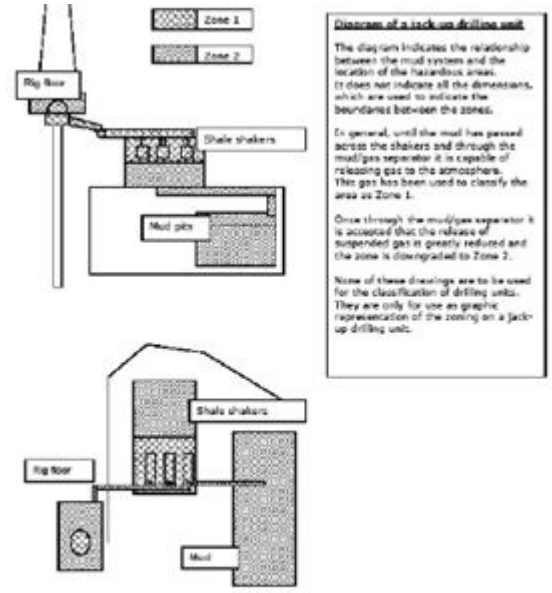


Figure 8 – EX zones

Figure 8 - Schematic of hazardous areas.

Figure 9 - Substantial ground cable for generator.

Figure 10 - Typical use of an EXd box.

Figure 11 - Typical spark arrestor arrangement.

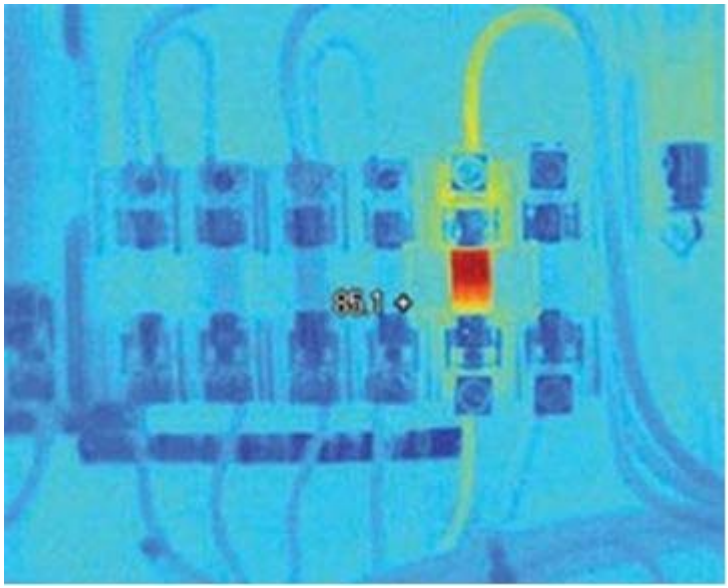


Figure 12 - Example of a thermographic photo.

Figure 13 - Example of a proper, tidy switchboard room.

2.1 Electrical safety equipment notes

Chapter 05

Safety equipment

1 Safety equipment

Figure 1 - Fire-fighting equipment.

1.1 Safety equipment checklist

- Check the condition of all fire-fighting equipment (pumps, hoses, suits and stations).
- Check the condition of all portable fire extinguishers and the date of the last hydrostatic testing (API RP 54 section 7.2).
- Check the condition of all fixed fire systems (CO_2).
- Check the condition of all lifeboats and life-rafts, as well as the frequency of lifeboat drills.
- Check all helicopter facilities and the rescue box.
- Check the emergency procedures.
- Verify the presence of inspection records of lifting- and handling-equipment inspections (six-monthly).
- Check the use of colour-coding lifting equipment.
- Check the accommodation facilities and hygiene level.
- Check the hospital and medical facilities.
- Check the condition and number of breathing-apparatus sets.
- Check the condition of the gas detection equipment and the test records (HC and H_2S in LEL and PPM).
- Ensure there is an adequate amount of PPE for the crew.
- Check that the permit-to-work system is enforced (API RP 54 section 20.1.1).

- Drilling safety:
  - Check handrails and tow boards for damage (API RP 54 section 9.3.18).
  - Check all grating and escape routes for damage and blockages.
  - Check all muster points, emergency showers and eyewash stations.
  - Check that the grinders and welding equipment are fit for purpose (API RP 54 section 20.4).
  - Check that the V-door has secure protection when not in use. (*)

Figure 2 - Typical fire hydrant

Figure 3 - Fire extinguisher with extension nozzle.

Figure 4 - Typical life-raft.

Figure 5 - V-door with sliding gate.

Figure 6 - Typical eyewash station.

Figure 7 - Mud pit with secure grating and proper toe boards.

1.2 Safety equipment notes

Chapter 06

Marine equipment

1 Anchor winches

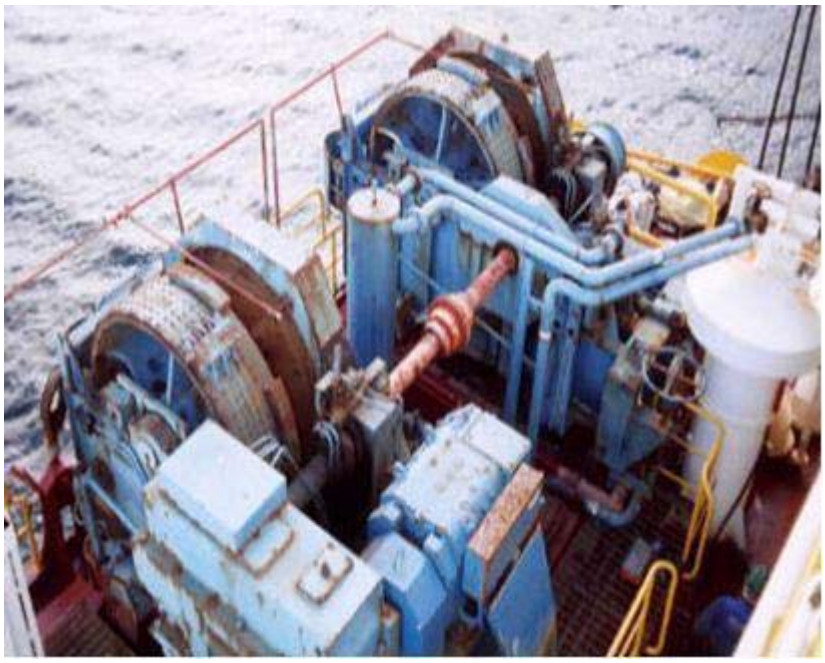


Figure 1 - Anchor winch.

1.1 Anchor winch checklist

- Check the length of each anchor chain in use.
- Record the age of each anchor chain in use.
- Check records of the maximum chain link wear inspections: 10% of d-nominal.
- Record the amount of sections of the anchor chain: maximum 10 sections in total and each section must be at least 400 feet long (API RP 2I section 3.5.3).
- Check the chain stretch records (allowable chain stretch is 6.15 times d-nominal of chain link).
- Check the wire inspection records: maximum deterioration is 8% of the cross-section or 10% in strength (API RP 2I section 2.4.4).
- Record the date of the last anchor chain and wire inspections (Classification DNV, ABS, etc.).
- Chain inspections:
  - 0 to 3 years old: every 36 months
  - 3 to 10 years old: every 24 months
  - more than 10 years old: every 8 months
- Wire inspections:
  - 0 to 2 years old: every 18 months
  - 2 to 5 years old: every 12 months
  - more than 5 years old: every 9 months
- Verify if there a sprinkler system installed to extinguish any possible sparks when releasing/raising the anchor chains in a shallow-gas situation.

- Record the dates of the last measurements of the fairlead grooves.
- Check the condition of the fairlead bearings.
- Record last test data of the anchor emergency release system operational during black-out condition.
- Check the condition of the brake bands/disc brakes or hydromatic brakes.
- Check the condition of any DC motors and heaters, if applicable.
- Check the condition of all couplings and spline shafts.
- Check the condition of any control panel systems.
- Check the condition and amount of pendant wires.
- Record the amount of available anchors and piggyback anchors.
- Record the types of anchors used and their suitability for the seabed of the next drilling location, as well as the load rating of the anchors and anchor chains.
- Record the amount and condition of anchor jewellery (such as Kenter links and shackles).
- Check the condition of the tow bridle and jewellery.

1.2 Anchor winch notes

Chapter 07

Well control equipment

1 Ram preventers

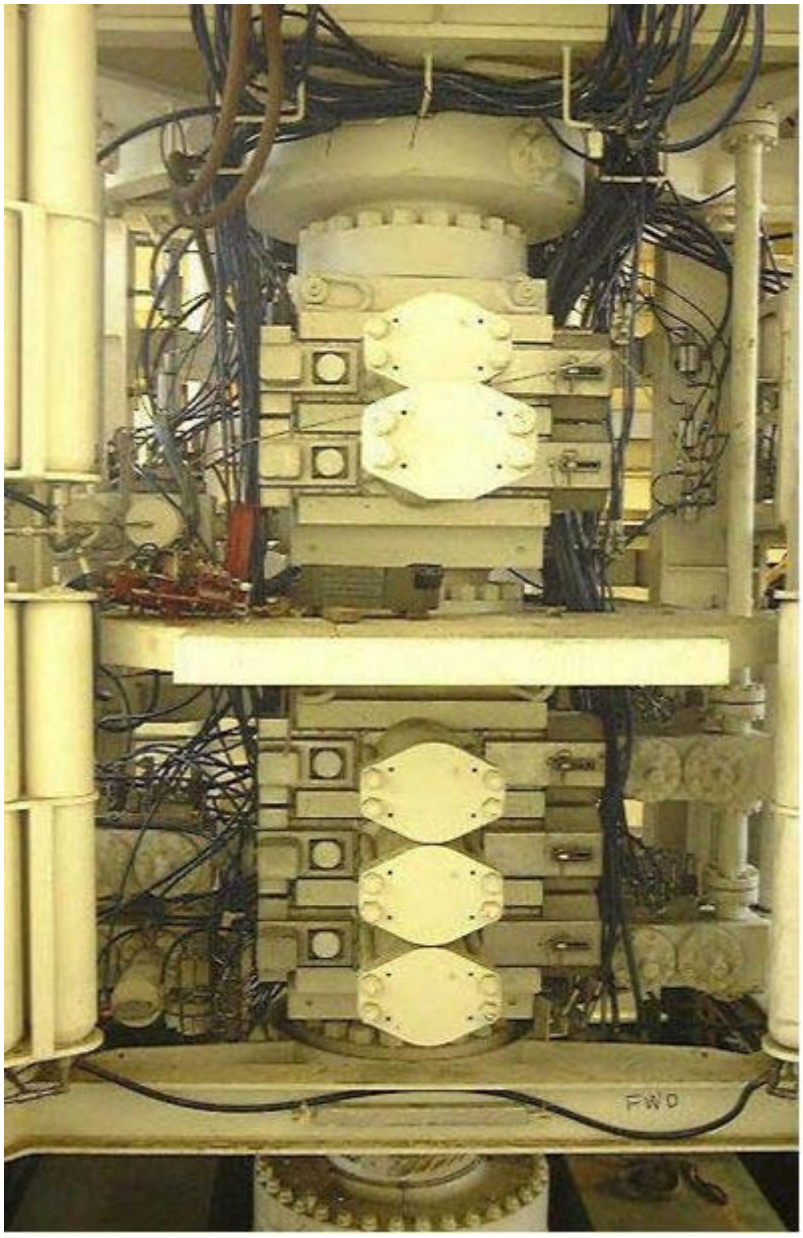


Figure 1 - Subsea ram preventer.

1.1 Ram preventers checklist

- Amount of rams available (old-style rigs: four rams; modern rigs: six rams).
- Last major five-yearly service (API RP 53 section 18.10.3).
- Suitable for H_2S (NACE 0175).
- API certification available (API RP 53 section 18.13.2).
- Condition of control hoses and corrosion level hose fittings.
- Control hoses suitable for deep-water/non-compressible operations.
- Last NDT of piston hubs and bonnet bolts.
- Last NDT of ram blocks and shear ram blades.

- Condition of fluid hinges (Shaffer/Hydril).
- Measurement of cavity and ram block clearances (check OEM for maximum clearances).
- Spare parts and shelf life of elastomers (API RP 53 sections 7.4 and 7.5).
- Suitable for HT/HP operations.
- Variable-bore rams: presence, size and hang-off capacity.
- Ram-locking system operational when last tested. Watch for trends of record values in the history files:
  - Signature test for Hydril MPLs (maximum 200 psi).
  - Signature test for Cameron ST locks (check OEM levels).
  - Signature test for Shaffer UltraLock and PosLocks (check OEM levels).
  - Function test of Cameron wedgelocks and check of the balance chambers membranes and oil levels.
- Capacity of casing shear ram and blind shear ram.
- Installation of large bore bonnet or booster cylinders for shear rams.
- Sufficient space to hang off rams; distance between pipe rams and bottom of the shear blind rams.
- Condition of ram elastomers (must be in as-new condition).
- Last test of hydraulic circuits (3,000 psi) to check integrity seals (API RP 53 section 18.3.2.5).
- Last pressure test to full working pressure (API RP 53 section 18.3.2).
- Condition of (blind) flanges and studs (API RP 53 section 18.11.2).
- Condition of bore (key seating or wear level maximum 0.219").
- Tell tale hole ram bonnets not plugged with debris.
- Condition of check valves installed in modern ram BOP tell tale holes.
- Condition of chrome on ram piston rod and ram change pistons.
- Condition of lock rings of piston rod seal.
- Low-torque modifications of the bonnet doors (Hydril/Shaffer).
- Upgrade of wear plates in the cavity of the Hydril and Shaffer rams.
- Upgrade of Hydril ram bonnet seal carriers and piston rod seal locking flange for deep-water operations.
- Condition of seal seats for Hydril and Shaffer rams.
- Different-style seal seats in the Shaffer NXT for pipe rams and (harder) seal seats for the blind/shear and shear rams.
- Proper shimming of bonnet doors and rams for the Shaffer NXT rams.
- Condition of hydraulic torque tools (API RP 53 section 18.11.4).
- Installation and operation of the auto-shear circuit.
- Installation of high-pressure shear circuit.
- VBRs to be tested initially with the largest and the smallest OD pipe sizes that may be used during the well operation (API RP 53 section 18.5.5).
- Configuration of rams.

1.2 Ram preventers notes

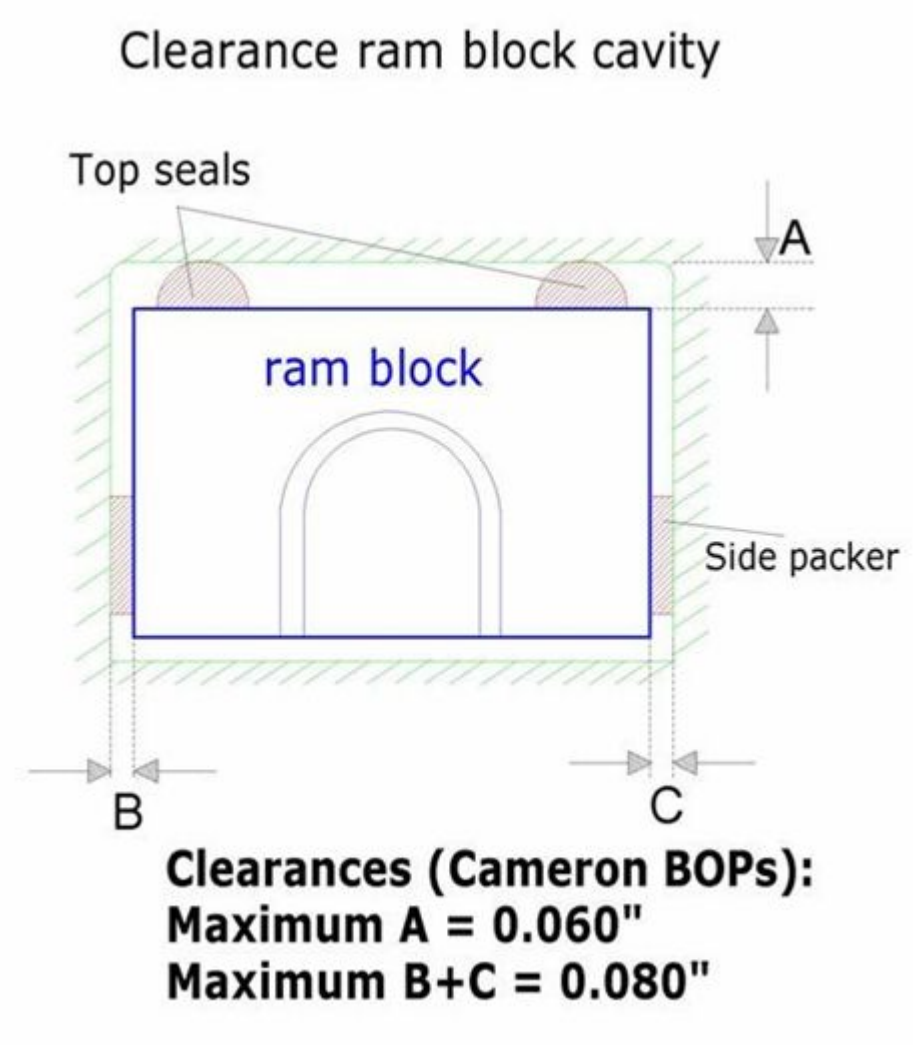


Figure 2 - Ram cavity clearance measurements for Cameron ram-type BOPs.

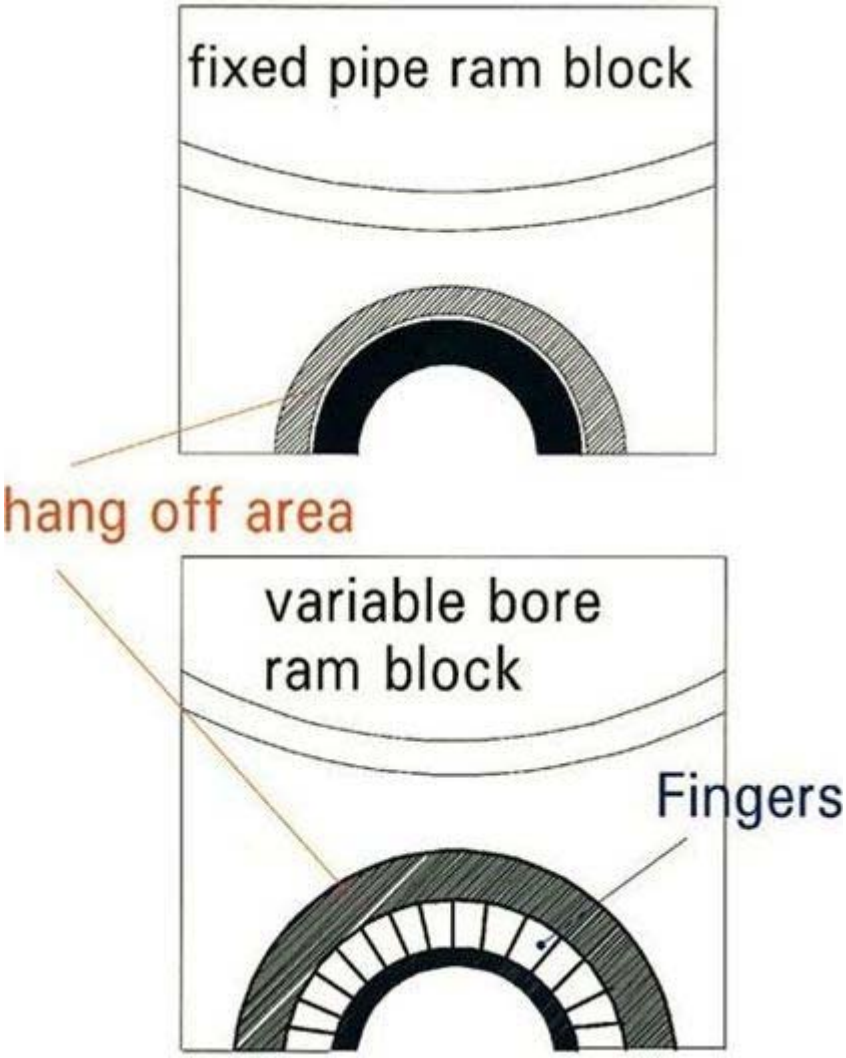


Figure 3 - Hang-off areas of fixed- and variable-bore rams.

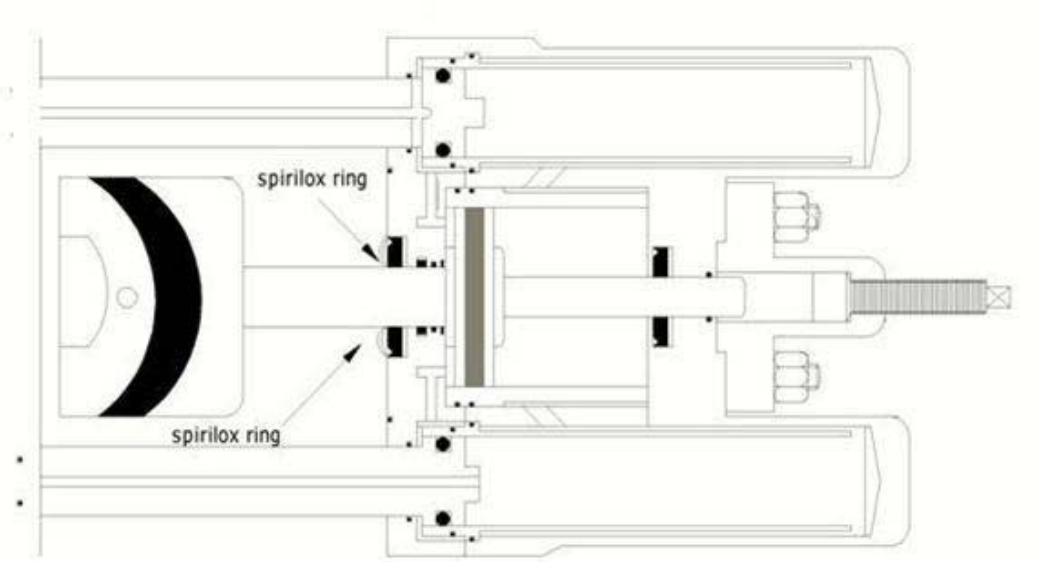


Figure 4 - Due to corrosion the lock rings are pushed out and a total failure of the control system is the result.

This is a schematic drawing of the land rig ram, but the important thing is a possible failure of the spirilox lock ring!

2 Annular preventers

Figure 5 - Hydril annular preventer.

2.1 Annular preventer checklist

- Last major overhaul.
- Suitable for H_2S (NACE 01.75).
- Presence of spare element and seal kit.
- Shelf life of element and seals.
- Hardness check on the seals (maximum 15 Shore above new).
- Storage condition of seals and element:
  - Away from light sources like sunlight or fluorescent light.
  - Away from electrical equipment which produce ozone (such as laser printers, photocopiers or AC motors).
  - Away from large air flows coming from ventilation systems.
  - In a relaxed, horizontal position without heavy items on top.
  - No petroleum or any product added to conserve the rubber.
  - Stored in a constant-temperature environment of approximate 20°C (below 8°C the Nitrile rubber can become brittle).
- Hydraulic seals replaced at least every three years (OEM recommendation).
- Annular BOPs should be tested with the smallest OD pipe to be used (API RP 53 section 18.5.3).
- Non-compressible control hoses at least 1-inch ID (preferably 1.5 inch).
- Stripping (surge) accumulator bottle connected (11 US gallons) (API RP 53 section 18.5.12).
- Pre-charge pressure surge bottle (400 psi plus hydrostatic pressure of seawater).
- Elements must be closed within 60 seconds for 18-¾" and larger annular BOPs (the element must relax to full bore within 30 minutes) (API RP 53 sections 18.3.1 and 13.3.5).
- Cameron annular preventer requires 1,500 to 3,000 psi operating pressure.

- Cameron annular BOPs require the element and donut to be replaced as one set (they must have the same rubber hardness).
- Presence of any key seating inside the bore (maximum wear limit 0.125").
- Weep holes open and not blocked with debris.
- Check the non-return valves in he weep holes of the newer design annular BOPs.
- Hook up the secondary chamber Hydril GL in three manners:
  - The standard hook-up: secondary chamber connected to the open side (water depths: 800 to 1,000 feet).
  - The optional hook-up: the secondary chamber connected to the close side (water depth up to 3,000 feet).
  - The counterbalance hook-up to the marine riser via an piston-type accumulator (deep water, i.e. over 3,000 feet).

Warning: Never leave a bull plug in the secondary chamber.

- Condition of the element in use (vertical section more important than the tapered section at the top of the element).
- Kind of rubber element in use (Nitrile/natural/neoprene rubber):
  - Natural rubber for water-based mud.
  - Nitrile rubber for oil-based mud.
  - Neoprene rubber for artic conditions (extremely low temperatures).
- NDT inspection of lifting eyes.
- Presence of a casing element for Shaffer annular preventers if sealing on larger objects is required. However:
  - The casing element can only hold 2,200 to 2,500 psi against a 5-inch drill pipe.
  - The casing element cannot perform a CSO.
  - The casing element is not recognized by API Spec 16A.
- No welding can be performed on well control equipment (API RP 53 section 17.11.7).

2.2 Annular preventers notes

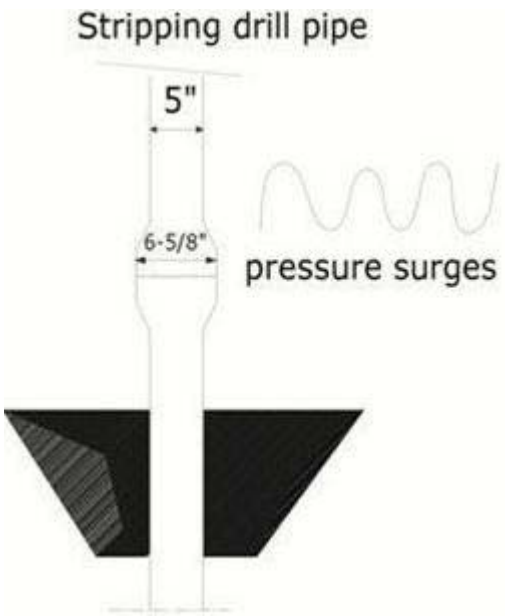


Figure 6 - Stripping drill pipe through annular element.

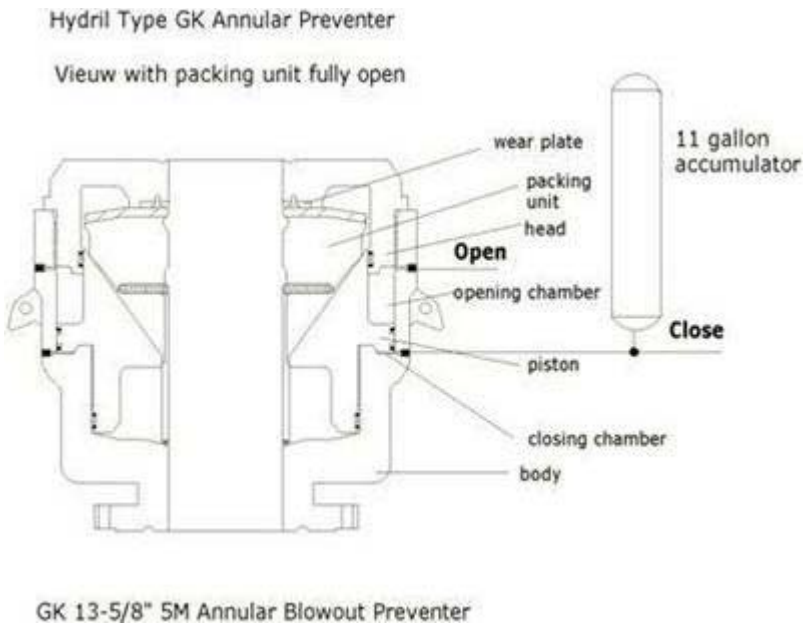


Figure 7 - Stripping bottle (accumulator) installation.

3 Gate valves

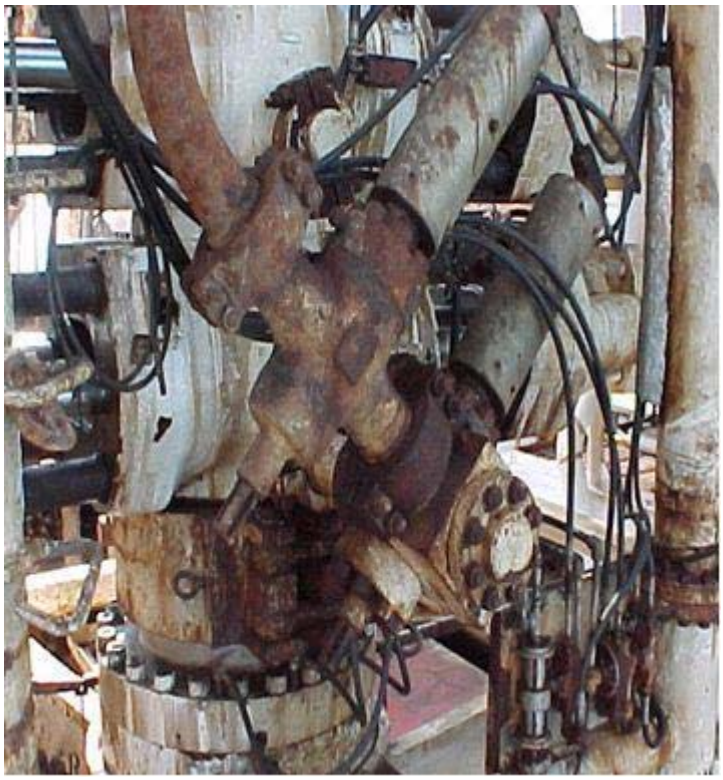


Figure 8 - Failsafe valves.

3.1 Fail-safe valves checklist

- Last major five-yearly service (API RP 53).
- Super Trim: resistant to H_2S (NACE 0175).
- Temperature rating.
- Use of the correct, OEM-approved grease.
- Presence of failsafe-assist system.
- Last test of failsafe operation.
- Signature testing to check the condition of the spring in the actuator.
- Presence of spare valve bodies for each type (target and straight valve).
- Presence of spare actuator.
- Installation of grease nipple covers.
- Condition the lock ring actuator end caps.
- Proper U-seals in case of HP/HT operation.
- Wall thickness measurement of the spool pieces (at least 87.5% of original wall thickness left).
- Location of choke and kill line outlets.
- Configuration of upper and lower choke and kill lines.
- Use of failsafe-open valves as isolation valves on LMRP.
- Presence of annular BOP vent valves in order to vent any gas bubble trapped underneath the annular BOP after the well has been killed through the choke line instead of the marine riser.

- Installation of flags on the balance stems.
- Last test of operators to full operating pressure (3,000 psi).
- Condition of clamps, B7-grade studs and H2-grade nuts.
- Use of grease on studs and nuts with a known friction coefficient (0.07).
- Re-torquing of studs and nuts after last pressure test (*).

3.2 Fail-safe valves notes

4 Choke and kill manifold

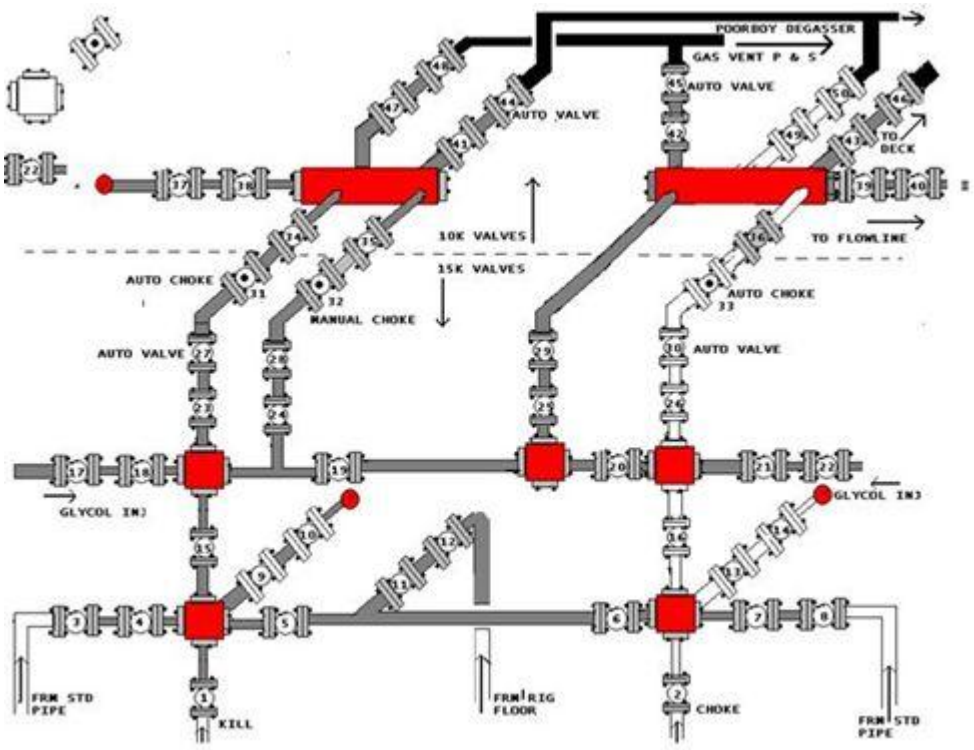
Figure 9 - Typical choke manifold with split buffer.

Figure 10 - Choke manifold with a single high-pressure buffer tank, which is not API-recommended.

4.1 Choke and kill manifold checklist

- Last service on the gate valves (API RP 53 section 18.10.3).
- H_2S rating (API 6A "DD" coded or higher).
- Temperature rating of valves upstream and downstream.
- Check the diameter of the downstream valves.
- Pressure rating of upstream chokes similar to rating of ram preventers (API RP 53 section 9.2).
- No NPT threaded connections of 2 inch and larger (API RP 53 sections 9.2.b and 11.2.1b).
- Presence of direct-overboard line: high-pressure vent line to poorboy degasser or straight overboard (so-called panic line) (API RP 53 section 11.3).
- Wall thickness measurements (minimum 87.5%).
- Last visual inspection of chokes (API RP 53 section 9.3).
- Certification of Coflexip hoses and boroscopic inspection as per OEM recommendations (API RP 53 section 11.3).
- Installation of targets in sharp bends or R > 10d (R = radius and d = nominal diameter of piping) (API RP 53 section 11.3.).
- Installation of targets or large-bend piping in the lines upstream and downstream the chokes.
- Buffer tank separated into two sections (API RP 53 section 11.3).
- Presence of remote-controlled choke unit on the drill floor doghouse (API RP 53 section 9.2.1).
- Number and colour coding of valve handles.
- Remote choke: one cycle (from open to close or vice versa) from minimum 25 seconds to 30 seconds maximum.
- Heavy-duty pressure gauges with flanged connections on manifold.
- Emergency air (N_2) connected to remote choke panel (API RP 53 section 9.2.1.k).
- Calibration of gauges (API RP 53 section 13.3.9).
- Adequate support of lines downstream the chokes and the vent lines in the derrick in order to handle excessive vibrations (API RP 53 section 11.3).
- Presence of low-pressure gauges on the remote-control panel.
- Pressure-equalizing holes drilled in lead targets plugs.
- The adjustable chokes are not required to be full-sealing devices. The pressure testing against a closed choke is not required (API RP 53 section 18.6.4).
- Condition of check valves (if installed).
- Temperature sensors for HP/HT applications:
  - One sensor on the choke line on the BOP (HT).
  - One sensor on the choke manifold upstream the chokes (HT).
  - One sensors on each of the buffer tanks downstream (LT).
  - One sensor on the mud/gas separator (LT).
  - One alarm and monitor cabinet in the driller's doghouse.
- Installation of glycol ethylene injection unit for HP/HT wells upstream the chokes.
- Presence of sufficient glycol ethylene in the vicinity of the glycol ethylene injection unit (*).

4.2 Choke and kill manifold notes



Valves	Pressure rating (psi)
Valve 47 (cement manifold)	300/15,000
Valve 48, 50, 52, 53, 54 (cement manifold)	300/15,000
Valve 49, 51 (cement manifold) 12 on (choke manifold)	300/15,000
11 (choke manifold)	300/15,000
5, 6	300/15,000
1, 2, 4, 15, 9, 7, 13, 16	300/15,000
3, 8, 14, 10, 18, 23, 24, 19, 20, 21, 26	300/15,000
17, 27, 28, 25, 30, 22	300/15,000
29 (auto chokes can be tested if required)	300/15,000
34, 35, 36	300/10,000
38, 41, 42, 43, 39	300/10,000
37, 44, 45, 46, 40	300/10,000

Figure 11 - Schematic example of a modern choke and kill manifold.

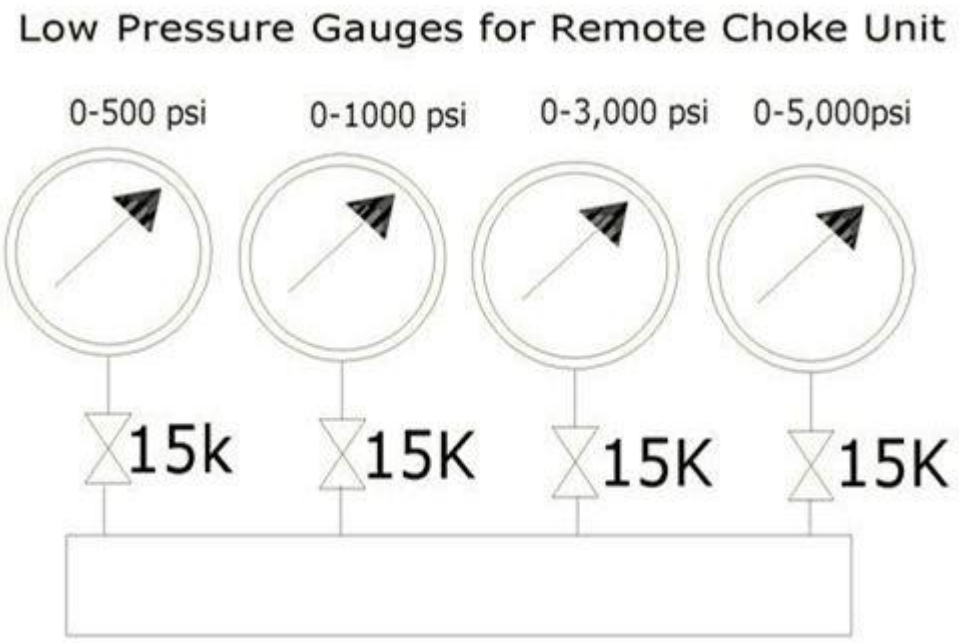


Figure 12 - Installation of a low-pressure gauge manifold.

5 BOP HPU

Figure 13 - BOP HPU Cameron-Payne control systems.

5.1 BOP HPU checklist

- Accumulator capacity test (API RP 16E, API RP 53 section 18.7.1 and API Spec 16D section 2.2.1.5 [2005]).
- No hoses in main accumulator supply system (single-point failure).
- No AKR regulators installed, but only TR-type regulators. Note: API Spec 16D section 5.2.4.3: "Provisions shall be made for manual intervention and control of the surface regulators at the control manifold".
- Presence of the following alarms (API Spec 16D sections 5.2.2.4 and 5.2.7):
  - mixture tank low-level alarm
  - soluble-oil tank low-level alarm
  - accumulator low-pressure alarm
  - rig air low-pressure alarm
  - emergency power engaged
  - pump-running indication
  - manifold readback low-pressure alarm
- Pre-charge accumulators: minimum 1,000 psi for 3M systems and minimum 1,500 psi for 5M systems.
- Accumulators bottles must be hydrostatically tested every ten years (API 510 section 6.4).
- Provision of pressure control circuits and memory circuits.

- Triplex pump should start pumping at 90% of the WP of the HPU (i.e. 2,700 psi for 3M HPUs and 4,500 psi for 5M HPUs).
- Air pumps should start pumping at 85% of the WP of the HPU (i.e. 2,550 or 4,250 psi).
- Presence of emergency air back-up system (API Spec 16D section 4.3.1).
- Condition of back-up batteries (API Spec 16D section 5.4.3).
- Biannual testing and certifying of relief valves.
- Extra protection of shear/blind valve panel (so-called fool's box) (API Spec 16D section 5.2.4.6).
- Safety signs on automatic-starting equipment.
- Calibration of pressure gauges (API RP 53 sections 12.3.6 and 12.5.2).
- Engraved signs on panels (no home-made scribbling or graffiti).
- Measurement of refractometer solution levels (more than 2% soluble oil).
- Measurement of pilot line solution levels (more than 5% soluble oil).
- Fluid sampling for presence and analysis of fungi and bacteria.
- Only potable water used for mixture tank, not drill water.
- Adequate amount of soluble oil spare on the rig to prevent too-low solution levels (*).

BOP HPU notes

6 BOP control systems

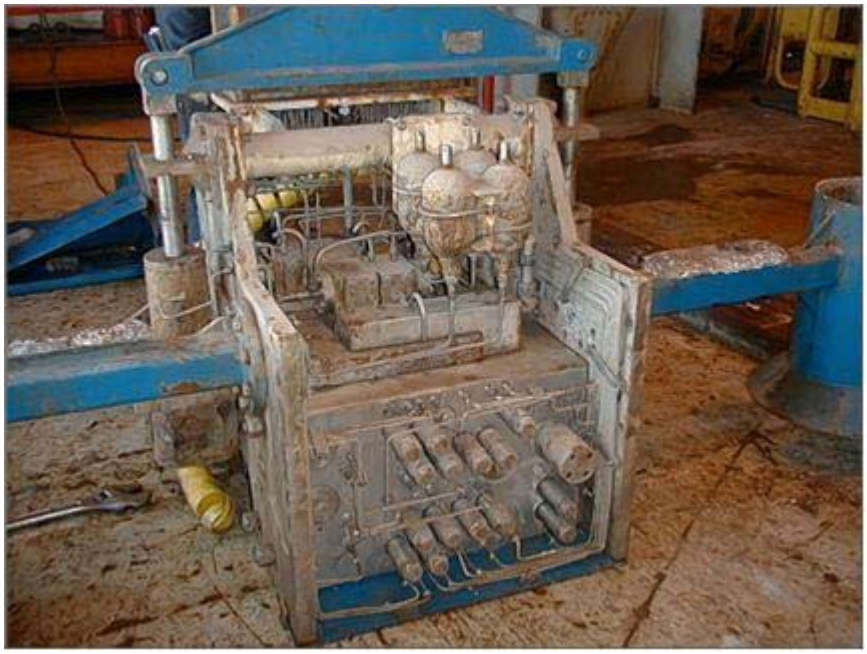


Figure 14 - Conventional control pod.

6.1 Conventional control system

- Presence of pod hoses with the maximum length.
- Condition of pod hose reel on hydraulic manifold.
- Condition of pod hoses and number of pilot hoses still useable.
- Condition of pod hose reel drives on motors and brakes.
- Number of SPM valves on the control pods.
- Retrievable pods using pod hose wires or non-retrievable pods which have their pod hoses connected to the marine riser choke and kill lines.
- Operational condition of control pod locking system.
- Condition of seals at the pod receptacles.
- Proper bent limiters used on pods.
- Number of HKR regulators installed.
- All HKR regulators must have one-pint accumulators installed in the pilot and readback circuit precharged as per OEM specifications to prevent regulators from hunting.
- Installation of an adequate number of anodes on the pods.
- No mild-steel pipe fittings used on the pods.
- PMS in place to replace the hoses periodically.
- PMS for the shuttle valves and the types in use.
- Exhaust of the shuttle valves must be made of rigid piping, not a single hose.
- No mild-steel hose fittings in use on the BOP.
- Routing of control hoses not too close to sharp edges on the BOP frame or its components.
- Routing of the hoses without sharp bends in them.
- Hoses must be non-compressible for operation in deep water.

- 3M or 5M accumulator system in use on the HPU and the BOP.
- Test procedure in place to test the control hoses made on the rig (dynamically testing the hose 10 times and statically shock loading the hose 1.5 times the MWP).
- All major control circuits to be tested to 3,000 psi before running the BOPs.
- Maximum response times: 45 seconds for ram-type BOPs and 60 seconds for annular BOPs.
- Presence of spare pod (fully operational).

6.2 Conventional control system notes

Figure 15 - Cameron MUX Mk III control pod.

6.3 Multiplex Control System

- Number of solenoids available.
- Maximum length of fibre optic cables.
- Condition of end terminations of the fibre optic cables and their history.
- Condition of slip rings and mirrors of the cable reels.
- Condition of air motors and brakes cable reels.
- Condition of CCU and any software problems of the network.
- Condition and last test of the UPS.
- Condition of the MMIs on the remote-control panels and in the HPU.
- Condition of the rigid conduit system and flexible hoses.
- PM of the rigid-conduit valves on the BOP and on the HPU.
- The water supply for the BOP fluid must be of distilled-water quality (i.e. maximum calcium content 60 ppm; maximum NaCl content 10 ppm).
- PM solenoid valves: check for calcium deposits and silting.
- Condition and last test results of MUX fault-monitoring system.
- Condition of the SEM components and sealing system.
- Condition of the pressure transducers.

- Installation of solenoid valves and pressure transducers in dielectric fluid chambers.
- Installation of flow reducers in all the hoses when operating in deep water to prevent the water hammer effect.
- Filtration system on the HPU and on the pods.
- Presence of ultrasonic filter cleaning unit.
- Gilmore shuttle valve must have HD (high drag) shuttle installed to prevent the hammer effect.
- All hoses must be non-compressible to handle hydrostatic pressures and the negative hammer effects in deep water.
- All studs of the control valves must be installed with Locktight and Nordlock washers to resist the water hammer effect.
- Condition of mini-pods and hot stabs.
- Condition and operation of the acoustic back-up system.
- Condition and last testing of auto-shear system.
- Condition and last testing of the deadman system.
- Condition and last testing of the EDS system.

6.4 Multiplex control system notes

Chapter 08

Riser and tensioner equipment

1 Drill string compensators

Figure 1 - Drill string compensator.

1.1 Drill string compensator checklist

- Measure the chain stretch/tension.
- Verify the last chain tension adjustment (for instance: combined strength = 1,500,000 lbs).
- Verify the certification of the high-pressure air or hydraulic hoses.
- Check if the high-pressure air hoses have stainless-steel wire.
- Check if the hose bundles are adequately wrapped.
- Check if the end connections of the hoses are secured with safety chains.
- Verify the NDT inspections of the load-bearing points.
- Check if certified relief valves are installed.
- Check oil sampling and analysis.
- Check the last replacement of pistons and rod seals. Note: Swelling of the piston rod seals creates problems with low loads.
- Check the scoring on the piston rods.
- Check if dolly catchers are installed.
- Check if spare high-pressure hoses are available.
- Check if spare silicone-based oil available.
- Check the operation of the stroke position indicator light.
- Check the operation of the lockbar LOCK and UNLOCK indication.
- Check the operation of the load cell of the drill string compensator. Note: Upgrade = piston rod locked with locking dogs, only opened by UNLOCK pressure applied.
- Check the condition of the low-pressure air regulator. Note: Continuous venting means that air leaks between high-pressure and low-pressure air systems.
- Check the maximum stroke (circa 15 feet).

- Check the operation of the speed control valves, the last inspection or the slingshot test.
- Check if the blind-end cushion oil level is ¼ inch below the air connection.

1.2 Drill string compensator notes

2 Crown-mounted compensators

2.1 Crown-mounted compensators checklist

- Check the maximum stroke of the piston rods.
- Check the maximum load rating, both open and closed.
- Check the condition of the high-pressure piping in the derrick.
- Check the last NDT inspection of the crown block sheave cluster.
- Check if an active heave compensator is available.
- Check the speed control valve setting (in per cents) and the last test or inspection.
- Check the condition control cabinet and verify that all indicators are working properly.
- Check the condition of the chrome on the piston rods.
- Check the amount of available APVs or GPVs/NPVs.
- Check that there are adequate work platforms to perform preventive maintenance around the CMC.
- Check that certified relief valves are installed.
- Check the oil sampling/analysis.
- Verify the last replacement of pistons and rod seals. (Note: Swelling of the piston rod seals creates problems with low loads.)
- Check that there are dolly catchers installed.
- Check that spare silicone-based oil is available.
- Check the operation of the stroke position indication light.
- Verify that a dropped-object policy is in place, and that all components are secondarily secured.
- Check the wall thickness of the high-pressure piping and analyse the results.
- Check the condition of the camera on the CMC platform.
- Check that the alarms are operational and verify when they were last tested.

2.2 Crown-mounted compensator notes

3 Marine risers

Figure 2 - Marine riser.

3.1 Marine riser checklist

- Check the last NDT inspection on the load-bearing areas (at least once a year in service as per API RP 16Q).
- Check that the Hughes riser pin wear rings are heated (190°F) and removed underneath the wear ring in order to perform NDT of the load-bearing areas.
- Check the total length of the available riser string.
- Check the number of risers dressed with buoyancy material.
- Check that the buoyancy modules are rated for their water depth (colour-coded).
- Carry out a visual inspection of the pins and boxes of the choke and kill lines (scoring of Colmanoy chrome coating).
- Check that there are new Polypak seals on the choke, kill, mud booster and rigid conduit lines every time the BOP is run.
- Carry out wall thickness measurements of the main tube, choke and kill lines, goosenecks, lip joint and inner barrel (see the OEM-recommended maximum wear levels).
- Measure the outside diameter of the choke and kill line pins with a micrometer.
- Check if there is damage on the riser bore (key seating).
- Do not always use the same riser just above the BOPs due to the use of the acoustic beacon basket (the first riser receives maximum load during operations).
- Check the condition of the riser spider and the last NDT inspection.
- Check the condition of tension ring and verify if it is adequately secured with a safety chain underneath the rotary table.

- Check the condition of the rotating mechanism of the tension ring for DP rigs.
- Check the condition and layout of the packer slip joints and the last pressure test of the slip joint packers. Note: These packers are very vulnerable for brines or high-temperature mud.
- Check that the primary packer slip joint is air-operated and that the secondary packer hydraulically is operated. Note: Two air-operated slip joint packers reduce the diverter system to rig air pressure level and create a single-point failure.
- Check the condition of the locking dogs or studs on the risers and slip joints.
- Check the condition of the O-ring seals, pins and boxes.
- Check the HP/HT seals for the choke and kill lines of all risers.
- Check that the riser joint is fitted with an automatic-/remote-operated fill-up valve.
- Check that an instrument riser joint is in service, and a spare instrument joint available.
- Check that the riser joint is fitted with a riser fill-up valve.
- Check the total number of slick and buoyancy risers.
- Check the condition of the buoyancy material. Note: No cracks are allowed on the polyester covers, as this may cause loss of buoyancy due to water ingress and cause potential dropped objects and foam falling down while running the risers.
- Check the selection of the riser pup joints.
- Check the wall thickness of riser main tubes (½, ⅝ or ¾ inch) and the load rating of the risers.
- Check the known friction coefficient of the grease in order to ensure that the correct torque values for the locking dogs/studs are applied.
- Check the slip joint stroke and locking system inner/outer barrel, and the last NDT of the locking studs.
- Check the storage conditions of the risers to prevent damage and to perform preventive maintenance.
- If risers are stored in town, check that all seals have been removed and the sealing areas cleaned and coated with grease before sending them away. Note: If the seals are left installed, trapped mud or water will cause severe pitting on the sealing areas.
- Check the condition of the hydraulic tools to make up brake riser joint connections.
- Check that there are enough spare tools such as hydraulic spanners and pumps.
- Check the presence of one or more certified torque wrenches.

3.2 Marine riser notes

4 Riser tensioners

Figure 3 - Riser tensioner.

4.1 Riser tensioner checklist

- Check the number, size and load rating of the riser tensioners.
- Check the condition of the wires and if a sampling programme is in place.
- Check that a ton-cycle programme is in place.
- Check the number of spare wires on the rig or in town.
- Check that a slip-and-cut or replacing wire programme is in place.
- Check the proper installation of the wedge-type sockets. Note: Wire clamps must only be placed on dead ends.
- Measure the sheaves with sheave gauges and perform a wobble test Note: This only applies when the tensioner is not in use.
- Check the certification of the relief valves (two-yearly).
- Check the condition of the rupture discs.
- Check the condition of the piston rods and seals.
- Check the condition of the grease lines and fittings.
- Check that the relief valves and exhausts are venting into a safe area. Note: Rigid piping is required.
- Check that the protection relief valves on the riser tensioners are located next to the V-door.
- Check the oil sampling and analysis.
- Carry out wall thickness measurements of APVs and high-pressure piping.

Warning: Never install hoses in high-pressure air systems. Hoses are dangerous to personnel; they may freeze due to high-pressure expansion and are not certified for high-pressure air.

- Check the calibration of the pressure gauges.
- Check the last function test of the speed control orifices.
- Check that there is a noise dampener installed in the vent lines.
- Check that certified pig tails are in use on the tension ring.
- Check the condition of the studs and nuts on the flanges of all high-pressure piping.
- Check that there are no twisted stems on high-pressure valves. Note: due to a high-pressure differential the stems easily twist and the valve starts leaking in the closed position.
- Check the minimum amount of air leaks measured in 24 hours.
- Check that there is adequate numbering on the tensioners and APVs.
- Check that there are work platforms around the tensioners to perform maintenance.
- Check the condition of the bearings of the fastline sheaves in the moonpool.
- Check the condition of the high-pressure air compressors.
- Check the condition of the nitrogen compressors.
- Check that there are clear warning signs stating that nitrogen is used for the high-pressure systems.
- Check the condition of the winches and guideline tensioners.

4.2 Riser tensioner notes