Activity	Prevention
Planning	• Highlight in the Drilling Program permeable formations that may lead to differential sticking. • Estimate the problem formation pressure using the best and most current offset data available. • Any requests to run RFTs or MDTs should be considered carefully as they may increase the possibility of differential sticking. • Careful consideration of the number of pad type logging tools employed in holes where differential pressures are known to be high. • Lubricants can reduce the high coefficient of friction between the wellbore and the drillpipe. • Reduce the filter cake thickness by the addition of "bridging" material to the drilling fluid. • Shaker screens must be selected to prevent or minimise a drilled solids build-up, as low gravity solids result in thick and sticky filter cakes. • HTHP fluid loss must be run on the drilling fluid when drilling in areas of known differential sticking, regardless of the bottom hole temperature. • Do not program any non-essential surveys, as they are a high risk operation.
Wellsite	• Continuously monitor the differential pressure across permeable formations as accurately as possible. Trends of overpull on connections, trip gas levels, and connection gas levels shall be followed to anticipate changing pressures. • Keep differential pressures across permeable formations to a minimum by keeping the mud weight at the lowest safe level. • Maintain drilling fluid parameters within the specifications of the Drilling Programme. • Stabilisation and spiral drill collars should be used to centralise and minimise wall contact. • Keep the pipe moving at all times. Reciprocate if possible. Do not leave the pipe static in high risk areas. • Spot LCM pills across depleted zones while drilling and prior to evaluation. • Utilise all solids control equipment to minimise the amount of drilled solids in the mud. • When running wireline surveys consider racking back the kelly and work the string with the elevators.

Table 8. Preventative Measures against Differential Sticking.

3.5.3 Inadequate Hole Cleaning

The DM is responsible for preparing a Drilling Program that minimises the potential for inadequate hole cleaning and stuck pipe. The DSV is responsible for ensuring that the preventative measures tabulated below are performed by the Drilling Contractor at the wellsite.

Activity	Prevention
Planning	• Circulation rates need to be kept as high as possible in large diameter hole sections. • Include recommended minimum circulation rates in the Drilling Fluids Program. • Hole angles between 50o and 60o are the most difficult to clean. The Drilling Program for wells with these angles shall highlight this potential. • A study of offset well data may indicate signs of over-gauge hole that may need to be included in minimum flow rate calculations.
Wellsite	• The hole shall be circulated clean prior to the start of a trip. Rotation and reciprocation of the pipe will improve cleaning. • Special tripping and circulating procedures may be necessary in wells with cutting beds and wells with severe over-gauge sections, such as pumping and backreaming out. • Do not let the flow rate drop below the minimum required to effectively clean the hole. • Do not continue to drill in anticipation of cleaning the hole at a later stage - that may be too late to avoid getting stuck. • Utilise all solids control equipment to minimise the amount of drilled solids in the mud.

Table 9. Hole cleaning - Preventative Measures against Stuck Pipe

The following indicators may identify hole cleaning problems:

☑ Excessive overpull on connections and trips.
☑ Reduced overpull when pumping.
☑ Excessive fill after trips.
☑ Erratic and increasing torque while drilling.
☑ Lack of cuttings over shakers.

Appropriate action must be initiated when any of the above indicators are encountered while drilling.

3.5.4 Formation Instability

The DM is responsible for highlighting in the Drilling Program all likely zones of formation instability using offset well data. The DSV is responsible for ensuring that the preventative measures tabulated below are performed by the Drilling Contractor at the wellsite.

Activity	Prevention
Planning	• Ensure that the drilling fluid formulation is designed to cope with gumbos and swelling shales where they are indicated.
Wellsite	• Trip cautiously through swelling formations. • In tight hole, ream each single. When using a top drive, pick up and ream midway through each stand. If hole conditions are severe, more frequent reaming may be required. • After pulling into a tight spot, run back into gauge hole and circulate before back reaming out. • Sections of the hole found to be tight on the way out of the hole shall always be reamed on the trip back in. • Wiper trips must be conducted regularly as defined in the Drilling Program with additional trips made as required. Consideration of the stuck pipe risks must be made before dropping a single shot survey in tight hole situations. • No unnecessary time shall be spent in open hole.

Table 10. Prevention of Stuck Pipe due to Formation Instability.

3.5.5 Key Seating

The DM is responsible for highlighting in the Drilling Program the possibility of key seating. The DSV is responsible for ensuring that the preventative measures tabulated below are performed by the Drilling Contractor at the wellsite.

Activity	Prevention
Planning	• Offset well data shall be reviewed for incidents of key seating and any occurrences shall be noted in the Drilling Program. • Ensure that a string reamer or key seat wiper (preferred) is available on the rig for each relevant hole size where key seating is considered to be a potential problem.
Wellsite	• Ream any severe doglegs to prevent key seats developing. • Use a string reamer with a diameter larger than the drill pipe tool joint and smaller than the drill collars in the drill pipe to wipe the build section or Dog Leg if a key seat is expected or suspected.

Table 11. Prevention of Key Seating.

3.5.6 Bottom Hole Assembly Changes

All BHA changes shall be identified in the Drilling Program by the DM. The DSV is responsible for ensuring that the preventative measures tabulated below are performed by the Drilling Contractor at the wellsite.

Activity	Prevention
Planning	• Do not plan a stiff assembly to follow a flexible BHA without flagging in the Drilling Program that care must be taken when tripping in.
Wellsite	• Bits and stabilisers shall always be gauged after each trip. • If the bit is pulled undergauge the whole of the section drilled by the previous bit may require reaming. • Do not trip a BHA of increased stiffness into the hole rapidly. Expect to have to ream. • If the hole is suspected to be undergauge, extreme caution must be applied when tripping into the hole.

Table 12. General Consideration for BHAs in Preventing Stuck Pipe.

3.6 PREVENTION OF LOST CIRCULATION

The following guidelines outline the key requirements to prevent or reduce lost circulation while drilling. It is the responsibility of the Drilling Contractor to recognise any lost circulation and immediately inform the DSV of its occurrence.

3.6.1 Procedures to Minimise Losses

There are five procedures that may be performed by the Drilling Contractor to minimise losses. These are tabulated below.

Control to Minimise Loss	Procedure
Mud weight	Ensure that the mud density is not allowed to increase due to build up of solids, by maintaining and fully utilising an efficient solids control system, and by dilution where necessary.
Drilling fluid properties	Excessive gel strengths and viscosity, frequently due to an unacceptable increase in drilled solids, may result in seepage losses as a result of downhole circulating pressures.
Overloading annulus	The drilling rate must be controlled to ensure that the annulus is adequately cleaned and the drilling fluid maintained with an adequate carrying capacity to clean the annulus. Solids control equipment must be fully utilised to maximise removal of solids. Failure to adequately clean the hole may result in the formation of annular "mud rings", causing partial or total impedance to circulation.
Reduce Pump pressure	Pump pressure can be reduced by reducing flow rate, increasing nozzle size or changing mud properties
Pressure surges	Run in hole slowly and steadily to avoid surging the well, especially in the smaller boreholes.

Table 13 Procedures for Minimising Losses.

3.6.2 Lost Circulation Pills

Lost circulation ranges from seepage losses to complete loss of returns.

The recommended lost circulation material (LCM) that may be used across reservoirs and other formations without causing formation damage is Enerseal super fine or its equivalent, Sandseal. Quantities shall be determined on site, and returns shall be carefully monitored. Enerseal can be used either in concentrated slugs or as a general drilling fluid treatment as required.

Where seepage losses increase to more than 20 bbls/hour, a LCM pill may be required to provide more effective prevention than can be achieved by circulating LCM in the drilling fluid.

The generic procedure for the preparation and application of a LCM pill is as follows:

1. Mix a LCM pill in the slugging pit using the recommended LCM material (or alternative approved material where applicable). The actual concentration will be dependent upon the magnitude of the losses and the size of the jets in the drilling bit.
2. Spot the LCM pill on bottom.
3. Pull the bit above the loss zone and the top of the LCM pill.
4. Observe the well for one hour, keeping the hole full as required.
5. Gradually commence circulation and attempt to regain full returns.

3.7 FIELD SUPERVISION

3.7.1 Introduction

The implementation of the Drilling Program is carried out by contractors and verified by the DSV. The DSV should ensure that the program is followed to control and minimise risk and to make sure that the ongoing program is safe, efficient and effective.

3.7.2 Activities

2.7.2.1 Prepare and Send Daily Drilling Report to the GSLM Drilling Manager

The DSV shall complete the DDR after receiving the IADC report from the drilling contractor and operational reports from other contractors..

3.7.2.2 Morning Call

The DSV will call the DM each morning to discuss and incidents, logistical requirements and past and future operations. Based on this the DSV and DM shall address the safety, operational or logistics requirements.

3.7.2.5 Issue Work Instructions

Where possible all work instructions should be in writing and given to the contractors rig manager, who shall discuss them with the DSV before issuing them to the driller. The DSV shall issue instructions to third party contractors as required..

3.7.2.6 Afternoon Report

The afternoon report shall be a short summary, unless non standard operations are underway, following the same structure as the Morning Report

3.7.2.7 Verify Rig Operations and Prepare Non-conformance Reports

The DSV shall, on an ongoing basis, verify that work is being carried out in accordance.with the Drilling Program, the DOM and HSWE requirements. He shall discuss the work as necessary with the GSLM DM and the rig TP.

Where a serious non-conformance is discovered, the DSV shall complete an incident report form detailing the action taken. The purpose of this is to initiate analysis and help ensure that the non-conformance is not repeated.

3.7.2.8 Analyse Non-conformance

All incident report forms shall be sent to the DM who shall investigate the report, carry out further analysis and discuss the report as necessary.

3.8 REPORTS AND REPORTING

Effective reporting is essential for a safe and efficient drilling operation. The objective is to keep the reports to an effective minimum and to simplify reporting lines wherever possible.

3.8.1 Reporting Relationships

- The DSV reports routinely to management via the DM assigned to the well.
- The DSV shall consult with the DM in the event of incidents occurring outside the scope of the drilling program (e.g. excessive tight hole, well control issues etc.).

Note: Drilling instructions shall ONLY be relayed to the rig via the DM

3.8.2 Daily Drilling Report

The morning report shall be transmitted to the DM by 0700 latest.

EXPLANATION OF TERMS IN DDR	
Term	**Explanation**
Date	The report is dated for the day of the report (day previous to dispatch).
Addressee	DM
Depth	Current depth at 0600, in feet or meters as specified in Drilling Program
Progress	Progress for previous 24 hours.
Day +/- Curve	Report days ahead (+) or behind (-) the TVD curve as in the Detailed Drilling Program.
Formation Tops	List the type and depth of each formation encountered during the last 24 hours.
Activity Report	Ensure that phase class and operating codes are correct because the software analyses the times by these classifications. Report times to the nearest 30 minutes.
Comments	It is important that the remarks / observation and solution / recommendation section is completed for any and all non-routine occurrences.
Mud Properties	Complete fully and in detail ensuring that the data matches the latest mud check.
Bit Data	Complete in full, note that the new IADC classification is to be used for dull grading.
BHA	Complete in full for the BHA in use. Include serial numbers and rotating hours for all NBRR, Stabilisers, Jars, NMDC, Motors etc.
Bulk Stocks	Complete in full for the stocks at 0600.
Surveys	List the tool type in "Last Tool Type" (i.e. Totco, MSS or MMS).

Table 15. Explanation of Terms in DDR

3.8.3 Other Reports

Casing and Cementing

- The following reports shall be E-mailed to the DM.
  I. Casing Tubing Tally – Sent to DM for checking and verification prior to the casing being run.
  II. Casing & Cement Report – Sent to the DM within 24 hours of the cement job.

Leak off Test/Formation Integrity Test

- Complete as per Chapter 9.7 and E-mailed to the DM with the next morning report.

BOP Test Sheet

- Complete for each BOP test.
  Ensure that all sections are accurate and E-mail to the DM.

Well Control Kill Sheet

- The pre-recorded data shall be completed at minimum everyday while drilling below the surface casing.
- The form is retained on the rig and may be audited by GSLM and/or regulatory personnel.

Daily Drilling Costs

- The DM shall complete the relevant sections of the daily cost report
-

End of Well Reports

- The following reports shall be completed at the end of the well and faxed to the DS/DE within 24 hours of rig release.
  (i) Wellhead Installation Report for Conventional wells
  (ii) Well Abandonment Report - if applicable
  (iii) End of Well Equipment Report
  (iv) Rental equipment used on well

End of Hitch Report

- To be completed by the DSV every hitch
- Should be E-mailed to the DM prior to leaving rig.

TRIPPING PROCEDURES

(To be displayed in Doghouse)

Tripping Practices

a) A minimum of one complete circulation shall be performed prior to any trip out of the hole. When circulating to condition mud, a circulating rate of 50 - 75% of the normal circulating rate shall be used.

b) A trip sheet shall be filled out by the Driller and Mud Logging Contractor for each trip in/out of the hole. All variances from expected fill/return shall be investigated. The trip tank shall be used on all trips.

c) The time spent with the pipe out of the hole shall be minimised wherever possible. Operations such as routine BOP testing (except blind rams), repairs and slipping and cutting of the drill-line shall be performed with pipe at the casing shoe whenever possible.

d) Check trips may be required in the following cases:

   1. During logging when hole conditions deteriorate and become sticky.
   2. Before RFT/MDT tools are run (If supercharged formations are possible, this wiper trip may be made 1 logging run prior to the MDT/RFT run).
   3. Before running casing, if hole indications during logging indicate that this is necessary.

   Notes:

   i. In all of the above cases, the BHA must be as short as possible.
   ii. In upper hole sections, the BHA should include full gauge stabilisers and be at least equal in stiffness to the casing string if required.
   iii. Monel DCs shall not normally be run in check trips

e) When the condition of the hole is unknown due to a major change in parameters, a short trip shall be made. The procedure is as follows:

   1. After circulating bottoms up flow check for 15 minutes. Slowly pull 10-15 stands while using the trip tank to ensure that the hole is taking the correct quantity of mud. Check for flow. Run back to bottom, check for fill and check for flow again.
   2. Circulate bottoms up and condition the mud. Check return mud weight and for signs of entrained gas or dilution. Increase the mud weight if there are signs of an influx.

f) Slow trip speeds while running drill collars (and BHAs) past coal seams is essential to the stability of the seams.

g) The majority of the world's blowouts occur while tripping in normally pressured areas. The main reasons are swabbing in a kick, failure to keep the hole full, or breaking down the formation due to excessive trip speed.

   The term 'swabbing' on a rig generally refers to the bit and/or stabilisers acting as a swab or piston and actually lifting the full mud column. This typically occurs with tight or sticky hole when the bit, stabilisers, or collars become packed with wallcake leaving a very restricted passage for the mud. This situation is readily noticeable as the mud level in the annulus tends to rise with the pipe rather than fall. In addition, since the drillstring is picking up all or a portion of the weight of the mud column above, the string weight shows an increase.

Swab and surge pressures actually occur every time the pipe is moved as a result of the viscous drag of the mud. The factors affecting the magnitude of these pressures for a given hole/pipe combination are mud rheology and pipe speed.

The swab situation is more insidious since the influx may occur in very small increments and may not become evident until the influx has migrated almost to surface after a period of hours. By the time this happens, the pipe is a long way off bottom and well control becomes extremely difficult and may become impossible. There are many instances of the drill string being blown out of the hole in these situations.

It is a fundamental fact of life on the wellsite that the hole must be kept full at all times. All too often complacency creeps into operations, corners start to be cut and drillers don't want to 'waste time' filling in trip sheets.

Hole filling should be a continuous operation performed with the trip tank, NOT WITH THE MUD PUMP. In order to fill the hole on a continuous basis a heavy slug must be pumped to allow the pipe to be pulled dry. Pulling wet pipe slows the operation and the loss of mud can make volume accounting difficult.

A trip sheet **must** be filled out for every trip including short wiper trips.

To minimise the risk of influxes occurring and to maximise the speed of detection when they do occur, it is imperative that safe trip procedures are strictly followed.

As always the golden rule is "if in doubt, stop and check". Do not blunder along into a disaster.

When tripping, ensure that the pipe is not set too high in the slips. Setting the pipe high can result in bending the pipe in the slip area.

The maximum height to avoid bending can be calculated. The procedure is shown below for two cases. Case 1 is for the make-up and break-out tongs at 90 degrees to each.other; Case 2 is for the make-up and break-out tongs at 180 degrees to each other.

Case 1

$$Hmax = \frac{0.53 \times Ym \times L \times (I/C)}{T}$$

Case 2

$$Hmax = \frac{0.38 \times Ym \times L \times (I/C)}{T}$$

Where:

Hmax = Height of tool joint shoulder above slips - ft
Ym = The minimum tensile yield stress of the pipe - psi
L = Length of tong arm - ft
P = Line pull - lb
T = Make up torque applied to tool joint (P x L) = lb.ft
Z = Section Modulus (I/C) of the pipe – unit of length^3 (See table, over)
Where I = Second Moment of Area (Moment of Section) of the pipe
C = Outside radius of the pipe

Pipe OD ins	Nominal Wt lb/ft	Z (=I/C)
2 3/8	4.85 6.65	0.66 0.87
2 7/8	6.85 10.40	1.12 1.60
3 1/2	9.50 13.30 15.50	1.96 2.57 2.92
4	11.85 14.00 15.70	2.70 3.22 3.58
4 1/2	13.75 16.60 20.00 22.82	3.59 4.27 5.17 5.68
5	16.25 19.50 25.60	4.86 5.71 7.25

Tripping Procedure

1. Fill the trip tank to the highest recording level using mud from the suction tank. Do not fill the tank by diverting returns - this will allow cuttings to settle. Record the initial volume in the tank.

2. If required, and for top hole only
   - While circulating prior to tripping, prepare a heavy slug in the pill tank.
     The volume of heavy slug required is calculated as follows:
     Slug Volume = (Drop length x pipe capacity x Mud wt) / (Slug wt - Mud wt)

     Example: *Volume of 12.0 ppg slug required to produce a level 300 ft down in 4 ½"pipe with 9.2 ppg mud in the hole is (300 x 0.01422 x 9.2) / (12.0 - 9.2) = 14 bbls.*

3. Prepare the trip sheet..Shut down the pump and flow check. If the hole is stable; (for top hole only - pump the slug) break out and set back the kelly.

4. When the levels have equalised and annulus flow has stopped, switch the returns to the trip tank.

5. Pull the first 5 - 10 stands without continuously filling the hole to allow the level to be visually monitored for piston type swabbing. Wiper rubbers are not to be installed until at least these 5 - 10 stands have been pulled without indication of swabbing.

Remember that bottom hole pressure is reduced by the swab pressure plus the loss of hydrostatic head due to the lower fluid level in the annulus.

CHAPTER 4
DRILL STRING EQUIPMENT

TABLE OF CONTENTS

4.1 OBJECTIVES

This Chapter describes the key items of drill string equipment (jars, stabilisers and drill string barriers) applicable to GSLM's drilling activities. The information contained in this Chapter can be used to gain an informed understanding of the benefits and applications of this equipment.

4.2 RESPONSIBILITIES

As this Chapter primarily provides a description of drill string equipment, very few responsibilities have been defined. Those defined are tabulated below.

Task	Performed by	Verified by
Permanent provision of Inside Blowout Preventer	Drilling Contractor	DSV
Provision of two lower kelly cocks for each size of drill pipe throughout drilling operations	Drilling Contractor	DSV
Inspection and certification of all drillstring components.	Contractor	DSV
Maintaining records of all drillstring inspections on the rig	Drilling Contractor	DSV
Tracking time in hole of BHA components (jars, stabilisers, motors NMDC etc).	Drilling Contractor / DSV	DSV / DM

Table 16. Responsibilities for Provision of Drill String Equipment at the Wellsite.

4.3 DRILL STRING DESIGN

Good drill string design aims to avoid abrupt changes in component cross-sectional area as abrupt changes that lead to concentrations in bending stress, which in turn may result in a twist off. The most important components for concern are the crossovers between drill collars, drill collars and heavy weight drill pipe and heavy weight drill pipe and drill pipe.

4.4 BHA Handling – Notes

- Stabilisers to be made up or broken out of the drill collar string shall either be suspended by a winch line or maintained vertical by means of another mechanical support (e.g. pin in rotary table, clamp support hooked around drill collar in the rotary). Manually supporting the stabiliser without mechanical back up while engaging or disengaging the threads is not permitted. It is dangerous and may cause damage to the stabiliser pin end.

- Stabilisers and roller reamers should be gauged and visually inspected on **each** trip. Consideration should be given to laying out stabilisers that are more than 1/8" undergauge (unless drilling directionally). Serial numbers and rotating hours should be recorded on the daily drilling report.

- No chicksan connection will be made up to a down hole string component before that component is actually incorporated in the string and lowered through the rotary table to refusal or safe working height. In the event circumstances dictate otherwise, the chicksan connection shall be safeguarded by attaching a safety line to prevent free fall.

- Any threaded connection carried on top of a string suspended above safe working height and not made up to recommended torque shall be marked with chalk and continuously monitored when rotating (part of) that string.

- Avoid rotating the drill string below the rotary to make up pipe once the BHA is run. Backing the rotary into a string to make up a connection is not permitted as it can result in a dropped string or an accident due to damaged threads, and should be avoided where possible.

- Redressing of stabilisers will normally be carried out by the supplier/agent.
- Break new threads in carefully when making up for the first time. Clean thread thoroughly, make up with chain tong to recommended torque. Break connection, clean and inspect threads and remake as above.

4.5 JARS

4.5.1 Jar Types

There are two types of jars: mechanical and hydraulic (oil) jars. These are described in the section below.

When jarring down the smaller the quantity of drill collars placed above the jar, the higher the impact force required to free the fish. Conversely, the larger the quantity of drill collars above the jar, the greater the impulse required to move the fish after freeing the pipe.

Mechanical Jars (not often used).

Mechanical jars are pre-set at the surface. They are frequently used in fishing at shallow depths when there is not enough stretch in the drillpipe to create impact with the hydraulic jar.

Hydraulic Jars

A hydraulic jar has a simple operation, in which overpull is applied to trip the jar, and lowering the string resets it. Jarring direction, impact intensity and frequency of impacts can all be controlled by the driller. A long stroke hydraulic jar should always be used where possible.

Some hydraulic jars are adjustable for overpull downhole and can handle torque during jarring.They are available in double-acting mode e.g. the Houston Engineers Hydra-Jar (Ref. Section 4.6.2).

Where a jar is single-acting and only jars upward, a bumper jar or sub can also be run to allow such a jar to jar in both directions..

4.5.2 Equipment Details

A hydraulic jar primarily consists of two moving parts, the inner mandrel installed with the seals, and the outer body. The principal elements in a hydraulic jar that determine effectiveness and reliability are the seal system (which provides the required restriction to the passage of oil when the jar is being set) and the hydraulic oil.

The effectiveness of the seal system is dependent on the seal clearances and their ability to withstand pressure and temperature. The hydraulic oil must retain its viscosity during operating conditions to provide the necessary resistance when the jar functions, and this property is mainly affected by temperature.

Specific details of jar applications and general information on force multiplying tools are contained in Chapter 12 of this Manual.

4.5.3 Jar Hours

Rotating hours shall be recorded each tour on the IADC tour report, reported daily on the Daily Drilling Report.

6 ¼" jars shall not normally be run for more than 400 hours before being replaced. If jars have been used extensively for jarring they should be replaced as soon as possible..

4.6 DRILL STRING STABILIZERS

Drill string stabilisation in GSLM's drilling operations is provided by the installation of one or more of the stabiliser types outlined in the following sections. Stabiliser placement to achieve a required borehole trajectory is described in Chapter 3 of this Manual.

The following procedure should be followed with all stabilisers:

- Stabilisers will be manufactured 1/64" undergauge (for vertical wells).
- All stabilisers and roller reamers must be gauged and visually inspected on each trip.
- Stabilisers should be replaced when they are more than 3/16" undergauge (or as required for vertical wells).
- The serial number of all stabilisers run in the hole should be recorded on the GSLM daily drilling report..

4.6.1 Integral Blade (IB) Stabiliser

Integral blade stabilisers are typically spiral to provide full circumference stabilisation over the total blade length. Undergauge sizes are also available for specific requirements. Blade faces are impregnated with hard-facing to prevent stabiliser gauge wear. Additional hard-facing material is applied to stabiliser shoulders.

The IB stabiliser may be a one piece, fully integral design, or a type with changeable blades.

4.6.2 Sleeve Stabiliser

Sleeve stabilisers provide an alternative means to change the blades, in which a removable sleeve incorporates the stabilising blades.

The sleeve is typically screwed onto the body, and is available in a range of sizes and blade face characteristics for each hole size.

4.6.3 Roller Reamer

The roller reamer typically replaces a nearbit or string stabiliser to reduce torque downhole, particularly in a packed BHA configuration, or where increased torque is anticipated such as in deviated hole.

In some cases, the effect of the rollers or cutters can be to stabilise the newly exposed borehole due to the rolling action and avoidance of relative movement between stabiliser blade and surface. Previously, this type of tool has been less reliable due to service life of roller bearings and redress difficulties. There are also concerns about the cross-sectional area with respect to hole cleaning or cuttings packing-off when POOH.

The roller reamer should be inspected every trip and should be changed out if more than

1/8" undergauge or if there is any indication of wear on the roller bearings.

4.7 DRILL STRING BARRIERS

This section describes the different types of drill string barriers. It is the responsibility of the Drilling Contractor to ensure that they are serviced and available on the drill floor as described below. The DSV shall verify their presence prior to and throughout all drilling operations..

4.7.1 Float Valves

Float valves are flapper or plunger type valves that are run just above the drilling bit to prevent uncontrollable flow occurring up the drill string. An installed float valve has the disadvantage that it complicates reading the shut in drill pipe pressure after a kick.

- Float valves shall not be run in surface hole unless detailed in the drilling program.
- Flapper valves shall be run while drilling the intermediate and main hole sections unless otherwise authorised in the Drilling Program.

When using float valves, the following procedures shall be carried out:

1. When RIH, break circulation as soon as all the drill collars and one stand of drill pipe are in the hole. This confirms that the float valve is functioning correctly.
2. Fill up the drill pipe every 10 stands.
3. Run in slowly and carefully, to avoid excessive surging as the drill pipe is effectively closed.

4.7.2 Drop-In Check Valve

A drop-in check valve provides an alternative to the float valve, as there is no check or restriction on return flow up the drillpipe until the check valve is installed.

4.7.3 Inside Blowout Preventer (IBOP)

An Inside BOP (IBOP), also known as a Gray valve, installed with the appropriate connections for the drill string in use, shall be present on the drill floor at all times and ready for immediate use..

4.7.4 Lower Kelly Cock

Two lower kelly cocks for each size of drill pipe in use shall always be available One of which shall be used below the kelly or top drive during all drilling operations. The other shall be on the drill floor complete with removable handles for easy stabbing and connecting. This valve should be kept in the open position for ease of installation..

4.8 INSPECTION OF DRILL STRING COMPONENTS

All drillstring components shall be regularly inspected and certified as shown below. A record of these inspections should be kept on the rig. All BHA components must have a unique serial number to enable the usage of each component can be tracked. The table below shows the type and frequency of inspection for the various drillstring components.

ITEM	TYPE OF INSPECTION	FREQUENCY	PERFORMED BY	VERIFIED BY
Drillpipe	Magnetic Particle/Calliper	6 months	Inspection Company	DSV
HWDP	Magnetic Particle/Calliper	3 months	Inspection Company	DSV
Drillcollars	Magnetic Particle/Calliper	3 months	Inspection Company	DSV
Crossovers	Magnetic Particle/Calliper	3 months	Inspection Company	DSV
Saver subs	Magnetic Particle/Calliper	6 months	Inspection Company	DSV
Jars	Magnetic Particle/Calliper	6 months	Jar supplier	DSV
Stabilizers	Magnetic Particle/Calliper	6 months	Inspection Company	DSV
Roller reamers	Magnetic Particle/Calliper	6 months	Inspection Company	DSV
Pony DC.	Magnetic Particle/Calliper	6 months	Inspection Company	DSV
NMDC	Magnetic Particle/Calliper	6 months	Inspection Company	DSV
Fishing tools.	Magnetic Particle/Calliper	After use	Inspection Company	DSV
MWD tools	Magnetic Particle/Calliper	After use	Tool supplier	DSV
Motors	Magnetic Particle/Calliper	After use	Tool supplier	DSV

Table 18. Inspection of Drill String Components

Drillstring components that have been subjected to abnormal stress (e.g. jarring or deviated wells) will have to be inspected more frequently.