12.3 STUCK PIPE

Drilling is considerably influenced by a large range of lithological conditions. These conditions can cause the following potential drilling-related problems:

- Tight hole due to swelling / reactive clays.
- Cuttings pack-off around drill pipe.
- Differentially stuck drill string (depleted reservoirs)
- Washouts and hole erosion.
- Borehole breakout and hole ovality.
- Hard and abrasive drilling with a potential for key seating.
- Maintaining effective directional control.

The causes and remedies of stuck pipe are described in the remainder of this Section.

12.3.1 Stuck Pipe Risks and Controls

The stuck pipe risks and controls for different hole sections of wells drilled by GSLM are described below.

Surface Hole

Hole instability and potential losses are the primary concerns in surface hole. Guidelines to controlling these include. Another potential cause of stuck pipe is the presence of fractured or weathered Diorite which may cause blocks to jamb the drillstring.

- Maintaining an initial low mud weight (essential).
- Maintain good rheology with bentonite and native clays.
- Addition of LCM to minimise losses.
- Using KCl (normally 2-3%) to minimise hydration of clays
- Increasing mud weight at section TD if indicated by hole condition.
- Maintaining good dilution rates (generally >0.5 bbl/ft) to control solids build up.
- Drill Diorite with slick BHA's
- If possible use mineral rig to pre-drill diorite with air.

Intermediate/ Production Hole.

Very few wells have been drilled in Tasmania and consequently it is not possible to predict likely problems. It is therefore important to be prepared for hole problems of any type at any time.

A wide variety of sediments and drilling conditions can be expected while drilling these in Tasmania. These will range from less consolidated Tertiary sediments to the hard and consolidated Permian/Ordovician sediments. A Dioritic sill (often fractured), up to 500m thick, is present in most arrears of Tasmania and this has the potential to cause stuck pipe (blocks falling in) and lost circulation.

Guidelines for maintaining optimum hole and drilling conditions include:

- Maintaining a balance between tight hole and losses by control of mud properties, primarily weight.
- Observing careful tripping practices past permeable formations (Monitor Swab / Surge pressures).
- Perform frequent, short wiper trips as indicated by hole condition.
- Taking into consideration the time-dependent nature of drilling reactive clays.
- Keeping pipe moving as much as possible through and below depleted zones.
- Use BHA's appropriate to the interval being drilled.
- Closely monitor the drilling parameters and cuttings for indications of potential problems. i.e. Listen to what the well is saying.
- Don't take short cuts. Do things properly not quickly.

12.3.2 Causes of Stuck Pipe

Stuck pipe falls into the following categories:

- Differential sticking.
- Mechanical sticking.

Prevention of stuck pipe is detailed in General Drilling Practices (Chapter 3.5 of this Manual).

The Appendix at the end of this chapter provides charts for identifying the causes of stuck pipe.

Differential Sticking

In normal overbalanced drilling conditions, the pressure exerted by the mud column is greater than that of the formation fluids. If the formation is permeable, and the drill string lies against the wellbore wall, the pipe may become differentially stuck due to the build up of filtercake.

Mechanical Sticking

Mechanical sticking results from one or more of the following conditions:

- Inadequate hole cleaning (cuttings packing off).
- Formation instability (Diorite blocks falling in)
- Key seating.
- Under gauge hole and BHA changes.
- Drilling plastic formations.

12.3.3 Freeing Stuck Pipe

The first actions taken when the drill string becomes stuck greatly influence the chance of freeing the pipe. The following points give guidance on the correct early response. The Driller must be fully briefed on the actions to be taken when hole problems are expected.

Differentially Stuck Pipe

The force necessary to free differentially stuck pipe depends upon the following factors:

- The pressure differential between the wellbore and the formation fluid pressure.
- The area of the pipe surface which is embedded in the filter cake.
- The sticking force, which is directly proportional to the coefficient of friction between the pipe and the wall cake, may increase with time.

The correct early response to free differentially stuck pipe is:

1. Jarring shall commence by immediately pulling the pipe to the maximum safe pull specified for the assembly and drilling rig.
2. If pulling and jarring are not immediately successful, the pipe may be slumped and right-hand torque applied in an attempt to free the pipe.
3. The pipe should continue to be worked and circulation continued while preparing the pipe lax pill.

A pipe lax pill shall be spotted at the stuck point as soon as possible after initial attempts to mechanically free the pipe have failed.

Mechanically Stuck Pipe

The pipe should be immediately worked and jarred in the opposite direction to that when it became stuck i.e. if stuck when POOH, jar down, if stuck when drilling or RIH, jar up.

Notes:

- The maximum safe pulling limits for the pipe and rig should be determined prior to any jarring operations.
- Pipe should be pulled to the maximum safe limit for the assembly and rig (whichever is the least). If the first attempts to free the pipe are unsuccessful, the pipe should be worked in both directions until alternative action can be taken.
- Before using any lubricating pill, the effect on the hydrostatic pressure in relation to the pore and fracture pressures shall be taken into account.
- The overpull to trip the jars safely may not be as high as the maximum safe pull for the BHA.
- If circulation is not possible and the drill pipe is pressured in an attempt to initiate circulation, the pressure applied shall not exceed the Maximum Allowable Annular Surface Pressure (MAASP) without the prior approval of the DM.

Determine Effective Pull on Stuck Pipe

When determining the pull on stuck drill pipe, the actual weight of the string in air is to be used, and not the indicated weight, as recorded by the weight indicator. A worked example is given below:

DEPTH;	10.000'
Weight of drill collars in air = 743' of 6 ½" OD x 3" ID = 743 x 89	66,100 lb
Weight of DP in air = 9,257' x 20.77 lb/ft	192,200 lb
Total weight of string in air	**258,300 lb**
Indicator reading	205,000 lb
Weight of hook, blocks, swivel, etc.	27,000 lb
Pull reported at 100,000 lb over indicator reading	305,000 lb
Less hook, block, swivel, etc.	-27,000 lb
Effective pull on string	**278,000 lb**
Assuming that pipe is stuck on bottom, then the effective pull at the stuck point = 278,000 - 258,300 (no buoyancy of pipe)	**19,700 lb**
In order to apply a pull of 100,000 lb at the bit, the Indicator reading would have to be 258,300 + 27,000 + 100,000 lb.	**385,300 lb**
This would mean that the pull on the pipe amounts to 385,300 - 27,000	**358,300 lb**

Table 70. Worked Example for Determining Effective Pull on Stuck Pipe

Reducing Hydrostatic Pressure

Reducing hydrostatic pressure is the best way of freeing differentially stuck pipe.

However, it is essential that all aspects of well control be considered before lowering the hydrostatic head.

The preferred method of reducing hydrostatic pressure is to reduce the mud weight. However, pills to reduce the overbalance may be spotted. Close attention must be paid to all kick indicators.

Spotting Pipe Release Agents

Differentially stuck pipe can be freed by spotting pipe-free pills at the earliest possible opportunity. The volume of spotting fluid depends upon the annular volume at the stuck point, the length of section thought to be stuck and the ID of the BHA/DP

- Once the pill is in place, it must be left to soak whilst continuously working the pipe. Soaking times of at least 12 hours should be considered.
- During soaking, the pipe should be worked, preferably by putting it in compression. Slack off about 10,000 lb below the weight of the pipe and put in some right-hand torque. The amount of torque should be roughly half a turn for every 1000' of pipe above the suspected stuck point.
- Mix enough soak pill to cover the BHA plus additional volume of 5-8 bbls to move the soak pill approximately 1 bbl every 30 minutes.
- Consider mixing pill at twice the suppliers recommended concentration
- A bradenhead squeeze may be considered if initial attempts fail.

Jar Applications

There are two types of jars. These are described in the table below.

Jar Placement	Guidelines
Drilling Jars	• Normally run in the string and available as hydraulic or mechanical • In fishing operations, the jar is located directly above the fishing tool (i.e. overshot). Two to four drill collars should be placed above the jar. • Jarring performance will be reduced if there is a large difference between the drill collar/HWDP size above and below the jar. • Jarring performance will be reduced if there is a large difference between the drill collar/HWDP size above and below the jar. • Do not drill with the jars at their neutral point. A jar accelerator or "intensifier" may be run above the drill collars placed over the jar (between the drill collars and drill pipe) thus greatly increasing the effectiveness of the jarring action. Less drill collars may be run when an accelerator is used.
Surface Jars	• Used to jar downwards, for example to release key-seated pipe • The impact load can be adjusted, and jarring action is usually light to begin with, gradually increasing in intensity. • It is important not to pre-set the trip weight above the weight of the string that is free. Jars are located at surface below the kelly, or a stand can be placed above them.

Table 71. Guidelines for Jar Types

Jar Placement

In straight holes the jars shall normally be located two to four drill collars below the top of the BHA (never directly below the drill pipe or HWDP).

In deviated wells the jars may be placed lower in the BHA and run under compression.

Jars should never be run in neutral, as this will cause them to fail prematurely.

When determining jar placement, it is essential to ensure that the jars are run in tension and that there is sufficient buoyant weight of drill collars below them, plus 15% safety factor.

The following jarring practices shall be followed:

- Ensure that all surface pulling equipment is in good working condition.
- Ensure that both the weight indicator and deadline anchor are correct and clear of debris.
- Visually check the derrick for loose fittings.
- All personnel must be kept clear of the derrick and drill floor while jarring
- Pull shall be limited on stuck pipe to 85% of the minimum yield strength of the weakest member.
- When jarring, overpull to the maximum figure to trip the jar, wait for the jar to trip, then increase the overpull to that recommended for the pipe.
- Regularly inspect the derrick and drill floor for damage.

Note: Whilst circulating, pump-open forces greatly influence jarring performance and have to be carefully considered.

Free Point Determination

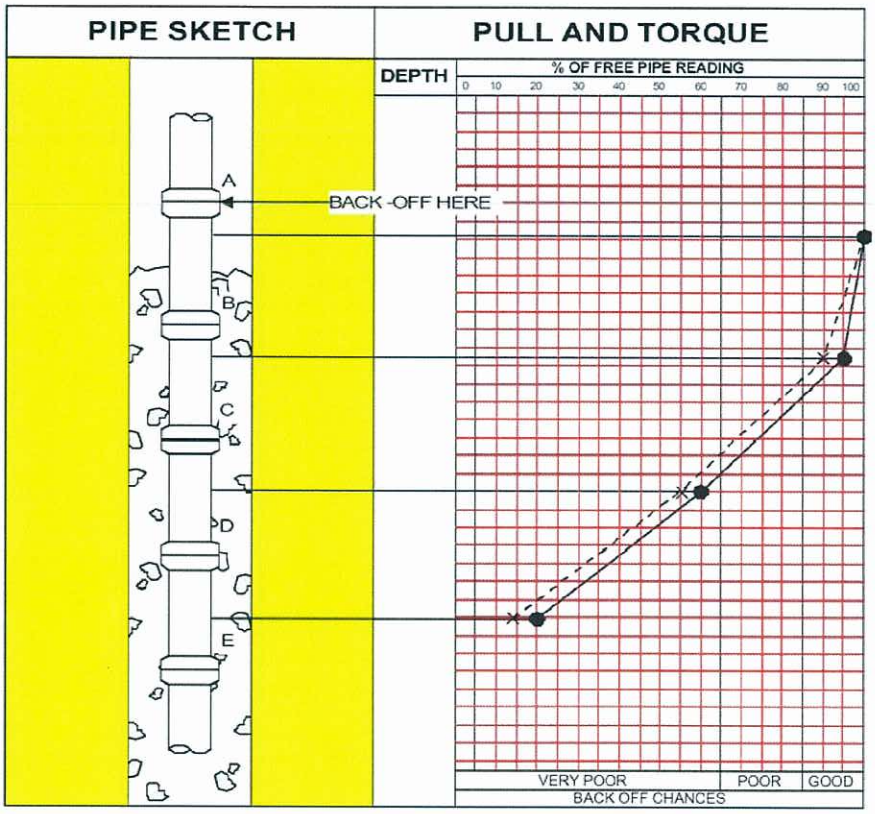
There are two methods to determine Free Point. These are tabulated below.

Method	Application
Stretch Method	Stuck point can be established by stretching the string and using the stretch charts for drill pipe. This method gives only an approximate value for the free point and should only be used to find the approximate stuck point for spotting pipe free pills and providing a starting point for using the Free Point Indicator Tool (FPIT).
Free Point Indicator Tool (FPIT)	This tool can be run on electrical wireline in order to back-off the string at the deepest possible point. By applying stretch and torque on the pipe, the FPIT can determine elongation or rotation at any depth. A plot of depth versus the percentage of surface torque and pull transmitted downhole shows the deepest point at which the string is free. This plot is shown overleaf.

Table 72. Free Point Determination Methods

FREE POINT DETERMINATION AND BACK-OFF PPROCEDURES

Differentially or stuck by heaving, sloughing formation.



To stretch or torque the pipe becomes more difficult as depth below the pipe free point increases. The FPIT decreases rapidly below collar B, the pipe should be backed-off either at collar A or collar B.

Figure 29. Diagram of Hole Condition and Typical FPIT Readings

12.3.4 Procedure for Backing-Off the Pipe

Before backing-off the pipe, the string shot size, weight, torque and turns on the string must be considered.

The string shot shall be determined by the Wireline Logging Contractor so that it is large enough to back-off the joint to be released without splitting the pipe. If the pipe does not back-off after the first shot, the charge can be increased on subsequent runs. The size of the primer cord bundle must be confirmed to be small enough to pass through the minimum pipe ID (this may be the jars).

Ideally the neutral point of the string weight distribution should be at the back-off point.The required surface pull to obtain a neutral point at the planned back-off point should be carefully determined when running the Free Point Indicator Tool.

Working Torque Down the Hole

Before working torque down the hole, the following safety precautions must be adhered to:

- Tong and slip dies must be clean and sharp and of the correct size.
- Tongs and back-up lines must be attached and in good condition.
- Slip handles should be tied together to prevent them jumping out of the rotary table in case the string parts high.
- Elevators should be latched around drill pipe but free from the tool joint, leaving the pipe free to rotate.
- The hook must be unlocked during rotation of the drill pipe.
- The possibility of residual torque when the drill pipe is first picked up must be considered. This may cause the slips to spin out of the rotary table.
- All non-essential personnel must be removed from the drill floor.

The procedure for working torque down the hole is as follows:

1. Set the string to the determined weight for back-off.
2. Mark the pipe at the top of the slips, and refer to that mark at all times (not the weight indicator as wall friction may give misleading effects on the weight reading).
3. Apply half of the left-hand torque required and lock the rotary table. Use a tong line and the rotary tongs to relieve the torque and unlock the rotary table, and hold the torque with the tongs.
4. Slowly pick up the string off the slips and work the pipe vertically several times, being careful not to go below the "weight" mark on the drill pipe, as the pipe could then part at some random point.
5. Set the pipe back in the slips at the weight mark and lock the rotary table at the applied torque.
6. If it is judged that the pipe will accept the remaining left hand torque, proceed to apply this. If not, apply half the remaining torque, in either case repeating the above procedure until all the required amount of left hand torque is in the drill pipe.

Note: Before applying left hand torque, torque the string to the right and note the torque-gauge reading. When later applying reverse torque, the torque reading should not exceed the maximum observed while torquing to the right.

Completing the Back-off

After the string shot has been detonated, check for back-off by picking up the string. In some cases the pipe may have only partially backed-off. To complete the back-off the following procedure must be followed:

1. Before applying left hand torque, torque the string to the right as before.
2. Apply approximately half the amount of left-hand torque originally used to back-off the string. While the torque is being applied, the pipe should back-off with a corresponding loss of torque load. If the pipe does not come free, release the torque in a controlled manner and note any loss of torque in the process
3. Repeat the process until back-off is completed.
4. After accomplishing the completed back-off, POOH.

12.4 STUCK LOGGING TOOLS

The wellsite geologist must be involved with all wireline logging tool fishing operations.

Logging tools may become stuck in either open or cased hole. The scenarios are described below

12.3.1 Open Hole

When a logging tool becomes stuck in open hole and all attempts to free it have failed, the following options exist (in order of consideration):

1. Strip over (cut and thread) the wireline cable to recover the tool.
2. Break the cable weak point and fish the tool.
3. Cement the tool in place.

The primary approach on all fishing operations (including tools with radioactive sources) should be to strip over the cable. This will minimise the risk of failing to fish the tool in an open hole configuration

Radioactive logging tools stuck in open hole shall always be fished by the stripover method. Under no circumstances shall the cable weak point be intentionally broken without the approval of the logging company and the DM. Reverse-strip out of hole.

For logging tools containing radioactive sources, the option of cementing in place may be subject to special regulations obtained through consultation with Mineral Resources Tasmania.

12.3.2 Cased Hole

For logging tools stuck in cased hole, the normal approach is to stripover the cable. As this will minimise the risk of the tool dropping free into open hole.

12.3.3 Stripping Over the Wireline Logging Cable

The following preparation shall be performed before stripping over the wireline logging cable.

Equipment

The following should be supplied by the Wireline Logging Contractor, and available on site for every logging tool to be run downhole.

- Fishing equipment (i.e. overshots) specific to the stuck tool.
- Additional tension meter with cable tension read-out for the Driller.
- 82 m of ¼" rope to control the run of cable going over the top sheave (if required).
- 27 m of ½" rope to hold the lower sheave straight (if required).
- Intercom between logging winch unit and drillfloor.
- Diagram of all tools with lengths, OD's, fish neck OD and length

Personnel

In addition to the regular drilling crew, the following personnel should be available throughout the stripping over operations:

- An experienced winch operator.
- One person at the rotary to engage and release the spear overshot.
- A Wireline Logging Operator on the drill floor to monitor the operation.

Preparation

An indicative sequence of events during the stripping over of wireline logging cable is tabulated below. The actual sequence will be determined by the Logging Contractors procedures.

Task	Preparation
1. Prepare Overshot	• Inspect, lubricate and dress the overshot contained in the loggers fishing kit. • Check the top end to ensure that the 2 3/16" bushing is in place. This holds the 2 ¼" hexagonal adapter of the lower rope socket, if the cable Is dropped at the surface.
2. Prepare Cable for Cut	• Secure the cable clamp (T-bar) to the cable, just above the rotary table. • Lower the cable until the cable clamp is supported by the rotary table. • Continue slacking off the cable, then cut it at a point 4 - 6' from the cable clamp, and secure the ends.
3. Re-rig the Derrick	• Position the lower sheave so that it does not interfere with drill floor operations, and hang the upper sheave from one of the main derrick beams, well above the drill pipe stand, in such a position that it does not interfere with the travelling block.
4. Prepare Cut and Thread Assembly·	• Fit rope sockets to both ends of the logging cable (standard types preferred). • Make up the remainder of the assembly, i.e. spearhead, spearhead overshot, swivel, and sub. Sinker bars may be added to the catcher assembly to provide the necessary weight.
Perform Full Test	• Latch the spearhead overshot to the spearhead while the cable clamp remains on the cable. Mark the cable adjacent to each rope socket with tape and test the cable with 2.5 MT tension for one minute. The end of the cable should be passed through the (fishing) overshot before the hex-adapter is replaced.

Table 73. Preparation of Stripping Over Wireline Logging Cable

Running in the Hole

The procedure for running in the hole while stripping over the logging cable is:

1. Pick up the first stand of drill pipe and install cross-over subs as required.
    - A circulating sub should be installed in all fishing strings
2. Draw the spearhead overshot up to the derrick man, who can then thread it through the first stand of drill pipe. If the sinker bars make the assembly too stiff to pass the travelling block, the assembly should be fed into each stand before it is picked up.
3. Attach the spearhead overshot to the spearhead and make-up the fishing overshot with chain tongs onto the bottom of the first stand.
4. With tension in the cable, check the operation of the remote tension indicator, then remove the cable clamp.
5. Complete the make up of the fishing assembly with the rig tongs.

6. Run the first stand into the hole:
   - Maintain a depth tally.
   - Maintain the cable tension to Wireline Logging Contractor specifications, paying close attention to the tension indicator.
7. Install the "C" plate and slack-off the cable until the slot in the spearhead is supported by the "C" plate.
8. The cable is now flagged for reference at each stand of drill pipe.
9. Release the spearhead overshot. Thread it through the next stand, and re-connect it to the spearhead.
10. Pull tension in the cable and remove the "C" plate. Make up the second stand onto the first and repeat the whole process for each stand.
11. Run in slowly and carefully, (according to the points listed in item 6), thus avoiding the following primary hazards:
    - The cable being dropped.
    - Broken armour wire balling-up ahead of the overshot.
    - The impact of the overshot on a bridge cutting the cable.
    - If the cable becomes key-seated it may double-back round the overshot.

    Note: Do not rotate the pipe in the hole.

12. When approaching the depth of the fish, it is good practice to clean out the fishing tool by circulating. Circulation at a bridge, at the fish, or during engagement of the fish is accomplished by hanging the cable spearhead on a bushing in a special circulating sub.
    - With the spearhead hanging on the "C" plate, thread the circulating sub and adapter sub over the spearhead overshot. Latch the spearhead overshot onto the spearhead, lift the cable and remove the "C" plate.
    - Make-up the subs onto the drill pipe. Place the special bushing over the cable and into the circulating sub. Lower the cable until the rope socket rests on the bushing. Unlatch the spearhead overshot.
    - Make up the kelly onto the circulating sub, using the appropriate cross-overs.
    - When the overshot is a short distance from the fish, the fish may come free. If this occurs circulation may be used to clean the overshot and then the logging tool can then be pulled into the grapple. The fish may, however, be covered by formation solids, requiring the overshot to be circulated down onto the fishing neck. In this case the overshot must reach the fish with sufficient tension still in the logging cable to prevent it going slack and looping over the rope socket.

Engaging the Tool

The fish can be engaged when the original tension at surface, including the weight of the logging tool, is known and the elongation (stretch) per 10,000' of standard logging cable sizes with respect to tool weight, has been determined from charts supplied by the Logging Contractor. The fish shall be engaged as follows:

1. Pull on the logging cable with the original logging tension and check the elevation of the spear point.

2. From the Logging Contractor's chart, find the cable stretch due to the weight of the logging tool in mud.

3. The elevation minus the stretch gives the elevation of the spear point for neutral tension in the cable at the logging tool. Space out the string with pup joints so that the spear point is below this elevation when the overshot engages the fish.
4. If circulating over the fish, continue pumping while lowering the pipe and engaging the fish. An increase in both pump pressure and cable tension should be noted as the tool head enters the overshot.
5. Stop circulating.

Pulling the Tool

After proving, by motion of the pipe and its effect on the cable tension, that the fish is engaged, the cable weak-point may be broken by:

1. Installing the cable clamp.
2. Latching the elevators around the cable, (under the cable clamp).
3. Pulling slowly until the weak point breaks.

The following procedure shall be adhered to:

1. Cut the cable to remove the rope sockets, then tie the two ends together with a reef knot. Tape the loose ends onto the logging cable to prevent them hanging up as they pass over the sheaves.
2. Spool the cable onto the winch, then pull the fish out of the hole.
3. Do not rotate because the fish may disengage from the overshot.

Problems while Stripping over the Cable

The following problems listed in the text and table below may be encountered whilst stripping over the wireline logging cable:

- If the spearhead rope socket fails, then a broken cable is left in the hole.
- If the spearhead with rope socket and cable is accidentally dropped into the pipe, run the thread through the overshot with the largest applicable guide down the pipe and attempt to engage the spear. If this fails, the drill pipe can be pulled because the bushing in the fishing overshot will catch the hexagon adapter on the spearhead.
- If a bridge is encountered, it should be removed by circulating gently.

The table below highlights some of the causes of changes to the cable which may occur when stripping over the cable.

Cable Tension	Cause
Increases Sharply	• The cable may be stuck in a key-seat and doubled back outside the overshot. • Picking up the pipe should cause a small decrease in tension. Increase the cable tension and the guide should free the cable ahead of the advancing overshot.
Increases Moderately Fast	• A broken armour cable may be balling up at the overshot.
Increases Gradually	• This is normal for a deviated well. The elevation of the spear point will be lower. • If the spear point becomes lower than the top of the pipe during running in, a short length of spacer bar may be introduced between the rope socket and spearhead.

Table 74. Increase in Cable Tension – Problems Whilst Stripping

12.5 MILLING

For the purposes of this Chapter, milling is defined as any non-planned milling of junk in open hole and in casing.

12.5.1 General Milling Guidelines

To effectively remove the cuttings while milling, the following should be adhered to:

- A minimum annular velocity to keep flow turbulent around the BHA should be used to prevent cuttings "bird nesting" and blocking the annulus.
- The Yield Point of the mud should be increased as high as possible before commencing milling.
- Viscous pills should be pumped if required.

Washing should begin at least one single above the fish. The fish should be tagged, the string picked up and rotation/washing started a minimum of one foot above the fish as the string is lowered. Weight and RPM should be adjusted to find the best milling rate while noting the rotating torque.

The table below tabulates some of the considerations to be made during milling operations.

Topic	Milling Considerations
Rotation	• Milling should be conducted using high rpm according to milling equipment manufacturer's instructions.
Weight	• A constant milling weight should be maintained. • The tool must not be allowed to drill off.
Monitor and Record	While milling, the following parameters must be monitored and recorded: · Progress made • Weight on mill • Torque • RPM • Pump pressure • Circulation rate • Description of milled cuttings • Any relevant observation

Table 75. Considerations During Milling

- In order to provide a high circulation rate, all subs and auxiliary tools should be full bore where possible. The tool must be picked up, circulated and rotated at regular intervals.
- BOP cavities must be flushed on completion of milling.
- The running of jars in the milling string should be considered on a case-specific basis.
- Stabilisers should be run to centralise the mill, but the number of stabilisers must be kept to a minimum to prevent excessive torque and bird nesting of cuttings.
- Ditch magnets should be used at the shale shakers or flowline. These magnets must be cleaned regularly and the weight of steel recorded.
- When milling junk, spudding should be periodically carried out to pound junk down to the bottom of the hole where it can be effectively milled.

The following table contains a summary of general operating recommendations and normal milling rates.

Type	RPM	Weight (1000 lb)	Remarks
Junk Mill	100+	10 - 50	Spud mill from time to time
Pilot Mill	125+	6 - 20	Vary weight to find best ROP
Taper Mill	50 - 80	6 - 30	Start with light weight & low rpm
Economill (Flat Mill)	100+	2 - 40	Start mill above fish
Rotary Mill	50 - 100	5 - 20	Pick up from time to time. Check overpull and torque

Table 76. General Operating Recommendations For Milling Operations

Material	Junk Mill	Pilot Mill	Flat Mill	Rotary Shoe/ Washover Shoe
Drill pipe	2.0 - 6.0	2.0 - 6.0	-	6.0 - 20.0
Drill Collars	1.0 - 2.0	1.0 - 2.0	-	4.0 - 6.0
Packers	4.0	-	2.0 - 3.0	2.0 - 4.0
Bit Cones, etc.	2.0- 4.0	-	-	-
General Junk	3.0 - 5.0	-	2.0 - 4.0	-
Washover Pipe	2.0 - 4.0	4.0 - 6.0	-	-

Table 77. Expected Milling Rates (ft / hr.)

12.5.2 Guidelines on Milling Junk

Guidelines for milling junk are tabulated below.

Milling Junk	Guidelines
In Open Hole	• The mill should be only 1/8" to ¼" less than the open hole diameter. • A junk sub should be placed in the milling assembly.
Inside Casing	• A non-rotating stabiliser may be run above the mill with the same OD as the mill head, which should be approximately the same as the drift ID of the casing. • At least one junk sub should be placed in the milling assembly. • No cutting action on sides of mill (to avoid damage to casing).
With a Pilot Mill	• A mill of similar diameter to the fish diameter should be used but stabiliser blades should be larger than the OD of the fish to be milled if hole conditions allow.
With a Taper Mill	• The diameter of the taper mill should be equal to the enlargement required. • Rotate slowly while entering the fish. • After the restriction has been enlarged, the rotation can be increased to 80-100 rpm while reciprocating the mill through the interval several times **Note:** The weight on the mill should be kept as low as possible. Beware of torque-up exceeding 80% of drill collar make-up torque.

Table 787. General Guidelines to Milling Junk

12.6 FISHING

This Section describes practices, tools and procedures used by GSLM during fishing jobs.

12.6.1 General Fishing Guidelines

In the event that equipment becomes lost or is stuck in the hole, the drilling should be notified immediately by the DSV. The decision to mobilise fishing specialists shall be made by the DM.

In principle, the preferred method of fishing shall be the overshot method. However, each case will be evaluated individually.

The following considerations (and questions) should be considered in deciding the optimum course of action:

- The type of equipment in the hole to be fished (drill pipe, collars, junk, bit cones, etc.).
- The fishing profile presented.
- The condition of the hole/mud. Will formation instability cause the hole to deteriorate?
- Is the fish stuck? If yes, what is causing it to be stuck?
- What is the probability of freeing the fish?
- Can tools be run inside the fish or should they be run outside it?
- Will wireline tools have to be run through the fishing assembly?
- What are the anticipated times and costs to free the fish?
- What is the optimum economic fishing time? (Economics shall be performed by the DE).
- Are there open reservoirs below the fish? Does this have any implications for well control?
- Is it necessary to run a pump out (or circulating sub) above the overshot in order that the well can be circulated in the event of a pack-off after engaging the fish?.

Classification of Fishing Tools

The table below shows a general classification of types of fishing tools and their applications.

Type of Fishing Job	Type of Fishing Tool	Names of Tools
Recovery of Tubular Fish	Connecting Tools • External catch • Internal catch • Accessories	• Overshot • Die collar • Taper tap (poor class of tool: overshot always preferable if available) • Spear (provides very good connection) • Bent drill pipe single • Hydraulic knucklejoint • Hydraulic wall hook • Wall hook
	Washover Tools	• Washover safety joint • Washover pipe • Washover shoe
	Force Multiplier Tools	• Jar, hydraulic or mechanical • Bumper sub • Surface bumper jar • Accelerator • Hydraulic pulling tool
Recovery of Fish	Disengagement Tools	• Safety joint • Bumper safety joint • External tubing/drill pipe cutter • Internal tubing/drill pipe cutter • Flash cutter (Schlumberger, etc.) • Jet cutter (Halliburton, etc.) • Chemical cutter (Schlumberger, etc.) • Electrical cable back-off (Schlumberger etc.)
Recovery of Non-tubular Fish	Information Tools	• Impression block • Free Point Indicator • Junk basket • Circulating junk basket (+ coring) • Reverse-circulate globe-type basket • Magnet • Wireline spear • Junk sub • Milling shoe • Packer retriever • Section mill • Jet bottomhole cleaner

Table 79. Classification of Fishing Tools.

The fishing equipment carried by the drilling rig shall be specified in the Drilling Contract.

Fishing Equipment

The following fishing equipment should be available at the well site or from a third party supplier:

- Overshots and oversized guides complete with baskets grapples and mill control to catch all sizes of tools in hole.
- Fishing bumper sub (18" stroke) matching with drill collar string in use.
- Hydraulic jar with matching accelerator for the drill collar string in use.
- Surface jar with matching drill pipe connections.
- Reverse circulating junk basket.
- Junk sub with the same or larger OD as the drill collar strings.
- Lead impression blocks for the various hole sizes.
- Flat mills for all hole sizes.
- Pump out sub or circulating sub.

12.6.2 General Practices

The table below defines some of the preparation to be performed before a fishing job.

Task	Preparations Before Fishing
Timing	• The maximum economical fishing time shall be determined by the DM
Recording	• All fishing tool details must be recorded on a drawing before running the tool. The safe working load for all fishing tools and associated equipment must be determined.
Equipment	• If the fishing operation involves jarring, refer to Chapter 4.5 of this Manual and remainder of this Chapter. • Internal diameters of fishing tools to be run must be checked to verify that back-off tools can pass through them. • A bumper sub should be considered for use in all fishing assemblies.

Table 80. Considerations to be Made Before Fishing

The following guidelines shall be adhered to when fishing:

- Where a twist-off has occurred, the fish should be tagged before pulling out of the hole and the pipe should be strapped on the trip out.
- If a twist-off occurs while drilling and hole conditions permit the hole should be circulated clean and mud conditioned before pulling out of the hole.
- Determine the size, shape, and condition of the fish. Ensure that a detailed drawing is sent to the DM.
- The pull must be limited to 80% of the minimum yield strength of the weakest point.
- Before connecting to the fish, the following information must be obtained:
    - Establish circulating pressures and rates.
    - String weight up/down and rotating (with and without circulation).
    - Free rotating torque of string.
    - Pipe stretch and stroke of bumper sub, jars, etc.