Appendix III: Minimum Pressure Control Equipment Standards

General BOP Arrangement

All pressure contained components of the BOP stack and related equipment shall be constructed of material that meets the standards of NACE MR-01-75 and API RP-53.

Welded, flanged, or hub connections are mandatory on all pressure systems above 2000 psi (as opposed to threaded connections).

BOP stacks should comprise at least:

1. One annular preventer.

2. One double, or two single hydraulic operated ram type preventers; one of which must be equipped with correct size pipe rams, the other with blind rams. Locking mechanisms (integral or mechanical) are required for these preventers.

3. One full opening drilling spool with two 3" bore (min) side outlets.

A single 10 gallon surge bottle will be placed near the annular preventer on the close port of the hydraulic lines.

Choke And Kill System

The choke and kill system shall provide the valves and piping required to allow controlled circulation of the well under pressure. The assembly, connections, full opening gate valves, fittings, piping, etc., subject to well or pump pressure should be flanged, clamped or welded and have a rated working pressure at least equal to the rated working pressure of the BOP. The choke and kill system shall include:

A double valve arrangement on every line/outlet of the BOP.

A hydraulically operated (HCR) valve included in the double valve arrangement on the choke line.

Lines connecting the BOP stack to the choke manifold.

A choke manifold.

A flare line connected to the choke manifold.

Choke and Kill Lines

Dedicated kill lines must not be smaller than 2" nominal and shall be fitted with two gate valves and a non-return valve. Choke lines must not be smaller than 3" through bore and are to be connected with two valves to the BOP stack of which the outer valve shall be hydraulically operated (ie HCR).

Choke lines shall be as straight as practicable and firmly anchored to prevent excessive whip or vibration. Turns, if required, should be targeted. Excessive bends in piping or 'Co-Flexip' spec hoses is not acceptable. A 'Co-Flexip' spec hose is acceptable in "straight short runs only". The hose must be placed between the hydraulic controlled valve and the flow line leading to the choke manifold.

The distance between anchoring points shall be 4 m (12 ft) or less.

Threaded connections and hammer unions are unacceptable in any section of the line.

Choke Manifold

The following recommended practices for the installation of a choke manifold shall be adhered to, as specified in API RP53 "API Recommended Practices for Blowout Prevention Systems":

a) All components should be selected in accordance with applicable API Specifications, taking into consideration pressures, volumes, temperatures and conditions under which they may be operated (i.e. gas, oil, drilling fluid, hydrogen sulphide, the environment, etc.).

b) All choke lines shall be 3" nominal diameter or larger, have a minimum number of turns and be securely anchored.

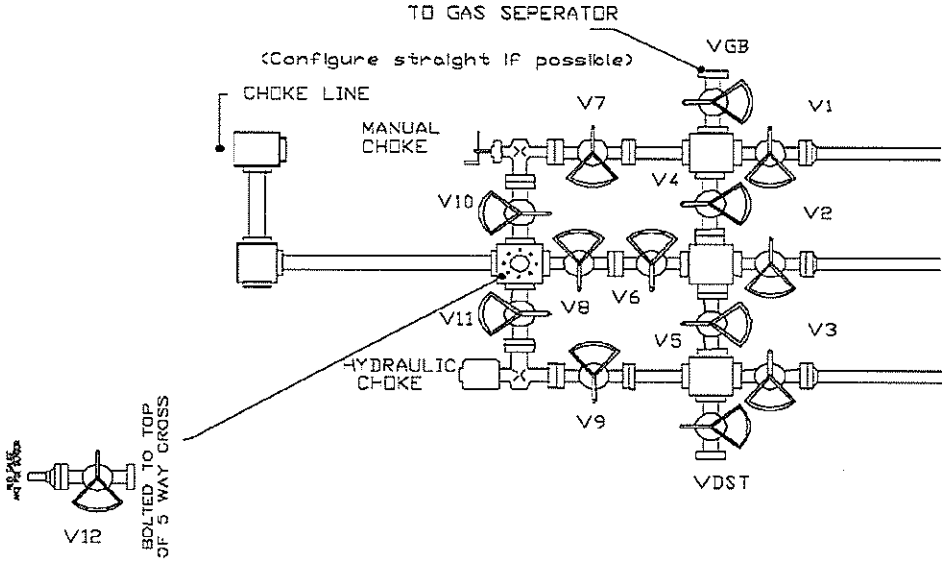

Figure 25. Minimum Choke Manifold Arrangement

c) Only right angle block turns shall be used in the choke manifold and discharge piping.

d) A 3" nominal internal diameter inlet (or larger) shall be provided into a block five way cross. The through bore of the cross will be 3" diameter (or larger) and the right angle flow paths shall be 3" diameter (or larger).

e) Outboard of the right angle flow path gate valves, will be one two inch, remotely operated hydraulic choke and one two inch, manually operated choke.

f) A pressure gauge and a remote sensor measuring the inlet pressure to the manifold shall be provided.

g) A remote choke control station shall be provided for the remotely operated choke,and must include all monitors necessary to furnish an overview of the well control situation. This includes standpipe pressure, casing pressure and pump strokes. Rig air systems must be of adequate capacity to provide the necessary pressure and volume requirements for control of hydraulically or pneumatically operated chokes and valves. A redundant automatic choke control system, which may be manually operated, should be provided in the event that rig air becomes unavailable

h) Baffle chambers not permitted – see Figure 25.

i) The flare line downstream of the choke manifold shall be 45 m (150") in length, with a minimum internal diameter of 2.7" (ie 3 ½" tubing).
In addition, chokes should incorporate a suitable bleeder valve facility to ensure that the pressure can be released prior to removal of the bonnet nut. Hammer type threaded bonnet nuts are not recommended. Flanged or bonnet clamp connections are preferred

Mud-Gas Separator

The unit vessel shall have a minimum inside diameter of 1.2 m (48") and be at least six metres (twenty feet) in length.

The top and bottom sections of the vessel shall be curved or dome topped. No flat top or bottom is acceptable. The vessel shall withstand a static pressure test of 600 psi when manufactured. Vessel will not be required to be pressure tested at regular intervals.

The mud gas separator shall be installed with a minimum 8" vent line, a minimum 4" choke manifold discharge line, and a mud seal of at least 1.5 m (5 ft) The mud gas separator discharge line (and the choke manifold discharge line) shall under no circumstances, be connected to the vacuum degasser inlet.

The following shall be met when configuring the pipework for the mud/gas separator;

- there are to be no valves, pipe expansion or contractions within 3 m (10 ft) of the inlet nozzle.
- if a bend is required in the feed pipe it shall be in a vertical plane through the axis of the feed nozzle.
- the gas outlet line reducer should be no nearer to the top of the vessel than 0.6 m (2 ft).

The mud-gas separator shall have the vent lines (8" min) leading to the flare pit (ie approx. 150' from well centre) and be manufactured from Schedule 40 (or higher) rated pipe. Low places in the vent lines should be avoided in order to prevent liquids being trapped in them.

The mud discharge line of the separator must be at least 6" in diameter and of similar pressure rating of the vessel.

A dump outlet shall be constructed at the base of the vessel and equipped with a full open valve consistent with the pressure rating of the vessel.

Vacuum Degasser
A vacuum degasser is required on all rigs. Degasser systems shall be positioned on the intermediate section of the active pits, the discharge may be allowed to flow into the suction pit. The flow capacity of this degasser must be at least equal to the maximum drilling flow rate expected in production hole (500 gallons per minute). A centrifugal type degasser is acceptable.

BOP Control Systems
Control systems for surface BOP stacks shall consist of the following:

- One independent automatic accumulator unit rated for 3000 psi WP with a control manifold, clearly showing 'open' and 'closed' positions for preventers and the hydraulic operated choke line valve. It is essential that the BOP operating unit be equipped with 0-3000 psi regulator valves similar to the Koomey type TR-5 which will not 'fail open', causing complete loss of operating pressure.

The system will be supported by two independent hydraulic power sources. These sources can be powered by rig air or electric powered pumps. These pumps will be rigged to automatically recharge the unit as the pressure in the accumulator bottles drops. Accumulator charging pump output shall be capable of charging the accumulator system from precharge pressure to operating pressure in 15 minutes or less.

The unit shall be located in a safe area away from the drilling floor. It shall include a low pressure warning alarm and hydraulic fluid level indicator or low fluid level warning alarm.

- All BOP stack installations should have at least one graphic remote control panel showing 'open' and 'closed' positions for each preventer and the pressure operated choke line valves. This panel must include a master shut-off valve and controls for regulator valves and for a bypass valve. The panel must be located near the driller's position. If the accumulator unit is not located in a safe area, a second remote panel must be available (in a safe area).

- High pressure fire-resistant control hoses with a working pressure of 3000 psi are preferred, although steel swivel joints are acceptable. The hoses should be steel wrapped (co-flex type) to provide greater resistance to fire and improved durability.

Accumulator Requirements
With an initial precharge of 1000 psi, the accumulator volume should be sized to keep at least 1200 psi on the unit (with pumps inoperative) after:

- Closing all functions
- Opening all functions
- Closing the annular
- Opening the remote operated valve

Closing systems of BOP's shall be capable of closing each ram preventer within 30 seconds; the closing time should not exceed 30 seconds for annular preventers smaller than 20".

Drillstring BOP Valves
Components for shutting in the drillpipe internally are a basic part of well control equipment. All drill string BOP valves must have a pressure rating equal to, or greater than, the BOP stack.

The following drill string BOP valves (with connections and/or cross-overs to suit the drill pipe and collars in use) shall be available on the drill floor and ready for immediate use at all times:

- A full bore Kelly Cock shall be installed at the base of the kelly.

- A ball type stabbing valve (lower kellycock), together with an operating handle for the valve, and removable handles for easy stabbing.

- A rotating type circulating head

- Inside BOP (Gray type or equivalent).

The outside diameter of the tools will be similar to the tool joint outside diameters to facilitate stripping operations.

A test sub for testing the kelly and kelly cocks shall be available on the rig.

Kick Detection And Well Monitoring Equipment
An indicating and recording mud pit level system, capable of providing early visual and audible warning of gain or loss of fluid in the well, shall be installed in those mud tanks which serve as active mud tanks. This system must be able to detect and allow shut in response by the Driller for a maximum loss/gain of 5 barrels.

The complete system must be kept in proper working condition at all times. An indicator or recording chart must be easily visible to the driller.

Other minimum requirements are below:

a) The following minimum kick detection equipment shall be available and fully operational:

- Flowline monitor
- Trip tank complete with a mechanically operated indicator of the trip tank level visible from the Driller's position. This system must be able to detect and allow a shut in response by the Driller for a maximum loss/gain of 1 barrels

b) Continuous monitoring and recording of the following parameters:

- Weight on bit and hook load
- Standpipe pressure and choke pressure
- Rate of penetration
- Mud pump rate(SPM)

CHAPTER 11
SUSPENSION AND ABANDONMENT

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11.1 OBJECTIVES

The Drilling Department shall produce "fit for purpose" suspension or abandonment designs in accordance with the standards and procedures detailed in this chapter and relevant statutory requirements and regulatory standards. The suspension and/or abandonment section of the Drilling Program shall ensure that:

- The final well status meets all relevant statutory requirements regarding zonal isolation.
- Primary well control is in place and shall not deteriorate with time.
- Cement plugs are set and tested with a minimum of delay.

The DSV shall ensure that the requirements for the suspension or abandonment detailed in the program are carried out by the Drilling Contractor in accordance with the standards and procedures contained in the following sections.

11.2 RESPONSIBILITIES

Responsibilities for the implementation, supervision and verification of suspension, abandonment and lease clean-up operations are tabulated below.

Task	Performed by	Verified by
Prepare suspension / abandonment programme (part of Drilling Programme)	DM	DM
Submit Suspension or Abandonment programme to regulatory authority for approval	DM	DM
Identify formation tops.	Mud Loggers / WGL	DSV
Execute the Suspension or Abandonment Programme	Drilling Contractor	DSV
Verify integrity of the plugs as specified	Drilling Contractor	DSV
Prepare Reports (Form F-331 and Form F-332) with diagrams	DSV	DM
Execute initial lease clean-up	Drilling Contractor	DSV

Table 66. Responsibilities for Suspension, Abandonment and Lease Clean-up

11.3 STANDARDS AND GUIDELINES

The GSLM standards for the suspension or abandonment of wells are outlined in this Chapter.

All wells that are permanently suspended or abandoned must be left in a condition that prevents the potential leakage of formation fluid to surface.

11.3.1 Well Suspension

The following standards shall apply to the long term suspension of wells:

1. To protect against ingress of wellbore pressure into the production casing, the well shall have, as a minimum, two lines of defence present of which at least one has been tested. These may include:

    - The Casing string
    - Cement filled shoe track
    - Mechanical Plug
    - Kill weight fluid

    Kill weight mud/brine can only be considered a line of defence if its weight is known and it has been tested to above leak-off to ensure there are no losses. The settling of weighting elements shall also be considered.

2. Suspended wells which have open perforations shall have all perforations isolated by a bridge plug and a cement plug depending upon the well requirements.

11.3.2 Well Abandonment

General Standard

Each well is to be evaluated individually to design the abandonment program. Abandonment of wells or sections of wells shall be conducted in such a manner that reservoir management is not compromised, hydrocarbons are prevented from migrating to surface or between zones of differing pressure regimes, and the well location is restored to its original condition or to an agreed condition. All potable water bearing, saline water bearing or hydrocarbon bearing permeable zones shall be effectively isolated from one another.

Potable Water Supplies

It is a statutory requirement that any saline water sands shall be isolated from fresh water sands in order to prevent contamination of artesian potable water supplies.

Hydrocarbon Zones

It is a statutory requirement that isolation procedures shall prevent commingling of any hydrocarbon or water producing zones.

Isolation Of Open Hole

- The open hole shall be isolated by placing a series of cement plugs (each a minimum of 50 m) to extend 25 m below into another permeable section if present, and 25 m above the top of the permeable/hydrocarbon zones (Refer to 8.10.2 for plug setting procedures).
- Only the cement plug set across the casing shoe needs to be pressure tested (LO plus 100 psi).
- Excess cement shall be 10% over caliper or 20% on theoretical volume if no caliper is available.
- In the absence of permeable/hydrocarbon zones the open hole shall be isolated by placing a cement plug across the previous casing shoe to extend a minimum of 25 m below and 25 m above the casing shoe.
- When lost circulation is anticipated, a mechanical isolation device should be set prior to setting the cement plug.

Isolation Of Hole With Stuck Pipe

- Provided that no permeable / hydrocarbon zones with cross flow potential are exposed in the stuck pipe section, the fish shall be isolated by cement plug(s) placed on top of the fish.
- In the event permeable zones do exist, attempts shall be made to isolate the annulus between the fish and the hole.

Abandonment of Casing Stubs

Casing stubs shall be isolated by a cement plug designed to extend a minimum of 25 m below the stub to a point 25 m above the stub. Alternatively a bridge plug can be set 15 m into the stub. In either case plugs must be located (tagged) and weight tested as a minimum and 25 m of cement plug set on top of a bridge plug.

Surface Cement Plugs

A surface cement plug of at least 15 m shall be placed in the smallest diameter casing string exposed at surface.

11.4 WELL SUSPENSION

The following standards shall apply to the long term suspension of wells:

- The well shall have a minimum two lines of defence present, of which at least one shall have been tested. These barriers may include:

Casing	Annulus
Cement filled shoe track	Cement filled annulus
Mechanical Plug	Annulus seal
Hydrostatic Head of kill weight fluid	Hydrostatic Head of kill weight fluid
The Casing string	

  Kill weight mud / brine can be considered a barrier, provided that its weight is known and it has been tested to above leak-off to ensure that there are no losses. The settling of weighting materials in the fluid shall also be assessed in determining the effectiveness of the fluid as a barrier over an extended period.

- All open perforations in suspended wells shall be isolated by a bridge plug and a cement plug (except where completion's have been run).
- If production casing is run, the well shall be suspended by installing an appropriate tubing spool.
- The wellhead or tubing spool shall be sealed by the installation of a blind flange or X-mas tree.

11.4.2 Procedures

If a well is to be temporarily suspended, the outline procedure below shall be followed:

1. Cement casing with top of lead cement a minimum of 150 m above the top of the previous casing shoe and the top of the tail cement 65 m above the uppermost hydrocarbon reservoir.
2. Pressure test the casing (as per the program).
3. Install tubing spool and companion flange (DO NOT energise the X-bushing at this stage).
4. Grease and cap off ring groove.

11.4.3 Minimum Mechanical Barrier Summary

The following minimum mechanical barriers are required prior to nippling down the BOP.

Borehole Location	Barrier
Annulus	1. Casing pack-off (slip and seal assembly / Tubing hanger). 2. Cement 150 m above the previous casing shoe
Wellbore	1. Wellhead 2. Kill weight fluid, and/or 3. Shoe track cement

Table 67. Minimum Mechanical Barriers - Suspension

11.4.4 Reporting

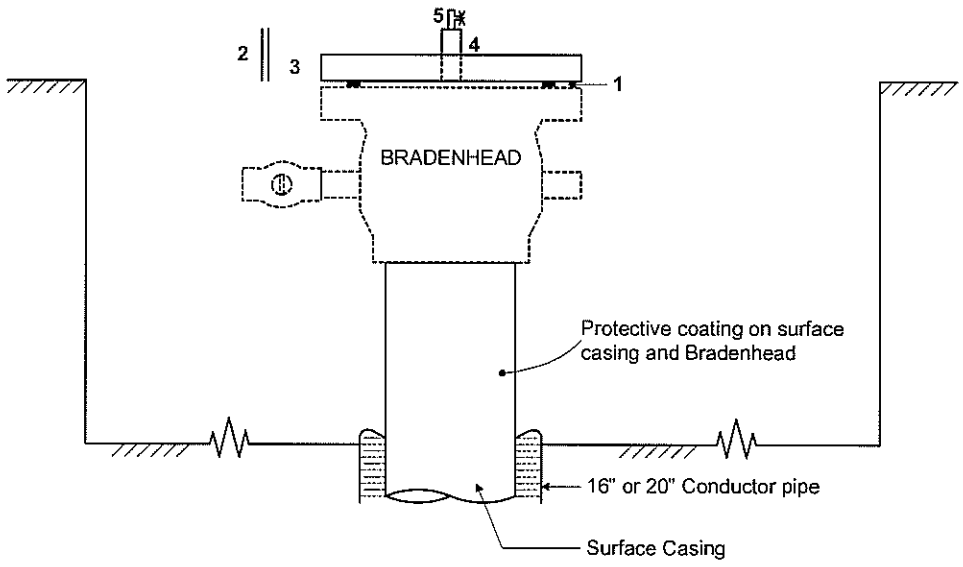
Upon completion of the suspension operations the DSV shall prepare the Wellhead Installation Report.

11.4.5 Suspension Schematics

The requirements for suspension and well status schematic diagrams are illustrated below for the following cases:

- Surface casing in place (2 string).
- Surface and intermediate casings in place (3 string).

WELL SUSPENSION
SURFACE CASING SET - (2 STRING)

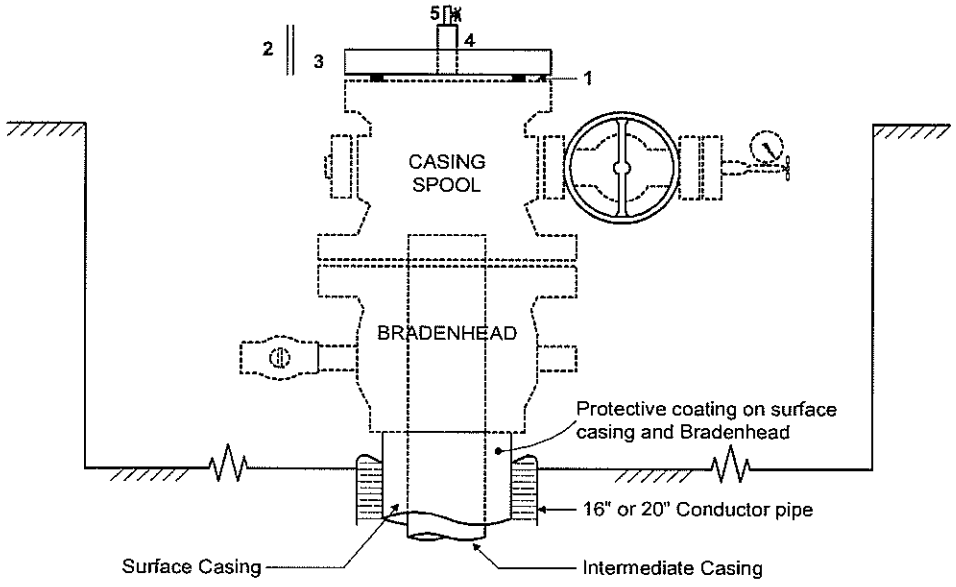


MATERIALS REQUIRED

ITEM NO.	QTY.	DESCRIPTION
1	1	RING GASKET
2	As required	STUDS C/W NUTS
3	1	FLANGE TAPPED 2" L.P.
4	1	BULL PLUG 2" L.P. TAPED TAPPED ½" N.P.T.
5	1	NEEDLE VALVE ½" N.P.T. MALE X FEMALE

Figure 26. Well Suspension Schematic - Surface Casing in Place

WELL SUSPENSION - SURFACE & INTERMEDIATE CASING SET (3 STRING)



MATERIALS REQUIRED

ITEM NO.	QTY.	DESCRIPTION
1	1	RING GASKET
2	As required	STUDS C/W NUTS
3	1	FLANGE TAPPED 2" L.P.
4	1	BULL PLUG 2" L.P. TAPED TAPPED ½" N.P.T.
5	1	NEEDLE VALVE ½" N.P.T. MALE X FEMALE

Figure 27. Well Suspension Schematic - Surface and Intermediate Casings in Place

11.5 WELL ABANDONMENT

11.5.1 Standards

The following standards shall apply to the abandonment of wells:

- Cement plugs should be set to isolate hydrocarbon zones, fresh water zones and zones containing saline water. Cement plugs should also be set across the previous casing shoe and at surface

  The open hole plugs shall extend 25 m below, into another permeable zone if present, and 25 m above the top of the permeable / hydrocarbon zones. Each plug should be a minimum of 50 m in length.
- Only the cement plug set across the previous casing shoe needs to be pressure tested (to LOT plus 100 psi.).
- Excess cement shall be 10% over caliper, or 20% on gauge hole if no caliper is available.
- In the absence of permeable zones the open hole shall be isolated by placing a cement plug across the previous casing shoe to extend a minimum of 23 m below and above the casing shoe. This plug should be pressure tested (LOT plus 100 psi).
- A surface cement plug of at least 15 m shall be placed in the smallest diameter casing string exposed at surface and between any casing strings not cemented to surface.

11.5.2 Procedures

When a well is to be permanently abandoned without running the production casing string, the outline procedure shall be as follows:

1. Set open hole cement plugs as required (see Chapter 8.10 of this Manual for plug setting procedures).
3. Set a 50 m cement plug across the previous casing shoe.
4. Pressure test casing shoe plug (LOT plus 100 psi).
5. Set surface cement plug 15 m (50') thick.
6. Nipple down the BOPs.
7. Remove casing spool and Bradenhead (see Spool Removal, below).
8. When the rig has been moved, install the Plug and Abandon Marker Plate. The Standard Marker Plate format is shown in Section 11.5.5.

11.5.3 Minimum Mechanical Barrier Summary

Borehole Location	Barrier
Wellbore	1. Surface cement plug 2. Casing shoe cement plug – must be pressure tested to LOT plus 100 psi. 3. Open hole plugs as required

Table 68. Minimum Mechanical Barriers - Abandonment

11.5.4 Removal of Wellhead Equipment

The following wellhead equipment shall be removed as applicable.

Removal of Spool

When removing the spool, wellhead equipment shall be handled assuming that it is suitable for refurbishment. The following shall occur:

1. The Spool and/or Bradenhead shall be removed (regardless of condition).
2. The Spool and/or Bradenhead shall be protectively packed and returned to the logistics base for a final decision on whether the item is to be refurbished or scrapped

Surface Casing in Place (2 hole section well)

On completion of the Abandonment Programme and removal of the BOP's, the Bradenhead shall be removed in one of the following ways:

- Back off the Bradenhead, if not welded.
- If welded cut the surface casing a minimum of 6 inches below the Bradenhead.

Surface and Intermediate Casings in Place (3 hole section well)

On completion of the Abandonment Programme and removal of the BOP's, the Spool and Bradenhead shall be removed in one of the following ways:

- Cut two diametrically opposed windows in the surface casing to allow cutting access to the intermediate casing. The windows should each extend for a maximum of 1/4 of the surface casing circumference, and the tops should be a minimum of 6" below the Bradenhead.
- Cut the intermediate casing, lift and remove the Spool.
- Remove the Bradenhead as above.

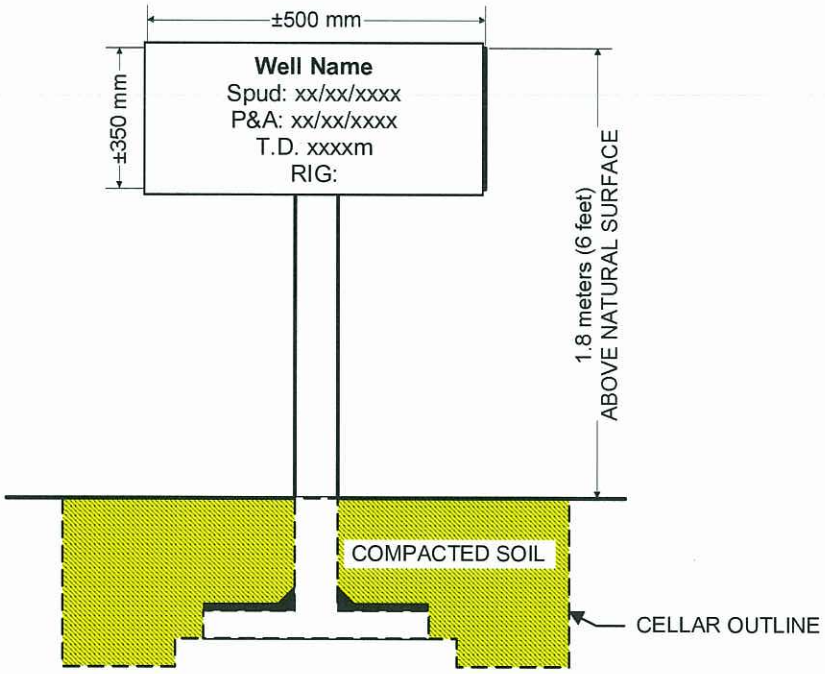
Reporting

Upon completion of the abandonment operations the DSV shall prepare the Well Abandonment Report.

11.5.5 Abandonment Schematic

A standard Plug and Abandon Marker Plate format is given in the figure below.

MARKER PLATE - P&A WELLS



1. Riser pipe to be minimum 2" O.D., welded to base plate fixed to 13-3/8" or 9-5/8" casing stub.
2. Top of I.D. plate to be 1.8 meters (6' 0") above natural surface (ie: after cellar filled in).
3. I.D. plate to be approx. 500 mm wide x 350 mm high (20" x 14") with well data bead welded as per above example.

Figure 28. Standard P & A Marker Plate Format

11.6 LEASE CLEANUP AND WASTE DISPOSAL

The following Sections provide a summary of the guidelines given in the lease preparation procedure.

11.6.1 Initial Lease Clean-Up

The DSV shall organise the following initial clean-up of the lease area at or near the time the rig is released. The following work is to be completed prior to the last personnel leaving the site.

- Any water remaining in the Turkeys Nest is to be pumped out so that the maximum amount of plastic pit liner can be recovered. The recovered liner is to be used on the next well location as protection between the shaker tank and the sump. If the water in the Turkeys Nest is required for completion operations the liner should be left in place. The DS will advise if this is required.
- Biodegradable rubbish should be placed in garbage bags, put in the correct segment of the rubbish bins and sent to the appropriate disposal depot.
- For plugged and abandoned wells, the rathole, mousehole and cellar must be filled to the level of the lease surface and compacted.
- For completed and suspended wells, the rathole and mousehole must be filled and compacted, the cellar ring removed and the cellar left unbackfilled.
- All recyclable materials are to be removed from the site and sent to the nearest Waste Management Depot for appropriate disposal.
- Any exposed or re-usable plastic which is lining the area by the shaker tank shall be removed and disposed of in the correct section of the rubbish bins. All other exposed plastic shall be cut off below the surface level in order to be covered once the sump is backfilled.
- A well identification plate (Marker Plate) shall be fabricated and securely installed where it is clearly visible (also see Section 11.5.5 above).
- The site must be cleared of all equipment and materials.
- An Initial Lease Clean-up Report shall be completed.

11.6.2 Final Lease Clean-Up

The drilling manager shall organise for the final clean-up to be conducted. This will include fencing the sump etc as part of the preliminary restoration. Final clean up will restore the lease to as close to original condition as practical.

CHAPTER 12
SPECIAL OPERATIONS

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12.1 OBJECTIVES

This Chapter provides an overview of the equipment and procedures used in non-standard drilling operational circumstances. These may be applicable to following personnel:

- Drilling Operations staff.
- Drilling Contractors.
- Specialist subcontractors.

The information contained in this Chapter can be used to improve the understanding of non-standard activities, and identify the alternative methods available.

12.2 RESPONSIBILITIES

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

Task	Performed by	Verified by
Stuck Pipe		
Address potential problems in the Drilling Programme	DM	DM
Conduct drilling operations to avoid stuck pipe	Drilling Contractor	DSV
Troubleshoot and free stuck pipe	DSV/ Drilling Contractor	DM
Run free point indicator logs	Logging Contractor	DSV
Back-off pipe	Logging/ Drilling Contractor	DSV
Decide to sidetrack	DSV/DM	DM
Stuck Logging Tools		
Ensure fishing equipment for all programmed logging tools available on site	DSV	DM
Notify Hobart office of stuck logging tools	DSV	DM
Decide on fishing method	Logging contractor/DSV	DM
Perform fishing operation	Drilling Contractor/ Logging Contractor	DSV
Milling		
Maintain list of milling equipment available at the wellsite / logistics base	DSV	DM
Notify Hobart office of milling requirements	DSV	DM
Decide to mill	DSV/DM	DM
Perform milling operations	Drilling Contractor	DSV
Fishing		
Maintain list of fishing equipment available at the wellsite/ logistics base	DSV/DM	DM
Notify Hobart office of stuck pipe or lost equipment in hole	DSV	DM
Decide to fish	DSV/DM	DM
Mobilise fishing specialist	DSV/DM	DM
Perform fishing operations	DSV / Drilling Contractor / Fishing Specialist	DM
Air Drilling		
Operate and maintain air drilling package	Air Drilling Contractor	DSV
Supervise drilling operations	DSV	DM

Table 69. Responsibilities for Special Operations