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**SHITTIM 1A
STRATIGRAPHIC SLIMHOLE DRILLING PROGRAM**

**CONTINGENCY WELL PLAN
BLOWOUT PREVENTION AND WELL CONTROL
RIG SAFETY AND EMERGENCY RESPONSE**

**FOR
CONDOR OIL INVESTMENTS PTY LTD**

FL 1/88

94-3659

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Shittim 1A
Contingency Well Plan

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Shittim 1A
Contingency Well plan

WELL LOCATION AND CONTRACTOR COMPANIES

Well Name	Shittim 1A	Shire	
Location	Nth Bruny Island	Coordinates	533 000E 5215 000N
State	Tasmania	Elevation	25m ASL
		Datum	Footclamps
		Rig Make	UDR 1500
Anticipated Spud Date	January 1995	Projected Depth	1,000 m

OPERATOR	CONDOR OIL INVESTMENTS PTY LTD BLACKMANS BAY TASMANIA TEL (002) 296 576, FAX (002) 292 153
COMPANY REPRESENTATIVE	MR MALCOLM BENDALL
DRILLING CONTRACTOR	PONTIL PTY LTD DRILLING CONTRACTORS JANNALI RD DUBBO NSW 2830 TEL (068) 884 2722 FAX (068) 842 697
DRILLING ENGINEERING	PECTIL ENGINEERING SERVICES TEL (09) 481 3322, FAX (09) 481 3330
DRILLING SUPERVISOR	EDWARD C. MCNALLY
GEOLOGICAL SUPERVISOR	DR CLIVE BURRETT
DRILL FLUID ENGINEERING	PECTIL ENGINEERING SERVICES
GEOPHYSICAL LOGGING	WHEN REQUIRED BPB AUSTRALIA
MUD LOGGING	WHEN REQUIRED BY EXLOG
CASING	PONTIL
CEMENTING	PONTIL
SURVEYING	PONTIL
BLOWOUT PREVENTER STACK	PECTIL ENGINEERING SERVICES
PRODUCTION TESTING	WHEN REQUIRED BY HALIBURTON

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Shittim 1A Well Configuration

	Hole Size	Casing Size	OD (in)	OD (mm)	ID (in)	ID (mm)	Weight (kg/m)
Conductor	8.5"	PW	5.5	139.7	4.94	125.5	23.14
Surface Hole	5.5"	HW	4.5	114.5	4.00	101.4	16.83
Intermediate	3.782"	HQ	3.5"	89.0	3.063	77.8	11.45
Objective Hole	2.98	NQ	2.76	70.0			

Shittim 1A Drilling Program

	Hole Size	Casing Size	Drilling Method	Max Depth	Mud System	Bit
Conductor	8.5"	PW	Mud Rotary	Consolidation	FW/Gel	Tricone
Surface Hole	4.875"	HW	Mud Rotary	150 m	FW/Gel	Button Tricone
Intermediate	3.782"	HQ	Diamond Core	<450 m	Brine Polymer	Impregnated
Objective Hole	2.98	NQ	Diamond Core	1,000 m	Brine Polymer	Impregnated

Shittim 1A Geological Prognosis

Depth	Formation	Lithology
0 - 20m	Minnie Point Formation	sandstone/siltstone
20 -- 50m	Deep Bay Formation	fossiliferous mudstone
50 - 400m	Dolerite	
400 - 450m	Deep Bay Formation	fossiliferous mudstone
450 - 550m	Bundella Formation	fossiliferous mudstone
550 - 700m	Woody Island Siltstone	mudstone
700 - 1000m	Truro Tillite	tillite
	Unconformity	
>1,000m	Precambrian	schists

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UDR 1500 DRILL RIG DESCRIPTION

Drill	Universal 1500 all Hydraulic Top Drive
Mast	16 m length with 12 m rod pull capacity
Power	172 kW GM 6-71N Diesel, 2100 rpm
Rotation Head	Top drive direct couple. High-Low manual gear range 5-380 rpm low range, 380-1500 high range Stepless speed range
Rotation Head Torque	Max 6,800 Nm low range, 360 Nm @ 1,500 rpm high range Fully automatic torque speed control running diamond bits at maximum 50 mm (2") ID floating hollow spindle, jet lubricated gears and bearings possible rpm using maximum available horsepower
General Features	Water to oil heat exchanger.
Head Traverse	Hydraulic cylinder over chain with 7.32 m of traverse Max traverse speed 24 m/min up and 18 m/min down Hydraulic head racks back in top mast
Pull Down	7,000 kg
Pull Up	15,000 kg
Water Pump	2 * FMC Bean triplex pumps Rated 140 LPM (36 USG/min), 7,000 kPa (700 psi)
Rod Breakout	Hydraulic Rigid Stillsons 9,500 Nm makeup torque, 12,000 Nm breakout torque
Rod Clamps	44.5 mm (1.75") to 168.3 mm (6.625") in rod clamps with 8.75" clamp opening Hydraulic, self energizing with hammer wrenches and bit baskets
Wireline Winch	2,000 m of 10 mm (3/8") wire rope. 1,800 kg full drum pull at 260 m/min
Hydraulics	Axial and radial piston pumps designed with 3 independent open loop circuits (Main - Water - Cylinders)

Rig Depth Rating

Drilling Method	Hole Size	Rod Size	Rated Depth	Diamond Core
Air/DHH	127 mm	73 mm	816 m	
Mud rotary	165 mm	89 mm	663 m	
Diamond Core	122.6 mm	117.5 mm	900 m	PQ
	96.0 mm	89 mm	1,200 m	HQ
	75.7 mm	70 mm	1,800 m	NQ
	60.0 mm	56 mm	2,300 m	BQ

Rig Dimensions	Weight	Length	Width	Height
	19,500 kg	16 m	2.5 m	3.6 m
	Bare drill on hydraulic jackup tray			

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DRILLING SCHEDULE AND ESTIMATED EXPENDITURE

Activity	Hours	Cost
Intangible Items		
Rig Mobilisation Dubbo to Bruny Is	(72)	\$7,500
Establishment unpack / rig up	(12)	\$2,500
Drill and set conductor pipe	0	
Mud rotary drilling to 150m surface HW casing point.	36	\$5,250
Conditioning hole	12	\$6,000
Run and cement surface HW casing	18	\$4,500
Install and test Blowout Preventer	12	\$3,000
Diamond HQ core drill to <450m intermediate casing point.	36	\$35,000
Condition hole	36	\$9,000
Run and cement intermediate HQ casing	18	\$4,500
Install and test Blowout Preventer	6	\$1,500
Diamond NQ core drill to Total Depth	165	\$57,600
Condition hole	24	\$6,000
Surveying	4	\$1,000
Cement abandonment plugs	24	\$6,000
Disestablishment rig down / packup	(12)	\$2,500
Demobilisation Bruny Is. to Dubbo	(72)	\$7,500
Miscellaneous Intangibles		\$3,000
Tangible Items		
BOP		\$6,000
Drill Fluids		\$5,546
Casing and Cement		\$11,880
Management		
Consultant Drilling Supervisor		\$7,500
Consulting Geologist		\$3,500
Totals	<u>24 days</u>	<u>\$196,696</u>

Anticipated Drilling Rates

Rig Hourly Rate \$200 and \$250/hour

Drilling Rates

Pre-Collar	Depth	Cost	4 7/8"	Depth	Cost
	0 - 100m	\$24/m	Rotary Drilling	0-100m	\$28
	100 -200m	\$28/m		100-200m	\$30
				200-400m	\$35
HQ Coring	0 - 600	\$69/m	NQ Coring	0 - 600m	\$68/m
	600 - 800m	\$90/m		600 - 800 m	\$79/m
	800 - 1000 m	\$100/m		800 - 1200 m	\$90/m
				1200 - 1600 m	\$100/m

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CONTRACTS SUMMARY

Description

Supplier

Location access, site survey and restoration
Mobilisation / Demob
Establishment / Disestablishment

Condor Oil Investments Pty Ltd
Pontil Drilling Contractors
Pontil Drilling Contractors

Water trucking
Water bore and materials

Hazel Brs. Construction
Pontil Drilling Contractors

Well site drilling supervisor
Rig Hire
Wages and on costs
Camp hire and catering

E. C. McNally
Pontil Drilling Contractors

Fuel & lubricants

Hazel Brothers Construction
Pontil Drilling Contractors

Mud chemicals and engineering

Baroid/AMC (Tasmania)

Communications
Miscellaneous intangibles

Pontil Drilling Contractors

Cement and chemicals
Cementing plant rental
PW, HW & HQ Casing and casing handling
Casing tooling

Readymix
Pontil Drilling Contractors
Pontil Drilling Contractors
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DST tool rental

Lynes as required

Core equipment
Core handling and core analysis

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Portable cellar
Blowout preventer equipment rental
Kill and test pump
HW well flange

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Downhole drill and casing tooling
Ancillary surface mud handling equipment rental
Ancillary mud surface equipment
Mud logging
Geophysical wireline logging

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Pontil Drilling Contractors

Exlog Gas Detector
BPB Australia as required

Materials transport
Personnel transport

Hazel Brothers Construction
Hazel Brothers Construction

Rig Insurance
Well overheads (3%)
Well Insurance
Office and administration

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DRILLING PROGRAM

Introduction to Wireline Diamond Core Drilling Practice

Wireline retrieval coring is integral to most stratigraphic drilling programs and frequently proceeds after setting and cementing the surface casing to the end of hole.

The wireline retrieval system permits core to be recovered while drilling without the necessity for tripping the drill string. This recovery system had its origins in the oil field where it was first developed to recover core inside the drill pipe. Core could be recovered on the drill floor without the time consuming and costly operation of tripping the drill string.

Later the Longyear Company in the USA further refined this tooling for the mineral drilling industry. Wireline retrieval tooling they developed is designated by the letter Q when describing the size of a hole. The common sizes used for slimhole drilling are BQ, NQ, HQ and PQ (see Table 3D & Table D4 of the Appendices). More recently this company has developed a line of heavy duty wireline tooling for use in three hole sizes. The tooling sizes are designated CHD 76, CHD 101 and CHD 134.

The priority for formation data collection is placed on core analysis techniques and is not restricted to the mud logging of drill cuttings or wireline geophysical log interpretation.

Geological stratigraphic evaluation may be more useful to development of the understanding of hydrocarbon resources of a permit at an early stage of exploration and oil companies may wish to use coring to determine reservoir, source, biostratigraphic, petrographic, stratigraphic and structural studies.

In circumstances where seismic exploration is being planned a core drilling program may be useful assisting subsurface control

Slimhole core drilling operations for oil and gas exploration are being increasingly applied for wildcat exploration in Europe, Canada, America, Asia and Australia and it is usual for 90% of a well is recovered as core. Using conventional oil drill rigs for this work would be prohibitively expensive.

In Australia Western Mining Corp in the central Canning Basin of Western Australia, CRA-Pacific Oil & Gas in the McArthur and Gorgina Basins of the Northern Territory and Shell Company of Australia in Queensland have all conducted slimhole continuous coring exploration drilling programs in recent years. The uphole and objective intervals in these areas were all cored and 90% successful recovery was achieved.

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DRILLING OPERATIONS PROCEDURES

Precollar Hole

Drill 8 1/2" hole on HW drill rods to indurated depth
Set and cement PVC precollar casing.

HW Drilling

Pick up 5 1/2" tricone bit on HW rod string
Drill 5 1/2" hole to HW casing point.
If dolerite is hard drill to reliable HW casing point with diamond core assembly
Run and Cement HW casing
Make up HW BOP and pressure test to schedule

HQ Coring

Make up HQ core barrel assembly to drill 3 7/8" hole to
Run in hole and tag top cement plug
Core drill cement plug and cement in the rat hole.
Core drill to HQ casing point.
Make up Run and cement HQ casing string

NQ Coring

Make up well BOP assembly for NQ rods and run pressure test schedule
Make up NQ core barrel assembly to core drill from HQ casing shoe
Run in hole and tag cement plug
Core drill cement plug and cement in rat hole
Core drill to end of hole

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DRILL FLUIDS PROGRAM

Introduction

Contractors charge operators for mud consumables landed at the location and are responsible for the design of the mud system and its maintenance. Coring muds are normally built using polymers to increase viscosity and hole cleaning properties of the mud. The contingency program below describes the use of weighted muds that may need to be used in the event that abnormal pressure is encountered while drilling the HQ or NQ hole. A mud scales and Marsh funnel will be supplied by the supply company.

Precollar Hole

Drilled 8 1/2" using water

HW Drilling

Fill three mud tanks with fresh water and treat out hardness with caustic soda and soda ash
Make up fresh water gel mud. Bring the viscosity to 60 sec with Pac polymer

Weight up tanks 1 and 2 with barytes. Bring the weight to 1.5 SG

Pick up 5 1/2" tricone bit on HW rod string. Displace mud via the hole while drilling from mud tank 3.
Continue to build mud in tank 3. as the drilling proceeds.

If the well is pressured displace the hole using the weighted mud in tanks 1 and 2.

Maintain the mud density below 1.1 SG and maintain a viscosity from 36 to 40 sec.
Condition pit mud in tank 3 while drilling.

Run desander/desilter from suction sump pit as required

HQ Coring

Discard HW drilling mud in the mud pits.

Maintain tanks 1 and 2 with weighted drilling mud while HQ coring.

Make up the brine tank with water and saturate with salt. Circulate the tank with the Gardner Denver Pump to achieve saturation. Maintain the saturated brine for use to displace the hole while HQ coring.

Core drill out of the cement shoe using water

Make up tank 3 with fresh water, treat out hardness and build polymer mud. Build viscosity from 36 to 40 sec and displace to the hole while core drilling in new formation. Continue to build mud in tank 3 as drilling proceeds.

Maintain the mud density below 1.1 SG and maintain a viscosity from 36 to 40 sec.

Condition pit mud in tank 3 while drilling. If underbalanced transfer the brine to the hole and continue to build a brine polymer drill fluid in tank 3. Continue to saturate the make up water in the brine tank while circulating with the Gardner Denver pump.

To control pressure displace the weighted mud in tanks 1 and 2 to the hole

Run desander/desilter from suction sump pit as required

NQ Coring

Continue to build and run the mud as for HQ core drilling procedures

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DRILL FLUIDS PROGRAM

Materials Inventory

Chemicals	Unit	Cost	Quantity
Weight Agent			
Barytes	2000kg		
Salt			
Calcium Chloride			
Viscosifier			
Gel	25kg	\$648	1,200kg
Quick mud (liquid polyaclyamide)	250kg (drum)		
Deflocculants			
QBroxin			
QB2			
Invirothin	50 lb	\$270	250 lb
Visco-Filtration Agent			
AquaPac	50 lb	\$3,960	1,000 lb
Pac-R (cross linked polymer)			
XC Polymer			
Inorganic Agents			
Magnesium Oxide	25kg	\$342	100kg
Caustic Soda	25kg	\$198	100kg
Soda Ash	25kg	\$128	100kg
Bicarbonate	50kg		
Total Cost		\$5,546	

Supply

Baroid Australia Contact Gus Van der Hyde Tel (03) 621 3311
AMC Contact John Quale Tel (09) 417 5001

Surface Plant

Mud Tanks	
3 x 2,000 litre mud tanks	Desander
1 x 2,000 litre brine and cement tank	
1 x 2,000 litre suction ground sump	3 x 3" centrifical mix pumps
1 x 2,000 litre discharge ground sump	mud hopper
2 x FMC 36 Bean rig mud pumps rated 1,200 psi	1 x 5 x 6 Gardner Denver Duplex Pump
1 x FMC 60 Bean kill pump rated 1,500 psi	(3" Liners, rated to 1120 psi @ 400 rpm)
NPT Mudline manifold	

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CASING & CEMENTING

The well casing plan is shown on page 4 of this report. The published dimensions and physical properties of the drill rods and casing used are described in Table D3 and D4 of the Appendices. A casing design program to consider the physical yield, collapse and burst properties of the rods and casing would not usefully develop the program.

A cementing program has been prepared using Class A cement properties tabled in "Drilling Data Handbook" 1978 Editions Technip.

No program for the abandonment of the well is included at this time.

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CASING AND CEMENTING

Materials Inventory

Cementing Unit

Gardner Denver 5x6 with 3" liners
Rated 1120 psi @ 400 rpm displacing 183 US gal/min

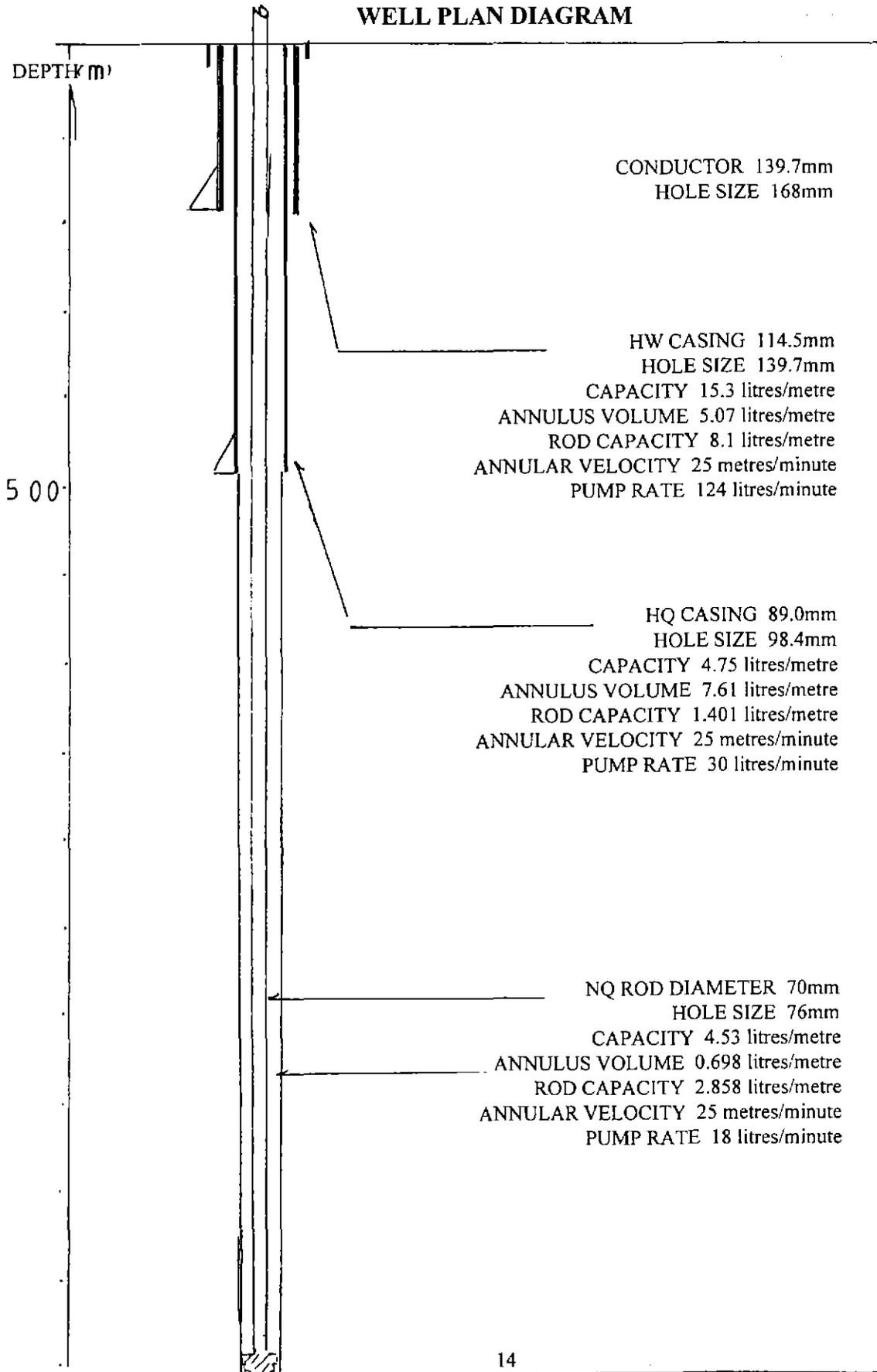
		Cost
Cementing Materials		
HW Casing Cement	30 Sacks Class A cement	\$180
HQ Casing Cement	45 Sacks Class A cement	\$270
Cement Additives		\$50
Abandonment Cement Plug		
Bottom Plug	Sacks Class A cement	\$5.95/sack \$
Casing Shoe Plug	Sacks Class A cement	\$5.95/sack \$
Top Plug	Sacks Class A cement	\$5.95/sack \$
Casing Materials		
PVC Conductor Pipe	6m	\$20 \$120
HW Casing Rods	150m	\$32/m \$6,400
HQ Casing Rods	<450m	\$28/m \$12,600
(HQ Recovered)	(400m)	\$20/m <\$8,000>
HW Casing shoe (optional)		
HQ Casing shoe (optional)		
HW Van Ruth Cement Wiper Plug		\$30
HQ Van Ruth Cement Wiper Plug		\$30
HW Van Ruth non return valve		\$100
HQ Van Ruth non return valve		\$100
Total Cost		\$11,880

Note

Cost of cementing abandonment plugs has not been determined.

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WELL PLAN DIAGRAM



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BLOWOUT PREVENTION AND WELL CONTROL

The Shittim 1A drilling program is to include the use of blowout prevention equipment. This blowout prevention and control program has been included in the well fore program as a contingency in the event abnormal over-pressure is encountered downhole.

This Blowout Prevention and Control Program has been prepared from Part 5 of Pectil Engineering's Slimhole Drilling Technology Manual. The manual describes manifestations of well pressure and sets the procedures to be followed by crews working for an operating company to control this pressure safely using previously tested blow out control methods.

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BLOWOUT PREVENTION AND WELL CONTROL

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BLOWOUT PREVENTION AND WELL CONTROL

Introduction to Pressure Control Engineering

Necessary rapid response to emergency situations may best be accorded when drilling crews are trained to react instinctively to implement actions which effectively prevents a situation from becoming unmanageable.

Where practical a well plan should identify those intervals in the well which have a history of abnormal formation pressure manifested either as lost circulation, as highly compacted and sloughing sediments or as highly pressured fluids which may cause a problem to the normal drilling activities undertaken. The investigation should seek to anticipate such problems for well intervals and so assist in designing casing strings as well as drilling procedures to provide the drilling programme, economy and safety in operations.

Supervisors need to provide regular crew drills to enact these procedures so each person on a location is fully practised as to his responsibilities and actions during such an emergency. Drilling crews are reminded that first response is most often a responsibility of the Contract Drilling Company performing operations at the site and that in the normal course of drilling the contractor's personnel will carry on all operations to secure well control.

The first responsibility of a rig crew in an emergency is to preserve personnel at the site from injury or loss of life. The consideration, that the most common cause for loss of life and property on oil and gas drilling rigs in the past has resulted from human error and not through equipment failure, should indicate the importance for carrying on regular drills in safety training on a location.

Our priority is to educate crews in understanding the principles, procedures and specification of equipment employed for safe handling of an emergency response as well as the necessity for communicating all appropriate details through correctly identified channels. Communication procedures for crews are those which have been identified with the operating company representative at the site during the course of a contract drilling programme.

The following section, 'Abnormal Formation Pressure', identifies the origins and indications for abnormal borehole pressure, causes for loss of control in a well bore when encountering abnormal pressure and procedures for carrying out flow checks to detect a kicking well.

Thereafter, 'Well Control Procedures', for handling HW/HQ/NQ rod strings are described

Well Kill Methods which include the 'Driller's Method' and the 'Wait and Weight Method' to shut in and kill the well to prevent a blowout.

Origins of Abnormal Formation Pressure

Formation pore pressure has often been classified as normal where it is equivalent to a normal sea water gradient of 0.1073 kgf/cm² / metre and subnormal when less than this. Abnormal over-pressured formations may be in excess of 0.2353 kgf/cm² / metre in some sedimentary basins of the world. In such extreme cases the over-pressure arises out of a condition in which formation pore fluids are supporting part or all of the rock overburden. The reasons for this condition are not always fully understood but most explanations argue that incomplete diagenetic compaction during burial of the sediments or geo-tectonic pressuring after compaction and burial is responsible.

Indications of Abnormal Formation Pressure

There are a number of seismic and wireline methods for predicting abnormal pressure in formations which may be employed when planning a well and there are a series of well documented indicators for the onset of abnormal pressure that may be observed when drilling a well. A number of warning signs can be observed at the surface when drilling which will indicate the onset of a kick. It is the responsibility of crew members to recognize these warning signs and act correctly and promptly to recover such a situation.

Early indicators are listed as follows-

1. an increase in the pit volume
2. a sudden increase in the drilling rate
3. an abrupt increase in bit torque
4. a reduction in pump pressure

BLOWOUT PREVENTION AND WELL CONTROL

5. an apparent increase in drill string weight
6. complete or partial loss of circulation
7. decreasing shale density

Secondary indicators which may forewarn of a kick include contamination of the drilling fluid by;

- gas cut
- water cut
- variation in mud chlorides indicating water cut above
- increasing mud temperature
- increasing trip gas and connection gas

Causes of Loss of Control of Abnormal Pressure

Kicks, lost circulation or blowouts may occur where formation pressure in the formation drilled is higher than or less than the hydrostatic pressure of the drilling fluid in the well bore. Such an imbalance may permit formation fluids to invade the well and produce a kick at the surface which may develop into a blowout of the well. In circumstances where the formation pressure is less than hydrostatic pressure an under-balanced condition exists and if porous or cavernous rock is being drilled, fluid may be lost to the formation. The loss of hydrostatic pressure arising out of this condition may permit the escape of formation fluids from higher formations into the well bore and similarly cause a well kick or blowout.

Present drilling practice requires maintaining near balanced mud densities and at the same time ensuring hydrostatic pressure is sufficient to control formation pressure. A rule of thumb often employed has been to control mud density to that required for balancing formation pressure plus enough weight to provide for the trip margin.

Australian land drilling operations are frequently complicated where formation pressures will not support the hydrostatic pressure exerted by a drilling fluid and partial or total loss of returns occurs in porous or cavernous surface and intermediate hole.

Less frequently, and often together with a lost circulation event, complications to drilling operations arise through formation pressure exceeding the mud hydrostatic pressure in a well. The causes for kicks are listed below;

1. insufficient mud density
2. failure to keep the hole full of fluid
3. swabbing
4. lost circulation
5. abnormal Over-pressure
6. equipment failure

Insufficient Mud Density:

The condition may occur when drilling into a zone with a drilling mud that is providing less hydrostatic pressure than the formation fluid. Where the formation is permeable, fluids will flow into the well bore. The fluids (gas or water and hydrocarbons) will cut the density of the drilling fluid and compound the condition. Increasing the density for control will not always be a satisfactory remedy since high mud densities may exceed formation fracture gradients and cause lost circulation. Excessive mud densities reduce penetration rates and can lead to the differential sticking of the drill rods and they can damage zones for investigation.

Failure to Keep the Hole Full of Fluid:

Most blowouts recorded have occurred during the pulling of pipe from the hole. Blowouts have resulted through not filling the hole with sufficient mud to replace the drill string volume that is withdrawn from the hole. The influence of swabbing while tripping together with the reduction of hydrostatic pressure from incorrect filling of the hole is the most common cause for rig misfortune and tragedy. The situation is avoided through care to make sure that the correct volume of fluid is being returned to the well after pulling a set quantity of pipe.

Tripping practice to change a bit should include the correct handling of a trip sheet and this should be signed and maintained with drilling tour reports.

BLOWOUT PREVENTION AND WELL CONTROL

The theoretical accumulated volume displacement should be compared through a trip with actual accumulated volumes that are returned to or from the well as the drill string is withdrawn or run back in the hole. When the hole is not taking the correct volume this should alert the driller that invading fluid may be flowing into the well bore.

Pump stroke counts and measuring the pit volume all assist the driller to calculate and confirm that the volumes to replace the displacement are correct.

An oil saver-wire line stripper connected to the top drill rod recovers mud from a travelling wire line and provides blow out protection when retrieving the inner core tube however this operation is carried out with flow check procedures outlined in the section Flow Checks for Core Drilling.

In some areas during tricone rotary drilling, it may become useful practice to slug the pipe with a barite plug before commencing to trip out of the hole. This will assist in stabilizing the hole when the drill string is at the surface.

Swabbing:

Swab pressure is created while pulling the drill string or inner core barrel from the hole. Suction arises, since mud does not re-enter the hole as fast as it is displaced. Where hydrostatic pressure of a mud column is only slightly above the formation pressure, the resulting pressure loss from swabbing may allow formation fluids to flow into the well. The pressure reduction from swabbing is a function of hoisting speed, clearance between the well bore and the drill string, mud properties and bit water course size.

The most critical period of influence from swabbing will occur while pulling the first few stands of the drill string off bottom. A check to ensure that formation fluid is not being swabbed into the hole at the early stages of a trip will often be advisable.

Lost Circulation:

There are numerous causes for lost circulation which may frequently arise in shallow un-consolidated beds and in deeper rocks which may fracture because the hydrostatic pressure exerted by the mud column exceeds the fracture pressure of a formation or because a formation is naturally fractured or cavernous.

When the hydrostatic pressure in the well bore exceeds the fracture pressure of the formation, the formation will break down and mud will be lost to that zone. Lost circulation is particularly hazardous when zones with pressure higher than the hydrostatic pressure of the mud column which stabilises after the losses become exposed and push fluids into the well.

Frequently circulated returns are lost and the fluid level will stabilize at some point down hole where the hydrostatic pressure balances the formation pressure in the lost circulation zone. On other occasions only partial losses are experienced to a zone and circulation may be restored after treatment to plug the formation.

If lost circulation occurs while a kick is being handled with pressure on the preventors, an underground blowout may occur. The zone of lost circulation must then be repaired before normal well control procedures are carried out. Sometimes it is possible to spot a heavy slug of high density mud below the thief zone in the zone of high pressure and this effect repairs to the zone of lost circulation.

On other occasions it will become necessary to repair the thief zone with a thixotropic cement squeeze and possibly then case out the two zones after drilling to a suitable formation in which the casing can be secured.

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BLOWOUT PREVENTION AND WELL CONTROL

Abnormal Over-pressure:

As stated abnormal over-pressured formations are frequently defined as those formations with a pressure gradient in excess of a normal column of sea water. This normal formation pressure gradient is $0.1073 \text{ kgf/cm}^2 / \text{metre}$.

If an high pressured formation is penetrated with insufficient mud density, then a kick situation is likely to develop. The response will usually depend on whether the permeability and porosity in the formation is sufficient to permit fluids to flow freely from the highly pressured formation into the well bore.

Under other conditions a formation may be pressured because compaction in the rock cannot sustain the overburden and although porosity and permeability are not sufficient to allow the escape of large quantities of fluid into the well

bore, there may be deformation and accelerated erosion to the well bore. Increasing the mud weight will often prevent or reduce the sloughing and caving of sediments in these formations.

Equipment Failure:

Failure to correctly test, maintain and operate equipment on the rig has in the past been a cause for concern in the industry and has been the reason for loss of life and property in times of blowout. The schedules for function testing surface well head and mud line equipment, the necessity for reporting testing to statutory authorities and training programmes for rig personnel have all assisted in reducing the problem but extra care needs to be given to required operational training in the use of this equipment.

BLOWOUT PREVENTION AND WELL CONTROL

Introduction to Abnormal Pressure Detection

The drillers and drilling crews are instructed to recognise and report any signs indicating the onset of abnormal pressure or those conditions indicating that the well is flowing. The crews are drilled regularly to make flow checks and shut in the well when necessary.

Flow Check Procedure

In order that drilling crews take all necessary precautions to prevent a kick situation arising, it is recommended that flow checks are carried out at specific times during drilling operations.

1. while drilling and in the event of indication of a kick
2. prior to tripping the drill string
3. in circumstances of indication of a kick while tripping
4. while out of the hole
5. while retrieving core

Rapid closing of the well is necessary if excessive surface pressure is to be avoided. Unnecessary and improper closing in procedures can however cause equipment damage and hole problems.

When one or more indicators that a well is kicking are recorded, a flow check should be conducted immediately to confirm the presence of formation fluids entering the well bore. The following procedures are observed.

1. While Drilling:

- call alert
- stop rotary, then hoist to position tool joint at surface
- shut off pump
- divert flow to record flow rate and volume
- record flow volume for 5 - 10 minutes

2. Before Tripping the Drill String:

- call alert
- position tool joint above the slip area
- divert the flow line to record flow rate and volume
- record the flow volume for 5 to 10 minutes
- if no flow is noted, trip out of the hole
- if the well is flowing, shut it in immediately

3. While Tripping the Drill String:

- call alert
- position the tool joint above the slip area
- install stabbing valve in open position then close
- ensure the hole is full
- shut down pump
- divert flow to record flow rate and volume
- monitor the trip tank for flow for 5 to 10 mins

5. While Out of the Hole:

- call alert.
- ensure the hole is full then shut down pump.
- divert flow to record flow rate and volume
- monitor the flow for 5 to 10 mins.
- continue to monitor the flow each half hour.

6. While Retrieving Core:

The well flow check procedures are those established for carrying on wireline operations in conventional drill string assemblies.

- call alert
- shut in the wireline oilsaver packer stripper
- monitor the flow for 5 to 10 mins. via by-pass
- ensure the well has stabilized before completing the flow check

BLOWOUT PREVENTION AND WELL CONTROL

Introduction to Abnormal Pressure Control

General to the procedures for well control and well kill operations in HW/HQ/NQ core drilling are those features of the drill rig and system controls which permit safe handling when drilling in over pressured formations.

Drillfluids suppliers have mud weighting materials compatible for use with wireline core drilling tooling and weighted mud systems are now regularly provided for slimhole operations. Baroid Australia in Victoria and AMC in Tasmania are to supply mud chemicals for drilling Shittim 1A.

Wireline coring drill holes are considerably downsized to conventional oil and gas holes. The surface mud volumes used and pump circulation rates to drill these wells are also much reduced. Fewer, smaller drill cuttings are produced while coring which reduces formation contamination of the drill fluid. A driller works above the hole and can monitor all aspects of the circulating system from his position at the rig consul

It is critical to operations that drill fluid rheological properties and particularly yield and gel strengths are readily controlled to maintain optimum conditions for pressure control management in these wells. The annular mud volumes in core hole geometries are only about 15% of those in conventional oil and gas wells while the circulation system is only about a third of that used by conventional oil field rigs. In these circumstances less time and fewer mud material are necessary build weight, condition the mud and control a kick.

While all other response times may be considered equal, the opportunity for detection of a more exact and smaller variation in pit volume is possible in these circumstances. Attention to this opportunity can provide a lead time for response in such an event.

While wireline coring tools are lighter than conventional rotary drill strings it may be pointed out that in a closed well situation with a HQ core drilling assembly in 4.33" hole locked in under a top drive UDR rig, in excess of 3,000 psi could be contained. This is with out the necessity of closing a shear ram. By comparison, the same situation in a 7 3/4" production hole with a fluted kelly, would require 132,000 lb of string weight to prevent drill pipe from moving up the hole.

While tripping rods, it should also be noted that in spite of these rods having a large bore and a narrow bit kerf area, the calculated resistance to flow (and its resultant implication for swabbing) when pulling a rotary tricone roller bit string will be found to be greater than in the case of the core string.

Wireline core retrieval has no unique feature which characterises the operation from other wireline activities in conventional drilling practice. Two adopted procedures are designed to prevent accident when pulling core;

a wireline Oil-saver packer stripper, rated to anticipated pressure control requirements (1,500 psi in this manual), is installed on top of the drill rod string. In the event of a kick, the packer may be closed. In this event the core inner barrel becomes suspended in a pressured chamber. mud which is allowed to rise while retrieving the core inner barrel is directed back into the hole via a fast acting mud by-pass valve in the drill string. This valve is also shut in the event of a kick. when stable, read the shut in casing and shut in drill pipe pressures and record the volume gain

Equipment Rated Pressure:

Well data calculated for carrying out well kill procedures uses rated working specifications for the pressure control equipment and recommended property specifications for the drilling fluids employed. The rated shut in pressure of the Blowout Preventer Well Head is 3,000 psi. The rated pressure of the Annular Blowout Preventer is 1,000 psi. The operating pressure of the Blowout Preventers is 750 psi. An equipment list and diagrams for the BOP equipment are shown in the Appendices.

Friction Pressure Loss in the Circulating System:

The following procedures programme identifies the fundamental concern for the handling of friction pressure losses in these geometries when planning to control and kill a kick.

BLOWOUT PREVENTION AND WELL CONTROL

A friction factor derived for conventional rotary drilling with a drill pipe to annulus ratio of 0.28 will be smaller than the friction factor derived where this ratio is to the order of 2.10 as is the case in wireline drilling geometries. As a result, 92% of circulating system friction pressure losses are derived in the annulus in these down hole configurations, whereas annulus pressure losses in conventional rotary drilling geometries will generally only be to the order of 10% of circulating system pressure losses.

As a consequence, a kick event in the well may be anticipated to evacuate -
the annulus while drilling
the drill string while tripping
the drill string while operating wireline tools.

As a further consequence of this distribution for friction pressure losses in a CHD circulating system, it may normally be expected while core drilling that equivalent mud densities will be higher than those in wells which are drilled using conventional oil-well rotary drilling practices.

For clarification of the following well shut in and kill procedures, a description of pressure control equipment and well data to support the drilling practices which is useful for preparing a well kill data sheet, has been included in the Appendices.

Friction Pressure Calculations:

The Power Law model for fluid flow behaviour has been employed in calculating friction pressure losses in the circulating system. The equations used to calculate the friction pressure loss are described in the IDF Drillfluids Manual and in the MI Data Handbook which is held at the location in the tool room. The circulating system pressure data obtained drilling Comalco's Ungoolya 1 in the Officer Basin of South Australia and the Pittston Minerals (Aust.), Sandfire Flat (SD1) mineral hole in the Canning Basin (described in the Slimhole Drilling Technology Manual) are empirical data sets used as models for applying these friction pressure loss equations at the location.

HW/HQ/NQ well geometries and drilling fluid properties are recorded on the kill sheet which describe the parameters used in these calculations.

The circulating system pressure loss in a well is the sum of friction pressure losses -

$$\text{CSPL} = P(\text{surface}) + P(\text{drill string}) + P(\text{core barrel}) + P(\text{annulus})$$

When a kick is detected and the well has been shut in it is well to wait for a few minutes to allow the pressure to stabilise. If a gas bubble has been encountered it will begin to migrate up the hole and it is not good practice to wait for too long before commencing remedial action. The driller may respond in two prescribed ways to control the pressure.

He may use the recorded surface pressures to plan for kill procedures and fill in the Pressure Control Worksheet at this time, or he may wish to circulate the well through the choke using the constant pump stroke method and displace all the invading formation fluids before commencing to kill the well.

The latter, which initially controls the over-pressure by circulating the hydrostatically under-balanced well through the choke, and displaces any invading fluid from the well is called 'The Driller's Method' and will provide more reliable data to calculate mud weight to control the abnormal pressure. The method requires a minimum of two complete circulations to kill the well.

The former, is known as 'The Wait and Weight Method' is designed to kill a well with one circulation and because of simplicity it is most often preferred as the procedure.

Methods for Kick Control:

This method and a worksheet for controlling a well is described in the IDF Drillfluids Manual and the MI Drillfluids Manual which are in the tool house at the location.

BLOWOUT PREVENTION AND WELL CONTROL

A well which has been shut in may be then circulated while the driller controls the 3,000 psi diverter line ball cock valve with the original mud weight to displace an invading fluid in the annulus. A constant bottom hole pressure is maintained while circulating at the slow pump rate to control further entry of formation fluid. It is useful to complete a Well Control Worksheet before commencing the procedure.

Circulation is commenced by cracking the diverter line ball cock valve and simultaneously bring the pump rate to the desired slow pump rate. While pumping at the constant pump rate the drill string pressure is held constant by adjustment at the choke. An initial pump pressure is obtained by adding the circulating system pressure loss to the shut in drill string pressure.

When all the invading fluid has been pumped from the hole clean uncut mud will appear and the well may be shut in once more. The shut in casing pressure and the shut in drill string pressure should now be equal and a Pressure Control Worksheet may be completed using this recorded data.

It is possible to continue circulating the well at any time while weighting up operations are in progress using this constant pump stroke - constant drill string pressure method and maintain control of the well.

Regardless of the two methods employed, to kill a kicking well is the same in both cases when displacing old mud with newly weighted mud of sufficient density to effectively control the over pressure.

The operation may proceed after the initial shut in, without displacing the invading fluid using the 'Wait & Weight Method' or it may proceed this circulation using the 'Drillers Method' to control the kick. In both cases the shut in pressures are used to fill out the Pressure Control Worksheet and mud density is increased in the pits to effectively control the abnormal pressure.

The Pressure Control Worksheet:

This work sheet is used for recording shut in data and is kept up to date during drilling operations to maintain the pre-recorded information which includes the circulating system pressure loss with the pump and well data.

Record the shut in drill string and the shut in casing pressure together with the kick volume. The initial circulating pressure required is found by adding the shut in drill string pressure to the system pressure loss.

The new mud density required to balance the formation pressure may be calculated from the shut in drill string pressure. This pressure is converted to an equivalent mud density (ECD) in units of specific gravity using the equation described on the worksheet. Adding the result to the original mud density will provide the new mud specific gravity which is required to balance the formation.

It is necessary to displace the original drilling mud in the drill string and annulus with newly weighted mud while pumping with a controlled pump rate and making adjustments at the diverter ball cock choke valve to maintain a regulated pressure. The pressure is regulated to reduce the pump pressure from the Initial Circulating Pressure to the Final Circulating Pressure as the old mud is pumped out of the drill string. Calculate the Final Circulating Pressure using the equation shown in the worksheet and then prepare a graph plan which plots the number of pump strokes and/or time vs the decrease in pumping pressure while the new mud is being pumped from the surface to the bottom of the drill string. This Final Circulating Pressure is then maintained by controlling the choke while pumping the new mud up through the annulus.

Remember when making these calculations

- the drill string hydrostatic pressure + the circulating system pressure - the friction pressure is always equal to
- the annulus hydrostatic pressure + the casing pressure + friction pressure in the annulus.

BLOWOUT PREVENTION AND WELL CONTROL

Pumping to Displace Mud in the Drill String:

Displacement is effected by pumping new mud at the controlled slow pump stroke rate and maintaining choke adjustment to control the pump pressure. This is the Initial Circulating Pressure at the commencement and is reduced to the Final Circulating Pressure when the new mud reaches the bit.

While making this choke correction it can be seen that pump strokes may increase as the pump pressure falls and to return the well to balance it is necessary to close the choke until pressure and pump rate return to their designated values. Should the pump pressure increase and the pump stroke rate begin to fall, then it is necessary to gradually open the choke to restore balance.

Pumping to Displace Mud in the Annulus:

When pumping to displace the annulus the final circulating pressure becomes the controlling factor. The new mud is pumped through the annulus while controlling back pressure on the choke to maintain this final pump pressure.

The casing pressure will vary considerably while displacement proceeds and the maximum pressure will be recorded when a gas bubble (if any) first reaches the surface.

The highest pressure recorded at any point in the well (e.g. the casing shoe) will occur when the top of any such gas bubble reaches that point.

Once new mud is returned to the surface, the well is once more balanced and back pressure required at the choke will be reduced to zero. The well may then be shut in once more to determine if the new weight is effectively controlling the formation pressure.

The higher annulus pressure associated with the driller's method for controlling a kick may become of serious concern if an inner casing string has a low pressure rating or if it is set at a shallow depth where fracture pressure in a formation is less than the probable annulus pressure that will occur when a gas bubble reaches the shoe. For this reason, cautious evaluation of well parameters needs to apply when selecting the method for controlling a well.

BLOWOUT PREVENTION AND WELL CONTROL

Well Shut in Procedures:

If the well is flowing, the drill crew should shut in the well and make the necessary arrangements to begin killing operations. The position of the drill string at the time of this decision determines which of the following procedures to use for the shut in. Both of the 3,000 psi ball cock valves on the kill and diverter lines are maintained in the closed position at all times while drilling or coring.

1. Shut in While Drilling:

- call alert
- stop rotary, hoist to place tool joint above slip area
- shut down pump
- check both ball cock valves are open
- close annular preventer
- slowly close 3,000 psi ball cock valves without exceeding allowable operating pressure
- when stable, read the shut in casing and shut in drill pipe pressures and record the volume gain

2. Shut in While Tripping:

- call alert.
- position upper tool joint above slip area
- set pipe in slips & release elevators
- install 3,000 psi stabbing ball cock valve open, then close
- check both ball cock valves are open
- close annular preventer
- slowly close the diverter ball cock valves without exceeding allowable casing pressure
- make up top drive rotary to top connection.
- open 3,000 psi ball cock stabbing valve
- allow well to stabilize
- when stable, read the shut in casing and shut in drill pipe pressures and record the volume gain

3. Shut in While Out of Hole:

- call alert
- check both 3,000 psi diverter line ball cock valves are open
- close the 5,000 psi gate valve
- slowly close diverter line ball cock valves without exceeding allowable operating pressure
- allow well to stabilize
- read the shut in casing pressure and volume gain

4. Shut in While Retrieving Core:

The well shut in procedures are those established for carrying on wireline operations in conventional drill string assemblies.

- call alert.
- check both 3,000 psi diverter line ball cock valves are open
- close in the packer stripper valve and by-pass valve.
- slowly close diverter line ball cock valves without exceeding allowable operating pressure
- allow well to stabilize.

BLOWOUT PREVENTION AND WELL CONTROL

Blowout Prevention Equipment

2" NPT 3,000 psi Diverter Line

2" NPT 3,000 psi Kill Line

2" NPT 3,000 psi Ball Cock Kill Line Valve

2" NPT 3,000 psi Ball Cock Diverter Line Valve

Cameron 3,000 psi NPT/Reg Kill Line Pressure Gauge

Cameron 3,000 psi NPT/Reg Diverter Line Pressure Gauge

Remet HW API Type 6B Flanged 1,000 psi Working Pressure Annular Blowout Preventer

Remet HQ/NQ 1,000 psi Working Pressure Bag Annulars

Demco 4 1/8" API Type 6B Flanged 5,000 psi Working Pressure Gate Valve

Feaver Engineering 4 1/8", API Type 6B Flanged 3,000 psi Working Pressure Diverter Spool

Feaver Engineering API Type 6B HW Casing Head Flange

Universal Fastners 7 1/16" 3,000 psi Flange Bolts (24)

R 45 API Type R Ring-joint Gaskets (4)

General Hydraulics Annular Preventer Closing Unit

Feaver Engineering 3,000 psi rated pressure Inside BOP

Feaver Engineering 1,000 psi rated pressure Wireline BOP

FMC 56 Bean Triplex 60 US gal/min 1,500 psi working pressure Kill Pump

NPT Mud Line Manifold

FMC 535 Bean 35 US gal/min, 1,200 psi working pressure Triplex Mud Pump

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BLOWOUT PREVENTION AND WELL CONTROL

Makeup of HQ/NQ Blowout Preventer Stack on HW Casing Head Flange

After the setting and cementing of the HW casing string the cellar is prepared to a depth to expose the top joint of the HW casing string.

A 2 part portable cellar is then made up in the excavated area and a cement base prepared. Where there is sufficient slope a drain pipe may be run from the cellar floor an external pit.

The top flange is made up on the top joint pin thread.

The Blowout Preventer Assembly is then made up on the top head flange in the cellar (see diagram).

Make the flang head bolts and torque with a tension wrench

Install 2" NPT kill line, 3000 psi ball ball valve, and 3,000 psi kill line pump manifold

Install 5,000 psi Pressure Gauge , 3,000 psi ball cock valve in exit line

Nipple up exit line to flare line and construct the flare pit

Install and test the HQ bag preventer for HQ coring. Install and test the NQ bag preventer for NQ coring

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BLOWOUT PREVENTION AND WELL CONTROL

Blowout Preventer Test Schedule:

The Test Schedule require test pressures of 5,170 Kpa (750 psi). Pressure test policy requires that the BOP's and associated well control equipment is tested to operation pressures recommended by the manufacturers.

Testing may be carried out with the least number of valve manipulations and in accordance with the instructions of the operating company.

In the event that a test indicates that the equipment is not operating correctly, operations shall not be continued until the deficiencies have been corrected to the satisfaction of the operating company.

All preventor equipment to be tested in accordance of such regulations requires that annular type blowout preventors shall be tested to 70% of the manufacturers rated pressure.

A complete BOP test is carried out at the installation of the equipment, before drilling out after setting each casing string, every 7 days while drilling and after each time repairs are made that require removal of a pressure seal in the assembly. The gate valve shall be tested at the times stipulated in the above paragraph, providing that after installing each casing string, the gate valve shall be pressure tested to the operating pressure provided above.

The annular preventors shall be function tested on each round trip or 24 hour period, which ever is the greater period of time with the exception of the annular type blowout preventors.

In conjunction with BOP tests, pressure tests of the inside BOP's, and rig mudlines require attention at this time. The pressure test for the rig mud line and pump manifold is 750 psi

Closing Unit:

1. Accumulators shall be located adjacent to the drillers consul with sufficient capacity at all times to close the annular type blowout preventor
2. Rig hydraulic pump shall be capable of rebuilding fluid pressure in the closing unit within a period of three minutes to a sufficiently high level to close the annular type blowout preventor.
3. Closing unit shall be connected to the blowout preventors with lines of working pressure at least equal to the working pressure of the unit.
4. Closing unit shall have an independent manual backup sources of power.

Closing Unit Tests

Tests are performed at installation or every 15 days, whichever is the shorter period of time. Regardless of the arrangement of a blowout preventor stack to be tested, a set of drawings is most useful when conducting this procedure. Tests are carried out with the least number of valve manipulations.

The diagrams (Figs. 1.to 5.) included in the following pages are for general information when carrying on BOP stack test procedures. All BOP testing is carried out using water after mud is flushed from the stack and lines. Low pressure tests must be applied for 3 minutes before increasing to the full test pressure on ram and annular BOP tests.

BOP Inspection Test Check List:

- Make frequent inspection to your satisfaction that you have;
- Ensured the BOP's are correctly installed and braced.
- Replaced hand wheels.
- Ensured the 3,000 psi ball cock valves on the diverter and kill lines are closed.
- Sufficient barite to meet location requirements
- Hydraulic properties recorded daily in the Pressure Control Worksheet.
- Drills and Safety Meeting requirements fully observed.
- Tested the stand pipe, pump lines, valves and mud line hose.

SHITTIM 1A
RIG SAFETY AND EMERGENCY RESPONSE

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RIG SAFETY AND EMERGENCY RESPONSE

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RIG SAFETY & EMERGENCY RESPONSE

Emergency Response

9:1:1. Introduction

The Safety and Emergency Response Program is prepared for the benefit of the Contracting drilling crews and management to ensure the correct response to emergencies which may arise out of contracting operations from time to time and for the laying down of guide lines for safe procedures when working on or around the drilling site.

Drilling supervisors are responsible to ensure that all personnel employed on the site are fully conversant with the content of this manual and are instructed in safe working practices on these operations. Pontil Pty Ltd, the Drilling Contractors, have a company hand book which is issued to all of the staff and provides the same information contained herein.

Company contractor personnel are then expected to sign the Safety Book to acknowledge they are fully aware and will abide by these instructions.

The Operator Company, Condor Oil Investments Pty Ltd, have prepared an Emergency Response Manual which covers those contingencies for the drilling programme being conducted.

Should an emergency arise, nothing in the contents, instructions or regulations provided in this programme shall be so constructed as to prevent the "person-in-charge" from taking the most effective action in his judgement for rectifying the conditions causing the emergency or action deemed necessary for the saving of life and property.

Emergency Alert Plan

An emergency is considered to be an unexpected event that may result in harm to life, environment or property and which calls for immediate action.

Examples

1. An event that results in loss of life, serious injury or causes a potential hazard to life and property.
2. Hydrocarbon or chemical spill or other emission harmful to the environment.
3. A fire causing equipment or property damage.
4. Explosion, rupture or well blow out.

Senior Company Employee at the scene

Contact the Operating Company Representative on site or at his location and report the emergency, where it occurred, when, what action is being taken to control the situation and what progress is being achieved in rectifying the emergency.

The Operating Company Representative in these circumstances is Mr Ted McNally

Tel. (002) 296576 After Hours (002) 296 576

The Senior Company Employee is then responsible for reporting the emergency to his immediate senior at the Contracting Company Head Office.

The Immediate Senior at the Contracting Company in these circumstances is Mr Tom Brown

Tel. (068) 84 2722 After Hours (068)

Your immediate reports then are ;

1. Operation Site Representative
2. Contracting Company Superior

RIG SAFETY & EMERGENCY RESPONSE

Emergency Response

A list of operating company personnel to whom you may report emergencies, will need to be prepared and kept handy in the supervisors office. Make sure that the contact level for these situations is fully established for each drilling programme.

9:1:2. Rig Emergency Procedure

The circumstances that will be encountered in any particular emergency are very often unpredictable. No all comprehending set of plans can be formulated to meet all emergencies, however normal reparations are the response for ;

1. Fire, explosion or blow out
2. An urgent need for medical assistance

Contracting Emergency Staff Team

1. Drilling Manager
Mr
2. Senior Drilling Supervisor
Mr
3. Co-ordinator 24 hour contact
Mr

9:1:3. Contractor Emergency Staff Response

1. Alert all members of the team.
2. Contact the senior member of the Operator's emergency staff.
3. Base the emergency team at the radio contact room.
4. Liase with the Operator's rig supervisor.
5. Liase with the Contractor Rig Supervisor at the location.
6. Ensure names and addresses of personnel on the rig are known.
7. Prepare response for the State Regulators.

Supply

As advised by the Operator,

1. Prepare warehouse personnel responsible for materials dispatch.
2. Mobilise and dispatch any materials requested to the rig.
3. Ascertain if any injured personnel are in need of evacuation.
4. Prepare mobilization for any evacuation.
5. Advise the local Police Department of the emergency.
6. Request Police assistance if necessary.
7. If necessary advise the most accessible medical facility.
8. Arrange medical assistance in transit if necessary.
9. Arrange emergency accommodation if necessary.
10. Maintain a record of evacuees, their location and condition.
11. Report back all Operator advised action.

Operator's Representative

The Operator will detail an Emergency Response Co-ordinator to supervise the operations and it is important the Condor Oil Investments Pty Ltd emergency staff act through his instructions. In these circumstances the person in charge is Mr Ted McNally.

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RIG SAFETY & EMERGENCY RESPONSE

Emergency Response

This Co-ordinating Supervisor has ultimate responsibility and will be making the decisions which are remedial for the emergency at the site and contingent to safe passage of any evacuees for medical purposes.

The Contracting organisation is responsible to act promptly on any proposed operation detailed and requested by this representative and to keep him fully informed as to the out come of the actions. Further, they are to advise him in all matters pertaining to the emergency, either requested or otherwise.

RIG SAFETY & EMERGENCY RESPONSE

Rig Safety

9:2:1. Introduction to Fire Fighting Procedures

In the petroleum industry and particularly for exploration, fire is an ever present hazard to life and property. It is necessary that the required fire fighting equipment on the rig is correctly serviced and maintained at convenient designated locations and that personnel are fully instructed in the effectively understood procedures for extinguishing any conflagration.

Burning and welding are two notable hazards that require attention and control at the location and preparation notices must always be requested for these activities so there is no breach of any regulation and so supervision is prepared for the job.

Sources for ignition

It is recognized that most of the hazard surrounding the occurrence of fires stems from lack of attention on the part of personnel to preparation and care on a job. Consideration for any sources of ignition during the carrying on of an activity and exclusion of the hazard potential through job preparation will lower the risk for accidental fire considerably. Think hard on this and your own past experience!

Ignition may result from;

1. An explosion, naked flame, molten sparks or spontaneous combustion.
2. Welding, cutting and sparks generated through cutting or grinding.
3. Electrical faults; loose connections or incorrect grounding.
4. Electrical faults; incorrect grounding or overloading.
5. Electrical faults; incorrect wiring or fuse placement.
6. Electrical faults; short circuits or unprotected installations.
7. Smoking in non designated areas.

9:2:2. Classification of fires and methods for their control

Fires have been classified as follows;

Solid Fires

extinguished using water, foam or any type extinguisher.

Liquid Fires

extinguished using foam, carbon dioxide or dry chemical.

Electrical Fires

extinguished using carbon dioxide or dry chemical.

DO NOT USE WATER OR FOAM TO EXTINGUISH ELECTRICAL FIRES.

9:2:3. Rig Fire Prevention

It is the responsibility of the Operating Company Supervisor to ensure that fire prevention and safety procedures are carried out on a location to the satisfaction of his companies set policy.

It is the responsibility of the Contracting Company Supervisor to ensure that his crew is performing duties in accordance with instructions provided by the Operator.

A Contracting Rig Supervisor should instruct crews of the following rig fire prevention responsibilities;

Ensure that the fire prevention procedures are introduced and displayed at the rig and are given attention in Safety Meeting Agendas.

Ensure that Fire Station notices are well prepared and displayed conspicuously around the rig. These notices contain equipment and duty information for personnel.

RIG SAFETY & EMERGENCY RESPONSE

Rig Safety

Ensure that new crew members taking up duties on the location are fully briefed in fire prevention and their responsibilities in an emergency situation.

Rig crew commencing operations at a site, are required to sign a log book to acknowledge that they have been instructed in fire prevention and rig safety in general.

All visitors to the rig are to be made aware of restriction notices and safety regulations operating at the site.

All fire extinguishers required under the regulations are to be correctly positioned at the site, are to be reported as inspected and operational at the commencement of drilling operations and thereafter every three months.

Smoking is only permitted in designated areas.

Electrical installations are to be inspected by a qualified electrician before the commencement of drilling operations and then following the installation of any replaced or additional new electrical installation.

Compressed gas cylinders are not to be operated unless they are installed with gauge and pressure regulating equipment.

Spilled hydrocarbons are to be immediately recovered even if it is necessary to curtail operations in doing so.

Engine oil is drained and stored in drums at the site. It is not permitted that drained oil is held in sumps under motors.

Waste oil rags, sacks, rope, plastic containers are not to be left around the location, but deposited in designated refuse containers on site.

9:2:4. Responsibility

The Contractor Supervisor and each service company senior representative is responsible for his unit and personnel safety.

The Contractor Supervisor is the person-in-charge of fire fighting on the rig.

This responsibility may be shared by the operator supervising staff or a deputy where operator liabilities are involved i.e. danger or damage to life, the well, the reservoir or property. In the event of fire, all precautions will be taken to eliminate danger to life and property even if drilling operations have to be curtailed as a result.

Responsibility for manning and operating fire stations will be properly delegated. Back up equipment and personnel are to be mobilised quickly.

If a fire cannot be brought under control on the rig with the resources at hand then the supervisor is required to inform the Operator and proceed to notify his company emergency staff that back up equipment is required forthwith.

9:2:5. Cutting & Welding

Authorization for welding jobs are provided by the contracting supervisor or a member of the crew delegated by him and each job needs to be detailed for his approval on a Welder's Job Sheet.

Cutting and welding operations need to be properly supervised and an inspection of the work area should be carried out to determine if the work is necessary and safe to carry out.

RIG SAFETY & EMERGENCY RESPONSE

Rig Safety

Ensure that the welder fully understands the work, that he is qualified to carry it out and that fire equipment is on hand.

9:2:6. Inspection

During pre-operation, inspection ensure that;

No spark, flame, or hot slag is likely to be blown or fall onto combustible material or equipment which could be ignited and cause damage.

No combustible vapours are present in open or confined spaces which could be ignited and adequate ventilation is provided while the work is in progress to prevent the accumulation of combustible or noxious fumes. Good ventilation is essential when cutting or welding alloy metals, plated steel or painted metal since harmful vapours will be produced.

If hydrocarbons are present on the metal surface, it should be thoroughly cleaned to remove as far as possible any residue which could foreseeable cause ignition.

Where welding or cutting is to be performed around any timber, the wood is well watered down before work commences, and that periodic wetting is kept up while the work is in progress.

Welding equipment is never used in the vicinity of asbestos material.

Any welding work to be carried out on service or connecting pipe is not commenced until inspection ensures that the pipe has been bled to atmospheric pressure, that it has been purged and cleaned and that there is no possibility of pressure rebuilding in the pipe during the operation.

Make sure that all connecting valves are correctly closed and any flanges to be used are correctly installed.

If work is to be performed on any structural member, no damage to the specification of the equipment will result so that the strength or efficiency of the member is in any way reduced.

Where any work of this nature is to be performed and the supervisor is unsure of the consequences of the job, another opinion will need to be sought from a higher authority.

9:2:7. Welding in Confined Spaces

Welding in confined spaces will require that the supervisor ensures;

any welding to be conducted in a tank compartment of any kind and regardless of its features, is not commenced before it has been inspected and ascertained that it is safe to proceed with the job,

a person who is designated to carry on the job is familiar with the work and that the compartment is free of any noxious or inflammable vapours,

air blowers are placed strategically to pick up and discharge any produced fumes,

ready access to and from the place of work is freely available,

at least one other observer is in attendance while the job is in progress and that the welder has a life line to signal for rescue should difficulties arise,

RIG SAFETY & EMERGENCY RESPONSE

Rig Safety

no person is permitted to enter the compartment if there is the slightest doubt that sufficient air to support life without self containing breathing apparatus is available,

service or connecting pipe is inspected and is to the requirements stated in the above and

where-ever possible, positive closures such as blind flanges, bull plugs or locked valves are employed on pipe lines entering confined spaces while this work is in progress.

9:2:8. The Use of an Observer

Welding operations on the rig unit and within a 15 meter radius of the well head shall not be permitted unless an observer is present to watch for flying sparks and falling slag so that no fire hazard is permitted from such an occasion.

Where welding operations are to be permitted within a 15 m. radius the well head while drilling is in progress, the welder and his observer are to arrange a system of signals which will provide for a job to be shut down in the event that a hazardous situation arises.

9:2:9. Electric Arc Welding

Inspection by the supervisor should ensure that;
the welder on the job is experienced and qualified to carry on the work which has been planned,

the welding equipment, leads, ground terminals and the environment where the work is to be carried on are satisfactory for the completion of the work,

a ground return connection is not made through a conductor such as a pipe or other object which may contain inflammable liquids or gasses and

the connection is similarly not to be made through other cables, conduits, chains, wire rope or carriers of this nature.

9:2:10. Operator safety

The welder and his assistant observer are required to be correctly attired and equipped for the duties of carrying on welding operations.

Clothing which is protective of sparks, hot slag, and ultra violet rays are necessary and should cover the hole body below a mask.

Shirt sleeves are to be rolled down.

Welding masks and goggles for electric welding and flame torch welding and cutting as well as gloves are to be supplied for the welder and his observer with any welding rig.

Shielding to protect other crew members from any harmful effects arising from welding practice must also be provided.

The work area should be recovered a the completion of the job and it is important to dispose of any rod ends that have been discarded.

RIG SAFETY & EMERGENCY RESPONSE

Rig Safety

9:2:11. Oxy - Acetylene Flame Cutting and Welding

Gas cylinders are to be stored outside a 15 meter radius of the well head and should be handled in a cradle to prevent the possibility of damage.

The cylinders should be stored and secured in an up-right position and capped unless they are in use. Ensure that cylinders which have been in use and are to be transported off a location, have been recapped for transport.

The storage area at the location should be one that is free from grease or other lubricants since these materials on the bottles and hoses will present a fire risk.

Cylinders should be stored in a protected location on the rig, out of the direct rays of the sun, outside any fire risk area, away from corrosive chemicals and out of work areas where they may be exposed to sparks of naked flames.

The cylinders are never to be used for jobbing to act as rollers or supports for other equipment.

It is important to match correctly, regulators and gauges for the gas rig. Never allow an oxygen regulator to be used on an inflammable gas bottle and ensure the rig personnel are familiar with colour codes for the appliance.

Never force threads or connections when breaking down or assembling the regulators. Always keep the tread area on bottles and regulators clean and away from harm when they are not in use. If leaks are to be explored, use a soap solution to detect any leak; not an inflammable solution. Don't permit any torch work using equipment which is leaking or defective in any other way.

Don't use oxygen as a source for compressed air or permit acetylene to escape into an enclosed space.

Ensure that the welder is experienced in the work that has been scheduled and that he is qualified to carry on the work. Supervise each job until inspection confirms correct procedures for handling the equipment are being observed and the work is being carried out in accordance with the job detail.

9:2:12. Safety Responsibility

It is the responsibility of the operator company to provide its emergency response programme for the handling of toxic hydrogen sulphide gas which may be vented while drilling. The occurrence of the gas is to be fully reported in the daily log and a full written report is to be made of each incident involving detection of the gas. The operator company may delegate duties for the safe handling of the gas to the Contractor Rig Supervisor in any situation which involves its occurrence during drilling operations.

RIG SAFETY & EMERGENCY RESPONSE

Production Testing

9:3:1. Production Testing

Well testing is supervised by the operator and crews for drill stem testing are supplied by service companies who supply down hole tooling and specialise in these operations.

Contractor personnel are provided to assist in the operation and the supervisor and or driller are generally required to run the down hole string with the assistance of a normal floor crew.

During the testing the driller is retained to work the string. Reporting for a drill stem test is from the time the string reaches the down hole location in the well, until the test tool is brought back and laid down on the surface.

Some Operators have especially prepared emergency response procedures for test operations and these may be distributed on the location.

The supervisor will inform crews of their assigned duties in the event of any emergency.

9:3:2. Procedures

The Contractor Rig Supervisor is required to notify all crew and Operator personnel that the tool is positioned down hole and that testing is to commence.

The supervisor is required to ensure that; adequate signs are placed on the rig to inform all personnel that all welding operations are suspended for the duration of the test,

the signs should also warn that no naked flame is permitted on the location during this period,

no smoking is permitted on the location during the test, either in or away from designated areas,

smoking is confined to enclosed accommodation areas only,

fire fighting equipment which has already been strategically positioned should also support the drill floor and the gas separator locations and

all available water outlets and hoses need to be run tested before the test is commenced.

The Operator is often obliged to provide self sustaining breathing apparatus and gas masks on the location in many areas for test operations. Condor Oil Investments Pty Ltd may be requested to provide this equipment in the event and should have access to and be able to supply the necessary items. Frequently one oxygen mask for each 3rd. man working on the test will be required.

Great care is required by crews working on the rig floor in order that no articles of equipment are carelessly permitted to slip down the hole. Maintain the drill floor so that all tools and other test tool items are handled away from the well head.

Drill stem tests are not scheduled to commence during hours of darkness and are programmed to be completed during daylight hours. This is not the case for wire line Formation Interval Testing however. Only persons directly connected with the test are permitted in the area of testing or on the drill floor.

Test supervisors and service personnel conducting these tests are frequently working under difficult conditions and are grateful for quiet assistance offered by crews.

RIG SAFETY & EMERGENCY RESPONSE

Production Testing

9:3:3. Gas Detection During Drilling & Testing

Gas detection is the responsibility of the operator company, and in normal situations two gas detectors are employed to detect and record flammable vapours around the rig and at the well head discharge.

Hydrogen Sulphide Gas - (H₂S)

Hydrogen Sulphide gas has not been reported on drilling operations in this basin during past exploration. Where it occurs the gas is normally controlled by attention to drilling and mud engineering practices.

Because of the highly toxic properties of this gas and its free occurrence in nature much effort has gone into understanding how to combat its deadly release from wells, particularly in wild cat drilling country where it may not be anticipated as a source for concern until it is too late.

The price of that neglect has often been catastrophic loss of life. Hydrogen Sulphide is a colourless gas which is heavier than air and soluble in water. In minute quantities it has a smell similar to rotten eggs (rotten egg gas).

Detection of the gas on a location by smell alone, is not an effective means for monitoring its occurrence since a person exposed to this gas in concentrations of 1 to 2 parts per million for a period of 2 to 15 minutes will lose the sense of its smell.

From concentrations of as little as 2 to 200 ppm people exposed to the gas will lose their sense of smell for the gas and will suffer burning in the eyes and throat.

At a concentration of 500 ppm in air (about .05%) the gas causes loss of the sense of reasoning and balance and respiratory disturbance all in the space of from 2 to 15 minutes.

At 700 ppm an exposed victim quickly loses consciousness and breathing stops.

At 1000 ppm an exposed victim immediately loses consciousness.

Such is the concern of this industry, and it has many examples which are conclusive for its appreciation of the life threatening properties of the gas, that it has spent many millions of dollars to educate, and train its people in safe, effective methods for handling its occurrence when drilling.

The progress towards safe handling for the occurrence of hydrogen sulphide gas in drilling today means that any catastrophic event from its eventuality has resulted from a lack of planning foresight.

The booklet which is enclosed in the appendices of this manual deals with all aspects of hydrogen sulphide gas; its properties and its occurrence, procedures for monitoring the gas while drilling and procedures to be adopted when detecting the gas while drilling, first aid and resuscitation then finally toxicity and symptom behaviour.

RIG SAFETY & EMERGENCY RESPONSE

Basic First Aid

9:4:1. First Aid at the Rig Site

Personnel at the rig site are trained to perform First Aid in the event of accident during operations to assist an accident victim prior to any requirement for additional professional medical assistance.

A First Aid Certificate is a valuable qualification to have and can result in the saving of a life. All crew personnel are encouraged to train for this certificate and are assisted by contractors to obtain the certificate.

Emergency procedures (including communications with head office) needs to be fully explained by the person in charge at a location and strictly adhered to.

Even minor injuries should be treated and reported on an accident report form. It is important the accident victim complete a Workers Compensation Report Form as soon as possible after any accident which involves such a claim.

9:4:2. Basic First Aid for Wounds

Any break in the skin can become infected if it is not promptly treated and the first aid treatment should be aimed at stopping any such infection from happening. Wash your hands before attempting any first aid.

Minor or Superficial Cuts, Scrapes or Scratches

Cleans the wound with a clean gauze pad or cotton wool using warm soapy water or a mild disinfectant, making sure to wash away from the wound and not towards it.

Rinse after cleaning with clean water and dry.

Apply antiseptic spray, cream or lotion to cover the wound and hold a gauze pad firmly to cover the damage.

Tape or bandage the gauze firmly but not so tight as to interfere with circulation.

Do not use skimpy dressings but make sure the wound and surrounding area is adequately covered.

Do not use cotton wool or adhesive tape directly to any part of the wounded area.

Deep or Extensive Wounds

Control the bleeding using a clean gauze pad and pressure over the wound.

If one pad becomes saturated place another on the top of the first pad and continue to apply pressure.

When the bleeding stops bandage the wound firmly but not too tightly.

If bleeding from a wound on a limb continues unabated, apply pressure to the artery which supplies the limb.

Should this fail it is necessary to apply a tourniquet. Once a tourniquet is applied it is not removed until a doctor has been called to the victim. It may be loosened for short periods from time to time on the advice of a doctor before he reaches the victim in order to permit circulation to the rest of the limb. A tourniquet is made of flat material about 5 cm. in width and is applied to the normal skin about 2.5 cm above the wound.

Obtain medical assistance as soon as possible.

Watch for any impending sign of shock and treat immediately if signs become obvious.

RIG SAFETY & EMERGENCY RESPONSE

Basic First Aid

Deep Puncture Wounds

Encourage bleeding by applying pressure around the wound.

Rinse the wound with clear water and cover with a sterile pad held in place with tape or a bandage.

Seek medical assistance.

Wounds with Foreign Bodies - Metal, Sand or Glass etc.

Do not attempt to probe for foreign bodies but pick off any particles which may be obviously removed. It is better to cover the wound with foreign bodies and all using a sterile gauze held in place with tape or a bandage.

Seek medical assistance as soon as is practical.

Injuries Caused by Crushing.

Lay the injured person down and cut away the clothing from the injury.

Control bleeding with gauze pads and treat the victim for shock.

Wrap the injury with gauze pads and bandage well. Keep the injured part of the body elevated.

If a fracture exists, splint the limb before moving the victim.

Request immediate medical attention.

9:4:3. Fractures

Fractures may be either simple or compound. In the case of the simple fracture a bone may be broken but the skin is not pierced.

Compound fractures are generally more serious and involve broken bones with piercing of the skin. In these cases there is likely to be a wound above the break with bleeding and the bone end may protrude from the skin.

Fractures may be recognised;

- where a victim heard the bone snap and can feel grating,
- where pain or tenderness exists in the region of the break,
- where partial or complete loss of the use of the limb exists,
- where there is deformity in the limb or
- where the limb is abnormally positioned or shows swelling or discolouration.

First Aid Treatment

Do not move the injured person more than is necessary.

Where possible merely place a bag of ice over the fracture and seek immediate medical assistance.

If a fracture is suspected treat it as the real thing unless a doctor tells you otherwise.

Treat for Shock After the Injury

If the injured person needs to be moved it is first necessary to apply splints to immobilise the limb handle slowly and gently onto a stretcher.

RIG SAFETY & EMERGENCY RESPONSE

Basic First Aid

In case of a compound fracture the wound is covered with gauze or a clean cloth and pressure is applied to control the bleeding before any required splinting is applied. Never attempt to push a protruding bone back into place

9:4:4. Burns & Scalds

Burns and scalds are classified in degrees of severity.

First Degree Burns are where the skin is reddened

Second Degree Burns are where blistering occurs

Third Degree Burns are where skin is charred or cooked.

First aid in the treatment of burns should be aimed at relieving pain, preventing infection and preventing or treating for shock.

There are a number of important 'DON'TS' associated with the treatment of burns.

- don't touch the burn with any thing which is not clean
- don't use butter, oils or boric, tannic or picric acid based ointments
- don't put absorbent cotton or blankets directly on a burn with broken skin
- don't break or drain blisters
- don't delay first aid treatment for shock in cases of serious burns
- don't delay obtaining professional medical assistance

Treatment of First Degree Burns

apply antiseptic- analgesic burn ointment, cover with a sterile gauze pad and bandage firmly

Treatment of Second Degree Burns

administer first aid for treating shock

If the victim is conscious and thirsty and there are no abdominal wounds it is advisable to give, freely, a weak saline and bicarbonate of soda solution. Prepare the solution using half a teaspoon of bicarbonate and 2 heaped teaspoons of salt in a litre of water.

Remove clothing from the burn being careful to cut around any cloth sticking or fused to the burn.

Cover the burn area with sterile gauze or a suitable substitute such as a freshly laundered sheet or pillow case.

Make the victim comfortable and warm while seeking immediate professional medical assistance.

Third Degree Burns

Immediately administer treatment for shock.

Do nothing to the burn but cover it with sterile gauze pads or cloth.

Seek immediate professional medical treatment for the victim.

RIG SAFETY & EMERGENCY RESPONSE

Basic First Aid

9:4:5. Treatment for Shock

Shock is a serious depression of vital functions that can often accompany even moderate injury.

In all cases of severe injury first aid for shock should be given immediately. It is important not to wait for shock to develop and to act immediately by keeping the victim lying down, warm and with an adequate supply of fluids.

All or any of the following symptoms may be present immediately following an accident or may develop over a period of time after the event.

weakness, faintness, mental sluggishness or collapse,
paleness with cool or clammy skin,
drooping eyelids, eyes vacant and dull or dilation of pupils,
rapid and shallow breathing,
nausea and/or vomiting,
rapid, irregular or weak or too weak to feel pulse or
unconsciousness.

Treatment

Lay the victim on his back with the face upward.

Loosen clothing and elevate the feet about 30 to 50 cm. or,

For a head injury elevate the head instead of the feet.

For chest injuries and breathing difficulties elevate head and shoulders

Keep victim comfortable and warm with top and bottom blankets.

In hot weather do not make the victim uncomfortably warm.

Conscious victims with out abdominal wounds should be provided as much fluid as is comfortable for them to take provided they are not nauseous or vomiting.

A teaspoon of baking soda with half a teaspoon of salt in a litre of water is suitable as a fluid or orange juice and other soft fluids may be used.

No alcohol or stimulants should be administered.

Attend any injuries and keep the victim quiet and comfortable while waiting for professional medical assistance.

9:4:6. Responsibility

First aid practiced at a drilling location is the responsibility of the rig Safety Officer who is trained as a First Aid Orderly.

The Officer is responsible for carrying out first aid on any victim injured at the location, for dispatch of any seriously injured victim in an accident and for the requesting of medical assistance for the victim of an accident.

This person is also responsible for reporting accidents and dispatching all correspondence associated with the mishap at the location.

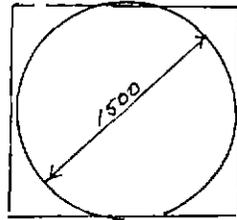
SHITTIM 1A
STRATIGRAPHIC SLIMHOLE DRILLING PROGRAM

CONTINGENCY WELL PLAN
BLOWOUT PREVENTION AND WELL CONTROL
RIG SAFETY AND EMERGENCY RESPONSE

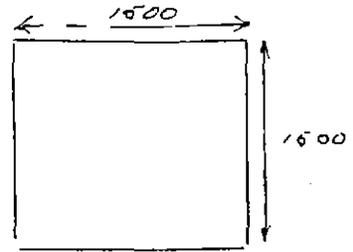
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WORKING SKETCH MUD & CEMENT PUMP DISCHARGE MANIFOLD
WORKING SKETCH FMC BEAN KILL PUMP 1,500 PSI DISCHARGE LINE
WORKING SKETCH GENERAL HYDRAULICS BOP CLOSING UNIT PARTS.
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TABLE WIRELINE BITS AND REAM SHELL DIMENSIONS
DIAGRAM NQ CORE BARREL ASSEMBLY DESCRIPTION
DIAGRAM NQ OVERSHOT ASSEMBLY
3 WORKING SKETCHES HW / HQ / NQ DRILL STRING ASSEMBLIES

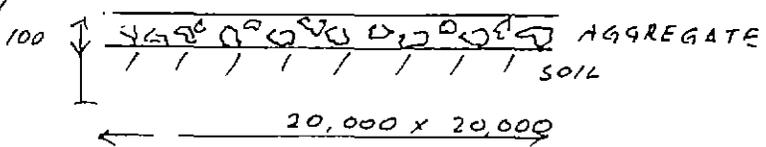
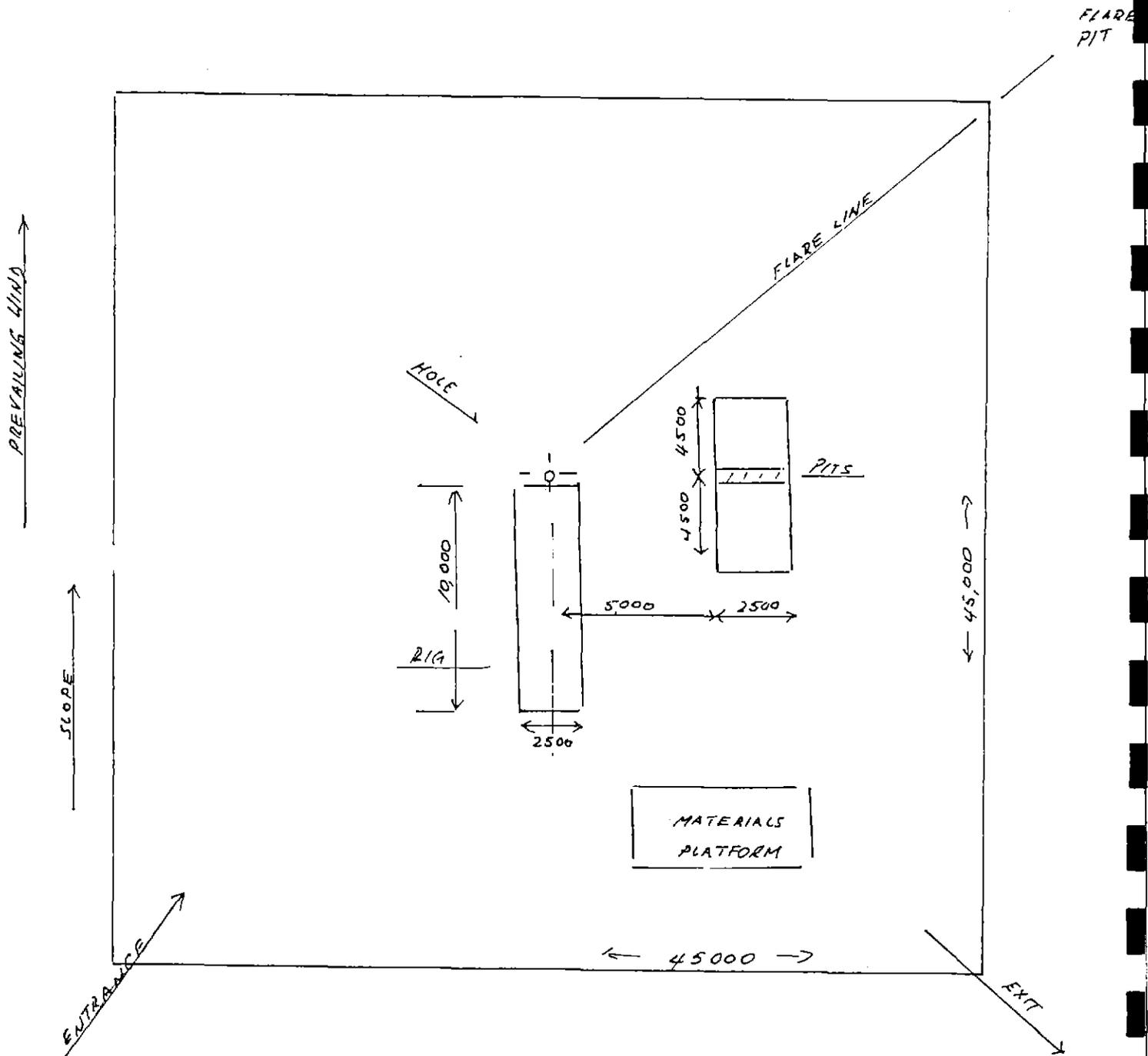
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CELLAR PLAN



CELLAR SECTION



BRUNI IS. SITE PLAN

PECTIL ENGINEERING

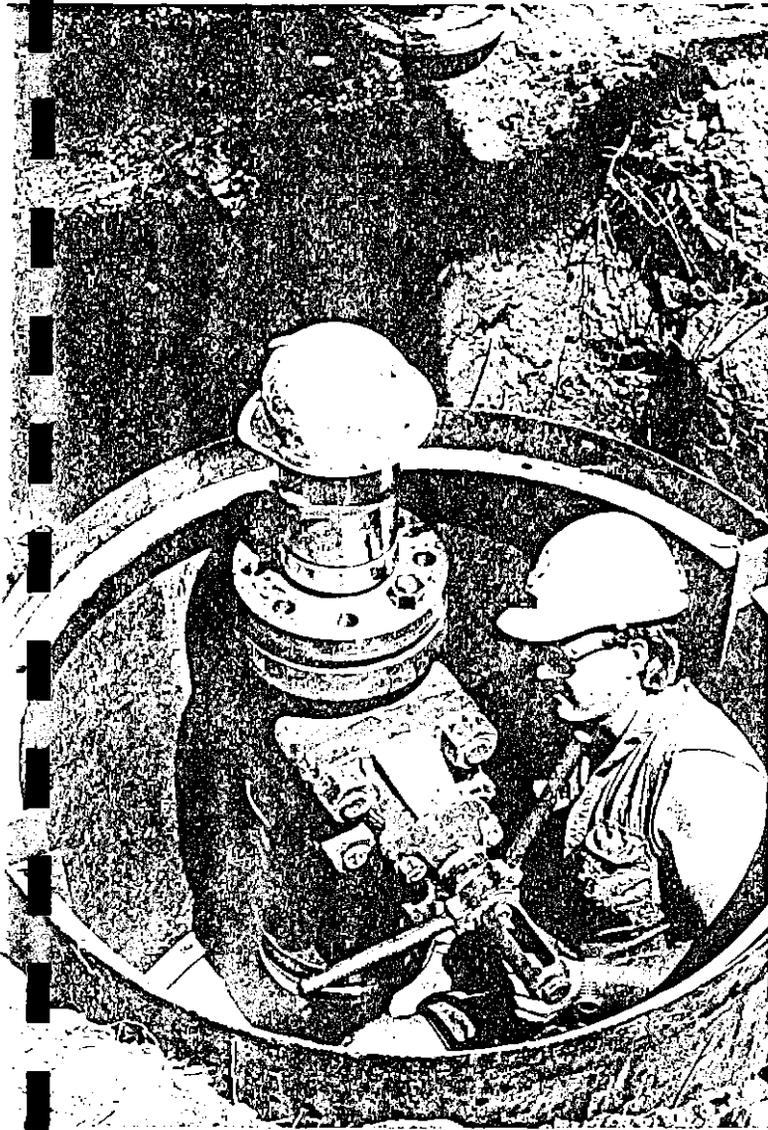
Oil & Gas Drilling
Development Engineering

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Telephone: (09) 481 5522 Facsimile: (09) 481 5550

Pectil Engineering Services
Oil & Gas Drilling Engineering Consultants

NOVEMBER 1992 SANDFIRE FLAT SD#1 DRILLING LOCATION
CANNING BASIN WESTERN AUSTRALIA

INSTALLATION OF REMET BLOWOUT PREVENTER STACK
RATED 1,000 PSI STACK TESTED TO 750 PSI WORKING PRESSURE

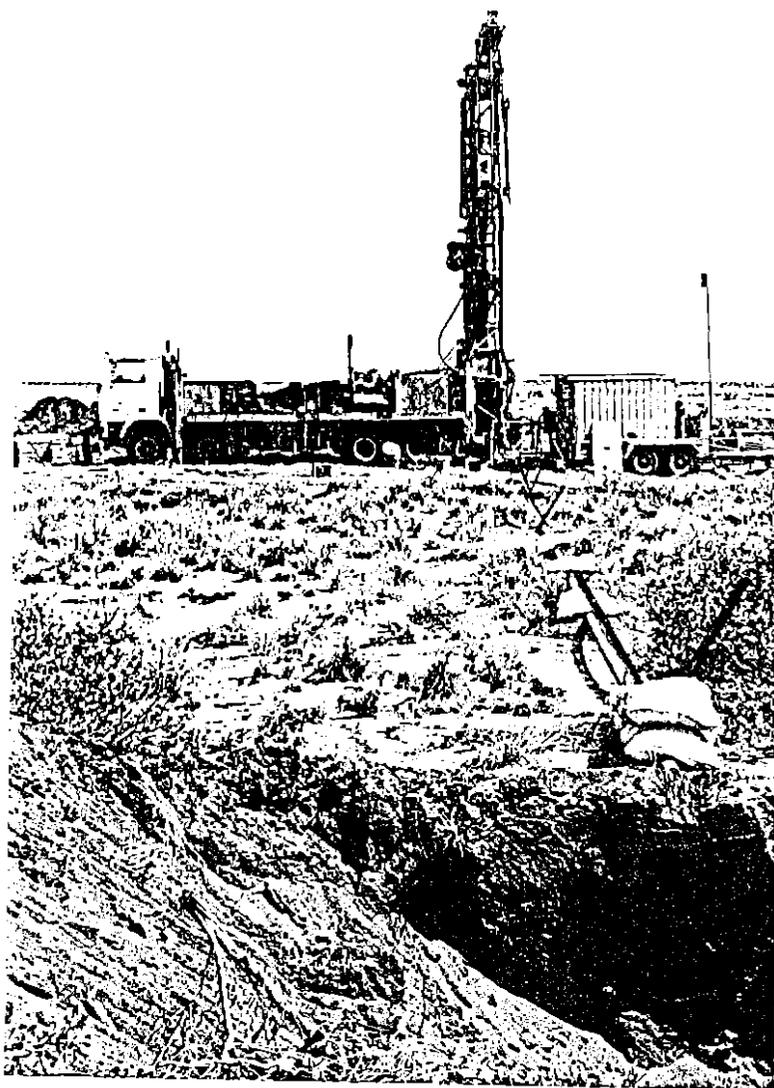


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Pectil Engineering Services
Oil & Gas Drilling Engineering Consultants

NOVEMBER 1992 SANDFIRE FLAT SD#1 DRILLING LOCATION
CANNING BASIN WESTERN AUSTRALIA

UDR 1000 DRILL RIG
NQ DIVERTER LINE TO FLARE PIT



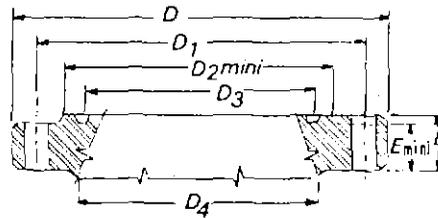
API TYPE 6B - 2 000 FLANGES

392

Maximum working pressure : 137 bars (2 000 psi)

Test pressure : flanged 14 in and smaller 275 bars (4 000 psi)

Test pressure : flanged 16 in and higher 206 bars (3 000 psi)



All dimensions in inches

Nominal size and bore (1)	Old nominal size	Outside diameter D	Total thickness E	Basic thickness E mini	Diameter of raised face D ₁ mini	Diameter of hub D ₂	Diameter of bolt circle D ₃	Number of bolts	Diameter of bolts	Length of stud bolts	Ring-joint Type R or RX	Pitch diam of groove D ₄
1 13/16*	1 1/2	6 1/8	1 1/8	7/8	3 9/16	2 3/4	4 1/2	4	3/4	4 1/4	20	2 11/16
2 1/16	2	6 1/2	1 5/16	1	4 1/4	3 5/16	5	8	5/8	4 1/2	23	3 1/4
2 9/16	2 1/2	7 1/2	1 7/16	1 1/8	5	3 15/16	5 7/8	8	3/4	5	26	4
3 1/8	3	8 1/4	1 9/16	1 1/4	5 3/4	4 5/8	6 5/8	8	3/4	5 1/4	31	4 7/8
4 1/16	4	10 3/4	1 13/16	1 1/2	6 7/8	6	8 1/2	8	7/8	6	37	5 7/8
5 1/8*	5	13	2 1/16	1 3/4	8 1/4	7 7/16	10 1/2	8	1	6 3/4	41	7 1/8
7 1/16	6	14	2 3/16	1 7/8	9 1/2	8 3/4	11 1/2	12	1	7	45	8 5/16
9	8	16 1/2	2 1/2	2 3/16	11 7/8	10 3/4	13 3/4	12	1 1/8	8	49	10 5/8
11	10	20	2 13/16	2 1/2	14	13 1/2	17	16	1 1/4	8 3/4	53	12 3/4
13 5/8	12	22	2 15/16	2 5/8	16 1/4	15 3/4	19 1/4	20	1 1/4	9	57	15
16 3/4	16	27	3 5/16	3	20	19 1/2	23 3/4	20	1 1/2	10 1/4	65	18 1/2
17 3/4*	18	29 1/4	3 9/16	3 1/4	22 5/8	21 1/2	25 3/4	20	1 5/8	11	69	21
21 1/4	20	32	3 17/8	3 1/2	25	24	28 1/2	24	1 5/8	11 3/4	73	23

* These sizes inactive : available on special order only.

(1) Beginning with the Eleven Edition of API Spec 6A (October 1977), the traditional 6B flange nominal size designation is changed to a through bore designation.

M 4

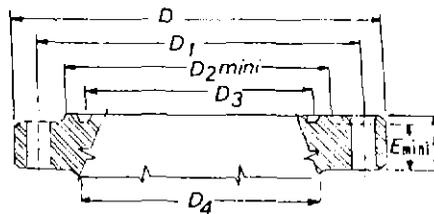
API TYPE 6B - 3 000 FLANGES

M 5

Maximum working pressure : 206 bars (3 000 psi)

Test pressure : flanged 14 in and smaller 412 bars (6 000 psi)

Test pressure : flanged 16 in and higher 3098 bars (4 500 psi)



All dimensions in inches

Nominal size and bore (1)	Old nominal size	Outside diameter D	Total thickness E	Basic thickness E mini	Diameter of raised face D ₁ mini	Diameter of hub D ₂	Diameter of bolt circle D ₃	Number of bolts	Diameter of bolts	Length of stud bolts	Ring-joint Type R or RX	Pitch diam of groove D ₄
1 13/16*	1 1/2	7	1 1/2	1 3/4	3 5/8	2 3/4	4 7/8	4	1	5 1/2	20	2 11/16
2 1/16	2	8 1/2	1 13/16	1 1/2	4 7/8	4 1/8	6 1/2	8	7/8	6	24	3 3/4
2 9/16	2 1/2	9 5/8	1 15/16	1 5/8	5 3/8	4 7/8	7 1/2	8	1	6 1/2	27	4 1/4
3 1/8	3	9 1/2	1 13/16	1 1/2	6 1/8	5	7 1/2	8	7/8	6	31	4 7/8
4 1/16	4	11 1/2	2 1/16	1 3/4	7 1/8	6 1/4	9 1/4	8	1 7/8	7	37	5 7/8
5 1/8*	5	13 3/4	2 5/16	2	8 1/2	7 1/2	11	8	1 1/4	7 3/4	41	7 1/8
7 1/16	6	15	2 1/2	2 3/16	9 1/2	9 1/4	12 1/2	12	1 1/8	8	45	8 5/16
9	8	18 1/2	2 13/16	2 1/2	12 1/8	11 3/4	15 1/2	12	1 3/8	9	49	10 5/8
11	10	21 1/2	3 1/16	2 3/4	14 1/4	14 1/2	18 1/2	16	1 3/8	9 1/2	53	12 3/4
13 5/8	12	24	3 7/16	3 1/8	16 1/2	16 1/2	21	20	1 3/8	10 1/4	57	15
16 3/4	16	27 3/4	3 15/16	3 1/2	20 5/8	20	24 1/4	20	1 5/8	11 3/4	66	18 1/2
17 3/4	18	31	4 1/2	4	23 3/8	22 1/4	27	20	1 7/8	13 3/4	70	21
21 1/4	20	33 3/4	4 3/4	4 1/4	25 1/2	24 1/2	29 1/2	20	2	14 1/2	74	23

(1) Beginning with the Eleven Edition of API Spec 6A (October 1977), the traditional 6B flange nominal size designation is changed to a through bore designation.

* These sizes inactive : available on special order only.

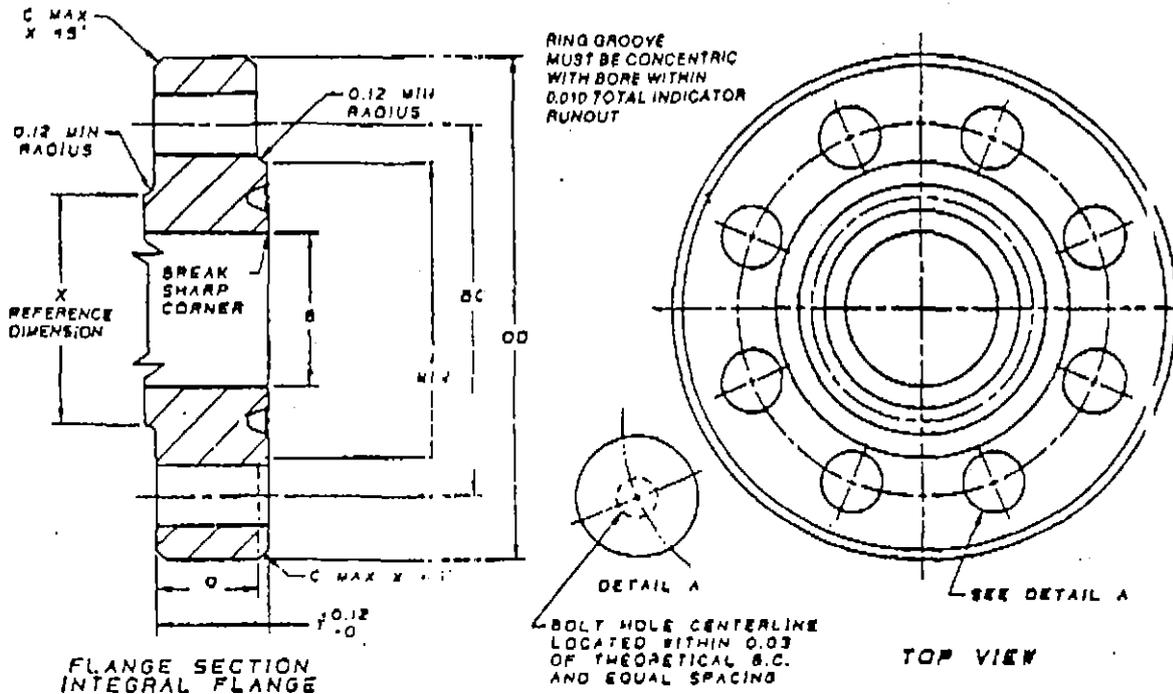
Note: Except for bore of welding neck flanges, dimensions for sizes 1 13/16 in to 2 9/16 in inclusive are identical with 5 000 psi flanges in table next page.

393

841051

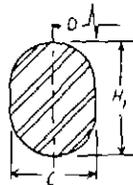
EQUIPMENT SPECIFIC REQUIREMENTS (continued)

TABLE X A8
TYPE 6B FLANGES FOR
3000 psig RATED WORKING PRESSURE



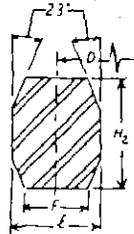
Nominal Size and Bore of Flange	Basic Flange Dimensions								Bolting Dimensions					
	Max Bore	Outside Diameter of Flange	Tolerance	Max Chamfer	Diameter of Bolt Circle	Flange Thickness	Basic Thickness of Flange	Diameter of Hub	Diameter of Bolt Circle	Number of Bolts	Diameter of Bolts	Diameter of Bolt Holes	Bolt Hole Tolerance	Lengths of Stud Bolts
	B	OD1	OD	C	K	T	Q	X	BC					L _{SB}
2 1/4"	2.09	8.50	±0.06	0.12	4.81	1.81	1.50	4.12	6.50	8	3/4	1.00	+0.06	6.00
2 3/4"	2.59	9.62	±0.06	0.12	5.31	1.94	1.62	4.88	7.50	8	1	1.12	+0.06	6.50
3 1/4"	3.10	9.50	±0.06	0.12	6.11	1.81	1.50	5.00	7.50	8	3/4	1.00	+0.06	6.00
4 1/4"	4.09	11.50	±0.06	0.12	7.11	2.06	1.75	6.25	9.25	8	1 1/4	1.25	+0.06	7.00
7 1/4"	7.09	15.00	±0.12	0.26	8.11	2.50	2.19	9.25	12.50	12	1 1/2	1.25	+0.06	8.00
9"	9.03	18.50	±0.12	0.26	12.11	2.81	2.50	11.75	16.50	12	1 3/4	1.50	+0.06	9.00
11"	11.03	21.50	+0.12	0.25	14.11	3.06	2.75	14.50	18.50	16	1 3/4	1.50	+0.06	9.50
13 1/4"	13.66	24.00	±0.12	0.25	16.61	3.44	3.12	16.50	21.00	20	1 3/4	1.50	+0.06	10.25
16 1/4"	16.78	27.75	±0.12	0.25	20.61	3.94	3.50	20.00	24.25	20	1 3/4	1.75	+0.09	11.75
20 1/4"	20.78	33.75	±0.12	0.25	25.61	4.75	4.25	24.50	29.50	20	2	2.12	+0.09	14.50

API TYPE R RING-JOINT GASKETS
(API Spec 6A) (for use in 6B flanges)



oval

All dimensions in inches

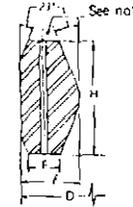


octagonal

Ring number	Pitch diam. of ring D	Width of ring F	Height of ring		Width of flat octagonal ring F	Approximate distance between make-up flanges
			oval	octagonal		
R 20	2 11/16	5/16	9/16	1/2	0.206	5/32
R 23	3 1/4	7/16	11/16	5/8	0.305	3/16
R 24	3 3/4	7/16	11/16	5/8	0.305	3/16
R 26	4	7/16	11/16	5/8	0.305	3/16
R 27	4 1/4	7/16	11/16	5/8	0.305	3/16
R 31	4 7/8	7/16	11/16	5/8	0.305	3/16
R 35	5 3/8	7/16	11/16	5/8	0.305	3/16
R 37	5 7/8	7/16	11/16	5/8	0.305	3/16
R 39	6 3/8	7/16	11/16	5/8	0.305	3/16
R 41	7 1/8	7/16	11/16	5/8	0.305	3/16
R 44	7 5/8	7/16	11/16	5/8	0.305	3/16
R 45	8 5/16	7/16	11/16	5/8	0.305	3/16
R 46	8 5/16	1/2	3/4	11/16	0.341	1/8
R 47	9	3/4	1	15/16	0.485	5/32
R 49	10 5/8	7/16	11/16	5/8	0.305	3/16
R 50	10 5/8	5/8	7/8	13/16	0.413	5/32
R 53	12 3/4	7/16	11/16	5/8	0.305	3/16
R 54	12 3/4	5/8	7/8	13/16	0.413	5/32
R 57	15	7/16	11/16	5/8	0.305	3/16
R 63	16 1/2	1	1 5/16	1 1/4	0.681	7/32
R 65	18 1/2	7/16	11/16	5/8	0.305	3/16
R 66	18 1/2	5/8	7/8	13/16	0.413	5/32
R 69	21	7/16	11/16	5/8	0.305	3/16
R 70	21	3/4	1	15/16	0.485	5/32
R 73	23	1/2	3/4	11/16	0.341	1/8
R 74	23	3/4	1	15/16	0.485	5/32
R 82	2 1/4	7/16	—	5/8	0.305	3/16
R 84	2 1/2	7/16	—	5/8	0.305	3/16
R 85	3 1/8	1/2	—	11/16	0.341	1/8
R 86	3 9/16	5/8	—	13/16	0.413	5/32
R 87	3 15/16	5/8	—	13/16	0.413	5/32
R 88	4 7/8	3/4	—	15/16	0.485	5/32
R 89	4 1/2	3/4	—	15/16	0.485	5/32
R 90	6 1/8	7/8	—	1 1/16	0.593	3/16
R 91	10 1/4	1 1/4	—	1 1/2	0.879	5/16
R 99	9 1/4	7/16	—	5/8	0.305	3/16

API TYPE RX PRESSURE ENERGIZED RING-JOINT GASKETS (API Spec 6A)
(for use in 6B flanges and segmented flanges)

All dimensions in inches



Ring number	Outside diameter of ring D	Total width F	Width of flat F	Height H	Pitch diameter of groove	Approximate distance between made-up flanges
RX 20	3	11/32	0.182	3/4	2 11/16	3.8
RX 23	3 43/64	15/32	0.254	1	3 1/4	15/32
RX 24	4 11/64	15/32	0.254	1	3 3/4	15/32
RX 26	4 13/32	15/32	0.254	1	4	15/32
RX 27	4 21/32	15/32	0.254	1	4 1/4	15/32
RX 31	5 19/64	15/32	0.254	1	4 7/8	15/32
RX 35	5 51/64	15/32	0.254	1	5 3/8	15/32
RX 37	6 19/64	15/32	0.254	1	5 7/8	15/32
RX 39	6 51/64	15/32	0.254	1	6 3/8	15/32
RX 41	7 35/64	15/32	0.254	1	7 1/8	15/32
RX 44	8 3/64	15/32	0.254	1	7 5/8	15/32
RX 45	8 47/64	15/32	0.254	1	8 5/16	15/32
RX 46	8 3/4	17/32	0.263	1 1/8	8 5/16	15/32
RX 47	9 21/32	25/32	0.407	1 5/8	9	23/32
RX 49	11 3/64	15/32	0.254	1	10 5/8	15/32
RX 50	11 5/32	21/32	0.335	1 1/4	10 5/8	15/32
RX 53	13 11/64	15/32	0.254	1	12 3/4	15/32
RX 54	13 9/32	21/32	0.335	1 1/4	12 3/4	15/32
RX 57	15 27/64	15/32	0.254	1	15	15/32
RX 63	17 25/64	1 1/16	0.582	2	16 1/2	27/32
RX 65	18 59/64	15/32	0.254	1	18 1/2	15/32
RX 66	19 1/32	21/32	0.335	1 1/4	18 1/2	15/32
RX 69	21 27/64	15/32	0.254	1	21	15/32
RX 70	21 21/32	25/32	0.407	1 5/8	21	23/32
RX 73	23 15/32	17/32	0.263	1 1/4	23	19/32
RX 74	23 21/32	25/32	0.407	1 5/8	23	23/32
RX 82	2 43/64	15/32	0.254	1	2 1/4	15/32
RX 84	2 59/64	15/32	0.254	1	2 1/2	15/32
RX 85	3 35/64	17/32	0.263	1	3 1/8	3.8
RX 86	4 5/64	19/32	0.335	1 1/8	3 9/16	3.8
RX 87	4 29/64	19/32	0.335	1 1/8	3 15/16	3.8
RX 88	5 31/64	11/16	0.407	1 1/4	4 7/8	3.8
RX 89	5 7/64	23/32	0.407	1 1/4	4 1/2	3.8
RX 90	6 7/8	25/32	0.479	1 3/4	6 1/8	23/32
RX 91	11 19/64	1 3/16	0.780	1 25/32	10 1/4	3.4
RX 99	9 43/64	15/32	0.254	1	9 1/4	15/32
RX 201	2.026	0.226	0.126	0.445	—	—
RX 205	2.29 64	7/32	0.120	0.437	—	—
RX 210	3.27 32	3/8	0.213	0.750	—	—
RX 215	5.35 64	15/32	0.210	1.000	—	—

Note: The pressure passage hole illustrated in the RX ring cross-section is required in rings RX 82 through RX 91 only.

841002

LAND AND PLATFORM PRODUCTION

STUD BOLTS, NUTS, RING GASKETS, AND WRENCHES

ASTM A193 GRADE B7 MATERIAL - BOLTING

ASTM A194 GRADE 2H MATERIAL - NUTS

Required for Bolting Two API Flanges Together

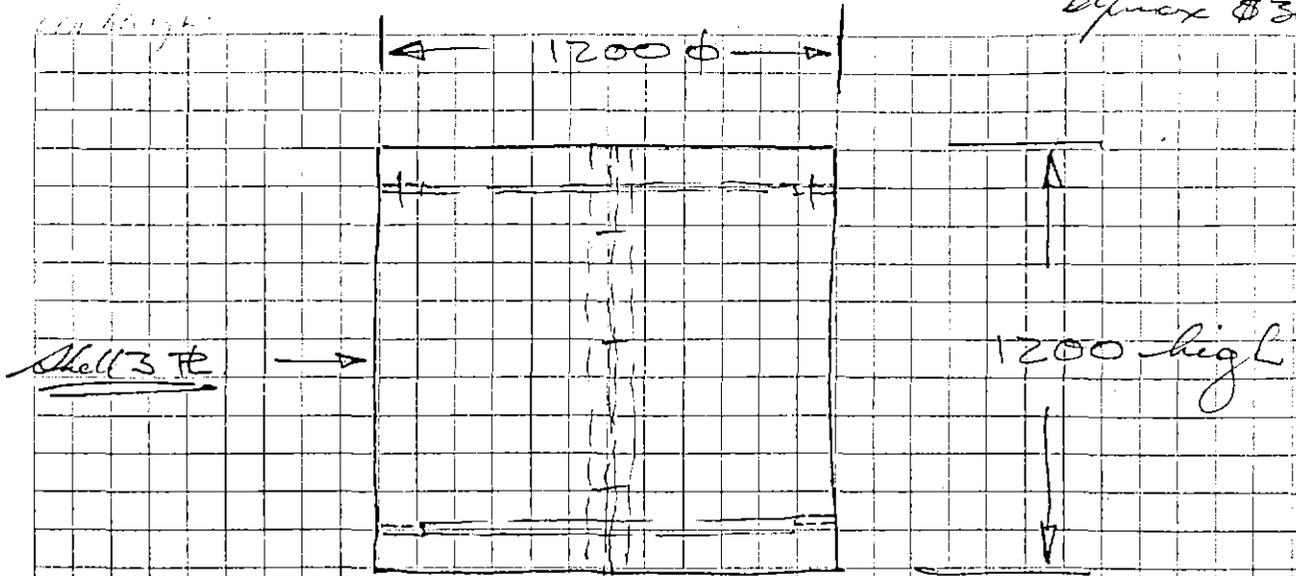
Nominal Flange Pressure	Stud Diameter and Length	Number of Stud	Stud Part Number - Customer Flange	API Part Number	Stud Wrench Part Number	API Ring Gaskets for Type B1 Flanges		Pressure-Engraved Gaskets for Type B2 Flanges			Pressure-Engraved Gaskets for Type B3 Flanges	
						API Part Number	API Part Number	API Part Number	API Part Number	API Part Number	API Part Number	
1 1/4" 10,000	3/4" x 5 1/2"	8	5911-07-10	12955-07-10	7959-11	-	-	-	-	-	150	18975-01
1 1/4" 15,000	3/4" x 5 1/2"	8	5911-10-10	12955-07-10	7959-11	-	-	-	-	-	150	18975-01
1 1/4" 20,000	3/4" x 5 1/2"	8	5911-07-10	12955-07-10	7959-11	-	-	-	-	-	151	19058-01
1 1/2" 15,000	7/8" x 5 1/2"	8	5912-05-10	12955-12-10	7959-01	-	-	-	-	-	151	19058-01
1 1/2" 20,000	1" x 7 1/2"	8	5913-22-10	12955-11-10	7959-02	-	-	-	-	-	151	19058-01
2 1/4" 2000	1 1/4" x 4 1/2"	8	8215-03-10	12955-10-10	7959-12	23	6590-10	23	19000-23	1 1/2"	-	-
2 1/4" 5000	1 1/4" x 6 1/2"	8	5912-20-10	12955-12-10	7959-01	24	6590-11	24	19000-24	1 1/2"	-	-
2 1/4" 10,000	1 1/4" x 5 1/2"	8	5911-05-10	12955-07-10	7959-11	-	-	-	-	-	152	18975-01
2 1/4" 15,000	1 1/4" x 6 1/2"	8	5912-20-10	12955-12-10	7959-01	-	-	-	-	-	152	18975-01
2 1/4" 20,000	1 1/4" x 5 1/2"	8	5914-25-10	12955-13-10	7959-03	-	-	-	-	-	152	18975-01
2 1/2" 2000	1 1/2" x 5 1/2"	8	5911-07-10	12955-07-10	7959-11	26	6590-27	26	19000-26	1 1/2"	-	-
2 1/2" 5000	1 1/2" x 7"	8	5913-14-10	12955-11-10	7959-02	27	6590-17	27	19000-27	1 1/2"	-	-
2 1/2" 10,000	1 1/2" x 6 1/2"	8	5912-20-10	12955-12-10	7959-01	-	-	-	-	-	153	19331-01
2 1/2" 15,000	1 1/2" x 7"	8	5913-14-10	12955-11-10	7959-02	-	-	-	-	-	153	19331-01
2 1/2" 20,000	1 1/2" x 9 1/2"	8	5915-38-10	12955-17-10	7959-04	-	-	-	-	-	153	19331-01
3 1/4" 2000	1 3/4" x 5 1/2"	8	5911-05-10	12955-07-10	7959-11	31	6590-09	31	19000-31	1 3/4"	-	-
3 1/4" 3000	1 3/4" x 6 1/2"	8	5912-20-10	12955-12-10	7959-01	31	6590-09	31	19000-31	1 3/4"	-	-
3 1/4" 5000	1 3/4" x 7 1/2"	8	5914-05-10	12955-13-10	7959-03	35	6590-10	35	19000-35	1 3/4"	-	-
3 1/4" 10,000	1 3/4" x 7 1/2"	8	5913-13-10	12955-11-10	7959-02	-	-	-	-	-	154	19319-01
3 1/4" 15,000	1 3/4" x 8"	8	5914-15-10	12955-13-10	7959-03	-	-	-	-	-	154	19319-01
3 1/4" 20,000	1 3/4" x 10 1/2"	8	5917-91-10	12955-19-10	7959-05	-	-	-	-	-	154	19319-01
4 1/4" 2000	1 3/4" x 6 1/2"	8	5912-20-10	12955-12-10	7959-01	37	6590-16	37	19000-37	1 3/4"	-	-
4 1/4" 3000	1 3/4" x 7 1/2"	8	5914-05-10	12955-13-10	7959-03	37	6590-16	37	19000-37	1 3/4"	-	-
4 1/4" 5000	1 3/4" x 8 1/2"	8	5915-11-10	12955-17-10	7959-04	39	6590-12	39	19000-39	1 3/4"	-	-
4 1/4" 10,000	1 3/4" x 8 1/2"	8	5914-23-10	12955-13-10	7959-03	-	-	-	-	-	155	25655-01
4 1/4" 15,000	1 3/4" x 9 1/2"	8	5917-89-10	12955-19-10	7959-05	-	-	-	-	-	155	25655-01
4 1/4" 20,000	1 3/4" x 12 1/2"	8	7311-34-10	12955-36-10	7959-08	-	-	-	-	-	155	25655-01
7 1/4" 2000	1 3/4" x 7 1/2"	12	5913-25-10	12955-11-10	7959-02	45	6590-01	45	19000-45	1 3/4"	-	-
7 1/4" 3000	1 3/4" x 8 1/2"	12	5914-25-10	12955-13-10	7959-03	45	6590-01	45	19000-45	1 3/4"	-	-
7 1/4" 5000	1 3/4" x 11 1/2"	12	5917-25-10	12955-19-10	7959-05	46	6590-38	46	19000-46	1 3/4"	-	-
7 1/4" 10,000	1 3/4" x 11 1/2"	12	5918-29-10	12955-31-10	7959-06	-	-	-	-	-	156	18317-01
7 1/4" 15,000	1 3/4" x 13"	16	5918-83-10	12955-31-10	7959-06	-	-	-	-	-	156	18317-01
7 1/4" 20,000	2" x 18"	16	5919-48-10	12955-49-10	7959-10	-	-	-	-	-	156	18977-01
8" 2000	1 3/4" x 8 1/2"	12	5914-25-10	12955-13-10	7959-03	49	6590-15	49	19000-49	1 3/4"	-	-
9" 3000	1 3/4" x 9 1/2"	12	5917-20-10	12955-19-10	7959-05	49	6590-15	49	19000-49	1 3/4"	-	-
9" 5000	1 3/4" x 12 1/2"	12	8305-24-10	12955-35-10	7959-07	50	6590-22	50	19000-50	1 3/4"	-	-
9" 10,000	1 3/4" x 13 1/2"	16	5918-84-10	12955-31-10	7959-06	-	-	-	-	-	157	19822-01
9" 15,000	1 3/4" x 16 1/2"	16	6832-63-10	12955-37-10	7959-09	-	-	-	-	-	157	15822-01
11" 2000	1 3/4" x 9 1/2"	16	5915-33-10	12955-17-10	7959-04	53	6590-07	53	19000-53	1 3/4"	-	-
11" 3000	1 3/4" x 10"	16	5917-09-10	12955-19-10	7959-05	53	6590-07	53	19000-53	1 3/4"	-	-
11" 5000	1 3/4" x 14 1/2"	12	6832-01-10	12955-37-10	7959-09	54	6590-58	54	19000-54	1 3/4"	-	-
11" 10,000	1 3/4" x 15 1/2"	10	7311-13-10	12955-36-10	7959-08	-	-	-	-	-	158	19497-01
11" 15,000	2" x 19 1/2"	20	5919-36-10	12955-49-10	7959-10	-	-	-	-	-	158	19497-01
13 1/4" 2000	1 3/4" x 8 1/2"	20	5915-38-10	12955-17-10	7959-04	57	6590-14	57	19000-57	1 3/4"	-	-
13 1/4" 3000	1 3/4" x 10 1/2"	20	5917-14-10	12955-19-10	7959-05	57	6590-14	57	19000-57	1 3/4"	-	-
13 1/4" 5000	1 3/4" x 12 1/2"	16	6305-35-10	12955-35-10	7959-07	-	-	-	-	-	160	29903-01
13 1/4" 10,000	1 3/4" x 17 1/2"	20	6832-42-10	12955-37-10	7959-09	-	-	-	-	-	159	19821-01
13 1/4" 15,000	2 1/4" x 21"	20	13576-01-10	12955-38-10	7959-13	-	-	-	-	-	159	19871-01
16 1/4" 2000	1 3/4" x 10 1/2"	20	5918-23-10	12955-31-10	7959-06	65	6590-18	65	19000-65	1 3/4"	-	-
16 1/4" 3000	1 3/4" x 12 1/2"	20	6306-16-10	12955-35-10	7959-07	66	6590-31	66	19000-66	1 3/4"	-	-
16 1/4" 5000	1 3/4" x 14 1/2"	16	7311-13-10	12955-36-10	7959-08	-	-	-	-	-	161	40312-01
16 1/4" 10,000	1 3/4" x 14 1/2"	16	6832-58-10	12955-37-10	7959-09	-	-	-	-	-	162	40400-01
16 1/4" 15,000	1 3/4" x 17 1/2"	24	6832-42-10	12955-37-10	7959-09	-	-	-	-	-	162	40400-01
18 1/4" 5000	2" x 18"	20	5919-48-10	12955-49-10	7959-10	-	-	-	-	-	163	700242
18 1/4" 10,000	2 1/4" x 22 1/2"	24	13576-01-10	12955-38-10	7959-13	-	-	-	-	-	164	67327-03-02
21 1/4" 2000	1 3/4" x 12 1/2"	24	6305-16-10	12955-35-10	7959-07	73	6590-28	73	19000-73	1 3/4"	-	-
20 1/2" 3000	2" x 15 1/2"	20	5919-05-10	12955-40-10	7959-10	74	6590-56	74	19000-74	1 3/4"	-	-

*Obtain API 5000 psi WP 7500 Test

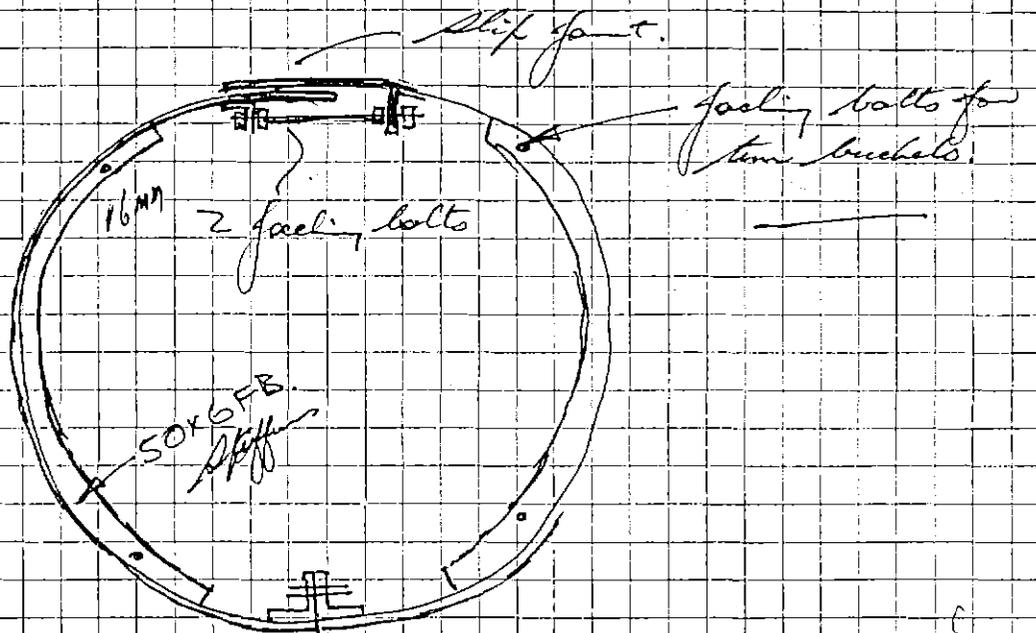
**For black studs and nuts, drop the second dash number (-10).

841054

Approx \$300.00



Side View



Note

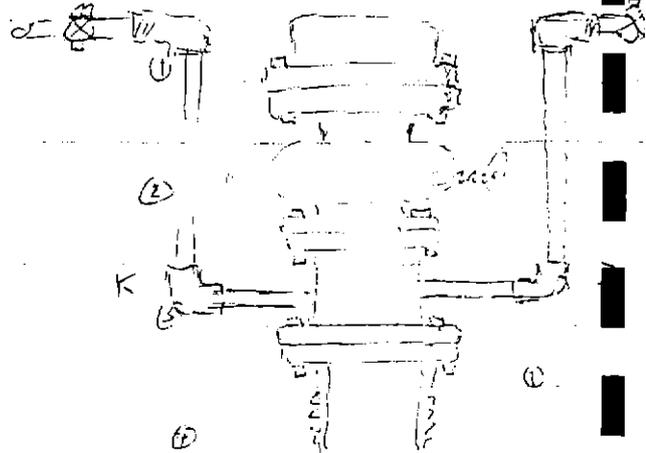
Murray wants height $1200 + () = 1371$

Ordered in already so it comes at 1200-

Lead out:

Wellhead Equipment.

- ✓ Conkough 4' dia Well Celler - Portable. ✓
 4 x 1/4" Turnbuckles
 6 1/2" casing Clamp.



1. Remed 3000 psi Annular preventer.
2. Demco 4", 5000 psi Gate valve.
3. Feaver 4" Diverter Bowl.
4. Feaver 4" HW casinghead pin flange.

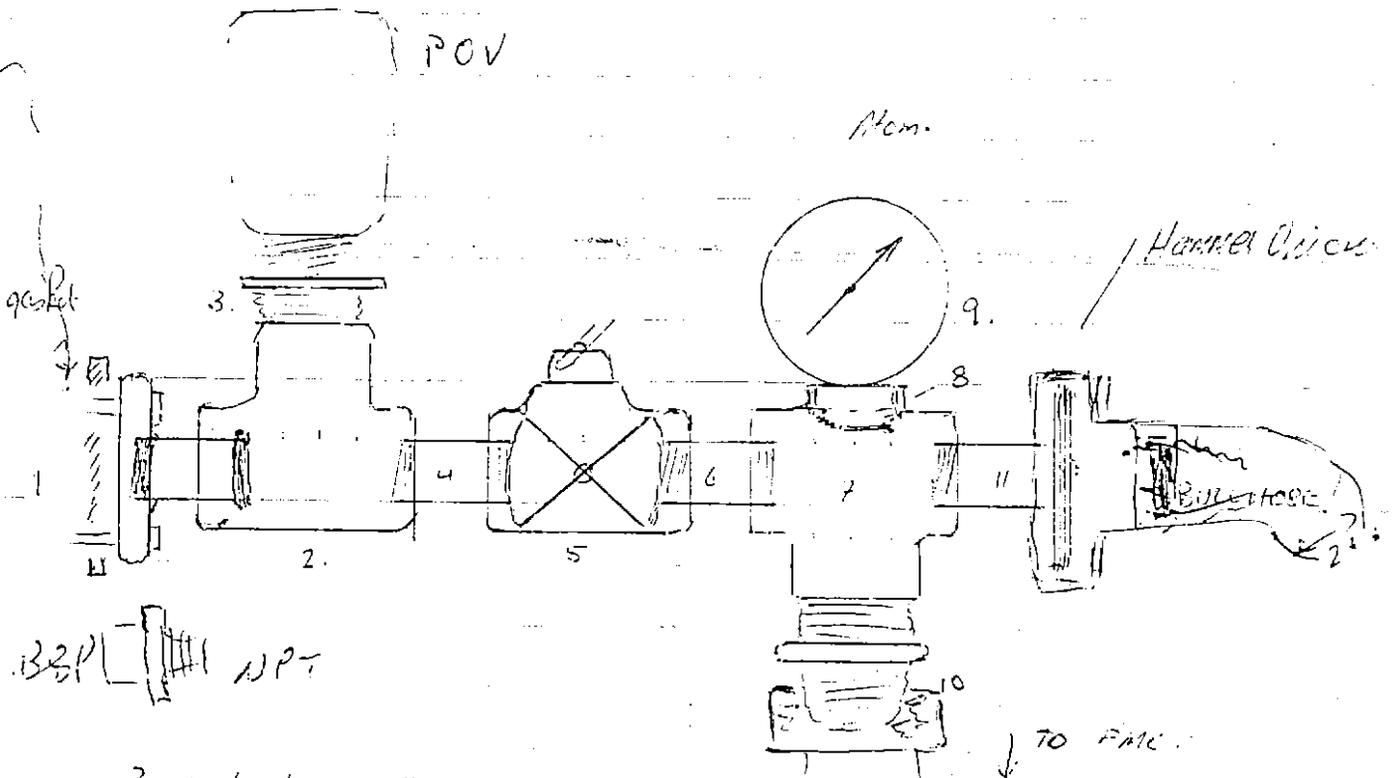
D Diverter line. 2" NPT diverter line assembly (see dia.)
 2" NPT - NR Flex line x 9 sub.

K Kill line. 2" NPT kill line assembly (see dia.)
 2" NPT - 1 5/16 JIC x 0 sub.

Flange Bolts. 24 x 1 1/8" Flange assembly, better nuts.

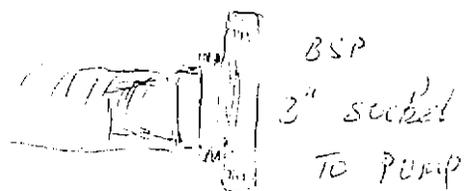
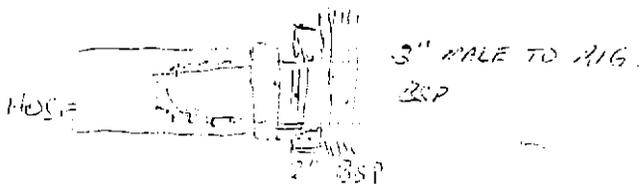
Note.
 Same from
 Atom.

DISCHARGE RATED 1500 PSI

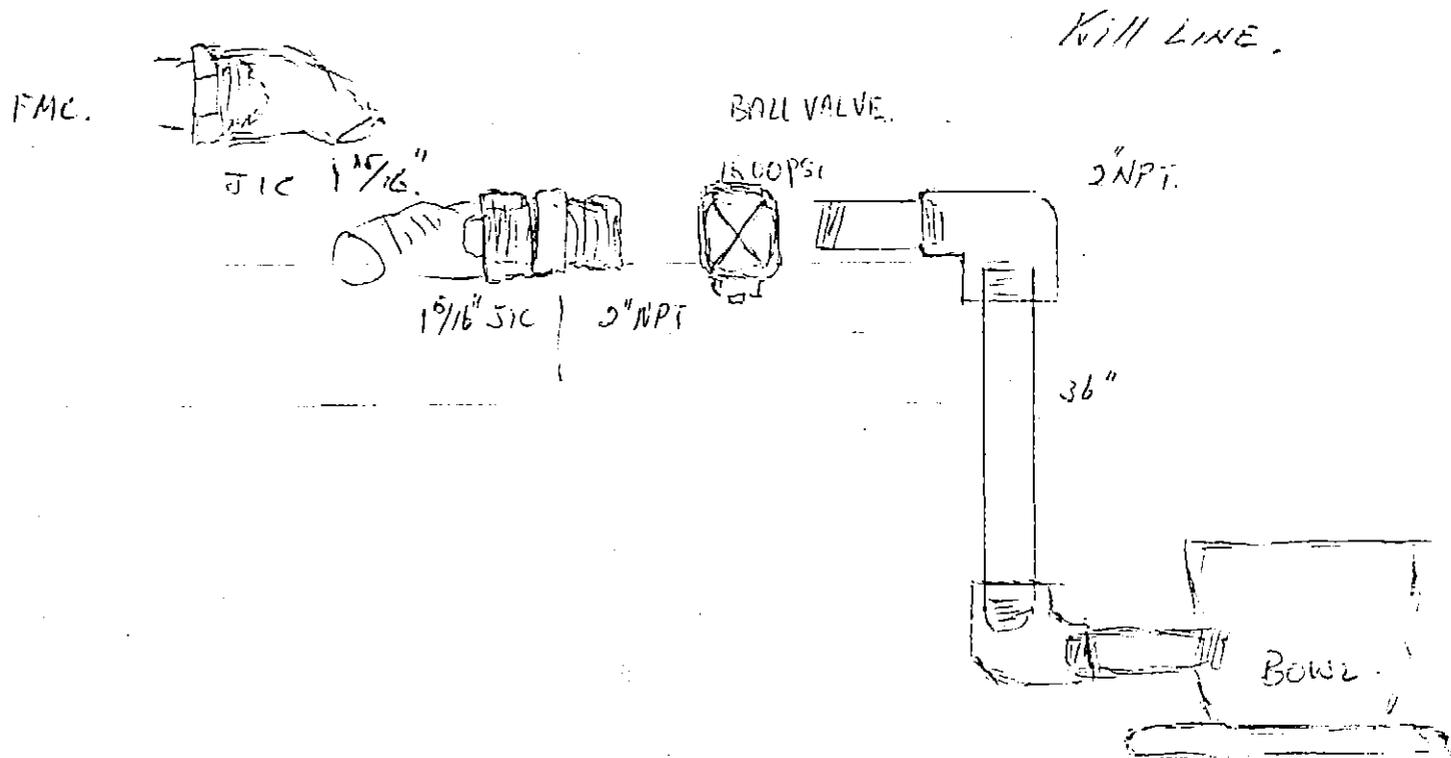


1. Pump discharge flange + 2" NPT NIPPLE.
2. 2" NPT T CONNECTION W/ SURGE CYLINDER.
3. 2" NPT → SURGE CHAMBER ?
4. 2" NPT NIPPLE.
- 5.
6. 2" NPT NIPPLE.
7. 2" NPT T CONNECTION
8. 2" NPT NIPPLE - PRESSURE GAUGE REDUCTION
9. 1500 PSI PRESSURE GAUGE.
10. 2" NPT - 1 1/4" NIPPLE.
11. 2" NPT → 3" BSP BULLHOSE NIPPLE.
12. JIC COUPLE HOSE TO FMC PUMP.

Note Bullhose Has BSP Rated Fittings.



FMC Discharge = Rated to 1500 PSI



841037

Mineral Drilling Handbook©

Diamond Core Drilling

Table D3: Physical Properties of Diamond Drill Rods

Rod Size	Nominal OD * ID (mm)	Wall Thickness (mm)	TPI	Coupling Dimension (mm)	Mass kg/m	Rod Capacity litre /10 m	Rod Plug Displacement litre / 10 m
<i>Original Diamond Core Drill Rods</i>							
E	33.3 * 21.4	6.0		11.1	4.17	3.6	8.71
A	41.3 * 28.6	6.4		14.3	5.64	6.4	
B	48.4 * 35.7	6.4		15.9	6.82	10.0	
N	60.3 * 50.8	4.8		25.4	7.28	20.3	
<i>DCDMA 'W' Series Core Drill Rods</i>							
RW	27.8 * 18.3	4.8	4	10.3	2.82	2.6	6.07
EW	35.0 * 25.4	4.8	3	12.7	3.74	5.1	9.62
AW	43.8 * 34.1	4.8	3	15.9	4.91	9.1	15.07
BW	54.1 * 44.5	4.8	3	19.0	6.23	15.6	23.00
NW	66.8 * 57.2	4.8	3	34.9	8.03	25.7	35.05
HW	89.1 * 77.8	5.7	3	60.3	12.66	47.5	62.35
<i>Longyear Wireline Core Drill Rods</i>							
EQ	34.9 * 26.5	4.2	4	26.5	3.20	5.5	9.6
AQ	44.5 * 34.9	4.8	4	34.9	4.63	9.6	15.6
BQ	55.6 * 46.0	4.8	3	46.0	5.97	16.6	24.3
BCQ-Composite	55.6 * 47.6	4.0	3	46.0	5.15		
NQ	70.0 * 60.3	4.9	3	60.3	7.58	28.6	38.5
NCQ-Composite	69.9 * 61.9	4.0	3	60.3	6.56		
HQ	88.9 * 77.8	5.6	3	77.8	11.45	47.5	62.1
HCQ-Composite	88.9 * 80.9	4.0	3	77.8	8.52		
PQ	114.3 * 103.2	5.6	3	103.2	15.26	83.6	102.6
<i>Longyear Composite Heavy Duty Wireline Core Drill Rods</i>							
CHD 76	69.9 * 60.3	4.8	2.5	55.0	9.2 / 8.5	28.6	38.3
CHD 101			2.5				
CHD 134			2.5				
CQ rods have 'Wedge Lok' tapered thread design							

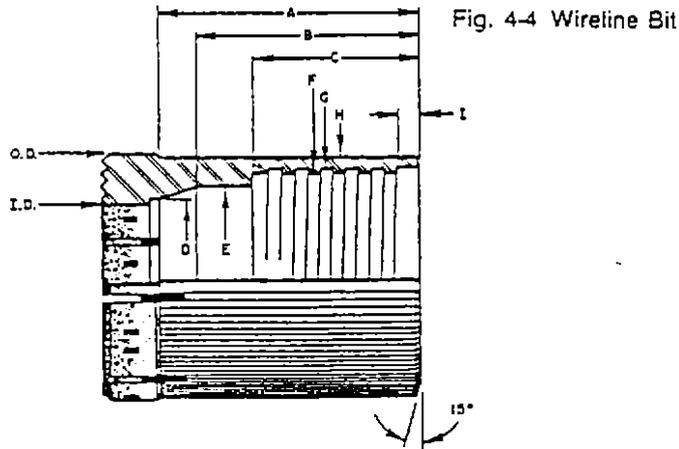
Table D4: Longyear W Series Flush Joint Casing to DCDMA CDDA & BSI Standards

Rod Size	Nominal OD * ID (mm)	Wall Thickness (mm)	Coupling Dimension (mm)	Mass kg/m	Rod Capacity litre /10 m	Rod Plug Displacement litre / 10 m
EW	46.0 * 38.1	3.95		4.16		
AW	57.1 * 48.4	4.35		5.64		
BW	73.0 * 60.3	6.35		10.43		
NW	88.9 * 76.2	6.35		12.80		
HW	114.3 * 101.6	6.35		16.83		
Joints with 4 thread per inch coupling supplied in 2 (609.6 mm), 5 (1524 mm) and 10 (3048 mm) foot.						

4.6 WIRELINE SIZES (Q-SERIES)

SIZE	SET O.D.		A I								
	IN	MM	A	B	C	D	E	F	G	H	I
AQ	1.875	1 062	2.281	1.937	1.660	1.095	1.437	1.597	1.656	1.835	0.25
	47.62	29.97	57.94	49.20	42.16	27.81	36.50	40.56	42.06	46.61	6.35
BQ	2.345	1.433	2.625	2.250	1.669	1.469	1.812	2.001	2.063	2.280	0.25
	59.56	36.40	66.67	57.15	42.39	37.31	46.02	50.83	52.40	57.91	6.35
NQ	2.965	1.875	2.622	2.125	1.125	1.906	2.375	2.597	2.657	2.908	0.25
	75.31	47.62	66.60	53.97	42.42	48.41	60.32	65.96	67.49	73.86	6.35
HQ	3.763	2.500	3.813	3.281	1.678	2.531	3.062	3.313	3.375	3.711	0.25
	95.58	63.50	96.85	83.34	42.62	64.29	77.77	84.15	85.72	94.26	6.35
PQ	4.805	3.345	4.627	4.120	2.919	3.408	4.060	4.293	4.386	4.745	0.25
	122.04	84.96	117.53	104.65	74.14	86.56	103.12	109.04	111.40	120.52	6.35
CHD76	2.980	1.712	2.810	2.125	1.669	1.802	2.250	2.535	2.595	2.908	0.25
	75.31	43.5	71.37	53.98	42.39	45.77	57.15	64.39	65.91	73.86	6.35
CHD101	3.967	2.500	4.000	3.281	1.669	2.590	3.123	3.441	3.566	3.908	0.25
	100.76	63.50	101.6	83.34	42.39	65.79	79.31	87.41	90.56	99.25	6.35

(Courtesy Longyear)



Q-Series, Reaming Shell

SIZE	SET O.D.		A L									
	IN	MM	A	B	D	E	F	G	H	I	J	L
AQ	1.890	1.656	1.597	1.437	1.591	1.651	1.625	1.531	2.397	6.375	1.835	
	48.00	42.06	40.56	36.50	40.41	41.93	41.27	38.89	60.98	161.92	46.61	
BQ	2.360	2.063	2.001	1.812	1.996	2.058	1.629	1.531	2.409	6.375	2.280	
	59.94	52.40	50.82	46.02	50.70	52.27	41.37	38.89	61.19	161.92	57.91	
NQ	2.980	2.657	2.597	2.375	2.592	2.652	1.625	1.531	2.260	6.750	2.908	
	75.69	67.49	65.96	60.32	65.84	67.36	41.27	38.89	57.40	171.45	73.86	
HQ	3.782	3.375	3.313	3.370	3.062	3.307	1.622	1.531	2.910	7.187	3.711	
	96.06	85.72	84.15	85.60	77.77	84.00	41.20	38.89	73.91	182.55	94.26	
PQ	4.827	4.385	4.295	4.062	4.288	4.379	1.620	1.531	1.658	7.000	4.743	
	122.60	111.38	109.09	103.17	108.91	111.23	41.15	38.89	42.11	177.80	120.47	
CHD76	2.980	2.595	2.535	2.250	2.530	2.590	1.617	1.531	2.848	6.750	2.908	
	75.69	65.91	64.39	57.15	64.26	65.79	41.07	38.89	72.34	171.45	73.86	
CHD101	3.990	3.566	3.441	3.123	3.433	3.560	1.610	1.675	2.910	7.188	3.928	
	101.3	90.56	87.39	79.31	87.19	90.41	40.89	42.55	73.91	182.56	99.76	

(Courtesy Longyear)

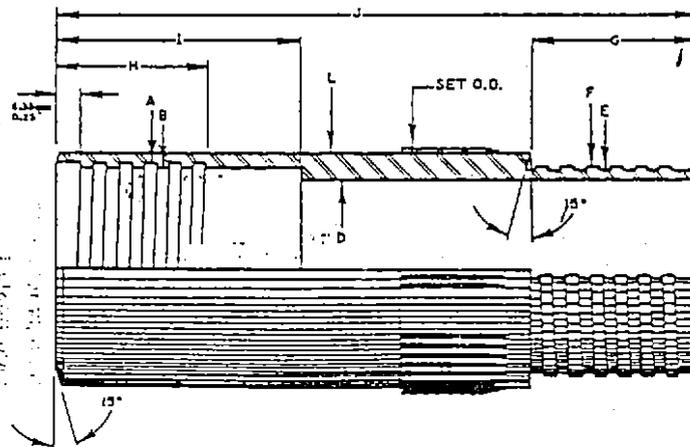


Fig. 4-5 Wireline Reaming Shell



NQ CORE BARREL ASSEMBLY

841002

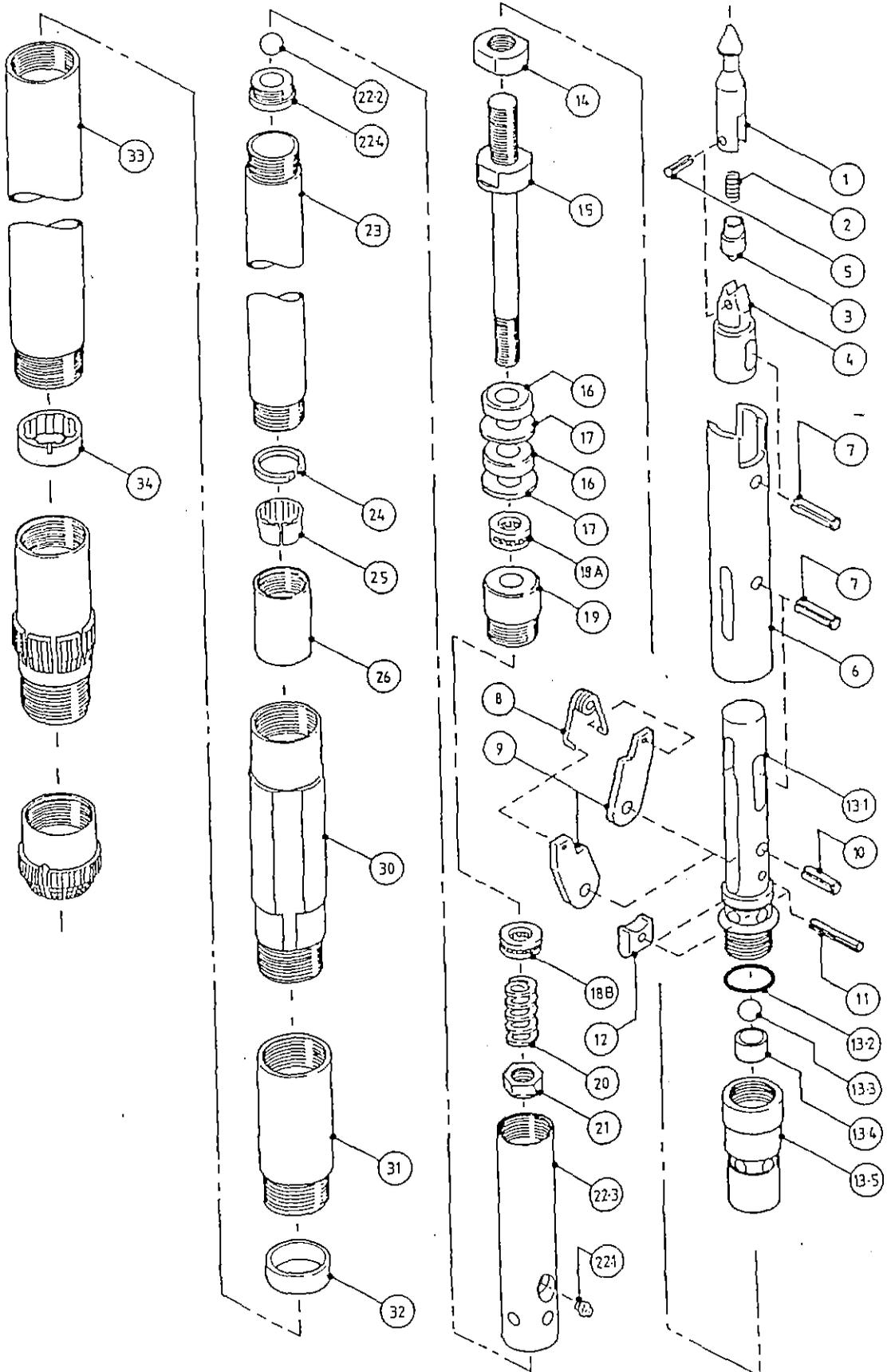
SECTION: 1A
 AUSTRALIAN PRICE LIST
 EFFECTIVE: 5.6.92
 REPLACES: 11.4.91
 FOB ADELAIDE/BRANCHES

ITEM NO	PART NO	DESCRIPTION	NO REQD	WEIGHT KG	ADELAIDE	BRANCH
1-35	63509	CORE BARREL ASSY 5FT	1	43.0		1439.55
1-35	63510	CORE BARREL ASSY 10FT	1	62.9		1518.30
1-26	63511	INNER TUBE ASSY 5FT	1	17.1		1001.70
1-26	63512	INNER TUBE ASSY 10FT	1	21.4		1017.45
1-22	63513	HEAD ASSY	1	9.5		829.50
1	42913	SPEARHEAD POINT	1	*		44.00
2	15141	COMPRESSION SPRING	1	*		2.68
3	42914	DETENT PLUNGER	1	*		11.76
4	42912	SPEARHEAD BSE	1	.6		90.51
5	42905	SPIRAL PIN, 7/16" X 1"	1	*		1.52
6	42910	LATCH RETRACTING CASE	1	1.3		116.24
7	24305	SPRING PIN 1/2" X 2"	2	*		3.57
8	44733	LATCH SPRING	1	*		3.62
9	40950	LATCH	2	*		15.49
10	24548	SPRING PIN, 1/2" X 1 1/2"	1	*		2.05
11	22646	SPRING PIN, 1/4" X 1 1/2"	1	*		0.79
12	24883	LATCH SUPPORT	1	*		20.21
13	62625	BODY LATCH NQ (NO. ASSY(13-1 TO-5)	1	2.5		336.00
13-1	62626	UPPER BODY	1			238.09
13-2	23676	O RING	1			0.47
13-3	62374	STEEL BALL	1			2.52
13-4	62380	BUSHING	1			18.48
13-6	63324	LOWER BODY(INCLUDES P/N 62380 BUSHING)	1			154.67
14	24885	LOCK NUT	1	*		5.30
15	24886	SPINDLE ASSY	1	1.4		86.05
16	24887	SHUT OFF VALVE	2	*		8.66
16	44209	SHUT OFF VALVE NQ ELAST	2	*		11.29
17	24888	VALVE ADJUSTING WASHER	2	*		9.92
18A	24312	BALL THRUST BEARING	1	*		19.43
18B	18298	HANGER BEARING	1	*		13.13
19	24889	SPINDLE BEARING	1	.7		55.23
20	24313	COMPRESSION SPRING	1	*		16.22
21	24314	SELF LOCKING NUT	1	*		2.57
22	40664	INNER TUBE CAP ASSY(22-1 TO-4)	-	1.5		193.67
22-1	17447	HYDRAULIC GREASE FITTING	1	*		0.59
22-2	25307	STAINLESS STEEL BALL	1	*		5.46
22-3	40677	INNER TUBE CAP	1	1.3		166.16
22-4	37382	CHECK VALVE BODY	1	*		48.98
23	24909	INNER TUBE 5FT	1	5.6		87.05
23	24909CP	INNER TUBE 5FT CP	1	5.6		184.64
23	24891	INNER TUBE 10FT	1	11.1		117.92
23	24891CP	INNER TUBE 10FT CP	1	11.1		291.17
24	24893	STOP RING	1	*		10.08
25	24894	CORE LIFTER	1	*		20.58
25	24894CP	CORE LIFTER CP	1	*		25.67
26	24892	CORE LIFTER CASE	1	*		35.91
30	24895	LOCKING COUPLING	1	2.6		193.10
31	24896	ADAPTOR COUPLING	1	1.6		46.67
32	24897	LANDING RING	1	*		21.11
33	24910	OUTER TUBE 5FT	1	20.0		211.58
33	24910CP	OUTER TUBE 5FTCP	1	20.0		341.04
33	24898	OUTER TUBE 10FT	1	35.9		300.88
33	24898CP	OUTER TUBE 10FT CP	1	35.9		430.40
34	44407	INNER TUBE STABILIZER	1	*		31.55
35	24900	THREAD PROTECTOR	1	1.8		57.59

Longyear

841063 NQ CORE BARREL ASSEMBLY

SECTION: 1A
AUSTRALIAN PRICE LIST
EFFECTIVE: 5.6.92
REPLACES: 11.4.91
FOB ADELAIDE/BRANCHES



Longyear is a registered trademark of Longyear's products and must, therefore, reserve the right to change designs, materials, specifications, and price without prior notice.



841004

NQ OVERSHOT ASSEMBLY

SECTION: 1A
 AUSTRALIAN PRICE LIST
 EFFECTIVE: 5.6.92
 REPLACES: 11.4.91
 FOB ADELAIDE/BRANCHES

ITEM NO	PART NO	DESCRIPTION	NO REQD	WEIGHT KG	BRANCH
1-20	68293	COMPLETE OVERSHOT ASSY 6MM	-	15.4	626.85
1	36244	CABLE CLAMP -6MM	1	*	57.23
2	36243	WIRE ROPE THIMBLE -6MM	1	*	2.20
3	25991	EYE BOLT	1	*	46.41
4	25990	SWIVEL CABLE COLLAR	1	*	41.32
5	25986	NEEDLE THRUST BEARING	1	*	7.56
6	25985	CASTLE NUT 1/2-20UNF	1	*	1.84
7	44615	COTTER PIN 3/32" X 3/4"	1	*	0.37
8	17447	HYDRAULIC GREASE FITTING	1	*	0.58
9	44444	BODY	1	7.3	189.63
10	44445	JAR TUBE WELDMENT	1	2.8	143.90
11	22917	SELF LOCKING NUT 1/2"-13 UNC	1	*	0.58
12	44448	JAR STAFF	1	1.1	65.26
13	15965	LOCKING SLEEVE**	1	1.6	67.04
14	45582	SPIRAL PIN 1/4" X 1 1/2"	2	*	1.68
15	44442	S/LOCKING S/SCREW 3/8-24 UNF X 5/8"	1	*	3.89
16	44449	OVERSHOT HEAD	1	3.3	273.16
17	06951	COMPRESSION SPRING	1	*	1.26
18	42906	PIN 1/2" X 1-15/16"	1	*	5.62
19	14651	LIFTING DOG	2	.5	50.82
20	37394	SPRING PIN 1/4" X 1-3/4"	1	*	0.89

ITEM NO	PART NO	DESCRIPTION	NO REQD	WEIGHT KG	BRANCH
1-20	44443	COMPLETE OVERSHOT ASSY 5MM	-	15.4	626.85
1	25987	CABLE CLAMP 5MM	1	*	57.23
2	25988	WIRE ROPE THIMBLE 5MM	1	*	2.20
3	25991	EYE BOLT	1	*	46.41
4	25990	SWIVEL CABLE COLLAR	1	*	41.32
5	25986	NEEDLE THRUST BEARING	1	*	7.56
6	25985	CASTLE NUT 1/2-20UNF	1	*	1.84
7	44615	COTTER PIN 3/32" X 3/4"	1	*	0.37
8	17447	HYDRAULIC GREASE FITTING	1	*	0.58
9	44444	BODY	1	7.3	189.63
10	44445	JAR TUBE WELDMENT	1	2.8	143.90
11	22917	SELF LOCKING NUT, 1/2" - 13UNC	1	*	0.58
12	44448	JAR STAFF	1	1.1	65.26
13	15965	LOCKING SLEEVE**	1	1.6	67.04
14	45582	SPIRAL PIN 1/4" X 1-1/2"	2	*	1.68
15	44442	S/LOCKING S/SCREW 3/8-24 UNF X 5/8"	1	*	3.89
16	44449	OVERSHOT HEAD	1	3.3	273.16
17	06951	COMPRESSION SPRING	1	*	1.26
18	42906	PIN, 1/2" x 1-15/16"	1	*	5.62
19	14651	LIFTING DOG	2	.5	50.82
20	37394	SPRING PIN 1/4" X 1 3/4"	1	*	0.89

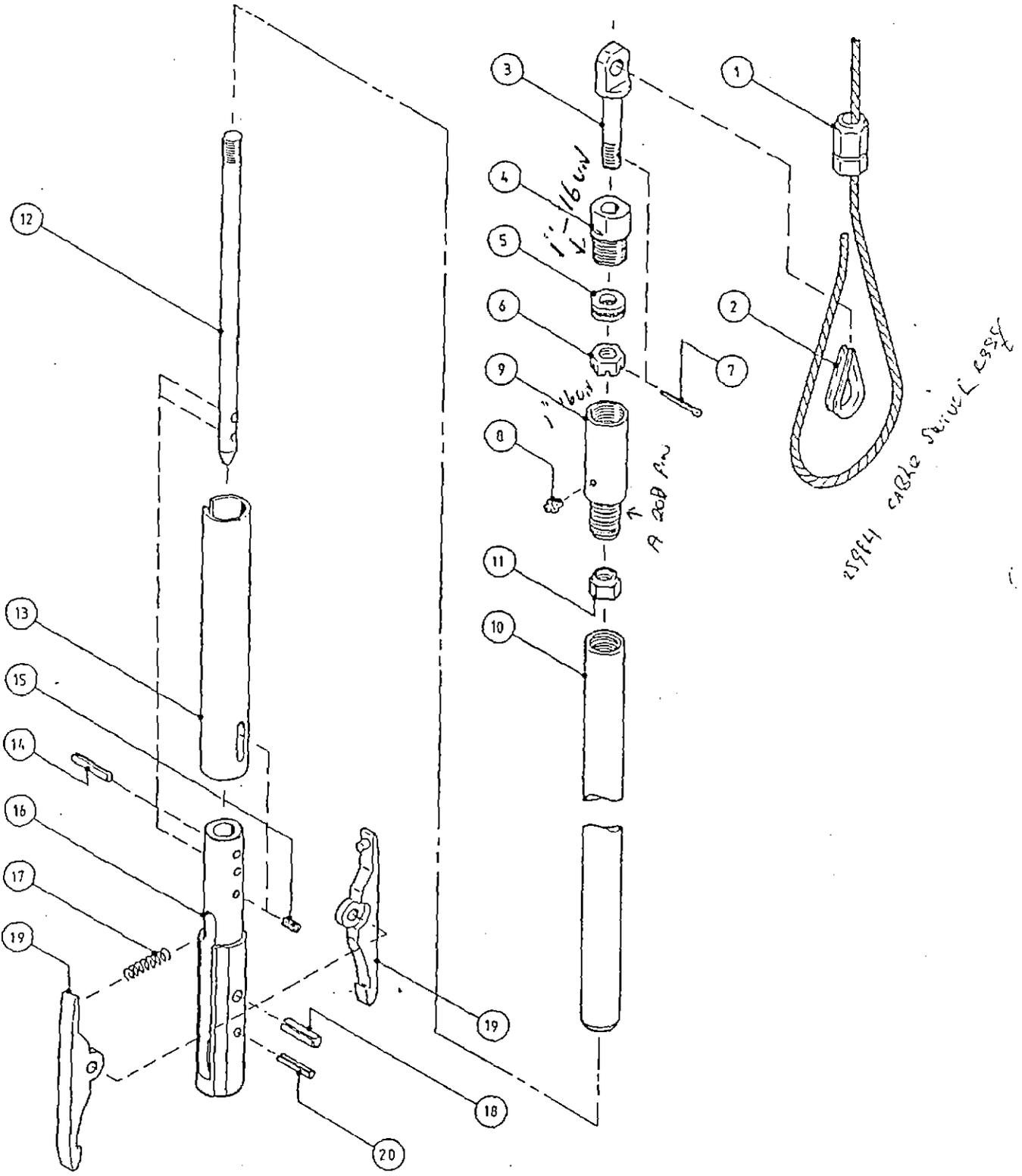
*WEIGHS LESS THAN ONE POUND (45KG) ** USE LOCKING SLEEVE FOR LOWERING IN DRY HOLES ONLY. IT MUST BE REMOVED WHEN HOISTING INNER TUBE.
 NOTE: FOR USE WITH THE KNUCKLEHEAD PIVOTING SPEARHEAD SYSTEM ONLY.

Longyear is constantly striving to improve its products and must, therefore, reserve the right to change designs, materials, specifications, and price without prior notice.



841005 NQ OVERSHOT ASSEMBLY

SECTION: 1A
AUSTRALIAN PRICE LIST
EFFECTIVE: 5.6.92
REPLACES: 11.4.91
FOB ADELAIDE/BRANCHES



Longyear is constantly striving to improve its products and must therefore, reserve the right to change designs, materials, specifications, and price without prior notice.

11W



VAN RUTH NRV.

275 m.

x 3



5 5/8" x 3 1/2" REG Diaq bit.
 5 1/2" x ? Dreg bit.

x 6



5 1/2" x 2 7/8" REG TCRB.



HW x 3 1/2" REG BS.
 HW x 2 7/8" REG BS.

HQ string

525-50m



VRNRV

2 x 3.875" Case bits.
 Ream Shell
 Case barrel.



HQ CBA.

Ream Shell.

HQ case bit. x 2.

C.
i



3 7/8" x 2 7/8" Reg 4/TERR.

3 7/8" x 2 7/8" Reg B/TERR.



HQ x 2 7/8" Reg BS

Load Col.

NA Core Rods

on Rig.

TRY 2 15/16"



NA CORE BARREL ASSEMBLY

NA REAM SHELL

NA CORE BITS

NA TRICONE BITS 2 15/16" is possible.

1000m

Series 2 NA requested.

Surface set coarse bits.

6 1/2" casing head swivel. (Feaver)

6 1/2" casing cementation head (")