A/S NORSKE SHELL E&P

TANANGER

PRODUCTION TEST PROGRAMME

MILLED CASING, UNDER-REAMED GRAVEL PACK.

P

COMLETION

WELL 31/2-9

RIG: BORGNY DOLPHIN

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OPERATIONS ENG.

SENIOR OPERATIONS ENG.

CHIEF PETR. ENGINEER

DRILLING SUPT.

OPERATIONS SUPERINTENDENT

TECHNICAL MANAGER

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1. OBJECTIVES AND GENERAL TEST OUTLINE

NOTE: Depth Control
All depths quoted in this programme for packer setting and milling/under-reaming refer to the LDT/CNL log, no. 0 of 00.00.00 made from the "Borgny Dolphin".

1.1 Objectives

a) To investigate the inflow performance and sand control effectiveness of a milled casing under-reamed gravel packed (MCURGP) completion for the oil zone reservoir.

b) To obtain accurate data on reservoir fluids, pressure and fluid compositions in the indicated oil bearing interval, to aid in the determination of reserves.

c) To assess the significance and producibility of the indicated oil bearing reservoir section from c. 0000-0000 m with regard to water/gas coning and thus enable calibration of a computer simulation model.

1.2 General Test Outline

a) The oil bearing reservoir section will be tested in the interval 0000-0000 m in loosely consolidated, highly porous sands. Accordingly, a wire wrapped inner liner will be gravel packed across the under-reamed interval prior to performing the actual flow testing. Following the gravel packing, the production string will be installed and the well flow tested as outlined below.

i) Clean up period - open the well up and flow at the following rates and durations:

Rate (bbl/d)	Duration (hrs)
1000	3
2000	3
4000	3

Close in and run pressure gauges.

ii) Main flow period - open the well up and flow at the following rates and durations:

Rate (bbl/d)	Duration (hrs)
2000	3
4000	3
Maximum rate (5000-10000)	12
Close in for build up	2
Maximum rate (5000-10000)	60
Close in for final build up	3
Conclude oil zone test	

NOTE: The above rates and durations are test design rates and should be considered as a guide only and may be varied as a result of actual well performance.

On completion of the flow testing the production string will be pulled, the test interval cemented off and the well abandoned.

2. MILLING CASING WINDOW INTERVAL 0000 - 0000 m.

2.1 Run 8½" bit (no nozzles), 9-5/8" casing scraper (for 47 lbs/ft casing), heviwate DP and 5" DP. Scrape the packer/plug setting intervals 0000 - 0000 m and 0000 - 0000 m. Continue down to bottom and tag the 9-5/8" float collar at +/- 0000 m. Circulate the hole clean with mud using viscous pills as required. POH.

NOTE: After POH the mud in pits 1,2,3 and 4 should be treated to make up the cutting/ milling mud, i.e. vicosity +/- 110 sec MF, 50YP and Mud WT. 1.15 SG. Use bentonite to increase viscosity and yield. Do not use xc-polymer.

2.2 Rig up Schlumberger and run CBL/VDL/CCL/GR log from the top of the float collar at +/- 0000 m to 1000 m. POH.

2.3 Run gauge ring/ junk basket. Set a Baker model 'N' bridge plug at 0000 m. POH and rig down Schlumberger. (Check shear bolt of setting tool).

2.4 RIH with Casing Cutter on drill pipe plus one DP pup joint 1 stand above the casing cutter and tag the bridge plug at 0000 m. Correlate wireline depth with DP measurement, and note tide indicator reading.

NOTE: Install three white painted singles in the string so that the top joint will be in the BOP when tagging the bridge plug.

2.5 With the pipe in this position, close 5" pipe rams around the painted single for spacing out purposes (use whichever pipe rams that are clear of tool joint).

NOTE: Tag bridge plug with max 5,000 lbs while closing pipe rams.

2.6 Pull back +/- 400 m and calculate spacing requirements for the section below the ram imprinted painted single so that when the Marine Swivel lands in the 9-5/8" wearbushing the Casing Cutter knives will be positioned at the top of the interval to be milled (i.e. at 0000 m BDF).

2.7 With the lower most white painted single removed install the required pup joints for the proper spacing out of the Casing Cutter knives allowing for the length of the sub below the Marine Swivel to be installed later.

2.8 RIH with the Casing Cutter, the spaced out pup joints and the two painted single and tag the bridge plug. The Marine Swivel should not be installed on this trip.

2.9 With the Casing Cutter gently (5,000 lbs) tagging the bridge plug, close same 5" pipe rams as in step 2.5 above for checking purpose.

2.10 POH +/- 400 m and check that the Marine Swivel hang-off point will be in the correct position. If so, insert the Marine Swivel/X-overs and RIH. Land the Marine Swivel in the 9-5/8" wearbushing.

2.11 Rig up Schlumberger and run a 1-11/16" SONIC/GR/CCL "slim-hole" log through the drill pipe and check the position of Casing Cutter knives with respect to the section to be milled. If the log and knives correlate then POH and rig down Schlumberger, if not POH with Schlumberger and advise Base.

NOTE: Correlate the SONIC/GR/CCL with the FDC/CNL/GR log and check that the drill pipe pup joint installed in step 2.4 is in the correct position which again puts the Casing Cutter knives at the top of the section to the milled.

2.12 Make the cut-out through the casing at the top of the 6 m interval to be milled at 0000 m using cutting/ milling mud. When cut-out is complete displace the complete hole to milling mud (M. WT. 1.15 SG, 110 sec. MF and 50 YP). Flow check and POH with cutter.

NOTE: At this stage the circulation system will be pit no.4 and the hole for milling mud. Mud pits 1, 2 and 3 are to be dumped and thoroughly cleaned prior to start mixing of 1000 bbls of under-reaming fluid.

See Appendix 5 for:

a) the handling of the Calcium Chloride brines
b) the formulation of Calcium Chloride brines from powder
c) the formulation of Calcium Chloride brine containing sized Calcium Carbonate (under-remaining fluid).

2.13 Remove Marine Swivel/Casing Cutter and change the BHA to Section Mill/ Jars/ 2 std. DC and drill pipe.

2.14 RIH and locate cut-out with the section Mill knives slightly extended, and when located mill a 6 m window in the casing using viscous milling mud.

2.15 After satisfactorily milling the required section, pull back to above the window and circulate the hole clean using milling mud. POH.

NOTE: Depth control is of the upmost importance in the above operations to ensure that the correct interval of casing is milled. Therefore exercise extreme care when making up pipe tallies, running lists and taking the measurements of tools etc.. Heave conditions must be conducive to accurate depth control at the rotary table.

2.16 RIH with jetting sub and wash BOP area clean using milling mud. POH.

3. UNDER-REAMING INTERVAL 0000 - 0000 M

3.1 RIH with bit (no nozzles) and casing scraper on drill pipe and tag the bridge plug. (The scraper should be spaced out so that when the bit tags the bridge plug the casing scraper is +/- 5 m above the top of the milled window). Circulate the hole clean with milling mud from pit no.4, if required.

3.2 With the bit 1 - 2 m above the plug, displace the mud from the well with the 1.15 SG under remaining fluid (slightly viscous Calcium Chloride brine containing 40 ppb sized Calcium Carbonate). A 40 bbl HIVIS brine pill (150 sec. MF) should be used as a spacer between the mud and brine. Monitor the hole for losses for 30 mins. If severe losses are observed, keep the hole full and spot a 40 bbl brine pill containing 75 ppb sized calcium carbonate and advise Base where upon a revised programme will be issued.

NOTE: a) Mud to be returned to pits 3 and 4 and kept as kill mud. An additonal 350 bbls of extra under-remaining fluid should be mixed up in pit no. 2.

b) DO NOT USE EXCESSIVE DP DOPE! - dope pins only using a small paint brush and wipe off excess dope squeezed out when making the connections. This is of the utmost importance to avoid DP dope plugging up the pore spaces when under-reaming.

3.3 With the well observed static POH.

3.4 Pick up the SERVCO 7200 x 14" Rock type under-reamer and RIH with exactly the same string as used for milling the 6 m window. Locate the top of the milled window and under-ream the hole to 14" using ca. 400 gal/min flow rate so that hole washing and filtration are minimized.

NOTE: Use the smallest screen size possible (+/- 120 mesh) on the shakers without removing calcium carbonate from the brine.

3.5 Pull back one stand and circulate a HIVIS brine pill around to clean annulus. Observe the well static. POH with under-reamer.

3.6 Rig up Schlumberger and run BGT/GR log to check under-reamed section. If average hole diameter is significantly less than 18" then run the SERVCO 8200 x 18" two cone Rock type under-reamer and open up hole to 18". Re-run the BGT/GR log to check hole size.

3.7 RIH with tapered mill. Rotate slowly whilst RIH into the lower casing sump below window. Care should be taken to ensure the mill enters the sump and does not side trak. Mill/clean the top of the sump casing and circulate well clean.

3.8 With the mill 1 - 2 m above the bridge plug circulate the well to filtered (3 - micron) 1.15 SG (500 psi/1000 ft) Calcium Chloride brine with the Dowell unit. Use a 50 bbl viscous brine pill ahead. Dump returned Calcium Chloride/Calcium Carbonate brine until return fluid is clean Calcium Chloride brine, then take returned brine in mud pit No. 1. Pumping rate should be such as to prevent washing out the hole (+/- 250 GPM). Monitor hole for losses. If losses are observed then spot a 20 bbl viscous brine pill containing 40 lbs/bbl sized Calcium Carbonate across the milled/under-reamed section.

NOTE: a) The returned "clean" brine should be taken via the shaker screens, Thule unit and pit no. 1 to improve cleaning of the brine before being pumped through the Dowell filters to the holding tanks. (See fig. 6).

b) Make sure that the kill and choke lines are flushed with clean brine during circulation to clean brine.

c) Use cleaned trip tank to circulate clean brine into the hole to keep the hole full.

d) Any mud lines used for circulating the completion brine should be flushed and cleaned before using for the brine, to prevent mud and or solids being pumped in the hole. Cleanliness is of critical importance to the success of the completion.

3.9 With the well observed static POH with the tapered mill.

4. INSTALLATION OF GRAVEL PACK ASSEMBLY

4.1 Make up 3 joints of 5½" LTC blank pipe in the rotary table. Pick up and run through the 3 joints of 5½" blank pipe the following wash pipe, from bottom up: -

a) 2-3/8" VAM wash pipe (as required)
b) 2-3/8" VAM(P) x CS(B) X-over
c) 2-3/8" CS(P) x 8 RD(B) X-over
d) Indicating collet
e) 2-3/8" 8 RD(P) x (B) pup joint
f) 2-3/8" 8 RD spacer pup

Item b, c, d and e are allready preassembled. Clamp off the 2-3/8" 8 RD spacer pup onto the top joint of blank pipe.

4.2 Pick up the 3 joints of 5½" blank pipe with the 2-3/8" tubing clamped to top joint of blank pipe and stand back this assembly in the derrick.

4.3 Make up additional 2 joints of 5½" blank pipe and install two joints of 2-3/8" VAM wash pipe plus a 2-3/8" VAM spacer pup inside the blank pipe. Stand back same in the derrick.

4.4 Pick up the pre-made Gravel Pack (GP) screen assembly and hang off in the rotary table. The assembly consists of, from bottom up: -

a) 5½", LTC box up GP bull plug (with centralizers)
b) 5½" x 3.10 m Bakerweld screen LTC pin x box
c) 5½" x 9.18 m Bakerweld screen LTC pin x box

4.5 Install the special 13.75 m long "slick" 2-3/8" VAM wash pipe (consisting of a 4.75 m joint, red tapered collar, 9 m joint and white collar) into the GP assembly and stand it on the bull plug.

4.6 With the wash pipe protruding from the screen take the 5½" Reverse flapper valve LTC pin x box and stab it over the wash pipe. Make up the flapper valve onto the top of the screen.

NOTE: The flapper valve and its seal are made from "MICARTA" a special material designed to shatter. Therefore the utmost care should be excersised when making pipe movements of the 2-3/8" washpipe through this valve so as not to prematurely shatter the flapper valve or its seat and thus make it redundant.

4.7 Pick up with elevators the two joints of blank pipe and wash pipe made up and stood back in step 4.3 above and position just above GP assembly. Make up the 2-3/8" VAM wash pipe pin protruding from the blank pipe onto the white 2-3/8" VAM wash pipe box inside the GP assembly.

4.8 Whilst holding the blank pipe in the elevators lift up the 2-3/8" VAM wash pipe, with a tugger, so that the 2-3/8" VAM spacer pup can be removed. With the pup joint removed clamp the 2-3/8" VAM wash pipe to the top joint of blank pipe.

4.9 Lower the 2 joints of 5½" blank pipe, together with the 2-3/8" VAM wash pipe, and make up the blank pipe onto the top of the GP assembly. Lower the made up assembly and set the 5½" blank pipe in the rotary table.

4.10 Install the three joints of blank pipe and wash pipe with indicating collet, made up and stood back in step 4.2 above onto the 5½" blank pipe in the rotary table. Remove the spacer pup and clamp off the wash pipe to the top of the blank pipe.

NOTE: The 2-3/8" VAM wash pipe is to be spaced out such that when the blank pipe is made up onto the GP assembly the shoe of the special "slick" wash pipe is +/- 0.75 m above the bull plug. This will than leave the top VAM tubing coupling (painted white) immediately above the flapper valve, ALWAYS at least 1.50 m above the valve. If, for any reason, this coupling is placed below the reverse flapper valve later pipe movements while gravel packing would pass the coupling through the valve and may prematurely shatter the valve.

4.11 Lower the made up assembly and set the top joint of 5½" blank pipe in the rotary table. Pick up the following preassembled GP assembly:

Model SC-1 gravel pack packer
Model "S" gravel pack extension with sliding sleeve
6-5/8" x 5½" crossover sub
Model GP shear-out safety joint
Indicating coupling

Preassembled and connected also will be:

Model "SC" crossover/setting tool (4½" IF box up)
Model S-1 shifting tool
2-3/8" EUE pup joints
Multiple acting indicating collet EUE 8 RD(P)

4.12 Connect the 2-3/8" 8 RD(B) wash pipe sticking out from the 5½" blank pipe to the 2-3/8" 8 RD pin protruding from the SC-1 packer assembly and remove the clamp from the 2-3/8" wash pipe. Connect the SC-1 packer assembly to the top joint of blank pipe.

NOTE: a) See Note to step 4.10 above.

b) Check and note the free hanging weight of the entire assembly.

c) See fig. 1 for schematic of the complete GP assembly.

4.13 RIH with the entire GP assembly, using 9 x 6-1/4" DC's, 4 stands of HWDP and 5" DP as the running string. Exercise extreme care when running the GP assembly past the milled casing window so that GP assembly remains inside the casing and the screen is not damaged or torn on the milled interval.

NOTE: a) All DP and DC's must be rabbitted to ensure they are clear.
b) Running speed - 60 seconds per stand.
c) Set slips slowly and avoid jarring the assembly to prevent shearing of the shear out safety joint.

d) DO NOT USE EXCESSIVE DP DOPE! - dope pins only using a small paint brush and wipe off excess dope squeezed out of the connection. This is of the utmost importance in ensuring a successful gravel pack.

4.14 Complete RIH with gravel pack assembly and set down gently on the bridge plug at 0000 m - c. 10,000 lbs wt. should be adequate: control with heave compensator. Space out drill pipe to place top at +/- 4 m above derrick floor. After spacing out and gently tagging the bridge plug at 0000 m again (do not set down any weight) install circulating valve on top of drill pipe. Hook up Dowell lines and pressure test same to 3000 psi. Circulate (with brine) drill pipe volume + 20% and then drop the 1-7/16" kirksite packer setting ball.

4.15 When packer setting ball is estimated to have landed pressure up on drill pipe slowly with brine in 500 psi increments, holding each increment for 1 minute. The SC-1, GP packer will set at approximately 1500 psi. Continue pressuring up to shear ball seat and blow ball out at approximately 2500 psi.

4.16 Pull 15,000 lbs over whole string weight to check packer set (use heave compensator). With drill pipe circulating valve open and upper annular closed, pressurise annulus to 500 psi down kill line to check packer element sealing. Open upper annular.

4.17 Using heave compensator, slack down to neutral point at packer. Rotate DP 10-12 turns to the right at the packer to back out with the crossover tool.

4.18 When the crossover tool comes free, set back down on packer with 30,000 lbs weight to ensure location of squeeze position, when the left hand running thread of the setting tool locates on the top of the packer. Mark the pipe - this mark will be referred to as mark (1) for the squeeze position.

4.19 Pick up approximately 1 - 1.5 m at the packer and set back down with the upper indicator collet on the indicating coupling, using sufficient weight (10,000 lbs) to ensure definite location of the coupling. Mark the pipe - this mark will be referred to as mark (2) for circulating through the screen.

4.20 Pick up a further 5-6 m at the packer and set back down with the lower indicator collet on the indicating coupling using sufficient weight (10,000 lbs) to ensure definite location of the coupling. Mark the pipe - this mark will be referred to as mark (3) for reverse circulating above the packer.

NOTE: The above pipe manipulations should be carried out as smoothly as possible so as not to prematurely shatter the reverse flapper valve assembly by the 2-3/8" wash pipe hanging up or jarring it. When locating the reverse circulating position do not pull up so far as to pull the 2-3/8" wash pipe out of the reverse flapper.

4.21 Slack off weight to push upper and lower indicator collets through the indicating coupling - approximately 15,000 to 20,000 lbs will be required. When mark (1) has been definitely re-located, pick up and locate mark (2). Set 10,000 lbs weight on indicating coupling/indicator collet to ensure definite location of the circulating position.

At this stage the string is in position to commence the preacidization and gravel packing operations and the following points are to be noted: -

a) It is essential that marks (1), (2) and (3) are unambiguous and hence they should be painted on the DP, 1 m above the DF at mid heave with simultaneous reading of the derrick floor tide indicator recorded.

b) When relocating marks (2) and (3) it must be remembered that the particular indicator collet has to be pulled up past the indicating coupling to meet it going down.

c) All lines must be arranged so that all operations can be performed via the Dowell manifold without shutting down for repositioning.

d) Sufficient chicksans must be available to the drill pipe circulating valve to accommodate the necessary pipe movements.

5. GRAVEL PACKING

5.1 Establish circulation through the screen and the 2-3/8" wash pipe, increasing pump rates up to maximum surface pressure of 900 psi. Do not exceed this pressure. Monitor returns closely for losses and plot surface pressures versus pump rates.

5.2 a) Mix 50 bbls of 15% HCl acid containing 10% (v/v) U66, 1% (v/v) A-200 and 150 lbs L-41 (3 lbs/bbl of acid).

b) Mix breaker and gravel into previously gelled fluid - see Figs. 2.0 and 2.1 for fluid formulations and specifications.

5.3 Pump acid and "water pack" fluids as follows:

a) 50 bbls 15 % HCL.
b) 10 bbls 1.15 SG $CaCl_2$ brine spacer.

c) 25 bbls "water pack" pre-pad 1.15 SG (500 psi/1000 ft).

d) 48.70 bbls "water pack" slurry containing 7 lbs/gallon fluid of Baker "Low Fines", 20-40 mesh gravel. The slurry density is 1.46 SG (633 psi/1000 ft).

e) 5 bbls "water pack" post pad 1.15 SG (500 psi/1000 ft).

f) Displacing fluid - 1.15 SG $CaCl_2$ brine.

These slurries will lead to an imbalance between the heavy drill pipe and lighter annulus fluids of +/- 000 psi while the fluids are in the drillpipe. Therefore, during the first 00 bbls of displacement with brine until the 00 bbl "water pack" pre-pad arrives at the crossover tool, a maximum surface pressure of 000 psi may be used. Close annular preventer and apply 100 - 200 psi backpressure.

NOTE: The HCl acid, brine spacer and the "water pack" fluids should be pumped in a continuous phase, therefore arrange the mixing of fluids storage, manifolds etc. accordingly.

5.4 Displace "water pack" with brine at maximum allowable rate (max surface pressure 000 psi) until pre-pad reaches crossover tool - approximately after 00 bbls of brine. Reduce pump rate to give maximum surface pressure of 200 psi. After pumping a further +/- 00 bbls the gravel slurry should completely cover the screen and a pressure rise should be noted at surface - do not exceed 900 psi.

5.5 Slack off work string down to mark (1), the squeezing position. Reduce pump rate to maintain surface pressure below 900 psi as long as possible but ultimately let pump pressure increase to 1050 psi for the final squeeze. Pull back to circulating position and wait 10 minutes and then attempt to repack but do not exceed 1050 psi.

NOTE: If no screen-out is obtained then overdisplace with 10 bbls of completion fluid to clear the packer. Mix and prepare additional "water-pack" pads and slurry volumes (50% of original job size) and re-pack. The string should be in the circulation position until a pressure increase is observed and then slacked off to the squeeze position.

5.6 After achieving satisfactory screen out, allow the pressure to bleed off. Pressurise the annulus to 500 psi. Pick up to mark (3), the reverse circulation position, and reverse out excess gravel/fines from above packer.

NOTE: The amount of gravel/fines returned should be measured as accurately as possible therefore returns should be switched to a holding tank (i.e. sand trap) when gravel/fines reach surface. Add breaker to the returned slurry to allow for quick setting out of gravel/fines and quantify the amount returned.

5.7 Open annular preventer, then POH with SC crossover/setting tool and 2-3/8" wash pipe.

NOTE: Exercise extreme care when pulling back so as to not cause the 2-3/8" wash pipe to prematurely shatter the reverse flapper valve assembly. When the wash pipe is above the valve and it is judged to have closed and sealed monitor the hole static for 30 mins. If continual severe losses are observed, indicating that the flapper valve has malfunctioned, spot 50 bbls of viscous brine containing sized Calcium Carbonate (same formulation as for under-reaming with addition of N130 and N0000, see appendix 5) to stabilize the well and advise Base where upon a revised programme will be issued. This spotting fluid should be mixed up prior to gravel packing.

5.8 With the well observed static and the reverse flapper valve functioning pull back until the crossover port in the crossover tool is +/- 50 m above the SC-1 packer. Circulate well clean and spot a 20 bbls viscous brine pill.

NOTE: The surface pumping pressure when circulating clean and spotting the 20 bbls viscous pill is to be such that the differential pressure across the reverse flapper valve is kept below 750 psi, to prevent its premature rupturing.

5.9 Continue out of the hole and lay down the GP assembly running tools.

NOTE: From this period until the complete test string is run and landed the well SHALL BE CONTINUOUSLY observed for losses. The hole is to be kept full with brine and a record is to be made of the amount and rate of losses, if any. If losses are observed inform Base immediately.

6. INSTALLATION OF PRODUCTION TESTSTRING

6.1 Make up 1 stand of drill pipe, fluted hanger, slick joint, SSTT. At this stage connect hydraulic hoses and test unlatching/latching feature. Blank off injection and control line ports and run 4½", 19.2 lbs/ft, C-75, PH-6 tubing riser including lubricator valve (+/- 30 m BDF) with blanked off control line ports. Run in and land fluted hanger on wearbushing. Space out so that top of riser is +/- 4 meters above rig floor. Close/open 5" pipe rams. Pull out and stand 4½" riser back in derrick, incl. SSTT. Check for ram-impressions on slick joint. See fig. 3 for SSTT space out.

6.2 Make up the flowhead on one single of 4½" PH-6 tubing joint and lay down same on piperack.

6.3 Run the test string sub assemblies H to A as shown in fig. 4, with a "lock-open" sleeve (ID= 1.950") installed through Halliburton's APR-N tester valve. Rig up wireline and install a 2-3/8" "PX" plug in the "X" nipple above the perforated pipe. Install 5" VAM testsub and pressure test to 3000 psi/ 15 min. Retrieve the "PX" plug and install a W/L retrievable straddle to blank off the perforated joint in order to allow for circulation through the mule shoe to clean up fill, if any, from above the GP reverse flapper valve.

6.4 Run 5", 15 lbs/ft, VAM N-80 tubing in the interval between the top of the sub assemblies and the wellhead. 5" DP is to be run from the BOP stack to surface with a white painted tubing single across the BOP's at the depth where by the "space out" seal assembly stabs into the seal bore of the baker SC-1 GP packer. Again a minimum of pipe dope to be used.

6.5 While reverse circulating stab into the SC-1 packer with the lower set 190-47 "space-out" seals.

Check the depth of the SC-1 packer by:

a) Noting entry of mule shoe into packer.

b) Noting pressure increase when "space-out" seals enter packer bore while pumping slowly. Do not exceed a surface pumping pressure that will create a 750 psi differential pressure across the reverse flapper valve.

6.6 With lower "space-out" seal assembly stabbed into seal bore, close middle 5" pipe rams around painted single for spacing purposes. Open pipe rams (N.B. check 5" VAM collar positions before closing rams).

6.7 Pull back to white painted single, identify ram-impression, calculate spacing requirements so that when fluted hanger lands in the wellhead, the top of the main upper locator seal assembly will be 2.5 - 3.0 m above the top of the SC-1 packer.

6.8 Space out the 5" VAM tubing, install the fluted hanger, slick joint and SSTT. Run 4½", PH-6 tubing riser, with the Flopetrol lubricator valve installed at +/- 30 m (one stand) BDF, spaced out so that the top of the tubing riser is +/- 4 m above rig floor.

6.9 Pick up flowhead and 4½" tubing joint. Install 60' x 2½" wire slings between bails and flowhead elevators. Install chicksan lines to flow and kill sides of flowhead. Connect assembly to upfacing tubing connection in rotary table. Test kill-line to 3000 psi.

6.10 While pumping very slowly note when the lower set of "space out" seals enters the packer bore via a pressure increase. Lower the string a further +/- 1.4 m and circulation should again be possible as the lower "space out" seals pass through the packer bore enabling circulation around the tubing pup joint between the upper and lower sets of seals.

NOTE: The moment that circulation is re-established the mule shoe of the tail pipe will be +/- 1.5 m above the reverse flapper valve.

6.11 While circulating continue to lower the production string and shatter the reverse flapper valve assembly. A pressure increase should be noticed immediately after the valve has shattered as the upper set of seals then first start to enter the SC-1 packer bore.

6.12 Land fluted hanger into wearbushing and fully engage the upper set of seals in the packer bore in the calculated spaced out position.

NOTE: The success of the above sequence of operations depends on accurate depth control. Therefore exercise great care while measuring tubing, sub assemblies, calculating space out requirements, making pipe tallies etc.

6.13 Connect flowline chicksans to dual sandfilter and to fixed 6" flowline, flush lines above closed automatic mastergate and pressure test to 3000 psi/ 15 min. against choke manifold.

6.14 Close middle 5" pipe rams around slick joint and pressure test annulus to 500 psi/15 minutes down kill line. Bleed off pressure and open rams.

6.15 Rig up wireline lubricator and retrieve straddle out of perforated pipe. Run 1.800" OD drift through mule shoe. RIH with wireline retained model "N" test tool (with extended fishing neck) and set same in 3½" XN nipple. Pressure test tubing and tubing riser to 3000 psi/15 min. Bleed off pressure slowly to zero and shear off so that plug and extended fishing neck stays behind. POH. RIH and open 3½" XA-SSD. POH.

6.14 Carry out the Post GP acidization as outlined below:

a) Pump the following fluids: -

i) 5 bbls diesel + 10% (v/v) U66
ii) 30 bbls 15% HCl containing 10% (v/v) U66, 1% (v/v) A-200 and 90 lbs L-41 (3 lbs/bbl of acid).

b) Displace the above fluids with diesel to within 2 bbls of the 3½" XA-SSD. Close 5" pipe rams.

c) RIH with positioning tool and 2½" SB-pulling tool. Close the 3½" XA-SSD. Pressure test annulus to 500 psi. Latch on to test plug, equalize pressure across the plug and POH.

NOTE: Scrap wireline which has been in contact with acid.

d) Bullhead the acid into the formation using diesel at low rate, approximatly 1 BPM. Do not overdisplace.

NOTE: Ensure that the pumping pressure is not sufficient to fracture the formation i.e. maximum BHP +/- 3500 psi. Note and report all injection rates/pressures.

6.16 Pressure up annulus to 500 psi/15 minutes. Bleed pressure down to 100 psi (just to give a gauge reading). Keep the middle 5" pipe rams closed throughout the production testing programme and observe the annulus pressure via the kill line.

6.17 RIH with 2" (1.62" max. OD) wireline sandbailer and tag bottom inside gravel pack. Record hold-up depth and retrieve sample of sand (if any).

7. TEST PROGRAMME

NOTE: This outline programme is a guide only. Specific items e.g. rates and durations, lengths of build ups etc. may be varied in the light of onsite information gained during the test.

7.1 Open the well up and unload slowly, flow through the separator at the earliest opportunity. Stabilize the flow at +/- 1000 bbl/d for 2 hours.

7.2 Flow the well at the following rates and durations:

Rate (bbl/d)	Duration (hrs)
1000	3
2000	3
4000	3

NOTE: Bean up gradually at each rate.

7.3 Close in the well. Run 2 Flopetrol SSDR gauges (144 hr clock) and 1 x Amerada (5000 psi element, 144 hr clock). Make gradient stops in the lubricator and at 600 m and 300 m above the mule shoe while RIH. Set gauges in the 2-3/8" 'XN' profile.

7.4 RIH with 3" GS pulling tool with brass shear pin. Latch on to "lock-open" sleeve. Pull 100 lbs overpull to confirm tool is latched. Slack off weight on wire. Pressure annulus to 500 psi over the opening pressure (1000 psi) of the APR-N tester valve. Retrieve the "lock-open" sleeve. Sufficient pressure (1000 psi) should be kept on the annulus throughout the complete flow period to keep the APR-N valve open.

NOTE: No jarring is required as the sleeve is free standing inside the APR-N as soon as the opening pressure has been applied. In case the sleeve does not come free increase the annulus pressure and pull again on sleeve. Do not at any time try to free the sleeve by jarring as the opening/closing mechanism of the valve might have failed. In this case the test will continue without a down hole close in facility.

7.5 Open up the well and flow at the following rates and durations:

Rate (bbl/d)	Duration (hrs)
2000	3
4000	3
Maximum rate (5000-10000)	12

7.6 Upon completion of the 12 hrs flow period close in for a 2 hr build up period by closing the APR-N tester valve immediately followed by closing in at surface.

7.7 Open up the well and flow for 60 hrs at maximum rate.

7.8 Upon completion of the 60 hrs flow test close in for a 3 hr build up period by closing the APR-N tester valve immediately followed by closing in at survace.

NOTE: If the down hole close-in fails, i.e. the APR-N valve leaks, the well will be re-opened and after reaching maximum flow rate, flowed for an additional 6 hrs before the well will be closed in at surface again.

7.9 After completion of the close-in period, pressure up the annulus to open the APR-N valve. RIH with wireline and set the "lock-open" sleeve in the APR-N valve. Bleed annulus pressure down to 200 psi (just to give a gauge reading).

7.10 Retrieve pressure gauges making gradient stops as in step 7.3 above and conclude the oil zone test.

NOTE: a) In all wireline work where the lubricator valve is closed, the lubricator is to be filled with water for an oil test and a 50/50 water/glycol for a gas tests. Prior to opening, the lubricator is to be re-pressurized to equalize across the valve.

b) Before re-opening the APR-N valve in steps 7.7 and 7.9 above the pressure should be equalized across the valve.

c) Monitor for sand production via the sand filter after each bean-up and when ever signs of sand production is evident.

7.11 RIH with wireline sand bailer and record HUD inside the GP. Recover a sample if any. POH.

NOTE: During this period inspect gauges and ensure that they have worked and the results are acceptable prior to continue with programme.

8. ABANDONMENT - TEST INTERVAL

8.1 Bullhead tubing contents down to test interval with brine of 1.15 SG (500 psi/1000 ft), using a 50 bbl, HIVIS brine pill ahead. Observe tubing dead.

NOTE: Take care not to fracture formation. Expected fracture gradient is 1.64 SG (710 psi/1000 ft), giving a maximum allowable BHP (200 psi safety) of +/- 3500 psi. Maximum allowable surface pressure with 1.15 SG brine in the tubing is thus +/- 900 psi.

8.2 Bleed off pressure on annulus. Open the 5" pipe rams. RIH with wireline and open the 3½" XA-SSD. POH. Reverse circulate well dead with 1.15 SG brine. RIH with wireline and close the XA-SSD. Rig down wireline.

8.3 Pick up lower "space out" seals out of packer and circulate normally and condition well with 1.15 SG brine. Observe well dead.

8.4 Rig down flow head and pull production string, standing back the 4½" tubing riser and the 5" tubing.

8.5 RIH with 175 m of 2-7/8" tubing on 5" drill pipe and stab into the SC-1 GP packer at +/- 0000 m. Continue down to 2 m above the bull plug. Displace the hole to uniform conditioned mud of 1.20 SG wt.

8.6 Set a 150 m cement plug using the following slurry: -

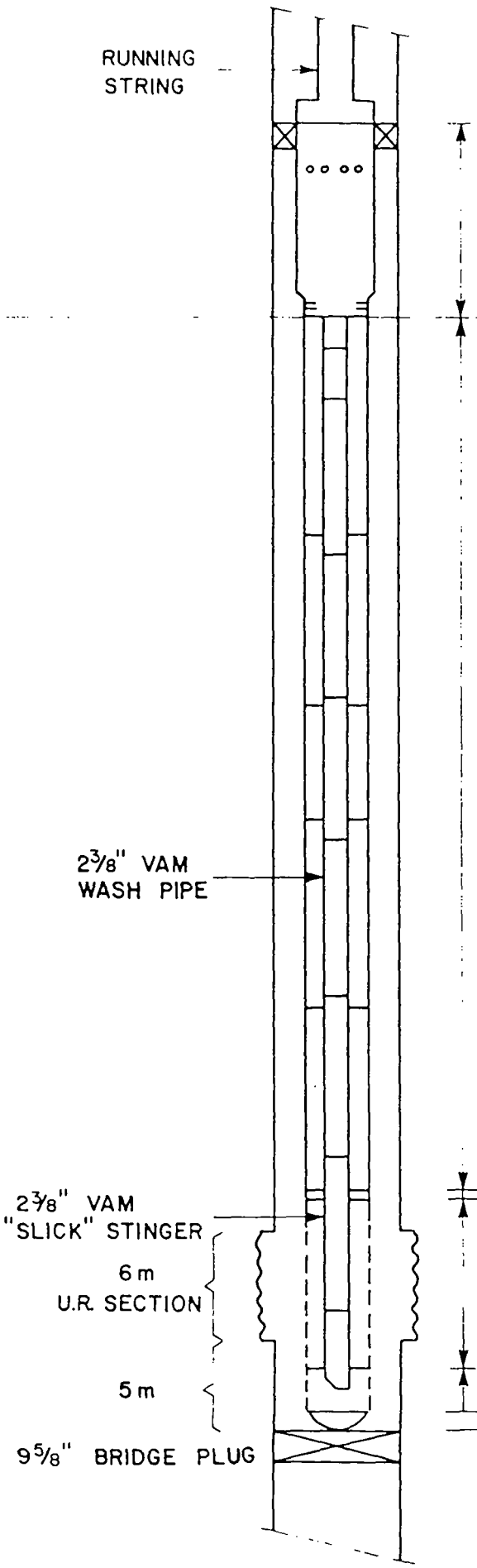
15.80 ppg class G cement
5.08 gps freshwater
1.15 cuft/sx yield
(Thickening time +/- 4.5 hrs).

Pull back to 30 m above the estimated TOC and reverse circulate the 2-7/8" tubing and 5" drill pipe clean.

8.7 Close the BOP's around the drill pipe and apply 2000 psi to attempt to squeeze away a maximum of 10 bbls of cement slurry. POH.

8.8 Further well abandonment programme will be advised separately.

GRAVEL PACK ASSEMBLY SCHEMATIC FOR 6m MCURGP IN 31/2-9

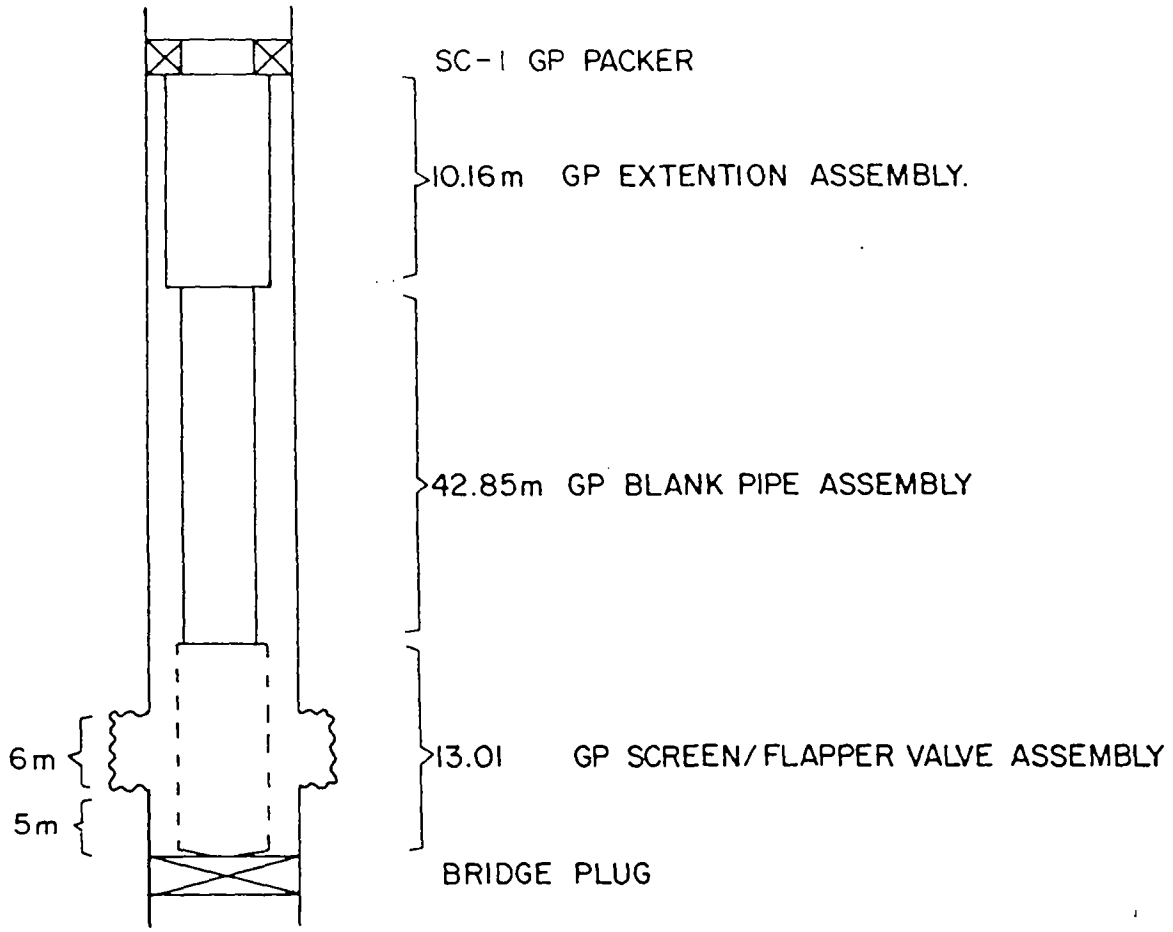


10.16 m	G.P. EXTENSION
	INDICATING COLLAR
42.85 m	5½" BLANC PIPE (TOP PIPE WITHOUT COLLAR)
0.38 m	FLAPPER VALVE
9.18 m	5½" G.P. SCREEN
3.10 m	5½" G.P. SCREEN
0.35 m	5½" BULL PLUG

GP VOLUMES OIL ZONE 31/2-9

(NB:ALL CALCULATIONS TO BE CHECKED ONSITE)

NOT TO SCALE



GRAVEL TO FILL ANNULUS

GP Extension x CSG	:	10.16 m x 3.281 x 0.1438 cuft/ft	=	4.79 cuft
Blank Pipe x CSG	:	42.85 m x 3.281 x 0.2460 cuft/ft	=	34.59 cuft
GP Screen x CSG	:	7.01 m x 3.281 x 0.2147 cuft/ft	=	4.94 cuft
GP Screen x UR Hole	:	6.00 m x 3.281 x 1.5708 cuft/ft	=	30.92 cuft
		Total	=	75.24 cuft

Therefore use 75.24 cuft x 105 lbs/cuft = 7900 lbs gravel
with 37.5 % excess = 10865 lbs gravel

Fig. 2.1.

GRAVEL PACK FLUID FORMULATION

(NOTE: All calculations to be checked on site).

1. "Pre-Pad" gelled brine: 25 bbls, 1.15 S.G.

25 bbls	-	1.15 SG $CaCl_2$ brine	
84 lbs	-	J164 gelling agent	(80 lbs/1000 galls)
8.5 oz	-	J218 breaker	(8.1oz/1000 galls)

2. "Water Pack" slurry: 48.70 bbls, 1.46 SG

19.60 bbls	-	1.15 SG CaCl2 brine	
17.40 bbls	-	1.00 SG Freshwater	
			= 37.00 bbls of 1.08 SG brine
124 lbs	-	J164 gelling agent	
12.5 oz	-	J218 breaker	
10,865 lbs	-	20-40 mesh gravel (at 7 ppg concentration), 37.5% excess.	

3. "Post Pad" gelled brine: 5 bbls, 1.15 SG

5 bbls	-	1.15 SG $CaCl_2$ brine
16.8 lbs	-	J164 gelling agent
1.70 oz	-	J218 breaker

NOTE: a) Check the pH of the brine. Adjust to pH of 4-5. Add the required amount of J164. The J164 is to be added in small amounts and in a continous manner - do not dump into tank. Allow a few minutes for the gell to disperse. Adjust the pH to 8-8.8 with a solution of caustic (observe all safety procedures). Add this in small amounts so as not to bring up the "local" pH too much. The viscosity should start to build up after 15 - 30 mins. (actual time is dependent on ambient temperature and brine pH).

b) Add the gravel with the paddles turning. The J218 breaker is to be added 5-10 mins prior to pumping the fluids downhole. Breakdown time for this job is designed to be +/- 3 hrs.

c) Use D47 antifoam as required to remove entrapped air from the slurry.

EZ TREE SPACE OUT WELL 31/2-9 RIG BORGNY DOLPHIN

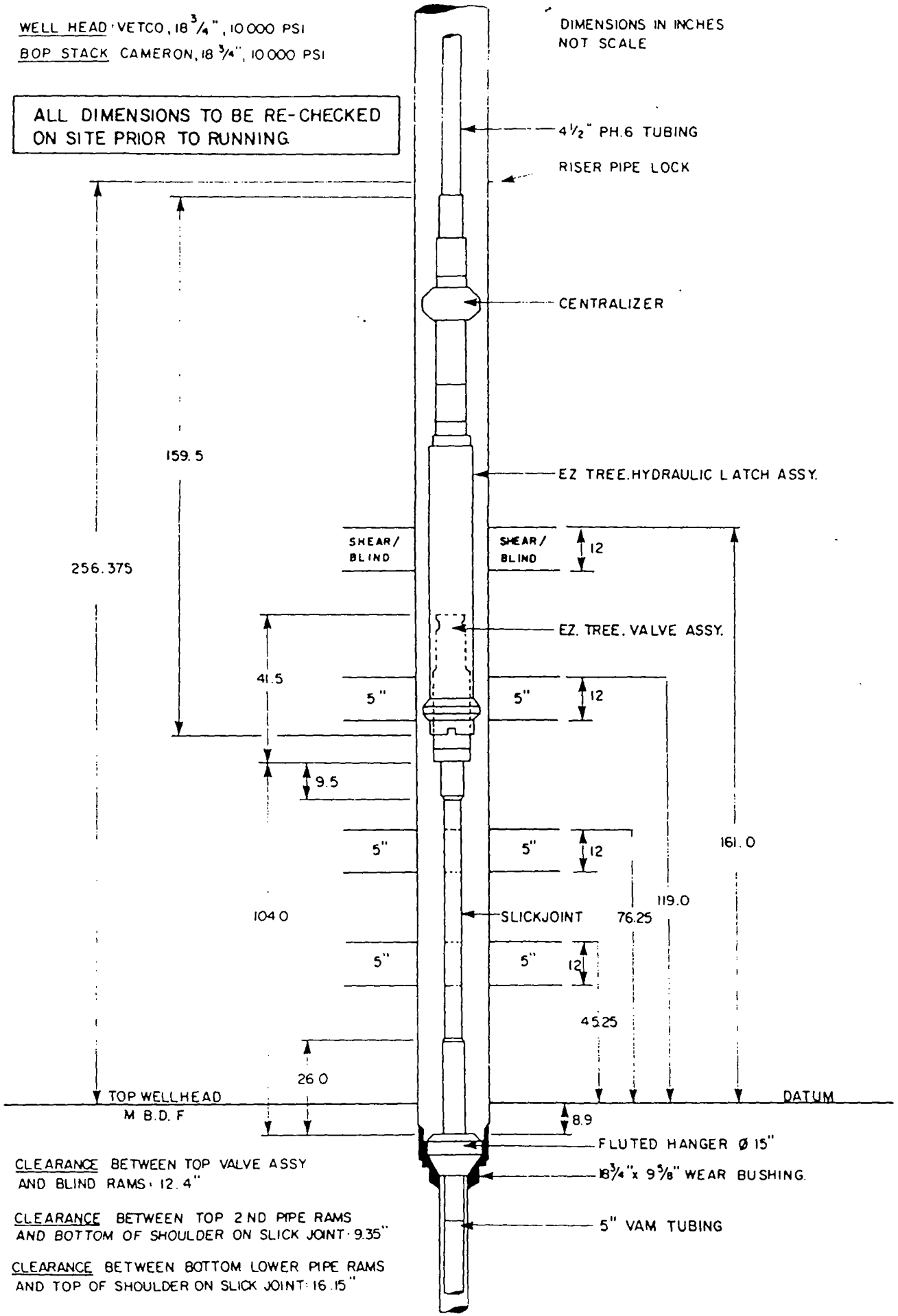
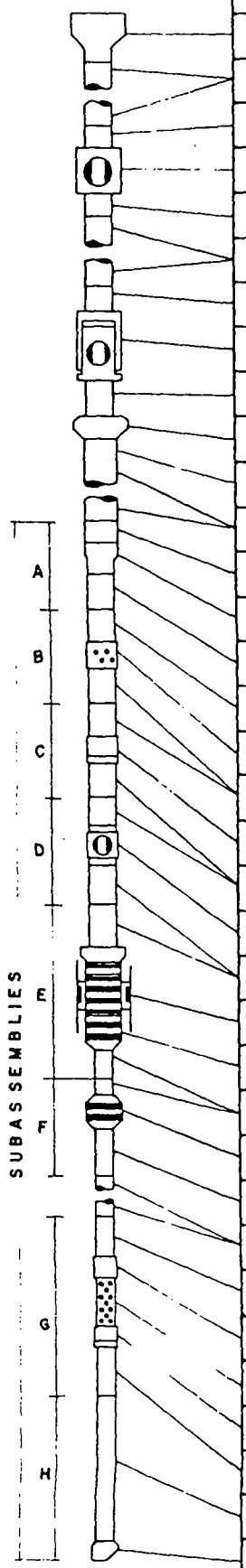


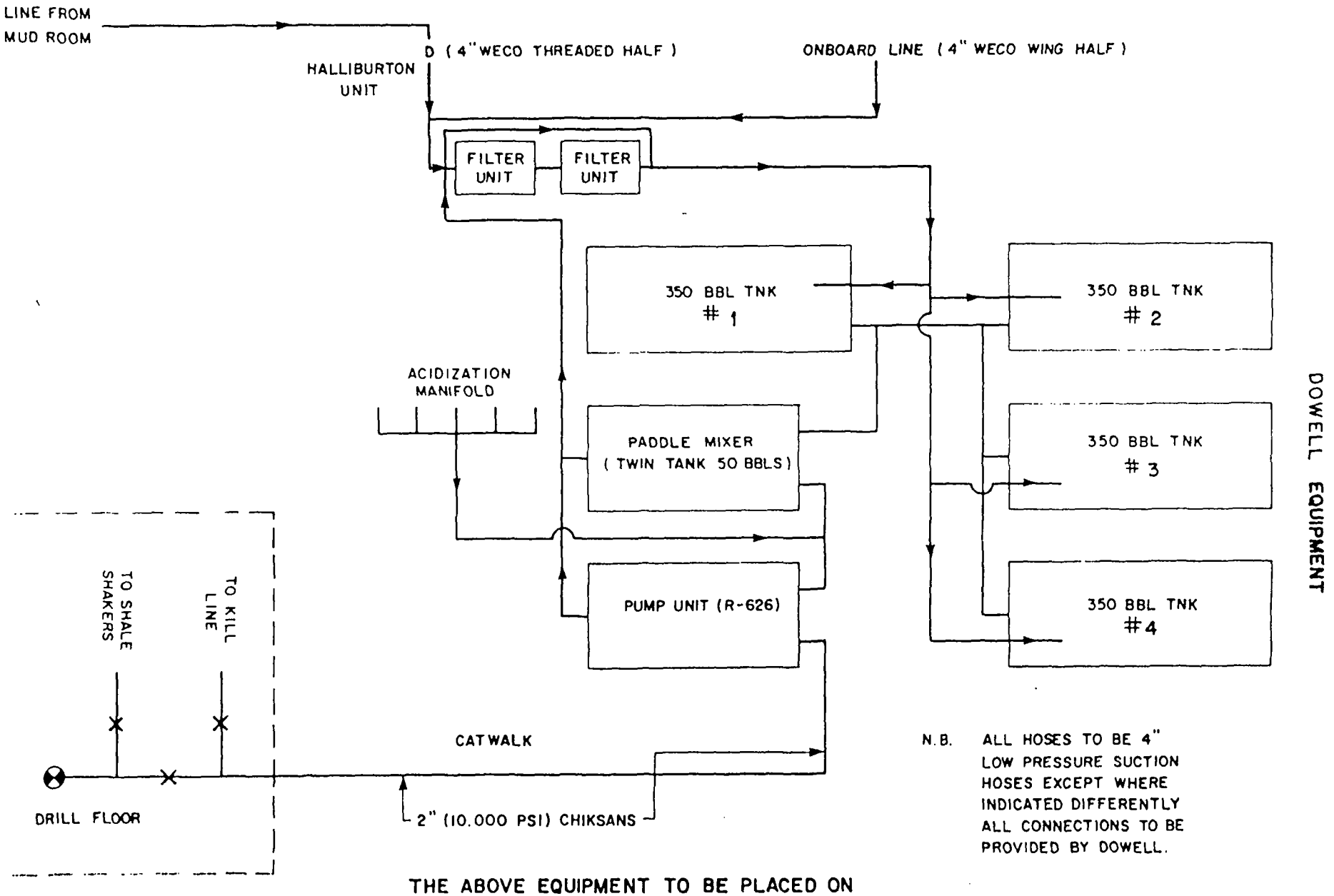
FIG. 4

9⅝" CASING BY 3½" PRODUCTION TEST STRING, WELL 31/2-9



ITEM DESCRIPTION	MIN. I.D.	MAX. O.D
X-OVER, 6½" ACME (B) x 4½" PH-6 (P), C-75	3.515	
TUBING, 4½", 19.2 LBS/FT, PH-6, C-75	3.515	5.313
X-OVER, 4½", PH-6 (B) x 4½", ACME (P), C-75	3.515	5.313
FLOPETROL LUBRICATOR VALVE, H25 SERVICE, 10000 PSI.W.P. 4½" ACMC (B) x (B)	3.000	10.750
X-OVER, 4½", ACME (P) x 4½", PH-6 (P), C-75	3.515	5.313
TUBING, 4½", 19.2 LBS/FT, PH-6, C-75	3.515	5.313
X-OVER, 4½", PH-6 (B) x 4½" ACME (P), C-75	3.515	5.313
FLOPETROL EZ TREE, H25 SERVICE, 10.000 PSI W.P. WITH GLYCOL INJECTION SYSTEM, 4½" ACME (B) x (B)	3.000	10.750
SLICK JOINT, 4½", ACME (P) x (P), C-75	3.000	5.000
FLUTED TUBING HANGER, 4½", ACME (B) x (B), C-75	3.000	15.000
X-OVER 4½", ACME (P) x 5" VAM (P) C-75	3.000	5.000
TUBING, 5", 15 LBS/FT, VAM, L-80	4.283	5.563
PUPJOINT (5'), 5", 15 LBS/FT, VAM, L-80	4.283	5.563
X-OVER, 5", VAM (B) x 3½", CS (P), C-75	2.867	5.563
TUBING JOINT, 3½", 9.3 LBS/FT, CS, C-75	2.867	3.905
PUPJOINT (10'), 3½", 9.3 LBS/FT, CS, L-80	2.867	3.905
OTIS, 3½" "XA" SSD, 2.75" SEAL BORE, CS (B) x (P), C-75	2.750	4.280
PUPJOINT (10'), 3½", 9.3 LBS/FT, CS, L-80	2.867	3.905
OTIS 3½" "XN" NIPPLE, NO-GO, 2.635, SEAL BORE: 2.750", CS (B) x (P) C-75	2.635	4.280
PUPJOINT (10'), 3½", 9.3 LBS/FT, CS, L-80	2.867	3.905
APR-N TESTER VALVE, ASSY, NO. 615.2272, 3½" I.F. (B) x (P) C/W. X-OVERS EITHER SIDE TO 3½" CS (B) x (P)	2.250	5.000
PUPJOINTS (10'), 3½", 9.3 LBS/FT, CS, L-80	2.867	3.905
BAKER SC-GP PACKER, SIZE 96 A4-47: 4.750" SEAL BORE	4.750	8.440
BAKER G-22 LOCATOR SEAL ASSY, 20' LONG, SIZE 190-47 3½" CS (B) x 2⅞" CS (P)	3.000	4.900 4.750
PUPJOINTS (5'+3'), 2⅞", 6.5 LBS/FT, CS, L-80	2.347	3.220
BAKER G-22 SEAL ASSEMBLY, 2' LONG, SIZE 190-47 2⅞" CS (B) x 2⅞" CS (P)	3.000	4.750
PUPJOINT (10'), 2⅞", 6.5 LBS/FT, CS, L-80	2.347	3.220
TUBING AND PUPJOINTS FOR SPACE OUT INSIDE G.P. ASSEMBLY, 2⅞" 6.5 LBS/FT, CS, L-80	2.347	3.220
PUPJOINT (5'), 2⅞", 6.5 LBS/FT, CS, L-80	2.347	3.220
OTIS, 2⅞" "X" NIPPLE, SEAL BORE 1.875, CS (B) x (P), 9 CR-1 MO.	1.875	3.250
PERFORATED PIPE (10'), 2⅞", CS (B) x (P), P-105	2.347	3.220
OTIS, 2⅞" "XN" NIPPLE, SEAL BORE: 1.875 NO-GO: 1.825, CS (B) x (P), 9 CR-1 MO	1.875	3.250
PUPJOINT (10'), 2⅞", 6.5 LBS/FT, CS, L-80	2.347	3.220
TUBING JOINT, 2⅞", 6.5 LBS/FT, CS, P-105.	2.347	3.220
HALF MULE SHOE, 2⅞" CS (B).	2.347	3.850
N.B. ALL DIMENSIONS TO BE CHECKED PRIOR TO RUNNING.		

LAYOUT OF DOWELL / SCHLUMB. SUPPLIED EQUIPMENT FOR BRINE STORAGE, GRAVEL PACKING AND ASSOCIATED STIMULATIONS ON BORGNY DOLPHIN.



N.B. ALL HOSES TO BE 4" LOW PRESSURE SUCTION HOSES EXCEPT WHERE INDICATED DIFFERENTLY ALL CONNECTIONS TO BE PROVIDED BY DOWELL.

THE ABOVE EQUIPMENT TO BE PLACED ON THE AFT STARBOARD PIPEDECK

FIG. 6

APPENDIX 1

PREPARATION OF TUBING

1. Offload and rack tubing, separating each layer with at least three evenly spaced wooden strips.

2. Number and measure each joint. WSPE and Production Test Supervisor to make separate tubing tallies.

3. Remove pin and box protectors, inspect threads for damage, clean with solvent, and if possible, with steam.

4. Brush each joint to remove scale and loose solids: if any joint has excessive scale it should be rejected.

5. Drift each joint with appropriate 42" long tubing drift. All drifts should be fitted with a fishing neck.

6. Reclean pins and boxes and replace protectors. (N.B. Protectors should also be clean and only lightly doped).

7. Check that there are a reasonable number of pup joints for spacing.

8. Inform Base of any further tubing requirements.

9. Return any unsatisfactory joints.

PREPARATION OF TUBING SUB-ASSEMBLIES/GP EQUIPMENT

1. Physically check all tubing and GP accessories and inspect and clean threads with solvent.

2. Ensure that spares of each item available on the rig.

3. Function test all equipment (sliding sleeves, nipples, etc.)

4. Make up tubing sub-assemblies.

5. Run wireline drift through each sub-assembly paying particular attention to polished sections as these can easily be squeezed in make up. N.B. Separate drift runs should be made down to and through No-Go nipples.

6. Carry out API pressure test on each sub-assembly to 5,000 psi (to be witnessed by WSPE, TP and Production Test Supervisor).

   NOTE: Items 2 through 6 only when not carried out on-shore and witnessed by PTS.

7. Accurately measure each tubing sub-assembly and GP equipment item and note the position of all accessories.

8. Replace protectors on each end of the tubing sub-assemblies and GP items.

9. Examine sub-assemblies for tong damage. If excessive, a new sub-assembly should be made up as above.

10. TP and WSPE to carry out final dimensions check.

APPENDIX 2

PRESSURE TESTING SURFACE LINES AND EQUIPMENT

NOTE: All pressure tests should be carried out with water.

See fig. 5 for schematic of the layout of the test equipment.

Before the well is flow tested (preferably prior to installation of the string) the following equipment will have been function/pressure tested on the deck as follows:

Flowhead

Install a single joint of 4-1/2" PH-6 tubing on the lower end of the flowhead. All inlet/outlet connections are to be blanked off with testsubs. Pressure test body with all valves open.

Close wingvalves and swabvalve. Open downstream of the valves to atmosphere. Pressure test. Close the mastergate and pressure test the valve from below. Close the swabvalve and pressure test from above. Drift the vertical bore of the tree/joint with a 2.797" OD drift. All the pressure tests to be 5000 psi/15 mins.

EZ Tree

Install a 4-1/2" PH-6 pupjoint on the upper end and the slick joint, fluted hanger, X-over and a 3-1/2" VAM pupjoint on the lower end of the tree. With testsubs installed pressure test the body to 5000 psi.

Check the non-return valve in the chemical injection line as follows: Bleed off the body pressure from 5000 to 4500 psi and re-pressure to 5000 psi through the chemical injection hose. Bleed-off the injection line and observe for returns. Close the ball valve and pressurize from below with the upper tree section open to atmosphere.

Test latching/unlatching with the E/Z tree assembly in the rotary table prior to running in for space out. Drift assembly with a 2.797" OD drift.

Lubricator valve

Install a 4-1/2" pupjoint above and below the valve and test the body and the ball valve from both sides to 5000 psi. Drift assembly with a 2.797" OD drift.

Production Test Equipment

The following tests should be carried out before the installation of the test string in order to save rig time. Connect the cement discharge line to the permanent 6" rig test line and pressure test as follows:

Lines to burners	:	1000 psi/15 min
Lines to T-manifold against bulk head	:	1000 psi/15 min
Separator	:	1350 psi/15 min
Relief valve(s) on separator	:	+/- 1450 psi

Flush the valves clean by pumping +/- 1 bbl of water and close the valve by bleeding the pressure to zero.

Lines to upstream inlet of separator and
By-pass valve : 1350 psi/15 min
Check "P" pilot trips at +/- 1350 psi
Lines downstream of steam heat exchanger: 3000 psi/15 min
Lines upstream of steam heat exchanger: 3000 psi/15 min

With 3000 psi through the choke manifold close all valves on same and bleed off the pressure between the upstream and downstream valves. Observe for leakages.

Calibrate the oil and water meters while hooked-up to the pump line.

TESTS TO BE CARRIED OUT AFTER THE INSTALLATION OF THE PRODUCTION EQUIPMENT

With the flowhead mastergate closed and the kill line/flowline chicksan loops installed pressure test against the closed choke manifold to 5000 psi/15 mins.

Check the automatic flow wing shut off valve is operational from the following area:

1. Separator
2. Dog house
3. "P" pilot

Checks should be carried out to ensure the following auxiliaries are operational:

1. Steam supply to the steam heat exchanger, the condensate feed back line to the rig system, and the steam degasser system.

2. Rig air supply to the burners.

3. Water sprays to burnerheads. Cooling water to the rig's hull/cranes etc readily available and at sufficient pressure.

NOTE: After pressure testing the burner boom oil and gas lines all valves downstream of the T-manifold must be kept open to allow for quick change-over of burners.

APPENDIX 3

SAFETY PROCEDURE FOR HANDLING EXPLOSIVES

Safety during loading and firing

Before gun/setting tool is armed all transmitters, cranes, welding machines, radar etc. must be switched off and remain switched off until the gun/packer is fired/set. After firing/setting, transmission can be resumed until the gun/packer setting tool has been pulled to about 100 m below the seabed, but must then cease until the gun/packer setting tool has been laid down and checked.

Portable transmitters should be placed in one room to prevent accidental transmission.

Helicopters should not be permitted to land on the platform during perforations, or to approach closer than 150 m.
Supply and standby boats must also stand off from the rig at this time.

Work involving explosives

Work involving the use of explosives should be carried out only by specialist personnel and should never be done during an electrical storm.

During any job involving the use of explosives, the number of personnel employed should be kept to a minimum. All other persons should be excluded from the danger area (e.g. walkway and derrick floor) throughout the operation.

Warning signs should be placed on access routes to the danger area to prevent access by unauthorised persons.

The Platform Manager (Captain) is to inspect equipment and check safety procedures.

Two hours before each perforating/packer setting run the WSPE will telex Base with an estimate of when the radio beacon, VHF transmitter, etc. will be closed down and for how long. Actual times will be advised by the Radio Operator.

This is particulary important if a helicopter flight is scheduled for the rig concerned.

The first perforation must be carried out in daylight but later runs and packer settings may be carried out at night. However, if in the course of the production test a well is killed due to unforeseen circumstances, the first of any subsequent perforations must also be carried out in daylight.

A constant check must be made to ensure that no voltage is measured between the riser and the rig at surface. In the event that voltage is measured, all sources of electrical energy must be switched off. (N.B. This may preclude perforating/packer setting at night).

APPENDIX 4

FLOWING THE WELL

Opening up a well to bleed off, or initial start up of a separator, must be carried out in daylight; production testing may then continue into the night.

Burning operations may be carried out under the following conditions:

a) Weather suitable for rescue operations.

b) Wind force sufficient to carry gases away from the platform.

c) Shipping and aircraft warned to stand clear during blowing off.

d) Standby boat and supply boat(s) advised that this operation is to take place and to take the action and precautions necessary for this operations.

HYDRATE PREVENTION

To prevent hydrate formation during the flow testing, pump facilities should be hooked up to the following injection points:

a) E/Z Tree
b) Flowhead
c) Data Header
d) Gasline downstream of the separator

c) and d) may be fed by one pump with a T-manifold to allow for changeover.

In order to safeguard against hydrate formation during shut-in periods it is recommended to continuously inject glycol in the vertical run of the flowhead as well as at the E/Z tree.

NOTE: Triethylene Glycol to be used for hydrate prevention.
Methanol to be used when hydrates have been formed.

APPENDIX 5

HANDLING AND MIXING OF CALCIUM CHOLORIDE BRINE

A) Handling of CaCl2 brine.

$CaCl_2$, both as brine and powder can cause unpleasant skin irritation and even blistering if allowed to remain in contact with the skin. It is therefore important that personnel involved in work where they may be exposed to the brine or powder should be protected as follows:

a) Rubber gloves (gauntlet type to cover wrists).

b) Waterproof slicker suits with hoods.

c) Rubber boots (leather boots are shrivelled by the brine).

d) Full face masks for use when mixing powdered $CaCl_2$.

e) Barrier cream (e.g. "Vaseline") for use on exposed skin, particularly face, neck and wrists, to prevent direct skin contact with the brine.

Additionally, whenever brine/powder is inadvertently splashed onto clothing then the affected clothes should be changed and washed forthwith. Never allow brine to dry on the skin or clothes. If brine is splashed into the eye, wash the eye at once with copious amount of fresh water.

B) Mixing of a CaCl2 brine pill using CaCl2 powder:

The following instructions are for the mixing of 50 bbls of Calcium Chloride brine in the slug pit, the formulation is to be verified by a pilot check performed at the wellsite.

1. Thoroughly clean the slug pit and flush all the mixing lines and hoppers that are to be used for mixing with water. Also flush clean with water the transfer lines from the slug pit to the Halliburton unit.

2. Add 46 bbls of drillwater to the slug pit.

3. Add 4500 lbs of Calcium Chloride (Peladow) to the drill water while circulating through the mixing hopper.

NOTE: a) Fluid in the slug pit is to be thoroughly agitated during mixing or the Calcium Chloride flakes will drop out and settle on the bottom of the tank.

b) This mixing process is a exothermic reaction therefore as the brine is quite hot while being mixed it will weigh less when initially mixed than when cooled down.

C. To viscosify the above pre-mixed Calcium Chloride brine.

1. Reduce the pH of the brine to below 7.8 by the addition of J286 powder or HCl acid.

2. Add +/- 50 lbs of J164 (HEC) to the brine.

   NOTE: The J 164 is to be added SLOWLY to the brine while circulating through the mixing hopper. If not added SLOWLY "fish eyes" will form which could possibly cause formation damage later.

   Agitate for 30 mins to ensure the J164 (HEC) is fully dispersed and hydrated. The viscosity should start to build after 15 - 30 mins dependent upon pH and ambiant temperature.

3. Add caustic soda (while taking the standard precautions for handling) to the brine and increase the pH to around 8.5.

   NOTE: Ensure that the caustic soda is fully dispersed in the gelled brine before adding more as precipitates will form if the pH increases above 10.

   The Wellsite Petroleum Engineer is to conduct and monitor the above brine mixing and gelling procedures to ensure correct formulation etc.

D) Formulation Calcium Chloride brine containing sized Calcium Carbonate

The formulation for 1 bbl of 1.15 brine containing 40 ppb sized Calcium Carbonate is: -

0.423 bbls 1.00 SG fresh water
0.538 bbls 1.15 SG Calcium Chloride brine
(To give 0.96 bbl of 1.08 SG brine)
1 ppb HEC and 1 ppb XC-Polymer
20 ppb Norcal N 40 Calcium Carbonate
20 ppb Norcal N 15 Calcium Carbonate

The mixing procedure for 1 bbl of brine containing 40 ppb sized Calcium Carbonate is: -

1. Dilute the 1.15 SG brine in the above ratio with freshwater to give the desired volume.

2. Add J286 to the 1.08 SG brine and adjust its pH to +/- 5.

3. Add (slowly) the required amount of HEC and XC-Polymer and mix throughly. Increase the Ph to 8 - 9 using caustic soda (while taking standard precautions for handling).

   NOTE: Ensure that the caustic soda is fully dispersed in the gelled brine before adding more as precipitates will form if the pH increases above 10.

4. Add the required amount of sized Calcium Carbonate and agitate well to ensure it is fully dispersed through out the brine.

   NOTE: a) For ease of shipping/handling the base Calcium Chloride brine will be sent to the rig at 1.15 SG and diluted back to 1.08 SG with freshwater.

   b) 1000 bbls of 1.15 SG brine containing sized Calcium Carbonate is to be available on surface prior to displacing mud from the hole for under-reaming.

E. Calcium Carbonate brine with addition of N130 and 0000 grades Calcium Carbonate

If severe losses are experienced after gravel packing and the flapper valve does not function, the following brine pill should be spotted:

Make up 40 bbls of Calcium Carbonate brine as described in section D above.

Add 10 ppb of both N130 and 0000 grades Calcium Carbonate. Adjust weight of solution to 1.15 SG by addition of freshwater.

APPENDIX 6

CONTINGENCY MEASURES

A. Surface Leaks/Malfunctions

1. Minor surface leak/malfunction:

   a) Close the well in at surface by activating the automatic and manual gate valves on the flowhead.

   b) Bleed off the pressure trapped in the surface test lines and equipment.

   c) Repair the minor leak/malfunction and re-pressure test the relevant surface equipment as required.

   d) Open up the well and resume testing.

2. Major surface leak/malfunction (assuming the automatic shut down system has activated).

   a) Close in the well manually at the flowhead and bleed off pressure trapped in surface lines and equipment.

   b) Rig up the wireline lubricator and BOP's pressure test same:

   c) Close the APR-N valve.

   d) RIH and open the SSD. POH with wireline. Reverse circulate the tubing contents to brine and observe tubing dead.

   e) RIH and close SSD, pressure test annulus to 500 psi:

   f) Complete repairs and re-pressure test the relevant surface equipment.

Re open the well as follows:

   a) RIH and open the SSD. POH.

   b) Circulate diesel into the tubing string to within 2 bbls of the SSD.

   c) RIH and close the SSD. Pressure test annulus to 500 psi/15 mins.

   d) RIH and retrieve the XN plug.

   e) Carry on and complete the testing programme.

B. Subsurface Tubing Leaks

1. If a tubing leak is suspected the following procedure is to be carried out:

   a) Close in the well at the flowhead and observe tubing and annulus pressures.

   b) Close the APR-N valve.

   c) Bleed off annulus pressure to close the APR-N valve.

   d) RIH and open the SSD. POH.

   e) Reverse circulate the tubing contents to brine and observe tubing dead. RIH and close the SSD. Pressure annulus to 500 psi/15 mins.

   f) Attempt to pressure test the tubing to 3000 psi. If this test is OK then proceed with the test programme, if not carry out step g) below.

   g) If either of the tubing or annular pressure tests fail then pull the test string and inspect the tubing and sub assemblies closely for leaks.

   h) The further test programme will be advised and will obviously be dependent on what is found to be the cause of the leak.

C. HYDROGEN SULPHIDE (H_2S)

1. If H_2S is monitored in the hydrocarbons produced while testing (H_2S is to be checked for immediately hydrocarbons reach surface) the following will apply.

   a) Inform Company Supervisor and Platform Manager.

   b) Air breathing apparatus is to be readily available on the rig floor and rig personnel are to be directed to keep clear of areas down wind of the test equipment and pipework.

c) A constant check is to be kept around the rig for H2S, if detected advise the Company Supervisor and Platform Manager immediately. If the presence of H2S is confirmed (in whatever quantities) the well is to be immediately closed in at the flow head and any leaks in the system traced and remedied.

NOTE: Breathing apparatus to be worn while checking for leaks.

d) If the H2S persists the test will be terminated by bull heading the tubing contents into the formation.

D. Deteriorating Weather

1. The test string will only be run once an acceptable weather window has been forecast for the duration of the test. If the weather begins to deteriorate rapidly once the string has started to be run a hang off tool will be picked up and the string hung off.

If deteriorating weather is expected once the flow testing has commenced the test will be suspended. The well will be secured as outlined below:

a) Close in well at the flowhead and bleed off pressure trapped in the surface lines.

b) Bullhead the tubing contents back into the formation with brine, using a 50 bbl slightly viscous brine pill containing sized Calcium Carbonate ahead of the brine. See Appendix 5 for formulation. Observe the tubing dead.

c) Close the EZ tree, bleed off any pressure in the annulus and monitor tubing pressure via the glycol injection line. Be prepared to unlatch the EZ tree.

d) An acidization will be required to remove the Calcium Carbonate after bullheading the well dead. Therefore 15% HCL acid (including additives A200, U-66 and L-41) is to be kept onboard.

APPENDIX 7

WELL STATUS 31/2-9

1. The well has been drilled vertically to a TD of 1725 m.

2. Casing Data

Size	Weight	Grade	Coupling	Depth (m BDF)	Collapse Strength	Internal Yield	Capacity BBL/FT
30"	310	X-52	Vetco ATD-RB	450			-
20"	133	X-52	LW-LH	808	1410	2930	-
13-3/8"	68	K-55	BTC	900	1950	3450	-
13-3/8"	72	L-80	BTC	1498	2670	5380	-
9-5/8"	47	L-80	VAM	+/- 1715	4750	6870	0.0732

3. Tubing Data

				Make up			
3-1/2"	10.2	C-75	VAM	4700ft/lbs	11360	10480	0.0083
3-1/2"	9.3	C-75	Hydril CS	3000ft/lbs	10040	9520	0.0087
4-1/2"	19.3	C-75	Hydril PH6	7500ft/lbs	12960	12540	0.0126
5-1/2"	15.5	J-55	LTC	2170ft/lbs	4040	4810	0.0238
2-7/8"	6.5	C-75	Hydril CS	2100ft/lbs	10470	9910	0.0058
5"	15.0	N-80	VAM	6500ft/lbs	7250	8290	0.0188
2-3/8"	4.7	P-105	Hydril CS	1500ft/lbs	15460	14700	0.00387

NOTE: No safety factors included in the pressure ratings.

APPENDIX 8

MEASUREMENTS REQUIRED

A. During flow periods

The following data should be recorded during flowing periods every 15 mins, or whenever a change occurs:

WHP, WHT, choke size flowline pressure
Separator pressure, separator temperature
Flowrate (liquid) and GOR
Sand concentration (see Appendix I)
Annulus pressure (via kill line)

In addition, all produced fluids should be measured for density. Gas should be analysed via the mud logging unit's gas chromatograph, with H2S measured with Draeger tubes. Produced water should be measured for salinity.

B. During BHP surveys

During all BHP surveys the following deadweight THP measurements are required:

a) Every 5 minutes during initial lubricator calibration stop.

b) Every 15 minutes during flow period.

c) After closing in for build up, every 5 minutes for the first hour, thereafter every ½ hour.

d) Every 5 minutes during the gradient stops at 300 m and 600 m above XN nipple and at seabed.

e) Every 5 minutes during the final lubricator calibration stop.

SAMPLING REQUIREMENTS

No bottom hole samples are required for the oil zone test. 1 set of separator recombination samples plus 1 x 45 gallon of oil should be taken every 6 hrs. The drums are to be clearly marked both on the top and the side with the well number, test interval, date, and time.

APPENDIX 9

SAND DETECTION DURING OIL TEST

A. Materials required (to be supplied by Flopetrol).

1. Acetone, toluene and paraffin
2. 10 x 63 sieves
3. 1 gallon cans
4. Electrically driven centrifuge and 50 centrifuge tubes
5. Watch glasses
6. Glass funnel

B. Procedure

1. Collect one imperial gallon crude oil from choke manifold as fast as possible in a clean container.

2. Shake the sample vigorously and slowly pour the contents over the sieve.

3. Wash the residue on top of the sieve with paraffin, toluene and acetone in that order and allow acetone to evaporate.

4. With a fine brush transfer the residue from the top of the sieve into a graduated conical centrifuge tube, wash the glass funnel and brush with toluene so that particles are flushed into the tube. (It is unsafe to centrifuge with acetone).

5. Centrifuge for about 3 minutes and determine the volume in cubic centimetres of solids collected at the bottom of the tube. The tube should be clearly marked with sample number, date, zone on test, production rate, concentration of sand, well number.

6. Estimated sand concentration in lbs/1000 lbs: Sand content = 102 x No. of cc volume of solids centrifuged out. (For more accuracy, multiples of imp. gallons could be processed and the concentration divided appropriately).

7. To establish whether the sediment is partially wax, pour off excess toluene and add acetone, shake and pour off sediment free acetone. Drain sediment onto a watch glass, allow it to dry and heat to above 100 degs C. Observe for melting. This can also be verified under a microscope.

8. Carefully store samples and send ashore for analysis.

9. If wax is found to be a large percentage in item (d) the screen contents can be flushed with water so that the wax will lie above the sand and can be easily distinguished.

APPENDIX 10

SAND CONCENTRATION - CRITERIA

The maximum allowable sustained concentration is 50 lbs/1000 bbls for all tests, including maximum rate tests. If the concentration exceeds this, the well should be beaned back and a further sample taken after 1½ tubing volumes. In the case of a maximum rate test, the test can be terminated once sustained sand production has been established. N.B. Some sand can always occurs after bean change.

In general:

25 lbs/1000 bbls	-	continue with programme
25 - 50 lbs/1000 bbls	-	maintain the rate steady.
50 lbs/1000 bbls	-	bean back rate by half and repeat beaning back until concentration declines.

It is expected that, during clean up, bursts of high sand concentration may be detected. These should not cause undue concern if they are not sustained.

APPENDIX 11

PROCEDURE FOR RECOMBINATION SAMPLES

A. Gas Sample

1. The bottles should be properly evacuated with a vacuum pump.
2. The Wellsite Petroleum Engineer ensures that bottles are filled up slowly and are at separator pressure prior to being closed.
3. Check container and valves for leaks.
4. Mark bottles with sample number.
5. Fill in surface PVT sampling forms.

B. Oil/Condensate

1. Oil/Condensate sample container to be filled with mercury.
2. Slowly displace 500 cc mercury from 600 cc container with oil/condensate from separator.
3. The WSPE ensures that bottles are at separator pressure prior to being closed.
4. Draw off 50 cc of mercury to create gas cap.
5. Check containers and valves for leaks.
6. Mark bottles with sample number, date, time and well no.
7. Fill in surface PVT sampling forms.

Sample Bottle Working Pressure

Capacity	W.P.
5 litres	2,800 psi
0.6 (0.7) litres	10,000 psi

GRAVEL TO FILL ANNULUS

GP Extension x CSG	:	10.16 m x 3.281 x 0.1438 cuft/ft	=	4.79 cuft
Blank Pipe x CSG	:	42.85 m x 3.281 x 0.2460 cuft/ft	=	34.59 cuft
GP Screen x CSG	:	7.01 m x 3.281 x 0.2147 cuft/ft	=	4.94 cuft
GP Screen x UR Hole	:	6.00 m x 3.281 x 1.5708 cuft/ft	=	30.92 cuft
		Total	=	75.24 cuft

Therefore use 75.24 cuft x 105 lbs/cuft = 7900 lbs gravel

with 37.5 % excess = 10865 lbs gravel