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# TEST PROGRAM 30/2-I

DYVI DELTA

**Den norske stats oljeselskap a.s**

TGT/MBH

10.09.82

# TEST PROGRAM 30/2-I

# DYVI DELTA

LIST OF CONTENT:



Attachments:

- Pressure testing procedure
- Drawing for pressure testing procedure
- Halliburton BHA
- Statoil tail pipe
- EZ-tree/BOP-spacing
- Statoil landing string
- Layout of surface eq. on rig floor

WELL 30/2-I TEST PROGRAM

The Test Program for well 30/2-I is based on the procedures given in Statoil Well Testing Manual.

Chapter 7, describing the test string running procedure, test intervals, well flowing program and sampling program has been changed in accordance with the specific well test and is valid for this well only.

PLUGBACK FOR TESTING

Wather depth 125m, 155m RKB.
7" Liner shoe at 3834 m.
7" liner top at 2902 m.

The open hole section will be plugged back with balanced cement plugs.

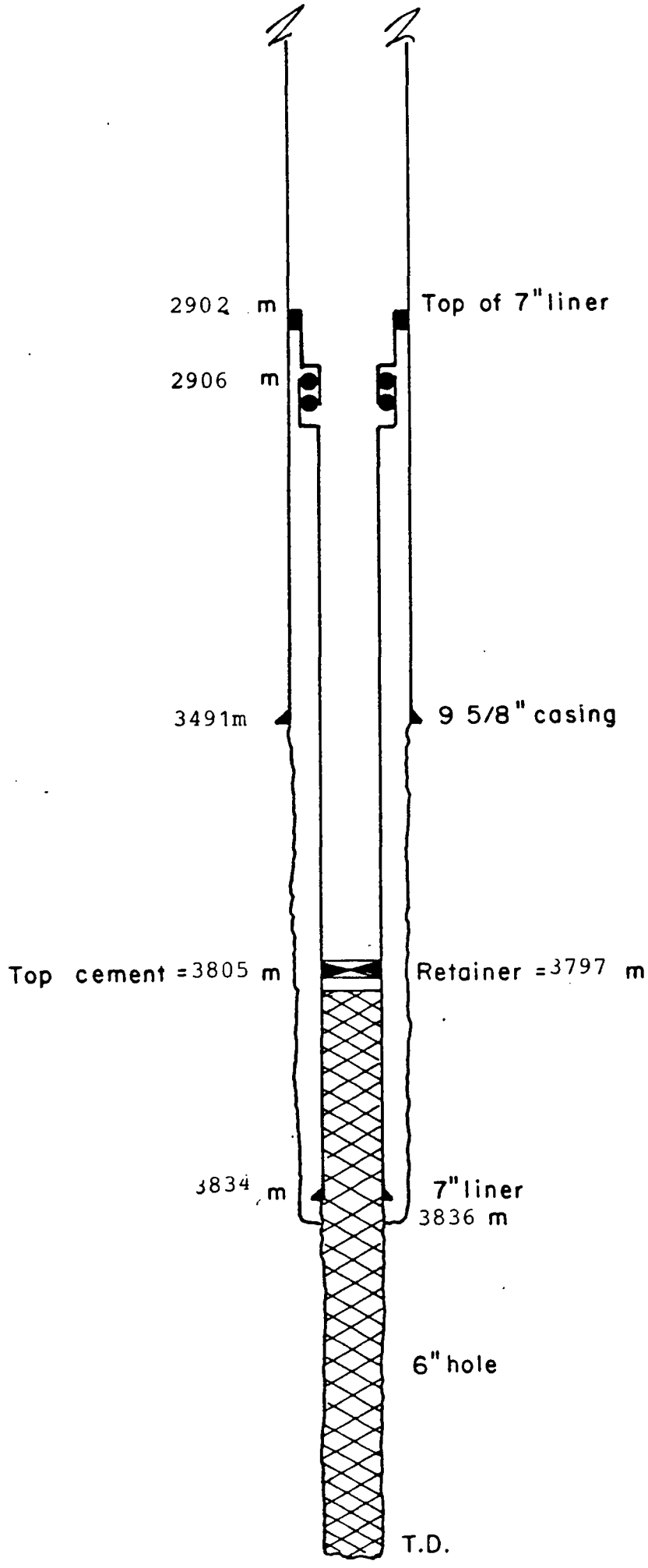
1. plug 4160 ~~T.D.~~ - 4040 ~~4100~~ m
2. plug ~~4100~~ 4020 m - 3920 ~~3950~~ m
3. plug ~~3950~~ 3900 m - 3800 m

The third plug will be tagged and dressed off to 3805 m with 6" bit.
If the third plug is not tagged before entering the open hole a 7" cement retainer will be set at 3820 m, and 5 tons cement will be squeezed through the retainer.

A cement isolation squeeze will be performed by perforating at 3801 and set a cement retainer at 3796 m and squeeze cement through perforation.

Run a CBL-log and if this shows good bonding between the test intervals then proceed with the test program.
Test 9 5/8" casing to 539 bar with 1.91 S.G. mud weight above 2150, and 345 bar below.

# PLUG BACK OF 30/2-1 PRIOR TO TESTING

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Original av: TGT
Tegnet av: AM
Dato: 9-12-81

Section 7.1.: Test Preparations and Perforations

The testing preparations outlined in Statoil "WELL TESTING MANUAL", chapter 6, page 68, are to be followed.

The Statoil Drilling Supervisor will be in overall charge throughout the test.

The Drilling Supervisor will be advised and assisted by a Test Engineer who will directly supervise the conduct of the test. Each morning after report time, there will be held a meeting with leading personnel involved in the test operation. Any change in the program, needed equipment will be checked out etc.
The main idea with this meeting is to have good communication between the different companies involved.

The Drilling Supervisor will also be assisted by a Drilling Engineer. He will be responsible for all equipment needed for the test and that sufficient back-up equipment is present on the rig. He will also be responsible for witnessing all pressure- and functiontesting of the equipment.

A "Dry run of the Test" - meeting with all involved parties must be held.

A Safety meeting with the whole rig crew must be held. Stress that smoking, welding, grinding and any use of open fire outside quarters are absolutely prohibited without a written hot work permit from the Drilling Supervisor and Rig Manager/ Toolpusher.

Fireguards with suitable fire fighting equipment must be placed at the drill floor and at the separator area.

A "Fire Alarm" and an "Abandon Ship Manouvre" must be carried out in conjunction with the safety meeting.

1) For plug back, see page 2.
   Correct mudweight should be 1.91 S.G.
   Pore pressure at 3785 m - 1.82 S.G.
   Pore pressure at 3762 m - 1.83 S.G.
   Pore pressure at 3703 m - 1.85 S.G.
   Circulate and condition mud to low yield (YP not less than 8) and low filtrate losses. Utilize the finest possible screens on shakers and mud cleaner.

2) Check weather conditions and forecasts. If good weather conditions are expected to continue for the duration of the test, then proceed with perforating preparations. Turn off all radio transmitters after notifying Operation Superintendant and vessels in the area.

3) Rig up Schlumberger, install the gun with CC-locator.
   a) Gun type: 4" Hyperjet II, 4/8 spf. 90° phasing.
      All shots to be fired simultaneously.
   b) Perforating interval: See section 7.3.
      Perforating are to be correlated to the FDC/CNL/GR and CCL/GR.

4) Pull perforating gun. Lay down and check gun before turning on radio transmitters. Nipple down Schlumberger.

Section 7.2.: Test String Assembly and Running Procedures

1) Prior to the test, the following procedure for handling of Mannesmann 3½" TDS tubing shall be followed.

When tubing is laying on deck, remove the protectors from the pin and the box. Clean and steam wash the threads thoroughly. Visually inspect the threads. If these are found damaged, lay out the damaged joint. If threads are OK, put on protectors on pin end only.

Make up a Statoil Pipe Tally sheet of the remaining joints. Paint the number and length on each joint.

When making up the tubing string, remove pin end protector on drill floor, clean and visually inspect the threads. Drift the tubing with 2.7 in. drift.

When making up the tubing connections, first make 3 turns by hand before using the tubing tong with controlled RPM.
Calibrate the torque-indicator before use.

Avoid to break out the same joints when tripping.

The stands of tubing should be stacked in the derrick on a firm wooden platform without protectors.

2) The following tools are to be pressure- and function tested prior to use:

- Halliburton slipjoints.
- Halliburton choke manifold.
- Halliburton Ful Flo DP Tester Safety Valve (from above)
- Halliburton APR-N tester valve (from below)
- Flopetrol choke manifold
- Flopetrol EZ-tree w/pupjoints above and below.
- Halliburton APR-M

- Flopetrol Control Head with a full joint below.

Test pressure 690 bar ( 10 000 psi)

3) Test surface equipment according to attached procedure before the test.

Also check the oil and water metering system by flowing into the metering tank.

Check ignition system on burner booms.

4) Make a dummy run with fluted hanger and a painted joint of tubing to check spacing inside BOP by closing M.P.R.

Use two stands of DC below the fluted hanger to put weight on the wear bushing.

5) Make up the EZ- tree together with the fluted hanger and the slick joint and make up a short pupjoint below and above. Make up the tubing landing string. Pull out and set back in derrick

- Make up torque is 3800 ft-lbs.
- Use API Modified Thread Compound on pin end only. Use a small paint brush to avoid excess dope inside the string.
- Tubing: 3½" TDS, 12.7 lbs/ft, L-80.
- Connections requiring higher torque values than the tubing (3800 ft-lbs) are to be made up with the back-up tong on the x-over, not on the tubing, in order to avoid overtorquing the tubing.

6) Make up Flopetrol Control Head with a full joint of tubing. Lay down same.

7) Run gauge ring and junk basket to 3795m.

8) Rih and perforate test interval.
Rih with Baker "D" production packer and set same on wireline at 3775m.

9) Make up the bottom hole assembly as per attached drawing.

10) Hang the pressure gauges as specificed by Test Engineer.

NOTE: Before the gauges are installed in the test string it must be clarified that the string will be run and the DST performed immediately aftherwards.

11) Precharge the Nitrogen chamber in the Halliburton APR-N tester valve to open at approx. 70 bar (1000 psi) annulus pressure. The valve is kept in an open position by applying 100 - 120 bar (1500 - 1700 psi) pressure on the annulus. The dump valve section (causing the tool to close permanently) should be blanked off.

12) Two annulus pressure operated reverse circulating valves will be run. The one above the drill pipe tester valve should be set to shear and open at approx. 185 bar (2700 psi) annular pressure. The other is run above the choke and handling subs and should be set to shear and open at approx. 222 bar ( 3200 psi)

13) Fill up 2 stands of DC above the APR-N tester valve with viscous gel to prevent solids setting out on top of the tester valve. (Tubing debris etc.) (Premix the gel mud in the cement unit.)

14) RIH with the test assembly,
The Ful Flo Hydraulic By-pass is run to avoid bullheading of mud into the perforations when the tailpipe enter the production packer.

15) When test assembly including one stand of tubing is in the hole, pressure test against the DP tester valve with 690 bar ( 10 000 psi).

16) If OK, continue to RIH. Take care when entering the 7" liner. Fill the string with water every 5 stand as RIH.

17) Continue RIH with string. When half way, test the string against the DP Tester Valve to 690 bar. Paint the tubing that will be in the BOP.

18) Locate the production packer by carefully stinging into the packer with the tailpipe. Set down weight on the packer. Close the MPR on the painted tubing. Pooh.

19) Pick up Flopetrol EZ-tree with pupjt's and space out to close on slick joint. Check the latch assembly by pressuring up the control line for the latch. Latch on again. Make up hose for methanol injection on the EZ-tree.

20) Pick up the tubing above the EZ-tree. Secure hoses properly and take care when setting down in slips.

21) Pick up the control head and connect chicksanlines to kill and flow side. Pick up same. (Using certified 50 ton slings.)

22) Space out so that the control head is at least +/- 5.5m above rotary at high tide and land the fluted hanger in the wear bushing.

23) Close kill side wing valve on the Flopetrol control head and test Chicksans from the cementing unit to 690 bar (10 000 psi). Have the swab valve and the lower master valve closed and the failsafe valve (flowside) open. Bleed off pressure.

24) Fill the string with water and pressure test the string against the DP Tester Valve to 690 bar.

25) Open the kill side wing valve and close the failsafe valve. Pressure test to 690 bar (10 000 psi). Bleed off pressure.

26) Open the failsafe wing valve and pressure test against the floor choke manifold upstream and downstream to 690 bar (10 000 psi). Bleed off pressure.

27) Open the floor choke manifold and close the inlet and by-pass valve on heater. Pressuretest to 690 bar (10 000 psi) Bleed off pressure.

28) Rig up one mud pump on burners to pump cooling water. Make sure to isolate this system. The throttle on the mud pump controle console must be marked properly to avoid mistake. (Like shearing the APR-M by operating wrong throttle.)

29) Open lower master valve, close wing valve on kill side and open failsafe valve on production side. Close floor choke. Close middle pipe ram (MPR).

30) Pressure up the annulus slowly to the predetermined opening working pressure of the APR-N tester valve using one mud pump. The annulus pressure is to be monitored from this step and till the well has been killed. Log annulus pressure every 15 min. Due to the heating of the test string the annulus pressure may have to be bled down to opening working pressure.

NOTE: Driller or toolpusher must stay on rig floor at all time during testing.

NOTE: Excessive annulus pressure will cause the APR-M reverse circulating valve to shear open. Be aware that an increase in the annulus pressure also can be caused by a leak in the test string.

31) A Sperry Sun Mister Six surface pressure gauge is attached to the data header to monitor wellhead pressure.

32) Flow the well in accordance with the instructions given in section 7.3. for this well and in accordance with the following restrictions/recommendations.

Section 7.3.:

DST no 1, RANNOCH, 3785-3792 mRKB (ref. FDC/CNL)

OBJECTIVES: Estimate productivity.
Obtain fluid samples.
Evaluate reservoir properties.
Reservoir pressure and temperature.

CUSHION: Full string w/sea water.

SEQUENCE:

1. Initial flow:

Flow back 0,5-1,0 $m^3$ (3-6 bbls) water to surge-tank or max 10-15 mins. flow.

2. Initial build-up:

Shut-in for at least 1 hr. depending on well response.

3. Final flow:

Clean-up and get stabilized flow through separator.
Collect 3 sets of separator samples during the flow period.
Flow the well for 6-10 hrs.

4. Final build-up:

Shut-in for at least 1,5-2,0 times the flow-period.

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DST no 2, ETIVE, 3762-3772 mRKB (ref. FDC/CNL)

OBJECTIVES: Evaluate reservoir properties.
Obtain fluid samples.
Reservoir pressure and temperature.

CUSHION: Full string w/sea water.

SEQUENCE: 1. First flow:

Clean up and get stabilized flow through separator.
Collect 3 sets of separator samples during the flow period.
Flow the well for 6-8 hrs..
If no indication of sand-production, increase the flow rate and flow the well for 4-6 hrs.

2. Final build-up:

Shut in for 1-2 times the flow period.

DST no 3, NESS, 3703-3714 mRKB (ref. FDC/CNL)

OBJECTIVES: Evaluate reservoir properties.
Obtain fluid samples.
Reservoir pressure and temperature.

CUSHION: Full string w/sea water.

SEQUENCE: 1. First flow:

Clean up and get stabilized flow through separator.
Collect 3 sets of separator samples during the flow period.
Flow the well for 6-8 hrs..
If no indication of sand-production, increase the flow rate and flow the well for 4-6 hrs..

2. Final build-up:

Shut in for 1-2 times the flow period.

## KILL AND PLUGGING PROCEDURE AFTER TESTS

After the flow period the well will be closed in at the choke-manifold. At the same time pressure up on the annulus to shear the APR-M valve. This operation will also close the ball in the APR-M valve, as well as closing the APR-N valve when the annulus pressure falls below 69 bar (1000 psi).

Open at the choke manifold and reverse out the gas to the burner until the gas has been displaced from the tubing and mud is coming out of the burner. Reverse circulate one more tubing volume back to the mud pits.

Circulate at last one hole volume through the tubing. During the final build-up there should not be any pressure on surface. However, check regularly for surface pressure on tubing and in annulus. A pressure build up is probably caused by a leaking packer/seal-assembly or APR-N and APR-M valve.

When the final pressure build up has been completed, pull out of the hole and lay down the STT and additional tubing to get the tail pipe out of the packer. Circulate bottoms up and check for 30 min that the well is stable. Pull out of the hole half way and circulate again before pulling out of hole.

Pick up a 10 ft sealassembly and run in hole on drill pipe. Circulate bottoms up until low gas readings. Sting into the packer and squeeze off the test perforations.

Pull out of the packer and reverse out any excess cement.

## PRESSURE TESTING OF SURFACE EQUIPMENT AND LINES

1. Flush all lines and equipment (preferable with fresh water) through the flowline, steam heat exchanger, separator, oil manifold and both burners. Flush through both gas and oil lines on burners. Make sure that separator is full of water and that there is a water level in the tank.

2. Close the oil line valves on both burners atomizers (no. 16 on the sketch) and the valve on the gas line close to the boom foot (15, both sides). Make sure that the tank and the transfer pump are isolated at the oil manifold (12, 10) and pressure the complete surface installation slowly up to 69 bar (1000 psi)

3. Close the two valves (14) on the oil line (one valve for each burner boom) and pressure test to 69 bar.

4. Close the valves on the gas line (19) and oil line (17) (close to the separator) for both burners, and pressure test against these valves to 69 bar.

5. Close the valves on the oil manifold and pressure test up to 69 bar.

6. Close gas outlet (9), gas bypass (8), oil bypass (6), oil outlet (5) and water outlet (-already closed) on separator and pressure up very slowly against separator outlets to 83 bar (1200 psi).

   NOTE:
   It is important not to go above this pressure as there is a possibility of opening the safety valve on the separator, and this is not good practice.
   If the gauge on the pumps doing the testing is not accurate, do not exceed 83 bar.

7. Close separator inlet valve (4) and pressure test to 96 bar (1400 psi).

8. Close steam heat exchanger outlet valve (3) and bypass valve (2) and pressure test to 200 bar (3000 psi).

9. If available a blind fixed choke shall be used in the steam heat exchanger, and the upstream, high pressure side of the choke shall be pressure tested to 690 bar (10000 psi).

10. Close steam heat exchanger inlet valve (1) and bypass valve (2) and pressure test to 690 bar.

PRESSURE TESTING OF FLOPETROL CHOKE MANIFOLD

1. Plug choke manifold outlet and pressure test the body to 690 bar (10000 psi).

2. Close the two upstream valves and pressure test from the upstream side to 690 bar (10000 psi). Also make low pressure tests to 290 bar, 138 bar and 69 bar from the upstream side of the same valves.

3. Open the two upstream valves. Close the two downstream valves and pressure test these to 690 bar from the downstream side. Make a low pressure test on these valves to 138 bar and 69 bar from the downstream side.

PRESSURE TESTING OF FLOPETROL CONTROL HEAD

1. Assemble the Control Head with one pupjoint below. Plug the kill side, flow side and above swab valve and pressure test the internal of Control Head to 690 bar (10000 psi).

2. Close kill side ving valve, swab valve and failsafe valve. Pressure test to 690 bar.

3. Close master valve and pressure test from below to 690 bar.

4. Pressure test the kill side ving valve from the outside to 690 bar. Open kill valve and pressuretest against mastervalve to 690 bar.

PRESSURE TESTING OG EZ - TREE

1. Assemble EZ tree with x-overs, centralizers, slickjoint, fluted hanger and pupjoints on top and bottom.

2. Plug top of the EZ tree and pressure test from bottom with the valves open. Test pressure; 690 bar (10000 psi).

3. Close the EZ tree valves and pressuretest from the bottom. Test pressure; 690 bar.

## USE OF MERCURY

NOTE: Before any use of mercury, Statoil Operating Office, CCB, must send an application to NPD to get the permission to perform the work.

Any operation involving handling of mercury must be approved and supervised by Statoil Test Engineer. Transfer of bottom hole samples to transport bottles and taking samples from test separator are of such kind.

The amount of personnel involved must be minimized. Statoil are responsible for taking urine samples of involved personnel the day this personnel arrives to the rig.

Also beforesuch work starts an urine sample shall be taken, and every morning as long as such work is done. There shall also be taken a sample before the personnel leave the rig.

Statoil Test Engineer is responsible for notifying NPD when work involving mercury is carried out. This telex shall include name of involved personnel address, date of birth, time and location for the work. After the test period of 30/2-I a final test report must be sent to NPD.

## METHANOL CHEMICAL PROPERTIES

The chemicals to be used for hydrate inhibition are somewhat dangerous. Attached are outline chemical properties,along with advice on safe handling.

### Methanol

METHYL ALCOHOL - General Information

Synonym: methanol.
Clear colorless very mobile liquid.
Formula: $CH_3OH$.

Toxicology:

Methyl alcohol possesses distinct narcotic properties. It is also a slight irritant to the mucous membranes. Its main toxic effect is exerted upon the nervous system, particularly the optic nerves and possibly the retinae.
The effect upon the eyes has been attributed to optic neuritis, which subsides but is followed by atrophy of the optic nerve. Once absorbed, methyl alcohol is only very slowly eliminated. Coma resulting from massive exposures may last as long as 2 to 4 days. In the body the products formed by its oxidation are formaldehyde and formic acid, both of which are toxic. Because of the slowness with which it is eliminated, methyl alcohol should be regarded effect, daily exposure may result in the accumulation of sufficient methyl alcohol in the body to cause illness.

Servere exposures may cause dizziness, unconsciousness, sighing respiration cardiac depression, and eventually death. Where the exposure is less severe, the first symtoms may be blurring of vision, photophobia and conjunctivitis, followed by the development of definite eye lesions. There may be headache, gastronitestinal disturbances, dizziness and a feeling of intoxication. The visual symtoms may clear temporarily,only to accur later and progress to actual blindness. Irritation of the mucous membranes of the throat and respiratory tract, peripheral neuritis, and occasionally, symptoms referable to other lesions of the nervous system have been reported. The skin may become dry and cracked due to the solvent action of methyl alcohol.

Methyl alcohol is a common air contaminant.It is used as a food additive permitted in foods for human consumption.

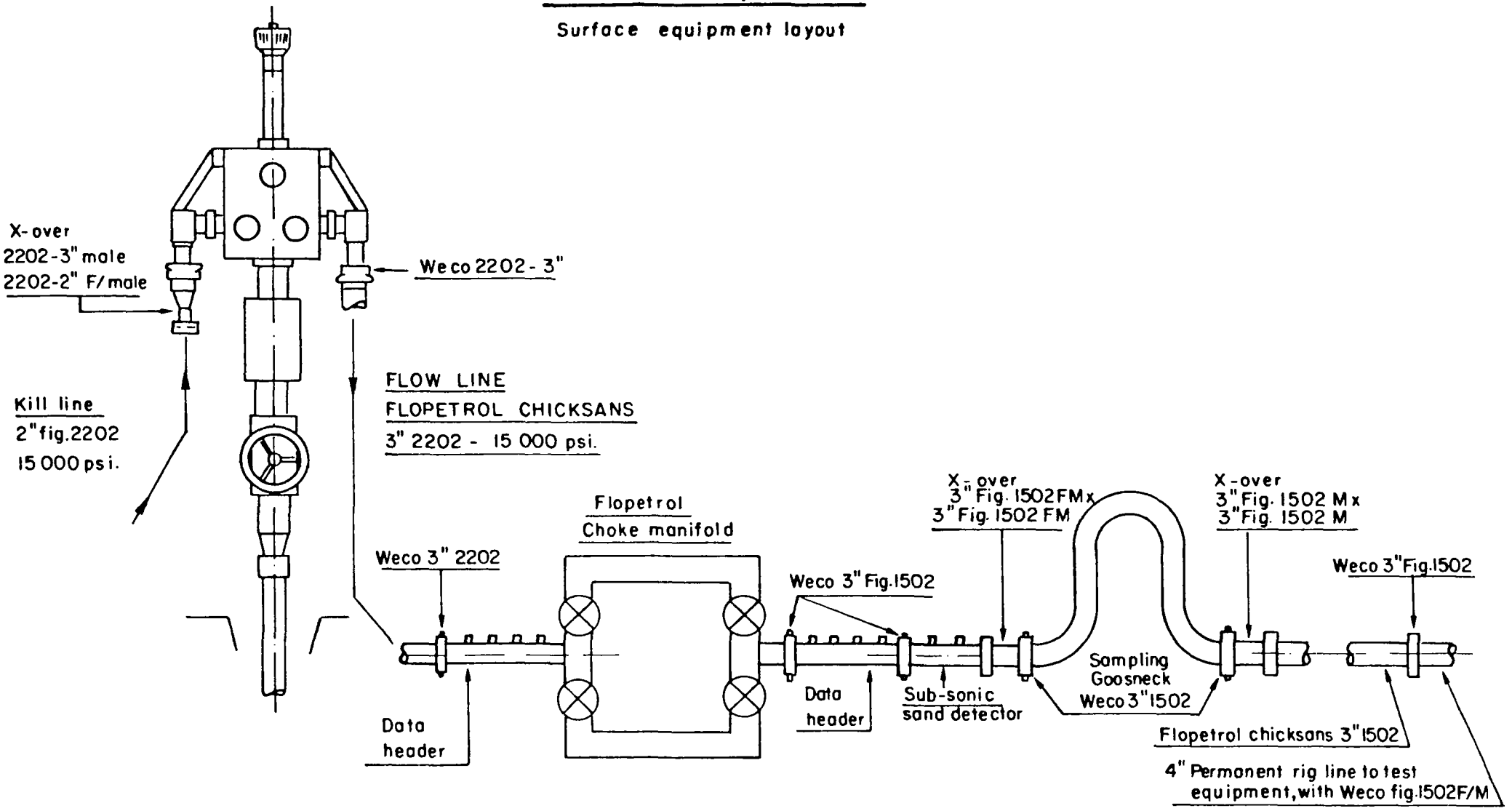
| | |
|---|---|
| Fire Hazard: | Dangerous, when exposed to heat or flame. |
| Spontaneous Heating: | No |
| Explosion Hazard: | Moderate, when exposed to flame. |
| Disaster Hazard: | Dangerous, upon exposure to heat or flame; Can react vigorously with oxidizing materials. |
| Storage: | Segregation in separate store away from naked lights and any source of heat. |

Emergency Action:

| | |
|---|---|
| Spillage: | Stop engines, no naked lights, use only explosionproof electrical equiment. Shut off leak if possible, drench with water, warn of explosion hazard. |
| Fire: | If exposed to fire keep containers cool by spraying with water. Extinguish with water spray, dry chemical, alcohol, $CO_2$ or carbon tetrochloride spray. |
| First Aid: | If the substance has got into the eyes, immediately wash out with plenty of water for serveral minutes. Remove soaked clothing immediately. Obtain medical treatment for anyone with symptoms of swallowing or contact with eyes. |

# DYVI DELTA, 30/2-1

## Surface equipment layout

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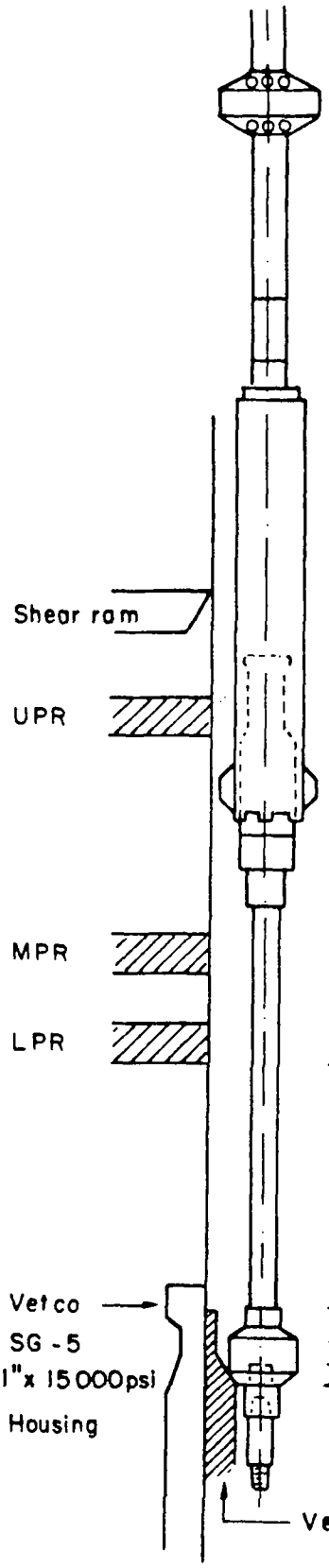
ORIGINAL AV: AJR
TEGNET AV: AM
DATO: 3-9-82

# Wellhead/11"-15000psi BOP/SSTT spacing Dyvi Delta




| | | | |
|---|---|---|---|
| Top blind/ Shear ram | 5.7189m | =225.1565in. | |
| Bottom shear ram | 5.4840m | =215.9065in. | clerance |
| EZ Tree disconn. point | 5.0266m | =197.90 in | 0.457m=18in. |
| Top upper pipe ram | 4.6458m | =182.90 in. | |
| Bottom upper pipe ram | 4.4108m | =173.6565in. | |
| Top X-over | 3.858m | = 151.90 in. | |
| Top slick joint | 3.658m | = 144.05 in. | |
| Top midle pipe ram | 3.215 m | = 126.5945in. | |
| Bottom middle pipe ram | 2.980m | = 117.3445in. | |
| Top lower pipe ram | 2.582 m | =101.6565 in. | |
| Bottom lower pipe ram | 2.347 m | = 92.40 in. | |
| Bottom slick joint | 1.728 m | = 68.05 in. | |
| Top fluted hanger | 1.529 m | = 60.20 in. | |
| Fluted hanger (12in) | | | |
| Bottom fluted hanger | 1.224 m | = 48.20 in. | |

Vetco 11"x 7" wear bushing

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Orginal arb.av: RuA
Tegnet av: A M
Dato: 2-4-81

3-2-1-87

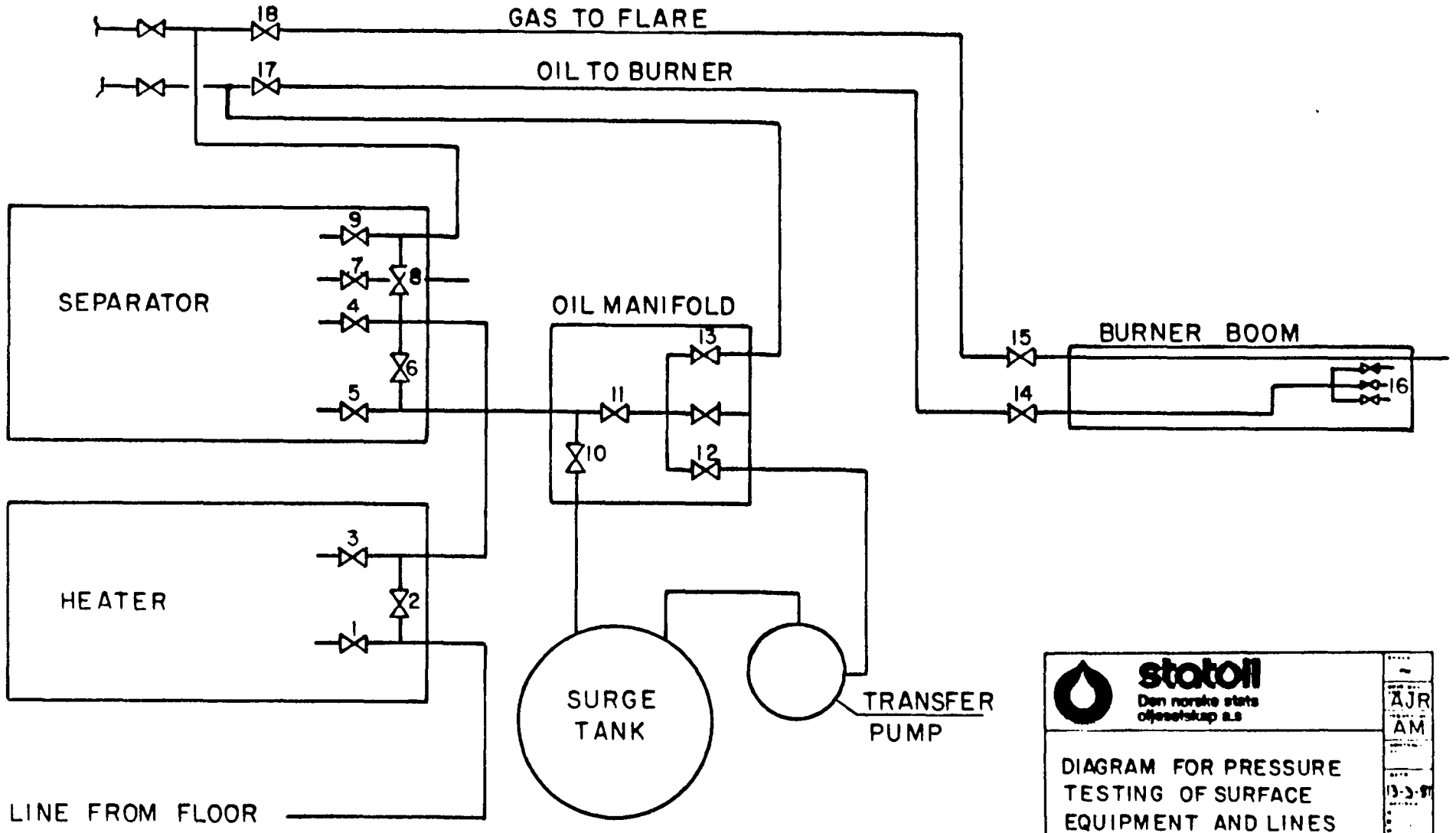


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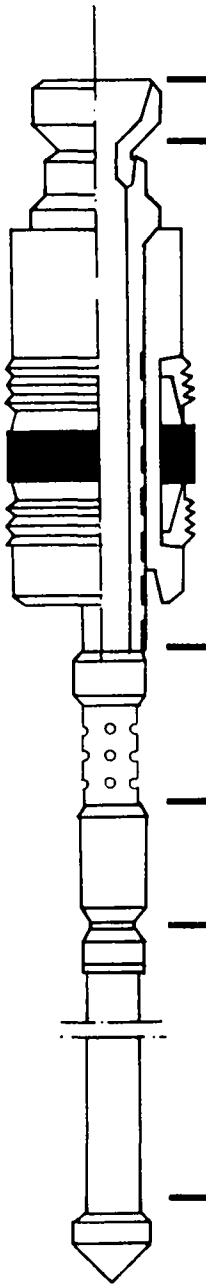
DIAGRAM FOR PRESSURE TESTING OF SURFACE EQUIPMENT AND LINES
DYVI DELTA

AJR
AM
13-3-91

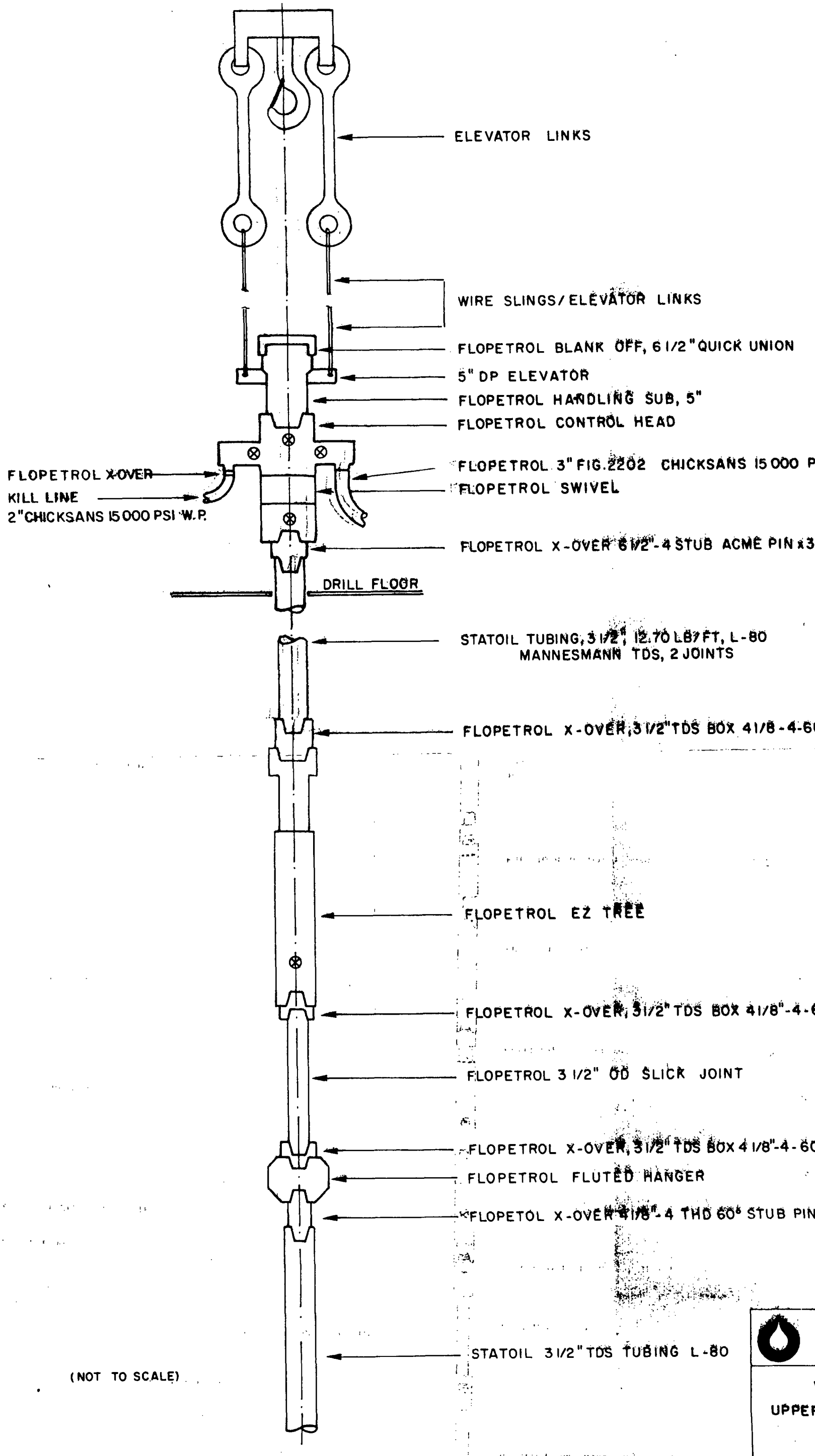
4-3-1-93

PRODUCTION PACKER WITH
TAIL PIPE
TEST 30/2-1



| | | |
|---|---|---|
| X-OVER 2 7/8 NU PIN X 3½ IF BOX | | 2.375 |
| MODEL D PACKER,<br>SIZE 801/32 W/FLAPPER VALVE | 5.687 | 3.250 |
| "G" LOCATOR TUBING SEAL<br>ASSEMBLY (20 FT) 2 7/8" VAM | | |
| PERFORATED SPACER TUBE 10 FT<br>2 7/8" VAM | 3.220 | 2.375 |
| "F" NIPPLE 2 7/8" VAM | 3.220 | 2.312 |
| 2 7/8" SPACER TUBE (30 FT) 2 7/8" VAM | 3.220 | 2.375 |
| HALF MULE SHOE 2 7/8" VAM | 3.220 | 2.375 |

# WELL 30/2-1 UPPER PART OF THE WELL TEST STRING ASSEMBLY




(NOT TO SCALE)

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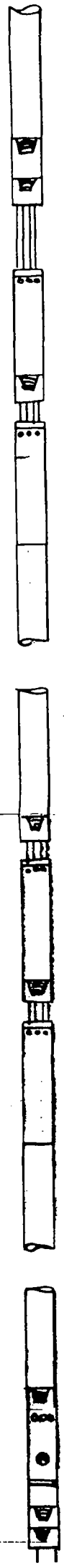
WELL 30/2-1
UPPER PART OF THE TEST STRING ASSAMBLY
DYVI DELTA

| | |
|---|---|
| SCALE | |
| ORIGINAL SIGN. BY | AJR |
| TECHNOL. BY | AM |
| CONTROL BY | |
| DATE | 3-8-92 |
| REVISED BY | |
| A | |
| B | |
| C | |
| CONTROLLED NO. | |
| TECHNOL NO. | |

# 7" CASING TEST



| | | ID" | OD" | Length/m |
|---|---|---|---|---|
| Test String | | | | |
| X.O. Test String to 3½ IF Pin | | | | |
| Slip Joint (open) | 5' Stroke | 2.25 | 5.00 | 5.53 |
| Slip Joint (closed) | | 2.25 | 5.00 | 4.01 |
| Drill Collars 10 000 lbs | | | | |
| Slip Joint (closed) | | 2.25 | 5.00 | 4.01 |
| Slip Joint (closed) | | 2.25 | 5.00 | 4.01 |
| Drill Collar 10 000 lbs | | | | |
| APR M Revers Circ./Safety valve | | 2.25 | 4.62 | 2.22 |
| X over 3½ IF Box 3½ F.H. Pin | | | | |
| Handling sub choke Assy. | choke | 5.00 | 1.37 | |
| Handling sub choke Assy. | choke | 5.00 | | |
| X over 3½ F. H. Box 3§ IF Pin | | | | |
| APR M Revers circ./Safety valve | | 2.25 | 4.62 | 2.22 |
| Drill Pipe tester valve | | 2.25 | 5.00 | 1.46 |
| LPR Tester Valve | | 2.25 | 5.00 | 4.88 |
| Ful Flo Hydraulic Bypass | | 2.25 | 4.62 | 2.48 |
| Big John Jars | | 2.37 | 4.625 | 1.53 |
| 3½IF Pin | | | | |

EQUIPMENT DESCRIPTION AND LOCATION IN STRING

UPPER SLIP JOINT - main purpose is for setting the packer - depending on depth, temperature and type of pipe as many slip joints can be run as desired to compensate for expansion and contraction while flowing the well.

DRILL COLLARS - Run mainly for weigh to ensure packer setting and stability in hole

APR M REVERSING SAFETY VALVE - This is a Ful Flo Ball Valve that is run in the open position. It is operated by annulus pressure that is predetermined. The pre-determined pressure is held by shear pins. When the pins are sheared, the ball moves to a locked closed position and opens circ. ports - thus the well is shut in and reverse circ. can start while the build up data is being recorded.

FUL FLO DRILL PIPE TESTING VALVE - This is a full bore ball valve that is run in the hole in the closed position. This allows the D.P. to be pressure tested to desired internal pressure. This tool opens when the packer is set.

Handling sub choke assy: Down Hole Choke

LPR N TESTER VALVE - Annulus operated full bore testing valve - can be ope and closed as often as required. Modified APR N tester valve.

FUL FLO HYDRAULIC BY PASS - This tool is a full bore by pass valve that meters closed. It takes approximately 2 - 3 minutes to close with 20 000 lbs setting on it. This allows any piston effect on the fomation caused by tool operation to disperse to the annulus while the by pass is mettering closed.