INTERNATIONAL PHASE OF OCEAN DRILLING (IPOD)
DEEP SEA DRILLING PROJECT
DEVELOPMENT ENGINEERING
TECHNICAL NOTE NO. 1

LYNES PACKER FORMATION TESTER SAFTY TOOL

SCRIPPS INSTITUTION OF OCEANOGRAPHY
UNIVERSITY OF CALIFORNIA AT SAN DIEGO
CONTRACT NSF C-482
PRIME CONTRACTOR: THE REGENTS, UNIVERSITY OF CALIFORNIA

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Prepared for the
NATIONAL SCIENCE FOUNDATION
National Ocean Sediment Coring Program
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by the

UNIVERSITY OF CALIFORNIA
Scripps Institution of Oceanography
Prime Contractor for the Project

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INTRODUCTION

The Lynes Formation Tester/Safety Tool (RFT) was accepted by SIO personnel in January 1974 after extensive shore based testing and approximately one years development time. Basically, the tool consists of a downhole inflatable packer element. This element when inflated will expand outward from the drill string and effect a seal against the borehole. The packer, when set in a competent indurated formation, will withstand approximately a 1500 psi differential pressure in a 12-5/8" hole. At a depth of 18,000 feet below sea level, this would have the same effect as raising mud weight from 9 lb/gal to 10.6 lb/gal.

The tool has two functions depending on the mode in which it is run. As a safety tool, the packer can be expanded with a safety go-devil, packing off the annulus and at the same time preventing flow up the drill string. Heavy mud and/or cement can then be circulated below the packer to regain control. The capability to circulate above the packer also exists.

In the formation tester mode the packer can be expanded with the sampler go-devil, a formation pressure recording obtained and a 15 gallon sample of formation fluid and annulus water taken.

Sea trials of the formation tester/safety tool were conducted aboard the D/V GLOMAR CHALLENGER during Leg 38 of the Deep Sea Drilling Project. Five tests were conducted on five separate sites.

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November 1974

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I INTRODUCTION

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The tool has two functions depending on the mode in which it is run. As a safety tool, the packer can be expanded with a safety go-devil, packing off the annulus and at the same time preventing flow up the drill string. Heavy mud and/or cement can then be circulated below the packer to regain control. The capability to circulate above the packer also exists.

In the formation tester mode the packer can be expanded with the sampler go-devil, a formation pressure recording obtained and a 15 gallon sample of formation fluid and annulus water taken.

Sea trials of the formation tester/safety tool were conducted aboard the D/V GLOMAR CHALLENGER during Leg 38 of the Deep Sea Drilling Project. Five tests were conducted on five separate sites. The results are documented in the following report.

II CONCLUSIONS AND RECOMMENDATIONS

1. The Lynes formation tester/safety tool operates as designed.

2. Operational limitations of the tool require an indurated formation before an effective seal can be accomplished. This is a severe restriction on the use of the tool in a safety mode.

3. Packer element endurance is satisfactory. 30-40 rotating hours in soft sediments and limited basalt penetration can be anticipated.

4. The following modifications to the prototype tool are being examined (in conjunction with Lynes) to improve handling and increase reliability:

   (a) Eliminate shoulder on I.D. of circulating sub assembly.

   (b) Move sample barrels below seal section in place of stinger subs.

5. Recommendations on modifications will be forthcoming prior to expiration date for optional tool on March 21, 1975

6. A special tools technician will be required to properly maintain and operate these tools at sea.

III PROBLEM AREAS

Although the tool functioned properly for most of the tests, there was a continuing series of minor problems that should be investigated and corrected for future runs.

On Site 342, the sampler was run in the hole for the first time. Attempts to retrieve the sampler were unsuccessful. The tool was jammed downhole. After tripping out of the hole, it was determined that the tool had pulled out of the packer body and jammed in the circulating assembly. After dislodging the sampler a band of grease with sand and silt was found on the leading edge of the seal assembly. Apparently the grease used on the seals prior to running in the hole had also gotten on the leading edge of the valve body. The foreign material must have been enough to jam the tool on the downward looking taper in the bore of the circulating assembly. The sampler probably would not have jammed had it not been greasy enough to capture the sand and silt. However, the downward looking taper also contributed to the problem. If at all feasible, the circulating sub should be bored out so that the same I.D. is carried throughout the entire assembly - no shoulders or tapers. This would necessitate larger seal rings to be used on the circulating go-devil. Another solution would be to increase the bore throughout to 3.875 and flute all areas other than the seal surface. This would necessitate machining some new parts but would allow use of the same size seal rings. Hydraulic locking of the sampler does not appear to be a problem as long as the standpipe manifold is cracked prior to retrieving.

The problem with the Kuster clocks stopping was not a surprise. I suspect that this will be a continuing problem. By running the sampler in on a wireline, no time is lost since the wireline will have to run in sooner or later anyway to retrieve the sampler. The one drawback to this solution is if the packer fails to unseat. The "stuffing box" on the wireline will not take the 3000 psi pressure necessary to shear the safety release pin. Therefore, the sampler would have to be retrieved; released from the overshot and then dropped back in the hole.

The high pressure in the sampler barrel after test No. 38-5 was almost assuredly due to an O-ring failure. Pump pressure was allowed to get into the barrel, probably past the equalizing piston in the sampler valve sub. It is interesting to note that the regulator valve was functioning correctly both before and after the test. The small difference in setting pressure was due to attempts to make up the float valve assembly backwards on the rig floor. There was not enough clearance between the regulator valve stem and the bottom of the float valve. Attempts to make up the joint with 36" wrenches twisted the valve stem and probably accounts for the slightly higher pressure setting.

After test No. 38-3 (first time packer was set) the packer came out of the hole stripped of the rubber element and in the inflated position. Upon breaking down the tool, two sleeves were found to be immobile. Two factors probably caused or contributed to the condition. First, the packer had cement and heavy mud pumped through it on the previous site and then it was not redressed prior to running in the hole. Also, due to the condition of the packer element itself, additional foreign material could have gotten into the passages while coming out of the hole. These events only solidify the argument that the packer must be redressed each time it is run in the hole, even if it is not set. There is no other evidence at this time as to why the packer did not deflate.

After running Test No. 38-4 on Site 345, the packer came out of the hole in relatively good condition and had never been inflated downhole. After inflating the packer during post site deck tests, numerous problems arose. The packer started to leak. It would not hold enough pressure to open the sampler (1250 psi) and did not deflate properly after the test. The external bulge was not present before the test. The internal bulge was found after removing the packer element from the assembly. It is unknown whether this was an isolated failure of the packer lining or if the failure was caused by the higher hydrostatic pressure on this site (approximately 5865 psi). This packer element will be shipped back for further analysis.

The safety go-devil was not run on this leg. It is felt that a severe problem exists in dampening the energy stored in the drill pipe when the shear plug releases at 1800 psi instantaneously shock loading the formation. This problem will be thoroughly explored at the conclusion of the leg.

If this problem can be alleviated, then it would be advantageous to build an adapter allowing the Kuster pressure recorder to be run on the safety go-devil.

There is an inherent weakness in the deck testing sequence not allowing the sample barrel assembly to be tested for pressure integrity. This can be corrected by making a sample barrel test plug and test cap.

It would also be desirable to run one or two additional float valves in the sample barrel assembly. This would help to isolate the formation fluid from the annulus water that would enter the chamber first.

The only other recommendation is to cut the chamfer on circulating go-devil further back so that less of shoulder is present. This will reduce the possibility of the go-devil hanging up while being retrieved through the bottomhole assembly. (Note: this was not a problem on Leg 38).

Another desirable option is to supply a 10' 7-1/2" spacer for the inner core barrel. This would allow the core barrel to be run without the circulating assembly in the string. The circulating assembly is not needed or used when operating the sampler.

IV SITE TEST REPORTS

Test Report I

Leg No. 38 - Site No. 338
August 13 through August 16, 1974

Iceland-Faeroe Ridge
67° 47'N Latitude
05° 23'E Longitude
Water Depth - 1315 m
Total Depth - 1752 m

Geological Summary

Pleistocene sandy muds to 57 m. Miocene sandy muds 57 m to 171 m. Oligocene diatomaceous ooze 171 m to 257 m upper and middle Eocene diatomaceous ooze 257 m to 285 m. Lower Eocene sandy muds 285 m to 401 m. Basalt basement at 201 m. Total penetration 437 m.

Operational Summary

Lynes formation tester/safety tool was redressed and deck tested prior to spudding Site No. 338. Packer was run in hole above outer core barrel assembly without stabilizers for endurance test only. Packer element No. 1 came out of hole in excellent condition. Rotating hours 15.3 (see Figure 3). Post Site No. 338 deck tests conducted on packer body assembly prior to redressing found tool to be fully operational.

Test Report II

Leg No. 38 - Site No. 341
August 18 through August 20, 1974

Inner Voring Plateau
67° 20'N Latitude
06° 07'E Longitude
Water Depth 1443.5 m
Total Depth 899.5 m

Geological Summary

Pleistocene and Pliocene sandy muds, ice rafted pebbles, reworked tertiary sediments, interbedded stiff clays and silts near bottom 323 m. Upper Miocene chalk and diatomite 323 m to 370 m. Middle Miocene diatomite 320 m to bottom. Methane found below 57 m. Traces of ethane found below 370 m. Clayey diatomite at bottom of hole appeared to contain soluble hydrocarbons possibly consisting of very light sweet interstitial oil. Hole terminated at 456 m total penetration, then filled with heavy mud and cement.

Operational Summary

Lynes formation tester/safety tool was redressed and deck tested prior to spudding Site No. 341. Packer was again run in hole above outer core barrel assembly without stabilizers. Intent was to obtain formation fluid sample and record formation pressure on optimum scientific hole. Gas and oil shows terminated hole prematurely. Absence of required indurated formation prevented setting of packer element. This emphasizes glaring weakness of assembly as a "safety tool". Packer element acquired an additional 13.5 hours rotation (see Figure 3). Visual inspection of packer element again showed it to be in excellent condition. Very little sign of wear. Due to projected steaming time of five hours to next site, a decision was made to lay down formation tester assembly with core barrel and run back in hole on Site No. 342.

Test Report III

Leg No. 38- Site No. 342
August 21 through August 22, 1974

Outer Voring Plateau
67° 57'N Latitude
04° 56'E Longitude
Water Depth 1316 m
Total Depth 1486.5 m

Geological Summary

Pleistocene sandy muds and pebbles to 70 m. Miocene diatomaceous ooze 70 m to 152 m overlies basalt. Total penetration 170 m (Figure 4).

Operational Summary

Due to anticipated minimal steaming time between Sites 341 and 342, the Lynes formation tester/safety tool was not redressed or deck tested prior to running in hole. The packer assembly already made up to the outer core barrel from proceeding site was again in hole without stabilizers. Intent was to set packer in basalt after scientific objectives reached and prior to pulling out of the hole. This would provide good

mechanical actuation test of tool with minimal risk to hole or scientific objectives. Sampler assembly was used to set packer. Back pressure valve was set at 500 psi below theoretical bottomhole pressure to minimize drawdown on formation (see Figure 5). Kuster pressure recorder with three hour clock was made up in sampler filter screen. To simplify operational handling, only one sampler barrel was run in the assembly. The mechanical actuation of the packer as well as the performance of the sampler would still be tested. There was no scientific interest for a formation fluid sample taken in basalt.

Chronological Events	Time	Increment
1. Kuster clock started	2100 hrs	
		18 min
2. Drop sampler downhole	2118 hrs	
		10 min
3. Sampler seater - begin to pressure up packer	2128 hrs	
		3 min
4. Packer set in basalt (see Figure 4)	2131 hrs	
		2 min
5. Reach 1500 psi pump pressure (sampler open)	2133 hrs	
6. Hold 1500 psi for 10 minutes		10 min
7. Conduct tension test to 10,000 lbs (Accidently hit 20,000+ lbs)	2143 hrs	
		2 min
8. Release pressure	2145 hrs	
9. Pipe not free (packer not deflated or formation pulled in - tool 50,000 lb strain on drill string)		15 min
10. No circulation		
11. Run in sandline - attempt to unseat sampler to regain circulation out bit	2200 hrs	
12. Attempt to pull sampler - sampler stuck - sheared pin in overshot		25 min
13. Pipe worked free (50,000 lbs+)	2225 hrs	
14. Thought circulation established trip clear of mudline pumped 0-2500 psi rapidly - blew the packing in stuffing box		
		6 hrs
15. Two attempts to pull sampler - sheared two more overshot shear pins		
16. P.O.H. (wet trip)		
17. Sampler on deck	0430 hrs	

When packer assembly had reached the drill floor it was hung off in the rotary table and connection to bottom stand of drill collars was broken. Air tugger lines were used to steady collars as they were lifted over sampler barrel and top sub assembly. Sampler assembly was dislodged and laid down. The sampler seal units had cleared the sampler seating sleeve but had jammed in the circulating assembly directly above the packer body. A silty sand accumulation was evident just ahead of the seal unit taper on the sampler seal assembly. This was probably responsible for jamming the sampler on the downward looking taper in the circulating sub sleeve. The very small clearance between seal unit and seal surface could easily be negated in this manner. Hydraulic locking also may have been a factor since all of the seawater in the drill pipe must bypass around the 3.875 O.D. sampler seal units or be lifted by the sand-line. Even in relatively shallow water the hydrostatic head could initiate a large back pressure on the sampler as it is being retrieved.

Sampler Condition

With the pressure release/gas sampling manifold made up to the sampler top sub, all shear pins removed and the stem lock screw backed out flush, there was no indication of any pressure inside the barrel. When the top sub connection was broken and backed off a few turns a small amount of pressure vented to atmosphere. Apparently there was not sufficient pressure inside the barrel to overcome the frictional resistance of the relief/drain valve stem. Under shop conditions it takes approximately 100-150 psi to slide valve stem and vent pressure. Barrel should have had + 437 psi but did not (see Figure 5). Two possible conclusions are: (1) actual downhole pressure was approximately 337 psi less than theoretical calculation, or (2) due to long time delay in recovering sampler (i.e. pipe trip) a small leak could have bled off pressure from barrel.

Aside from a slightly lower than expected barrel pressure the sampler appeared to operate normally. A full 2-1/2 gal sample (1 barrel) was recovered. The sample was reddish brown in color with a yellowish/white foam on top when pressure was released and while being drained from the barrel.

The Kuster K-3 three hour clock stopped almost immediately after the sampler was dropped. No pressure record was obtained. Failure to check water level in drill pipe may have contributed to the clock malfunction.

Kuster K-3 Clock/Pressure Recorder Data

1. Kuster K-3 clock #13106 with three hour gear box
2. Pressure element N9542 P9950
3. Site No. 342, Leg 38
4. Date: August 21, 1974
5. Water Depth - 1316 meters
6. Penetration - 170 meters
7. Packer setting depth - 1475 meters
8. Test No. 38-1

Packer Condition

Packer element No. 1 was irrepairable. The assembly came out of the hole in the expanded position with all external rubber missing and metallic strength members exposed. The safety release valve was still intact. The shear pin had not sheared. (Note: drill pipe was never pressured up high enough to shear the pin.) Because of the packer element condition no post site pressure tests were conducted. When the packer body assembly was broken down routinely for redressing, it was found that both the sampler seating sleeve and the control valve were jammed. It appeared that foreign material was interfering with the freedom of movement of these two sleeves. Both were eventually removed with the use of an air tugger and chain tongs. Strongly believe that failure of packer to deflate was related to the immobility of these two sleeves. The sleeves also could have become locked up on the way out of the hole because of the packer not deflating. It is impossible to tell for sure which event occurred first. After cleaning and redressing the formation tester assembly was successfully pressure tested. The tool was functioning normally.

Test Report IV

Leg No. 38 - Site No. 345
September 1 through September 4, 1974

Lofoten Basin
69°N Latitude
01.14'W Longitude
Water Depth 3205 m
Total Depth 4018 m

Geological Summary

Glacial sandy muds to 40 m. Middle Miocene muds and clays 40 m to 110 m. Oligocene muds, sandy muds and sands 110 m to 770 m. Turbidites prominent near base. Basalt basement below 770 m. Total penetration 802 m.

Operational Summary

Lynes formation tester/safety tool was redressed and deck tested prior to spudding Site No. 345. Packer was run in hole above outer core barrel assembly without stabilizers for evaluation in the safety tool mode. After coring basement at this site it became apparent that the basalt was not suitable for a good packer seat. It was badly weathered, brecciated and fractured. Of secondary importance the weather was rapidly deteriorating. Winds were picking up and swells were beginning to build. The weather report called for conditions to worsen at least through the night and all of the following day. Weight fluctuations of ±25,000 lbs were observed on the drill string. The heave compensator was not in the string for reasons not pertinent to this report. Based on these facts a decision was made to cancel the safety go-devil test. Instead it was agreed to pull up above the mudline and test the circulating assembly.

Order of events in the circulating assembly test were as follows:

1. Test Otis overshot on go-devils
2. Pull up pipe to clear mudline
3. Drop safety go-devil

   Note: Shear plug was left out so as not to risk expanding packer out of the hole. The back pressure check valve was also left out since it served no useful purpose in the test.

4. Circulating go-devil was dropped three minutes after safety go-devil
5. Pump both go-devils to bottom monitoring pump pressure and strokes very carefully.
6. With both go-devils unseated: 25 strokes per min at 125 psi pump pressure (see Figure 6)
7. With safety go-devil seated: 20 strokes per min at 350 psi pump pressure (see Figure 6)
8. With both safety and circulating go-devils seated: 26 strokes per min at 175 psi pump pressure (see Figure 6)

Positive confirmation was obtained during this test that the circulating ports had opened and performed as designed. An additional 1200 gallons were circulated through the ports at 35 strokes per min and 400 (?) psi pump pressure.

9. Stop circulating and retrieve circulating go-devil
10. Retrieve safety go-devil

    Note: Safety go-devil required two wireline trips and numerous set down attempts before latching. After retrieving circulating go-devil derrick man ran in hole to same weight, however was stopped 30 feet shy of flag. Finally on the second wireline run the derrick man set down harder, the go-devil latched and was retrieved without incident.

Packer came out of hole in good condition. Visual inspection showed one small gouge, however it did not appear to affect integrity of the packer. During post site deck tests, however, the packer element expanded but started leaking. Unable to pressure up enough to open sampler. After shutting off pump and bleeding pressure, the packer element was still inflated and still leaking. After a two hour delay the packer had deflated enough to remove the test casing. A small circumferential bulge remained on the upper end of the packer element. After removing the packer element from the packer body assembly a close inspection revealed an internal longitudinal bulge three quarters the length of the element. A question has arisen as to the possibility that on deep holes the high ambient pressure causes influx of sea water into the packer lining and becomes entrapped or otherwise unable to expel rapidly enough when pressure is relieved to atmospheric. There was a total of 32.9 rotating hours on packer element No. 2.

Test Report V

Leg No. 38 - Site No. 348
September 9 through September 12, 1974

Icelandic Plateau
68° 31'N Latitude
12° 28'W Longitude
Water Depth 1777 meters
Total Depth 2321 meters

Geological Summary

Glacial sandy muds and clay, 64 meters. Early Pliocene to middle Miocene biogenic siliceous oozes 64 meters to 265 meters. Lower Miocene upper Oligocene terrigenous mudstone and claystone 265 meters to 527 meters. Basalt 527 meters to bottom. Total penetration 544 meters.

Operational Summary

Prior to running in the hole on Site No. 348, the formation tester/safety tool was cleaned, redressed with packer element No. 3 and fully pressure tested. The tool was run in the hole without the circulating assembly. The intent being to set and release the packer at the conclusion of the hole in basalt (see Figure 7). One 2.5 gallon sample barrel was run to simplify the operation and still test the mechanical actuation and performance of the tool. The regulator valve was set for 3000 psi (see Figure No. 8). After the derrick man "tested" the lifting clamp and overshot engagement by attempting to pull the assembly through the drill pipe without success, the sampler was run in the hole. Circulation was broke to flush the hole and the lower bumper subs were closed. It was empirically determined that 6000-7000 ft-lbs applied "static" torque was necessary to rotate the drill pipe without the packer set.

When the sampler reached bottom, it appeared to seat 25 feet shy of the landing shoulder. Attempts were made to pull up but the sampler became stuck. After picking the bit up off bottom and opening the lower set of bumper subs, the sampler was freed. A second attempt to seat the sampler again was shy of the sandline flag. At this point the drill pipe was pressured up to see if the sampler was seated in the proper position. After reaching 1500-1600 psi pump pressure, the drill pipe was torqued to 7,000 ft-lbs for one minute to verify that the packer was set. Pressure was held on the drill pipe for five minutes and then released slowly by venting through the standpipe manifold.

The sampler was retrieved without difficulty, however, there was a strong drag on the wireline - approximately 1000-2000 lbs. Leaving the standpipe manifold open helps to allevaite this somewhat.

While retrieving the sampler a 25,000 lb strain was taken on the drill pipe. Believe this increase in weight was due to basaltic fill in bottom of hole rather than a packer malfunction.

The sampler was retrieved far enough to break circulation. While pumping 20 spm at 150 psi the pipe became free.

The sampler reached the rig floor at 1325 hours with approximately a 2-1/2 gallon sample under 2100 psi pressure. The Kuster clock was still running and a pressure recording was obtained (see Figure 9). The packer element, after coming out of the hole, had numerous cuts and gouges as well as having slight upsets on each end. A post site pressure test was conducted with all functions operating normally, including the packer element. Since the element did pass the pressure test without any leaks or malfunctions, it was decided to leave it aboard as a spare. The tool was then broken down, cleaned and redressed with a new packer element and the on-deck pressure tests were performed.

V. SUMMARY

The formation tester/safety tool sea trials conducted on Leg 38 proved conclusively that a downhole inflatable packer could be set and released during deep sea drilling operations. Also tested and proven was this capability to sample formation fluid and record downhole pressures. Although there were minor operational and mechanical difficulties, the tool did function acceptably. As the drilling crews become more familiar with its operation, the efficiency will certainly improve. A few key modifications such as those mentioned earlier will help to improve its reliability.

During endurance testing, three packer elements were subjected to a total of 84 rotating hours on five different sites without stabilizers in the string. One packer element, while set in basalt, was subjected to 20,000 lbs tensional strain and 7,000 ft-lbs torsion without unsetting or failure. In summary, the packer performed admirably throughout the endurance testing.

The packer was not set using the safety go-devil because of the "theoretical" possibility that when 1800 psi drill pipe pressure is introduced beneath the packer a formation failure might occure resulting in stuck pipe, lost hole and probable loss of tools. This theory is still being evaluated. For all practical purpose the seal section on the safety go-devil is the same as that of the sampler. It therefore seems reasonable to assume that the safety go-devil is also capable of setting the packer.

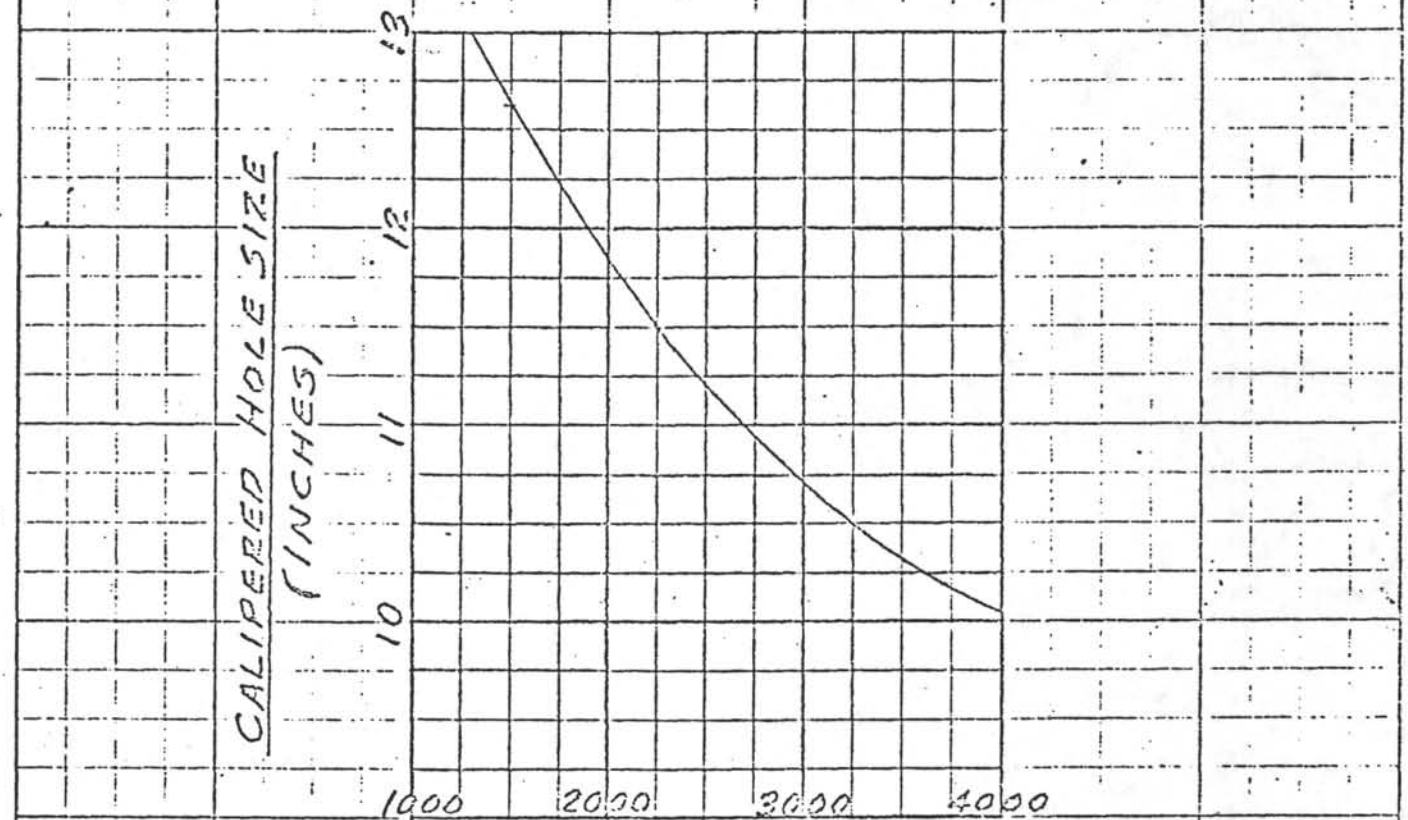
Although the formation tester can technically be described as operational in the safety tool mode, its usefulness remains severely limited by operational requirements; that is, the necessity of finding the proper hard indurated formation to use as a packer seat. This will, of course, fluctuate considerably between legs. On Leg 38, of the 18 holes drilled, less than 10% had suitable formations in which to set the packer (basement not included). The packer could not have been set effectively on any of the sites where there was concern over possible oil or gas findings. Of course, it would be extremely unusual, if not impossible, to find an over pressured reservoir in a soft unindurated

formation. The one drawback to operate in the formation tester mode is the need to run the tool in the lower position (i.e., beneath the outer core barrel). To run the tool in this position (necessary to minimize the amount of annulus fluid introduced into the sample barrel) requires lengthening the inner core barrel assembly by 13 feet. Handling the resulting 47 foot long barrel will present some real operational problems. The over abundance of operating hardware (i.e., heave compensator, cold weather screens, etc.) to be found on the rig floor, has all but eliminated any excess handling room. Use of this barrel will almost certainly increase the core barrel handling time. The already time conscious chief scientists are sure to resist running the tool in this mode.

Even though the GMI crews are competent and perfectly capable of understanding and operating the tester, their workload is becoming increasingly saturated. The care and operation of complex tools such as this one in an ocean environment is a time consuming job. If SIO expects to continue sending special tools to sea, they must again consider the need for a special tools technician to sail routinely aboard ship and handle the abundance of tools. These tolls need special attention if they are to accomplish their scientific mission. Global Marine just does not have the time available to do this and continue performing their principle job with the excellence in which they have in the past.

DIFFERENTIAL PRESSURE VS. HOLE SIZE

15-02851-18 "8.50 O.D. x 54 LONG PACKER ELEMENT"

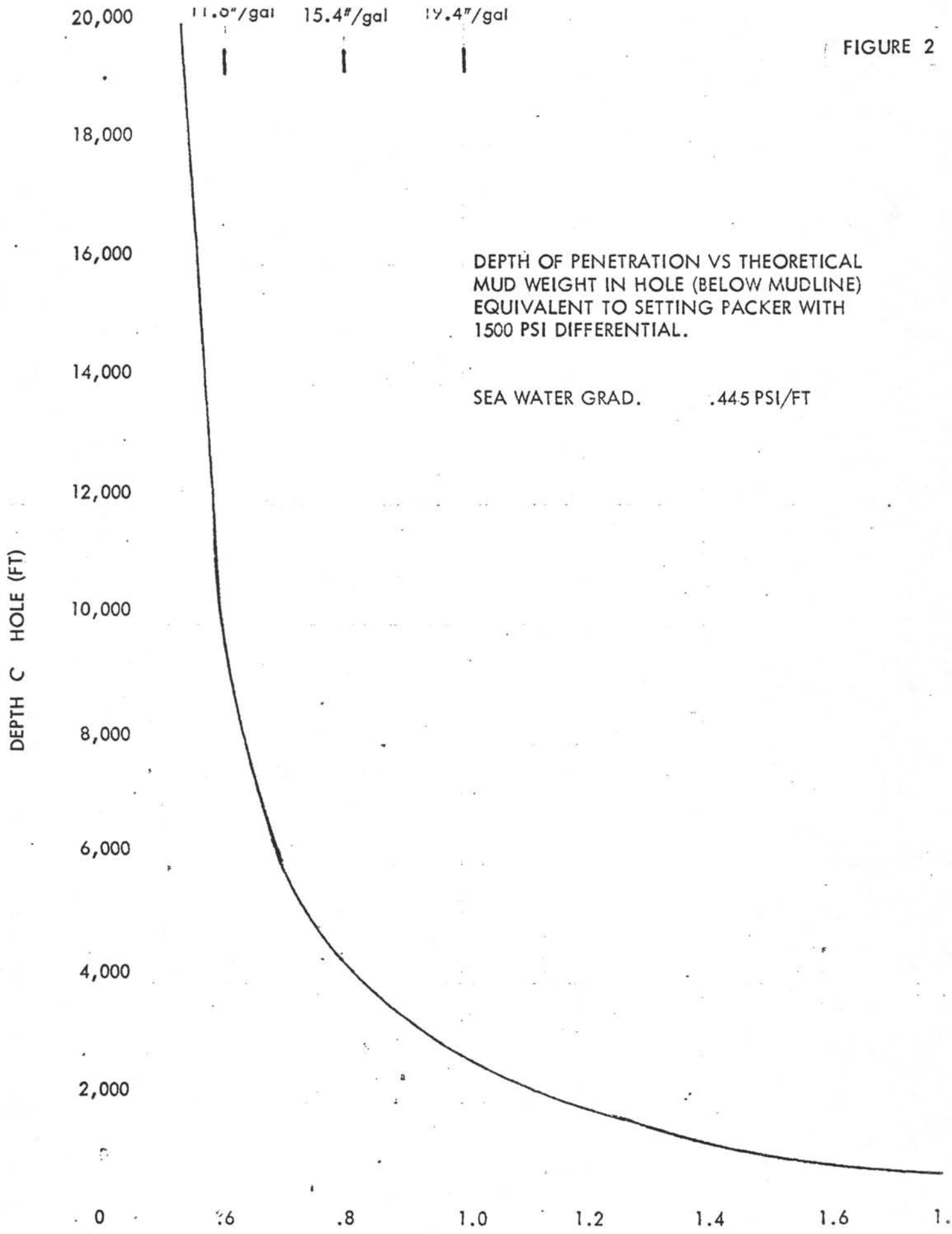


HOUSTON TEXAS

LYNES

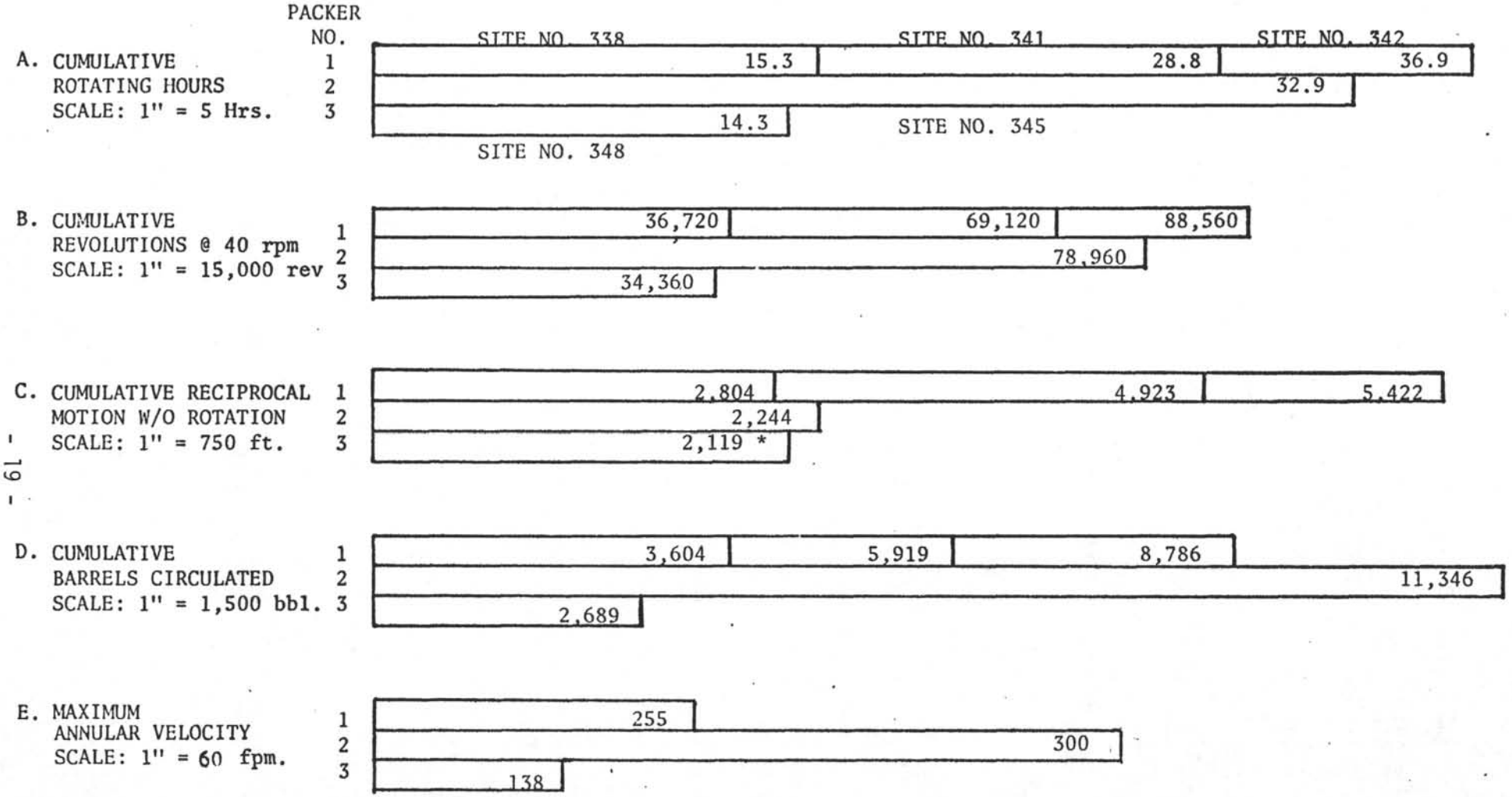
FIGURE 1

FIGURE 2



S. T. Serocki
5/11/73

FORMATION TESTER / SAFETY TOOL
ENDURANCE TEST DATA -- LEG 38



* 24 Hrs. intermittent stroking of pipe while Bowen unit down not included in total.

FIGURE 3

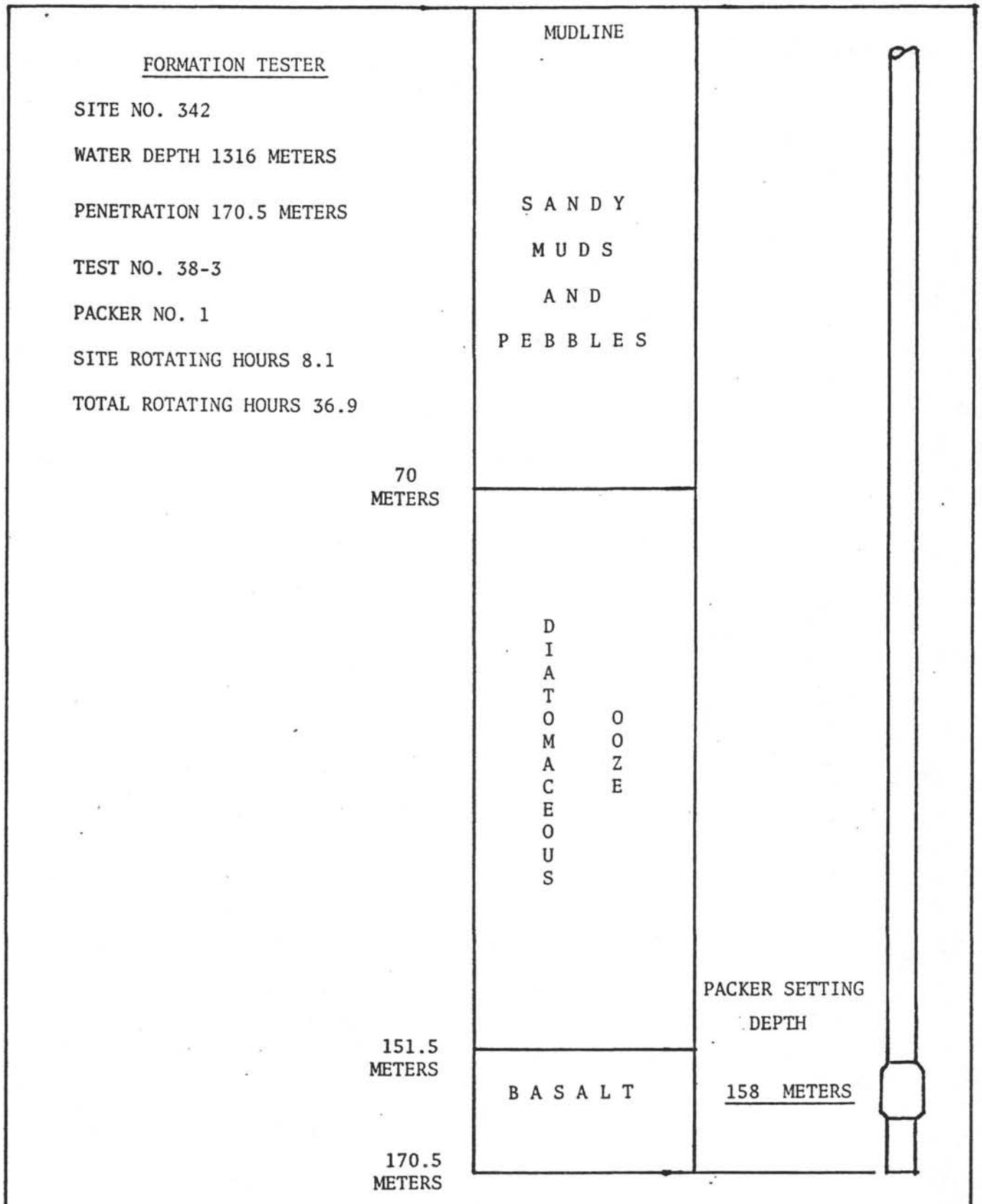

FORMATION TESTER
SITE NO. 342
WATER DEPTH 1316 METERS
PENETRATION 170.5 METERS
TEST NO. 38-3
PACKER NO. 1
SITE ROTATING HOURS 8.1
TOTAL ROTATING HOURS 36.9
MUDLINE
SANDY MUDS AND PEBBLES
70 METERS
DIATOMACEOUS OOZE
PACKER SETTING DEPTH
151.5 METERS
BASALT
158 METERS
170.5 METERS

FIGURE 4

FORMATION TESTER / SAFETY TOOL

FORMATION PRESSURE ESTIMATES FOR SAMPLER REGULATOR VALVE SETTING SITE NO. 342

I. WATER DEPTH 1316 METERS
ESTIMATED SETTING DEPTH 200 METERS

CALCULATIONS:

(1) 1316 meters x 3.28 meters per foot
= 4316 feet

(2) 4316 feet x .445 psi per foot salt water gradient
= 1921 psi

(3) 200 meters x 3.28 meters per foot
= 656 feet

(4) 656 feet x .454 psi per foot formation pressure gradient = 298 psi

(5)

hydrostatic pressure	1921 psi
formation pressure	+ 298 psi
downhole pressure	2219 psi
	- 500 psi drawdown

(6) regulator valve setting 1719 psi

II. WATER DEPTH 1316 METERS
ACTUAL SETTING DEPTH 158 METERS

CALCULATIONS:

(1) 158 meters x 3.28 meters per foot
= 518 feet

(2) 518 feet x .454 psi per foot formation pressure gradient = 235 psi

(3)

hydrostatic pressure	1921 psi
formation pressure	+ 235 psi
downhole pressure	2156 psi
	- 500 psi drawdown

(4) corrected regulator valve setting 1656 psi

(5) actual regulator valve setting 1719 psi
correct regulator valve setting 1656 psi

(6) actual drawdown on formation -63 + 500 = 437 psi

FIGURE 5

FORMATION TESTER / SAFETY TOOL

TEST NO. 38-4 - CIRCULATING TEST DATA

SITE NO. 345

I. SAFETY GO-DEVIL AND CIRCULATING GO-DEVIL IN PIPE BUT NOT SEATED:

SLUSH PUMP: 25 STROKES PER MINUTE @ 125 PSI

BIT ORIFICE: 2.5 INCH DIAMETER

A_1 = 4.9 SQUARE INCHES

$$\frac{25 \text{ SPM}}{5.25 \text{ SPB}} = 4.76 \text{ BARRELS PER MINUTE}$$

4.76 BPM x 42 GALLONS PER BARREL = 200 GPM

TOTAL VOLUME DISPLACED = 200 GPM x 17 MINUTES = 4000 GALLONS

II. SAFETY GO-DEVIL SEATED AND CIRCULATING GO-DEVIL UNSEATED:

SLUSH PUMP: 20 STROKES PER MINUTE @ 350 PSI

ORIFICE IN STINGER SUB: 0.750 INCH DIAMETER

A_2 = .44 SQUARE INCHES

$$\frac{20 \text{ SPM}}{5.25 \text{ SPB}} = 3.81 \text{ BARRELS PER MINUTE}$$

3.81 BPM x 42 GALLONS PER BARREL = 160 GPM

TOTAL VOLUME DISPLACED = 160 GPM x 9 MINUTES = 1440 GALLONS

FIGURE 6

Figure 6 (Continued)

FORMATION TESTER / SAFETY TOOL

TEST NO. 38-4 - CIRCULATING TEST DATA
SITE NO. 345 (CONTINUED)

III. CIRCULATING GO-DEVIL SEATED ON SAFETY GO-DEVIL:

SLUSH PUMP: 26 STROKES PER MINUTE @ 175 PSI

TWO CIRCULATING PORTS: 0.750 INCH DIAMETER

$A_3 = 0.44 \times 2 = 0.88$ SQUARE INCHES

$\frac{26 \text{ SPM}}{5.25 \text{ SPB}} = 4.95$ BARRELS PER MINUTE

4.95 BPM x 42 GALLONS PER BARREL = 208 GPM

VOLUME (V_1) = 208 GPM x 3 MINUTES = 624 GALLONS

AND $\frac{35 \text{ SPM}}{5.25 \text{ SPB}} = 6.67$ BARRELS PER MINUTE

6.67 BPM x 42 GALLONS PER BARREL = 280 GPM

VOLUME (V_2) = 280 GPM x 2 MINUTES = 560 GALLONS

TOTAL VOLUME DISPLACED (IN 5 MINUTES) = 624 + 560 = 1184 GALLONS

THE SPECIFICATIONS FOR THE CIRCULATING ASSEMBLY REQUIRE:

120 GALLONS PER MINUTE @ 50 PSI

FORMATION TESTER

SITE NO. 348
WATER DEPTH 1777 METERS
PENETRATION 544 METERS
TEST NO. 38-5
PACKER NO. 3
SITE ROTATING HOURS 14.3
TOTAL ROTATING HOURS 14.3

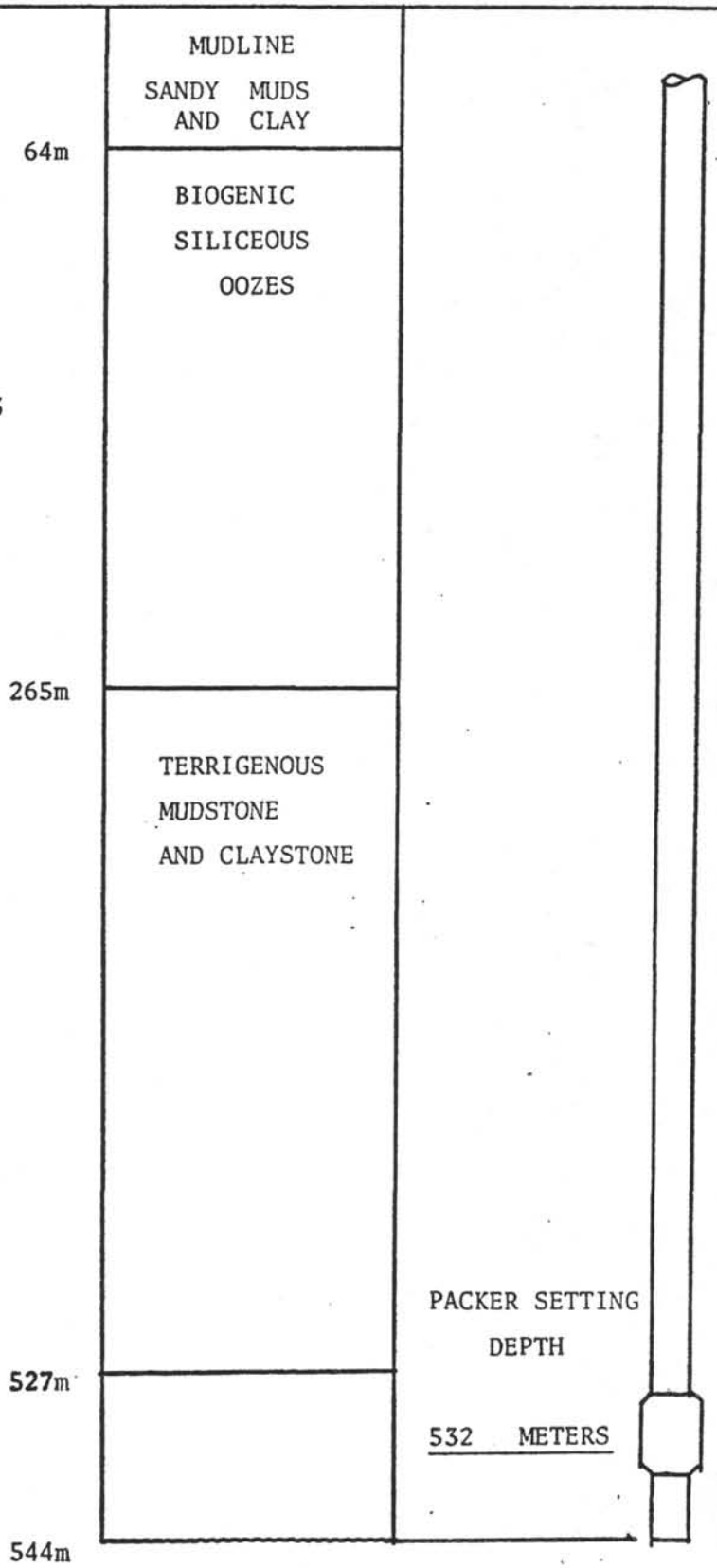


FIGURE 7

FORMATION TESTER / SAFETY TOOL

THEORETICAL BOTTOMHOLE PRESSURE FOR SITE NO. 348

WATER DEPTH	1777.0 METERS
PENETRATION DEPTH	544 METERS
SALT WATER GRADIENT	.445 PSI PER FOOT
FORMATION PRESSURE GRADIENT	.454 PSI PER FOOT
PACKER SETTING DEPTH	532 METERS

I. USING SALT WATER GRADIENT ONLY:

1777.0 METERS + 532 METERS = 2309.0 METERS

2309.0 METERS x 3.28 = 7573.5 FEET

7573.5 FEET x .445 PSI PER FOOT = 3370 PSI

ACTUAL SETTING ON REGULATOR 3000 PSI

DRAWDOWN 370 PSI

II. USING SALT WATER AND FORMATION PRESSURE GRADIENT:

1777.0 METERS x 3.28 FEET PER METER = 5828.6 FEET

5828.6 FEET x .445 PSI PER FOOT = 2593.7 PSI

532.0 METERS x 3.28 FEET PER METERS = 1745.0 FEET

1745.0 FEET x .454 PSI PER FOOT = 792.2 PSI

TOTAL PRESSURE = 2594 + 792 = 3386 PSI

ACTUAL SETTING ON REGULATOR 3000 PSI

DRAWDOWN 386 PSI

FIGURE 8

FORMATION TESTER / SAFETY TOOL

SAMPLER PRESSURE RECORDING

LEG 38 ----- SITE NO. 348 DATE: SEPT. 12, 1974

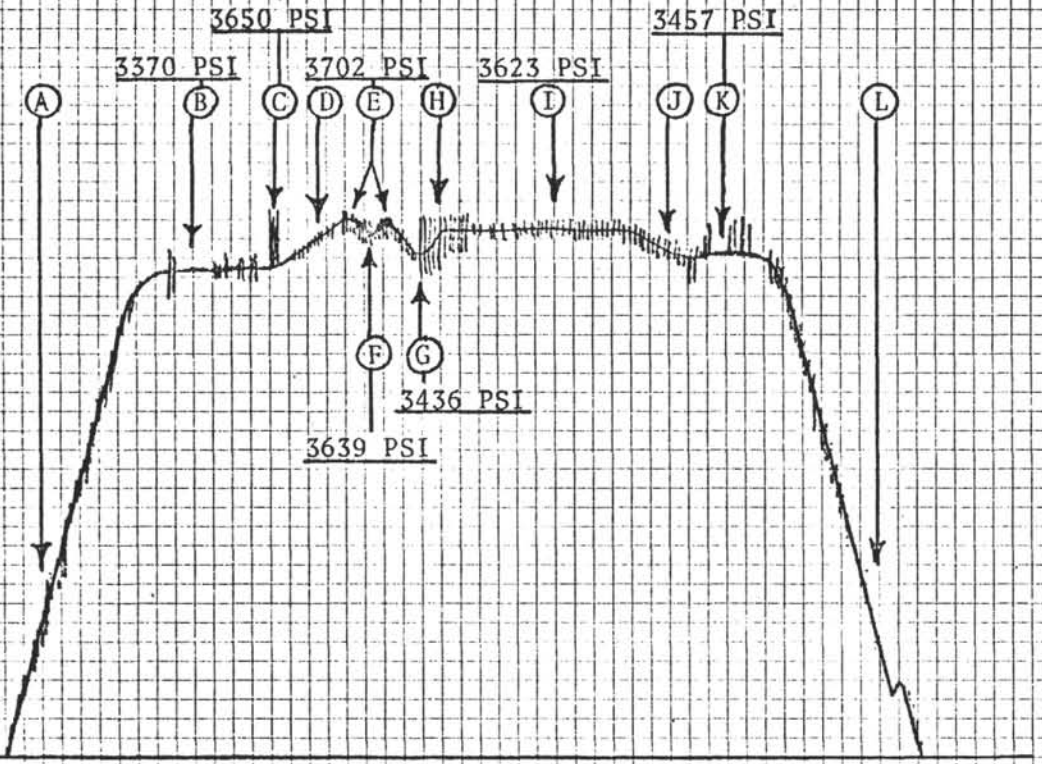
SAMPLER RUN ON WIRELINE WATER DEPTH: 1777 METERS

K-3 CLOCK NO. 13105 PENETRATION: 544.5 METERS

3 HOUR GEAR BOX PACKER SETTING DEPTH: 532 METERS

PRESSURE ELEMENT 2.5 GALLON SAMPLE BARREL

N9542 P9950 PRESSURE REGULATOR SET FOR 3000 PSI



START CLOCK 1128 HOURS ON DECK 1325 HOURS

(A) RUNNING IN WIRELINE WITH SAMPLER

(B) THEORETICAL HYDROSTATIC PRESSURE

(C) CIRCULATING TO CLEAR FILL FROM THE BOTTOM OF THE HOLE

(D) SUPERCHARGING FLUID AS PACKER EXPANDED AND MOVED DOWNWARD

(E) SAMPLER OPENS / FILLED /

(F) SAMPLER FILLING / REGULATOR WORKING

(G) PRESSURE FULLY RELEASED

(H) DRILL STRING IN TENSION BS OPEN

(I) CIRCULATING PRESSURE

(J) STOP CIRCULATION

(K) HYDROSTATIC (SLIGHTLY HIGHER PRESSURE PROBABLY DUE TO SUSPENDED MATERIAL IN THE ANNULUS FLUID

(L) RETRIEVING SAMPLER ON WIRELINE

SCALE:

1 MINUTE = .061 INCHES

1000 PSI = .800 INCHES

9/15/74

FIGURE 9

FORMATION TESTER / SAFETY TOOL

OPERATIONAL TIME USED TO TEST THE LYNES RETRIEVABLE FORMATION TESTER (RFT) ON LEG 38. THE TIME CONSUMED INCLUDES 15 MINUTES EACH SITE FOR MAKING-UP PACKER IN BOTTOM HOLE ASSEMBLY AND 15 MINUTES EACH SITE FOR BREAKING CONNECTIONS AFTER PULLING OUT OF THE HOLE.

SITE NO. 338	0.5 Hrs.
SITE NO. 341	0.5 Hrs.
SITE NO. 342	5.5 Hrs.
SITE NO. 345	3.5 Hrs.
SITE NO. 348	2.5 Hrs.
TOTAL OPERATING TIME EXPENDED	12.5 Hrs.

TABLE I

ESTIMATED OPERATING TIME FOR THE FORMATION TESTER/SAFETY TOOL

WATER DEPTH 3,000 METERS

FORMATION TESTER	TIME	ELAPSED TIME PER OPERATION	TOTAL TIME
1. Suspicion of hydrocarbons or over pressured formation	--	--	--
2. Drop sampling go-devil w/pressure recorder* then pressure up to 1,200 psi to set packer	15 min.	15 min.	
3. Sample formation fluid	15 min.	30 min.	
4. Relieve pressure and retrieve sampler	45 min.	1 hr., 15 min.	
5. Open sampler - evaluate sample and pressure record	15 min.	1 hr., 30 min.	1 hr., 30 min.
SAFETY TOOL			
6. Drop setting go-devil* - then pressure up to 1,200 psi to set packer	15 min.	15 min.	1 hr., 45 min.
7. Verify pack-off with 400-800 psi - allow 100-200 psi bleed off in 15 minutes	15 min.	30 min.	2 hrs.
8. Drop circulating go-devil*	15 min.	45 min.	2 hrs., 15 min.
9. Circulate heavy mud (45 min.) and/or cement (1 hr.)	10 min.	55 min.	2 hrs., 25 min.
10. Retrieve circulating go-devil	45 min.	1 hrs., 40 min.	3 hrs. 10 min.
11. Drop unsetting ball - pressure drill pipe to verify circulation ports are closed	15 min.	1 hrs., 55 min.	3 hrs. 25 min.
12. Retrieve setting go-devil	45 min.	2 hrs., 40 min.	4 hrs. 10 min.
13. Shoot off pipe	5 hr.	7 hrs., 40 min.	9 hrs.10 min
14. Circulate additional cement	1 hr.	8 hrs., 40 min.	10 hrs.10 min.

* Pressure go-devil down pipe to increase terminal velocity

TABLE 2

REVISED: 7/14

ESTIMATED OPERATING TIME FOR THE FORMATION TESTER/SAFETY TOOL

WATER DEPTH 6,000 METERS

FORMATION TESTER	TIME	ELAPSED TIME PER OPERATION	TOTAL TIME
1. Suspicion of hydrocarbons or over pressured formation	--	--	--
2. Drop sampling go-devil w/pressure recorder* - then pressure up to 1,200 psi to set packer	30 min.	30 min.	
3. Sample formation fluid	15 min.	45 min.	
4. Relieve pressure and retrieve sampler	1 hr., 45 min.	2 hrs., 30 min.	
5. Open sampler - evaluate sample and pressure record	15 min.	2 hrs., 45 min.	2 hrs., 45 min.
SAFETY TOOL			
6. Drop setting go-devil* - then pressure up to 1,200 psi to set packer	30 min.	30 min.	3 hrs., 15 min.
7. Verify pack-off with 400-800 psi - allow 100-200 psi bleed off in 15 minutes	15 min.	45 min.	3 hrs., 30 min.
8. Drop circulating go-devil*	30 min.	1 hr., 15 min.	4 hrs.
9. Circulate heavy mud (1 hr.) and/ or cement (1 hr., 15 min).	5 min.	1 hrs., 20 min.	4 hrs., 5 min.
10. Retrieve circulating go-devil	1 hr., 45 min.	3 hrs., 5 min.	5 hrs. 50 min
11. Drop unsetting ball - pressure drill pipe to verify circulation ports are closed	30 min.	3 hrs., 35 min.	6 hrs., 20 min.
12. Retrieve setting go-devil	1 hr., 45 min.	5 hrs., 20 min.	8 hrs., 5 min.
13. Shoot off pipe	5 hrs.	10 hrs., 20 min.	13 hrs., 5 min.
14. Circulate additional cement	1 hr., 15 min.	11 hrs., 35 min.	14 hrs., 20 min.

* Pressure go-devil down pipe to increase terminal velocity

TABLE 3

FORMATION TESTER / SAFETY TOOL

CALCULATIONS FOR ENDURANCE TEST DATA

A. CUMULATIVE ROTATING HOURS

ROTATING HOURS FOR EACH SITE WERE TOTALED DIRECTLY FROM THE DRILLING AND CORING RECORD SHEETS MAINTAINED BY THE RIG FLOOR.

B. CUMULATIVE REVOLUTIONS @ 40 rpm

THE NUMBER OF REVOLUTIONS FOR EACH SITE WERE DERIVED BY MULTIPLYING THE TOTAL NUMBER OF MINUTES ROTATING TIMES 40 REVOLUTIONS PER MINUTE.

C. CUMULATIVE RECIPROCAL MOTION

ASSUMPTION: PULL UP ONE SINGLE LENGTH OF DRILL PIPE FOR EACH CORE TAKEN.

LENGTH OF ONE SINGLE = 9.5 METERS

RUN ONE SINGLE LENGTH OF DRILL PIPE BACK TO BOTTOM AFTER DROPPING CORE BARREL.

CALCULATIONS:

SITE NO. 338

45 core x 9.5 meters = 427.5 meters
x 2 (both directions) = 855 meters
x 3.28 ft. per meter = 2804 feet

SITE NO. 341

34 core x 9.5 meters = 323 meters
x 2 (both directions) = 646 meters
x 3.28 ft. per meter = 2119 feet

SITE NO. 342

8 core x 9.5 meters = 76 meters
x 2 (both directions) = 152 meters
x 3.28 ft. per meter = 499 feet

TABLE 4

FORMATION TESTER / SAFETY TOOL

CALCULATIONS FOR ENDURANCE TEST DATA
(CONTINUED)

SITE NO. 345

36 core x 9.5 meters = 342 meters
x 2 (both directions) = 684 meters
x 3.28 ft. per meter = 2244 feet

SITE NO. 348

34 core x 9.5 meters = 323 meters
x 2 (both directions) = 646 meters
x 3.28 ft. per meter = 2119 feet

D. CUMULATIVE BARRELS CIRCULATED

ASSUMPTION: TOTAL PUMP STROKES TAKEN FROM THE DRILLING AND CORING RECORD (SPM x TIME INTERVAL IN MINUTES) DIVIDED BY 5.25 STROKES PER BARREL.

CALCULATIONS: SITE NO. 338

TOTAL PUMP STROKES = 18,923
÷ 5.25 SPB = 3604 BARRELS

SITE NO. 341

TOTAL PUMP STROKES = 12,154
÷ 5.25 SPB = 2315 BARRELS

SITE NO. 342

TOTAL PUMP STROKES = 15,050
÷ 5.25 SPB = 2867 BARRELS

TABLE 4 (Continued)

CALCULATIONS FOR ENDURANCE TEST DATA
(CONTINUED)

SITE NO. 345

TOTAL PUMP STROKES = 59,569
÷ 5.25 SPB = 11,346 BARRELS

SITE NO. 348

TOTAL PUMP STROKES = 14,117
÷ 5.25 SPB = 2,689 BARRELS

E. MAXIMUM ANNULAR VELOCITY

THE MAXIMUM ANNULAR VELOCITY FOR EACH SITE WAS CALCULATED WITH THE USE OF A "REED" HYDRAULIC SLIDERULE. PERTINENT INFORMATION NECCESSARY TO USE THIS METHOD IS AS FOLLOWS: SLUSH PUMP STROKE = 16 INCHES, LINER I.D. = 6.5 INCHES, HOLE I.D. = 10.50 INCHES, PACKER ELEMENT O.D. = 8.375 INCHES, HOLE I.D. MINUS PACKER O.D. = 2.125 INCHES, HOLE I.D. PLUS PACKER O.D. = 18.875 INCHES.

CALCULATIONS: SITE NO. 338

MAXIMUM STROKES PER MINUTE = 35
PUMP OUTPUT = 263 GALLONS PER MINUTE
ANNULAR VELOCITY BY SLIDERULE = 162 FEET PER MINUTE

CHECK ON SLIDERULE CALCULATIONS FOR SITE NO. 338

(1) HOLE AREA = $3.14r^2$ = 3.14 $(5.250)^2$ = 86.6 in^2
(2) PACKER AREA = $3.14r^2$ = 3.14 $(4.0625)^2$ = 55.1 in^2

TABLE 4 (Continued)

FORMATION TESTER / SAFETY TOOL

CALCULATIONS FOR ENDURANCE TEST DATA
(CONTINUED)

(3) ANNULUS AREA = 86.6 in^2 - 55.1 in^2 = 31.5 in^2

(4) 1 LINEAR FOOT OF ANNULUS = 12 in. x 31.5 in^2
= 378.0 in^3 = .22 ft^3

(5) A 35 STROKES PER MINUTE PUMPING RATE YIELDS 263 GALLONS PER MINUTE FLOW RATE WHICH @ 7.5 GALLONS PER CUBIC FOOT YIELDS 35.1 CUBIC FEET PER MINUTE

(6) 35.1 ft^3 per min. / .22 = 159 FEET PER MINUTE

SLIDERULE CHECKS OK.

SITE NO. 341

MAXIMUM STROKES PER MINUTE = 35
PUMP OUTPUT = 263 GALLONS PER MINUTE
ANNULAR VELOCITY BY SLIDERULE = 162 FEET PER MINUTE

SITE NO. 342

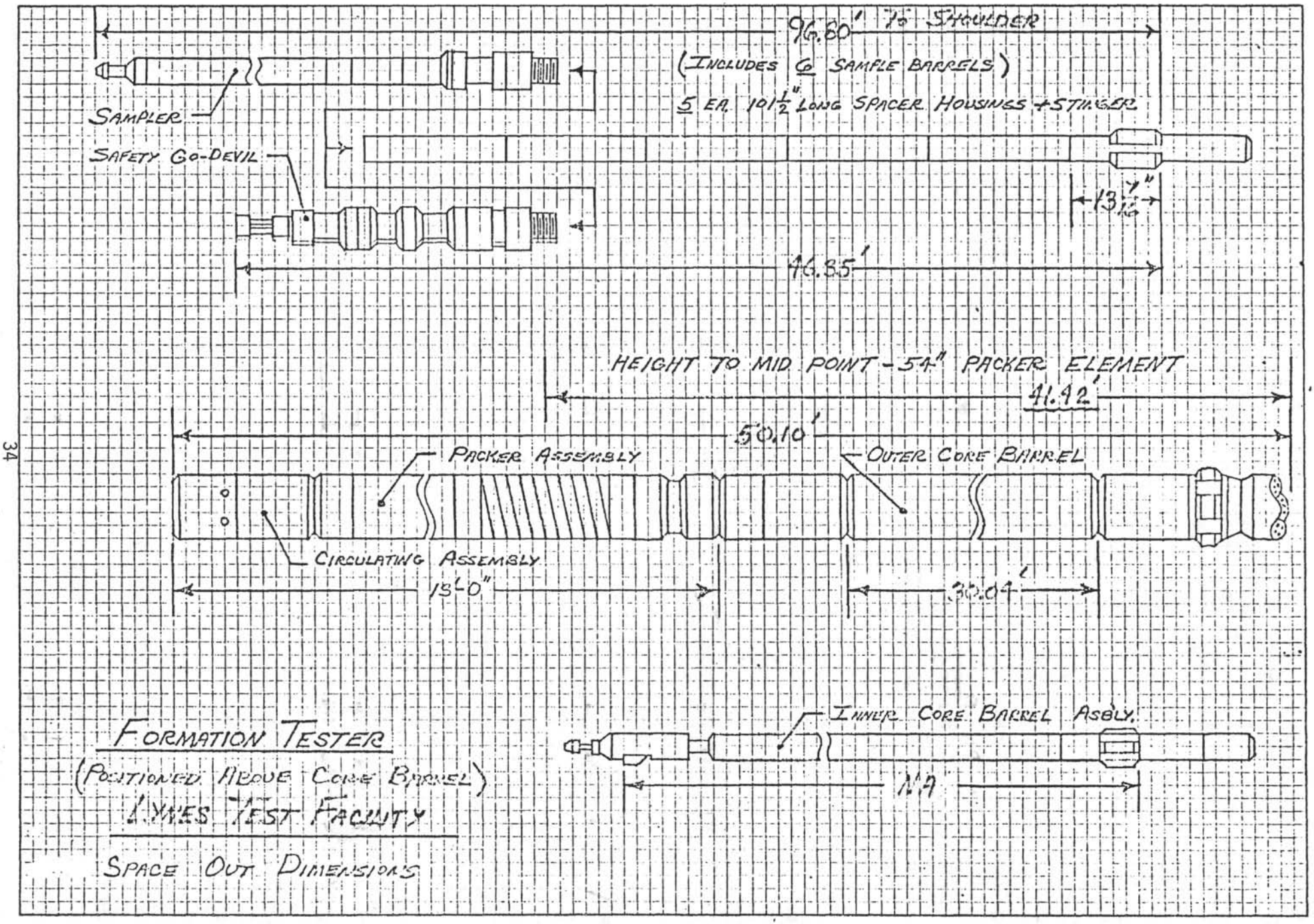
MAXIMUM STROKES PER MINUTE = 55
PUMP OUTPUT = 412 GALLONS PER MINUTE
ANNULAR VELOCITY BY SLIDERULE = 255 FEET PER MINUTE

SITE NO. 345

MAXIMUM STROKES PER MINUTE = 65
PUMP OUTPUT = 488 GALLONS PER MINUTE
ANNULAR VELOCITY BY SLIDERULE = 300 FEET PER MINUTE

SITE NO. 348

MAXIMUM STROKES PER MINUTE = 30
PUMP OUTPUT = 225 GALLONS PER MINUTE
ANNULAR VELOCITY BY SLIDERULE = 138 FEET PER MINUTE



Formation Tester

(Positioned Above Core Barrel)

Lynes Test Facility

Space Out Dimensions

FIGURE 10

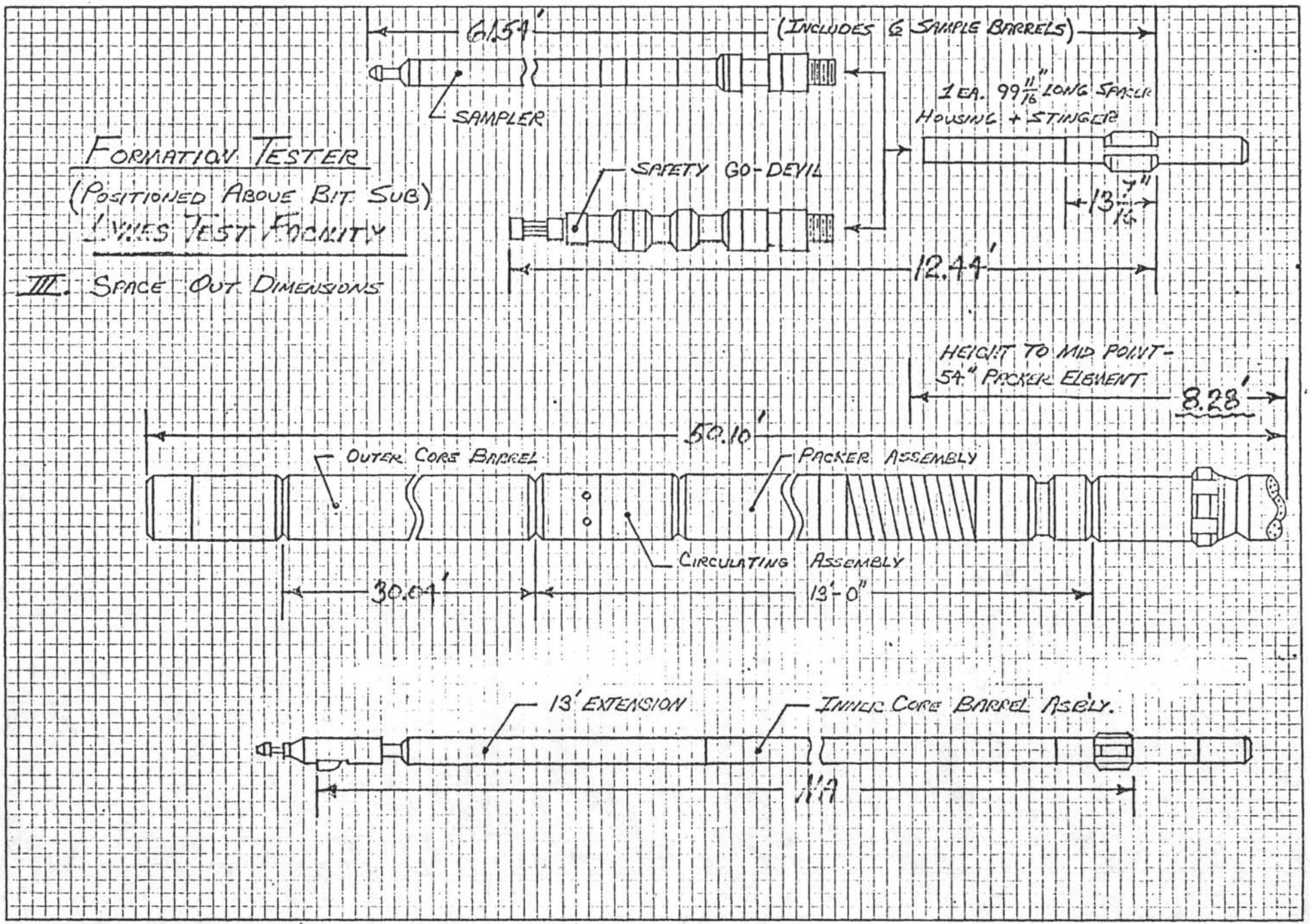
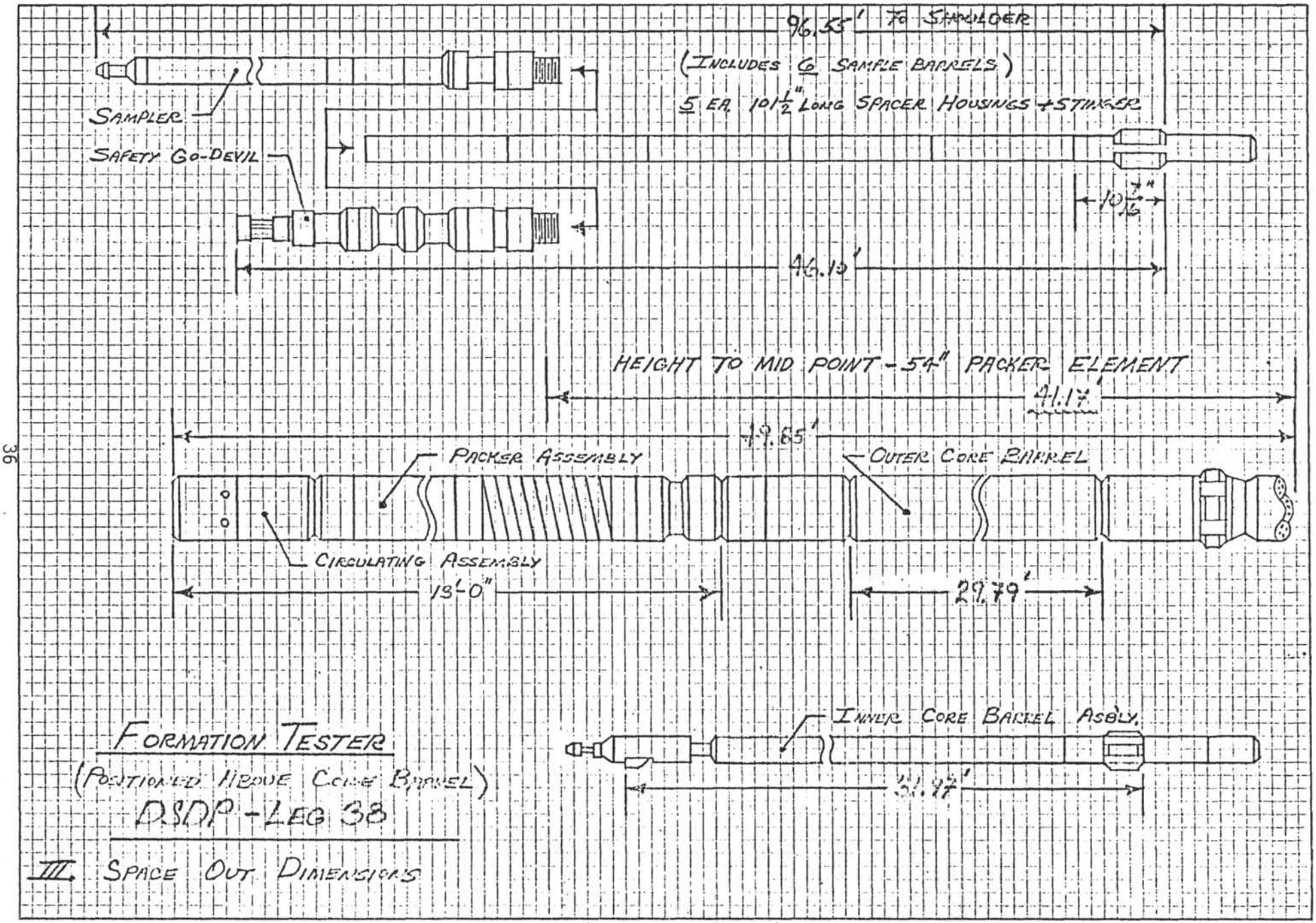


FIGURE 10 (Continued)



Formation Tester

(Positioned Above Core Barrel)

DSDP - Leg 38

III. Space Out Dimensions

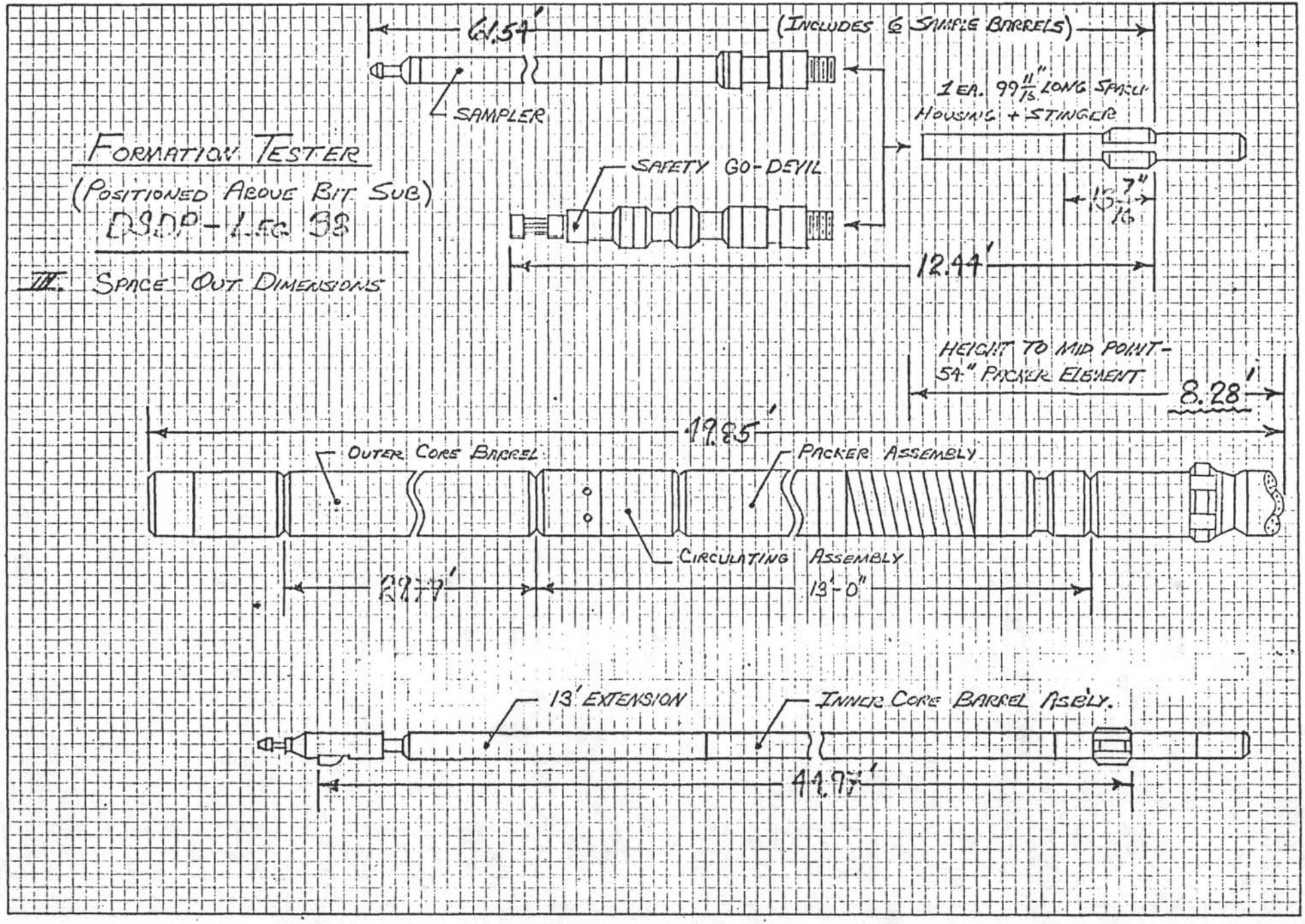


FIGURE 11 (Continued)

IV Connection Procedure For Lynes RFT

A. Making Up Connections On Rig Floor (See Schematic)

1. Set slips on core barrel just below head sub. Make up tongs on mandrel crossover sub (28). Back up tongs on core barrel head sub. Make up torque joint "A" 32,000 ft-lbs.

2. Remove slips. Make up tongs on bottom sub for packer (25). Back up tongs on mandrel crossover sub (28). Make up torque joint "C" 3,000 ft-lbs.

3. Make up tongs on top sub for packer (23). Back up tongs on mandrel crossover sub (28). Make up torque joint "B" 22,000 ft-lbs.

4. Make up tongs on lower packer element. Back up tongs on bottom sub for packer (25). Make up torque joint "D" 3,000 ft-lbs.

5. Make up tongs on top sub for packer (23) back up tongs on upper packer element. Make up torque joint "E" 3,000 ft-lbs.

6. Make up tongs on stabilizer housing (21) back up tongs on top sub for packer (23). Make up torque joint "F" 22,000 ft-lbs.

7. Make up tongs on top sub (20). Back up tongs on stabilizer housing (21). Make up torque joint "G" 22,000 ft-lbs.

8. Make up tongs on circulating sub housing (4). Back up tongs on top sub (20). Make up torque joint "H" 22,000 ft-lbs.

9. Make up tongs on circulating sub port body (3). Back up tongs on circulating sub housing (4). Make up torque joint "I" 22,000 ft-lbs.

10. Make up tongs on drill collar. Back up tongs on circulating sub port body (3). Make up torque joint "J" 32,000 ft-lbs.

B. Breaking Connections On Rig Floor (See Schematic)

1. Set slips just above packer element. Break out tongs on collar. Back up tongs on circulating sub port body (3). Break out torque joint "J" 32,000 ft-lbs. Stand back collars and make up lifting joint onto circulating sub port body.

2. Break out tongs on circulating sub port body (3). Back up tongs on circulating sub housing (4). Break out torque joint "I" 22,000 ft-lbs.

3. Break out tongs on circulating sub housing (4). Back up tongs on top sub (20) break out torque joint "H" 22,000 ft-lbs.

4. Break out tongs on top sub (20). Back up tongs on stabilizer housng (21). Back out torque joint "G" 22,000 ft-lbs.

5. Break out tongs on stabilizer housing (21). Back up tongs on top sub for packer (23). Break out torque joint "F" 22,000 ft-lbs.

6. Remove slips. Pick up on assembly and reset slips just below core barrel head sub. Break out tongs on top sub for packer (23). Back up tongs on upper packer element. Break out torque joint "E" 3,000 ft-lbs.

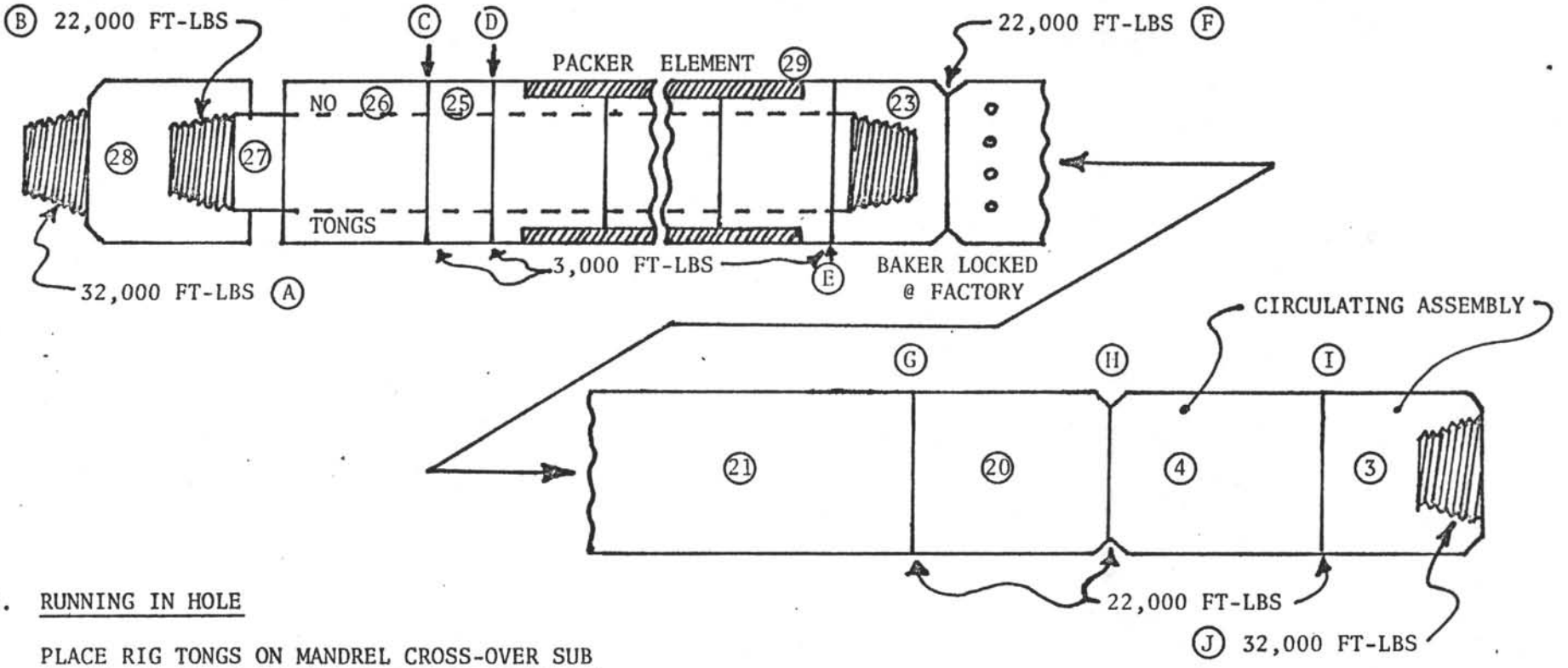
7. Break out tongs on lower packer element. Back up tongs on bottom sub for packer (25). Break out torque joint "D" 3,000 ft-lbs.

8. Break out tongs on bottom sub for packer (25). Back up tongs on mandrel crossover sub (28), break out torque joint "C" 3,000 ft-lbs.

   NOTE: It is important that the 3,000 ft-lb joint "C" be broken before breaking the 22,000 ft-lb joint "B". If joint "B" should accidently be broken first, then joint "C" may be broken very carefully by placing break out tongs on bottom sub for packer (25) and putting back up tongs on lower most edge (1 to 2 inches max) of deflation spring cap (26). Extreme caution must be used or thin walled sub will be crushed. This procedure should be avoided at all costs unless absolutely necessary.

9. Break out tongs on top sub for packer (23). Back up tongs on mandrel crossover sub (28). Break out torque joint "B" 22,000 ft-lbs.

10. Break out tongs on mandrel crossover sub (28). Back up tongs on core barrel head sub. Break out torque joint "A" 32,000 ft-lbs.



I. RUNNING IN HOLE

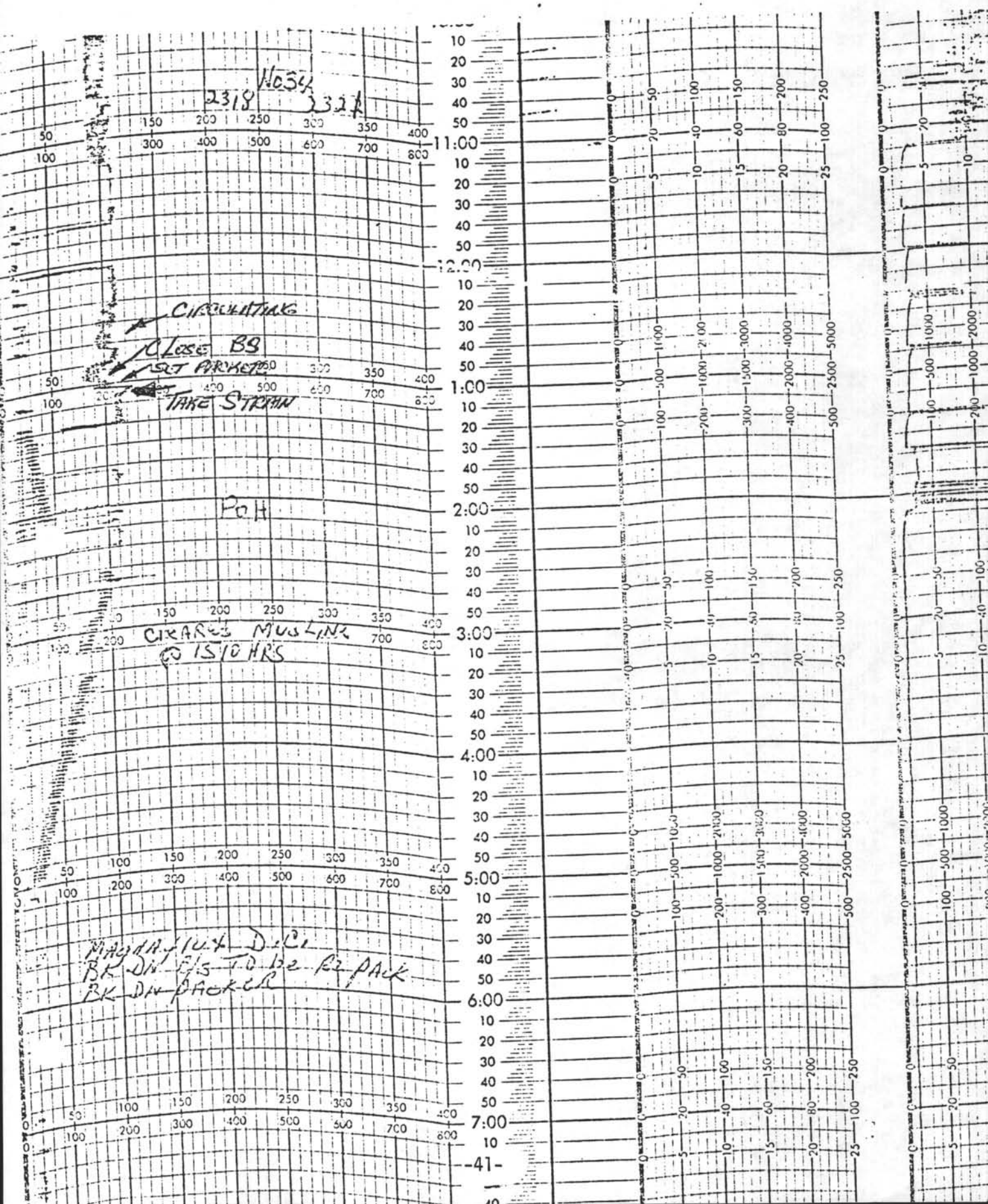
PLACE RIG TONGS ON MANDREL CROSS-OVER SUB (ITEM 28) AND TOP SUB FOR PACKER (ITEM 23) TO MAKE-UP CROSS-OVER SUB TO THE PACKER MANDREL (ITEM 27).

II. COMMING OUT OF HOLE

BE SURE TO BREAK DEFLATION SPRING CAP (ITEM 26) FROM BOTTOM SUB FOR PACKER (ITEM 25) PRIOR TO BREAKING MANDREL CROSS-OVER SUB (ITEM 28) FROM PACKER MANDREL (ITEM 27). THAT IS BREAK THE 3,000 LB JOINT FIRST THEN THE 22,000 LB JOINT.

IV. TORQUE VALUES AND SCHEMATIC FOR LYNES FORMATION TESTER

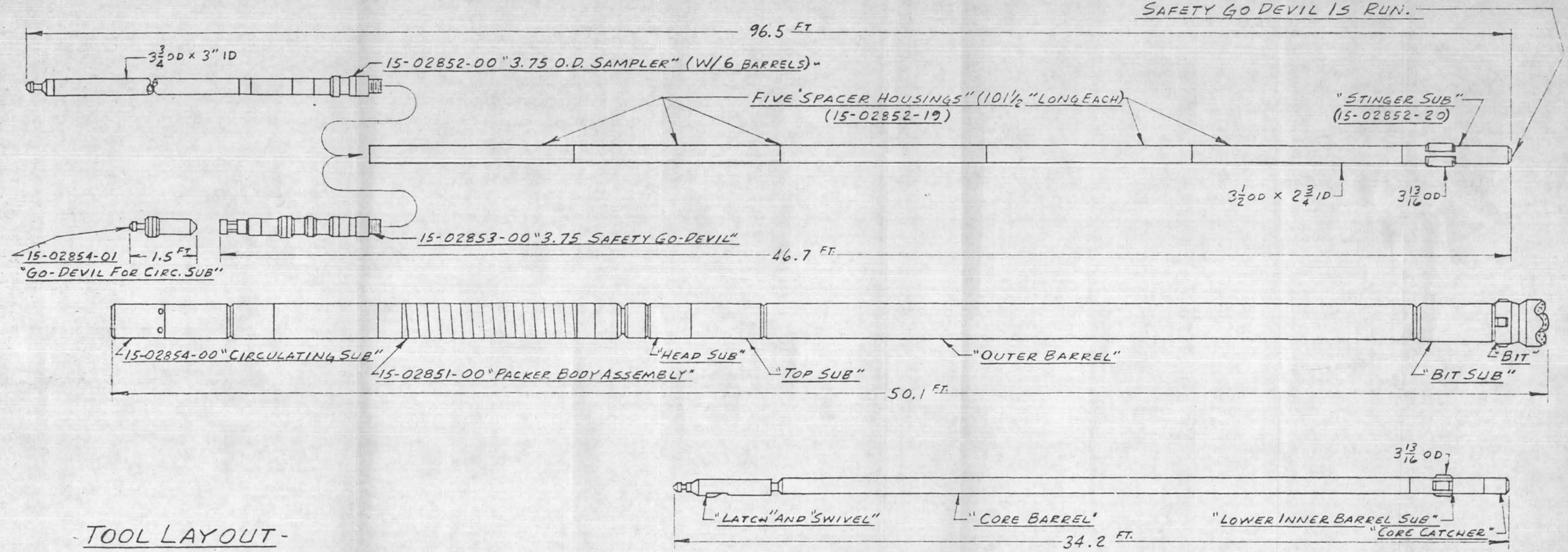
FIGURE 13


2318
WOSH
3314
CIRCULATING
CLOSE BS
SET PARKER
TAKE STRAIN
POH
CLEARED MUDLINE
@ 1510 HRS
MAGNAFLUX DC's
BK DN BS TO BE RE-PACK
BK DN PACKER
11:00
12:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00

FORMATION TESTER
FOR THE DEEP SEA DRILLING PROJECT
OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY

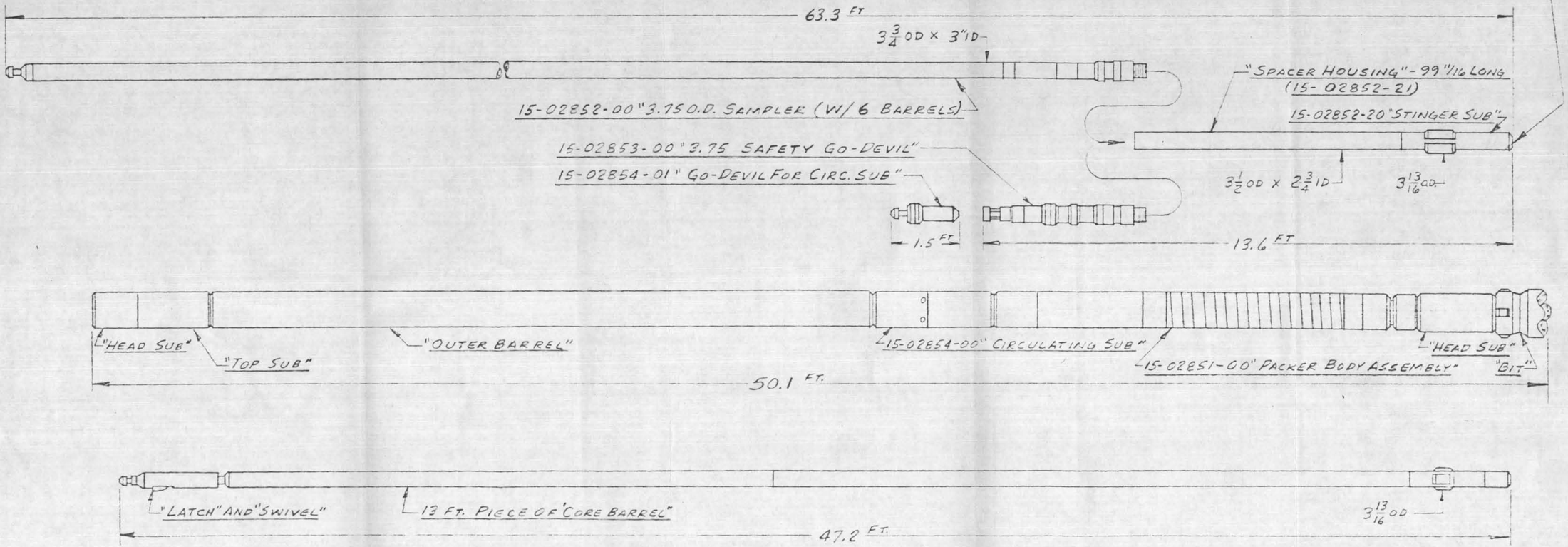
LYNES, INC.
P.O. BOX 12486
HOUSTON, TEXAS
PROJECT 285

NOTE: "STINGER SUB" HAS 3/4 NPT HOLE IN BOTTOM. PLUG WITH PIPE PLUG WHEN SAMPLER IS RUN. REMOVE PLUG WHEN SAFETY GO DEVIL IS RUN.



TOOL LAYOUT -
"PACKER BODY ABOVE CORE BARREL TOOL"

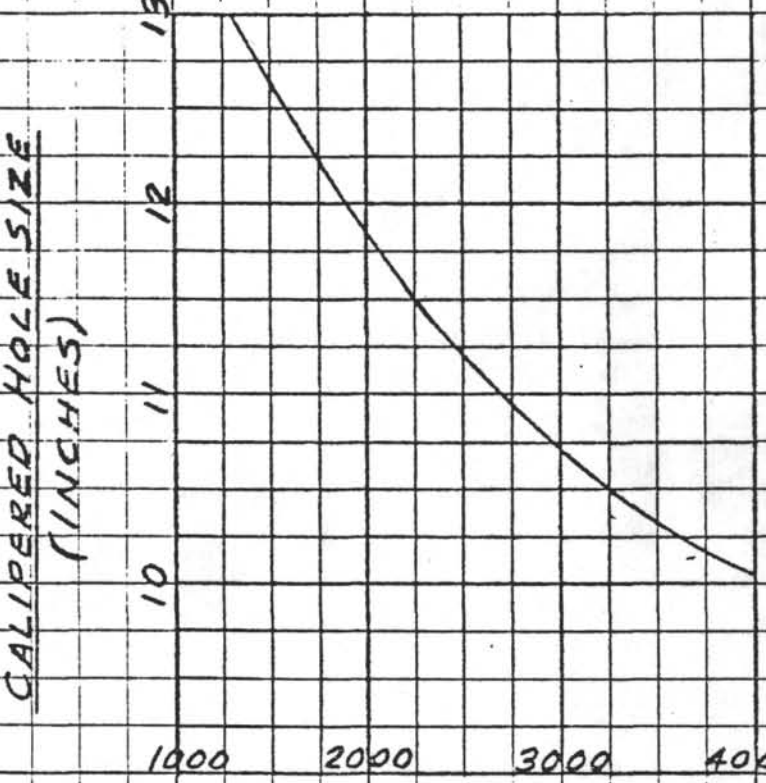
NOTE: "STINGER SUB HAS 3/4 NPT HOLE IN BOTTOM.
PLUG WITH PIPE PLUG WHEN SAMPLER IS RUN.
REMOVE PLUG WHEN SAFETY GO-DEVIL IS RUN.



TOOL LAYOUT -
"PACKER BODY BELOW CORE BARREL TOOL"

DIFFERENTIAL PRESSURE VS. HOLE SIZE

15-02851-18 "8.50 O.D. x 54 LONG PACKER ELEMENT"



MAXIMUM DIFFERENTIAL PRESSURE ACROSS PACKER

HOUSTON TEXAS

LYNES

4

INDEX

15-02851-00 "PACKER BODY ASSEMBLY"

I. DESIGN AND OPERATION OF PACKER BODY ASSEMBLY

1. DESIGN & DIMENSIONAL DATA:

A) PACKER BODY ASSEMBLY HAS API ROTARY SHOULDERED NC-61 BOX ON THE TOP END. AND PIN ON THE BOTTOM END. THE PACKER BODY ASSEMBLY MAY BE RUN ABOVE THE "WIRE LINE CORE BARREL ASSEMBLY" (THREADED INTO "HEAD SUB") OR BETWEEN "OUTER BARREL" AND "BIT SUB". IF IT IS RUN BETWEEN THE "OUTER BARREL" AND "BIT SUB", THE "CORE BARREL" MUST BE LENGTHENED BY 13 FEET IN ORDER TO SEAT THE STINGER AND LOCATE THE "LATCH ASSEMBLY" PROPERLY.

B) THE PACKER BODY ASSEMBLY IS 8-1/2 INCHES O.D. ON THE LOWER END. ABOVE THE PACKER ELEMENT TOP SUB THE O.D. IS REDUCED TO 8-3/8 INCHES. THE SUB AT THE TOP OF THE ASSEMBLY IS 8-1/4 INCHES.

C) SHOULDER TO SHOULDER LENGTH OF THE PACKER BODY ASSEMBLY IS 127-3/16 INCHES (+ OR - 1/2 INCH). OVER ALL LENGTH WILL BE 132 INCHES. SHIPPING LENGTH WILL BE 142 INCHES. (NOTE: PACKER BODY ASSEMBLY MAY BE SHIPPED AS TWO UNITS, ONE APPROXIMATELY 8 FT. LONG, AND THE OTHER 4 FT. LONG).

D) WEIGHT OF THE PACKER BODY ASSEMBLY IS 1325 LBS. (CALC. WT.)

E) THE PACKER BODY HAS A BORE OF 3.875 INCHES MINIMUM FOR SEALING ON THE SAMPLER OR SAFETY GO-DEVIL ASSEMBLY.

F) THE TOP PORTION OF THE PACKER BODY ASSEMBLY HOUSES THE "CONTROL VALVE", WHICH IS ACTUATED BY DRILL PIPE PRESSURE AGAINST A SPRING LOAD.

G) THE LOWER PORTION OF THE PACKER BODY ASSEMBLY CONTAINS THE INFLATABLE PACKER ELEMENT. THE PACKER ELEMENT IS HELD IN LIGHT TENSION TO PREVENT WHIPPING AS DRILL STRING IS ROTATED. THE PACKER ELEMENT IS KEYED TO THE MANDREL (DRILL STRING) TO PREVENT ITS LOOSENING DUE TO CONTACT WITH HOLEWALL.

H) MINIMUM STRENGTH IN "PACKER BODY ASSEMBLY" IS AS FOLLOWS:

TENSILE STRENGTH----------1,614,000 LBS.
COMPRESSION STRENGTH----------1,825,000 LBS.
TORSIONAL STRENGTH----------370,000 FT. LBS.

2. OPERATION OF THE PACKER BODY ASSEMBLY

A) THE PACKER BODY ASSEMBLY HAS "CONTROL VALVE" WHICH IS POSITIONED BY A HEAVY SPRING. THE CONTROL VALVE HAS PASSAGES WHICH ARE COVERED (OR UNCOVERED) BY O-RINGS MOVING PAST THEM. THE CONTROL VALVE IS MOVED BY DRILL PIPE PRESSURE.

B) THE PACKER BODY ASSEMBLY CANNOT BE OPERATED ALONE-IT REQUIRES EITHER "3.75 O.D. SAMPLER ASSEMBLY" OR "3.75 SAFETY GO-DEVIL ASSEMBLY" TO BE USED AS A SEALING MEANS TO DIRECT THE DRILL PIPE PRESSURE INTO THE ACTUATING PASSAGE.

C) WHEN THE SAMPLER OR GO-DEVIL HAS SEATED, SLIGHT DRILL PIPE PRESSURE MOVES THE INNER SEATING SLEEVE DOWN AND OPENS DRILL PIPE TO CONTROL VALVE.

D) AS THE CONTROL VALVE MOVES IT OPENS DRILL PIPE TO INFLATE THE PACKER ELEMENT STARTING AT ABOUT 700 PSI.

E) WHEN THE PACKER REACHES SETTING PRESSURE, THE CONTROL VALVE MOVES FURTHER OPENING THE SAMPLER VALVE PASSAGE AT ABOUT 1100 PSI (SEE "SAMPLER" OPERATION).

F) IF THE SAFETY GO-DEVIL IS USED, SAMPLER PASSAGE IS BLOCKED. INCREASE IN DRILL PIPE PRESSURE CAUSES SHEAR PLUG TO SHEAR (SEE "SAFETY GO-DEVIL" OPERATION).

G) REDUCING DRILL PIPE PRESSURE FIRST CLOSES SAMPLER VALVE, THEN OPENS TO EQUALIZE FORMATION TO ANNULUS, THEN OPENS INFLATE PASSAGE TO ANNULUS, THEN DRILL PIPE TO CONTROL VALVE. PACKER ELEMENT IS OPEN TO BYPASS AND DEFLATES TO ANNULUS.

H) THE "PACKER BODY ASSEMBLY" IS EQUIPPED WITH AN "OVER PRESSURE SAFETY VALVE" THAT WILL SHEAR OPEN AND DEFLATE THE PACKER SHOULD THE INFLATION PRESSURE EXCEED THE HYDROSTATIC PRESSURE IMMEDIATELY ABOVE THE PACKER BY 3000 PSI (± 15%).

SHOULD THE PACKER NOT DEFLATE BY THE NORMAL DEFLATING PROCEDURE, THE OPERATOR CAN DEFLATE THE PACKER BY PRESSURING THE DRILL PIPE TO 3000 PSI (± 15%) WITH EITHER THE SAMPLER ASSEMBLY OR THE SAFETY GO-DEVIL INSTALLED.

NO CIRCULATION CAN OCCUR THROUGH THE SHEARED OVER PRESSURED SAFETY VALVE WITHOUT THE SAMPLER ASSEMBLY OR THE SAFETY GO-DEVIL INSTALLED, THEREFORE NORMAL DRILLING OPERATIONS CAN BE RESUMED BUT THE PACKER CAN NOT SET UNTIL THE PACKER BODY ASSEMBLY HAS BEEN RETRIEVED AND THE OVER PRESSURE SAFETY VALVE RE-DRESSED WITH A NEW SHEAR PIN.

3. INSPECTING AND DRESSING PACKER BODY AFTER JOB.

A) HOSE WASH OUTSIDE AND INSIDE OF TOOL. VISUALLY CHECK CONDITION OF PACKER ELEMENT. IT SHOULD BE REPLACED IF: EITHER END IS UPSET OR BULGED - METAL ENDS ARE SCORED OR GOUGED. - IF RUBBER COVER IS TORN OR BADLY ABRADED. THE SEATING SLEEVE INTERIOR SHOULD BE EXAMINED FOR DEEP SCRATCHES OR OTHER DAMAGES.

B) THE PACKER BODY ASSEMBLY SHOULD BE PRESSURE TESTED AS A UNIT. IT IS NOT NECESSARY TO DISMANTLE TOOL UNLESS THERE IS DAMAGE TO PACKER ELEMENT OR SEATING SLEEVE, OR IF AN INTERNAL SEAL IS LEAKING, OR IF THE CONTROL VALVE IS NOT OPERATING PROPERLY. SEE SEC.III FOR TESTING PROCEDURE.

C) TO REPLACE PACKER ELEMENT -

- REMOVE "CROSSOVER SUB" (28) FROM MANDREL (VISE ON TOP SUB FOR PACKER, ITEM (23).
- REMOVE "DEFLATION SPRING CAP" (26).
- REMOVE "DEFLATION SPRING" (17).
- REMOVE "DEFLATION SPRING STOP COLLAR" (24).
  NOTE: TAPPED HOLES FOR REMOVAL.
- REMOVE "BOTTOM SUB FOR PACKER" (25).
  INSPECT "O-RINGS" (9) AND (8).
- REMOVE "PACKER ELEMENT" (29).
  INSPECT "O-RINGS" (8) ON TOP SUB.

RE-ASSEMBLE IN REVERSE ORDER, AND PRESSURE TEST.

D) IF NECESSARY TO REPLACE SEATING SLEEVE, IT WOULD BE BEST TO DIS-MANTLE ENTIRE TOP PORTION FOR PARTS INSPECTION AS EACH PART IS REMOVED, EXAMINE I.D. AND O.D. FOR ABRASION OR WASHING AND REPLACE O-RINGS. PROCEED AS FOLLOWS:

- REMOVE "TOP SUB" (20).
- REMOVE "SAMPLER SEATING SLEEVE" (18) AND "SPRING" (16).
- REMOVE "STABILIZER HOUSING" (21) AND "CONTROL VALVE SPRING" (15).
- REMOVE "CONTROL VALVE" (19) AND "CONTROL VALVE BODY" (22).
  NOTE: "CONTROL VALVE BODY" IS THREADED INTO "TOP SUB FOR PACKER". DO NOT WRENCH ON SEAL SURFACE.

RE-ASSEMBLE TOP PORTION AS IN SEC. III, STEP 3.

II. ASSEMBLY PROCEDURE

1. INSTALL ALL O-RINGS ON ALL PARTS AS SHOWN. INSTALL "SPRING", (16) ON "SAMPLER SEATING SLEEVE" BEFORE O-RINGS (3A). LIGHTLY OIL O-RINGS AND THREADS.

2. VISE ON "TOP SUB FOR PACKER" (23).

3. ASSEMBLE TOP PORTION:

   A) THREAD "CONTROL VALVE BODY" (22) INTO TOP SUB FOR PACKER. DO NOT WRENCH ON SEAL SURFACE.

   B) SLIDE "CONTROL VALVE" (19) ONTO CONTROL VALVE BODY, GROOVED END MUST ABUT TOP SUB FOR PACKER.

   C) SLIDE "STABLIZER HOUSING" (21) ON AND THREAD ONTO TOP SUB. TIGHTEN TO 22,000 FT. LBS.

   D) INSERT "CONTROL VALVE SPRING" (15).

   E) INSERT "SAMPLER SEATING SLEEVE" (18) INTO CONTROL VALVE BODY.

   F) THREAD "TOP SUB" (20) INTO HOUSING TURNING SLOWLY TO ALLOW SEATING SLEEVE AND CONTROL VALVE BODY TO ENTER BORES. TIGHTEN TO 22,000 FT. LBS.

4. ASSEMBLE LOWER PORTION:

   A) NOTE - "PACKER MANDREL" (27) AND "TOP SUB FOR PACKER" (23) ARE ASSEMBLED AND TESTED AS A UNIT AT THE FACTORY.

   B) OIL SEALING SURFACE ON MANDREL.

   C) SLIDE "PACKER ELEMENT" (29) ON OVER MANDREL. THREAD ONTO TOP SUB. TIGHTEN TO 3000 FT. LBS. MAXIMUM.

   D) SLIDE "BOTTOM SUB FOR PACKER" (25) ON OVER MANDREL. THREAD ONTO PACKER ELEMENT. TIGHTEN TO 3,000 FT. LBS. MAXIMUM.

   E) INSERT "SPRINGS" (30) INTO "STOP COLLAR" (24), AND INSERT STOP COLLAR PIECES INTO SLOTS IN MANDREL AND SLIDE INTO SPLINED BORE IN BOTTOM SUB.

   F) SLIDE "SPRING" (17) ON OVER MANDREL, FOLLOWED BY "DEFLATION SPRING CAP" (26). TIGHTEN TO 3,000 FT. LBS. MAXIMUM.

   G) THREAD "MANDREL CROSSOVER SUB" (28) ONTO MANDREL. TORQUE TO 22,000 FT. LBS. CAUTION - VISE AND TONG ONLY ON "TOP SUB FOR PACKER", AND "CROSSOVER SUB". USE SUPPORT UNDER "BOTTOM SUB FOR PACKER".

   H) INSTALL "OVER PRESSURE SAFETY VALVE" PARTS (ITEMS 1,2,10,11,12 & 13).

III. TESTING PROCEDURE

1. TESTING STATIC SEALS:

A) PLUG 2-7/8 HOLE IN "TEST PLUG". CONNECT PUMP TO 1/4 NPT HOLE IN "TEST CAP". ELEVATE TOP END. START PUMP. WHEN FLUID FLOWS OUT 1/4 NPT HOLE IN "TEST PLUG" THREAD IN PIPE PLUG.

B) PRESSURE UP SLOWLY. THERE SHOULD BE NO FLUID DRIP, NOR PACKER ELEMENT INFLATION. THERE SHOULD BE NO PRESSURE DROP AFTER PUMP HAS STOPPED. INCREASE TO 4000 PSI.

C) BLEED PRESSURE, REMOVE PUMP HOSE. REMOVE "TEST PLUG" FROM TOP END.

2. TESTING MOVING SEALS IN CONTROL VALVE AND SAMPLER SEATING SLEEVE.

A) CONNECT AIR HOSE WITH VALVE TO 1/4 NPT HOLE IN TEST CAP (CLOSE VALVE).

B) GREASE I.D. OF SEATING SLEEVE. THREAD "BUSHING - NC 61 X 5 IN. CASING" INTO TOP OF PACKER BODY.

C) ASSEMBLE "SAMPLER VALVE SECTION", "SPACER HOUSING", "TEST NIPPLE" AND "HOUSING F/3F FLOAT VALVE". SLIDE THIS ASSEMBLY INTO PACKER BODY. INSTALL "PACKER BODY TEST ADAPTER" ON OVER END OF ASSEMBLY, AND THREAD ADAPTER INTO BUSHING.

D) SLIDE TEST CASING ON OVER EXPANDABLE PART OF ELEMENT.

E) CONNECT PUMP HOSE TO 1/4 NPT HOLE IN ADAPTER.

F) START PUMPING - SLIGHT FLUID FLOW OUT HOLE IN TEST CAP IS NORMAL (DISPLACEMENT AS SEALING SLEEVE SHIFTS). LIGHT FLOW FROM HOLES IN STABILIZER HOUSING IS ALSO NORMAL (BYPASS OPENS "FORMATION" TO "ANNULUS" BEFORE ELEMENT INFLATES).

G) CONTINUE PUMPING AT A MODERATE RATE. PUMP PRESSURE WILL LAG AS INFLATE PASSAGE OPENS AND ELEMENT STARTS INFLATING. PRESSURE WILL BUILD UP AS ELEMENT CONTACTS TEST CASING.

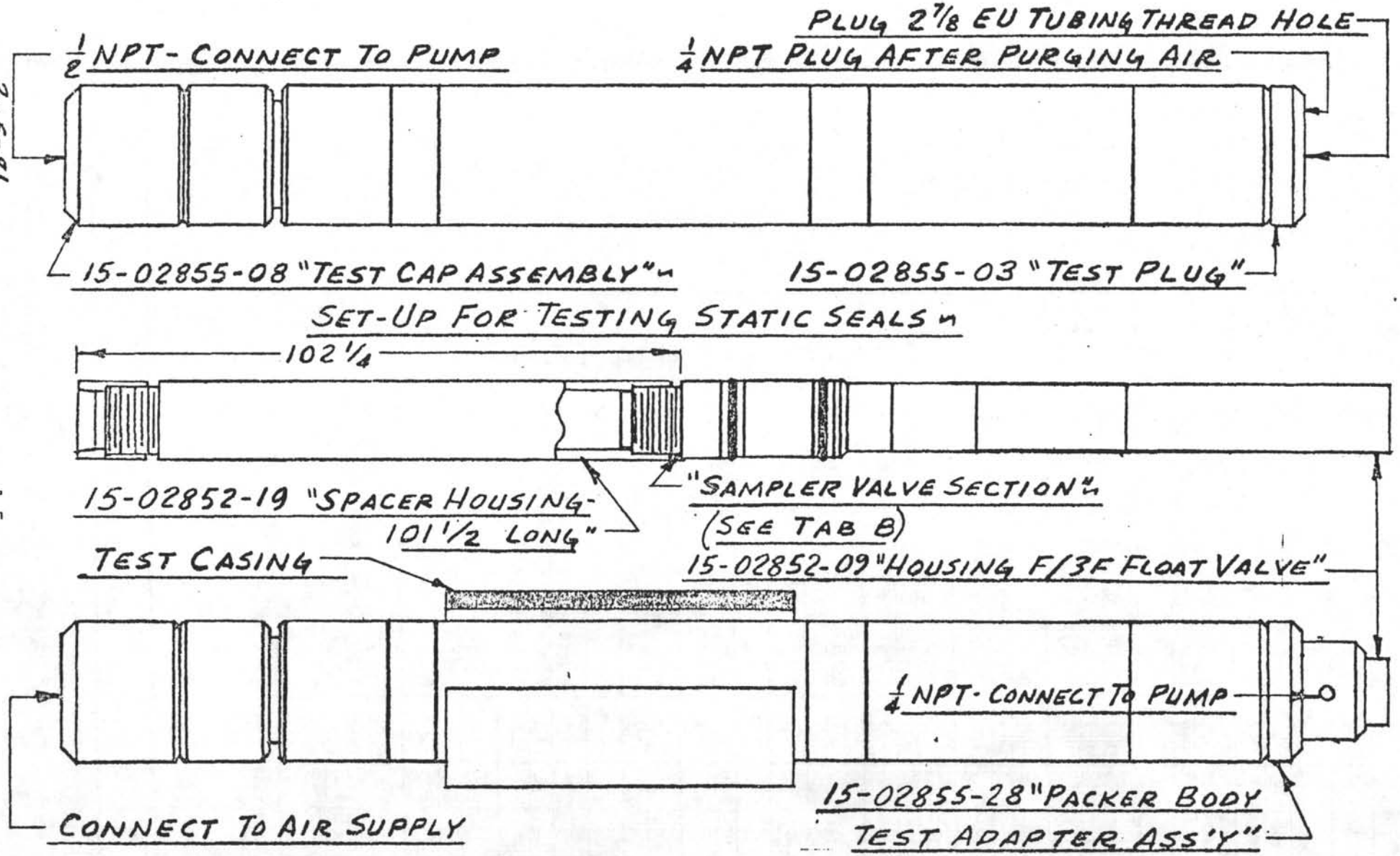
H) AS PUMP PRESSURE REACHES APPROXIMATELY 850 PSI, OPEN AIR VALVE TO TEST BYPASS BEING OPEN (AIR SHOULD BLOW OUT HOLES IN STABILIZER HOUSING).

I) AT APPROXIMATELY 1200 PSI BYPASS SHOULD BE SHUT OFF.

J) INCREASE PRESSURE. AIR FLOW OUT HOUSING F/3F FLOAT VALVE SHOWS THAT SAMPLER VALVE IS OPEN.

K) AS PUMP PRESSURE IS LOWERED, SAMPLER VALVE WILL CLOSE, BYPASS OPENS, AND PACKER ELEMENT WILL DEFLATE.

L) WHEN PRESSURE IS BACK TO ZERO, REMOVE ALL TEST EQUIPMENT.



SET-UP FOR TESTING SEALS IN CONTROL VALVE AND SAMPLER SEATING SLEEVE

PACKER BODY TESTING DETAIL

A-5

56

ITEM	PROJ.DWG. NO.	DESCRIPTION	QUANT.
1	WW-B011-H40	O-RING BACK PRESSURE POP	1
2	WW-B012-H40	O-RING CHECK VALVE PLUG	2
3	WW-B243-H40	O-RING SEATING SLEEVE	1
3A	WW-B347-H40	O-RING SEATING SLEEVE	9
4	WW-B255-H40	O-RING CONTROL VALVE BODY	2
6	WW-B360-H40	O-RING CONTROL VALVE	3
7	WW-B361-H40	O-RING CONTROL VALVE	2
8	WW-B367-H40	O-RING PACKER SUBS	2
9	WW-B439-H40	O-RING PKR SUB & DEF CAP	5
10	04-00459-06	.500 LONG SHEAR PIN .072	1
11	04-09515-00	CHECK VALVE PLUG	2
12	04-09517-00	SHEAR PIN PLUNGER	1
13	04-09520-00	POPPET BACK PRESSURE VLV	1
14	04-15099-00	.062-27NPT PIPE PLUG	2
15	15-02851-70	CONTROL VALVE SPRING	1
16	15-02851-02	SAMP SEATING SLV SPRING	1
17	15-02851-03	DEFLATION SPRING	1
18	15-02851-22	SAMPLER SEATING SLEEVE	1
19	15-02851-06	CONTROL VALVE	1
20	15-02851-07	TOP SUB	1
21	15-02851-08	STABILIZER HOUSING	1
22	15-02851-10	CONTROL VALVE BODY	1
23	15-02851-11	TOP SUB FOR PACKER	1
24	15-02851-12	DEFLATION SPRG STOP CLR	1
25	15-02851-13	BOTTOM SUB FOR PACKER	1
26	15-02851-14	DEFLATION SPRING CAP	1
27	15-02851-15	PACKER MANDREL	1
28	15-02851-16	MANDREL CROSSOVER SUB	1
29	15-02851-18	8.50 OD-54 PKR ELEMENT	1
30	15-02851-19	SPRING C600-072-12505	4
31	15-02851-20	TEFLON BACK-UP	1

"PACKER BODY ASSEMBLY"

HOUSTON TEXAS

LYNES

A-6

15-02851-00

DRAWN BY PAR | CHECKED BY

2-5-81

⋈ SPRINGS (15), (16), AND (17) MAY BE SQUARE WIRE AS SHOWN OR ROUND WIRE - LOAD WILL BE THE SAME.

PACKER BODY ASSEMBLY	
HOUSTON, TEXAS LYNES INC.	15-02851-00
DRAWN BY RVW	CHECKED BY
DATE 8-27-73	DATE

2-3-81 * WAS NC 61 PIN
2-5-81 ADDED ⋈ NOTE

15-02852-00 "3.75 O.D. SAMPLER ASSEMBLY"

I. DESIGN AND OPERATION OF SAMPLER

1. DESIGN & DIMENSIONAL DATA:

A) O.D. OF THE SAMPLER IS 3.75 INCHES, EXCEPT FOR TWO SEAL UNITS WHICH ARE 3.870 INCHES X 4-1/2 INCHES LONG (INCLUDING PROTECTIVE HUBS).

B) THE OVERALL LENGTH OF THE SAMPLER IS 53.39 FT., NOT INCLUDING SPACER HOUSINGS RUN BELOW. THIS LENGTH IS BASED ON SIX "SAMPLE BARRELS". CAPACITY OF SAMPLER IS 15 GALLONS.

C) THE SAMPLER WEIGHS 975 LBS. (NOT INCLUDING SPACER HOUSINGS OR STINGER).

D) THE TOP END OF THE SAMPLER HAS A 2-5/16 DIAMETER FISHING NECK. THE TOP END SUB HOUSES THE "SAFETY/RELIEF VALVE", WHICH IS SHEAR PINNED TO SHEAR OPEN IF PRESSURE IN SAMPLER IS HIGHER THAN 15,000 PSI.

E) THE "DRAIN VALVE" CAN BE LOCATED ANY WHERE BELOW THE FIRST BARREL FROM TOP. IT ACTS AS A CHECK VALVE WHEN UNCOUPLED.

F) THE "REGULATOR VALVE" IS LOCATED JUST ABOVE THE SAMPLER VALVE. THIS IS A PRESSURE REGULATOR VALVE WHICH IS PRESET RELATIVE TO SAMPLING DEPTH. ITS FUNCTION IS TO CONTROL OR LIMIT THE PRESSURE DROP TO 1500 PSI BELOW PACKER WHEN THE SAMPLER IS OPEN.

G) THE "SAMPLE VALVE" IS ACTUATED BY DRILL PIPE PRESSURE. IT OPENS TO ALLOW FLUID OR GAS TO FILL SAMPLER, THEN CLOSES AS DRILL PIPE PRESSURE IS REDUCED.

H) AT THE BOTTOM OF THE SAMPLER IS AN INTERNAL THREAD TO FIT 15-02852-01 "HANGER FOR K-3 RECORDER", AND AN EXTERNAL THREAD TO FIT SPACER HOUSINGS.

I) WHEN "PACKER BODY" IS RUN ABOVE "HEAD SUB" ON "WIRE LINE CORE BARREL ASSEMBLY", THE SAMPLER MUST BE ASSEMBLED WITH FIVE "SPACER HOUSINGS" EACH 101.5 IN. LG. OVERALL AND "STINGER SUB" ON BOTTOM. IF "PACKER BODY" IS RUN BETWEEN "OUTER BARREL" AND "BIT SUB", ASSEMBLE SAMPLER WITH ONE "SPACER HOUSING" 99-11/16 INCHES LONG OVERALL AND "STINGER SUB" ON BOTTOM. TAPPED HOLE IN BOTTOM OF "STINGER SUB" MUST BE PLUGGED WITH 3/4 NPT PLUG.

J) THE SAMPLER IS DESIGNED FOR A SAFE WORKING PRESSURE OF 15,000 PSI.

2. OPERATION OF SAMPLER:

A) OPENING AND CLOSING OF "SAMPLER VALVE" IS CONTROLLED BY DRILL PIPE PRESSURE. AS THE PACKER ELEMENT IS BEING INFLATED AND SET, DRILL PIPE PRESSURE IS ON BOTH SIDES OF "SAMPLER VALVE SPOOL". AFTER SETTING PACKER, DRILL PIPE PRESSURE MOVES "CONTROL VALVE". OPENING LOWER SIDE OF "SAMPLER VALVE" TO ANNULUS PRESSURE. DRILL PIPE PRESSURE ON TOP SIDE OF "SAMPLER VALVE" MOVES SAMPLER VALVE SPOOL, OPENING SAMPLER TO FORMATION FLUID THRU REGULATOR VALVE. REDUCING DRILL PIPE PRESSURE CAUSES "CONTROL VALVE" TO MOVE, CLOSING PORT TO ANNULUS, AND APPLYING DRILL PIPE PRESSURE TO BOTH SIDES OF "SAMPLER VALVE". A SPRING LOCATED BELOW THE VALVE SPOOL CLOSES THE "SAMPLER VALVE", TRAPPING A SAMPLE OF THE FORMATION FLUID.

B) AFTER THE PACKER IS DEFLATED, THE "SAMPLER" IS RETRIEVED WITH OVERSHOT ON WIRE LINE. WHEN THE SAMPLER REACHES THE WELL HEAD AND OVERSHOT IS REMOVED, THE SAFETY RELIEF AND DRAIN VALVE MUST BE SET. MEASURE THRU HOLE IN FISHING NECK WITH A PIECE OF 1/8 DIAMETER ROD TO TOUCH "RELIEF/ DRAIN VALVE STEM". A MEASUREMENT OF 3-1/8 TO 3-1/4" MEANS SHEAR PINS HAVE NOT SHEARED, AND SAMPLER MAY CONTAIN HIGH PRESSURE. USE HEX WRENCH, AND THREAD "LOCK SCREW" IN TO BEAR AGAINST VALVE STEM. REMOVE "FISHING HEAD" AND "SHEAR PINS". (A MEASUREMENT OF LESS THAN 3" MEANS THAT A DIFFERENTIAL PRESSURE GREATER THAN 15,000 PSI HAS BEEN REACHED DOWN HOLE, AND THAT PINS HAVE SHEARED, RELIEVING PRESSURE IN SAMPLER).

C) TO BLEED PRESSURE FROM SAMPLER, CONNECT MANIFOLD TO 1/4 NPT HOLE IN TOP SUB. BACK OUT LOCK SCREW FLUSH WITH FACE OF TOP SUB.

D) TO DRAIN SAMPLE, BREAK SUB FOR FLOAT VALVE HOUSING LOOSE FROM SAMPLER DRAIN SUB, AND THREAD APART. FLOAT VALVE SHUTS BEFORE O-RING LOSES SEAL. REMOVE DRAIN SUB FROM SAMPLER SEAL SUB, AND THREAD DRAIN SUB ONTO SUB FOR FLOAT VALVE HOUSING. PROBE WILL OPEN FLOAT VALVE AS SUB THREADS ON.

3. INSPECTING AND DRESSING SAMPLER AFTER JOB.
SAMPLER SHOULD HAVE PRESSURE RELEASED AND FLUID DRAINED AS IN (C) AND (D) OF "SAMPLER OPERATION".

A) REMOVE "SAMPLER TOP SUB" (10) FROM TOP SAMPLE BARREL. REMOVE "HOUSING FOR 3 F VALVE" (16) FROM SAMPLE BARREL SUB. CLEAN OUT INSIDE AND OUTSIDE OF BARRELS AS NEEDED. SUBS MAY BE REMOVED FROM BARRELS IF NEEDED FOR CLEANING. AFTER CLEANING, GREASE BOTH THREAD ENDS ON SUBS, AND BOX THREAD ON BARREL (END WITH CLAMP GROOVE). THREAD SUB INTO OPPOSITE END OF BARREL. INSTALL THREAD PROTECTOR.

B) REMOVE "3 F VALVE" (8) FROM "HOUSING FOR 3 F VALVE" (16). REMOVE "SUB FOR FLOAT VALVE HOUSING" (25) AND "DRAIN VALVE SUB" (26). WASH ALL PARTS, CHECK O-RINGS, GREASE THREADS, AND RE-ASSEMBLE.

C) REMOVE "RELIEF VALVE STEM" (11) AFTER THREADING OUT "LOCK SCREW" (24). REMOVE SHEARED ENDS OF PINS (IF THEY WERE SHEARED). WASH INSIDE AND OUTSIDE OF TOP SUB. GREASE ALL THREADS. INSERT STEM AND THREAD LOCK SCREW IN FLUSH WITH FACE OF TOP SUB.

D) REMOVE "SAMPLER CONNECTOR HOUSING" (38) FROM "REGULATOR VALVE SUB" (32), AND CLEAN OUT BARREL.

E) REMOVE SPACER HOUSINGS FROM "CORE BARREL ADAPTER" (20). REMOVE CORE BARREL ADAPTER AND RECORDER HANGER.

F) IT IS NOT NECESSARY TO DISASSEMBLE VALVE SECTION UNLESS LEAK SHOWS UP WHILE TESTING (SEE SECTION III).

II. ASSEMBLY PROCEDURE:

1. INSTALL O-RINGS AND BACK-UPS ON ALL PARTS AS SHOWN. LIGHTLY OIL O-RINGS AND THREADS.

2. ASSEMBLE PARTS FOR DRAIN VALVE SECTION:

A) VISE ON "HOUSING FOR SIZE 3 F VALVE" (16).

B) OIL SEALS ON "DP FLOAT VALVE" (8) AND INSERT SEAL END FIRST INTO HOUSING.

C) THREAD "SUB FOR FLOAT VALVE HOUSING" (25) INTO END OF HOUSING NEXT TO SEALS. THREAD "DRAIN SUB" (26) ON.

3. ASSEMBLE SAMPLE VALVE SECTION:

A) VISE ON "SAMPLE VALVE SUB" (17).

B) INSERT "EQUALIZE PISTON" (35) INTO "SAMPLER VALVE SPOOL" (19). THREAD IN "PISTON RETAINER NUT" (36).

C) INSERT SAMPLER VALVE SPOOL INTO SAMPLER VALVE SUB.

D) INSERT "SAMPLER VALVE SPRING" (23) INTO "SAMPLER SEAL SUB" (18) AND THREAD SEAL SUB ONTO VALVE SUB, AND TIGHTEN JOINT.

E) ASSEMBLE "SEAL UNITS" (21) AND "SPACER" (22). BLANK HOLES IN SPACER TO LINE UP WITH HOLE IN SAMPLER SEAL SUB. THREAD SIX "SETSCREWS" (5) INTO SPACER AND BOTTOM IN SHALLOW HOLES IN SEAL SUB.

F) THREAD "REGULATOR VALVE SUB" (32) INTO VALVE SUB. INSERT "REGULATOR VALVE" (34) INTO SUB. THREAD IN "RETAINER" (33). INSTALL "SETSCREWS" (37).

4. ASSEMBLE PARTS FOR TOP SUB:

A) STAND "SAMPLER TOP SUB" (10) VERTICAL, SMALL END DOWN.

B) INSERT "RELIEF/DRAIN VALVE PACKING" (12) INTO TOP SUB. THREAD "PACKING RETAINER NUT" (13) INTO TOP SUB. TIGHTEN.

C) REVERSE ENDS. INSERT "RELIEF/DRAIN VALVE STEM" (11) INTO TOP SUB. THREAD "STEM LOCK SCREW" (24) IN FLUSH WITH FACE OF TOP SUB.

III. TESTING PROCEDURES AND FINAL ASSEMBLY.

1. TESTING SEAL UNITS, TESTING REGULATOR VALVE, AND TESTING RELIEF VALVE.

A) TEFLON TAPE THREADS ON ALL PIPE PLUGS (6) AND (31), AND TIGHTEN INTO PROPER HOLES.

B) THREAD "SAMPLER SEAL TESTER" 15-02855-18 ONTO SAMPLER SEAL SUB.

C) TEST SEAL UNITS AND LOWER O-RING ON VALVE SPOOL: PRESSURE INTO PORT ON SIDE OF TESTER TO 3000 PSI.

D) TEST LOWER SEAL UNIT (REVERSE FROM C), LOWER AND CENTER SPOOL SEALS, AND SAMPLER VALVE SUB SEAL: PRESSURE INTO END PORT IN TEST FIXTURE TO 3000 PSI.

E) TESTING REGULATOR VALVE, TEST UPPER O-RING ON VALVE SPOOL, EQUALIZE PISTON O-RINGS, REGULATOR VALVE O-RINGS AND PIPE PLUGS:

STAND VALVE BODY TO VERTICAL, REGULATOR VALVE UP. BACK OUT ADJUSTING SCREW, THEN THREAD IN 3 TURNS. TIGHTEN LOCK NUT.

PRESSURE INTO END PORT IN TEST FIXTURE, AND AT THE SAME TIME , APPLY AIR PRESSURE (125 PSI OR MORE) INTO PILOT PRESSURE PORT TO SHIFT SPOOL. THIS OPENS PASSAGE TO REGULATOR. WHEN REGULATOR RELIEVES, CHECK PRESSURE AND STOP PUMP. BLEED PRESSURE .

THREAD IN SCREW ADDITIONAL TURNS AS NEEDED TO GIVE 3000 PSI TEST. BLEED PRESSURE.

F) TEST SAFETY/RELIEF VALVE SEALS IN TOP SUB:

THREAD "SAMPLER CONNECTOR HOUSING" AND ONE "SAMPLE BARREL ASSEMBLY" ONTO "REGULATOR VALVE SUB", AND THE "SAFETY/RELIEF ASSEMBLY" INTO THE BARREL. THREAD "LOCK SCREW" IN TO SEAT "STEM".

PUMP THRU SAMPLER VALVE AND REGULATOR VALVE TO 3500 PSI. STOP PUMP. BLEED PRESSURE FROM PUMP, AND REMOVE PILOT PRESSURE TO ALLOW SPOOL TO CLOSE.

BACK OUT LOCK SCREW TO FLUSH WITH END OF TOP SUB. PRESSURE IN BARREL WILL RELIEVE AS STEM IS FORCED OPEN.

WHEN PRESSURE IS RELIEVED, REMOVE "SAFETY RELIEF ASSEMBLY", "SAMPLE BARREL ASSEMBLY" AND "SEAL UNIT TESTER".

THREAD CORE BARREL ADAPTER ONTO BOTTOM END.

2. BEFORE SAMPLER IS RUN, THE "REGULATOR VALVE" MUST BE SET RELATIVE TO PRESSURE AT SAMPLING DEPTH.

SETTING REGULATOR VALVE:

A) REMOVE HOUSING FROM REGULATOR VALVE BODY. REMOVE " 1/8 NPT PLUG" (6) FROM "SAMPLER VALVE SUB" (17).

B) CONNECT HAND PUMP TO HOLE. ADJUST STEM IN REGULATOR VALVE TO GIVE 1500 PSI LESS THAN PRESSURE AT SAMPLING DEPTH. TIGHTEN LOCK NUT. REMOVE PUMP, AND THREAD PLUG (6) INTO HOLE. THREAD HOUSING ONTO SUB.

3. FINAL ASSEMBLY.

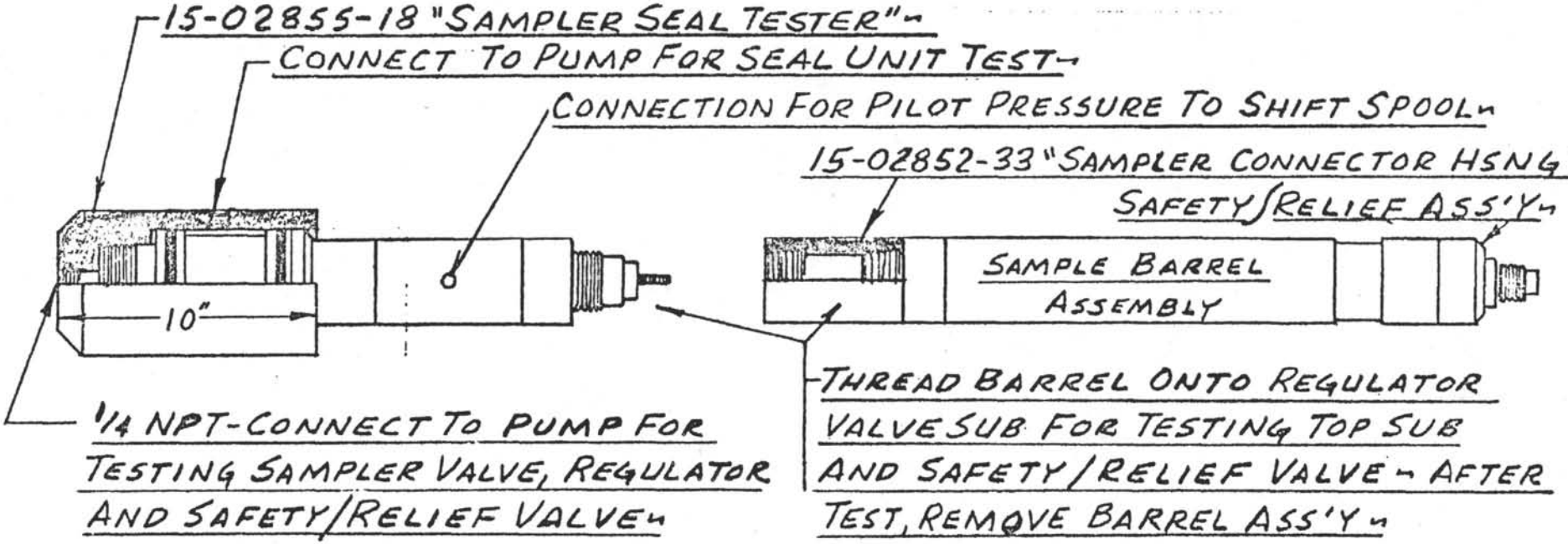
A) THREAD "DRAIN VALVE ASSEMBLY" (ITEMS 8, 16, 25, 26 & 27) INTO HOUSING ABOVE REGULATOR VALVE.

B) THREAD SAMPLER BARRELS INTO DRAIN VALVE ASSEMBLY.

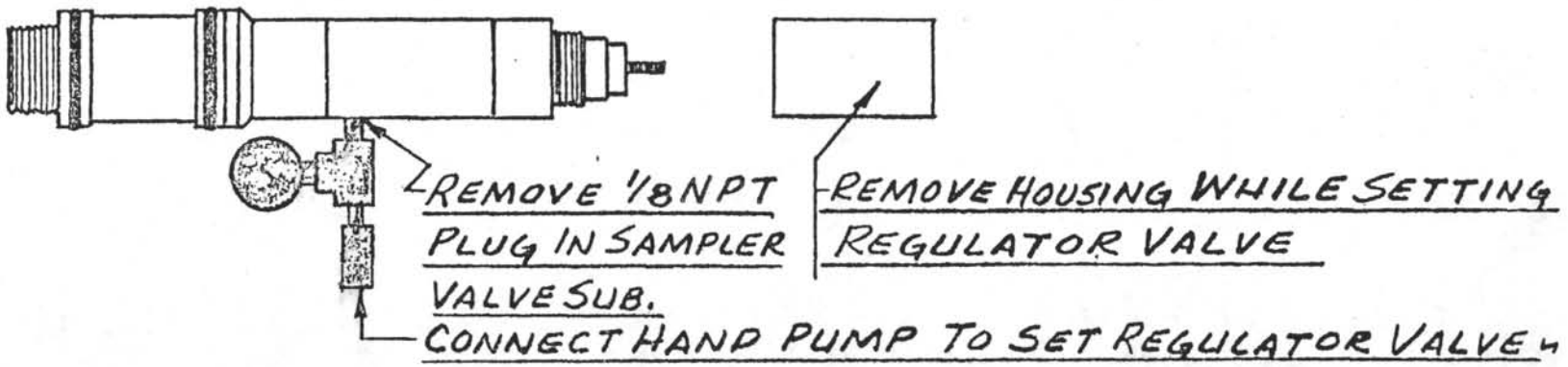
C) THREAD TOP SUB INTO TOP BARREL.

D) THREAD LOCK SCREW IN TO SEAT STEM. INSTALL "SHEAR PINS" (7). BACK OUT LOCK SCREW FLUSH WITH END OF TOP SUB.

E) THREAD "FISHING HEAD" (9) ONTO TOP SUB.



"TESTING SEAL UNITS AND VALVES"



"SETTING REGULATOR VALVE"

SAMPLER TEST DETAIL

REGULATOR VALVE F/SAMPLER

15-02852-30

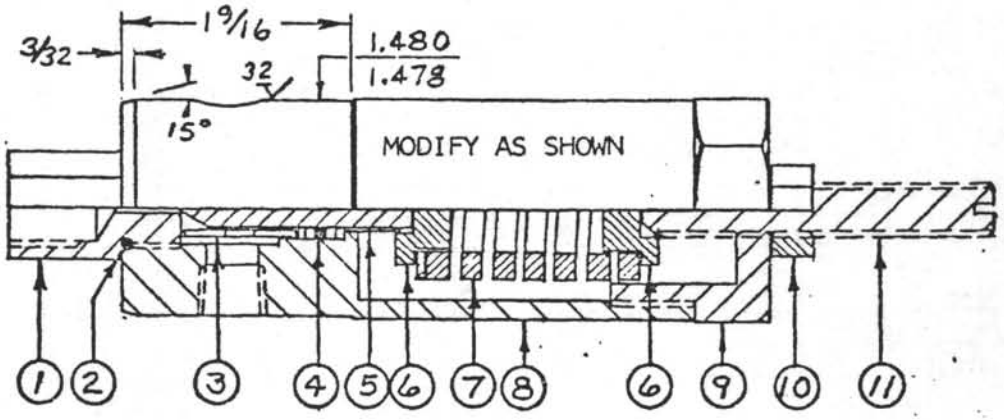
SPECIFICATIONS: HASKEL PRESSURE REGULATOR, MODEL 15700-10
1,000 - 10,000 PSI ADJUSTABLE RANGE, .070 DIA. ORIFICE.

MANUFACTURER: HASKEL ENGINEERING & SUPPLY CO.
BURBANK, CALIFORNIA

HASKEL DIRECT OPERATING - 3 PORT REGULATING RELIEF VALVES MAY ALSO SERVE AS BACK PRESSURE REGULATORS. SUITABLE FOR CONTINUOUS FLOW FINE PRESSURE REGULATION AT LOW FLOWS TO 25,000 PSI. MAXIMUM RECOMMENDED CAPACITY 0.5 GPM.

THESE VALVES ARE DESIGNED FOR ACCURATE CONTINUOUS CONTROL OF UPSTREAM PRESSURE FOR FINE PRESSURE REGULATION AT RATED FLOWS AND PRESSURES. REPEATABILITY IS WITHIN APPROXIMATELY ± 1% OF TOTAL RANGE AND ADJUSTABILITY APPROACHES 1/10 OF 1% OF TOTAL RANGE.

THEY ARE DESIGNED SO THAT THE SENSING AREA AND SEAT AREA ARE SEPARATE. (THE SENSING AREA IS MUCH LARGER THAN THE SEAT AREA.) THEREFORE, FLOW GRADIENTS DO NOT AFFECT THE PRESSURE SETTING. BECAUSE OF THIS UNIQUE FEATURE, THESE VALVES DO NOT "SQUEAL" OR "CHATTER" AT VERY LOW FLOWS LIKE MOST EVERY RELIEF VALVE DOES.



PARTS LIST (1 REQ'D UNLESS NOTED)

ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	OUTLET ORIFICE CONNECTOR (.070)	6	SPRING CAPS(2)
2	O-RING'	7	REGULATOR SPRING
3	SPACER SLEEVE	8	REGULATOR HOUSING
4	PACKING SET: (2) BRASS BACKUPS; (2) TEFLON BACKUPS; (1) O-RING.	9	END CAP
		10	LOCK NUT
5	REGULATOR NEEDLE VALVE	11	ADJUSTMENT SCREW

ITEM	COMMODITY NO.	DESCRIPTION	REQ.
1	WW-B111-H40 04-14911-11	O-RING (90 DURO) .06 TEF BU F/-111 O-RING	2 4
2	WW-B214-H40 04-14912-14	O-RING (90 DURO) .06 TEF BU F/-214 O-RING	2 4
3	WW-B218-H40 04-14912-18	O-RING (90 DURO) .06 TEF BU F/-218 O-RING	4 8:::
4	WW-B232-H40 04-14912-32	O-RING (90 DURO) .06 TEF BU F/-232 O'RING	17 34:::
5	WW-G71H-0H0	.5NC X .5 DOG PT S'SCREW	6
6	04-15100-01	PLUG-.125 NPT STNLS SKT HD	4
7	04-00468-12	SHEAR PIN - .938 LG X .125	4
8	480-13-3400	MOD 'F' DP FLOAT VALVE - 3F	1
9	15-02852-02	FISHING HEAD-F/OTIS TYP R	1
10	15-02852-03	SAMPLER TOP SUB - 3.75	1
11	04-08444-00	RELIEF/DRAIN VALVE STEM	1
12	04-08447-00	RELIEF/DRAIN VALVE PACKING	1
13	15-02852-06	PACKING RETAINER NUT	1
14	15-02852-07	SAMPLER BARREL - 3.75 OD	6
15	15-02852-08	SAMPLER BARREL SUB - 3.75	5
16	15-02852-09	HOUSING F/SIZE 3F VALVE	1
17	15-02852-10	SAMPLER VALVE SUB	1
18	15-02852-11	SAMPLER SEAL SUB	1
19	15-02852-12	SAMPLER VALVE SPOOL	1
20	15-02852-13	CORE BARREL ADAPTER F/SAMPLER	1
21	15-02852-14	SEAL-UNIT - 3.88 X 3.06	2
22	15-02852-16	SPACER F/3.88 SEAL UNIT	1
23	15-02852-17	SPRING FOR SAMPLER VALVE	1
24	04-08441-00	STEM LOCK SCREW	1
25	15-02852-22	SUB FOR FLOAT VALVE HOUSING	1
26	15-02852-23	SAMPLER DRAIN SUB	1
27	15-02852-24	FLOAT VALVE OPENING PROBE	1
28	WW-B231-H40 04-14912-31	O-RING (90 DURO) .06 TEF BU F/-231 O-RING	1 2:::
29	WW-B012-H40	O-RING (90 DURO)	2
30	WW-B222-H40	O-RING (90 DURO)	2
32	15-02852-28	REGULATOR VALVE SUB	1
33	15-02852-29	REGULATOR VALVE RETAINER	1
34	15-02852-30	REGULATOR VALVE F/SAMPLER	1
35	15-02852-31	EQUALIZE PISTON	1
36	15-02852-32	PISTON RETAINER NUT	1
37	WW-G51D-0H0	3/8-16NC X 1/2 CUP POINT SETSCREW	3
38	15-02852-33	SAMPLER CONNECTOR	1

::: BACKUPS FOR O'RINGS(3),(4) AND (28) ARE TO BE ENDLESS (THEY WILL BE DAMAGED ON ASSEMBLY IF ANGLE CUT). 90 DURO PARBAK BACKUPS MAY BE USED.

PARTS LIST FOR 3.75 O.D. SAMPLER ASSEMBLY

HOUSTON TEXAS

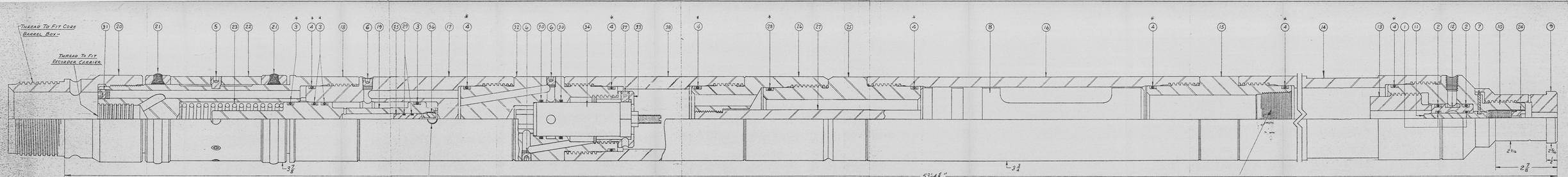
LYNES INC.

2-5-81
2-3-81

15-0285200

DRAWN BY PS | CHECKED BY

DATE 12/17/73 | DATE



3.75 O.D. SAMPLER ASSEMBLY

HOUSTON LYNES INC. TEXAS

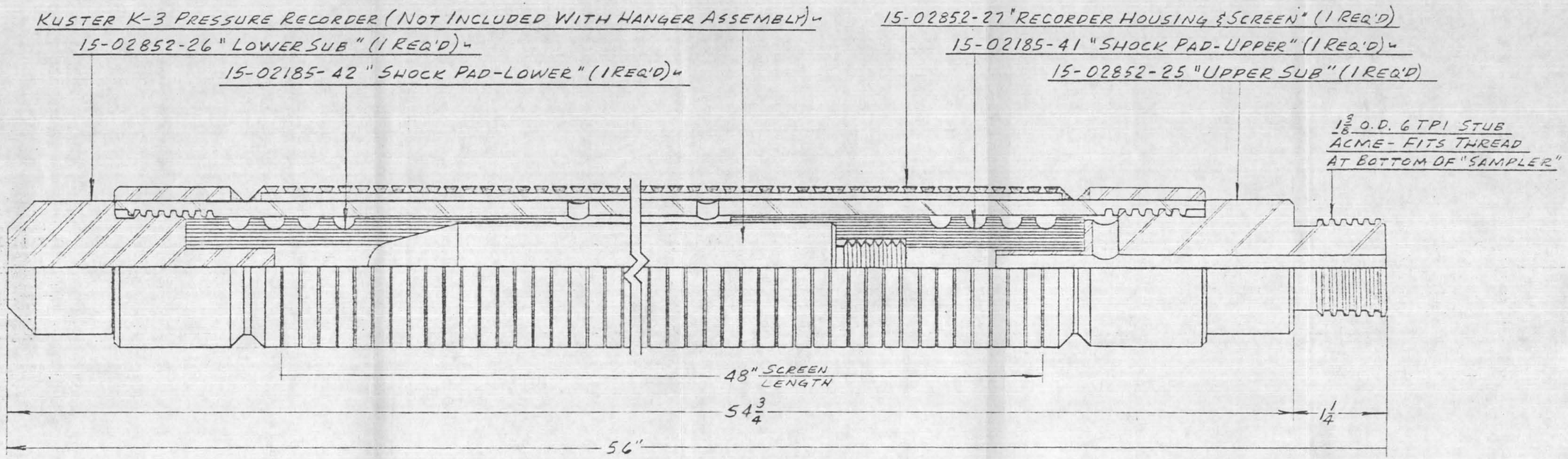
15-02852-00

DRAWN BY: [illegible] CHECKED BY:

DATE: 8-17-77 DATE:

Rev. 2-2-91

REV. 2-21-74 [illegible]



HANGER FOR K-3 RECORDER

HOUSTON TEXAS LYNES I.D.

15-02852-01

DRAWN BY TA DATE 1-14-74 CHECKED BY DATE

15-02853-00 "3.75 SAFETY-GO-DEVIL"

I. DESIGN AND OPERATION OF SAFETY GO-DEVIL:

1. DESIGN & DIMENSIONAL DATA:

A) TOP END OF THE SAFETY GO-DEVIL HAS A 2-5/16 FISHING NECK. THE 3-7/16 O.D. RING SERVES TWO PURPOSES:

ACTS AS A GUIDE FOR THE "DEFLATE BALL, AND AS A MEANS FOR ACTUATING THE UNLOCKING STINGER.

B) THE LATCH-IN SYSTEM USED ON THE SAFETY GO-DEVIL IS A BAKER 4-1/2 Z-LOCK SUB, MODIFIED BY TURNING A CONNECTING THREAD ON TOP.

C) THE BODY OF THE SAFETY GO-DEVIL HOUSES THE "INFLATION CHECK VALVE" (SAME AS USED ON LYNES EXTERNAL CASING PACKERS), "CIRCULATING SHEAR PLUG" (SAME AS USED ON LYNES PRODUCTION-INJECTION PACKERS), "BACK PRESSURE CHECK VALVE" (BAKER MODEL "F" DRILL PIPE FLOAT) AND "DEFLATE SLEEVE" (SIMILAR TO SYSTEM USED ON LYNES DRILL STEM TEST TOOL). THE BODY ALSO LOCATES THE SEAL UNITS WHICH SEAL IN THE BORE OF THE PACKER BODY.

D) THE LOWER END HAS A MALE THREAD ON THE O.D. TO FIT THE BOX ON CORE BARREL. THE SAME LENGTH SEATING STINGER AND SPACER AS USED ON SAMPLER MUST BE USED ON SAFETY GO-DEVIL TO PROPERLY LOCATE THE SEAL UNITS IN THE BORE OF THE PACKER BODY. THE TAPPED HOLE ON THE BOTTOM END OF "STINGER" MUST BE OPEN WHEN SAFETY GO-DEVIL IS RUN.

E) THERE IS ALSO A 1-1/2 LINE PIPE THREAD FOR ADDING A "CATCHER" FOR THE SHEAR PLUG (THE CATCHER MAY BE MADE UP FROM A BULL PLUG, PERFORATED NIPPLE AND 2 COLLARS, ALL 1-1/2 LINE PIPE) DURING SHOP TESTING ONLY.

F) WHEN "PACKER BODY" IS RUN ABOVE "HEAD SUB" ON "WIRE CORE BARREL ASSEMBLY", THE SAFETY GO-DEVIL MUST BE ASSEMBLED WITH FIVE "SPACER HOUSINGS" EACH 101.5 IN LG OVERALL AND "STINGER SUB" ON BOTTOM. IF "PACKER BODY" IS RUN BETWEEN "OUTER BARREL" AND "BIT SUB", ASSEMBLE SAFETY GO-DEVIL WITH ONE "SPACER HOUSING" 99-11/16 INCHES LONG OVERALL AND "STINGER SUB" ON BOTTOM.

2. OPERATION OF SAFETY GO-DEVIL

A) THE SAFETY GO-DEVIL IS ALLOWED TO DROP THRU DRILL PIPE. WHEN IT HAS SEATED, THE FINGERS OF THE Z-LOCK WILL BE OUT IN A RECESS IN THE BORE OF THE PACKER BODY.

B) APPLYING PRESSURE TO THE DRILL PIPE MOVES THE SAMPLER SEATING SLEEVE, AND OPENS THE PASSAGE TO THE CONTROL VALVE BODY.

C) DRILL PIPE PRESSURE FLOWS THRU THE "INFLATION CHECK VALVE" AND OPERATES THE CONTROL VALVE IN THE PACKER BODY. DRILL PIPE PRESSURE INFLATES THE PACKER ELEMENT.

D) WHEN THE SHEAR PLUG SHEARS, PRESSURE IN THE PACKER ELEMENT IS CHECKED BY THE "INFLATION CHECK VALVE". THE SAFETY GO-DEVIL IS OPEN FOR PUMPING INTO THE FORMATION. THE "BACK PRESSURE CHECK VALVE" PREVENTS FLOW BACK UP THE DRILL PIPE. THE Z-LOCK SUB PREVENTS THE SAFETY GO-DEVIL FROM BEING KICKED UPHOLE.

E) TO DEFLATE THE PACKER A 1-1/4 DIA. BALL IS DROPPED THRU THE DRILL PIPE TO SEAT IN THE "DEFLATE SLEEVE". PRESSURE UP ON DRILL PIPE TO SHEAR PINS. GROOVES IN DEFLATE SLEEVE PASS ACROSS SEALS, RELEASING PRESSURE AND DEFLATING PACKER.

F) THE SAFETY GO-DEVIL IS RETRIEVED BY AN OVERSHOT RUN IN ON WIRE LINE. THE OVERSHOT HITS THE 3-7/16 O.D. RING, PUSHING THE LOCK RELEASE STINGER DOWN, RELEASING THE LOCK DOGS. THIS SAME MOVEMENT UNCOVERS THE FISHING NECK WHICH IS GRASPED BY THE OVERSHOT.

3. INSPECTING AND DRESSING SAFETY GO-DEVIL AFTER JOB.

A) BREAK JOINT BETWEEN SPACER AND "CORE BARREL ADAPTER" (16). REMOVE STINGER SUB FROM BOTTOM, AND RETRIEVE SHEAR PLUG.

B) REMOVE "CORE BARREL ADAPTER" AND "RETAINER SUB" (27).

C) REMOVE AND INSPECT "FLOAT VALVE" (15) "SEAL UNITS" (17) AND "SPACER" (18).

D) CHECK OPERATION OF UNLOCKING MECHANISM ON TOP END. IF MECHANISM WORKS FREELY, AND THERE IS NO DAMAGE TO LOCKS, FISHING NECK, OR SEAL UNITS, IT IS NOT NECESSARY TO DISMANTLE THIS SECTION.

E) BREAK JOINT BETWEEN "BODY" (26) AND "DEFLATE SUB" (28).

F) REMOVE SHEARED PINS. REMOVE "DEFLATE SLEEVE" (25). REPLACE "O-RINGS" (4) IN BORE OF BODY AND DEFLATE SUB. REMOVE SHEARED PINS FROM DEFLATE SLEEVE.

G) REMOVE "INFLATION CHECK VALVE PARTS" AND INSPECT RUBBER NOSE ON "POPPET" (14).

H) IF NECESSARY TO DISMANTLE UNLOCKING MECHANISM, BREAK JOINT BETWEEN "Z-LOCK SUB" (22) AND "FISHING SUB" (21). REMOVE "SPRING" (24). REMOVE "CAPSCREWS" (5). REMOVE "OVERSHOT BUMPER" (19). REMOVE "LOCK RELEASE STINGER" (20) OUT OF "FISHING SUB" (21). TO DRESS LOCK DOGS, DRIVE OUT PIVOT PINS AND DRESS ALL THREE DOGS TO SAME SHAPE, THEN RE-ASSEMBLE Z-LOCK SUB.

II. ASSEMBLY PROCEDURE.

1. INSTALL "O-RINGS" (4) "SEAL UNITS" (17), AND "SPACER" (18) ONTO BODY. THREAD IN "SETSCREWS" (7) TO BOTTOM IN HOLES IN BODY. INSTALL "O-RING " (2) IN BORE OF "RETAINER SUB" (27) AND "O-RING " (3) ON O.D. LIGHTLY OIL SEAL UNITS, O-RINGS AND THREADS.

2. VISE ON "BODY" (26) AT RELIEF NEXT TO SIDEWALL POCKET FOR CHECK VALVE.

3. ASSEMBLE LOWER END:

A) INSERT "FLOAT VALVE" (15) SEAL END FIRST INTO BODY.

B) THREAD IN "RETAINER SUB" (27). LEAVE HAND TIGHT.

C) INSTALL "SHEAR PLUG" (8) AND "SHEAR PIN" (10). RETAIN WITH "SETSCREW" (6).

4. ASSEMBLE UPPER END:

A) INSTALL "O-RING" (4) IN BORE OF "BODY" (26).
INSERT "DEFLATE SLEEVE" (25) INTO BORE OF BODY, ROTATE TO LINE UP SHEAR PIN HOLES. INSTALL "SHEAR PINS" (9).

B) INSTALL "O-RING " (4) IN BORE OF "DEFLATE SUB" (28). THREAD DEFLATE SUB ONTO BODY.

C) ASSEMBLE "SEAL UNIT" (17), AND "RETAINER" (23) ON DEFLATE SUB.

D) ASSEMBLE CHECK VALVE PARTS INTO POCKET.

E) SLIDE "LOCK RELEASE STINGER" (20) INTO "FISHING SUB" (21). SLIDE "SPRING" (24) INTO FISHING SUB, THEN THREAD ONTO Z-LOCK SUB.

F) ASSEMBLE "OVERSHOT BUMPER" ONTO LOCK RELEASE STINGER. THREAD IN "CAPSCREWS" (5).

G) PRESSURE TEST BODY ASSEMBLY BEFORE THREADING ON LOCKING ASSEMBLY.

III. TESTING PROCEDURE AND FINAL ASSEMBLY.

1. TESTING LOWER SEAL UNIT AND BACK PRESSURE CHECK VALVE.

A) REMOVE "RETAINER SUB" (27).

B) THREAD "SAMPLER SEAL" ONTO BOTTOM END.

C) CONNECT TO END FITTING. PRESSURE TO 3000 PSI. CHECK FOR LEAKS. BLEED PRESSURE, AND DISCONNECT HOSE. REMOVE TESTER.

2. TESTING INTERNAL SEALS:

A) THREAD "GO-DEVIL SEAL TESTER" ONTO TOP END.

B) THREAD RETAINER SUB ASSEMBLY INTO BOTTOM END. THREAD PLUG CATCHER ONTO RETAINER SUB.

C) CONNECT TO O.D. FITTING WITH A MANIFOLD WHICH INCLUDES A PRESSURE GAGE AND NEEDLE VALVE.

D) CONNECT PRESSURE HOSE TO END FITTING. START PUMPING WITH NEEDLE VALVE OPEN. WHEN AIR IS PURGED, CLOSE NEEDLE VALVE. PRESSURE TO 1500 PSI. CHECK FOR LEAKS. INCREASE PRESSURE TO TEST SHEAR PLUG. PIN SHOULD SHEAR AT APP'X 1800 PSI.

3. TESTING UPPER SEAL UNITS, CHECK VALVE AND DEFLATE VALVE.

A) CONNECT HOSE TO NEEDLE VALVE.

B) PRESSURE TO 3000 PSI. CHECK FOR LEAKS. BLEED PRESSURE.

4. FINAL ASSEMBLY:

A) REMOVE SEAL UNIT TESTER.

B) THREAD ON LOCKING ASSEMBLY. TIGHTEN.

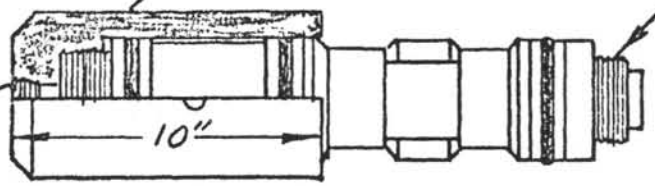
C) REMOVE "PLUG CATCHER" LOOSEN "SETSCREW" (6) AND REMOVE SHEARED PIN. REPLACE WITH NEW SHEAR PIN. TIGHTEN SETSCREW TO RETAIN SHEAR PIN.

D) THREAD ON "CORE BARREL ADAPTER" (16).

15-02855-18 "SAMPLER SEAL TESTER"

GO-DEVIL BODY (PARTIAL ASSEMBLY, SEC. II)

CONNECT TO PUMP

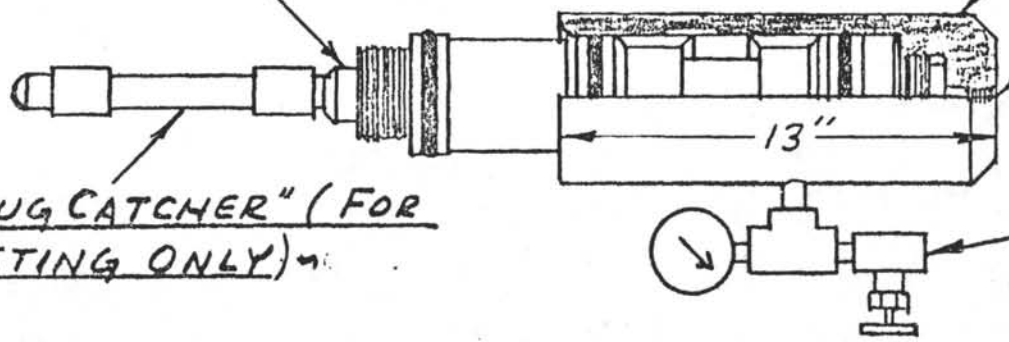


SET-UP FOR TESTING LOWER SEAL UNIT AND BACK PRESSURE CHECK VALVE

"RETAINER SUB" 15-02853-09

15-02855-10" GO-DEVIL SEAL TESTER

CONNECT TO PUMP FOR TESTING INTERNAL SEALS



PLUG CATCHER" (FOR TESTING ONLY)

CONNECT TO PUMP FOR TESTING SEAL UNITS, CHECK VALVE, AND DEFLATE SLEEVE

SET-UP FOR TESTING INTERNAL SEALS, SEAL UNITS, AND INFLATION CHECK VALVE

C-6

GO-DEVIL TESTING DETAIL

ITEM	PROJ.DWG. NO.	DESCRIPTION	QUANT.
1	WW-B012-H40	O-RING ON C.V. PLUG	1
2	WW-B120-H40	O-RING - SHEAR PLUG SEAL	1
3	WW-B327-H40	O-RING - RETAINER SUB SEAL	1
4	WW-B329-H40	O-RING - DEFLATE SEAL	2
5	WW-G118-080	1/4-NC X 1/4 SS CAPSCREW	4
6	WW-G506-080	#6-32NC X 5/16 SETSCREW	1
7	WW-G71H-0H0	1/2-NC X 1/2 DP SETSCREW	6
8	04-00048-00	SOLID SHEAR PLUG - 1.000	1
9	04-00463-14	.593 LG SHEAR PIN - .156 O.D.	4
10	04-00471-13	1.437 LG SHEAR PIN-.140 O.D.	1
11	04-09514-00	GUIDE PIN - ECP CHECK VALVE	1
12	04-09515-00	CHECK VALVE PLUG	1
13	04-09518-00	SPRING - ECP CHECK VALVE	1
14	04-09519-00	CHECK VALVE POPPET - ECP	1
15	480-13-1422	MOD F DP FLOAT VLVE-1F/2R	1
16	15-02853-12	CORE BARREL ADPTR F/GO-DEVIL	1
17	15-02852-14	SEAL UNIT-3.88 X 3.06	3
18	15-02852-16	SPACER-F/3.88 SEAL UNIT	1
19	15-02853-01	OVERSHOT BUMPER	1
20	15-02853-02	LOCK RELEASE STINGER	1
21	15-02853-03	FISHING SUB F/GO-DEVIL	1
22	15-02853-04	4.5 Z-LOCK SUB - MODIFIED	1
23	15-02853-05	SEAL UNIT RETAINER	1
24	15-02853-06	SPRING-F/SAFETY GO-DEVIL	1
25	15-02853-07	DEFLATE SLEEVE - 3.75	1
26	15-02853-08	BODY - 3.75 SAFETY GO-DEVIL	1
27	15-02853-09	RETAINER SUB	1
28	15-02853-10	DEFLATE SUB - 3.75	1

3.75 SAFETY GO-DEVIL ASSEMBLY

HOUSTON TEXAS

LYNES

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15-02853-00

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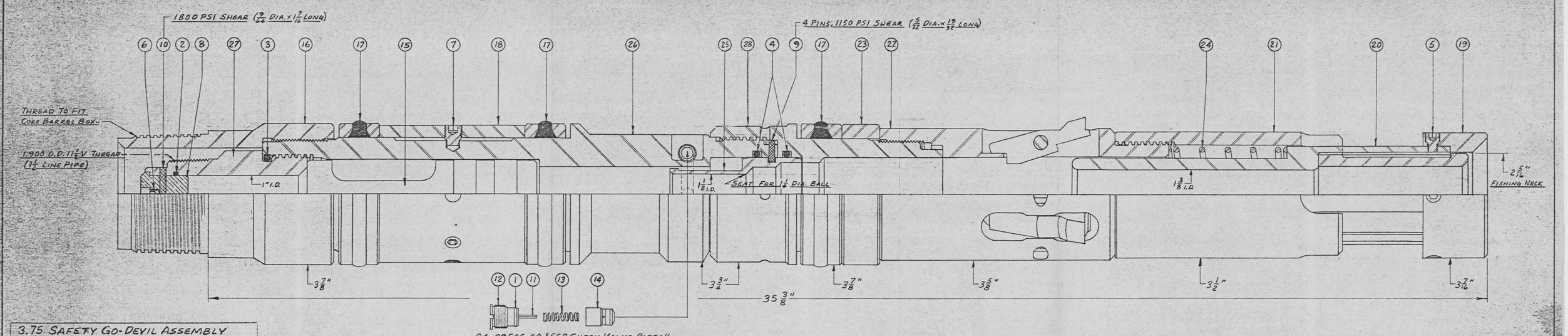

3.75 SAFETY GO-DEVIL ASSEMBLY

HOUSTON TEXAS
LYNES INC.

15-02853-00

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DATE 8-23-73 | DATE

C-8

15-02854-00 "CIRCULATING SUB ASSEMBLY"
&
15-02854-01 "GO-DEVIL FOR CIRCULATING SUB 'ASSEMBLY"

I DESIGN AND OPERATION OF CIRCULATING SUB

1. DESIGN AND DIMENSIONAL DATA:

A) O.D. OF THE CIRCULATING SUB IS 8.375 INCHES.

B) THE CIRCULATING SUB HAS NC-61 CONNECTIONS, BOX UP AND PIN DOWN.

C) I.D. OF THE CIRCULATING SUB HAS A 3.875 INCH SEAL BORE FOR GO-DEVIL.

D) THE CIRCULATING SUB IS 28-1/2 INCHES LONG, NOT INCLUDING THREAD PIN.

E) WEIGHT OF THE CIRCULATING SUB IS 315 LBS. (CALC. WT.)

F) TORSIONAL, TENSIONAL AND COMPRESSIVE STRENGTH OF THE CIRCULATING SUB IS THE SAME AS FOR THE "PACKER BODY ASSEMBLY".

G) THE GO-DEVIL IS 18-1/4 INCHES LONG, WITH A 2-5/16 FISHING NECK. IT IS 3-3/4 O.D. EXCEPT FOR SEAL UNIT AND PROTECTIVE HUBS, WHICH ARE 3.870 INCHES X 3-1/4 INCHES LONG.

H) WEIGHT OF THE GO-DEVIL IS 50 LBS. (CALC. WT.)

2. OPERATION OF CIRCULATING SUB:

A) THE "CIRCULATING SUB" IS TO BE RUN IMMEDIATELY ABOVE "THE PACKER BODY ASSEMBLY". THE "SAFETY GO-DEVIL" MUST BE SEATED IN THE "PACKER BODY ASSEMBLY" BECAUSE THE TOP END OF THE "SAFETY GO-DEVIL" IS THE LOCATING STOP FOR THE "GO-DEVIL FOR CIRCULATING SUB".

B) WHEN THE "GO-DEVIL FOR CIRCULATING SUB" HAS SEATED, DRILL PIPE PRESSURE IS APPLIED TO THE AREA (10 SQ. IN.) OF THE FACE OF THE "SLEEVE". THE "SPRING" IS PRE-LOADED TO GIVE 50 PSI BACK PRESSURE. AS DRILL PIPE PRESSURE IS INCREASED, IT WORKS AGAINST SPRING LOAD TO OPEN PORTS FOR CIRCULATING.

C) THE "CIRCULATING SUB" CLOSES AS DRILL PIPE PRESSURE IS DECREASED. THE "GO-DEVIL" IS RETRIEVED BY AN OVERSHOT ON WIRE LINE.

3. INSPECTING AND DRESSING AFTER JOB.

1) WASH CIRCULATING SUB AND GO-DEVIL WITH FRESH WATER.

2) PRESSURE TEST AS IN SEC. III. IF CIRCULATING SUB CHECKS OUT O.K., IT IS NOT NECESSARY TO DISMANTLE TOOL. IF NOT O.K., CONTINUE AS FOLLOWS:

3) BREAK JOINT BETWEEN "PORT BODY" (3) AND "HOUSING" (4). REMOVE HOUSING.

4) REMOVE "SPRING" (7), AND SLEEVE ASSEMBLY.

5) REMOVE "SEAL UNIT RETAINER" (6) AND "SEAL UNIT" (8).

6) INSPECT ALL O-RINGS, SPRING AND SEAL UNIT.

7) REMOVE "GUIDE RING" (10) FROM GO-DEVIL. INSPECT "SEAL UNIT" (11).

II ASSEMBLY PROCEDURE:

1) INSTALL O-RINGS ON ALL PARTS. LIGHTLY OIL O-RINGS AND THREADS.

2) ASSEMBLE "SEAL UNIT" (8) ONTO "RETAINER" (6) AND THREAD RETAINER INTO "SLEEVE" (5). TIGHTEN.

3) OIL SEAL UNIT ON SLEEVE ASSEMBLY, AND INSERT INTO "PORT BODY" (3).

4) SLIDE "SPRING" (7) ON OVER SLEEVE ASSEMBLY.

5) START "HOUSING" (4) ON OVER SPRING, AND THREAD ONTO PORT BODY. TORQUE TO 22,000 FT. LBS.

6) INSTALL "SEAL UNIT" (11) ONTO "GO-DEVIL FISHING BODY" (9). THREAD ON "GUIDE RING" (10). TIGHTEN.

III TESTING PROCEDURE:

1. TESTING O-RING SEAL AND SEAL UNIT ON SLEEVE ASSEMBLY.

A) THREAD 15-02855-06 "TEST CAP ASSEMBLY ONTO PIN END. PLUG 1/4 NPT HOLE IN CAP.

B) THREAD 15-02855-02 "TEST PLUG" INTO BOX END. PLUG 2-7/8 HOLE.

C) CONNECT PRESSURE HOSE TO 1/4 NPT HOLE IN "TEST PLUG". PRESSURE TO 3000 PSI. BLEED PRESSURE.

D) REMOVE 1/4 NPT PLUG FROM TEST CAP. REMOVE TEST PLUG.

2. TESTING OPENING OF SLEEVE.

A) INSERT "GO-DEVIL". THREAD TEST PLUG INTO BOX END.

B) PRESSURE UP SLOWLY. SLEEVE SHOULD START TO OPEN AT APPROXIMATELY 50 PSI, AND SEAL SHOULD BE OPEN AT APPROXIMATELY 60 PSI.

C) BLEED PRESSURE. REMOVE 2-7/8 PLUG AND PRESSURE HOSE.

3. TESTING SLEEVE WITH PRESSURE SURGE.

A) CONNECT NEEDLE VALVE TO 1/4 NPT HOLE IN TEST PLUG. CONNECT 2-7/8 HOLE TO HOSE FROM ACCUMULATOR (OR HIGH VOLUME PUMP - SEE "D"). CLOSE NEEDLE VALVE.

B) CHARGE ACCUMULATOR WITH AIR PRESSURE (APP'X 100 PSI), THEN PRESSURE TO 500 PSI. OPEN ACCUMULATOR VALVE.

C) WHEN ACCUMULATOR IS NEARLY DISCHARGED, CIRCULATING SUB WILL CLOSE.

D) IF HIGH VOLUME PUMP IS USED INSTEAD OF ACCUMULATOR, START PUMP. VALVE WILL OPEN AS PRESSURE STARTS TO BUILD UP, AND REMAIN OPEN UNTIL PUMP IS STOPPED. VALVE CLOSES AS PRESSURE DROPS.

E) OPEN NEEDLE VALVE. REMOVE HOSE FROM 2-7/8 HOLE.

4. FINAL INSPECTION AND TEST.

A) LOOK INTO PORT HOLE. SLEEVE SHOULD BE FULLY CLOSED. (EDGE OF METAL BACK-UP FOR SEAL UNIT BARELY EXPOSED AS SHOWN ON ASSEMBLY).

B) PLUG 2-7/8 HOLE IN TEST PLUG.

C) CONNECT PRESSURE HOSE TO 1/4 NPT HOLE IN TEST CAP (BOTTOM END). START PUMPING TO UNSEAT GO-DEVIL.

D) WHEN FLUID FLOWS OUT NEEDLE VALVE IN TEST PLUG, CLOSE NEEDLE VALVE.

E) PRESSURE TEST TO 3000 PSI. BLEED OFF PRESSURE.

F) REMOVE TEST CAP, TEST PLUG AND GO-DEVIL.

"PARTS FOR CIRCULATING SUB ASSEMBLY"

ITEM	COMMODITY NO.	DESCRIPTION	QUANT.
1	WW-B244-H40	O-RING - 90 DURO	1
2	WW-B427-H40	O-RING - 90 DURO	2
3	15-02854-02	CIRCULATING SUB PORT BODY	1
4	15-02854-03	CIRCULATING SUB HOUSING	1
5	15-02854-04	CIRCULATING SUB SLEEVE	1
6	15-02854-05	SEAL UNIT RETAINER - 5.25	1
7	15-02854-06	CIRCULATING SUB SPRING	1
8	15-02854-08	SEAL UNIT - 5.25 X 4.75	1
"PARTS FOR GO-DEVIL"			
9	15-02854-09	GO-DEVIL FISHING BODY	1
10	15-02854-10	GO-DEVIL GUIDE RING	1
11	15-02852-14	SEAL UNIT - 3.88 X 3.06	1

CIRCULATING SUB ASSEMBLY ---------- GO-DEVIL FOR CIRCULATING SUB ASSEMBLY

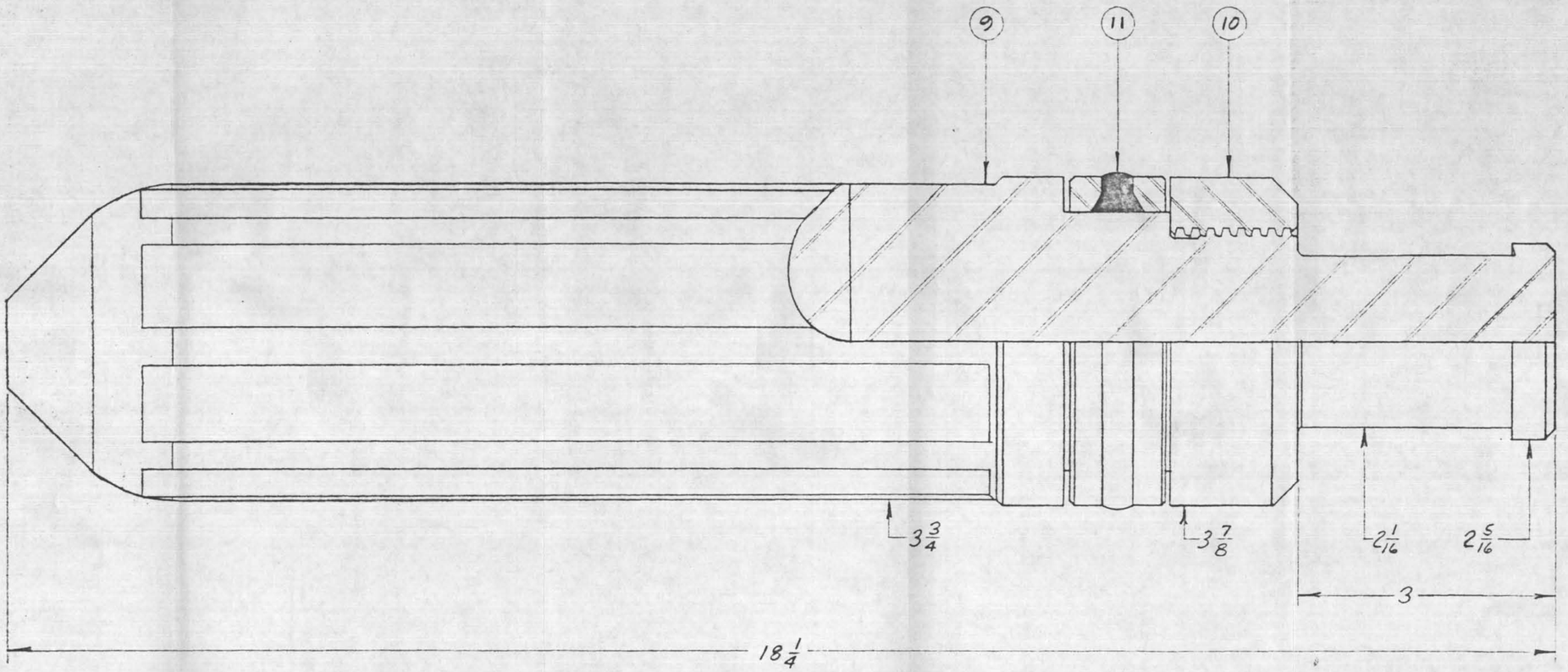
HOUSTON LYNES TEXAS

D - 4

15-02854-00
15-02854-01

DRAWN BY: PAR

CHECKED BY



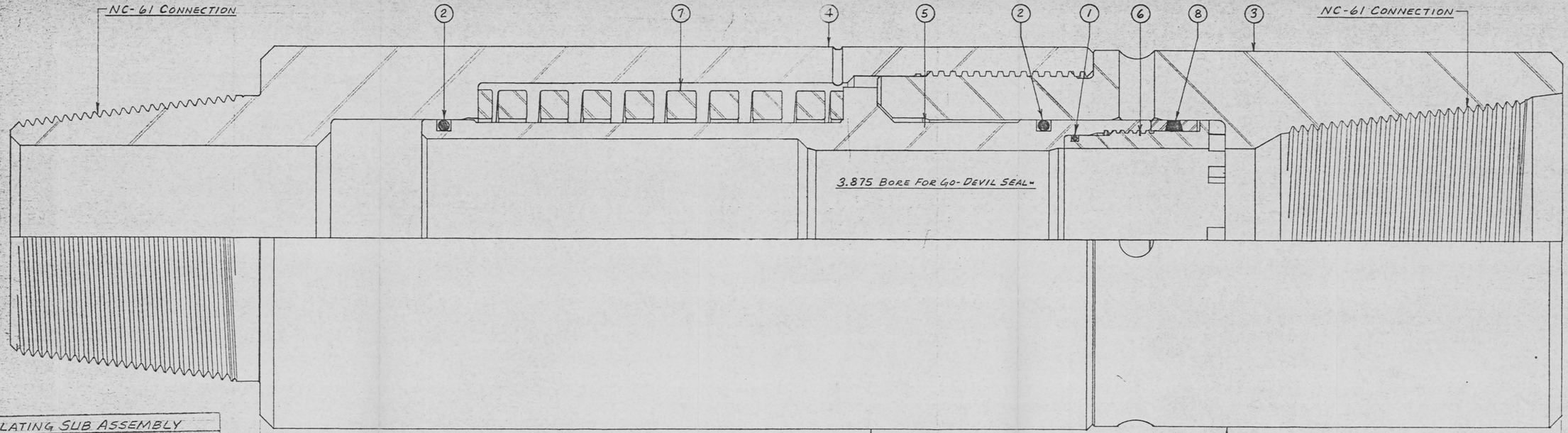
GO-DEVIL FOR CIRCULATING SUB

HOUSTON TEXAS LYNES INC.

15-02854-01

DRAWN BY [illegible] | CHECKED BY

DATE 9-6-73 | DATE



CIRCULATING SUB ASSEMBLY

HOUSTON TEXAS LYNES INC.

15-02854-00

DRAWN BY ??? | CHECKED BY

DATE 9-6-73 | DATE