Project Memo

Operator:	Devon Energy	**Job Number:**	2013-119
Well Name:	Lava Tube #27 State 1H		
Date:	April 11, 2013		
To:	Mark Williamson / Geoff Roberts	**From**	Dicky Robichaux
CC:	Larry Nixon/ David Moody/ Dan Eby / Fred Ng / Kerry Girlinghouse		
Subject:	Snubbing/Fishing and Well Kill Operations for Lava Tube #27		

PROJECT MEMO # 7

Background

While drilling 8¾" pilot hole; a kick was taken at 12,650' with 9.2 ppg brine, strong flow was observed at surface. WWCI was dispatched and observed 2,550 psi on the casing upon arrival on location. The surface casing in this well is 9⅝" 40 ppf J-55 set at 4,110'. A Formation Integrity Test (FIT) was performed with 8.6 ppg fluid giving a 9.2 ppg equivalent (129 psi surface pressure). As of March 30, lubricate and Bleed operations have been performed in an attempt to reduce surface casing pressure from 2,550 psi. Current casing pressure is 500 psi and has held steady for over 18+ hours. Noise / Temperature log and stuck pipe log have been run and identified a possible loss zone at 6,600' and 7,040'. Surface casing pressures have been kept below 2,750 psi, 70% burst of casing.

Additional logs have been ran that indicate the flow is from bottom to top based on the temperature logs, also we note an additional location for a thief zone where the temperature spikes at 7,040'. The sonic stuck pipe log has indicated there is a possible bridge located between 5,694' to 5,712'.

April 3, 2013: The drill string was opened to the pump truck to apply pressure on the string before severing the drill string at 11214 feet. Once the low torque valve was opened, a pressure of 715 psi was observed on the pump trucks pressure gauges. Discussions of why and how the pressure was discussed.

April 4, 2013: While waiting on the equipment to arrive, the string parted at a currently unknown depth. A sling shot affect lifted the drillpipe about 4 to 5 feet up, the slips kicked out and the drillpipe fell into the well. The pump line that had been installed sheared off. The low torque valve was in the open position for monitoring purpose was pulled into the rotating head and lodged. During this event the low torque valve closed, isolating the drillpipe pressure.

April 8, 2013 a set of Tandem large bore shear bonnets were installed on the rigs blind rams with DS shear rams, the drill pipe was sheared 5′ 1″ below tool joint. It appears the pipe was sheared in natural and did not drop. Additional blind rams were installed in the upper pipe rams giving a duel barrier for snubbing operations.

Objective

The objective of this Project Memo is to provide the on-site team a forward plan to safely bring the well under control. The Scan Texas Rig is to be rigged down and moved off of location. A 460-K ISS snubbing unit will be mobilized and rigged up in the configuration identified in this project memo. It is deemed important to maintain the surface pressure below ≤ 500 psi by the lube and bleed method. This aspect is deemed important to not change the current well dynamics which could change the current state of the well relative to an uncontrolled flow situation with the drillpipe.

The high pressure Baker Hughes pump will be moved to a safe location and be re-installed on to the annulus with one 500 bbl frac tank to hold brine water for the lube and bleed operation. A second tie in for the lube and bleed operation has been installed into the 9-$^{5}/_{8}$″ casing annulus. This line will have a tee installed with redundant isolation low torque valves on each side, one line will run to the high pressure pump and the second to be installed to the choke manifold. This will allow the well to be monitored and pressure maintenance to continue when the lower pipe rams are closed.

The lube and bleed procedure will be applied throughout the snubbing operation at night. The Snubbing operation will be carried out during day light operation only or until the well has been killed. A separate Plug and Abandonment procedure will be required from Devon Energy to complete this project memo. This Project Memo #7 will be enhanced during the mobilization and rig up process and as the project progress with recoveries of the fish to kill and or P&A depth. Additional layout and BHA drawings will be up-dated with in this document pending site survey and vendor meetings on the Lave Tube #27 well location.

The Lava Tube #27 procedures begin on page 19 under General Overview of the Lave Tube #27 Well. Pricing of the estimated day rates will be provided to Devon Energy in an additional document as soon as all cost have been identified and confirmed.

The below snubbing information has been provided to support the upcoming Devon operation on the Lava Tube #27 well. It is also included to offer definitions and understanding of typical snubbing equipment and issues encountered during snubbing operation carried out worldwide.

DEFINITION OF SNUBBING TERMS

- Snubbing is a process of tripping pipe into and out of a well with surface pressure.
- When the surface pressure and tubing / work string are such that, if unrestrained, the pipe would be ejected from the well, moving the pipe is called "snubbing".
- When the surface pressure and work string combination are such that, if unrestrained, the pipe would fall into the well is called heavy, Both snubbing and stripping may be done using a snubbing unit. The general terminology used in the field is that when snubbing, the pipe is in the "light" condition and when tripping the pipe is in the "heavy" condition.
- SNUBBING - the process of running or pulling pipe where the well pressure acting on the cross sectional area of the pipe is greater than the weight of the pipe. In other words, the well pressure is attempting to push the pipe out of the well.
- STRIPPING –refers to the process of moving tubulars or BHA's (Bottom Hole
- Assemblies) into or out live wells using BOP's for ram to ram, annular stripping or stripping rubber depending on used method.
- LIGHT PIPE - describes the condition of the pipe when the well pressure acting on the cross sectional area of the pipe exceeds its weight. Light pipe must be 'snubbed. Light pipe tries to be pushed out of the hole.
- HEAVY PIPE - describes the condition of the pipe when the pipe weight exceeds the forces created by the well pressure acting on the cross sectional area of the pipe. Conventional rigs can strip heavy pipe into or out of a live well through a stripping rubber, annular BOP or stripper rubber.
- BALANCE POINT - that point when light pipe becomes heavy or vice versa. In other words, when the weight of the pipe equals the forces created by the well pressure acting on the cross sectional area of the pipe. Also known as the 'breakover' point or 'snub'' point.
- STRIPPERS - normally refers to the blow out preventers used to lubricate tubing connections through the BOP stack. The inner seals of these BOP's have usually been modified to accept stripper or wear inserts.
- SAFETIES - refers to those BOP's that are used to seal around the pipe while the stripper inserts are being changed. There must be a separate safety for each pipe size to be run or pulled. Variable bore rams are common used to seal around various pipe sizes.
- JACK - the hydraulic cylinders used to provide the force to pull or push the pipe.

- STATIONARIES - the lower set of slip bowls attached to the BOP stack that holds the pipe while the other slip bowls are open. The stationeries include a slip bowl for "light pipe" and a slip bowl for "heavy pipe".
- TRAVELERS - the upper slip bowls attached to the cylinder or jack rods. Most hydraulic workover units contain one traveller that can be rotated for light or heavy pipe.
- WINDOW - an open two, three or four legged structures used for mounting annular preventers, strippers, or slip bowls. (slip window). Or an access guide for larger OD. BHA. Not passing jack system above.
- LUBRICATE - to run tools (packers, sleeves, etc.) into or pull tools out of a pressurized well bore while maintaining a seal.

HYDRAULIC SNUBBING UNIT

- The most widely used snubbing unit is the hydraulic unit. In some areas such units are termed hydraulic workover units. Hydraulic pressures act on cylinders to produce a force which is transmitted to the work string. The snubbing unit performs the operation of pushing pipe into or pulling pipe from a pressurized well. Travelling slips are located on the travelling assembly and move vertically as cylinders are retracted or extended. They grip the pipe and transmit the lifting or snubbing force from jack to pipe.

OPERATING PRINCIPLES

- All snubbing units must have a minimum of one set stationary slips for pipe heavy and pipe light conditions, one travelling slip bowl and sufficient BOP's to allow for annulus control while lubricating tools and tubular goods into or out of the well.
- In the case of the Hydraulic Rig Assist Unit, the force to inject or "snub" the tubing is supplied by the travelling snubbing slips which are attached to the travelling slip plate. This plate is attached to two hydraulic cylinders which are driven by the remote hydraulic power pack. The slips and hydraulic cylinders are operated from a control console manned by a snubbing specialist.
- The slip and hydraulic cylinder sequence used to snub in would be:
- Close uppermost BOP and pull pipe in stationary inverted slips.
- Pressure test all BOP'S.
- With only top BOP closed and pressure in BOP stack, open blind rams
- (equalize pressure across blind ram using equalizing loop).
- Open travelling snubbing slips and raise them to the top of the stroke by
- extending the hydraulic cylinders.

- Close travelling slips.
- Open stationary slips.
- Snub tubing in by lowering the travelling slips to the bottom of the stroke
- (retracting hydraulic cylinders).
- Close stationary snubbing slips.
- Return to step #4 and repeat.
- The BOP stack is used to seal well pressure between the casing and the pipe being run or pulled. It consists of two or more BOP's, two hydraulically actuated valves, an equalizing loop and bleed off line, and a control console manned by a snubbing specialist. On Rig assist below the snubbing BOP stack there must also be the normal service rig BOP stack which has a blind ram, a pipe safety ram and usually, an annular BOP on top of BOP stack. Depending upon the shut-in surface pressures, the tubing will be stripped through the BOP stack in three ways. The first method is used on sweet wells whose shut-in pressures are less than 1500 psi (10,300 kPa) and involves stripping through a modified annular BOP. The modification in question is the installation of a five gallon hydraulic accumulator (stripping bottle) in the closing circuit of the BOP. This allows the element to flex as the tubing connection is stripped into the BOP stack. The second method or stripper rubber, if HWO unit is equipped with such. The third method is employed when higher pressures (in excess of 1500 psi/10,300 kPa) or sour well conditions make safety considerations a higher priority. This method is called stripping through the rams and involves a series of operational steps which will allow tubing connections to enter the well with one "stripper" pipe ram closed at all times. The equipment involved consists of an upper and lower stripper ram with an equalize/bleed-off spool in between. The steps necessary to "stage in" a tubing connection would be as follows:
- The lower BOP is closed with full well bore pressure below and zero pressure above the ram blocks.
- The tubing connection is lowered into the BOP stack to the point where it is in the equalize/bleed-off spool (between the rams).
- The upper ram is closed and the pressure between the rams is equalized to full well bore pressure.
- The lower ram is opened and the tubing connection is lowered into the well.
- The lower ram is closed and the pressure between the rams is bled off.
- The upper ram is opened and the sequence is repeated.

- NOTE: This same procedure is employed when lubricating tools (packers, etc.) or the tubing hanger (dog-nut) into or out of the well. With longer tools, it may be necessary to include a spool in the initial rig-up. Any variations of BOP stack arrangement which may be necessary should be conducted in consultation with the snubbing specialists on location and the management of the snubbing contractor.

WELL CONTROL

- Proposed well control (BOP's) set-up is illustrated in attachments to this Project Memo.
- Equipment: The primary well control equipment will comprise of the below:
- Two stripper BOP's (annular and two ram type)
- Equalizing loop
- Bleed off line
- Secondary deployment system (Pipe and shear BOP's) below stripper BOP's will be designed for job specific specifications but will be in line with the proposed BOP set up for this specific type of snubbing operations.
- Standard well control equipment. Designed for emergency well control as per Devon and snubbing service provider requirements.
- Additional special requirements for snubbing that should be evaluated are number and size of choke and kill lines.
- Available fluid in accumulators shall be 150% of required total volume to close, open, and close all BOP's rigged up. Dual Barrier Concept: well control in snubbing shall be maintained using the concept of two tested barriers. These barriers consist of (1) the snubbing BOP's and (2) the service rig BOP's or “safeties”. Inside well control is provided by back pressure valves or wireline plugs set in the tubing or work string. Two BPV's or wireline plugs should be installed in the tubing or work string. Further protection can be provided by filling the tubing with water. However, snubbing operators prefer to pull the pipe dry. The major barriers for standard “snubbing” ea. plain pipe will consist off;
- Number of barriers. For all operations the work string will be provided with two barriers, two additional wireline profiles will be part of the BHA in case the work string will be operated with two dual flapper valves as main barriers.
- Type of barrier. Wireline plugs will be the preferred type of barrier, retrievable bridge plugs will be available as contingency.
- Back pressure valves, for all other operations as “snubbing” plain tubing flapper type back pressure valves will be used as barrier.

- Testing the barriers. Back pressure type of valves will be tested from below while running in, both valves can be tested. Wireline plugs can be tested from two sides from the lower- and from above for the upper plug.
- Stabbing Valve - before work starts the stabbing valve shall be serviced, drifted to allow access for planned wireline tools and plugs, pressure tested to MWP.
- During running and pulling a stabbing valve must be available in basket at all times. Also the valve handle shall be on the work floor at all times and routine checks made that the valve functions smoothly. It is recommended that a backup valve be on location.
- The use of a stabbing valve during running in and pulling out. For snubbing operations during "overpull conditions" the pipe will be run with a stabbing valve installed in the open position, on the upper side of the stabbing valve a needle valve will be installed in the open position. This will guarantee two barriers in place during all phases of moving the work string. Only during making up or breaking out the work string will be open from the inside, at this moment the work string will be stationary. BOP hook-up. The BOP hook-up will be according to a WWCI proposed set up, BOP hook up can be divided in three main parts.
- Stripping BOP's. BOP's are required for the normal plain pipe stripping process.
- Fish and/or deployment BOP's. This part of BOP stack is installed specifically for the deployment or extraction of the production completion equipment or Fishing operations.
- Safety BOP's. This part of the BOP stack is installed in the BOP stack hook-up for specific well control in case failure on any BOP component above.
- During running operations of plain pipe the string will not be filled up regularly. Only in case of job specific applications the work string will be liquid filled constantly. For the handling of the BHA the standard procedure has to be adapted to allow handling of the BHA components, barriers in the work string will be replaced by barriers in the BHA assembly in case needed.
- Pulling on stuck pipe. For pulling stuck pipe special procedures will be followed. Internal string protection should be safeguarded at all times. Pipe failure during pulling on stuck pipe can in case of a string failure jeopardize the internal string safety. When pulling on stuck pipe an additional barrier will be installed on top of the work string in the workbasket of the unit, very often this will be accomplished by installing a kelly cock or TIW on top of the pipe.

- Prevention of hydrates. Hydrate prevention will be carried out according to requirements. If well head pressure cannot be dropped the attached steps in this document should be considered.
- Emergency well killing procedure. Emergency well killing procedures will be for job specific conditions special adaptations will be made and will be identified during the job specific procedures Hook up of well kill facilities. During operations the well kill facilities will be hooked up permanently, fluid with the appropriate weight to kill the well if possible will be at site during the entire operation. If well kill operations is not possible well kill hook up is such that well pressure is reduced to the bare minimum.

COMPLETION AND WORK STRING (DRILLPIPE)

- Buckling resistance of pipe (unsupported) should be checked from top travelling slips down to lower stripper ram. Tubing/work string external surface should be smooth and clean, to ensure positive seal and economic pack off life of stripping BOP. Excessive scale can hamper proper operation of the slips. Thread connection for work string. The work string will consist of pipe equipped with premium type of thread connections, for this operation. In case of working under pressure in gas wells a gastight connection is required. For this specific operation a 5", 19.5# ppf, S-135 is preferred.

DAYLIGHT OPERATIONS

- Generally snubbing operations are executed as daylight operations. Full visibility of possible pipe movement when placed in the slips is crucial for executing snubbing operations safely. Only during extended snubbing operations, well conditions and behaviors are known to people involved, night operations can be accepted. Snubbing operations will be limited to daylight hours only.

SNUBBING JACK SYSTEMS

- The snub capacity of the jack should equal or exceed the maximum expected snub force by at least 5%. Note that when snubbing through an annular BOP, the tubing coupling OD and not the tubing OD determines the maximum upward force (snub force). The maximum loads on the wellhead while snubbing shall be determined and checked for acceptability. In case the maximum expected load exceeds the maximum allowable wellhead loading the snubbing unit will be supported by a substructure which will allow the access load to be transmitted away from the wellhead.

SNUBBING JACK SAFETY SYSTEMS

- While pulling on stuck items in the pipe light mode, double traveller slips should be installed. Special consideration to the resultant shock loads shall be made.

- The jack snub force should be set and locked to prevent a snub force in excess of 70% of the work string (tubing) buckling load. Graph of maximum allowable buckling load vs. unsupported pipe length to be provided by service provider.
- The jack force upwards, should be set and locked to prevent force in excess of 80% of pipe yield point. This SF should be reduced if applying torque -and/or pressure simultaneously.
- If the tubing is being pulled from a well with a corrosion history, determine the reduced pipe yield based on wall loss due to corrosion and set jack force upwards at 80% of the reduced yield.
- The annulus pressure shall not exceed differential pressure across tubing in excess of 80% of collapse. Similar comments as above related to reduced collapse due to corrosion.

SNUBBING FORCES

- The vertical forces acting on a snubbing tubing/work string should be analyzed to determine the force necessary to run the tubing/work string into the well.
- Generally there are four forces acting on the string being tension, torque, inside- and outside pressure.
- Gravitational force or weight of the string.
- Frictional force to pass through BOP's.
- Force applied by the snubbing unit.
- Buckling of the unsupported pipe above the BOP's when snubbing must be determined, A buckling failure can result in the work string being ejected from the well and loss of pressure integrity at surface. Pipe guides will be installed to prevent pipe buckling in the snubbing unit.
- To ensure the safety of a snubbing operation, calculations are required to confirm all equipment is suitable for the service to which it will be exposed. These include: Maximum snubbing force required, Depth of neutral point, Critical buckling load of the tubing string for the support conditions provided by the snubbing unit, Collapse of the tubing, Maximum allowed pull under all conditions.

RECOMMEND DESIGN FACTORS FOR SNUBBING:

- Tension = 80% of pipe tensile yield (DF = 1.25)
- Buckling = 70% of critical buckling load (DF = 1.43)
- Collapse = 80% collapse pressure resistance rating (DF = 1.25)

- Burst = 80% burst pressure rating (DF = 1.25)
- For wells with a history of corrosion, the reduced wall thickness shall be estimated and reduced mechanical properties compared to snubbing pressure and load conditions. To prevent buckling caused by unsupported length pipe guides must be installed.

PLANNING

- Safety is a prime concern for snubbing operations especially on sour wells. Meetings will be arranged to fully familiarize all people involved with the snubbing technology and convey the importance of teamwork and communication. The planning phase will comprise:
- Formalizing the workover program
- Discussions with snubbing contractor concerning procedures
- Equipment selection
- Defining restrictions opposed by the location facilities
- Definition of specific safety requirements

SPACING

- Careful consideration is needed when designing assemblies for snubbing operations. In the event that there are odd shaped items to be run or pulled, a spool is placed in the BOP assembly with sufficient length to cover the item. This spool then becomes a lubricator.

SITE SURVEY

- Prior to mobilizing the snubbing equipment to the location a site visit should be performed to allow a proper panning for the spotting of the equipment. Proper spotting of the equipment is needed to allow proper escape routes, loading areas etc on location when all the needed equipment is on site. This is normally worked out jointly between Devon Energy and the contractor(s). The location specific planning should at least include:
- Wellhead and snubbing equipment stack up sketch preferred placement of the Snubbing and BOP equipment on site
- Planned positions for other contractor equipment on site in combination with the already placed Snubbing and BOP equipment
- Diagram of well/kill fluid control piping system
- Equipment layout on location (plan view)

PRE-JOB

- All BOP's will be tested to low and high (working) pressure. In general, test to working pressure of BOP's whenever possible. The pressure integrity and functionality of the blind rams is especially crucial for snubbing. The jack system should be function tested. Set snubbing jack safety systems. It is the responsibility of the snubbing supervisor to ensure the correct adjustment of the safety systems, and that they are set and deployed as required throughout the operation.
- Function test/pressure test all hydraulically operated and manual valves on equalizing loop, bleed off lines, choke- and kill lines. Pressure test all surface lines, valves, etc. to at least 1.5 x maximum anticipated wellhead pressure (rated working pressure recommended). Check condition of snubbing travelling/stationary slips. Install proper pipe guides to prevent buckling.
- Pressure test downhole plugs preferably using water. Check stabbing valve(s) connections, pressure test and ensure all valves do close smoothly.

KILL FLUIDS

- Prior to starting snubbing operations the well must be hooked up to a kill pump and at least 2 hole volumes of kill fluid available on location.

CONTINGENCY PROCEDURES GENERAL

- In the course of snubbing operations, operational failures can be anticipated. This section lists possible events and general procedures for remedial effort. The cases discussed below can differ in an unforeseen manner from a given actual train of events in the field. Some events such as stripper rubber failure and slip die failure can be considered a certainty. Modern snubbing systems utilize known equipment and technology to further reduce the incidence of equipment failure. Snubbing systems possess unique abilities to retain well control in the event of equipment failures due to its ability to inject tubular' s into a pressurized well.
- The field personnel in charge of snubbing operations have the authority to adapt recommended practices to actual field conditions. Qualified and immediate action in failure modes are often required to minimize or eliminate secondary effects or hazardous conditions. The equipment failure procedures outlined, assume that surface pressures are present, or anticipated, thereby complicating the operations. New or unforeseen developments could necessitate some changes in the procedures outlined below. All of the contingent operations call for closing one or more of the BOP'S. As a consequence of the design of the hydraulic BOP operating system, it is recommended to actuate single rams individually and consecutively, to ensure rapid shut off of the well fluids.

EQUIPMENT FAILURE – SURFACE

- Power Pack Failure
- This section addresses total shutdown of the hydraulic power pack. Malfunction of a power pack subsystem, not resulting in a shutdown, should be evaluated on an individual basis. The recommended course of action in case of power pack failure is:
- Position tubing with connection at snubbing basket level. Set snubbing or heavy slips as required. Install stabbing valve.
- Close and lock service rig "safety" pipe rams. Bleed off pressure through hydraulic valves on bleed off line. If step two not possible due to position of tools, close snubbing pipe rams and lock.
- NOTE.: check daily both service rig and snubbing unit accumulators to assure ease of operation during an emergency.

Slip Failure

- During normal snubbing operations slip failure is minimized by regular inspections. This must become a standard operating procedure as the slip systems are considered part of the well control system. Power slips are typically actuated 3 to 4 times per joint of pipe being jacked, and workover fluid or scale caking of slip die inserts can occur quite rapidly in some circumstances. This prevents the slips from getting proper grip on the work string. Stopping and cleaning slip dies regularly is part of a safe snubbing operation. The recommended course of action in the event of slip failure is as follows:
- Immediately close an alternative slip bowl.
- Close stripper pipe ram.
- Install stabbing valve in the open position. Close stabbing valve.
- Repair, clean, or replace slip dies and service the slip bowl as required.
- Test the load supporting ability of the slip bowl by transferring load with snubbing jack (stripper ram remains closed).
- Inspect alternative bowl for slip die condition as "mileage" will usually be similar.
- Resume normal operation.

Stripper Annular Failure

- As elements wear, a failure can be expected which will make it self-present by a low rate of leakage over the closed annular. Element service life will vary with pipe "mileage", elastomer quality, pipe surface condition, well pressures, and workover fluid composition. In some circumstances an annular element leak can result in well pressure fluctuation sufficient to significantly affect string weight. Both the heavy and snub travelling slips must be set until the well pressure stabilizes. The recommended course of action in the event of an annular stripper element failure is as follows:

- Immediately close the stripper pipe ram and close stationary and traveler slips.
- Position work string / drillpipe connection at work basket level.
- Install landing-sub c/w safety joint.
- Close stripper no 2.
- Strip in / snub in till landing sub bottoms out on stripper no 2.
- Close stripper no 1. Equalize pressure, open stripper no 2.
- Strip in / snub in and land string on landing sub with stripper no 2 rams closed and locked.
- Close variable rams of "safety" BOP's.
- Bleed off pressure below stripper rams no 2.
- Back out safety joint.
- Pull back landing joint.
- Rig down equipment above annular.
- Change out leaking stripper annular element
- In all cases ensure that pressure below the stripper annular element is vented and that this space remains vented until maintenance operations are completed. This is generally achieved by leaving the vent line open to atmosphere. Clean annular surrounding before change packing. After removal cover direct entry to hydraulic system.

Leaking Stripper Pipe Ram (Below Stripper Annular)

- In case of stripper pipe ram failing, stripper number 2 should always be actuated first. However, if the stripper pipe ram fails to seal, the following procedures are recommended:
- Immediately close the stripper pipe ram no 2 and the stationary and travelling slips
- Position work string / drillpipe connection at work basket level.
- Close safety and or (VBR) pipe rams.
- Bleed off pressure above safety ram.

- Lock Safety and or (VBR) pipe rams.
- Observe pressure integrity of closed (VBR) pipe rams.
- Repair the leaking stripper ram as required. If wellbore fluids are still leaking after closing (VBR) safety rams and depending on severity and location of leak, variable options include:
- (a) Pump kill weight workover fluid.
- (b) Land string on top of the leaking (VBR) safety rams, cut work string using the shear rams, pull back remainder of work string till above the blind rams, close blind rams.
- (c) Drop string in the hole and close blind rams

Leaking Blind Ram

- In case that after pulling the BHA or retrieved completion section into the BOP stack in order to lubricate out of the well, the blind ram (s) does not seal the following procedures are recommenced;
- Immediately close the stripper pipe ram and close stationary and traveler slips.
- Position work string / drillpipe connection at work basket level.
- Install landing-sub c/w safety joint.
- Close stripper no 2.
- Strip in / snub in till landing sub bottoms out on stripper no 2.
- Close stripper no 1. Equalize pressure, open stripper no 2
- Strip in / snub in and land string on landing sub with (VBR) rams closed and locked.
- Close bottom variable rams of "safety" BOP's.
- Bleed off pressure between (VBR) rams and observe.
- Back out safety joint.
- Pull back landing joint till above leaking blind rams.
- Repair leaking blind rams.
- Test repaired blind ram.
- RIH landing joint and connect safety joint.
- Equalize pressure over closed (VBR) rams.
- Open (VBR) rams

- Continue with normal operations.

EQUIPMENT FAILURE – SUBSURFACE

- Back Pressure, Valves or Down hole Plugs Leaking
- Ball and seat and flapper type back pressure valves (BPV) or wireline plugs are used in the BHA to control the inside pressure of the work string. To maintain the two barrier principle at least two complete BPV or wireline plug assemblies are needed. When BPV's are used, wireline nipples-above should be included in the work string, allowing setting of plugs in the event of BPV failure. In the event of developing uncontrolled well fluid flow-back through the work string, assuming the indicated work string weight is correct (i.e. a parted work string is unlikely), the most probable cause is a failure of these BPV's or plugs. Tubing connection leak would be the next most possible cause of an uncontrolled flow through the tubing. In the event of flow back through the BPV's or wireline plugs the following procedures are recommended:
- Immediately position work string box connection to work basket level and install stabbing valve in the open position, then close stabbing valve.Set slips.Verify string weight. Close stripper rams.
- Rig up wireline lubricator and install wireline plug above leaking BPV's or plugs. Alternatively retrieve leaking BPV's/plugs and replace. Pressure test. If necessary, kill well down annulus. Remark; killing operations are not possible on all wells.

Work String / completion parted

- Subsurface parting of the work string or completion can be caused by a number of factors such as tubing connection leak, defective tubing, subsurface obstruction cutting into the tubular during milling operations, and pull or torque forces in excess of rated work string values the following procedures are recommended:.
- Install and close stabbing valve.
- Set stationary and traveller slips.
- Close stripper rams.
- Rig up wireline and tools to determine work string / drillpipe end and to set a minimum of two bridge plugs in last joint. Pressure test.
- Bleed off tubing, rig down wireline.
- Pull out of hole.
- Fish parted string as required.

- If tubing control cannot be restored by stabbing a valve due to high or irregular flow rates, three options exist:
- Start pumping kill fluid into annulus to kill well.
- Attach stabbing valve to joint of tubing.
- Elevate with the blocks and stab into flowing stub (the length of the joint helps stabilize the valve vertically so that it is easier to stab). Close stabbing valve.
- If this is not possible close Blind Shears.

EQUIPMENT FAILURE - PERSONNEL RELATED

- Errors of judgment are possible. A few possible situations pertaining to workovers are addressed below:
- Accidental Closing of Blind or Undersize Rams
- In some circumstances this action can flatten or split the work string, resulting in string parting and or communication to annulus. All following procedures are recommended:
- Immediately and simultaneously: Close travelling snub and heavy slips, install and close stabbing valve, and close stripper rams.
- Conduct emergency meeting to determine course of action. Decision criteria to include:
- Well pressures - annular/work string
- Ability to wireline through the work string / completion
- Ability to circulate
- Ability to support work string / completion weight
- Lubrication length through BOP stack
- Buckling factors if pipe is light

Secure well

- Before installation of the HWO / snubbing unit, the well has to be secured. The securing of the inside of the tubing string will be accomplished by placing of BPV with in the hanger, if this is not possible two retrievable bridgeplugs inside the tubing near to the bottom of the hanger at +/- 20'. These bridge plugs will be set with slick line. The bridge plugs will be set and tested according the manufactures procedures and by releasing pressure above the deepest set bridge plug. In the case of the Lava Tube #27 well the Duel barriers are the 13 5/8" Blind shears and Blind rams.
- Install snubbing BOP stack.

- With the know wellhead pressure parameters the actual forces on the tubing hanger will be calculated. If these forces exceed the Wellhead specifications the wellhead pressure will be reduced to an acceptable level by pumping brine into the annulus of the well. Make sure no trapped pressure is present in the wellhead area. Check wellhead area on the presence of hydrocarbons. Remove X-Mastree and adaptor flange according manufacturer's instructions. After the removal of this component the hanger nipple neck thread has to be inspected. In the case of the Lava Tube #27 well heavy lifting of the BOP equipment should be discussed.
- Rig up surrounding equipment ie. Test facilities, pump facilities, tanks, piping etc.
- As soon as the BOP stack installation will be finished to such an extent that full well control is guaranteed at all times the surrounding equipment will be hooked up. The spotting and rig up of the surrounding equipment will be according to the provided layout plan and rig up drawing. By doing so all equipment will be placed in the proper safety zones.
- Bleed off and vent lines will go through choke manifold and gas buster or separator.
- All piping will be laid down in an additional piping drawing P&ID to be completed.
- Rig up Snubbing unit, pressure test all equipment.
- After installation of the snubbing Bop stack the snubbing unit will be rigged up. The unit will be supported by a guide wire system. The unit finally will be equipped with a safety escape system allowing the personnel working in the operating basket a safe escape route at all times. Forces on guy wire lines are calculated and the lines must be pre tensioned to pre-calculated values. Guy wire data should be made available on drawing provided by service provider.
- After finalizing the rig up of the unit all hydraulic lines will be connect and the unit can be tested to make sure that no hydraulic leaks will be present during operations.
- Hydraulic pressure on lift and snub forces will be set according to pre-calculated pressures. (HWO job prognoses sheet). This will prevent excessive force on the completion / work string during the operations. As soon as the unit is rigged up and tested the BOP stack will be pressure tested to desired test pressures. Pressure testing will be reduced to a minimum by testing all BOP components to a (low pressure) and (working pressure of the wellhead) in the shop.
- After the rig up pressure test will be repeated were possible but only to maximum wellhead rated pressure. Wellhead, tubing and hanger conditions may dictate test pressure.

- All surface lines (pump, bleed off and vent lines) will be tested to maximum wellhead rating.
- All pressure test with description of tested items will be registered on chart recorders.
- Finally all alarm systems and escape systems will be tested.
- Secure well and rig up procedure.
- Rig up HWO unit.
- Rig up and test gas detection equipment
- Function test all equipment
- Pressure test all pump and flow lines
- Test all alarm systems
- Perform safety drill.

Pressure test procedures.

- A pressure test procedure to be provided by the service provider and attached to this procedure.
- Verified and Observe carefully for visual leakage on all test.
- Tannoy announcements should be made prior to starting and completion of testing operation.
- Observe for possible pressure build up on well bore annuli. Report build up rate.
- All pressure test to consist of a low and high pressure test and recorded on test chart.
- Once all pressure test are completed a Push / Pull test is to be preformed on all slip and recorded on daily report.

General Overview of the Lava Tube #27 Well.

A staged load out of the required equipment will be organized to minimize the amount of equipment on location and maximize efficiencies of the rig up procedure.

- Phased Load Out of Equipment Package
    - Pumps, Choke Manifold & Treating Iron
    - Pressure Control Equipment
    - Snubbing Unit Equipment Package
- Pumps Choke Manifold & Treating Iron Load Out and Rig Up, Hook Up and Commission Fluids Routing
- PC Equipment Load Out and Rig Up, Hook Up
    - Rig NU 13 5/8" X 11" BOP Stack & Test Same
- Snubbing Unit and Associated Equipment Load Out and Rig Up, Hook Up
    - Jack, Basket, Gin pole, etc
    - HPUs & Close Units
- Commission & Function Test Unit and Associated Equipment
- Pressure Test Choke & Pressure Control Package to 250psi low and 5,000psi high.
- ISS Rig Up and Rig Down procedures to be followed

Procedure for Snubbing Equipment Rig Up and Operations

- Check Scaffold is secure and usable on Well Head & 13 5/8" Scan Texas BOP Stack
- NU $13^{5}/_{8}$" BOP dressed with an Inverted Blind Ram (Cavity 6) onto Rigs BOP Stack
- Install scaffolding up to top of Inverted BOP height
- NU $13^{5}/_{8}$" Shear Blind Assembly (Cavity 5)
- Install scaffolding to top of Cavity 5 BOP
- Install Guy Wires and secure same
- NU DSA 13 5/8" X 11" 10m and 11" 10M pipe ram (Cavity 4)
- NU Mud Cross Assembly
- Install scaffolding to top of Mud Cross
- NU 11" Risers as needed to lubricate milling and fishing assembly's

- NU 11" 10m pipe ram (Cavity 3)
- Install scaffolding to top of Cavity 3
- NU 11" Stripping BOP Assembly (Cavity 2 & 1)
- NU Loop, Bleed & Shaffer 11" Annular Install guide wires
- Install scaffolding to top of Annular
- NU Window Adaptor
- RU ISS 460k Slip Window & Basket, to Window Adaptor
- RU ISS 460K Jack c/w Jack Base Basket to Slip Window
- Install Guy Wires to Jack / Basket
- NU Ladders to Work Basket / Jack Base Basket
- NU Ladders Jack Base Basket / Window Basket
- NU Ladder from Window Basket to Stripper 1 Level
- NU Travelling Head & Rotary to Jack
- RU Gin Pole
- RU Tong Pole
- RU Hydraulic Power Tongs to Basket / Tong Pole
- RU C&K lines to mud cross and 11" BOP Access Points
- NU 'Pump In' Line from Stripper 2 to the Circ Manifold on the Ground
- NU Standpipe from Work Basket to the Circ Manifold on the Ground
- Nipple Up Kelly Hose to Stand Pipe in the Work Basket
- Commence Hydraulic Hose Runs from Work Basket /Jack to Ground
- Commence Hydraulic Hose Runs (Extensions) from Ground to HPU
- Commence BOP & HCR Hose Runs from BOPs / HCRs to Ground

Pressure Control Assemblies to be Installed on Lava Tube #27

Assembly 1

Equipment Description	Weight	Height
13 5/8" Inverted BOPs (Cavity 6)	10,500#	41.69"

Assembly 2

Equipment Description	Weight	Height
13 5/8" Shear Blind with Tandem Booster Bonnets(Cavity 5)	10,500#	41.69"

Assembly 3

Equipment Description	Weight	Height
13 5/8" X 11" DSA and 11" Pipe Ram BOP (Cavity 4)	7,000#	36.688"
11" Mud Cross c/w Upper Kill & Choke Valve Assembly	2,500#	26"

Assembly 4

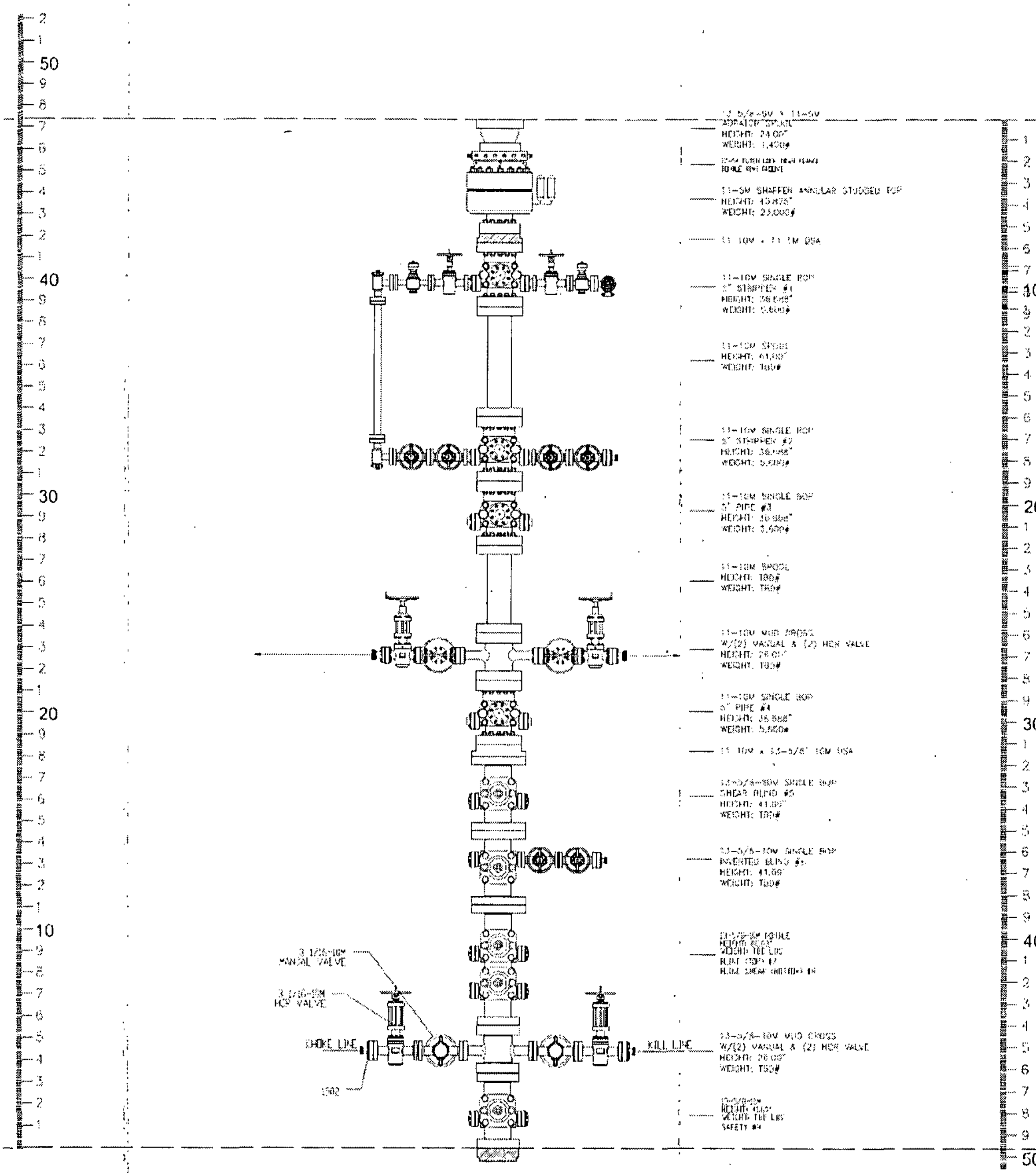
Equipment Description	Weight	Height
11" Riser Spool (?Ft)	?	?
11" Pipe Ram BOP (Cavity 3)	6,400#	36.688"

Assembly 5

Equipment Description	Weight (Lbs)	Height
11"Stripping BOP (Cavity 2)	6,400#	36.688"
Equalize Loop Assembly	1,500#	---
Bleed Line Assembly		---
11" Stripping Spool	750#	5' 1"
11"Stripping BOP (Cavity 2)	6,400#	36.688"
11" Shaffer Annular	23,000#	40.875"

Rig up and Elevations of 13 5/8" X 11" BOP Stack

DEVON ENERGY / ISS RIG 28
LAVA TUBE #27
CARLSBAD, NM
11"-10M SNUBBING BOP STACK



Commissioning of Snubbing Unit & Associated Equipment

- ISS Procedure for Commissioning Snubbing Unit and BOP Closing Units

Pressure Testing BOPs & Associated Equipment

- Pressure test Pump & Choke Package as per procedure (Ref No XXXX)
- Pressure test Snubbing Unit Package as per procedure (Ref No XXXX)
- Close Inverted Blind Ram and Test remainder of BOP Stack to 250 low & 5,000 high

Procedure for Operations- Run 1

- Spot 5" Pipe on pipe racks
- PU BHA, Make up BHA and prepare to RIH
- 8 1/8" Skirted flat bottom Mill
- Dual Flapper style BPV
- 1 jt of 5" S-135 19.5# DP
- Dual Flapper style BPV
- 1 jt of 5" S-135 19.5# DP
- 1 RN Nipple profile
- Trip in hole and tag top of fish
- Confirm all compensator settings prior to drilling out
- Rig Up 2" high pressure Circulating Hose
- Line up circulating system
- Plan to use 9.3 ppg WBM fluid with a 45 visc.
- Make Up TIW (Full Bore)
- Make up 4.50" IF pin x 2" 1502 WECO
- Utilize high pressure King circulating swivel
- Pick up off fish and perform hydraulics modeling test
- Line up to take returns to the choke, MGS and solids control
- Clear non-essential personnel from near well area – identified red zone
- Pending tool joint location close either #1 or #2 stripping ram
- Break circulation. Begin pumping at 2 bpm, fill all surface lines and MGS to full returns
- Increase rate incrementally to 4 bpm
- Record circulating pressures @ 2 bpm, 4 bpm – record pressures at each rate
- Record all weight and pump parameters
- RPM and set down X,XXX lbs on mill (to be determined per Fishing company's recommendation)

- With lower pipe ram closed, estimated 3 ½' of fish above lower pipe ram
- Mill down 18" on fish, POOH
- Lay down BHA

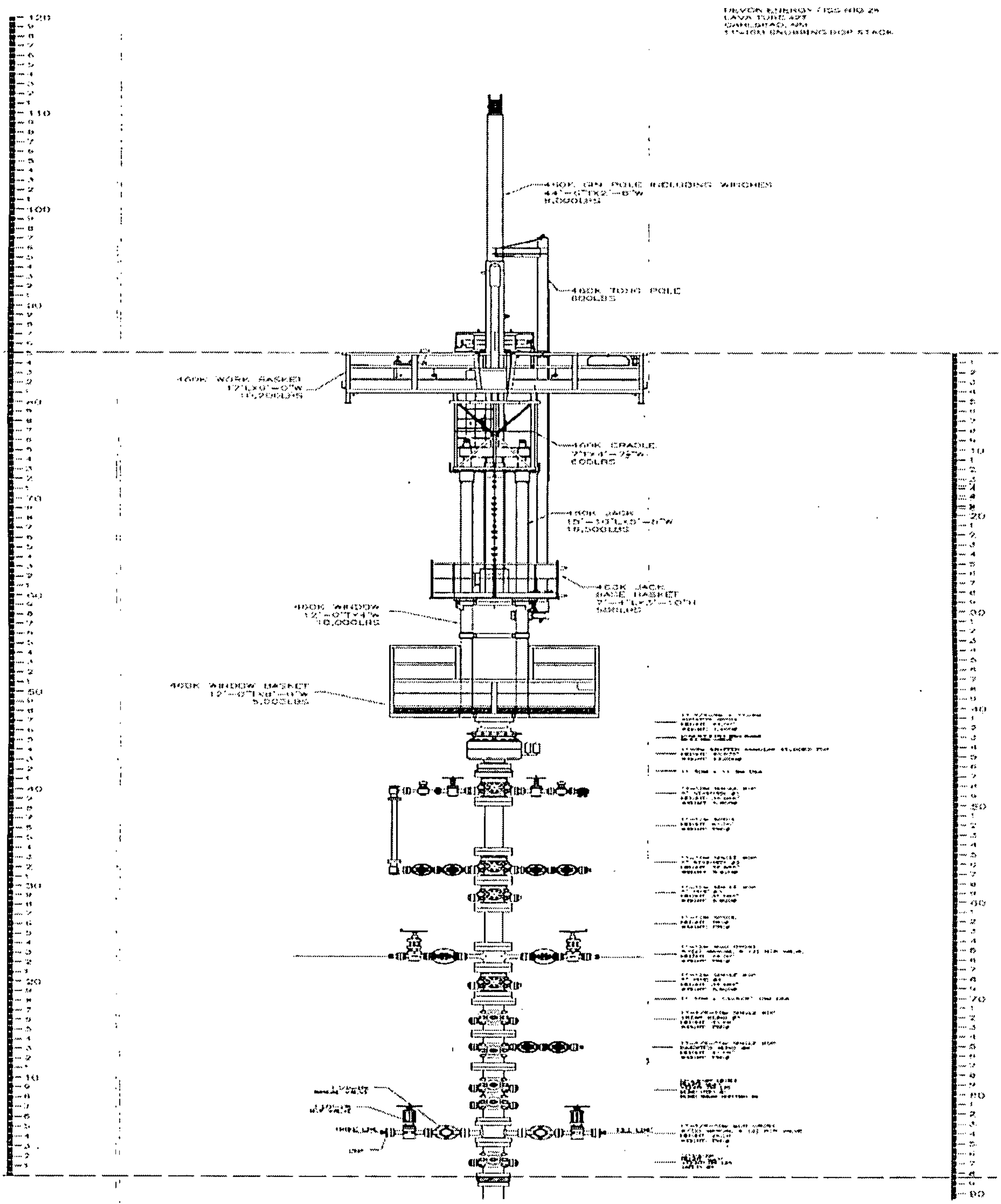
Procedure for Operations- Run 2

- Make up BHA and prepare to RIH.
- Bowen series 150 high pressure pack off over shot with mill control guide
- RN Nipple 2.562, with plugs in place
- 1 jt of 5" S-135 19.5# DP
- R Nipple 2.562, with plugs in place
- 1 jt of 5" S-135 19.5# DP
- RIH to top of fish and latch same.
- Perform pick up and slack off to determine latch and stuck point.
- Rig up wire line and recover plugs
- RIH with tubing end locator and identify end of fish, POOH & Rig down same
- Attempt to circulate or bullhead into well, record rates and pressures.
- Note: If circulation can be established circulate well with 9.3ppg WBM
- Note: If pipe can be worked free and bottom of drill pipe is below or near thief zone
- Circulate 50ppb LCM with 9.3ppg 45 visc WBM spotting LCM across open hole section of well, killing the well.
- Note: If circulation cannot be established and pipe is stuck, Rig up wire line and perform free point, cut pipe above bridge, set 2,28" magna range plugs and recover fish.

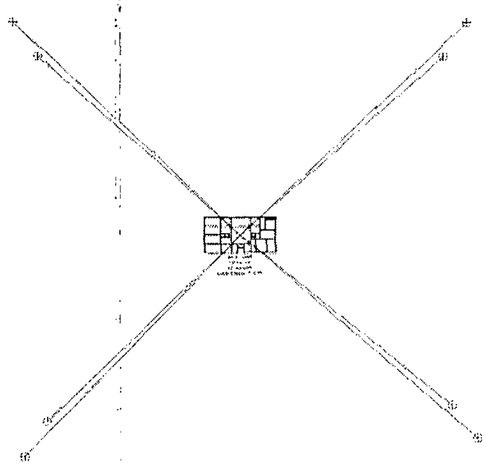
Procedure for Operations- Run 3 Option if required

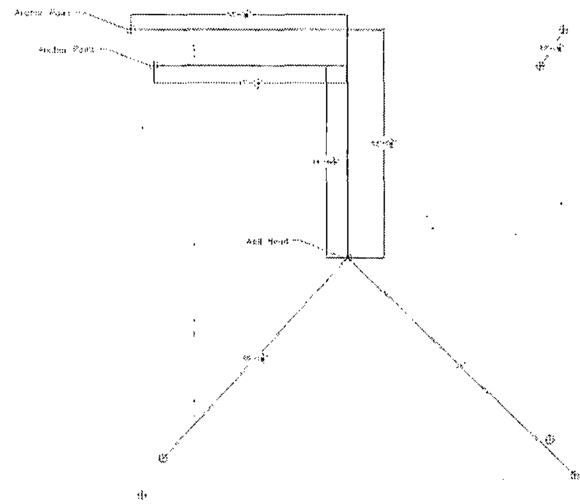
The 3rd or more runs in the Lava Tube #27 well will be very dependent on the above out come and achievements. The following trips into the well will have an objective to clean the open hole section of the well bore to a depth that will facilitate killing the well. This minimum depth at this time is 7,050'. This is the lower thief zone shown on the noise and temp logs. The minimum depth will also be dependent on the Devon Energy requirements for the acceptable plug and abandonment procedure approved. The above procedures assume a drill pipe part below the thief zones and just above the heavy weight drill pipe currently in the well.

Rig up & Elevations of 460-K Snubbing Unit



Guide Wire Foot Print and Layout





Additional equipment required to be supplied by ISS:

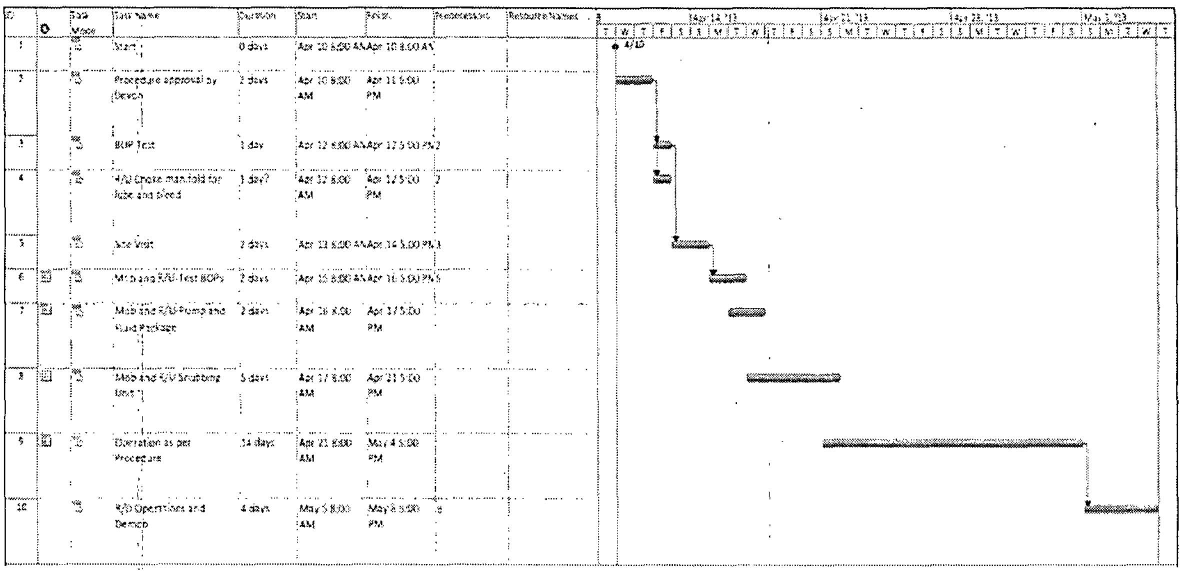
- Fluid pumps (2 required)
- Circulating Manifold (2" 10M")
- Chicksan Pump Iron (400'-2" 1502)
- 2-7/8" Standpipe with 1502 Xovers
- 11" 5M Dutch Lockdown Flange
- 100 BBL Gas buster tank
- 3" Transfer pump baskets
- 3 Each- NOV 150K Generators with 1 Switch box (only 2 will be required if MI Swaco supplies own generators)
- 2 Additional ISS personnel for nights, Maintenance, Lube,& Bleed]

Additional Equipment required to be supplied by 3rd Party:

- 2 Each- 200 BBL Open (ISS)
- 2 Each- 350 BBL Open top tank with 2 compartments, agitators, Shaker, Hopper and Gen Package(MI Swaco)
- Transfer pumps
- 2 Each- 5"X6" Charge pumps
- Vacuum trucks (When Pumping)
- Pipe racks – 2 Sets
- 8 Guy Wire Anchor sets
- Fork Lift
- Man Lift
- Nipples and Plugs

Note: Additional BHA drawing will update rig up the Rig up drawings once we have all of our required lubrication lengths. The Well Control and Snubbing equipment for this rig up will be 160,000lb's. It is recommended to install a support base to the system in supporting the equipment packages, pipe weight to be encountered and minimal over pull = 500-K system.

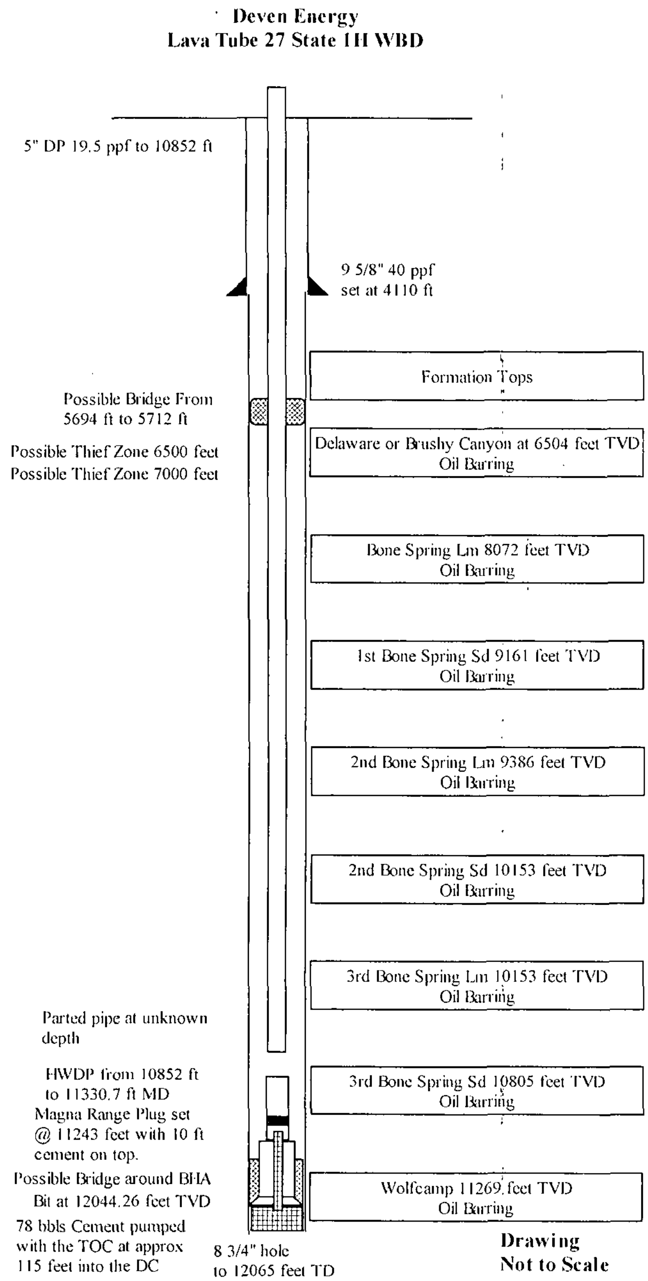
Lava Tube #27 Time Table for Project



Well Bore volumes

Item	Length (ft)	Ann bpf	Ann Volume	ID (in)	Volume (BPF)	DP Volume (bbls)	Description
1	1			0.01	0.0000	0.0000	bit
2	30.28	0.030	0.9119	1	0.0010	0.0294	motor
3	2.34	0.033	0.0780	2.312	0.0052	0.0122	XO
4	6.38	0.036	0.2277	2.312	0.0052	0.0331	stabilizer
5	29.23	0.033	0.9743	2.5	0.0061	0.1775	DC
6	5.17	0.033	0.1723	2.312	0.0052	0.0268	stabilizer
7	14.96	0.034	0.5105	2.312	0.0052	0.0777	Survey tool - Teledrift
8	351.27	0.033	11.7087	2.5	0.0061	2.1327	DC
9	2.83	0.033	0.0943	2.5	0.0061	0.0172	XO
10	748.69	0.050	37.5018	3.0625	0.0091	6.8213	HWDP
11	6742	0.050	337.7058		0.0172	115.8950	
12	4110	0.052	211.8372	4.276	0.0172	70.6509	DP
Totals	12044.15		601.7225		Total	195.8738	

Current Wellbore Diagram



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