SDL Field Procedures			HALLIBURTON MANAGEMENT SYSTEM Global	
DOCUMENT NO.: WM-GL-HAL-SDS-SDL400	PREPARED BY: NICKY PELLERIN NICK BUCK	APPROVED BY: PAUL ZIEGLER	REVISION NO: 1	DATE: 21 March 2007

PURPOSE

The purpose of this Work Method is to document the minimum requirements for mobilising, rigging-up and calibrating standard SDL equipment and for carrying out standard SDL operations.

SCOPE

This Work Method applies to all Sperry Drilling Services operations globally.

REFERENCES

- **ST-GL-HAL-SDS-SDL400**
- **ST-GL-HAL-SDS-SDL402**
- **ST-GL-HAL-SDS-400**
- **PM-GL-HAL-SDS-SDL400**

PROCEDUES

1. SDL PRE-JOB UNIT CHECKOUT

1.1. After the Pre-Job/Spud Meeting with the Customer, a detail list of all "Customer Specific" requirements for the Surface Data Logging job will be completed as per procedure QP81-58-01 SDL Job Preparation.

1.2. Any "Customer Specific" parts and/or equipment not listed in the Unit Inventory Checklist will be ordered as per (QP81-58-12 SDL Field Parts Requisition) and stocked in the unit prior to it leaving the District Office for the well site or the Customer's shipping point.

1.3. Any parts and/or equipment listed in the SDL Unit Inventory Checklist but with amounts requested by the Customer over the standard amounts in the checklist will be ordered and stocked in the unit prior to it being shipped.

1.4. The SDL Lead Field Specialist and/or Relief Lead Field Specialist will perform a check to ensure that all parts and equipment listed in the SDL Unit Inventory Checklist are present and in proper working condition.

1.5. The SDL Lead Field Specialist and/or Relief Lead Field Specialist will ensure that all equipment Operating Manuals needed to do a complete Surface Data Logging job to the Customer's requirements are present, updated and stocked in the unit prior to it leaving for the rig site or Customer's shipping point.

1.6. The SDL Lead Field Specialist and/or Relief Lead Field Specialist will ensure that all forms and necessary paperwork required to meet the Customer's requirements are placed in the Surface Data Logging unit prior to the unit leaving the District Office for the rig site or Customer's shipping point.

2. SDL PRE-JOB INSITE CHECKOUT

2.1. After the Pre-Job/Spud Meeting with the Customer, a detailed list of all "Customer Specific" requirements of the log formats and any additional hardware / software needed beyond the normal INSITE setup will be completed as per procedure QP81-58-01 SDL Job Preparation.

2.2. The SDL Lead Field Specialist and/or Relief Lead Field Specialist will perform a check of all INSITE equipment and software to ensure that all needed equipment and software is present.

2.3. The SDL Lead Field Specialist and/or Relief Lead Field Specialist will power up all INSITE equipment in order to test that all the equipment is in proper working condition.

2.3.1. The Lead Field Specialist and/or Relief Lead Field Specialist will ensure all Log Plot Definitions meet the Customer's log format requirements.

2.3.2. The Lead Field Specialist and/or Relief Lead Field Specialist will ensure that backup software and Log Plot Definitions to be used are stored in a safe area.

2.4. A check will be made to ensure that an up to date set of Operating Manuals for the software and hardware being used is placed in a safe area of the unit.

2.5. A check will be made to ensure that an adequate stock of all supplies needed to meet the Customer's requirements for the Surface Data Logging job are placed in the unit prior to shipment.

3. SDL FIELD SPECIALIST'S PRELIMINARY RIG SITE DUTIES

3.1. On arrival at the rig site it must be ensured that any hand-carried equipment is offloaded.

3.2. The Field Specialists will check in with the Rig Safety/Training Representative and ensure that arrangements are made to attend any necessary safety induction courses.

3.3. The Field Specialist will introduce himself to the Company Representative and discuss any preliminary job details.

3.4. A copy of the equipment shipping manifest will be obtained from the Company Representative if not already possessed.

3.5. The equipment must be visually checked to verify that it is all present and undamaged.

3.6. If any equipment has been damaged in transit or during offload, a Loss Damage Equipment Form (LDE) must be completed.

3.7. If any equipment is damaged a Faulty Equipment Return form must be completed.

3.8. If replacement equipment is required SDL Field Parts Requisition will be followed.

3.9. The SDL Field Specialist will make contact with any involved parties to further discuss the job

4. SDL UNIT MAIN POWER CABLE RIG UP

4.1. After completing the rig check-in and rig safety briefing, contact the Toolpusher/Rig Electrician/Rig Engineer on the location where the unit will be placed.

4.2. On offshore installations, after the unit is spotted, have the Rig Welder tack weld the unit to the deck of the rig in at least two (2) places to ensure proper grounding once the unit is energized.

4.3. If the unit cannot be welded to the deck a grounding cable must be run back to the ground of the power source.

4.4. On land locations, at the back of the unit, drive an eight (8) foot steel rod into the ground for six (6) feet. Then run a grounding wire from the rod to the back of the unit.

4.5. Consult the Rig Electrician/Rig Engineer on the closest source of clean power available for the unit. The power source should be 440 volts single phase. If 440 volt single phase is not available locate a 220 volt single phase power source.

4.6. Ensure that the rig power source has a large enough circuit breaker to handle the power demands of the unit during peak power usage. A 60 amp breaker is recommended for 220 volt and a 30 amp breaker is recommended for 440 volt.

4.7. If the rig cannot furnish either a 440 volt or 220 volt power source, immediately call the Service Coordinator for advice.

4.8. With the Rig Electrician/Rig Engineer survey the path the main power cable must be run from the unit to the rig power source. This path must meet all local regulations for cabling on an offshore installation.

4.9. Verify ground by use of voltmeter prior to running power cable. Ensure that the rig power source ground wire and the unit ground wire are the same.

4.10. Prior to running the power cable ensure that enough cable is present to complete the run from the rig power source to the unit. If there is not enough, order what is needed using an SDL Field Parts Requisition.

4.11. Visually inspect the power cable to ensure that it is in good condition with no worn or cut places in the cable.

4.12. Run the power cable from the unit to the rig power source as per all local regulations for cabling on an offshore installation.

4.13. Inside the unit, place the Step-Down transformer selector switch to the position that matches the voltage of the rig power source.

4.14. Have the certified/designated electrician connect the power cable at the rig power source.

4.15. Remove the "Lock-Out/Tag-Out" device from the rig power source and energize the power.

4.16. Ensure all circuit breakers in the unit are in the "off" position.

4.17. Turn the main power circuit breaker in the unit on.

4.18. If any problems or questions occur during any of the above steps, immediately call the Service Coordinator for advice.

SHOULD THE UNIT BE REQUIRED TO BE PRESSURISED, ENSURE THAT PROPER STEPS ARE TAKEN TO START MAINTAIN PRESSURISATION AND THAT THE BLOWER AND AIR INLET ARE SITUATED IN APPROPRAITE LOCATIONS.

5. SDL SENSOR CABLING RIG UP

5.1. Remove all sensor cabling from the unit equipment box and inspect the cabling to ensure that the type and gauge meets all Local requirements for cabling on an offshore installation.
5.2. Inspect all cables for worn or cut areas. Discard any worn, cut or suspect cabling.
5.3. Contact the Rig Electrician/Rig Engineer and walk through all locations where the cabling must be run. Reach an agreement with the Rig Electrician/Rig Engineer on all paths the cabling must follow.
5.4. Inspect any bulkheads that the cabling must pass through to ensure that there are enough openings for the number of cables that must be run through the bulkhead.
5.5. Inspect the bulkhead fittings to ensure that they meet all Local regulations. If the bulkhead fittings do not meet the regulations, notify the Rig Electrician/Rig Engineer so that they may be modified or added to meet all regulations.
5.6. Prior to running any cabling, hold a safety huddle and complete a JSA with all personnel who will be involved in the running of the cabling. Go over all the paths and areas that the cables must be run and ensure that all personnel have the proper safety equipment for the job. (i.e. safety harness, hard hat, safety glasses, ear plugs, etc.).
5.7. When running the cabling ensure that they follow only the path agreed upon with the Rig Electrician/Rig Engineer.
5.8. When possible, run all cabling in any existing raceways and conduit trays that are available.
5.9. All cabling not run in a raceway or conduit tray must be run as follows.
5.10. As a minimum - Overhead cables run in an open wire rack must be cable tied every 12 inches/30 centimetres with steel cable ties. Vertical cables run in an open wire rack must be cable-tied every 18 inches/45 cm – or according to local regulations
5.11. If any area is encountered where there are no raceways, conduit trays or wire racks, then wire stand-offs must be installed every 18 inches/45 cm. Notify the Toolpusher/Rig Electricians/Rig Engineer of any such areas whereas the stand-offs can be installed.
5.12. Cables passing through any bulkheads must be passed through a nipple and CGB. After the cable is passed through the CGB must be tightened until there is no movement of the cable.
5.13. For cables being run to a junction box, a gland fitting must be used for each cable. The gland fitting will be installed as per the manufacturer's instructions.
5.14. All cabling will pass through the appropriate type and size gland fitting before being connected to any sensor.
5.15. All cabling entering the logging unit bulkhead will pass through the appropriate size bulkhead fitting. The bulkhead adjustment bolt(s) will then be tightened so there is no movement of the cable.
5.16. Make the sensor connections to the ISBs (Intrinsic Safety Barriers) in the IRIS box.
5.17. Connect all shield wires to the grounding strip in the IRIS box. Never connect the shield wire at the sensor end of the cable.

6. SDL EXPLOSION PROOF CONNECTIONS

6.1. Any cable that is wired into a sensor on an offshore installation must pass through an explosion proof fitting that is connected to the explosion proof housing of the sensor.
6.2. SDL currently utilizes a gland type fitting to meet this requirement. Making this connection requires very specific components and procedures.
6.3. Utilize HAWKE glands procedure.
6.4. Attach the wires required by the sensor to the terminal strip with forked terminals.

7. SDL SENSOR INSTALLATION

7.1.1. Inspect all areas of the rig where sensors are to be installed. Discuss with all appropriate parties the requirements for sensor installation in every area where sensors will be required to be installed. Discuss with all involved parties as to the best time and methods of sensor installation as to ensure the installation is carried out in a safe manner.
7.1.2. Remove all sensors from the unit equipment box and inspect them for any damage that may have occurred during shipment. IF any sensors were damaged during shipment, complete the Lost/Damage report the Field Failure Report (FFR) (Ref. QP81-58-21 SDL Field Failure Reporting) and order the replacement sensor immediately (Ref. QP81-58-12 SDL Field Parts Requisition)
7.1.3. Gather all the tools that will be required for the sensors to be installed and place them in an area where they can be quickly accessed.

The following are the actions to be taken when installing the SDL standard sensors.

7.2. Crown Depth Wheel

7.2.1. Inspect the crown wheel area to ascertain what type of mounting bracket will be required to mount the Depth Wheel. If any modifications are required to the standard SDL Depth Wheel mounting bracket, notify all involved parties and discuss the modification and the safety of the installation.
7.2.2. Before installing the Depth Wheel inform the Driller of your intent and get his approval. Warn all rig floor personnel that equipment is being installed overhead.
7.2.3. Ensure that the Depth Wheel has all required safety wires attached before leaving the rig floor.
7.2.4. Ensure that all tools that will be used during installation of the Depth Wheel have safety tie-off lines attached.
7.2.5. Raise the Depth Wheel to the crown by tying it to the pack frame supplied.Once at the crown, connect a safety wire from the Depth Wheel mounting bracket to the crown, then mount the bracket.
7.2.6. Connect a safety wire from the Depth Wheel to the crown, then attach the Depth Wheel to the mounting bracket.
7.2.7. Position the wheel to a point where it is on the "Slow Sheave" of the crown pulley. Normally this is the second pulley from the "dead line" pulley. Position the wheel firmly on the pulley itself and not the line in the pulley. Then finish tightening the wheel to the mounting bracket.

7.2.8. When the wheel is completely tighten to the mounting bracket, then tighten the wheel tension spring to maintain a good wheel to pulley pressure that will have a minimum of slippage during the normal rig operations.

7.3. Standpipe Pressure Transducer

7.3.1. Prior to rigging up the Standpipe Pressure (SPP) transducer, check with the Driller to ensure that it is safe to do so. Inform the Driller that it is SDL policy that all fittings from the standpipe manifold to the transducer must be SDL equipment, but he must inspect all the fittings and give his approval for installation. If the SDL fittings do not meet the rig requirements, then the rig must furnish the fittings.

7.3.2. With the Driller present, select a location on the standpipe manifold where a constant pressure reading can be obtained during all phases of rig operations.

7.3.3. Open all the valves necessary to ensure that there is no mud trapped in the area of the standpipe manifold that the sensor will be installed. Then close all the valves to ensure that no mud can enter the standpipe manifold until the rig up is complete.

7.3.4. Remove the plug where the transducer is to be mounted, clean and inspect the threads of the nipple, if applicable. If any damage is seen, notify the Driller.

7.3.5. Wrap all threads on the high pressure fittings with Teflon tape, if needed, before installing the fittings.

7.3.6. Mount the fittings and tighten each connection with the appropriate pipe wrench to a degree where no mud will leak at the maximum rated pump pressure.

7.4. Choke Pressure Transducer

7.4.1. Mount the choke manifold pressure transducer following all the procedures used to mount the standpipe pressure transducer.

7.5. Digital Rotary Tachometer

7.5.1. If a conventional type rotary sensor is to be used, check with the Driller prior to installation to be sure that it is safe.

7.5.2. Have the Driller "lock-out" the rotary table to ensure that it cannot be turned on during sensor installation.

7.5.3. Have the Driller lift and secure the cover over the rotary motor and rotary shaft.

7.5.4. Locate an area on an I-beam to mount the rotary sensor. Align the pulley on the rotary sensor with the smallest part of the rotary shaft that turns when the rotary is engaged.

7.5.5. Measure, cut and connect the rotary belt around both the smallest part of the rotary shaft and the rotary sensor pulley.

7.5.6. Move the rotary sensor away from the rotary shaft until the belt is tight. Once the belt is tight, clamp the sensor to the I-beam with "C" clamps.

7.5.7. If the rig is equipped with a Top Drive, inform the Rig Electrician/Rig Engineer that it is SDL policy that only qualified rig personnel will wire into the Top Drive system. SDL personnel will only wire into the unit end.

7.6. Torque Sensor

7.6.1. To install the torque sensor, locate the four (4) main shunt cables leaving the rotary motor.

7.6.2. Clamp the two (2) halves of the torque sensor around one (1) of the shunt cables. Ensure that the two (2) dots on the torque sensor are aligned.

7.7. Flowline Flow Out Sensor

7.7.1. Inspect the flowline with the Driller in order to select a location for the flow out sensor.
7.7.2. If an opening in the flowline suitable for the SDL flow out sensor does not exist, have the Rig Welder cut an opening and weld the SDL flow sensor mounting flange in place.
7.7.3. Mount the flow sensor into the mounting flange.

7.8. Pit level Sensors

7.8.1. When installing the pit level sensors, choose an area of the pit that has the least amount of surface movement.
7.8.2. Mount the "Z" bracket to the pit cover using a "C" clamp.
7.8.3. Install the pit watcher into the "Z" bracket using the appropriate mounting hardware.

7.9. Temperature Out Sensor

7.9.1. Loosely mount the Temperature Out probe to the "L" mounting bracket with two (2) U-bolts.
7.9.2. Mount the "L" bracket to the double "C" clamp bracket.
7.9.3. Select a free area of the possum belly and tighten the double "C" clamps.
7.9.4. Raise the Temperature Out probe to a height where it will be covered with mud at normal flow rates. Ensure that the probe is not so deep as to be buried in any cuttings that may build up during drilling operations.

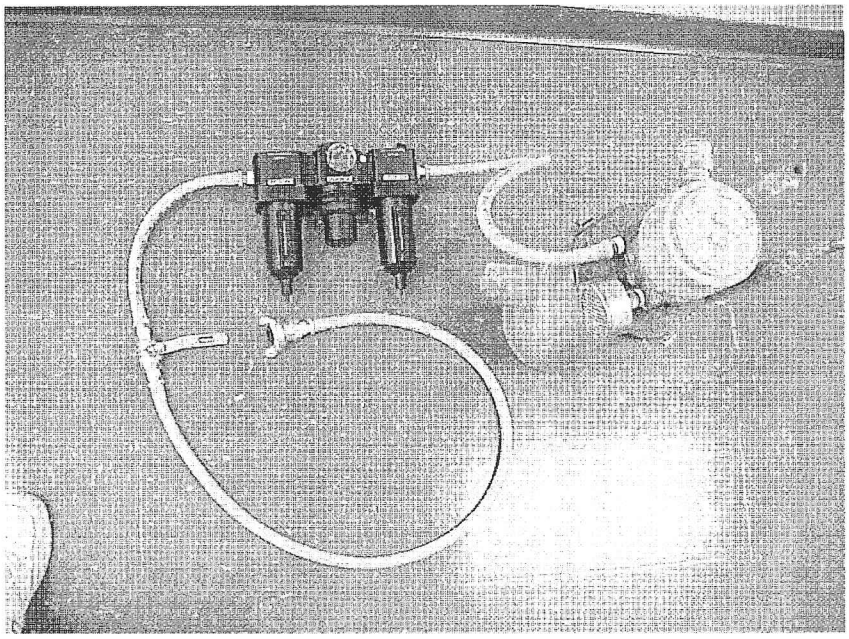
7.10. Temperature In Sensor

7.10.1. Mount the Temperature In probe following the same procedures as the Temperature Out probe. Ensure that the Temperature In probe is mounted in the Suction pit.

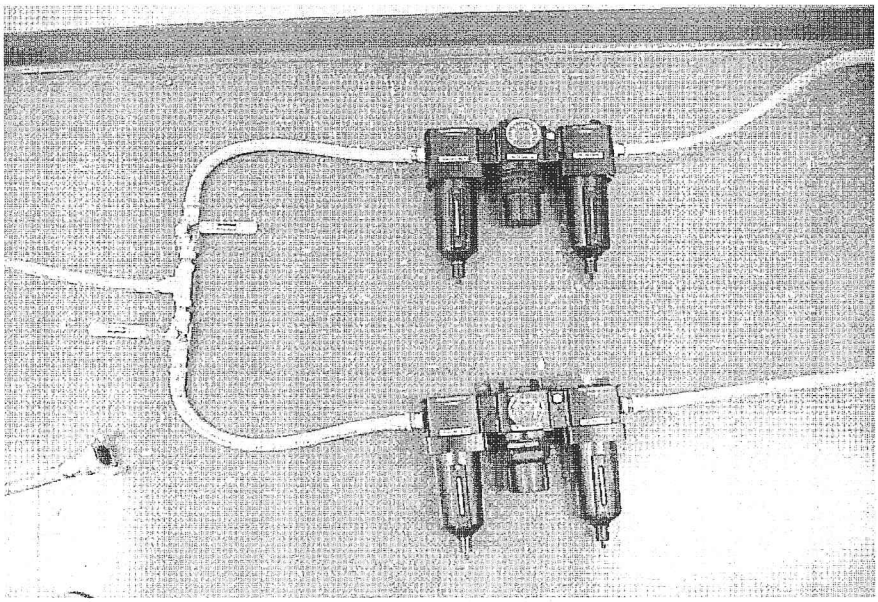
7.11. Gas Trap

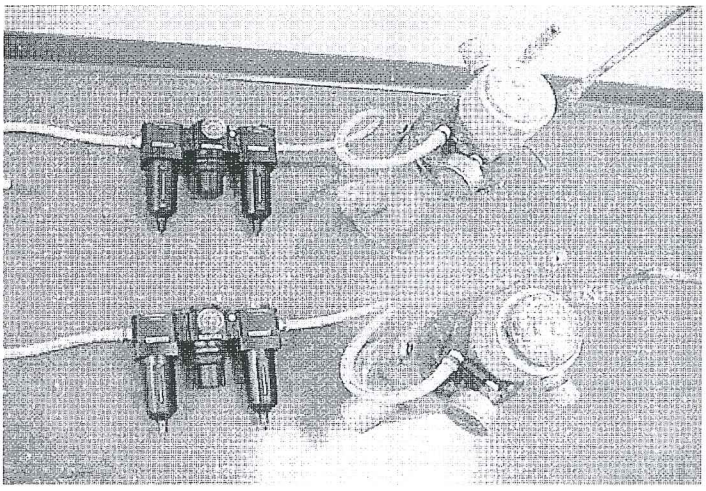
7.11.1. Locate the gas trap in an area of possum belly that will have the best mud flow from the flowline as possible.
7.11.2. Brace the trap "A" frame to the possum belly where there will be no movement of the trap when there is mud flow and the shakers are turned on. If this cannot be achieved, then have the Rig Welder modify the "A" frame or build a mounting bracket that will suffice.
7.11.3. On rigs with an open ditch type flowline, the Rig Welder will have to make a special mounting bracket in order for the SDL flow out sensor to fit.
7.11.4. Inspect the rig air system and plan your air hose route. Install the Filter-Regulator-Lubricator assembly as close as possible to the trap. This will ensure that the trap is not starved of air. If the regulator package is too far from the trap assembly, the trap may become sluggish and less responsive. Try and install the regulator package no more than 15 linear feet/ 5 metres from the trap.

Below is a condensed illustration of a single trap configuration.

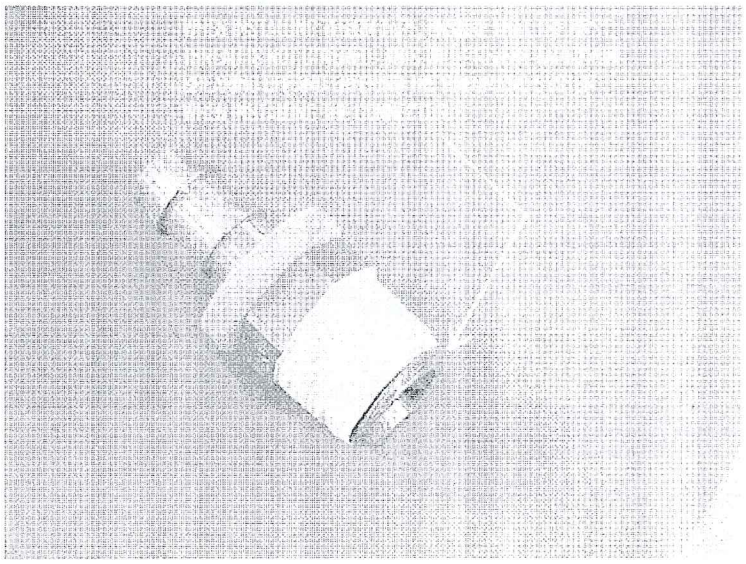


This is a condensed illustration of a dual trap configuration.





7.11.5. Fittings: When installing threaded pipe fittings, Teflon tape is required to seal the fitting. Teflon also acts as a lubricant to that the threads will not gall up and may be reused. When using Teflon tape, it is very important to apply it correctly. For brass fittings, two to four wraps should be sufficient to provide a good tight seal between threads. Do not allow tape to be applied to the first thread of the fitting. If this happens, it is possible for this tape to be sheared off during installation and clog or damage downstream components.



7.11.6. Connecting to rig air: The crowfoot is a metal connector common on most rigs. It is used mostly for water and air service. This connector is very simply installed by pushing it onto an opposite (female or male) connector and turning it clockwise about 45 degrees.

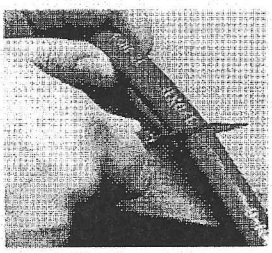
The connector will lock in place and pressure will help it to seal. Install a small metal pin or wire into the holes to ensure that the connector does not vibrate loose during operation. A safety lanyard should also be attached across the connection. If the connection does become separated, the hose will stay in the immediate vicinity while it discharges.

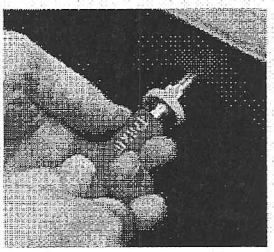
7.11.7. Running the hoses: Once the crowfoot is connected, attach a Push-Lok hose to it. Refer to the Push-Lok instructions. Once the hose is connected, run a sufficient length to the area of the trap assembly(s). Leave enough slack in the hose to make a small coil near the end. This will allow future cutting and splicing if necessary. Install the hose into the tee and valve assembly for two traps or directly to the valve assembly for a single trap.

7.11.8. DO NOT USE ANY TYPE OF HOSE CLAMP. THE PUSH-LOK SYSTEM DOES NOT REQUIRE CLAMPS, AND THE SYSTEM MAY BE COMPRIMIZED IF CLAMPS ARE INSTALLED.

To assemble Push-Lok

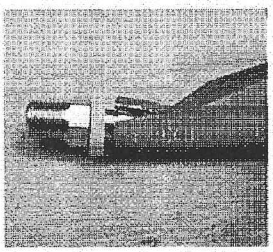
1. Cut hose cleanly and squarely with a sharp knife or a Parker Push-Lok cut-off tool.
2. Lubricate the Push-Lok fitting and/or hose I.D., with light oil or soapy water only--do not use heavy oil or grease.
3. Insert fitting into hose until first barb is in the hose.
4. Place end fitting against a flat object (bench, wall). Grip hose approximately one inch from end and push with steady force until the end of the hose is covered by the yellow plastic cap.

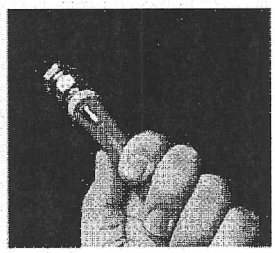




To disassemble Push-Lok

1. Leave fitting in place, and cut hose lengthwise from the yellow plastic cap approximately one inch. IMPORTANT: Be careful not to nick barbs when cutting hose.
2. Grip hose and give a sharp downward tug to disengage from the fitting.

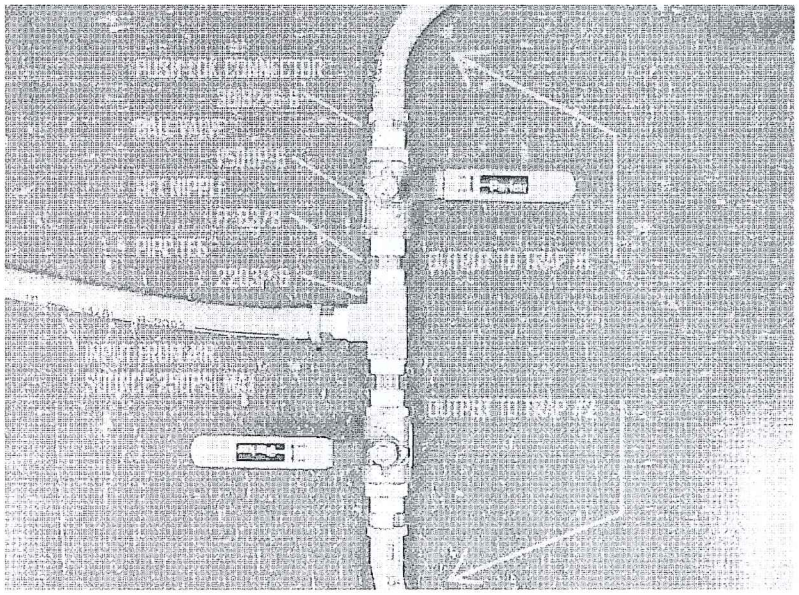




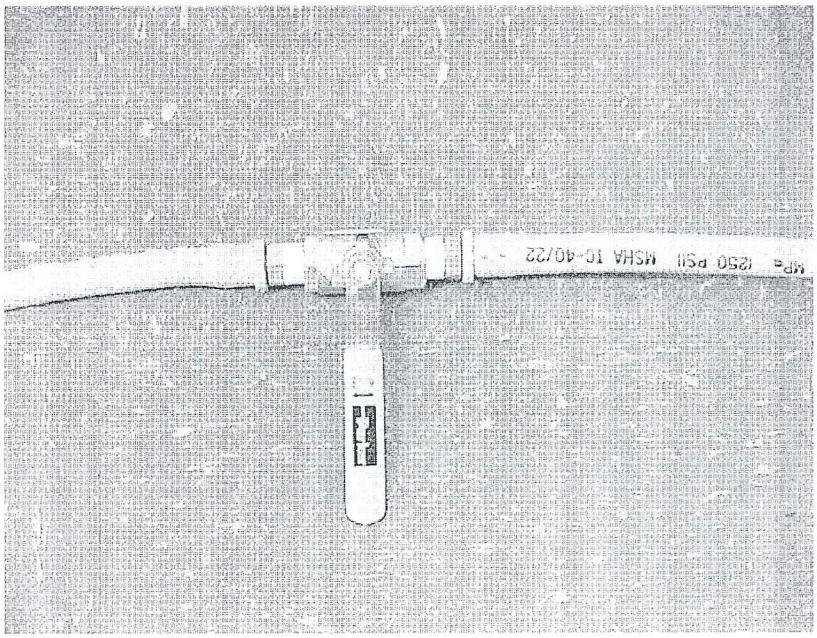
CAUTION: Push-Lok fittings will properly grip Push-Lok hose only when pushed all the way in, with the cut end of the hose completely concealed by the yellow plastic cap.

Sealing integrity may be damaged by use of exterior clamps.

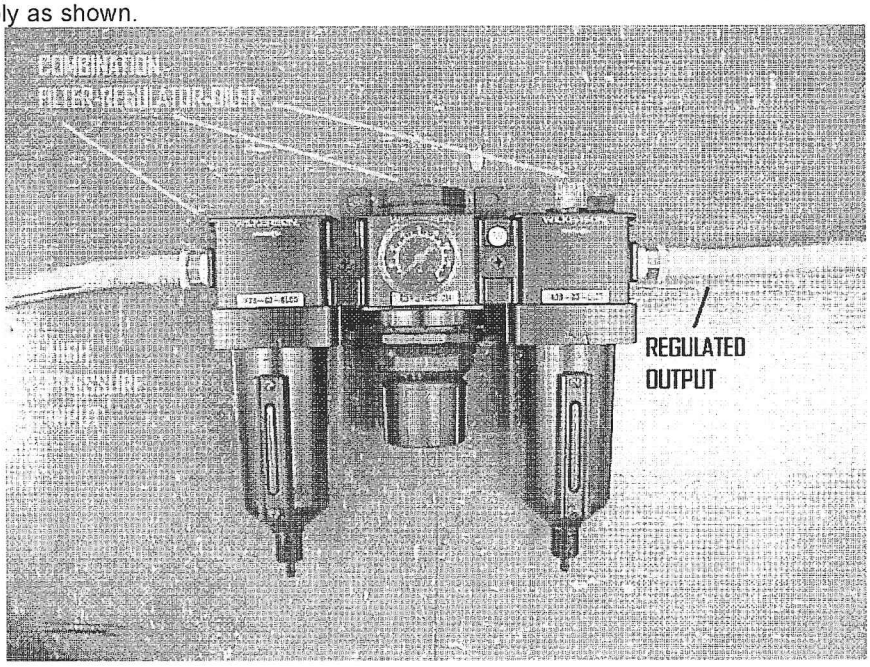
Tee Valve Assembly for dual traps.

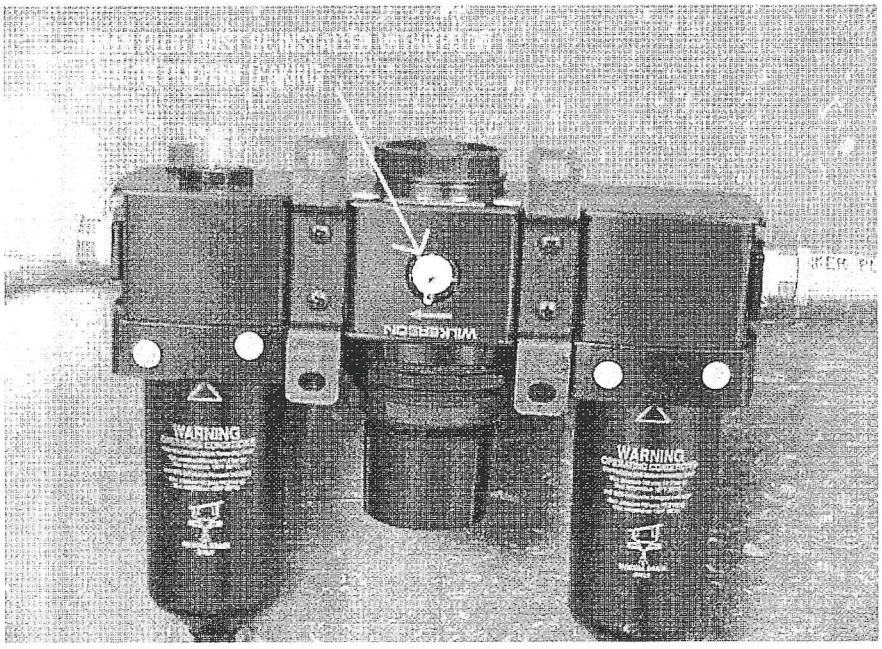


Single valve assembly for single trap.

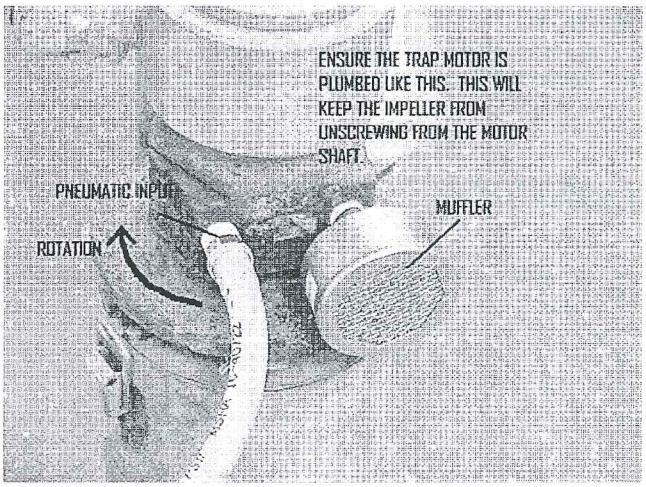


Once this is done, connect another section of hose to the Filter-Regulator-Lubricator assembly as shown.





7.11.9. Finally, connect a third section of hose to from the Filter-Regulator-Lubricator assembly to the trap itself. Filter-Regulator-Lubricator: This device is designed to do exactly what its name implies. This all-in-one device filters the pressurized air, regulates the air pressure, and lubricates the air going to the trap motor. It is essential to the proper operation of the system and should be taken care of.



7.11.10. Installing the gas trap: Install the trap in the possum belly that will be most likely used by the rig. Most rigs have three or more locations for the trap. Locate the one that is most accessible and utilized during drilling. It is a good idea to install two traps to make it easier when the rig switches shakers for maintenance and/or drilling parameters. Multiple traps give the SDL personnel more options when the rig lines out different shakers.

7.11.11. Check for leaks: Once all of the air hoses and fixtures are installed, it is a good idea to check the system for leaks and proper operation. Inspect the entire system for loose fittings, loose hose connections and Teflon tape. Double-check all crowfoot connections to ensure they are safety wired to each other. Once you are satisfied with the rig-up, fill the lubricator with oil and double check all of the bowls on the Filter-Regulator-Lubricator package. Make sure all personnel are clear of the trap and then open the supply valve to the system to allow compressed air to flow to the trap. You may spray the hose and plumbing connections with soapy water or leak detector fluid to check for leaks.

7.11.12. Operation: If no leaks are found, make adjustments to the regulator to bring the trap to the proper RPM, (the trap is operating correctly when it flows 1quart of drilling fluid in five seconds). Once this is done adjust the clear knob on top of the lubricator to allow oil to flow to the trap. It may take time to get this adjustment right. A typical setting is about one drop every ten seconds.

7.12. Hookload Sensor

7.12.1. Mount the Hookload sensor on the deadline. Tighten down the Hookload sensor by adjusting the hookload lever to accommodate approximately 1/8" spacing between wire cable and sensor to assist in a more stable voltage reading.

7.12.2. NOTE: TIGHTENING OF SENSOR SHOULD BE DONE WHEN THE HOOK IS IN THE "INSLIPS" POSITION.

7.12.3. If the Customer requires any non-standard sensors to be installed, contact the appropriate District Operations Support personnel for the proper installation procedures for those sensors.

8. SDL SENSOR CALIBRATION

8.1.1. There are two (2) classes of sensors in use by SDL at the present time; they are **Analog** (voltage/amperage output) and **Digital** (on/off output) sensors. Each sensor type requires a different type of calibration into the INSITE computer.

8.1.2. Although each sensor has its own characteristics, several general comments can be made concerning calibration procedures.

8.1.3. Sensor calibration has two (2) phases, rig-up (initial calibration) and maintenance (real-time adjustments). During sensor rig-up you select function types and calibration points (i.e. value/voltage). Depending upon the sensor, you have various degrees of freedom in this specification. For example, you have complete freedom in the Polynomial Function and calibration point selection for the pit sensors.

8.1.4. There are three (3) types of calibrations used for **Analog Sensors**. All calibration functions utilize an X, Y grid reference. These functions are discussed in the following:

8.1.4.1. **Linear Function** - having or being a response or output that is directly proportional to the input. The graph of a linear function is a **straight line**. Linear functions are the easiest to perform since only two (2) calibration points are needed. These two points are Low and High. The linear function can be used when the sensor output is a straight line. (For example; a mud pit with vertical walls that has the same fluid volume per vertical foot from top to bottom.)

8.1.4.2. **Multi-Linear Function** (Piecewise Linear) is the second choice. This function is made up of parts of a graph of linear functions. It is essentially a set of connected linear functions. It is made up of up to five (5) linear segments. A minimum of three (3) calibration points will be needed for this calibration. An example of the correct application of this type of function would be for a mud pit having a "ledge" where the fluid volume per vertical foot changes abruptly. The bottom section of the pit will have one linear function (line section one) and the upper section would have the second linear function (line section two) and so on. The middle point will be where the "ledge" of the pit is located. Some guidelines of this function include:

8.1.4.2.1. Spacing the calibration points equally along the span of the function. For example: If a mud pit was 10 feet deep, divide the total tank height into five (5) equal vertical sections (every two (2) feet) and calibrate these sensor outputs.

8.1.4.2.2. Set the calibration points in ascending order. Start the "Low" point at the bottom of the pit and calibrate each successive point until the "High" point is

reached. Keep the calibration points in order. Do not skip between the low the high and the middle.

8.1.4.2.3. Set the "Order" (2-6)". The Order will determine how close the function line will fall in relation to each calibration point. The higher the number, the closer to center the line is to the graph points.

8.1.4.3. **Polynomial Function** is the third type of calibration. A polynomial function is the interpolation of a given set of data by a polynomial. In other words, you are given some data points (such as obtained by sampling) and you want to find a polynomial which goes exactly through these points; This calibration can be used for more complicated, non-linear sensor outputs. This may include a mud pit with irregular shaped sides and/or internal piping. Six (6) calibration points must be used with this function. Use order six (6) with this function. The function points would be best implemented using the same guidelines as in the Multi-Linear function. If less than six (6) calibration points are obtained, use the last point in more than one window. For example, you can set point five (5) and point six (6) at exactly the same point. This will ensure all the function windows are populated. Note: **If you intend to use point five (5) and point six (6) as the same point to populate a window, make sure exactly the same value is entered.**

8.1.5. The following general rules apply to the **Analog** calibration point specifications. Rules 1 and 2 are the most important.

1. The low point voltage should be greater than or equal to zero volts. You should not calibrate a negative voltage for zero.
2. For sensors permitting specification of the low point value, the value chosen should be close to the minimum value, which might be encountered during actual monitoring. For instance: The torque value for zero (0) Foot-Pounds may be 250 mV at the lowest point.
3. As a general rule, the high point voltage should be somewhat greater than the maximum expected signals during monitoring.
4. The middle voltage, where applicable, must lie between the low and high voltages (i.e. it lies half-way between them).
5. The calibration curve must have a positive slope at all voltages between the low and high points. (i.e. there should not be a "dip" on the calibration curve)
6. The curve must be concave upwards. All normally operating sensors have either a constant sensitivity volts change per value change, or a sensitivity that decreases as the value increases.

8.1.6. The following applies to the **Digital** calibration specifications.

8.1.6.1. **Digital** Sensors have only three (3) calibration options.

8.1.6.2. They will be calibrated as a **Cumulative Counter, Digital Input ON = 1, or Digital Input ON = 0.**

8.1.6.3. **Cumulative Counter (Digital Counter)** – Increasing or enlarging by successive addition. This calibration is normally used for a repetitive type sensor, such as a pump stroke sensor. Proximity switches or whisker (micro) switches are commonly used to count pump strokes.

8.1.6.4. **Digital Input -ON = 1, ON = 0**. This calibration is used for logic functions only. A digital sensor will output only an ON/Off indication. This output can be further defined by INSITE as either ON = 1 or ON = 0. This gives the user the flexibility to

invert the sensor output if needed. A contact switch such as a MWD in-slips switch is a good example of such a sensor.

8.1.7. For any special circumstances, contact technical support for specifics.

8.1.8. Once initial calibrations have been established, calibration enters the "maintenance" (real-time adjustments) phase during which relatively minor changes in the calibration points are made to maintain agreement between actual and reported values.

8.1.8.1. During the "maintenance" phase, a change in the zero and/or span calibration points may be needed.

8.1.8.2. A zero change will shift the entire calibration until the zero signal corresponds to the value you have input.

8.1.8.3. A span change will rotate the entire calibration around the low and/or zero point to the value you have input.

8.1.8.4. Note that in both cases, the system alters your calibration point values; presumably you know what you wish these to be. Over time these changes become necessary due to temperature drifts, sensor aging, etc.

8.1.8.5. The **Analog** sensors are calibrated using value/voltage. (i.e. 400 bbls = 10 volts)

Analog sensors requiring a value/voltage are as follows:

Hook-load
Mud Pit Level
Flow out
Temperature
Pressure
Torque

8.1.9. **Digital** sensors are not calibrated using low and high point values and voltages. They are calibrated by counts per value (Ref. INSITE User's Manual Rev. 1.04).
The digital sensors requiring a count per value calibrations are as follows:

Depth Wheel (counts per foot).
Compensator (counts per foot).
Riser Wheel (counts per foot).
Wireline Wheel (counts per foot).
Digital Rotary (counts per revolution).
Pumps (calculated gallons per stroke).

8.1.10. For any non-standard sensors needing special calibration, contact technical support for specifics of the sensors.

9. SDL FIELD PARTS REQUISITION

9.1. Immediately after a Pre-Job/Spud meeting with the Customer, any "Customer Specific" sensors or test equipment will be listed and a Field Material Request Form will be completed and communicated to the proper Service Coordinator. This will ensure that any "Customer

Specific" equipment is stocked prior to the unit leaving the District Office for the well site or the Customer's shipping point.

9.2. The Lead Field Specialist and/or Relief Lead Field Specialist will double check the local SDL Unit Inventory Checklist and the SDL Equipment Box Inventory to ensure that all equipment and parts are physically present. If any parts or equipment are missing, immediately complete the FMR.

9.3. When performing the SDL Pre-Job checks ensure that all standard equipment, software and supplies are accounted for. Order any "Customer Specific" equipment and supplies that may be needed.

9.4. Upon arrival at the well site, the Lead Field Specialist and/or Relief Lead Field Specialist will inspect all equipment. If any equipment is lost or damaged during the transit reference an LDE form shall be required.

9.5. If any special equipment is required during the unit rig up, immediately complete the FMR form and contact the Service Coordinator for shipment of the needed parts or equipment to the well site.

9.6. While the job is ongoing, it will be the Lead Field Specialists and/or Relief Lead Field Specialists job to ensure that any parts and/or equipment used during the preceding weeks is ordered for replacement.

9.7. An FMR will preferably be e-mailed, or faxed, at least twenty-four (24) hours before the parts need to be shipped. This will ensure enough time to fill the order.

9.8. It is mandatory that the proper part number be used on all orders.

9.9. If any parts or equipment is ordered that is not listed in the standard local SDL Parts inventory, the Service Coordinator must give his permission for the part or equipment.

9.10. At the completion of the job, the Lead Field Specialist and/or Relief Lead Field Specialist will complete an FMR for parts or equipment that need to be replaced due to normal usage during the job.

10. SDL SURFACE DATA LOGGING ROUTINE DUTIES

10.1. Prior to arrival at the rig site, all SDL Field Specialists should meet with the SDL Lead Field Specialist and SDL Service Coordinator to acquaint them with all the Customer's requirements for the Surface Data Logging job.

10.2. Before beginning their tour the SDL Field Specialist shall attend the rigs Pre-tour safety/operations meeting to become familiar with the current and future rig operations.

10.3. If the rig does not hold a Pre-tour meeting for all hands prior to beginning the tours, the SDL Field Specialist should meet with either the Driller coming on tour or the Company Representative to discuss the up coming rig operations for their tour.

10.4. During the Surface Data Logging crew change over, the SDL Field Specialist on tour shall inform the relieving Field Specialist of the current well and unit status.

10.4.1.1. Discuss the current rig operations (i.e. drilling, tripping, etc.).

10.4.1.2. Inform relief of any parameter/equipment overrides.

10.4.1.3. If tripping, discuss any surge/swab alarms that may be set and for what value the limits are currently set.

10.4.1.4. If any stroke counters have been set, inform the relieving Field Specialist of why they were set and if anyone needs to be informed and at what time they need to be informed.

10.4.1.5. Inform the relieving Field Specialist of any possible changes in formation pressure (i.e. abnormal/subnormal) that may be encountered during the upcoming tour.

10.4.1.6. Discuss with your relieving Field Specialist any Zones of Interest and/or Shows that may have been encountered during the tour or any possible Zones of Interest and/or Shows that may be encountered during the upcoming tour.

10.4.1.7. Discuss any possible unit equipment or sensor problems that have occurred during the tour and the current status of all equipment and sensors.

10.4.1.8. Discuss any communications that may be required of the relieving Field Specialist (i.e. Driller, Mud Field Specialist, Company Representative, etc...) and who needs to be informed when different events occur.

10.5. Before the tour change, if time allows, the relieving Field Specialist should make a physical inspection of all sensors.

10.5.1. The Field Specialist should also check the accuracy of the sensors with the Driller's sensors. Any "maintenance" calibration should be done as per above - Sensor Calibration.

10.6. At the beginning of the tour the Field Specialist should check the following:

10.6.1. Check that all INSITE core servers are running and that data is being written to the database.

10.6.2. If applicable, ensure that WITS is running and being written to the database.

10.6.3. If applicable, ensure that Data Exchange is running.

10.7. It will be ensured that the gas trap is at the correct, optimal height. Checks to be made every hour or as circumstances dictate to ensure this level is maintained.

10.7.1. It is **recommended** that once per work tour; the Field Specialist should check the calibration of the Total Hydrocarbon Analyzer (THA). Select a time when the lag depth will not be advancing; such as during trips, after bottoms up, etc..., the Field Specialist shall verify with the appropriate parties on an acceptable time to check the calibration of the THA. (Reference: Series 8800 Total Hydrocarbon Analyzer Rev. D)

10.7.2. It is recommended that once per day the GC must be checked for calibration contingent on rig operations.

10.7.3. An integrity test of the gas system and trap line must be run once a tour contingent on rig operations.

10.7.4. Calibrate the THA, if necessary following the Series 8800 Total Hydrocarbon Analyzer.

10.7.5. Field Specialists are responsible to ensure the internal flows are properly set in the THA and GC and that they are within SDL or the Customer's specifications.

10.8. Drill rates and depths are shall be recorded accurately. Drilling breaks should be immediately reported to the relevant rig site personnel. Pipe tallies shall be regularly checked against drill floor totals.

10.9. The lag will be correct and kept up to date and all cuttings samples are to be caught at the correct time to give a true representation of that depth interval. Checks on the lag shall be made when permitted.

10.10. The Field Specialists will be responsible for (more or less depending upon scope of work)

- ✓ Geology Descriptions and analysis
- ✓ The continuous logging of total gas and chromatograph analysis.
- ✓ Hydrocarbon Show Evaluation.
- ✓ Bulk Density Measurements from cuttings.
- ✓ Cuttings Gas
- ✓ Calcimetry
- ✓ Cuttings Volume Estimation

10.10.1. A geological evaluation of all data collected and computed will be provided and all pertinent data will be recorded in an accurate, legible manner.

10.10.2. Cuttings lithology, gas analysis and hydrocarbon evaluation will be correlated with drilling parameters and available reference material.

10.10.3. The relevant personnel shall be informed of any changes in cutting shape and volume.

10.10.4. When a trip is made the hole fill/displacement must be accurately monitored both on the trip in and the trip out. The correct displacements must be known for the complete drill string and the trip monitor until the bit is on the surface or back on bottom circulating. The well will be closely monitored especially through open hole and the first 5 stand when tripping out of the hole. Or tighter controls as required by the customer. The relevant people must be informed on any discrepancies according to procedures.

10.10.5. All charts (computer screen or hard-copy) will be labelled, annotated and filed, all raw data including data sheets are to be kept, and in accordance with defined procedures to either be given to the customers or archived at HAL.

10.10.6. Accurate and legible geological morning reports will be completed for the customers as specified. In the absence of a wellsite geologist, a copy of the report will be transmitted to the customer's office or as directed.

10.10.7. A Zone of Interest Report and/or a Show Report must be completed whenever the need for one is indicated and a copy kept on file in the unit and electronically.

10.10.8. The "Mud Log" including lithology descriptions is to be updated as often as possible (preferably after each sample interval) and a hard copy will be produced at each request of the company representative.

10.10.9. All wet sample bags, dry sample envelops geo-chemical sample tins etc will be marked and labelled in the manner dictated by the customer. They should be stored and sent to town as directed by the customer.

10.10.10. Alarms are to be set at such a level that any changes in the well status will be immediately noticed. The Field Specialist should not rely entirely on the alarms to warn of potential well problems, but should be aware of the well status at **ALL** times. The alarms should be used **especially** during times that the Field Specialist is busy doing other SDL functions (i.e. sample examination).

10.11. Unit Logbook entries shall be noted whenever anything of significance occurs. These include, but are not limited to the following:

10.11.1. Anytime the Field Specialist notifies the Company Representative of possible changes in the formation pressure.

10.11.1.1. Whenever any samples were shipped off location. This should include the depth ranges and the number of samples shipped. The shipping manifest number should also be noted in the Logbook.

10.11.2. When the Geologist, Petrophysicist, or other concerned parties are called, the name of the person called, the time of call, and the subject that was discussed should be noted.

10.11.3. Whenever the THA and/or the GC are calibrated, the calibration should be noted. Any other specific customer requirements concerning the gas analyzers should be noted as well.

10.11.4. If any logs were faxed, the name of the person receiving the fax along with the type of log and time shall be noted in the logbook. If the logs were sent by e-mail, the same information should be recorded.

10.11.5. Any equipment problems or failures will be recorded, along with the procedures that were taken to correct these problems. Failure report numbers will be documented with a description of the incident (Reference Failure Reporting QP81-58-16).

10.11.6. Any changes in the well status will be recorded (i.e. lost returns, well kick, hole problems etc.).

10.11.7. Any changes in the rig activities are to be recorded.

10.11.8. Record any trips, trip gases and trip chlorides taken. Also record the maximum drag during any trips.

10.12. It is mandatory that the Field Specialist make two (2) backup copies of the entire INSITE database and the IRIS/Data Folder at least once per tour or more often depending on rate of penetration. Ensure that these copies are only utilized with the same version of INSITE.

10.13. The Field Specialist is responsible for housekeeping of the unit. The unit should be kept as clean as circumstances will allow without neglect of the Field Specialist's other duties.

10.14. Allow adequate time to update all logs and have them faxed/e-mailed at the time set by the Customer in the Pre-job meeting.

10.15. Ensure that adequate time is allocated to complete all Morning Report(s) to be submitted at the time selected in the Pre-job meeting. A hardcopy shall be kept on file in the logging unit. It is recommended that an electronic copy of all reports be kept on file.

10.16. All replacement parts orders should be placed at least seventy-two (72) hours prior to the date of shipment.

10.17. As parts are used during the week, write down the SDL part number, quantity used and the description of the part on a running parts list. This will help during larger part orders.

10.18. If any equipment fails during the hitch, complete the required forms – as above.

10.18.1. If the failed parts or equipment is repairable, complete the Faulty Equipment Return Form and any necessary accompanying paperwork.

10.18.2. Any equipment that may be damaged in other than normal usage must have a Lost and Damage Equipment Report completed.

10.19. Assistance with core catching operations and the geological description of core will be given as directed by the Data Engineer or Well Site Geologist.

10.20. The Lead Field Specialist is responsible for all samples being shipped to the Customer's Lab in a timely manner. The Customer should be notified when the samples leave the rig site.

10.21. The Lead Field Specialist should complete a weekly inspection of the unit and all equipment to ensure that it is working properly and meets safety requirements.

10.22. The Lead Field Specialist will ensure that a correct Job Ticket is completed once per month or as required. This Job Ticket will be sent to the Service Coordinator prior to signing for approval of correctness and completeness. The Service Coordinator will approve the unsigned ticket and inform the Lead Field Specialist to have the job ticket signed. Upon signature by Customer Representative the signed job ticket will be faxed/emailed to the Service Coordinator for processing and the original will be brought in on normal crew change

10.23. All Field Specialists will complete a Job Debrief form and turn in all accompanying paperwork to the relevant supervisor/coordinator.

10.24. At the completion of each well, the Lead Field Specialist shall request that the Customer Representative complete a SDL End of Job Customer Satisfaction (EJCS) form so that any areas that may need improvement can be noted (Reference Appendix 5). A Key Performance Indicator (KPI) form must also be completed and accompany the EJCS for submittal to the FSQC.

11. SDL ADDITIONAL DUTIES – DATA ENGINEERING

Printed copy, verified accurate against web copy, signed, dated:

If Data Engineering services are provided by a two man crew the Field Specialist carrying out Data Engineering duties shall be considered the senior crew member on tour and will, I addition to the above, also be responsible for the following.[1]

11.1. Providing surface logging data representation and analysis to the customer at the rig site and in the End of Well Report.

11.2. Ensuring that the SDL equipment is in proper working order. In the event of a logging equipment malfunction, proper steps to obtain valid data by other means must be taken. Any preventive maintenance of surface unit and sensors may be carried out while tripping in the hole.

11.3. Drilling data from all sources will be analysed and integrated into relevant interpretations for the use and advice to the customer. Professional recommendations will be made based upon sound data supported by evidence for a daily morning report and at other times specified by the customer.

11.4. Being especially aware of early warning signs for any potential stuck pipe situation.

11.5. Being vigilant for the early warning signs of a potential kick situation.

11.6. Monitoring mud volumes (both reserve and active) during ALL operations. Any changes must be reported to the appropriate personnel.

11.7. Advising the customer to aid the process of drilling the well both safely and economically.

11.8. Calculating fracture gradient and the over burden gradient based on all available information, using approved industry techniques combined with personal experience. The customer and the relevant rig personnel must be informed when the Equivalent Circulating Density (ECD) is approaching the fracture gradient for any point in the open hole. There must be an awareness of the kick tolerance and advice to the customer given accordingly

11.9. Keeping an up to date drilling data log will be prepared including raw data plots such as ROP, corrected D- exponent ditch gas etc as defined. An up to date Pressure analysis log will be prepared and pore pressure derived based on drilling models

11.10. Interpreting the mud and bit hydraulics in use must along with those proposed for the next bit run, such that the optimum flow rates, jet selection and mud properties shall be recommended.

11.11. Providing an estimate of swab surge pressures, and with recommended maximum running speeds in advance of any trips. Swab surge calculations will be made prior to any trip and customer advised of any MAXIMUM Tripping In (Running speed -potential fracturing of formation) and Maximum Trip out or Pulling Speed which has the potential of reducing bottom hole hydrostatic and initiate a kick

11.12. Depending on scope of work, assisting the relevant rig personnel to utilize the networking system and ensure that the screens/monitors are updated during operations. Any communications shall be kept functioning as far as it is within our control, i.e. networks to town, data transfers etc.

11.13. Unit files will be maintained by the senior crew members at all times to ensure that accurate and relevant information is retained regarding all aspects of the operation.

12. FIELD FAILURE REPORTING PROCEDURE

[1] Note that in the case of a one man crew these tasks will be the responsibility of the single crew member if they lie within the scope of work

12.1. An Faulty Equipment Return form will be written at the rig site when any item fails in operation.

12.1.1. If documentation is incomplete, the originator will be contacted for further details. When the failed components are transferred to the repair facility a partially completed FERF will have to accompany the component. A copy of the FERF will be delivered to the Service Coordinator.

12.2. Components must be labelled with identifying tag as to where they came from. Standard HMS R&M procedures will be followed to process returned equipment.