

Writing an Intervention Procedure

- Varies across companies,
- Has same core objectives – to get work done safely, successfully and capture learnings.
- Items not frequently done to same standard:
 - Risk and uncertainty mitigation
 - Warning signs described w/ resultant actions
 - Learnings captured

Safety

- Controlling factor
 - All policies, processes and approvals must be satisfied.
 - Safety risk and hazard review.
 - Contractors knowledgeable on company requirements?
 - Training needed?
 - Everyone involved in procedure and execution has required training and certifications?
 - Permits to work and Risk/Hazard assessment

Communications

- Pre-job meeting w/ contractor personnel.
 - Determine equipment needs, including warning flags any possibilities for contingency operations.
 - Safety issues
- Field personnel
 - Is objective understood
 - Do they have information, history, experience that can help – LISTEN!
- Management
- Networks – get an external opinion in higher level jobs and “high cost well work”.
- Feed back – wellfile, WETS,

Policies and Practices

- What are the controlling elements?
 - Company policies
 - Chain of command
 - Governmental regulations
 - Environmental concerns.
- Rig ups must be in compliance with company policies.
- Service companies familiar with company procedures, scope of work, all components and what defines success for the job?

Responsibilities

Operation	Subsea Rep	WSS
Safety of the well	P	S
Run guide wires	P	S
Retrieve tree cap	P	S
Preparation of subsea/completion equipment	P	S
Run Subsea Intervention Lubricator, and test	P	S
Run drift run(s) and RST log	S	P
Run packer and shut in tool	S	P
Perforate	S	P
Perform PLT	S	P
Recover SIL	P	S
Run tree cap/commission/handover well	P	S
Retrieve guide wires/move rig	P	S
P Primary Responsibility	www.GEKEngineering.com	5
S Secondary Responsibility		

Procedure Basics

- History
- Analysis of the problem.
- Objectives and scope of the program. Definition of success.
- Options to accomplish objectives.
- Barriers and policies
- Warning flags and contingency actions
- Changes to the plan.
- Risk and Uncertainty.
- Responsibilities and contacts.
- Approvals

Writing the Technical End of the Well Work Procedure

- Won't touch further on policy, safety, contacts, communication or approval.
- Every job needs a minimum of five technical elements:
 1. Prepwork
 2. Executing the job
 3. Warning flags and contingencies
 4. When is the job over?
 5. Reporting the results

Technical Prepwork

- What needs to be done first:
 - Can the equipment get to the well? Layout?
 - Is service equipment fit for purpose & inspected?
 - Tree ready to receive tie-in?
 - Pre-work pressure testing done?
 - Schematic current, evaluated?
 - Can BHA get to depth? Drift needed?
 - Surveillance opportunities considered?

An example of high level well data

Operating Company	XYZ Co., location and accountability
Vessel	
Rig Owner	
Reference Safety Conditions	What ever safety cases or regulations apply
Well Particulars	
Quadrant/Block	
Part Block letter	
Well Name	
Licence Number	
Planned Start Date	
Operator for development area	
Depth Measurement Unit	
Water Depth (m, MSL)	
Water Depth (m, LAT)	
Slot Location (surface)	<i>50°00' 00.000" N and 02°00' 00.000" E</i>
Well Work Cost Code	www.GEKEngineering.com

Specifics

- Average deviation through pay zone is 60° degrees.
- SSXT (Sub-Sea Xmas Tree) is a Cameron 10,000 psi, 5" x 2" Dual Bore. The installation of the sub-sea equipment has been designed such that only ROV assistance is required. No provision for divers has been made.
- The completion is a 5 ½" OD x 5" Liner completion. The well is mono-bore.
- TRDHSV (SSSV) depth is 150 m SS.
- The well is live with measured CITHP of around 100 bar (1500 psi).
- The well is a producing oil well and currently shut in due to facilities PWRI and slug-catcher limits.

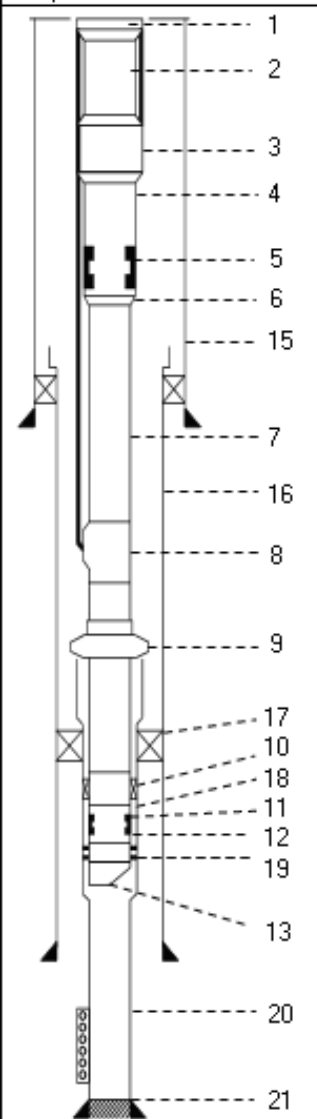
Valve Specifics

Valve Description	Valve Position
SSXT-PSV	CLOSED
SSXT-PMV	CLOSED
SSXT-PWV	CLOSED
SSXT-ASV	CLOSED
TRDHSV	CLOSED
PIV	OPEN
Gas Lift line to annulus	OPEN
Methanol Line	OPEN
Scale Inhibitor Line	OPEN

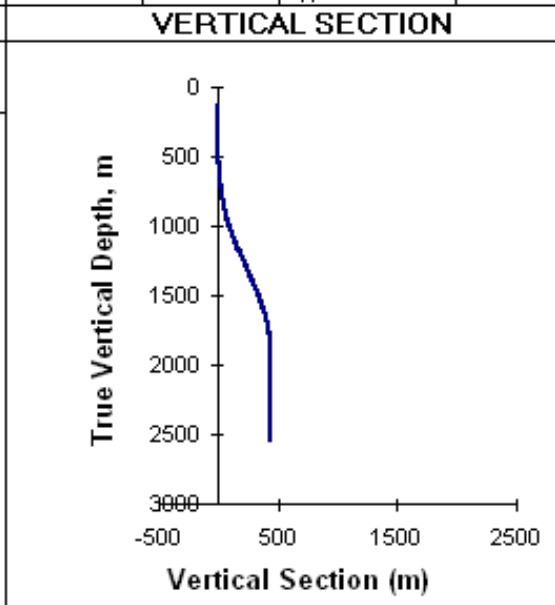
WELLBORE SCHEMATIC

All depths referred to RKB

GENERAL				FORMATION			FORMATION			Compl. String Instl.	
Wellbore volume (bbl)	142,5	Max.dev.(deg)	30,3		TVD	MD		m TVD	m MD	Latest Update	
Tbg.Hanger to top of perms			at 1461m MD		L. Miocene	1450	1517	L	2460	2555	Prep.
Wellbore volume (bbl)	144,6	Dev. across pay	3,3	M.Eocene	2198	2293	T	2470	2565	Checked	
Tbg.Hanger to PBDT			Min ID" to top of perms	3.725"	Ba	2433	2528	H	2525	2620	DF/Drig.Eng.
Completion Fluid		Inhib. seawater	Annulus Fluid	Inhib. seawater	Sel	2448	2543	TD	2540	2635	Approved



COMPLETION STRING						
Item	Description	Drift ID"	Max OD"	Depth m MD	Depth m TVD	
1	ABB Vetco Gray tubing hanger	4.653		29.31	29.31	
2	5 1/2" 20 ppf N-80 New Vam tubing	4.653	6.075	36.5	36.5	
3	Camco TRDP SCSSV	4562 ID	8.250	201.47	201.47	
4	5 1/2" 20 ppf N-80 New Vam tubing	4.653	6.075	206.5	206.50	
5	Baker 4.312" AF nipple	4312 ID	6.120	605.87	605.05	
6	5 1/2" x 4 1/2" crossover	3.833	6.100	608.52	607.66	
7	4 1/2" 12.6 ppf New Vam tubing	3.833	4.892	610.72	609.83	
8	Smedvig Gauge Carrier	3.833	5.710	2450.30	2355.97	
9	Nodeco Shear sleeve	3.833	8.250	2463.26	2368.92	
10	Halliburton 7" AHR prod. packer assy	3.833	5.910	2472.26	2377.92	
11	3.813" Halliburton XN Nipple	3725 ID	5.010	2473.75	2379.41	
12	Nodeco Seal assy. w/shear disk	3.833	5.750	2475.0	2380.66	
13	Halliburton Self align. muleshoe (btm.)	3.833	5.700	2476.76	2382.37	



CASING/LINER DATA						
Item	Description	Drift ID"	TOC	Top MD	Shoe MD	
14	20" 94 ppf X-56 casing	18.63	Seabed	Wellhead	351	2593.7 - 2613 (2 SPF 120 shots)
15	13 3/8" 72 ppf P-110 casing	12.491	251	Wellhead	1389	2578.0 - 2584 (new propped frac)
16	9 5/8" 53.5 ppf C-95 liner	8.379	2521	1223	2575	
17	Nodeco MHR/TSP liner hanger/packer			2463,55		
18	7" 32 ppf pup joint	5,97		2471	2474,06	
19	5.75" ID PBR	5,75		2474,06	2477,06	
20	6 5/8" 65.8 ppf Q-125 liner	4.250	2463,55		2634	
21	PBDT			2628		

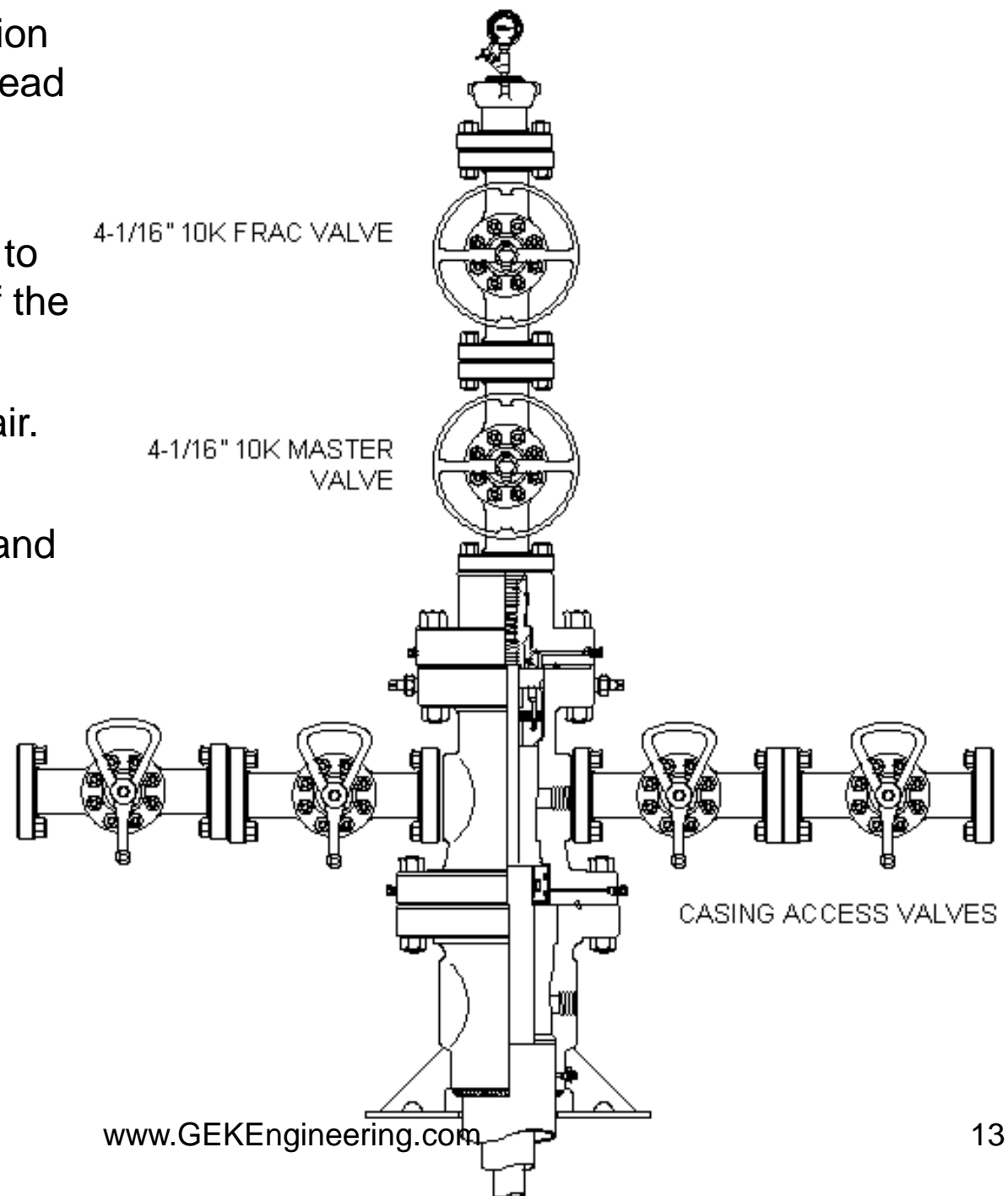
PERFORATED INTERVALS m MD	
2593.7 - 2613	(2 SPF 120 shots)
2578.0 - 2584	(new propped frac)

A very widespread intervention problem is uncertainty of thread type, flange size, flange bolt pattern and seal type.

One of the prep functions is to verify the type and quality of the connection point.

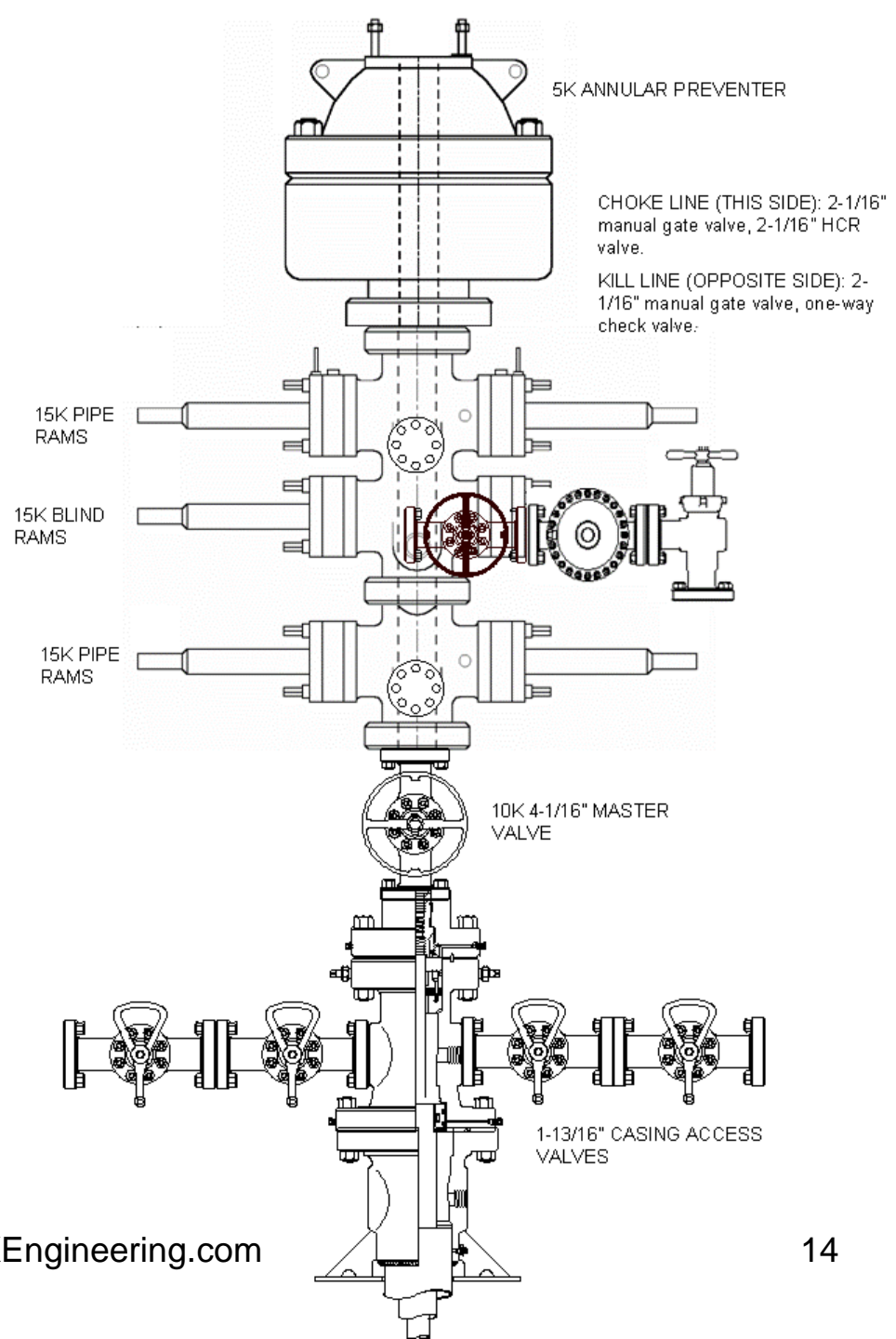
Valves must be in good repair.

Prep work of this type can reduce rig-up risk and time and even stop some equipment mobilization on wells that require wellhead work first.



What is necessary in the Rig-up?

1. Does it meet safety standards?
 1. Barriers in compliance? Each piece of BHA sealable? What is not shearable?
 2. Working pressure rating OK?
 3. Can it be tested? On the well?
 4. Personnel trained and rated to handle?
2. Will height and width fit in the location or bay?
3. What is the flange connection type, rating, bolt pattern and size?
4. Check every clearance with run-in BHA and recovered BHA (including fish)

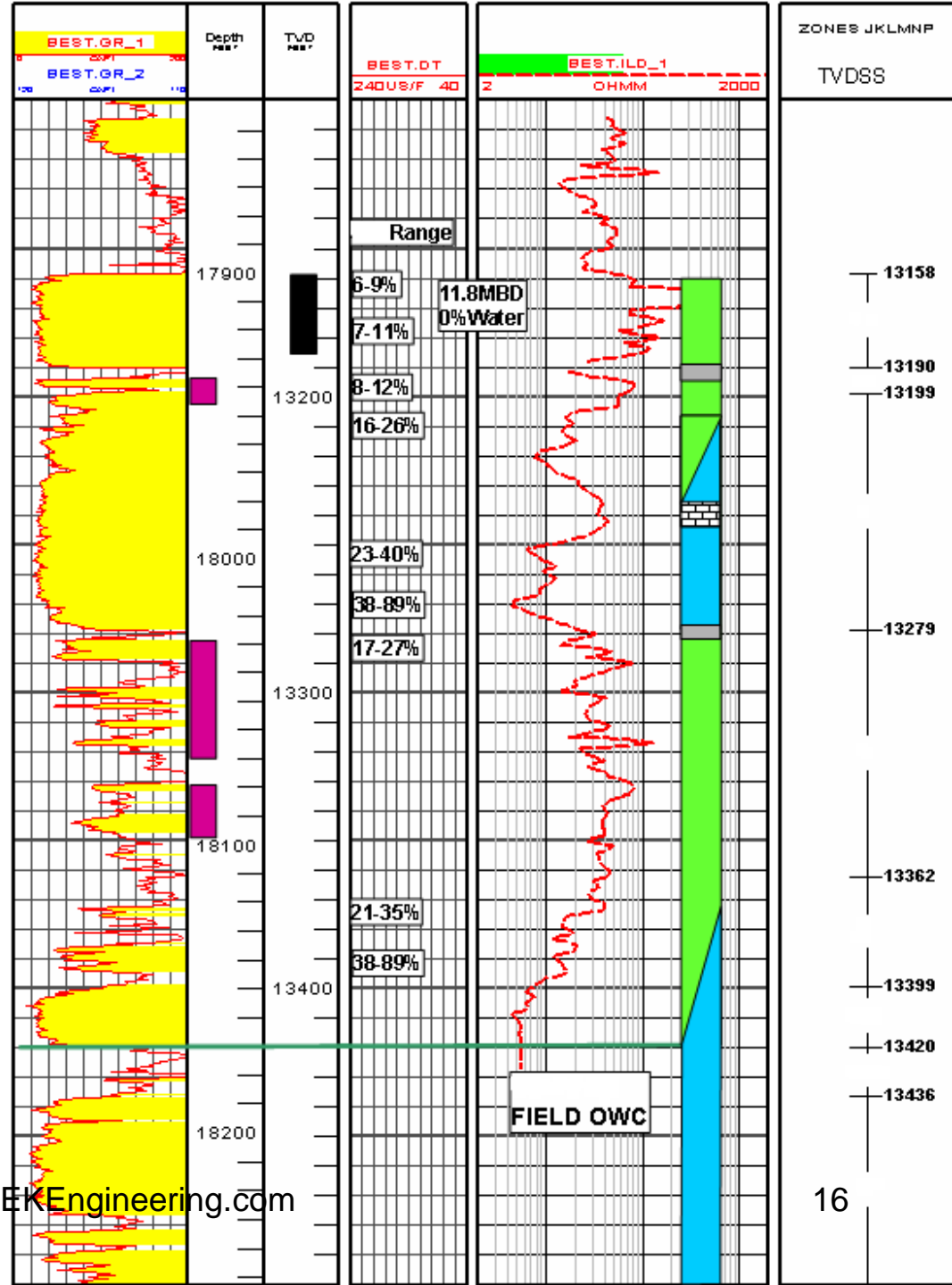


Modeling the Runs

- Run predictive models such as CoilCade to determine weight and CT forces. String weight is dependent on the length of CT, wellbore geometry, WHP, fluids in the CT and tubing, and stripper psi. Run simulations for all of the anticipated conditions.
- While RIH check actual weights against simulations. If there are significant differences determine the reason before proceeding further.

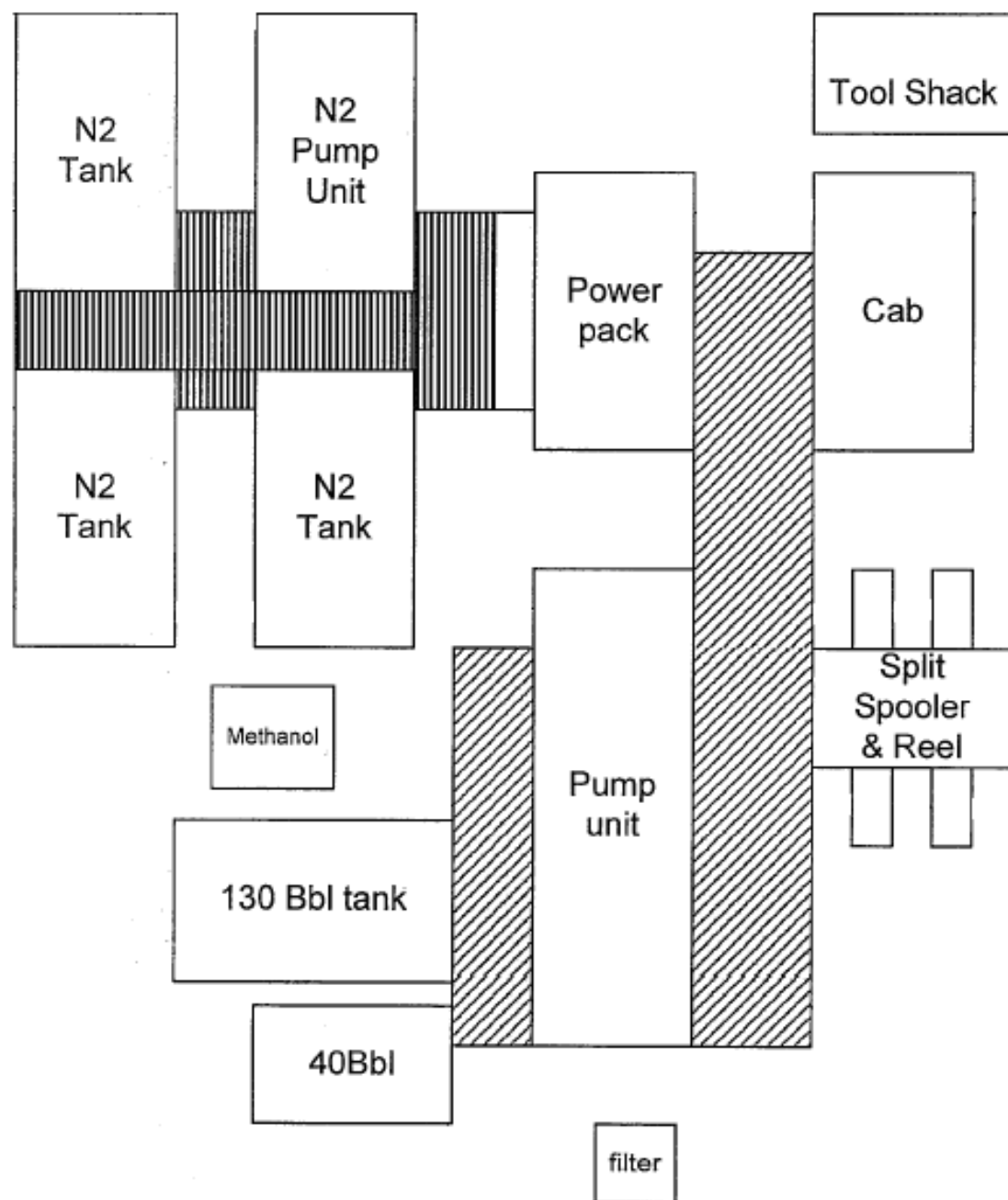
What logs are available:

1. Depth control,
2. Invasion depth
3. Porosity and permeability,
4. Natural fractures,
5. Pay identification,
6. Pay differentiation,
7. Pay evaluation,
8. Water and gas contacts,
9. Cement quality and channels,
10. Remaining reserve verification.



Platform Layout

1. Constrained space
2. Bracing often required
3. Simops operations a possibility
4. Evacuation and traffic areas are a concern.
5. Nearby wells may have to be shut in in some cases.



Scope

- Ideally, the scope is the extent of operations.
- Scope change - an needed activity has been identified that is not discussed in the initial scope, or directly referred to in the program. (Example: during operations to run a wireline log it is discovered that all the tree valves leak and a tree or valve replacement is required).
- Solutions: prepwork to identify problems before equipment mobilization and decision points and planned actions for circumstances that are routinely encountered in the job.

Other Changes

- **OPERATIONAL CHANGE** - within the program scope, a change is required that may increase the risk of the operation.
- Operational changes must be assessed in consultation with onshore/office engineering. Approval to implement the change must be acquired. A designated program reviewer from the wells team must be involved in the assessment.
- **DETAIL CHANGE** - a change to program which clearly does not impact the risk of the programmed operation. (Example: a wireline gauge run with desired OD is unsuccessful and the decision is taken to attempt a run with a smaller tool).
- Detail changes can be assessed and approved on site but notification must be made to the program author or supervisor in most cases.

A Simple Job Overview

- Objective of work is to enable well to be produced by isolating the current perforations with a packer and shut in tool and perforating the oil bearing sands at 1500-1550 m BRT.
- Take control of well XX (W345).
- Remove tree cap
- Establish Subsea Intervention Lubricator onto well
- Make a drift run on slickline.
- Perform RST logging programme to identify the potential oil producing zones.
- Set the packer with Electronic Shut In Tool.
- Perforate potential oil producing zones (maximum of 50 meters)
- Complete a production log
- Suspend well – re-isolate.
- Remove the Subsea Intervention Lubricator.
- Replace the tree cap
- Hand well XX (W345) back to production operations.

Preparation Checks

- Review, agree and document prior to rig-up, the valve opening time for the ESIT.
- The complete assembly has been pre made-up and pressure body tested, prior to shipping to the location, however, if a different configuration is required, any connections “broken”, must be re-tested to 1,500psi for a 30min period.
- Connect the battery to the ESIT, document the ESIT tool start time and perform a visual confirmation function test of the ESIT tool, prior to RIH.
- Review, agree and document prior to rig-up, the sample rate and duration of the sapphire memory gauges.
- Connect battery to the sapphire memory gauges, document the memory gauges start time, prior to RIH

More – Note level of detail

- Pick up carefully, the complete assembly including 4.12” PB Packer, 2-7/8” x 5ft Safety Joint, Electronic Downhole Shut-in Tool, (optional 2.6” od roller centraliser), 2 x Extended Electronic Sapphire Memory Gauges, Hole Finder. Ensure that no sudden “jerking” movement of the BHA assembly is evident at this stage, while “making” it up to the upper section of the deployment BHA.
- Make up the setting adapter into the PB packer until tight (left hand thread). Confirm that twelve SS ¼-20 x ½”-UN Steel shear screws are installed in the adapter. Setting Force = 27,000 lbs (+/- 10%).
- Slide the outer sleeve of the setting sleeve assembly over the 3 5/8” #20 setting tool
- Make up the inner mandrel of the setting sleeve assembly to the 3 5/8 #20 Setting tool. Tighten locking grub screws.
- Screw the 3 5/8” #20 Setting tool to the setting adapter and tighten the locking grub screws. Care must be taken when making up this connection.
- Back down the outer sleeve of the setting sleeve assembly, ensuring that the outer sleeve bottoms out on the top of the PB packer. Tighten the locking screws to hold the sleeve in place.
- Pick up completed assembly and make it up to the remainder of the upper deployment section of the BHA, consisting of CCL, Safe firing system and any other optional weight bars required to overcome well parameters. Follow well entering procedure. – (refer to location in the procedure)
- RIH not exceeding 120ft per min. Slow the running speed at all well bore restrictions and carry out weight tests as per E-line procedures.
- Correlate the BHA to a Setting Depth of 3 meters above existing top perf.

After Setting a Packer – Test!

- 1991 meters - completion depth.
 - Allow a 15mins time period after setting the PB Packer assembly. Record CCL on time and Slack off carefully on cable while monitoring the CCL time trace to confirm that the BHA assembly is set and located successfully. Once confirmed, Log CCL on time and pick up off of the deployed assembly, carefully monitoring the weight indicator. A noticeable decrease in weight should be witnessed. Continue to POOH.
 - Confirm the packer has set before POOH.
 - POOH with the running/ deployment tool assembly.
 - Follow well exit procedure (Refer to location of the spec)
 - Confirm that the deployed BHA assembly has set successfully by observing the “activated/ sheared” setting adapter kit, once retrieved at surface
 - Pressure test packer.

Some Special Cases - Perforating

- Perforate zone x after evaluating RST log. Maximum length to perforate will be 50 meters. This will be done in 6 runs
- From the previous RST's the potential perforations are:
 - 1500 – 1510 m
 - 1515– 1555 m
- **Safety**
- Verify that a suitable weather window exists to complete the operation.
- Conduct a pre job safety meeting including a brief outline of the perforating plan, discussing who has what responsibilities and telling all non essential personnel to stay clear until notified.
- Radio silence is not required
- Decide where gun make-up will take place. Clear all unnecessary personnel from the controlled area and put up barriers if necessary.
- Agree to any hand signals that may be used during the operation
- **Question – what steps are missing?**

Perforating - Next

- Make up perforating gun string to perforate XXXX to XXXX meters
- Make up the tool-string
- Follow the well entry procedure.
- Run in hole. Verify shot depth on the reference log. Verify depth correction based on tool-string offset.
- Log across the zone of interest to enable correlation. Verify log quality.
- Correlate bottom shot at 1555 m.
- Prepare for perforating. Confirm all personnel are ready.
- Initiate the perforation.
- Confirm guns fired
- POOH with guns
- Follow well exit procedure, when guns are above sea floor, ensure all non-essential personnel are kept inside accommodation until guns are confirmed as fired and there is no trapped pressure in the fired guns.
- Confirm all guns fired, making a note of any un-fired charges or unusual shaped or ovaled hole in the carrier. .
- Perforate the required intervals completing the following perforating gun runs : XXXX - XXXX
- De isolate the well to test.
- Flow the well to facilities to clean up for 6 hours

Logging Example

- Make up the FSI PLT string.
- Follow the well entry procedures
- Run in hole taking care at restrictions
- Record a down FSI (flowing shut-in) pass from xxxx to xxxx m at 30 ft/min.
- Take 5-min shut-in stations at xxxx and xxxx m to observe possible cross-flow.
- With the tool-string positioned at xxxx m, slowly bean the well up bpd as per procedures to a maximum of x bpd. **E-line tension must be monitored closely each time the choke is increased to guard against potential tool lift.**
- Once the desired maximum flow-rate has been achieved, allow the well to stabilise until the down-hole flowing pressure varies by less than X psi / minute
- Take 15-min PLT flowing stations at a,b,c.. and at any additional depths deemed important based on the results on the flowing passes.
- Shut-in the well at the choke and then wing valve and POOH .

Some Appendices

- **Decision Tree**
- **Completion Diagram**
- **Surface and Subsea Equipment Layout**
- **BHA Stack Up**
- **Heavy Weather Disconnect Procedures**
- **Weather Operating Guidelines**
- **SIMOPS**
- **Pressure Testing Procedure**
- **Handover Document**

What is missing?

- When to quit when the procedure is not working.
- Warning signs and contingencies. Are they needed?

Depth	Est. Pick Up Weight (lbs)	Actual Pick Up Weight (lbs)
1000	1300	
2000	3800	
3000	6600	
4000	9600	
5000	12700	<p>If specific information – such as checking pick-up weight every 1,000 ft is needed, include a table with needed data – can be useful in spotting a developing problem.</p>
6000	15900	
7000	19100	
8000	22400	
9000	25600	
10,000	28200	
11,000	30000	
12,000	31500	
13,000	33000	
14,000	34000	
15,000	35100	
15700	35900	

Well Component Inventory – what, where, ID (drift?)

Component	MD (ft)	ID (inches)
SCSSV	1197	4.562
GLM #1	1462	4.778
GLM #2	2200	4.778
GLM #3	2783	4.778
GLM #4	3360	4.778
AOF Nipple	3630	4.312
AOF Nipple	12803	4.125

What is going in the well?

Description	OD (in)	ID (in)	Length (in)
Coiled tubing connector	2.125	1.031	12
Double Flapper Check valve	2.125	1.031	18
Hydraulic Disconnect	2.125	0.9375	18
CCT	3.0	0.9375	10
Total			58

Different BHAs?

Item	OD (in)	ID (in)	Length (ft)
Standard Slip Type CT Connector	2.875	1.38	0.93
Lockable Swivel	2.875	1.00	1.87
Dual Flapper Check Valve	2.875	0.94	1.42
Double Acting Oil Jar	2.500	0.96	7.60
FDL Hydraulic Disconnect	2.875	0.69	2.26
Dual Actuated Circulating Sub	2.875	0.56	1.34
Fixed Blade Stabilizer	4.500	1.25	3.16
SmithDril Work Over Motor	2.875	N/A	10.66
Stage Mill	4.550 4.375 4.095	1.38	3.5
Total Length	www.GEKEngineering.com		32.74 32

Personnel	Total	Off-load	CTCO	CT-p	CT-m	SL	CT-OL	GLV	
Wellsite Sup.	2	2	2	2	2	2	2	2	
(Technical Support)	1	1	1	1	1	1	1	1	
JOS	5	10	5	5	5	5	5	5	
Rig Support	2	2	2	2	2	2	2	2	
Catering	6	6	6	6	6	6	6	6	
Portable Works	3	--	3	--	3	--	--	--	
Slickline	6	--	--	--	3	6	--	6	
Electric Line	6	--	--	--	--	--	--	6	
CT/Pumping/N2	12	12	12	10	10	10	12	--	
Service Engineer	2	--	--	--	2	2	--	--	
Sand Separator	5	5	5	5	5	5	5	5	
ISS	1	--	--	--	1	1	--	--	
Service 1	2	--	--	2	--	--	--	--	
Service 2	3	--	--	3	--	--	--	2	
Service 3	1	--	1	1	--	--	--	--	
		www.GEKEngineering.com							33
W/I Total	57	38	37	37	40	40	33	35	

Materials Requirements

Material	Quantity	Supplier
Liquid Nitrogen	25,000 gals	A
KCl	7,000 lbs	B
Gel Breaker (AP)	40 lbs	B
Perm A	60 lbs	C
Perm D	1 lb	C
Laponite RD	55 lbs	C
Laponite RDS	55 lbs	C
Baracarb 50	60 sacks (3000lbs)	B
N-DRIL-HT	250 lbs	B
Liqui-Vis	15pails	B
N-Vis	1200 lbs	B
HT-Breaker	25 gals	B
Caustic soda	25 lbs	B
FDP-S653-02 Breaker	275 gals	B

Lift No	Coiled Tubing Equipment	Length (ft)	Width (ft)	Weight (lbs)
1	PTS Sand Separator Metal Container	16 10	6 8	23,880 (empty) 8,240
2	100 bbl Return Tank	13	11'8"	2,000
3	Tool Box with Tarps & Plywood	8	6	3,500
4,5	Nitrogen Tank 3000 gallon	20	8	34,000
6,7,8,9	Nitrogen Tank 2000 gallon	15	8	23,000
10	Nitrogen Unit	13	8	20,000
11	DID Tubing Reel/Skid	14.2	8.5	12,500
12	DID Tubing Spool (17,000 ft, 1.75" OD Tapered String)	11'10"	8	56,000
13	Control Cabin/Power Pack	16	8'6"	18,500
14	Triplex Pump P17 Triplex Pump P27	17 18'6"	6'7" 7	20,500 22,400
15	Injector Basket	14'10"	8'2"	22,000
16	Chicsan Tool Box	24	4'6"	14,000
17	Power Hose Reel	8'5"	7'2"	6,250
18	Nitrogen Tool Box	6	3	3,000

Pertinent Data on the Well

Well Name	EX 1-st 97-801-03965-00 [API]
Sand name / H₂S?	22 / 0 ppm.
Completion Type	Open Hole Gravel Pack
Perforated Interval:	8 ½" Open hole 13,676'-15,731' MD(ORKB)
Screen type	5 ½" 316L SLHT Excelflo w/ Spirolizers (110 µm)
Screen interval	13,607'-15,724' MD-ORKB
Reservoir pressure	+/-3008 psig (Sept 2004, 9327' TVD)
SITP	725 psig (April 2005 Well currently SI)
BHST/FBHP	3008 psig /2800 psig (Sept 2004, 9327' TVD)
Tubing capacity	0.0222 bbl/ft for 5-1/2" 20 ppf Vam TOP
Minimum ID	2.125" [Dbl Flapper Wash Down Shoe @ 15,726'MD']
Tubing volume	285 +/- bbls to top of pkr @ 12,814' MD-ORKB.
Annular Volume	530 +/- bbls to top of pkr @ 12,814' MD-ORKB.
Production casing	8.535" [9-5/8" 53.5 ppf, P-110 New Vam]
PBTD	Ported Dbl Flapper Wash Shoe @ 15,726'MD-ORKB Last SLTD @ 10,088' (May 2005)
Maximum Deviation	90.51 deg. @ 14,283' MD-ORKB

Prep Work and Valve Information

1.0	Prior to Rig Up	<ul style="list-style-type: none">1.1 Frac Tree and casing have been previously tested to 10,000 psi.1.2 Flare Lines have been previously tested to 6000 psi.1.3 Record in DIMS the initial pressure on the well.1.4 Confirm position of Tree Valves.1.5 Wing Valves:<ul style="list-style-type: none">a. 1-13/16" or 2" Cameron gate valve requires 12-1/2 turns to full openb. Master Valve: 3-1/2" Cameron gate valve requires 18-1/2 turns to full openc. Master Valve: 4-1/2" Cameron gate valve requires 23-1/2 turns to full opend. 1-13/16" 10K FMC gate valve requires 11-3/8 turns to full open (once fully opened rotate back 1/4 turn)e. 4-1/2" 10K FMC gate valve requires 19-1/8 turns to full open (once fully opened rotate back 1/4 turn)1.6 Starting position on all valves on tree and tubing head are in the closed position.1.7 Prior to rig-up of wireline, open and close the swab valve, noting the turns to open and close the valve. (DWOP 19. 3.4)
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2.0	Perf Stage 1	<p>2.1 Move in Electric Line Unit with 10K psi wireline BOP's and 10K psi lubricator.</p> <p>2.2 Prior to rig up, complete a critical lift permit.</p> <p>2.3 Barriers to Nipple up wireline lubricator are: Closed frac valve, Closed swab valve, Closed double wing valves on both sides of flow cross.</p> <p>2.4 BOP stack will consist from bottom up of the following (DWOP 9.7.1):</p> <ul style="list-style-type: none"> a. Double wireline rams – conductor line, b. Single wireline rams – conductor line, c. Pump in tee, d. Lubricator, e. Grease head. <p>2.5 PU CCL and perforating guns.</p> <ul style="list-style-type: none"> a. Connect the lubricator in preparation for pressure test. b. While connecting & arming perf guns, ensure location under radio silence (DWOP 21.8) <p>All non-essential personnel are to be away from this operation (DWOP 21.5)</p> <p>2.6 RU pressure test pump to pump in tee.</p> <p style="padding-left: 40px;">Press test BOP & lubricator against Swab Valve to 250 psi. (DWOP 20.1.1) Hold 5 min. Increase pressure to 5000 psi for a high pressure test. (DWOP 20.2.2) Hold for 5 min. Bleed pressure off lubricator to anticipated well pressure, Open Frac and Swab Valve Lock out and tag out open Frac and Swab Valve</p> <p>2.7 TIH with CCL & perforating guns.</p> <p>2.8 Perforate the stage as per the Perforation CSOR</p> <p>2.9 TOOH with spent guns</p> <p>2.10 Once back in lubricator close the Frac Valve.</p> <p>2.11 Bleed fluid out of lubricator through choke line to flare pit.</p> <p>2,12 Close Swab Valve</p> <p>2.13 Close wing valves.</p> <p>2.14 Remove wireline BOP's and lubricator at the WECO flange above the swab valve.</p> <p>2.15 Check that guns fired.</p> <ul style="list-style-type: none"> a. If guns did not fire, return to step 2.5 and repeat perforating process. b. If guns fired, proceed to rig down or prepare for next stage of perforating.
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