DIMENSION BID

PETRONAS

DULANG A-12
CT MILLING & ADD PERFORATION

Revision: 2
Prepared for: Ellisa Suzrin Shamsul
Date Prepared: 26th August 2024
Well: A-12
Field: Dulang A
Operation Region: PMA
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DESIGN VERIFICATION

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APPROVED BY DB CTS General Manager	 Aliff Adenan	26/08/2024 Date
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APPROVED BY PCSB Head of Cluster 2 Well Intervention, PMA	Ahmad Hafizi B Ahmad Zaini	Date

Remark: Do not execute the procedures in this document if it is not fully approved and signed by all parties.

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REVISION HISTORY

Rev. No	Section	Date	Revised By
0	All	21/8/2024	M. Ameerul Zaeem
1	Revise step on cementing procedure.	25/8/2024	M. Ameerul Zaeem
2	Include CIRCA Cleanout Simulation Result	26/8/2024	M. Ameerul Zaeem

ACRONYM

Acronym	Abbreviation
BHA	Bottom Hole Assembly
RIH	Run In Hole
POOH	Pull Out of Hole
HUD	Hang Up Depth
TCC	Tubing Clearance Check
SCO	Sand Clean Out
TIT	Tubing Integrity Test
BOP	Blow Out Preventer
CT	CT
ID	Internal Diameter

MDTHF	Measure Depth Tubing Head Flange
TOP	Top of Plug
MASTP	Maximum Allowable Surface Treating Pressure
STP	Surface Treating Pressure
OHSAS	Open Hole Stand Alone Screen
TIW	Treated Injection Water
TFW	Treated Fresh Water
IW	Injection Water
SSD	Sliding Side Door
DKCV	Dual Kelly Cock Valve

TABLE OF CONTENT

OBJECTIVES

The objective of this job is:

1) To perform CT Milling on fish (parted tubing stop sleeve) with burnshoe mill bit to have wellbore access until depth 2,749 m MDDF.
2) To perform CT Add Perforation for E34A zone (2,740 m – 2,749 m MDDF).
3) Contingency Zonal Isolation on zone E22A via CT Cement Shut Off

PROBLEM STATEMENT

Dulang A-12 is an oil producer. Currently the well is producing from zone E23U & E32 with 392 BOPD & 90% of water cut. Latest HUD depth at 2,611 m MDDF recorded on April 2023 with clear image of parted tubing stop sleeve. PCSB has engaged DB to mill the fish & drift until target depth prior to add perforation at zone E34A.

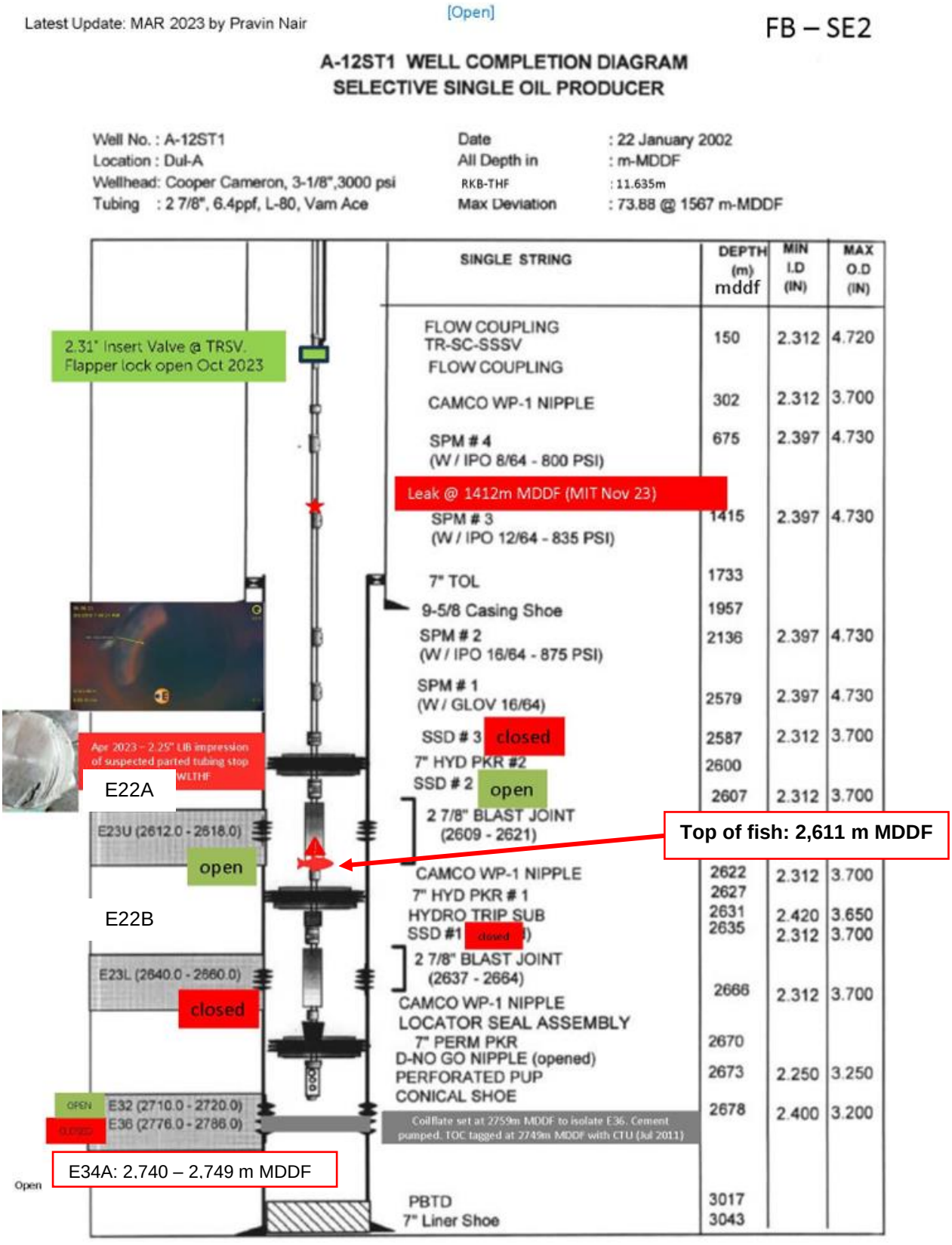
WELL DATA

Input Parameter	Parameter Value
Field	Dulang A-12
Max. Deviation (degrees)	73.88 Deg @ 1,567 m MDDF
Min. Restriction (inch)	2.25” @ 2,670 m MDDF (‘D’ Nogo Nipple)
Tubing Specification	2-7/8” Production Tubing (Refer Well Schematic)
Type of Fluid & Density	N/A
Top of Fluid	716 m MDDF
Current Well Status	Flowing
Depth of zone	E23U (2,612 – 2,618 m MDDF) E32 (2,710 – 2,720 m MDDF) Future: E34A (2,740 – 2,749 m MDDF)
Reservoir Pressure (psi)	E32: 1,542 psi, E34A (Future): 1,436 psi
Reservoir Temperature (deg F)	E32: 214 deg F, E34A (Future): 218 deg F
Porosity	E32: 22%, E34A (Future): 24%
Permeability (mD)	E32: 300 mD, E34A (Future): 300 mD
Fracture Gradient	0.67 psi/ft
H_2S Content	0%
CO_2 Content	65%
Mercury, HG	0%
Additional Information / Notes / Special Requirement:	
• Top of Fish (Tubing Stop Sleeve): 2,611 m MDDF	

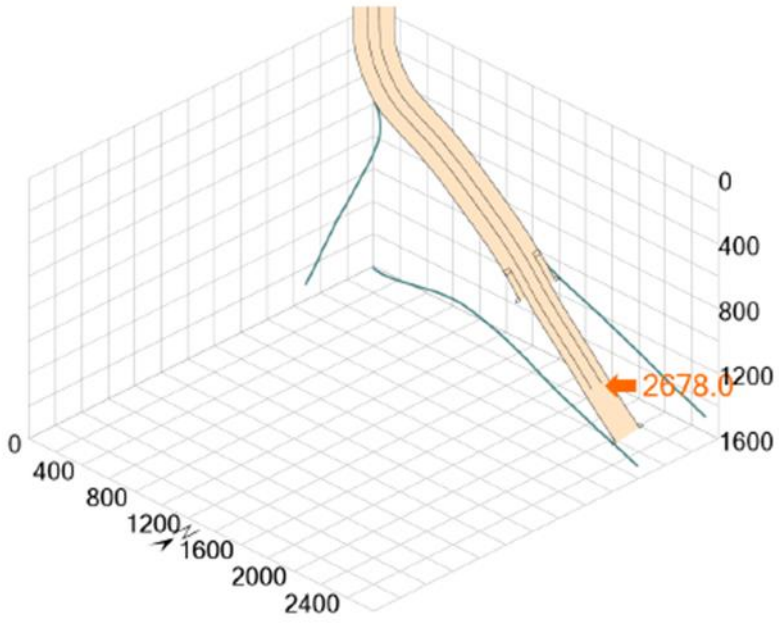
OPERATION SUMMARY

Item	*Job Description*	*Remark*
A	**CT Operation**	1. **CT Run#1**: Burnshoe milling top of fish at 2,611 m MDDF (parted tubing stop sleeve) until 'D' Nogo Nipple 2. **CT Run#2**: Drift & depth correlation until PBTD at 3,017 m MDDF 3. **CT Run#3**: GRCCL with dummy Gun (2.00" OD x 6m length) 4. **CT Run#4**: CT Perforation (Gun 2.00" OD x 9m length)
B	**CT Contingency**	5. **CT Contingency#1**: Fishing with Magnet 6. **CT Contingency#2**: Venturi Junk Basket (VJB) Cleanout 7. **CT Contingency#3**: Cement Shut Off to isolate zone E36 until E34A Bottom Perf at 2,749 m MDDF 8. **CT Contingency#4**: Drift run until tag top of cement (TOC) 9. Cement Integrity Test a. CT Contingency CT Packer – to isolate leak at depth 1,412m and pressure test cement b. Bullheading fill-up PCP volume before fill up tubing volume and pressure test 10. **CT Contingency#5**: Underreamer milling until E34A Bottom Perf at 2,749 m MDDF 11. **CT Contingency#6**: Post milling cleanout until E34A Bottom Perf at 2,749 m MDDF

WELL DIAGRAM



WELL 3D PLOT



Well name: Dulang A12
Total depth: 3048.0 m
Max Inclination: 73.8° at 1571.8 m
Max DLS: 6.230 °/100ft at 173.6 m
Min ID: 2.250 in at 2673.0 m
WHP: 150 psi

Input Parameter	*Parameter Value*
Field	Dulang A-12
Trajectory Until Depth	3,048 m MDDF
Max. Deviation (degrees)	73.8 degree at 1,571.8 m MDDF
Min. Restriction (inch)	2.25” @ 2,673 m MDDF

TREATMENT VOLUME

Description	Details
Tubing Specification	2-7/8" 6.4ppf# L-80
Liner Size	7" Liner

Tubing Volume

Type	External Pipe			Internal Pipe 1			Internal Pipe 2			Caps	From	To	From	To	Length	Total Volume (bbls)
	OD (inch)	ID (inch)	W(lb/ft)	OD (inch)	ID (inch)	W(lb/ft)	OD (inch)	ID (inch)	W(lb/ft)	Barrel/lin (ft)	m	m	ft	ft	ft	
Tubing volume until fish area	2 7/8	2.441								0.00579	0	2,611	0	8,567	8,567	**50**
Tubing volume until EOT	2 7/8	2.441								0.00579	0	2,678	0	8,787	8,787	**51**
Annular volume below EOT	7	6.366								0.03937	2,670	2,759	8,760	9,052	292	**11**
PCP volume	9 5/8	8.835		2 7/8						0.06780	0	1,733	0	5,686	5,686	**385**
PCP volume	7	6.366		2 7/8						0.03134	1,733	2,600	5,686	8,531	2,845	**89**
Assuming Coilflate fail, and drop until PBTD. (Cement volume calculation)																
Annular volume above EOT	7	6.366		2 7/8						0.03134	2,670	2,678	8,760	8,787	26	**1**
Annular volume below EOT until PBTD	7	6.366								0.03937	2,678	3,017	8,787	9,899	1,112	**44**
Annular volume from PBTD until top of zone E36	7	6.366								0.03937	2,776	3,017	9,108	9,899	791	**31**
Annular volume from PBTD until top of zone E32	7	6.366								0.03937	2,710	3,017	8,892	9,899	1,007	**40**
Annular volume from PBTD until top of zone E32 (+10m above)	7	6.366								0.03937	2,700	3,017	8,859	9,899	1,040	**41**
Annular volume from PBTD new perforation zone btm interval (2,740 - 2,749)	7	6.366								0.03937	2,749	3,017	9,019	9,899	879	**35**

MAXIMUM ALLOWABLE SURFACE TREATING PRESSURE (MASTP)

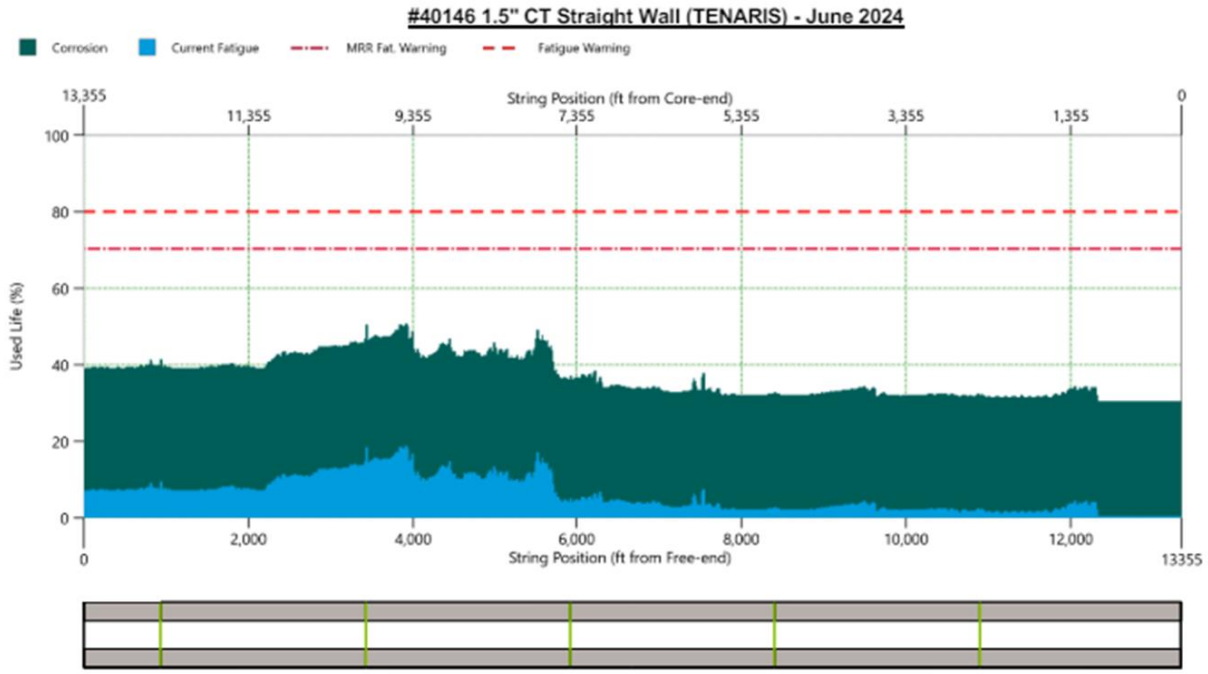
Fluid	Fluid Density (ppg)	Interval TVD (ft)	Hydrostatic Pressure (psi)	Fracture Gradient (psi/ft)	Fracture Pressure (psi)	STP	80% MASTP
Sea Water	8.50	4,380	2,044	0.67	3,028	984	787
Cement Slurry	15.0	138					

CT STRING INFORMATION

OD (in)	Spec	W/T (in)	ID (in)	Length (ft)
1.5	TENARIS HS-90	0.125	1.25	13,355
CT Volume: 20.3 bbls				

CT STRING FATIGUE

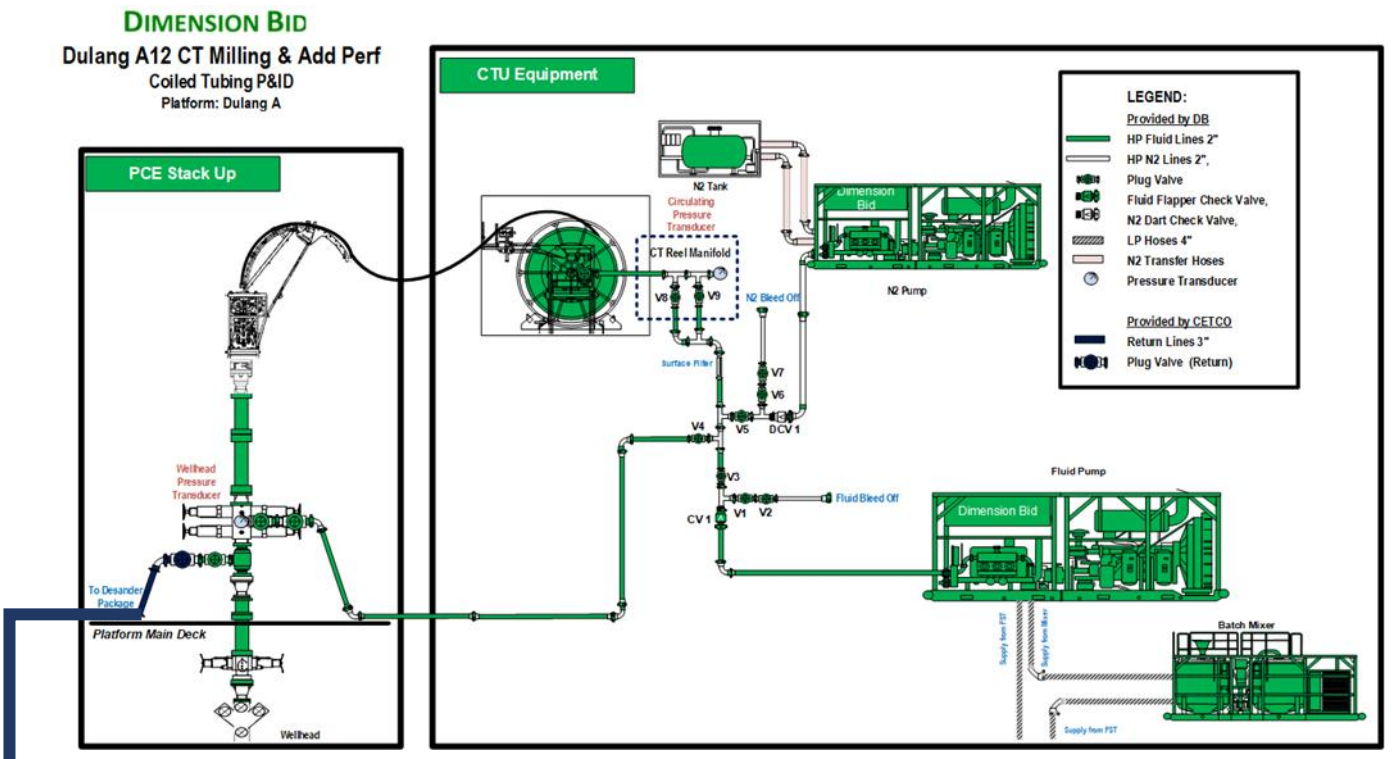
- Current **used life** for Tenaris #40146 is at **50.57%**

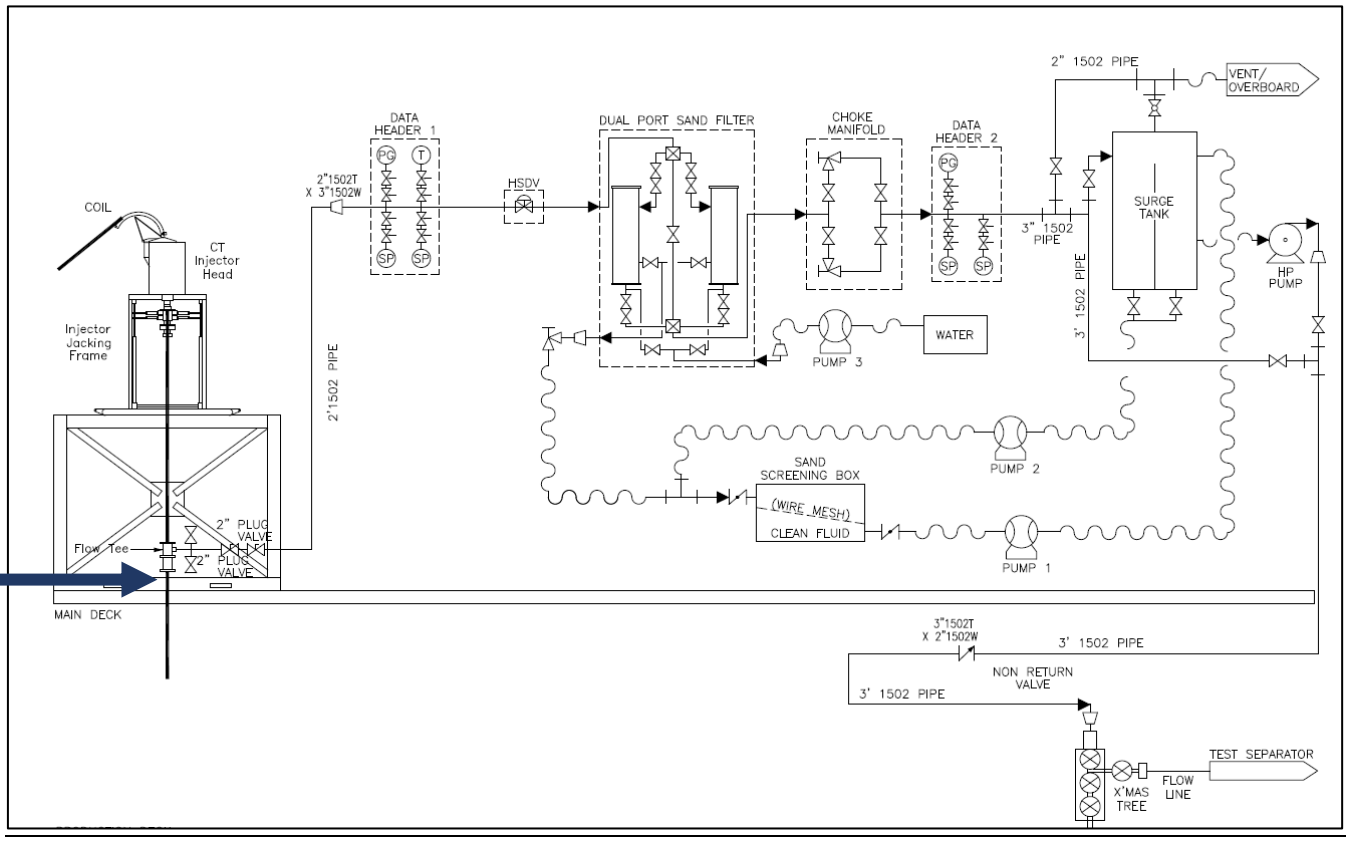


Run #	Date	Client Name	Field Name	Well Num	Job type	CT leng ft	CT cut ft	New CT leng ft	Job Fatigue %	Job Corrosion %	Max Fatigue	Cum. Corrosion %	Used String Life %
NA	11-Mar-24	PCSB	Open yard	NA	EMC 2	13,389	0	13,389	0	0.5	0	N/A	N/A
NA	27-Apr-24	PCSB	Dulang-D	D-06S	Trim Coil 32FT	13,389	32	13,357	N/A	N/A	N/A	N/A	N/A
NA	9-May-24	PCSB	Dulang-D	D-06S	Trim Coil 2FT	13,357	2	13,355	N/A	N/A	N/A	N/A	N/A
24	10-May-24	PCSB	Dulang-D	D-06S	Cementing	13,355		13,355	0.71	0.5	22.76	23	45.81
25	11-May-24	PCSB	Dulang-D	D-06S	Cementing	13,355		13,355	0.95	0.5	23.47	23.50	46.97
26	20-Jun-24	PCSB	Dulang-D	D-31	Scale Cleanout	13,355		13,355	3.1	0.5	26.57	24.00	50.57

Remarks: Above latest file job for CT string based on previous 3 CT run.

PROCESS FLOW DIAGRAM





SAFETY OPERATIONAL PROCEDURES

Prior to commencement of the CT / Bullheading operation, a pre-job meeting will be held. This should be attended by the following parties as a minimum:

OIM, WSS, CT Supervisor, Representatives of other service companies involved and others as necessary.

Safety meetings should be held at the start of every shift and risk assessments must be evaluated during this time. Tool box talks should be held immediately prior to the job execution.

Note: The safety meeting must be driven by DB Supervisor addressing the following topics as a minimum:

1. Muster point.
2. Take list of personnel on site (Head count)
3. All personnel should review and be familiar with escape routes and emergency procedures.
4. Describe the **job objective, fluids and volumes to be pumped, pressures expected** during the job, and others.
5. Review **Dimension Bid Operations Policy and Procedure Manual.**
   - 5.1. Ensure at all steps carried out during the operations comply with this Manual.
   - 5.2. Management of change MUST be applied any time there is a need to deviate from the steps contained this procedure.
   - 5.3. A document MUST be created describing each the step of the deviation. This document shall also include the deviation Risk Assessment and it MUST be approved and signed by PCSB – Head of Well Intervention and Dimension Bid Operations Manager.
6. Exercise Stop work authority if unsafe condition occurs and assess situation with all team members, resume operation after mitigation plan is in place.
7. Personnel responsibilities throughout the job.
8. Spills, fire, blow out, unexpected well behaviour.
9. Emergency shower station and eye wash station location.
10. Trapped potential energy such as pressure or CT stiffness.
11. Prepare related Job Hazard Analysis (JHA) prior commencement of any work, get approval from Client Site Representative (CSR) and review it with all personnel involved as well as to review Risk Assessment.
12. Discuss the well H_2S, CO_2, Hg (Mercury) content (if applicable).
13. Adhere all **PCSB Zeto Rules** and other guidelines.
14. Take a physical count of inventory and make sure all required materials are available on site.
15. **Barricade** the work area and display the appropriate **warning sign**.
16. On chemical mixing and handling; all personnel involved shall hold **safety meeting** and review **Safety Data Sheet** (SDS).
    - 16.1. Personnel involve during chemical handling shall be briefed by DB Chemical Specialist onsite and extra precautions must be taken. All SDS must be available on site and reviewed prior chemical handling.
    - 16.2. All non-essential personnel shall stay away from mixing site.
    - 16.3. Use PPE including respirators, hard hats, eye protection and steel-toed boots.
    - 16.4. Verify if there is any **dead volume** in the mixing tanks and adjust volumes to account for non-usable volume in the blender / mix tank.

16.5. Consider wind direction and note all trip hazards in the mix / pumping area.

16.6. Prior to mixing chemicals, clean and verify the tank/batch mixer and lines are free of any debris and or contaminants.

16.7. In case of spill; wash the place where any chemical has been spilt with available spill kit.

16.8. Take care to prevent leakage due to ejection from valves, fittings, flanges, or other joints flexible chemical hoses and pumps. Never repair the equipment during transfer into mixing tank/container.

17. Take reading of Shut in / Flowing Tubing Head Pressure (SI/F/THP), Casing Head Pressure (CHP) and fluid sample (if available) prior to operation.
18. Check gas lift condition and capability with Site Operation Representative (SOR).
19. Ensure fitness prior to perform duties assigned.
20. Ensure all barriers are in place and followed.

HEALTH, SAFETY & ENVIRONMENT

1. Evaluate possible risks to arise during the job execution.
2. Evaluate risk assessment. Report any abnormal or insecure condition on site, taking into account all the steps or procedures to follow. Discuss with PCSB HSE coordinator, the execution or suspension of the job.
3. Review SDS of each product that will be used. Verify that all personnel on location handling toxic or corrosive products have the proper PPE.
4. Review the contingency plan for spills.
5. Do not vent / release any hydrocarbons from the well to atmosphere. Returns from the well should be handled safely by Flowback Company.
6. Prior to DB personnel walking on upper deck, DB Supervisor to inspect upper deck and ensure that the area it is in good condition (Gratings, Hatches, etc.)

EQUIPMENT RIG UP PROCEDURE

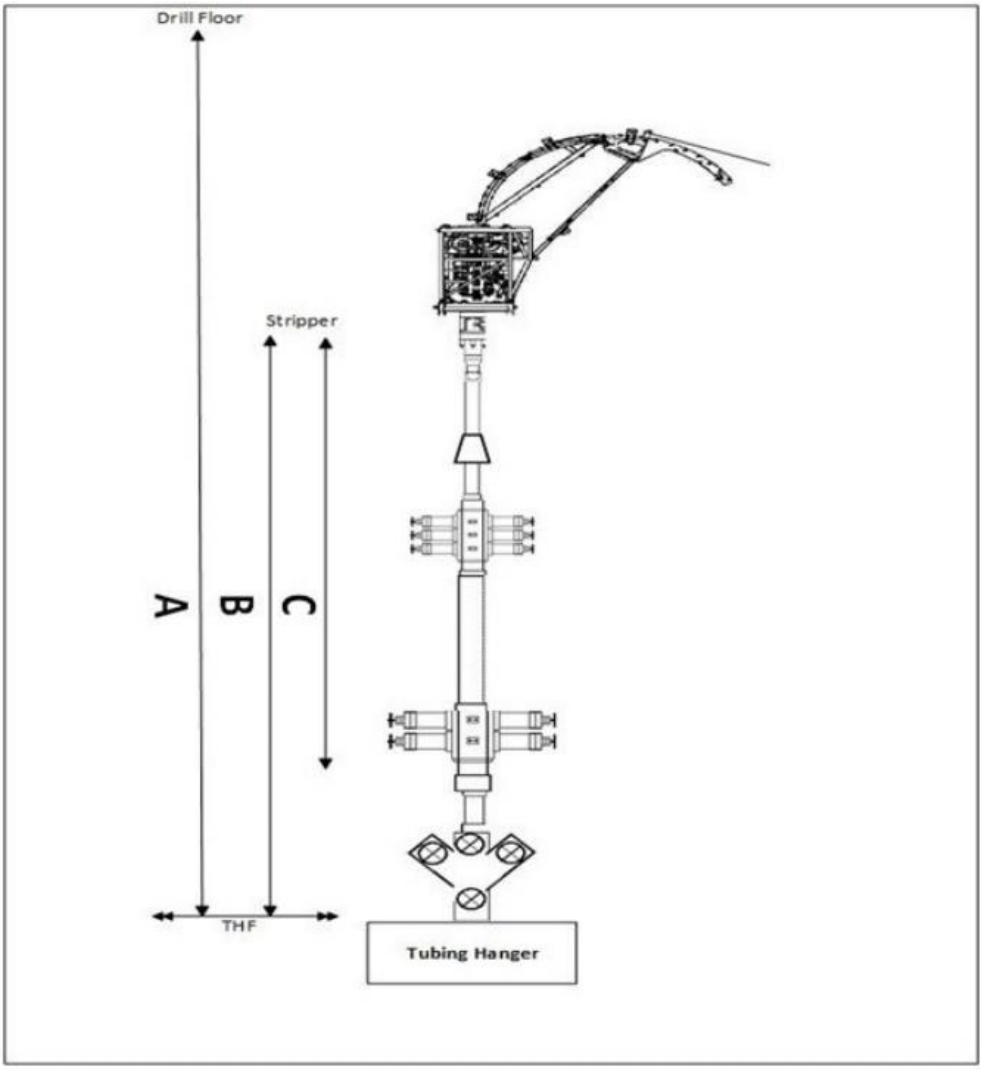
Conduct safety meeting with all personnel on location detailing the program, pressure limitations, and personnel responsibilities, well control emergency drill and safety precautions.

1. Spot the equipment accordingly to space availability, ensure reel position is aligned with the well.
2. Spot jacking frame at available space with sufficient height and crane capacity to rig up the injector head and gooseneck.
3. Rig up the 4” LP hoses from fluid storage tanks to batch mixer and single pump unit
4. Rig up 2” HP treating line as per DB Technical Standard from single pump unit and N2 converter unit to CT reel manifold. Include bleed off line on both lines as well.
5. Install correct wellhead crossover on the wellhead. Ensure well is fully secure and record the MV and CV turns.
6. Install Blowout Preventer (BOPs):
   - 6.1. Rig up Single BOP with necessary length of risers on top of the wellhead crossover.
   - 6.2. Rig up Combi BOP with flow tee above the risers
   - 6.3. Hook up BOP hoses and conduct function test for each ram.
7. Rig up 2” kill line from single pump unit line to BOP kill port
8. Rig up flow back line from flow tee to Choke manifold -> desander unit -> High pressure flowback pump -> Donor Well
9. Spot injector head assembly (c/w stripper) with jacking frame on top of wellhead area. Ensure the gooseneck is aligned with the reel position
10. Inspect the chain and gripper block condition and ensure the alignment is correct
11. Rig up the following hydraulic hoses:
    - 11.1. From CT Power Pack to CT Control Cabin
    - 11.2. From CT Power Pack to CT Injector hose reel
    - 11.3. From CT Control Cabin to CT Reel
    - 11.4. From CT Control Cabin to CT BOPs
    - 11.5. From CT Power Pack to Jacking Frame
12. Perform EMC 1 for all equipment. Start up and run all equipment for few minutes.
13. Jack up CT control cabin.
14. Function test both BOP rams.

    *Observe indicator pin to confirm that all rams are in good working condition.
15. Install the stab-in-guide on the CT then stab the string into injector head.
16. Record the total cut length of CT String in Cerberus and Pipe Management for future reference.
17. Make up the CT connector and perform pull test at least 15,000 lbs as per DB SOP. This test to be recorded in OrionNET.

    *Do not perform pull test more than 80% from CT Limit.
18. Install pressure test plate onto the CT connector.
19. Circulate the string with water until clean return is seen prior to proceed with pressure test CT Connector.

20. Pressure up the CT string to 5,000 psi gradually by 500 psi increment then hold for 10 minutes.
21. Open the needle valve to release the pressure slowly.
22. Make up the BHA onto the string as per BHA diagram provided.
23. Use the jacking frame to pick up the injector and risers then connect to the Combi BOP. Secure down the injector assembly with chains.
24. Measure the following length to set the CT depth:



Distance	Length (ft)
A: Tubing Hanger (THF) to RKB	
B: Tubing Hanger (THF) to Stripper	
C: BHA Length	

25. Pick up CT and tag the stripper to set CT depth based on this calculation “A-B+C”.

Ensure to cut sufficient CT String length in order to shift fatigue after every three (3) CT run.

EQUIPMENT PRESSURE TESTING PROCEDURE

Conduct safety meeting with all personnel on location detailing the program, pressure limitations, and personnel responsibilities, well control emergency drill and safety precautions. Refer the following procedure to pressure test BOP Body, Blind Ram, Surface Line and Wellhead connection.

1. Isolate the line to CT. Double confirm the valve is closed.
2. Fill and pressure test the treating line with water to 500 psi and hold for 5 minutes. Inspect the lines for leaks and observe for any pressure drop.
3. Increase pressure to 3,000 psi and hold for 10 minutes. Inspect the lines for leaks and observe for any pressure drop.
4. Fill the pressure control equipment and ensure air is vented from the system by leaving the blind ram and blind ram equalizing valves open.
5. Close blind ram and equalizing valve. Pressure up the surface lines, BOP body, blind rams and wellhead connection to 500 psi then increase gradually to 3,000 psi through the kill line, hold for 10 minutes. Inspect the lines for leaks and observe for any pressure drop.
6. Once test complete, open blind ram pressure equalizing port then bleed off any residual pressure and open the blind rams.

Conduct safety meeting with all personnel on location detailing the program, pressure limitations, and personnel responsibilities, well control emergency drill and safety precautions. Refer the following procedure to pressure test BOP Body, Blind Ram, Surface Line and Wellhead connection.

1. Fill up the CT string and stack up until leak can be seen at stripper.
2. Energize the stripper and begin pressure test the complete stack up (CT string, stripper, CT stack and risers) to 3,000 psi against Crown Valve, hold for 10 minutes.
3. Bleed down pressure inside PCE stack up to 1,500psi. Thereafter, bleed off pressure inside CT to 0psi immediately to test the Double Flapper Check Valve with DP of 1,500psi and hold for 10 minutes.
4. Bleed off the pressure from BOP kill port side.

OPERATIONAL PROCEDURE

All depths specified below are in m-MDDF (RKB to THF is 11.635-m as per well diagram)

CT RUN#1: BURNSHOE MILLING TOP OF FISH (PARTED TUBING STOP SLEEVE) UNTIL 'D' NOGO NIPPLE

Conduct safety meeting with all personnel on location detailing the program, pressure limitations, personnel responsibilities, emergency well control drill, and safety precautions.

1. Rig up CT unit and surface line on Dulang-A platform:
   - 1.1. Review JHA and risk assessment with all personnel involve in the rig up operation. Please send a copy of JHA to Engineer in Charge.
   - 1.2. Make up the **CT End Connector**.
   - 1.3. Install the Pull and Pressure Test Sub.
   - 1.4. Perform Pull Test on the CT End Connector **to 15,000 lbf** and record this in OrionNET.

     Note: Do not perform pull test more than 80% CT string limit. Consult with town if require.
   - 1.5. Perform Pressure Test on CT End Connector. Pumping IW through the CT, apply low pressure test of **300 psi for 5 minutes** and high-pressure test of **5,000 psi for 15 minutes** after stabilization. Record the pressure test.
     - **1.5.1. For low pressure:** Acceptance criteria: No visible leaks. Pressure drop is less than 10% (above 270 psi) over 5-minutes test interval after the pressure stabilizes.
     - 1.5.2. **For high pressure:** Acceptance criteria: No visible leaks. Pressure drop is less than 10% (above 4,500 psi) over the 15- minutes test interval after the pressure stabilizes.
   - 1.6. To address long term inactivity (CT string idle >2 weeks). Pickle the CT String with 10 bbls of 7.5% HCl, followed by 25 bbls of IW and neutralization fluid (soda ash) to remove internal rust / foreign debris inside the CT string and flush with IW until clear water is observed. Please refer below 7.5% HCl mixing chemical recipe:

7.5% HCl (CT Pickle)			420	gals	10	bbls	Description
Products	Concentration		Volume				
Injection Water	794	gptg	333	gals	7.92	bbls	Base Fluid
33% HCl	202	gptg	84	gals	2.00	bbls	Raw acid
Corr 400	4	gptg	2	gals	0.01	bbls	Corrosion Inhibitor

Mixing Instruction:
1. Fill up tank with IW
2. Add 33% HCl & Corr 400 into the tank
3. Agitate until the mixture is homogenous

2. Bunker 100 bbls of Injection Water (IW) in storage tank.
3. Prepare 10 bbls of D801 Cleanout Gel as per recipe below:

D801 Cleanout Gel				10	BBL	Description
Seq.	Product	Concentration		Volume		
1	Injection Water	992	gptg	417	gal	Base Fluid
2	D801 Gel	40.5	pptg	17	lbs	Gelling Agent

Mixing Instruction:
1. Prepare IW in the mixing tank.
2. Add D801 Gel into the tank and circulate the mixture until homogenous.

Note: The above recipe is for 10bbls of gel. Please prepare another batch of gel once needed.

4. Make up 2-1/8" PDM Motor c/w 2.28" Burnshoe Mill Bit tool as per **BHA#1: 2.28" Burnshoe Mill Bit BHA** in **Appendix 1**. Only run this 2.28" Burnshoe Mill Bit after TCC with 2.29" Gauge Ring has been done.

5. Perform function test of the Milling Motor to determine at which pump rate and pressure the tool start to operate / rotate. Record the data in the table below and include in daily report. Refer to the Motor Performance data for the operating envelope. Recommended flowrate is **0.7 bpm to 1.3 bpm** (refer to the motor performance data as per advise from RG Tool Specialist).

Flow rates (bpm)		Pressure (psi)	Remark
GPM	BPM		
21.0	0.50		
30.0	0.70		
37.8	0.90		
46.2	1.10		
50.0	1.20		
55.0	1.30		

6. For reference, flow rate range to operate the motor is between 0.70 – 1.30 bpm (as per PDM technical specification). RG Tool Specialist will be on site to advise on milling tool function and performance.

7. Pick up CT and tag the stripper with the BHA.

8. Make up the Injector Head and Stripper to the stack up.

9. CT stack up pressure test against Wellhead Swab valve. Pumping IW through the CT, apply low pressure test of **300 psi for 5 minutes** and high-pressure test of **3,000 psi for 15 minutes** after stabilization. Record the pressure test. Record test on a chart. Upon successful pressure test, bleed off pressure via Pump-In Sub.

   9.1. For low pressure:

   Acceptance criteria: No visible leaks. Pressure drop is less than 10% (above 270 psi) over 5-minutes test interval after the pressure stabilizes.

   9.2. For high pressure:

   Acceptance criteria: No visible leaks. Pressure drop is less than 10% (above 2,700 psi) over the 15- minutes test interval after the pressure stabilizes.

10. Pressure test the BHA Check Valve with **3,000 psi** in the CT stack up, bleed off the stack up pressure to **1,500 psi** via pump-in sub; and bleed off pressure in the CT to zero (0) psi via reel manifold.

    10.1. Acceptance criteria: **Pressure drop is less than 10% (above 1,350 psi) over the 15- minute test interval after the pressure stabilizes.** Observe for any pressure changes in the stack up. If the BHA check valve is not holding, proceed to replace the MHA; do not run-in hole with leaking check valve; repeat steps 9.2 and 10.

11. Upon successful test, bleed off the pressure in the CT stack up to zero through the pump-in sub.

12. Zero both depth counters at reference point.

13. Confirm all wellhead and BOP valves are in open position via physical check.

    13.1. Prior to opening the wellhead valve pressure up above master valves to a pressure equal to the expected shut-in wellhead pressure.

    13.2. Count wellhead valves turns while opening and record it the treatment report for reference in future.

13.3. Manipulate surface valve to the following position:

Valve	Position
Reel Manifold	OPEN
Flow Cross Return Valve (Cetco lines)	OPEN
Wing Valve	CLOSE

14. Start RIH CT to **10m above last known HUD (2,601 m MDDF)** while pumping **Injection Water** at 0.3 bpm.

14.1. Refer to CT Tubing Force simulation (Orpheus modelling), refer Appendix III.

14.2. Ensure Milling Tool Specialist from RG is inside control cabin all the time during operation.

14.3. Conduct pull test as per for every 300m (1,000ft), use CT Fatigue graph as reference. Ensure the CT Fatigue graph is available at location before RIH. Record RIH, Hanging and POOH weight in treatment report.

14.4. Maximum coil speed running in hole is **30-50 ft/min.**

14.5. Slow down coil speed to **10 ft/min**, 50 ft before and after passing through completion accessories.

14.6. Closely observe weight indicator in control cabin while running in hole.

14.7. Observe return all the times.

14.8. Regularly inform WSS on job status at all times.

14.9. Do not exceed operating safety limits **5,000 psi.**

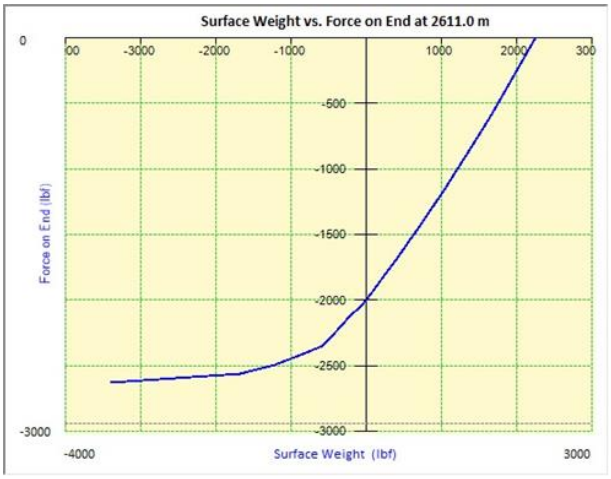
14.10. If the well condition differs from original job design, contact appropriate personnel in charge before proceeding.

14.11. At all time, while run-in hole, the injector torque control shall be set at the minimum pressure required to move the CT at specified speed.

15. Once CT reach **2,601 m (10 m above HUD),** conduct pull test **a minimum** of 10m/30ft with pumping rate 0.3 bpm and record the pulling weight both static and dynamic (IMPORTANT).

Depth, ft	*RIH weight, lbf*	*Static weight, lbf*	*Pick up weight, lbf*

16. Continue RIH slowly while pumping at idle rate at **0.3 bpm** to tag HUD (TOF) at **2,611 m**. Do not slack off more than -500 lbf at downhole. Please refer below available set down force reference:



17. Record the depth at which the HUD was tagged. Pick up CT to the normal weight and flag the CT string on surface (Flag #1).

Flag Number	Colour
Flag#1	

18. Pick up 10 m above HUD at **2,601 m** & start pumping IW to start the Milling Motor. Record all the parameter (Flow Rate, Pumping Pressure). Refer to the Motor Performance Data. Record the "Off Bottom" pump pressure prior milling.

    18.1. The pressure is considered No Load Pressure **(P No Load).** No Load Pressure will increase as milling in progress.

Flow rates (bpm)		Pressure (psi)	Remark
GPM	BPM		
21.0	0.50		
30.0	0.70		
37.8	0.90		
46.2	1.10		
50.0	1.20		
55.0	1.30		

19. Once "Off Bottom" parameters have been recorded, increase pumping rate as per RG Tool Specialist recommendation and record the circulating pressure.

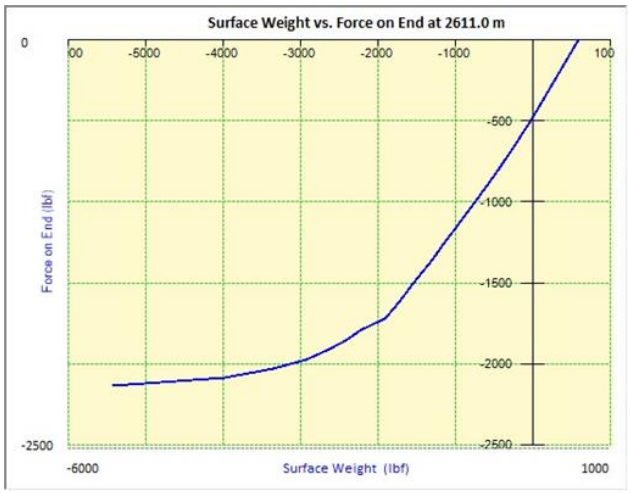
    19.1. Do not exceed the maximum CT working pressure of 5,000 psi.

    19.2. Flow rate range for the motor to operate is 0.50 – 1.20 bpm.

20. Continue to RIH until loss in weight (-500 lb_f slack off) is observed on fish and start milling while maintaining -500 lb_f weight on bit (or as advised on site by RG Tool Specialist). Record the bottom circulating pressure and start milling with minimum WOB.

    Note: At this point, patience is critical. Motor stalls can occur repeatedly until milling pattern is established. Set down weight should be applied until approximately **300 – 700 psi** differential pressure above the "Off Bottom" circulating pressure is maintained. RG Tool Specialist onsite will further asses and advise to address the condition during milling operation.

    20.1. Continue slacking off weight as differential pressure and ROP (Rate of Penetration) indicates the progress of fish milling. Keep WOB within limit while pumping as per RG Tool Specialist recommendation.



20.2. Regularly monitor return on surface, advise RG Tool Specialist immediately if there is no return while milling in progress. Flowback personnel must standby all the time at the Choke Manifold to monitor the choke size and keep the WHP/THP at least 150 psi.

20.3. If observe metal debris at surface. Collect sample from time to time and send to town for analysis.

20.4. **Set down weight between 300 to 500 lb_f, in 100 lb_f incremental**. **Maximum set down weight is -1,000 lb_f** at downhole. Motor work is indicated by differential pressure not the WOB.

20.5. Please record the bottom hole circulating pressure. **Keep the DP between 300 – 700 psi**. **Maximum DP is 1,300 psi ($P_{Load} – P_{No\ Load}$).**

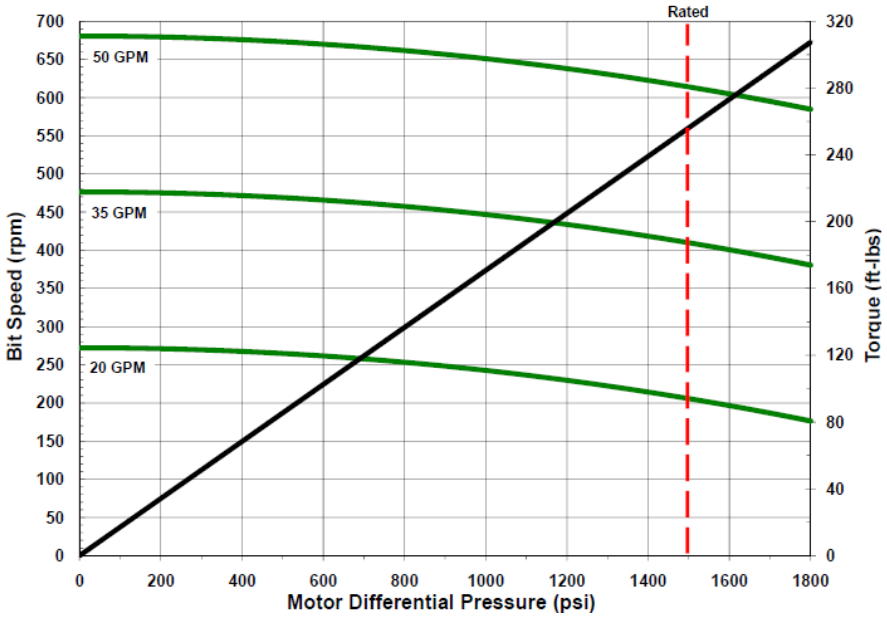
20.6. If motor stall, stop pumping, bleed off pressure and pick up CT 10 m above the current depth. Resume the pumping and note the pressure and compare to the previous pressure. Refer to the Motor Performance Curve below as guideline.

20.7. RG Tool Specialist to **record all the parameter before milling and during milling manually in log sheet**.

20.8. Please refer below Bico PDM Motor technical specification for reference:

Performance Curves Based on Dynamometer Test Data

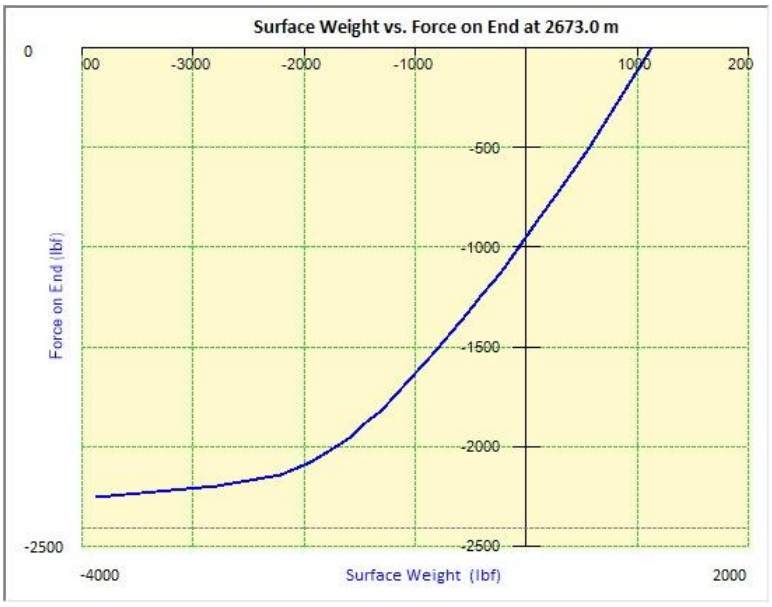
Operating Data			
Flow Range		gpm (lpm)	20 - 50 (76 - 190)
Motor Pressure		psi (bar)	1,500 (103)
Bit Speed		rpm	270 - 680
Displacement		rev/gal (rev/l)	13.612 (3.630)
Torque		ft-lbs (Nm)	256 (347)
Power		HP (Kw)	33 (25)
Physical Dimensions			
Power Section Configuration		Stages	6
		Lobes	5/6
Overall Motor Length		ft (m)	11.0 (3.4)
Weight		lbs (kg)	86 (39)
Connections	Standard	Box	1-1/2" Reg, Top and Bottom
	Optional	Box	Available Upon Request
Mill Size		in (mm)	3-1/2 Max (88.9 mm Max)
Bit Size		in (mm)	2-3/16 to 3-1/4 (55.6 - 82.6)



21. Once milling pattern is established, vary the set down weight between 300 to 500 lb_f until achieve 300–700 psi differential pressure. Maximum DP is 1,300 psi.

22. Continue milling the fish / HUD depth until encounter lost in weight that indicate the fish has been milled or fell downhole.
    22.1. Pay close attention to the weight indicator and circulation pressure gauge
        22.1.1. The weight indicator will monitor the amount of WOB.
        22.1.2. The circulation pressure gauge will inform the DP at which motor is functioning.
    22.2. Continue milling to clear the fish until **2,673 m ('D' Nogo Nipple)**. Rest the PDM for every 30 minutes attempt if no progress.
    22.3. If no movement or progress after 30 minutes milling, gradually increase the downhole force max to 1,000 lbs, and increase the circulating pressure Max DP 1,300 psi (P load – P no load), **subject to recommendation by RG Tool Specialist**.
23. Once indication of the fish has been clear until **2,663 m (10 m above 'D' Nogo Nipple)**, slowly RIH to tag 'D' Nogo Nipple at 2,673 m. Do not slack off more than -500 lbf at downhole. Flag the coil on surface (Flag#2).

Flag Number	*Colour*
Flag#2	



24. Once confirm tag **'D' Nogo Nipple at 2,673 m**, **pick up 1m to 2,672 m** before proceed to pump 10 bbls of D801 Gel and followed by 5 hours of CBU with Nitrified IW at 0.9 bpm & 300 scf/min.
25. After completed CBU, wiper trip to depth 2,667 m while pumping Nitrified IW at 0.9 bpm & 300 scf/min.
26. POOH CT to surface. Prepare BHA for next run.

CT RUN#2 DRIFT AND DEPTH CORRELATION RUN UNTIL EOT

27. Make up 2-1/8" MultiJet Nozzle c/w Tubing End Locator as per **BHA#2: 2-1/8" MultiJet Nozzle c/w 2.20" FC & Tubing End Locator** in **Appendix I**.
28. Record initial SITHP and annulus pressure of well A-12. Compare pressure parameter record in previous run and inform town if there any changes.

SITHP	Annulus Pressure

29. Perform function test of the MultiJet Nozzle c/w 2.20" FC & Tubing End Locator to determine at which pump rate and pressure of the tool start activate / the key locator start expand. Record the data in the table below, do not exceed 5,000psi.

Flow rates (bpm)	Pressure (psi)	Remark
0.3		
0.5		
0.6		
0.7		
0.8		
0.9		
1.0		
1.1		
1.2		

30. Repeat **step 7 - 13** in Run#1 prior opening the well.
31. Start RIH CT to **2,668 m (10 m above EOT) with reference of previous Flag #2** without pumping
    - 31.1. Refer to CT Tubing Force simulation (Orpheus modelling), refer Appendix III.
    - 31.2. Conduct pull test as per for every 300m (1,000ft), use CT Fatigue graph as reference. Ensure the CT Fatigue graph is available at location before RIH. Record RIH, Hanging and POOH weight in treatment report.
    - 31.3. Maximum CT speed RIH is **30-50 ft/min.**
    - 31.4. Slow down CT speed to **10 ft/min**, 50 ft before and after passing through completion accessories.
    - 31.5. Closely observe weight indicator in control cabin while RIH.
    - 31.6. Observe return all the times.
    - 31.7. Regularly inform WSS on job status at all times.
    - 31.8. Do not exceed operating safety limits **5,000 psi.**
    - 31.9. If the well condition differs from original job design, contact appropriate personnel in charge before proceeding.
    - 31.10. At all time, while RIH, the injector torque control shall be set at the minimum pressure required to move the CT at specified speed.
32. At **2,668 (10m above EOT)**, stop CT and conduct pull test of 10m/30ft and record the pulling weight both static and dynamic (IMPORTANT).

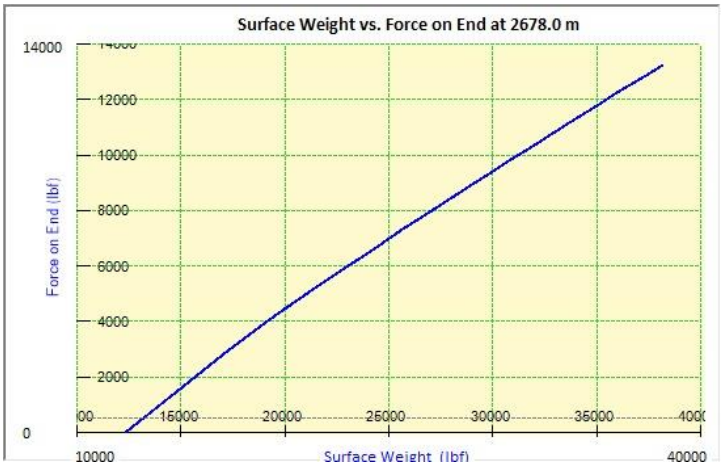
Depth, ft	*RIH weight, lbf*	*Static weight, lbf*	*Pick up weight, lbf*

33. RIH slowly until **2,683 m (5m below EOT).** Monitor changes in CT weight before and after entering casing section.

34. Start pump to activate and expand the Tubing End Locator (TEL) (per reference from surface function test), pick up CT slowly until observe increase in CT weight which indicate the EOT has been located.

    34.1. Key locator fully open/expand: 2.974”

    34.2. Do not tension more than 4,000 lbf at downhole. Please refer below **pickup force** graph for reference:



    34.3. Once confirmed EOT is located, repeat to confirm & flag the CT on surface, as Flag#3 & reset depth counter & Orion depth to **2,678 m** as per well schematic. Please note end of nozzle to key locator is 3 ft / 1 m.

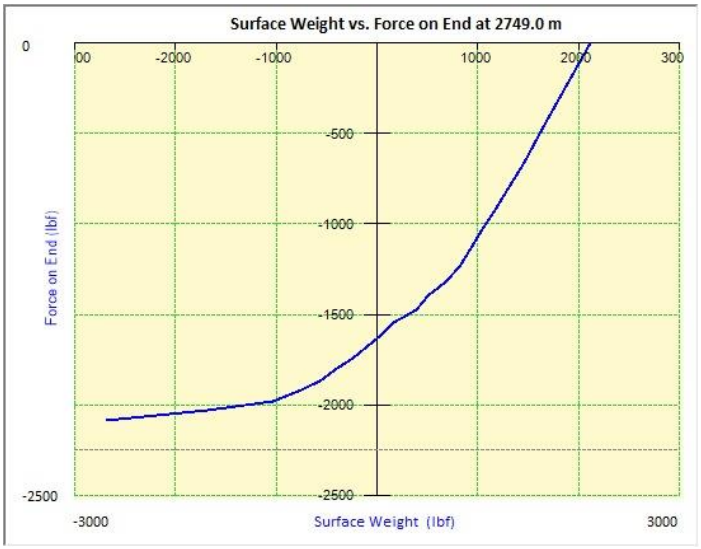
Flag Number	*Colour*
Flag#3 (EOT)	

35. Stop pump & wait for 10 minutes until the key locator is fully collapse.

36. RIH CT at 5 ft/min without pumping to tag TOC (as per well history **TOC is at 2,749 m**).

    36.1. Perform weight check for every 30m RIH.

    36.2. Do not slack off more than -1,000 lbf at downhole. Please refer below **setdown force** graph for reference:



    36.3. Once confirmed tag TOC, pick up 20m above & repeat to tag again to confirm.

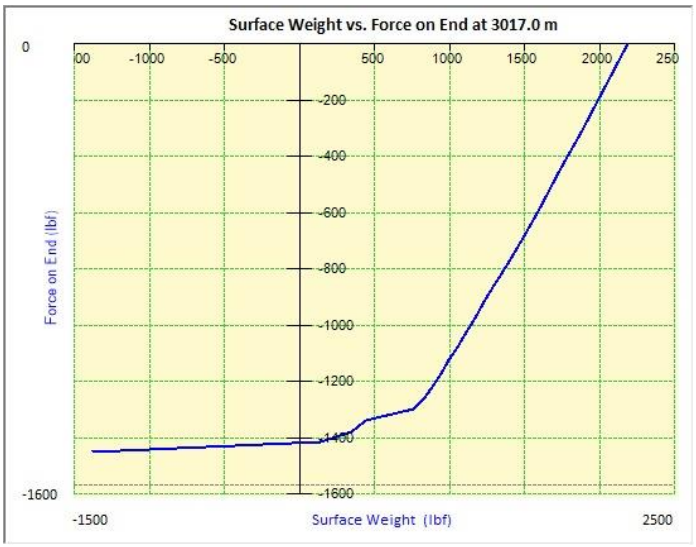
    36.4. Flag the CT on surface, as Flag#4 & record depth for our reference.

Flag Number	Colour	Depth
Flag#4 (TOC)		

36.5. If CT able to pass through TOC at 2,749 m, continue RIH slowly until tagging the HUD (**NOTE: PBTD at 3,017 m)**.

36.6. Perform weight check for every 30m RIH.

36.7. Do not slack off more than -1,000 lbf at downhole. Please refer below **setdown force** graph for reference:



36.8. Once confirmed tag HUD, pick up 20m above & repeat to tag again to confirm.

36.9. Flag the CT on surface, as Flag#5 & record depth for our reference.

Flag Number	Colour	Depth
Flag#5 (PBTD)		

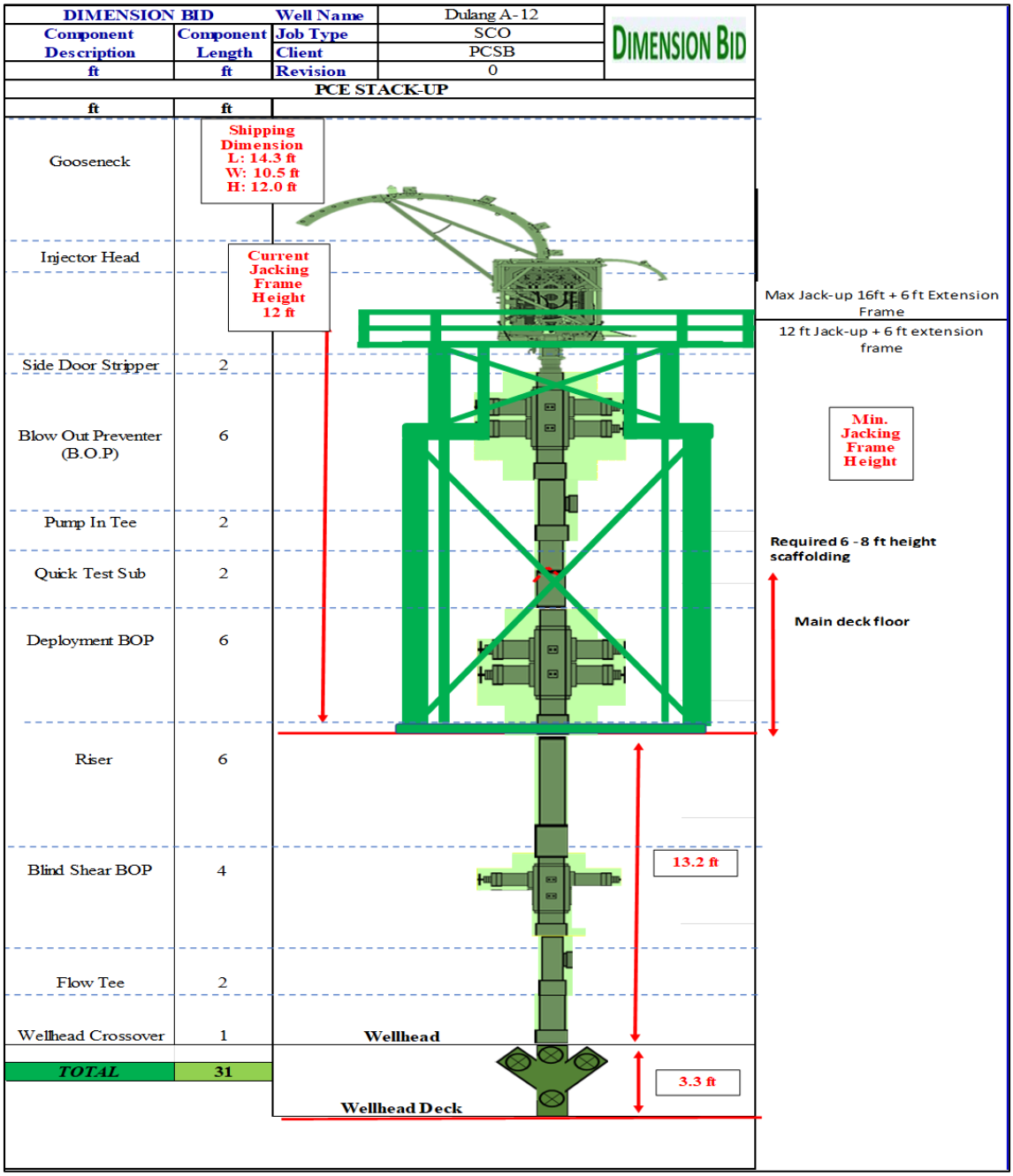
37. POOH CT to surface.

CT RUN#3 GRCCL WITH 2" DUMMY GUN

Perforation Gun / BHA Pressure Deployment Rig up Procedure

38. Prepare for deployment rig up as per rig up procedure below:

38.1. Please refer CT Stack up below:



38.2. Rig-up treating line and flowback line to Flow tee at Wellhead area. (Contingency Kill well if required)

38.3. Connect CT connector, MHA and deployment Bar as per below schematic (**BHA#8 as per Appendix I**). Verify 7/16" ball from UZMA can pass through 1-11/16" MHA & DKCV.

BHA DRAWING	DESCRIPTION	CONNECTION		ID	OD	TOOL LENGTH	CUMULATIVE LENGTH	WEIGHT
		UPHOLE	DOWNHOLE	INCH	INCH	FT	FT	KG
	Dimple Connector	1.5" CT	1.0" AMMT PIN		1.690	0.3	0.3	2.0
	MH A Disconnect drop ball 5/8" Circulating drop ball 1/2" Burst Disc 5000 psi	1.0" AMMT BOX	1.0" AMMT PIN		1.690	2.3	2.6	6.5
	6 ft Deployment Bar	1.0" AMMT BOX	1.0" AMMT PIN		1.500	6.0	6.00	20.0
								1.0
								Total 29.50

38.4. Pressure test CT PCE stack up / riser against the crown valve, low pressure (300 psi) and High pressure (3,000 psi) for 15 minutes each after stabilization. Record the pressure test.

38.5. Upon successful test, bleed off the pressure and test DFCV low- and high-pressure test for 15 minutes.

38.6. Once complete test DFCV, slowly RIH to place deployment bar across deployment BOP. Close Upper Pipe/Slip ram on deployment BOP.

38.7. Pressure test through Flow tee above the Wellhead crossover.

38.8. Fill-up the line and low pressure test the upper pipe/slip ram to 500 psi and hold for 5 minutes. Inspect the lines for leaks and observe for any pressure drop.

38.9. On successful low pressure test, increase pressure to 3,000 psi and hold for 15 minutes. Inspect the lines for leaks and observe for any pressure drop.

38.10. Once confirm pressure holding good, first bleed off test pressure. Retract upper pipe/slip ram. Bleed off pressure.

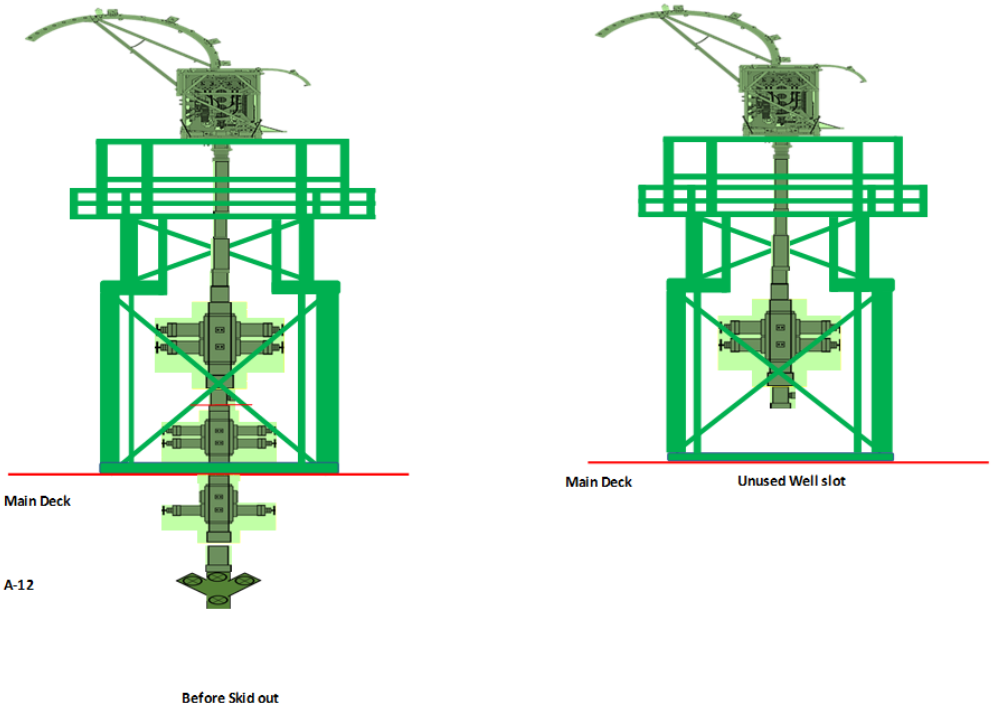
38.11. Proceed to close lower pipe/slip ram, pressure test through Flow Tee above the Wellhead crossover.

38.12. Fill-up the line and low pressure test the upper pipe/slip ram to 500 psi and hold for 5 minutes. Inspect the lines for leaks and observe for any pressure drop.

38.13. On successful low pressure test, Increase pressure to 3,000 psi and hold for 15 minutes. Inspect the lines for leaks and observe for any pressure drop.

38.14. Once confirm pressure holding good, first bleed off test pressure. Retract lower pipe/slip ram.

38.15. Break the riser section until upper QTS connection and skid aside the IH, stripper, combi BOP and riser as per illustration below to another well slot.

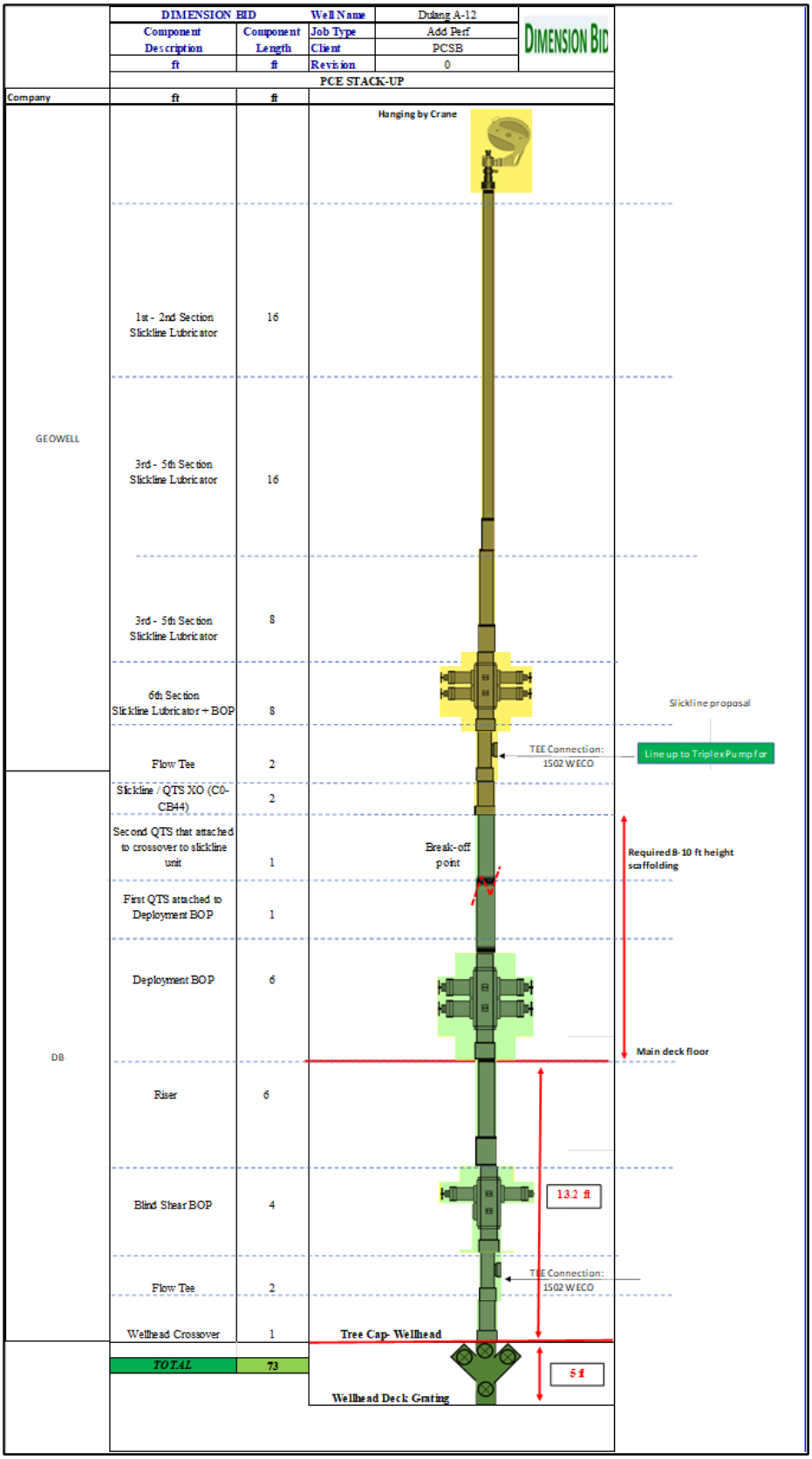


38.16. The BHA will be deployed in 2 separate sections as per below:

Section	Items		Description	BHA OD, Inch	Length, ft	Deploy by
1 (First)	1	DB	Dimple End Connector	1.687	2.6	CT
	2	DB	CT MHA	1.687		
2 (Second)	3	DB	Torque-Thru Deployment Connector / CARSAC High-Torque Connectors	1.687	39.03	Slickline
	4	DB	Dual-ball Kelly cock valve (DKCV)	1.687		
	5	DB	Deployment bar	1.5		
	6	UZMA	Crossover (CRP)	1.687		
	7	UZMA	CT Firing Head	1.687		
	8	UZMA	6m Dummy Gun	2.00		
	9	UZMA	Bullplug	2.00		
	10	UZMA	GRCCL Tool	1.687		

38.17. Slickline to prepare PCE stack for deploying section #2.

38.18. Slickline PCE stack will make up to top of lower QTS, CT deployment BOP as per below stack up diagram:



38.19. Manually make up BHA on the platform main deck from Torque-Thru Deployment Connector / CARSAC High-Torque Connector until deployment bar.

38.20. Slickline to physically space out BHA beside PCE stack and mark/flag wire accordingly. This will serve as a visual guide during the next deployment procedure. The position of the 1.5" OD deployment bar, which is the main focus, should span across both the pipe and slip ram of the CT deployment BOP.RIH wireline thru PCE stack and connect to Torque-Thru Deployment Connector / CARSAC High-Torque Connector. POOH wireline and retrieve/swallow the attached BHA into the slickline lubricator. Lower BHA and cross reference vertically the deployment bar vs deployment BOP.

38.21. Close both Pipe/Slip ram and engage the deployment bar with the deployment BOP, slickline to overpull 800 lbs (1.2 x 2nd Section BHA weight).

38.22. Box-down the PCE stack-up, Fill and pressure test the treating line with IW/TSW (subject to IW availability) to 500 psi and hold for 5 minutes. Inspect the lines for leaks and observe for any pressure drop.

38.23. Increase pressure to 3,000 psi and hold for 15 minutes. Inspect the lines for leaks and observe for any pressure drop.

38.24. On successful pressure test, first bleed off test pressure. Retract both Pipe/Slip ram on the deployment BOP, disconnect at QTS.

38.25. Make-up full BHA as per **2nd section CT BHA**. (POOH wireline and swallow piece by piece all 2nd Section BHA).

38.26. Lower the slickline PCE stack up and connect with Upper and Lower QTS section.

38.27. Pressure test QTS.

38.28. Confirm all wellhead valves are in open position via physical check. During the opening process, count the number of turns made by the wellhead valves and document this in the operation report. This record will serve as a reference for future operations.

CV Opening Turns	LMV Opening Turns

38.29. Record initial SITHP and all annulus pressure (PCP, ICP, SCP etc) in the Daily Operation Report (DOR).

38.30. RIH slickline and deploy BHA section #2. Earlier wire mark/flag to be used as guide to ensure the 1.5" OD deployment bar spans across both the pipe and slip ram of the CT deployment BOP.

38.31. On confirming deployment bar position, close pipe/slip ram on LOWER section of deployment bop and manually lock the ram. Observe for 15 minutes, any pressure builds up above the upper section of deployment BOP. Once confirm no pressure build, proceed for next step.

38.32. Perform light weight check by pulling the slickline cable to observe the weight increase to make sure that pipe slip ram is functioning good and holding.

38.33. Pump IW thru the 2" Flow Tee and pressure test against the upper pipe/slip ram, low pressure test (300 psi) for 5 minutes & high pressure test 3,000 psi for 15 minutes.

38.34. After successfully pressure test, bleed off PCE stack pressure to zero.

38.35. Activate and close UPPER section of pipe/slip ram of the CT deployment BOP. Perform pressure ow pressure test (300 psi) for 5 minutes & high pressure test 3,000 psi for 15 minutes through the kill port between the deployment BOP for 15 minutes. On successfully pressure test, bleed off the pressure.

38.36. Disconnect PCE stack at slickline crossover along with upper QTS. Rig a side slickline stack-up.

38.37. Skid in injector frame with IH and CT PCE stack-up to wellhead slot for Dulang A12.

38.38. Make up **Section 1- BHA to CT String**.

38.39. Lower section #1 BHA until it meets the 2nd BHA at the Torque-Thru Deployment Connector / CARSAC High-Torque Connector connection.

38.40. Make up and connect Section#1 and Section#2 BHA at Torque-Thru Deployment Connector / CARSAC High-Torque Connector.

38.41. Close the DCKV.

38.42. Pump through CT String, and pressure test against DKCV 1,500 psi to test the connection at MHA and Torque-Thru Deployment Connector / CARSAC High-Torque Connector.

38.43. Box-down PCE stack-up, perform pressure test at QTS.

38.44. Break-off at the QTS.

38.45. Slowly open DKCV, ensure both valves at DKCV are opened before RIH. If it is closed, unable to pump through CT.

38.46. Connect back at QTS and pressure test at QTS.

38.47. Unlock the manual lock of the CT deployment BOP and retract both upper & lower pipe/slip rams.

38.48. Flag CT String at surface and pick-up BHA until it tags the stripper, this will be the distance as reference for reverse deployment later after complete the job. Once tag Stripper, flag CT string against and measure the distance between two flag depth. Reset depth to (A-B+C) for m MDDF as reference point. Record in the Daily report.

39. Start RIH to **2,739 m (10 m above TOC depth)** while break circulation by pumping IW with 0.2 bpm and circulation pressure less than 500psi.

Correlation Interval (m-MDDF)
2,600– 2,749 m

40. Once CT at depth to **2,739 m**, stop CT and conduct pull test of 5m. Record the pulling weight both static and dynamic (IMPORTANT).

Depth, ft	*RIH weight, lbf*	*Static weight, lbf*	*Pick up weight, lbf*

41. RIH slowly at 5 ft/min until 2,749 m or soft tag TOC.

42. Pick up CT to tension the CT and allow the tool to remain stationary about 5 minutes. Record the depth and static weight. (Uzma rep to advise if need to simulate drop ball and pumping sequence).

Depth, ft	*Static weight, lbf*

43. Flag CT at surface. This will be **Flag#1 (GRCCL Bottom of Logging Depth).** Record the following and include in daily report.

Flag Number	*Colour*
Flag#1	

44. Perform main pass correlation log from **2,749 m to 2,600 m** with speed of 10m/min or 30ft/min. Once reach at **2,600 m**, stop CT and allow tool to stationary for 5 minutes.

45. Repeat step 41 until 44 to repeat logging passes as per Uzma procedure.

46. After complete logging, begin POOH CT to surface: -
    46.1. Pump at minimum rate while POOH
    46.2. Maximum CT speed while POOH is 50ft/min.
    46.3. Slow down CT speed to 10ft/min 50ft before and after passing through completion accessories.
    46.4. Do not exceed CT operating limit (refer to CT Force simulation)

Reverse Deployment Procedure

47. Once CT reaches at surface, **proceed to reverse deploy the dummy gun prior next run**.
    47.1. Once BHA tag stripper, RIH back XX ft (calculated previously during BHA tag before RIH), to position the deployment bar across the deployment BOP.
    47.2. Close the LOWER Pipe/Slip ram of the deployment BOP. Manually lock it.
    47.3. Observe if there any remaining pressure above the pipe/slip ram of CT deployment BOP. (for 5 minutes)
    47.4. Perform pressure test through the flow tee above the maindeck, low pressure test (300 psi) for 5 minutes & high pressure test 3,000 psi for 15 minutes.
    47.5. Bleed the remaining pressure (if any) inside the riser through flowback line.
    47.6. Once confirmed no pressure build up thru the deployment BOP, activate and close UPPER section of pipe/slip ram of the CT deployment BOP. Perform pressure test low pressure test (300 psi) for 5 minutes & high pressure test 3,000 psi for 15 minutes through the kill port between the deployment BOP. On successfully pressure test, bleed off the pressure.
    47.7. Break the PCE at QTS and jack-up the JF.
    47.8. Flush the DKCV until clean water observe at bleed off point at DKCV. (In the event got trace of hydrocarbon at bleed off point, continue to flush until clean trace of water is observed at bleed off point. (in the event miss-fire, no indicator Gun fire, ensure return is establish first (active circulation sub) before proceed with step 47.9 & 47.10)
    47.9. Close LOWER DKCV, perform low pressure test (300 psi) for 5 minutes & high pressure test 3,000 psi for 15 minutes. Upon successfully pressure test, bleed off the pressure through the bleed off point at DKCV.
    47.10. Close the UPPER DKCV, perform low pressure test (300 psi) for 5 minutes & high pressure test 3,000 psi for 15 minutes. Upon successfully pressure test, bleed off the pressure through the bleed off point at DKCV.
    47.11. Secure the 2nd section BHA with C-Plate and disconnect at Torque-Thru Deployment Connector / CARSAC High-Torque Connector connection.
    47.12. Skid the JF aside along with the PCE above the QTS section.
    47.13. Rig-up back slickline lubricator 6 (section) with slickline PCE on top of the QTS connect through slickline crossover.
    47.14. Once rig-up, RIH slickline wire and connect at Torque-Thru Deployment Connector / CARSAC High-Torque Connector connection.
    47.15. Box down Slickline crossover and perform pressure test for the stack-up.
    47.16. Retract Pipe/Slip rams of the deployment BOP.
    47.17. POOH slickline wire until tag slickline stuffing box.
    47.18. Secure the well by close the crown and master valve. Bleed off remaining pressure inside lubricator.
    47.19. Break the QTS connection, and disconnect the 2nd section BHA.

CT RUN#4 ADD PERF WITH 9M 2" GUN

48. Repeat **step 38** for live gun pressure deployment rig up procedure and make up the 2.00" 9 metre length gun.
49. The BHA will be in 2 sections (**BHA#9 as per Appendix I**):

Section	Items		Description	BHA OD, Inch	Length, ft	Deploy by
1 (First)	1	DB	Dimple End Connector	1.687	2.6	CT
	2	DB	CT MHA	1.687		
2 (Second)	3	DB	Torque-Thru Deployment Connector / CARSAC High-Torque Connectors	1.687	41.45	Slickline
	4	DB	Dual-ball Kelly cock valve	1.687		
	5	DB	Deployment bar	1.5		
	6	UZMA	Crossover (CRP)	1.687		
	7	UZMA	CT Firing Head	1.687		
	8	UZMA	9m Dummy Gun	2.00		
	9	UZMA	Bullplug	2.00		

50. CT RIH to **2,749 m MDDF or TOC depth**. Slowly pickup tool to ensure CT is in tension, stop winch at Flag#1 (Bottom perforation correlation flag depth).
51. Using Perforation Correlation Sheet at Appendix "A", Together with Client Site Representative (CSR), Uzma engineer to perform step by step space out calculation with based on BHA measurement and Depth offset agreed by (Client & Uzma Office). Space out calculation will position gun "top shot" to the respective perforation interval.

Note:

In the event of discrepancy or non-agreement situation offshore, any further step must be put on hold until further verification and approval is given by the town.

52. Once the gun space out is determined and agreed by both parties, Uzma engineer gives instruction to CT Supervisor to position the gun accordingly.
53. Calculate the amount of cable need to be moved to place the gun top shot at top perforation interval:

Firing Sequence Perforation Gun Run#2

53. Conduct toolbox talk and safety meeting with crew involved in operation.

Note:

a) Uzma engineer to brief pump man and CTU Operator on the pumping requirement to fire the gun.
b) Uzma Engineer to record CT weight & pressure before firing sequence.

54. Initiate drop ball sequence at CT Launcher with assist of CT Supervisor.
55. Perform circulation at 0.3 BPM. Pump Operator to ensure CT pressure is less than 1,000psi. Keep pumping until the ball is passing gooseneck.
56. Once indication of ball passing gooseneck is monitored, lower down pump circulation to 0.2 BPM. This is to ensure a clear indication of ball seated at firing head is observed.
57. Keep pumping until the ball reaches the firing head piston. Once the ball has seated at the firing head, fluid circulation will stop, and coil pressure will increase slowly.

Note:

1 - CTU operator confirm to minimum volume of liquid that will be required to be pumped to place the ball at the firing head has been reached.

2 - Depending on well geometry, deployment method and fluids used, the pressure profile may be misleading. Observation of a pressure increase, and pressure drop should not necessarily be interpreted as guns firing. The minimum pressure AND volume must be reached before a determination can be made that the guns have fired.

3 - If having difficulty and no indication of ball seat, perform circulation at high rate (> 0.3 BPM) and high pressure (> 1,000 psi). Attempt to pressure up the CT and increase the tubing pressure to a maximum firing head actuating pressure until see pressure drop and circulation regained. Monitor WHP and weight indicator for indication of gun firing.

58. Pump operator to continue pumping at same rate until firing head initiation pressure is reached.

Note:

Don't stop the pump and continue with the same flow rate until shear pins sheared. At this time monitor indications that guns are fired.

a) If no indication of gun fire after pressurizes tubing to 2500 psi, increase coil pressure gradually and observed for pressure drop and circulation established.
b) If there is still no indication, increase tubing pressure until it reaches max coil pressure. (CT Supervisor to Advise) and observe any pressure drop and circulation is established.

59. Upon confirmation guns are fired, Uzma Engineer to announce that guns fired after receiving positive indications (drop of pressure, CT vibration, tension / weight changes and return of CT circulation). POOH the CT with the BHA to 100ft or 30m above the perforated interval to avoid sticking (depending on well condition).
60. POOH CT once receiving CSR approval.
61. Continue to POOH until gun is 70m or 200ft below sea level, hold safety meeting with crew involved in operation.

Note:

a) Always treat the guns as live guns.

b) Clear all personnel from BOP and Xmas tree area.

c) Only Uzma Engineer and dedicated CT operator to work on retrieving guns.

62. Tag Stripper and close X-mas tree. Bleed off any trap pressure before disconnecting riser.

Note: Uzma Engineer to verify gun condition before giving approval to break gun connection and lay down gun.

63. Once CT tag stripper, proceed reverse deployment process as per **step 47**.

CT CONTINGENCY RUN#1: FISHING WITH MAGNET

64. In the event during CT Run#2 experience HUD shallower than depth 2,673 m ('D' Nogo Nipple), proceed with contingency fishing with magnet.
65. Make up 2.125" Fishing Tool c/w Slickline High Power Magnet as per **BHA#3: 2.125" Fishing Tool c/w Slickline High Power Magnet BHA** in **Appendix 1**.

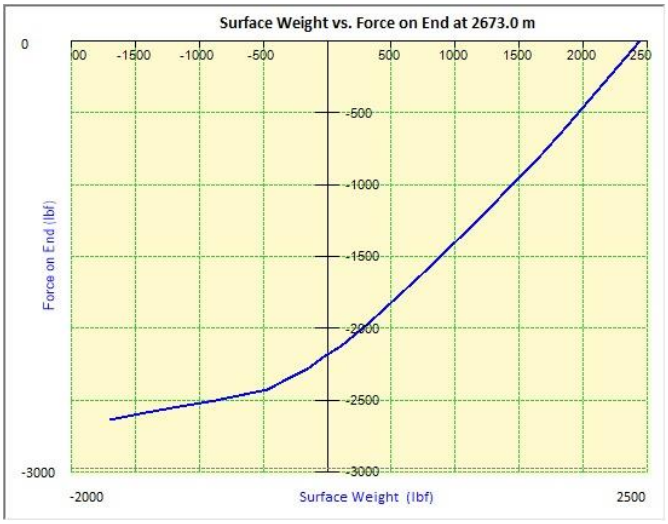
    Note: Take the below measurement and record in the DOR.
66. Perform circulation test through ported X-over. Record the data in the table below, do not exceed 5,000 psi circulating pressure.

Flow Rates (bpm)	Pressure (psi)	Remark
0.3		
0.5		
0.7		
0.8		
0.9		
1.0		

67. Repeat **step 7 to 13** in CT Run#1.
68. Start RIH CT **without pumping** until **10 m above latest top of dish depth**.
    - 68.1. RG Tool Specialist to be available inside Control Cabin all the time during operation.
    - 68.2. Refer to CT Tubing Force simulation (Orpheus modelling), refer **Appendix III**.
    - 68.3. Maximum CT speed RIH is **30-50 ft/min.**
    - 68.4. Closely observe weight indicator in control cabin while RIH.
    - 68.5. Conduct pull test minimum of every 300m (1,000ft) interval, use CT Fatigue graph as reference. Ensure the CT Fatigue graph is available at location before RIH. Record RIH, Hanging and POOH weight in treatment report.
    - 68.6. Slow down CT speed to 10 ft/min before and after passing through completion accessories.
    - 68.7. Observe return all the times. Flowback crew to monitor & record all return from time to time in Field Data Report.
    - 68.8. Do not exceed operating safety limits **5,000 psi.**
    - 68.9. If the well condition differs from original job design, contact appropriate personnel in charge before proceeding.
    - 68.10. At all time, while RIH, the injector torque control shall be set at the minimum pressure required to move the CT at specified speed.
69. Once CT reached at 10 m above top of fish depth, stop CT and conduct pull test of 10m/30ft and record the pulling weight both static and dynamic in the DOR as per table below.

Depth, ft	*RIH weight, lbf*	*Static weight, lbf*	*Pick up weight, lbf*

70. Continue RIH at 1 ft/min until tag top of fish HUD at 2,673 m (TBC). Do not slack off more than -1,000 lbf (downhole force).
    - 70.1. Apply setdown weight gradually at fish depth.



70.2. Pick up CT and observe any dragging weight (if available)

70.3. RIH back to confirm no set-down weight acting on CT (unless the depth around No-Go nipple).

71. POOH CT to surface at 10 ft/min.

72. Once confirm the fish is retrieved, proceed with CT Run#2 Drift & Depth Correlation Run, else proceed with contingency to use VJB to clean the area suspected debris fish (CT Contingency #2).

CT CONTINGENCY RUN#2: VJB CLEANOUT

73. Make up 2.063" Venturi Junk Basket Tool as per **BHA#4: 2.063" Venturi Junk Basket BHA** in **Appendix 1**.

    Note: Take the below measurement and record in the DOR.

74. Perform function test of the Venturi Junk Basket to determine pump rate & pressure parameter for the tool. Record the data in the table below, do not exceed 5,000 psi circulating pressure.

Flow Rates (bpm)	Pressure (psi)	Remark
0.3		
0.5		
0.7		
0.8		
0.9		
1.0		

75. Repeat **step 7 to 13** in CT Run#1.
76. Start RIH CT without pumping until **10 m above latest top of dish depth**.
    - 76.1. RG Tool Specialist to be available inside Control Cabin all the time during operation.
    - 76.2. Refer to CT Tubing Force simulation (Orpheus modelling), refer **Appendix III**.
    - 76.3. Maximum CT speed RIH is **30-50 ft/min.**
    - 76.4. Closely observe weight indicator in control cabin while RIH.
    - 76.5. Conduct pull test minimum of every 300m (1,000ft) interval, use CT Fatigue graph as reference. Ensure the CT Fatigue graph is available at location before RIH. Record RIH, Hanging and POOH weight in treatment report.
    - 76.6. Slow down CT speed to 10 ft/min before and after passing through completion accessories.
    - 76.7. Observe return all the times. Flowback crew to monitor & record all return from time to time in Field Data Report.
    - 76.8. Do not exceed operating safety limits **5,000 psi.**
    - 76.9. If the well condition differs from original job design, contact appropriate personnel in charge before proceeding.
    - 76.10. At all time, while RIH, the injector torque control shall be set at the minimum pressure required to move the CT at specified speed.
77. Once CT reached at **10 m above top of fish depth**, stop CT and conduct pull test of 10m/30ft and record the pulling weight both static and dynamic in the DOR as per table below.

Depth, ft	*RIH weight, lbf*	*Static weight, lbf*	*Pick up weight, lbf*

78. Increase pump rate gradually until 1 bpm and monitor circulating pressure.
79. Once observe stable circulating pressure, continue RIH at 1 ft/min until **1 ft above top of fish**.
80. Stop BHA 1 ft above top of fish & continue pumping at 1 bpm while monitor circulating pressure.
81. Once pressure has increased to 4,000 psi or is constant for 30 minutes, pick up BHA 30ft above top of plug and observe for 20 minutes.

81.1. If circulating pressure drop, repeat **step 77 to 81**.

81.2. If circulating pressure constant, stop pump and POOH to surface

81.3. If circulating pressure reached maximum 4000 psi, stop pump and POOH to surface

82. POOH CT to surface.

83. Once CT on surface, close well and bleed off pressure in CT and stack up. RG Tool Specialist to open the junk basket and send photo of the debris recovered to town. Consult with town on whether require to re-run VJB or can proceed with CT Run#2 Drift & Depth Correlation.

CT CONTINGENCY RUN#3: SPOT CEMENTING

84. Make up 1.69" Single Bore Nozzle Tool as per **BHA#5: 1.69" Single Bore Nozzle BHA** in **Appendix 1**.

    Note: Take the below measurement and record in the DOR.

85. Perform function test of the Single Bore Nozzle to determine at which pump rate and pressure limit. Record the data in the table below, do not exceed 5,000 psi circulating pressure.

Flow Rates (bpm)	Pressure (psi)	Remark
0.3		
0.5		
0.7		
0.8		
0.9		
1.0		
1.1		
1.2		

86. Repeat **step 7 to 13** in CT Run#1.
87. Start RIH CT to **Flag#3 at 2,678 m (EOT)** while pumping SW at minimum rate permissible.
    - 87.1. Refer to CT Tubing Force simulation (Orpheus modelling), refer **Appendix III**.
    - 87.2. Maximum CT speed RIH is **30-50 ft/min.**
    - 87.3. Closely observe weight indicator in control cabin while RIH.
    - 87.4. Conduct pull test minimum of every 300m (1,000ft) interval, use CT Fatigue graph as reference. Ensure the CT Fatigue graph is available at location before RIH. Record RIH, Hanging and POOH weight in treatment report.
    - 87.5. Slow down CT speed to 10 ft/min before and after passing through completion accessories.
    - 87.6. Observe return all the times. Flowback crew to monitor & record all return from time to time in Field Data Report.
    - 87.7. Do not exceed operating safety limits **5,000 psi.**
    - 87.8. If the well condition differs from original job design, contact appropriate personnel in charge before proceeding.
    - 87.9. At all time, while RIH, the injector torque control shall be set at the minimum pressure required to move the CT at specified speed.
88. Once CT reached at **Flag#3 at 2,678 m (EOT)**, stop CT and conduct pull test of 10m/30ft and record the pulling weight both static and dynamic in the DOR as per table below.

Depth, ft	*RIH weight, lbf*	*Static weight, lbf*	*Pick up weight, lbf*

89. After complete pull test, slow down CT speed to 5 ft/min, and continue to RIH out of tubing to 7" Liner section until **3,017 m (Flag#5 at PBTD)**. Closely observe weight indicator in Control Cabin while RIH, do not slack off more than 1,000 lbf in the event encounter any HUD.
90. When CT at **3,017 m (Flag#5 at PBTD)**, pick-up CT 1 ft above PBTD with reference on Flag#5.
91. Proceed with downhole nozzle parameter test.

91.1. Fill up CT with 20 bbls of SW (CT Volume)

91.2. Begin downhole parameter test. Fill up and include table below in daily report:

Rates (bpm)	Pumping Pressure (psi)	Time (min)	Volume (bbl)	THP (psi)	PCP (psi)	Remark
0.3						
0.5						
0.7						
0.8						
0.9						
1.0						
1.1						
1.2						

91.3. Report the downhole parameter test result to WSS & town.

92. Conduct job specific meeting between technical support team (base/office) and operation team (offshore).

93. Proceed to mix 45 bbls of 15.0 ppg cement in one BMX Tank and 30 bbls of Contaminated Gel in another BMX Tank as per below while continue pumping **Sea Water** through CT at idle rate.

93.1. Precaution and standard practice during mixing cement:

93.1.1. Make sure to well-stir the liquid additives especially for BA-58L, R-21LS & ASA-304L

93.1.2. To follow the mixing sequence

93.1.3. Make sure mix fluid homogenous before cut cement sack. Take mix fluid sample (recommend 5 liter).

93.1.4. Record time once 1st cement sack dump into BMX. Cement transfer should be not more than cut-off time (3 hr as per lab report/program)

93.1.5. Check the density (min 2 times each sampling), gradually taken before the last sacks pallet. Stop adding cement once reaching 15.0 ppg +/- 0.2ppg.

93.1.6. Take 4 cement samples - to put inside water bath at 190F & surface temperature.

Contaminated Gel				420	gals	10	bbls	Description
Seq	Product	Concentration		Volume				
1	Sea Water	944	gptg	397	gals	9.4	bbls	Base Fluid
2	SCR	50	gptg	21	gals	0.5	bbls	Cement retarder
3	Gel	41	pptg	17	lbs			Gelling agent

Mixing Instruction:
1. Fill up tank with sea Water
2. Add additives as per above sequence
3. Agitate until mixture is homogeneous

15ppg Cement			1890	gals	45	bbls
Products	**Concentration**		**Volume**			
Sea Water	4.90	gps	918.07	gals	21.86	bbl
FP-32L (Defoamer)	0.05	gps	9.21	gals	0.22	bbl
ASA-304L (Anti Settling Agent)	0.022	gps	4.05	gals	0.10	bbl
BA-58L (Bonding Agent)	0.55	gps	101.36	gals	2.41	bbl
FL-70L (Fluid Loss Agent)	0.45	gps	82.93	gals	1.97	bbl
CD-38L (Dispersant)	0.12	gps	22.11	gals	0.53	bbl
R-21LS (Retarder)	0.085	gps	15.66	gals	0.37	bbl
Blended Slagment with 12.25% Silica	1.37	cuft/sk	17,969.95	lbs	326.7	55 lbs per sacks
EC-4 (Expanding Agent)	1.0%	bwoc	160.09	lbs	2.91	55 lbs per sacks

1. Fill up batch mixer with sea water
2. Add additives as per above sequence
3. Note the time when 1st cement sack is added into mixed water mixture. Thickening time starts once 1st cement sacks is added into mixed
4. Refer to Appendix 5 for cement lab test results

Note:

1. **Record and inform Engineer in Charge when the first sack of cement is added to mixed water mixture.**
2. **Cement Thickening Time is 18 hours 55 minutes from first sack of cement added.**
3. **Cement Mixing Time is 2 hours and additional safety margin 1 hour.**
4. **Total Cement Mixing Cut-Off Time is 3 hours.**
5. **After complete mixing, take cement sample from Batch Mixer and CT Reel Manifold and keep sample for monitoring. Label sample properly.**

94. Upon complete mixing and density witness and confirmation of WSS, begin to pump cement according to the following steps:

94.1. Collect a sample from the surface and divide it into two for testing in separate conditions: one maintained at surface temperature and the other placed in a water bath at reservoir temperature.

94.2. Open overboard valve and displace surface lines to cement slurry.

94.3. Reset data acquisition before start pumping.

94.4. Close overboard valve and equalize pressure across reel valve.

94.5. Ensure wellhead valves are configured according to table below: -

Valve	Position
Reel Manifold	OPEN
Flow Cross Return Valve (Cetco lines)	OPEN
Wing Valve	CLOSE

94.6. Start pumping according to pumping sequence specified below (CT Volume 20.3 bbls), maximum pumping rate subject to circulating pressure. Do not exceed 4,500 psi:

#	Start Depth (ft)	End Depth (ft)	Fluid at Reel Manifold	Fluid Entry Volume (bbl)	Total Fluid Pumped (bbl)	Pump Rate (bpm)	CT Speed (ft/min)	Fluid at Nozzle	Valves Config. Flow Tee	Remarks
1	9,899	9,899	SW	5	5	0.5	-	SW	*Open Return	Reset DAS Volume
2	9,899	9,899	Install lead cement dart (3,000 psi cement dart rating), **Green color**							
3	9,899	9,899	Cement	20.3	20.3	0.3 – 1.0	-	SW	*Open Return	Reduce pump rate to 0.3 bpm once 19.3 bbls is pumped until lead dart land at

										connector. Cement at tip of nozzle.
4	9,899	9,899	Once observe circulation pressure increase, apply at least +/-1,200 psi pumping pressure to burst the lead Cement Dart							
5	9,899	9,531	Cement	14.7	35	0.3	-7.5	Cement	*Open Return	Cement at tip of nozzle
6	9,531	9,531	Install tail cement dart (1,650 psi cement dart rating), **Purple color**							
7	9,531	9,019	SW	20.3	55.3	0.3	-7.5	SW	*Open Return	Reduce pump rate to 0.3 bpm once19.3 bbls is pumped until tail dart land at connector. All 35 bbls cement outside of nozzle.
8	9,019	8,787	Once Observe circulation pressure increase, Stop pumping. Pick up CT to EOT at 8,787 ft							
9	8,787	8,787	Apply at least +/-1,200 psi pumping pressure to burst the tail Cement Dart							
10	8,787	8,787	Contaminated Gel	5	60.3	0.5	0	SW	*Open Return	-
11	8,787	8,787	SW	15.3	75.6	1.0	0	Contaminated Gel	*Open Return	Contaminated gel at Nozzle.
12	8,787	8,294	SW	5	80.6	0.3	-50	SW	*Open Return	Spot Contaminated gel, 5 bbls
13	8,294	8,194	Gel	10	90.6	Max Rate	-10	SW	*Open Return	Pick-up CT 100 ft above top of Contaminated Gel
14	8,194	8,757	SW	20.3	110.9	Max Rate	30	SW	*Open Return	RIH back to 30 ft above EOT
15	8,757	8,757	Gel	10	120.9	Max Rate	-	SW	*Open Return	Circulate out excess cement in Coil and Tubing.
16	8,757	8,778	SW	51	171.9	Max Rate	-	SW	*Open Return	Bottom Up 1x tubing volume to circulate out gel / until clear return.
17	8,778	0	SW	-	-	0	-30	SW	*Open Return	Continue POOH to surface

1. Actual CT string volume will be confirmed during rig up.
2. (-) refers to CT moving upward / pick up coil
3. During Pumping cement and displacement fluid, Field Engineer / Cementer / WSS / CT Supv to verify and

witness the fluid level inside batch mixer.
4. **DO NOT EXCEED** pumping pressure of 5,000 psi (Circulating Pressure) during cementing stage.
5. **DO NOT EXCEED** MASTP at 787 psi.

95. Proceed POOH CT to surface (follow step 94.6):
    95.1. Maximum coil speed while POOH is 50 ft/min.
    95.2. Slow down coil speed to 10ft/min 50ft before and after passing through completion accessories.
    95.3. Do not exceed CT operating limit (refer to Appendix Section: TFA simulation)
96. Once CT reaches at surface:
    96.1. Close master and swab valve.
    96.2. Flush pumping line, CT and BHA with IW to clean excess cement.
    96.3. Service all BHA & fluid end of pumping unit and prepare for next run.
97. Wait on cement to **completely harden after 28 hours from 1st cement sack added.**

CT CONTINGENCY RUN#4: TAG TOP OF CEMENT

98. Make up 1.69" MultiJet Nozzle c/w 2.20" Fluted Centralizer Tool as per **BHA#6: 1.69" MultiJet Nozzle c/w 2.20" FC BHA** in **Appendix 1**.

    Note: Take the below measurement and record in the DOR.

99. Perform function test of the MultiJet Nozzle to determine at which pump rate and pressure limit. Record the data in the table below, do not exceed 5,000 psi circulating pressure.

Flow Rates (bpm)	Pressure (psi)	Remark
0.3		
0.5		
0.7		
0.8		
0.9		
1.0		
1.1		
1.2		

100. Repeat **step 7 to 13** in CT Run#1.

101. Start RIH CT to **2,668 m (10 m above EOT)** without pumping.

    101.1. Refer to CT Tubing Force simulation (Orpheus modelling), refer **Appendix III**.

    101.2. Maximum CT speed RIH is **30-50 ft/min.**

    101.3. Closely observe weight indicator in control cabin while RIH.

    101.4. Conduct pull test minimum of every 300m (1,000ft) interval, use CT Fatigue graph as reference. Ensure the CT Fatigue graph is available at location before RIH. Record RIH, Hanging and POOH weight in treatment report.

    101.5. Slow down CT speed to 10 ft/min before and after passing through completion accessories.

    101.6. Observe return all the times. Flowback crew to monitor & record all return from time to time in Field Data Report.

    101.7. Do not exceed operating safety limits **5,000 psi.**

    101.8. If the well condition differs from original job design, contact appropriate personnel in charge before proceeding.

    101.9. At all time, while RIH, the injector torque control shall be set at the minimum pressure required to move the CT at specified speed.

102. Once CT reached at **2,668 m (10m above EOT)**, stop CT and conduct pull test of 10m/30ft and record the pulling weight both static and dynamic in the DOR as per table below.(IMPORTANT)

Depth, ft	*RIH weight, lbf*	*Static weight, lbf*	*Pick up weight, lbf*

103. Slow down CT speed to 5 ft/min, and continue to RIH out of tubing to 7" Liner section until **2,739 m (10m above intended TOC)**. Stop CT and conduct pull test of 10/30 ft with pumping rate at 0.3 bpm.

104. After complete pull test, slow down CT speed to 5 ft/min, and continue to RIH to **tag Intended TOC at 2,749 m**. Closely observe weight indicator in Control Cabin while RIH, do not slack off more than -1,000 lbf in the event encounter any HUD.

105. When CT tag TOC at 2,749 **m (Flag#)**, pick up CT to 30ft above TOC, and retag again on HUD not exceeding -1,000 lbf to verify the depth. Flag the CT on surface. Record the following and include in daily report.

Flag Number	*Colour*	*Depth*
Flag#		

105.1. If TOC tagged is different from intended TOC, consult with EIC at town.

106. Once confirmed tag TOC, POOH CT to surface.

CT CONTINGENCY RUN#5: SET CT PACKER AT 1,442 M AND PERFORM CEMENT INTEGRITY TEST

107. Make up CT Packer BHA tool as per **BHA#7: CT Packer BHA** in **Appendix 1**.

I. Ensure that burst disk at Motor Head Assembly (MHA) is changed to 6,000 psi pressure rating. Record the burst disk rating in BHA checklist, witnessed and verify by WSS.

II. Measure length of BHA & length from CT Connector to Packer Mid Element (COE) in ft.

III. Ensure all BHA is properly torque according to Weatherford procedure.

IV. Perform function test of the Nozzle to determine the pumping parameter. Record the data in the table below, do not exceed 5,000psi.

Flow rates (bpm)	Flowrate (scfm) (if applicable)	Pressure (psi)	Remark
0.3			
0.5			
0.7			
1.0			
1.1			
1.3			

V. Ensure PCE stack is as APPENDIX II – CT STACK UP with quick test sub is in place.

VI. Nipple up riser, pressure test quick test sub, pick up CT and tag the stripper and manipulate surface valve to the following position:

Valve	Position
Reel Manifold	OPEN
Flow Cross Return Valve (Cetco lines)	OPEN
Wing Valve	CLOSE

108. Start RIH to **1,402 m (10 m above leakpoint)** while pumping break circulation with **IW** at 0.3 bpm for 2 bbl during pull test every 1,000 ft.

108.1. Refer to CT Tubing Force simulation (Orpheus modelling), refer Appendix II.

108.2. Ensure Weatherford Tool Specialist is available on site during the whole operation.

108.3. Conduct pull test as per for every 300m (1,000ft), use CT Fatigue graph as reference. Ensure the CT Fatigue graph is available at location before RIH. Record RIH, Hanging and POOH weight in treatment report. Break circulation as well.

108.4. In the event of Jay mechanism activated during pull test, RIH to cycle the packer to release it (As per advice by Weatherford Toolman onboard).

108.5. Maximum coil speed running in hole is **30-40 ft/min.**

108.6. Slow down coil speed to **10 ft/min**, 50 ft before and after passing through completion accessories.

108.7. Closely observe weight indicator in control cabin while running in hole.

108.8. Observe return all the times.

108.9. Do not exceed operating safety limits **6,000 psi.**

108.10. If the well condition differs from original job design, contact appropriate personnel in charge before proceeding.

108.11. At all time, while RIH, the injector torque control shall be set at the minimum pressure required to move the CT at specified speed.

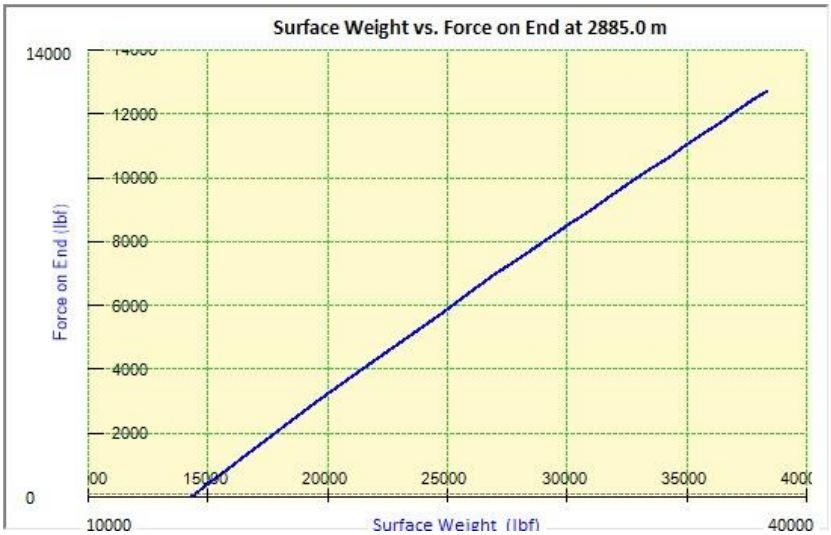
108.12. Do not snub more than -1,000 lbf (downhole force). If encounter snub force, inform WSS.

109. Once CT reach at **1,402 m (10 m above leakpoint)**, stop coil and conduct pull test of 10m/30ft without pumping and record the pulling weight both static and dynamic (IMPORTANT).

Depth, ft	*RIH weight, lbf*	*Static weight, lbf*	*Pick up weight, lbf*

110. RIH to **1,442 m (30m below leakpoint)** TBC. Proposed CT packer setting depth is at 1,442 m (TBC), any changes in depth subject to discussion and approval from client and town. Once CT in tension condition, proceed to set the CT packer as per Weatherford procedure below.

110.1. Active the Jay mechanism, once observed overpull (anchor at tubing), apply 3,000 lbs overpull (downhole) to set the CT packer. Please refer below pick up force graph for reference:



111. Once confirmed CT packer already set, perform pressure test 500 psi for 30 minutes by pumping IW through CT, if pressure test fail, re-set the CT packer (2-m above the initial position) and re-do the pressure test.

112. Once confirm circulating pressure is holding at 500 psi for 30 minutes, unset the CT Packer as per Weatherford's procedure.

113. POOH CT to surface.

CT CONTINGENCY RUN #6: MILLING OPERATION WITH BARRACUDA UNDERREAMER

114. Make up 2.125" PDM Motor c/w Barracuda Underreamer & NRS tool as per **BHA#8: 2.125" PDM Motor c/w Barracuda Underreamer & NRS BHA** in **Appendix I**.

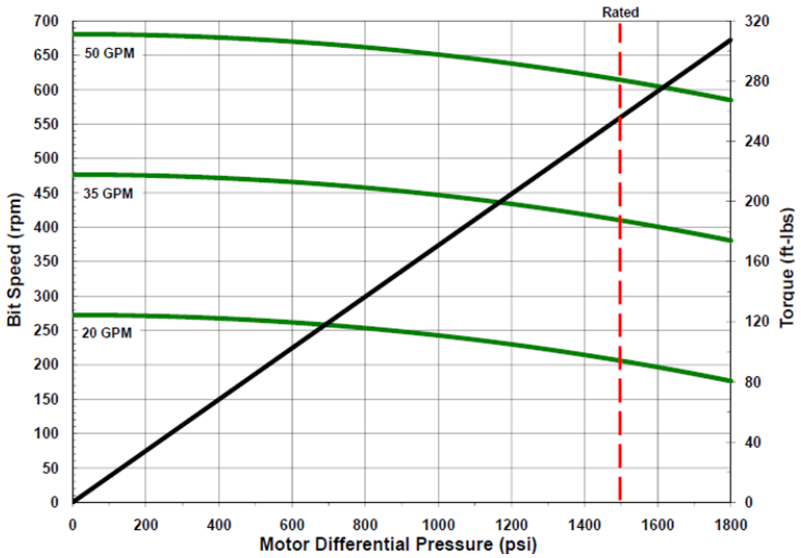
115. Perform function test of the Milling Motor to determine at which pump rate and pressure the tool start to operate / rotate & Hydraulic Non-Rotating Stabiliser start expand. Record the data in the table below and include in daily report. Refer the Motor Performance data for the operating envelope.

Flow rates (bpm)		Pressure (psi)	Remark
GPM	BPM		
21.0	0.50		
30.0	0.70		
37.8	0.90		
46.2	1.10		
50.0	1.20		
55.0	1.30		

116. For reference, flow rate range to operate the motor is between 0.50 – 1.20 bpm as per the following specification.

Performance Curves Based on Dynamometer Test Data

Operating Data			
Flow Range		gpm (lpm)	20 - 50 (76 - 190)
Motor Pressure		psi (bar)	1,500 (103)
Bit Speed		rpm	270 - 680
Displacement		rev/gal (rev/l)	13.612 (3.630)
Torque		ft-lbs (Nm)	256 (347)
Power		HP (Kw)	33 (25)
Physical Dimensions			
Power Section Configuration		Stages	6
		Lobes	5/6
Overall Motor Length		ft (m)	11.0 (3.4)
Weight		lbs (kg)	86 (39)
Connections	Standard	Box	1-1/2" Reg, Top and Bottom
	Optional	Box	Available Upon Request
Mill Size		in (mm)	3-1/2 Max (88.9 mm Max)
Bit Size		in (mm)	2-3/16 to 3-1/4 (55.6 - 82.6)



117. Repeat Step 7 till 13 in Run#1.
118. Start RIH CT to **2,668 m** (**10m above EOT)** without pumping.
    118.1. RG Tool Specialist to be available inside Control Cabin all the time during operation.
    118.2. Refer to CT Tubing Force simulation (Orpheus modelling), refer Appendix III.
    118.3. Conduct pull test as per for every 300m (1,000ft), use CT Fatigue graph as reference. Ensure the CT Fatigue graph is available at location before RIH. Record RIH, Hanging and POOH weight in treatment report.
    118.4. Maximum coil speed running in hole is **30-50 ft/min.**
    118.5. Slow down coil speed to **10 ft/min**, 50 ft before and after passing through completion accessories.
    118.6. Closely observe weight indicator in control cabin while running in hole.
    118.7. Observe return all the times.
    118.8. Regularly inform WSS on job status at all times.
    118.9. Do not exceed operating safety limits **5,000 psi.**
    118.10. If the well condition differs from original job design, contact appropriate personnel in charge before proceeding.
    118.11. At all time, while run-in hole, the injector torque control shall be set at the minimum pressure required to move the CT at specified speed.
119. Once CT reach at **2,668 m MDDF** (**10m above EOT**), stop coil and conduct pull test of 10m/30ft with pumping rate 0.3BPM and record the pulling weight both static and dynamic (IMPORTANT).

Depth, ft	*RIH weight, lbf*	*Static weight, lbf*	*Pick up weight, lbf*

120. Continue RIH slowly at 10ft/min without pumping until tag TOC. Do not slack off more than -500 lbf at downhole.
121. Record the depth at which the HUD was tagged. Pick up CT to the normal weight and flag the coil on surface (Flag #).

Flag Number	*Colour*
Flag#	

122. Pick up CT 10m above HUD, start pumping IW to start the Milling Motor. Record all the parameter (Flow Rate, Pumping Pressure). Refer to the Motor Performance Data. Record the “Off Bottom” pump pressure prior milling.
    122.1. The pressure is considered No Load Pressure **(P No Load).** No Load Pressure will increase as milling in progress.

Flow rates (bpm)		Pressure (psi)	Remark
GPM	BPM		
21.0	0.50		
30.0	0.71		
37.8	0.90		
46.2	1.10		
50.0	1.20		

123. Once Off Bottom parameters have been recorded, increase pumping rate as per RG Tool Specialist recommendation and record the circulating pressure.

123.1. Do not exceed the maximum CT working pressure of 5,000 psi.

123.2. Flow rate range for the motor to operate is 0.50 – 1.20 bpm.

124. Continue to RIH until loss in weight (-500 lbf slack off) is observed on mill and start milling while maintaining -500 lbf weight on bit. Record the bottom circulating pressure and start milling with minimum WOB.

Note: At this point, patience is critical. Motor stalls can occur repeatedly until milling pattern is established. Set down weight should be applied until approximately 300 – 700 psi differential pressure above the Off Bottom circulating pressure is maintained. RG Tool Specialist onsite will further asses the condition during milling operation.

124.1. Continue slacking off weight as differential pressure and ROP (Rate of Penetration) indicates the progress of scale milling. Keep WOB within limit as per RG Tool Specialist recommendation.

124.2. Regularly monitor return on surface, advise RG Tool Specialist immediately if there is no return while milling in progress. Flowback personnel must standby all the time at the Choke Manifold to monitor the choke size and keep the WHP/THP at least 100 psi.

124.3. Set down weight between 500 to 1,500 lbf, in 100 lbf incremental. Maximum set down weight is 1,500 lbf. Motor work is indicated by differential pressure not the WOB.

124.4. Please record the bottom hole circulating pressure. Keep the DP between 300 – 700 psi. **Maximum DP is 1400 psi ($P_{Load} - P_{No\ Load}$).**

124.5. If motor stall, stop pumping, bleed off pressure and pick up CT 20ft above the current depth. Resume the pumping and note the pressure and compare to the previous pressure. Refer to the Motor Performance Curve below as guideline.

124.6. Monitor the return on surface at all time.

125. Once milling pattern is established, vary the set down weight between 500 to 1,500 lbf until achieve 300–700 psi differential pressure. Maximum DP is 1,400 psi.

126. Continue milling the **HUD depth** until back to normal weight that indicate the cement has been clear or fall to the next restriction inside the casing.

126.1. Pay close attention to the weight indicator and circulation pressure gauge

126.2. The weight indicator will monitor the amount of WOB.

126.3. The circulation pressure gauge will inform the DP at which motor is functioning.

127. Once indication of the cement has been clear or fall to the next restriction, proceed to pump 60 bbls of D801 Gel and followed by 2x tubing & wellbore volume with IW to flush the remaining debris out from the well.

128. Once completed bottoms up, drop 5/8” back to activate circulation sub & continue pump at high rate to gravitate the ball along the gooseneck & wait for 30 minutes until fully seat. Pressure up the CT to activate circulation sub of MHA.

129. On positive indication that flow path is now thru the circulation sub, continue pumping at high rate & POOH CT to surface.

CT CONTINGENCY RUN#7: POST MILLING CLEANOUT

130. Make up 1.69" MultiJET Nozzle tool as per **BHA#1: 1.69" MultiJET Nozzle BHA** in **Appendix 1**.

Note: Take the below measurement and record in the DOR.

131. Perform function test of the MultiJET Nozzle to determine the associated circulating pressure vs. pump rate. Record the data in the table below, do not exceed 5,000psi circulating pressure.

Flow Rates (bpm)	Pressure (psi)	Remark
0.3		
0.5		
0.7		
0.8		
0.9		
1.0		
1.1		
1.2		
1.3		

132. Repeat **step 7 to 13** in CT Run#1.

133. After complete pull test, establish return by pumping at 1.2 bpm (or consider 1x tubing + wellbore volume: 95 bbls if no return at surface).

Notes:

- If no return, please follow pumping parameter as per CIRCA: **1.2 bpm with 300 scfm (Nitrified IW)**
- After establish constant return at surface, divert the flow into surge tank for 15 – 30 minutes, record the volume inside the surge tank to calculate losses rate into reservoir. Repeat this step every time change in choke size (due to several reason such as high and low THP).
- **Continuously record return volume during cleanout operation. (Record inside updated FDR)**
    - Check surface flowback back pressure. Must be less than WHP
    - Wait till system stabilizes
    - Check gas lift injection (Is it on? Injection Pressure > Wellbore Pressure?)
    - Manipulate choke size
- If still no return at surface, pick-up BHA by stages to establish return. (Proposed to depth where returns were previously obtained).
- If still unable to establish return, consult town. (Provide the details of THP, choke size and circulation pressure).
- After return establish, RIH to perform cleanout.
- At all times, monitor the return pattern, THP and debris sample at surface. (Take note if there any THP drop during penetration).
- **If no debris recover at surface while penetrating HUD with fluid return, stop penetration and circulate with Gel and CBU until debris recover at surface.**
- Pump 5 bbls gel to lift the suspected debris to surface.
- CBU at least 2x Annulus volume at that depth.
- After confirm there's no longer debris at that depth, proceed penetration.

- In the event unable to penetrate due to hard solid, slowly increase jetting rate until maximum allowable during penetration (ensure the return always establish at surface), after complete 1 cycle penetration, follow rate suggest by CIRCA to lift up the debris.
- Continue RIH to perform cleanout at 1 ft/min while pumping nitrified IW (1.2 bpm & 300 scf/min) starting at depth **2,678 (EOT**) until **2,759 m** as per summary table below:

Note: Every 10m/30ft penetration, sweep with 5 bbls of Gel & wiper trip 10m above previous HUD before continue penetrate in casing section.

No.	Stage	Fluid	Liquid Rate	Total Liquid	N2 Rate (If require)	CT Speed	Duration	Depth	Remarks
			BPM	BBL	SCF/M	ft/min	Minute	m	
1	CT at 10m above EOT	IW	1.2	0.0	300	0	0	2,678 m (EOT)	Establish return on surface
2	RIH to HUD and Penetrate HUD/Fill	IW	1.2	36	300	1	30	HUD + 10m	Monitor return & CT weight on surface
3	Circulate	D801 Gel	1.2	6	300	0	5	Stationary CT	Provide suspension to the fill and lift to surface
Wiper Trip 10m above EOT									
4	RIH to last HUD and Penetrate HUD/Fill	IW	1.2	36	300	1	30	HUD + 10m	Monitor return & CT weight on surface
5	Circulate	D801 Gel	1.2	6	300	0	5	Stationary CT	Provide suspension to the fill and lift to surface
Wiper Trip 10m above EOT									
6	Hole Cleaning (Circulate)	D801 Gel	1.2	70	300	0	60	Stationary CT at 2,759 m	Hole cleaning stage. 1.0x CT/Tubing Annulus Volume
7	Bottoms Up (Circulate)	IW	1.2	0.0	300	0	58 Hrs	Stationary CT at 2,759 m	Hole Cleaning stage. As per Circa Simulation
8	POOH	IW	1.2	362	0	30	5 Hrs	To Surface	Monitor return on surface

134. Once CT reach 2,759 m, circulate 60 bbls of Gel and perform bottoms up with Nitrified TIW (1.2 bpm & 300 scf/min) for 58 hours at depth 2,759 m as per CIRCA Simulation. Flag #1 CT at surface at depth 2,759 m.

Note: Perform pull test of CT at depth for every 30 minutes. Always monitor weight parameter.

Flag Number	*Colour*
Flag#1	

135. POOH CT to surface at 30 ft/min while pumping at 1.1 bpm.

APPENDIX I – BHA SCHEMATIC

BHA#1: 2.28" BURNSHOE MILL BIT BHA

DIMENSION BID

BHA DIAGRAM #1 -2.28" Burnshoe Mill Bit

Client	Petronas Carigali
Field	Dulang A
Job Type	CT Milling & Add Perf
Job No.	

Well	A-12
Min Restriction	2.25
BHP	
BHT	

BHA DRAWING	DESCRIPTION	CONNECTION		ID	OD	TOOL LENGTH	CUMULATIVE LENGTH
		UPHOLE	DOWNHOLE	INCH	INCH	FT	FT
	**External Dimple CT Connector**	1.5" CT	1.5" AMMT Pin		2.000	0.41	0.4
	2-1/8" Motorhead Assembly Disconnect drop ball 3/4" Circulating drop ball 5/8" Burst Disc 5,000 psi	1.5" AMMT Box	1.5" AMMT Pin		2.125	3.00	3.4
	2-1/8" BICO PDM Motor	1.5" AMMT Box	1.5" AMMT Box		2.125	11.4	14.81
	2.28" Burnshoe Mill bit	1.5" AMMT Pin			2.280	1.42	16.23

BHA LENGTH	16.23
MAXIMUM OD	2.28
MINIMUM ID	

Prepared by:	M. Ameerul Zaeem
Review by:	
Revision:	
Date:	

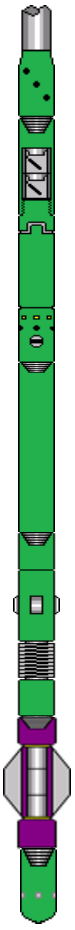
ADDITIONAL INFORMATION:

BHA#2: 2.125” MULTIJET NOZZLE C/W 2.20” FC & EOT LOCATOR BHA

DIMENSION BID

BHA DIAGRAM #2 -2.125" MultiJet Nozzle c/w 2.20" FC & EOT Locator

Client	Petronas Carigali	Well	A-12
Field	Dulang A	Min Restriction	2.25
Job Type	CT Milling & Add Perf	BHP	
Job No.		BHT	

BHA DRAWING	DESCRIPTION	CONNECTION		ID	OD	TOOL LENGTH	CUMULATIVE LENGTH
		UPHOLE	DOWNHOLE	INCH	INCH	FT	FT
	**External Dimple CT Connector**	1.5" CT	1.5" AMMT Pin		2.000	0.50	0.5
	2-1/8" Motorhead Assembly Disconnect drop ball 3/4" Circulating drop ball 5/8" Burst Disc 5,000 psi	1.5" AMMT Box	1.5" AMMT Pin		2.125	2.50	3.0
	3 FT Straight Bar	1.5" AMMT BOX	1.5" AMMT PIN		2.125	3.0	6.0
	Flo-Activated EOT Locator Collapsed OD: 2.125" Max Expansion OD: 2.974"	1.5" AMMT BOX	1.5" AMMT PIN		2.125	2.3	8.30
	Crossover	1.5" AMMT BOX	1.0" AMMT PIN		2.125	0.50	8.80
	2.20" Fluted Centralizer	1.0" AMMT BOX	1.0" AMMT PIN		2.200	1.0	9.30
	Crossover	1.0" AMMT BOX	1.5" AMMT PIN		1.69	0.50	9.80
	2-1/8" MultiJet Nozzle	1.5" AMMT BOX			2.125	1.0	10.80

BHA LENGTH	10.80
MAXIMUM OD	2.20
MINIMUM ID	

Prepared by:	M. Ameerul Zaeem
Review by:	
Revision:	
Date:	

ADDITIONAL INFORMATION:

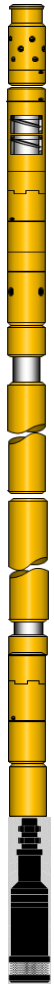
BHA#3: 2.125” FISHING TOOL C/W SLICKLINE HIGH POWERED MAGNET BHA

DIMENSION BID

BHA DIAGRAM #3 -2.125" Fishing Tool c/w Slickline High Powered Magnet BHA

Client	Petronas Carigali
Field	Dulang A
Job Type	CT Milling & Add Perf
Job No.	

Well	A-12
Min Restriction	2.25
BHP	
BHT	

BHA DRAWING	DESCRIPTION	CONNECTION		ID	OD	TOOL LENGTH	CUMULATIVE LENGTH
		UPHOLE	DOWNHOLE	INCH	INCH	FT	FT
	**External Dimple CT Connector**	1.5" CT	1.5" AMMT Pin		2.000	0.41	0.4
	2-1/8" Motorhead Assembly Disconnect drop ball 3/4" Circulating drop ball 5/8" Burst Disc 5,000 psi	1.5" AMMT Box	1.5" AMMT Pin		2.125	3.00	3.4
	2-1/8" Dual Acting Jar	1.5" AMMT Box	1.5" AMMT Pin		2.125	6.20	9.6
	2-1/8" HD Lower Disconnect	1.5" AMMT Box	1.5" AMMT Pin		2.125	1.73	11.34
	Crossover (DB)	1.5" AMMT Box	15/16" SR		2.00	0.42	11.76
	Slickline High Powered Magnet	15/16" SR			1.75	0.80	12.56

BHA LENGTH	12.56
MAXIMUM OD	2.13
MINIMUM ID	

Prepared by:	M. Ameerul Zaeem
Review by:	
Revision:	
Date:	

ADDITIONAL INFORMATION:

BHA#4: 2.063” VENTURI JUNK BASKET BHA

DIMENSION BID

BHA DIAGRAM #4 -2.063" VENTURI JUNK BASKET BHA

Client	**Petronas Carigali**	**Well**	**A-12**
Field	**Dulang A**	**Min Restriction**	**2.25**
Job Type	**CT Milling & Add Perf**	**BHP**	
Job No.		**BHT**	

BHA DRAWING	DESCRIPTION	CONNECTION		ID	OD	TOOL LENGTH	CUMULATIVE LENGTH
		UPHOLE	DOWNHOLE	INCH	INCH	FT	FT
	**External Dimple CT Connector**	1.5" CT	1.5" AMMT Pin		2.000	0.41	0.4
	2-1/8" Motorhead Assembly Disconnect drop ball 3/4" Circulating drop ball 5/8" Burst Disc 5,000 psi	1.5" AMMT Box	1.5" AMMT Pin		2.125	3.00	3.4
	Crossover	1.5" AMMT Box	1.5" AMMT Box		2.125	0.70	4.1
	2.063" Venturi Junk Basket Included 4 ft Extension	1.5" AMMT Pin			2.063	7.3	11.36

BHA LENGTH	**11.36**
MAXIMUM OD	**2.13**
MINIMUM ID	

Prepared by:	M. Ameerul Zaeem
Review by:	
Revision:	
Date:	

ADDITIONAL INFORMATION:

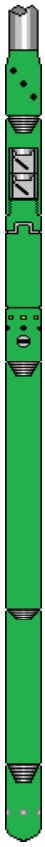
BHA#5: 1.69” SINGLE BORE NOZZLE BHA

DIMENSION BID

BHA DIAGRAM #5 -1.69" SINGLE BORE NOZZLE BHA

Client	Petronas Carigali
Field	Dulang A
Job Type	CT Milling & Add Perf
Job No.	

Well	A-12
Min Restriction	2.25
BHP	
BHT	

BHA DRAWING	DESCRIPTION	CONNECTION		ID	OD	TOOL LENGTH	CUMULATIVE LENGTH
		UPHOLE	DOWNHOLE	INCH	INCH	FT	FT
	**Internal Dimple CT Connector**	1.5" CT	1.0" AMMT Pin		1.690	0.30	0.3
	1-11/16" Motorhead Assembly Disconnect drop ball 5/8" Circulating drop ball 1/2" Burst Disc 5,000 psi	1.0" AMMT Box	1.0" AMMT Pin		1.690	2.30	2.6
	5 FT Straight Bar	1.0" AMMT Box	1.0" AMMT Pin		1.690	5.0	7.6
	3 FT Straight Bar	1.0" AMMT Box	1.0" AMMT Pin		1.690	3.0	10.6
	Single Bore Nozzle	1.0" AMMT Box			1.690	0.6	11.2

BHA LENGTH	11.20
MAXIMUM OD	1.69
MINIMUM ID	

Prepared by:	M. Ameerul Zaeem
Review by:	
Revision:	
Date:	

ADDITIONAL INFORMATION:

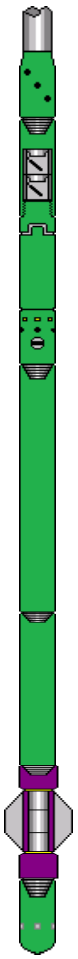
BHA#6: 1.69" MULTIJET NOZZLE C/W 2.20" FC BHA

DIMENSION BID

BHA DIAGRAM #6 -1.69" MULTIJET NOZZLE C/W 2.20" FC BHA

Client	Petronas Carigali
Field	Dulang A
Job Type	CT Milling & Add Perf
Job No.	

Well	A-12
Min Restriction	2.25
BHP	
BHT	

BHA DRAWING	DESCRIPTION	CONNECTION		ID	OD	TOOL LENGTH	CUMULATIVE LENGTH
		UPHOLE	DOWNHOLE	INCH	INCH	FT	FT
	**Internal Dimple CT Connector**	1.5" CT	1.0" AMMT Pin		1.690	0.30	0.3
	1-11/16" Motorhead Assembly Disconnect drop ball 5/8" Circulating drop ball 1/2" Burst Disc 5,000 psi	1.0" AMMT Box	1.0" AMMT Pin		1.690	2.30	2.6
	5 FT Straight Bar	1.0" AMMT Box	1.0" AMMT Pin		1.690	5.0	7.6
	3 FT Straight Bar	1.0" AMMT Box	1.0" AMMT Pin		1.690	3.0	10.6
	2.20" Fluted Centralizer	1.0" AMMT Box	1.0" AMMT Pin		2.200	1.0	11.6
	MultiJet Nozzle	1.0" AMMT Box			1.690	0.6	12.2

BHA LENGTH	12.20
MAXIMUM OD	2.20
MINIMUM ID	

Prepared by:	M. Ameerul Zaeem
Review by:	
Revision:	
Date:	

ADDITIONAL INFORMATION:

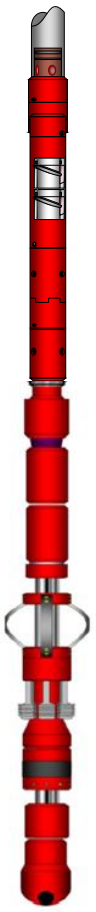
BHA#7: CT PACKER BHA

DIMENSION BID

BHA DIAGRAM #7- CT Packer

Client	**Petronas Carigali**
Field	**Dulang A**
Job Type	**CT Milling & Add Perf**
Job No.	

Well	**A-12**
Min Restriction	**2.25**
BHP	
BHT	

BHA DRAWING	DESCRIPTION	CONNECTION		ID	OD	TOOL LENGTH	CUMULATIVE LENGTH
		UPHOLE	DOWNHOLE	INCH	INCH	FT	FT
	**External Dimple CT Connector (DB)**	1.5" CT	1.5" AMMT PIN		2.125	0.5	0.5
	2 -1/8" MHA (Weatherford) Disconnect drop ball 0.75" Shear pressure 2 pin 2,000 psi Circulating drop ball 0.63" Shear pressure 2 pin 2,000 psi Burst Disc 6,000 psi	1.5" AMMT BOX	1.5" AMMT PIN		2.125	1.9	2.4
	Crossover	1.5" AMMT BOX	1.25 WTS 8-PIN		2.000	0.5	2.85
	Setdown Unloader	1.25 WTS 8-BOX	1.25 WTS 8-PIN		2.125	2.83	5.68
	Crossover	1.25 WTS 8-BOX	1.5 WTS 8-PIN		2.125	0.50	6.18
	Crossover	1.5 WTS 8-BOX	1.5 WTS 8-BOX		2.125	1.00	7.18
	CT Packer Each - 2,050 lbf	1.5 WTS 8-PIN	1.5 WTS 8-BOX		2.250	4.60	11.78
	Wash Nozzle	1.5 WTS 8-PIN			2.125	1.00	12.78

BHA LENGTH	**12.78**
MAXIMUM OD	**2.250**
MINIMUM ID	

Prepared by:	Muhd Ameerul Zaeem
Review by:	
Revision:	
Date:	

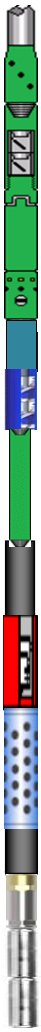
ADDITIONAL INFORMATION:
Ensure to measure length and OD of each BHA tool & record before makeup.

BHA#8: GRCCL C/W DUMMY GUN BHA

DIMENSION BID

BHA DIAGRAM #8 -GRCCL C/W DUMMY GUN BHA

Client	Petronas Carigali	Well	A-12
Field	Dulang A	Min Restriction	2.25
Job Type	CT Milling & Add Perf	BHP	
Job No.		BHT	

BHA DRAWING	DESCRIPTION	CONNECTION		ID	OD	TOOL LENGTH	CUMULATIVE LENGTH	WEIGHT
		UPHOLE	DOWNHOLE	INCH	INCH	FT	FT	KG
	**Internal Dimple CT Connector**	1.5" CT	1.0" AMMT Pin		1.690	0.30	0.30	2.0
	1-11/16" Motorhead Assembly Disconnect drop ball 5/8" Circulating drop ball 1/2" Burst Disc 5,000 psi	1.0" AMMT Box	1.0" AMMT Pin		1.690	2.30	2.60	6.5
	Carsac	1.0" AMMT Box	1.0" AMMT Pin		1.69	1.60	4.20	1.0
	Dual Ball Kelly Cock Valve	1.0" AMMT Box	1.0" AMMT Pin		1.69	1.60	5.80	2.0
	1.5" Deployment Bar 6 ft length	1.0" AMMT Box	1.0" AMMT Pin		1.50	6.00	11.80	20.0
	UZMA Crossover (CRP)	1.0" AMMT Box	1.275" - 12 TPI Box ACME		1.69	0.33	12.13	
	UZMA CT Firing Head *Firing Drop Ball: 7/16"	1.275" - 12 TPI Stub ACME	1.275" - 12 TPI Box ACME		1.69	0.67	12.80	
	2 ea 3m X 2" 6SPF Gun + Top Sub	1.275" - 12 TPI Stub ACME	1.687" - 8 TPI Box ACME		2.00	22.40	35.20	
	UZMA Bullplug	1.687" - 8 TPI Stub ACME	1.687" - 8 TPI Stub ACME		2.00	0.26	35.46	
	UZMA GRCCL Tool	1.687" - 8 TPI Stub ACME			1.69	6.17	41.63	

BHA LENGTH	41.63
MAXIMUM OD	2.00
MINIMUM ID	
WEIGHT	

Prepared by:	M. Ameerul Zaeem (DB) / Farhaan (UZMA)
Review by:	
Revision:	
Date:	

ADDITIONAL INFORMATION:

*Drift 7/16" ball through 1-11/16" MHA prior to RIH

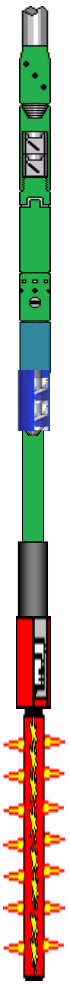
BHA#9: PERF GUN 9M BHA

DIMENSION BID

BHA DIAGRAM #9 - PERF GUN 9M BHA

Client	Petronas Carigali
Field	Dulang A
Job Type	CT Milling & Add Perf
Job No.	

Well	A-12
Min Restriction	2.25
BHP	
BHT	

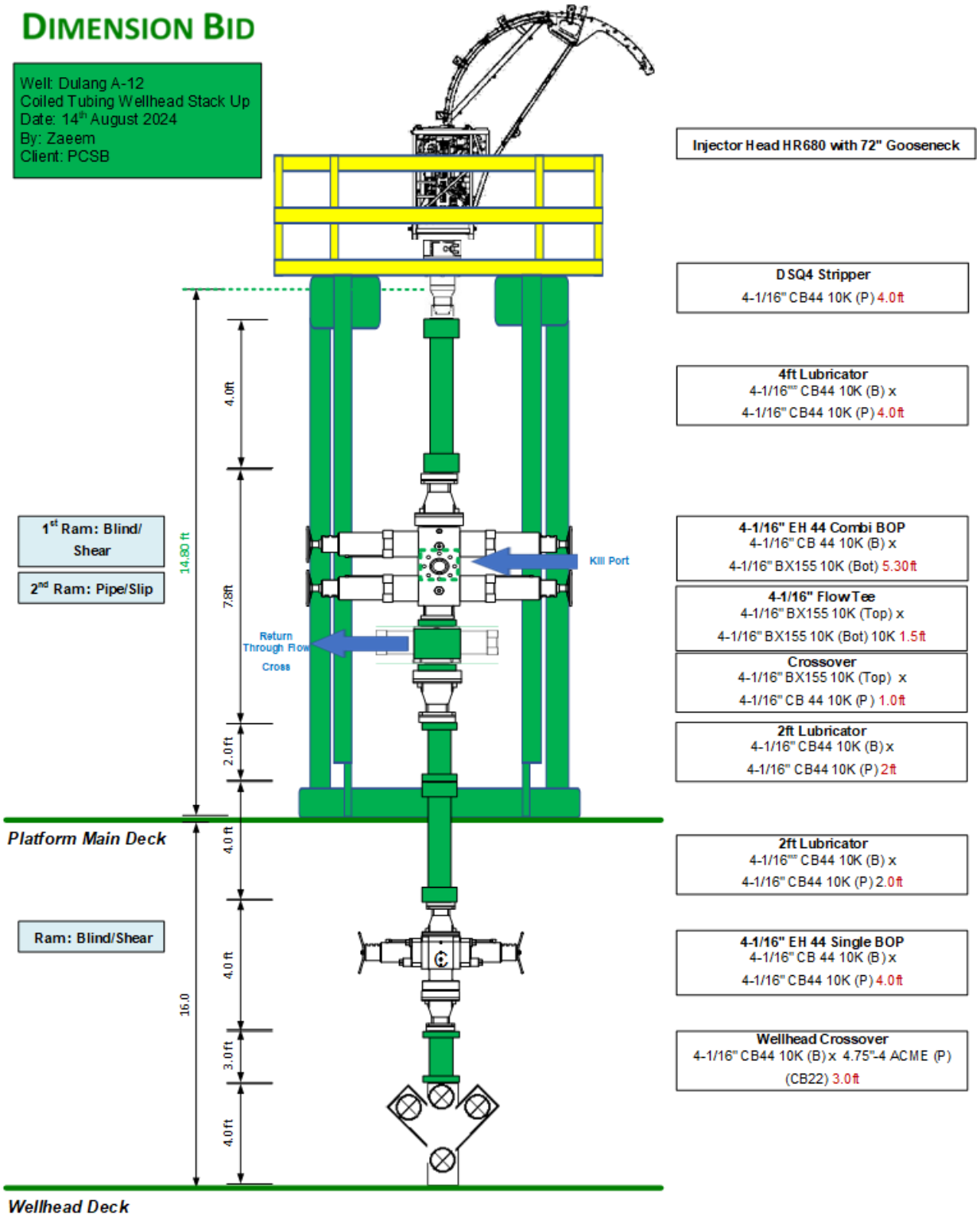
BHA DRAWING	DESCRIPTION	CONNECTION		ID	OD	TOOL LENGTH	CUMULATIVE LENGTH	WEIGHT
		UPHOLE	DOWNHOLE	INCH	INCH	FT	FT	KG
	**Internal Dimple CT Connector**	1.5" CT	1.0" AMMT Pin		1.690	0.30	0.30	2.0
	1-11/16" Motorhead Assembly Disconnect drop ball 5/8" Circulating drop ball 1/2" Burst Disc 5,000 psi	1.0" AMMT Box	1.0" AMMT Pin		1.690	2.30	2.60	6.5
	Carsac	1.0" AMMT Box	1.0" AMMT Pin		1.69	1.60	4.20	1.0
	Dual Ball Kelly Cock Valve	1.0" AMMT Box	1.0" AMMT Pin		1.69	1.60	5.80	2.0
	1.5" Deployment Bar 6 ft length	1.0" AMMT Box	1.0" AMMT Pin		1.50	6.00	11.80	20.0
	UZMA Crossover (CRP)	1.0" AMMT Box	1.275" - 12 TPI Box ACME		1.69	0.33	12.13	
	UZMA CT Firing Head *Firing Drop Ball: 7/16"	1.275" - 12 TPI Stub ACME	1.275" - 12 TPI Box ACME		1.69	0.67	12.80	
	3m X 2" 6SPF Gun + Top Sub	1.275" - 12 TPI Stub ACME	1.687" - 8 TPI Box ACME		2.00	11.24	24.04	
	6m X 2" 6SPF Gun + Tandem Sub	1.275" - 12 TPI Stub ACME	1.687" - 8 TPI Box ACME		2.00	19.80	43.84	
	UZMA Bullplug	1.687" - 8 TPI Stub ACME			2.00	0.21	44.05	

BHA LENGTH	44.05
MAXIMUM OD	2.00
MINIMUM ID	
WEIGHT	

Prepared by:	M. Ameerul Zaeem (DB) / Farhaan (UZMA)
Review by:	
Revision:	
Date:	

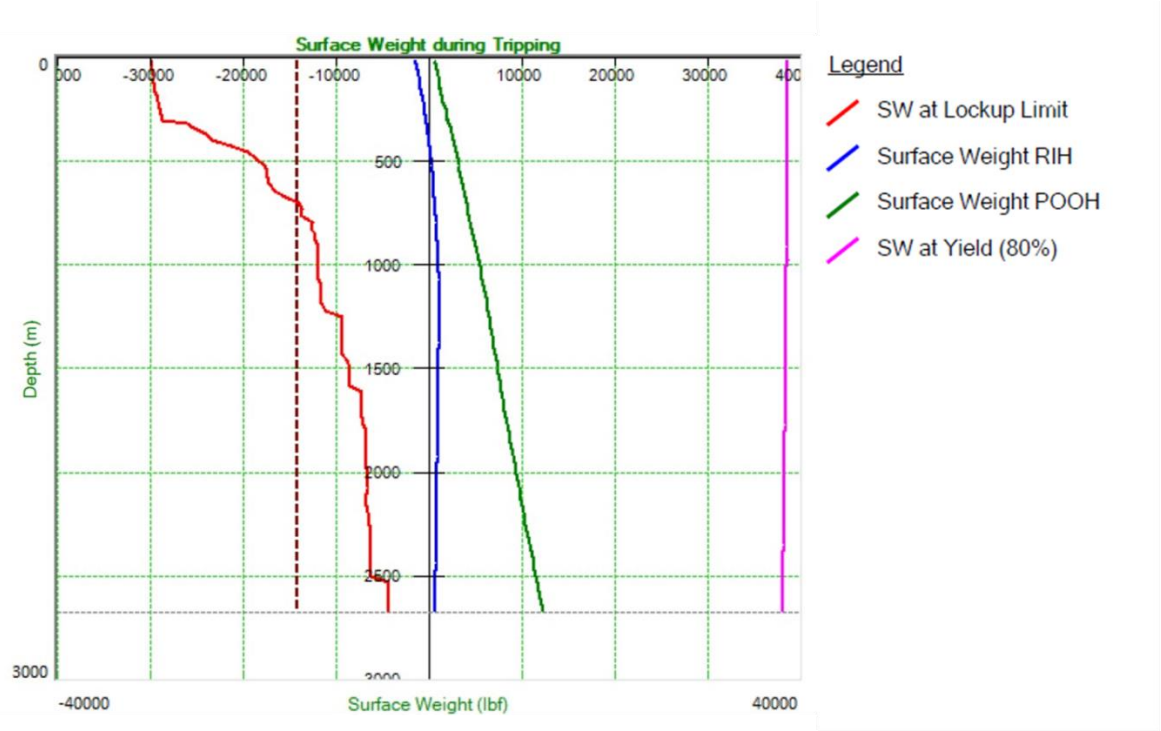
ADDITIONAL INFORMATION:
*Drift 7/16" ball through 1-11/16" MHA prior to RIH

APPENDIX II – CT STACK UP

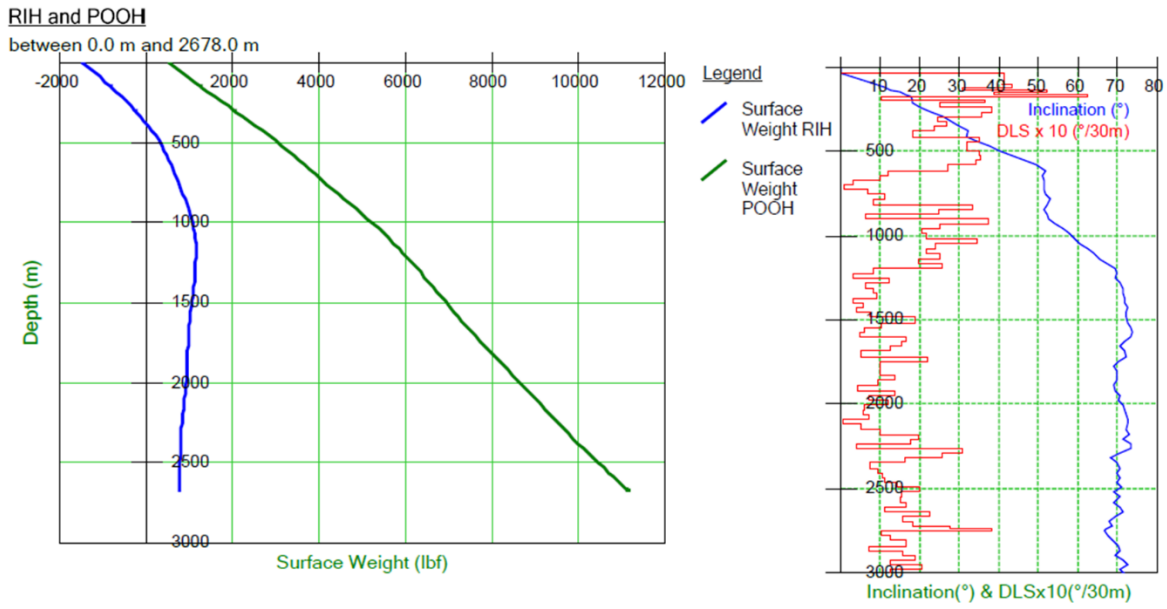


APPENDIX III – ORPHEUS SIMULATIONS

TUBING FORCE ANALYSIS AT 2,678 M (EOT)

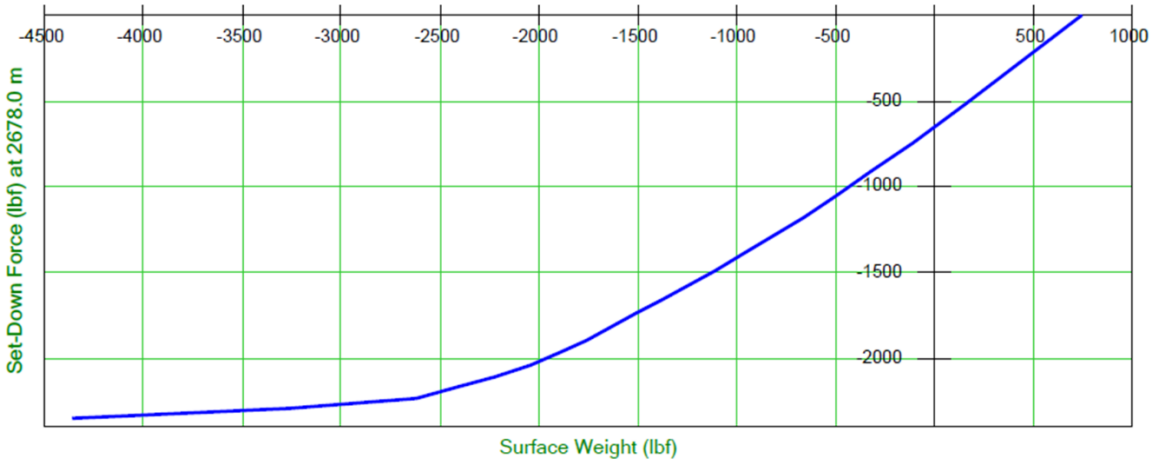


RIH & POOH WEIGHT



MAXIMUM STRING SET DOWN LIMIT

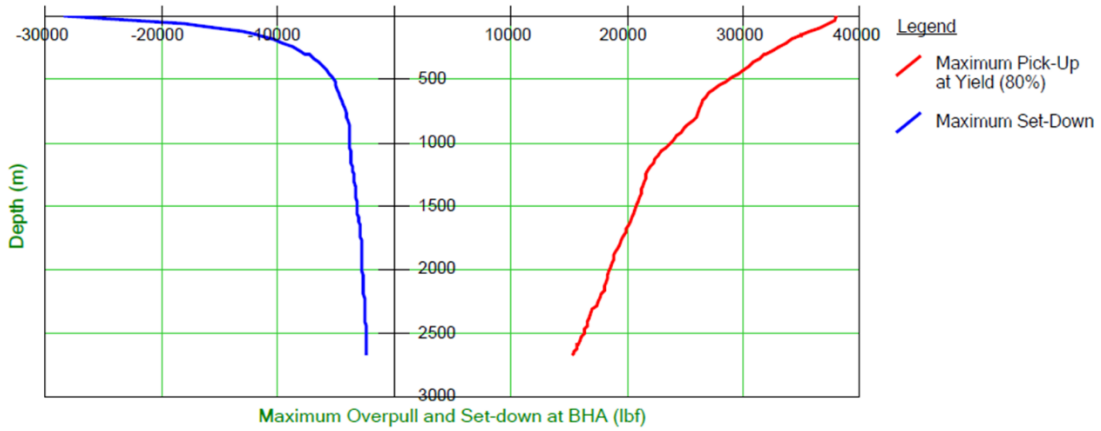
MD3 The available set-down force at 2678.0 m is -2353 lbf at the end of the string.
The weight indicator reading will be -4362 lbf on surface.
The minimum available set-down force is -2350 lbf at 2673.3 m.



MAXIMUM STRING PICK UP LIMIT

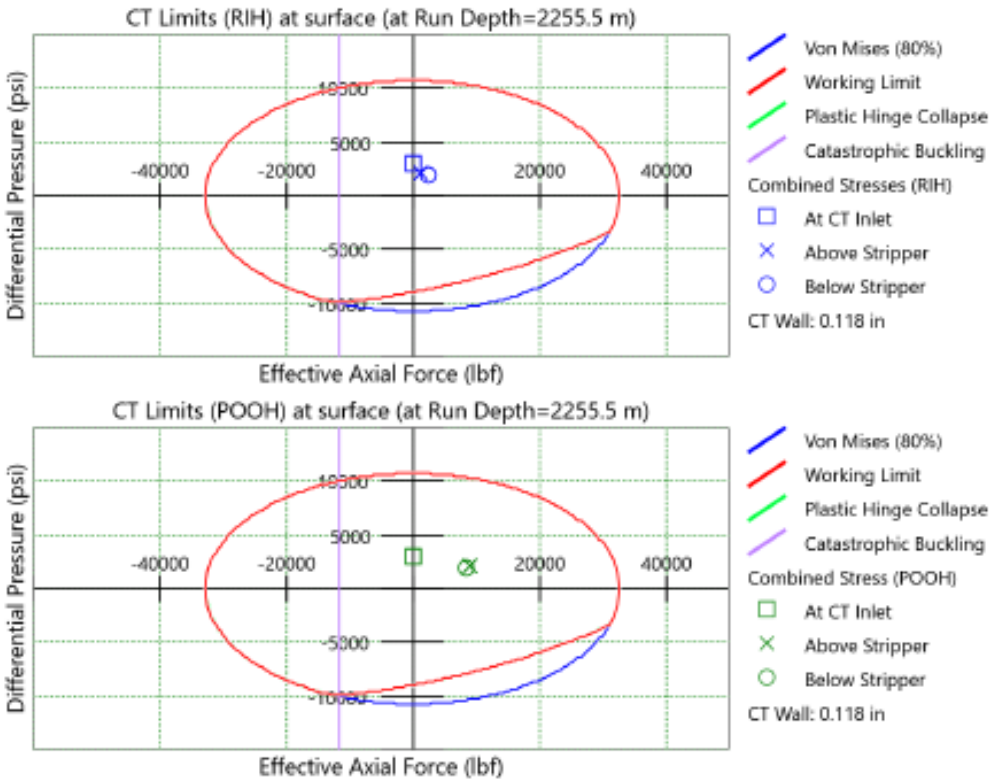
Calculations at 2678.0 m

MD1 The available pick-up at 2678.0 m based on 80% of yield strength is 15303 lbf.
The weight indicator reading will then be 38019 lbf.

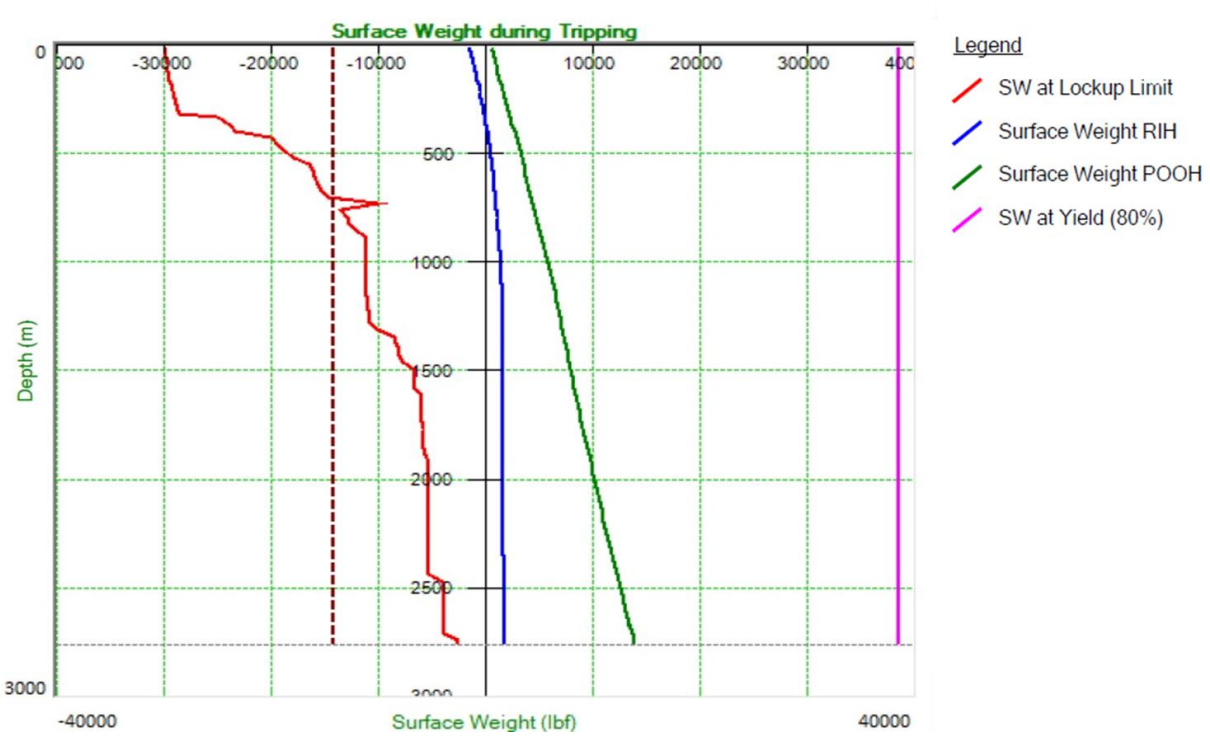


STRING LIMIT

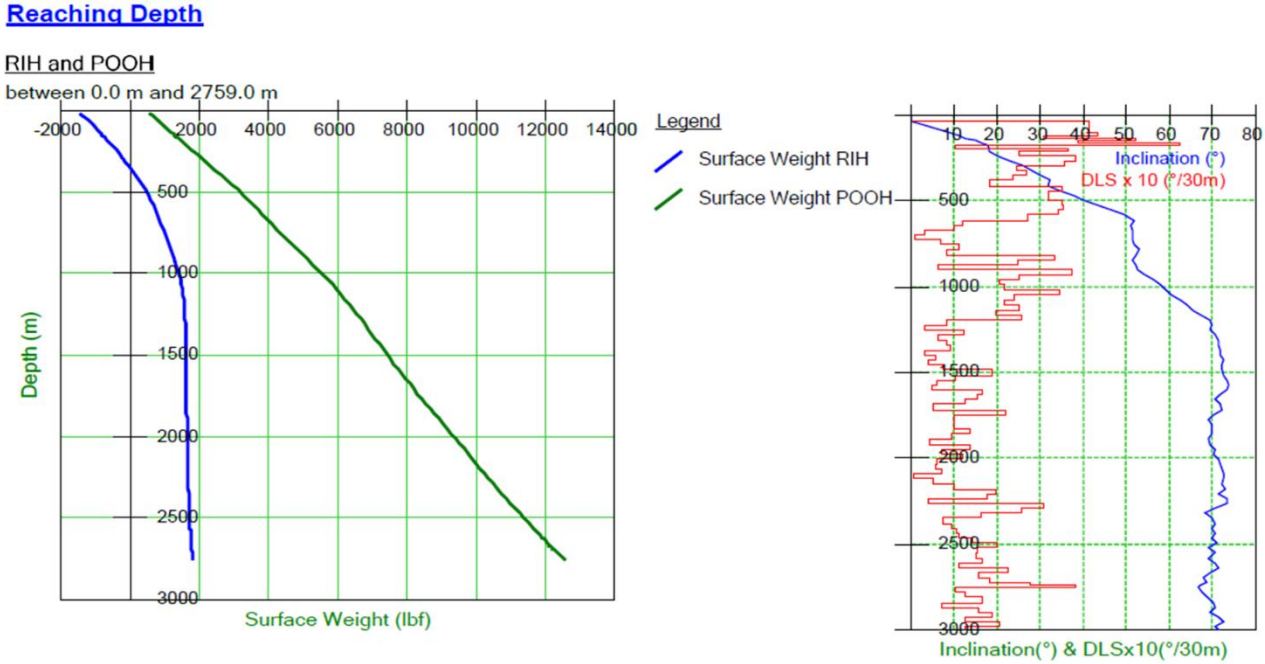
CT Limits



TUBING FORCE ANALYSIS AT 2,759 M (TOC)

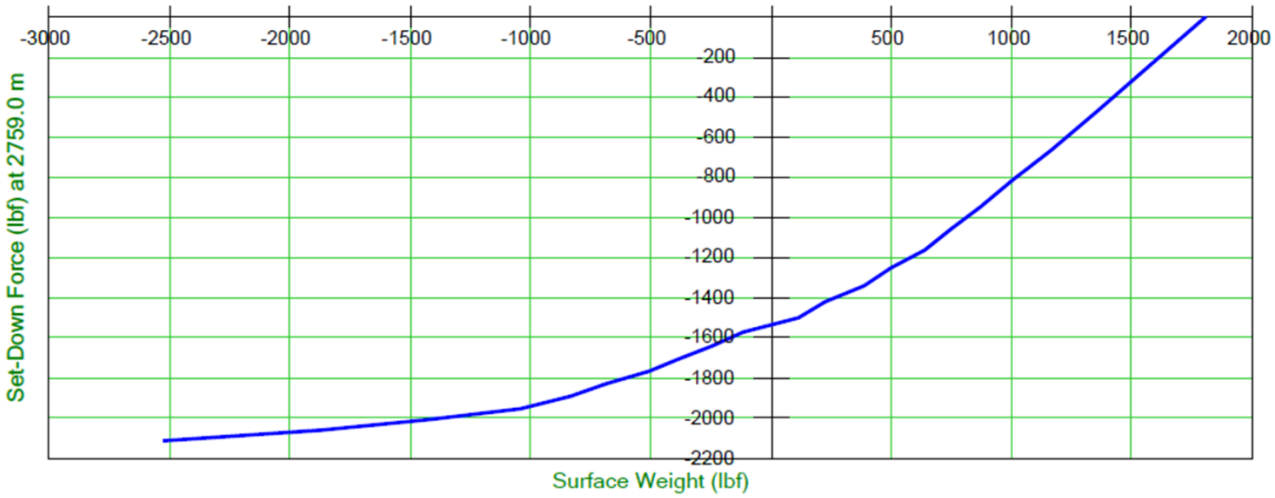


RIH & POOH WEIGHT



MAXIMUM STRING SET DOWN LIMIT

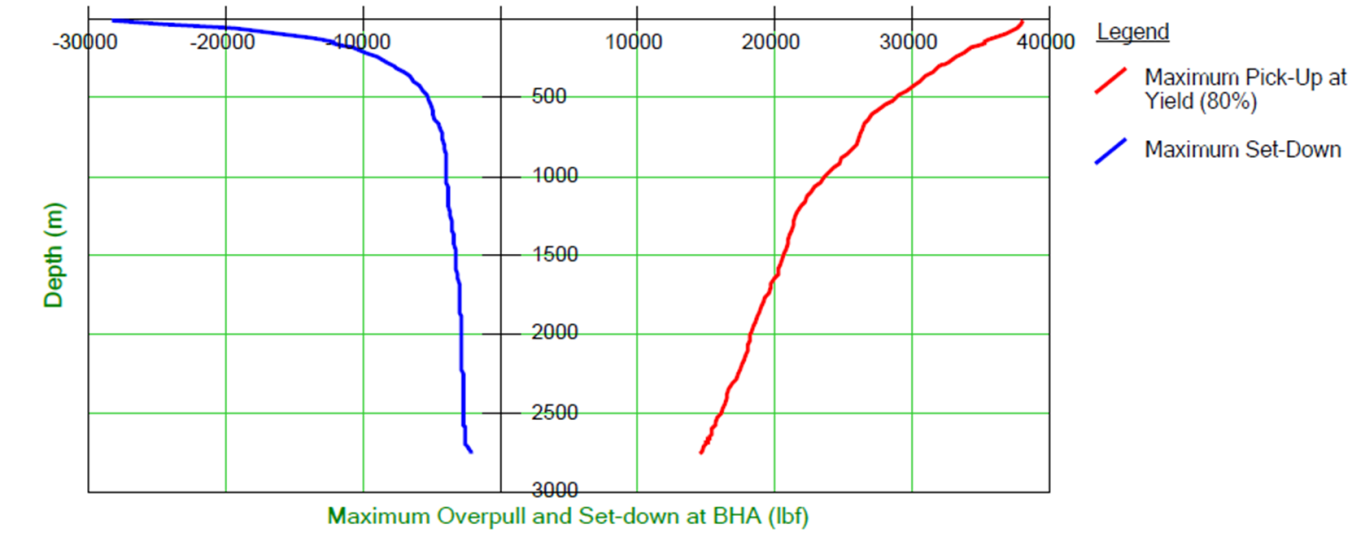
MD3 The available set-down force at 2759.0 m is -2115 lbf at the end of the string.
The weight indicator reading will be -2526 lbf on surface.



MAXIMUM STRING PICK UP LIMIT

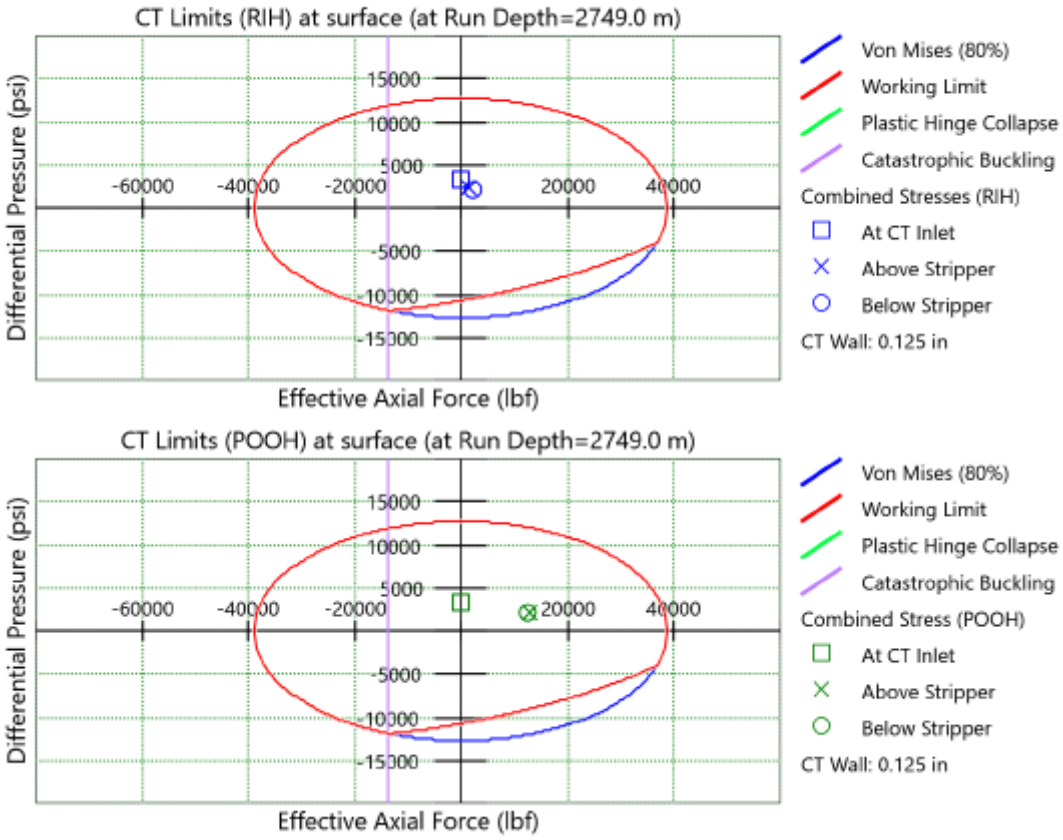
Calculations at 2759.0 m

MD1 The available pick-up at 2759.0 m based on 80% of yield strength is 14502 lbf.
The weight indicator reading will then be 38559 lbf.



STRING LIMIT

CT Limits



SENSITIVY ANALYSIS TFA

TFA Sensitivity Analysis with various Friction Factor – Idle Rate at 0.3 bpm

Friction Factor	Depth (m)	Lock-up Limit (lbf)	RIH Weight (lbf)	POOH Weight (lbf)	Max Pulling Weight at 80% Yield Limit
0.2	1,000	-12,737	1,726	5,318	38,563
	2,000	-4,034	2,429	8,670	38,565
	2,759	-3,338	2,881	11,339	38,555
0.3	1,000	-11,110	1,414	5,810	38,569
	2,000	-5,362	1,667	10,213	38,563
	2,759	-2,521	1,810	13,936	38,554
0.4	1,000	-9,606	1,116	6,365	38,568
	2,000	-8,076	864	12,071	38,561
	2,759	-6,178	620	17,207	38,560
0.5	1,000	-9,385	825	6,994	38,553
	2,000	-8,498	-71	14,321	38,556
	2,759	-6,929	-1,014	21,329	38,562

TFA Sensitivity Analysis with various Friction Factor – 1 BPM, 300scfm

Friction Factor	Depth (m)	Lock-up Limit (lbf)	RIH Weight (lbf)	POOH Weight (lbf)	Max Pulling Weight at 80% Yield Limit
0.2	1,000	-13,521	980	4,474	38,265
	2,000	-7,532	1,377	7,338	37,856
	2,759	-4,968	1,735	9,742	37,456
0.3	1,000	-12,381	705	4,888	38,265
	2,000	-6,844	625	8,673	37,852
	2,759	-5,174	632	12,019	37,461
0.4	1,000	-10,777	437	5353	38,260
	2,000	-9,095	-223	10,278	37,844
	2,759	-5,015	-724	14,888	37,455
0.5	1,000	-9,504	169	5,880	38,253
	2,000	-8,138	-1,415	12,220	37,837
	2,759	-8,257	-3,033	18,517	37,461

APPENDIX IV – EMERGENCY PROCEDURE

EMERGENCY BOP OPERATIONS

In the event of an emergency arising and the well having to be secured, the following steps should be taken:

1. Stop CT movement, close the Slip and Pipe rams and slack off string weight to ensure slips are holding. If time permits, review all options with the client representative. (Ensure that rams with guides are activated first to avoid damaging the CT).

   Note: The decision to proceed past the above step should normally be made after consultation with the client representative unless there is an immediate and serious danger to personnel and/or equipment and the client representative is not immediately available to be involved in the decision.

2. Stop pumping.
3. Close the upper Shear Seal rams to cut the CT.
4. Set up to circulate well to kill fluid through the CT remaining in the well.
5. Make arrangements necessary to fish the CT from the BOP.

   Note: When actuating any ram in the BOP system, the corresponding manual lock should be closed behind it to prevent accidental release in the event of total loss of hydraulic power. The force required to close the rams manually against pressure cannot be supplied by turning in the locks. Use of a pipe wrench, cheater bars or snipes will damage the internal workings of the ram actuators. Some form of hydraulic power is required to operate the actuators. This pressure can be supplied via a hand pump or a hydraulic pump from any other piece of equipment on location, including a fluid pumper.

Actuating the BOP System Hydraulic Controls

1. Remove locks on control panel
2. Move the control lever to the desired position.
3. Push the BOP activate button supplying pressure to the circuit.
4. Observe the pressure drop in the hydraulic circuit and subsequent pressuring back up to system pressure as ram opens or closes completely.
5. Observe the ram indicator pins to verify the operation of the ram.
6. Close in the manual locks if required. (Flag system to indicate position of rams.)

The connections below the CT BOP must be all flanged. Should one of these connections start leaking, the following steps should be taken in consultation with the client representative:

1. Call local alert and ensure all personnel are removed from the wellhead area.
2. Notify the client representative of the problem and determine the best method to make the area safe.
3. If the leak is minor, it may be possible to continue to pull the CT to surface. Assess the scenario and consider all the risks associated then proceed to pull the CT to surface. Once at surface, close available valves below the leak point.
4. If the leak is more severe, initiate a well kill through the well kill line and continue to pull the CT to surface.
5. If the leak is catastrophic, run the CT to HUD; pick up sufficient so that after the CT is cut at surface by CT BOP shear; the top of the CT falls below the X-mass Tree. Once the end of the CT is off bottom, proceed to cut the cut the CT with the shear RAM then close the available valves below the leak point. A well kill operation can be started through the kill line if requested by the client representative.

LEAK IN CT AT SURFACE

In the event of a leak in the CT occurring at surface, the following steps should be taken:

1. Call local alert and ensure all personnel are removed from the operational area. In particular make sure all personnel remain clear of the area between the Injector Head and the CT reel.
2. If the leak is small or a pinhole leak, POOH and position the leak on the lower part of the CT reel as soon as possible. Be careful when area of leak is bent onto the reel as failure may occur. Make arrangements to have a water hose present to wash away any fluid from the reel which may be hazardous. Make arrangements to start pumping water through the CT reel. Depressurize reel as much as conditions allow without exceeding collapse limitations of CT.
3. Notify client representative of problem and determine best method to make area safe. If leak is minor and water can be displaced to leak, continue to POOH and change reel.
4. If leak is considered to be too serious to displace to water and POOH, or serious and uncontrolled leakage of hydrocarbon or hazardous materials prevents this, (i.e. check valves not holding, lost BHA, parted CT) set the CT slips and pipe rams. Activate the upper Shear Seal rams on either the triple or quad BOP and manually lock in place.
5. Depressurize the CT reel and flush through the reel. If hydrocarbons are present in the reel, displace the reel with water and empty the contents to specified safe disposal area.

LEAK IN CT BELOW SURFACE

If a leak occurs in the CT below the Stuffing Box during down hole operations (usually indicated by a drop in pump pressure or loss of string weight), suspend CT operations and alert the client representative.

Note: If indications are that the BHA has been lost in hole then revert to section 0.

1. Once the client representative has been alerted, clear all personnel from the immediate area of the CT around the Injector Head and between the Injector Head and the CT reel.
2. Displace the CT to water and commence to POOH at not more than 20 ft per minute (5 meters/min). Ensure at all times that all personnel are clear of the immediate area as the possibility exists to pull the CT out of the Stuffing Box. Continue pumping water at a slow rate through the CT.
3. When the leak in the CT appears above the Stuffing Box, stop the injector and hold the leaking section of CT between the chains and the Stuffing Box.
4. Inspect leak. If leak is minor continue to POOH.
5. If leak is major, or CT is actually severed or well bore fluids are escaping through the CT, continue as per Section 09.2.

LEAK IN SURFACE PRESSURE CONTROL EQUIPMENT

Stuffing Box

1. **Stop** CT movement and close both sets of pipe rams to seal CT annulus. Set manual lock.
2. On semi-submersible operations this will be a set of pipe rams and pipe/slip rams.
3. Notify Client representative.
4. Ensure the injector is in neutral and that the brake is engaged.
5. Bleed off pressure above pipe rams
6. Set reel brake. On Semi-Submersible jobs the CT should be clamped at the level wind and CT run out of hole until enough slack between the injector and reel is obtained to cope with the heave from the rig, prior to setting reel brake.
7. Bleed off closing pressure on Stuffing Box. Open side doors and apply pressure to retract piston. Replace packer elements and then re-apply pressure to Stuffing Box. Close side doors.

   Note: 3" side door Stuffing Boxes first bleed off closing pressure. Remove hoses from pack and retract piston and connect to open and close on side door. Open door and replace packer element. Close door, bleed off pressure and connect to pack and retract piston.
8. Slowly open both equalizing valve on pipe rams and check that stripper is holding pressure.
9. If stripper is holding pressure, undo manual locks and open pipe rams or pipe slip rams. When using pipe/slip rams the depth that they were set on the CT must be recorded. Release reel brake and continue operations.

Surface Leaks Other Than Stuffing Box

1. If leak is minor and a relatively short length of CT is in the hole and the Shear Seal safety head is **below the leak:**
2. Call local alert and notify the client representative.
3. Clear all non-essential personnel away from the area
4. Continue POOH and monitor situation closely
5. Hook up kill line to BOP and pump water slowly down annulus.

Note: Avoid collapse situation

1. Close swab valve and Shear Seal once CT is in riser and repair leak
2. Perform reinstatement test on surface equipment after leak has been repaired
3. If CT is in the well to a considerable depth and leak is considered serious:
4. Call local alert and notify Client representative.
5. Ensure all non-essential personnel are removed from the area.
6. Ensure that CT is sufficiently off bottom so that when the Shear Seal safety head is activated the pipe will drop below the Xmas tree manual master valve. If the CT is stuck down hole, pull to 80% of operating limit before activating Shear Seal BOP, thus allowing the CT to drop below the Xmas tree manual master valve. If the CT is attached to a fish, packer etc pull to 80% of operating limit (if possible) or maximum weight possible before activating Shear Seal BOP, thus allowing the CT to drop below the Xmas tree manual master valve. **If at all possible**, the decision to cut the CT and activate the system will be taken by the Client representative in charge of the operation. This may not always be possible. If the situation is extremely dangerous and requires a fast decision, the Supervisor in charge will take this decision.

7. Close the Shear Seal rams in the safety head to cut the pipe and allow it to drop. (If the safety head has separate shear and blind rams, close the shear rams to cut the pipe, pull up the CT and close the blind rams).
8. Close the swab valve on the Xmas tree.
9. Close the master valve on the Xmas tree
10. Repair leak and pressure test riser.
11. Plan for fishing operations.

Rotating Joint Leak

Eliminate the potential for reel movement by securing the reel with turnbuckles and set reel brake. On Semi-Submersible jobs the CT should be clamped at the level wind and CT run out of hole until enough slack between the injector and reel is obtained to cope with the heave from the rig. Close the reel isolation valve inside the reel and repair or replace the rotating joint as required. Re-test and resume operations.

CT RUNS AWAY INTO WELL

If the inside chain tension system on the Injector Head should fail for any reason, and CT is pulled into the well under its own weight with no control, the procedure should be as per the following:

1. Call a local alert.
2. Attempt to speed the injector up to match the speed of the descending CT.
3. Increase inside chain tension to increase friction on CT.
4. Increase stripper pressure to exert more friction on CT.
5. If these actions fail to make any difference, reduce injector hydraulic pressure to zero.
6. In the event that there is insufficient CT on the reel to reach bottom close CT slips. This action may damage or break the CT. This is the preferred option to using the pipe rams as these will become damaged and a primary well control system will be lost.
7. If the CT is not too far off bottom it may be practical to let it fall to bottom then investigate the causes and repair. This can only be done if there is sufficient CT on the reel to reach bottom.

Note: CT may helix when hitting bottom making it difficult to pull into tail pipe.

8. Once CT has been controlled, examine Injector Head for damage including chains and POOH.
9. The CT run away may be caused by the injector becoming overloaded with the weight of the CT and fluid in the CT. This situation should not occur if proper pre job planning is done. Correct selection of Injector Head or ensuring CT is full of Nitrogen would prevent this situation from occurring.
10. If a runaway situation occurs, reduce the injector hydraulic pressure to zero. This may cause the safety brake in the motors to actuate and counter balance valves to close, stopping the injector.
11. Under certain circumstances if the runaway CT is at a speed above the critical speed, the back pressure created by the circulating hydraulic fluid may prevent the injector motor brakes from actuating. If this situation occurs, select the pull mode for the injector and increase system hydraulic pressure until the CT comes to a standstill.

CT IS PULLED OUT OF STUFFING BOX

This situation is most likely to occur when the CT is being pulled into the riser section. If the BHA is lost including the End Connector there will be no external upset to prevent the CT from passing through the Stuffing Box. If this situation occurs, stop injector before CT passes through the chains and shut in Shear Seal rams on upper BOP's.

If it is thought that the BHA may be lost while down hole, stop the CT at 300ft from surface. Slowly close in the swab valve counting the number of turns. If the CT is still deemed to be across the wellhead, POOH the CT no more than the distance between the top of the wellhead and the top of the CT BOP's. Repeat this step until the swab valve can be fully shut. Once the swab valve is shut, bleed off the pressure in riser.

CT COLLAPSED AT SURFACE

Collapsed CT at surface will be obvious by escape of well bore fluids from the Stuffing Box, as the strippers will no longer seal round the deformed pipe. In addition to this the collapsed pipe will not allow the Injector Head to grip the CT due to its change in shape. Usually collapsed CT will not pull through the bottom brass bushings on the Stuffing Box.

1. If POOH, immediately run CT back in well a sufficient distance to make sure round pipe is in contact with the Stuffing Box.
2. Call alert and notify client representative.
3. Ensure that all non-essential personnel are cleared from the immediate area.
4. Immediately reduce well head pressure by all safe means possible; either flow well through choke at a higher rate or stop annular fluid injection if reverse circulating.
5. Increase CT internal pressure by circulating.
6. Once pressure conditions inside and outside the CT have been optimized, a decision can be taken on how to proceed. If it is not possible to position un-collapsed pipe across the stripper rubbers, i.e., well contents are escaping from stripper rubbers:
7. Call alert and notify client representative.
8. Close pipe rams in an effort to reduce flow of fluid/gas around CT.

Note: If it is not possible to control the well, the slips will have to be set, and the CT cut using the Shear Seal rams.

9. Arrange for clamps to be fitted to CT above Injector Head.
10. Remove all non-essential personnel from immediate area
11. Under authority from client representative, kill well.
12. Release pressure from Stuffing Box and remove bushings.
13. Open pipe rams.
14. Attempt to pull CT from the well using the Injector Head.
15. Cut CT at the gooseneck and use the rig or a crane to pull the CT through the injector. Re-clamp the CT above the Injector Head and cut off in thirty-foot sections (or as appropriate to the crane or rig)
16. Continue pulling and cutting CT until the CT pulled to surface can be pulled by the Injector Head.
17. Once CT in good condition (i.e. not collapsed) is at surface, set CT slips and pipe rams and make up roll-on connector to CT on reel.
18. Continue POOH.

If the leak is too serious and cannot be controlled and well fluids are escaping, continue as per Section 9.2.

CT BREAKS AT SURFACE

If CT breaks at surface into two separate sections:

1. Stop the injector and set the slips.
2. Stop pumping operations.
3. Call alert and notify client representative. Ensure all non-essential personnel are cleared from the area and that the area is secure.
4. Secure CT reel.
5. If the reel capacity is insufficient to hold all of the CT remaining in the well due to uneven spooling resulting from the CT failure, it may be necessary to obtain another reel with sufficient capacity to hold the CT remaining in the well.
6. After consulting with client representative, remove damaged section of CT and insert in line roll-on connector and continue to POOH.
7. If this course of action is considered inappropriate or dangerous due to well conditions or condition of CT still in the well, continue as per Section 0.

BUCKLED TUBING

Should the CT hit an obstruction down hole while RIH with the thrust pressure set too high or running speed too fast, the CT will buckle in a 'Z' shape (plastically hinged).

CT being run inside CT and through small ID BOP's/lubricators will normally buckle between the Stuffing Box and the chains.

CT being run through casing or open hole will normally break below the BOP, usually somewhere around the largest ID.

- The CT will generally buckle several times.
- This type of failure is a little more difficult to detect.

If the CT is being run into casing and a large amount of weight is lost suddenly, there is a very good possibility that the CT is buckled somewhere down hole. Indications of this could be:

- An increase in pump pressure as fluid or gas is now being pushed through an additional restriction created by a hinge.
- A decrease in pump pressure as the CT may have broken removing a restriction such as a BHA.
- A loss of string weight due to the CT breaking and falling off.
- An increase in string weight while pulling out of the hole as the buckled portion of CT creates additional drag or needs to be straightened to get through a restricted ID.

In the event CT buckling is suspected, the CT movement should be stopped and the pump pressure kept within operating limits allowing the situation to be analyzed and determine the correct action to be taken for existing conditions.

If there is an increase in pump pressure or an increase in string weight:

1. Stop the pumps and pick up slowly.
2. POOH slowly (10 to 20 feet per minute) watching the weight indicator carefully.
3. If the CT is buckled close to surface, the buckled CT will pull into the bottom of the Stuffing Box and stop.
4. Close and lock the slip and pipe rams.

5. If the ram indicators show that the rams are not completely closed, there may be more than one piece of CT inside the BOP. In this event, open the rams and try to put undamaged CT across the pipe and slip rams.
6. Make arrangements to kill the well and retrieve the remaining CT from the well.
7. If the buckled CT is down hole and cannot be pulled free, consult the client representative as he may want the CT left at TD prior to being hung off in the slip and CT rams.
8. Arrangements should be made to run CT cutter on wireline to retrieve the CT above stuck point.

If there is a decrease in pump pressure or a loss of string weight:

1. It must be assumed that the CT has parted somewhere down hole.
2. Calculate from the remaining string weight approximately how much CT is left in the well.
3. Stop the pumps and POOH slowly.
4. Should the CT come out of the Stuffing Box, the blind rams should also be closed in.

If the CT is buckled above the Stuffing Box, the following steps should be taken:

1. Stop the injector as quickly as possible.
2. Close the slip and pipe rams and manually lock them.
3. If the down hole check valves are holding, bleed the pressure in the CT down to zero and monitor for 15 minutes for pressure build up.
4. Consider at this stage whether to kill the well.
5. Use a hacksaw to start the cut until you are sure there is no trapped pressure in the CT.
6. Cut the CT
7. Remove as much of the buckled CT as possible leaving any undamaged CT showing above the Stuffing Box intact so that it may be rejoined later.
8. Bleed the pressure from above the CT rams and undo the connection below the injector.
9. Slowly raise the injector until it is clear of the damaged CT.
10. Cut away any damaged CT, dress the CT and install an inline connector.
11. Run some fresh CT down through the injector until it is just out of the Stuffing Box.
12. Lower the injector until immediately over the pipe sticking out of the BOP.
13. Attach the pipe to the inline connection attached to the pipe sticking up out of BOP.
14. Pump off the inside chain tension and rotate the chains slowly in the OOH direction, while lowering the injector until the connection below the injector can be fastened.
15. Pump up the inside chain tension and pull weight equal to the weight of the CT suspended below the slips plus 2,000 lbf for friction or CERBERUS prediction, whichever is greatest.
16. Equalize the pressure across the CT rams.
17. Unlock the pipe and slip rams.
18. Open the slip and pipe rams and POOH.
19. If the down hole check valves do not hold then the CT will have to be cut.

CT STUCK IN HOLE PROCEDURES

There are various scenarios by which CT can be deemed as a stuck in hole situation. The following procedures are to be used as generic guidelines prior to the compilation of a signed off chemical cutting program applicable to the current situation.

In the event of being stuck in hole, several factors would have to be taken into consideration, the first of which would be whether the CT is stuck in hole on a platform, or a semi-submersible, as the procedures to be followed may vary greatly between the two options.

Other factors to be considered are:

- Type of well, i.e., flowing oil or gas well, water injector etc.
- The type of BHA being used, i.e., perforating guns, milling assembly, plug etc.
- The type of operation being carried out when the CT became stuck.

In all of the above cases, the CT would be defined as being “stuck” when the pipe cannot be retrieved from the well bore without the pipe exceeding its 80% minimum yield rating, or without exceeding 80% stress of the weak link release rating. The lower of these two factors should always be used when attempting large pulls.

Regardless of the specifics involved, the following procedures should be adopted:

1. Inform the client representative of the situation.
2. Inform the Onshore Engineer.
3. From the information available, and taking into account the well conditions, try to determine the reason for the pipe/BHA being stuck.
4. Attempt to pull free by applying a steady pull to a maximum of 80% of the CT yield. If in doubt as to what this figure is, consult Engineering Department before proceeding.
5. When applying the maximum pull, hold the maximum value for a minimum of 10 minutes and observe the trend (if any) on the weight indicator and chart. Measure the amount of pipe extension that is required when this pull is applied. The figure can be used to determine where the CT is stuck. As a rule of thumb, the depth that the pipe is held at will be the extension of the CT (in feet) when pulled to 80% of yield divided by 0.002. This can be determined using CERBERUS.

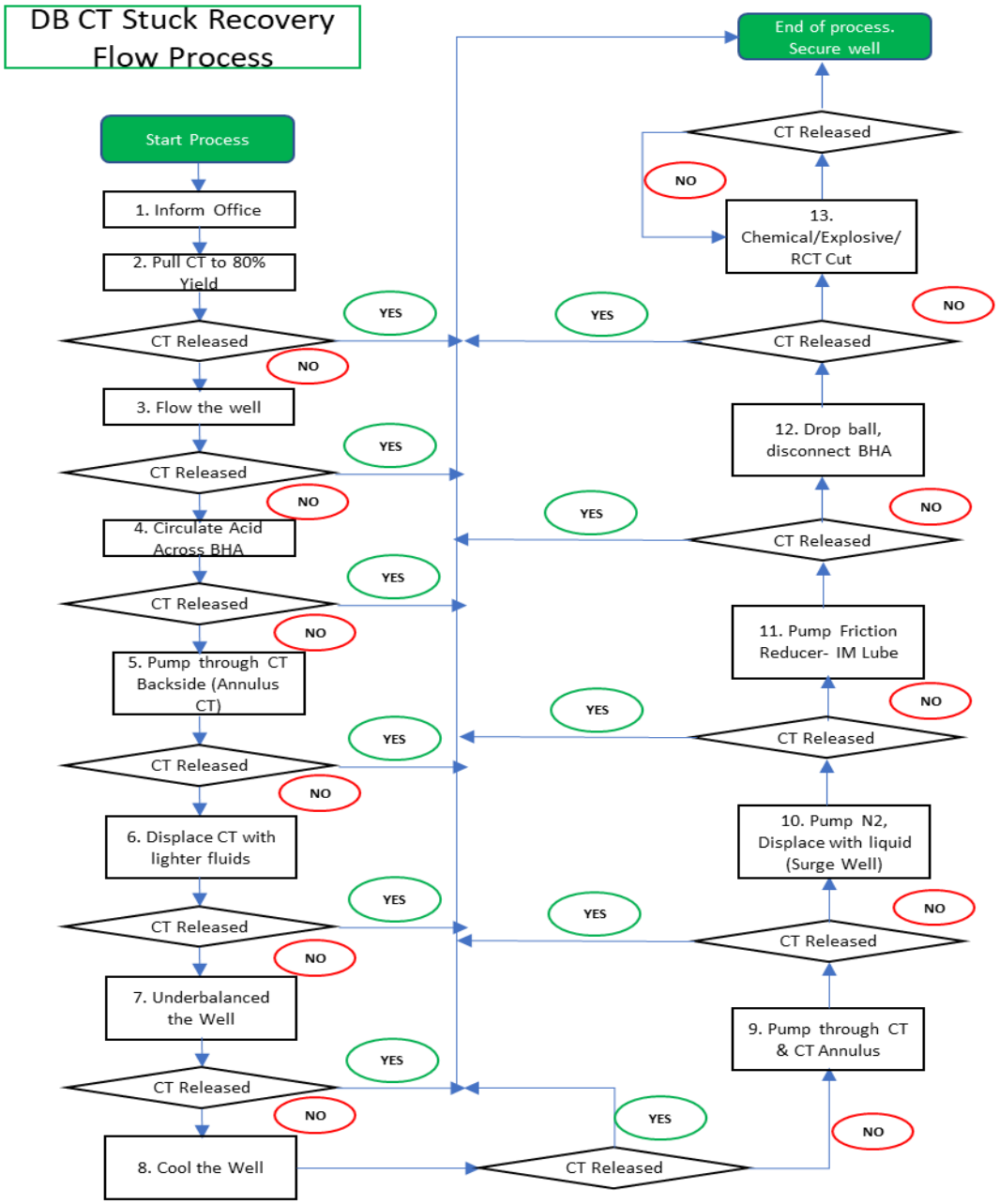
The following are options that may be appropriate depending on the particular circumstances:

1. If possible, flow the well, or increase well flow in an effort to remove debris in the well bore that may be holding the CT/BHA. Maintain maximum circulation through the CT at the same time. This is particularly relevant if well cleanout or drilling operations have been performed.
2. Circulate acid across the BHA in an attempt to remove any acid soluble material that may be holding the CT.
3. Pump fluid down the backside of the CT to the formation in an attempt to dislodge debris from around the BHA. Potential CT collapse must be considered if engineering this scenario.
4. Displace CT contents to a lighter fluid (base oil) or gas (Nitrogen) to increase buoyancy and allow greater end force to be applied at BHA.
5. Underbalance the well in the case of differentially stuck CT.
6. Cool the well if the CT is helically stuck in corkscrewed Production Tubing.
7. Pump down the CT / completion annulus to try and move the source of hold-up.
8. Displace slugs of Nitrogen with water to create a surge effect at the BHA.
9. Pump friction reducer, IM Lube in seawater at 2-3% by volume, down the CT and into the well. Ideally, one well volume will be pumped.

10. After consultation with the client representative and the on-call Engineer, activate the emergency disconnect mechanism in the BHA to allow the CT to be released. The release mechanism should only be implemented after all avenues have been explored.
11. When attempting maximum pull, do not work the CT violently across the gooseneck by frequent intervals.
12. The number of cycles across the gooseneck must be logged, and if in doubt of the CT fatigue condition, the Engineer must be consulted and the cycles entered into the CERBERUS FATIQUE program, to determine the number of cycles left available.

After consultation with the client representative, kill the well and commence preparations for chemical cutting operations.

STUCK CT COIL RECOVERY PROCE



Precautionary Steps to avoid Stuck while Cleanout in Dual string Completion:

1) To monitor pressure trending all the times during operation and record for any abnormalities. If there is continue pressure increasing trend during cleanout, proceed to pick up coil to the previous pull test depth and perform flow rate test.
2) In the event of coil entangle on the Long string, proceed to pick up coil and simulate pumping lost prime scenario to create vibration and tip of coil wobble to release from entanglement.

APPENDIX VI – CIRCA SIMULATION

Milling Cleanout from depth 2,677 m until 2,678 m with 0.9 bpm & 300 scf/min

Flow Summary

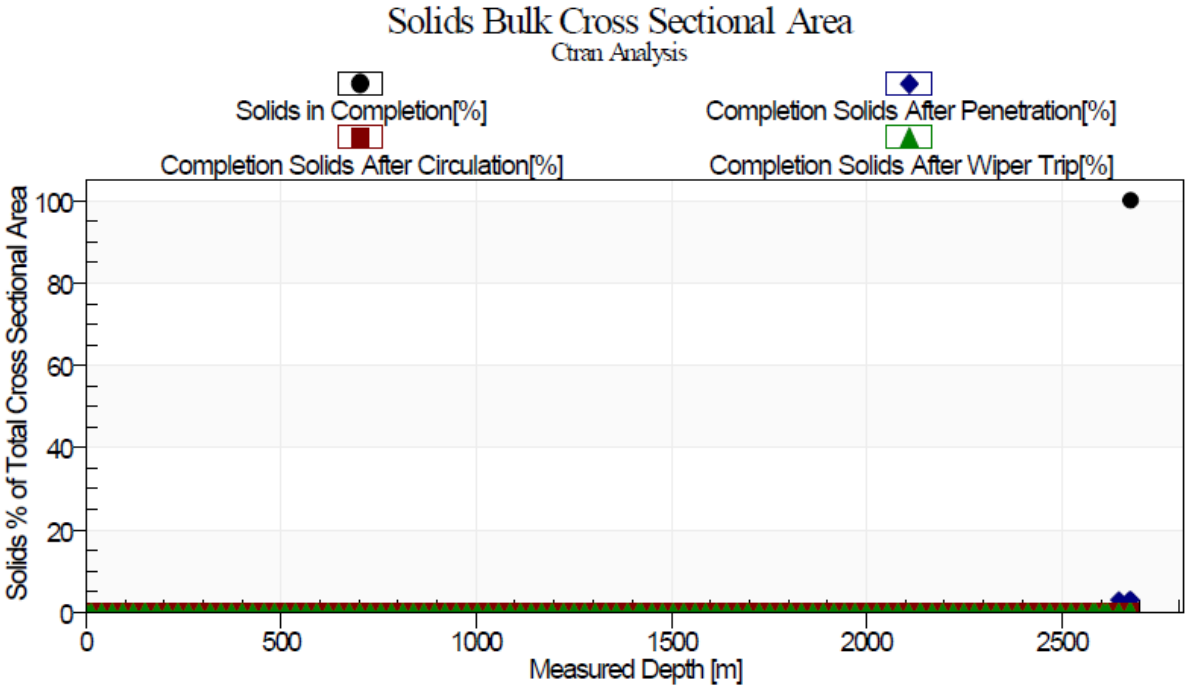
SUMMARY OF FLOW RESULTS

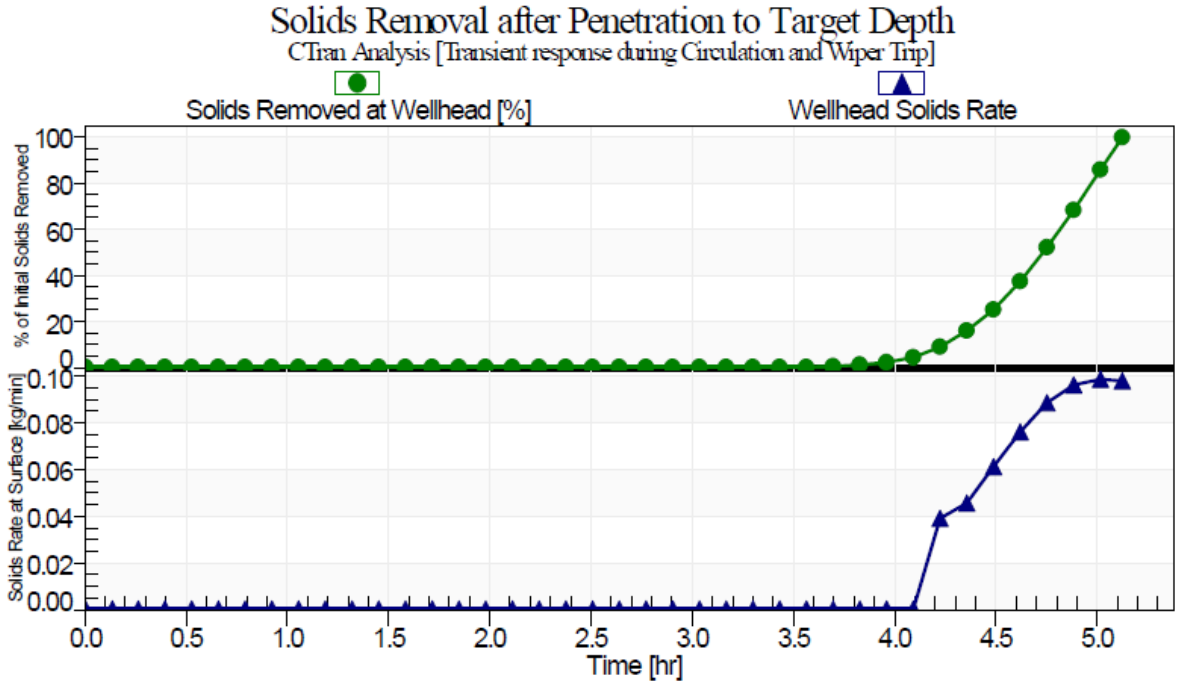
Produced Fluids	
Pressure known at:	Perforations
Production Mode:	No Production
Fluid Composition:	Oil Only
Circulated Fluids	
Fluid Composition:	Nitrified Water
Liquid:	0.90 bbl/min
Solids:	0.00 bbl/min
Gas:	300.0 scf/min
Circulation Point:	2678.00 m
HHP Required :	96.32 KW
COMPLETION:	
Wellhead Pressure	75.5 psi g
Hydrostatic pressure loss	863.0 psi
Friction pressure loss	603.4 psi
Kinetic pressure loss	-0.8 psi
Restriction pressure loss	0.9 psi
Equivalent Circulation Density[ECD]	6.36 lb/gal (US)
Perforation Pressure	1542.0 psi g
Hydrostatic pressure loss	153.9 psi
Bottom Hole Pressure	1695.9 psi g
FROM CIRCULATION POINT TO WELLHEAD:	
Liquid transit time	16 min
Gas transit time	14 min
Annular volume	31.6 bbl
Volume below circulation point	47.1 bbl
Total liquid volume	62.4 bbl
Total gas volume	16.4 bbl

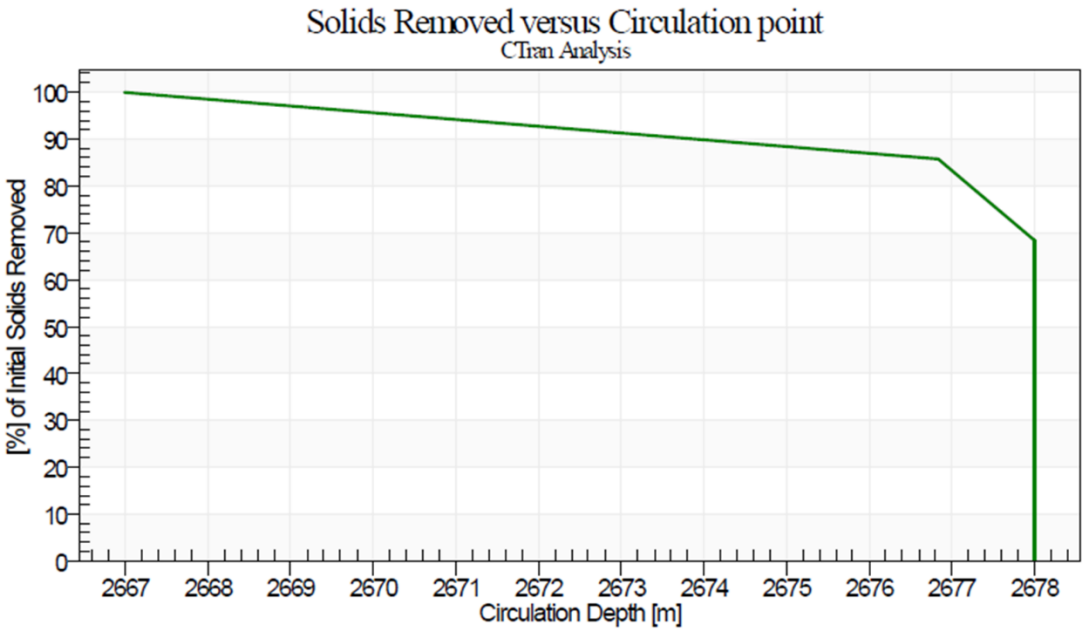
Ctran Summary

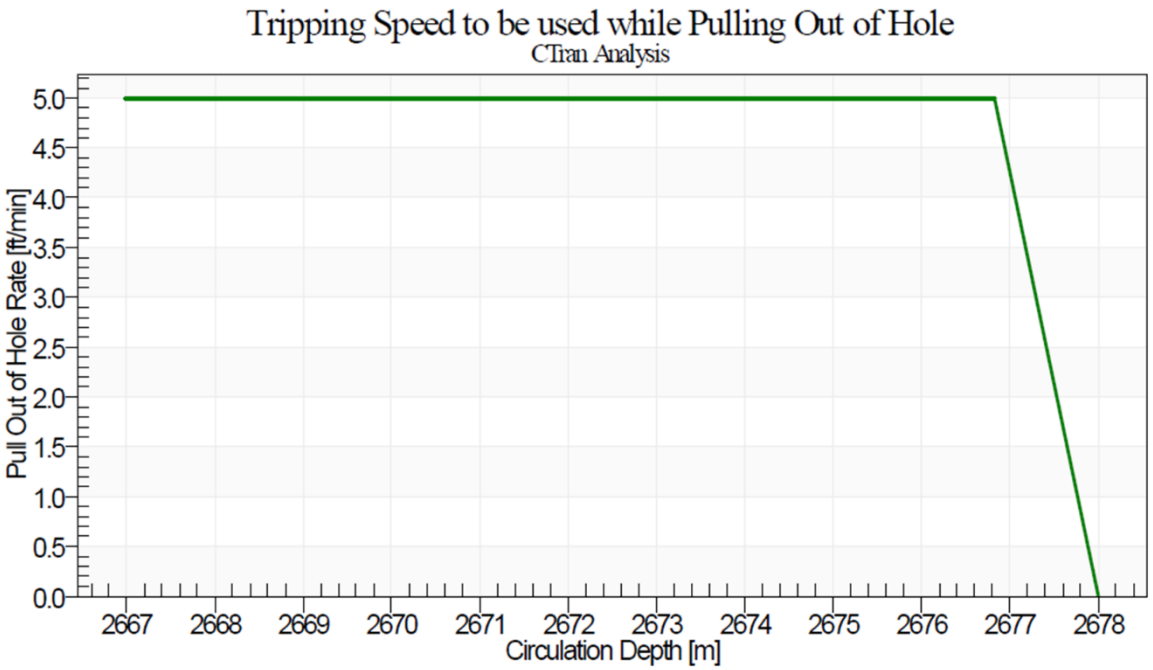
SUMMARY OF HOLE CLEANING RESULTS

Initial Condition:	
% of fill interval occupied by solids before cleanout	100.0 %
Top of fill	2677.00 m
Deepest Circulation point	2678.00 m
Bottom of fill	2678.00 m
Initial Volume of Solids	0.0 bbl
Initial Mass of Solids	9.9 lb
Solids type:	Mixed Solids
Fluid Description:	Nitrified Water
Penetration Hole Cleaning Mode:	
Penetration rate	5.0 ft/min
Penetration time	0.01 hr
Solids volume in the well after penetration	0.0 bbl
Solids mass in the well after penetration	9.9 lb
Circulation Hole Cleaning Mode:	
Hole circulation time	5.00 hr
Solids volume in the well after circulation	0.0 bbl
Solids mass in the well after circulation	1.6 lb
Wiper Trip Hole Cleaning Mode:	
Wiper Trip Scheme:	User Specified rate, Tornado not
Wiper trip time	0.12 hr
Solids volume in the well after wiper trip	0.0 bbl
Solids mass in the well after wiper trip	0.0 lb
Volume of Fluids Pumped During Penetration, Circulation & Wiper Trip:	
Gas volume	92362.2 scf
Liquid Volume	277.1 bbl
Penetration, Circulation & Wiper Trip time	5.13 hr




Solids Removal after Penetration to Target Depth
CTran Analysis [Transient response during Circulation and Wiper Trip]
Solids Removed at Wellhead [%]
Wellhead Solids Rate
% of Initial Solids Removed
Solids Rate at Surface [kg/min]
Time [hr]


Solids Removed versus Circulation point
CTran Analysis
[%] of Initial Solids Removed
Circulation Depth [m]



Flow State (continued)

Measured Depth[Flow] m	Temperature	Completion Pressure	Workstring Pressure	Concentric Pressure	Completion Liquid Velocity ft/min	Workstring Liquid Velocity ft/min	Concentric Liquid Velocity ft/min
1834.2	183.3	1152.8	5289.4	0.0	466	907	0
1861.7	184.2	1165.1	5287.3	0.0	465	908	0
1889.1	185.0	1177.4	5285.4	0.0	463	909	0
1916.5	185.9	1189.9	5283.6	0.0	462	910	0
1944.0	186.8	1202.1	5281.5	0.0	460	908	0
1971.4	187.6	1214.1	5279.1	0.0	459	907	0
1998.8	188.5	1226.1	5276.7	0.0	458	907	0
2026.3	189.3	1237.8	5273.9	0.0	456	905	0
2053.7	190.1	1249.4	5270.8	0.0	455	904	0
2081.1	190.8	1260.8	5267.6	0.0	454	903	0
2108.6	191.6	1272.0	5264.1	0.0	452	902	0
2136.0	192.3	1283.2	5260.6	0.0	479	902	0
2140.1	192.4	1284.9	5260.1	0.0	451	903	0
2167.5	193.2	1296.3	5256.7	0.0	450	903	0
2195.0	194.0	1307.5	5253.1	0.0	449	903	0
2222.4	194.7	1319.0	5250.0	0.0	448	905	0
2249.8	195.5	1330.1	5246.3	0.0	446	903	0
2277.2	196.2	1341.2	5242.5	0.0	445	904	0
2304.7	197.0	1353.1	5239.8	0.0	444	911	0
2332.1	197.9	1365.8	5238.1	0.0	443	917	0
2359.5	198.8	1378.2	5236.0	0.0	442	916	0
2387.0	199.7	1390.4	5233.5	0.0	441	914	0
2414.4	200.5	1402.7	5231.2	0.0	440	915	0

Flow State (continued)

Measured Depth[Flow] m	Temperature	Completion Pressure	Workstring Pressure	Concentric Pressure	Completion Liquid Velocity ft/min	Workstring Liquid Velocity ft/min	Concentric Liquid Velocity ft/min
2441.8	201.4	1414.9	5228.8	0.0	439	915	0
2469.3	202.2	1427.1	5226.4	0.0	438	916	0
2496.7	203.1	1439.3	5223.9	0.0	437	916	0
2524.1	203.9	1451.7	5221.6	0.0	436	918	0
2551.6	204.8	1464.1	5219.4	0.0	435	919	0
2579.0	205.7	1476.5	5217.2	0.0	460	919	0
2587.0	205.9	1480.3	5216.7	0.0	519	921	0
2607.0	206.6	1489.5	5215.0	0.0	518	920	0
2618.1	206.9	1494.5	5214.0	0.0	432	917	0
2645.6	207.7	1506.5	5211.1	0.0	431	916	0
2673.0	208.6	1520.2	5208.8	0.0	602	920	0
2674.5	208.6	1521.3	5208.7	0.0	530	923	0
2674.9	208.6	1521.3	5208.6	0.0	612	923	0
2675.2	208.6	1521.4	5208.6	0.0	612	923	0
2677.0	208.7	1522.7	5203.8	0.0	611	1651	0
2677.7	208.7	1523.2	5202.7	0.0	606	1652	0
2678.0	208.7	1523.3	4502.2	0.0	596	36101	0
2687.6	209.1	1528.0	0.0	0.0	0	0	0
2715.0	210.0	1542.0	0.0	0.0	0	0	0
2741.2	210.9	1555.4	0.0	0.0	0	0	0
2768.7	211.9	1570.1	0.0	0.0	0	0	0
2796.1	212.9	1584.5	0.0	0.0	0	0	0
2823.5	213.8	1598.1	0.0	0.0	0	0	0

APPENDIX VII – CEMENT LAB REPORT

CLIENT/WELL INFORMATION

Client Name	PETRONAS CARIGALI SDN BHD			**District**	Kemaman
Well Name	DULANG D	**MD**	2,300 m	**Date Requested**	8/4/2024
Well Type	Horizontal	**TVD**	2,800 m	**Date Result Needed**	7/29/2024
Well Location	MALAYSIA	**GG**	1.71 °F/100ft	**Tubing Size**	3.5" Tubing
Job Type	Squeeze	**WD**	72m	**Casing Size**	8.5" OH
Job Description	CT CEMENTING - Blended Slagme	**BHST**	214.00 °F	**Mud Type**	Oil-Based
UWI	0000000000000	**Surface Temp**	91.00 °F	**Mud Density**	8.60 ppg
Rig #	NA	**BHCT**	°F	**Mud Density**	

SLURRY DESIGN

Slurry ID	399270-001	**Slurry Type**	Pilot	**Slurry Description**	SLURRY

SLURRY PROPERTIES

399270-001 | SLURRY

Slurry	15.00 ppg	**Liquid Volume**	60.80 %
Slurry Yield	1.37 ft³/sack	**Mix Fluid**	6.22 gal/sack
Mix Water	4.95 gal/sack	**Mix Fluid Total**	6.25 gal/sack

SLURRY COMPOSITION

399270-001 | SLURRY

Component Type	Component	Concentration	Lot/Batch	Source
Water	Sea Water	48.604 %	N/A	1. DULANG
Additive	FP-32L	0.050 gal/sack	IM23386 (ND)	2. DULANG
Additive	ASA-304L	0.022 gal/sack	102239762 (ND)	3. DULANG
Additive	BA-58L	0.550 gal/sack	LOT 216 (ND)	4. DULANG
Additive	FL-70L	0.450 gal/sack	LA07CQ690M	5. DULANG
Additive	CD-38L	0.120 gal/sack	IM 23334 (ND)	6. DULANG
Additive	R-21LSG	0.085 gal/sack	R21173G (ND)	7. DULANG
Additive	EC-4	1.000 %BWOB	IM23388	8. DULANG
Additive	S-8, Silica Flour	12.250 %BWOB	N/A	9. DULANG
Base	Blast Furnace Slag-Cementing Pro	100.000 %	SL24003 (ND)	9.1 DULANG

Profile:	Thickening Time	Description:	
Start	End	Time To	

Results:	Thickening Time	Analyst:	AZIZMOH
		Equipment:	N/A
Test Temperature		214.0 °F	
Test Pressure		2200 psi	
40 Bc		18:55 hh:mm	
70 Bc		19:08 hh:mm	
100 Bc		19:12 hh:mm	
Mix Time - Seconds		21 sec	
Final Pressure		2200 PSI	

399270-001 | SLURRY

Results:	Compressive Strength - Non Destructive	Analyst:	AZIZMOH
		Equipment:	N/A
24 hr		130 PSI	
Final Strength		2481 psi	
50 psi		23:08 hh:mm	
500 psi		25:21:00 hh:mm	
1000 psi		26:11:00 hh:mm	
2000 psi		28:35:00 hh:mm	
Final Time		49:32:00 hh:mm	
Test Temperature		214.0 °F	
Test Pressure		2200 PSI	

399270-001 | SLURRY

Results:	Fluid Loss - Static Cell (Screw-in End Caps)	Analyst:	AZIZMOH
		Equipment:	N/A
Liquid Volume		22.0 cc	
Test Time		30:00:00 mm:ss	
Test Temperature		214.0 °F	
API Fluids Loss Calculated		44.0 cc	

Results:	Free Fluid	Analyst:	AZIZMOH
		Equipment:	N/A
Test Temperature		190.0 °F	
Deviation Angle		45°	
Sample Volume		250 cc	
Liquid Volume		0.0 cc	
% Free Fluid		0.0 %	
Channeling		NO	
Settling		NO	

399270-001 | SLURRY

Results:	Static Gel Strength	Analyst:	AZIZMOH
		Equipment:	N/A
Test Temperature		214 °F	
Test Pressure		2200 psi	
Time to reach 100 lb/100ft²		22:09 hh:mm	
Time from 100 to 500 lb/100ft²		0:24 hh:mm	
Time to reach 500 lb/100ft²		22:33 hh:mm	

399270-001 | SLURRY

Results:	Rheology - Temp 1	Analyst:	AZIZMOH
		Equipment:	
Test Temperature		80.0 °F	
API PV		114 cP	
API YP		10 lbf/100ft²	
10 sec Gel Strength		5.0 FDR	
10 min Gel Strength		8.0 FDR	

RPM	300	200	100	60	30	6	3
Up	121.0	86.0	57.0	39.0	23.0	8.0	5.0
Dwn		83.0	55.0	36.0	20.0	7.0	5.0
Avg		84.5	56.0	37.5	21.5	7.5	5.0

399270-001 | SLURRY

Results:	Rheology - Temp 2	Analyst:	AZIZMOH
		Equipment:	
Test Temperature		214.0 °F	
API PV		94 cP	
API YP		12 lbf/100ft²	
10 sec Gel Strength		6.0 FDR	
10 min Gel Strength		12.0 FDR	

RPM	300	200	100	60	30	6	3
Up	101.0	78.0	55.0	37.0	25.0	11.0	8.0
Dwn		75.0	47.0	31.0	19.0	7.0	6.0
Avg		76.5	51.0	34.0	22.0	9.0	7.0

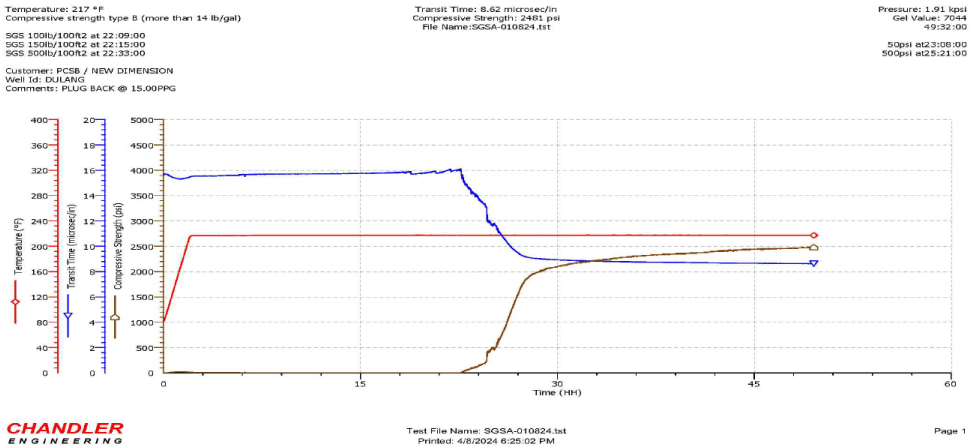
LAB NOTES

1. Water temperature 81degF
2. Cement blend temperature 81degF
3. Mixing time 26 seconds@ <35 sec in 600ml blender.
4. Yield calculation is based on 1 cuft of neat slag 87 lbs/sack.
5. Mixing Sequences as per below :

I. FP-32L
II. ASA-304L
III. BA-58L
Iv. FL-70L
v. CD-38L
vI. R-21LSG
vII. EC-4
vIII. Blended Slag

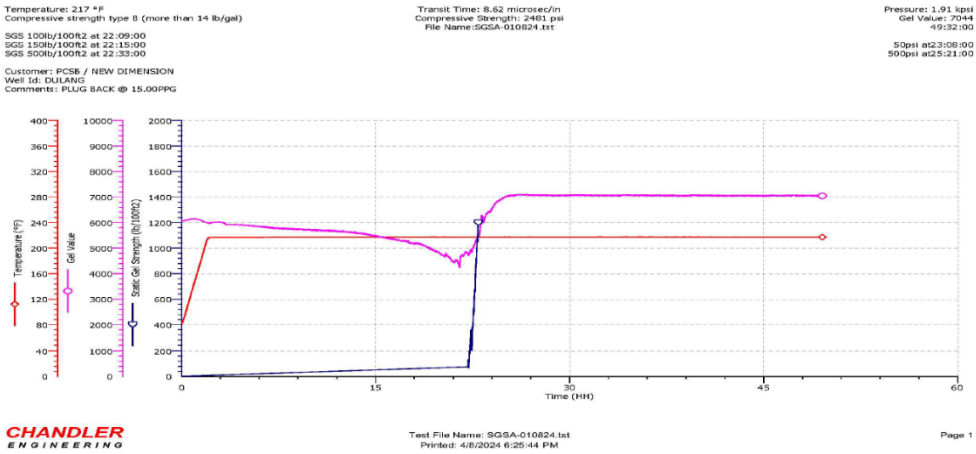
399270-001 | SLURRY

Profile:	Compressive Strength - Non Destructive	Description:	



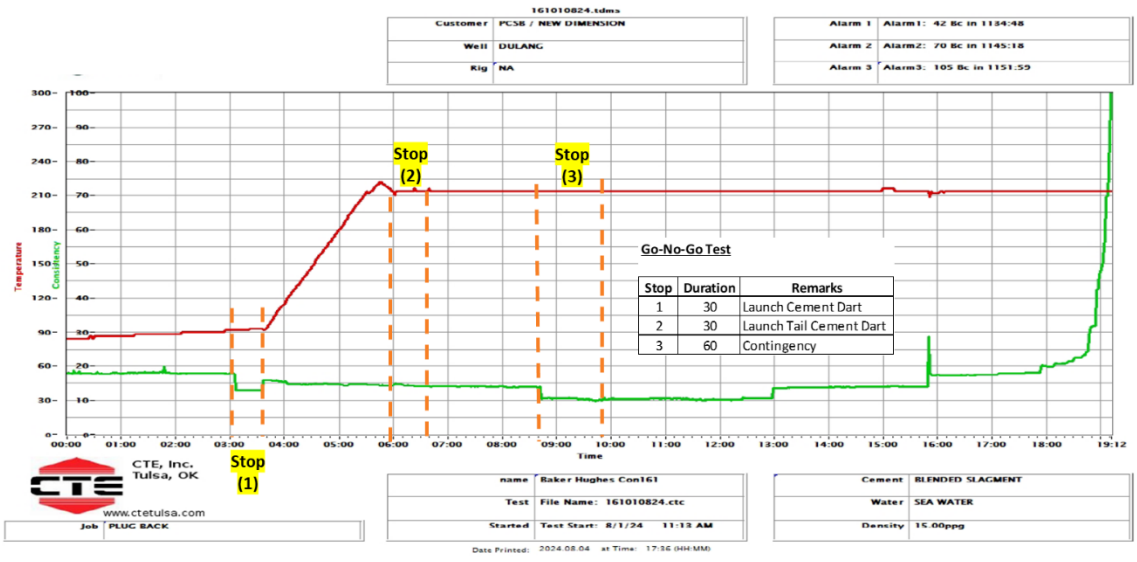
399270-001 | SLURRY

Profile:	Static Gel Strength	Description:	

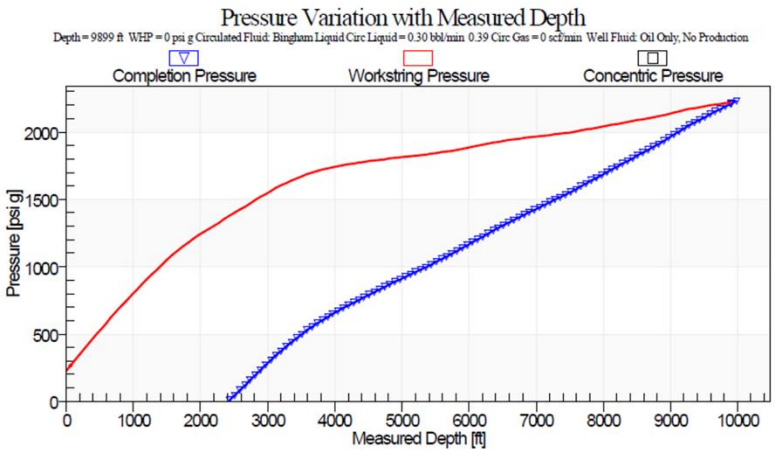


399270-001 | SLURRY

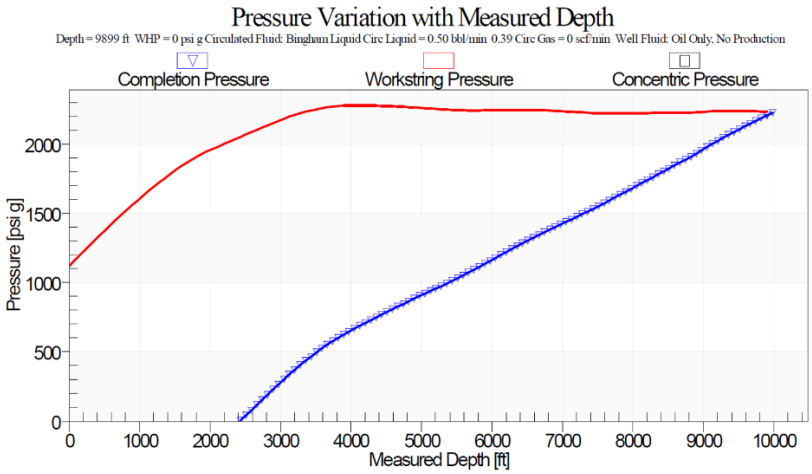
Profile:	Thickening Time	Description:	



Expected Cement Pumping Pressure



At 0.3 bpm



At 0.5 bpm

DECISION TREE