

# DIMENSION BID




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## ANGSI A-38 SCALE MILLING & STIMULATION


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Revision: 2  
Prepared for: Mohamad Shamsuri Bin Mahussin  
Date Prepared: 7<sup>th</sup> June 2023  
Well: A-38  
Field: ANCSI  
Operation Region: PMA  
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<b>DIMENSION BID</b>	DIMENSION BID COILED TUBING SERVICES		
	ANGSI A-38	SCALE MILLING & STIMULATION	


**DESIGN VERIFICATION**

**PREPARED BY DB**  
CTS Field Engineer

  
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Muhammad Ameerul Zaeem

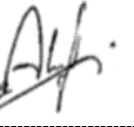
7/6/2023  
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Date

**REVIEWED BY DB**  
CTS Technical Advisor

  
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Kung Yee Han

7/6/2023  
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Date

**APPROVED BY DB**  
CTS Operation Manager

  
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Aliff Amirul Adenan

7/6/2023  
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Date

**APPROVED BY PCSB**  
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Well Intervention Engineer

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Mohamad Shamsuri Bin Mahusin

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Date

**APPROVED BY PCSB**  
Technical Professional  
Well Intervention, PMA

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M Izwan B A Jalil

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Date


**APPROVED BY PCSB**  
Head of Cluster 1  
Well Intervention, PMA

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Ahmad Hafizi B Ahmad Zaini

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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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## DISTRIBUTION LIST

No	Personnel	Company	Name	Email
1	Well Intervention Engineer	PCSB	Mohd Shamsuri Bin Mahussin	shamsuri.mahussin@petronas.com
2	Well Service Supervisor (WSS)	PCSB	TBA	TBA
3	Offshore Installation Manager (OIM)	PCSB	TBA	TBA
4	Production Technologist	PCSB	TBA	TBA
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9	Service Supervisor	DB – Kemaman	TBA	TBA
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11	Operation Engineer Coiled Tubing Services	DB – Kemaman	Mohammad Faizal Ali	faizal.ali@neudimension.com
12	Technical Advisor Coiled Tubing Services	DB – Kemaman	Kung Yee Han	yeehan.kung@neudimension.com
13	Operation Manager Coiled Tubing Services	DB – Kemaman	Aliff Amirul Adenan	aliff.adenan@neudimension.com
14	Field Service Manager Coiled Tubing Services	DB – Kemaman	Mohd Khairul Ridhwan	khairul.ridhwan@neudimension.com
15	HSE Supervisor	DB – Kemaman	Ahmad	ahmad@neudimension.com

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## PERSONNEL CONTACT

Any means of following doubt / unusual parameters / Emergency, please contact Dimension Bid personnel in onshore immediately.

No	Name	Position	Company	Location	Contact No
1	Aliff Amirul Adenan	Operation Manager	DB	Kemaman	011 – 1225 7044
2	Mohd Khairul Ridhwan	Field Services Manager	DB	Kemaman	014 – 515 4452
3	Kung Yee Han	Technical Advisor	DB	Kemaman	011 – 612 05611
4	Mohammad Faizal Ali	Operation Engineer	DB	Kemaman	013 – 736 1046

## REVISION HISTORY


Rev. No	Section	Date	Revised By
0	All	23/5/2023	Muhd Ameerul Zaeem
1	To change fluid to TIW for injectivity test prior SISQ Treatment	25/5/2023	Muhd Ameerul Zaeem
2	To revised latest volume for each pumping stage of SISQ Treatment	7/6/2023	Muhd 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
ZSO	Zone Shut Off
SCO	Sand Clean Out
TIT	Tubing Integrity Test

BOP	Blow Out Preventer
CT	Coil Tubing
ID	Internal Diameter
MDTHF	Measure Depth Tubing Head Flange
SSD	Sliding Side Door
P&A	Plug and Abandonment
MASTP	Maximum Allowable Surface Treating Pressure
STP	Surface Treating Pressure


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<b>DIMENSION BID</b>	DIMENSION BID COILED TUBING SERVICES		 <b>PETRONAS</b>
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## OBJECTIVES


The objective of this job is:

1. To perform scale milling and clear HUD inside tubing until XN Nipple.
2. To perform acid stimulation on zone I-68 (2,419 – 2,434 m MDDF) on Angsi Well A-38 to clean perforation area.
3. To perform bullheading Scale Inhibitor Squeeze (SISQ) on I-68 zone.

## BACKGROUND

Angsi-A38 is a single oil producer which was completed on March 2005 with maximum deviation of 52.27 degree at 1,311 m MDDF. Currently the well is flowing producing from I-68 zone with 294 liquid bbl/d. However, the well is underperforming due to HUD is found at 2,372 m MDDF with impression of scale around 2.62" LIB (June 2022) and smaller ID is recorded from SPM #2 all the way to the bottom of the tubing suspected from scale deposition during MIT conducted in 2020. PCSB has engaged DB to perform scale milling and acid stimulation on zone I-68.


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## WELL DATA

Input Parameter	Parameter Value
Field	Angsi-A38
Max. Deviation (degrees)	52 degree @ 1,311 m MDDF
Min. Restriction (inch)	<b>2.69" (XN Nipple) @ 2,403 m MDDF</b>
Tubing Specification	3-1/2" Production Tubing, 9.2# ppf, L-80
Type of Fluid & Density	9.3 PPG NaCl (based on Completion Fluid data in Well Diagram)
Top of Fluid	567 m MDDF / 550 m WLTHF
Current Well Status	Producing
Depth of zone	I-68: 2,419 m – 2,434 m MDDF
Reservoir Pressure	1,800 psi
Reservoir Temperature	249 deg F
Porosity	21%
Permeability	381 mD
Fracture Gradient	0.70psi/ft
Water cut	82%
Water Production Rate	240 bwpd
Oil Production Rate	54 bpd
Mercury, HG	N/A
<b>Additional Information / Notes / Special Requirement:</b>	
<ul style="list-style-type: none"> <li>• Smaller ID is recorded from SPM #2 all the way to the bottom of the tubing (MIT 2020)</li> <li>• Slickline HUD at 2,372 m MDDF / 7,782 ft MDDF (June 2022)</li> </ul>	

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## OPERATION SUMMARY

<i>Item</i>	<i>Job Description</i>	<i>Remark</i>
A	Slickline	1. To perform TCC until HUD
B	Coiled Tubing Operation	2. Run#1: Scale Milling Until EOT 3. Run#2: Clean Out Post Milling 4. Run#3: Depth Correlation and Stimulation on I-68
C	CT Contingency	5. Contingency #1: Well Unloading
D	Bullheading	6. Perform Tubing Pickling 7. Perform Pumping SISQ Treatment on Zone I-68

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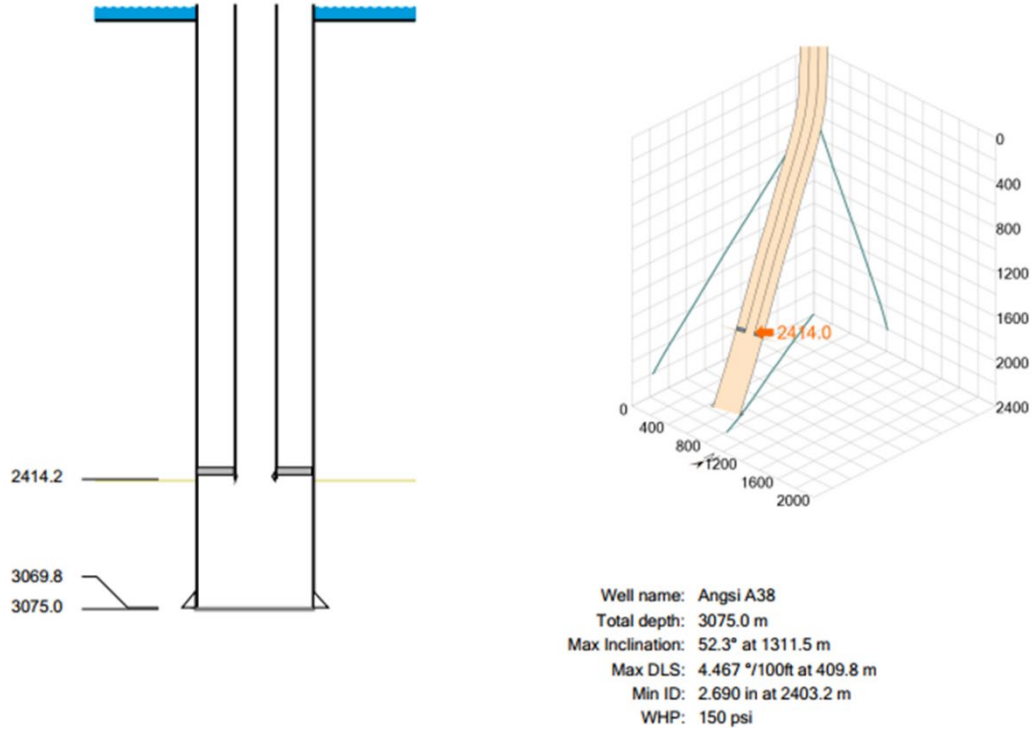
## DIMENSION BID COILED TUBING SERVICES




ANGSI-A38

SCALE MILLING &  
STIMULATION

### WELL 3D PLOT



Input Parameter	Parameter Value
Field	ANGSI ANDRA
Trajectory Until Depth	3,032.6 m MDDF (PBTD)
Max. Deviation (degrees)	52.27 degree at 1,311 m MDDF
Min. Restriction (inch)	2.69" @ 2,403 m MDDF

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## TREATMENT VOLUME

Description	Details
Tubing Specification	3-1/2", 9.2#, L-80
Prod. Casing Specification	9-5/8", 47#, L-80

Angsi A-38

Downhole Calculation

Prepared Date:  
11/4/2023


Tubing																
Type	External Pipe			Internal Pipe			Internal Pipe			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)							
THF to SSD#1	3 1/2	2.992	9.2							0.00870	16.90	2385.77	55	7828	7772	68
SSD#1 to EOT	3 1/2	2.992	9.2							0.00870	2385.77	2414.16	7828	7921	93	1
<b>TOTAL</b>															<b>68</b>	

A-Annulus (PCP)																
Type	External Pipe			Internal Pipe			Internal Pipe			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)							
THF to Packer#1	9 5/8	8.681	47	3 1/2	2.992	9.2				0.06130	16.90	2396.02	55	7861	7806	479

Wellbore Area on I-68 Reservoir																
Type	External Pipe			Internal Pipe			Internal Pipe			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)							
Packer#1 to EOT	9 5/8	8.681	47	3 1/2	2.992	9.2				0.06130	2396.02	2414.16	7861	7921	60	4
EOT to I-68 Top Perf	9 5/8	8.681	47							0.07320	2414.16	2419.00	7921	7937	16	1
I-68 Top Perf to I-68 Bottom Perf	9 5/8	8.681	47							0.07320	2419.00	2434.00	7937	7986	49	4
I-68 Bottom Perf to PBTD	9 5/8	8.681	47							0.07320	2434.00	3032.60	7986	9950	1964	144
<b>TOTAL</b>															<b>152</b>	

1.5 ft Penetration - Zone I-68 Reservoir															
Type	External Pipe			Internal Pipe			Penetration	Caps	From	To	From	To	Length	Total Volume (bbls)	
	OD (inch)	ID (inch)	W(lb/ft)	OD (inch)	ID (inch)	W(lb/ft)									(in)
I-68 Reservoir			45.625			9 5/8		1.93211	2419.00	2434.00	7937	7986	49	95	
													Porosity	0.21	
													Total	20	
<b>Total Treatment Volume</b>														<b>30</b>	

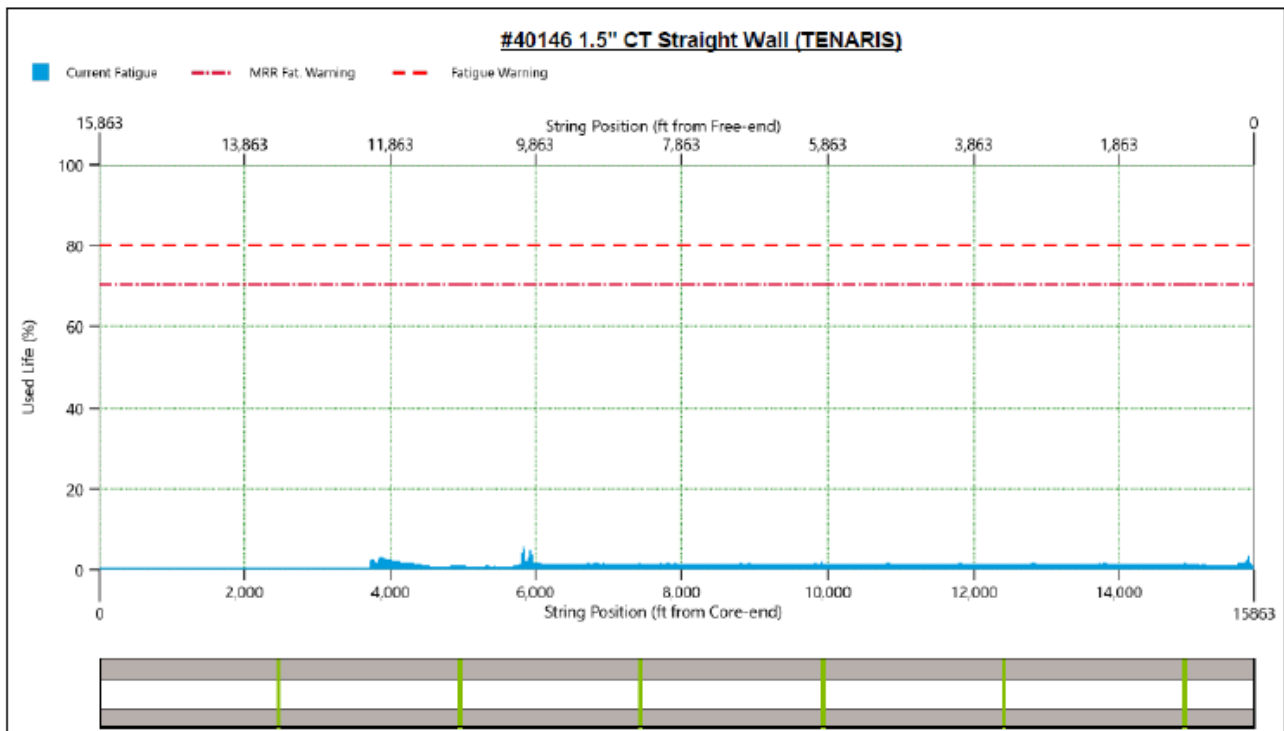
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**COILED TUBING STRING INFORMATION**

OD (in)	Spec	W/T (in)	ID (in)	Length (ft)
1.5	Tenaris HS-90	0.125	1.25	15,863
<b>CT Volume: 24.1 bbls</b>				

**CT STRING FATIGUE**



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### CT STRING #40146 LATEST PIPE MANAGEMENT

History:

Event	Date	User	Comment	Action Max Fatigue	Depth of Action Max Fatigue (ft)	Job Running Feet	Max Fatigue for String (w/Corr)
Created	29/1/2023 11:37:44 AM	faiz	String database created				
Reversed	29/1/2023 3:23:58 PM	faiz	String Reversed (No Fatigue).				
Spooling Operation	29/1/2023 3:25:42 PM	faiz	String reversed. Fatigue recorded.	0.33%	14920		0.33%
String Cut	29/1/2023 3:25:57 PM	faiz	4 ft cut off end of string				0.33%
Job: 4April23 A12S 1st run with drift Real Recording	5/4/2023 6:58:23 PM	DB CTS	Running Drift	2.94%	5815	10690	3.17%
Job: 6April23 Well A12S 2nd Run Wt Camera EV	8/4/2023 6:41:03 AM	DB CTS		2.37%	15785	11087	4.80%
Job: 12April23 A12S 4th Run DownJet Nozzle Stimulation	15/4/2023 3:13:07 PM	DB CTS		0.62%	13745	10474	5.20%
Job: 18April23_AngsiA24L_N2UNLOADING#F	21/4/2023 12:35:22 PM	DB CTS		2.77%	3865	17737	5.71%

Based on above pipe management;

- Current CT Length is **15,863 ft.**
- Current String Used Life is **5.71 %.**
- Current Running Footage in Chrome Completion is 52,003 ft
- Current Total Running Footage is **52,003 ft.**

Based on Dimension Bid Standard Operating Procedure (SOP) of Pipe Management for Chrome Completion:

- Max Running Footage in Chrome Completion is **200,000 ft**

Based on Dimension Bid Standard Operating Procedure (SOP) of Pipe Management to junk the CT:

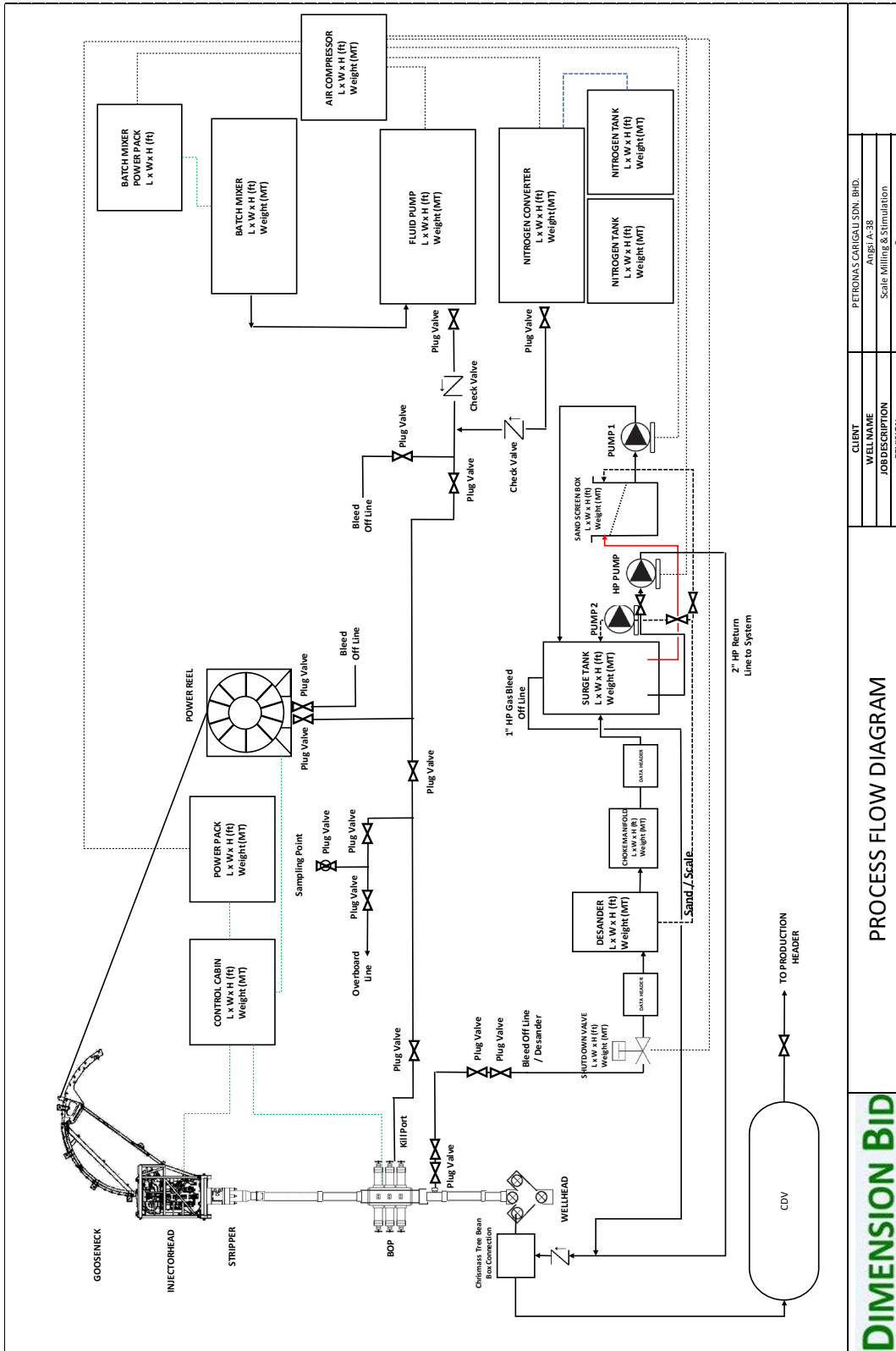
- **100%** of CT String Life reached
- Experienced two separate pinholes for the same CT String
- CT String exceed max working pressure

### MAXIMUM ALLOWABLE SURFACE TREATING PRESSURE (MASTP)

Fluid	Fluid Density, ppg	Mid Perf, TVD, ft	Hyd. Pressure, psi	Fracture Pressure, psi	STP, psi	80% MASTP, psi
Treated Fresh Water	8.46	5,840	2,569	4088	1,519	1,100
Treated Injection Water	8.62	5,840	2,618	4088	1,470	1,100
7.5% HCl	8.63	5,840	2,621	4088	1,467	1,100
Pre-Flush Solvent	8.46	5,840	2,569	4088	1,519	1,100
15% HCl	8.96	5,840	2,721	4088	1,367	1,100
Flush Solvent	8.46	5,840	2,569	4088	1,519	1,100
SISQ	8.64	5,840	2,624	4088	1,464	1,100

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### PROCESS FLOW DIAGRAM



**DIMENSION BID**

**PROCESS FLOW DIAGRAM**

CLIENT	PETRONAS CARIGALI Sdn. Bhd.
WELL NAME	ANGSI A-38
JOB DESCRIPTION	Scale Milling & Stimulation
REVISION	0

<b>DIMENSION BID</b>	DIMENSION BID COILED TUBING SERVICES		 <b>PETRONAS</b>
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## SAFETY OPERATIONAL PROCEDURES

**Prior to commencement of the Coiled Tubing / Bull-heading operation, a pre-job meeting will be held. This should be attended by the following parties as a minimum:**


OIM, WSS, Coiled Tubing 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 stops 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 coiled tubing 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<sub>2</sub>S, CO<sub>2</sub>, 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.

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- 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/FTHP), 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 Cetco 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.)

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	ANGSI-A38	SCALE MILLING & STIMULATION	

## 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.

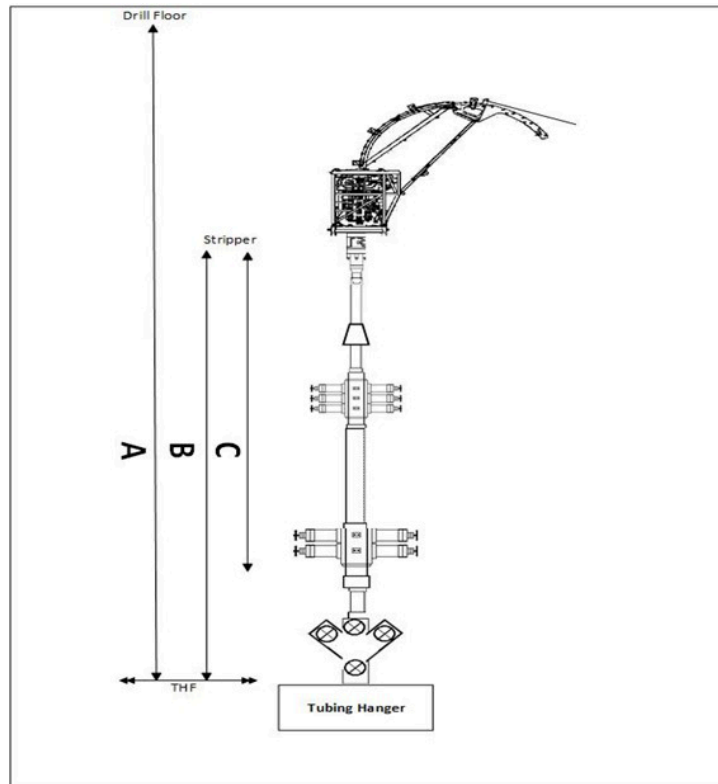
1. Spot the equipment accordingly to space availability, ensure reel position is aligned with the well.
2. Spot jacking frame at available space with sufficient height and crane capacity to rig up the injector head and gooseneck.
3. Rig up the 4" LP hoses from fluid storage tanks to batch mixer and single pump unit
4. Rig up 2" HP treating line as per DB Technical Standard from single pump unit and N2 converter unit to coiled tubing 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 / production system
9. Spot injector head assembly 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. 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 (34,300 lbs)**
17. Install pressure test plate onto the CT connector.
18. Circulate the string with water until clean return is seen prior to proceed with pressure test CT Connector.
19. Pressure up the CT string to 5000 psi gradually by 500 psi increment then hold for 10 minutes. Pressure test acceptance criteria:

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- 19.1. 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.**
- 19.2. 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**
20. Open the needle valve to release the pressure slowly.
21. Make up the BHA onto the string as per BHA diagram provided.
22. Use the jacking frame to pick up the injector and risers then connect to the Combi BOP. Secure down the injector assembly with chains.
23. 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	

\*The reference depth is at the tip of BHA

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

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## 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 Coiled Tubing. 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 3000 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 3000 psi through the kill line, hold for 10 minutes. Inspect the lines for leaks and observe for any pressure drop. PT acceptance criteria as per below:
  - 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.**
  - 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**
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 3000 psi against Crown Valve, hold for 10 minutes.
3. Bleed off pressure inside stack up to 1,500 psi and bleed off pressure inside CT to 0 psi to test the Double Flapper Check Valve to 1500 psi and hold for 10 minutes. Do not apply pressure more than CT Collapse Pressure (1500 psi)
4. Bleed off the pressure from BOP kill port side.
 

\*Step 4-8 can be neglected if pipe ram has been pressure tested prior to the job.
5. Place CT string across pipe ram then close the ram.
6. Open pipe ram equalizing valve then fill up the BOP slowly.
7. Close the equalizing valve and begin pressure test the pipe ram to 3000 psi, hold for 10 minutes.
8. When the tests are complete, bleed off the pressure.


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**CT STRING MANAGEMENT DURING OPERATION**

1. When RIH CT String in 13CR Chrome Completion, there are few mitigations plan need to be executed throughout the CT Operation to ensure we avoid CT String Failure event. However, this mitigation also should be applied in every job regardless of any grade of completion for better execution.
2. Visually inspect the overall CT String prior our 1<sup>st</sup> run.
3. Ensure to check the end of coil condition when making up connector for the 1<sup>st</sup> run. Below is the parameter that we need to verify to town prior making up the connector:
  - a. Record overall wall thickness from the end of coil up to 3-5ft.
  - b. Visually inspect if there is any flat surface/ovality.
 Please proceed cut the coil till the recommended wall thickness is reached. This visual inspection needs to be done for **every run**.
4. As per current Dimension Bid standard, we need to cut the coil tubing string of approximately **100 ft**. The purpose of this method is to:
  - a. Shift the fatigue of our CT String
  - b. To reduce the possibility of flat surface due to abrasion effect at the whip end of coil.
5. Throughout the CT Operation, we need to lubricate the annulus side of coil tubing string with our friction reducer solution.
6. After every **1000 ft** of running, please ensure to;
  - a. Perform pull test
  - b. Pump at least **2 bbls** of friction reducer solution whether through coil or kill port is subject to the tubing head pressure (THP).
7. For additional precaution and by referring to the Angsi A-38 survey deviation below, we need to;
  - a. Monitor the weight frequently
  - b. Perform additional pull test
  - c. Pump additional 2 bbls of friction reducer solution

Depth Interval (MDDF)	Deviation Range (deg)
0 – 700	30 - 40

Please include all these precautionary steps into each run to ensure we reduce the abrasion effect between our CT String & production tubing.

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## PRE-OPERATIONAL PROCEDURE

### SLICKLINE OPERATION

All depths specified below are in m-MDDF (Drill floor to THF is 16.9-m as per well diagram)

1. Slickline to conduct TCC run to ensure the tubing path is clear from obstruction and record the min ID of the tubing:

<i>Drift ID</i>	<i>Unit</i>

2. If fluid level or encountered HUD is found, record it in the following table:

<i>Description</i>	<i>Depth (m)</i>
Fluid level	
HUD	

3. Once completed, rig down Slickline unit and handover well to CT operation.

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## OPERATIONAL PROCEDURE

### COILED TUBING OPERATION – RUN#1 SCALE MILLING UNTIL XN NIPPLE AT 2,403 M MDDF

All depths specified below are in m-MDDF (**Drill floor to THF is 16.9-m as per well diagram**)

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

1. Prior to start CT operation, record initial well pressure parameter & perform pre-treatment by collect well fluid sample before shut in well and record pH & water cut. This will be reference during flowback after finish soaking period during CT Run#3.
  - 1.1. Collect sample prior shut in well. Label the sample bottle with type of sample, name of well, date and time the sample was collected.

Sample	Volume	pH Reading	Water Cut, %
Produced Fluid	1,000 mL		

- 1.2. Record initial SITHP and PCP of well A-38.

SITHP	CHP

- 1.3. Bleed off PCP to minimum as possible or 200 psi. Ensure the FCV is isolate properly. Continuously monitor PCP & record in daily report from time to time during operation.

2. Prepare 100bbls of Treated Injection Water, TIW as per recipe below:

Treated Injection Water			4,200	gals	100	bbls	Description
Products	Concentration		Volume				
Injection Water	992	gptg	4,166	gals	99.19	bbls	Base Fluid
MESB NE-Surf 200	2	gptg	8	gals	0.19	bbls	Non-Emulsifier Surfactant
ACM Oxyfree 100	2	gptg	8	gals	0.19	bbls	Oxygen Scavenger
ACM H2SClear 200	2	gptg	8	gals	0.19	bbls	CO2 & H2S Corrosion Inhibitor
ACM Bact 200	2	gptg	8	gals	0.19	bbls	Microbiocide

**Mixing Instruction:**

1. Transfer injection water into mixing tank
2. Add ACM OXYFEE & ACM H2S Clear 200 into the Batch Mixer and circulate the mixture
3. Add NE Surf 200 and ACM BACT 200 into the Batch Mixer and circulate the mixture till homogenous.

**Note:** The above recipe is for 100bbls of TIW. Please prepare another batch of TIW once needed.

3. Prepare 50bbls of D801 Cleanout Gel as per recipe below:

D801 Cleanout Gel				50	BBL	Description
Seq.	Product	Concentration		Volume		
1	Injection Water	992	gptg	2,083	gal	Base Fluid
2	D801 Gel	40.5	pptg	85	lbs	Gelling Agent

**Mixing Instruction:**

1. Prepare injection water in the mixing tank.
2. Add D801 Gel into the tank and circulate the mixture until homogenous.

**Note:** The above recipe is for 50bbls of D801 Gel. Please prepare another batch of D801Gel once needed.

4. Rig up coiled tubing unit and surface line on Angsi-A platform as per Site Visit Report:

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- 4.1. Review JHA and risk assessment with all personnel involve in the rig up operation. Please send a copy of JHA to Engineer in Charge.
- 4.2. Lift up coiled tubing unit using crane and spot on platform.
- 4.3. Rig up Coiled Tubing package and surface treating line.
- 4.4. Rig up 2" kill line to BOP kill port.
- 4.5. Rig up 2" flexible hose from pumping tee.
- 4.6. Pig coil tubing with TIW to ensure no debris is inside coil. **Record CT volume in treatment report.**
- 4.7. Make up the **CT End Connector**.
- 4.8. Install the Pull and Pressure Test Sub.
- 4.9. Perform Pull Test on the CT End Connector **to 20,000 lbf** and record this in OrionNet.  
**Note: Do not perform pull test more than 80% coil limit. Consult with town if require.**
- 4.10. Perform Pressure Test on CT End Connector. Pumping TIW 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.
  - 4.10.1. 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.**
  - 4.10.2. 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.**
5. Make up 2-1/8" PDM Motor c/w 2.75" Mill Bit tool as per **BHA#1: 2.75" Mill Bit BHA** in **Appendix 1**.
6. 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 Slb Milling 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		
60.0	1.40		

7. For reference, flow rate range to operate the motor is between 0.70 – 1.30 bpm as per advise from Slb Milling Tool Specialist.
8. Pick up coiled tubing and tag the stripper with the BHA.
9. Make up the Injector Head and Stripper to the stack up.

10. Coiled tubing stack up pressure test against Wellhead Swab valve. Pumping treated sea water through the coiled tubing, 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.
  - 10.1. 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.**
  - 10.2. 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.**
11. Pressure test the BHA Check Valve with **3,000 psi** in the coiled tubing stack up, bleed off the stack up pressure to **1,500 psi** via pump-in sub; and bleed off pressure in the coiled tubing to zero (0) psi via reel manifold.
  - 11.1. 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.
12. Upon successful test, bleed off the pressure in the coiled tubing stack up to zero through the pump-in sub.
13. Zero both depth counters at reference point.
14. Confirm all wellhead and BOP valves are in open position via physical check.
  - 14.1. Prior to opening the wellhead valve pressure up above master valves to a pressure equal to the expected shut-in wellhead pressure.
  - 14.2. Count wellhead valves turns while opening and record it the treatment report for reference in future.
  - 14.3. Manipulate surface valve to the following position:

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

15. Start running in hole coil tubing to **10m above last known HUD (2,372 m MDDF) / latest HUD from previous TCC** while pumping **Treated Injection Water** at 0.3 bpm.
  - 15.1. Refer to CT Tubing Force simulation (Orpheus modelling), refer Appendix III.
  - 15.2. Ensure Milling Tool Specialist from Slb is inside control cabin all the time during operation.
  - 15.3. 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.**
  - 15.4. Maximum coil speed running in hole is **30-50 ft/min**.
  - 15.5. Slow down coil speed to **10 ft/min**, 50 ft before and after passing through completion accessories.
  - 15.6. Closely observe weight indicator in control cabin while running in hole.
  - 15.7. Observe return all the times.
  - 15.8. Regularly inform WSS on job status at all times.

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

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

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

16. Once CT reach **2,362 m MDDF / 7,750 ft MDDF (10 m above HUD)**, 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

17. Continue RIH slowly at 10 ft/min while pumping at idle rate at 0.3 bpm to tag HUD at **2,372 m MDDF / 7,783 ft MDDF**. Do not slack off more than -1,000 lbf at downhole.

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

Flag Number	Colour
Flag#1	

19. Pick up 3 m above HUD at **2,369 m / 7,772 ft MDDF** & start pumping TIW 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.

19.1. 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		
60.0	1.40		

20. Once Off Bottom parameters have been recorded, increase pumping rate as per Slb Milling Specialist recommendation and record the circulating pressure.

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

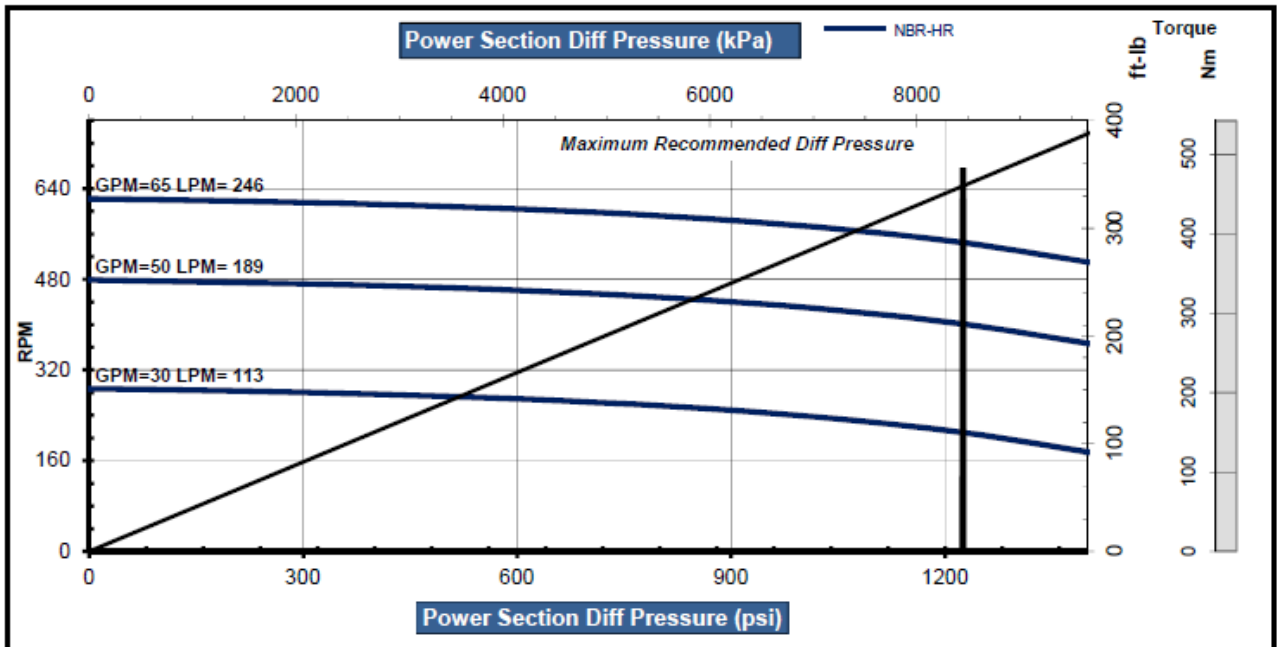
20.2. Flow rate range for the motor to operate is 0.50 – 1.40 bpm.

21. 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 – 400 psi differential pressure above the "Off Bottom" circulating pressure is maintained. Milling Specialist onsite will further asses the condition during milling operation.**

- 21.1. Continue slacking off weight as differential pressure and ROP (Rate of Penetration) indicates the progress of scale milling. Keep WOB within limit as per Milling Specialist recommendation.
- 21.2. Regularly monitor return on surface, advise Milling 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.
- 21.3. If observe debris at surface. Collect sample from time to time and send to town for analysis.
- 21.4. Set down weight between 300 to 500 lb<sub>r</sub>, in 100 lb<sub>r</sub> incremental. **Maximum set down weight is - 1,000 lb<sub>r</sub>** at downhole. Motor work is indicated by differential pressure not the WOB.
- 21.5. Please record the bottom hole circulating pressure. Keep the DP between 300 – 700 psi. **Maximum DP is 1230 psi (P<sub>Load</sub> – P<sub>No Load</sub>).**
- 21.6. 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.
- 21.7. Milling Specialist to record all the parameter before milling and during milling manually in log sheet.
- 21.8. Please refer below DynaDrill Motor technical specification for reference:

PERFORMANCE SPECIFICATIONS		PERFORMANCE DETAILS	
Torque Slope	0.277 ft-lb/psi 0.054 Nm/kPa	Max Diff Press psi (kPa)	NBR-HR 1230 (8450)
Flow Range	30 to 65 GPM 110 to 250 Litre/min	Max Torque ft-lb (Nm)	340 (460)
Rotation	9.574 Rev/Gal 2.529 Rev/Litre	Stall Diff Press psi (kPa)	1840 (12670)
Speed Range	287 to 630 RPM	Stall Torque ft-lb (Nm)	510 (680)
Off Bottom Press	68 psi 470 kPa	Max Recommended HP(kW)	38 (28)




22. Once milling pattern is established, vary the set down weight between 300 to 500 lb<sub>r</sub> until achieve 300–700 psi differential pressure. Maximum DP is 1230 psi.
23. Continue milling the **HUD depth** until encounter sudden lost weight that indicate the scale has been clear or fall to the next restriction inside the tubing.
  - 23.1. Pay close attention to the weight indicator and circulation pressure gauge

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- 23.1.1. The weight indicator will monitor the amount of WOB.
- 23.1.2. The circulation pressure gauge will inform the DP at which motor is functioning.
- 23.2. Once good return observed at surface, continue milling to penetrate HUD at **10 ft/min** and circulate **5 bbls of Gel for every 10m / 30 ft bite** to clear HUD along tubing wall.
- 23.3. Continue milling to penetrate HUD as per below table until **2,403 m MDDF / 7,884 ft MDDF (XN Nipple)**.

No.	Stage	Fluid	Liquid Rate (Vary)	Total Liquid	N2 Rate (if requires)	CT Speed	Duration	Depth	Remarks
			BPM	BBL	SCF/M	ft/min	Minute		
1	CT at 3 m above HUD (2,369 m MDDF)	TIW	1.0	0.0	300	0	0	3 m above HUD	Establish return on surface
2	RIH to HUD and Penetrate HUD/Fill	TIW	1.0	10.0	300	10	10	HUD + 10 m	Monitor return & CT weight on surface
3	Circulate & wiper trip to top of HUD	D801 Gel	1.0	5.0	300	0	5	Stationary CT	Provide suspension to the fill and lift to surface
Pull Test 10m									
4	RIH to last HUD and Penetrate HUD/Fill	TIW	1.0	10.0	300	10	10	HUD + 10 m	Monitor return & CT weight on surface
5	Circulate & wiper trip to top of previous HUD	D801 Gel	1.0	5.0	300	0	5	Stationary CT	Provide suspension to the fill and lift to surface
Pull Test 10m									
Repeat above step 1 to 5 until reached XN Nipple at <b>2,403 m / 7,884 ft MDDF</b>									
7	Hole Cleaning (Circulate)	D801 Gel	1.0	50	300	0	50	Stationary CT @ XN Nipple at 2,403m MDDF	Hole cleaning stage. 1.0x CT/Tubing Annulus Volume
8	Bottoms Up (Circulate)	TIW	1.0	102	300	0	102	Stationary CT @ XN Nipple at 2,403m MDDF	Hole Cleaning stage. 1.5x Tubing volume.
Once completed CBU and clear return is established, flag#2 at surface.									
9	POOH	TIW	0.3	80	300	30	270	To Surface	Monitor return on surface

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24. Once indication of the scale has been clear until **2,403 m MDDF / 7,884 ft MDDF (XN Nipple)**, slowly RIH to tag XN Nipple at 2,403 m / 7,884 MDDF. Do not slack off more than -500 lbf at downhole. Flag the coil on surface (Flag#2).

<i>Flag Number</i>	<i>Colour</i>
Flag#2	

25. Once confirm tag XN Nipple, proceed to pump 50 bbls of D801 Gel (1X CT/Annulus Volume) and followed by 102 bbls of TIW (1.5X Tubing Volume) to flush the remaining debris out from the well.
26. Once completed, continue to POOH CT to surface.
27. Once CT on surface, close well and bleed off pressure in coil and stack up. Prepare BHA for next run.

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**COILED TUBING OPERATION – RUN#2 SCO USING 2.125” SPINCAT NOZZLE UNTIL EOT AT 2,414 M MDDF**

All depths specified below are in m-MDDF (**Drill floor to THF is 16.9-m as per well diagram**)

28. Make up 2.125” SpinCat Nozzle tool as per **BHA#2: 2.125” SpinCat Nozzle** in Appendix 1.
29. Perform function test of the SpinCat Nozzle to determine at which pump rate and pressure of the tool start to rotate / operate. Record the data in the table below, do not exceed 5,000psi. Recommended flowrate is 0.7 bpm to 1.3 bpm.

Flow rates (bpm)	Pressure (psi)	Remark
0.3		
0.5		
0.6		
0.7		
0.8		
0.9		
1.0		
1.1		
1.2		
1.3		
1.4		

30. Repeat **step 8 - 14** in Run#1 prior opening the well.
31. Start running in hole coil tubing to **2,372 m / 7,782 ft MDDF** while pumping **Treated Injection Water** at minimum rate 0.3 bpm.
  - 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 coil speed running in hole is **30-50 ft/min**.
  - 31.4. Slow down coil speed to **10 ft/min**, 50 ft before and after passing through completion accessories.
  - 31.5. Closely observe weight indicator in control cabin while running in hole.
  - 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 run-in hole, the injector torque control shall be set at the minimum pressure required to move the Coiled Tubing at specified speed.

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32. Once CT reach **2,362 m MDDF / 7,749 ft MDDF (10 m above previous HUD)**, conduct pull test of 10m/30ft with pumping rate 0.3B PM and record the pulling weight both static and dynamic (**IMPORTANT**).

<i>Depth, ft</i>	<i>RIH weight, lbf</i>	<i>Static weight, lbf</i>	<i>Pick up weight, lbf</i>

33. If CT encounter HUD (**previous HUD at 2,372 m MDDF**), **flag CT on surface** and record in report as our reference point, pick up CT back to 10m above HUD. Increase pump rate to maximum pump rate achievable (with reference to pump rate in **step 29**) before start penetrate the HUD. Continue circulating until good return establish at surface. (Proceed to **steps 34** if CT did not encounter any HUD)

**Note:** Pump rate can be increase to max 1.3bpm or until reach maximum circulating pressure of 5,000 psi.


- 33.1. Once good return observed at surface, continue to penetrate into HUD with 10ft/min CT speed. Circulate 5bbbls of D801 gel after each penetration of 30 ft bite
- 33.2. **IF** no return is observed on surface, continue to fill up tubing with **102 bbbls** (1.5 Tubing Volume) of TIW. Monitor pressure on CHP if there are any build ups and fluid return observe on tubing and casing (Tubing communicate with A-Annulus).
- 33.2.1. **IF** no pressure built up in CHP and returns established at surface while pumping 83 bbbls of TIW, proceed with Step 33.4.
- 33.2.2. **IF** no constant return is observed on surface after exceeding 102 bbbls of TIW with a pressure build up on CHP, continue fill up until return observe on PCP and return establish at tubing.
- 33.3. **IF** no constant return is observed on surface, introduce nitrogen at pumping rate (350 – 400 scf/min).
- 33.3.1. Monitor THP and well condition while establishing return.
- 33.3.2. Upon establishing constant return, proceed with penetrate the HUD.

**Note: Monitor weight during penetration. If no weight loss more than 500lbs observes during penetration, continue penetrate HUD. Maximum cleanout penetration is 10m/30ft.**

**Perform wiper trip for every 10m/30ft interval cleanout (from cleanout depth until initial depth) while pumping 5bbbls of D801 Gel.**

- 33.4. Continue penetrate HUD as per below table until **1,970 m / 6,464ft MDDF (EOT)**.

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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 HUD	TIW	1.0	0.0	300	0	0	10m above HUD	Establish return on surface
2	RIH to HUD and Penetrate HUD/Fill	TIW	1.0	10.0	300	10	10	HUD + 10m	Monitor return & CT weight on surface
3	Circulate & wiper trip to top of HUD	D801 Gel	1.0	5.0	300	0	5	Stationary CT	Provide suspension to the fill and lift to surface
Pull Test 10m									
4	RIH to last HUD and Penetrate HUD/Fill	TIW	1.0	10.0	300	10	10	HUD + 10m	Monitor return & CT weight on surface
5	Circulate & wiper trip to top of previous HUD	D801 Gel	1.0	5.0	300	0	5	Stationary CT	Provide suspension to the fill and lift to surface
Pull Test 10m									
Repeat above step 1 to 4 until reached EOT@2,414 m-MDDF									
7	Hole Cleaning (Circulate)	D801 Gel	1.0	50	300	0	50	Stationary CT @ EOT at 2,414m MDDF	Hole cleaning stage. 1.0x CT/Tubing Annulus Volume
8	Bottoms Up (Circulate)	TIW	1.0	102	300	0	102	Stationary CT @ EOT at 2,414m MDDF	Hole Cleaning stage. 1.5x Tubing volume.
Once completed CBU and clear return is established, POOH to SPM#5 and start jetting across SPM until SPM#1. Repeat for three passes at 1.1 bpm.									
9	POOH	TIW	0.3	26	300	30	85	To Surface	Monitor return on surface

34. Once CT reach at EOT depth at **2,414 m / 7,920 ft MDDF**, proceed hole cleaning by pump 1x annulus volume of gel (**50 bbls**) and follow by bottoms up with TIW **102 bbls** (1.5x Tubing Volume) or until clear return at surface.

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35. If CT encountered hard obstruction, proceed to pick up CT 10m above the obstruction and circulate at least 2x bottom up until clear return is observe on surface before proceed with the following steps.

35.1. RIH and slack off CT not exceeding 500 lbf on top of the obstruction and attempt to jet on the obstruction. If no success proceeds to mix **10 bbls of 15% HCl acid and Neutralization Fluid** as per the following recipe:

15% HCl (Main Treatment)				10	BBL	Description
Seq.	Product	Concentration		Volume		
1	Fresh Water	419	gptg	176	gals	Base Fluid
2	ACM CORR 400	4	gptg	2	gals	Acid Corrosion Inhibitor
3	MESB NE 200	4	gptg	2	gals	Non-Emulsifier
4	ACM Surf 210	3	gptg	1	gals	Surfactant
5	Ammonium Chloride	417	pptg	175	lbs	Clay Stabilizer
6	ACM Iron 300	25	pptg	11	lbs	Iron Sequestering
7	ACM Iron 200	15	gptg	6	gals	Iron Control
8	33% HCl	419	gptg	176	gals	Raw Acid
9	MESB MS 300	100	gptg	42	gals	Mutual Solvent

**Mixing Instruction:**

1. Fill up tank with fresh water.
2. Add additives as per above sequence.
3. Agitate until mixture is homogenous.

Neutralization Fluid				10	BBL	Description
Seq.	Product	Concentration		Volume		
1	Injection Water	976	Gptg	410	gal	Base fluid
2	Soda Ash	500	pptg	210	lbs	Neutralization fluid

**Mixing Instruction:**

1. Prepare injection water in the mixing tank.
2. Mix soda ash into tank and agitate until mixture is homogenous.

35.2. Upon completion mixing 15% HCl acid, proceed to jet 5 bbls of 15% HCl on top of the obstruction (HUD) while attempt to pass through the obstruction.


35.3. If no success during jetting HCl acid, proceed to spot another 5 bbls of 15% HCl on top of obstruction (HUD) and pick up CT at least **550m** above the obstruction depth to soak the acid for 2 hours. After completed soaking, proceed to RIH to pass through the obstruction while pumping nitrified TIW. If unable to penetrate consult town for further instruction.

35.4. During circulation, if acid return observes on surface return line, inject soda ash using chemical injection pump on the surface return line to neutralize the acid.

36. At **2,404 m / 7,887 ft 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

37. Continue RIH slowly at 5ft/min with pumping rate 0.3BPM until EOT at **2,414 m / 7,920 ft MDDF**. Once completed CBU and observed clear return is established.

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38. Upon completed bottoms up, pickup CT to XN-Nipple at 2,403 m / 7,884 ft MDDF and flag CT at surface as Flag#3. Compare with Flag#2 in previous run.

<i>Flag Number</i>	<i>Colour</i>
Flag#3	

39. After completed flag, wiper trip CT to **SPM#5** depth at **2,375-m / 7,792 ft MDDF**, increase pump rate to 1.1 bpm or without exceeding circulating pressure of 5,000 psi. Continue **jetting across each SPM until SPM#1**. Repeat for **three passes** at 1.1 bpm. Keep monitor return at surface.
40. POOH CT to surface while pumping TIW at 0.3bpm. Ensure continuous return on surface is observed.
- 40.1. Maximum coil speed while POOH is 50ft/min.
- 40.2. Slow down coil speed to 10ft/min 50ft before and after passing through completion accessories.
41. Once CT on surface, close well and bleed off pressure in coil and stack up.
42. Ensure to collect sample at DPSF and send to town for analysis.

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### COILED TUBING OPERATION – RUN#3 DRIFT RUN AND ACID STIMULATION ON I-68

All depths specified below are in m-MDDF (**Drill floor to THF is 16.9-m as per well diagram**)

43. Prior to start acidizing operation, pickle the CT String with 10 bbls of 7.5% HCl, followed by 25 bbls of TFW and neutralization fluid (soda ash) to remove internal rust and ensure no foreign debris inside the CT string. Please refer below 7.5% HCl mixing chemical recipe:

7.5% HCl (CT Pickle)			4,200	gals	100	bbls	Description
Products	Concentration		Volume				
Fresh Water	798	gptg	335	gals	7.98	bbls	Base Fluid
33% HCl	202	gptg	85	gals	2.02	bbls	Raw acid

**Mixing Instruction:**

- Fill up tank with fresh water
- Add 33% HCl into the tank
- Agitate until the mixture is homogenous

44. Make up 2-1/8" DownJet Nozzle c/w 2.75" FC tool as per **BHA#3: 2-1/8" DownJet Nozzle c/w 2.75" FC** in Appendix I.
45. Record initial SITHP and annulus pressure of well A-38. Compare pressure parameter record in previous run and inform town if there any changes.

SITHP	Annulus Pressure

46. Perform function test of the DownJet Nozzle to determine at which pump rate and pressure of the tool. 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		
1.3		
1.4		

47. Repeat **step 8 - 14** in Run#1 prior opening the well.
48. Start RIH CT to **2,403 m / 7,884 MDDF (XN-Nipple)** with reference of previous **flag#2 & flag#3** while pumping **TIW** at minimum rate 0.3 bpm.
- Refer to CT Tubing Force simulation (Orpheus modelling), refer Appendix III.
  - 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.**
  - Maximum CT speed RIH is **30-50 ft/min**.
  - Slow down CT speed to **10 ft/min**, 50 ft before and after passing through completion accessories.
  - Closely observe weight indicator in control cabin while RIH.

- 48.6. Observe return all the times.
- 48.7. Regularly inform WSS on job status at all times.
- 48.8. Do not exceed operating safety limits **5,000 psi**.
- 48.9. If the well condition differs from original job design, contact appropriate personnel in charge before proceeding.
- 48.10. At all time, while RIH, the injector torque control shall be set at the minimum pressure required to move the CT at specified speed.
49. At **2,393 m / 7,851 ft MDDF (10m above XN Nipple)**, stop CT and conduct pull test 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

50. Prepare 250 bbls of **Treated Fresh Water, TFW** as per recipe below:

Treated Fresh Water			4,200	gals	100	bbls	Description
Products	Concentration		Volume				
Fresh Water	959	gptg	4,028	gals	95.90	bbls	Base Fluid
MESB NE-Surf 200	2	gptg	8	gals	0.20	bbls	Non-Emulsifier Surfactant
Ammonium Chloride	417	pptg	1,751	lbs			Clay Stabilizer
ACM Oxyfree 100	2	gptg	8	gals	0.20	bbls	Oxygen Scavenger
ACM H2SClear 200	2	gptg	8	gals	0.20	bbls	CO2 & H2S Corrosion Inhibitor
ACM Bact 200	2	gptg	8	gals	0.20	bbls	Microbiocide
<b>Mixing Instruction:</b>							
4. Fill up tank with fresh water							
5. Add additives as per above sequence							
6. Agitate until the mixture is homogenous							

**Note:** The above recipe is for 100bbls of TFW. Please prepare another batch of TFW once needed.

51. Prior start pumping activity once completed mixing, record shut in tubing head pressure (SITHP) and annulus pressure Include in daily report.

SITHP	Annulus Pressure

52. Bleed off tubing and casing pressure to 0 psi or to minimum as possible.
53. Once complete above step, proceed to fill up the completion volume with 220 bbls (1x completion volume) TFW or till steady return is observe on surface without any Nitrogen injection, whichever comes first.
- 53.1. Do not exceed 5,000 psi CT Circulation pressure or 1,100 psi MASTP during pumping activity. Whichever comes first.
- 53.2. If MASTP exceed 1,100 psi during pumping, stop pump and bleed off pressure prior re-attempt the Injectivity Test.
- 53.3. Consult town in the event the pumping pressure still above 1,100 psi after re-attempt.
- 53.4. Ensure a physical verification is done to reconfirm actual fluid displacement in premix tank vs DAS reading.
- 53.5. While filling up tubing, record THP and CHP as per table below. Include the following table in

daily report.

Time (min)	Pump Pressure (psi)	Volume (bbl)	THP (psi)	CHP (psi)	Remark

54. Proceed with pump TFW to fill up completion volume (**220 bbls**) prior injectivity test as per below table:

Pumping Schedule to Fill up Completion Volume for Injectivity Test						
Stage	Description	Fluid	Vol (bbl)	Pump Rates (bpm)	Remarks	MASTP (psi)
1	<b>Fill-up Completion Volume</b>	<b>TFW</b>	220 bbls or till return is observed on surface without N2 Injection	0.3-1.4	220 bbls is calculated based on 1x completion volume	1,100

55. Once the well is full with TFW, manipulate surface valves as following position prior commence with Injectivity test.

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

56. Begin injectivity test via CT as per table below:

Rate (bpm)	Pumping Pressure (psi)	Time (min)	Volume (bbls)	THP (psi)	CHP (psi)
0.30					
0.40					
0.50					
0.60					
0.70					
0.80					
0.90					
1.00					
1.10					
1.20					
1.30					
1.40					

56.1. Ensure PCSB Representative is available and witness the injectivity test.

56.2. Sustain each pumping rate for 5 minutes after pressure stabilises.

56.3. DO NOT exceed MASTP of 1,100 psi.

56.4. Fill up table and include in daily report. Report the results of injectivity test to PCSB and DB EIC.

56.5. Minimum injectivity require for this treatment is **0.3 bpm to 0.5 bpm**.

57. After completed injectivity test, manipulate wellhead valves as below:

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

58. **Continue pump TFW** with idle rate to ensure well is full with fluid and monitor return while preparing all required treatment fluid.

59. Report the injectivity test result to EIC and WSS.

60. Once obtain approval from DB EIC and PCSB EIC to proceed with the stimulation operation, prepare main treatment fluid as per below recipe:

Pre-Flush Solvent				1470	gals	35	bbls	Description
Seq	Product	Concentration		Volume				
1	Fresh Water	863	gptg	1,269	gals	30.2	bbls	Base Fluid
2	MESB NE-Surf 200	4	gptg	6	gals	0.1	bbls	Non-Emulsifier Surfactant
3	NH4Cl Powder	417	pptg	613	lbs			Clay Stabilizer
4	MESB MS 300	100	gptg	147	gals	3.5	bbls	Mutual Solvent


**Mixing Instruction:**

1. Fill up tank with fresh water
2. Add additives as per above sequence
3. Agitate until mixture is homogeneous

15% HCl				3360	gals	35	bbls	Description
Seq	Product	Concentration		Volume				
1	Fresh Water	419	gptg	616	gals	14.67	bbls	Base Fluid
2	ACM CORR 400	4	gptg	6	gals	0.14	bbls	Acid Corrosion Inhibitor
3	MESB NE 200	4	gptg	6	gals	0.14	bbls	Non-Emulsifier
4	ACM Surf 210	3	gptg	4	gals	0.11	bbls	Surfactant
5	NH4Cl Powder	417	pptg	613	lbs			Clay Stabilizer
6	ACM Iron 300	25	pptg	37	lbs			Iron Sequestering
7	ACM Iron 200	15	gptg	22	gals	0.53	bbls	Iron Control
8	33% HCl	419	gptg	616	gals	14.67	bbls	Raw Acid
9	MESB MS 300	100	gptg	147	gals	3.50	bbls	Mutual Solvent

**Mixing Instruction:**

1. Fill up tank with fresh water
2. Add additives as per above sequence
3. Agitate until mixture is homogeneous

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Treated Fresh Water				1050	gals	25	bbls	Description
Seq	Product	Concentration		Volume				
1	Fresh Water	959	gptg	1,007	gals	23.98	bbls	Base Fluid
2	MESB NE Surf 200	2	gptg	2	gals	0.05	bbls	Non-Emulsifier Surfactant
3	Ammonium Chloride	417	pptg	438	lbs			Clay Stabilizer
4	ACM OXYFREE 100	2	pptg	2	gals	0.05	bbls	Oxygen Scavenger
5	ACM H2SClear 200	2	gptg	2	gals	0.05	bbls	CO2 & H2S Corrosion Inhibitor
6	ACM BACT 200	2	gptg	2	gals	0.05	bbls	Microbiocide

**Mixing Instruction:**

1. Fill up tank with fresh water
2. Add additives as per above sequence
3. Agitate until mixture is homogeneous

**Note:** The above recipe is for 25bbls of TFW. Please prepare another batch of TFW once needed.

61. Once all the treatment fluid are prepared, manipulate wellhead valves as below:


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

62. After completed fluid preparation, while CT station at XN Nipple at **2,403 m / 7,884 MDDF** with reference of previous flag#2, proceed with pumping main treatment via CT as per below pumping schedule:

- 62.1. Do not exceed MASTP of 1,100 psi during pumping operation.
- 62.2. In the event MASTP pressure exceed the limit during pumping operation, stop pump and bleed off the tubing pressure to minimum prior continue with pumping operation.
- 62.3. Consult town if the pumping pressure still exceeding MASTP after bleed off operation.

Acidizing Pumping Schedule via CT										
Stage	Start Depth (m)	End Depth (m)	Fluid at Reel Manifold	Fluid Entry Volume	Total Fluid Pumped (bbls)	Pump rate (bpm)	Fluid at nozzle	Surface Valve Config.	Remark	MASTP
1	Reciprocate CT (2,393 – 2,403 m MDDF) during stimulation pumping		Pre-Flush	25	25	0.5	Pre-Flush	Close	Pre-Flush at tip of Nozzle	1,100
2			Pre-Flush	5	30	0.5	Pre-Flush	Close	Pre-Flush start exit Nozzle	
3			15% HCl	25	55	0.5	15% HCl	Close	All Pre-Flush exit Nozzle	

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4			15% HCl	5	60	0.5	15% HCl	Close	15% HCl at tip of Nozzle
5			TFW	25	85	0.5	TFW	Close	15% HCl start exit Nozzle
7			TFW	8	93	0.5	TFW	Close	All 15% HCl squeeze into formation
7	2,403	0	-	-	-	-	TFW	Open	<b>Station CT at surface</b> for Contingency Nitrogen unloading after complete soaking period

63. Record the following parameters while pumping via CT. Include the following table in daily report.

Time (min)	Pump Pressure (psi)	Volume (bbl)	THP (psi)	CHP (psi)	Remark

64. Upon completing pumping all treatment fluid according to **step 62**, pick up CT to surface & **soak the treatment for 4 hours**.

65. After complete **soaking**, manipulate surface valve as per the following position and flowback the well immediately to recover the total fluid pumped approximately **242 bbls** (1.5x total pumped fluid during stimulation).

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

66. Ensure the Single Pump is already rig up at the tapping point of flowback line. Mix Soda Ash to neutralize the flowback fluid as per the following recipe.

Neutralization Fluid				50	BBL	Description
Seq.	Product	Concentration		Volume		
1	Injection Water	976	gptg	49	bbls	Base fluid
2	Soda Ash	500	pptg	1,050	lbs	Neutralization fluid

**Mixing Instruction:**

1. Prepare injection water in the mixing tank.
2. Mix soda ash into tank and agitate until mixture is homogenous.

**Note:** The above recipe is for 50 bbls of Neutralization Fluid. Please prepare another batch if needed.

67. Monitor pH of return fluids and start injecting soda ash once pH reading is below than pH value obtained prior starting treatment. If no acid return observes on surface, continue flow the well without injecting soda ash.

68. Continuously monitor pH of return fluids constantly, every 30 minutes. Stop injecting soda ash when pH reading is equivalent to pH value prior starting treatment.

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69. Record the following parameters during monitor well flowback. Include the following table in daily report.

<b>Monitoring Checklist</b>									
Field/Platform/Well :									
Engineer :									
No.	Date	Time	Choke Size	pH.	% Water Cut	Bbl Counter	FLT	FTHP	Remark
1									
2									
3									
4									
5									
6									
7									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

70. Once well is able to flow naturally, POOH to surface.

71. In the event, well is unable to flow naturally after 4 hours period, proceed to unload the well by pumping Nitrogen to lighten the hydrostatic.

71.1. RIH CT to first circulation point depth at **700 m / 2,297 ft MDDF**, assuming fluid column full of TFW with 8.46 ppg), conduct pull test of at least 10m or more. Record the pulling weight both static and dynamic in the following table.


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

71.2. Once CT at **700 m / 2,297 ft MDDF**, increase the N2 rate at 300 scf/min until 600 scf/min at this depth while monitoring the returns on the surface.

71.2.1. If there is fluid return on surface, continue to pump N2 until only gas return on surface which indicate that the column of fluid above CT BHA is lifted.

71.2.2. Constantly monitor & record the return from the well and THP. Periodically take fluid sample and verify the pH of fluid until achieve baseline pH fluid prior stimulation operation.

71.2.3. If there is no fluid return at surface, continue pumping nitrogen and RIH to the next depth as per table below:

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No.	Stage	N2 Rate		Total N2		Duration		Coiled Tubing			
		SCFM	SCF	Minute	ft/min	From (ft)	From (m)	To (ft)	To (m)	Total Footage (ft)	Remarks
1	Circulation*	300	9000	30	0	2296	700	2296	700	0	
2	RIH	300	7550	25	30	2296	700	3051	930	755	
3	Pull test	300	765	3	20	3051	930	3000	914	51	
4	Circulation	300	9000	30	0	3000	914	3000	914	0	
5	RIH	300	10500	35	30	3000	914	4050	1234	1050	
6	Pull test	300	750	3	20	4050	1234	4000	1219	50	
7	Circulation	300	9000	30	0	4000	1219	4000	1219	0	
8	RIH	300	10500	35	30	4000	1219	5050	1539	1050	
9	Pull test	300	750	3	20	5050	1539	5000	1524	50	
10	Circulation	300	9000	30	0	5000	1524	5000	1524	0	
11	RIH	300	10500	35	30	5000	1524	6050	1844	1050	
12	Pull test	300	750	3	20	6050	1844	6000	1829	50	
13	Circulation	300	9000	30	0	6000	1829	6000	1829	0	
14	RIH	300	10020	33	30	6000	1829	7002	2134	1002	
15	Pull test	300	750	3	20	7002	2134	6952	2119	50	
16	Circulation (Max Circulation Depth at 300 m above I-68 Top Perf)	300	9000	30	0	6952	2119	6952	2119	0	Circulate out liquid until solid N2 gas return at surface
17	POOH	0	0	232	30	6952	2119	0	0	6952	
		Total N2, SCF	106,835	588	MINS						
		Total N2, Gal	1,147	10	HOURS						
		3x Priming	900								
		Dead Volume N2 / Tank	200								
		Total N2 Including 3% Losses	2,315								

**\*\*Circulation\*: First circulation point depth**

**\*\*The unloading time for each specific depth can subject to change depending on return condition**

**\*\* The volume of required N2 above not including cooling down and 10% losses**

72. Please note the maximum depth of circulation is at **2,119 m / 6,952 ft MDDF (300m above top perf of I-68)**. This is to avoid N2 losses to formation.

73. Once the well is flowing, stop pumping N2 and monitor the well flow for one hour.

73.1. If the well continues flowing naturally, start to POOH and continue monitor the pH of fluid return until achieve baseline pH prior stimulation operation.

73.2. If the well stops flowing naturally, repeat **step 71.2** by pumping nitrogen again.

74. POOH CT to surface while pumping TIW at 0.3 bpm. Ensure continuous return on surface is observe.

74.1. Maximum CT speed while POOH is 50 ft/min.

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74.2. Slow down CT speed to 10 ft/min 50 ft before and after passing through completion accessories.

75. Once CT on surface, close well and bleed off pressure in CT and stack up.

**BULLHEADING OPERATION – TUBING PICKLING**

76. Line up transfer hose from IBC into mixing tank and 4” LP hoses from holding tank to single pump.

77. Line up 2” HP treating line from single pump to the wellhead.

78. Perform pressure test for the treating line against crown valve up to 500 psi and holds for 5 minutes and increase to 3000 psi and holds for 10 minutes.

79. Once completed, bleed off pressure through the bleed off line by fully opening the master plug valve (2x1 plug valve) then slowly open the control valve (2x1 plug valve). Ensure pressure is bled to zero.

80. Prior to start Tubing Pickling, record initial well pressure parameter & perform pre-treatment by collect well fluid sample before shut in well and record pH & water cut. This will be reference during flowback.

80.1. Record initial SITHP and Annulus Pressure of well A-38.

SITHP	Annulus Pressure

80.2. Label the sample bottle with type of sample, name of well, date and time the sample was collected.

Sample	Volume	pH Reading	Water Cut, %
Produced Fluid	1,000 mL		

81. Prepare treatment fluids as per below recipe for pumping activity:

7.5% HCl (Pickling Solution)				2940	gals	70	bbls	Description
Seq	Product	Concentration		Volume				
1	Fresh Water	771	gptg	2,266	gals	53.95	bbls	Base Fluid
2	ACM CORR 400	4	gptg	12	gals	0.29	bbls	Acid Corrosion Inhibitor
3	MESB NE 200	4	gptg	12	gals	0.29	bbls	Non-Emulsifier
4	ACM Surf 210	3	gptg	9	gals	0.21	bbls	Surfactant
5	ACM Iron 300	10	pptg	29	lbs			Iron Sequestering
6	ACM Iron 200	15	gptg	44	gals	1.05	bbls	Iron Control
7	33% HCl	202	gptg	594	gals	14.14	bbls	Raw Acid

**Mixing Instruction:**

- 4. Fill up tank with fresh water
- 5. Add additives as per above sequence
- 6. Agitate until mixture is homogeneous

82. Manipulate surface valve to the following position prior pumping activity:

Valve	Position
Flow Cross Pumping Valve (DB lines)	OPEN
Swab Valve	OPEN
Lower Master Valve	OPEN
Wing Valve	CLOSE

82.1. While opening up swab valve and lower master valve, count turns for future reference.

83. Prior start pumping activity, complete the following:

83.1. Record shut in tubing head pressure (THP) and casing head pressure (CHP). Include in daily report.

83.2. Bleed off tubing and casing pressure to 0 psi or to minimum as possible.

84. Open plug valve at the surface line that connects to pump-in tee and start pumping Pickling Solution according to the pumping table in Step 84.3.

84.1. **Do not exceed maximum allowable surface pressure 1,100psi.**

84.2. Ensure that one personnel is on standby at mixing tank during pumping to monitor fluid level.

84.3. Pumping sequence as per table below:

Pumping Schedule for Tubing Pickling						
Stage	Description	Fluid	Vol (bbl)	Pump Rates (bpm)	Remarks	MASTP (psi)
1	<b>Pickling Solution</b>	7.5% HCl	68	0.5	Tubing Pickling	1,100
2	<b>Displacement Fluid</b>	TIW	*	0.5	To displace all pickling solution in surface treating lines	1,100
Shut in well and soak for 1 hour						
Once complete, open up well & flowback to recover 102 bbls (1.5x total pumped fluid)						
<ul style="list-style-type: none"> <li>• <b>Max WHP is 1,100 psi throughout pumping sequence.</b></li> <li>• <b>Maintain pumping rate throughout the pumping stage. To compare injectivity index pre and post treatment.</b></li> </ul>						

84.4. Ensure that one personnel is on standby at mixing tank during pumping to monitor fluid level.

84.5. Record the following parameters while pumping. Include the following table in daily report.

Time (min)	Pump Pressure (psi)	Volume (bbl)	THP (psi)	CHP (psi)	Remark

85. Close well and **soak for 1 hours** after complete pumping 68 bbls of Pickling Solution.

86. After soaking for 1 hours, flow back well. Volume to recover on surface is at least **102 bbls** (1.5x volume pumped).

86.1. Take 500ml return sample after recovering 102 bbls of liquid on surface.

86.2. Label the sample as "7.5% HCl flow back" along with time and date of sampling.

86.3. Record flow back observation as per table below and include in the daily report.

Time (min)	Observation (oil/water/mixed)	Volume (bbl)	THP (psi)	CHP (psi)	Remark (pH, water cut, emulsion)

87. Once flowback activity is completed (102 bbls fluid recover), inform WSS and close well prior proceed with next step.

**BULLHEADING OPERATION – SISQ TREATMENT**

88. Prior to perform SISQ treatment, proceed to fill up 220 bbls of TIW (1x completion volume) and perform injectivity test.
89. Prepare treatment fluids as per below recipe for pumping activity:

Treated Injection Water			4,200	gals	100	bbls	Description
Products	Concentration		Volume				
Injection Water	992	gptg	4,166	gals	99.19	bbls	Base Fluid
MESB NE-Surf 200	2	gptg	8	gals	0.19	bbls	Non-Emulsifier Surfactant
ACM Oxyfree 100	2	gptg	8	gals	0.19	bbls	Oxygen Scavenger
ACM H2SClear 200	2	gptg	8	gals	0.19	bbls	CO2 & H2S Corrosion Inhibitor
ACM Bact 200	2	gptg	8	gals	0.19	bbls	Microbiocide
<b>Mixing Instruction:</b>							
<ol style="list-style-type: none"> <li>Transfer injection water into mixing tank</li> <li>Add ACM OXYFEE &amp; ACM H2S Clear 200 into the Batch Mixer and circulate the mixture</li> <li>Add NE Surf 200 and ACM BACT 200 into the Batch Mixer and circulate the mixture till homogenous.</li> </ol>							

**Note:** The above recipe is for 100bbls of TIW. Please prepare another batch of TIW if needed.

90. Manipulate surface valve to the following position prior pumping activity:

Valve	Position
Flow Cross Pumping Valve (DB lines)	OPEN
Swab Valve	OPEN
Lower Master Valve	OPEN
Wing Valve	CLOSE

90.1. While opening up swab valve and lower master valve, count turns for future reference.

91. Prior start pumping activity, complete the following:

91.1. Record shut in tubing head pressure (THP) and annulus pressure (. Include in daily report.

SITHP	Annulus Pressure


91.2. Bleed off tubing and casing pressure to 0 psi or to minimum as possible.

92. Open plug valve at the surface line that connects to pump-in tee and start pumping according to the pumping table in **Step 93**.

92.1. **Do not exceed maximum allowable surface treating pressure 1,100psi.**

92.2. Ensure that one personnel is on standby at fluid storage tank during pumping to monitor fluid level.

92.3. While filling up tubing, record THP and CHP as per table below. Include the following table in daily report.

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Time (min)	Pump Pressure (psi)	Volume (bbl)	THP (psi)	CHP (psi)	Remark

93. Proceed with pump TIW to fill up completion volume (**220 bbls**) prior injectivity test as per below table:

Pumping Schedule to Fill up Completion Volume for Injectivity Test						
Stage	Description	Fluid	Vol (bbl)	Pump Rates (bpm)	Remarks	MASTP (psi)
1	<b>Fill-up Completion Volume</b>	<b>TIW</b>	220 bbls or till return is observed on surface without N2 Injection	1.0	220 bbls is calculated based on 1x completion volume (Tubing & Wellbore)	1,100

94. After complete pumping as per above pumping schedule, do not stop pumping and continue pumping at idle rate.

- 94.1. Ensure Baker Hughes EIC is available and witness the injectivity test.
- 94.2. Sustain each pumping rate for 5 minutes after pressure stabilises. For last achievable rate, prolong the monitoring for 15 minutes.
- 94.3. DO NOT exceed MASTP 1,100 psi.
- 94.4. **Proposed injection rate for SISQ treatment is 3 – 5 bpm.**
- 94.5. Begin injectivity test as per table below:


Rate (bpm)	Pumping Pressure (psi)	Time (min)	Volume (bbls)	THP (psi)	CHP (psi)
0.30					
0.50					
0.70					
1.00					
1.50					
2.00					
2.50					
3.00					
3.50					
4.00					
4.50					
5.00					

95. Fill up table and include in daily report. Report the results of injectivity test to WSS, Baker Hughes EIC and DB EIC.

96. Upon completion of injectivity test and get approval from EIC to proceed with main treatment, prepare treatment fluid as per below:

- 96.1. **Ensure that all personnel involved in mixing are in a full required PPE for acid job.**

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<b>DIMENSION BID</b>	DIMENSION BID COILED TUBING SERVICES		 <b>PETRONAS</b>
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<b>Flush Solvent (Mutual Solvent)</b>				<b>20</b>	<b>BBL</b>	<b>Description</b>
Seq	Product	Concentration		Volume		
1	Mutual Solvent (WAW85202)	1,000	gptg	840	gals	Mutual Solvent
<b>Mixing Instruction:</b>						
2. Transfer WAW85202 from IBC/Chemical Drum into Tank and circulate the mixture until homogenous.						

<b>Pre-Flush Solvent</b>				<b>50</b>	<b>BBL</b>	<b>Description</b>
Seq	Product	Concentration		Volume		
1	Injection Water	999	gptg	2,098	gals	Base Fluid
2	SISQ (SCW82451)	1	gptg	2	gals	SISQ
<b>Mixing Instruction:</b>						
1. Prepare injection water into mixing tank						
2. Transfer SCW82451 from IBC into Tank and circulate the mixture until homogenous.						

<b>Main Treatment (SISQ SCW82451)</b>				<b>239</b>	<b>BBL</b>	<b>Description</b>
Seq	Product	Concentration		Volume		
1	Injection Water	900	gptg	9,034	gals	Base Fluid
2	SISQ (SCW82451)	100	gptg	1,004	gals	SISQ
<b>Mixing Instruction:</b>						
1. Prepare injection water into mixing tank						
2. Transfer SCW82451 from IBC into Tank and circulate the mixture until homogenous.						

<b>Post Flush (Treated Injection Water)</b>				<b>741</b>	<b>BBL</b>	<b>Description</b>
Seq	Product	Concentration		Volume		
1	Injection Water	1000	gptg	31,122	gals	Base Fluid
<b>Mixing Instruction:</b>						
1. Prepare treated injection water into mixing tank						

97. Once all fluids are readily mix, prepare for pumping operation.

98. Manipulate Surface valve to the following position prior pumping activity;

Valve	Position
Flow Cross Pumping Valve (DB lines)	OPEN
Swab Valve	OPEN
Lower Master Valve	OPEN
Wing Valve	CLOSE

98.1. While opening up swab valve and lower master valve, count turns for future reference.


99. Prior start pumping activity, complete the following:

99.1. Record shut in tubing head pressure (THP) and annulus pressure. Include in daily report.

SITHP	Annulus Pressure

99.2. Bleed off tubing and casing pressure to 0 psi or to minimum as possible.

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<b>DIMENSION BID</b>	DIMENSION BID COILED TUBING SERVICES		 <b>PETRONAS</b>
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100. Commence pumping as per below pumping schedule:

SISQ Treatment for I-68									
Stage	Description	Pump #1 (Single Pump)			Pump #2 (Micro Pump)			Remarks	MASTP (psi)
		Fluid	Vol (bbl)	Pump Rates (bpm)	Fluid	Vol (bbl)	Pump Rates (bpm)		
1	Mutual Solvent	WAW85202	18.9	1.0					1,100
2	Preflush	0.1% of SISQ in TIW	50	1.0				To condition the well	1,100
3	Main Treatment	TIW	215	2.7	SISQ SCW82451	24	0.3	Scale Inhibitor (10% of SCW 82451 in TIW)	1,100
4	Overflush	TIW	741	3.0				To push SISQ in treatment zone	1,100
5	Post Flush (Tubing Displacement)	TIW	68	3.0				To push Overflush in treatment zone	1,100
6	Displacement	TIW	*	1.0				To displace surface line	1,100
Shut in well and soak for 12 hours									
Flowback well once complete 12 hours soaking									
<ul style="list-style-type: none"> <li>Ensure Baker Hughes EIC is available on-site during main treatment pumping.</li> <li>Optimum pumping rate will be advised by Baker Hughes EIC without exceeding capacity of pumping unit.</li> <li>Injection rate for SISQ treatment is 3-5 bpm.</li> </ul> <p><b>Note: * Volume of surface treating line.</b></p>									


101. Record the following parameters while pumping. Include the following table in daily report.

Time (min)	Pump Pressure (psi)	Volume (bbl)	THP (psi)	CHP (psi)	Remark

102. Upon completing pumping all treatment fluid according to step 100, **soak the treatment for 12 hours.**

103. After complete **soaking for 12 hours**, manipulate surface valve as per the following position and flowback the well immediately to recover the total fluid pumped approximately **1,676 bbls** (1.5x total pumped fluid during stimulation).

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<b>DIMENSION BID</b>	DIMENSION BID COILED TUBING SERVICES		 <b>PETRONAS</b>
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Valve	Position
Flow Cross Pumping Valve (DB lines)	CLOSE
Swab Valve	CLOSE
Lower Master Valve	CLOSE
Wing Valve	OPEN

104. Ensure Chemical Injection Pump is already rigged up at tapping point downstream of wing valve and soda ash is mixed. Refer to table below for soda ash recipe:

Neutralization Fluid (Soda Ash)				50	BBL	Description
Seq	Product	Concentration		Volume		
1	Injection Water	976	gptg	49	bbl	Base Fluid
2	Soda Ash	500	gptg	1,050	lbs	Neutralization Fluid

**Mixing Instruction:**  
1. Prepare injection water into mixing tank  
2. Mix soda ash into tank and agitate until the mixture is homogenous.

105. Start injecting soda ash once acid return or after **809 bbls** of fluid recovered on surface (estimated first acid return on surface). If no acid return observed on surface, continue flow the well without injecting soda ash.


106. Monitor pH of return fluids constantly, every 60 minutes. Stop injecting soda ash when pH reading is equivalent to pH value prior starting treatment.

107. Record the following parameters during monitor well flowback. Include the following table in daily report.

Monitoring Checklist									
Field/Platform/Well : Engineer :									
No.	Date	Time	Choke Size	pH.	% Water Cut	Bbl Counter	FLT	FTHP	Remark
1									
2									
3									
4									
5									
6									
7									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

108. Once flowback activity is completed (**2,628 bbls** fluid recover), inform WSS and handover well to production.


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<b>DIMENSION BID</b>	DIMENSION BID COILED TUBING SERVICES		 <b>PETRONAS</b>
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109. In the event well unable to flow, proceed to **step 111** as stated in **CT Contingency#1**.

110. Proceed with equipment rig down upon receiving instruction to do so.

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## CONTINGENCY #1 - WELL UNLOADING


All depths specified below are in m-MDDF (**Drill floor to THF is 16.9-m as per well diagram**)

111. This contingency run is made in case the well is still unable to flow upon SISQ treatment.
112. Make up 2-1/8" Upward Jetting Nozzle tool as per **BHA#4: 2-1/8" Upward Jetting Nozzle** in Appendix I.
113. Repeat step 8 till 14 in CT Run#1 procedure prior opening the well.
114. Start running in hole coil tubing to the first circulation point depth at **700-m / 2,296 ft MDDF**.
- 114.1. Refer to CT Tubing Force simulation (Orpheus modelling), refer Appendix III.
- 114.2. 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.**
- 114.3. After pull test for every 300m RIH, perform break circulation by pump nitrogen at minimum pump rate permissible to ensure differential pressure between CT and Tubing is not more than 1,500ps.
- 114.4. Maximum coil speed running in hole is **30-50 ft/min**.
- 114.5. Slow down coil speed to **10 ft/min**, 50 ft before and after passing through completion accessories.
- 114.6. Closely observe weight indicator in control cabin while running in hole.
- 114.7. Observe return all the times.
- 114.8. Regularly inform WSS on job status at all times.
- 114.9. Do not exceed operating safety limits **5,000 psi**.
- 114.10. If the well condition differs from original job design, contact appropriate personnel in charge before proceeding.
- 114.11. At all time, while run-in hole, the injector torque control shall be set at the minimum pressure required to move the Coiled Tubing at specified speed.
115. At **690-m / 2,263 ft MDDF**, stop coil 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

116. Upon completion pull test, start pumping nitrogen with rate 300 scf/min until 600 scf/min for 30 minutes while monitoring the returns on surface.
- 116.1. If fluid is observed at surface at a good flow rate, continue lifting until all fluid is recovered.
- 116.2. Constantly monitor & record the return from the well and THP. Periodically take fluid sample and verify the salinity.
- 116.3. If there is no fluid return at surface, continue pumping nitrogen and RIH to the next depth as per table below:

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<b>DIMENSION BID</b>	DIMENSION BID COILED TUBING SERVICES		 <b>PETRONAS</b>
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No.	Stage	N2 Rate		Total N2		Duration		Coiled Tubing			
		SCFM	SCF	Minute	ft/min	From (ft)	From (m)	To (ft)	To (m)	Total Footage (ft)	Remarks
1	Circulation*	300	9000	30	0	2296	700	2296	700	0	
2	RIH	300	7550	25	30	2296	700	3051	930	755	
3	Pull test	300	765	3	20	3051	930	3000	914	51	
4	Circulation	300	9000	30	0	3000	914	3000	914	0	
5	RIH	300	10500	35	30	3000	914	4050	1234	1050	
6	Pull test	300	750	3	20	4050	1234	4000	1219	50	
7	Circulation	300	9000	30	0	4000	1219	4000	1219	0	
8	RIH	300	10500	35	30	4000	1219	5050	1539	1050	
9	Pull test	300	750	3	20	5050	1539	5000	1524	50	
10	Circulation	300	9000	30	0	5000	1524	5000	1524	0	
11	RIH	300	10500	35	30	5000	1524	6050	1844	1050	
12	Pull test	300	750	3	20	6050	1844	6000	1829	50	
13	Circulation	300	9000	30	0	6000	1829	6000	1829	0	
14	RIH	300	10020	33	30	6000	1829	7002	2134	1002	
15	Pull test	300	750	3	20	7002	2134	6952	2119	50	
16	Circulation (Max Circulation Depth at 300 m above I-68 Top Perf)	300	9000	30	0	6952	2119	6952	2119	0	Circulate out liquid until solid N2 gas return at surface
17	POOH	0	0	232	30	6952	2119	0	0	6952	
		Total N2, SCF	106,835	588	MINS						
		Total N2, Gal	1,147	10	HOURS						
		3x Priming	900								
		Dead Volume N2 / Tank	200								
		Total N2 Including 3% Losses	2,315								

117. Please note the maximum depth of circulation is at **2,119m MDDF (1,000 ft above top perf of I-68)**. This is to ensure no nitrogen losses into formation.

118. Stop pumping N2 once get continuous gas return on surface.

119. Once the well start flowing, stop pumping nitrogen and monitor the well flow for **one hour**.


119.1. If the well continues flowing naturally, start to pull coiled tubing out of the hole to surface.

119.2. If the well stops flowing naturally, repeat **step 116** by pumping nitrogen again.

119.3. In the event that after unloading the well was unsuccessful, consult town for further assistance whether to repeat nitrogen unloading.

120. In the event, coil experience high surface weight reading while RIH and Pull test, proceed to mix Metal to Metal friction reducer as per the following recipe and pump at 1.0 bpm through coil.

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<b>DIMENSION BID</b>	DIMENSION BID COILED TUBING SERVICES		 <b>PETRONAS</b>
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Treated Injection Water (3% Friction Reducer)				10	<i>BBL</i>	<i>Description</i>
<i>Seq.</i>	<i>Product</i>	<i>Concentration</i>		<i>Volume</i>		
1	Injection Water	968	gptg	406	gal	Base Fluid
2	IM Lube	32	gptg	13	gal	Friction Reducer
<b>Mixing Instruction:</b>						
3. Prepare sea water in the mixing tank.						
4. Add IM Lube into the tank and circulate the mixture at least 10 minutes until homogenous.						

121. Upon well commencing to flow satisfactorily, POOH CT to surface.

121.1. Pump N2 at minimum permissible rate while POOH. Do not exceed 5,000 psi pumping pressure.


121.2. Maximum coil speed while POOH is 50ft/min.

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

121.4. Do not exceed CT Operating Limit.

122. Once CT on surface, close well, bleed off pressure in coil and stack up and handover well to PCSB.

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<b>DIMENSION BID</b>	DIMENSION BID COILED TUBING SERVICES		 <b>PETRONAS</b>
	ANGSI-A38	SCALE MILLING & STIMULATION	

**APPENDIX I – BOTTOM HOLE ASSEMBLY SCHEMATIC**


**BHA #1: 2.75" Mill Bit BHA**

**DIMENSION BID**

**BHA DIAGRAM #1 - 2.75" Mill Bit BHA**

<b>Client</b>	Petronas Carigali
<b>Field</b>	Angsi A
<b>Job Type</b>	Scale Milling & Acidizing
<b>Job No.</b>	


<b>Well</b>	A-38
<b>Min Restriction</b>	2.69"
<b>BHP</b>	
<b>BHT</b>	249 F

BHA DRAWING	DESCRIPTION	CONNECTION		ID INCH	OD INCH	TOOL LENGTH FT	CUMULATIVE LENGTH FT
		UPHOLE	DOWNHOLE				
	<b>External Dimple CT</b>	1.5" CT	1.5" AMMT PIN		2.125	0.6	0.6
	<b>MHA</b> Disconnect drop ball 3/4" Shear pressure 5,636 psi  Circulating drop ball 5/8" Shear pressure 2,520 psi Burst Disc 5000 psi	1.5" AMMT BOX	1.5" AMMT PIN		2.125	2.5	3.1
	<b>DynaDrill Motor</b>	1.5" AMMT BOX	1.5" AMMT BOX		2.125	11.3	14.4
	<b>2.75" Mill Bit</b>	1.5" AMMT PIN			2.750	1.00	15.4

<b>BHA LENGTH</b>	15.35
<b>MAXIMUM OD</b>	2.750
<b>MINIMUM ID</b>	

<b>Prepared by:</b>	Muhd Ameerul Zaeem
<b>Review by:</b>	
<b>Revision:</b>	
<b>Date:</b>	

<b>ADDITIONAL INFORMATION:</b>
Ensure to measure length and OD of each BHA tool before makeup.


<b>DIMENSION BID</b>	<b>DIMENSION BID COILED TUBING SERVICES</b>		
	ANGSI-A38	SCALE MILLING & STIMULATION	

**BHA #2: 2-1/8" SpinCAT Nozzle BHA**

**DIMENSION BID**

**BHA DIAGRAM #2 - 2-1/8" SpinCAT Nozzle BHA**


<b>Client</b>	Petronas Carigali	<b>Well</b>	A-38
<b>Field</b>	Angsi A	<b>Min Restriction</b>	2.69"
<b>Job Type</b>	Scale Milling & Acidizing	<b>BHP</b>	
<b>Job No.</b>		<b>BHT</b>	249 F

BHA DRAWING	DESCRIPTION	CONNECTION		ID INCH	OD INCH	TOOL LENGTH FT	CUMULATIVE LENGTH FT
		UPHOLE	DOWNHOLE				
	<b>External Dimple CT</b>	1.5" CT	1.5" AMMT PIN		2.125	0.6	0.6
	<b>MHA</b> Disconnect drop ball 3/4" Shear pressure 5,636 psi  Circulating drop ball 5/8" Shear pressure 2,520 psi Burst Disc 5000 psi	1.5" AMMT BOX	1.5" AMMT PIN		2.125	2.5	3.1
	<b>5 FT Straight Bar</b>	1.5" AMMT BOX	1.5" AMMT PIN		2.125	5.0	8.1
	<b>2-1/8" Downhole Filter</b>	1.5" AMMT BOX	1.5" AMMT PIN		2.125	3.2	11.3
	<b>2-1/8" SpinCAT Nozzle</b>	1.5" AMMT BOX			2.125	1.0	12.3

<b>BHA LENGTH</b>	12.30
<b>MAXIMUM OD</b>	2.13
<b>MINIMUM ID</b>	

<b>Prepared by:</b>	Muhd Ameerul Zaeem
<b>Review by:</b>	
<b>Revision:</b>	
<b>Date:</b>	

<b>ADDITIONAL INFORMATION:</b>
Ensure to measure length and OD of each BHA tool before makeup.

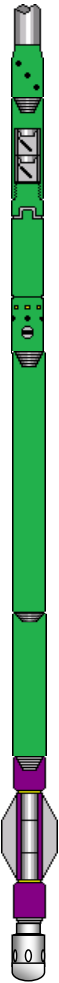
<b>DIMENSION BID</b>	<b>DIMENSION BID COILED TUBING SERVICES</b>		
	ANGSI-A38	SCALE MILLING & STIMULATION	

**BHA #3: 2-1/8" DownJET Nozzle c/w 2.75" Fluted Centralizer**

**DIMENSION BID**

**BHA DIAGRAM #3 - 2-1/8" DownJET Nozzle c/w 2.75" Fluted Centralizer BHA**


<b>Client</b>	Petronas Carigali	<b>Well</b>	A-38
<b>Field</b>	Angsi A	<b>Min Restriction</b>	2.69"
<b>Job Type</b>	Scale Milling & Acidizing	<b>BHP</b>	
<b>Job No.</b>		<b>BHT</b>	249 F

BHA DRAWING	DESCRIPTION	CONNECTION		ID INCH	OD INCH	TOOL LENGTH FT	CUMULATIVE LENGTH FT
		UPHOLE	DOWNHOLE				
	<b>External Dimple CT</b>	1.5" CT	1.5" AMMT PIN		2.125	0.6	0.6
	<b>MHA</b> Disconnect drop ball 3/4" Shear pressure 5,636 psi  Circulating drop ball 5/8" Shear pressure 2,520 psi Burst Disc 5000 psi	1.5" AMMT BOX	1.5" AMMT PIN		2.125	2.5	3.1
	<b>5 FT Straight Bar</b>	1.5" AMMT BOX	1.5" AMMT PIN		2.125	5.0	8.1
	<b>3 FT Straight Bar</b>	1.5" AMMT BOX	1.5" AMMT PIN		2.125	3.00	11.1
	<b>2.75" Fluted Centralizer</b>	1.5" AMMT BOX	1.5" AMMT PIN		2.750	1.0	12.1
	<b>2-1/8" DownJet Nozzle</b>	1.5" AMMT BOX			2.125	0.8	12.9

<b>BHA LENGTH</b>	12.90
<b>MAXIMUM OD</b>	2.75
<b>MINIMUM ID</b>	

<b>Prepared by:</b>	Muhd Ameerul Zaeem
<b>Review by:</b>	
<b>Revision:</b>	
<b>Date:</b>	

<b>ADDITIONAL INFORMATION:</b>
Ensure to measure length and OD of each BHA tool before makeup.

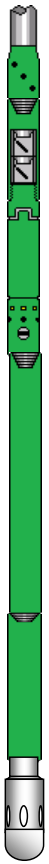
<b>DIMENSION BID</b>	<b>DIMENSION BID COILED TUBING SERVICES</b>		
	ANGSI-A38	SCALE MILLING & STIMULATION	

**BHA #4: 2-1/8" Upward Jetting Nozzle BHA**

**DIMENSION BID**

**BHA DIAGRAM #4 - 2-1/8" Upward Jetting Nozzle**

<b>Client</b>	Petronas Carigali	<b>Well</b>	A-38
<b>Field</b>	Angsi A	<b>Min Restriction</b>	2.69"
<b>Job Type</b>	Scale Milling & Acidizing	<b>BHP</b>	
<b>Job No.</b>		<b>BHT</b>	249 F

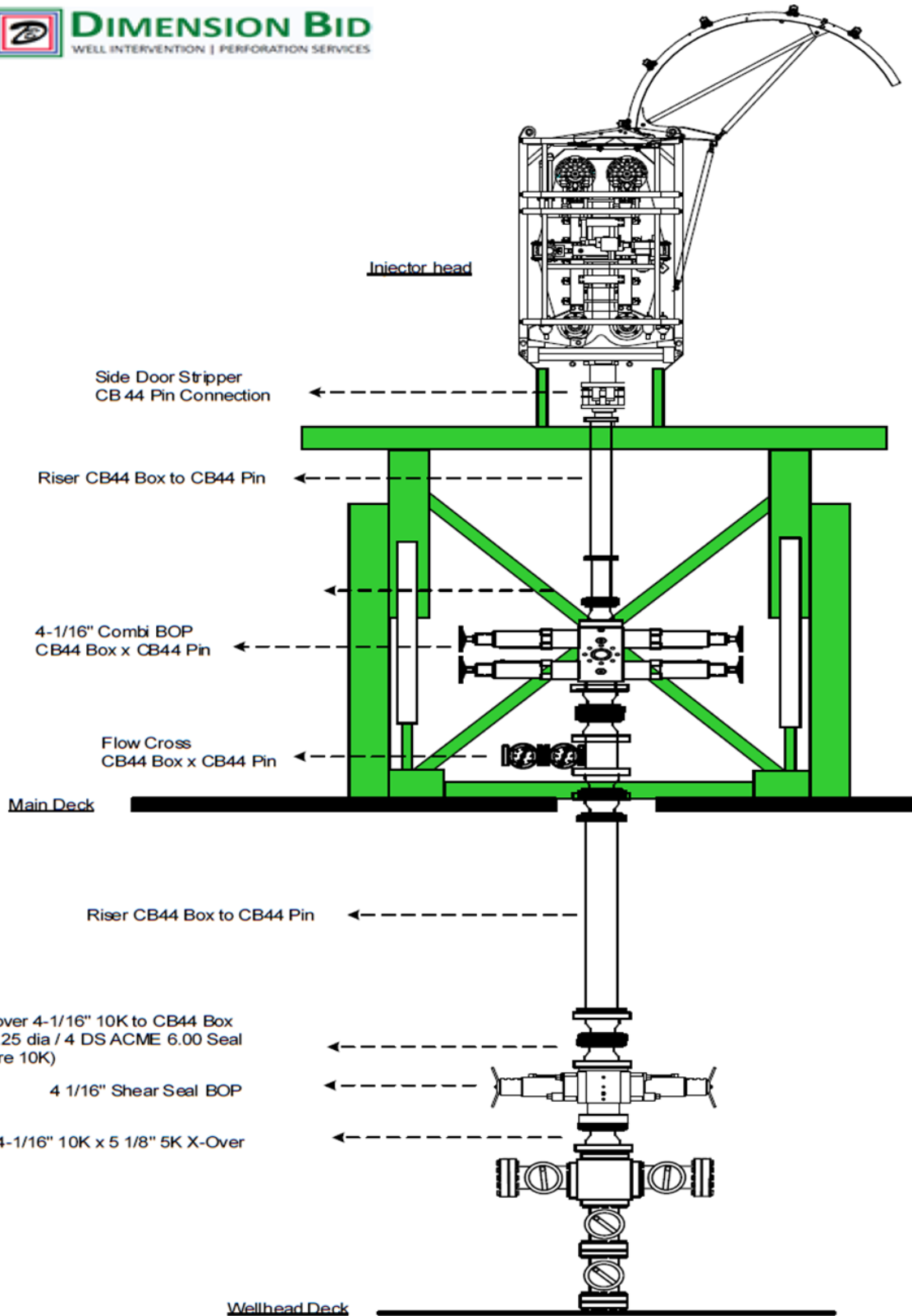
BHA DRAWING	DESCRIPTION	CONNECTION		ID INCH	OD INCH	TOOL LENGTH FT	CUMULATIVE LENGTH FT
		UPHOLE	DOWNHOLE				
	<b>External Dimple Connector</b>	1.5" CT	1.5" AMMT PIN		2.125	0.6	0.6
	<b>MHA</b> Disconnect drop ball 3/4" Shear pressure 5,636 psi  Circulating drop ball 10/16" Shear pressure 2,932 psi Burst Disc 5000 psi	1.5" AMMT BOX	1.5" AMMT PIN		2.125	2.5	3.1
	<b>5 FT Straight Bar</b>	1.5" AMMT BOX	1.5" AMMT PIN		2.125	5.0	8.1
	<b>3 FT Straight Bar</b>	1.5" AMMT BOX	1.5" AMMT PIN		2.125	3.0	11.1
	<b>45° Upward Jetting Nozzle</b>	1.5" AMMT BOX			2.125	0.60	11.7

<b>BHA LENGTH</b>	11.70
<b>MAXIMUM OD</b>	2.13
<b>MINIMUM ID</b>	

<b>Prepared by:</b>	Muhd Ameerul Zaeem
<b>Review by:</b>	
<b>Revision:</b>	
<b>Date:</b>	

<b>ADDITIONAL INFORMATION:</b>
Ensure to measure length and OD of each BHA tool before makeup.

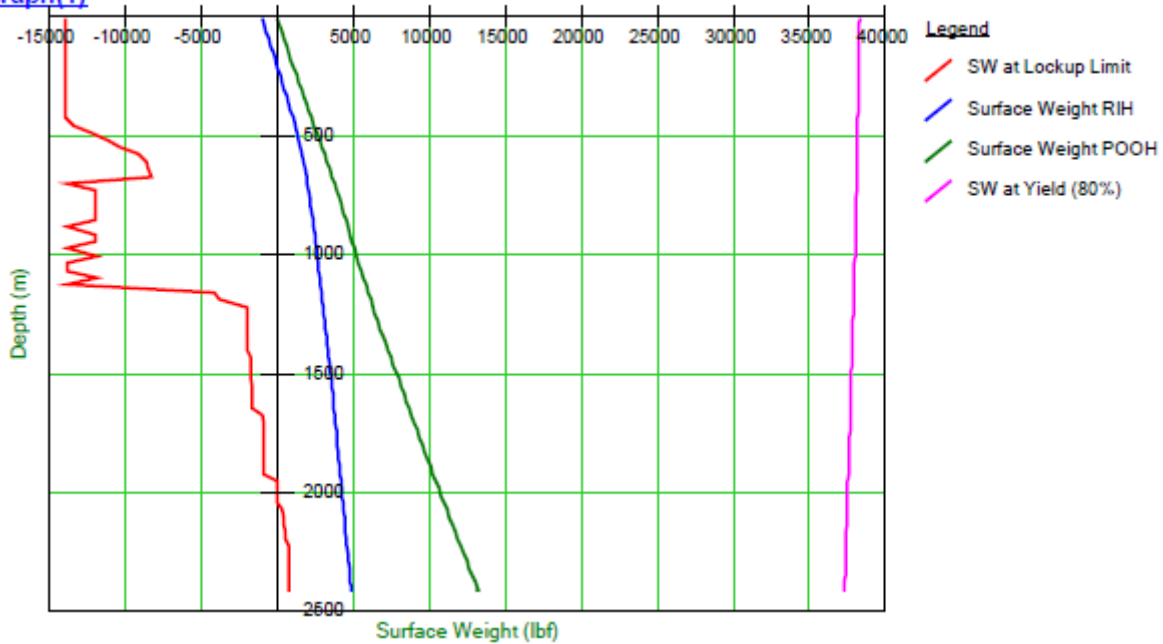
**APPENDIX II – COILED TUBING STACK UP**



**APPENDIX III – ORPHEUS SIMULATIONS**

**TUBING FORCE ANALYSIS (1.1 BPM of TIW with SpinCAT BHA)**

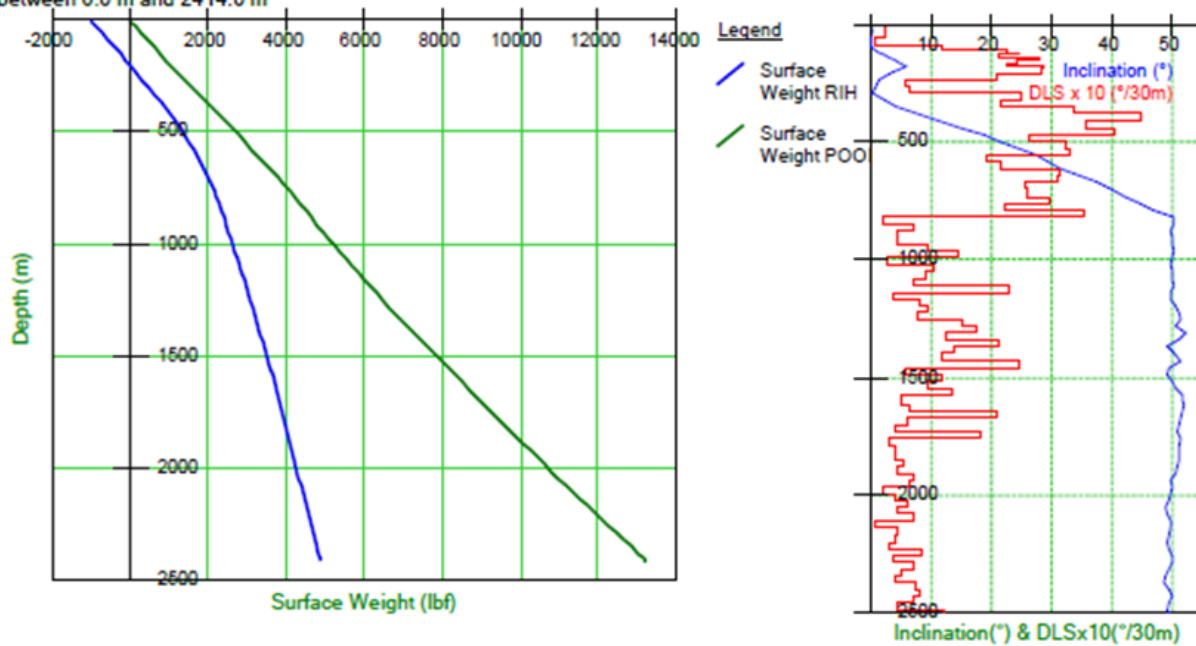
Graph(1)



**RIH & POOH WEIGHT**

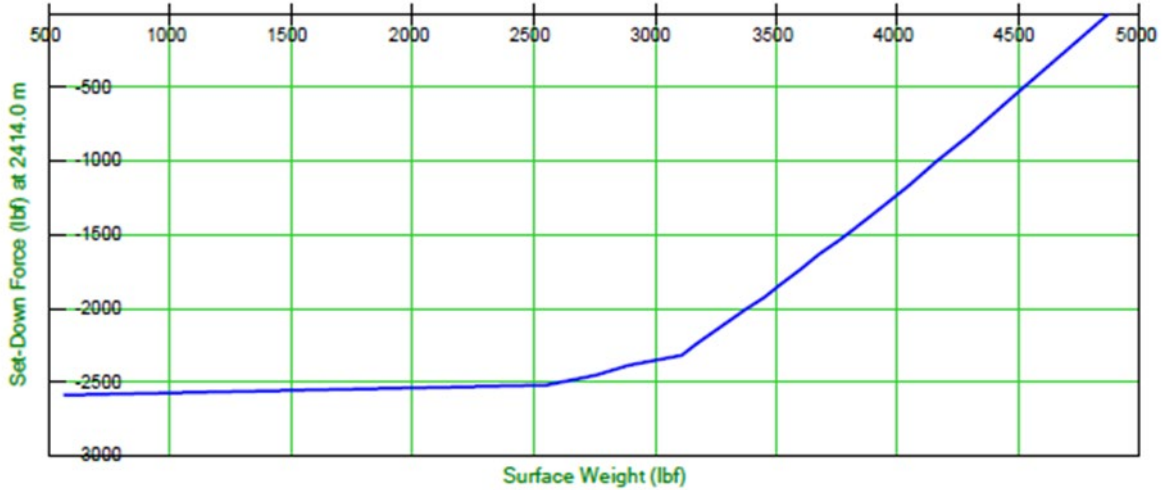
RIH and POOH

between 0.0 m and 2414.0 m



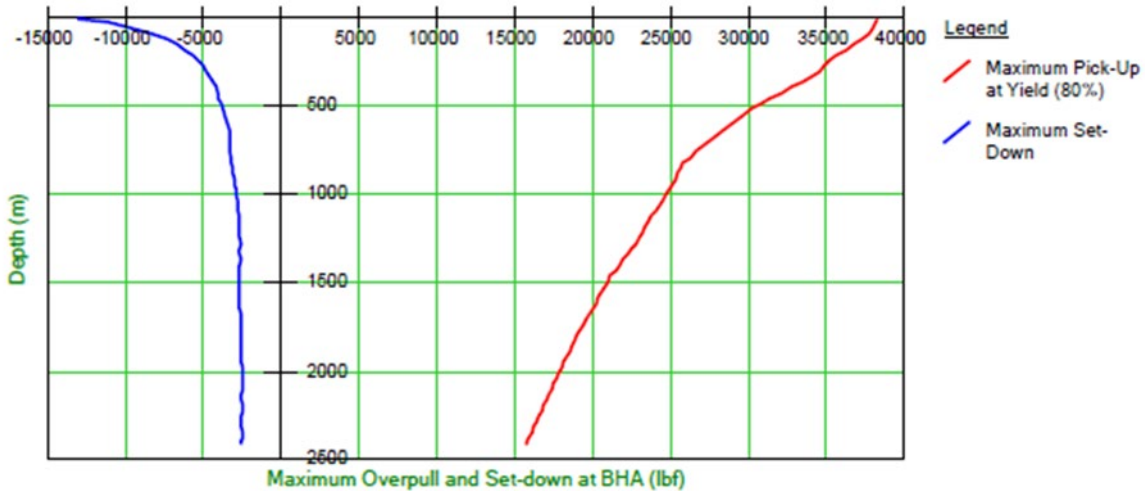
### MAXIMUM STRING SET DOWN LIMIT

MD3 ■ The available set-down force at 2414.0 m is -2584 lbf at the end of the string.  
 The weight indicator reading will be 727 lbf on surface.  
 The minimum available set-down force is -2493 lbf at 2072.6 m.



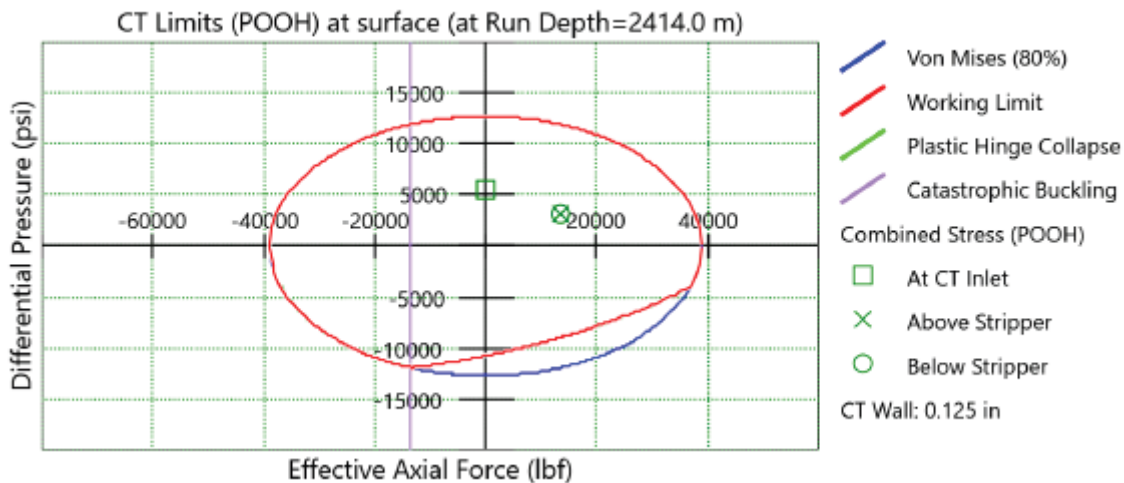
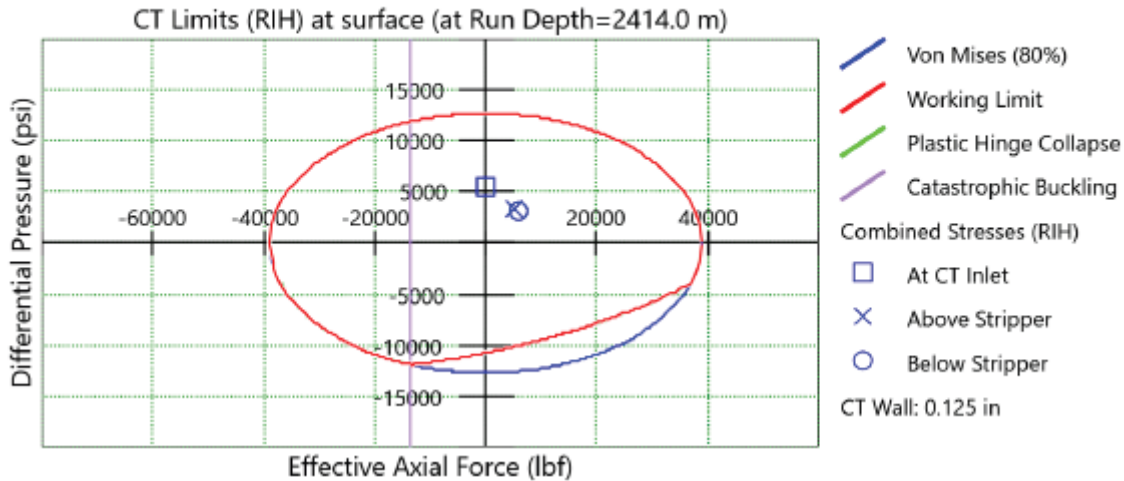
### MAXIMUM STRING PICK UP LIMIT

MD1 ■ The available pick-up at 2414.0 m based on 80% of yield strength is 15723 lbf.  
 The weight indicator reading will then be 37303 lbf.



**STRING LIMIT**

CT Limits



**Summary of Maximum Set Down Weight & Maximum Pick Up Weight at EOT 2,414 -m MDDF**

Parameter	Maximum set down weight (lbf)	Surface weight reading (lbf)	Maximum pick up weight (lbf)	Surface weight reading (lbf)
Max rate at 1.1 bpm of TIW with SpinCAT	-2,584	727	15,723	37,303

### APPENDIX VI – CIRCA CLEANOUT SIMULATIONS



## Circa Clean Out Simulation (CTran) at 1.1 BPM and 50% Fill

#### SUMMARY OF HOLE CLEANING RESULTS

<b>Initial Condition:</b>	
% of fill interval occupied by solids before cleanout ...	50.0 %
Top of fill .....	2372.01 m
Deepest Circulation point .....	2402.49 m
Bottom of fill .....	2403.01 m
Initial Volume of Solids .....	0.4 bbl
Initial Mass of Solids .....	94.3 kg
Solids type:	Carbonate/Silica Scales
Fluid Description:	Water
<b>Penetration Hole Cleaning Mode:</b>	
Penetration rate .....	5.0 ft/min
Penetration time .....	0.33 hr
Solids volume in the well after penetration .....	0.4 bbl
Solids mass in the well after penetration .....	92.9 kg
<b>Circulation Hole Cleaning Mode:</b>	
Hole circulation time .....	1.00 hr
Solids volume in the well after circulation .....	0.4 bbl
Solids mass in the well after circulation .....	92.9 kg
<b>Wiper Trip Hole Cleaning Mode:</b>	
Wiper Trip Scheme:	User Specified rate, Tornado not
Wiper trip time .....	5.97 hr
Solids volume in the well after wiper trip .....	0.0 bbl
Solids mass in the well after wiper trip .....	0.0 kg
<b>Volume of Fluids Pumped During Penetration, Circulation &amp; Wiper Trip:</b>	
Liquid Volume .....	482.0 bbl
Penetration, Circulation & Wiper Trip time .....	7.30 hr

In this simulation, the total clean out time (penetration hour, circulation hour and wiper trip hour) is **7.3 hours**.

#### Cleanout Parameter:

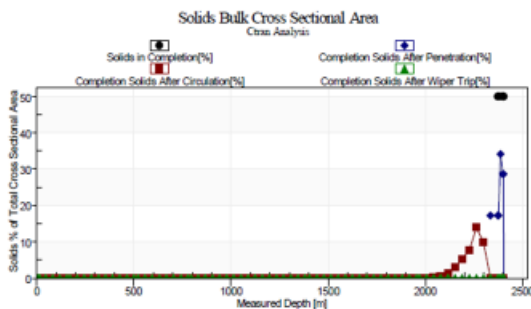
Pump rate: 1.1 BPM  
 N2 Rate: 0 scf/min  
 Cleanout Interval: 2,372 – 2,403 m MDDF  
 Penetration rate: 5 ft/min  
 Wiper Trip: Sweep to 1,857 m MDDF  
 Wiper Trip Speed: 5 ft/min  
 Circulation Pressure: 2,936 psi  
 Avg Annular Velocity: 200-300 ft/min

Based on 50% Carbonate/Calcite Scale assumption present inside tubing (2,372 – 2,403 m), cleanout can be successfully done; **0% solid left in tubing**.

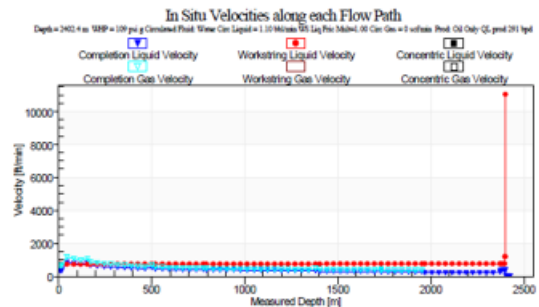
28



## Circa Clean Out Simulation (CTran)




**CIRCA**  
 The graph shows Total Solids Bulk Cross Sectional Area in the tubing after penetration, circulation and wiper trip throughout the intervention. Initial fill was 50%, upon wiper trip, there will be 0% fill left inside the tubing (refer Green Line).



**CIRCA**  
 Refer to light blue and dark blue line for Annular Velocity (AV). Expected average AV is to be around 200 - 300 ft/min at depth 2,400 m.

Measured Depth(Flow)	Temperature	Completion Pressure	Workingstring Pressure	Concentric Pressure	Completion Liquid Velocity	Workingstring Liquid Velocity	Concentric Liquid Velocity
m	Deg. C	psi g	psi g	psi g	ft/min	ft/min	ft/min
2372.0	118.8	1742.6	2113.7	0.0	253	765	0
2375.3	118.9	1746.5	2114.8	0.0	355	765	0
2385.8	119.2	1758.8	2118.2	0.0	388	765	0
2397.8	119.6	1772.9	2122.1	0.0	331	765	0
2398.0	119.6	1772.9	2120.4	0.0	403	1198	0
2398.8	119.6	1773.8	2119.7	0.0	403	1198	0

<b>DIMENSION BID</b>	DIMENSION BID COILED TUBING SERVICES		 <b>PETRONAS</b>
	ANGSI-A38	SCALE MILLING & STIMULATION	

## APPENDIX V – 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 Coiled Tubing 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 Coiled Tubing).

**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 Coiled Tubing.
4. Set up to circulate well to kill fluid through the Coiled Tubing remaining in the well.
5. Make arrangements necessary to fish the Coiled Tubing 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 coiled tubing 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 coiled tubing to surface. Assess the scenario and consider all the risks associated then proceed to pull the coiled tubing 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 coiled tubing to surface.
5. If the leak is catastrophic, run the coiled tubing to HUD; pick up sufficient so that after the coiled tubing is cut at surface by CT BOP shear; the top of the coiled tubing falls below the X-mass Tree. Once the end of the coiled tubing is off bottom, proceed to cut the coiled tubing 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.

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<b>DIMENSION BID</b>	DIMENSION BID COILED TUBING SERVICES		 <b>PETRONAS</b>
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## LEAK IN COILED TUBING AT SURFACE

In the event of a leak in the Coiled Tubing 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 Coiled Tubing reel.
2. If the leak is small or a pinhole leak, POOH and position the leak on the lower part of the Coiled Tubing 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 Coiled Tubing reel. Depressurize reel as much as conditions allow without exceeding collapse limitations of Coiled Tubing.
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 Coiled Tubing) set the Coiled Tubing 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 Coiled Tubing 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 COILED TUBING BELOW SURFACE


If a leak occurs in the Coiled Tubing below the Stuffing Box during down hole operations (usually indicated by a drop in pump pressure or loss of string weight), suspend Coiled Tubing 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 Coiled Tubing around the Injector Head and between the Injector Head and the Coiled Tubing reel.
2. Displace the Coiled Tubing 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 Coiled Tubing out of the Stuffing Box. Continue pumping water at a slow rate through the Coiled Tubing.
3. When the leak in the Coiled Tubing appears above the Stuffing Box, stop the injector and hold the leaking section of Coiled Tubing between the chains and the Stuffing Box.
4. Inspect leak. If leak is minor continue to POOH.
5. If leak is major, or Coiled Tubing is actually severed or well bore fluids are escaping through the Coiled Tubing, continue as per Section 09.2.

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<b>DIMENSION BID</b>	DIMENSION BID COILED TUBING SERVICES		 <b>PETRONAS</b>
	ANGSI-A38	SCALE MILLING & STIMULATION	

## LEAK IN SURFACE PRESSURE CONTROL EQUIPMENT

### Stuffing Box

1. **Stop** Coiled Tubing movement and close both sets of pipe rams to seal Coiled Tubing 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 Coiled Tubing should be clamped at the level wind and Coiled Tubing 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 Coiled Tubing 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 Coiled Tubing 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 Coiled Tubing is in riser and repair leak
2. Perform reinstatement test on surface equipment after leak has been repaired
3. If Coiled Tubing 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 Coiled Tubing 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 Coiled Tubing is stuck down hole, pull to 80% of operating limit before activating Shear Seal BOP, thus allowing the Coiled Tubing to drop below the Xmas tree manual master valve. If the Coiled Tubing 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 Coiled Tubing to drop below the Xmas tree manual master valve. **If at all possible**, the decision to cut the Coiled Tubing 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.

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<b>DIMENSION BID</b>	DIMENSION BID COILED TUBING SERVICES		 <b>PETRONAS</b>
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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 Coiled Tubing 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 Coiled Tubing should be clamped at the level wind and Coiled Tubing 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.

#### COILED TUBING RUNS AWAY INTO WELL


If the inside chain tension system on the Injector Head should fail for any reason, and Coiled Tubing 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 Coiled Tubing.
3. Increase inside chain tension to increase friction on Coiled Tubing.
4. Increase stripper pressure to exert more friction on Coiled Tubing.
5. If these actions fail to make any difference, reduce injector hydraulic pressure to zero.
6. In the event that there is insufficient Coiled Tubing on the reel to reach bottom close Coiled Tubing slips. This action may damage or break the Coiled Tubing. 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 Coiled Tubing 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 Coiled Tubing on the reel to reach bottom.

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

8. Once Coiled Tubing has been controlled, examine Injector Head for damage including chains and POOH.
9. The Coiled Tubing run away may be caused by the injector becoming overloaded with the weight of the Coiled Tubing and fluid in the Coiled Tubing. This situation should not occur if proper pre job planning is done. Correct selection of Injector Head or ensuring Coiled Tubing is full of Nitrogen would prevent this situation from occurring.
10. If a run away 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 run away Coiled Tubing 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 Coiled Tubing comes to a standstill.

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## COILED TUBING IS PULLED OUT OF STUFFING BOX

This situation is most likely to occur when the Coiled Tubing 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 Coiled Tubing from passing through the Stuffing Box. If this situation occurs, stop injector before Coiled Tubing 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 Coiled Tubing at 300ft from surface. Slowly close in the swab valve counting the number of turns. If the Coiled Tubing is still deemed to be across the wellhead, POOH the Coiled Tubing no more than the distance between the top of the wellhead and the top of the Coiled Tubing 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.

## COILED TUBING COLLAPSED AT SURFACE


Collapsed Coiled Tubing 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 Coiled Tubing due to its change in shape. Usually collapsed Coiled Tubing will not pull through the bottom brass bushings on the Stuffing Box.

1. If POOH, immediately run Coiled Tubing 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 Coiled Tubing internal pressure by circulating.
6. Once pressure conditions inside and outside the Coiled Tubing have been optimized, a decision can be taken on how to proceed. If it is not possible to position uncollapsed 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 Coiled Tubing.

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

9. Arrange for clamps to be fitted to Coiled Tubing 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 Coiled Tubing from the well using the Injector Head.
15. Cut Coiled Tubing at the gooseneck and use the rig or a crane to pull the Coiled Tubing through the injector. Re-clamp the Coiled Tubing above the Injector Head and cut off in thirty foot sections (or as appropriate to the crane or rig)
16. Continue pulling and cutting Coiled Tubing until the Coiled Tubing pulled to surface can be pulled by the Injector Head.

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17. Once Coiled Tubing in good condition (i.e. not collapsed) is at surface, set Coiled Tubing slips and pipe rams and make up roll-on connector to Coiled Tubing 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.

## COILED TUBING BREAKS AT SURFACE

If Coiled Tubing 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 Coiled Tubing reel.
5. If the reel capacity is insufficient to hold all of the Coiled Tubing remaining in the well due to uneven spooling resulting from the Coiled Tubing failure, it may be necessary to obtain another reel with sufficient capacity to hold the Coiled Tubing remaining in the well.
6. After consulting with client representative, remove damaged section of Coiled Tubing 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 Coiled Tubing still in the well, continue as per Section 0.

## BUCKLED TUBING

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

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

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

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


If the Coiled Tubing is being run into casing and a large amount of weight is lost suddenly, there is a very good possibility that the Coiled Tubing 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 Coiled Tubing may have broken removing a restriction such as a BHA.
- A loss of string weight due to the Coiled Tubing breaking and falling off.
- An increase in string weight while pulling out of the hole as the buckled portion of Coiled Tubing creates additional drag or needs to be straightened to get through a restricted ID.

In the event Coiled Tubing buckling is suspected, the Coiled Tubing 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:**

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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 Coiled Tubing is buckled close to surface, the buckled Coiled Tubing 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 Coiled Tubing inside the BOP. In this event, open the rams and try to put undamaged Coiled Tubing across the pipe and slip rams.
6. Make arrangements to kill the well and retrieve the remaining Coiled Tubing from the well.
7. If the buckled Coiled Tubing is down hole and cannot be pulled free, consult the client representative as he may want the Coiled Tubing left at TD prior to being hung off in the slip and Coiled Tubing rams.
8. Arrangements should be made to run Coiled Tubing cutter on wireline to retrieve the Coiled Tubing above stuck point.


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

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

**If the Coiled Tubing 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 Coiled Tubing 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 Coiled Tubing.
6. Cut the Coiled Tubing
7. Remove as much of the buckled Coiled Tubing as possible leaving any undamaged Coiled Tubing showing above the Stuffing Box intact so that it may be rejoined later.
8. Bleed the pressure from above the Coiled Tubing rams and undo the connection below the injector.
9. Slowly raise the injector until it is clear of the damaged Coiled Tubing.
10. Cut away any damaged Coiled Tubing, dress the Coiled Tubing and install an inline connector.
11. Run some fresh Coiled Tubing 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 Coiled Tubing suspended below the slips plus 2,000 lbf for friction or CERBERUS prediction, whichever is greatest.
16. Equalize the pressure across the Coiled Tubing rams.

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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 Coiled Tubing will have to be cut.

### **COILED TUBING STUCK IN HOLE PROCEDURES**

There are various scenarios by which Coiled Tubing 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 Coiled Tubing 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 Coiled Tubing became stuck.

In all of the above cases, the Coiled Tubing 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 Coiled Tubing 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 Coiled Tubing is stuck. As a rule of thumb, the depth that the pipe is held at will be the extension of the Coiled Tubing (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 Coiled Tubing/BHA. Maintain maximum circulation through the Coiled Tubing 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 Coiled Tubing.
3. Pump fluid down the backside of the Coiled Tubing to the formation in an attempt to dislodge debris from around the BHA. Potential Coiled Tubing collapse must be considered if engineering this scenario.
4. Displace Coiled Tubing 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 Coiled Tubing.

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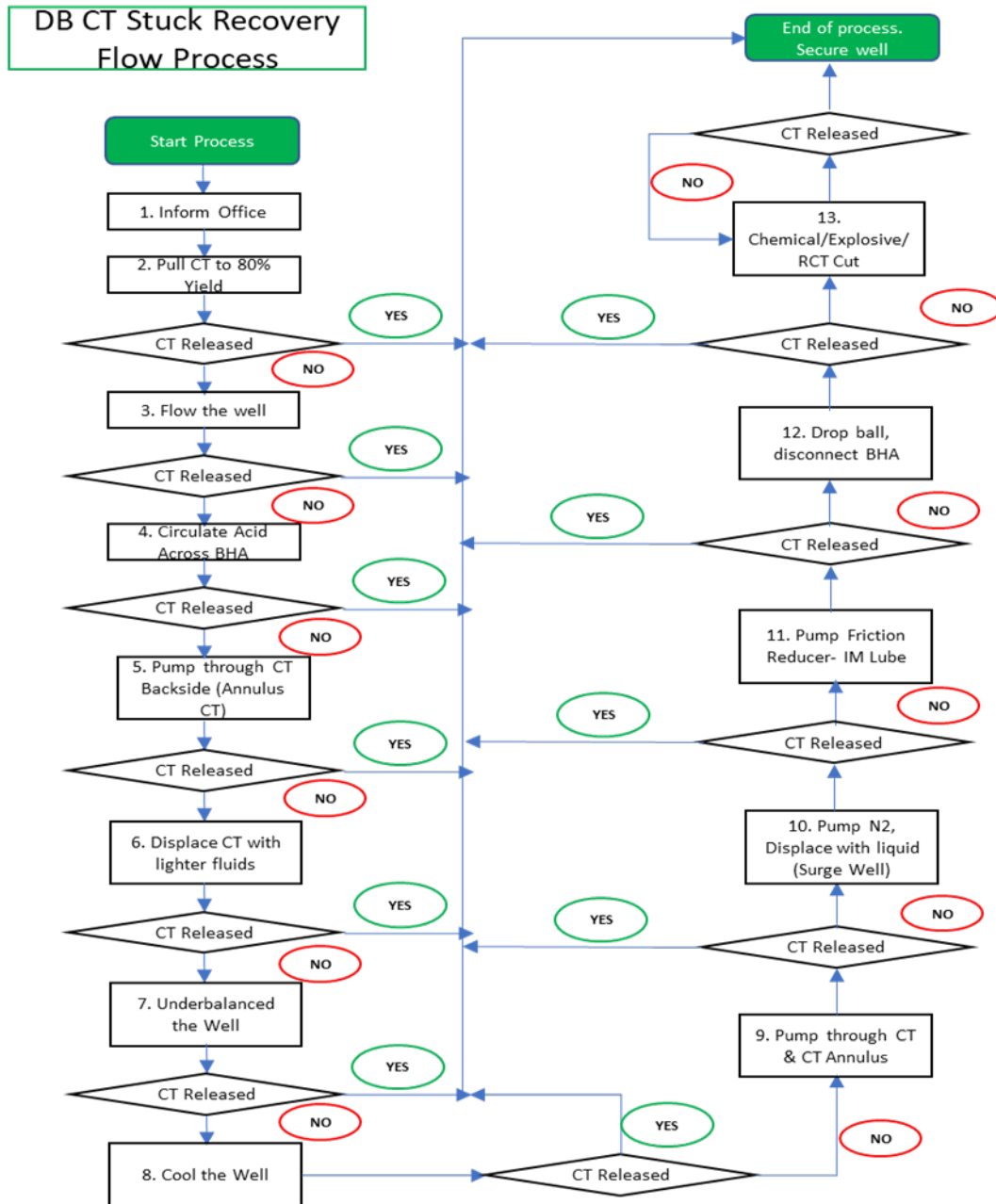
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6. Cool the well if the Coiled Tubing is helically stuck in corkscrewed Production Tubing.
7. Pump down the Coiled Tubing / completion annulus to try and move the source of hold-up.
8. Displace slugs of Nitrogen with water to create a surge effect at the BHA.
9. Pump friction reducer, IM Lube in seawater at 2-3% by volume, down the Coiled Tubing 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 Coiled Tubing 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 Coiled Tubing violently across the gooseneck by frequent intervals.
12. The amount of cycles across the gooseneck must be logged, and if in doubt of the Coiled Tubing fatigue condition, the Engineer must be consulted and the cycles entered into the CERBERUS FATIGUE program, to determine the amount of cycles left available.

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

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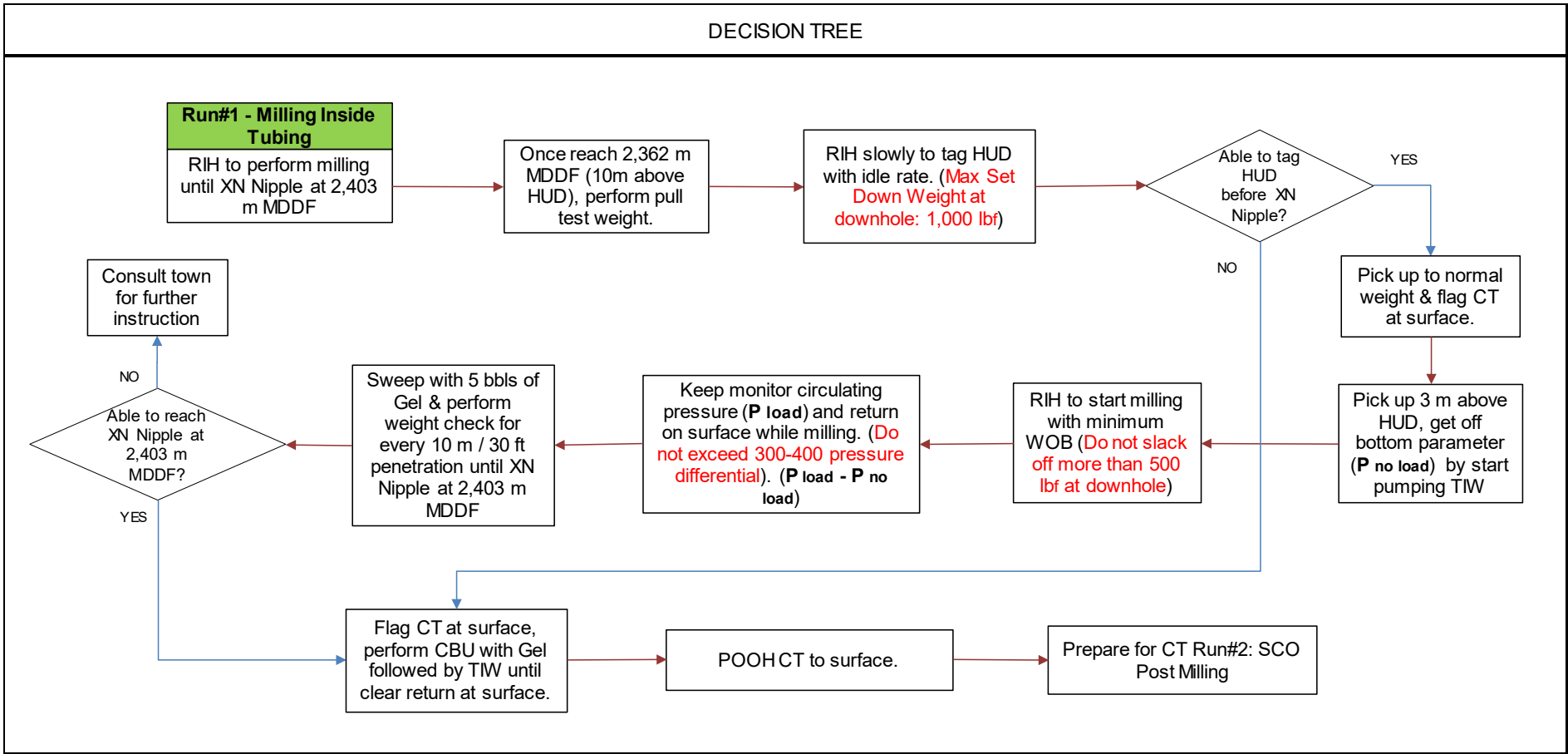
### STUCK CT COIL RECOVERY PROCESS

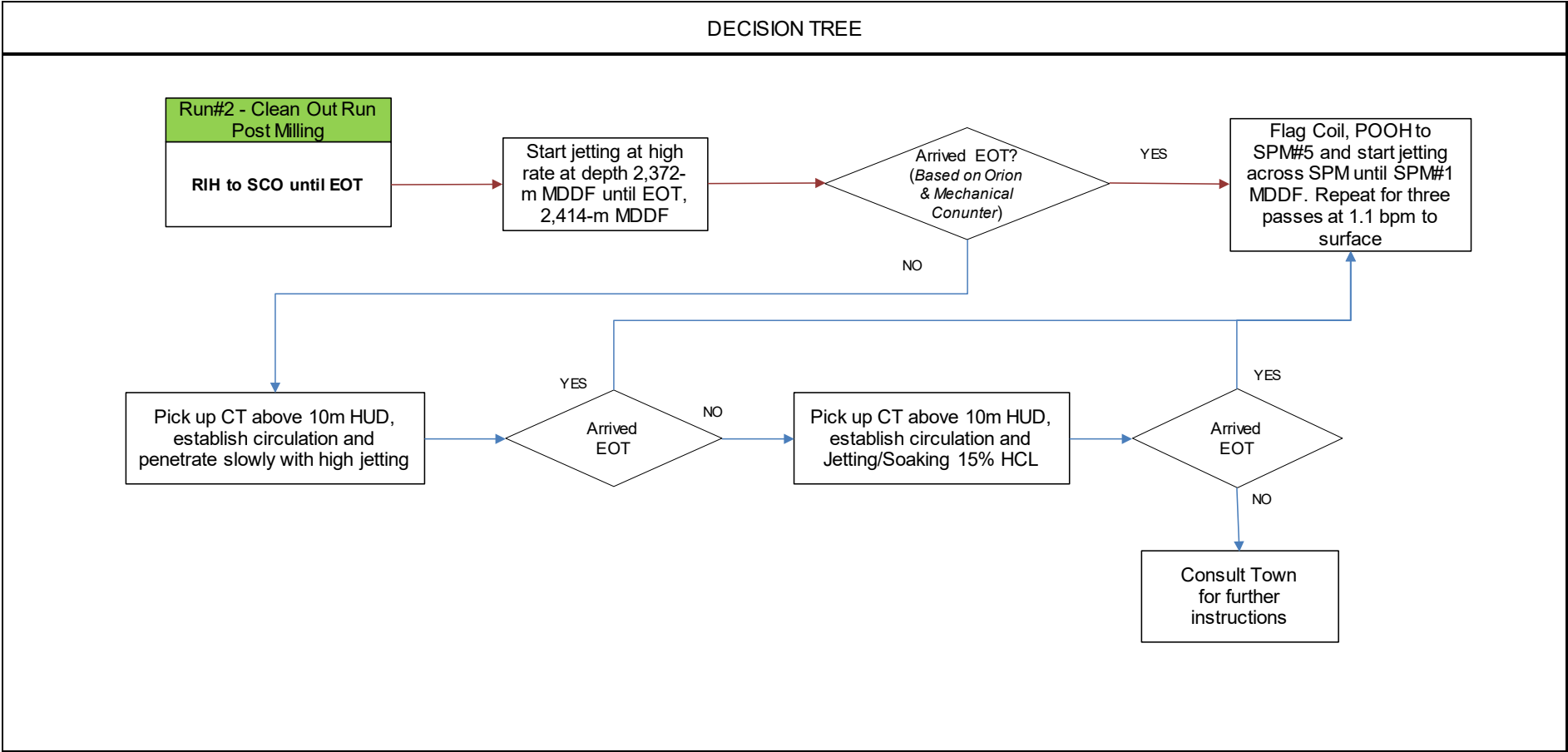


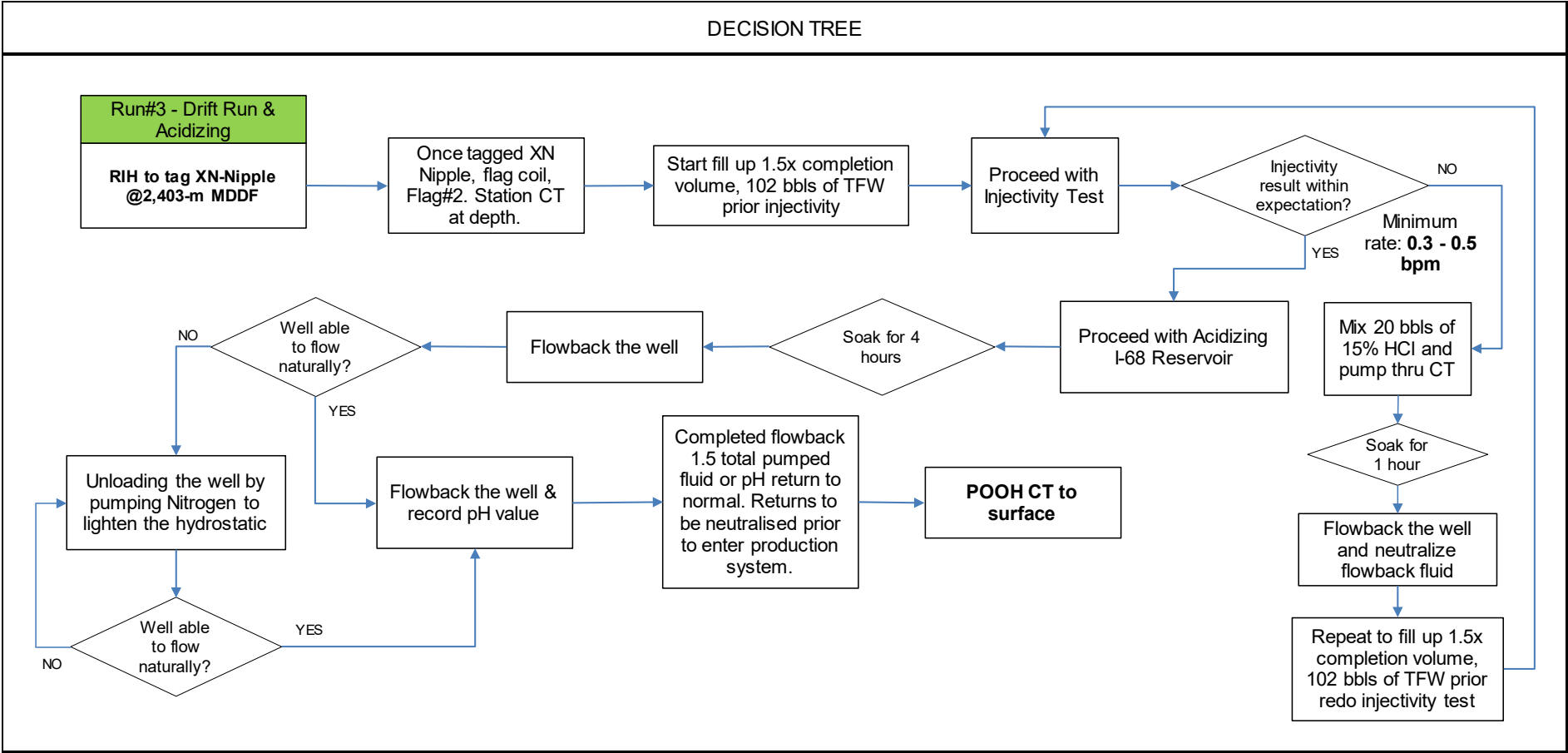
**Precautionary Steps to avoid Stuck while Cleanout in Dual string Completion:**

- 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 – DECISION TREE**









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**APPENDIX VII – SISQ PROPOSAL**

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