



WELL STIMULATION AND COMPLETION PROCEDURE

PCU 296-7A8 and PCU 296-7A9

Operations Engineer: Bola Adeyeye Office: (303)3973606 Cell: (720) 5391660

Objective

Frac and complete the remaining upper zones on PCU 296-7A8 and PCU 296-7A9. Well stimulation will be conducted via Just-in-Time Perforating.

Table 1: PCU 296-7A pad well casing configurations

	PCU 296-7A8	PCU 296-7A9
4-1/2" casing		
Top, ft MD	26	26
Bottom, ft,MD	14,030	13,974
PBTD, ft MD	12,550 (Proposed Bridge Plug)	13,250 (Proposed Bridge Plug)
TOC, ft MD	8170	6950
7" Casing		
Top, ftMD	26	26
Bottom, ft MD	9,655	7,490
3' Marker Joints on 4-1/2" Csg, Top MD	6278, 7240, 9244, 10206, 11169, 12132, 13093	7168, 8155, 9155, 10141, 11130, 12100, 13080

SUMMARY PROCEDURE

1. Observe the wellhead tubing pressure, shut in the well and verify the gauge is functioning.
2. Move in and rig up wireline unit, close the master valve and wing valve. Nipple down the well cap and rig-up pipeline to enable pumping into the well.

3. Open the master valve and pump produce water down the tubing to kill the well, monitor the tubing and tubing-casing annulus pressure and confirm the well is killed/overbalance.
4. Once the well is confirmed to be 'dead', pick-up back pressure valve, run through the production tree and set in the tubing hanger
5. Nipple down production tree and nipple up adaptor spool.
6. Nipple up the BOPE with blind and pipe rams, function and pressure test the BOP to 250 psi low and 3500 psi high pressure
7. Run the 2-3/8" pup-joint through the BOP and thread into the tubing hanger. Pick up on the tubing hanger and gradually trip out of the BOP. Remove the tubing hanger and the rest of the production tubing. Lay-down the tubing and assemble off the pad site to create adequate space for frac operation.
8. Nipple down the BOP, and nipple up the frac valve.
9. Rig down the workover unit and move off the location
10. Move in and rig-up the wireline unit. Nipple down 'well cap', nipple up the wireline BOP, lubricator and test to 3000 psi and 250 psi, high and low pressure respectively
11. Pick up 3.8" gauge ring, open the master valve and run into the hole to approximately 100 ft above the topmost perforation. This will verify the well is clear of any obstruction. Pull out of the well.
12. Pick up the 3.7" Copperhead bridge plug and setting tool, run into the well and set the bridge plug at 150 ft above the topmost perforation, pull wireline out of the well.
13. Pump produce water down the well to pressure test the production casing, pressure test to 9000 psi for 20 minutes. Once passed, bleed-off the pressure; otherwise, call Operations Engineer to discuss forward plan.
14. Nipple down the wireline BOP and lubricator. Rig down and move off the wireline unit.
15. Resume the preparation of the location for stimulation activity.

First Zone of JITP Event

1. PU and RIH (at appropriate speed) with a frac plug, setting tool, and multi-gun JITP assembly to the desired depth for setting the plug (setting depth selected by onsite team with consultation from the wireline operator). Refer to well construction information at the beginning of this document for marker joint depths.
 - NOTE: If it is the first zone in the well, a frac plug and setting tool do not need to be run on the gun assembly.
2. Set the frac plug and pressure test according to "Operational Guideline #1" specified above.
 - If the plug is not set properly, tag the plug with the gun assembly to verify its depth and POOH with the gun assembly. PU and RIH with a new gun assembly and set another plug above the previous plug. Repeat pressure test.
 - If the plug tests successfully, proceed with the operations.
3. Raise the gun assembly to appropriate depth and perforate the zone.

4. Begin pumping the treatment per the pumping schedule. At the beginning of the pad stage, perform step rate test by reducing the rate by 3 – 5 bpm on consecutive steps. Record the rate and pressure on the calculation spreadsheet to estimate the number of opened perforations.
5. Adjust the rate on based on the calculated number of opened perfs to account for 3 bpm for each opened perforation (do not exceed 36 bpm). Continue pumping the job as designed.
6. Conduct another step-rate test stage prior to the over-displacement stage of the design. Drop the rate by 3 -5 bpm on consecutive steps. Record the rate and pressure on the calculation spreadsheet to estimate the number of opened perforations.
7. Launch the same number of ball sealers that correlate to the number of opened perfs in step 6. At the appropriate time at the tail-end of the treatment to ensure the balls arrive prior to the flush stage. Consult with the onsite team as needed for timing of the ball drop. Raise the gun assembly to the next zone to be perforated and prepare to pump the next treatment.
8. Monitor the treatment pressure as the ball sealers are transported downhole. Reduce the pumping rate if needed to provide sufficient room (below the pump kick-out setting) for pressure to rise once the balls seal the perfs. Inform the wireline crew when the balls are within ~1 minute of arrival.
9. When the balls arrive at the zone and the observed pressure rise achieves the desired amount (refer to "Operational Guideline #2" above), fire the gun into the next zone and proceed with the next treatment.
 - NOTE: If a screen-out occurs prior to ball arrival, refer to "Operational Guideline #3" for suggestions on the proper course of action.

Subsequent Zones of JITP Event

10. Pull the gun assembly to the next zone immediately after firing to reduce the chance of gun sticking. (If gun sticking is encountered, refer to "Operational Guideline #4" above for suggested mitigation steps.)
11. Begin pumping the treatment per the pumping schedule. At the beginning of the pad stage, perform step rate test by reducing the rate by 3 – 5 bpm on consecutive steps. Record the rate and pressure on the calculation spreadsheet to estimate the number of opened perforations.
12. Adjust the rate on based on the calculated number of opened perfs to account for 3 bpm for each opened perforation (do not exceed 36 bpm). Continue pumping the job as designed.
13. Conduct another step-rate test stage prior to the over-displacement stage of the design. Drop the rate by 3 -5 bpm on consecutive steps. Record the rate and pressure on the calculation spreadsheet to estimate the number of opened perforations.

14. Launch the same number of ball sealers that correlates to the number of opened perforations in step 13. At the appropriate time at the tail-end of the treatment to ensure the balls arrive prior to the flush stage. Consult with the onsite team as needed for timing of the ball drop and the need to drop extra ball sealers. Raise the gun assembly to the next zone to be perforated and prepare to pump the next treatment.
15. Monitor the treatment pressure as the ball sealers are transported downhole. Reduce the pumping rate if needed to provide sufficient room (below the pump kick-out setting) for pressure to rise once the balls seal the perfs. Inform the wireline crew when the balls are within ~1 minute of arrival.
16. When the balls arrive at the zone and the observed pressure rise achieves the required amount (refer to "Operational Guideline #2" above), fire the gun into the next zone and proceed with the next treatment.
 - NOTE: If a screen-out occurs prior to ball arrival, refer to "Operational Guideline #3" for suggestions on the proper course of action.
17. Repeat Steps 10-16 for each zone of the JITP event prior to the last zone planned for the event.
 - Zip to the next well after finishing each event. After proper notification and confirmation, open the current well to clean-out and recover fluid and ball sealers.

Last Zone of JITP Event

18. POOH (at appropriate speed) with the gun assembly as the treatment is pumped. (If gun sticking is encountered, refer to "Operational Guideline #4" above for suggested mitigation steps.) Do not remove the gun assembly from the well before the treatment is completed.
19. Pump the treatment per the pumping schedule provided by the Operations Engineer.
20. When the treatment is completed, remove the gun assembly from the well.
21. If no additional work will be done in the well during that day, begin flowback operations. The well will be flowed overnight to recover as much fluid as possible prior to initiating the next JITP event. Coordinate gas sales and facilities with operations to optimize sales.
22. If another JITP event is planned during that day, shut-in the well and proceed with preparations for running a new gun assembly with frac plug and setting tool.
23. Repeat Steps 1 - 17 for each of the JITP events planned for that day.
24. After all zones in the well have been treated, RDMO pumping and wireline equipment and all other equipment not needed for the plug drill-out operations.
25. Shut in the two bottom frac valves on each well and ND frac head equipment.
26. Prepare to drill out the frac plugs with stick pipe via workover rig.

PCU 297-7A8		Zone ID	Lithology	Zone		Zonal Feet	Est. Gross Feet	Perfs	
DDEZZ	Well			Bottom Depth	Top Depth			Top Depth	Bottom Depth
990101	7A8 (Red)	18	Cameo	12,410	12,400	10	10	12,407	12,409
990102	7A8 (Red)	19	Cameo	12,390	12,374	16	16	12,384	12,386
990103	7A8 (Red)	20	Cameo	12,345	12,320	25	25	12,335	12,337
990104	7A8 (Red)	22	WF 200	12,250	12,220	30	30	12,237	12,239
990105	7A8 (Red)	24	WF 200	12,170	12,130	40	40	12,152	12,154
991101	7A8 (Red)	25	WF 200	12,125	12,075	50	50	12,102	12,104
991102	7A8 (Red)	26	WF 200	12,060	12,040	20	20	12,052	12,054
991103	7A8 (Red)	27	WF 200	12,015	11,985	30	30	12,002	12,004
991104	7A8 (Red)	28	WF 300	11,965	11,950	15	15	11,960	11,962
991105	7A8 (Red)	29	WF 300	11,945	11,910	35	35	11,930	11,932
991106	7A8 (Red)	30	WF 300	11,900	11,885	15	15	11,895	11,897
992101	7A8 (Red)	32	WF 300	11,852	11,800	52	52	11,828	11,830
992102	7A8 (Red)	33	WF 300	11,785	11,750	35	35	11,770	11,772
992103	7A8 (Red)	34	WF 300	11,735	11,685	50	50	11,712	11,714
992104	7A8 (Red)	36	WF 300	11,650	11,625	25	25	11,640	11,642
992105	7A8 (Red)	37	WF 300	11,436	11,428	8	8	11,434	11,436
992106	7A8 (Red)	38	WF 300	11,384	11,366	18	18	11,377	11,379
992107	7A8 (Red)	39	WF 300	11,236	11,208	28	28	11,224	11,226
993101	7A8 (Red)	40	WF 300	11,120	11,100	20	20	11,112	11,114
993102	7A8 (Red)	41	WF 300	11,072	11,056	16	16	11,066	11,068
993103	7A8 (Red)	42	WF 300	11,004	10,990	14	14	10,999	11,001
993104	7A8 (Red)	43	WF 300	10,976	10,950	26	26	10,965	10,967
993105	7A8 (Red)	44	WF 300	10,832	10,802	30	30	10,819	10,821
993106	7A8 (Red)	45	WF 300	10,698	10,680	18	18	10,691	10,693
994101	7A8 (Red)	46	WF 300	10,640	10,612	28	28	10,628	10,630
994102	7A8 (Red)	47	WF 300	10,580	10,540	40	40	10,562	10,564
994103	7A8 (Red)	48	WF 300	10,470	10,434	36	36	10,454	10,456
994104	7A8 (Red)	49	WF 400	10,340	10,300	40	40	10,322	10,324