

Typical Procedure for a True Fluidic Oscillator (TFO) Coiled Tubing Operation

1. Check well file for the following information: a) minimum I.D. of the tubing string, b) are there any seating nipples, gas lift valves, control valves, etc. and what is the minimum I.D., c) packer depth and I.D., d) end of the tubing, e) if well is an injector, is it on water or CO₂ injection.
2. Check the placement of tanks or pits used for circulating into during the job and for flowback. Check for ability to catch samples from fluid returns. Check that the proper connections and lines are used for flowback and well control.
3. Verify the size and wall thickness of the coiled tubing and select the appropriate connector. If possible use connectors that maintain the same O.D. as the coil tubing. *Check and verify before using connectors or accessories that have a greater O.D. than the coiled tubing.*
4. Attach TFO tool BHA to the coil, rig up CTU to wellhead and pressure test.
5. While TFO tool is being run into the well, it is advisable in most cases to be pumping down the coil through the tool at a minimum rate using water or nitrogen to prevent plugging of the tool string.
6. If the depth of fill or bridges is known, then activate the TFO tool by increasing the pump rate above the activation rate for that size TFO tool before tagging. The recommended pump rate for the 1.25" TFO tool is 1 BPM. The recommended pump rate for the 1.50" TFO tool is 1.75 - 2 BPM. It is best to use straight fluid when washing but when wellbore conditions require, you can also pump N₂ or air. This should be done in a slugging operation by alternating between fluid and gas as the tool functions best with straight fluid. The key to remember is that the best condition for cleaning is for the tool to be submerged in a wellbore fluid that is incompressible in order to provide maximum efficiency in coupling the pulse energy of the tool to the scale or formation. Another item to consider is that it is also desirable to be able to maintain circulation while during CT operations.
7. After a rate has been established and the TFO tool is washing through the scale / fill, it is important to maintain a consistent flow rate. Changing the rates will effect the washing action of the tool, which may result in stringers of scale left behind. Slowing the rate (especially fluid) can result in leaving behind some of the solids due to inefficient sweeping of the annulus.
8. While washing hard scales and fill it is best to move at a slow feed rate. The operator should be able to set the coil injector so that it "feeds itself" into the well at 2 – 10 FPM. It may be necessary to "set down" on the bridge / fill to get through it. If this is necessary, caution must be exercised by the operator not to damage the coil string.
9. If the coil tags hard and will not go any further, pull back up hole approximately 20 – 30 feet. Go back into the hole very slowly for the last five feet or so and let the tool wash through the bridge. It may be necessary to repeat this step a few times. If the bridge will not wash away, spot 1 – 2 bbls of acid on top of it, close the annulus and continue to wash. After getting through the top "crust", open the backside again.

10. After reaching the desired depth, make at least 4 passes across the perms at 5 – 20 FPM while pumping water. The backside should be open for this for sample catching. Circulate the wellbore clean. Close annulus and check the injection rate into the formation. After establishing rate, open the annulus.

11. Start pumping acid (or other chemical treatment) down the coil. When the acid reaches the end of the coil, resume moving it through the interval. You should make at least two passes across the perforations or open hole.

12. The slow trip speeds with the coil are critical to reducing the number of cycles on a coil string. Moving the coil at slower speeds may be time consuming, but it will ensure proper placement and maximum results of the treatment.

(Example: Wash and acidize a 100' interval with 50 bbls acid at 1 BPM
100' at 20 fpm = 5 barrels per pass which equals 10 passes
100' at 5 fpm = 20 barrels of fluid per pass which equals 2.5 passes)

13. Some units are unable to maintain slow feed rates in both directions, but this is easily compensated for.

14. The coiled tubing x production tubing annulus should be monitored at all time for pressure as this will be a good indication of what is happening downhole.