

# M-Bubble Water Shut-Off Application

Additive manufactured Metal-Bubble Plug deployed and set on coiled tubing for a water shut off application in a highly deviated well.

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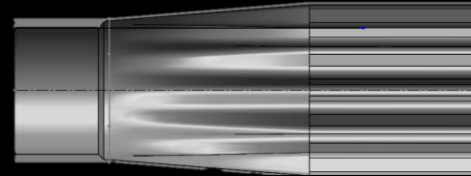
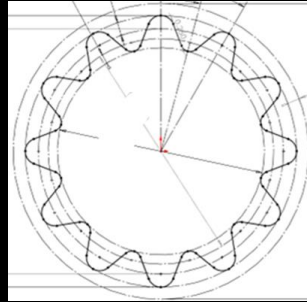
# M-Bubble Technology

- Inconel alloy unfolding metal mandrel (M-Bubble) with elastomer outer seal.
- Unfolded metal mandrel provides support for elastomer at close to sealing diameter.
- Facilitates high pressure rating at high expansion ratios, at temperature.
- Elastomer can utilise high performance compounds not easily possible with other sealing technology.

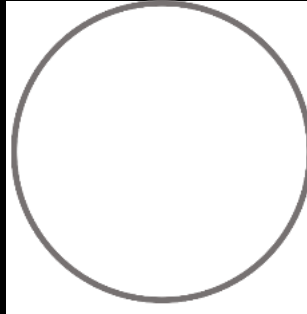


# Unfolding Method

When RIH the metal bubble is folded.



When internal pressure is applied, the bubble unfolds to fill the casing.



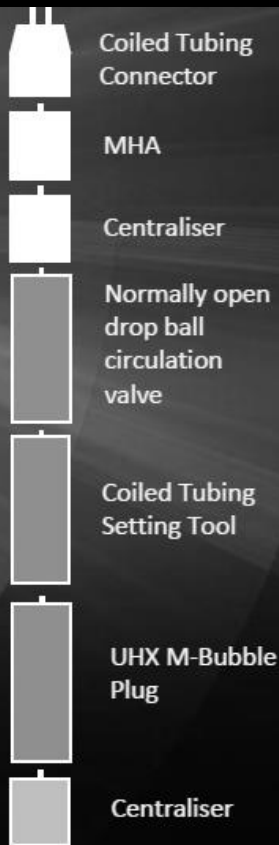


## Water Shut Off Application

- Set in 5-1/2" 17 lb/ft Liner.
- Setting ID 4.95" (5 1/2" 17 lb/ft).
- 2-1/8" OD Tool.
- 245% expansion, sealing to 3,500 psi.
- Highly deviated well.

# Coiled Tubing Deployment

1. Rig up coiled tubing
2. Run assembly to depth and correlate
3. Drop ball to circulate through bore
4. Flow activate setting tool
5. Slips set mechanically in casing
6. Flow activated setting tools pushes fluid into expanding element which expands to set in casing
7. Fluid is sealed into expanding element
8. Flow activated setting tool disconnects from plug
9. Pull up to confirm string is off the plug
10. Pressure test plug to confirm seal integrity
11. Pull running string out of hole.



## Considerations

### Safe Deployment

- Protect M-Bubble Plug from unexpected pressure surges or accidental pump rate increase.
- Use Normally Open Drop Ball Circulation Valve

### Centralisation

- Deviated wells.
- Ensure M-Bubble expands evenly.
- Install centraliser or second set of slips below element.

# Coiled Tubing Setting Tool

- 5 stage tool: 15,000 lbs of force @ ~1500 psi.
- Staged so that initial pressure partially sets slips, continuation further sets slips and inflates bubble element.
- Pressure relief valve prevents over-pressuring of element.
- Continuation of applied pressure and load would apply full force of setting load to slips and shear the shear stub, subsequently releasing the setting tool from plug.



# M-Bubble Summary

- Unrivalled 300% OD transformation
- In-flow, thru-tubing, high-pressure deployment
- Permanent plugging, zonal isolation, cement retainer, hanger, workover, abandonment
- Oil and gas, CCS and gas storage.

With industry-leading OD transformation and high-pressure, in-flow deployment capability, our M-Bubble solutions help to solve complex plugging, sealing and isolation challenges in a variety of wells.

For wells with narrow restrictions or with small diameter completion tubing, this technology provides the ideal diameter delta and strength to deliver a reliable seal in lower sections of the well that may be up to three times wider.

These outstanding solutions are suited to completion, production optimisation and abandonment applications in oil and gas wells and enable the repurposing of wells for carbon capture and gas storage by enabling the plugging of the lower completion.





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