



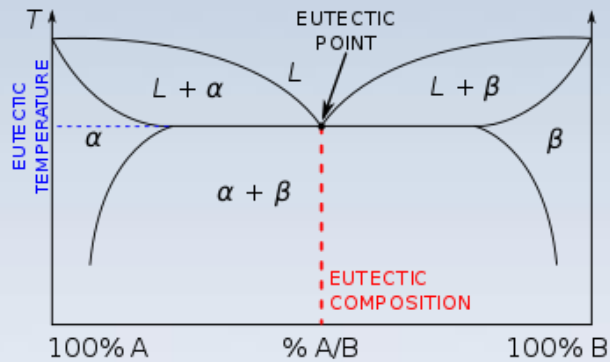
Sealing Solutions

Wel-lok M2M



M2M Sealing Solutions

Why Bismuth-based Alloys?



Eutectic Metal



Expands like ice



Viscosity similar to water



Corrosion resistant



Dense – SG 10



Works Like a Candle



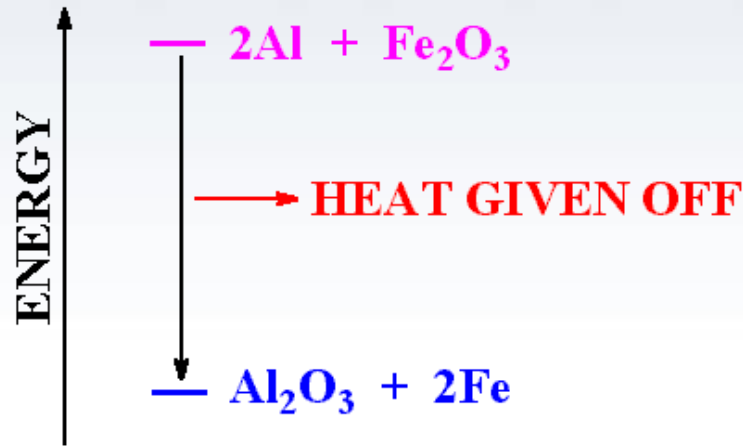
Alloy Viscosity & Expansion

https://www.bisn.com/portfolio_page/alloy-solidifies-in-glass-bottle/

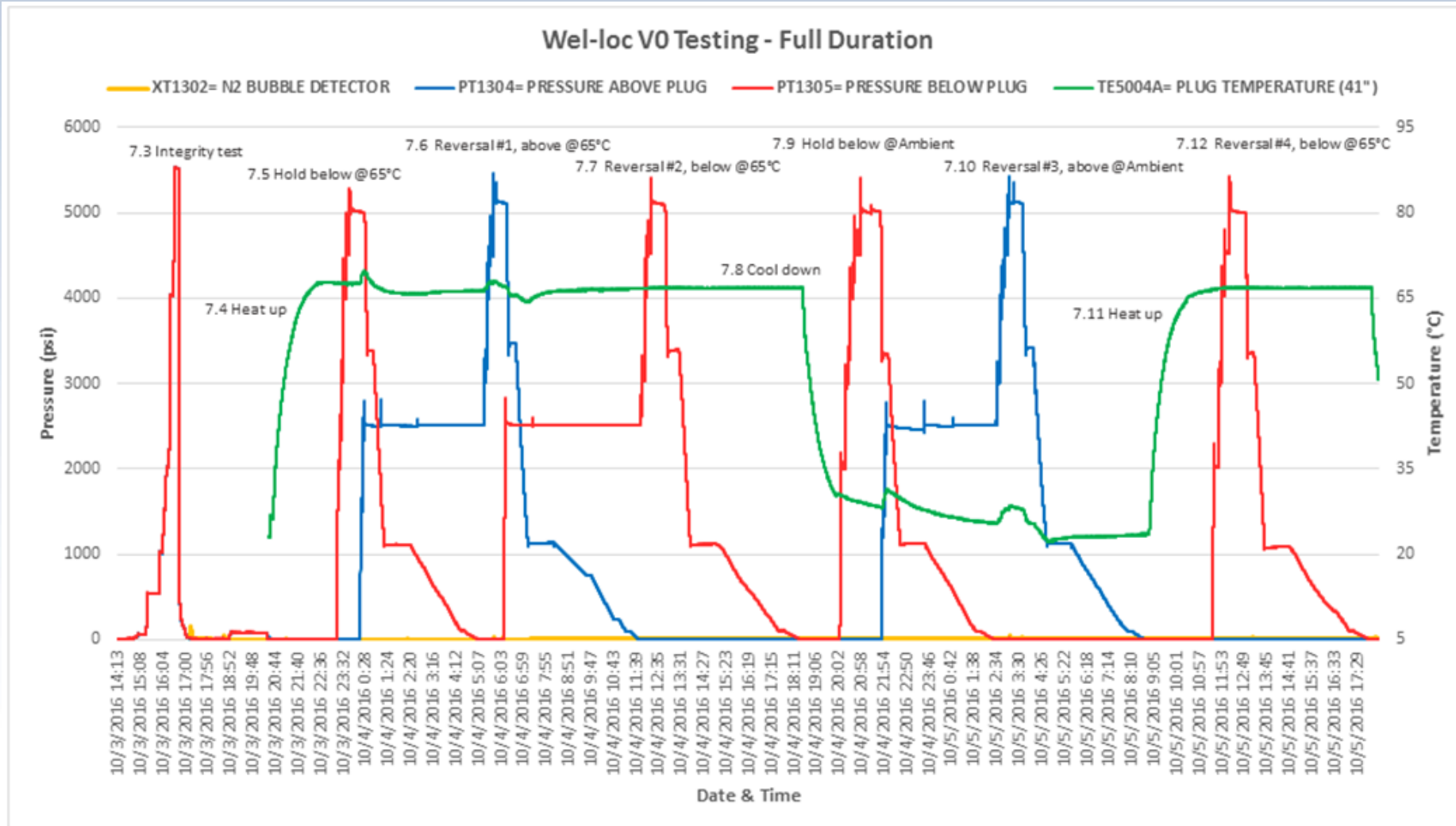


M2M Sealing Solutions

The Thermite Reaction



Independent ISO 14310 VO Testing



April 2017 Offshore Norway

Wel-lok M2M TS

• Problem

- P&A plug inside 5" liner
- V0 rated mechanical plug and cement previously set
- Gas pressure at surface leaking past existing plug up ~1,200 psi

• Solution

- Set 3.45" OD Wel-lok M2M TS
- Pressure tested to 4,200 psi
- Initial inflow test charted
- One year monitor of well for pressure buildup

Inflow Test



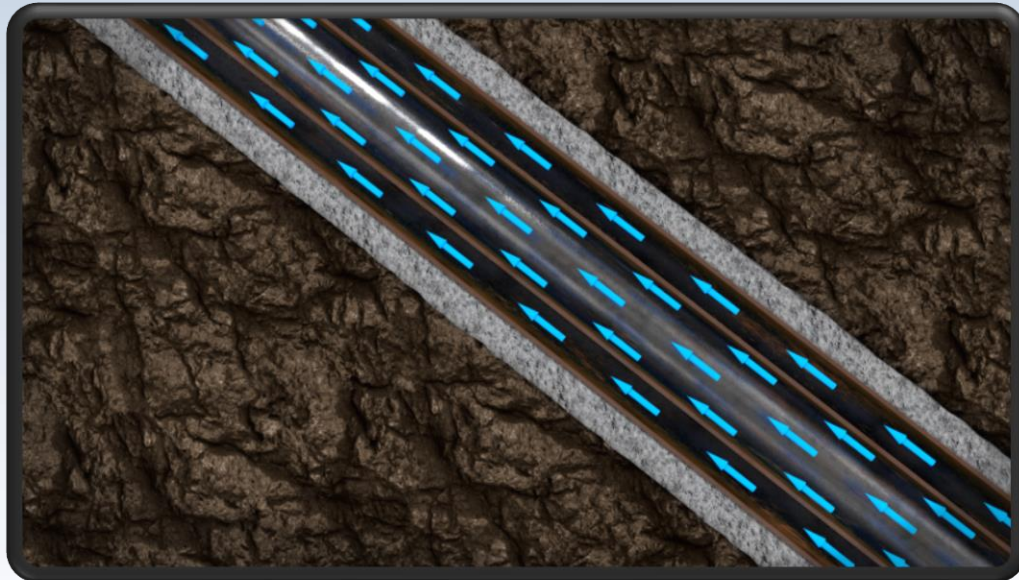
5.5" Tubing Seal

- **Problem:**
 - 5.5" Tubing, 90C fluid, 40deg deviation
 - Seal tubing and remove heater
 - 5,000 PSI differential required
- **Tool:**
 - Alloy: High Temp
 - Pressure actuated anchoring skirt
 - Heater: 2-7/8", Tool OD: 4.25"



Wel-lok M2M STC

Provide a Permanent Seal in Multiple Annuli

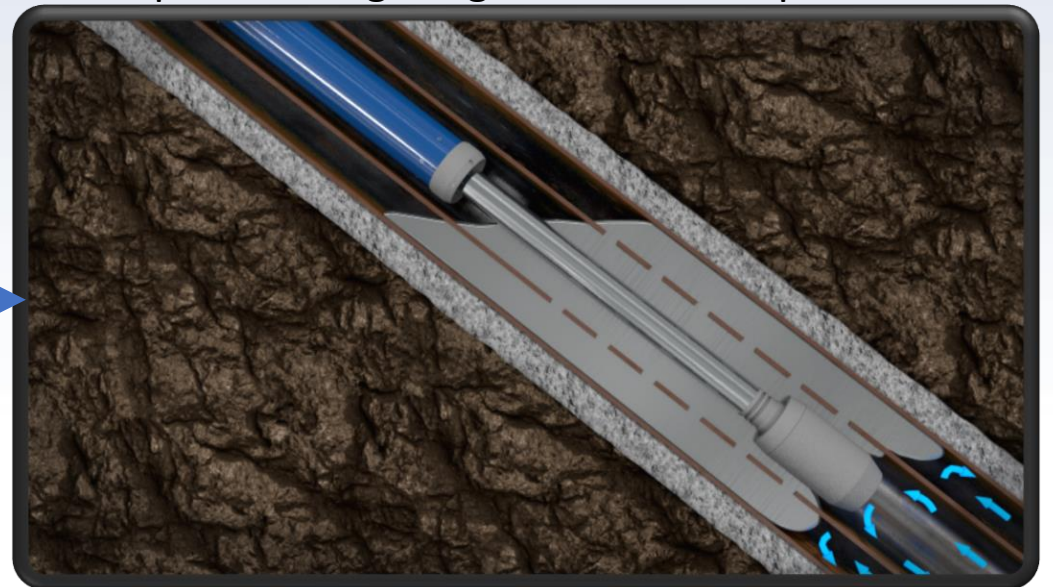


Pressure in the "A" annulus

BEFORE

AFTER

STC provides a gas tight seal in multiple annuli



M2M Sealing Solutions

Open Annulus



- Uses only the annulus fluid to solidify the alloy
- Pressure tested to 5,000psi
- Developed during 2017
- Ran on Valhall North Sea: April 2017

13 3/8" x 20" STC - Results

- **Method**

- Drill large holes in inner casing
- Break cement loose
- Flow to remove cement
- Set BiSN plug, remove heater

- **Qualification method**

- Hydro test (Cycle)
- Gas test

- **Field test Q3 2018**



9 5/8" x 13 3/8" x 20" STC - Results

- **Method**

- Drill large holes in inner casings
- Set BiSN plug

- **Qualification method**

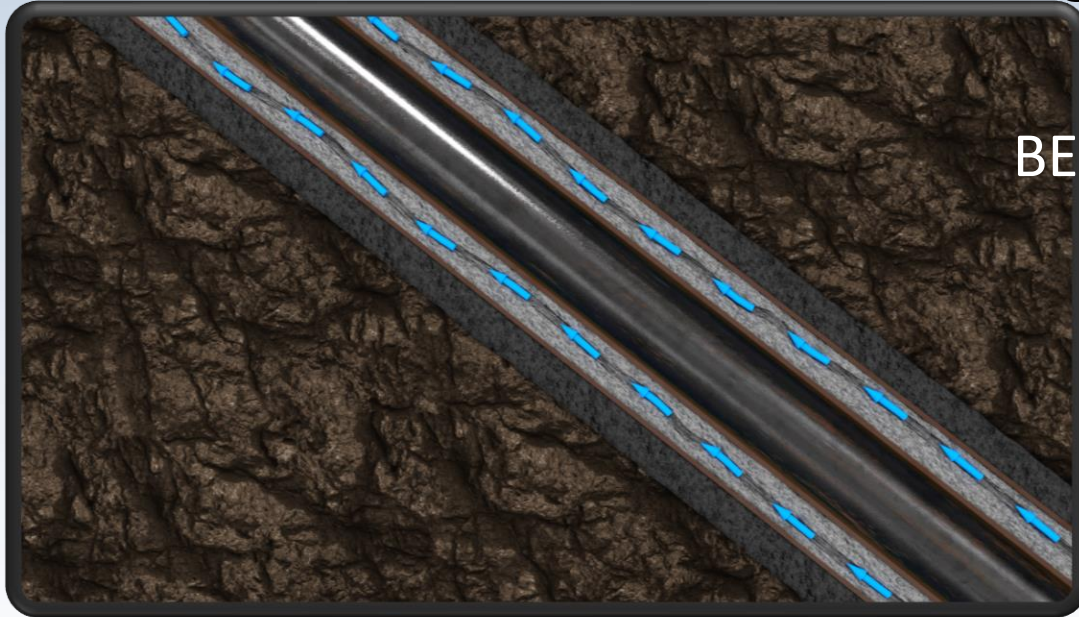
- Hydro test to 3,000 psi differential

- **Field test Q4 2018**



Wel-lok M2M CRT

Eliminate Gas Migration in Cemented Annuli

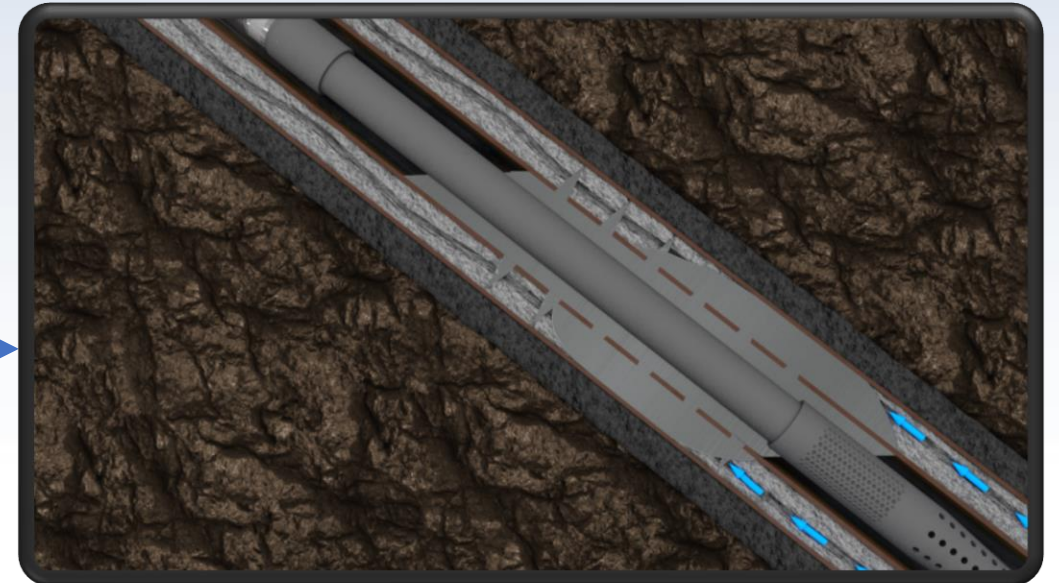


BEFORE

Casing vent flow through channeled cement

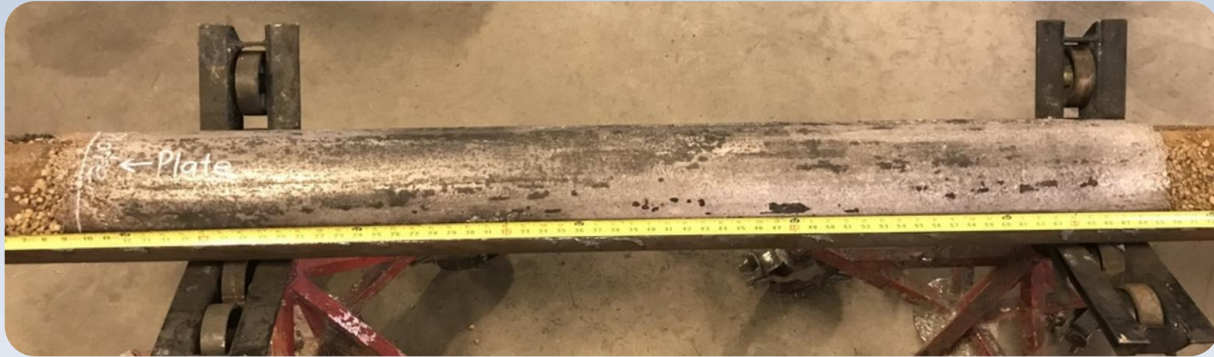
AFTER

CRT provides a gas tight seal in a cemented annulus



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Wel-lok M2M CRT



Gas tested to 2,500 psi
with nitrogen for 24
hours with no bubbles

Wel-lok M2M MXD

- Run through tubing or restriction
- Seals inside a large diameter casing or open hole
- Alloy in pellet form, deployed downhole in a bailer
- One-trip deployment

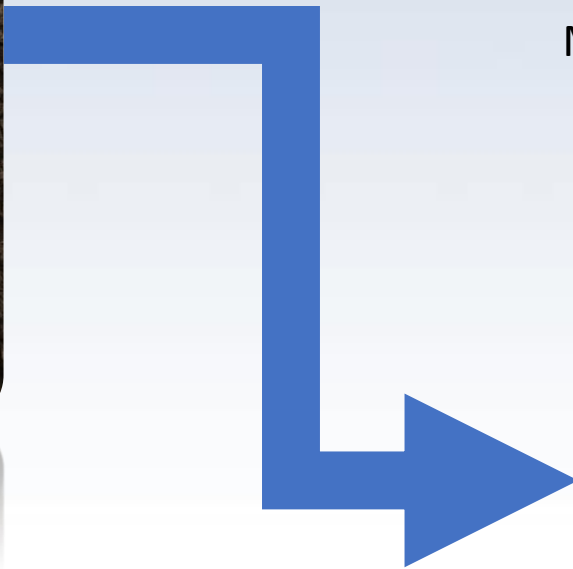


Wel-lok M2M MXD

Provide a Seal in Through Tubing Applications, Wells with Restrictions & Large Diameter Casings



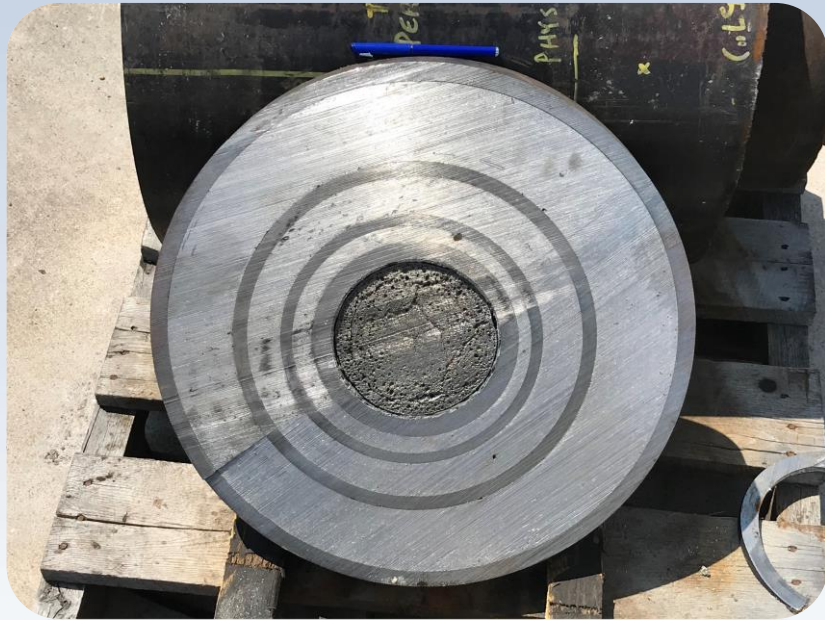
Alloy beads deployed in a bailer



MXD provides a gas tight seal in through tubing applications in a single deployment

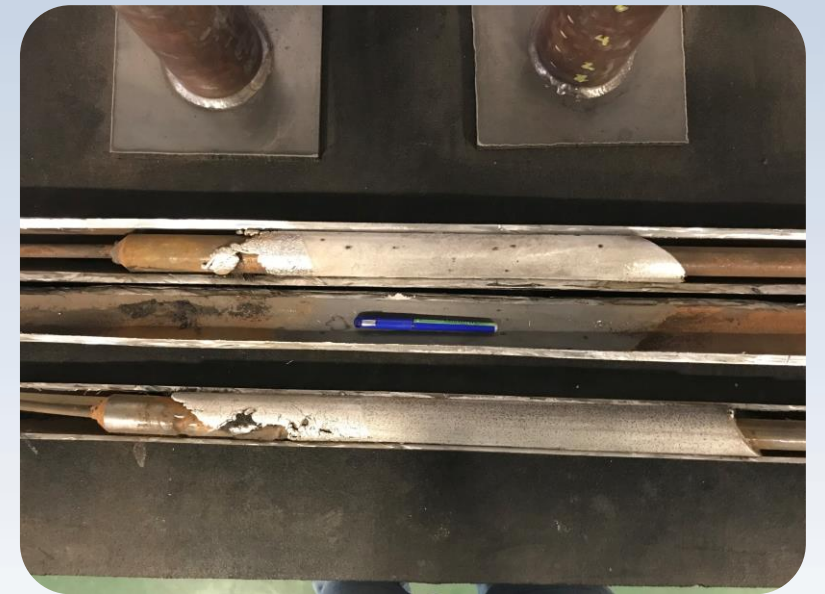


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*9 5/8" x 13 3/8" x 20"
Casing Seal*

Tools of All Sizes



2" Coil Tubing Seal

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