Externally Banded Capillary Strings

Multiple Options For Multiple Artificial Lifts
Metalurgy

- Why metallurgy is important!

  - Considerations
    » Partial pressures of $\text{H}_2\text{S}$ & $\text{CO}_2$
    » Chlorides, BHT and pH
    » Depth
Corrosion Metallurgy up to 230 degrees

Susceptibility of CRA to Pitting and Crevice Corrosion in Acid Brine

MILD ENVIRONMENT

- Inconel 625
- Duplex 2205
- 304 Stainless

Region Of Most Oil Field Brines

Chloride Concentration, ppm (MILD ENVIRONMENT)

Acidity, pH
Corrosion Metallurgy 230-390 degrees

Susceptibility of CRA to Pitting and Crevice Corrosion in Acid Brine

MODERATE ENVIRONMENT

- Inconel 625
- Duplex 2205
- 304 Stainless

Region Of Most Oil Field Brines

Weatherford®
External and Internal Capillary Injection Installations

“A Chemical Delivery System”

- ¼” or 3/8” Capillary Injection Tubing
- Installed Near End of Production Tubing
- Primarily Used for Inhibitors (Oil Production)
- External With or without Capillary TAC
Primary Focus

• What if you could help eliminate rod parts and tubing leaks?

• What if you could lower your chemical cost and downtime?

• No more batch treatments and shutting wells in.

• Reducing failure rates and improving well profits!!!
Externally Banded Capillary Treatment Methods

- Cap String
- Gas Lift Mandrel
- Tubing Anchor
- Rod Pump
- Perf Sub
- Internal Injection Through GL Mandrel
- Banded Capillary Back side Injection
Issues with Conventional Tubing Anchors

- Sometimes it takes multiple turns to set
- Cannot get capillary through it
- Everything below it exposed to well conditions
Injection Tubing Anchor

• Reciprocating Rod Pump Tubing Anchor (Anchor only)

• By-Pass Area for ¼” and 3/8” Capillary Injection Tubing

• Allows for Injection Point Below Tubing Anchor Near Pump (high and low fluid levels)

• Perfect for Extended Perforation Interval and Horizontal Completions

• Tubing and rod protection
Injection Tubing Anchor

- Made out of 4130. With a controlled hardness of 18-20 Rockwell.
- NACE approved for H2s and CO2
- QTQ coated
- ¼ turn to set and pick up to unset
- Running procedure available
- 4.5”, 5.5” and 7”
Downhole below the TAC

- Production Tubing
- Perfs
- Capillary String
- Injection Valve
- Tubing Inlet
Capillary Injection TAC

Capillary String

Slips

5000# shear pins
Maximum 55000#

6 drag springs
Sheave for Capillary String
Going in the hole

Top of the Cap String

Bottom of the Cap String
Capillary Connection
Injection Valve Set Point

CCI-1A Chemical Injection Valve

Desander Injection Port
Downhole Injection Valve CCI-1A

- **Material**
  - Monel Alloy Steel
- **Dimensions**
  - 12” L X 1.0” O.D.
- **Working Pressure**
  - Maximum 8,400 psi Differential
- **Temperature**
  - 450 Degrees F

**Purpose:**

- Prevents Chemical Siphoning
- Prevents Gas Back Flow
- Allows for Precise Chemical Injection

Continued on Next Slide
Set Pressure Determined By:

- Hydrostatic Weight of the Chemical in Capillary Tubing
- Flowing Bottomhole Pressure
- Injection Pump Pressure @ Surface
- Set By Hand On Location
Wellhead

½” by ¼” for Capillary String

Special Lock ring
Final Set Up for wellhead
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