Magnetic Fluid Conditioners

Magnetic Fluid Conditioners (MFC’s) are tools that mechanically treat fluid using magnetic technology to control and prevent paraffin, scale, and emulsion. Using our patented technology 100% of production is treated as it passes through the MFC.

Critical MFC Components:
- Adequate magnetic strength
- Number of magnetic poles
- Sufficient fluid velocity through the MFC
- Orthogonal application of the magnetic field to the flowing fluid
- All metal components 100% high quality stainless steel

Due to the complexity of some flowing systems, we may need to adjust or enhance the MFC’s deployed in order to achieve satisfactory performance.

Placement of the tool is key in maintaining equipment. Downhole tools are installed in tubing or seat nipple or right above ESP or below the Rod Pump and surface units are placed at the well head or circulating pump.
Downhole Applications of the MFC

Rod Pump Unit
Installed on wells that use insert pumps. The MFC is installed directly between the insert pump and the gas strainer.

Tubing Unit
Installed on wells that are not using insert pumps (Flowing, Gas Lift, Plunger Lift, and ESPs). The MFC is installed in the tubing string at the bottom of the well.
Surface Applications of the MFC

**Flow-line Unit**
Flowline MFCs installed at the well head to treat the flowlines all the way to the storage tanks.

**Circulating Pump Unit**
Circulating Pump MFCs installed at tank battery on the discharge side of the circulating pump. The oil gets pulled out of tank goes through our MFC, heater and or separator, then back to the tank. Treats for emulsion and bad tank bottoms.
**How does the Technology work?**

**Lorentz Force:**

The force exerted on a charged particle (q) moving with velocity (v) through an electric (E) and magnetic field (B). The entire electromagnetic force (F) on the charged particle is called the Lorentz force (after the Dutch physicist Hendrik A. Lorentz) and is given by

\[ F = qE + qv \times B \]

![Diagram of Lorentz Force with vectors](image)

**Braking force on fluid**

**Accelerating force on magnet**
Effect on Hydrocarbon Molecules:

The paraffin molecules align their poles with the magnetic field - it changes the electrons rotation and translation patterns which in turn changes their orbital angular momentum. This leads to a disturbance in the crystal agglomeration process. **Hydrocarbons form clusters and the magnetic fields align the chain making a dipole relationship with itself which de-clusters, and reduces size of crystals:** This prevents paraffin deposition and actually develops a repulsion between the molecules changing the rheological and morphological properties.
What Makes the Tool Successful?

• Of particular note are Russian scientists that determined three key variables to successful applications of magnetic treatment of flowing fluids from their early days using bulky and crude magnet designs:

1. adequate magnetic strength
2. sufficient fluid velocity through the magnetic field
3. Right angles of the magnetic field to the flowing fluid

• The magnetic treatment increases the coagulating tendency of the suspension ions by decreasing double-layer repulsion thus keeping micro crystals in solution rather than allowing them to crystallize on the pipe walls.

• In the particle double layer, orthogonal fluid flow with respect to the magnetic field in conjunction with the Lorentz force causes a change in the charge at the Helmholtz shear plane. Both particle-to-particle and particle-to-solvating-liquid interactions are affected, changing either the crystal habit or the hydration number.

• It is fairly well agreed that the anti-scale effect results from changes in crystallization behavior promoting bulk solution precipitation rather than formation of adherent scale.
Cost Savings and Operational Benefits

- Minimize or eliminate:
  - Chemical treatments for scale and paraffin deposition
  - Hot oiling flowlines and production tubing
  - Downhole paraffin or scale cutting

- Stabilize production rates

- Minimize downtime and increase present value

- Minimize work overs and expensive treatments

- Improve the quality of crude oil by eliminating emulsions in the storage tank or pipeline...thus, increasing value

- Reduce corrosion by allowing inhibitor to reach pipe

- The costs of one hot oil & chemical treatments for a single month could be more than the costs of a full year of MFC downhole tools, per well

“I WAS AMAZED... I reduced MY LOE by 80%!”
**Field Example - Flowline**

**INITIAL**
Picture before a MFC tool unit was installed on a flowline. Line was being chemically treated.

**WEEK 1**
The same flowline after 1 week with MFC tool unit installed and no chemical treatment.

**WEEK 2**
2 weeks after MFC tool unit installed.

**WEEK 4**
4 weeks after installation of the MFC tool unit without any chemical or hot oil treatment.
Field Example - Paraffin Treatment with MFC

**Before MFC Tool Install:**

**Initial**
Picture before treatment of any kind was applied to a Wolfcamp flowline.

**Hot Oil**
A hot oil treatment cleaned the flowline entirely, but in just 10 days buildup was rapidly occurring again.

**MFC Tool Installed:**

**Week 1**
Following the installation of an MFC, in 1 week the buildup stopped and even began dissipating.

**Week 10**
After 10 weeks with the MFC tool unit installed, flowline walls are visible (no other treatment applied).

**Week 20**
After 5 months without any chemical or hot oil treatments the flowline is virtually clean from buildup.
Field Example - Wolfcamp Paraffin

Rods pulled before the installation of a downhole unit

Rods pulled after 10 weeks with the downhole unit installed
**Emulsion Benefits**

These samples were taken out of the same well off the same stroke. The sample on the left came out of the flowline after it had passed through the MFC, the sample on the right came out of the 1" side of the pumping tee.
Safety...

MFC tools provide a safer environment for people and wildlife

- Since the tools treat the fluid mechanically instead of chemically, there is no chance of a chemical spill or possibility of chemical contact with humans or wildlife

- There is no risk of electrocution due to the fact the tools require no external power

- No MSDS required

- No storage space is required for hazardous materials
Magnetic Fluid Conditioners use magnetic technology to treat paraffin, scale, and emulsion.

MFC tools treat 100% of the fluid physical instead of chemically, making it environmentally safe.

Saves money by reducing the need for other treatments, downtime, electricity, and extends equipment life.
Drawing MFC for the Tubing

**2-7/8" TUBING UNIT**

- **Length of Tool** – 58-1/2"
- A - 2-7/8" EUE (BRD)
- B - 304 Stainless Steel
  - OD – 3.125”
  - ID – 2.499”
  - Wall Thickness – 0.313”
- C - 304 Stainless Steel
  - OD: 0.50” x 1.50”
  - ID: 0.375” x 1.375”
  - Wall Thickness – 0.065”
- D - Epoxy

**58-1/2”**

**3.125”**
MFC in the Workshop, Ready to be Shipped out

The outside housing (Tubing) is made from Stainless Steel.
MFC Scheme

From MFC to Storage Tank Max 10 Km

MFC in flowline

Inspection point

MFC (Magnetic Fluid Conditioner)

ESP Pump

STORAGE TANK
Circulating Pump Unit

This tank was rejected twice because the Water / Oil was over 2%. An MFC was installed and circulated the tank for 24 hours.

Circulating Pump MFCs installed at tank storage on the discharge side of the circulating pump. The oil gets pulled out of tank goes through our MFC, heater and or separator, then back to the tank. Treats for emulsion and bad tank bottoms.

Same tank after circulating fluid for 24 hours. Emulsion has been broken out and water / oil separated.
Water Injection well

The MFC can be installed at any requested place and at every requested size.
MFC Equipment

The MFC is placed in the tubing with a wireline set and retrievable packer.