



FLOPRO NT

Water-based reservoir drill-in fluid



The M-I SWACO
FLOPRO NT*
water-based
reservoir drill-in
fluid (RDF) for
low-density
openhole
completions

Every RDF from M-I SWACO, a Schlumberger company, is created based on an understanding of and focus on optimizing openhole completion performance by minimizing reservoir damage and maintaining compatibility with the completion design.

The FLOPRO NT fluid provides a nondamaging water-based system characterized by excellent drilling performance, completion compatibility, excellent cuttings transport, easy filtercake removal, and global environmental compliance.

Next-level technology minimizes formation damage and optimizes production

Applications

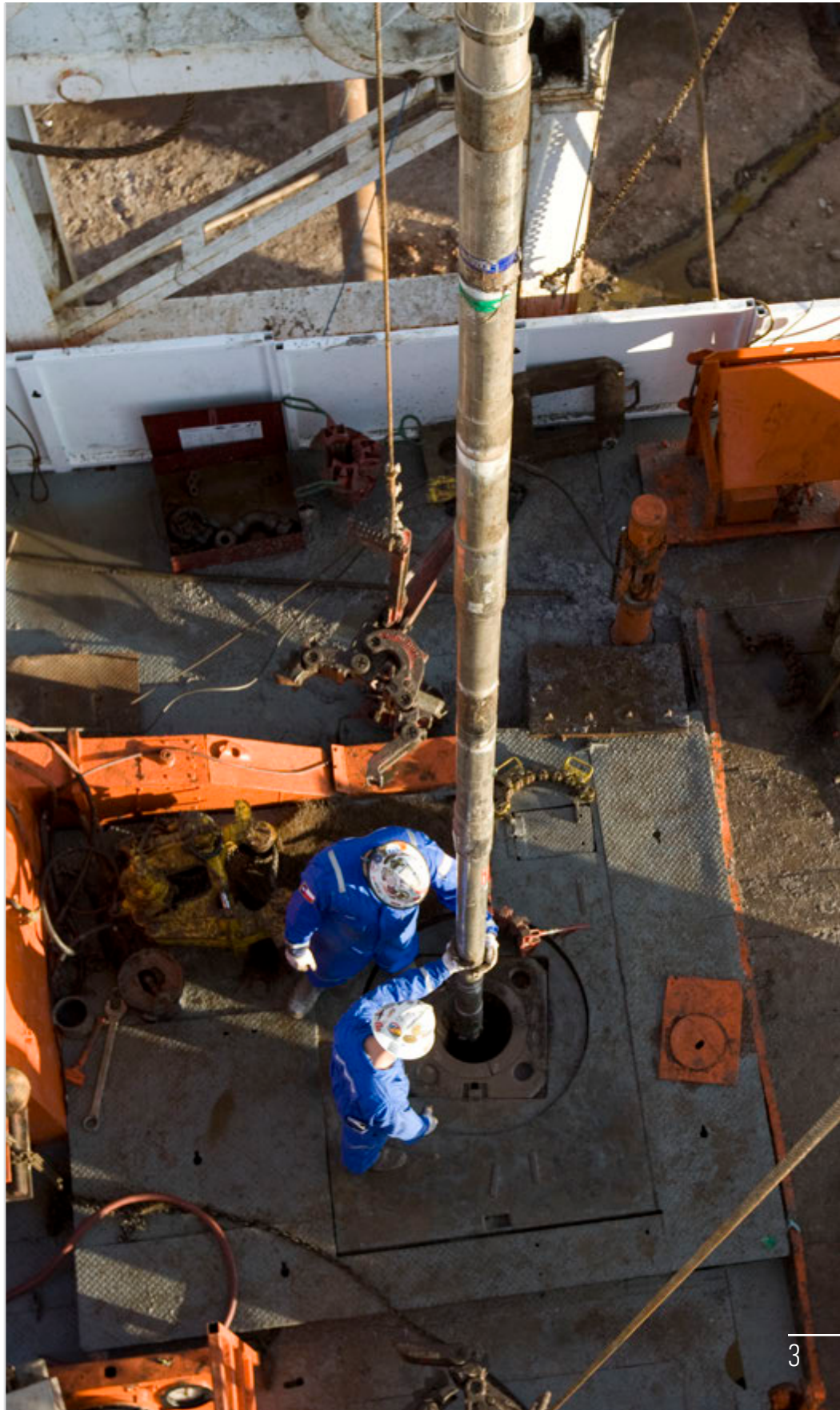
- Onshore and offshore wells requiring a flexible, nondamaging RDF for a variety of completion methods
- Openhole gravel-pack or stand-alone screen completions
- Barefoot, slotted, or perforated liner
- Cased holes requiring hole cleaning or minimal fluid invasion
- Expandable sand screen completions

Benefits

- Maximizes production and ROP to save drilling time
- Reduces remediation, cleanup, and disposal costs
- Enhances early production rates
- Minimizes solids and fluid invasion to the formation
- Decreases pump pressures
- Provides excellent hole-cleaning profile
- Promotes low skin values
- Integrates with any completion assembly
- Removes filtercake gently

Features

- Customized formulations
- Precisely controlled bridging agent particle-size distribution
- Rheologically engineered for elevated low-shear-rate viscosities (LSRV)
- Nondamaging
- High-return permeability
- Ultralow-permeability filtercake
- Extremely low fluid friction factor
- Compatible with various breaker treatments
- Environmentally acceptable





Challenges

- Many drilling fluids and RDFs can damage producing formations with high solids content, persistent filtercakes, or deep invasion into the reservoir.

Solutions

- The FLOPRO NT fluid is a proven water-based drill-in system with nondamaging characteristics; breaker compatibility; extremely low friction factor for low pump pressures; and high ROP, extremely high capacity for cuttings transport, and global environmental compliance.

Economics

- FLOPRO NT fluids are designed, tested, and qualified to meet productivity and operational targets by optimizing the formulation and the completion procedures for the reservoir characteristics and completion design. As the well is drilled and completed, an M-I SWACO fluids engineer ensures that the system is maintained to deliver what it promises—maximum reservoir productivity, lower total well costs, and minimal environmental risk.

Environmental

- In response to the industry's needs for improved drilling efficiency and production with minimal environmental risk, M-I SWACO developed the FLOPRO NT fluid. Additionally, all speciality products that are used with the FLOPRO NT fluid are rigorously evaluated to the local environmental standards.

FLOPRO NT fluid prepares your reservoir for improved production from the start

A new way of looking at a well, starting with the reservoir

M-I SWACO began developing the FLOPRO NT fluid by starting with a set of properties the system would have to demonstrate. The result: a system that provides clear-cut benefits as a high-performance, nondamaging drill-in fluid, which optimizes production rates across a wide range of completion methods.

Early production that benefits production and reservoir engineers

Because the design of a FLOPRO NT fluid is based on the completion method being used, the completion process itself is greatly simplified. Every system component is soluble in some type of treatment chemical — such as acids, chelants, enzymes, or oxidizers. The flexibility of the FLOPRO NT fluid is another big step toward simplifying completions. The M-I SWACO engineer can build a FLOPRO NT fluid from a number of base fluids, including fresh water, seawater, potassium chloride, sodium chloride, sodium bromide, and FORMIX* formate-based brine technology, which includes sodium formate, potassium formate, and cesium formate.

Maximized ROP and reduced drilling costs that benefit drilling engineers

During drill-in operations, the FLOPRO NT fluid exhibits excellent drag reduction inside the drillstring and can lower string pressure loss by as

much as 40% compared with conventional water- or oil-based drilling fluids. The fluid prevents clay hydration and dispersion, while its gel-like structure traps and suspends cuttings, resulting in a cleaner hole. Because the viscosity of FLOPRO NT fluid is such that cuttings beds are virtually eliminated, the fluid greatly reduces torque, drag, and differential sticking.

Fluid technology that has earned approval worldwide

Operators in all major drilling areas worldwide have proved the effectiveness of FLOPRO NT fluid technology in a variety of applications.

These applications include thousands of wells with diameters ranging from 3¼ in to 17 in [95.3 mm to 444.5 mm], with angles ranging from 0° to more than 100°, horizontal displacements to more than 8,000 ft [2,438.4 m], and permeabilities up to 10 D. In the US West Coast, Alaska, the Gulf of Mexico, Latin America, the North Sea, Europe, Russia, southeast Asia, Australia, Africa, and in the Middle East, FLOPRO NT fluid technology has met or exceeded environmental regulations while continuing to surpass customer expectations.



FLOPRO NT fluid—a proven deployment process

When planning a well in which the FLOPRO NT fluid will be used, M-I SWACO uses a combination of state-of-the-art software and testing equipment. As with all M-I SWACO RDFs, M-I SWACO technicians and engineers begin with the customer's production goals and the completion design of the well, and then work in reverse to the drilling phase.

This approach is field-proven to ensure that drill-in and completion operations leave the completion as damage-free as possible. A step-by-step overview of the processes used in planning for, and drilling with, the FLOPRO NT fluid follow, with the design tools highlighted.

In the customer's office

M-I SWACO engineers provide a brief RDF questionnaire for the customer to complete. The responses help determine the best fluid design for the well and reduce overall design time. On occasion, the M-I SWACO RDF team members can assist in acquiring portions of the required well information.

In the laboratory prior to drilling operations

- OPTIBRIDGE* bridging agent selection software is used to design the optimal blend of calcium carbonate bridging material.
- Shale dispersion and shale exposure tests identify the ideal base brine and supplemental inhibitor package if reactive formations are present.
- M-I SWACO uses a modified HPHT tester that employs a synthetic disc to determine fluid loss and filtercake quality on a medium closely resembling the formation to be drilled.
- This test can also be used to determine the optimal chemistry of the MUDSOLV NG* integrated filtercake removal service, such as whether to use the BREAKFREE* enzyme-based filtercake breaker system or BREAKDOWN* enzyme and chelant filtercake breaker system.
- One of the many M-I SWACO return permeameters further optimizes the fluid formulation and cleanup procedure by testing an actual core sample from offset wells.
- A Brookfield viscometer is used to design the proper rheological profile and properties.
- To help determine the environmental impact of the base brine for US operations, an environmental impact test that follows international regulatory protocol is required.
- A comprehensive drill-in and completion fluid program is presented that outlines detailed procedures.

On a well during drilling and completion

- On the well, a production screen tester (PST) apparatus can be used to demonstrate compatibility of a RDF sample taken from the circulating mud system. The PST is fitted with a sample of the actual screen type to be used in the completion.
- Acid or breaker insolubles are monitored closely while drilling the interval. Acid insolubles, especially reactive solids, will make the filtercake more difficult to destroy. These solids can also plug the formation pores, in particular on injector wells, as the filtercake is destroyed.
- A Brookfield viscometer is used to monitor low-shear-rate viscosity to optimize ROP.



**Put FLOPRO NT water-based
reservoir drill-in fluid to work
at your rig site.**

To find out more about the FLOPRO NT
fluid and how it performs for operators
worldwide, contact M-I SWACO.



slb.com/drilling

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