



Drilling Fluid Systems & Products

Drilling Solutions

Version 6

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The M-I SWACO solutions mindset permeates our company and positively influences the problem-solving orientation we have toward our clients, the solutions we deliver, our new-technology advancement, people development within our company and our future strategies.

Before people work for M-I SWACO, a Schlumberger company, we screen them not only for current skills and experience, but also for their willingness to learn new things, solve problems and help others. Once they join the M-I SWACO organization, employees have the benefits of a global learning-management system which provides worldwide access to learning, in-house and custom e-learning solutions, talent and competency management, and performance management.

Starting with the basic building blocks of training for the job at hand, M-I SWACO instructors quickly bring new specialists up to speed in the disciplines required for them to deliver maximum value from our products and services.

M-I SWACO ensures customers around the world get the highest level of service by standardizing training courses to meet the universal expectations of all operators. Where locale dictates certain specialized practices, M-I SWACO trainers prepare field personnel for those details as well.

Once these capable people are working in the field, their learning and training are not over. In fact, basic training is just the beginning of a successful career with M-I SWACO. As an organization, we are developing career paths, checkpoint criteria and progress-measurement methods to keep M-I SWACO and its people at the forefront of the industry.



Research and development

M-I SWACO has made considerable investments in research and engineering facilities as well as laboratories and field-support operations. Our Research and Engineering Center in Houston and our three International Technical Centers - in Houston; Aberdeen, Scotland and Stavanger, Norway - provide 24 hr assistance, and innovative solutions, anywhere in the world. Our Ecotoxicological Laboratory in Bergen, Norway, performs a wide range of analytical services. Drilling and production frontiers such as offshore Canada, Russia and the Caspian Sea, China, Latin America, and land and offshore operations throughout North America are now just a phone call or mouse click away from powerful technical support.

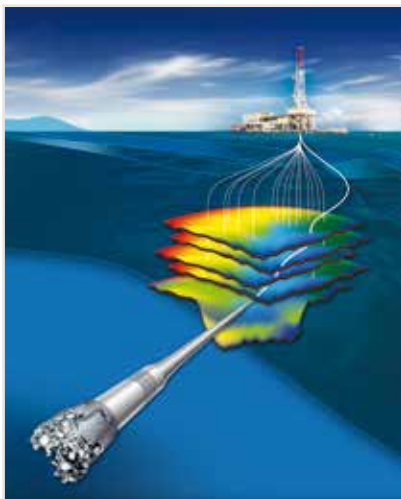
QHSE

Each of our global business units has a Quality, Health, Safety and Environmental (QHSE) manager who reports to our headquarters in Houston. Our loss-prevention teams ensure that M-I SWACO operations are in compliance with the latest safety standards. Full-time occupational health and safety specialists make sure that our locations and the customer locations and rigs where our people work are safe. The Occupational Health group provides a management framework that monitors and investigates a broad range of health hazards and initiates controls to manage those hazards through programs such as Hearing Conservation, Respiratory Protection, Ergonomics and Malaria Control. Our customers also frequently utilize our expertise to assess potential occupational health issues involving our products at their sites.

M-I SWACO people operate with an awareness of the environment and a sense of responsibility for protecting it. We operate specialized laboratories, including a greenhouse, where our environmental specialists conduct exhaustive tests for toxicity, biodegradation, recyclability, reuse and more. On a larger scale, our environmental emphasis and expertise are guiding forces behind the company's focus on Environmental Solutions. Prime examples of this philosophy can be seen in our line of production chemicals and our Ecotoxicological Laboratory in Bergen, Norway.

M-I SWACO will continue to establish itself as a leader by listening to customers and trusting our people to develop customized solutions to solve their problems.

Drilling Solutions for you and your well



Drilling Fluid Systems & Products

- Wellsite and project engineering
- Simulation software
- Drilling-fluid systems and additives
- ALPINE SPECIALTY CHEMICALS†
- FEDERAL† Wholesale
- HDD Mining & Waterwell
- Technical support

Solids Control, Pressure Control & Waste Management

- Rig-equipment engineering
 - Solids control
 - Solids-control systems
 - Drilling fluids mixing
 - Shakers
 - Drilling fluids cleaners
 - Centrifuges
 - FLUIDS PROCESSING SYSTEM† (FPS)
- Cuttings handling and transportation
- Oilfield screens
- Waste injection
- Cuttings treatment
- Rig instrumentation
- Enhanced fluids treatment
- Vessel cleaning
- Produced water treatment
- Production waste management

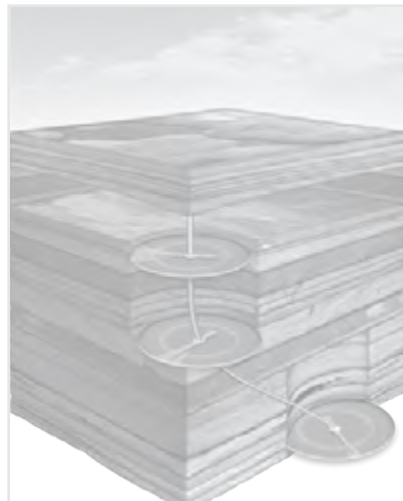
Production Technologies

- Specialty chemicals and services
- Produced water & sand management
- Scale, NORM & decommissioning services
- H₂S & mercury removal
- DRA (pipeline flow improvers)
- Integrated chemical management
- Data services



Completion Fluid, Systems & Tools

- Reservoir drill-in fluids
- Completion fluids
- Packer fluids & Breakers
- Completion software
- Fluid loss control systems
- Spacers and displacement chemicals
- Wellbore preparation tools
- Filtration



Underbalanced Drilling, Managed Pressure Drilling & @balance Services†

- Rotating Control Devices
 - Low Pressure
 - High Pressure
- Fluid Separation Products
 - Drilling fluids Gas Separators
 - D-GASSERS
 - TOTAL GAS CONTAINMENT† (TOGA)
- Flow Control Products
 - Drilling Chokes
 - Choke Manifolds
 - Choke Control Consoles
- Flow Measurements Products
 - CARBONTRACKER† gas flow meter

Integrated Solutions:

INTEGRATED BOREHOLE STRENGTHENING SOLUTIONS (I-BOSS)



The exclusive I-BOSS[†] multi-disciplinary wellbore strengthening strategy is a revolutionary approach to minimizing the excessive non-production time (NPT) and enormously expensive costs of dealing with wellbore instability and lost circulation.

How it works

I-BOSS combines chemicals, mechanical and engineering software tools into an integrated solution that effectively stabilizes wellbores during well construction. The I-BOSS approach does not necessarily prevent fracturing, rather it uses techniques that manipulate existing and/or drilling-induced fractures to increase wellbore stresses, mitigate fracture propagation and seal the wellbore.

As no universal cure exists for all drilling problems, the I-BOSS solutions draw upon a range of proven tools and integrate the elements needed for a successful outcome on a well-by-well basis. As such, operators can construct wellbores in zones with low fracture gradients, resulting in

significantly reduced drilling costs, less non-productive time, and possibly elimination of an entire casing string.

The mechanics I-BOSS wellbore strengthening

The fundamental difference between I-BOSS and simple lost circulation cures is that the latter deals only with mitigating losses of whole drilling fluids. Wellbore strengthening with I-BOSS focuses on avoiding losses by increasing the apparent fracture gradient. This is accomplished through enhancement of wellbore circumferential stresses, sealing induced and existing fractures, and isolating the fracture tip to prevent its elongation.

This stress environment is created in much the same way that one would shore up an arch with a keystone, and thus, in a similar fashion, wedging or propping open fractures and maintaining them in that state with particulates or settable chemicals.

I-BOSS pre-drilling planning

During planning, the M-I SWACO specialist gathers information about the proposed well and uses M-I SWACO procedures, software and laboratory equipment to determine the exact combination of particulates that are needed.

Benefits

- Reduced downhole fluid-loss
- Lower NPT
- Potential to drill difficult plays
- Applicable for depleted zones
- Reduced stuck pipe incidence
- Potential reduction of one or more casing strings
- Reduced waste volumes
- Reduced well construction costs

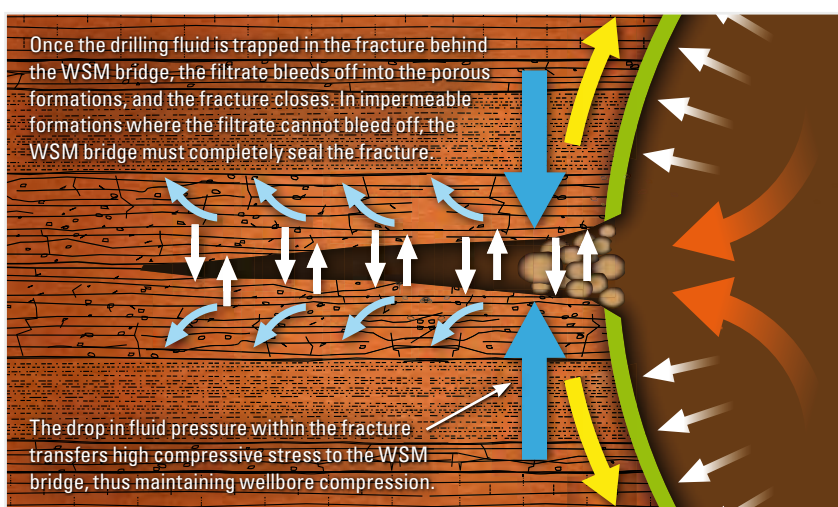
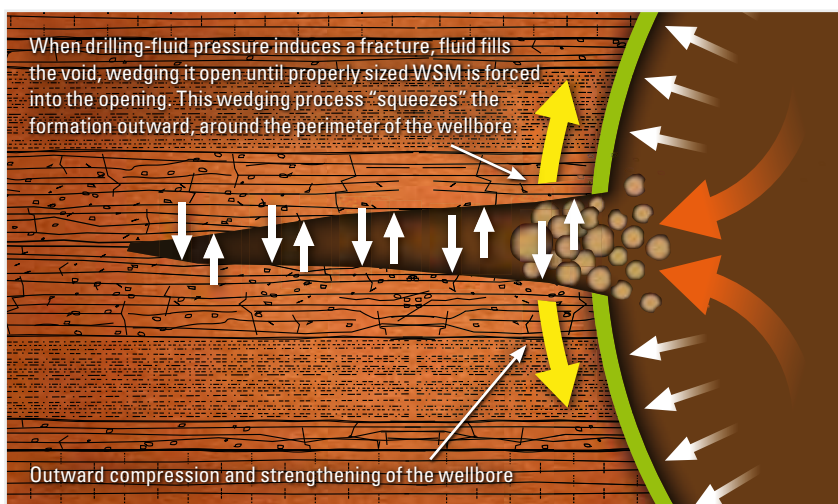
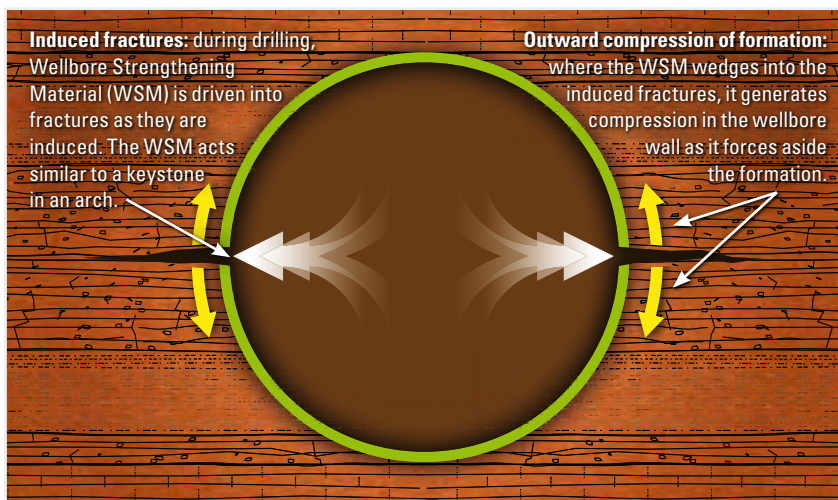
Those tools include:

- OPTI-STRESS[†] software for designing particulate-based solutions
- Laboratory testing equipment specifically designed for validation and pre-planning, including
 - High-pressure matrix loss tester
 - Low-pressure matrix loss tester
 - Fracture tester
 - Cylindrical fracture cell

Drilling and monitoring

Throughout the well construction process, M-I SWACO proprietary software, specialized wellbore strengthening products, testing equipment and procedures are used to identify the most cost-effective solution for the specific project. As drilling progresses, real-time sampling, monitoring and adjustments keep the wellbore-strengthening process optimized for the drilling conditions at hand.

A suite of proprietary engineering software is employed to monitor the operation during execution that, among other functions, identifies potential problems and creates a virtual snapshot of downhole fluid behavior during drilling.



Applications

The I-BOSS strategy is an ideal option for mature fields, extended-reach drilling, complex well configurations, zones with narrow pore-pressure/fracture-gradient drilling windows and when drilling through fragile or depleted zones above the target. The multi-pronged methodology, which begins with a pre-drilling well analysis, resolves many of the limitations of after-the-fact remedial treatments for stopping drilling fluid-losses that often are unsuccessful.

In addition, the comprehensive I-BOSS toolkit includes the patented **MANAGED PARTICLE-SIZE RECOVERY¹ (MPSR)** technology that recycles wellbore strengthening materials, thus reducing drilling waste and cleanup problems. Overall, the I-BOSS suite of solutions reduces the waste associated with building larger volumes of whole drilling fluids to accommodate downhole losses.

Features

- Flexible solution can be tailored for specific wells
- Computer optimization
- Rigsite testing apparatus
- Ideal for permeable formations
- Novel solutions for shale and carbonate formations
- Ability to recover bridging particles
- Real-time, in-line particle size measurement

OPTI-STRESS



The proprietary OPTI-STRESS[†] engineering software package was developed to assist with the design of Wellbore Strengthening Material (WSM) treatments.

How it works

The software utilizes the Circumferential, or Hoop, Stress Enhancement concept of I-BOSS to first calculate the fracture width required to be achieved by a desired wellbore pressure, then calculates an WSM formulation of the correct particle size distribution (PSD) to fill, prop and seal the fractures.

OPTI-STRESS comprises three main components that calculate

- Fracture width
- Total concentration of the WSM blend required to bridge and seal the fracture
- The particle size distribution and concentrations of individual WSM components in the WSM blend.

OPTI-STRESS employs a probabilistic technique that utilizes WSM expected uncertainties in rock properties and drilling parameters. The software is Excel-based and is designed to operate as part of the M-I SWACO

Engineering Constellation Control Program (ECCP) suite of programs.

In making the calculations, the user inputs a variety of rock properties and available WSM products. The program uses a finite element analysis technique employed in rock mechanics to calculate the fracture width. Once the fracture width is calculated, the program selects the appropriate particle size distribution (PSD) and wellbore strengthening material blends to bridge, prop and seal fractures to maintain the required wellbore stress that allows use of the desired wellbore pressure in targeted formations.

As some uncertainty always exist in the input parameters used to calculate the fracture width, OPTI-STRESS employs Monte Carlo analysis, typically running thousands of calculations that pick random values of the input parameters within their uncertainty bands and in the process generating a scatter-shot probability distribution curve for the fracture width ties in the input parameters. WSM blends can be calculated for any point on that curve.

Benefits

- Helps assure success of wellbore strengthening strategy
- Reduces uncertainties
- Minimizes NPT
- Accurately and quickly identifies product solutions
- Reduces drilling costs
- Enhances well control

Applications

The proprietary OPTI-STRESS software utilizes wellbore pressure data and geomechanical properties of the formations to be drilled (provided by the operator), to calculate the fracture width (aperture) probability. The software then selects an optimum blend of WSM, based upon defined available material PSD and calculates the required concentrations.

Features

- Comprises three components that determine fracture width, WSM concentration and PSD
- Proprietary engineering tool
- Uses probabilistic techniques based on Monte Carlo simulation
- Probability model addresses uncertainties
- Utilizes “hoop stress enhancement” concept

Drilling Fluid Simulation Software:

OPTIBRIDGE



Our proprietary OPTIBRIDGE[†] software gives the M-I SWACO engineer a tool for precisely and quickly selecting correctly sized bridging agents.

How it works

The first step in designing a non-damaging fluid is to determine the ideal particle-size distribution for the bridging material.

With the OPTIBRIDGE program, the M-I SWACO engineer inputs formation data as well as information about locally available products. Then the software calculates the “best-fit” mixture of locally produced bridging particles for effectively sealing the formation face.

The OPTIBRIDGE program improves on the popular Ideal Packing Theory, which takes a graphical approach to determine the optimum sizing of bridging material for specific formation characteristics. Basically, this theory examines all the voids in a given formation and considers the full range of particle-size distribution that will be required to fill them effectively.

OPTIBRIDGE software takes that theory a major step further. It generates a mathematical model based on the largest pore size, also known as the d^2 rule.

Using the software, the M-I SWACO engineer examines data from the targeted formation, including maximum pore-size opening, permeability and/or screen sizes, and combines that input with the bridging-particle information. From that model, the OPTIBRIDGE program automatically generates a target line of the optimum blend of particles that will effectively minimize solids and filtrate invasion. Once the optimum blend is known, the ratio of bridging materials can be perfectly matched to the formation characteristics.

Because the OPTIBRIDGE program considers characteristics of your specific formation and matches them with bridging particles available in your area, there is no concern about having to wait or bear the burden of extraordinary delivery costs. What’s more, this powerful software package ensures the desired solids are maintained in the fluid system, allowing you to maximize your solids-control program while still maintaining the precise particle-size distribution of the bridging agent.

Benefits

- Reduces formation damage
- Takes the guesswork out of selecting bridging material
- Lowers material costs
- Optimizes production
- Prevents fluid invasion

Applications

OPTIBRIDGE is used in selecting the optimum blend of bridging particles, focusing on an ideal packing sequence for minimizing fluid invasion in sandstone reservoirs. OPTIBRIDGE can also be used to optimize a blend based on screen sizes commonly used in open-hole completions. OPTIBRIDGE takes a graphical approach to determine the optimum particle-size distribution of bridging material for given formation characteristics. OPTIBRIDGE uses either pore sizing from thin section analyses or permeability information, combined with particle-size distributions of the bridging material, to determine the Ideal Packing Sequence.

Features

- Accurately matches local bridging agents with formation characteristics
- Applicable for reservoir drill-in fluids, lost-circulation treatments, kill pills, fracture sealing and perforation sealing
- Uses actual formation and bridging-agent information that will provide an optimum filter cake

PRESSPRO RT



The PRESSPRO⁺ RT service from M-I SWACO provides unprecedented remote and wellsite engineering support with a unique, specifically designed suite of software. This proprietary and innovative suite of programs use surface measurements to calculate downhole pressure profiles and fluid properties in real time during drilling, tripping and other critical operations.

How it works

The PRESSPRO RT system leverages the proven technologies in the VIRTUAL HYDRAULICS⁺ module and displays key downhole profiles and fluid properties in a real-time SNAPSHOT⁺ graph that is continuously updated with live drilling and tripping data. Whereas VIRTUAL HYDRAULICS provides accurate planning and sensitivity analyses, the PRESSPRO RT system closes the feedback loop by monitoring current conditions, helping personnel modify drilling practices and plan for contingencies in advance. VH RHECON⁺ module closes the information loop by generating

projections that look ahead of the bit, based on current operating conditions.

If it impacts drilling or tripping, the PRESSPRO RT service has you covered

Specially designed PRESSPRO RT modules provide valuable information about all the properties of the fluids in the wellbore.

- DRILLPRO⁺ RT software targets critical parameters that must be considered when drilling a well. For the very first time, equivalent circulating density (ECD) profiles are calculated and displayed every second while both drilling and making connections
- TRIPPRO⁺ RT software calculates and displays real-time fluid parameters while tripping drill pipe and running casing—situations where wellbore conditions can change very quickly
- SNAPSHOT RT software provides a continuous graphical display of downhole profiles
- VISUAL HYDRAULICS software provides a visual representation of downhole metrics using an easy-to-understand color scale
- PRESSPRO RT NAVIGATOR⁺ provides a virtual window into downhole hydraulics using sophisticated 3D visualization and interactive navigation

Benefits

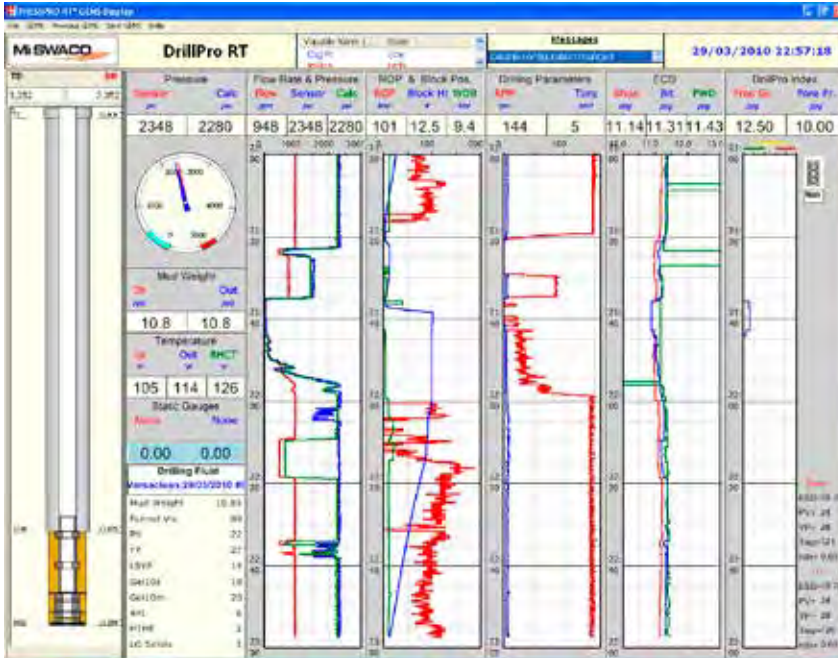
- Prevents/minimizes downhole fluid-losses due to lost circulation
- Early detection of impending problems by providing “what should be” data to compare with “what is”
- Minimized drilling fluids related non-productive time
- Helps reduce drilling costs
- Provides real-time monitoring for immediate response
- Enhances ECD management by providing downhole pressure profiles during drilling, tripping, and other critical parameters
- Complements PWD when available and substitutes for PWD when the data is not available

that combine advanced drilling technology and 3-D computer graphics

Applications

PRESSPRO RT and APWD: a perfect match

The PRESSPRO RT package is an integral part of ECD management. It does not replace the popular APWD tool. Instead, it complements APWD data, comparing the “what are” measurements of APWD with a “what should be” scenario for early detection of impending problems. While APWD provides a single-point measurement at the bit, the PRESSPRO RT package calculates complete profiles of downhole hydraulics and drilling fluids behavior. Additionally, it can substitute for the PWD when the tool is unavailable, such as while running casing, when the tool is non-operational, or when temperatures or pressures exceed tool limitations.



PRESSPRO RT and VIRTUAL HYDRAULICS packages are a winning combination

Now a vital element in many operators’ onshore real-time drilling centers, the PRESSPRO RT package is the only technology that provides in-time equivalent static and equivalent circulating densities at any point in the wellbore during drilling.

Features

- Managed by a specially trained, onsite, critical-well analyst
- Can be operated from remote Operation Centers
- Monitors drilling and tripping parameters
- A dedicated computer can be interfaced to an existing data-acquisition system with the data-acquisition source on the rig
- Predefined screens for targeted drilling/tripping components
- Downhole profiles calculated and updated every second and displayed as virtual sensors

VIRTUAL HYDRAULICS



Benefits

- Transient ECD prediction and recommendations
- Office-based critical well planning made easy
- Reduced drilling fluids losses during all critical well operations
- Drilling fluid properties can be engineered to meet the wellbore conditions of the demanding wells

VIRTUAL HYDRAULICS⁺ is a powerful tool for maximizing drilling fluid performance, minimizing overall costs, and improving confidence levels while using high-performance fluids in challenging deepwater and HPHT environments.

How it works

VIRTUAL HYDRAULICS is based on two fundamental concepts. The first concept is based on variable downhole properties and parameters and sub-divides the well into short segments each with own set of properties. The second concept called VIRTUAL RHEOLOGY⁺ takes full advantage of the best available rheological data for the specific drilling fluids in use by combining data from different instruments. VIRTUAL RHEOLOGY uses an innovative “data-cube” concept to predict drilling fluids rheological properties under downhole conditions. Rheology data from field and laboratory viscometers are combined into a 3D cube of temperature, pressure and shear rate.

Applications

The true value of the VIRTUAL HYDRAULICS software suite is truly appreciated in deepwater wells where uncontrolled ECDs can quickly exceed the boundaries of narrow operating windows, in extended-reach and horizontal wells, in HPHT applications and other technically demanding wells. Proven on thousands of projects, both critical and more routine applications, this powerful computational tool literally gives M-I SWACO specialists a virtual snapshot of downhole fluid behavior before drilling begins and while the well is in progress. This accurate prediction of downhole hydraulics has a proven, positive effect on overall well performance.

Features

- Transient analysis of hydraulics of all major drilling phases: drilling, tripping, circulating
- Interactive 3D visualization of downhole hydraulics
- Dynamic “reconnaissance” simulations to optimize hydraulics ahead of the bit
- Bit hydraulics optimization where rheological properties are part of the optimization process
- Improved models and parametric analyses for hole cleaning, ECD management, annular velocity profiles, downhole temperatures and pressures
- New graphics that address key hydraulics-related issues

DRILPLEX



Benefits

- Ideal for lost-circulation zones, unconsolidated formations, milling situations, and high-angle and horizontal wells
- Minimizes losses
- Reduces environmental impact
- High rates of penetration
- Well-suited for coiled-tubing drilling
- Cost-effective

Applications

Many drilling operations require a fluid system that is cost-effective and environmentally acceptable in addition to having exceptional hole-cleaning ability, good screenability at high flow rates and the ability to control losses in hard rock as well as unconsolidated sedimentary formations. Those applications would include the following: drilling lost-circulation zones, casing-milling operations, stabilizing unconsolidated formations, coiled-tubing operations, environmentally sensitive areas, and high-angle and horizontal wells.

Features

- Latest-generation Mixed-Metal Oxide (MMO) system
- Highly shear-thinning
- Excellent QHSE profile
- Temperature-stable to 250°F (121°C)
- Exceptional hole cleaning and suspension
- Excellent ability to seal the high-permeability formations found in deepwater drilling

Product	Function
GELPLEX	Complexing-agent
Soda Ash	Secondary pH control & Ca++ removal agent
DRILPLEX	Viscosifier
FLOPLEX	Primary fluid-loss control additive
Caustic soda	pH control additive

The versatile water-base system with exceptional rheological properties designed to lower costs in a wide range of wells

How it works

The DRILPLEX¹ system is the current generation of Mixed-Metal Oxide (MMO) products, a water-base drilling fluid system with unequaled solids suspension, but one that still screens easily, even at high flow rates—the ideal system for an array of applications. The system's water-base chemistry reduces costs and environmental impact, minimizes torque and drag and limits the chance of hole erosion because the DRILPLEX system provides flow that is low to zero across the wellbore cross-section. The basic system contains essentially no components that can harm the environment; all its

components are virtually non-toxic, with low concentration of organic material. The primary fluid-loss control additive is a starch derivative for minimal environmental impact.

The ability to stabilize goes with the flow

The flow profile of the fluid in the annulus affords DRILPLEX the ability to stabilize mechanically weak and poorly consolidated formations. The high viscosity of the fluid at low shear rates results in a stationary layer of fluid on the sides of the wellbore. This protective layer shields weak rock formations from erosion caused by the flow. The capacity of the fluid to stabilize these weak and unconsolidated formations is further enhanced by the lower pump rates used with the DRILPLEX system. This tendency may also explain the lower seepage losses that occurred in several wells in which the formations were fractured.

DRILPLEX AR PLUS



Benefits

- Improved stability of the fluid in the presence of anionic contaminants with less dilution required
- Expanded operational envelope (i.e. drilling in running gravel in permafrost)
- Fluid-loss is controlled reducing the filtrate penetration
- Reduced torque and drag with lubricant addition.

Product	Function
GELPLEX	Complexing agent
Soda Ash	Secondary pH control
DRILPLEX	Viscosifier
FLOPLEX PLUS	Filtration control
TROLPLEX	HT fluid-loss control
Shale inhibitors	K-silicate or polyamines
REPLEX	Anionic scavenger
LUBEPLEX	Lubricant

Applications

Many drilling operations require a fluid system that is cost-effective and environmentally acceptable in addition to having exceptional hole-cleaning ability, good screenability at high flow rates and the ability to control losses in hard rock as well as unconsolidated sedimentary formations. Those applications would include the following: drilling lost-circulation zones, casing-milling operations, stabilizing unconsolidated formations, coiled-tubing operations, environmentally sensitive areas, and high-angle and horizontal wells.

Features

- Anionic scavenger neutralizes the contaminants and protects the MMO complexes
- Filtration control allows to reduce fluid-loss
- Lubricant adds extra lubricity when it is required
- Latest-generation Mixed-Metal Oxide (MMO) system
- Highly shear-thinning
- Excellent QHSE profile
- Temperature-stable to 250°F (121°C)
- Exceptional hole cleaning and suspension
- Excellent ability to seal the high-permeability formations found in deepwater drilling

The versatile water-base system with exceptional rheological properties and with a robust resistance to withstand the common field anionic contaminants.

How it works

The uniqueness of the DRILPLEX AR PLUS[®] system is derived from the formation of a complex between small, flat cationic MMO crystals and bentonite platelets, and is unchanged from the original DRILPLEX. The DRILPLEX AR PLUS drilling fluid system is the most recent variant of MMO system. The DRILPLEX AR PLUS system provides increased temperature stability, inhibition, improved lubricity and anionic compatibility in comparison to the original DRILPLEX system. In a word, a more robust drilling fluid system.

DURATHERM



Benefits

- Ideal for lost-circulation zones, unconsolidated formations, milling situations, and high-angle and horizontal wells
- Minimizes losses
- Reduces environmental impact
- High rates of penetration
- Well-suited for coiled-tubing drilling
- Cost-effective

High ROPs, improved solids-removal capability and minimal formation damage help reduce drilling costs, while its aqueous-base chemistry gives it environmental advantages over oil-base systems. The system is especially useful when there are concerns about formation evaluation, kick detection or lost circulation. It may be formulated with freshwater or seawater, and non-flocculating salts may be incorporated for inhibition.

Product	Function
XP-20	HT thinner & fluid-loss control
RESINEX	HT stabilizer & fluid-loss control
TANNATHIN	Thinner & fluid-loss control
POLYPAC-UL or R	Fluid-loss control, viscosifier
M-I GEL SUPREME	Viscosifier, filter-cake & fluid-loss control
M-I BAR or FER-OX	Weighting agent
Caustic, lime and gypsum	pH control & CO ₂ contamination

The DURATHERM[†] system has been recognized as a drilling fluid applicable in areas of high temperature and pressure. Due to its physical characteristics it also may be used as a packer fluid.

How it works

The DURATHERM system evolved from formulations used as packer fluids, where long-term rheological stability is necessary, this low-colloid system remains stable in the presence of acid gases, salts, and drill solids.

The system's stability can be maintained by minimizing the concentration of active solids, and using polymeric materials for viscosity requirements. This reduces

gelation caused by the flocculation of active clays at high temperature, as well as the viscosity increase resulting from saltwater flows, acid gases, or salt.

Generally, treatments with lignosulfonate (SPERSENE[®]) should be discontinued at bottomhole temperatures above 325°F (163°C). Solids-control equipment—shakers, hydroclones and centrifuges—must be operated as efficiently as possible to minimize maintenance costs.

Applications

The DURATHERM system is a low-colloid, contaminant-resistant water-base fluid designed for high-temperature drilling. It provides good inhibition, minimizes clay migration and swelling, and is stable to >500°F (>260°C) ambient, with densities from 9 to 20 lb/gal (1.1 to 2.4 kg/L), and at depths from 5,000 to 25,000 ft (1,524 to 7,620 m).

Features

- Thermal stability to temperatures in excess of 500°F (260°C)
- Minimal liquid separation or breakout
- Ability to suspend barite and solids without settling
- Non-corrosive (when freshwater is used as a base)
- Low static shear strengths
- Quick reversion to fluid state upon agitation

ENVIROTHERM NT



Product	Function
CALOVIS FL	Fluid-loss control and secondary viscosifier
CALOVIS HT	Fluid-loss control and secondary viscosifier
CALOTHIN	HPHT rheology stabilizer
CALOSPERSER and/or CALOSPERSER ZR	Chrome-free HPHT thinners
POROSEAL	Shale / filter-cake sealing additive
M-I GEL SUPREME	Viscosifier, LSRV, hole cleaning

The ENVIROTHERM NT[†] system is the result of three simultaneous operator demands. We have consistently received requests for a single drilling-fluid system that is chrome-free for environmental reasons, that can resist bottomhole temperatures in excess of 450°F (232°C) and that uses water-base chemistry.

How it works

The system is a successful, field-proven HPHT water-base fluid and has been used under very severe conditions—to more than 350°F (177°C). It maintains its stable properties not only while drilling, but also during the prolonged static conditions experienced during tripping, logging and testing operations. The ENVIROTHERM NT system is characterized by low and stable rheological properties, low HPHT fluid-loss and minimizes hole problems, providing shale inhibition and resistance to contamination for extreme conditions of density and temperature.

The ENVIROTHERM NT chemistry is water-base and chrome-free, making it environmentally acceptable worldwide. The system is stable in the presence of contamination from soluble calcium, salts and acid gases, and can be used

Benefits

- Reduces NPT
- Maintains optimum ROP in highly compacted/hard shales
- Environmentally acceptable worldwide
- Reduces pressure spikes caused by gelation
- Less time spent treating the system
- Drilling can proceed in a range of conditions
- Economical to use, as fluid formulation can be customized for various temperature ranges
- Less waste for disposal

at temperatures in excess of 450°F (232°C) and densities up to 19 ppg.

The system's stability derives from its low reactive-solids content and temperature-stable, chrome-free materials. The low reactive-solids content is achieved by decreasing the bentonite and drill solids content as fluid density and wellbore temperatures increase. High-temperature-resistant polymeric materials replace the bentonite and stabilize the overall viscosity and gel strengths. This minimizes the problems caused by flocculation of reactive clay solids at high temperatures and the viscosity increase resulting from chemical contamination.

- CALOSPERSER[†] additive is a unique blend of polymeric and organic chrome-free thinners specially formulated for improved rheology control of the ENVIROTHERM NT and other water-base drilling fluids. CALOSPERSER additive functions effectively in high-temperature (HT) applications. It reduces and stabilizes overall viscosity and gel strengths and also contributes to reducing the fluid-loss.

- CALOTHIN[†] is a liquid anionic acrylic copolymer designed to provide rheology control in the ENVIROTHERM NT and other HPHT water-base drilling fluids. In addition to its thinning effect, the product also is used effectively to reduce fluid-loss. This synthetic additive has a temperature limit in excess of 450°F (232°C) and is not subject to bacterial degradation.
- CALOVIS[†] FL synthetic polymer is a specially formulated additive designed for use as a fluid-loss reducing and stabilizing agent in the ENVIROTHERM NT system and other high-temperature water-base drilling fluids. It is an excellent additive for high-temperature high-pressure (HPHT) filtration control and rheological stabilization for drilling fluids subjected to high temperatures.
- CALOVIS[†] HT synthetic polymer is a specially formulated additive designed for use as a fluid-loss reducing and rheology stabilizing agent in the ENVIROTHERM NT system and other high-temperature water-base drilling fluids. It is an excellent additive for high-temperature high-pressure (HPHT) filtration control and rheological stabilization for fluids subjected to temperatures up to 500°F (260°C).

Applications

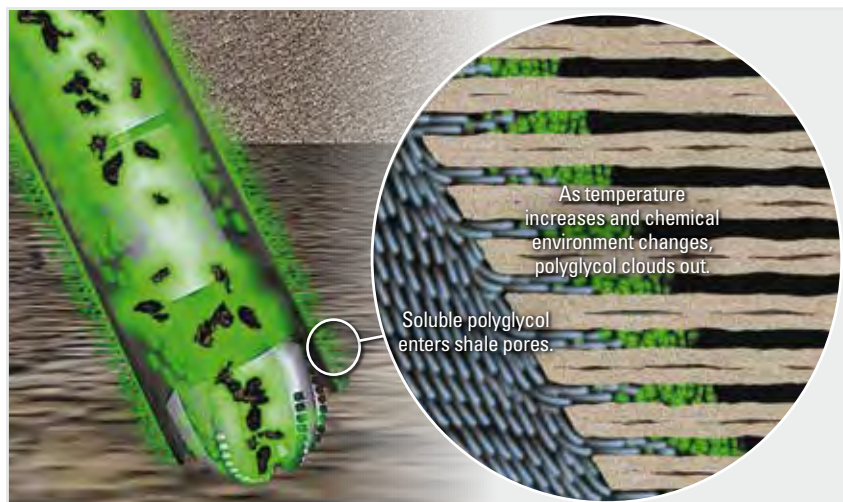
The ENVIROTHERM NT system is a low-colloid, contaminant-resistant water-base fluid designed for high-temperature drilling. Water-base fluids are often preferred when there are environmental regulations, formation evaluation, kick-detection or lost circulation concerns. Also they have a lower unit cost compared to non-aqueous fluids. The system is run as a chrome-free polymer/ bentonite drilling fluid and has been used in the field at densities up to 18.4 lb/gal (2.20 sg). The system is also suitable for conversion to a super-saturated salt drilling fluid for drilling Zechstein sequences. Normally a water-based fluid would be converted to the ENVIROTHERM NT system once the reactive shales are cased off, and the temperature profile increases.

Operational guidelines and controls involving extensive on-site and onshore testing of the drilling fluid have been developed and are used to ensure that no problems arise when drilling these critical wells.

Features

- Easily managed in the field
- Excellent shale inhibition
- Water-base, chrome-free chemistry
- Stable at high temperatures
- Stable rheological properties
- Resists contamination
- Flexible formulation that can be adapted as temperatures increase
- Reduces the need for dilution

GLYDRIL



Benefits

- In-gauge wellbores
- Lower fluid-losses
- Lower potential for differential sticking
- Less torque, drag and bit balling
- Lower dilution rates
- Slicker, firmer filter cake
- Greater wellbore stability

shale formations—where wellbore stability, torque and drag are major concerns. In addition, the glycols in the GLYDRIL system enhance the thermal stability of FLO-VIS[†], DUO-VIS[†], DUO-TEC viscosifiers and polyanionic cellulose (PAC)/starch systems, and also enhance the low-shear rheological behavior of FLO-VIS polymers at temperatures above 248°F (120°C).

GLYDRIL and ROP enhancement

Like most water-base systems, the GLYDRIL system's performance can benefit from the addition of an ROP enhancer in certain applications.

Features

- Improved wellbore stability and shale inhibition
- Improved lubricity
- Low toxicity
- Improved high-temperature filtration control
- Reduced dilution rates and drilling fluids consumption
- Reduced bit balling potential

Product	Function
Water	Base fluid
Soda Ash	Treating calcium ions
KOH	pH adjustments
KCl	Shale inhibition
POLYPAC UL	Fluid-loss control
POLYPAC R	Fluid-loss and rheology
DUOVIS	Rheology control
M-I WATE	Weighting agent
GLYDRIL MC	Shale inhibition

The GLYDRIL[†] system uses an enhanced-polymer, water-base chemistry that employs polyglycol technology. Thanks to that technology, operators can count on the GLYDRIL system to deliver a high degree of shale inhibition; wellbore stability; HPHT fluid-loss control and lubricity.

How it works

Provides improved wellbore stability, lubricity, high-temperature filtration control, plus reduced dilution rates and bit balling. GLYDRIL MC additive is recommended for freshwater to

high-saline polyglycol systems. While polyglycols are most effective when used in conjunction with an inhibitive-salt, non-dispersed polymer system, they can be used as additives in most water-base systems. GLYDRIL MC agent is acceptable for most applications specifying low-toxicity additives.

Applications

In fact, the system's broad range of glycols makes it a preferred system where environmental guidelines dictate a water-base fluid. The GLYDRIL system can be customized to meet a variety of drilling challenges—large-diameter wellbores, extended-reach drilling, deepwater and subsalt applications, and particularly reactive shales. The system also is ideal for drilling high-angle wells in reactive

K-MAG



Benefits

- Reduced dispersion of drill cuttings for easier removal
- Near-gauge wellbores for better cement jobs, even in water-sensitive shales
- Reduced swelling for wellbore stability

Features

- Flexible system can be formulated to suit drilling environment
- Excellent shale inhibition and wellbore stability
- Minimizes bit balling, improves ROP
- Preserves drill cuttings for easier removal
- Tolerates salinity from freshwater to seawater levels
- Substitutes for some synthetics where environmental issues are a concern

Note: Not to be confused with systems having a similar name such as K+-Mg, K+Mag, K+/Mg. This system is a K/Mg saturated WBM to drill Carnalite complex salt formations.

Product	Function
M-I WATE or FER-OX	Weighting agent
M-I GEL	Viscosity and fluid-loss control
Potassium Hydroxide	pH control
Lime or Gyp.	Treat CO ₂ out
SHALE CHECK†	Shale stability
DUO-VIS	Low shear rate viscosity
POLYPAC R	Viscosity/gel strengths
K-17	Shale control/filtration/thinner
RESINEX†	HT stabilizer and fluid-loss control
K-52	Potassium source/inhibition
XP-20N/XP-20K	Thinner and fluid-loss control

Used primarily in the Gulf of Mexico, the K-MAG[†] system is an inhibitive water-base system that provides shale inhibition and wellbore stability while it minimizes bit balling.

How it works

The K-MAG system is designed to perform most efficiently in freshwater to seawater-salinity environments, but the salinity can be increased to improve shale stability and gas-hydrate inhibition when necessary. The use of a powerful dispersant, such as lignosulfonate, is usually kept as low as possible in order to minimize excessive dispersion of drill solids and wellbore washout.

Applications

The system's popularity has increased as the use of synthetic-base fluids in offshore drilling has become more challenging due to more stringent environmental regulations, biodegradation restrictions and other environmental issues. In addition, low fracture gradients and narrow ECD windows often encountered in deepwater operations greatly increase the risk of lost circulation, which can drastically increase the cost of the operation. More economical water-base fluids, such as the K-MAG system, with good shale inhibition and effective ROP enhancement are now competing with synthetics in deepwater applications.

KLA-SHIELD



Benefits

- Lower dilution rates and total costs
- Achieve higher ROP and lubricity
- Effectively drill high-angle wells in reactive shale formations,

The right choice for the environment

Products that make up the KLA-SHIELD system are formulated to address environmental concerns worldwide, both on land and offshore. Onshore, the KLA-SHIELD system can be engineered to provide shale inhibition without the use of salts, and it contains no aromatic or cyclic hydrocarbon compounds, making cuttings ideally suited for landfarming. For offshore operations, the system displays relatively low marine toxicity, provides relatively fast biodegradation rates, and minimizes cuttings piles and benthic impacts.

Features

- Polyamine base for enhanced environmental performance over potassium chloride-based systems
- Flexible enough to meet geological and performance requirements
- Better waste management
- Superior stabilization in fractured shales
- Economical and technical solutions to WBM issues
- Easy to build and maintain systems for optimized inhibition and reduced costs
- Ideal for drilling high-angle wells in reactive shale formations
- More tolerant to contamination with drill solids
- Reduced clay dispersion and hydration

Inhibitor	Function
KLA-CURE [†]	Shale inhibitor
KLA-GARD [†]	Shale inhibitor
KLA-GARD B	Shale inhibitor
KLA-GARD D	Shale inhibitor
KLA-STOP [†]	Shale inhibitor

The KLA-SHIELD[†] system's broad range of polyamines makes it a preferred system where environmental guidelines dictate a water-base fluid and hole conditions demand flexibility.

How it works

The polyamines in the KLA-SHIELD system enhance the thermal stability of both the FLO-VIS[†] xanthan gum/DUO-VIS[†] biopolymer and modified starches/PAC which are used in the systems.

These same polyamines also enhance the low-shear rheological behavior of FLO-VIS polymers at temperatures above 248°F (120°C).

KLA-SHIELD and Rop enhancement

For faster, smoother drilling, ROP enhancers and accretion inhibitors, such as DRILZONE[†] or DRILZONE L products, can be added to the system in addition to other products for improving rheology, fluid-loss control, formation bridging and density.

Applications

This gives you a water-base system that is fine-tuned to meet a variety of drilling challenges—large diameter wellbores, extended-reach drilling, and highly reactive shales.

The system is also ideal for drilling high-angle wells in reactive shale formations where wellbore stability, torque and drag, and borehole and logging quality are major concerns.

POLY-PLUS



Product	Function
M-I BAR	Increase density
M-I GEL	Viscosity and fluid-loss control
POLY-PLUS	Inhibition and gel extender
Caustic soda and KOH	pH and pF
POLYPAC	Fluid-loss control
SP-101	Fluid-loss control
POLY-SAL	Fluid-loss control
Soda ash	Control hardness
DUO-VIS	Control low-shear-rate viscosities
TACKLE	Reduce gel strengths
KCl and NaCl	Ionic inhibition

A high-molecular-weight polymer, anionic liquid designed to provide cuttings encapsulation and shale stabilization.

How it works

The shale-inhibition feature of POLY-PLUS occurs when the polymer attaches to clays on the wellbore and blocks the hydration and dispersion that normally occurs. The anionic carboxyl groups attach to the positive charges on the edges of the clay particles.

Since the polymer has a high molecular weight and is relatively long, it combines with several sites along the wellbore. This has the effect of coating the wellbore and restricting water from entering the clay.

Applications

POLY-PLUS polymer drilling fluid systems:

The POLY-PLUS system provides excellent cuttings encapsulation and improved wellbore stability. It is effective in fresh water fluids but also in salt drilling fluids, such as KCl- or NaCl-enhanced fluids, although slightly higher concentrations of POLY-PLUS polymer may be required.

Benefits

- Provides excellent cuttings encapsulation and limits cuttings dispersion
- Provides improved shale stabilization
- Less dilution due to enhanced removal of drill solids
- Helps in preventing balling on the bit, stabilizers and BHA by coating and lubricating solids
- Improves the lubricity of most drilling fluids systems, particularly nondispersed drilling fluids, when used in combination with a lubricant
- Can be used to viscosify clear-water and low-solids drilling fluids
- Reduced torque and drag
- Promotes good cement jobs
- Reduced costs

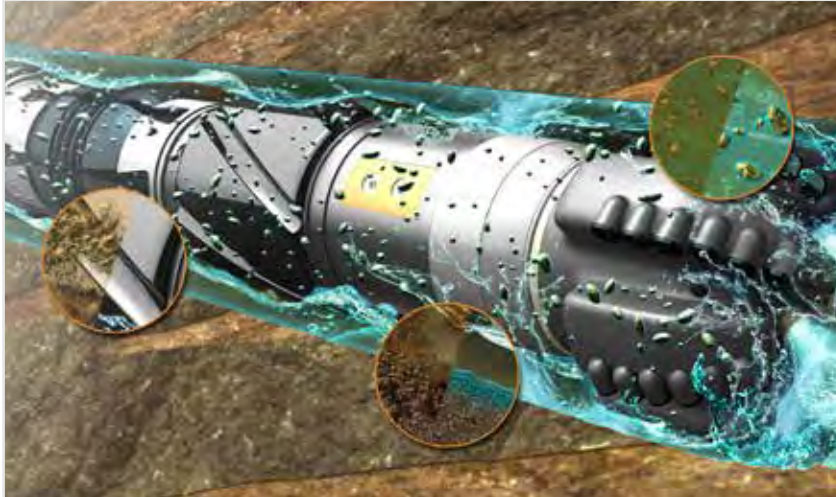
Clear-water fluids:

POLY-PLUS polymer can be used in clear-water, solids-free drilling fluids. The POLY-PLUS system increases viscosity and enhances solids removal by flocculating the undesired solids. It also provides very good cuttings encapsulation and improved wellbore stability. This system is frequently used in slim-hole, continuous-coring applications. Adding 0.5–1.75 lb/bbl (1.4–5 kg/m³) enhances solids removal by flocculating solids.

Features

- Good shale encapsulation
- Low cuttings dispersion
- Low solids content
- Low coefficient of friction
- Low toxicity

ULTRADRIL



Benefits

- Optimizes inhibition
- Environmentally acceptable
- Deepwater alternative
- Reduced costs
- Increases drilling rates

Applications

Deepwater and other offshore and onshore projects in environmentally sensitive areas characterized by highly reactive shales.

Features

- High chemical stabilization
- Low dilution, low toxicity
- Near-OBM/SBM performance
- Easy to build and maintain
- Anti-accretion agent
- Micro-pore plugging agent

Product	Function
Base fluid	Continuous phase
ULTRAHIB	Primary shale inhibition
ULTRACAP (or ULTRACAP PLUS)	Clay-dispersion inhibition
ULTRAFREE	Clay-accretion inhibition, lubricity, and ROP enhancement

ULTRADRIL has a proven industry track record as the standard in high performance, ultra-inhibitive water-based drilling fluids

How it works

ULTRADRIL employs a triple inhibition approach to suppress the hydration of reactive shales. The inhibitive capability of the ULTRADRIL system closely matches that of non-aqueous drilling fluids. The system's low moisture

content results in drier, firmer drilled cuttings. ULTRADRIL systems have successfully drilled long sections of highly reactive gumbo shales and graded out very high in terms of stability, inhibition, screenability and maintenance. In sections typically drilled with CaCl₂ or 20% NaCl/PHPA water-base fluids, the high performance ULTRADRIL system eliminated shaker-screen binding, rapid encapsulator depletion and high-dilution rates that had severely impacted wells drilled with its more traditional counterparts.

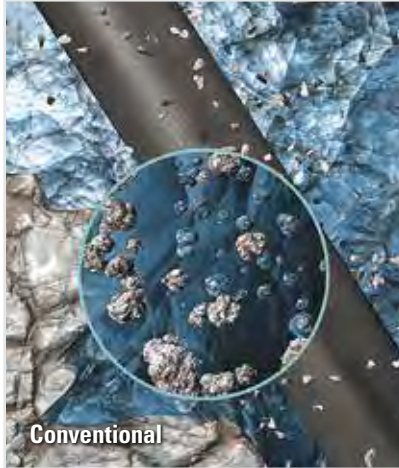
**Inhibition action #1:
Superior clay inhibition**



Conventional water-base systems do not have the highly inhibitive quality of the ULTRADRIL system, so shales are prone to sloughing and swelling that can cause stuck pipe, and washouts.

The first feature of the ULTRADRIL system's triple-inhibition approach is its ability to inhibit the most reactive shales and provide superb wellbore stability, even in the most reactive clays.

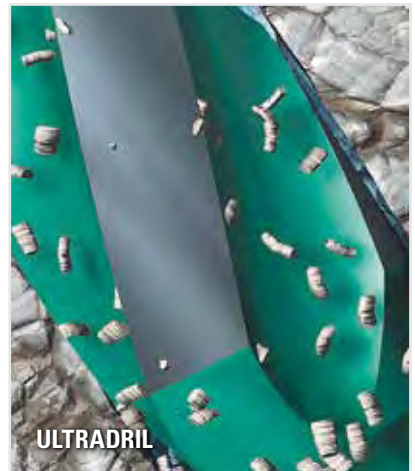
**Inhibition action #2:
Cuttings encapsulation**



With conventional systems, drilling is slower, the cuttings are smaller, and there is not the same, high level of inhibition as we have with the ULTRADRIL system. Many of the cuttings break apart and disperse, creating fines that not only require dilution of the system but that settle in the hole and can packoff the bit. Other particulates swell and agglomerate into large masses that adhere to the bit, drill pipe and Bottomhole Assembly (BHA).

The second feature of the ULTRADRIL system's triple-inhibition approach is the way it encapsulates cuttings with a thin polymer coating that virtually eliminates shale dispersion. This, in turn, reduces the need for dilution and the disposal of large fluid volumes. Because it is a high-performance system, the well can be drilled at higher ROP, producing larger cuttings which reach the shaker firm and intact.

**Inhibition action #3:
Protected metal surfaces**



Conventional fluids allow gumbo buildup and bit balling to occur, slowing down the entire drilling process.

The third feature of the system's triple-inhibition approach is its ability to coat the bit, BHA and drill pipe with an accretion-inhibitive coating. The cutting structure stays clean and effective, resulting in less bit balling and higher ROP.

ECOGREEN



Benefits

- Wellbore stability
- Increased ROP
- Cuttings integrity
- Lubricity
- Permission to discharge

The true value of the ECOGREEN system lies in its versatility. It is easily formulated to address a wide range of drilling requirements, including Extended-Reach Drilling (ERD) and horizontal drilling, and drill-in fluid applications. ECOGREEN produces the penetration rates consistent with oil drilling fluids, while eliminating or dramatically reducing the instances of stuck pipe, out-of-gauge holes and unstable wellbores normally associated with water-base systems. Its low lubricity coefficients dramatically reduce torque and drag, making it particularly beneficial in deviated and high-angle wellbores.

From an environmental standpoint, ECOGREEN is a synthesized material, and the fatty-acid ester comprising its base fluid contains no “priority pollutants” and is biodegradable. ECOGREEN has passed some of the most rigorous toxicity, biodegradation and vapor tests in the industry and has been approved for discharge in some of the world’s most restricted environments.

ECOGREEN is also completely reusable after only minimal treatment, significantly reducing your drilling fluids consumption costs.

Features

- Biodegradable
- Synthetic, invert-like system
- Non-aqueous-fluid system
- Ester chemistry

Product	Function
ECOGREEN B	Base fluid
ECOGREEN P	Primary emulsifier, wetting agent; HPHT fluid-loss control
ECOGREEN S	Secondary emulsifier, wetting agent; rheology and HPHT fluid-loss control
ECOGREEN VIS	Impart viscosity
ECOGREEN A	Emulsifier for low-alkalinity environments

ECOGREEN[†], our ester-base synthetic fluid system, to balance high performance downhole with environmental stewardship.

How it works

The ECOGREEN “fingerprint” simplifies crude detection

The unique chemistry of ECOGREEN generates a very identifiable fingerprint - so identifiable, in fact, that crude oil concentrations as low as 0.5% are easily detectable.

The ester that is the base for the ECOGREEN system is synthesized from natural fatty acids and alcohol. The system is synthetically formulated as an emulsion in which the ester

forms the continuous phase while a brine solution serves as the dispersed phase. As such, it contains no toxic hydrocarbons and possesses an aromatic content of zero.

ECOGREEN has been formulated with Synthetic/Water (S/W) ratios as low as 60/40 and as high as 95/5 with densities ranging from unweighted to as high as 17 lb/gal.

Applications

Versatility is an ECOGREEN trademark

When you prefer an ester-base system in order to meet local discharge requirements without sacrificing the economic benefits of a high-performance fluid, look no further than ECOGREEN.

ENVIROVERT



Benefits

- Eliminates typical chloride disposal problem
- Promotes faster biodegradation
- Reduces unexpected events
- Also works as a spotting, packer and casing-pack fluid
- Reduces drilling, completion and disposal costs

ENVIROVERT reduces your environmental costs and concerns

For a landfarming operation to succeed in its biodegradation activity, one or more supplemental applications of a fertilizer high in nitrogen is necessary. The ENVIROVERT system gives you a head start by providing the nitrogen required for hydrocarbon-degrading microorganisms to perform effectively in landfarming operations. The ENVIROVERT calcium nitrate salt not only eliminates the trouble and costs associated with chlorides, it also facilitates faster biodegradation. In addition, ENVIROVERT meets NMX-L-162-1996-SCFI specifications.

Product	Function
VG-69	Viscosifier
Diesel	Base fluid
Calcium Nitrate	Water phase activity
ENVIROFLOC	Primary flocculation
Lime	Drilling fluids alkalinity
ENVIROTREAT	Oil-wetting agent
ENVIROTONE	Develops gel strength/ increases rheology
ENVIROMUL I	Primary emulsifier
ENVIROMUL II	Secondary emulsifier
M-I WATE	Weighting agent

With the ENVIROVERT⁺ system, operators now have all the performance advantages of a conventional invert-emulsion drilling fluid, with the added benefit of reduced disposal costs.

How it works

The system contains no chlorides, but rather a proprietary calcium nitrate salt that not only inhibits reactive shales, but also provides nitrogen that accelerates biodegradation.

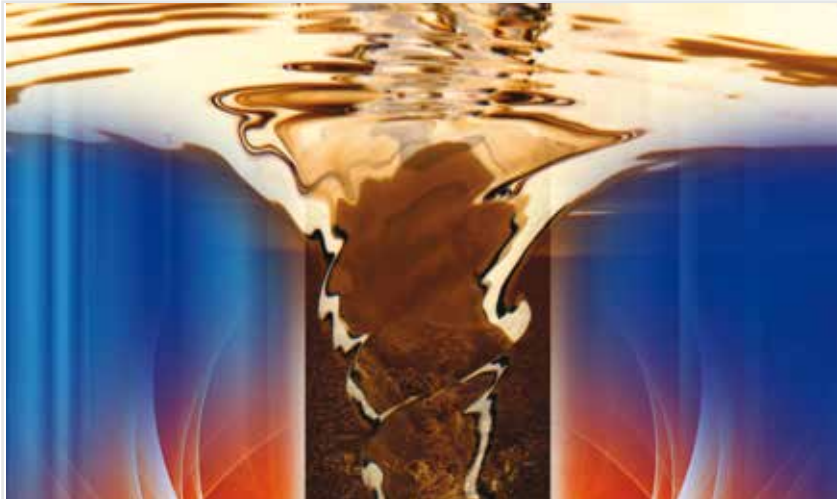
Applications

The ENVIROVERT system has been shown to significantly reduce torque and drag, making it an ideal option for drilling high-angle or horizontal wellbores. Its high-temperature stability gives you a dependable system for drilling deep, hot holes. What's more, this highly versatile system has demonstrated its effectiveness as a perforating, completion, spotting and casing-pack fluid.

Features

- Invert drilling-fluid system for water-sensitive formations
- Uses calcium nitrate in place of calcium chloride
- Excellent torque and drag reduction
- Prevents lost circulation in low-pressure zones

MEGADRIL



Product	Function
Diesel	Base fluid
VERSAGEL HT	Viscosifier
LIME	Drilling fluids alkalinity
ACTIMUL RD	Emulsifier and wetting agent
MEGAMUL	Emulsifier and wetting agent
VERSATROL or MEGATROL	Fluid-loss control agent
CaCl ₂ brine	Water phase activity
M-I WATE	Weighting agent

This new drilling-fluid system delivers the durable and temperature-stable invert-emulsion fluid operators want, without the associated elevated gel strengths.

How it works

Through its unique combination of chemistries, the MEGADRIL[†] system produces an improved relationship among the 6 RPM reading, gel strength and yield point. The result is a system that controls filtration without increasing overall viscosity and that has a higher tolerance for drill solids which can cause progressive gel strengths. This allows for reduced pump pressures and increased hole-cleaning capabilities while retaining manageable ECD values.

Applications

The MEGADRIL system in action

The system's relationship among the yield point, 6 RPM dial reading and the gel structure allows for superior cuttings transport, dramatically improving hole cleaning. The system's constant rheological relationship ensures efficient cuttings transport and fewer packoffs.

These properties are based on actual field data where the fluid design is optimized for an 8.5 in. horizontal well and where the OWR remains constant at 87:13 with 5.3% low-gravity solids in the system.

Challenge A: High gels

In the mid-continent, operators required elevated yield points and 3 and 6 RPM dial readings for sufficient hole cleaning, when drilling horizontally but wish to maintain a close relationship with the gels.

Benefits

- Simplified logistics
- Reduced disposal costs
- Decreased ECD for better hole cleaning
- Optimized drilling efficiency
- Lower pump pressures
- Increased hole cleaning

The MEGADRIL solution:

With its tight rheological profile, this new invert-emulsion system maintained a close relationship between the 6 RPM readings and the 10 sec through 30 min gel strengths.

Challenge B: Base-oil costs

Base-oil costs were driving up the total AFE costs of wells drilled in the Bakken shale area of North Dakota.

The MEGADRIL solution:

Because the MEGADRIL system lowered the overall diesel content by 10%, the operator not only saved an average of \$20,000 per well but also benefitted from a generally lower overall rheological profile for the drilling-fluid system.

Features

- Single-drum emulsifier / wetting agent
- Reduced rheological properties result in lower pump pressure and ECD values
- Excellent drill-solids, temperature and contamination tolerance
- Lower HPHT fluid-loss
- Capable of withstanding higher water content, especially in the lower drilling fluids densities

RHADIANT



Product	Function
Base fluid	Continuous phase
VG-Plus and VG-SUPREME	Viscosifier
Lime	Drilling fluids alkalinity
MUL XT	Primary emulsifier
ONETROL HT	Primary fluid-loss control agent
ECOTROL HT	Secondary fluid-loss control agent
CaCl ₂ brine	Water phase activity
M-I WATE	Weighting agent

The components of the RHADIANT⁺ fluid system are specially engineered to work synergistically to maintain stability throughout the drilling phase and evaluation of an ultra-high temperature well. The RHADIANT fluid system performs equally well with various synthetic and mineral oil-base fluid chemistries, providing the flexibility to formulate a system tailored to meet specific downhole and environmental demands.

How it works

The RHADIANT fluid system performs in ultra high-temperature (uHT) environments (>500°F) with various synthetic and mineral oil-base fluid chemistries by using specialty chemicals which remains stable and do not decompose at the uHT BHST. The components of the RHADIANT fluid system are specially engineered to work synergistically to maintain stability throughout the drilling and evaluation phases. Unlike conventional non-aqueous drilling fluids, the RHADIANT fluid system maintains extreme-temperature stability even during prolonged static conditions. Stable rheologies in tandem with ultra-thin and slick filter cake deposits clear the path for efficient logging, casing and cementing operations.

Benefits

- Maintains thermal stability greater than 500°F (260°C) BHST
- Resists acid gas contamination
- Effectively controls equivalent circulating densities (ECDs)
- Improves tripping
- Reduces drilling fluids loss and stuck pipe incidents
- Reduces torque and drag
- Provides ideal logging, casing and cementing operations
- Eliminates fluid-related nonproductive time (NPT)
- Minimizes HSE risks
- Accelerates production
- Maximizes asset value
- Minimized potential for high temperature gelation

Applications

Any ultra-high temperature well (BHST 400F and higher) where stable drilling fluid properties are critical in static conditions with no gelation or thermal degradation issues.

Features

- Maintains thermal stability greater than 500°F (260°C) BHST
- Resists acid gas contamination
- Effectively controls equivalent circulating densities (ECDs)
- Improves tripping
- Provides ideal logging, casing and cementing operations
- Eliminates fluid-related nonproductive time (NPT)
- Minimizes HSE risks
- Accelerates production
- Maximizes asset value
- Minimized potential for high temperature gelation

RHELIANT



Benefits

- Reduced fluid and well-construction costs
- Improved ECD management
- Minimized formation fractures
- Reduced environmental costs, greater safety
- Optimized drilling efficiency
- Significantly reduced whole-drilling fluids losses

Applications

Field results that deliver on the promise of the laboratory

In the field, the RHELIANT system has shown performance characteristics far superior to those of any conventional synthetic-base and other invert drilling fluids in deepwater applications.

- ROP as much as 20 ft/hr (6.1 m/hr) faster than typical synthetic-base systems
- On-bottom drilling time reduced by as much as 24 hrs per interval
- Reduced drilling fluids losses, less dilution and improved displacement characteristics
- Balanced yield point delivers higher penetration rates, vastly improved cuttings-transport and considerable savings in hole-conditioning time

Features

- Flat rheological profile over a wide temperature range
- Reduced sag potential
- Less dilution/maintenance
- Improved hole cleaning, cuttings suspension
- Reduced pressure spikes

Product	Function
VG-PLUS and VG-SUPREME	Viscosifier
LIME	Drilling fluids alkalinity
SUREMUL	Primary emulsifier
SUREWET	Wetting agent and secondary emulsifier
RHEFLAT	Rheology modifier
RHETHIK	Viscosifier
RHEDUCE	Thinner
RHEBUILD	Temporary viscosifying agent
ECOTROL RD	Filtration control
CaCl ₂ brine	Water phase activity
M-I WATE	Weighting agent

The RHELIANT system's lower clay content, fit-for-purpose viscosifiers, specially designed emulsifiers, rheology modifiers and adaptability to different base fluids yield a high-performance system that is cost-effective yet easy to maintain.

How it works

With its flat rheology, this unique system maintains consistent fluid properties that are independent of temperature and pressure. ECDs with RHELIANT are consistently lower than with conventional invert systems while encountering fewer drilling problems and minimizing loss of whole drilling fluids.

VERSACLEAN/VERSADRIL



Benefits

- Maximizes production
- Reduces torque and drag
- In-gauge wellbores
- Optimized ROP
- Stable wellbores

Applications

Both systems deliver very good thermal stability for drilling deep, hot holes. VERSACLEAN and VERSADRIL systems minimize damage to producing formations through the prevention of water intrusion, thereby eliminating clay swelling which can cause reduced permeability of the pay zone. They also provide increased rates of penetration and ability to drill thick, water-sensitive shale sections with relative ease, thus providing for gauge hole drilling.

In many cases, oil drilling fluids are not considered, although the drilling conditions warrant their use, because of their initial makeup costs. However, if the overall drilling costs are considered, the costs accompanying the use of an oil drilling fluids are usually comparable with, or less than, those of a water-base fluid, particularly when most drilling problems are eliminated, resulting in substantial time savings. In addition, both VERSACLEAN and VERSADRIL oil drilling fluids can be salvaged and reused following the drilling operation.

Features

- Low coefficient of friction
- High-temperature stability
- Chemically stable
- Excellent filtration control

Product	Function
VG-69 and VG-PLUS	Viscosifier
VERSAGEL HT and VG-HT	High temperature viscosifier
VERSAMUL	Primary emulsifier
VERSACOAT	Coating agent
VERSAWET	Wetting agent and secondary emulsifier
VERSAMOD	Rheology modifier
SWA	Supplemental wetting agent
HRP	Temporary viscosifying agent
VERSALIG	HPHT fluid-loss control agent
Lime	Drilling fluids alkalinity
Calcium chloride	Water phase activity
M-I WATE	Weighting agent

How it works

Their formulation provides inherent protection against acid gases, such as CO₂ and H₂S, as well as corrosion due to the presence of Lime (used as an alkalinity control reagent) in the continuous oil phase. VERSACLEAN and VERSADRIL systems can drill water-soluble formations (anhydrite, gypsum, salts and complex salts) with minimum or no hole-washout problems. They provide improved lubricity for drilling deviated holes and for significantly reducing occurrences of stuck pipe.

The VERSACLEAN[†] and VERSADRIL[†] systems are oil-base fluids formulated with VERSACOAT-VERSAWET or VERSAMUL-VERSACOAT emulsification packages and engineered to meet any drilling-fluid requirement. The only difference between the two systems is that the VERSACLEAN system uses a highly refined mineral oil while the VERSADRIL system is formulated with No. 2 diesel oil as the continuous external phase.

PARALAND



Product	Function
Linear Paraffin Fluid	Base fluid
VERSAGEL-HT	Viscosifier
Lime	Drilling fluids alkalinity
ECOTROL RD	Filtration control
NOVAMUL	Emulsifier
VERSAWET	Oil-wetting agent
Internal Phase (Chlorides-free salt)	Low water activity for shale stability
FER-OX	Weighting agent

The non-aqueous system designed to deliver outstanding performance coupled with unsurpassed environmental excellence

How it works

The PARALAND system design incorporates ready biodegradability and low terrestrial toxicity into all of its organic components. In addition, the inorganic components are designed to minimize conductivity and enhance plant growth. All of this is accomplished while maintaining the high-performance characteristics of an invert-emulsion fluid.

Applications

In the field, PARALAND has consistently exceeded performance expectations with high rates of penetration, low dilution rates and high levels of contamination tolerance. Drilling fluids weights from 7.5 to 16 lb/gal (0.9 to 1.92 kg/L) have been easily achieved with ideal rheological and filtration properties. The system is easily and economically maintained with actual total fluid-cost reductions of as much as 30% below estimate.

The PARALAND system has been used in various zero-waste operations. In New Zealand, PARALAND cuttings were used as a food source for

Benefits

- Optimized drilling performance
- Low dilution rates
- Minimum environmental exposure
- Lower well costs
- Beneficial reuse of cuttings
- Zero-waste option

worms in a local vermiculture farm, converting the cuttings into vermicast fertilizer. In Colorado, PARALAND cuttings were co-composted with straw, bark and sand to provide a topsoil for reseeding the drillsite.

Features

- High-performance, invert-emulsion system
- Readily engineered and maintained
- Biodegradable organic components
- All components low terrestrial toxicity
- Variety of compatible treatment options

PARATHERM/VERSATHERM



Benefits

- Optimized ROP
- In gauge well bores
- Reduction in Equivalent Circulating Density (ECD)
- Reduced pump pressure
- Reduced sag potential.
- Reduced torque and drag

narrow-hydraulic window well. The well was successful due in large part to the lower rheological properties and associated reduction in ECD obtainable with the PARATHERM system. This application confirmed the ability of the PARATHERM system to provide a fluid with reduced high-shear-rate viscosity compared to conventional systems, providing a direct benefit in reduced total system pressure loss.

The PARATHERM system has also been used successfully to drill Extended-Reach Drilling (ERD) wells.

The VERSATHERM system has been successfully used in HPHT applications. The maximum bottomhole static temperature the system has been used to drill is slightly above 356°F (180°C). The system has exhibited very stable properties and low, non-progressive gel strengths.

Product/Additive	Function
BARITE	Weight material
EDC 99-DW	Base fluid
SIPDRIL 2/0	Base fluid
PARAMUL	Primary emulsifier
PARAWET	Secondary emulsifier
BENTONE 128 / BENTONE 38 / VG SUPREME	Viscosifier
CaCl ₂ -brine	Salinity
LIME	Alkalinity
VERSATROL M, VERSATROL HT	Fluid-loss control
ECOTROL HT, ECOTROL RD	Fluid-loss control
ONETROL HT	Fluid-loss control
Barite	Density

The PARATHERM[†] and VERSATHERM[†] systems are invert-emulsion systems with one significant difference in their formulations. PARATHERM uses a linear-paraffin base oil, while VERSATHERM employs a low-toxicity mineral oil.

How it works

The PARATHERM and VERSATHERM systems was designed to deliver a non aqueous fluid with the following qualities:

- Stability at high temperatures
- Reduced high shear rate viscosity
- Stable low shear rate viscosity
- Reduction in Equivalent Circulating Density (ECD)
- Reduced sag potential

Applications

The PARATHERM system is suitable for applications with narrow hydraulic windows, regardless of the expected Bottomhole Static Temperature (BHST). The first field application of the PARATHERM system was in a low-temperature (160°F [71°C]),

Features

- Low coefficient of friction
- High temperature stability
- Chemically stable
- Excellent filtration control
- Reduced high shear rate viscosity
- Stable low shear rate viscosity

WARP Advanced Fluids Technology



WARP Fluids Technology allows for low rheology fluids without barite sag.

How it works

The concept behind WARP Fluids Technology lies in grinding the weighting material to extremely fine particle sizes — from 0.1 to 10 microns. By treating these extremely fine particles, there is no rheology increase.

Applications

These and other advantages make WARP Fluids Technology the ultimate choice for reducing drilling risk and well costs for a wide array of critical drilling applications, including:

- Horizontal and extended-reach wells
- Coiled-tubing and through-tubing rotary drilling
- Managed-pressure drilling
- Reservoir drill-in fluids
- Wells with narrow operating windows
- HPHT wells
- Casing drilling
- Inhibitive fluids
- Wells with risk of barite sag
- Drilling waste management
- Critical cementing operations

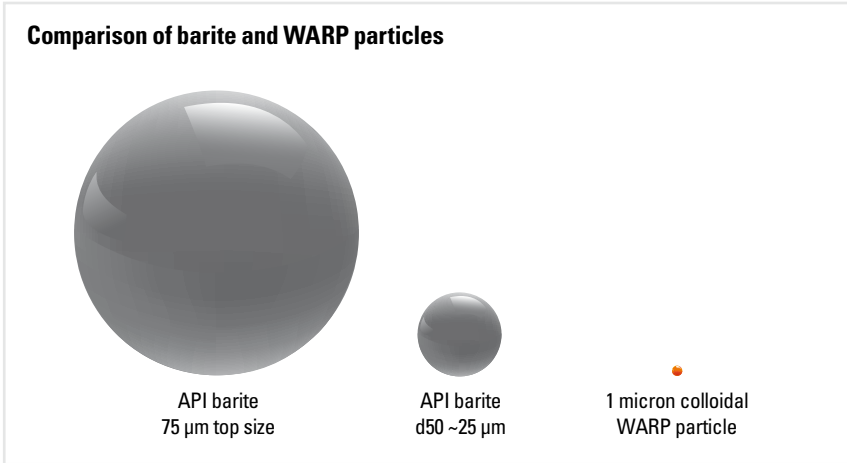
The boundaries of extended-reach and horizontal drilling in “green” and “brown” field development are extending outward. API-grade barite has served the industry well for the last 80 years or more as the natural product of choice to increase the density of fluids. In practice, drilling-fluid viscosity was controlled to ensure that the barite remained suspended, preventing it from settling out in the wellbore. That was fine in the past, but now well trajectories are becoming increasingly complex, forcing an inevitable compromise between the rheological requirements for barite suspension and hydraulics for well control.

Benefits

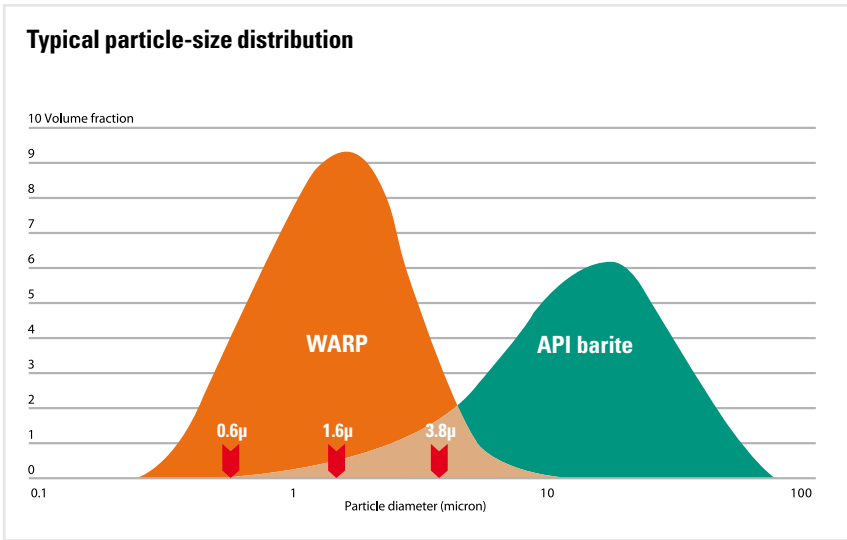
- Reduces risk of static and dynamic sag
- Lower ECD values
- Lower swab and surge pressures
- Lower pump pressures
- Improves cement-job quality
- Faster pipe-running and tripping speeds
- Improves MWD/LWD data quality
- Lowers rotary torque and friction factors
- Increases solids-removal efficiency and lower dilution/maintenance
- Reduces risk of completion-screen plugging
- Lower downhole fluid-losses can be used

Features

- WARP¹ Fluids Technology particles are 10 times smaller than drilling-grade barite
- Low-viscosity fluids with low plastic viscosities and yield point and low-shear-rate viscosity, a drilling fluids reduced risk of barite sag
- Lower friction factors: up to 10% in cased hole and 25% in openhole
- WARP micron-sized weighting agents pass more efficiently through shaker screens and openhole-completion screens
- Non-damaging to producing formations and completion hardware
- Lower dynamic and static fluid-loss with thinner filter cakes and lower breakthrough pressures



The specially treated micron-size weighting materials unique to WARP Fluids Technology are 10 times smaller than drilling-grade barite. Their ultra-small size, combined with their proprietary treatment, ensures that fluids formulated with WARP Fluids Technology have exceptionally stable properties.



The average size of particles in WARP Fluids Technology are less than 2 microns and nearly all the particles are less than 5 microns — about the same size as human red blood cells. For the first time since weighting agents were first used in drilling fluids more than 80 years ago, WARP Fluids Technology overcomes many of the deficiencies of barite. It is the weighting agent for solving 21st-century drilling problems.

Product Summaries

	Name	Description	Type	Primary function	Secondary function
Biocides	M-I CIDE [†]	Biocide—Not available in the U.S.A.	Water	Biocide	—
	SAFE-CIDE [†]	Biocide—Not available in the U.S.A.	Water	Biocide	—
Breakers	BREAKLOOSE	Lithium Hypochlorite	Water	Breaker	—
Alkalinity Control	CITRIC ACID	pH reducer	Water	Calcium remover	pH reducer
	SODA ASH	Sodium carbonate	Water	Calcium remover	pH control
	SODIUM BICARBONATE	Bicarbonates of Soda	Water	Calcium remover	pH reducer
Corrosion inhibitors	CONQOR [†] 101	Filming amine	Water	Corrosion inhibitor	—
	CONQOR [†] 202 B	Persistent filming amine	Water	Corrosion inhibitor	—
	CONQOR [†] 303 A	Amine corrosion inhibitor for clear brines	Water	Corrosion inhibitor	—
	CONQOR [†] 404	General-use, phosphorus-base inhibitor	Water	Corrosion inhibitor	—
	OS-1L [†]	Sulfite-base oxygen scavenger	Water	Corrosion inhibitor	Thermal stability
	SULFATREAT [†] DFS	H ₂ S scavenger	Water	Corrosion inhibitor	—
	SULFATREAT [†] XLP	Extended-life H ₂ S scavenger	Water	Corrosion inhibitor	—
Defoamers	BUBBLE BUSTER [†]	Low-toxicity defoamer	Water	Defoamer	—
	DEFOAM-A [†]	Alcohol-base defoamer	Water	Defoamer	—
	DEFOAM-X [†]	All-purpose liquid defoamer	Water	Defoamer	—
Emulsifiers/ Wetting Agents	ACTIMUL RD	100% active, dry emulsifier	Oil/ Synthetic	Emulsifier	Wetting agent
	ECOGREEN [†] P	Primary emulsifier for the ECOGREEN system	Synthetic	Emulsifier	Surfactant
	ECOGREEN [†] S	Secondary emulsifier for the ECOGREEN system	Synthetic	Emulsifier	Surfactant
	EMUL HT [†]	HPHT emulsifier	Oil	Emulsifier	—
			Synthetic		
	MEGAMUL [†]	Multi-purpose emulsifier	Oil	Emulsifier	Wetting agent
	NOVAMUL [†]	Basic emulsifier package	Synthetic	Emulsifier	Surfactant
					Filtration
					Thermal stability
					Viscosifier
	NOVAPRO P/S	Sufactant	Synthetic	Emulsifier	Wetting agent
	NOVATEC [†] P	Primary emulsifier for the NOVATEC system	Synthetic	Emulsifier	Filtration
	NOVATEC [†] S	Secondary emulsifier for the NOVATEC system	Synthetic	Emulsifier	Filtration
	OILFAZE [†]	Sacked oil-base concentrate	Oil	Emulsifier	Filtration
					Viscosifier
	ONE-MUL [†]	Emulsifier package	Oil	Emulsifier	Wetting agent
PARAMUL	Environmentally acceptable emulsifier	Synthetic	Emulsifier	Filtration	
PARAWET [†]	Primary wetting agent for RHELIANT	Oil	Wetting agent	Emulsifier	
		Synthetic			
SUREMUL [†]	Primary emulsifier for invert-emulsion systems	Oil	Emulsifier	Surfactant	
		Synthetic			
SUREWET	Primary wetting agent for RHELIANT	Oil Synthetic	Wetting agent	Emulsifier	

	Name	Description	Type	Primary function	Secondary function
Emulsifiers/ Wetting Agents	VERSACOAT[†] HF	High flash-point emulsifier for oil-base fluids	Oil	Emulsifier	Temp stability
	VERSACOAT Na	Primary emulsifier for oil-base fluids	Oil	Emulsifier	Surfactant Thermal stability
	VERSAMUL[†]	Basic emulsifier package	Oil	Emulsifier	Surfactant Filtration Thermal stability Viscosifier
	VERSATRIM	Cutting retention reducer	Oil	Wetting agent	LSRV modifier
	VERSAWET	Organic surfactant	Oil	Wetting agent	—
	Filtration reducers	CAUSTILIG	Causticized lignite	Water	Filtration
DUAL-FLO		Specially modified starch additive	Water	Filtration	LSRV modifier
DUAL-FLO HT		Specially modified starch additive	Water	HT Filtration	LSRV modifier
DURALON[†]		High-temperature filtration-control polymer	Water	Filtration	Thermal stability
FLO-PLEX		Polysaccharide derivative to control filtration in DRILPLEX system	Water	Filtration	—
FLO-TROL		Special starch derivative	Water	Filtration	—
HIBTROL[†]		Modified metal-cellulose polymer	Water	Filtration	Shale inhibition
HIBTROL[†] Ulv		Fluid-loss additive and secondary shale inhibitor with ultra-low viscosity	Water	Filtration	Shale Control
HIBTROL[†] Hv		Modified metal-cellulose polymer that also provides viscosity	Water	Filtration	Shale inhibition Viscosifier
MEGATROL[†]		Readily dispersible filtration control additive	Oil	Filtration	—
M-I 157		Specialized emulsifier for filtration	Oil	Filtration Control	Emulsion stability
M-I GEL[†]		Bentonite, meets API specifications	Water	Filtration Viscosifier	—
M-I PAC[†] R		PAC polymer, tech grade		Filtration	Viscosifier Shale inhibitor
M-I PAC SR		Regular semi-pure grade quality PAC	Water	Filtration	Viscosity control
M-I PAC SUL		Regular semi-pure grade quality PAC	Water	Filtration	—
M-I PAC[†] UL		PAC polymer, low-viscosity, tech grade	Water	Filtration	Shale inhibitor
MY-LO-JEL[†]		Pregelatinized starch	Water	Filtration	—

Product Summaries (Continued)

	Name	Description	Type	Primary function	Secondary function
Filtration reducers	NOVATEC F	Maleated rosin polymer/glycol ether	Synthetic	Filtration	—
	ONETROL[†] HT	Filtration control additive	Oil Synthetic	Filtration	—
	POLY-SAL[†]	Preserved modified starch	Water	Filtration	Viscosifier
	POLY-SAL[†] HT	High-quality preserved polysaccharide	Water	Filtration	Viscosifier
	POLY-SAL[†] T	Non-fermenting tapioca starch derivative	Water	Filtration	Viscosifier
	POLYPAC[†] ELV	Extra-low-viscosity PAC	Water	Filtration	Shale inhibitor
	POLYPAC[†] R	Polyanionic cellulose	Water	Filtration	Viscosifier
	POLYPAC[†] SUPREME UL	PAC, premium-grade, ultra-low viscosity	Water	Filtration	Shale control
	POLYPAC[†] UL	Polyanionic cellulose	Water	Filtration	Shale control
	RESINEX[†]	Resinated lignite complex	Water	Filtration	Thermal stability Thinner
	RESINEX[†] II	Resinated lignite, tech grade	Water	Filtration	Thermal stability Thinner
	RESINEX EH	Resinated lignite additive	Water	Filtration	Thermal stability Thinner
	SP-101[†]	Sodium polyacrylate	Water	Filtration	Shale control Thermal stability
	TANNATHIN[†]	Ground lignite	Water	Filtration Thinner	Emulsifier Thermal stability
	THERMPAC UL	Pure grade polyanionic polymer	Water	Filtration	—
	UNIPAC SUPREME R	Modified polyanionic cellulose	Water	Filtration	Viscosity
	UNIPAC SUPREME UL	Modified polyanionic cellulose	Water	Filtration	—
	UNITROL[†]	Modified polysaccharide	Water	Filtration	—
	VERSALIG[†]	Amine-treated lignite	Oil	Filtration	Lost circulation
	VERSATROL[†]	Asphaltic resin	Oil	Filtration	Lost circulation Viscosifier
VERSATROL[†] HT	High-temperature Gilsonite	Oil Synthetic	Filtration	—	
VERSATROL NS	Blend of lignite & gilsonite for HPHT filtration	Oil	Filtration	Thermal stability	
VERT-TROL	Asphaltic fluid-loss additive	Oil	Filtration	—	
Flocculants	FLOXIT	Powerful organic flocculant	Water	Flocculant	Shale control
	GELEX[†]	Bentonite extender	Water	Flocculant viscosifier	—
Foaming agents	PLATINUM FOAM	Biodegradable foaming agent	Water	Foaming agent	—
	PLATINUM FOAM PLUS	Foaming agent for air drilling applications	Water	Foaming agent	—
Lost circulation materials	C-SEAL[†]	Coke FLCA	Water	Lost circulation	—
			Oil		
			Synthetic		

	Name	Description	Type	Primary function	Secondary function
Lost circulation materials	C-SEAL[†] F	Coke FLCA (fine grind)	Water	Lost circulation	—
			Oil		
			Synthetic		
	FORM-A-PLUG[†] ACC	Accelerator for the FORM-A-SET II system	Water	Lost circulation	—
			Oil		
			Synthetic		
	FORM-A-PLUG[†] II	Acid-soluble plug	Water	Lost circulation	Filtration
			Oil		
			Synthetic		
	FORM-A-PLUG[†] RET	Retarder for the FORM-A-SET II system	Water	Lost circulation	—
			Oil		
			Synthetic		
	FORM-A-SET[†]	Cross-linked polymer plug	Water	Lost circulation	—
	FORM-A-SET[†] ACC	Accelerator for the FORM-A-SET pill	Water	Lost circulation	—
			Oil		
			Synthetic		
	FORM-A-SET[†]AK	Polymeric lost-circulation material	Water	Lost circulation	—
			Oil		
			Synthetic		
	FORM-A-SET[†] AKX	Variant of FORM-A-SET AK for water shut off	Water	Lost circulation	—
Oil					
Synthetic					
FORM-A-SET[†] RET	Retarder for the FORM-A-SET pill	Water	Lost circulation	—	
		Oil			
		Synthetic			
FORM-A-SET[†] XL	Cross-linker for the FORM-A-SET pill	Water	Lost circulation	—	
		Oil			
		Synthetic			
G-SEAL[†]	Sized graphite bridging agent	Water	Lost circulation	Lubricant	
		Oil			
		Synthetic			
G-SEAL PUS COARSE	Coarse-size graphite bridging agent	Water	Lost circulation	Lubricant	
		Oil			
		Synthetic			
G-SEAL PLUS	Sized graphite bridging agent	Water	Lost circulation	Lubricant	
		Oil			
		Synthetic			
G-SEAL HRG FINE	Fine-size high-resiliency graphite	Water	Lost circulation	Lubricant	
		Oil			
		Synthetic			

Product Summaries (Continued)

	Name	Description	Type	Primary function	Secondary function
Lost circulation materials	G-SEAL HRG	Coarse-size high-resiliency graphite	Water	Lost circulation	Lubricant
			Oil		
			Synthetic		
	M-I CEDAR FIBER [†]	Shredded cedar fiber	Water	Lost circulation	—
	M-I SEAL [†]	LCM for fractured or vugular formations	Water	Lost circulation	Filtration
			Oil		
			Synthetic		
	M-I-X [†] II	Ground cellulose	Water	Lost circulation	Filtration
			Oil		
			Synthetic		
	NUT PLUG [†]	Ground nut shells	Water	Lost circulation	—
			Oil		
Synthetic					
SAFE-CARB [†]	Ground marble (calcium carbonate)	Water	Bridging agent	Density	
		Oil			
		Synthetic			
VERSAPAC	Thermally activated organic thixotrope	Oil	Lost circulation	Gelling agent	
VINSEAL [†]	Filtration control and electrical stability agent	Oil	Lost circulation	Filtration	
		Synthetic			
Lubricant	DRIL-FREE [†]	High-performance lubricant, anti-sticking agent	Water	Lubricant	Surfactant
	IDLUBE [†] XL	Extreme-pressure lubricant	Water	Lubricant	—
	LOTORQ	Lubricant for high potential torque and drag in FLOPRO systems	Water	Lubricant	—
	LUBE-945 [†]	Water-dispersible lubricant	Water	Lubricant	Shale inhibition
	LUBE-100 [†]	Water-dispersible lubricant	Water	Lubricant	Shale inhibition
	LUBE-167 [†]	Water-dispersible lubricant	Water	Lubricant	Shale inhibition
	LUBE-776 [†]	Water-dispersible lubricant	Water	Lubricant	Shale inhibition
	LUBE-1722 [†]	Water-dispersible lubricant	Water	Lubricant	Shale inhibition
	LUBE XLS	Extreme-pressure lubricant	Water	Lubricant	—
	M-I LUBE [†]	General-purpose lubricant	Water	Lubricant	—
	SIL-LUBE [†]	Lubricant for the SILDRIL system	Water	Lubricant	—
	SILDRIL EPL	SILDRIL torque/drag/differential sticking reducer	Water	Lubricant	—
	STARGLIDE [†]	Lubricant and ROP enhancer	Water	Lubricant	Surfactant
	STEEL LUBE [†] EP	Extreme-pressure lubricant	Water	Lubricant	—
	VERSALUBE [†]	Oil-soluble lubricant	Oil	Lubricant	—
Pipe freeing compounds	PIPE-LAX [†]	Oil-base, stuck-pipe-freeing surfactant	Water	Free pipe	—
			Oil		
PIPE-LAX [†] ENV	Low-toxicity, stuck-pipe spotting fluid	Water	Free pipe	Lubricant	

	Name	Description	Type	Primary function	Secondary function
Pipe freeing compounds	PIPE-LAX [†] W EXPORT	Liquid, one-drum, stuck-pipe spotting fluid	Water	Free pipe	—
			Oil		
	PIPE-LAX [†] W EH	Liquid, one-drum, stuck-pipe spotting fluid	Water	Free pipe	—
			Oil		
Scale inhibitors	SI-1000	Blend containing water soluble organic phosphorus compounds	Water	Scale inhibitor	—
Scavengers	ZINC OXIDE	Very fine particle size Sulfide Scavenger	Water	Sulfide scavenger	—
			Oil		
			Synthetic		
	ZINC CARBONATE	Fine particle size zinc carbonate	Water	Sulfide scavenger	—
Oil					
Synthetic					
Shale inhibitors	ASPHASOL [†]	Sulfonated organic-resin blend	Water	Shale inhibitor	Filtration
	ASPHASOL [†] D	Sulfonated organic blend	Water	Shale inhibitor	Filtration
	ASPHASOL [†] SUPREME	Sulfonated asphalt	Water	Shale inhibitor	Filtration
	BORETEX	Water dispersible asphaltic compound for shale stability	Water	Shale Inhibitor	Filtration
	GLYDRIL [†] GP	Broad-cloud-point, general-purpose polyglycol for low-salinity fluids and low temperatures	Water	Shale control Filtration	Lubricity
	GLYDRIL [†] HC	Polyglycol for high-salinity fluids and high temperatures	Water	Shale control Filtration	Lubricity
	GLYDRIL [†] LC	Low-cloud-point polyglycol for low-salinity fluids and low temperatures	Water	Shale control Filtration	Lubricity
	GLYDRIL [†] MC	Medium-cloud-point polyglycol for moderate-salinity fluids and high temperatures	Water	Shale control Filtration	Lubricity
	IDCAP [†] D	Polymeric shale inhibitor	Water	Shale inhibition	—
	KLA-CAP [†]	Shale encapsulator	Water	Shale inhibition	—
	K-52 [†]	Potassium supplement	Water	Shale control	—
	KLA-CURE [†]	Hydration suppressant	Water	Shale control	—
	KLA-CURE [†] II	Hydration suppressant plus detergent	Water	Shale control	—
	KLA-GARD [†]	Shale stabilizer and inhibitor	Water	Shale control	Filtration
	KLA-GARD [†] B	Salt-free KLA-GARD	Water	Shale inhibitor	
	KLAFLOC [†] I	Low-cost shale inhibitor for floc water drilling	Water	Shale inhibitor	—
	KLAFLOC [†] II	Cationic flocculant for floc water drilling	Water	Shale inhibitor	—
	KLA-STOP [†]	Shale inhibitor	Water	Shale control	—
	POLY-PLUS [†]	Liquid PHPA	Water	Encapsulator	Shale stabilization
	POLY-PLUS [†] DRY	Dry PHPA polymer	Water	Encapsulator	Shale stabilization
	POROSEAL	Co-polymeric shale sealing additive	Water	Shale control	Filtration
	POLY-PLUS [†] LV	Low-viscosity PHPA	Water	Encapsulator	Shale stabilization
	POLY-PLUS [†] RD	Readily dispersible PHPA powder	Water	Encapsulator	Shale stabilization
SILDRIIL [†] D	Dry sodium silicate	Water	Shale inhibitor	—	

Product Summaries (Continued)

	Name	Description	Type	Primary function	Secondary function
Shale inhibitors	SILDRIL[†] K	Potassium silicate	Water	Shale inhibitor	—
	SILDRIL[†] L	Liquid sodium silicate	Water	Shale inhibitor	—
	TARCLEAN[†]	Anticrete agent for heavy oil to thin asphaltenes	Water	Shale control	—
	ULTRACAP[†]	Encapsulator for the ULTRADRIL system	Water	Shale inhibitor	—
	ULTRACAP P	Encapsulator for the ULTRADRIL system - powder	Water	Shale inhibitor	—
	ULTRACAP PLUS	Encapsulator for the ULTRADRIL system	Water	Shale inhibitor	—
	ULTRAHIB[†]	Shale inhibitor for the ULTRADRIL system	Water	Shale inhibitor	—
Surfactants	CLEAN UP[†]	Detergent for general rig cleaning when using oil- and synthetic-base fluids	Water	Surfactant	Emulsifier
			Oil		
			Synthetic		
	D-D[†]	Drilling detergent	Water	Surfactant	Emulsifier Shale control
	D-SPERSE	Mixed surfactant solution	Water	Surfactant	Dispersant
	DRIL-KLEEN[†]	Concentrated, mild drilling detergent with low toxicity	Water	Surfactant	Emulsifier
					Shale control
	DRIL-KLEEN[†] II	Anti-bit balling agent	Water	Surfactant	Emulsifier Lubricant
	DRILZONE[†]	ROP enhancer	Water	Surfactant	—
	DRILZONE[†] L	Low-cost anticrete	Water	Surfactant	—
	ECOKLEEN[†]	Anticrete for tar applications	Water	Surfactant	—
	FAZE-MUL	Primary emulsifier and wetting agent for FAZEPRO systems	Oil	Emulsifier	Wetting agent
			Synthetic		
	DRILLING FLUIDSWASH[†]	Rig wash	Rig wash	Rig wash	—
	NOVAWET[†]	Wetting agent	Synthetic	Surfactant	Emulsifier
					Thinner
					Thermal stability
	SUREWET[†]	Wetting agent for invert-emulsion systems	Synthetic	Surfactant	Emulsifier
			Oil		
	SWA[†] EH	Oil-base wetting agent for high-brine-content systems	Oil	Surfactant	Emulsifier
	TARLIFT[†]	Solvent for the SAGDRIL [†] system	Water	Surfactant	—
	TARSURF[†]	Water-wetter for the SAGDRIL system	Water	Surfactant	—
ULTRAFREE[†]	ROP enhancer for the ULTRADRIL system	Water	Surfactant	—	
ULTRAFREE[†] L	Low-cost anticrete	Water	Surfactant	Lubricant	
ULTRAFREE[†] NH	Non-hydrocarbon version of ULTRAFREE ROP enhancer	Water	Surfactant	Lubricant	
VERSACOAT[†]	Emulsifier and wetting agent	Oil	Surfactant	Emulsifier	
				Thermal stability	
VERSAWET[†]	Wetting agent for oil-base fluids	Oil	Surfactant	Emulsifier	
				Thinner	
				Thermal stability	

	Name	Description	Type	Primary function	Secondary function
Temperature stabilizers	GLYDRIL [†] DG	Water-miscible glycol-hydrate inhibitor	Water	Thermal stability	Surfactant
	PTS-200 [†]	Polymeric temperature stabilizer	Water	Thermal stability	—
	XP-20K [†]	Potassium chrome lignite	Water	Thermal stability	Emulsifier Filtration Thinner
	XP-20 [†] N	Chrome lignite, sodium hydroxide, neutralized	Water	Thermal stability	Thinner Filtration
Thinners	CAUSTILIG [†]	Caustilized lignite	Water	Thinner filtration	Thermal stability Emulsifier
	IDSPERSE [†] XT	High-temperature polymeric dispersant	Water	Thinner	—
	K-17 [†]	Potassium lignite	Water	Thinner	Filtration Shale control
	RHEDUCE [†]	Thinner for RHELIANT system	Synthetic Oil	Thinner	—
	RHEOCHECK	Modified lignin compound	Water	Thinner	—
	RHEOSPERSE [†]	Polymeric high-temperature deflocculant	Water	Thinner	—
	SPERSENE [†]	Chrome lignosulfonate	Water	Thinner	Emulsifier Filtration Thermal stability
	SPERSENE [†] CF	Chrome-free lignosulfonate	Water	Deflocculant	Filtration
	SPERSENE [†] CFI	Iron lignosulfonate	Water	Thinner	—
	SPERSENE [†] I	Ferrochrome lignosulfonate	Water	Thinner	Thermal stability Filtration
	SURETHIN [†]	Thinner for invert-emulsion systems	Synthetic Oil	Thinner	Surfactant
	TACKLE [†]	Liquid, low-molecular-weight polyacrylate (dry available)	Water	Thinner	Filtration
	TACKLE [†] DRY	Powdered low-molecular-weight polyacrylate	Water	Thinner	—
	THINSMART [†]	Thinner for water-base drilling fluids	Water	Thinner	—
	VERSATHIN [†]	Thinner and conditioner for oil-base fluids	Oil	Thinner	—
	VERSATHIN [†] HF	High Flashpoint thinner and conditioner for oil-base fluids	Oil	Thinner	Conditioner
	XP-20 N	Chrome Lignite	Water	Thinner	Filtration
	Tracers	OPTITRAK 600	Blue dye	Water	Tracer
Viscosifiers	DRILPLEX [†]	Viscosifier for the DRILPLEX MMO system	Water	Viscosifier	Shale inhibitor
	DUO-TEC [†]	Xanthan gum	Water	Viscosifier	—
	DUO-TEC [†] NS	High molecular weight biopolymer	Water	Viscosifier	—
	Duo-VIS [†]	Xanthan gum	Water	Viscosifier	—
	DUO-VIS [†] L	Liquified xanthan gum, non-clarified	—	Viscosifier	—
	DUO-VIS [†] NS	Xanthan gum	Water	Viscosifier	—
	DUO-VIS [†] PLUS	Xanthan gum	Water	Viscosifier	—

Product Summaries (Continued)

	Name	Description	Type	Primary function	Secondary function
Viscosifiers	DUO-VIS[†] PLUS NS	High molecular weight, nondispersible biopolymer	Water	Viscosifier	—
	DUROGEL[†]	Sepiolite clay	Water	Viscosifier	—
	ECOGREEN[†] M	Low-end rheology modifier	Synthetic	Viscosifier	—
	FLO-VIS PLUS	High yield, premium-grade, clarified xanthan gum	Water	Viscosifier	—
	GELPLEX[†]				
	GUAR GUM	Rapidly mixing, high viscosity polymer	Water	Viscosifier	—
	HRP[†]	Liquid viscosifier for oil fluids	Oil	Viscosifier	—
	M-I GEL[†] SUPREME	Non-treated bentonite, meets API specifications	Water	Viscosifier	Filtration
	M-I GEL[†] WYOMING	API-spec bentonite sourced only from Wyoming	Water	Viscosifier	Filtration
	NOVAMOD[†]	Rheology modifier, LSRV	Synthetic	Viscosifier	—
	NOVATEC[†] M	Low-end rheology modifier for the NOVATEC system	Synthetic	Viscosifier	—
	RHEBUILD[†]	Viscosifier for RHELIANT system	Synthetic Oil	Viscosifier	—
	RHEFLAT[†]	Rheological modifier for RHELIANT system	Synthetic Oil	Viscosifier	—
	RHETHIK[†]	Rheological modifier for RHELIANT system	Synthetic Oil	Viscosifier	—
	SALT GEL[†]	Attapulgitic clay	Water	Viscosifier	—
	SUPRA-VIS[†]	High-performance biopolymer viscosifier	Water	Viscosifier	—
	SUREMOD[†]	Viscosifier, gelling agent for invert-emulsion systems	Synthetic Oil	Viscosifier	—
	SURETHIK[†]	Rheological modifier	Synthetic	Viscosifier	—
	TARVIS[†]	Liquid viscosifier for the SAGDRIL system	Water	Viscosifier	—
	TRUVIS[†]	Viscosifier for the TRUDRIL system	Oil	Viscosifier	Filtration
	VERSAGEL[†] HT	Hectorite	Oil	Viscosifier	Filtration
	VERSAMOD[†]	Rheology modifier, LSRV	Oil	Viscosifier	—
VG-69[†]	Organophilic clay	Oil	Viscosifier	Filtration	
VG-PLUS[†]	Organophilic clay	Oil Synthetic	Viscosifier	Filtration	
VG-SUPREME[†]	Organophilic clay for the NOVA systems	Synthetic	Viscosifier	Filtration	
Weighting agents	FER-OX[†]	Hematite	Water Oil Synthetic	Density	—
	M-I BAR[†]	Barite, meets API specifications	Water Oil Synthetic	Density	—
	M-I WATE	High quality drilling grade barite	Water Oil Synthetic	Density	—

	Name	Description	Type	Primary function	Secondary function
Weighting agents	SALT	Sodium Chloride	Water	Density	Inhibition
	WARP	Micronized weighting agent	Water	Density	Eco reduction
			Synthetic		SAG mitigation
Wellbore strengthening material	OPTISEAL I	LCM blend designed for wellbore strengthening	Water	Fracture sealing	Fluid-loss control
			Oil		
			Synthetic		
	OPTISEAL II	LCM blend designed for wellbore strengthening	Water	Fracture sealing	Fluid-loss control
			Oil		
			Synthetic		
	OPTISEAL III	LCM blend designed for wellbore strengthening	Oil	Fracture sealing	Fluid-loss control
			Synthetic		
OPTISEAL IV	LCM blend designed for wellbore strengthening	Water	Fracture sealing	Fluid-loss control	
		Oil			
		Synthetic			
General Products	ECOGREEN [†] B	Ester base fluid	Synthetic	Thinner	Lubricant
	ENVIROBLEND [†]	Salt for ENVIROVERT system	Oil	Shale inhibitor	—
	HYDRABLOK [†]	Deepwater hydrate inhibitor	Water	Surfactant	—
	NOVATEC [†] B	LAO base fluid	Synthetic	Thinner	Lubricant
	PARADRIL [†] B	Base fluid for the PARADRIL system	Synthetic	Thinner	—
	PARALAND [†] B	Base fluid C11-17 linear paraffin for the PARALAND system	Synthetic	Thinner	—
	PARAMIX [†] A	Salt for the PARALAND system	Synthetic	Shale inhibitor	—
	PARAMIX [†] N	Salt for the PARALAND system	Synthetic	Shale inhibitor	—
	VERSACLEAN [†] B	Base fluid for the VERSACLEAN system	Oil	Thinner	Lubricant
	VERSAVERT [†] B	Base fluid for VERSAVERT system	Oil	Thinner	Lubricant
VERSAVERT [†] BT	Thin version of worker-friendly base oil	Oil	Thinner	Lubricant	

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