Shell GTL SARALINE 185V

Synthetic Base Fluid for High Performance Drilling

SHELL GTL SARALINE 185V

The drilling base fluid of choice for leading operators

Shell GTL Saraline 185V is an innovative, non-toxic, multi-application synthetic drilling base fluid derived from natural gas. It is at the forefront in meeting drilling demands and challenges of the future in the most environmentally-friendly and safe manner – from scorching desert to subarctic temperatures, from deep water to high-temperature wells.

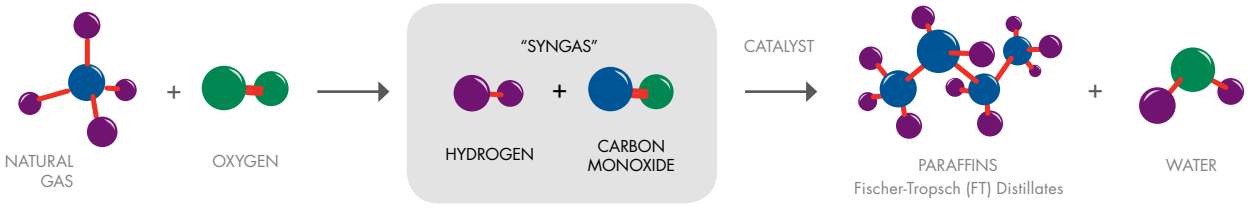
Its distinctive properties result in excellent drilling performance in a wide range of conditions, in addition to outstanding environmental attributes.

Used in over 20 countries, it has a proven track record of excellence with supply security through a world-class distribution network, supported by two unique Gas-to-Liquids (GTL) plants and over a dozen supply hubs across the globe.

The Process

Shell pioneered the Fischer-Trospch GTL technology in the world's first full-scale GTL plant of its kind in Bintulu, Malaysia, achieving commercial GTL production in1993.

It is the culmination of 20 years of research into the utilisation of natural gas for the production of synthetic fuels and specialty chemicals, according to the GTL process diagram below.



The whole reaction is irreversible

Key
Carbon Hydrogen Oxygen

Derived from the heart of Shell's innovation, Shell GTL Saraline 185V is the epitome of the Shell brand: high quality, high performance and highly reliable

Excellent Drilling Performance

Shell GTL Saraline 185V has a low viscosity, a low pour point and relatively high flash point, making it ideal for use in drilling in a range of well conditions and in different environments.

- Its low viscosity results in a better equivalent circulating density (ECD), faster drilling rate and increased hole cleaning efficiency.
- Its rheological profile is relatively flat over a wide working temperature,therefore enabling better mud control while drilling with less time spent on mud conditioning, and ultimately reducing non-performing time (NPT).
- It is suitable for deep water environments with mud line temperatures of 40°F or 4.4°C.
- It is also suitable for high-temperature high-pressure (HTHP) environments with exceptional thermal stability in borehole temperatures up to 400°F or 205°C.

Outstanding Environmental Properties

Shell GTL Saraline 185V is classified as a synthetic base fluid (SBF, Group III: low to negligible aromatic content) for Non-Aqueous Drilling Fluid (NADF) mud formulations under the definitions provided by the International Association of Oil and Gas Producers (OGP).

- **Approved for Offshore Discharge**
  Shell GTL Saraline 185V has an extremely favourable environmental profile which makes it an excellent candidate as an environmentally-friendly drilling base fluid. This is evident from the offshore discharge approval of drill cuttings received in Malaysia, Australia, New Zealand, Thailand, Indonesia, Brunei, India, Nigeria, Dubai and most recently, in China. This reduces complexity, costs and safety risks in managing drill cuttings.

- **Minimal Health and Safety Risk**
  Shell GTL Saraline 185V is odourless, has a clear appearance, low volatility, high flashpoint and contains virtually no sulphur and aromatics, all of which provide safe working conditions for operators. It does not contain known carcinogens (e.g: poly-aromatic hydrocarbons) nor BTEX (benzene, toluene, ethylbenzene and xylenes).

- **Low Ecotoxicity**
  Shell GTL Saraline 185V is readily biodegradable in both marine water (OECD 306) and freshwater (OECD 301F). It does not bioaccumulate and is non-toxic. Its superior environmental performance is confirmed with an OCNS (Offshore Chemical Notification Scheme for the North Sea) ranking of group E (lowest environmental hazard).

- **Bioremediation**
  Shell GTL Saraline 185V consists of a specific range and class of hydrocarbons (linear and branched paraffins) which shows excellent potential for bioremediation through land-farming methods producing successful plant growth media, as proven in onshore studies in Bangladesh, China and New Zealand. This reduces complexity, costs and safety risks in transportation of drill cuttings.

Property	Test Protocol	Results
Biodegradation		
Aerobic (freshwater)	OECD 301F	75% after 28d, (readily biodegradable)
Aerobic (marine water)	OECD 306	62% after 28d (readily biodegradable)
Aerobic (soil)	OECD 307	Half-life (DT50) = 21 days (based on 1000 mg/kg initial dose)
Water Column Toxicity		
Acartia tonsa	PARCOM, ISO 14569	48h EL50: >1,000 mg/L (non-toxic)
Skeletonema costatum	OSPAR/PARCOM	72h EL50: >1,000 mg/L (non-toxic)
Mysidopsis bahia	US-EPA 2001 40 CFR 435	96hr LC50: >1,000,000 ppm of 10% SPP (non-toxic)
Pagrus auratus	US-EPA 2003	7d LC50: > 100,000 mg/L (non-toxic)
Daphina magna	OECD 202	48h EL50: >1,000 mg/L (non-toxic)
Brachydanio rerio	OECD 203	96h LL50: >1,000 mg/L (non-toxic)
Sediment Organism Toxicity		
Corophium volutator	PARCOM Protocol 1995 (A)	10d LC50 >20,000 mg/kg (wet basis)
Bioaccumulation Potential		
Octanol-water partition coefficient	OECD 117	Log Kow >6.5 (not bioaccumulative due to poor bioavailability)

GLOBAL COVERAGE

Manufacturing, Sales, Distribution and Customer Service

At Shell, we are committed to high quality as reflected in our policy of strict quality assurance through constant control and monitoring of our manufacturing processes – from incoming feedstock to the finished products.

Shell GTL Saraline 185V is globally available with supply security through widespread regional hubs in partnership with strategic distributors who excel in storage and logistics.

We continue to build on our excellent customer service track record through our strong sales, marketing and technical teams

Shell GTL Saraline 185V from Qatar

Pearl GTL, Qatar
140,000 bpd of GTL Products

Shell GTL Saraline 185V from Malaysia

Shell MDS, Malaysia
14,700 bpd of GTL Products

bpd = barrel of oil equivalent per day

Proven Track Record in Onshore & Offshore Drilling

Sold to more than 40 customers in over 20 countries worldwide

Shell GTL Saraline 185V has upheld the excellent standards of Shell products over the past decade. It is a well-established (since 1997), highly regarded synthetic drilling base fluid used in a wide range of operating conditions globally.

Shell GTL Saraline 185V is used by operators worldwide:

- Angola
- Argentina
- Australia
- Bangladesh
- Brunei
- Chile
- China
- India
- Indonesia
- Kenya
- Malaysia
- Mozambique
- Myanmar
- Netherlands
- New Zealand
- Nigeria
- Oman
- Philippines
- Qatar
- Russia
- Saudi Arabia
- Tanzania
- Thailand
- Uganda
- United Arab Emirates
- United States of America

Shell GTL Saraline 185V is also ideal as a base fluid in Hydraulic Fracturing

- The preferred health, safety and environmentally-friendly fluid for hydraulic fracturing
- No BTEX and extremely low aromatics, thus reducing harm to health and the environment
- Conducive to groundwater protection due to limited water solubility, lack of aquatic toxicity and limited soil transport
- An established carrier fluid for proppant and guar gum package in worldwide fracking operations

Customer Satisfaction

Malaysia
"When using Shell GTL Saraline 185V based mud in our SBM (synthetic based mud) wells, the drilling speed was two times faster than that of a high performance WBM (water based mud) well, and the SBM did not cause any stoppage."
Oil and gas MNC

India
"Significant improvement in drilling speeds is seen in deeper wells with Shell GTL Saraline 185V."
Oil and gas MNC

China
"Shell GTL Saraline 185V performed very well in China's Bohai Bay and Indonesian fields. In Bohai Bay, the average drilling speed improved by 30% and was even higher in Indonesia."
Major oil and gas player with interests in China and Indonesia

"Shell GTL Saraline 185V provided good hole stability especially in the shale gas projects, holding the geometry of the hole well enough to support good logging. Shell GTL Saraline 185V helped in our underbalance drilling, as gas entered the wellbore into solution and came out mostly at the surface fluid processing plant. It also allowed for constant hole pressure and ensured the hole remained in good state."
Shale gas projects operator

CASE STUDY

Shell GTL Saraline 185V vs diesel in land drilling

REDUCES TOTAL WELL COSTS IN LAND DRILLING

Improved Drilling and Equipment Performance + **Advantaged Waste Management** + **Better Health Management** = **Lower Total Well Costs**

Shell GTL Saraline 185V is steadily expanding into land operations following its success in offshore drilling. For over 50 years, diesel has been commonly used as drilling base fluid in land operations. In comparison to diesel, results from a field test carried out in the United States (Permian Basin, onshore Texas) clearly showed that Shell GTL Saraline 185V is capable of lowering **total well costs** and generating significant benefits to overall land drilling operations.

DRILLING	BENEFITS
■ Overall rate of penetration (ROP): 10-30% higher ■ Drilling mud recovery at solid control system: 38%-58% higher ■ Drilling fluid consumption: 30%-50% lower ■ Chemical reconditioning cost: 30% lower ■ No elastomer failure due to high aniline point	■ Less rig time ■ Lower mud bill ■ Less fluid for disposal ■ Less non-performing time (NPT)

WASTE MANAGEMENT	BENEFITS
■ On-site drill cuttings remediation proven ■ Reduction of total petroleum hydrocarbon (TPH) after 2 months to <1% through soil amendment dilution and bio remediation processes	■ Simple and lower cost ■ Less road exposure ■ No harm to environment

HEALTH	BENEFITS
■ Total hydrocarbons (THC) inhalation exposure: 50 times lower for short term (15 min), 4 times lower for full shift (8 hours) ■ Dermal exposure: 4 times lower ■ Total aromatics content: up to 2,000 times lower. Virtually zero poly-aromatic hydrocarbons (PAH) and BTEX ■ Odourless, easy to clean	■ Significant reduction of inhalation & dermal exposure to rig workers ■ Improve working conditions ■ Strongly preferred by workers ■ Easier to attract best talent

TECHNICAL SPECIFICATIONS

High Flash Point and Low Viscosity

PROPERTIES	Unit	Test Method	Typical Values
Density @ 15°C	kg/m^3	ASTM D4052	779
Flash point	°C	ASTM D93	85
Kinematic viscosity @ 40°C	mm^2/s	ASTM D445	2.8
Pour point	°C	ASTM D97	-21
Aniline point	°C	ASTM D611	94

Least Toxic OCNS Rating vs Others

PARAMETERS	Shell GTL Saraline 185V	Diesel	LTMO1	LTMO2
Total BTEX, ppm	ND	3840	ND	ND
Total Aromatics, %m	~0.02	34	~0.02	~0.03
Sulphur, ppm	~1	10 - 5000	10 max	~1
OCNS Designation*	E	A	C	D

LTMO = Low Toxicity Mineral Oil
ND = Not Detected by GC/MS

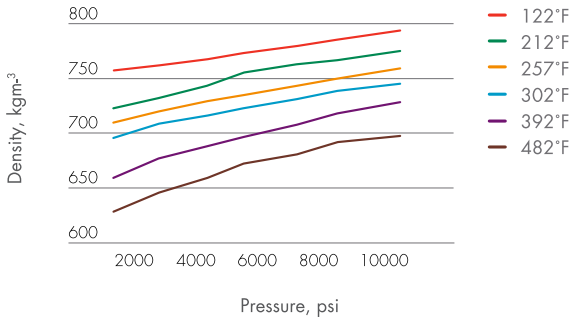
* Details of OCNS Rating

The OCNS (i.e. Offshore Chemical Notification Scheme) list is produced by CEFAS on behalf of the United Kingdom Department for Energy and Climate Change and the Netherlands State Supervision of Mines. Group "A" is the most toxic while Group "E" is the least toxic.

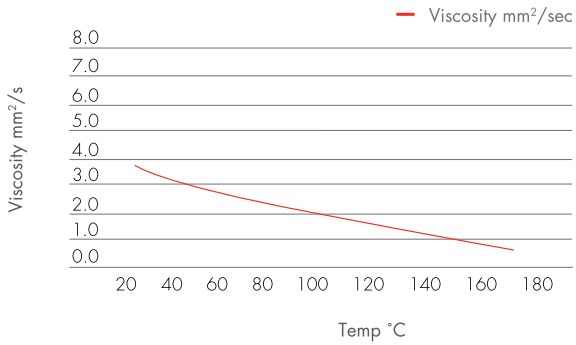
OCNS	A	B	C	D	E
Result for aquatic-toxicity data, ppm	<1	>1-10	>10-100	>100-1,000	>1,000
Result for sediment-toxicity data, ppm	<10	>10-100	>100-1,000	>1,000-10,000	>10,000

Stable Properties over a Wide Range of Temperatures

Density vs Pressure Profile at different temperatures



Viscosity vs Temperature Profile



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