

Clearly productive  
formate solutions  
for the oil industry

# PETROFORM

High performance drill-in and completion fluids



- ✓ Reduced well delivery time and costs
- ✓ Faster delivery of oil and gas reserves
- ✓ Improved well control and safety
- ✓ Precise reservoir definition

# PETROFORM

## Maximizing the profitability of oil and gas field developments

PETROFORM sodium formate and potassium formate from ADDCON GmbH are environmentally-responsible non-damaging organic salts used by the oil industry in high-performance well construction fluids to maximize the profitability of oil and gas field developments.

### The PETROFORM product range comprises:

- ✓ PETROFORM PF75- Clear 75% w/w potassium formate brine, SG 1.57
- ✓ PETROFORM PF97 – The patented non-caking potassium formate powder
- ✓ PETROFORM SF40 – Clear 40% w/w sodium formate brine, SG 1.28
- ✓ PETROFORM SF45 – Clear 45% w/w sodium formate brine, SG 1.32



ADDCON is the world's largest producer of formate products and the leading supplier of formate brines and powders to the oil industry.

The PETROFORM formate brines and powder are manufactured from high-grade feedstocks, creating products of exceptional purity.

The ADDCON formate production facilities in Norway and Germany have a capacity of 800,000 bbl/annum of formate brine and 10,000 MT/annum of formate powder.



We always hold kilotonne quantities of formate products in stock and can guarantee prompt shipments at short notice by sea, rail, road or air.

ADDCON is the only formate producer with a production plant located next to a deep water quayside, allowing bulk shipments to any port in the world.

With a long and successful track record of supplying formate products to well construction projects all over the world we understand the special needs of the oil industry.

Make ADDCON your global supply partner now and see why we are the leading supplier of formate brines and powders to oil industry.

## PRODUCT PROPERTIES AND FEATURES

Sodium formate and potassium formate dissolved in water make clear brines with the following useful properties and features:

- ✓ Densities up to SG 1.57 (13.1 ppg)
- ✓ Can be blended with cesium formate to provide densities up to SG 2.20 (18.2 ppg)
- ✓ Can be emulsified in oil to make heavy solids-free oil invert emulsions
- ✓ Only monovalent ions in solution
- ✓ Low viscosity → low hydraulic pressure losses during flow in pipes
- ✓ Low water activity
- ✓ Low freezing point – down to -50°C at certain brine densities
- ✓ Slightly alkaline pH 9-10
- ✓ Compatible with most metals and elastomers - low corrosion
- ✓ Good compatibility with reservoir minerals and formation fluids
- ✓ Cannot form water-insoluble scales
- ✓ Shale inhibition
- ✓ Hydrate melting and inhibition
- ✓ Lubricating – equivalent to oil-based fluids
- ✓ Compatible with pH buffers like soluble carbonates and bicarbonates
- ✓ High thermal conductivity and specific heat capacity
- ✓ High electrical conductivity
- ✓ High boiling point
- ✓ Compatible with water-soluble polymers
- ✓ Protects water-soluble polymers at high temperatures
- ✓ Low toxicity and low hazard to humans and the environment
- ✓ Highly biodegradable
- ✓ No halides or heavy metals
- ✓ Easy to recycle and re-use

Dry formate powders can also be dissolved in a number of non-aqueous solvents to make unusual high-density water-free fluids.

## APPLICATIONS IN THE OILFIELD



Formate brines make safe and reliable solids-free well control fluids for any well operation. The absence of weighting solids in formate brines brings economic benefits to all well operations, from drilling through to completion, workover, well suspension and well stimulation. The absence of weighting solids also makes formate brines easy to recycle and reuse time after time.

### Reservoir drilling and completion

The formate brines are particularly useful as non-damaging reservoir drilling and completion fluids, enabling the construction of long horizontal wellbores completed in open hole. Lower completions are run in the formate drill-in fluids and upper completions are run in clear formate brine. No well stimulation is required. Reservoir sections drilled and completed in open hole in formate brines clean up naturally during early production. A review of the long-term production from fields developed entirely with formate drilling and completion fluids confirms that formates are very effective in delivering oil and gas reserves (SPE paper 165151 see- <https://www.onepetro.org/conference-paper/SPE-165151-MS>).

### Shale drilling

Solids-free potassium formate brine drills long horizontals in shales much faster than oil-based muds, as demonstrated in the Montney oil and gas shales in Canada. The formate-based drilling fluids also have a much lower environmental impact than oil-based muds.

### Deep HPHT well drilling, completion and workover

The formate brines were originally developed by Shell as high-performance drilling and completion fluids for deep HPHT wells. Using solids-free formate brines brings huge technical and economic advantages in all deep well operations (e.g. see SPE paper 130376 and SPE paper 145562 ; see: <https://www.onepetro.org/conference-paper/SPE-130376-MS> and <https://www.onepetro.org/conference-paper/SPE-145562-MS>).

## Well suspension and packer fluids

The excellent compatibility of formate brines with metals and elastomers makes them useful as long-term well suspension and packer fluids, particularly for HPHT wells where conventional brines and muds would cause problems. The formate brines are also much safer and easier to handle than the old traditional brines. Potassium formate brines have been used as packer fluids in HPHT wells in the Gulf of Mexico since 2002.

## Pills

Formate brines have a long history of use as perforating fluid pills in wells previously drilled with oil-based muds. The formate brines can be used directly or emulsified in oil to make solids-free heavy oil-based completion fluids. Formate brines can be used as pills to free differentially-stuck pipes and melt hydrate plugs.

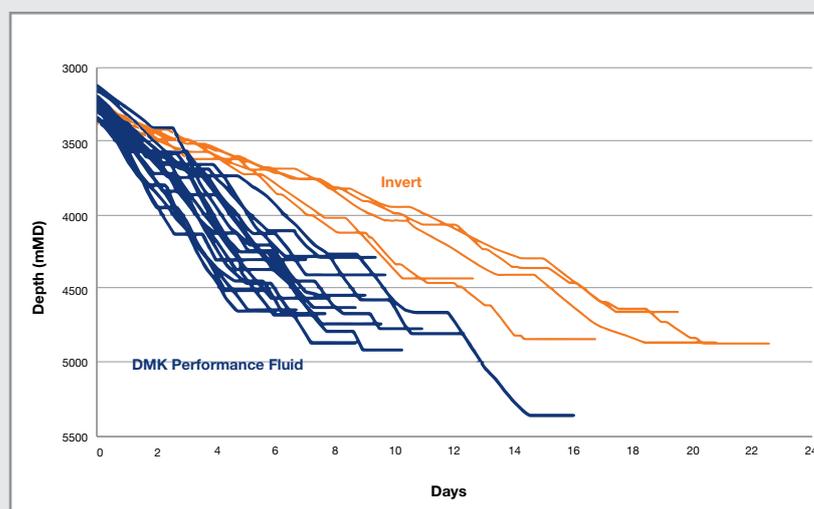
## ECONOMIC BENEFITS

Replacing traditional fluids with clear formate brines in drilling and completion operations has a remarkable effect on the economics of oil and gas field development projects.

### Faster well delivery time

Drilling and completing in simple solids-free formate brines is much faster than with solids-weighted traditional fluids. The presence of solid weighting agents in a wellbore slows down all aspects of drilling and completion. Drilling solids-free with formate brines has beneficial effect on well control, wellbore stability, hydraulics, ECD, bit performance, bit life, torque and drag, differential sticking, NP and completion times. These benefits translate into time and costs savings on every well. The effects are particularly noticeable while drilling unconventional shale oil and shale gas formations where ROPs with potassium formate can be 50-100% higher than in wells drilled with oil-based muds.

**Days vs. Depth Comparison -**  
Dist. Invert vs. DMK Performance Fluid



### Faster production of reserves

Formate brines can provide better drainage of oil and gas reserves by enabling the construction of long horizontal reservoir sections completed in open hole. Because the formate brines are non-damaging the wellbores in conventional sandstone and carbonate reservoirs do not need stimulation before start-up. The end result is cheaper completions with good connectivity to the reservoir. Analysis of long-term production figures confirm that gas fields developed entirely with formate brines produce 90% of their recoverable reserves within 8 years (SPE paper 165151).

### Improved well control and safety

Well construction and workover operations are significantly safer when solids-free formate brines are the well control fluids. Formate brines provide a stable pressure regime in the wellbore - do not sag and their beneficial hydraulics makes them less likely to destabilize the wellbore (reduced ECD and swab/surge pressures). They inhibit hydrates and they give early kick detection. They are also much safer to handle than conventional chloride and bromide brines.

### Precise reservoir definition

Formate brines provide a low-solids conductive fluid medium which is ideal for all acoustic measurements and high-resolution resistivity image logging. If cesium formate is a component of the brine then the photoelectric effect of the cesium in the filtrate can be combined with resistivity measurements to produce a very reliable and accurate net reservoir definition.

## PRODUCTION & DELIVERY

PETROFORM formate brines and powders are manufactured by ADDCON NORDIC AS and ADDCON Europe GmbH, both being subsidiaries of the German-based ADDCON GmbH.

ADDCON is by far the world's largest producer of formates. With two large-scale and highly-flexible formate production sites in Norway and Germany, ADDCON is the world's leading supplier of formate products to the oil and gas industry.



**ADDCON Nordic AS**  
Porsgrunn, Norway



**ADDCON Europe GmbH**  
Bitterfeld, Germany



ADDCON's formate production and storage plant in Norway is situated next to a deep water quayside, allowing bulk formate brine shipments by ship to any port in the world.

**In effect it is a massive offshore supply base for formate brines and powder.**



Our new formate production plant in Bitterfeld/Germany can supply formates by truck to any location in Europe, the Mediterranean, the Black Sea and even the Caspian within several days.



For non-bulk deliveries PETROFORM brines can be packed in 1,000 liter IBCs which also act as temporary storage units. Bulk deliveries can be transported in ISO-containers, Flexitanks, rail cars and road tankers - or by sea in chemical tanker vessels and supply boats.

ADDCON has a long and successful track record of supplying formate products to well construction projects all over the world and understands the special needs of the oil industry.



## TECHNICAL SPECIFICATION PETROFORM:

### PETROFORM PF75

pure, solids-free potassium formate brine

### PETROFORM PF97

Patented, non-caking potassium formate powder

<b>COMPOSITION</b>	Potassium Formate: 75 % Water: 25 %	Potassium formate 97 % Anti Caking agent ≥ 2.5 %
<b>PHYSICAL DATA</b>		
Appearance	Clear liquid	White crystals
Particle distribution	n.a.	< 100 μ <10 % < 1000 μ 100 %
Smell	None	None
Density	1.570 kg/liter	1080 kg/m <sup>3</sup>
Melting point	n.a.	169 (°C)
Crystallization temperature	6 °C	n.a.
Solubility in water	Completely	380 g/100g water
Critical relative humidity at 22 °C	n.a.	16 %
pH, 25 °C	10	n.a.
Turbidity	< 10 NTU	n.a.
Colour	< 75 Hazen	n.a.
<b>SHELF LIFE</b>	10 years from production date if stored under recommended conditions	more than 12 months, if stored under recommended conditions
<b>PACKAGING</b>	1000 l IBC Container ISO container, Flexitank in Container, tank lorry, ship	25 kg PE bags (42 x 25 kg) 500 kg Big Bags
<b>HANDLING AND STORAGE</b>	PETROFORM PF75 should be stored in closed containers or storage tanks at room temperature in a cool dry place out of direct sunlight and protected from freezing.	PETROFORM should be stored in a dry and preferably well-ventilated area. The patented anti-caking agent used is securing free flow conditions as long as PETROFORM PF97 is stored in closed bags.

## THE ADDCON SERVICE

ADDCON is the leading supplier of formates to the oil industry because we offer security of supply, consistently high-quality products and a responsive service:

### SECURITY OF SUPPLY



- ✓ Supplying formates to the oil industry is ADDCON's core business.
- ✓ ADDCON is the world's largest producer/stockist of formate products
- ✓ ADDCON produces brines and powders
- ✓ ADDCON's products are "made on purpose" – not linked to polyol production
- ✓ ADDCON's production capacity is almost 1 million barrels/year of formate brine
- ✓ ADDCON has two production sites – one in Norway and the other in Germany - reducing the risk of product shortages from unscheduled plant shut-downs
- ✓ ADDCON has secure long-term contracts with major European suppliers of key feedstocks
- ✓ ADDCON can deliver large-volumes of formates from stock at short notice
- ✓ ADDCON can arrange bulk shipments of formate brine by chemical tanker vessels to any port in the world

**PETROFORM** <sub>SF40</sub>  
Sodium Formate, 40 % aqueous solution

**PETROFORM** <sub>SF45</sub>  
Sodium Formate, 45 % aqueous solution

<b>COMPOSITION</b>	Sodium Formate: 40 % Water: 60 %	Sodium Formate: 45 % Water: 55 %
<b>PHYSICAL DATA</b>		
Appearance	Clear liquid	Clear liquid
Particle distribution	n.a.	n.a.
Smell	None	None
Density	1.276 kg/liter	1.316 kg/liter
Melting point	n.a.	n.a.
Crystallization temperature	8 °C	17,5 °C
Solubility in water	Completely	Completely
Critical relative humidity at 22 °C	n.a.	n.a.
pH, 25 °C	10	10
Turbidity	< 10 NTU	< 10 NTU
Colour	< 75 Hazen	< 75 Hazen
<b>SHELF LIFE</b>	10 years from production date if stored under recommended conditions	10 years from production date if stored under recommended conditions
<b>PACKAGING</b>	1000 l IBC Container ISO container tank lorry, ship	1000 l IBC Container ISO container tank lorry, ship
<b>HANDLING AND STORAGE</b>	Petroform SF40 should preferably be stored in closed container at warm (room temperature) conditions.	Petroform SF45 should preferably be stored in closed container at warm (room temperature) conditions.

We can also make custom-designed potassium formate brines with freezing point or crystallization temperatures (TCT) tailored to customer requirements, right down to as low as -50o C (-58o F).

**ADDCON of Germany – Your secure and reliable source of high-quality formate brines and non-caking potassium formate powder for oilfield operations.**

## CONSISTENTLY HIGH-QUALITY PRODUCT & SERVICE



- ✓ ADDCON's production sites are ISO 9001:2008 certified
- ✓ PETROFORM product purity is outstanding - almost pharmaceutical standard
- ✓ ADDCON's PETROFORM products are of a consistently high quality
- ✓ PETROFORM PF97 potassium formate powder contains a patented anti-caking additive
- ✓ Fast delivery of PETROFORM sodium and potassium formate direct from stock
- ✓ ADDCON can supply summer and winter grades of PETROFORM brines, with the TCT tailored to user requirements
- ✓ ADDCON has been supplying formates to oilfield customers around the world since 1995 – we understand your needs.



## QUALITY

ADDCON's PETROFORM formate products are of exceptional purity, manufactured from high-quality feedstocks sourced from major European chemical companies.

Our production laboratories operate a stringent quality control system, ensuring that all PETROFORM products comply strictly with our product sales specification.

Both PETROFORM production sites are ISO 9001:2008 certified. Unlike formates from other suppliers, our products are not waste streams from polyol production.

## ADDCON GmbH

The German based ADDCON looks back on more than 60 years of history.

Over the years the company grew from a producer of Silage additives to a global player in various industries.

To date, there are ADDCON offices in Germany, Norway, China, Philippines, Thailand and South Africa as well as a global network of business partners.

ADDCON specializes in Green Chemistry. Its production sites in Bitterfeld/Germany and in Porsgrunn/Norway ADDCON add value to organic acids and their respective salts.

The products are used in the feed and food industry as well as in the deicing of airports and in the oil drilling industry. All products break down by nature and have little impact on the environment.

## FURTHER INFORMATION

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**ADDCON**