

 PETROBRAS	TECHNICAL SPECIFICATION		Nº: I-ET-3010.2A-1200-010-P3W-001						
	CLIENT: POCOS/CAMAP-AUP/PROJ/PROJ-I		FOLHA: 1 de 9						
	PROGRAM: SEAP		-						
	AREA: FPSO								
POCOS/CAMAP-AUP/PROJ/PROJ-I	TITLE: FLUIDS FOR SPECIAL OPERATIONS		PUBLIC						
			POCOS/SPO/PEP/PROJ-CA						
REVISION INDEX									
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1 INTRODUCTION

Operations in which acids, solvents or other chemical products are pumped into ~~a the~~ well from a Well Stimulation Vessel (WSV) ~~by through the FPSO~~ **flowlines** (not through a Drilling or Workover Rig) are considered ~~known technicians~~ as remote operations by Petrobras.

This section **present** ~~lists the fluids that can be~~ **used to perform** those during these special operations. These fluids are used to ~~will be pumped into the formation for reservoir formation stimulation, to removing organic/inorganic deposits or for scale inhibition, by using WSV, installations on the FPSO and subsea equipment (risers, flowlines, and Wet Christmas Trees).~~

This is not extensive list, and the use of other fluids may be ~~designed and required by Petrobras during the oilfield operation of the Field.~~ Some typical commercial products ~~fluid compositions~~ are mentioned but other similar ones, **under different names**, formulations may be **provided by according to each** different service companies.

2 COMPLETION SOLUTIONS


This Section lists the fluids that were used in completion of the wells and may return to production facilities.

Brine I:

Product	Concentration	Product description
Salt	24% m/m	Sodium Chloride
Surfactant	0,2% v/v	Ethoxylate and quaternary ammonium salts
Biocide	200 ppm	Glutaraldehyde

Brine II: Vamos usar cloreto de cálcio em SEAP?

Product	Concentration	Product description
Salt	36% m/m	Calcium Chloride
Surfactant	0,2% v/v	Ethoxylate and quaternary ammonium salts
Biocide	200 ppm	Glutaraldehyde

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Spent Acid I:

Product	Concentration	Product description
Acetic Acid	5% m/m	Acid
Surfactant	0,2% v/v	Ethoxylate and quaternary ammonium salts

Spent Acid II:

Product	Concentration	Product description
Acetic/Formic Acid	3,5/2,5% m/m	Acid
Surfactant	0,2% v/v	Ethoxylate and quaternary ammonium salts

Spent Acid III:

Product	Concentration	Product description
Formic Acid	5% m/m	Acid
Surfactant	0,2% v/v	Ethoxylate and quaternary ammonium salts


3 SCALE REMOVAL SOLUTIONS

This Section lists the fluids that may be pumped to the wells to remove well string/formation scale deposits or to inhibit scale deposition.

3.1 Sulfate scale removal

Aqueous Solution I, with chelating agent as main product:

Product	Concentration	Product description
EDTA tetrassodium salt	10% m/m	Chelant
Water or completion fluid	QSP	Diluent
Emulsion preventer	0,2% v/v	Ethoxylate + quaternary ammonium salt surfactants
Wetting agent	0,1% v/v	Wettability modifier

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Aqueous Solution II, with chelating agent as main product:

Product	Concentration	Product description
DTPA pentapotassium salt	10% m/m	Chelant
Water	QSP	Diluent
Emulsion preventer	0,2% v/v	Ethoxylate + quaternary ammonium salt surfactants
Wetting agent	0,1% v/v	Ethoxylate + quaternary ammonium salt surfactants

3.2 Organic scale removal

Solvent mixture I, Xylene as main product:

Product	Concentration	Product description
Xylene	100% v/v	Aromatic solvent

Solvent mixture II, mixture with diesel:


Product	Concentration	Product description
Butylglycol	10%	Solvent
Diesel	90% v/v	Aliphatic solvent

Solvent mixture III, hydrocarbon solvents mixture

Product	Concentration	Product description
Xilene	50% v/v	Aromatic solvent
Diesel	50% v/v	Aliphatic solvent

Solvent mixture IV, DBX mixture of solvents:

Product	Concentration	Product description
Diesel	45% v/v	Aliphatic solvent
Butylglycol	10% v/v	Biodegradable solvent
Xylene	45% v/v	Aromatic solvent

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3.3 Sulfate scale Inhibition

Aqueous Solution III, scaling inhibitor as main product with pH adjuster:

Product	Concentration	Product description
Scaling inhibitor	10% m/m	Polyphosphonate, polyacrylates or polysulphonates
Water or completion fluid	QSP	Diluent
Emulsion preventer	0,2% v/v	Ethoxylate + quaternary ammonium salt surfactants
Sodium hydroxide	QSP pH = 5 a 6	Alkali

4 RESERVOIR STIMULATION SOLUTIONS


This Section lists the fluids that are usually pumped to the well in reservoir stimulation operations.


Aqueous Solution IV – Acetic Acid 20% m/m as main product


Product	Concentration	Product description
Acetic acid 98%	20% m/m	Acid
Water	QSP	Diluent
Corrosion inhibitor	1% v/v	Amine-based corrosion inhibitor
Emulsion preventer	0,2% v/v	Isopropanol + quaternary ammonium salt
Surface tension reducer	0,1% v/v	Ethoxylate + quaternary ammonium salt

Aqueous Solution V - Formic Acid 10% m/m as main product:

Product	Concentration	Product description
Formic acid 85%	10% m/m	Acid
Water	QSP	Diluent
Corrosion inhibitor	1% v/v	Amine-based corrosion inhibitor
Emulsion preventer	0,2% v/v	Ethoxylate + quaternary ammonium salt
Surface tension reducer	0,1% v/v	Ethoxylate + quaternary ammonium salt

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Aqueous Solution VI, with Acetic Acid 13% m/m and Formic Acid 9% m/m as main products:			
Product	Concentration	Product description	
Acetic acid 98%	13% m/m	Acid	
Formic acid 85%	9% m/m	Acid	
Water	QSP	Diluent	
Corrosion inhibitor	1% v/v	Amine-based corrosion inhibitor	
Emulsion preventer	0,2% v/v	Isopropanol + quaternary ammonium salt surfactants	
Surface tension reducer	0,1% v/v	Ethoxylate + quaternary ammonium salt surfactants	
Aqueous Solution VII, Hydrochloric acid 15% m/m as main product:			
Product	Concentration	Product description	
Hydrochloric acid 32%	15% m/m	Inorganic acid	
Water		Diluent	
Corrosion inhibitor		Amine-based corrosion inhibitor	
Emulsion preventer		Isopropanol + quaternary ammonium salt surfactants	
Aqueous Solution VIII, HCl 10% m/m - based viscoelastic divergent			
Product	Concentration	Product description	
Diverting agent	10% v/v	Viscoelastic surfactant	
Hydrochloric acid 32%	10% m/m	Inorganic acid	
Water	QSP	Diluent	
Corrosion inhibitor	1% v/v	Amine-based corrosion inhibitor	
Emulsion preventer	0,2% v/v	Isopropanol + quaternary ammonium salt surfactants	
Viscosity breaker	0,2% v/v	Ethoxylate, paraffin and mineral oil mixture	

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Aqueous Solution IX, HCl 5% m/m – Polymer-based acid system as a diverter			
Product	Concentration	Product description	
Friction loss reducer	2% v/v	Hydro-soluble polymer	
Hydrochloric acid 32%	15% m/m	Inorganic acid	
Water	QSP	Diluent	
Corrosion inhibitor	1% v/v	Amine-based corrosion inhibitor	
Emulsion preventer	0,2% v/v	Isopropanol + quaternary ammonium salt surfactants	
Temperature activated polymer breaker	1% m/v	Calcium peroxide	
Viscosifying	5% v/v	Hydrosoluble polymer	
Crosslinker agent	0,2% v/v	Inorganic salt	
Aqueous Solution X, Emulsified HCl 15% m/m acid system as main product:			
Product	Concentration	Product description	
Hydrochloric acid 32%	15% m/m	Inorganic acid	
Water	QSP	Diluent	
Diesel		Aliphatic solvent	
Corrosion inhibitor		Amine-based corrosion inhibitor	
Iron Scavenger		Chelating agent	
Emulsifier		Surfactant	
Friction loss reducer		Oil base friction reducer	
Aqueous Solution XI, with Acetic Acid 13% m/m, Formic Acid 9% m/m and HF 1,5% m/m as main products:			
Product	Concentration	Product description	
Acetic acid 98%	13% m/m	Acid	
Formic acid 85%	9% m/m	Acid	
Hydrofluoridric Acid Water	1,5% m/m	Acid	
Water	QSP	Diluent	
Corrosion inhibitor	1% v/v	Amine-based corrosion inhibitor	
Emulsion preventer	0,2% v/v	Isopropanol + quaternary ammonium salt surfactants	
Surface tension reducer	0,1% v/v	Ethoxylate + quaternary ammonium salt surfactants	

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Aqueous Solution XII, with Acetic Acid 20% m/m and HF 1,5% m/m as main products:

Product	Concentration	Product description
Acetic acid 98%	20% m/m	Acid
Hydrofluoridric Acid	1,5% m/m	Acid
Water	QSP	Diluent
Corrosion inhibitor	1% v/v	Amine-based corrosion inhibitor
Emulsion preventer	0,2% v/v	Isopropanol + quaternary ammonium salt surfactants
Surface tension reducer	0,1% v/v	Ethoxylate + quaternary ammonium salt surfactants

Aqueous Solution XIII, with HCl 15% m/m and HF 1,5% m/m main products:

Product	Concentration	Product description
Hydrochloric acid 98%	15% m/m	Acid
Hydrofluoridric Acid	1,5% m/m	Acid
Water	QSP	Diluent
Corrosion inhibitor	1% v/v	Amine-based corrosion inhibitor
Emulsion preventer	0,2% v/v	Isopropanol + quaternary ammonium salt surfactants
Surface tension reducer	0,1% v/v	Ethoxylate + quaternary ammonium salt surfactants

5 OPERATION CONDITIONS

The presented frequency and pumping time for each type of treatment may vary depending on well conditions. The values below must be considered as a reference based on usual Petrobras operations and/or estimates, considering an average pump rate for usual pumped volumes.

Operation Type	Operational parameters (per well)				
	Pumping time (h)	Well cleanup (h)	Frequency (jobs/year)	Pumping Temperature (°C)	Pressure (psi)
Sulfate scale removal	12	24	2	25 - 30	4000
Organic deposits removal					
Sulfate scale Inhibition					
Reservoir Stimulation Solutions	15	48	0,5	25 - 30	4000