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	CLIENT: Pre Salt Production Units/Subsurface equipment							SHEET: 1 of 11		
	JOB:									
	AREA:									
	TITLE: <b>FLUIDS FOR SPECIAL OPERATIONS</b>							<b>PÚBLICA</b>		
POCOS/EP/ITC/ETP										
<b>INDEX OF REVISIONS</b>										
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## 1. INTRODUCTION

Operations in which acid or other chemical products are pumped to the well from a Stimulation vessel through the Production Unit and not through a drilling or Workover rig may be required more than once during the wells life time.

This section lists the fluids that can be used during these operations, in pre salt fields such as Buzios, Mero, Itapu. These fluids will be pumped for removal of organic/inorganic deposits, scale inhibition or formation stimulation, using special purpose boats and through installations on the FPSO and subsea equipment (risers, flowlines and Wet Christmas Trees).

This list is not extensive and the use of other fluids may be designed and required by Petrobras during the operation of the field. Typical commercial compositions are not mentioned since the chemical products may be provided by different suppliers.

## 2. COMPLETION FLUIDS

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

### Brine I:


Salt	Sodium Chloride
Surfactant	Ethoxylate and quaternary ammonium salts
Biocide	Glutaraldehyde

### Brines II:

Salt	Calcium Chloride
Surfactant	Ethoxylate and quaternary ammonium salts
Biocide	Glutaraldehyde

### Spent Acid:

Salt	Calcium Chloride
Surfactant	Ethoxylate and quaternary ammonium salts

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### 3. SCALE REMOVAL AND INHIBITION

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

#### 3.1 Carbonate scale removal

##### Aqueous Solution I, with Acetic Acid as main product:


Acetic acid up to 20%	Product function
Acetic acid 98%	Raw organic acid
Water	Diluent
Corrosion inhibitor	Amine-based corrosion inhibitor
Emulsion preventer	Isopropanol + quaternary ammonium salt surfactants
Surface tension reducer	Ethoxylate + quaternary ammonium salt surfactants

##### Aqueous Solution II, with Formic Acid as main product:

Formic acid up to 10%	Product function
Formic acid 85%	Raw organic acid
Water	Diluent
Corrosion inhibitor	Amine-based corrosion inhibitor
Emulsion preventer	Ethoxylate + quaternary ammonium salt surfactants
Surface tension reducer	Ethoxylate + quaternary ammonium salt surfactants

##### Aqueous Solution III, with Acetic Acid and Formic Acid as main products:

Organic acid up to 20%	Product function
Acetic acid 98%	Raw organic acid
Formic acid 58%	Raw organic acid
Water	Diluent
Corrosion inhibitor	Amine-based corrosion inhibitor
Emulsion preventer	Isopropanol + quaternary ammonium salt surfactants
Surface tension reducer	Ethoxylate + quaternary ammonium salt surfactants

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**Aqueous Solution IV, with EDTA chelating agent as main product:**

Chelating agent	Product function
EDTA diammonium salt	Chelant
Water or completion fluid	Diluent
Emulsion preventer	Ethoxylate + quaternary ammonium salt surfactants
Wetting agent	Ethoxylate + quaternary ammonium salt surfactants

**Aqueous Solution V, with EDTA and EGMBE as main products:**


Chelant and EGMBE	Product function
EDTA diammonium salt	Chelant
Water or completion fluid	Diluent
Emulsion preventer	Ethoxylate + quaternary ammonium salt surfactants
Corrosion inhibitor	Amine-based corrosion inhibitor
EGMBE	Ethylene glycol monobutyl ether

**Aqueous Solution VI, with GLDA chelating agent as main product**

Chelating agent solution	Product function
GLDA monosodium salt	Chelant
Water	Diluent
Emulsion preventer	Ethoxylate + quaternary ammonium salt surfactants
Corrosion inhibitor	Amine-based corrosion inhibitor
EGMBE	Ethylene glycol monobutyl ether

**Aqueous Solution XVII, Hydrochloric acid as main product:**

Hydrochloric acid 10%	Product function
Hydrochloric acid 32%	Raw inorganic acid
Water	Diluent
Corrosion inhibitor	Amine-based corrosion inhibitor
Emulsion preventer	Isopropanol + quaternary ammonium salt surfactants

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### 3.2 Sulfate scale removal

**Aqueous Solution VIII, with chelating agent as main product:**

Chelating agent aqueous solution (pH 4.3 to 13)	Product function
EDTA tetrasodium/dissodium or ammonium salt	Chelant
Water or completion fluid	Diluent
Emulsion preventer	Ethoxylate + quaternary ammonium salt surfactants
Wetting agent	Wettability modifier
PH buffer	pH adjustment, if needed

**Aqueous Solution IX, with chelating agent as main product:**

Chelating agent alkaline solution (up to total 30% mass)	Product function
DTPA pentapotassium salt + EDTA diammonium salt	Chelant
Water	Diluent
Emulsion preventer	Ethoxylate + quaternary ammonium salt surfactants
Wetting agent	Ethoxylate + quaternary ammonium salt surfactants


### 3.3 Organic deposits removal

**Solvent mixture I, Xylene as main product:**

Solvent	Product function
Xylene	Aromatic solvent

**Solvent mixture II, mixture with diesel:**

Solvent	Product function
Butilglycol	Solvent
Diesel	Aliphatic solvent

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### Solvent mixture III, hydrocarbon solvents mixture

Example:

Solvent	Product function
Xilene	Aromatic solvent
Diesel	Aliphatic solvent

### Solvent mixture IV, DBX mixture of solvents:

Solvent	Product function
Diesel	Aliphatic solvent
Butilglycol	Biodegradable solvent
Xylene	Aromatic solvent

## 3.4 Carbonate scale Inhibition


**Aqueous Solution X, scaling inhibitor as main product:**

Solvent	Product function
Scaling inhibitor	Polyphosphonate, polyacrylates or polysulphonates
Water	Diluent
Emulsion preventer	Ethoxylate + quaternary ammonium salt surfactants
Cloreto de Potássio (2 a 3%)	Diluent (clay inhibition)

## 3.5 Sulfate scale Inhibition

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

Solvent	Product function
Scaling inhibitor	Polyphosphonate, polyacrylates or polysulphonates
Water or completion fluid	Diluent
Emulsion preventer	Ethoxylate + quaternary ammonium salt surfactants
Cloreto de Potássio (2 a 3%)	Diluent (clay inhibition)

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#### 4 Reservoir Stimulation Solutions

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

##### Aqueous Solution XII – Acetic Acid as main product

Acetic acid up to 20%	Product function
Acetic acid 98%	Acid
Water	Diluent
Corrosion inhibitor	Amine-based corrosion inhibitor
Emulsion preventer	Isopropanol + quaternary ammonium salt surfactants
Surface tension reducer	Ethoxylate + quaternary ammonium salt surfactants

##### Aqueous Solution XIII - Formic Acid as main product:

Formic acid up to 10%	Product function
Formic acid 85%	Raw organic acid
Water	Diluent
Corrosion inhibitor	Amine-based corrosion inhibitor
Emulsion preventer	Isopropanol + quaternary ammonium salt surfactants
Surface tension reducer	Ethoxylate + quaternary ammonium salt surfactants


##### Aqueous Solution XIV, with Acetic Acid and Formic Acid as main products:

Organic acid up to 20%	Product function
Acetic acid 98%	Raw organic acid
Formic acid 85%	Raw organic acid
Water	Diluent
Corrosion inhibitor	Amine-based corrosion inhibitor
Emulsion preventer	Isopropanol + quaternary ammonium salt surfactants
Surface tension reducer	Ethoxylate + quaternary ammonium salt surfactants

##### Aqueous Solution XV, Hydrochloric acid as main product:

Hydrochloric acid 15%	Product function
Hydrochloric acid 32%	Raw inorganic acid
Water	Diluent
Corrosion inhibitor	Amine-based corrosion inhibitor



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Emulsion preventer		Isopropanol + quaternary ammonium salt surfactants	
<b>Aqueous Solution XVI, HCl- based Viscoelastic diverter</b>			
<b>Viscoelastic divergent, HCl 15% m/m</b>		<b>Product function</b>	
Diverting agent	Viscoelastic surfactant		
Hydrochloric acid 32%	Raw inorganic acid		
Water	Diluent		
Corrosion inhibitor	Amine-based corrosion inhibitor		
Emulsion preventer	Isopropanol + quaternary ammonium salt surfactants		
Viscosity breaker	Ethoxylate, paraffin and mineral oil mixture		
<b>Aqueous Solution XVII, polymer based acid system as a diverter</b>			
<b>Polymer based diverting agent (up to 5% m/m HCl)</b>		<b>Product function</b>	
Friction loss reducer	Hydrosoluble polymer		
Hydrochloric acid 32%	Raw inorganic acid		
Water	Diluent		
Corrosion inhibitor	Amine-based corrosion inhibitor		
Emulsion preventer	Isopropanol + quaternary ammonium salt surfactants		
Temperature activated polymer breaker	Calcium peroxide		
Viscosifier	Hydrosoluble polymer		
Crosslinker agent	Inorganic salt		
<b>Aqueous Solution XVIII, Emulsified acid system as main product:</b>			
<b>HCl emulsified in diesel (HCl 15%)</b>		<b>Product function</b>	
Hydrochloric acid 32%	Raw inorganic acid		
Water	Diluent		
Diesel	Aliphatic solvent		
Corrosion inhibitor	Amine-based corrosion inhibitor		
Iron Scavenger	Chelating agent		
Emulsifier	Surfactant		



Friction loss reducer

Oil base friction reducer

**5 Operation Conditions**

5.1 Frequency and time of exposition

The presented frequency and pumping time for each kind 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.

Job name	Maximum pumping time (h)	Well clean up time (h)	Frequency	Pumping Temperature (°C)	Treating Pressure (psi)
Carbonate Scale Removal	12	24	2 jobs / year /well	25 - 30	4000
Sulfate scale removal					
Organic deposits removal					
Carbonate scale Inhibition					
Sulfate scale Inhibition					
Reservoir Stimulation Solutions	15	48	1 job each 2 years / well	25 - 30	4000

5.2 Pressure rate during pumping

While pumping the fluids to the well, both pressure increase and pressure decline rates depend on well conditions. The values below must be considered as references based on usual recent Petrobras operations and/or estimates.



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Pressure increase (psi/min)	up to 1500
Pressure decline (psi/min)	up to 4000