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TITLE:			FLUIDS FOR SPECIAL OPERATIONS		
			NP-1		
			SOE/PM/PROJ		

INDEX OF REVISIONS

REV.	DESCRIPTION AND/OR REVISED SHEETS
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TITLE:

FLUIDS FOR SPECIAL OPERATIONS

NP-1

SOE/PM/PROJ

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1. REMOTE ACIDIZING

The 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 is called by Petrobras technicians as remote acidizing jobs.

This section lists the fluids that can be used during special operations. These fluids will be pumped for formation stimulation, using special purpose boats, 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 evaluated by Petrobras during the operation of the field. Some commercial additive names are mentioned but similar products may be provided by different service companies.

1.1 Carbonate scale removal

Aqueous Solution I, with Acetic Acid as main product:

Example:

Aqueous Solution I – Acetic Acid As main product

Acetic acid up to 20%	Product function
Acetic acid 98%	Acid
Water	Dilution
CI-111	Isopropanol + quaternary ammonium salt surfactants
NE-18 LB	Amine-based corrosion inhibitor
Inflo-45 LB	Ethoxylate + quaternary ammonium salt surfactants

Aqueous Solution II, with Formic Acid as main product:

Example:

Formic acid up to 10%	Product function
Formic acid 85%	Acid
Water	Dilution
CI-111	Isopropanol + quaternary ammonium salt surfactants
NE-18 LB	Ethoxylate + quaternary ammonium salt surfactants
Inflo-45 LB	Ethoxylate + quaternary ammonium salt surfactants

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

Organic acid up to 20%	Product function
Acetic acid 98%	Acid
Formic acid 58%	Acid
Water	Dilution
CI-111	Isopropanol + quaternary ammonium compound
NE-18 LB	Ethoxylate + quaternary ammonium salt surfactants
Inflo-45 LB	Ethoxylate + quaternary ammonium salt surfactants

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

Chelating agent	Product function
EDTA	Chelant, diammonium salt
Water or completion fluid	Dilution
Ultrawet 70	Ethoxylate + quaternary ammonium salt surfactants
Renex 100	Wettability modifier

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

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

Aqueous Solution VI, with GLDA chelating agent as main product
Example:

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

1.2 Sulfate scale removal
Aqueous Solution VII, with chelating agent as main product:
Example:

Chelating agent solution	Product function
EDTA diammonium salt	Chelant
Water or completion fluid	Dilution
Ultrawet 70	Emulsion preventor, Ethoxylate + quaternary ammonium salt surfactants
Renex 100	Wettability modifier

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

Chelating agent solution	Product function
DTPA	Chelant
Water	Dilution
Ultrawet 70	Emulsion preventer, Ethoxylate + quaternary ammonium salt surfactants
Renex 100	Wettability modifier

1.3 Organic deposits removal

Solvent mixture I, Xylene as main product:

Example:

Solvent	Product function
Xylene	Aromatic solvent

Solvent mixture II, mixture with diesel:

Example:

Solvent	Product function
Butilglycol	Solvent
Diesel	Aliphatic solvent

Solvent mixture III, hydrocarbon solvents mixture

Example:

Solvent	Product function
Xilene	Aromatic solvent
Diesel	Aliphatic solvent

Solvent mixture IV, DBX mixture of solvents:

Example:

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

1.4 Carbonate scale Inhibition

Aqueous Solution IX, scaling inhibitor as main product:

Example:

Solvent	Product function
SCW-356	Scaling inhibitor
Water	Dilution
Ultrawet 70	Ethoxylate + quaternary ammonium salt surfactants

1.5 Sulfate scale Inhibition

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

Example:

Solvent	Product function
SCW-260	Scaling inhibitor
Water or completion fluid	Dilution
Ultrawet 70	Ethoxylate + quaternary ammonium salt surfactants
Sodium hydroxide	Alkali

1.6 Reservoir Stimulation Solutions

Aqueous Solution XI – Acetic Acid as main product

Acetic acid up to 20%	Product function
Acetic acid 98%	Acid
Water	Dilution
CI-111	Isopropanol + quaternary ammonium salt surfactants
NE-18 LB	Amine- based corrosion inhibitor
Inflo-45 LB	Ethoxylate + quaternary ammonium salt surfactants

Aqueous Solution XII - Formic Acid as main product:

Example:

Formic acid up to 10%	Product function
Formic acid 85%	Acid
Water	Dilution
CI-111	Isopropanol + quaternary ammonium salt surfactants
NE-18 LB	Ethoxylate + quaternary ammonium salt surfactants
Inflo-45 LB	Ethoxylate + quaternary ammonium salt surfactants

Aqueous Solution XIII, with Acetic Acid and Formic Acid as main products:
Example:

Organic acid up to 20%	Product function
Acetic acid 98%	Acid
Formic acid 85%	Acid
Water	Dilution
CI-111	Isopropanol + quaternary ammonium salt surfactants
NE-18 LB	Ethoxylate + quaternary ammonium salt surfactants
Inflo-45 LB	Ethoxylate + quaternary ammonium salt surfactants

Aqueous Solution XIV, Hydrochloric acid as main product:
Example:

Hydrochloric acid 15%	Product function
hydrochloric acid 32%	Inorganic acid
Water	Dilution
CI-27 or similar	Corrosion Inhibitor for inorganic acids
NE-18LB or similar	Emulsion preventer

Aqueous Solution XV, HCl- based Viscoelastic diverter
Example:

Viscoelastic divergent	Product function
Divert S or similar	Viscoelastic surfactant

Hydrochloric acid 32%	Inorganic acid
Water	Dilution
CI-27 or similar	Corrosion Inhibitor for inorganic acids
NE-18LB or similar	Emulsion preventer
Breaker-AC or similar	Additive, breaker

Aqueous Solution XVI, polymer based acid system as a diverter
Example:

EAS (up to 5% m/m HCl)	Product function
AG-61	Additive
Hydrochloric acid 32%	Inorganic acid
Water	Dilution
CI-27	Corrosion Inhibitor for inorganic acids
NE-18LB	Emulsion preventer
GBW-24	Additive
PSA-2LB	Additive, polymer
XLA-4	Additive, crosslinker

Aqueous Solution XVII, Emulsified acid system as main product:
Example:

Dual Phase	Product function
hydrochloric acid 32%	Inorganic acid
Water	Dilution
Diesel	Aliphatic solvent
CI-27	Corrosion Inhibitor for inorganic acids
Ferrotrol-300LB	Additive, chelating agent
E-31	Additive
FRO-18	Additive

1.7 Operation Conditions

1.7.1 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

1.7.2 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.

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