

# Flowback Surfactant KMA001S

## 1. Introduction

Surface active reagents were generally used in aqueous-based stimulation fluids to lower the interfacial tension that restricts fluid flow in the rock matrix. KMA001S surfactant lowers the capillary pressure by both improving the wettability of the pore throat and reducing the interfacial tension.

Both laboratory testing and field results have shown that KMA001S can provide superior cleanup due to the wetting properties and surface tension reduction that leads to lower capillary pressures. The use of KMA001S results in less swabbing time, faster cleanup and more complete recovery of the stimulation fluids.

## 2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KMA001S	Light brownish liquid	1.00-1.05	Soluble	Eyes, skin, inhalation	Fire	N/A

## 3. Chemical Properties and Application

KMA001S promotes the cleanup of the fluid from the rock matrix because the contact angles resulting from the use of KMA001S are higher than those for other conventional cleanup surfactants. In addition, the surface and interfacial tension values from the use of KMA001S are also lower than most conventional surfactants used. This leads to significantly lower capillary pressures which reduces the force required to initiate flow of the stimulation fluid and therefore, KMA001S should provide better and quicker fluid recovery following a stimulation treatment.

KMA001S are compatible with all additives used in most matrix stimulation and acid fracturing fluids. Lab testing indicates that KMA001S can be used for temperature applications up to 350°F (177°C).

KMA001S can reduce the surface tension to as low as 22 Dynes/cm.

## 4. Treatment

The CMC value for KMA001S is low. However, 1-2 gal/Mgal is the generally recommended concentration for most stimulation fluids.

## 5. Packaging

KMA001S is supplied in 55 gallons high density polyethylene (HDPE) drums. Keep it away from extreme conditions such as places near flames or direct sunlight.

# Iron Reducing Agent KMA003

## 1. Introduction

Ferric and ferrous ions remain in acid solutions during acidizing operations due to the very low pH of acids. When acid travels from surface to formation, it will dissolve iron from equipment, tubulars, scales and iron minerals in the formation. During spending of the acid, the pH of the acid will go up, and can result in the precipitation of iron. Trivalent Iron (Ferric) precipitate at about pH 3, while the divalent Iron (Ferrous) will not precipitate until the acid spent to a pH of 8. To minimize the precipitation of iron, it is better to keep the iron in the ferrous state. It is therefore required to add an iron stabilizer (reducer) in acid systems. KMA003 is a high performance iron reducing agent used in acids to convert the Ferric iron into ferrous iron so that it will prevent Ferric hydroxide precipitation.

## 2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KMA003	White powder	1.62-1.82	Soluble	Eyes, skin	Dust	5.0-8.0 (5%)

## 3. Chemical Properties and Application

KMA003 is an iron reducing agent used in both fresh and spent acids to keep iron in solution instead of precipitating. It can be used for most applicable stimulation fluid systems at various well conditions.

Ferrous iron will not form iron hydroxides until pH of 8. As we know, pH of most spent acids will not be more than pH of 6. Therefore, if the Ferric iron is converted into Ferrous iron, the chance of forming ferric hydroxide precipitation will be dramatically reduced. KMA003 is a high-performance iron reducing agent, which will react with ferric iron in acids and convert it in ferrous iron.

KMA003 is compatible with most additives in stimulation fluid systems.

## 4. Treatment

15 lbs/Mgal KMA003 is typically enough for control each 1000 ppm of ferric iron.

## 5. Packaging

KMA003 is supplied in plastic-lining bags with net weight of 25 kg/bag. It should be stored in shaded areas with good ventilation. Keep it away from high temperature, humidity and direct sunlight.

# Iron Stabilizer KMA003B

## 1. Introduction

Ferric and ferrous ions remain in acid solutions during acidizing operations. When acid travels from surface to formation, it will dissolve iron from equipment, tubulars, scales and iron minerals in the formation. It is, therefore, required to add iron stabilizer in acid systems. KMA003B is a high-performance iron stabilizing agent used in acids to prevent iron hydroxide precipitations.

## 2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KMA003B	White powder	1.57-1.77	Soluble	Eyes, skin	Dust	10.0-11.0 (1%)

## 3. Chemical Properties and Application

KMA003B is a chelating agent used in both fresh and spent acids to keep iron in solution instead of precipitation. It can be used for most applicable stimulation fluid systems at various well conditions.

Ferrous iron will not form iron hydroxides until pH of 8.5. As we know, pH of most spent acids will not be more than pH of 6. Therefore, Ferric iron is generally required to be stabilized in solution because it will precipitate to ferric hydroxide at pH above 3, which is an insoluble gelatinous mass. KMA003B is a high-performance chelating agent, which will react with ferric irons in acids and keep it in solution.

KMA003B is compatible with most additives in stimulation fluid systems.

## 4. Treatment

20-150 lbs/Mgal KMA003B is typically enough for most cleanup and acidizing jobs. 50 lbs/Mgal is considered optimum concentration in most fluid design.

## 5. Packaging

KMA003B is supplied in plastic-lined bags with net weight of 25 kg/bag. It should be stored in shaded areas with good ventilation. Keep it away from high temperature, humidity and direct sunlight.

# DPA Additive I - KMA008

## 1. Introduction

Hydrofluoric acids are widely used in oilfields to remove damages in sandstone formations. There are usually two ways to prepare hydrofluoric acids. One is using concentrated (generally 20%) HF, and the other is to obtain HF by reaction between a precursor and HCl to avoid hazards of handling HF directly. KMA008 is a HF precursor for acid systems used in sandstone matrix stimulation treatment.

## 2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KMA008	White crystals	1.40-1.60	Soluble	Eyes, skin	Dust	2.0-2.5 (0.5%)

## 3. Chemical Properties and Application

KMA008 is ammonium bifluoride which can be used to prepare most sandstone acidizing systems at various applicable well conditions.

Instead of preparing HF from concentrated acids, HF precursor can be used to prepare hydrofluoric acids to avoid hazardous handling situations. In addition, the kinetics of forming HF from reactions between protons and KMA008 is controllable by using weak acids such as organic acids.

KMA008 is compatible with most additives and acid systems for sandstone acidizing. The mixing or preparation procedures are described in individual acid system manual.

## 4. Treatment

1-5% weight is typically enough for most acid system design. 2% weight is considered the optimum concentration in most fluid systems.

## 5. Packaging

KMA008 is supplied in plastic-lining bags with net weight of 25 kg/bag. It should be stored in shaded areas with good ventilation. Keep it away from high temperature, humidity and direct sunlight.

# H<sub>2</sub>S Scavenger KMA009

## 1. Introduction

Major problems are generally encountered when acidizing sour oil or gas wells. Sulfide scales or minerals presented in the formation or production tubular will react with acids to release H<sub>2</sub>S, which is corrosive and hazardous. H<sub>2</sub>S scavenger is generally required while acidizing sour gas or oil wells to inhibit corrosion and resolve safety concerns. H<sub>2</sub>S scavenger KMA009 is used in acid fluids to control corrosion effect of H<sub>2</sub>S that may present due to acid reaction with sulfide scales or formation minerals. KMA009 will remove H<sub>2</sub>S in acids by reaction to form non-corrosive or non-hazardous compounds.

## 2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KMA009	Colorless to light yellow liquid	1.05-1.15	Dispersible	Eyes, skin	Fire	N/A

## 3. Chemical Properties and Application

Sulfide minerals present in the formation or sulfide scales deposited at tubulars will react with acids while acidizing sour gas or oil wells. KMA009 is a mixture of organic compound that can be easily dispersed in acids, brines, or solvents. The active ingredients in KMA009 will react with H<sub>2</sub>S to form stable and non-corrosive compounds.

KMA009 is effective in most acid systems such as HCl and mud acids. It can be used at temperature up to 350°F and for protection time up to 24 hours.

The loading of KMA009 depends on formation mineralogical property and scaling conditions of wellbore. The acidizing design must also include procedures to flush away produced gas from tubing or casing before acid comes in contact with formation or scales.

KMA009 is compatible with most additives in acids. It is also readily biodegradable and presents lower toxicity to organisms than other H<sub>2</sub>S scavengers.

## 4. Treatment

Typical concentrations range from 2 to 10 Gal/1,000 Gal (2 to 10 L/m<sup>3</sup>) of acid. Laboratory testing is required to determine the optimum concentration that will provide enough protection time at well conditions.

## 5. Packaging

KMA009 is supplied in 55 gallons high density polyethylene (HDPE) drums or 265 gallons HDPE totes. Keep it away from extreme conditions such as places near flames or direct sunlight.

# H<sub>2</sub>S Scavenger Aid KMA009B

## 1. Introduction

One of the major problems that is generally encountered when acidizing sour oil or gas well is the production of H<sub>2</sub>S. Sulfide scales or minerals presented in the formation or production tubular will react with acids to release H<sub>2</sub>S, which is corrosive and hazardous. H<sub>2</sub>S Scavenger and Scavenger Aid are generally required while acidizing sour gas or oil wells to inhibit corrosion and resolve safety concerns.

H<sub>2</sub>S Scavenger Aid KMA009B is used in acid fluids in combination with H<sub>2</sub>S Scavenger to control corrosion effect of H<sub>2</sub>S that may be present due to acid reaction with sulfide scales or formation minerals. KMA009B will remove H<sub>2</sub>S in acids by reaction to form non-corrosive or non-hazardous compounds.

## 2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KMA009B	Colorless to yellowish liquid	1.06-1.11	Miscible	Eyes	Fire	8.5-9.5 (1%)

## 3. Chemical Properties and Application

Sulfide minerals present in the formation or sulfide scales deposited at tubulars will react with acids while acidizing sour gas or oil wells. KMA009B is a mixture of organic amino compounds that can be easily dispersed into acids, brines, or solvents.

KMA009B is effective in most acid systems such as HCl and mud acids. It can be used at temperatures up to 350°F and for protection time up to 24 hours.

The loading of KMA009B depends on the formation of mineralogical property and scaling conditions of wellbore.

The acidizing design must also include procedures to flush away produced gas from tubing or casing before acid comes in contact with formation or scales. KMA009B is compatible with most additives in acids.

## 4. Treatment

Typical concentrations range from 2 to 10 Gal/1,000 Gal (2 to 10 L/m<sup>3</sup>) of acid. Laboratory testing is required to determine the optimum concentration that will provide enough protection time at well conditions.

## 5. Packaging

KMA009B supplied 55 gallons high density polyethylene (HDPE) drums. Keep it away from extreme conditions such as places near flames or direct sunlight.

# DPA Additive II - KMA011

## 1. Introduction

Secondary and tertiary precipitations cause adverse effects in sandstone acidizing. Deep Penetrating Acidizing (DPA) technology introduces unique chemistry in Hydrofluoric acids to minimize potential damage from HF reactions with aluminosilicate minerals in the formation. KMA011 is a chelating agent that stabilizes most cations in spent acids and prevents reaction products from precipitation.

## 2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KMA011	Colorless crystals	1.45-1.65	Soluble	Eyes, skin	Dust	2.0-3.0 (1%)

## 3. Chemical Properties and Application

KMA011 is a chelating agent which can be used to prevent aluminum and other cations form precipitation with hydrofluoric acids in sandstone acidizing treatment.

Aluminum, iron, calcium, and magnesium compounds are usually present in most sandstone formation minerals. Dissolution of sandstone minerals by hydrofluoric acids will release cations from the above compounds in solution. However, their fluoride salts are usually insoluble and therefore precipitation will occur. KMA011 is selected to stabilize these cations and minimize precipitations of their fluoride salts.

KMA011 is compatible with most additives and acid systems for sandstone acidizing.

## 4. Treatment

5-15% Weight is generally required in DPA acid system design. 10-13% Weight is considered the optimum concentration as indicated from laboratory and field results.

## 5. Packaging

KMA011 is supplied in plastic-lined bags with net weight of 25 kg/bag. It should be stored in shaded areas with good ventilation. Keep it away from high temperature, humidity and direct sunlight.

# DPA Additive III - KMA012

## 1. Introduction

Hydrofluoric acids are widely used in oilfields to remove damage in sandstone formations. Hydrofluoric acids in Deep Penetrating Acids (DPA) are released slowly to penetrate longer distance from wellbore before spending. KMA012 and KMA008 are two additives used in DPA acids to provide this chemical mechanism. DPA is specifically designed for stimulation of acid sensitive and high temperature sandstone reservoirs.

## 2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KMA012	Colorless crystals	1.40-1.60	Soluble	Eyes, skin	Dust	6.0-7.0(1%)

## 3. Chemical Properties and Application

KMA012 will react with hydrofluoric molecules in DPA systems to form a new compound which slowly releases hydrofluoric acids during sandstone acidizing.

Due to the slow release of hydrofluoric acids from DPA, there are always limiting amounts of HF molecules available in dissolution of aluminosilicate minerals. Therefore, the reaction rate between DPA and sandstone minerals is dramatically reduced, and acids will penetrate much further from the wellbore. Another unique chemical nature of KMA012 is forming a thin coating around clays and fines and “glue” them in place. Therefore, fines migration is minimized in DPA reacted areas.

KMA012 is compatible with most additives and acid systems for sandstone acidizing.

## 4. Treatment

1-3% Weight is typically enough for most DPA acidizing design. 2% Weight is considered the optimum concentration in most DPA acidizing treatments.

## 5. Packaging

KMA012 is supplied in plastic-lining bags with net weight of 25 kg/bag. It should be stored in shaded areas with good ventilation. Keep it away from high temperature, humidity and direct sunlight.



# Inhibitor Aid KMA030

## 1. Introduction

Destructive reactions between metals and acids cause serious corrosion problems in acidizing operations. Corrosion inhibitors are generally required in acids to minimize these destructive reactions without introducing adverse effect on reactions between acids and formations. For high temperature or chemically aggressive environment, inhibitor aid is also required to prevent tubulars and downhole tools from strong acid corrosion and pitting. KMA030 is an effective inhibitor aid used in hydrochloride and mud acid systems to prevent tubular or equipment from serious acid corrosion.

## 2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KMA030	Colorless liquid	1.20-1.25	Soluble	Eyes, skin, inhalation	Fire	2.0-3.0 (1%)

## 3. Chemical Properties and Application

KMA030 is an organic acid which can be used for most strong acid systems to prevent tubular and tool materials from acid corrosion.

KMA030 is soluble in acids. The decomposition products from KMA030 at well conditions create a barrier between acids and metal surfaces and therefore corrosion chemical reactions are stopped. KMA030 is effective for most metals including carbon steel and chrome steel. It can also be used in most acids such as hydrochloride and hydro fluoride. Minimal corrosion and pitting problems are observed on tubulars and tools using acids containing KMA030. KMA030 is compatible with most additives and acid systems. Attention is required for KMA030 design if it is used for sour gas (H<sub>2</sub>S and CO<sub>2</sub>) wells or protection of special tubular or tool materials.

## 4. Treatment

1-10% Volume is typically enough for most cleanup and acidizing jobs. 3-5% Volume is considered the optimum concentration in most fluid design.

## 5. Packaging

KMA030 is supplied with 55 gallons high density polyethylene (HDPE) drums or 265 gallons HDPE totes. Keep it away from extreme conditions such as places near flames or direct sunlight.

# Iron Stabilizer KMA033

## 1. Introduction

Ferric and ferrous ions remain in acid solutions during acidizing operations. When acid travels from surface to formation, it will dissolve iron from equipment, tubulars, scales and iron minerals in the formation. It is therefore required to add iron agent in acid systems. KMA033 is an effective iron control agent used in acids to prevent iron hydroxide precipitations.

## 2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KMA033	Colorless liquid	1.12-1.17	Soluble	Eyes	N/A	7.0-8.0

## 3. Chemical Properties and Application

KMA033 is used in both fresh and spent acids as a chelating agent to form a complex with iron ions, which helps to prevent the precipitation of iron hydroxide in acid solutions. It is typically used for low to medium temperature depend on the iron concentration presented at well conditions.

Ferrous iron will not form iron hydroxides until pH of 8. As we know that pH of most spent acids will not be more than pH of 6 and therefore Ferric irons are generally required to be stabilized in solution because it will precipitate to ferric hydroxide at pH of 2-3. KMA033 is often used to react with ferric irons in acids especially organic acids and keep it in solution.

KMA033 is compatible with most additives in stimulation fluid systems except for high concentration of calcium presented.

## 4. Treatment

15-50 Gal /1,000 Gal KMA033 is typically enough for most cleanup and acidizing jobs. 50 Gal/1,000 Gal KMA033 is typically enough for control each 3000 ppm of ferric iron.

## 5. Packaging

KMA033 is supplied in 265 gallons high density polyethylene (HDPE) totes. Keep it away from extreme conditions such as places near flames or direct sunlight.

# Corrosion Inhibitor KMA044

## 1. Introduction

KMA044 is a quaternary ammonium based surfactant, a synergistic blend of solvents, and a highly effective dispersion package that enables it to inhibit corrosion in all hydrochloric (HCl) and HCl-hydrofluoric (HCl-HF) acid up to 392°F. This corrosion inhibitor can be used for mild steel to very exotic tubulars.

## 2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KMA044	Dark red to dark brown liquid	1.03-1.08	Soluble	Eyes, skin	None	0-3

## 3. Chemical Properties and Application

KMA044 contains no propargyl alcohol, which makes this product environmentally friendly. This product disperses well in acid solutions, resulting in good inhibitor distribution and pipe protection. It can provide acid-corrosion protection for as long as 24 hours. KMA044 provides corrosion protection in all HCl and HCl-HF blends up to 392°F. It can increase the upper temperature limit by use of acid corrosion inhibitor intensifiers, and is compatible with intensifiers such as organic acids, metal halides, and antimony compounds for higher temperature.

KMA044 is not suitable for emulsified acid systems. It contains special surfactants that can disrupt the stability of emulsified acids.

## 4. Treatment

The recommended concentration range is 1 to 40 Gal/1,000 Gal (1 to 40 L/m<sup>3</sup>) of the total acid blend. Concentration is dependent on acid type, strength, bottomhole temperature, contact time, and additional additives.

## 5. Packaging

KMA044 is packed in 55 gallons HDPE drum or 265 gallons HDPE IBC tank. Keep it away from extreme conditions such as places near flames or direct sunlight. Store at temperatures lower than 30°C.