

Clay Stabilizer KHF002C

1. Introduction

Clay stabilizers are routinely added to aqueous-based fracturing fluids to help prevent damage to the formation caused by clay migration and swelling. These clay stabilizers are either a temporary or permanent type, and they are often used in combination.

The clay stabilizer KHF002C is a KCl substitute and can be used with Guar, HPG, CMHPG and Friction Reducer-based frac fluids. KHF002C is a temporary clay stabilizer that helps to prevent clay particles from swelling and plugging of reactive clays in water-sensitive formations during fracturing and flowback operations.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF002C	Colorless liquid	1.02-1.07	Soluble	Moderate-Eyes	None	6.5-8.0

3. Chemical Properties and Application

Temporary Clay Stabilizer KHF002C is an organic liquid clay stabilizer. It is NOT a solution of KCl, but it can be substituted for KCl in most oilfield applications.

KHF002C has been used at temperatures up to 350°F without any adverse effect on fluid rheology.

KHF002C can be batch mixed, or continuously mixed into the fracturing fluid using a liquid-additive system. This eliminates the time-consuming step of batch mixing dry KCl in the base fluid. KHF002C can be used in most aqueous-based fracturing fluids and is compatible with most additives used in the fracturing fluid systems.

KHF002C is highly recommended for systems that are sensitive to high salt concentrations.

4. Treatment

The recommended KHF002C concentration is 0.5 to 2 Gal/1,000 Gal (0.5 to 2 L/m³). For specific formations such as high reactive clay content, the KHF002C concentration can be further optimized using laboratory core tests.

5. Packaging

KHF002C 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.

Biocide KHF003

1. Introduction

The mixing water for the preparation of fracture fluid should be free of bacteria and enzymes. Either can cause degradation of the polymer and premature viscosity break. They can also prevent viscosity development. Bacteria produce enzymes to which most guar or guar derivative polymers are particularly sensitive.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF003	Colorless to yellowish liquid	0.95-1.00	Soluble	Eyes, skin, inhalation	Flammable	7.0-8.0

3. Chemical Properties and Application

The biocide KHF003 is added to the mix-water as early as possible before the bacterial problem develops. It can be continuously mixed during the treatment to prevent bacterial growth in the reservoir, but it will be of little or no benefit to the stability of the fracturing fluid if added by continuous mix. This product will kill bacteria but cannot remove enzymes.

When using polymer-free systems (such as SurFrac), biocides or bactericides are NOT required because KHF003 may interfere with rheological properties of SurFrac fluids.

KHF003 is compatible with most additives used in crosslinked guar based fracturing fluids, but certain additives such as scale inhibitors, demulsifiers especially enzyme breakers might not be compatible with KHF003. Laboratory testing is required before using these additives together in fluid systems.

4. Treatment

The recommended concentration for KHF003 is 0.25-0.75 Gal/1,000 Gal of mixing water.

5. Packaging

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

Biocide KHF003N

1. Introduction

The mixing water for the preparation of fracture fluid should be free of bacteria and enzymes. Either can cause degradation of the polymer and premature viscosity break. They can also prevent viscosity development. Bacteria produce enzymes to which most guar or guar derivative polymers are particularly sensitive.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF003N	Colorless to yellowish liquid	0.95-1.00	Soluble	Eyes, skin, inhalation	Flammable	7.0-8.0

3. Chemical Properties and Application

The biocide KHF003N is added to the mix-water as early as possible before the bacterial problem develops. It can be continuously mixed during the treatment to prevent bacterial growth in the reservoir, but it will be of little or no benefit to the stability of the fracturing fluid if added by continuous mix. This product will kill bacteria but cannot remove enzymes.

When using polymer-free systems (such as SurFrac), biocides or bactericides are NOT required because KHF003N may interfere with rheological properties of SurFrac fluids.

KHF003N is compatible with most additives used in crosslinked guar based fracturing fluids, but certain additives such as scale inhibitors, demulsifiers especially enzyme breakers might not be compatible with KHF003N. Laboratory testing is required before using these additives together in fluid systems.

4. Treatment

The recommended concentration for KHF003N is 0.25-0.75 Gal/1,000 Gal of mixing water.

5. Packaging

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

Flowback Additive KHF007S

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. KHF007S 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 KHF007S can provide superior cleanup due to the wetting properties and surface tension reduction that leads to lower capillary pressures. The use of KHF007S results in less swabbing time, faster cleanup and more complete recovery of stimulation fluids.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF007S	Light yellow liquid	1.00-1.05	Soluble	Eyes, skin, inhalation	Fire	7.0-9.5

3. Chemical Properties and Application

KHF007S promotes fracturing fluid cleanup of the proppant pack and the invaded rock matrix because the contact angles resulting from the use of KHF007S are higher than those for other conventional cleanup surfactants. In addition, the surface and interfacial tension values from the use of KHF007S 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, KHF007S should provide better and quicker fluid recovery following a stimulation treatment.

KHF007S are compatible with all additives used in Guar-based fracturing fluids such as OPTiFrac. Lab testing indicates that KHF007S can be used for temperature applications up to 350°F.

KHF007S can reduce the surface tension to as low as 22 Dynes/cm at 30°C.

4. Treatment

The CMC value for KHF007S is low. However, 1-2 Gal/1,000 Gal is the generally recommended concentration for most fracturing fluids.

5. Packaging

KHF007S 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.

Low Temperature Breaker KHF011

1. Introduction

Proppant-pack permeability can be severely damaged by gelling agents such as guar or its derivatives. The amount of damage increases as polymer concentration increases. Breakers are generally used to reduce the viscosity of the fracturing fluids by degrading the polymer that is concentrated in the proppant pack. KHF011 is an oxidizer breaker used in most guar or guar derivative based fracturing fluids.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF011	White crystals	1.89-2.09	Soluble	Eyes, skin	Oxidizer	3.0-7.0 (5%)

3. Chemical Properties and Application

The reactivity of KHF011 is strongly dependent on temperature. Thermal decomposition of KHF011 produces highly reactive radicals that can attack the guar-based polymer backbone.

By itself, KHF011 is effective in the temperature range of 125 to 225°F. KHF011 can be used at fluid temperatures less than 125°F when breaker aid is used together. Encapsulated breaker KHF012 should be used at high temperature greater than 225°F.

KHF011 is not compatible with reducing chemicals and stronger oxidizers. Care should be taken to avoid the use of reducing additives and stronger breakers together with KHF011.

4. Treatment

Breaker KHF011 is an oxidative breaker. It can be used in both linear gel and crosslinked fluids. Breaker KHF011 can be batch mixed, continuously mixed or used as a dry material.

Typical concentration of 0.01-2.0 lbs/Mgal is recommended to cover most fracturing operations.

5. Packaging

KHF011 is supplied in 55 lbs plastic-lining bags generally in buckets with net weight of 25 kg/package. Keep it away from extreme conditions such as places wet and humid or direct sunlight.

Medium Temperature Encapsulated Breaker KHF012

1. Introduction

Proppant-pack permeability can be severely damaged by gelling agents such as guar or its derivatives. The amount of damage increases as polymer concentration increases. Breakers are used to reduce the viscosity of the fracturing fluid by degrading the polymer that is concentrated in the proppant pack. KHF012 is the encapsulated version of KHF011, which is used for breaking polymers in fracturing fluids.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF012	White to tan granules	1.76-1.96	N/A	Eyes, skin	Oxidizer	N/A

3. Chemical Properties and Application

KHF012 is a particulate material with specific size produced by coating (encapsulating) KHF011 with a water-resistant barrier. Encapsulation of the breaker greatly reduces fracturing fluid exposure to the breaker and enables the use of high concentrations of breaker that, without coating, would rapidly reduce the fluid viscosity. KHF012 cannot leak off and be lost to the formation, KHF012 remains in the fracture where it is needed to degrade concentrated polymers. After fracturing treatment, release of the breaker occurs as the reservoir temperature increases and the fracture closes.

The effective working temperature for KHF012 is in the range of 125-275°F.

KHF012 can be used in most guar and derivative based fracturing fluid systems such as OPTiFrac and UniFrac. It is compatible with most additives used in these systems except for reducers or stronger oxidizers.

4. Treatment

Breaker KHF012 is an oxidative breaker. It can be used in both linear gel and crosslink fluids. KHF012 can be used with proppant sizes 16/30 mesh and smaller. As much as 5 times of KHF011 loading (up to 10 lbs/Mgal) can be added into fracturing fluids by using encapsulation technique such as in KHF012.

5. Packaging

KHF012 is supplied in 55 lbs plastic-lining bags generally in buckets with net weight of 25 kg/package. Keep it away from extreme conditions such as places wet and humid or direct sunlight.

High Temperature Breaker KHF013

1. Introduction

Proppant-pack permeability can be severely damaged by gelling agents such as guar or its derivatives. The amount of damage increases as polymer concentration increases. Breakers are generally used to reduce the viscosity of the fracturing fluids by degrading the polymer that is concentrated in the proppant pack. KHF013 is an oxidizer designed for breaking guar or guar derivative based fracturing fluids at high temperature applications.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF013	White granules	3.27-3.47	Soluble	Eyes, Skin	Oxidizer	7.0-8.0 (1%)

3. Chemical Properties and Application

The reactivity of KHF013 is strongly dependent on temperature. Thermal decomposition of KHF013 produces highly reactive radicals that attack the guar-based polymer backbone.

KHF013 is effective in the temperature range of 200 to 300°F. KHF011 can be used at fluid temperatures less than 200°F. KHF014 (encapsulated KHF013) should be used at high temperatures greater than 300°F.

KHF013 is a strong oxidizer which is reactive with most chemicals such as acids, salts, and all reducing agents.

Toxic or corrosive gases may release from the above reactions. Care should be taken seriously to avoid the use of reducing agents, acids, salts and other oxidizers together with KHF013.

4. Treatment

KHF013 concentration depends on factors such as polymer concentration, temperature, break time requirement, and polymer type. Typical concentration of 0.01-2.0 lbs/Mgal is recommended to cover most fracturing operations. Laboratory testing may be required for optimized breaker schedule design.

5. Packaging

KHF013 is supplied in 55 lbs plastic-lining bags generally in buckets with net weight of 25 kg/package. Keep it away from extreme conditions such as places wet and humid or direct sunlight.

High Temperature Encapsulated Breaker KHF014

1. Introduction

Proppant-pack permeability can be severely damaged by gelling agents such as guar or its derivatives. The amount of damage increases as polymer concentration increases. Breakers are used to reduce the viscosity of the fracturing fluid by degrading the polymer that is concentrated in the proppant pack. KHF014 is the encapsulated version of KHF013, which is used for breaking polymers in fracturing fluids at high temperatures.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF014	Light yellow granules	1.92-2.12	N/A	Eyes, Skin	Oxidizer	N/A

3. Chemical Properties and Application

KHF014 is a particulate material with specific size produced by coating (encapsulating) KHF013 with a water-resistant barrier. Encapsulation of the breaker greatly reduces fracturing fluid exposure to the breaker and enables the use of high concentrations of breaker that, without coating, would rapidly reduce the fluid viscosity. KHF014 cannot leak off and be lost to the formation, KHF014 remains in the fracture where it is needed to degrade concentrated polymers. After the fracturing treatment, release of the breaker occurs as reservoir temperature increase and the fracture closes.

The effective working temperature for KHF014 is in the range of 200-350°F.

KHF014 can be used in most guar and derivative based fracturing fluid systems such as OPTiFrac and EZFrac. It is compatible with most additives used in these systems except for reducers, acids, salts, and other oxidizers, which require extra care to confirm using them together.

4. Treatment

As much as 5 times of KHF013 loading (up to 10 lbs/Mgal) can be added into fracturing fluids by using encapsulation technique such as in KHF014.

5. Packaging

KHF014 is supplied in 55 lbs plastic-lining bags generally in buckets with net weight of 25 kg/packaging. Keep it away from extreme conditions such as places wet and humid or direct sunlight.

High Viscosity Friction Reducer KHF027LV

1. Introduction

Friction resistance is very high when pumping slick water at high rate for unconventional fracturing. Therefore, friction reducers are generally required for high-rate slick water fracturing. Normal Friction Reducers can suspend only 0.5 lbs to 1 lbs per gal of fluid (ppa) and in order to suspend higher concentrations of proppant, a more viscous or viscoelastic FR is needed. KHF027LV is a more viscoelastic Friction Reducer that is effective in suspending higher concentrations of proppant and further reduce friction pressure during fracturing operations.

2. Physical Properties and Hazards

Additives	Form	S.G.	Water Solubility	Health Hazard	Physical Hazard	pH
KHF027LV	Milky white to pale yellow liquid	1.03-1.08	Soluble	Eyes, skin	Water slick	N/A

3. Chemical Properties and Application

KHF027LV is a slurry of polyacrylamide polymer in a hydrocarbon solvent. The anionic polymer will hydrate into water during pumping and will reduce friction pressure. More than 70% friction pressure can be reduced using KHF027LV. This fluid can also give viscoelastic properties to suspend 3 to 5 ppa of proppant without significant damage of the proppant pack. Ammonium persulfate breakers can be used to break this system to water-like viscosity. KHF027LV has been used in the field for fracturing applications up to 350°F.

KHF027LV is generally used in fresh water and or up to 5% potassium chloride brines. It is also compatible with most liquid clay stabilizers such as KHF002C. High concentrations of calcium, magnesium and iron in mix water will adversely affect KHF027LV performance.

KHF027LV is not compatible with most cationic surfactant and polymers due to its anionic nature.

4. Treatment

KHF027LV is generally added at the level of 3 to 10 Gal/1,000 Gal for best performance.

5. Packaging

KHF027LV is supplied in 265 gallons high density polyethylene (HDPE) totes. Keep it away from extreme conditions such as places near flames, moisture and direct sunlight.