

SAG* 7133 and SAG 220 antifoams for natural gas processing

SPECIALTY FLUIDS - OIL & GAS



Momentive Performance Materials offers SAG 7133 antifoam emulsion and its more concentrated version, SAG 220 antifoam emulsion, that are an excellent candidate for controlling foam in amine and glycol dehydration units. Both have been extensively tested in a variety of gas plants. Both have demonstrated excellent stability in the presence of salts, resulting in reduced deposits on the plant's equipment. Both help preserve foam control under the severe conditions of a dehydrating unit. These conditions can remove water from other antifoam emulsions, rendering them immediately inactive.

Gas plants utilizing SAG 7133 antifoam emulsion or its more concentrated version, SAG 220 antifoam emulsion, can benefit from a longer service life, helping to reduce the cost of maintenance. Additionally, compared to other products that deal with foaming problems, lower quantities of SAG 7133 antifoam emulsion and its more concentrated version, SAG 220 antifoam emulsion, can be used in the amine or dehydrating process of gas recovery.

SAG 47 antifoam compound is the product of choice if the antifoam is to be stored in extreme climate conditions, especially for very cold weather. It can easily be diluted to reduce its viscosity and actives.

Key Features and Typical Benefits

- quick foam knockdown - particularly useful when foam suddenly builds up in the absorber and rapid control is needed.
- excellent antifoam stability and durability - over a period of time the concentration of salts in an amine or glycol dehydration unit can reach high levels. SAG 7133 antifoam emulsion and its more concentrated version, SAG 220 antifoam emulsion, are very stable in their presence. Additionally, lower amounts of antifoam are needed to retain line control, potentially resulting in lower costs and reduced propensity for fouling and clogging. Further, since these products are easily dispersed in water and are compatible with glycols, they do not allow the presence of these glycols to easily remove water from their state of emulsion, thus remaining effective for a longer period.
- excellent stability at high temperatures - because of their excellent dispersibility. SAG 7133 antifoam emulsion and SAG 220 antifoam emulsion do not show a propensity to deposit on heat exchangers as many other antifoams tend to. Instead, they remain finely dispersed in the amine or glycol solution and are eventually filtered out.
- easy dilution and use - simple addition of water and minimum agitation is sufficient to dilute SAG 7133 antifoam emulsion and SAG 220 antifoam emulsion to required concentrations. Pumping of the diluted emulsions is easy, due to their low viscosity.
- reduced clogging or scaling in the heat exchangers - potentially resulting in less service maintenance.
- low concentrations can provide effective foam control - SAG 7133 antifoam emulsion and SAG 220 antifoam emulsion are often two to three times more effective than other antifoams used in gas treating units.

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Typical Physical Properties

Emulsion: Silicone Antifoam Emulsion SAG 7133	
Chemical Nature	Emulsion of a silicone antifoam compound
Appearance	White, homogeneous, slightly viscous liquid
Viscosity at 25°C, cSt	600
Active Ingredients, %	10
Specific Gravity at 25°/25°C	1
pH	7
Emulsion Type	Non-ionic
Suitable Diluents	Water only
Emulsion: Silicone Antifoam Emulsion SAG 220	
Chemical Nature	Emulsion of a silicone antifoam compound
Appearance	White, homogeneous, slightly viscous liquid
Viscosity at 25°C, cSt	600
Active Ingredients, %	20
Specific Gravity at 25/25°C	1
pH	7
Emulsion Type	Non-ionic
Suitable Diluents	Water only
Compound: Silicone Antifoam Compound SAG 47	
Chemical Nature	Polydimethyl siloxane compound
Appearance	Translucent white
Viscosity at 25°C, (after stirring), cP	2500
Active Ingredients, % by weight	100
Specific Gravity at 25°/25°C	0.988
Emulsifiers	None
Suitable Diluents	Process liquid, hydrocarbons

Potential Applications

SAG 7133 antifoam emulsion, its more concentrated version, SAG 220 antifoam emulsion, and SAG 47 antifoam compound are targeted for gas recovery plants, where natural gas must be washed, or scrubbed, before distribution, and for liquefied natural gas (LNG) plants that must achieve high gas purity before liquefaction.

In many amine units, foam can be problematic. Proper line control without antifoam is, generally, extremely difficult.

General-purpose antifoams have a wide range of applicability, but not all of them are suitable for use in the treatment of gas. Some foam control agents can aggravate the problem. Foam control in gas scrubbers is only one of the process parameters to be monitored. It is equally important to prevent or slow the fouling of the unit, because dismantling of the gas-scrubbing units is manually intensive. Incorrectly specified antifoams can easily lead to increased fouling and clogging, particularly in the heat exchangers. Momentive Performance Materials SAG antifoams are designed to provide foam control with a minimum of such problems.

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Formulation and Use

The following applies to SAG 7133 antifoam emulsion, SAG 220 antifoam emulsion and to SAG 47 antifoam compound:

- the foam control agent should be diluted before use. In the case of SAG 47 antifoam compound, an appropriate dilution is down to 10% actives. In the case of SAG 7133 antifoam emulsion and SAG 220 antifoam emulsion, an appropriate dilution would be 3 parts of the emulsion and 1 part of water.
- we recommend that initial dosing of these dilutions start at 6lt/hr to a total of 800m³ of amine solution, proportionally less for smaller units. Over a period of a few days, the dosing should be fine-tuned to the requirements of the particular unit.
- to retain homogeneity, gentle stirring of the dilution is important, particularly if the dilution is to be retained for a period of more than 2 or 3 days. Avoid high shear mixing, especially for the dilutions of SAG 7133 antifoam emulsion and SAG 220 antifoam emulsion, as this may reduce the activity of the emulsion.
- in the amine units, the outlet (not the suction) side of the pump (where the lean amine solvent is sent back into the absorber) should be the point of introduction of the diluted antifoam.
- we recommend using a positive displacement piston pump to dose the antifoam dilutions from the antifoam diluting tank into the amine unit.
- it is preferable to add the foam control agents on a continuous, rather than batch, basis. This will help ensure line stability and quicker availability of the antifoam, in case of an emergency. However, arrangements should be made to ensure rapid batch dosing of large quantities of antifoam, in case of excessive foaming.

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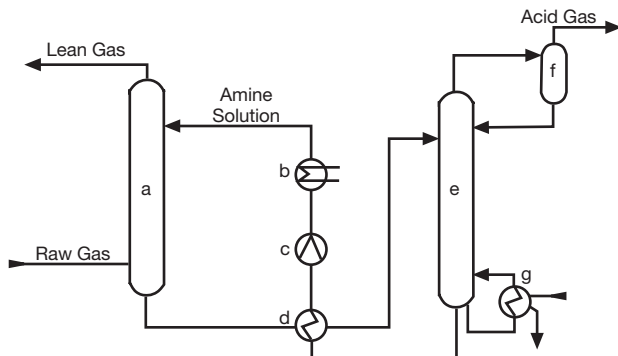
Basic Principles in Amine Processes

Aqueous amine solutions have been used on an industrial scale for the absorption of carbon dioxide and hydrogen sulfide for many years. Mono- and diethanolamine (MEA, DEA), as well as diglycolamine (DGA), diisopropylamine (DIPA), and methyldiethanolamine (MDEA), are typical constituents.

In the amine process, the acid gas components, i.e., CO₂ and H₂S, react with the basic solvent (usually a solution of amine in water) to form an adduct. When the temperature of the solvent is increased and the pressure is reduced, the adduct decomposes, the acid gas is released and the amine regenerated.

The flow diagram (see below) is similar for all amine processes. In a counter flow arrangement, raw gas is brought into contact with the solvent in an absorber (a). Laden solvent flows through a heat exchanger (d) to the regeneration system (e), where acid gases are desorbed from the solvent at reduced pressure with vapor generated, by reboiling. Acid gases leave the regenerator overhead after the stripping steam has been condensed (f). Regenerated solvent is returned to the absorber by way of the solvent heat exchanger (d) and solvent cooler (b).

Figure 1



The counter flow arrangement of the absorber unit is efficient for gas absorption, but encourages the formation of foam. Stable foam in amine units is undesirable, as it can lead to reduced throughput, reduced efficiency, and, in severe cases, to a shutdown of operations. Foam in amine units can be stabilized as a result of various impurities that have accumulated in the solvent. These impurities have formed in the solvent over time due to the causes such as:

- anionic species formed by oxidation of aromatic hydrocarbons and their subsequent reaction with the basic amine solution,
- polymers formed as a result of the degradation process of the amine,
- impurities coming in with the sour gas, such as antioxidants and corrosion inhibitors, and/or
- any solid matter.

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Basic Principles in Glycol Dehydration Processes

In most cases, for safety reasons, natural gas is dehydrated close to the gas well, to prevent formation of gas hydrates in high-pressure pipelines and to reduce corrosion of the pipelines and of the gas treating plant. Hydrates formation is a particularly acute problem in offshore operations and can lead to complete blocking of the pipeline. Corrosion can be severe if (as is very often the case) the gas contains carbon dioxide, hydrogen sulfide or chlorides.

Dehydration through the use of glycols is the most widespread process for natural gas dehydration. Triethylene glycol is the preferred glycol because of its high thermal stability, its high water absorption capacity and its low vapor pressure (low losses during regeneration). A typical glycol dehydration plant is shown below.

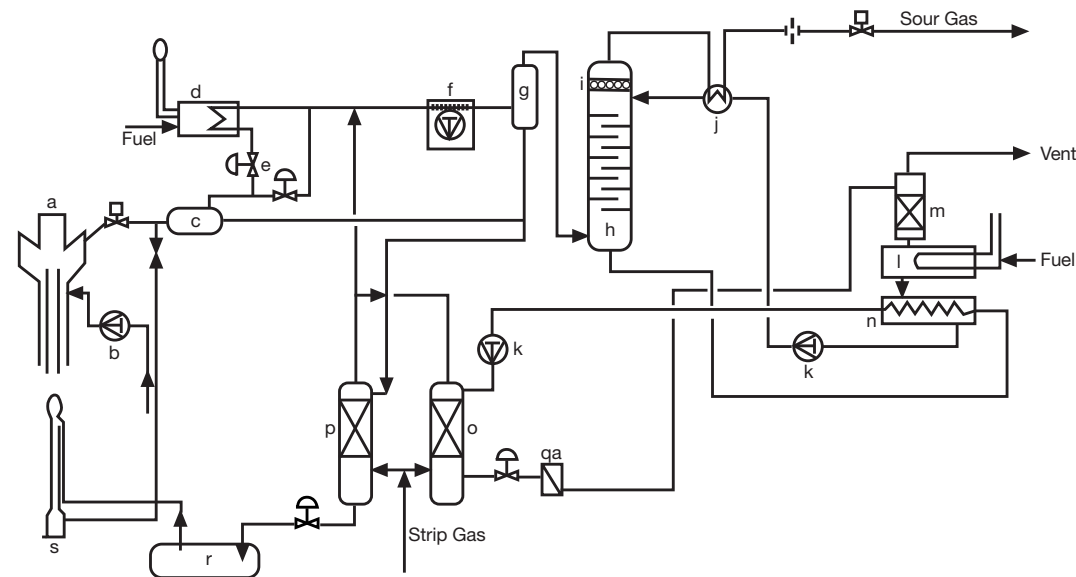
In the absorber (h), glycol and natural gas are brought into contact in a counter current way: gas moves from the bottom up and glycol falls, through the various plates of the absorber, from the top down. Water vapor is absorbed by the glycol during this operation. The water-laden glycol is regenerated in the glycol reboiler (l) and high concentration stripper (m). This is achieved by heating the water-laden glycol to about 200°C under nearly pressureless conditions. The regenerated glycol is cooled down and re-introduced in the absorber to start the cycle again.

Foaming can occur in both the absorber and the regenerator. Foam is stabilized by:

- degradation products resulting from reactions between the glycol and oxygen (oxygen does enter, inadvertently, into the glycol units).
- thermal decomposition products from the glycol itself.
- influx of acids from bore hole treatment rendering the glycol corrosive. Control of this is usually carried out by the addition of inhibitors that increase the pH. These react with the acids to form anionic species that stabilize foam.

Uncontrolled foaming can lead to reduced throughput, and in severe cases, to complete shutdown of the unit. Foam control is thus essential for the smooth functioning of the dehydration units.

Figure 2



- | | |
|---|----------------------------------|
| a) Well head | k) Glycol pump |
| b) corrosion inhibitor – sulphur solvent injection pump | l) Glycol reboiler |
| c) High-pressure separator (free water knockout) | m) High-concentration stripper |
| d) Heater | n) Glycol storage tank |
| e) Flow control valve | o) Glycol stripper |
| f) Air cooler | p) Water solvent stripper |
| g) Separator | q) Glycol filter |
| h) Glycol absorber | r) Produced liquids storage tank |
| i) Demister | s) Flare |
| j) Glycol - gas heat exchanger | |

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Patent Status

Nothing contained herein shall be construed to imply the nonexistence of any relevant patents or to constitute the permission, inducement or recommendation to practice any invention covered by any patent, without authority from the owner of the patent.

Product Safety, Handling and Storage

Customers should review the latest Material Safety Data Sheet (MSDS) and label for product safety information, safe handling instructions, personal protective equipment if necessary, and any special storage conditions required for safety. MSDS are available at www.momentive.com or, upon request, from any Momentive Performance Materials (MPM) representative. For product storage and handling procedures to maintain the product quality within our stated specifications, please review Certificates of Analysis, which are available in the Order Center. Use of other materials in conjunction with MPM products (for example, primers) may require additional precautions. Please review and follow the safety information provided by the manufacturer of such other materials.

Limitations

Customers must evaluate Momentive Performance Materials products and make their own determination as to fitness of use in their particular applications.

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Emergency Service

Momentive Performance Materials maintains an around-the-clock emergency service for its products.

<u>Location</u>	<u>Emergency Service Provider</u>	<u>Emergency Contact Number</u>
Mainland U.S., Puerto Rico	CHEMTREC	1-800-424-9300
Alaska, Hawaii	CHEMTREC	1-800-424-9300
Canada	CHEMTREC	1-800-424-9300
Europe, Israel	NCEC	+44 (0) 1235239670
Middle East	NCEC	+44 (0) 1235239671
Asia Pacific (except China)	NCEC	+44 (0) 1235239670
China	NCEC	+86-10-5100-3039
Latin America (except Brazil)	NCEC	+44 (0) 1235239670
Brazil	SOS Cotec	08000111767 or 08007071767
All other locations world wide	NCEC	+44 (0) 1235239670
At sea	Radio U.S. Coast Guard in U.S. waters NCEC in International waters	+44 (0) 1235239670

For Health related calls, contact Momentive Performance Materials at +1-518-233-2500 (English only).

DO NOT WAIT. Phone if in doubt. You will be referred to a specialist for advice.

Customer Service Centers

Worldwide

4information@momentive.com

+1 614 986 2495 / T +1 800 295 2392

North America

Silicones

T +1 800 332 3390

Consumer Sealants/ Construction Sealants and Adhesives

T +1 877 943 7325

Latin America

South America

T +55 11 4534 9650

Mexico and Central America

T +52 55 2169 7670

Europe, Middle East, Africa and India

T +00 800 4321 1000 / +40 21 3111848

Pacific

China

T +800 820 0202 / +86 21 3860 4892

Japan

T +0120 975 400 / +81 276 20 6182

Korea

T +82 2 6201 4600

Malaysia

T +60 3 9206 1532

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22 Corporate Woods Boulevard
Albany, NY 12211 USA
momentive.com