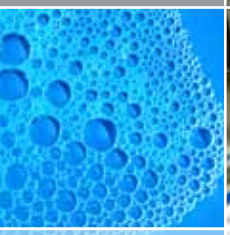
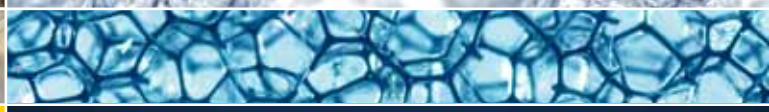
MOMENTIVE™

Antifoam Solutions



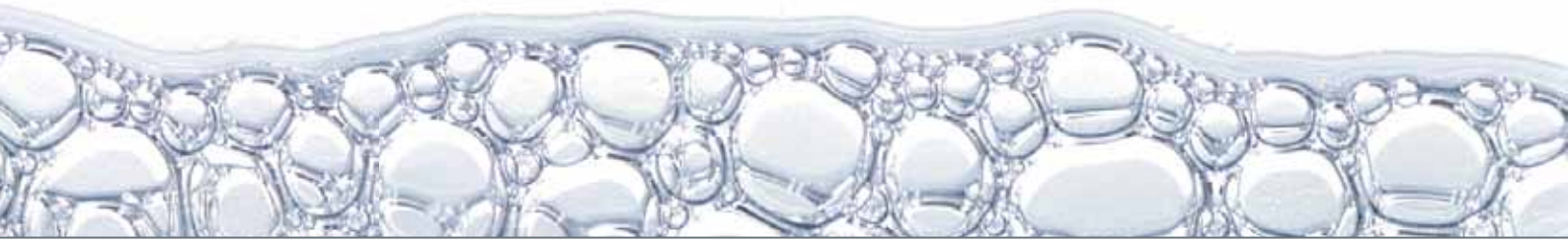



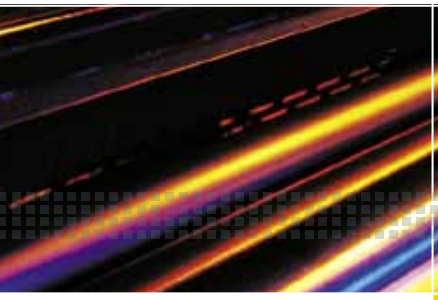


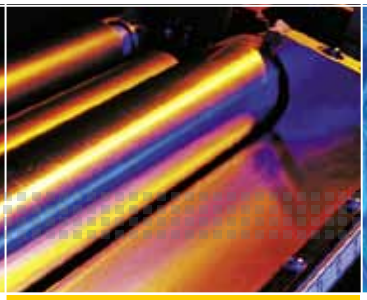



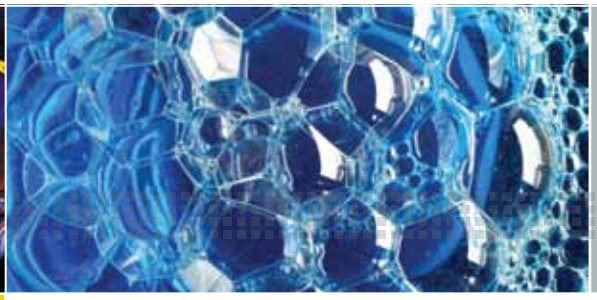

Why Use Antifoams and Defoamers?

Foam is a mass of bubbles created when gas is dispersed into a liquid and the dispersion is stabilized. High-strength films of liquid surround the bubbles, forming large volumes of foam (Figure 1). While the cause of foam is a complicated study in physical chemistry, its existence presents serious problems in the operation of industrial processes, the filling, transportation and the quality of finished products. If not properly controlled, foam can reduce equipment capacity and increase processing time and expense. Typically foam occurs in blending or mixing, reflux and distillation steps, filtration and filling.









Applications

- textile & carpet
- food & beverage
- chemical & plastics
- pulp & paper
- water treatment
- coatings
- mechanical fluids
- construction
- oil & mining

Foam can be controlled by making basic changes in the process itself or by using mechanical defoaming equipment. However, chemical foam control agents have proven to be the most versatile, effective and economical solution to the problem.

Antifoams must have lower surface tension than the foaming solution, be insoluble in it and form small drops (See Figure 1), which then break the foam films by bridging them. Besides breaking foams effective chemical defoaming agents generally also meet the following requirements:

- Disperse readily in the system.
- Possess poor or low solubility (incompatibility) in the system.
- Be inert.
- Leave no substantial residue or odor.
- Meet regulatory requirements, e.g. FDA and USDA where applicable.
- Be certified kosher, parve, and halal where applicable.

For many applications silicone foam control agents match all these requirements effectively. Due to their efficient foam destruction even at extremely low dose rates, they can be very cost competitive.

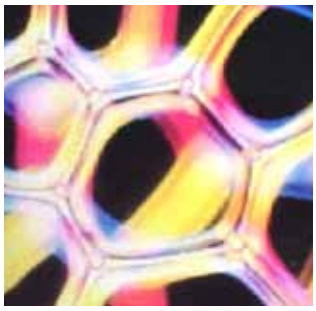


Figure 1
Image of a foam with oil droplets in it.

Performance Measurement

The performance of antifoams is not easy to measure, since various factors, like the nature of the foaming medium, the temperature or shear rate – among many others – have a strong impact and may be difficult to foresee.

A good test should mimic as close as possible the specific application conditions (type of mixing, temperature etc.). The most widely used test is the shake test, in which the antifoam is added to a foaming medium in a closed container and is shaken either by hand or – more reliably – by automated shaking machine equipment for a defined time period or number of shakes. The time for the foam to collapse and the amount of foam remaining are typical comparison results.

Another way to measure the defoaming performance is the recirculation test. A cylindrical glass container with a bottom outlet is filled to approximately a quarter of its volume with the foaming medium. The outlet is connected to a pump, which pumps the liquid at defined speed out of the container and re-injects it from the top. This test is more challenging as it entrains a lot of air and stresses the antifoam with shear. Optionally the liquid can be heated to mimic process conditions.

After starting the pump the stream of falling liquid leads to a quick buildup of foam. When the foam reaches the top of the container, the antifoam is added. As the foam collapses, the time and level at which the foam collapses is monitored. This reflects the knockdown ability of the antifoam. Continuing recirculation means the foam will start to rise again. The more time passes until the foam builds, the more persistent is the antifoam.

Selecting the best antifoam is ultimately a delicate balance between the performance and cost requirements of each specific application. Basic silicone antifoams are very cost-effective solutions for many applications where foam knockdown is the main performance objective. High performance silicone antifoams (such as SagTex* PhD silicone antifoam, SagTex DSA silicone antifoam, and Y-14991 silicone antifoam) are more complex formulations offering better solutions in extreme conditions, with strong foam where both foam knockdown and durability (persistence to re-foaming) are required. Since antifoams are used in many diverse markets and applications, Momentive has developed a broad antifoam product line that covers a wide range of performance and cost requirements.

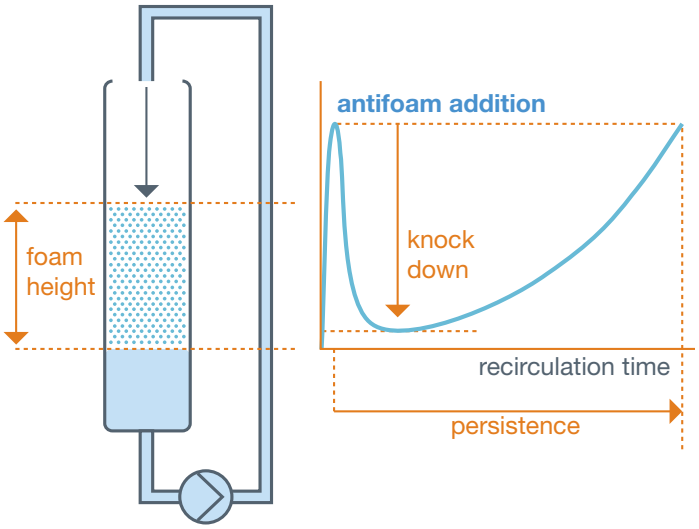


Figure 2

Scheme of recirculation pumping rig: The measurement yields knock-down height, which is the ability of the defoamer to destroy existing foam an also persistence, which is the time the foam takes to rebuild to the original height.

*SagTex is a trademark of Momentive Performance Materials Inc.



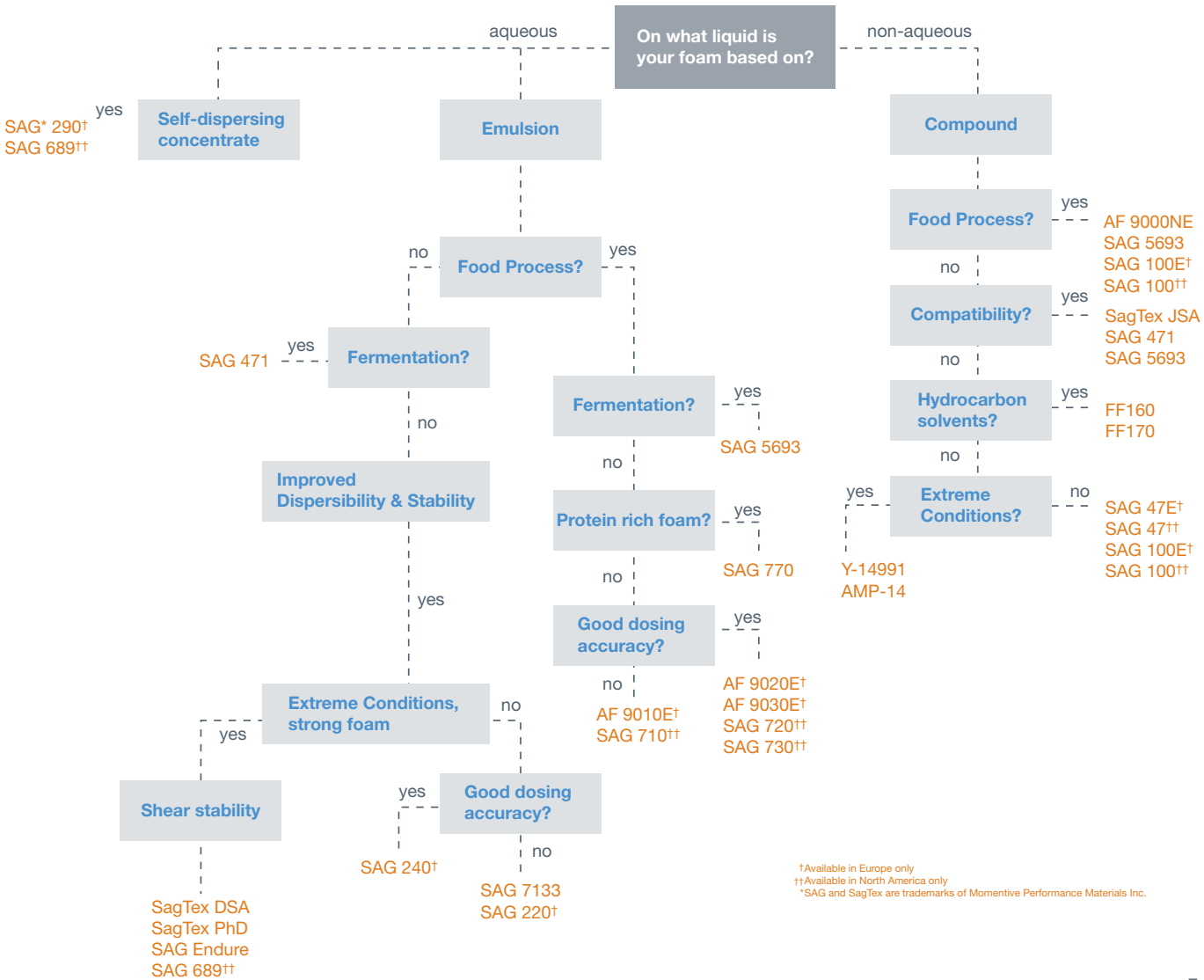
Silicone Antifoam Selection

This selector guide (Figure 3) describes those Momentive antifoams, that have been found particularly useful in many applications. In selecting the best type and quantity of silicone defoamer, each application must be assessed separately. It is therefore best to evaluate several antifoams in each system to determine the type and concentration needed to assure optimum results.

Factor	Options
Chemical nature of the foam-forming agent	Aqueous / non-aqueous.
Temperature	High / low
pH-value	High / neutral / low
Compatibility	Clear appearance / turbid formulation
Dosing accuracy	Concentration of antifoam
Processing equipment	Low shear / high shear
End use of product containing the antifoam	Food contact / sensitive to de-wetting

Figure 3

Antifoam Selection Tree



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*SAG and SagTex are trademarks of Momentive Performance Materials Inc.

Aqueous Antifoams

Aqueous antifoams are formulated emulsions or concentrates that allow easy dilution in systems based on water or polar solvents. Various concentrations are available to aid dosing accuracy and handling.

Concentrates	Water dispersible systems of high active content developed for formulators or processes with high dosing accuracy.
Emulsions	Ready-to-use water-based products of various active contents, which provide easy disperse-ability for maximum defoaming efficiency.

The impact of dosing and handling are often underestimated when chemical antifoams are used:

Dosing	Silicone antifoams are often sufficient at a level 10 to 100ppm of the active material. This equals 50 to 500 g of a 20% emulsion for one metric ton of defoaming media, whereas only 10 to 100 g would be needed of a 100% active material. Thus, in cases where the dosing equipment is not very accurate or very low dose rates are sufficient, we recommend use of antifoam emulsions with a 10 or 20% active content. The higher dosing volume will reduce any error from inaccurate dosing equipment. With precise dosing equipment, we recommend the use of higher concentrated antifoam emulsions, since they need less storage space and offer better cost performance.
Handling	Compounds are used undiluted or pre-dispersed in organic solvents for non-aqueous applications and need emulsification prior usage in aqueous media. In addition, viscosities of compounds and concentrates are typically in the range of 1,500 to 2,000,000 cSt. The handling of such high viscosities requires appropriate equipment. Aqueous emulsions typically have viscosities of 40 to 3,000 cSt depending on active content and formulation. They are therefore much easier to handle and can be diluted with simple stirring equipment.

Non-Aqueous Antifoams

Compounds

100% active fluid products and formulations of fluids containing special active ingredients that boost the defoaming performance.

Non-aqueous antifoams can be considered for defoaming in non-water based systems like organic solvents and mineral oils. They are 100% active materials, so they do not introduce water into these systems.

Non-aqueous antifoams can be chosen from four categories:

- Polydimethylsiloxane (PDMS) fluids of our Element14* PDMS series (predominantly higher viscosities)
- Silicone compounds
- Organo-functional silicone fluid copolymers (such as silicone polyethers) of our Silwet* and Silbreak* product portfolios
- Fluorosilicone fluids

In many cases a dilution of the silicone compound in a suitable organic solvent is advisable to reduce the actives content for a more accurate dosing and decrease the viscosity for an easier handling. Formulators can also use these grades to manufacture their own antifoam emulsions.

Polydimethylsiloxane (PDMS) fluids and silicone compounds:

Some foaming problems can be solved by applying high viscosity PDMS fluids, like Element14 PDMS 12.5K silicone fluid and Element14 PDMS 60K silicone fluid. If higher defoaming performance is required silicone compounds can often provide improved defoaming performance compounds.

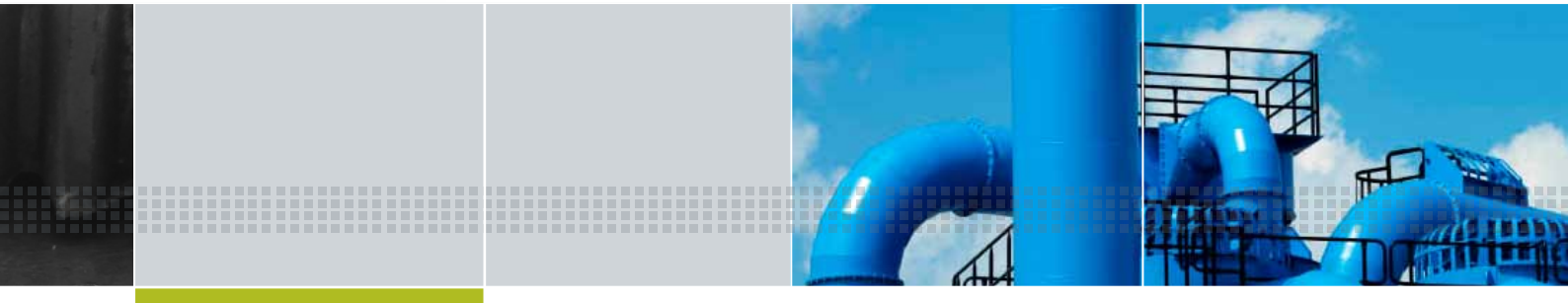
Organo-functional silicone fluids:

In some applications PDMS fluids are too incompatible and separate out or are too soluble in the foaming medium (e.g. toluene or diesel fuel) and thus may even stabilize foam. Here organo-functional silicone copolymers of our Silwet and Silbreak portfolios can help. Our separate Silwet and Silbreak brochures provide a complete overview.

Fluorosilicone fluids:

In certain non-aqueous applications, fluorosilicone fluids can be good choices, as they can provide effective oil/gas separation and foam control in solvents like hydrocarbons and fluorinated or chlorinated hydrocarbons at extremely low dose levels, providing foam control and degassing e.g. in offshore oil wells and solvent distillation and recovery units.

*Element 14, Silwet and Silbreak are trademarks of Momentive Performance Materials Inc.



Dilution Instructions

Once you have selected the right antifoam for your application, you should determine the appropriate concentration level for your use: using excess antifoam could cause undesirable effects such as gushing of carbonated beverages, or formation of residues on cooking vats. To test the effectiveness of a product, a good starting concentration is 100 parts per million (ppm) of active ingredient from basic silicone antifoams and 10 ppm from the high-performance products (SagTex* DSA silicone antifoam, SagTex PhD silicone antifoam, & Y-14991 silicone antifoam).

Please follow the instructions below to dilute the antifoam to the desired end use concentration required for each specific application.

For an approximate dilution to 100 ppm actives blend:

1 drop in 1 pint **OR**
8 drops in 1 gallon **OR**
1 tablespoon in 20 gallons **OR**
1 fluid ounce in 75 gallons

Table 1

For an accurate dilution to **100 ppm antifoam actives** blend:

% Actives	Dilution of Antifoam			
100	1.00	37.8	1.28	0.80
30	3.33	126.2	4.27	2.66
20	5.0	189.3	6.40	4.00
10	10	378	12.80	8.00
	parts In	mL in	fl. ounces in	pints in
	10,000	100	100	1000
	parts	gallons	gallons	gallons

If you need X ppm actives from a product with Y% actives content you have to dilute X/Y parts of product in 10,000 parts of liquids.

For example if you want 30 ppm actives dilution from 30% active antifoam you have to dilute 30/30 = 1.0 part of the 30% antifoam with 10,000 parts of liquid.

Product Overview

Table 2. Antifoam compounds, concentrates and fluorosilicone antifoams

Product	Type	Active Content [%]	Viscosity [cSt]	pH	Potential Applications
Element14* PDMS-XXX	Fluid	100%	5 - 3.000.000	-	food process, industrial, non-aqueous
AF9000NE	Compound	100%	1550	-	food process, non-aqueous
SAG* 47E†	Compound	100%	1400	-	general, industrial, non-aqueous
SAG 47††	Compound	100%	1400	-	general, industrial, non-aqueous
SAG 100E†	Compound	100%	1500	-	general, industrial, non-aqueous
SAG 100††	Compound	100%	2000	-	food, non-aqueous
Y-14991	Compound	100%	60000	-	general, pulp & paper
AMP-14	Compound	100%	gel like	-	chemical, pulp & paper
SagTex* JSA	Compound	100%	250	-	general, coatings
SAG 471	Concentrate	100%	2200	-	fermentation
SAG 5693	Concentrate	100%	350	-	food process, fermentation
SAG 290†	Concentrate	90%	3000	-	general, aqueous
SAG 689††	Concentrate	100%	4000	-	general, aqueous
FF160	Fluorosilicone	100%	20000	-	chemical, non-aqueous
FF170	Fluorosilicone	100%	4000	-	chemical, non-aqueous
FF190	Fluorosilicone	100%	580	-	chemical, non-aqueous

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Typical data are average. The average values may vary.
These typical data values of Momentive antifoam products should not be used as specifications. Please consult our Technical Data Sheets and material Safety Datasheets as changes might occur. Assistance and specifications are available by contacting Momentive or your Momentive Distributor.
*Element14, SAG and SagTex are trademarks of Momentive Performance Materials Inc.

Table 3. Powder antifoam

Product	Type	Active Content [%]	Viscosity [cSt]	pH	Potential Applications
Indusil* FINA	Powder antifoam	30%	-	-	Cement, mortar deaeration, antifoaming

Table 4. Antifoam emulsions

Product	Type	Active Content [%]	Viscosity [cSt]	pH	Potential Applications
AF9010E†	Emulsion	10%	1250	4.5 - 5.5	food process, aqueous
AF9020E†	Emulsion	20%	1750	4.5 - 5.5	food process, aqueous
AF9030E†	Emulsion	30%	3500	4.5 - 5.5	food process, aqueous
SAG* 710††	Emulsion	10%	1250	4.5 - 5.5	food, beverages, aqueous
SAG 720††	Emulsion	20%	1250	4.5 - 5.5	food, beverages, aqueous
SAG 730††	Emulsion	30%	1250	4.5 - 5.5	food, beverages, aqueous
SAG 770	Emulsion	30%	1500	3.5 - 5.0	food process, protein & starch foams
SAG 7133	Emulsion	10%	700	7.0 - 8.5	aqueous, industrial, oil & mining
SAG 2001††	Emulsion	10%	1100	7.0 - 8.5	aqueous, industrial
SAG Endure	Emulsion	35%	2000	7.0 - 8.5	aqueous, industrial
SAG 10E†	Emulsion	10%	2000	7.0 - 8.5	general, aqueous
SAG 10††	Emulsion	10%	2000	7.0 - 8.5	general, aqueous
SAG 30††	Emulsion	30%	2000	7.0 - 8.5	general, aqueous
SAG 220†	Emulsion	20%	700	7.0 - 8.5	general, aqueous
SAG 240†	Emulsion	40%	900	7.0 - 8.5	general, aqueous
Indusil 1571	Emulsion	10%	1000	7.0 – 9.0	general, aqueous
SagTex* DSA	Emulsion	20%	1500	7.0 - 10.0	general, aqueous
SagTex PhD	Emulsion	45%	2900	7.0 - 10.0	general, aqueous

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Antifoam Selector

Table 5

Market	Segment	Potential Applications	Products to Consider
Textile & Carpet		Scouring	SagTex* PhD, SagTex DSA, SAG* Endure, SagTex JSA
		Dyeing	SagTex PhD, SagTex DSA, SAG Endure
		Finishing	SagTex PhD, SagTex DSA, SAG Endure
		Cleaning	SagTex PhD, SagTex DSA, SAG 2001
Food & Beverage		Food Process Aid Carbonated Beverages	SAG 770†††, AF9000NE†††, AF9010E, AF9020E, AF9030E, Element14* 350†††, SAG 5693, SAG 471, SAG 710†††, SAG 720†††, SAG 730†††
		Protein/Starch Foam	SAG 770†††
		Fermentation	SAG 5693, SAG 471
Chemical & Plastics	Distillation	Aqueous	SAG 7133, SAG 220, SAG 290, SagTex PhD, SagTex DSA
		Non-polar	Element14 PDMS 60K, SAG 47E, SAG 100E, Y-14991, FF160, FF170
	Vacuum Distillation	Hydrocarbon	SAG 47E, SAG 100E, FF160, FF170
		Solvent & Alcohol	Element14 PDMS 12.5K, Element 14 PDMS 60K, SAG 471, FF160, FF170
		Aqueous	SAG 5693, SAG 7133, SagTex PhD
	Polymerization	Latex	SagTex JSA, SAG 7133, SAG 220, SAG 240, SAG 290
		Nylon	Silwet* L-7605, SAG 220, SAG 240, SagTex PhD
		Aqueous	SAG 7133, SAG 220, SAG 290, Sag 10, SagTex PhD, SagTex DAS, Sag 2001
		Non-Polar	Element14 PDMS 60K, SAG 47E, SAG 47, Y-14991, FF60, FF170
	Minerals & Pigments	Phosphates	SAG 7133, Silwet L-7605
		TiO2	SAG 7133, SAG 220, SagTex DSA
	Oil, Crude oil	Gas Sweetening	SAG 7133, SagTex PhD
		Gas/Oil Separators	Element14 PDMS 60K, FF160, FF170, Silbreak* 638
		Distillation	Element14 PDMS 60K, FF160, FF170
	Emulsions	Emulsion Polymerization	SAG 7133, SAG 220, SAG 240, SagTex DSA, SagTex PhD, Silwet DA-33, Silwet DA-40, Silwet DA-63
		Mechanical Emulsification	SAG 7133, SAG 220, SAG 240, SagTex DSA, SagTex PhD
		Bitumen Emulsification	SAG 7133, SAG 220, SAG 240, SagTex DSA, SagTex PhD
	Surfactants	Surfactant Solutions	SAG 7133, SAG 220, SAG 240, SagTex DSA, SagTex PhD, SAG 2001
		Biodiesel	TP-325, TP-645, TP-745, SAG 47E

††† Certified Kosher. Please consider that usage and/or dosage restrictions may apply, depending on application or other ingredients of same chemistry. For more details please contact the respective brochure, technical datasheet or your responsible Momentive distributor or sales representative.

*SAG, SagTex, Element14, Silwet and Silbreak are trademarks of Momentive Performance Materials Inc.

Antifoam Selector

Table 5 (continued)

Market	Segment	Potential Applications	Products to Consider
Pulp & Paper		Formulation Ingredient	Silwet* DA-33, Silwet DA-40, Silwet DA-63, SAG 47E, SAG* 100E, Y-14991
		Pulp Process	SagTex* DSA, SagTex PhD, Y-14991, AMP-14
Water Treatment		Biological Effluent	SAG 471, SAG 5693, SAG 7133, SAG 220, SAG 240
		Sea Water Distillation	SAG 7133, SAG 220, SAG 240, SagTex DSA
Coatings	Paints, Inks & Varnishes		SagTex JSA, Silwet DA-33, Silwet DA-40, Silwet DA-60
	Adhesives		SAG 471, SagTex JSA, Silwet DA-33, Silwet DA-40, Silwet DA-60
	Sealants		SAG 471, SagTex JSA, Silwet DA-33, Silwet DA-40, Silwet DA-60
Mechanical Fluids	Coolants	Glycol Based	Silbreak* 320, SAG 471, SagTex PhD
	Hydraulic Fluids		Element14* PDMS 5000, SAG 5693, FF160, FF170
	Engine Oils		Element14 PDMS 350, 5000, 12.5K FF60, FF170, Silbreak 322, Silbreak 320, SAG TP-325, Silbreak 638
	Transmission Oils	Mineral Oil Based	Element14 PDMS 350, 5000, 12.5K Silbreak 320, Silbreak 322, SAG TP-325, Silbreak 638, TP-367, FF160, FF170
		Synthetic Oil Based	FF160, FF170
	Aqueous Cutting Fluids, Metalworking fluids	Semi-synthetic, Synthetic	SAG Endure, SAG 689, SAG 290, SagTex DSA, SagTex PhD
	Non-Aqueous Cutting Fluids	Synthetic Oil Based	SAG 471, SAG 290, SagTex DSA
	Heat Transfer		SAG 471, SAG 5693
Construction	Cement		Indusil* FINA, SAG 240, SagTex DSA, SagTex PhD
	Asphalt		SAG 47E, SAG 100E, Y-14991
Oil & Mining	Ore Extraction		SAG 7133, SAG 220, SAG 240, SagTex DSA, SagTex PhD
	Ore Flotation		SAG 7133, SAG 220, SAG 240, SagTex DSA, SagTex PhD
	Drilling Muds	Aqueous	SAG 7133, SAG 220, SAG 240, SAG 290
		Non-Aqueous	Element14 PDMS 5000, Element14 PDMS 12.5K

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