

# CORROSION INHIBITORS CATALOGUE





## PETROSTEP® CORROSION INHIBITORS: PROTECT AND PRESERVE

Corrosive agents can be found throughout the oilfield, from pipelines to production and injection wells, to storage tanks, pumps and treatment units. One of the best ways to keep operations running smoothly and avoid costly consequences of pipeline and equipment failures is to use corrosion inhibitors.

Those used in the production, processing and transportation of oil and gas are almost exclusively blends of several components and surface actives in appropriate solvent packages. Their activity and composition is dictated by the end-use application and corresponding conditions. Stepan Oilfield Solutions' PETROSTEP CI products are designed to meet this wide range of application needs.

**OIL SOLUBLE FORMULATIONS** have been predominantly used in batch applications where a predetermined volume of neat or diluted chemical is sent downhole or in the pipeline to lay down a protective film on the pipe or tubing wall. This operation needs to be repeated over time as the film is slowly washed away during the production. This process often requires shutting the well or interfering with production and so has become less popular with operators over the last few decades.

**WATER SOLUBLE FORMULATIONS** are applied continuously at predetermined injection rates using chemical pumps. In conjunction with a corrosion monitoring program, their dosages can be optimized to achieve an effective integrity management program in the field. The water-soluble PETROSTEP CI products can be formulated to accommodate specific dosage requirements and take advantage of a key characteristic of water-soluble formulations: the capability to partition into the aqueous phase where corrosion takes place.

**SOLVENTS** used in the formulation generally determine the nature of oilfield corrosion inhibitors as most actives can be used in both oil and water soluble formulations. They typically consist of 50 – 80% of the final blend and their composition is mainly dictated by its intended use.

The two most prevalent solvents in water-soluble corrosion inhibitors are water and methanol; the latter is also used to winterize the products. If a low flash point is an issue, ethylene glycol (EG) or ethylene glycol monobutyl ether (EGMBE) are used instead. Other solvents, such as, isopropyl alcohol, butanol, xylene or toluene are also used but in a much lower amounts.

Oil soluble formulations are blended mainly with heavy or light aromatic naphtha (HAN/LAN), kerosene or diesel.

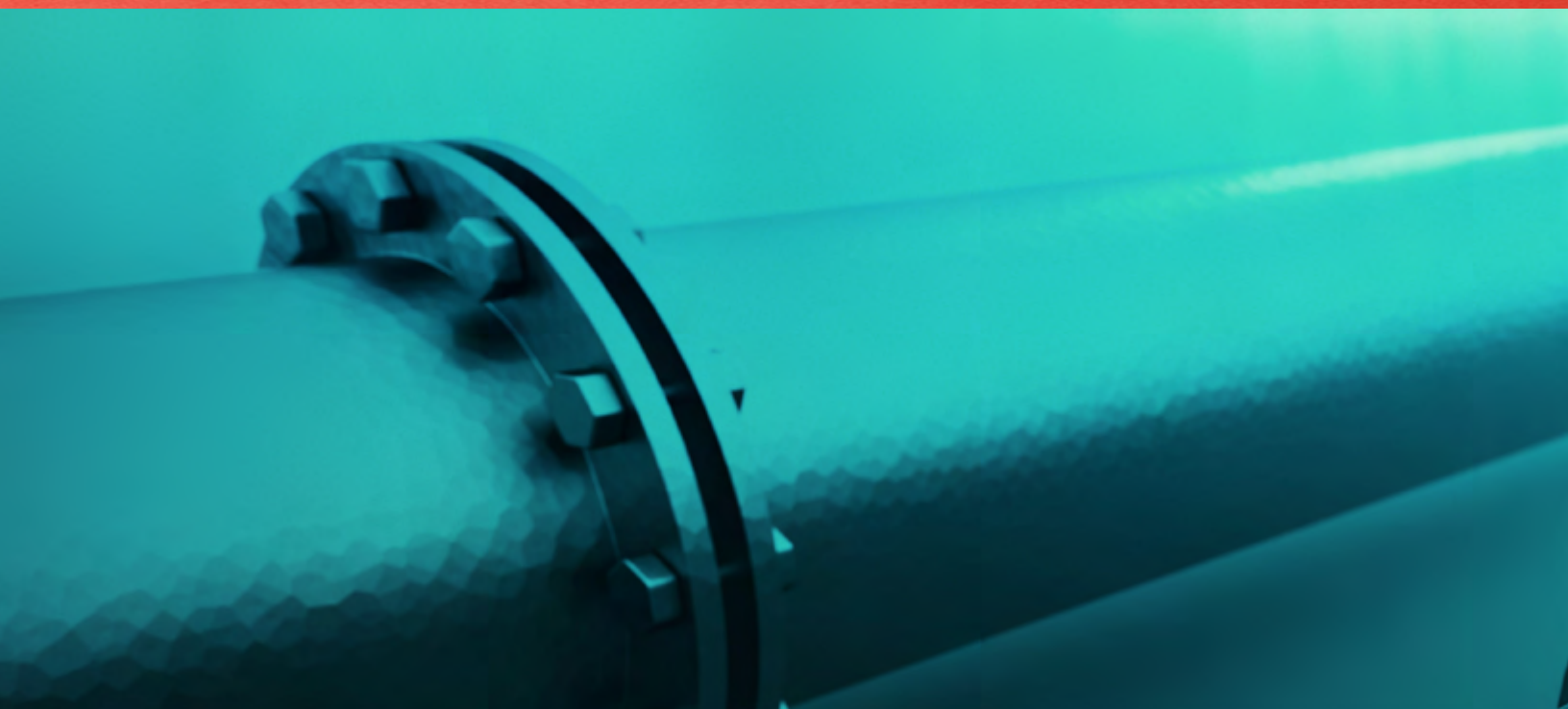
The following pages detail the full PETROSTEP CI line that includes amides and imidazolines; quaternary ammonium compounds or quats; phosphate esters; and formulation aids.

## AMIDES AND IMIDAZOLINES

Imidazolines and their precursors, amido amines, have been successfully used in the industry for decades. By their nature, they are oil soluble and thus form the basis of many oil-soluble blends. However, they can be used in water-soluble formulations as well by either salting them with carboxylic acids and making them water dispersible; reacting them with ethylene oxide; or mixing them with various surfactants and an appropriate solvent package to help them partition into the brine.

Stepan Oilfield Solutions offers the following products:

***PETROSTEP CI-A1*** and ***PETROSTEP CI-A2*** are biodegradable surfactants.



PHYSICAL PROPERTY	PETROSTEP CI-A1	PETROSTEP CI-A2
APPEARANCE @ 25°C	AMBER LIQUID	PALE YELLOW LIQUID
DENSITY @ 25°C, G/ML	0.986	0.991
PH, 1% IN WATER	10-11	9.0
ACTIVITY, %	100.0	100.0
VISCOSITY @ 25°C, CPS	1017	1155
FLASH POINT, °C	>94	>94
POUR POINT, °C	-15	6
WATER SOLUBILITY	DISPERSIBLE	SOLUBLE
METHANOL SOLUBILITY	SOLUBLE	SOLUBLE
GLYCOL SOLUBILITY	SOLUBLE	SOLUBLE
KEROSENE SOLUBILITY	INSOLUBLE	INSOLUBLE
HAN SOLUBILITY	SOLUBLE	SOLUBLE
XYLENE SOLUBILITY	SOLUBLE	SOLUBLE





## QUATERNARY AMMONIUM COMPOUNDS OR QUATS

Quats are typically used in water-soluble formulations, but they can be used in batch chemicals as well. The two well-known chemistries are alkyl pyridine and benzyl chloride quats, however, their application is limited in higher salinity brines where smaller molecules generally provide better solubility. Formulators should note that using excess product could potentially have a detrimental effect on the filming properties of a final blend.

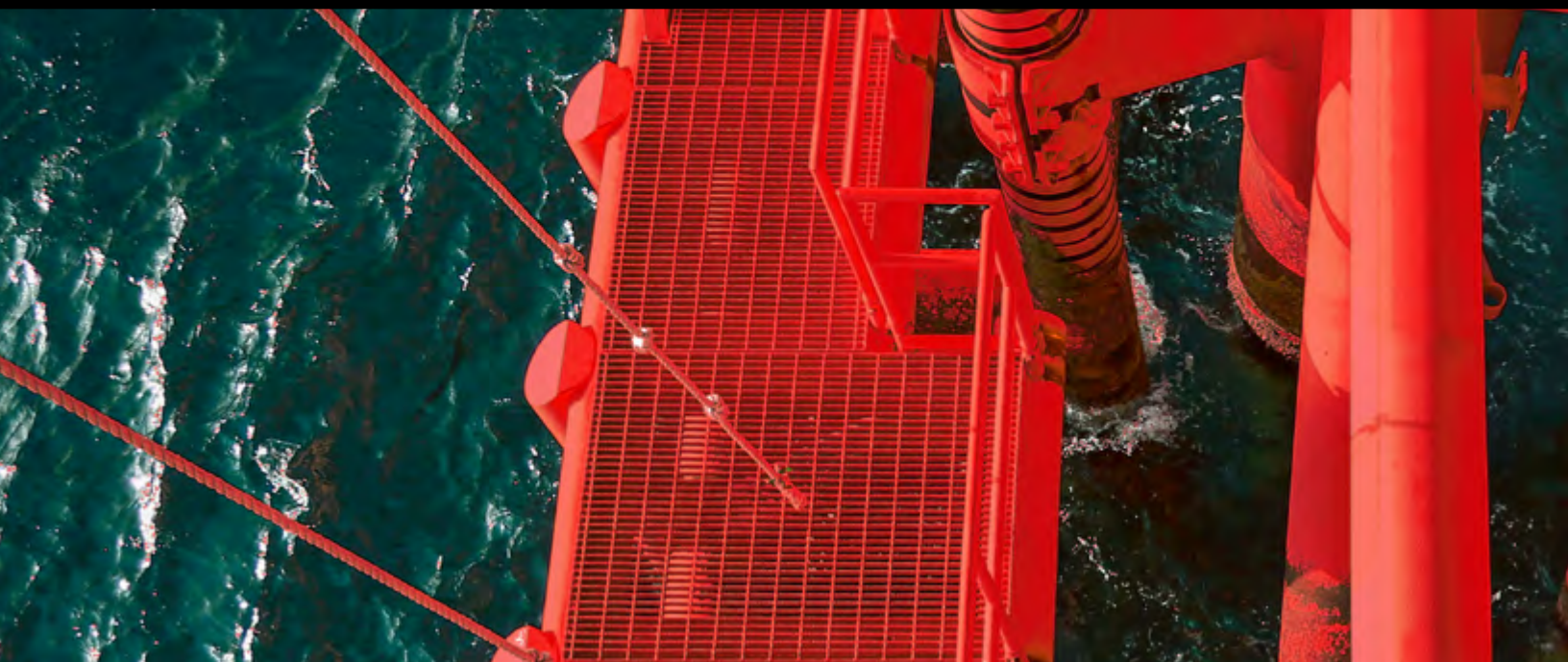
Stepan Oilfield Solutions offers the following quats:

**PETROSTEP CI-Q1** is methyl chloride quat and **PETROSTEP CI-Q2** is a benzyl chloride quat.

PHYSICAL PROPERTY	PETROSTEP CI-Q1	PETROSTEP CI-Q2
APPEARANCE @ 25°C	CLEAR LIQUID	CLEAR LIQUID
DENSITY @ 25°C, G/ML	0.89	0.97
PH, 10% IN WATER	7.2	8.5
VISCOSITY @ 25°C, CPS	210	1000
ACTIVITY, %	80	80
FLASH POINT, °C	36.8	32.0
POUR POINT, °C	-9.0	1.0
WATER SOLUBILITY	SOLUBLE	SOLUBLE
METHANOL SOLUBILITY	SOLUBLE	SOLUBLE
GLYCOL SOLUBILITY	SOLUBLE	SOLUBLE
KEROSENE SOLUBILITY	SOLUBLE	INSOLUBLE
HAN SOLUBILITY	SOLUBLE	SOLUBLE
XYLENE SOLUBILITY	SOLUBLE	SOLUBLE

**PETROSTEP CI-Q3** and **PETROSTEP CI-Q4** are methyl chloride quats.

PHYSICAL PROPERTY	PETROSTEP CI-Q3	PETROSTEP CI-Q4
APPEARANCE @ 25°C	AMBER LIQUID	CLEAR LIQUID
DENSITY @ 25°C, G/ML	0.87	0.965
PH, 10 % RESP. 2%, IN WATER	7.0	7.0
VISCOSITY @ 25°C, CPS	103	6
ACTIVITY, %	50	29.5
FLASH POINT, °C	11	>94
POUR POINT, °C	<3	4
WATER SOLUBILITY	SOLUBLE	SOLUBLE
METHANOL SOLUBILITY	SOLUBLE	SOLUBLE
GLYCOL SOLUBILITY	SOLUBLE	SOLUBLE
KEROSENE SOLUBILITY	SOLUBLE	INSOLUBLE
HAN SOLUBILITY	SOLUBLE	INSOLUBLE
XYLENE SOLUBILITY	SOLUBLE	INSOLUBLE





**PETROSTEP CI-Q5** is an imidazoline quat.

PHYSICAL PROPERTY	PETROSTEP CI-Q5
APPEARANCE @ 25°C	YELLOW OPAQUE LIQUID
DENSITY @ 25°C, G/ML	0.91
PH, 10% IN H2O/IPA	6.0
VISCOSITY @ 15°C, CPS	1500
ACTIVITY, %	MIN. 80
FLASH POINT, °C	23.5
POUR POINT, °C	10
WATER SOLUBILITY	INSOLUBLE
METHANOL SOLUBILITY	INSOLUBLE
GLYCOL SOLUBILITY	INSOLUBLE
KEROSENE SOLUBILITY	SOLUBLE
HAN SOLUBILITY	SOLUBLE
XYLENE SOLUBILITY	SOLUBLE





## PHOSPHATE ESTERS

Phosphate esters are major components of many oilfield corrosion inhibitors for both sweet and sour applications. They are very effective at moderate temperatures and some are said to be effective in the presence of trace amounts of oxygen. Because of their relatively low toxicity, they have been used for formulating “green” corrosion inhibitors.

The PETROSTEP CI-PE series are ethoxylated phosphate esters. These are tolerant in brines containing high amounts of calcium, making them ideal for well stimulation and completion treatments. Phosphate esters are also powerful emulsifiers and formulators need to be aware of the potentially negative impact on separation process and water quality. These products should be used in environments with temperatures below 250°F.

Stepan Oilfield Solutions offers the following phosphate esters:

***PETROSTEP CI-PE1*** is a non-neutralized phosphate ester.

PHYSICAL PROPERTY	PETROSTEP CI-PE1
APPEARANCE @ 25°C	CLEAR LIQUID
DENSITY @ 25°C, G/ML	0.98
PH, 10% IN WATER	1.8
VISCOSITY @ 25°C, CPS	165
ACTIVITY, %	100
FLASH POINT, °C	>94
POUR POINT, °C	-1
WATER SOLUBILITY	DISPERSIBLE
METHANOL SOLUBILITY	SOLUBLE
GLYCOL SOLUBILITY	INSOLUBLE
KEROSENE SOLUBILITY	SOLUBLE
HAN SOLUBILITY	SOLUBLE
XYLENE SOLUBILITY	SOLUBLE

**PETROSTEP CI-PE2** and **PETROSTEP CI-PE3** are non-neutralized phosphate esters. They are typically used in formulations for higher salinity brines.

PHYSICAL PROPERTY	PETROSTEP CI-PE2	PETROSTEP CI-PE3
APPEARANCE @ 25°C	HAZY LIQUID	HAZY LIQUID
DENSITY @ 25°C, G/ML	1.03	1.06
PH, 1% IN WATER	2.6	2.4
VISCOSITY @ 25°C, CPS	760	845
ACTIVITY, %	MIN.95	MIN.90
FLASH POINT, °C	>94	>94
POUR POINT, °C	-18	-16
WATER SOLUBILITY	DISPERSIBLE	DISPERSIBLE
METHANOL SOLUBILITY	SOLUBLE	SOLUBLE
GLYCOL SOLUBILITY	INSOLUBLE	INSOLUBLE
KEROSENE SOLUBILITY	SOLUBLE	SOLUBLE
HAN SOLUBILITY	SOLUBLE	SOLUBLE
XYLENE SOLUBILITY	SOLUBLE	SOLUBLE



**PETROSTEP CI-PE4** is a non-neutralized NPE phosphate ester.

PHYSICAL PROPERTY	PETROSTEP CI-PE4
APPEARANCE @ 25°C	AMBER LIQUID
DENSITY @ 25°C, G/ML	1.088
PH, 1% IN H2O	<1.5
VISCOSITY @ 20°C, CPS	6,000
ACTIVITY, %	MIN. 73
FLASH POINT, °C	>94
POUR POINT, °C	3
WATER SOLUBILITY	SOLUBLE
METHANOL SOLUBILITY	SOLUBLE
GLYCOL SOLUBILITY	INSOLUBLE
KEROSENE SOLUBILITY	INSOLUBLE
HAN SOLUBILITY	SOLUBLE
XYLENE SOLUBILITY	SOLUBLE





## FORMULATION AIDS

Most water-soluble formulations contain small amounts of various surfactants that allow the oil-soluble components to become water soluble/water dispersible, thus boosting their corrosion inhibition performance. Sulphonates and ethoxylated amines are two groups that have been successfully used in oilfield formulations for years.

Stepan Oilfield Solutions offers the following formulation aids:

**PETROSTEP CI-FA1 – FA6** are ethoxylated amines.

PHYSICAL PROPERTY	PETROSTEP CI-FA1	PETROSTEP CI-FA2	PETROSTEP CI-FA3	PETROSTEP CI-FA4
APPEARANCE @ 25°C	AMBER LIQUID	PALE YELLOW LIQUID	AMBER LIQUID	AMBER LIQUID
DENSITY @ 25°C, G/ML	0.89*	0.95	0.98	1.02
PH, 5% IN IPA/H2O (1:1)	9.8	10.0	9.5	9.7
VISCOSITY @ 25°C, CPS	70*	230	150	180
ACTIVITY, %	MIN. 96	MIN. 96	MIN. 96	MIN. 96
FLASH POINT, °C	>94	>94	>94	>94
POUR POINT, °C	21	15	2	-2
WATER SOLUBILITY	INSOLUBLE	SOLUBLE	SOLUBLE	SOLUBLE
METHANOL SOLUBILITY	SOLUBLE	SOLUBLE	SOLUBLE	SOLUBLE
GLYCOL SOLUBILITY	INSOLUBLE	SOLUBLE	SOLUBLE	SOLUBLE
KEROSENE SOLUBILITY	SOLUBLE	SOLUBLE	SOLUBLE	INSOLUBLE
HAN SOLUBILITY	SOLUBLE	SOLUBLE	SOLUBLE	SOLUBLE
XYLENE SOLUBILITY	SOLUBLE	SOLUBLE	SOLUBLE	SOLUBLE

<b>PHYSICAL PROPERTY</b>	<b>PETROSTEP CI-FA5</b>	<b>PETROSTEP CI-FA6</b>
<b>APPEARANCE @ 25°C</b>	<b>PALE YELLOW LIQUID</b>	<b>CLEAR LIQUID</b>
<b>DENSITY @ 25°C, G/ML</b>	<b>0.9</b>	<b>0.99</b>
<b>PH, 5% IN IPA/H2O (1:1)</b>	<b>10.8</b>	<b>11.9</b>
<b>VISCOSITY @ 25°C, CPS</b>	<b>117</b>	<b>115</b>
<b>ACTIVITY, %</b>	<b>MIN. 96</b>	<b>MIN. 96</b>
<b>FLASH POINT, °C</b>	<b>&gt;94</b>	<b>&gt;94</b>
<b>POUR POINT, °C</b>	<b>2</b>	<b>-18</b>
<b>WATER SOLUBILITY</b>	<b>DISPERSIBLE</b>	<b>SOLUBLE</b>
<b>METHANOL SOLUBILITY</b>	<b>SOLUBLE</b>	<b>SOLUBLE</b>
<b>GLYCOL SOLUBILITY</b>	<b>SOLUBLE</b>	<b>SOLUBLE</b>
<b>KEROSENE SOLUBILITY</b>	<b>SOLUBLE</b>	<b>SOLUBLE</b>
<b>HAN SOLUBILITY</b>	<b>SOLUBLE</b>	<b>SOLUBLE</b>
<b>XYLENE SOLUBILITY</b>	<b>SOLUBLE</b>	<b>SOLUBLE</b>





**PETROSTEP CI-FA7** is a sulphonated fatty acid salt.

PHYSICAL PROPERTY	PETROSTEP CI-FA7
APPEARANCE @ 25°C	AMBER LIQUID
DENSITY @ 25°C, G/ML	1.12
PH, IN 20% IPA/H2O (1:1)	5.6 - 6.0
VISCOSITY @ 25°C, CPS	225
ACTIVITY, %	50
FLASH POINT, °C	>107
POUR POINT, °C	<0
WATER SOLUBILITY	SOLUBLE
METHANOL SOLUBILITY	INSOLUBLE
GLYCOL SOLUBILITY	SOLUBLE
KEROSENE SOLUBILITY	INSOLUBLE
HAN SOLUBILITY	INSOLUBLE
XYLENE SOLUBILITY	INSOLUBLE





**PETROSTEP CI-FA8** is a sulfonic acid salt.

PHYSICAL PROPERTY	PETROSTEP CI-FA8
APPEARANCE @ 25°C	VISCOUS YELLOW LIQUID
DENSITY @ 25°C, G/ML	1.02
PH, IN 20% IPA/H2O (1:1)	3.5
VISCOSITY @ 25°C, CPS	4500
ACTIVITY, %	88 MIN.
FLASH POINT, °C	>94
POUR POINT, °C	-1
WATER SOLUBILITY	DISPERSIBLE
METHANOL SOLUBILITY	SOLUBLE
GLYCOL SOLUBILITY	DISPERSIBLE
KEROSENE SOLUBILITY	SOLUBLE
HAN SOLUBILITY	SOLUBLE
XYLENE SOLUBILITY	SOLUBLE

**PETROSTEP S-101** is a sulfonic acid.

PHYSICAL PROPERTY	PETROSTEP S-101
APPEARANCE @ 25°C	DARK, VISCOUS LIQUID
DENSITY @ 25°C, G/ML	1.06
PH, AS IS	<1
VISCOSITY @ 25°C, CPS	890
ACTIVITY, %	MIN. 96
FLASH POINT, °C	>94
POUR POINT, °C	-15
WATER SOLUBILITY	SOLUBLE
METHANOL SOLUBILITY	SOLUBLE
GLYCOL SOLUBILITY	DISPERSIBLE
KEROSENE SOLUBILITY	SOLUBLE
HAN SOLUBILITY	SOLUBLE
XYLENE SOLUBILITY	SOLUBLE

For more information about the PETROSTEP corrosion inhibitors line and our other products and technologies, visit [stepan.com/oilfield](http://stepan.com/oilfield) or contact your Stepan Oilfield Solutions sales representative.



2901 W Sam Houston Parkway N, Suite E-350, Houston, TX 77043 713.955.8100

**ALL TRADEMARKS ARE OWNED BY STEPAN COMPANY.** The information contained herein is based on the manufacturer's own study and the works of others and is subject to change without prior notice. The information is not intended to be all-inclusive, including as to the manner and conditions of use, handling, storage or disposal or other factors that may involve additional legal, environmental, safety or performance considerations. Nothing contained herein grants or extends a license, express or implied, in connection with any patents issued or pending of the manufacturer or others, or shall be construed as a recommendation to infringe any patents. STEPAN COMPANY MAKES NO PRODUCT WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR USE, EXPRESS OR IMPLIED, AND NO OTHER WARRANTY OR GUARANTY, EXPRESS OR IMPLIED, IS MADE, INCLUDING AS TO INFORMATION REGARDING PERFORMANCE, SAFETY, SUITABILITY, STABILITY, ACCURACY, COMPLETENESS, OR ADEQUACY. Stepan Company (and its employees, subsidiaries and affiliates) shall not be liable (regardless of fault) to the vendee, its employees, or any other party for any direct, indirect, special or consequential damages arising out of or in connection with the accuracy, completeness, adequacy, furnishing, use, or reliance upon information provided herein. The vendee assumes and releases Stepan Company (and its employees, subsidiaries and affiliates) from all liability, whether in tort, contract or otherwise to the fullest extent possible under the relevant law.  
© Stepan Company, 2017