ALIGEL

Non toxic antifreeze for solar panels and food

DESCRIPTION:
Antifreeze blue or colorless on request. Thanks to its particular composition behaves without causing corrosion of metals which comes into contact with. ALIGEL as antifreeze of permanent type based MONOPROPYLENE GLYCOL is characterized by the absence in its inhibitor package of amines and nitrite. The protective properties of ALIGEL are conducted to all metals, particularly towards aluminum and copper, which constitute the main parts of a circuit of cooling or heating. ALIGEL is specific for food plants and solar panels.
Thanks to its formulation is also compatible with all materials that are commonly found in heat pumps

CORROSION IN THE GLYCOLATES CIRCUIT:
Premises.
The phenomenon linked to the chemical-physical characteristics of the recirculating solution that causes the greatest number of drawbacks in systems glycol water is corrosion. Moreover the formation of insoluble metal oxides, not moved away in the absence of bleeding, creates large amounts of sludge that may be deposited on the heat exchange surfaces lowering the yields.
The main causes of corrosion can be:

- Oxidation of metal by the action of oxygen dissolved in water
- Attack promoted by acid degradation products of the glycols

Concerning the first point it must be reminded that at low temperatures typical of the circuits glycolates the concentration of dissolved oxygen is particularly high (> 15 ppm); the high concentration of oxygen is also due to the decomposition of the glycols, an oxidation reaction (Fig. 1) catalyzed by metals such as copper and aluminum, responsible for sudden drops in pH (Fig. 2 and Fig. 3).

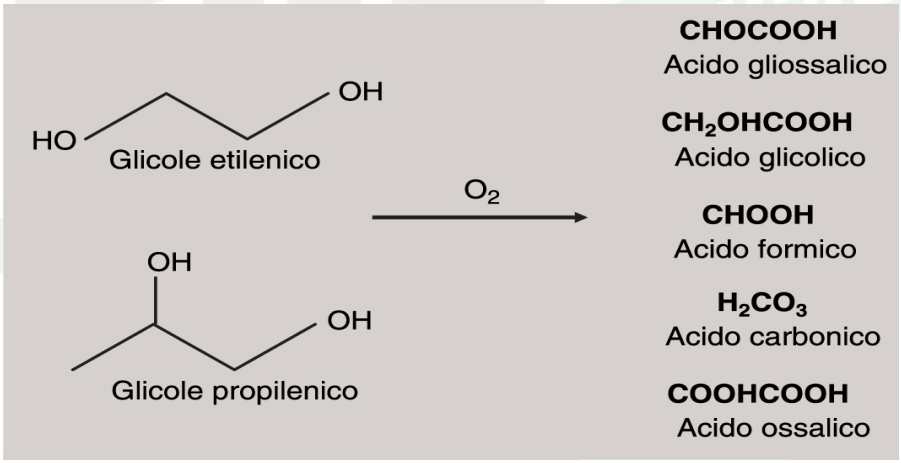

Fig. 1 – Decomposition reactions of the glycols with the formation of organic acids.

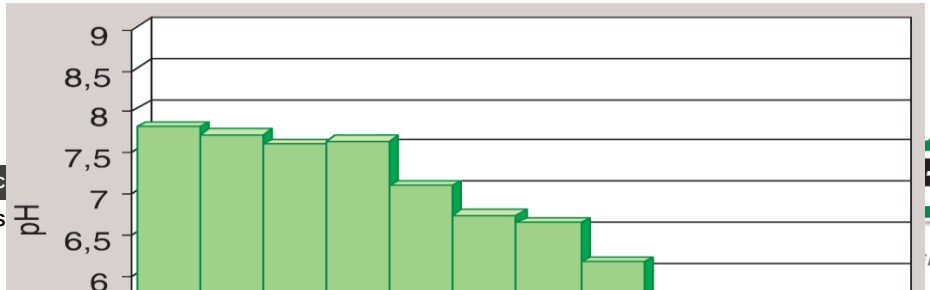

Fig. 2 – A real case of change of pH in water loop glycol (70 % demineralised water, 30 % propylene glycol), no conditioning treatment in place.

Conditioning of the sludge. The absence of bleeding typical of closed systems frequently leads to the formation of sludge due to the accumulation of corrosion products, to the precipitation of insoluble salts and the possible precipitation of any degradation product of the glycol.
It is therefore essential to maintain suspension of this sludge in order to reduce the formation of scale and to avoid the occurrence of phenomena of abrasion, for this reason the recirculating solution must be added to specific additives dispersing action.

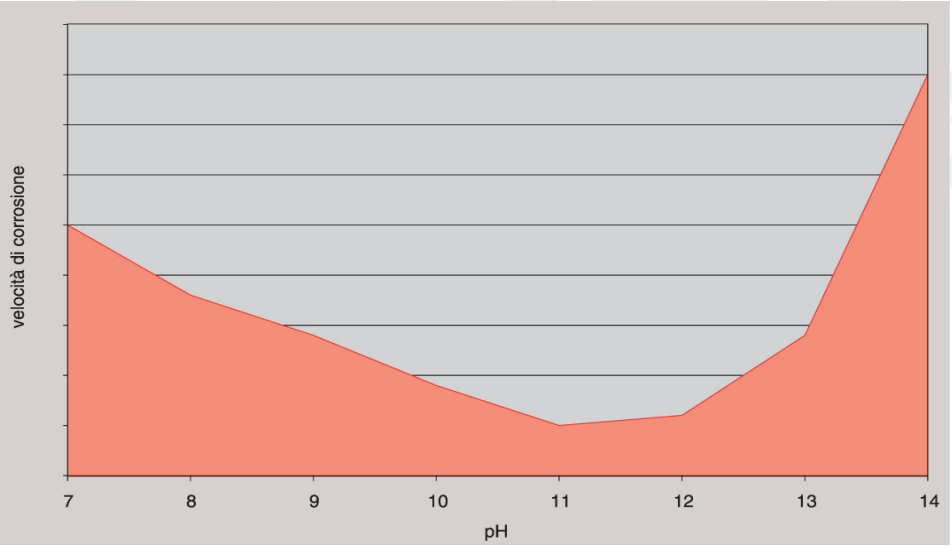

Fig. 3 – Variation of the speed corrosion as a function of pH for carbon steel.

Choice of water mixing. In some systems it is common practice to make the filling of the glycolates circuits by mixing the softened water with glycol or even demineralised / osmosis in order to avoid precipitation of calcium salts: in reality this practice is very often counterproductive, because the correct chemical conditioning of water of these circuits provides for the conditioning of sludge, including those produced by precipitation of salts of hardness, however, that in a closed circuit are present in small quantities, hardly capable of causing significant drawbacks. The softened water and even more demineralised/osmosed water are potentially aggressive, especially for amphoteric metals (including zinc and aluminium).

Microbiological control. If the glycolates water is employed or remains in the works for some time at temperatures above zero centigrade degrees may be affected by microbial growth promoted by the

presence of glycols, very easily metabolized by certain bacterial species. Bacterial contamination is manifested by a sudden lowering of the pH, the formation of gelatinous deposits, the stench from the recirculating solution, in some cases a marked increase in viscosity. To overcome this drawback, simply add a biocide regularly (THERMAKIL or ANTIALGA PREVENTORE), paying attention to its compatibility with glycol and corrosion inhibitor (can not be an oxidizing biocide) and choosing an active ingredient which is as little foam as possible.

HOW TO USE:
Thoroughly clean the affected parts of the plant in accordance with current regulations (available on request) eg. UNI CTI 8065, 8364, 8884 (treatment of the water in heating systems), if necessary perform a pickling of pipes in order to eliminate waste of rust or welding. Prepare the mixture water-antifreeze by mixing antifreeze in the water and not the other. Introducing the mixture into the circuit from the most accessible point close to the boiler pump. Running at full plant cold for several hours after you turn the boiler vent carefully at the points where there is poor circulation.
CAUTION: for a good corrosion protection in general do not use percentages under 30 % of ALIGEL, while for solar panels is a recommended percentage of 45 – 75 %. These higher concentrations allow the heat exchange fluid to remain unchanged in times of stagnation (no movement) of the system even at high temperatures (see graph).

ANALYSES AND PROPERTIES:

	Analysis method	**Technical data**
Specific weight @ 15 °C	ASTM D 1122	1,04 ÷ 1,06 g/ml
H_2O content max	ASTM D 1123	4,5 % max
pH 50 % vol. in water	ASTM D 1287	8,5 ÷10,0
Alkaline reserve	ASTM D 1121	15 min
Ashes	ASTM D 1119	1,5 % max
Freezing point (sol. 50 % in vol.)	ASTM D 1177	-33 °C
Freezing point (pure product)	ASTM D 1177	-60 °C
Pour point	ASTM D 1177	< -57 °C
Boiling point	ASTM D 1120	180 °C min.
Refractive index nD20		1,4310 ÷ 1,4330
Impact on motor vehicles finishes	ASTM D 1882	none
Odour		not unpleasant
Foaming (ml/sec)	ASTM D 1881	50/2 max
Water solubility	-	complete
Resistance to hard water	NC 956-14 CUNA	limpid
Dynamic viscosity at 25 °C (77 °F)	Brookfield	48,6 Centipoise (mPa·s)
Dynamic viscosity at 60 °C (140 °F)	Brookfield	8,4 Centipoise (mPa·s)
Kinematic viscosity at 20 °C		46,7 mm^2/s
Kinematic viscosity at 60 °C		8,07 mm^2/s
Specific heat at 25 °C		2,51 J/g °K
Thermal conductivity at 25 °C		0,2061 W/m °K
Heat of formation		-422 KJ/mol (-101 kcal/g mol)
Heat of vaporization at 25 °C		67,0 KJ/mol
Auto-ignition temperature		371 °C
Flash point (closet cup)	ASTM D 92	113 °C

ALIGEL thanks to the base of MONOPROPYLENE GLYCOL PURE and the choice of the additives package of the inhibitor is a highly reliable product in respect of non-metallic and metallic materials that make up the cooling and heating.

TEST OF CORROSION IN GLASS:
Method ASTM D 1384 (weight loss mg/specimen)

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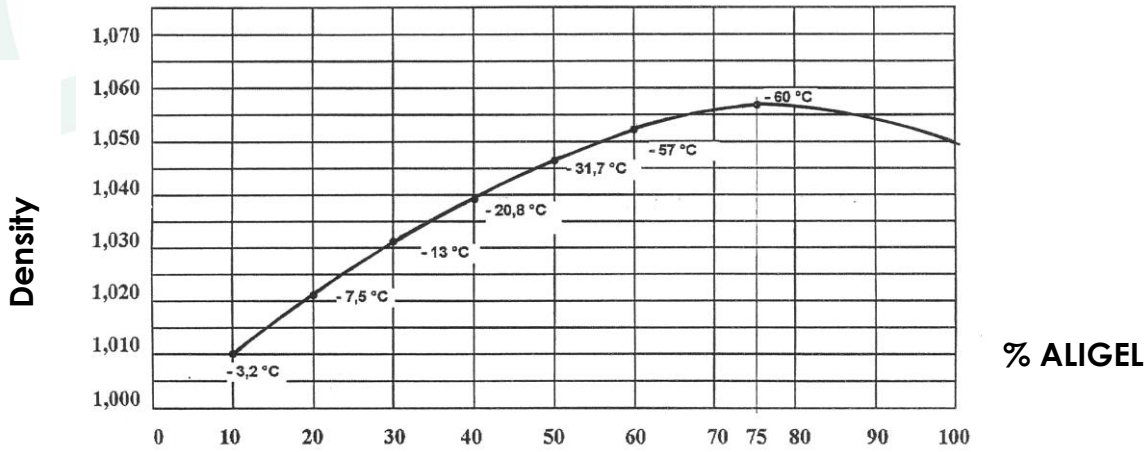
METALS	**ASTM D 3306 LIMITS (mg)**	**ALIGEL SPECIFICATION (mg)**
Copper	10 max	0,7
Soldering alloy	30 max	1,4
Brass	10 max	0,6
Steel	10 max	0,2
Cast iron	10 max	0,6
Aluminium	30 max	0,8

FREEZING / BOILING POINT:
The following values are obtained using different concentrations of ALIGEL in H_20:

% VOLUME (lt)	**FREEZING TEMPERATURE (°C)**	**BOILING TEMPERATURE (°C)**
20	-8	101
30	-14	103
40	-22	103
50	-33	104
60	-48	106
100	-60	180

INTERACTION WITH RUBBER MATERIALS:
The product is generally compatible with the elastomers and in particular with the tires of EPDM. As expected the product fully meets the requirements of compatibility standards and precisely CUNA NC 956-16 and 956-18.

DENSITY ALIGEL IN WATER SOLUTION AT 15 °C



BOILING CURVES

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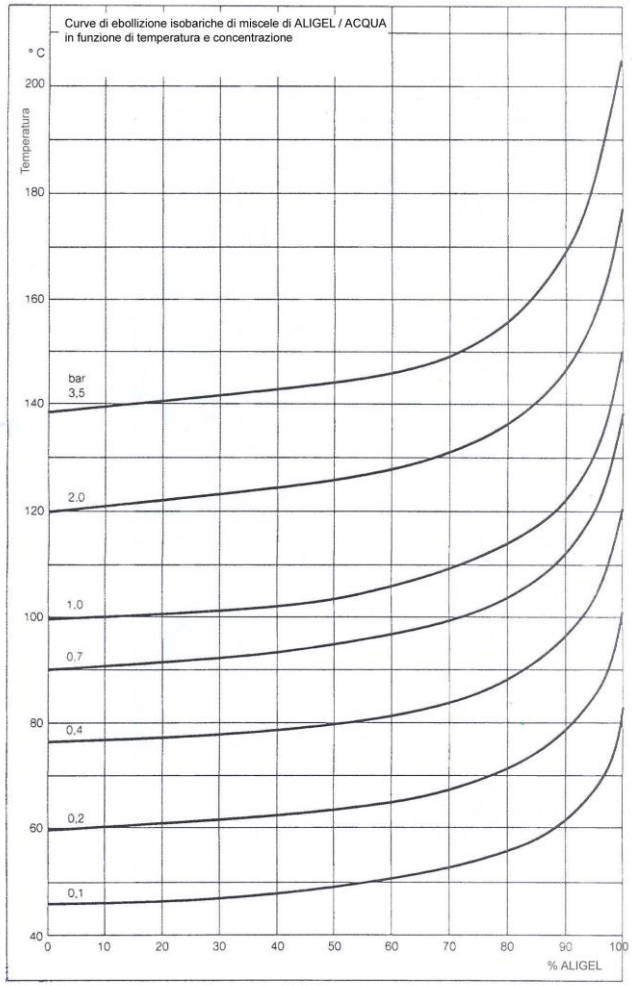

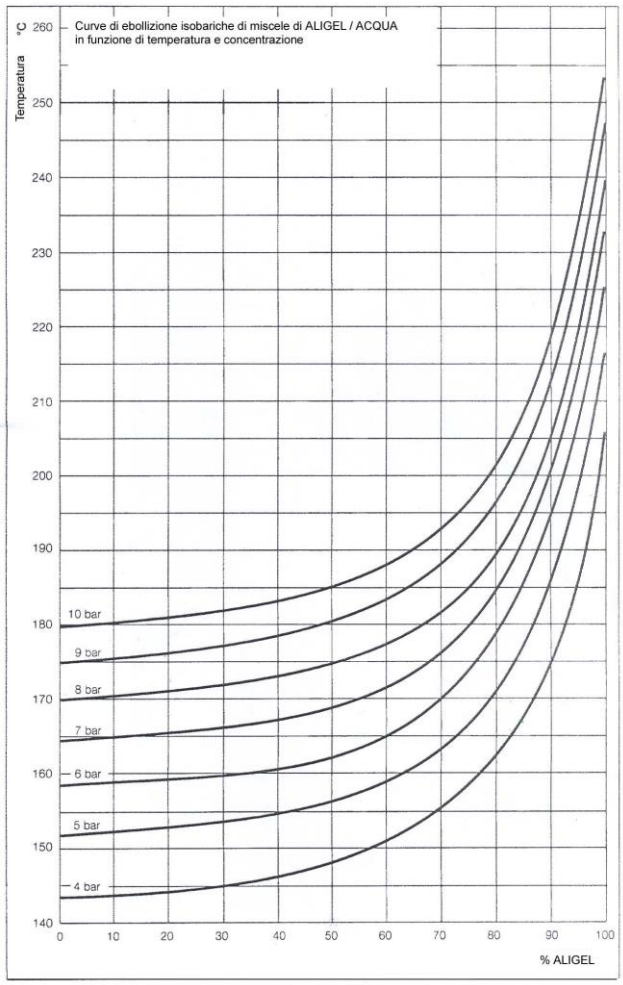

TOXICITY:
The LD50 value is generally used to show oral toxicity; the higher this value is, the lower the product toxicity will be. The LD50 value of MONOPROPYLENE GLYCOL, the base product of the propylene antifreezing product, is 33 g/kg (body weight) - as per tests on rats. This value is 5 times higher than the one of a traditional monoethylene glycol-based antifreezing product (LD50 = 6,2 g/kg). It is clear that the use of a monopropylene-based antifreezing product offers a better safety margin (in case of accidental ingestion).

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