FLUISOL ECO DW PRODUCTS
Heat transfer fluid for Thermal Solar Energy systems exempt ethylene glycol

Chemical composition:

Mixture of polyalcohol, with anticorrosion additives, antifoam, biocides and antiscale chemicals.

Product description:

The **Fluisol Eco DW products** are specially designed to be used in as Heat Transfer Medium in Solar Heating systems.

Fluisol Eco DW has been formulated with no toxic polyalcohol in order to avoid traditional glycol products toxicity.

Fluisol Eco DW has excellent thermo-physics properties. The formula includes special additives in order to protect the solar plates and increase the lifetime of the thermal solar energy systems.

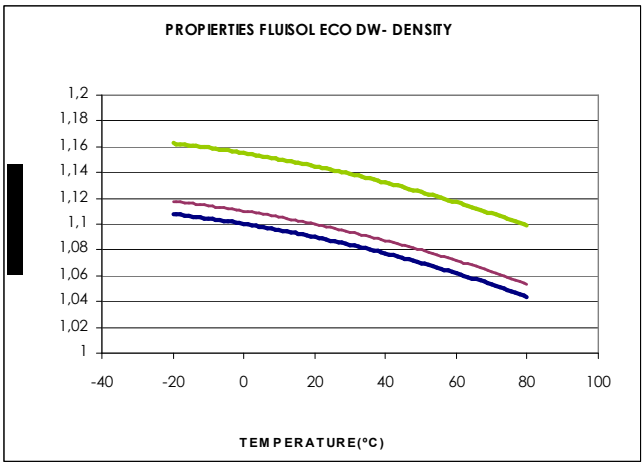
The outstanding properties of Fluisol Eco DW are:

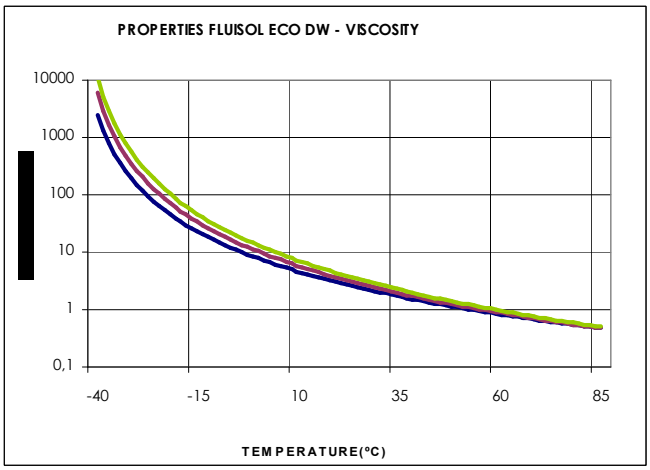
- **No corrosion of any part of the system.**
- **Protection against microorganisms, specially "*Legionela*".**
- **Anti-scale additives to avoid calcium salt deposits.**
- **Reduce the Chemical Oxygen Demand in waste water.**
- **Avoid the bubble formation inside the circuit.**

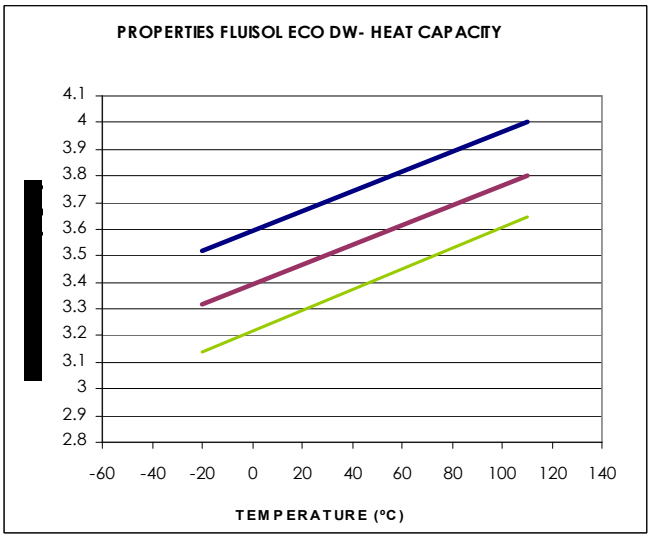
Physical properties:

PROPERTIES	-15ºC	-25ºC	-35ºC	REGULATION
Aspect:	**Red tinted Liquid**	**Red tinted Liquid**	**Red tinted Liquid**	
Density (20°C)	**1,085-1,095 kg/l**	**1,090-1,110 kg/l**	**1,110-1,180 kg/l**	ASTM D1122
Viscosity (20°C)	**4-6 cps**	**7-10 cps**	**19-20 cps**	DIN 51562
Heat capacity	**3.58-3.70 J/g*K**	**3.45-3.50 J/g*K**	**3.21-3.33 J/g*K**	
pH (20°C)	**7,8-8,7**	**7,8-8,7**	**7,8-8,7**	ASTM D 1287
Alkaline reserve	**>4**	**>4**	**>4**	ASTM D 1121
Boiling point	**<110ºC**	**<116ºC**	**<123ºC**	ASTM D 1120
Freezing point	**-17ºC**	**-28ºC**	**-35ºC**	ASTM D 1177
Water Content	**54-56%**	**43-46%**	**28-32%**	DIN 51 777

These data corresponds to average values in production, are not to be regarded as specifications.







PRODUCTS
FLUISOL ECO DW -15
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The following graphs provide information on the most important physical properties of FLUISOL ECO DW versus temperature.

Chemical properties:

Fluisol ECO DW is a red tinted liquid formed by an aqueous concentrate solution of non-toxic polyalcohol.

The additives pack has been enhanced with:

- Inhibitors based in Hybrid technology exempt of Nitrates and Nitrites which provide a durable protection against the corrosion and the degradation in both, metallic parts as well as parts of plastic or polymeric nature.
- Synthetic anti-scaling agents (to avoid the formation of any type of salt deposit).
- Biocides with the purpose to prevent "*Legionela*" development or any other microorganism formation

Fluisol ECO DW guarantees a high and uniform performance of the solar energy system and assures the stability of all the mechanic systems in the circuit.

To preserve its specific properties, the product must not be mixed with another heat bearer fluid, and neither diluted in water. The leaks of heat transfer fluid must be refill exclusively with **Fluisol ECO DW.**

Fluisol ECO DW could be used like a heat transfer fluid for solar systems with high activity temperatures (vacuum collectors) keeping in mind the following recommendations:

- In case of sudden accidental stop or maintenance stops, the solar fluid must be extracted completely from the circuit and must be kept it in expansion deposits.
- **Fluisol ECO DW** cannot be exposed to prolonged high temperatures (over 150°C), because temperatures over 165 °C causes a progressive thermal decomposition of the polyalcohol. This affects the efficiency of the product, making it more corrosive towards the circuit metallic parts.

Corrosion protection tests:

The tests were done based in the rule ASTM D 1384 (American Society for Testing and Materials). The following table shows the test results in g/m^2.

In the assay were included the following metals: cupper, steel, aluminium.

Galvanic corrosion effects were also studied the in presence of **Fluisol ECO DW** in the next combinations: cupper - aluminium, cupper - steel, steel – aluminium (Figure 1).

The formulation of this additives is based in a hybrid technology in a rate Water:Antifreezing 66:34 % to accomplish with the limits in the rule ASTM D-1384.

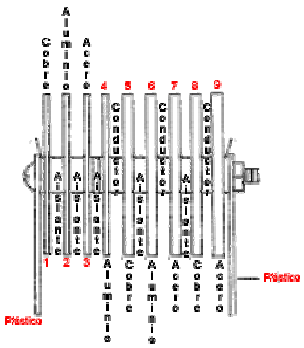

Figure 1: Metal disposition in the corrosion test. In 1st, 2nd and 3rd position we placed aluminium, steel and cupper isolated, avoiding formation of galvanic pairs. In positions 4 and 5, we formed galvanic pairs Al-Cu; in positions 6 and 7 Al-Steel, and in positions 8 and 9 we formed the pair Cu-Steel.

Table 1 shows results of the anticorrosion tests. These tests have been done by LABCYP ("Laboratorio de Ensayos, Corrosión y Protección de la Universidad de Cádiz").

Table 1: Anticorrosion results **ASTM D 1384**		
Material	**Weight gain/loss** ***Per surface unit***	**Corrosion rate (mm/year)**
Cupper	0.07 mg/cm^2	0.001 mm
Steel	-0.20 mg/cm^2	0.010 mm
Aluminium	0.03 mg/cm^2	-0.005 mm
Galvanic Pairs		
Cupper-Aluminium	0.04 mg/cm^2	0.001 mm
Cupper - Steel	0.05 mg/cm^2	0.002 mm
Aluminium - Steel	-0.04 mg/cm^2	-0.004 mm
Aluminium-Cupper	-0.05 mg/cm^2	-0.005 mm
Steel - Cupper	0.20 mg/cm^2	0.020 mm
Steel - Aluminium	0.20 mg/cm^2	0.020 mm

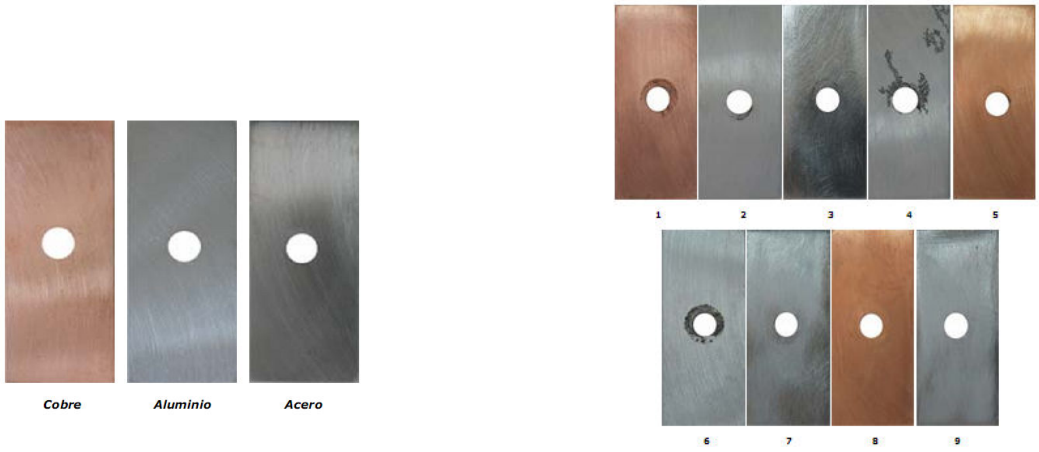

Figure 2: Samples of materials tested. Left: before corrosion test. Right: after corrosion test. Numbers correspond to those in **figure 1**.

Fluisol ECO DW does not attack the rubber or plastic joints used in EST Systems. The following information has been devised based in own tests in **Quimacer S.L.** and bibliography research.

Table 2: Compatibility between **Fluisol ECO DW** and different polymers

Butyl rubber	IIR
Ethylene Propylene Diene Monomer rubber up to 140 °C	EPDM
Fluorocarbon Rubber	FPM
Natural rubber up to 85 °C	NR
Polyacetilenes	POM
Polybutadiene	PB
Polyethylene soft / hard	PE-LD, PE-HD
Crosslinked Polyethylene	PE-X
Polypropylene	PP
Polyvinyl chloride	PVC
Styrene Butadiene rubber up to 100 °C	SBR

Fenolic, ureic, soft Polyvinyl chloride and polyurethane rubbers are not resistant to chemical attack. We recommend a previous test with different materials. This is specially important when using rubber materials for expansion deposits according DIN 4807 regulation.

Additional recommendations:

With the finality to get the maximum efficiency and durability in the thermal solar energy systems where **Fluisol ECO DW** is going to be used, it can be recommended some advises:

- TSE systems must be closed systems to avoid the entrance of atmospheric oxygen.

- The installations must not contain heat exchangers, storage heater, deposits or galvanic tubes made with Zn because polyalcohol can dissolve the tin.
- **Fluisol ECO DW** is an inert product. Because of the large variety of materials in this kind of systems (different manufacturers), it is completely necessary to be sure that the materials of the joints are resistant, according the manufacturer instructions when the fluid reach the maximum temperature.
- Small waste particles of cupper formed during the system assembly must be removed completely from the circuit.
- Expansion containers must accomplish all requirements from DIN 4807 regulation.
- It is necessary that all the system is well isolated from electrical currents in order to minimize corrosion risk.
- It is important to check that the circuit is free from air. All cavities must be filled completely with **Fluisol ECO DW**
- System losses must be filled only with **Fluisol ECO DW**.

¡Do not dilute with water!

Packaging handling and storage:

Fluisol ECO DW is available in plastic containers of 5, 10 and 25 litres, in drums of 60 and 120 litres. If the customer needs it is possible to supply in tanks of 1000 litres. The product keeps its properties for a period of 2 years if stored properly in its original packaging.

Handling:

Handle **Fluisol ECO DW** following all safety rules and industrial hygiene (See the instructions of the security data sheet).

Fluisol ECO DW is considered easily biodegradable. In case of small spills, there won't be any effect on the active sludge.

Quimacer S.L. has a Security data sheet accomplishing the directives of 91/155/CEE and 2001/58/CEE for **Fluisol ECO DW**.