

## Blue Sun<sup>®</sup> -15°C

### NON TOXIC – BIODEGRADABLE COOLANT – ANTIFREEZE

#### **Description y applications:**

*Blue Sun<sup>®</sup> -15°C* is a transparent blue liquid. It is safe to handle as it is composed of propylene glycol.

*Blue Sun<sup>®</sup> -15°C* meets with European quality specifications and standards.

The product is presented ready to use. Do not dilute because the properties would not be guaranteed.

It maintains cooling circuits in perfect condition for longer periods of time than conventional products due to its antirust organic additives. This product optimises heat transference and so enhances the performance of the installations.

It protects from corrosion: aluminium, cooper, brass, steel and cast iron. Its blue colour helps to detect leaks.

It does not contain Nitrite or Amine as these are products that may react to give nitrosamines which are potential carcinogen agents. It does not contain phosphates either as their environmental implications have been questioned.

#### **Technical Data:**

Appearance	Transparent Blue Liquid
pH (20°C)	8,5 – 9,5
Boiling Point <sup>1</sup>	127°C
Frost Protection <sup>2</sup>	-15 °C
Density (20°C)	1,026-1,030 g/ml
Viscosity (20°C)	2,96 mPa s
Specific Heat Capacity (20°C)	3,87 KJ/KgK
Cubic Expansion Coefficient	0,00052 1/K

Data has been gathered in specific bibliography and proprietary tests. It is not part, necessarily, of the technical specifications.

<sup>1</sup>Calculated for a pressure in cooling circuit of 2 bars..

<sup>2</sup>Freezing point according to ASTM D 1177 is the temperature for the first ice crystal formation.

DIN 51583 normative establishes the temperature from the product does not flow and there is danger for the circuit integrity.

Between both temperatures exists a mixture of ice crystals and not-frozen fluid that flows without volume increase, thus, without bursting problems.

### **Attributes:**

- Prevents circuit damage by freezing.
- Raises boiling point, reducing overheating problems.
- Prevents corrosion of metals widely used in cooling circuits.
- Prevents deposits and foaming.
- Biodegradable.
- Non toxic

### **Homologations:<sup>3</sup>**

- AA-52624A** Antifreeze, multi-engine type.  
**ASTM D 3306** Glycol base engine coolant for automobile and Light-duty Service.

ASTM D 3306 homologation contains the next tests:

- ASTM D 5931 Density and Relative Density of Engine Coolant Concentrates and Aqueous Engine Coolants by Digital Density Meter*  
*ASTM D 1177 Freezing Point of Aqueous Engine Coolants*  
*ASTM D 1120 Boiling Point of Engine Coolants*  
*ASTM D 1119 Percent Ash Content of Engine Coolants and Antirusts I*  
*ASTM D 1287 Standard Test Method for pH of Engine Coolants and Antirusts*  
*ASTM D 3634 Standard Test Method for Trace Chloride Ion in Engine Coolants*  
*ASTM D 1123 Water in Engine Coolant Concentrate by the Karl Fischer Reagent Method*  
*ASTM D 1121 Standard Test Method for Reserve Alkalinity of Engine Coolants and Antirusts*  
*ASTM D 1882 Effect of Cooling System Chemical Solutions on Organic Finishes for Automotive Vehicles*  
*ASTM D 1881 Foaming Tendencies of Engine Coolants in Glassware*  
*ASTM D 1384 Corrosion Test for Engine Coolants in Glassware*  
*ASTM D 4340 Corrosion of Cast Aluminium Alloys in Engine Coolants Under Heat-Rejecting Conditions*

### **Corrosion Table:**

Mixtures of propylene glycol and water are more corrosive than pure water so additives should be used in order to ensure the integrity of the circuit.

The following table shows the effectiveness of mixtures Blue Sun – Water in inhibiting corrosion according to ASTM D 1384. For a comparative purpose results for water and propylene glycol alone are presented. Presented data are from test run by INTA laboratories.

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<sup>3</sup> Homologations by laboratories of INTA (National Institute of Aerospace Techniques) depending on Ministry of Defense of Spain with document: CL/RPT/7430/006/INTA/10 for concentrated product and its dilutions with water.

Material	<i>Blue Sun</i> <sup>®</sup> -15°C	Propylene glycol (33% v/v)	Tap Water	ASTM D 3306 Max. Limit
Copper	0,50	4	2	10
Solder	0,14	1095	99	30
Brass	-0,51	5	5	10
Mild Steel	-0,96	214	212	10
Cast Iron	-3,71	345	450	10
Aluminum	2,02	15	110	30

The results above are an average change in weight of coupons in mg. A negative number indicates an increase in weight due to the formation of a stable protective layer on the metal's surface.

In the next table are presented the test under ASTM D 4340:

Material	Product	Result	Max. allowed
Aluminium	<i>Blue Sun</i> <sup>®</sup> (25% v/v)	0,5 mg/cm <sup>2</sup> week	1,0 mg/cm <sup>2</sup> week

**Test description:**

ASTM D 1384:

*In this test method, specimens of metals typical of those present in engine cooling systems are totally immersed in aerated engine coolant solutions with corrosive water for 336 h at 88°C (190°F). The corrosion inhibitive properties of the test solution are evaluated on the basis of the weight changes incurred by the specimens. Each test is run in triplicate, and the average weight change is determined for each metal.*

ASTM D 4340:

*In this test method, a heat flux is established through a cast aluminium alloy typical of that used for engine cylinder heads while exposed to an engine coolant under a pressure of 193 kPa (28 psi). The temperature of the aluminium specimen is maintained at 135°C (275°F) and the test is continued for 1 week (168 h). The effectiveness of the coolant for preventing corrosion of the aluminium under heat-transfer conditions (hereafter referred to as heat-transfer corrosion) is evaluated on the basis of the weight change of the test specimen.*

**Compatibility table:**

*Blue Sun*<sup>®</sup>-15°C is compatible with the usual materials of cooling circuits. The next table shows plastics, sealants and elastomers compatible with the product. Data has been gathered in specific bibliography and proprietary tests.

Name	Abbreviation
Butyl rubber	IIR
Cloropropene	CR
Ethylene-propylene-diene rubber	EPDM
Fluorocarbon elastomers	FPM
Natural rubber up to 80°C	NR
Nitrile Rubber	NBR
Polyacetal	POM
Polyamide up to 115°C	PA
Polybutene	PB
Polyethylene high/low density	PE-LD/PE-HD
Polyethylene cross linked	VPE
Polypropylene	PP
Poly (tetrafluoroethylene)	PTFE
Polyvinyl chloride, rigid	PVC h
Silicone Rubber	Si
Styrene-butadiene rubber up to 100°C	SBR
Unsaturated polyester resins	UP

Phenolic resins, plasticized PVC and polyurethane elastomers are not compatible with *Blue Sun*<sup>®</sup>-15°C.

Zinc is not compatible with propylene glycol or their mixtures with water, avoid zinc or galvanized reservoirs.

**Filling the Installation:**

After pressure testing, which also affords an opportunity to determine the volume of the system from the amount of water used (water meter), the system should be drained and then filled immediately with the antifreeze. Air pockets are to eliminate immediately.

Before filling the systems should be flushed with water to remove traces of flux, especially when chlorine containing flux has been used.



After draining the circuit of old antifreeze, it should be flushed with water in order to clean possible deposits and particles before filling with *Blue Sun*<sup>®</sup>. The product's useful life will be reduced if the system is already corroded. If corrosion is detected, corrective action should be taken before filling up the circuit.

**The product is presented ready to use, do not dilute.**

Mixtures with other kind of antifreeze should be avoided for possible incompatibilities which would reduce the useful life of the product. For specific compatibilities you can contact our technical department: please email [carpemar@carpemar.com](mailto:carpemar@carpemar.com).

Long-term no-load operation of the system should be avoided because this can adversely affect the stability of the heat transfer medium and considerably reduce its service life.

Equipment must not be fitted with galvanized heat exchangers, heat reservoirs, tanks or pipes, because propylene glycol can corrode zinc.

The minor surface tension of *Blue Sun*<sup>®</sup> -15°C compared with water may make minor damage due to previous corrosion more apparent.

**Heat Resistance:**

Sustained temperatures higher than 180°C cause premature ageing of propylene glycol. For solar thermal systems with stagnation temperatures above 180°C it is thus recommended to choose expansion vessels of sufficient size to ensure that the solar antifreeze will be taken up completely in case of stagnation.

Temperatures above 200°C lead to slow alteration of the chemical properties of antifreeze fluid, with the result that the reliability of operation of the system may be endangered.

In the case of not-closed systems or the insert of oxygen (e.g. via valves) the maximum usage temperature is lower.

**Precautions:**

*Blue Sun*<sup>®</sup> -15°C is a non flammable, non corrosive product, so no special precautions are required. In any case good industrial practices are recommendable. *Blue Sun*-15°C<sup>®</sup> is stable for at least two years in regular stocks conditions in airtight containers.

Avoid contact with eyes, in case of splashing flush with running water for at least 10 minutes. Do not eat or drink, keep away of children. Store in a clean and well-ventilated place. Tightly sealed containers are recommended in order to maintain the properties of the product.

Temperature	Density	Specific Heat Capacity	Thermal Conductivity	Dynamic Viscosity	Cinematic Viscosity	Prandtl Number	Cubical Expansion Coefficient
°C	$\rho$ (Kg/m <sup>3</sup> )	Cp (KJ/KgK)	$\lambda$ (W/mK)	$\mu$ (mPas)	$\nu$ (mm <sup>2</sup> /s)		$\beta$ (*10 <sup>-5</sup> 1/K)
-15	1041,8	3,823	0,440	16,42	15,76	143,53	19,9
-10	1040,6	3,829	0,445	12,12	11,64	105,30	26,4
-5	1039,1	3,835	0,449	9,15	8,80	79,01	32,2
0	1037,3	3,841	0,453	7,05	6,79	60,53	37,3
10	1033,0	3,854	0,461	4,42	4,28	37,57	45,8
20	1027,9	3,867	0,468	2,96	2,88	24,88	52,5
30	1022,3	3,879	0,476	2,10	2,05	17,42	57,8
40	1016,1	3,892	0,482	1,55	1,53	12,79	61,9
50	1009,7	3,905	0,489	1,20	1,19	9,79	65,1
60	1003,0	3,918	0,495	0,96	0,96	7,75	67,5
70	996,2	3,930	0,501	0,79	0,79	6,34	69,3
80	989,2	3,943	0,507	0,67	0,68	5,32	70,6
90	982,2	3,955	0,512	0,58	0,59	4,57	71,5
100	975,2	3,966	0,517	0,51	0,52	4,00	72,1