

**RB-23 ACTION OF THE ADDITIVES
“rb bertomeu” beco F-Plus Concentrated AND
“rb bertomeu” beco DC-Ship Concentrated
ON THE CONDENSATION WATER IN TANKS
AND ON THE WATER OF DIESEL OIL**

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ACTION OF THE ADDITIVES “*rb bertomeu*” beco F-Plus Concentrated and “*rb bertomeu*” beco DC-Ship Concentrated ON THE CONDENSATION WATER IN TANKS AND ON THE WATER OF DIESEL OIL

One of the effects of the additives for diesel oil “*rb bertomeu*” beco F-Plus Concentrated and the “*rb bertomeu*” beco DC-Ship Concentrated is that of aiding the decantation of water contained in the fuel, in addition to the already-known combustion **optimization**, **reduction** of polluting emissions and **saving** in maintenance costs.

Diesel oil contains small amounts of water at the moment it is delivered by any supplier. The water content may vary from one batch to another, but the usual specified maximum is 1,000 ppm, although the actual content is usually lower than this maximum value.

Once it has been stored in tanks or storage deposits, the water content of the diesel oil may increase due to condensation of water vapour from the air inside the tank. This air, which is always present in tanks and storage deposits, contains a certain amount of water vapour, depending on the temperature and the relative atmospheric humidity. As the atmospheric temperature varies throughout the day (a higher temperature during the day, lower during the night), the air contained in the tanks and storage deposits becomes saturated with humidity and thus the condensation of LIQUID WATER takes place, and this is poured into the diesel oil. The consequence is that after several successive occurrences of condensation, the initial water content of the diesel oil increases steadily, and it becomes ever more necessary to employ a chemical agent to help decant the water. This study includes calculations based on practical assumptions relating to the amounts of water condensation that may be expected in smaller storage deposits or fuel tanks.

The total amount of water contained in the diesel oil (both the fuel's and that caused by condensation) must be perfectly decanted and removed to avoid its pernicious effects on the engine injectors: that is, the seizing up produced by the minute water droplets dragged by the diesel oil if water has not previously been separated.

A seized-up injector, in addition to the fact that it will have to be replaced, causes a drastic reduction in its capacity to atomise the diesel oil while it is in place. This, in turn, causes poor combustion of the diesel oil, with the consequent loss of potential energy and the appearance of polluting black smoke in the engine's exhaust gases.

As mentioned, both the additives “rb bertomeu” beco **F-Plus Concentrated** and the “rb bertomeu” beco **DC-Ship Concentrated**, favourish the process of water decantation to the bottom of the fuel tank or storage deposit. Once we are at this stage, there are various methods for its removal:

- 1- In storage tanks, the water decanted at the bottom must be removed by bleeding (by gravity or pumping with a submergible pump) until the level is below that of the extraction pump. If this operation is not performed, water (in greater or lesser amounts) will pass into the next part of the application (cogeneration plant, machine, etc.), causing a greater operating workload on filters and removal systems.
- 2- In the engine’s diesel oil supply circuits, in cogeneration plants, marine applications, or heavy machinery. In all these cases, the system of diesel oil filtration incorporates separation of the water by centrifuge, by which the water is separated and accumulated, to later be eliminated automatically when a certain level is reached, or to be eliminated by manual bleeding when the control panel indicates the maximum level. It is important that the water phase is well separated from the diesel oil phase to optimise the potential of the centrifugal separator. **This separation of water from diesel oil is complete when the diesel oil is treated with the additives “rb bertomeu” beco F-Plus Concentrated or “rb bertomeu” beco DC-Ship Concentrated.**

The following tables and examples show the magnitude of the problem of water condensation in storage deposits and fuel tanks:

TABLE 1: Water Content in 1 m³ of air, with a Relative Humidity of 70% and with Relative Humidity of 100%, expressed in ml. of water in liquid form.

<u>Temperature °C</u>	<u>with 70% R.H.</u>	<u>with 100% R.H.</u>
0	3,6	5,1
5	4,2	6,0
10	5,8	8,3
15	8,4	12,0
20	11,7	16,7
25	15,7	22,4
30	20,1	28,7

TABLE 2: Condensed Water in 1 m³ of air, with Relative Humidity (RH) of 70 %, as the temperature falls. Expressed in ml of water in liquid form.

Final Air Temp.	Initial air temperature						
	30°	25°	20°	15°	10°	5°	0°
30°	---	---	---	---	---	---	---
25°	---	---	---	---	---	---	---
20°	3,4	---	---	---	---	---	---
15°	8,1	3,7	---	---	---	---	---
10°	11,8	7,4	3,4	0,1	---	---	---
5°	14,1	9,7	5,7	2,4	---	---	---
0°	15,0	10,6	6,6	3,3	0,7	---	---

TABLE 3 : Condensed water in 1 m³ of air, with Relative Humidity (RH) of 100 %, as the temperature falls. Expressed in ml of water in liquid form.

Final Air Temperature	Initial air temperature						
	30°	25°	20°	15°	10°	5°	0°
30°	---	---	---	---	---	---	---
25°	6,3	---	---	---	---	---	---
20°	12,0	5,7	---	---	---	---	---
15°	16,7	10,4	4,7	---	---	---	---
10°	20,4	14,1	8,4	3,7	---	---	---
5°	22,7	16,4	10,7	6,0	2,3	---	---
0°	23,6	17,3	11,6	6,9	3,2	0,9	---

PRACTICAL EXAMPLE Nº 1 :

Let us imagine a diesel oil storage tank of 30 m³ containing 6,000 liters of fuel (filled up to 20 % of capacity). The rest of the tank, 24 m³, is full of air. Let us also suppose that the relative humidity of this air is to be found in the range of 70 % and 100 %, and that the temperature variation between day and night are of 25°C and 5°C respectively. Let us calculate the quantity of water that can condense before the next filling with fuel.

A) If the relative humidity is 70 % :

Table 2 as it passes from 25° to 5° C = 9.7 ml of water/m³ of air.
 9.7 x 24 m³ of air = 232.8 ml = 0.23 liters of water

B) If the relative humidity is 100 % :

Table 3 as it passes from 25° to 5° C = 16.4 ml of water/m³ of air.
 16.4 x 24 m³ of air = 393.6 ml = 0.39 liters of water

Therefore, the condensed water will vary between 0.23 and 0.39 liters according to the relative humidity of the air of the atmosphere, which would represent 38 – 66 ppm of water relative to the 6,000 liters of the diesel oil considered in this example.

When the tank is refilled with diesel oil, the saturated air will be expelled through the outlet valve, and it will become filled with new air as the fuel is consumed, beginning a new cycle of condensation. After 10 cycles of emptying and refilling, the tank will have accumulated between 2.3 and 3.9 liters of condensation water, in addition to the water present in the supplied diesel oil.

This condensation water, along with that of the diesel oil, must be quickly decanted and removed by gravity or pumping bleeding, in order to avoid being extracted by the pump along with the fuel.

PRACTICAL EXAMPLE Nº 2 :

Let us imagine a diesel oil fuel tank of a machine with a capacity of 600 liters, which only contains 100 liters of fuel.

The air content is: $600 - 100 = 500$ liters = 0.5 m^3

Considering the same assumptions for temperature and relative humidity as in the previous example, the quantity of water that would condense before filling with fuel is as follows:

A) If the relative humidity is 70 % :

Table 2 as it passes from 25° to 5° C = 9.7 ml of water/ m^3 of air.

$9.7 \times 0.5 \text{ m}^3$ of air = 4.85 ml of water

B) If the relative humidity is 100 % :

Table 2 as it passes from 25° to 5° C = 16.4 ml of water/ m^3 of air

$16.4 \times 0.5 \text{ m}^3$ of air = 8.2 ml of water

As in the previous example, this quantity of water will gradually increase in volume after several cycles of emptying and refilling, provided that the necessary temperature changes take place.

The water from condensation would be equivalent to 48 – 82 ppm, with respect to the 100 liters of diesel oil being considered.

All the decanted water (from condensation and the water originally present in the diesel oil) must be eliminated by bleeding via the decanting filter incorporated in the majority of plant engines.