

# Modular Cover for Open Water Reservoirs

The TopUp Ball System was developed in order to decrease the evaporation from aboveground reservoirs and to improve the water quality

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While most of the world's surface is covered by water, only a small percentage of that water is useable. This fact makes water a scarce resource whose importance is invaluable and essential for maintaining life as we know it.

Throughout history man has stored water, principally in underground storages, in an attempt to preserve water quality and prevent evaporation.

In the last century many aboveground reservoirs have been built for water storage, flood capture and the regulation of supply and demand, and those reservoirs faced many problems such as water loss due to evaporation, the growth of harmful algae and attraction of birds that pollute the reservoir and endanger airplanes flying overhead. While up to 50% of the reservoir's water can be lost due to evaporation, most of the world's reservoirs are uncovered. To explain this phenomenon the following points need to be considered:

Covering aboveground water reservoirs in a closed structure is not economically viable and for large reservoirs it is not mechanically feasible. Moreover, evaporation is not just a waste of water but also a method of cooling the water exactly as we cool our bodies by perspiration. A covered reservoir can heat up to the extent that the level of oxygen in the water is lowered to the point where life in the water becomes impossible and we know that water quality is dependent on preserving the water's ecosystem.

The TopUp Ball System™ was developed in order to solve these engineering and economic problems. The system is

based on identical white balls, which are spread out over the surface of the reservoir and cover it.

Each ball is comprised of two identical semi-spheres with a float in the middle, which keeps the ball floating so that half the ball is in the water and the other half remains in the air. The top, bottom and sides of the ball have openings, which allow for the movement of air and water.

Inside the ball there is a constant process of evaporation and condensation that is essentially a process of thermal distillation for purification and disinfection of the water and from the energy perspective, converts solar energy into mechanical energy instead of heat. In fact each ball acts as a small "cooling tower" thereby preventing the problem of reduced oxygen.

Algae present a difficult problem that can block pipes and filters and they are potentially toxic. The shading of the water by the balls solves this problem. Algae depend on light for photosynthesis and the shading of the water dramatically reduces their growth.

Mechanically, a half filled ball is stable in strong winds and is not easily driven blown out of the water. The water inside the ball increases its stability and prevents rolling that would increase the area subject to evaporation. The evaporation-condensation process ensures movement of air and water inside the ball that is essential to prevent the growth of bacteria and parasites that characterizes standing water and which might cause contamination. Internal evaporation pressures cause the water to move in the top half of the ball, whereas the increase in salinity due to evaporation moves the water in the bottom half of the ball.

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In fact there are two opposing forces inside the ball. The ball both cools and warms the water. When evaporation is high, such as in summer, the cooling effect is greater than the warming effect and a drop of 4-9 degrees centigrade was recorded. On the other hand when there is less evaporation the layer of air in the top half of the ball acts as insulation and so the ball moderates rapid changes in temperature. This characteristic led to the development of a version of the ball especially designed for fish farming as it prevents the loss of fish due to the cold winter temperatures. The ball also serves as a hiding place for the fish from predators and even contributes to the feeding of the fish with nutritious micro-algae.

With full coverage, The TopUp Ball System™ covers 92% of the reservoir's surface such that an area is left open for the release of gasses and for the entrance of minimal light, which is essential for supporting life. The System also supports partial coverage, for example for fish farms, thereby creating an artificial "island" which serves to protect and feed fish without disrupting the daily activities of the fish farmer.

The TopUp Ball System™ has been tested for the past 3 years, in large area tests by "Mekorot", the Israel national water company, in which the physical aspects and the principal water quality parameters were examined. No other cover system has been so thoroughly tested and the results exceeded all expectations. A significant decrease in evaporation was achieved (up to 90%) and water quality

was also improved across all parameters.

In order to test the extent to which the balls warm the water and their influence on fish survival and health, a pilot is planned for winter 2015-1016 in cooperation with the Ministry of Agriculture.

The TopUp Ball System™ won the Prime Minister's Award for Entrepreneurship and Innovation and it is absolutely clear that the System's application on open reservoirs will significantly increase the amount and quality of water available for agriculture.

Neotop Water Systems shall present the TopUp Ball System™ at WATEC Israel 2015 Exhibition which shall take place in Tel-Aviv on 13-15 of October. 💧

