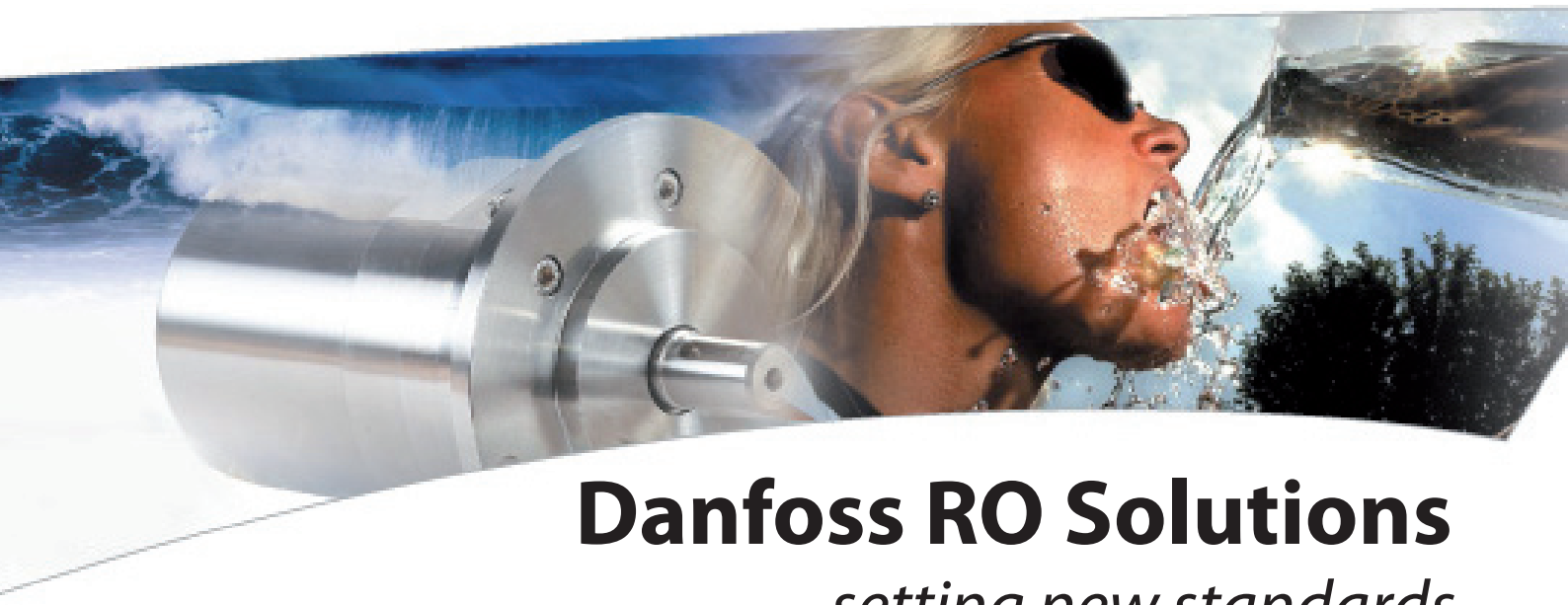


Danfoss RO Solutions

... setting new standards

Price is not just price

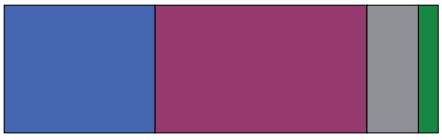
When comparing pump prices, you must take into account not only the investment costs, but also consider any costs that may come up during all of the pump's lifetime.

One method of considering all these costs is to look at the total cost of ownership (TCO). TCO is a financial modeling tool which is designed to help consumers and enterprise managers estimate any direct and indirect costs related to the purchase of a capital investment, such as an APP pump.

The TCO calculation offers a final statement reflecting not only the cost of purchase but all aspects in the further use and maintenance of the pump. This includes the costs of training support personnel and the users of the pump, energy costs, costs associated with failure or maintenance, downtime costs, replacement costs, costs for decommissioning, and more.

APP pump

Typical plunger pump



Typical centrifugal pump

Purchase
- Capital costs
- Accessories

Operation
- Energy consumption
- Commissioning
- Training

Maintenance
- Consumables
- Wages
- Downtime
- Service/inspection

Replacement
- Decommissioning
- Disposal

Purchase

The **purchase** of a pump requires some capital costs, which are quite easily compared. But what accessories are required to get the pump installed? Some pumps require pulsation dampeners in order to operate satisfactorily. Often also check valves are required.

The APP pump is only to be connected to the rest of the system using flexible hoses. No pulsation dampener is required to reduce noise and vibrations.

Operation

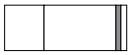
The **operation** of an RO plant requires energy. The high-pressure pump consumes more than 70% of all energy used in the RO plant, and ever increasing energy prices force the desalination industry to focus on overall power consumption of the high-pressure pump and the total RO plant. Selecting the most effective pump technology means selecting a pump with high volumetric efficiency as well as high mechanical efficiency. If the pump can be operated without a gearing or belt drive, a very high mechanical efficiency can be reached.

The APP pump is the most effective pump on the market and can be combined with any available energy recovery unit. For very small demands Danfoss A/S RO Solutions offers a complete energy recovery unit, the SWPE (Sea Water Pump with Energy recovery), which is built up of an APP pump and an APM motor – both connected to a double-shafted electric motor. This unit recovers some energy from the brine and uses it for pressurizing the fresh seawater lowering the energy costs significantly.

When a pump is installed, it is important to align the pump shaft and the shaft of the electric motor in order to reduce the risk of damaging both pump and motor. Also the plant operators need to be trained to operate and maintain the pump. Both aligning the shafts and training the staff can take quite some time, and this cost is also part of the TCO calculation.

As the APP pump is delivered with bell housing, its shaft is automatically aligned to the shaft of the electric motor when it is installed - simply "plug & play".

Maintenance



Also **maintenance** is an issue to be considered. Pumps that are lubricated with oil need oil change from time to time. The costs of such consumables must also be taken into account when the total costs are calculated, and so must the costs for shipping and storage of any consumables and spare parts as well as the service personnel's wages. Furthermore, the downtime is increased each time the pump is serviced or inspected.

Danfoss A/S RO Solutions guarantees 8000 hours maintenance-free operation of the APP pump. As water lubricates the APP pump, the time and money needed for servicing the APP pump is very limited. In fact, when service is required, a complete pump service can be performed within less than one hour, and as spare parts are in stock at Danfoss A/S RO Solutions for overnight shipment, no stock is required.

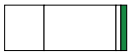
Another issue is reliability. Each time a pump fails, the pump's downtime is increased, and the higher downtime, the lesser production of clean water. If the water demanded is not supplied, the customer may have to pay a penalty or rent other equipment or even ensure that water is shipped to the location by truck.

The APP pump is very reliable. In the unlikely event that the pump breaks down, new pumps and spare parts are in stock at Danfoss A/S RO Solutions for overnight shipment. This reduces the downtime considerably, and no stock is to be depreciated.

Different pumps have different lifetimes. Is the pump's lifetime two years? Four years? Or even 10 years? The comparison period must be defined before making a TCO calculation in order to know if a replacement pump must be bought during the calculation period. If the pump is used on a land-based RO plant running non-stop, its lifetime in years is much shorter than the lifetime of a pump used in leisure boats operating only a few hundred hours a year.

The APP pump generally has a lifetime exceeding 40,000 hours operation, thus the lifetime in years depends on the application and on the quality of the water, i.e. the efficiency of the filtration.

Replacement



The **replacement** of a pump is required, when the RO plant has to be upgraded because the demand for fresh water increases. This can be done by decommissioning the old pump system and installing a new and bigger system. To decommission an old pump means to demount it, empty it from oil and dispose the pump as well as the oil.

Using APP pumps makes it very easy to upgrade the RO plant as the APP pumps can be mounted in parallel. That way it is not necessary to decommission the old pump when it is still running satisfactorily. Simply mount one or more pumps in parallel with the old pump and the system is upgraded. When the pump eventually has to be replaced, it can either be shipped back to Danfoss RO Solutions who then disposes the pump in accordance with prevailing rules, or it can be disposed as scrap metal as there is no oil in the pump.

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