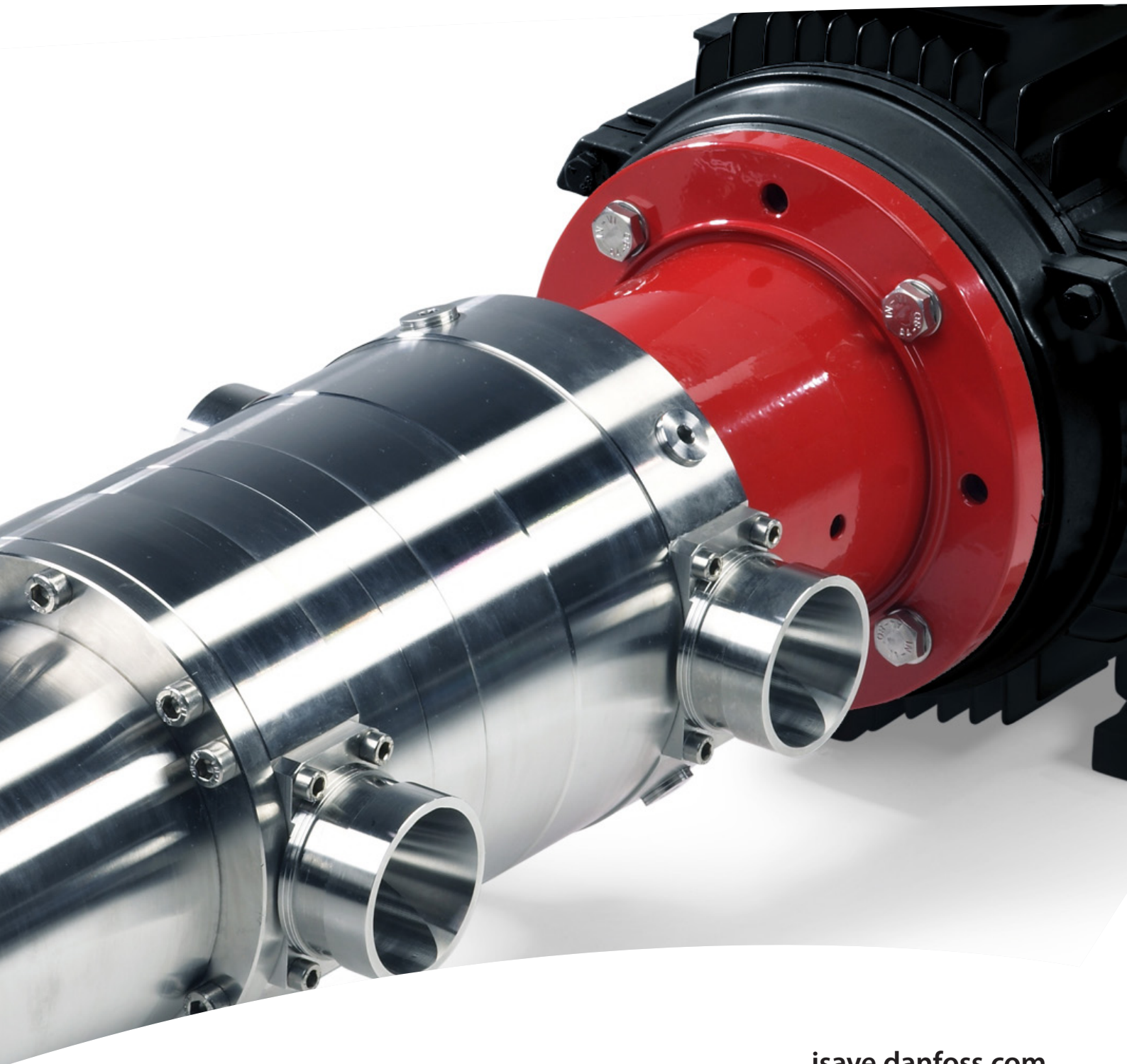
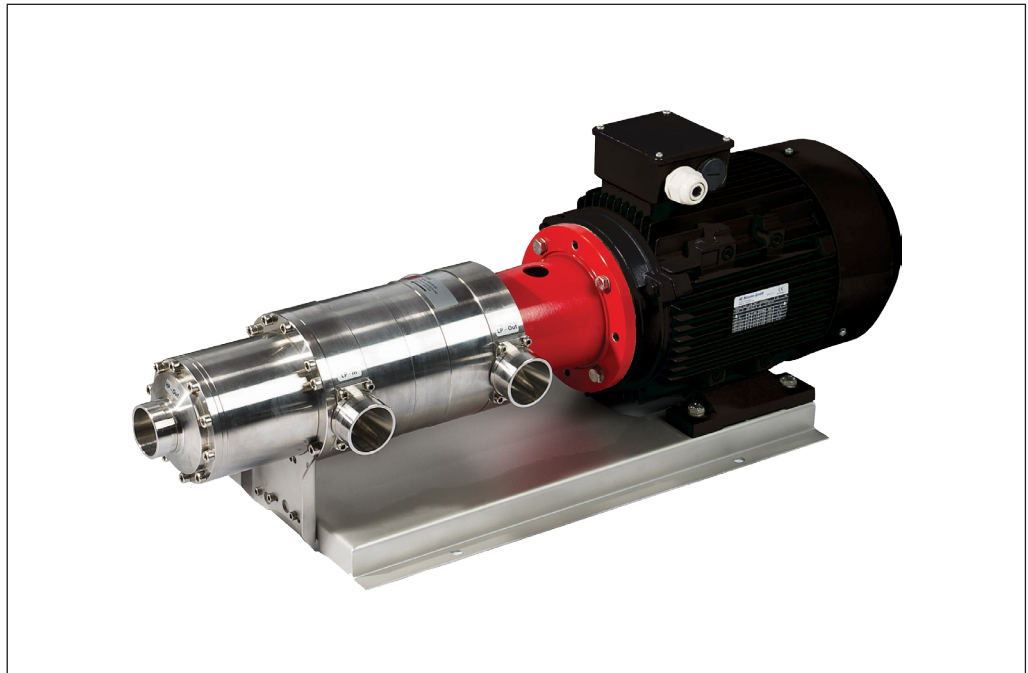


Instruction

Start and stop of the SWRO with iSave unit





Below procedures are general guidelines for the start-up and shut-down functions of SWRO-systems with the Danfoss iSave Energy Recovery Device.

Procedure details may differ depending on the system design.

The numbers marked in () refer to the diagram below.

Prior to start-up

Prior to initial start-up all piping connected with the iSave unit must be thoroughly flushed to ensure that no impurities enter the iSave. Inadequate pre-flushing will strongly influence the life of the iSave and might lead to breakdown of the iSave.

1. Install all filter cartridges in the system.
2. With the iSave *disconnected* from the piping, the system must be flushed in order to remove possible impurities from the system (pipes, hoses, membranes etc.).
Flushing must run until the system can be ensured clean.
3. Connect the iSave to the pipework. The iSave is now ready for start-up.

Instruction	Start and stop of the SWRO with iSave unit
--------------------	---

Starting up the system

1. Make sure that all valves are set in normal operating positions.
2. Start the seawater supply pump (1)
3. Make sure all pipework is flushed with water.
Vent all air from the system through air valve (8) and iSave unit (11).
iSave has ¼" plugs to vent both the HP and LP side.
4. Start the iSave unit when the pipework is full of water and the system and iSave unit has been bled.
NB! Always start the iSave unit before the high-pressure pump is started.
The speed of the iSave unit must be ramped up over a period of minimum 10 seconds.
If possible run the iSave at maximum 750 rpm.
5. With a pressure control valve (15), adjust the back pressure of the "LP-out" to a minimum of 1 bar/14.5 psig (14).
6. An "over flush" of the iSave can be done to bleed any remaining air from the system.
Flush minimum 10% higher flow rate (12) at "LP in" compared to the flow rate on "HP out".
Flush over a period of minimum 5 minutes.
7. Adjust the speed of the iSave unit to desired flow. The speed is controlled by a VFD.
8. Start the high-pressure pump (4), and the system pressure (5) will rise until the permeate flow (17) almost equals the flow (2) from the high-pressure pump.
Check the low-pressure flow rates (12), and if required, adjust flow to achieve balanced flow to the iSave unit. It might be a benefit to "over flush" the iSave with up to 10% to lower the mixing.
 1. If the "LP-in" flow (12) is too low and the "LP-out" pressure (14) is higher than 1 bar/14.5 psig, increase flow and pressure on the pressure control valve (15).
 2. If the "LP-in" flow (12) is too low and the "LP-out" pressure (14) is below 1 bar/14.5 psig, adjust the flow by raising the flow from the seawater supply pump (1).
 3. If the "LP-in" flow (12) is too high, reduce flow by the pressure control valve (15) or the flow from the seawater supply pump (1).
9. Check that the pressure (14) of "LP-OUT" is at least 1 bar/14.5 psig.

1-3 days system shutdown

1. The system is running in normal operation and producing permeate flow.
2. Stop the high-pressure pump (4).
3. Keep the iSave unit (11) running until the wanted pressure (5) at the membranes is reached and the TDS in the high-pressure line is equal to the TDS in the low-pressure line.
NB! If the pressure (10) at "HP in" drops below 3 bars/43.5 psig, the sound will change of the iSave. This is due to cavitation. "HP in" pressure between 1-3 bars/43.5 psig is acceptable for less than 10 minutes within a period of 6 hours. Also see datasheet for iSave.
If possible run the iSave at maximum 750 rpm.
4. Stop the iSave unit (11).
5. Stop the seawater supply pump (1).

Instruction
Start and stop of the SWRO with iSave unit
4-14 days system shutdown

1. Run the "1-3 days' system shutdown" procedure.
2. Supply fresh water to the iSave unit (11) and the SWRO system. Make sure that the iSave unit and the SWRO system are filled at the same time to ensure optimal flushing.
3. Run the system for 10 minutes while the iSave unit is running, until all seawater is discharged.
NB! If the pressure (10) in "HP in" drops below 3 bars/43.5 psig, the sound will change of the iSave. This is due to cavitation. "HP in" pressure between 1-3 bars/43.5 psig is acceptable for less than 10 minutes within a period of 6 hours. Also see datasheet for iSave. If possible run the iSave at maximum 750 rpm.
4. Stop the iSave unit (11).
5. After minimum one minute delay, stop fresh water supply.

Long-term system shutdown

For a long-term shutdown period, the SWRO system including the iSave units must be thoroughly flushed with fresh water to remove any salt. Run the "1-3 days' system shutdown" procedure.

Further, any biological growth should be prevented. Make a final flush of the iSave unit with the same solution used to preserve the SWRO membranes. Flush both the high-pressure and low-pressure sides of the iSave (11). The high-pressure flush is performed by circulating the solution through the iSave unit and the membranes by rotating the iSave unit.

NB! If possible run the iSave at maximum 750 rpm.

