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ENGINEERING
TOMORROW

Danfoss

Instruction

APP Pump Instruction

APP 53 / APP 65 / APP 78 / APP 86 / APP 92

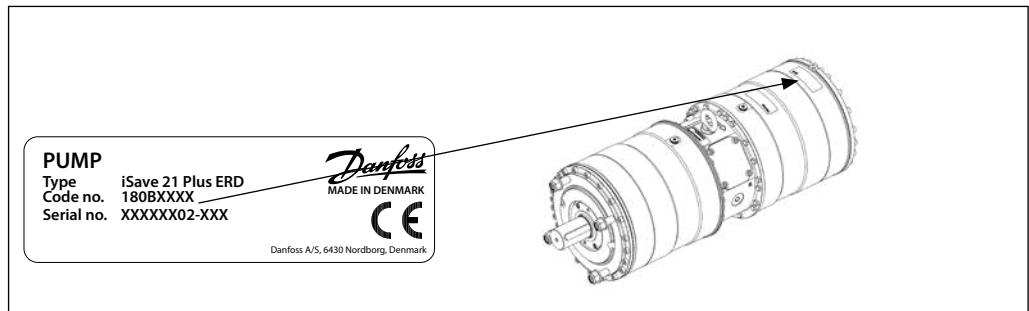


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1. Identification



2. System design

The design of the system must ensure that self-emptying of the pump during standstill is avoided.

The inlet pressure of the pump must never exceed the outlet pressure. This may typically occur in boosted or open-ended systems with direct water supply.

To protect the pump from being damaged by peaks of high-pressure in case the pump stops momentarily, it is required to mount a low-pressure relief valve on the inlet line.

Note: The inlet connection must be properly tightened, as possible entrance of air will cause cavitation.

2.1 Open-ended systems with direct water supply

Axial piston pumps require a certain inlet pressure to perform as intended. Please find min. required feed pressure in the pump data sheet. Please also note that feed pressure must not exceed 5 barg (72.5 psig).

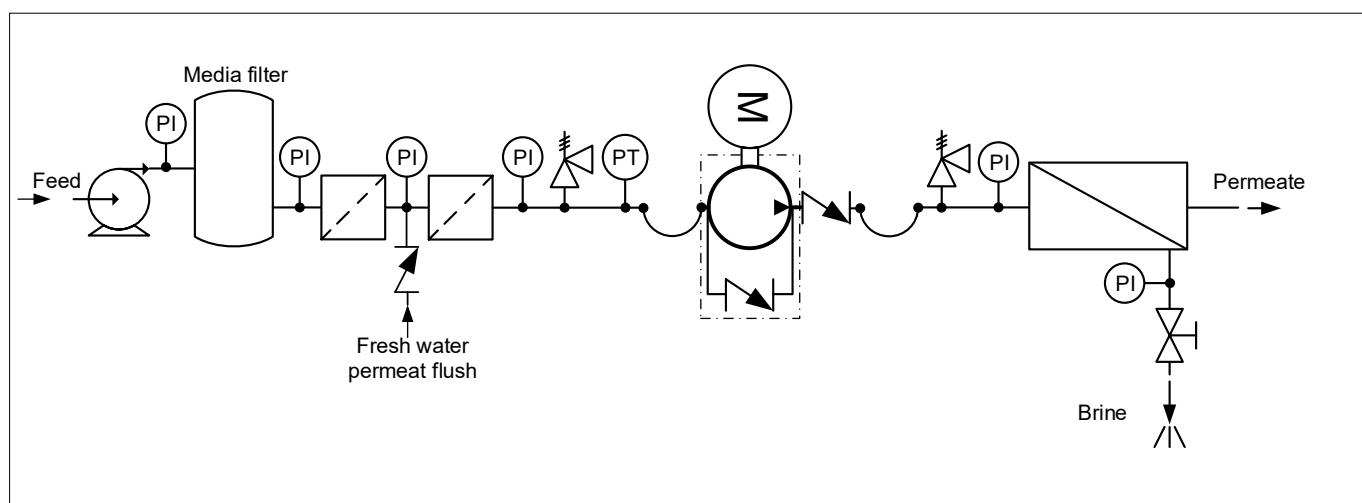
2.2 Preferred RO system design without ERD

1. Dimension the inlet line to obtain minimum pressure loss (large flow, minimum pipe length, minimum number of bends/connections, and fittings with small pressure losses).
2. Place an inlet filter (1) in front of the APP pump (2). Please consult Danfoss filter data sheet for guidance on how to select the right filter. Thoroughly clean pipes and flush system prior to start-up.
3. Place a monitoring pressure switch (3) set at min. inlet pressure between filter and pump inlet. The monitoring switch must stop the pump at pressures lower than minimum pressure.
4. Use flexible hoses (4) to minimize vibrations and noise.
5. In order to eliminate the risk of damage and cavitation, a positive pressure at the inlet (5) is always to be maintained at min. inlet pressure and max. inlet pressure.

It is recommended to install safety valve or a pressure relief valve (9) in order to avoid high-pressure peaks in case the pump stops momentarily or is spinning backwards.

6. For easy system bleeding and flushing, a bypass non-return valve (6) is integrated in the APP pump.
7. A non-return valve (7) in outlet can be installed in order to avoid backspin of the pump. The volume of water in the membrane vessel works as an accumulator and will send flow backwards in case of the pump stops momentarily.
8. A safety valve or a pressure relief valve (8) can be installed in order to avoid system damage as the Danfoss APP pump creates pressure and flow immediately after start-up, regardless of any counter pressure.

Note: If a non-return valve is mounted in the inlet line, a low-pressure relief valve is also required between non-return valve and pump as protection against high-pressure peaks.



2.3 Preferred RO system design with ERD

For P&ID of a setup with an iSave, please see the iSave® Data sheet 521B1378

2.4 Preferred RO system design with pumps and ERDs in parallel

For systems with Danfoss pumps and ERDs in parallel, please see our publication 180R9354, Guideline for Parallel-coupled pumps and ERD.

2.5 Reversible pumps

If exposed to high-pressure in the outlet while the electric motor is not energized, the pumps may start spinning backwards. This will not harm the pumps as long as the pressure in the inlet does not exceed the max. pressure peak of 10 barg (145 psig).

If a non-return valve is mounted in the inlet line, a low-pressure relief valve is required as protection against high-pressure pulses and high-pressure in general.

Alternatively a high-pressure check valve can be mounted in the pump discharge line to prevent the pump from reversing.

The setup of "open-end system" ensures that the inlet pressure does not exceed 10 barg (145 psig), when a non-return valve is mounted in the inlet.

2.6 General comments

A good filtration is vital to ensure a long and trouble-free life of the pump.

As water has very low viscosity, the APP pumps have been designed with very narrow clearance in order to control internal leakage rates and improve component performance. Therefore it is important that the inlet water is filtered properly to minimize the wear of the pump.

The main filter must have a filtration efficiency of 99.98% at 10 µm. We recommend to use precision depth filter cartridges rated 10 µm abs. $\beta_{10} \geq 5000$ (equivalent to a filtration efficiency of 99.98%). Bag filters and string wound filter cartridges typically have only 50% filtration efficiency. This means that for each 100,000 particles reaching the filter, 50,000 particles pass through it compared to only 20 particles in a filter with an efficiency of 99.98%.

For more information on the importance of proper filtration, please see our data sheet 521B1009 on "Filtration", which also will provide you with an explanation of filtration definitions and a guidance on how to select the right filter.

Monitoring

It is recommended to continuously monitor the following conditions:

- Filter clogging
- Pressure (inlet- and outlet side of the pump)

3. Building up the pump unit with BoWex coupling

3.1 Assembly of the coupling



We recommend to inspect bores, shaft, keyway and feather key for dimensional accuracy before assembly.



Heating the hubs lightly (approx. 80 °C) allows for an easier mounting on the shaft.



Please pay attention to the ignition risk in potentially explosive atmospheres!

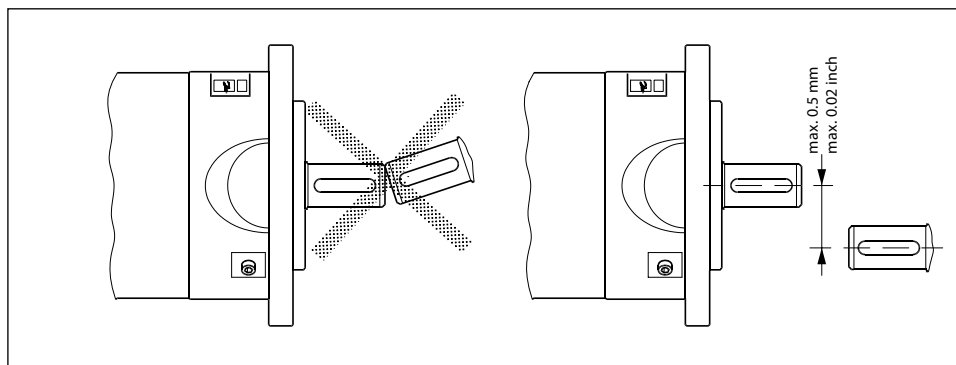


Touching the heated hubs causes burns. Please wear safety gloves.



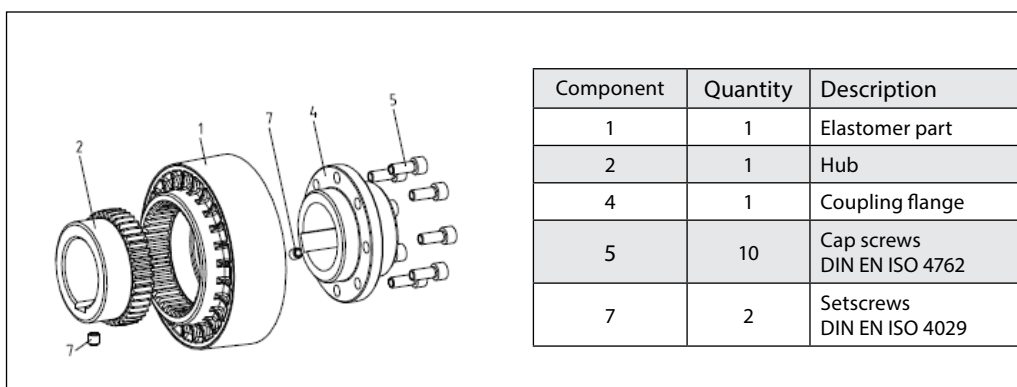
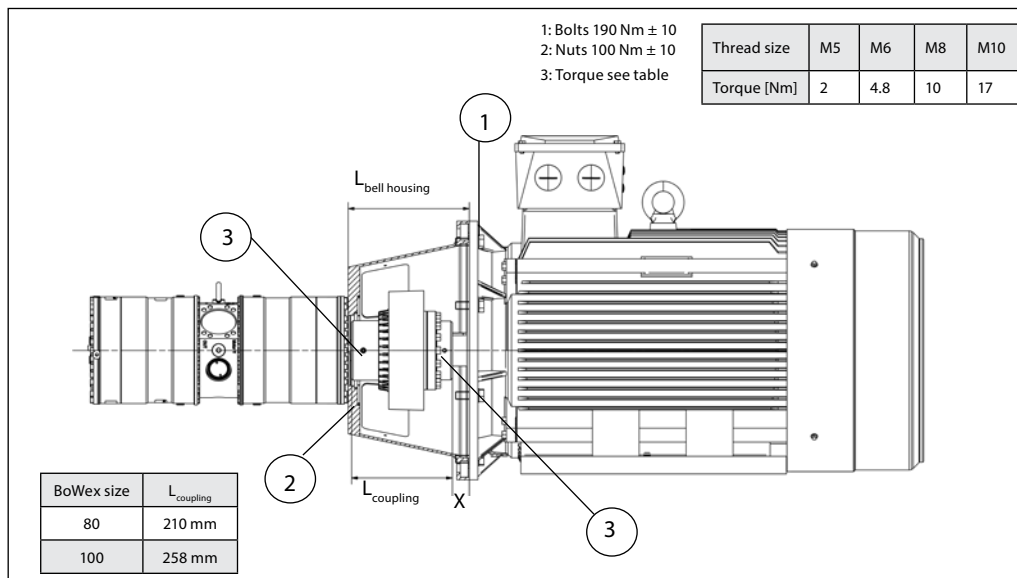
With the assembly please make sure that the spline of the hub is fully covered by the internal spline of elastomer (please observe mounting dimensions L_{coupling}). Disregarding this advice may cause damage to the coupling.

3.2 Alignment between the motor and pump shaft



3.3 Overall assembly with coupling BoWex-ELASTIC®, type HEW compact

Danfoss recommends to use a Bowex Elastic HEW Compact Coupling.
See the **Coupling Manual from BoWex**.



3.3.1 Mounting

- Mount the coupling flange (component 4) in front of the elastomer part (component 1) and screw the components together with a tightening torque of 120 Nm.



If used in potentially explosive atmospheres the setscrews to fasten the hubs as well as all screw connections must be secured against working loose additionally, e.g. conglutinating with Loctite (average strength).



Please observe the manufacturer's instructions regarding the use of adhesives. Do not apply glue on the rubber surfaces.

- Mount the bell housing on pump. Secure nuts with the right torque. Measure the height of the bell housing (L_{bell housing})

- Push the coupling part all the way down the pump shaft and secure with right torque on the locking screws.
- Mount the coupling on motor shaft. Ensure the coupling and motor flange are not in contact with each other.
- Measure from motor flange to the end of the coupling. That measurement "X" can be calculated by the below formula:

$$x = L_{\text{bell housing}} - L_{\text{coupling}} - 8$$
- Adjust respectively, verify the measurement, and secure coupling on motor with the right torques on the locking screws.
- Secure flange bolts with the right torque.

If alternative mounting is desired, please contact Danfoss High Pressure Pumps.

Please take care to observe the recommended length tolerances of the chosen coupling, as an axial force on the pump will damage the pump.

3.4 Direction of rotation

Is indicated by an arrow engraved in the flange of the pump.

3.5 Orientation

APP 53-92 can be mounted/orientated in steps of 45 degrees. Please see Data sheet 521B1340.

3.6 Protection from too high pressures

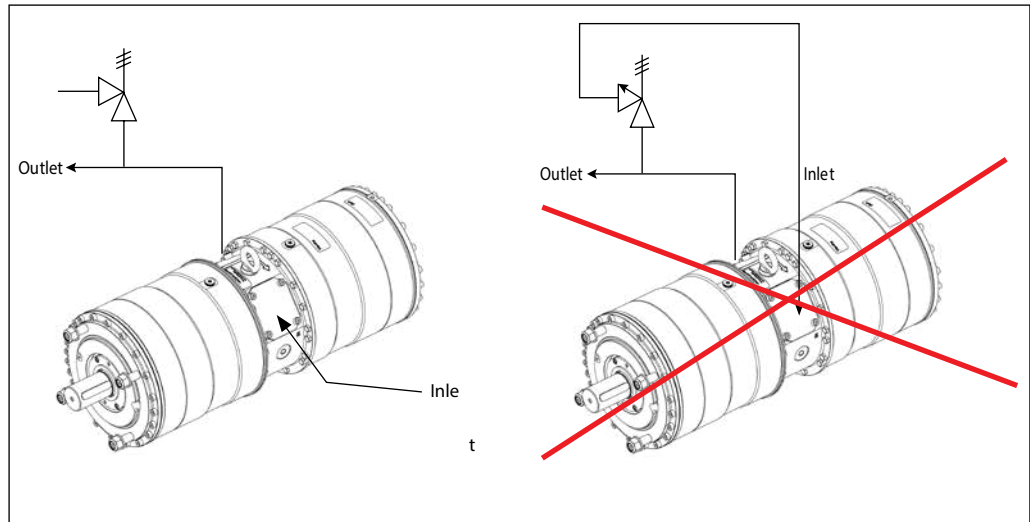
The pump should be protected against too high pressure by means of a safety valve or a pressure relief valve.

The opening characteristics of the valve must not result in peak pressures higher than 100 barg (1450 psig).

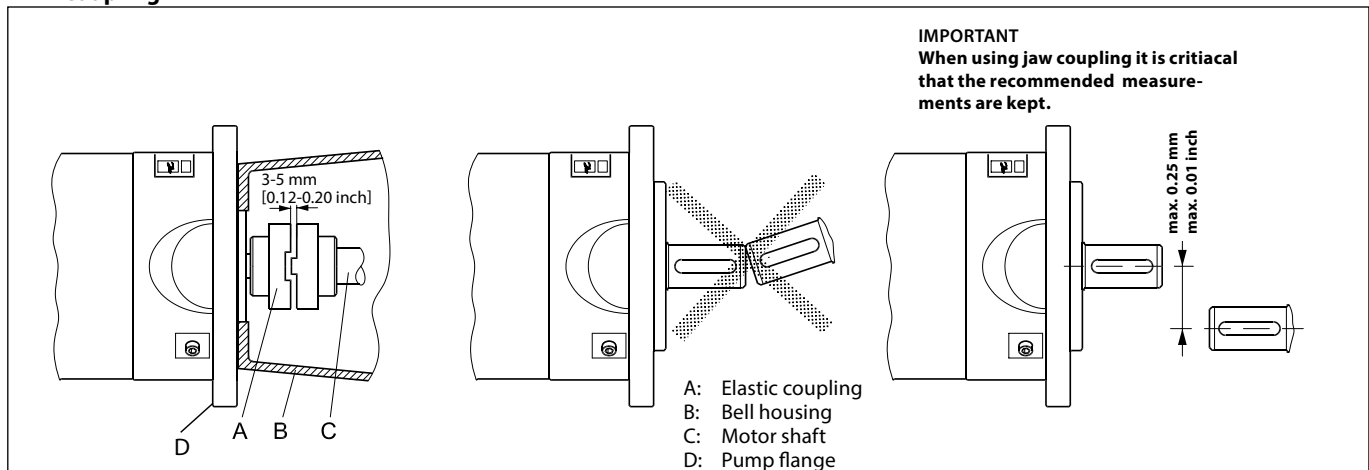
The valve should be placed as close to the pump as possible.

We recommend to install flexible soft hoses both in the inlet and outlet lines.

The valve outlet must not be connected directly to the pump suction line. It must be connected directly to the drain.



4. Building up the pump unit with jaw coupling



4.1 Mounting

1. Mount the coupling flush with the pump shaft end or maximum 1 mm offset from the pump shaft end. Ensure an air gap between coupling parts of 3-5 mm (0.12-0.2 inch).
2. Mount the bell housing on pump. Secure nuts with the right torque.
3. Measure the longest distance "A" from top of bell housing to the button of coupling claw.

4. Mount the coupling on motor shaft. Ensure the coupling and motor flange are not in contact with each other.
5. Measure from motor flange to the top of the coupling. That measurement "B" shall be 3-5 mm (0.12-0.2 inch) shorter than the measurement "A".

("A" and "B" can be found on the next page).

6. Adjust respectively, verify the measurement, and secure both couplings with the right torques on the locking screws (see coupling operation & mounting instruction).
7. Mount the elastic gear ring and mount the bell housing/pump on the motor. After mounting it must be possible to move the elastic gear ring 3-5 mm (0.12 - 0.2 inch) axial "C". The check can be done through the inspection hole of bell housing. Secure flange bolts with the right torque.

If alternative mounting is desired, please contact Danfoss High Pressure Pumps.

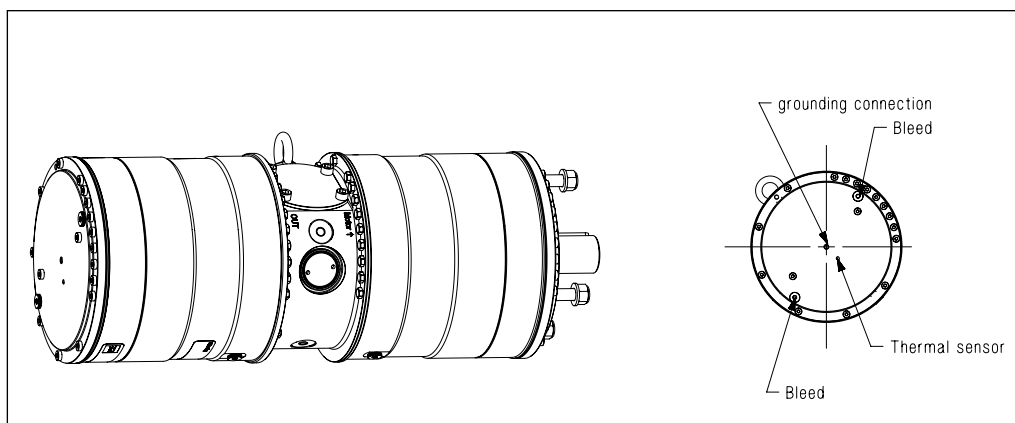
Choose proper tolerances to ensure an easy mounting of the elastic coupling without use of tools.

Please take care to observe the recommended length tolerances of the chosen coupling, as an axial force on the pump will damage the pump.

1: Bolts 100 Nm ± 10
 2: Nuts 100 Nm ± 10
 3: Torque se table below

Thread size	M5	M6	M8	M10
Torque [Nm]	2	4.8	10	17

4.2 Connections



To prevent stray current corrosion we recommend grounding of the pump and all other parts in the system.

All parts in the system must be electrical potential equalized to a single reference point (grounding point).

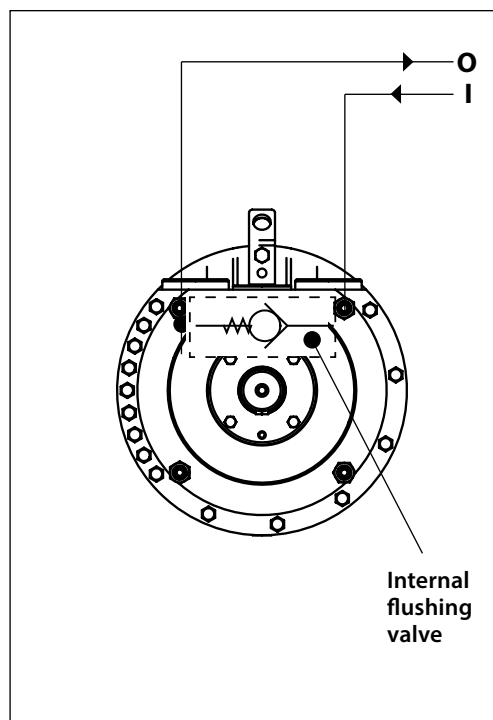
It is recommended that the electrical resistance in the grounding cable is equal to or below 0.25 Ohm towards the grounding point.

5. Initial start-up

1. Flush inlet line before connecting the pump, to remove possible impurities from pipes, hoses etc.
2. Connect pump inlet to inlet line and flush the pump for 5 min. by means of the internal flushing valve, to remove possible impurities from pipes, hoses etc.
3. Loosen top bleeding plug (see item 3.5) using an allen key (only plugs with internal hexagon sockets). Retighten the plug, when water appears from the bleeding plug.
4. Make sure that the direction of rotation of the electric motor corresponds to the direction of rotation of the pump, show on the pump flange.
5. Now the pump is ready for start-up.

WARNING

Make sure that the direction of rotation of the electric motor corresponds to the direction of rotation of the pump. Otherwise the pump will be damaged if a check valve is placed between pump and feed pump.



6. Operation

6.1 Temperature

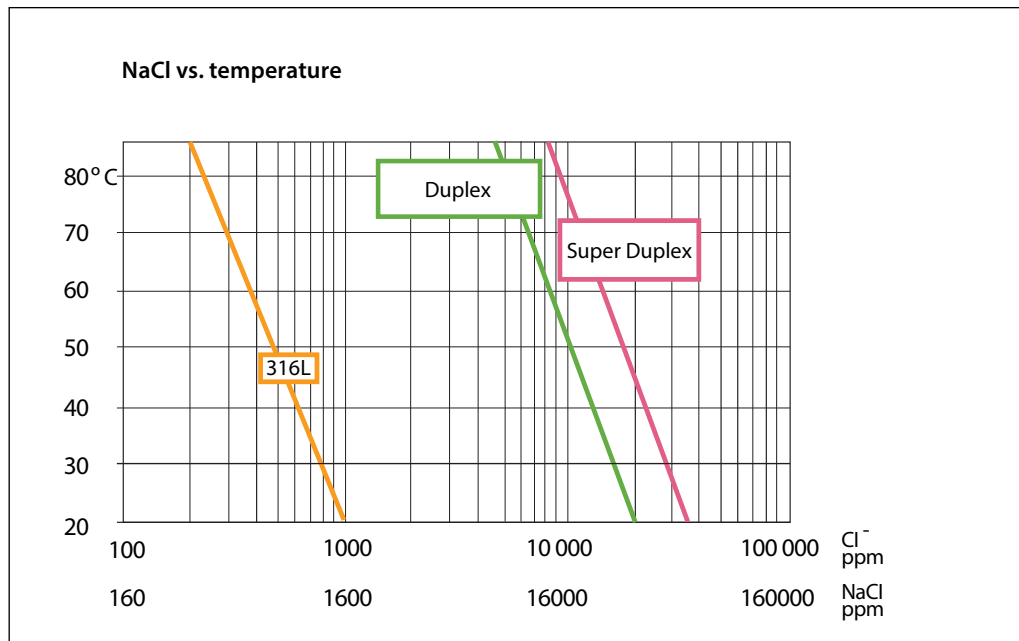
Fluid temperature: Min. +2°C to max. +50°C (Min. +35.6°F to max. +122°F)
Ambient temperature: Min. +2°C to max. +50°C (Min. +35.6°F to max. +122°F)

The chart below illustrates the corrosive resistance of different types of stainless steel related to NaCl concentration and temperature.

The APP water pump is made of Duplex and Super Duplex.

If the water pump is operated above the Super Duplex line, always flush water pump with fresh water at operation stop in order to minimize the risk of crevice corrosion.

In case of lower operating temperatures, please contact Danfoss High Pressure Pumps.



6.2 Pressure

The inlet pressure shall be min. 2 barg (30 psig) and max. 5 barg (72.5 psig). At lower pressures the pump will cavitate, resulting in damage of the pump.

Max. inlet pressure peak (e.g. in case the pump stops momentarily) up to 10 barg (145 psig) are acceptable.

Max. pressure on the pump's outlet line shall be limited at 80 barg (1160 psig) continuously.

For APP 86 min. inlet pressure shall be 2.5 barg (36 psig) and max. outlet pressure shall be 70 barg (1015 psig).

For APP 92 min. inlet pressure shall be 3.5 barg (50 psig) and max. outlet pressure shall be 70 barg (1015 psig).

Note: The pump unit should include a pressure gauge on the high-pressure side.

6.3 Dry running

When running, the pump must always be connected to the water supply in order to avoid damage if it should run dry.

6.4 Disconnection

If the inlet line is disconnected from the water supply, the pump will be emptied of water through the disconnected inlet line.

When starting up again, follow the bleeding procedure described under section 4: Initial start up.

6.5 Storage

Storage temperature:
Min. -40°C to max. +70°C
(Min. -40°F to max. +158°F)

When preparing the pump for long-term storage at temperatures below the freezing point, flush the pump with an anti-freeze medium type monopropylene glycol to prevent internal corrosion or frost in the pump.

For further information on anti-freeze media, please contact Danfoss High Pressure Pumps.

Recommended procedure:

1. Disconnect the water supply to the pump.
2. Through the lower bleeding plug, empty the pump housing of water and close it again.
3. Connect the pump to a tank containing anti-freeze additive. Connect a hose to the inlet port of the pump and via another hose return the flow from the outlet port to the tank with antifreeze additives.

4. Quickly start and stop the pump. **Make sure that the pump does not run dry.** The pump is now protected against internal corrosion and frost.

Storage:

Storage of pump that have been in operation: For shorter periods of storage flush the pump with permeate by rotating the pump for 10 sec. empty permeate and store.

For long term storage (more than 2 months) Danfoss recommends servicing the product and clean any biological growth of the surfaces. Store the pump without water inside.

7. Service and warranty

Warranty

Danfoss APP pumps are designed for long operation, low maintenance and reduced lifecycle costs.

Provided that the pump has been running according to the Danfoss specifications, Danfoss guarantees 8,000 hours service-free operation, however, max. 18 months from date of production.

If Danfoss recommendations concerning system-design are not followed, it will strongly influence the life of the APP pumps. Other factors that affect pump performance and lifetime include:

- Insufficient filtration
- Insufficient bleeding and venting
- Running the pump at speed outside specifications.
- Supplying the pump with water at temperature higher than recommended.
- Running the pump at inlet pressure outside specifications.
- Running the pump at outlet pressure outside the specifications.
- Wrong direction of rotation.

Maintenance

After 8,000 hours of operation it is strongly recommended to inspect the pump and change any worn parts, e.g. pistons and shaft seal. This is done in order to prevent a potential breakdown of the pump. If the parts are not replaced, more frequent inspection is recommended according to our guidelines.

Pump shutdown:

The APP pumps are made of Duplex/Super Duplex materials with excellent corrosion properties. It is, however, always recommended to flush the pump with freshwater when the system is shut down.

When stopping the pump for more than 1 day flush the pump with permeate by rotating the pump for 10 sec. Flushing through the flashing valve of the pump without rotating the pump is not enough for cleaning the inside of the pump. The pump can be flushed with biocide like the membranes. The biocide must be compatible with the materials used in our pump (materials can be found in the parts list in the Service guide and Operating manual).

Repair

In case of irregular function of the APP pump, please contact Danfoss High Pressure Pumps.

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