

1. General information



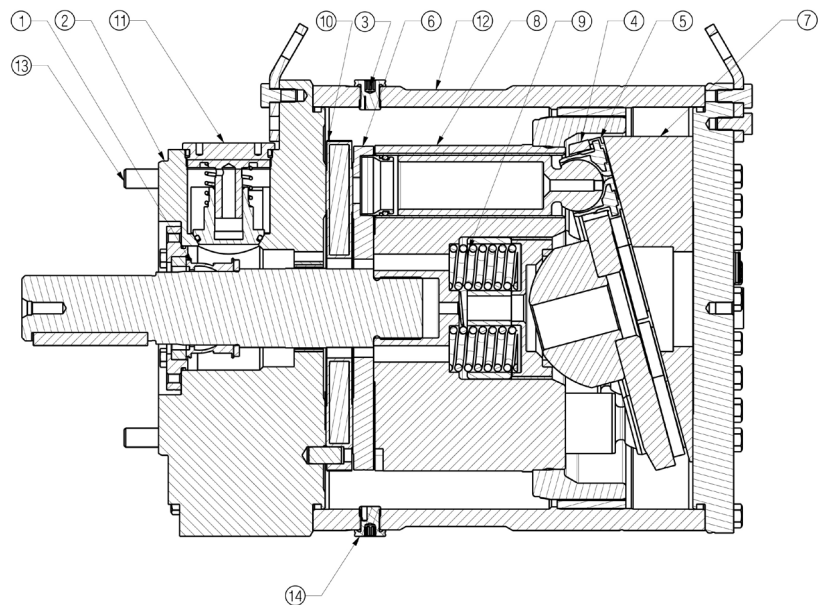
APP21-30 pumps are designed to supply low viscosity and corrosive fluids under high pressure, eg. in seawater reverse osmosis filtration applications and for high pressure salt water pumping.

The pumps are based on the axial piston principle enabling a very light and compact design, and they are designed so that the lubrication of the moving parts in the pumps is provided by the fluid itself. No oil lubrication is thus required.

The pump has an integrated flushing valve that allows the salt water to flow from inlet to the outlet, when the pump is not running.

All parts included in the pumps are designed to provide long service life, i.e. long service life with a constantly high efficiency and minimum service required.

The pumps are fixed displacement pumps in which the flow is proportional to the number of revolutions of the input shaft and the pump displacement.



- 1: Shaft sealing
- 2: Mounting and port flange
- 3: Bleeding plugs
- 4: Retaining ring
- 5: Piston/shoe
- 6: Valve/thrust plate
- 7: Swash plate
- 8: Cylinder barrel
- 9: Springs
- 10: Port plate
- 11: Flushing valve
- 12: Housing with bearing
- 13: Bolts for bell housing
- 14: Drain plug

2. Benefits

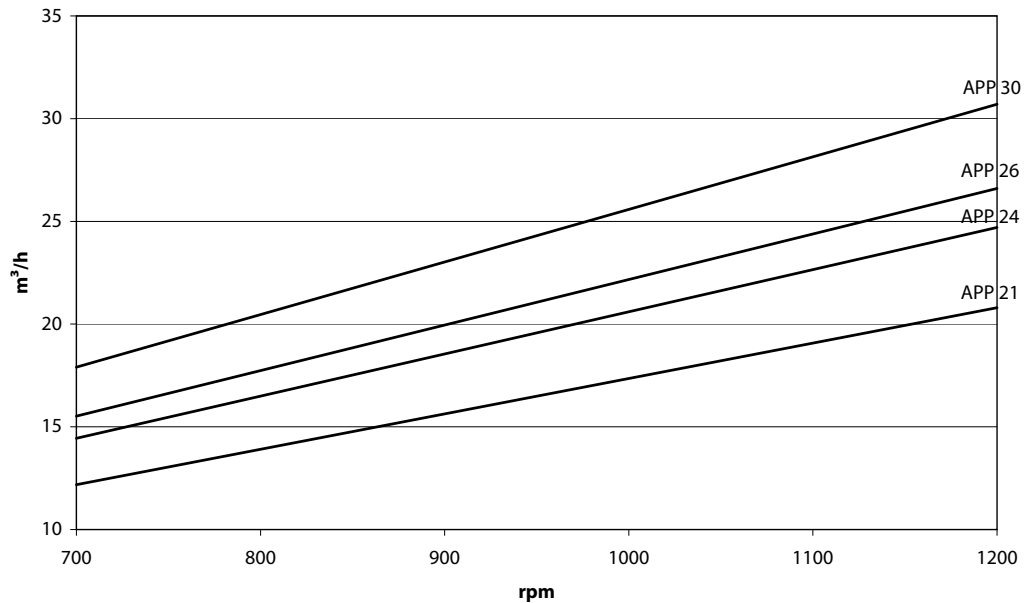
- One of the smallest and lightest pumps on the market.
- Can be powered by a combustion engine provided that a special coupling is used.
- Long service life / No preventive maintenance required in the warranty period.
- Generates insignificant pulsations in the pressure line.
- No oil lubricant.
- Integrated flushing valve
- All parts of the pump are made of non-corrosive materials eg. Duplex (SAF 2205/EN1.4462/UNS S31803-S32205) and Super-duplex (SAF 2507/EN1.4410/UNS S32750) stainless steel and carbon reinforced PEEK
- High efficiency

3. Technical data

Code number		180B3051		180B3054		180B3056		180B3060	
APP pumps		APP21		APP24		APP26		APP30	
Geometric displacement	cm ³ /rpm (in ³ /rpm)	308	(18,8)	362	(22,1)	389	(23,7)	444,0	(27,1)
Flow (1200 rpm) at 60 bar	m ³ /h (gpm)	20,8	(91,5)	24,77	(108,7)	26,6	(117,1)	30,7	(135,1)
Min. outlet pressure	bar (psi)	40	(580)	40	(580)	40	(580)	40,0	(580)
Max. outlet pressure	bar (psi)	80	(1160)	80	(1160)	80	(1160)	80,0	(1160)
Min. inlet pressure cont.		2	(29)	2	(29)	2	(29)	3	(44)
Max inlet pressure cont.	bar (psi)	6	(87)	6	(87)	6	(87)	6	(87)
Max inlet pressure peak	bar (psi)	10	(145)	10	(145)	10	(145)	10	(145)
Maximum speed	rpm	1200		1200		1200		1200	
Minimum speed	rpm	700		700		700		700	
Power requirement at max. speed and 80 bar (1160 psi):	kW(hp)	55	(73,7)	65	(87,1)	70	(93,8)	81	(108,6)
Torque	Nm (lbf-ft)	436	(321)	512	(377)	550	(405)	642	(473)
Weight	kg (lb)	105	(231,5)	105	(231,5)	105	(231,5)	105	(231,5)
Flushing valve Kv value (Δp = 1 bar)	m ³ /h (gpm)	14,4	(63,4)	14,4	(63,4)	14,4	(63,4)	14,4	(63,4)

4. Flow at different rpm

When using the diagram shown below, it is easy to select the pump which fits the application best if the flow required and the rotation speed (rpm) of the pump are known.



Furthermore, this diagram shows that the flow can be changed by changing the rotation speed of the pump. The flow/rpm ratio is constant, and the "desired" flow can be obtained by changing the rotation speed to a corresponding value. Thus, the required rpm can be determined as:

$$\text{Required rpm} = \frac{\text{Desired flow} \times 1200 \text{ rpm}}{\text{Rated flow}}$$

5. Temperature and corrosion

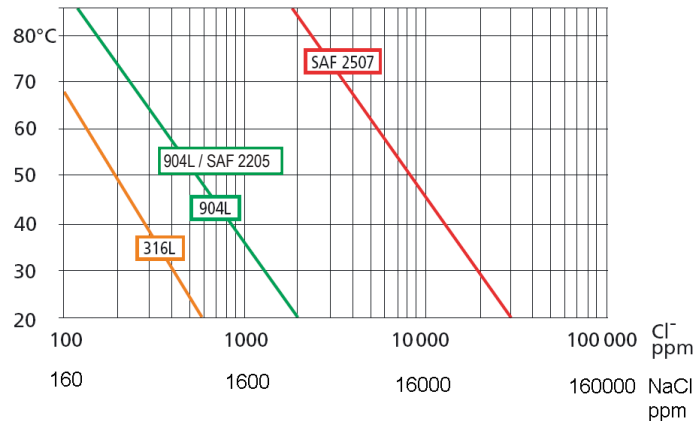
5.1 Operation:

- Fluid temperature: +3°C to +40°C (+37.4°F to +104°F) - dependent on the NaCl concentration
- Ambient temperature: +3°C to +50°C (+37.4°F to +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 SAF 2507 and SAF 2205.

If the water pump is operated above the SAF 2507 line, always flush the the water pump with fresh water at operation stop in order to minimise the risk of crevice corrosion.



NaCl vs. temperature

5.2 Storage:

- Storage temperature: -40°C to +70°C (-40°F to 158°F) – provided that the pump is drained of fluid and stored “plugged”.
- Antifreeze protection is required at temperatures below 2°C. Danfoss recommends using Dowcal N from Dow Chemical Company or Chillsafe mono propylene glycol from Arco Chemical Company.

6. Noise level

The noise from the APP21-30 is typically 84 dB(A) at 60 bar / 1200 rpm.

Generally, noise will be reduced if speed is reduced and vice versa. Use flexible hoses in order to minimize vibrations and noise.

Since the pump typically is mounted on a bell housing or frame, the noise level can only be determined for the complete unit (system).

It is therefore very important that the pump is mounted correctly on a frame with vibration absorber to minimize vibrations and noise.

The noise level is influenced by:

- The speed of the pump, high rpm create more noise than low rpm
- Rigid mounting of the pump generates more noise than flexible mounting
- Pipe mounting direct to the pump increases the noise level compared to a flexible hose

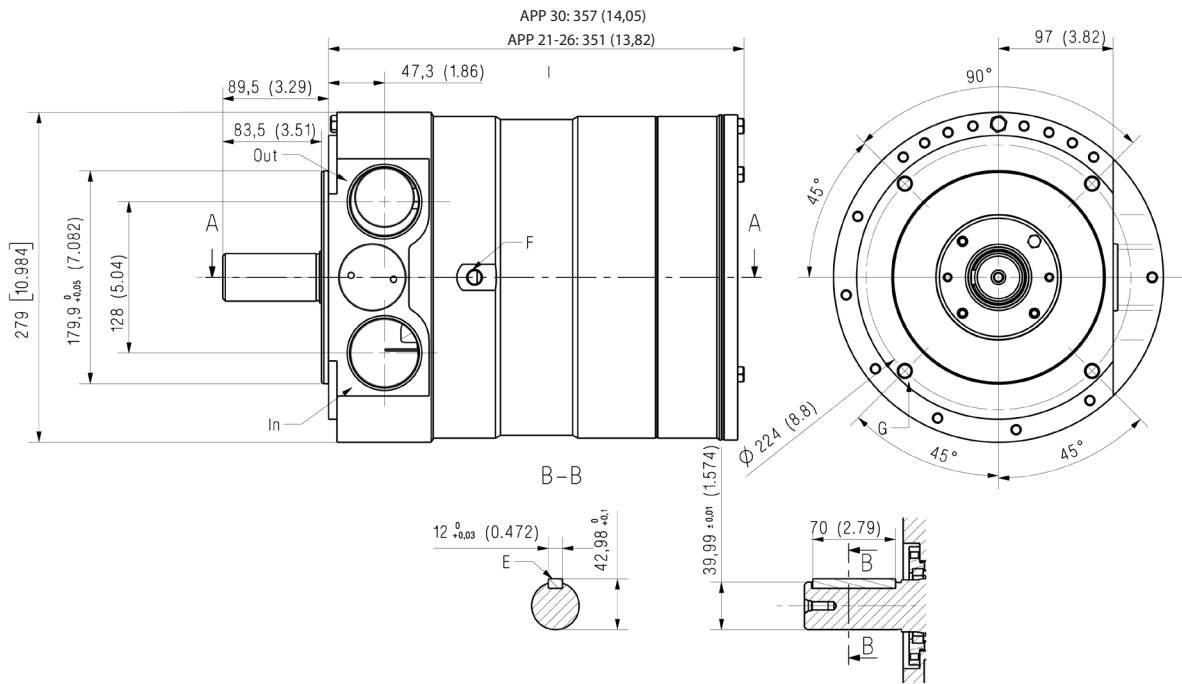
7. Filtration

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 that you use precision depth filter cartridges rated 10µm abs. β10>5000 (equivalent to a filtration efficiency of 99.98%). Bag filters and string wound filter cartridges typically have only 90% filtration efficiency. This means that for each 100,000 particles reaching the filter, 10,000 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 consult our publication “Filtration” (code number 521B0861), which also will provide you with an explanation of filtration definitions and a guidance on how to select the right filter.

8. Dimensions

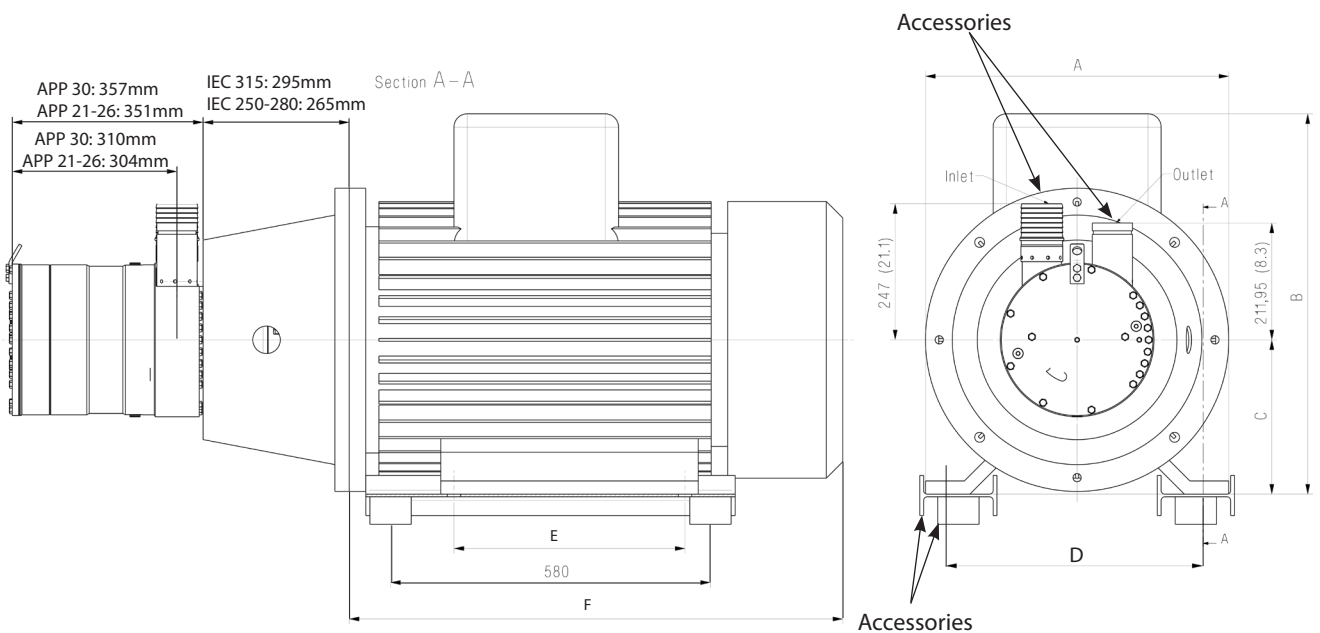


Description	APP21 - APP30
E Parallel key, DIN 6885, mm (in)	12 × 8 × 70 (0.47 × 0.31 × 2.76)
F Bleeding	G ¼", Hexagon AF = 8 mm
I Inlet port	M60 x 1.5; depth 24 mm
O Outlet port	M60 x 1.5; depth 24 mm
Pump mounting flange	180 B 4

Accessories	Type	Code number
3" inlet hose kit 2 m / 79"	3" Victaulic	180Z0277
Non-return valve (outlet)	2½" Victaulic (OD 73.1 mm)	180H0050

For more details on the accessories, please consult our publication "Hoses and hose fittings" (code number 521B0909).

9. Dimensions, complete unit



Pump	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	IEC Electric motor
APP21-24	550	635	250	406	349	770	55 kW, IEC 250 M-4
APP24-26	550	693	280	457	368	845	75 kW, IEC 280 S-4
APP26-30	550	693	280	457	419	895	90 kW, IEC 280 M-4
APP30	660	810	315	508	406	990	110kW, IEC 315 M-4

Note: Code numbers 180B3051, 180B3054, 180B3056 and 180B3060 do not include electric motor, bell housing and fittings.

10. Installation

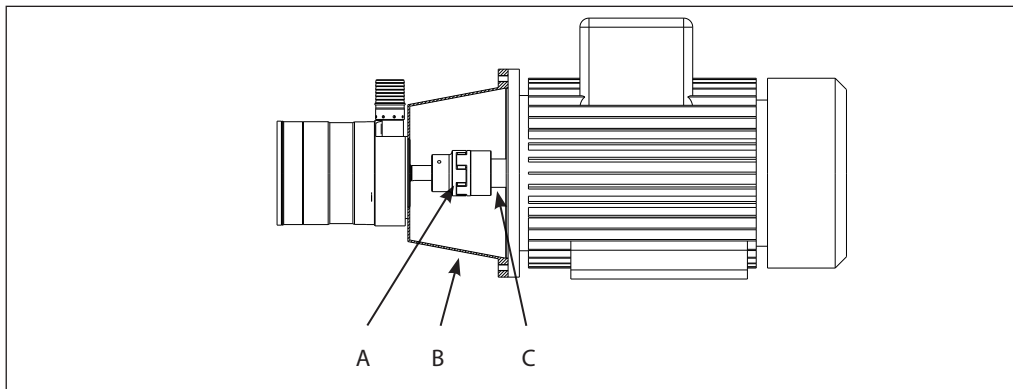
10.1 Mounting

The figure below illustrates how to mount the pump and connect it to the electric motor/combustion engine.

- A: Flexible coupling
- B: Bell housing
- C: Motor shaft

If alternative mounting is required, please contact Danfoss RO Sales Organization for further information. To ensure easy mounting of the flexible coupling without using tools, the tolerances must be dimensioned accordingly.

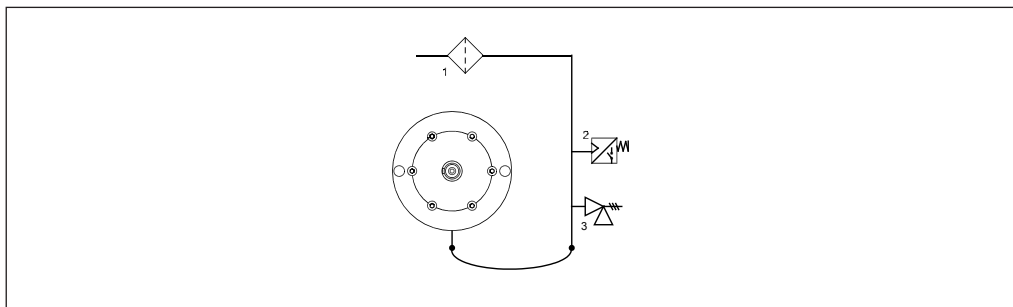
Note: Any axial and radial loads on the pump shaft must be avoided.



10.2 Open-ended system with direct water supply

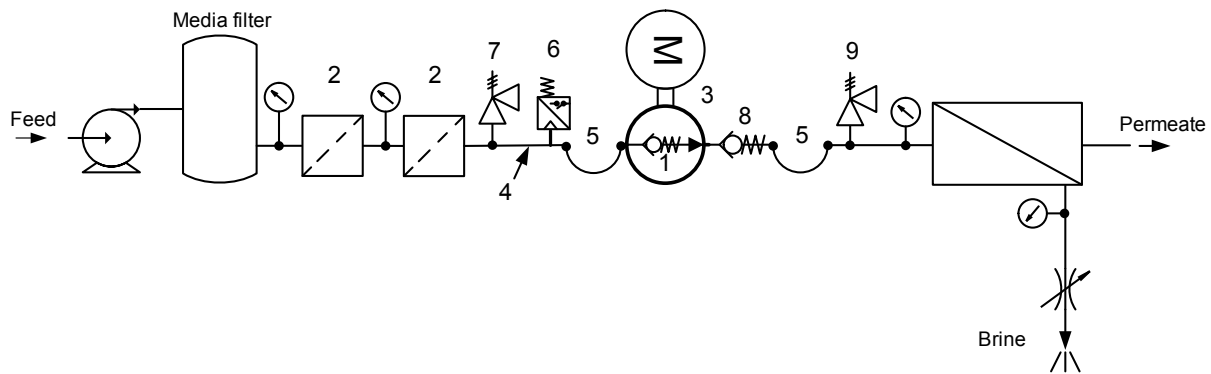
In order to eliminate the risk of cavitation, a positive inlet pressure is always to be maintained at min. 2 bar (29 psi) for APP21-26, 3 bar (44 psi) for APP 30 and max. 6 bar (72.5 psi).

1. Place the filter (1) in the water supply line in front of the pump.
2. Place a monitoring pressure switch (2) set at min. inlet pressure between filter and pump inlet. The monitoring switch must stop the pump at pressures lower than min. inlet pressure.
3. Install a safety valve (3) in order to avoid system or pump damage in case the pump stops momentarily.



10.3 RO system with APP pump

1. For easy system bleeding and flushing, a bypass non-return valve (1) is integrated in the APP pump.
2. Place inlet filter (2) in front of the APP pump (3). Please consult section 7, "Filtration" 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 (6) set at min. inlet pressure between filter and pump inlet. The monitoring switch must stop the pump at pressures lower than min. inlet pressure.
4. 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).
5. In order to eliminate the risk of damage and cavitation, a positive pressure at the inlet (4) is always to be maintained at min. inlet pressure and max. inlet pressure. Recommend to install safety valve (7) in order to avoid high pressure peaks.
6. Install a non-return valve (8) in outlet 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 the pump stops momentarily.
7. Use flexible hoses (5) to minimize vibrations and noise.
8. Install a safety valve (9) in order to avoid system damage as the Danfoss APP pump creates pressure and flow immediately after start-up, regardless of any counter-pressure.



11. Service and 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.

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.

Standstill:

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.**

11.2 Repair

In case of irregular function of the APP, please contact the Danfoss RO Solutions Sales Organisation.