

### 1. General information

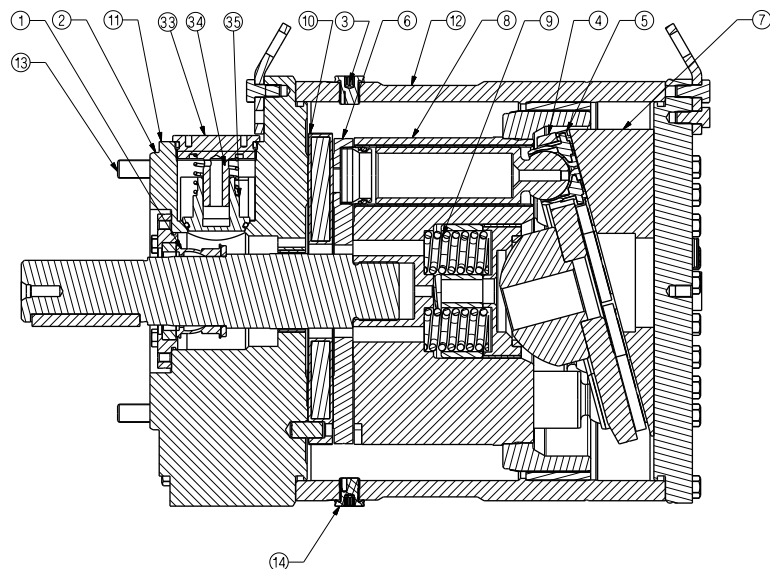


APP21-26 pumps are designed to supply low viscosity and corrosive fluids under high pressure, eg. in seawater reverse osmosis filtration applications and for high pressure salt water pumping.

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.

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

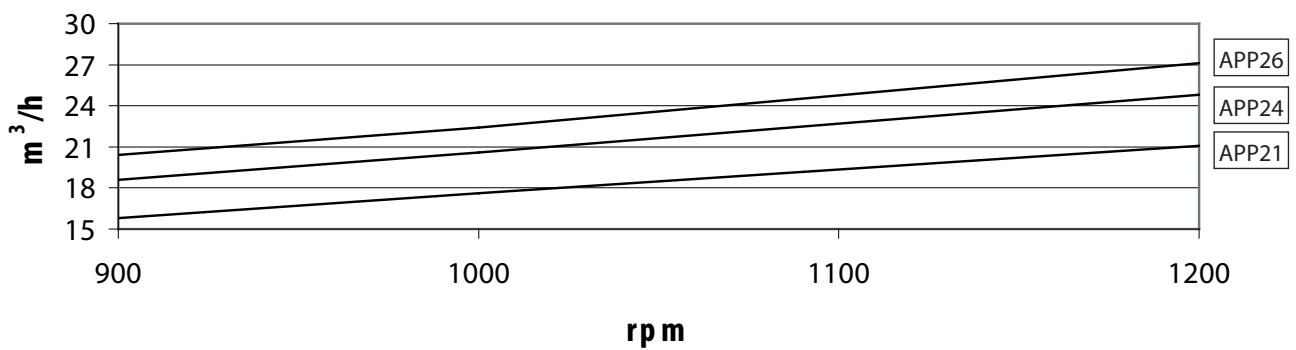
- One of the smallest and lightest pumps on the market.
- Can be powered by a combustion engine provided that a special coupling is used.
- Generates insignificant pulsations in the pressure line.
- No preventive maintenance required (no periodic service like e.g. change of lubricant and wearing parts).
- Long service life
- 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	
APP pumps		APP21		APP24		APP26	
Geometric displacement	cm <sup>3</sup> /rpm (in <sup>3</sup> /rpm)	308	(18.8)	362	(22.1)	389	(23.7)
Flow (1200 rpm)	m <sup>3</sup> /h (gpm)	20.7	(91.1)	24.5	(107.9)	27.1	(119.3)
Min. pressure	bar (psi)	40	(580)	40	(580)	40	(580)
Max. pressure	bar (psi)	80	(1160)	80	(1160)	80	(1160)
Rated speed	rpm	1200		1200		1200	
Maximum speed	rpm	1200		1200		1200	
Minimum speed	rpm	700		700		700	
Power requirement at max. speed and 80 bar (1160 psi):	kW(hp)	56	(75.1)	66	(88.5)	69	(92.5)
Torque	Nm (lbf-ft)	427	(315)	501	(370)	545	(402)
Weight	kg (lb)	105	(231.5)	105	(231.5)	105	(231.5)

### 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:

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

### 5. Inlet pressure

Water supply to the pump is either made from a tank placed above the pump or directly from the mains. The pressure at the pump inlet (l) must be in the range: 2 - 5 bar (29 - 72.5 psi)

## 6. Temperature and corrosion

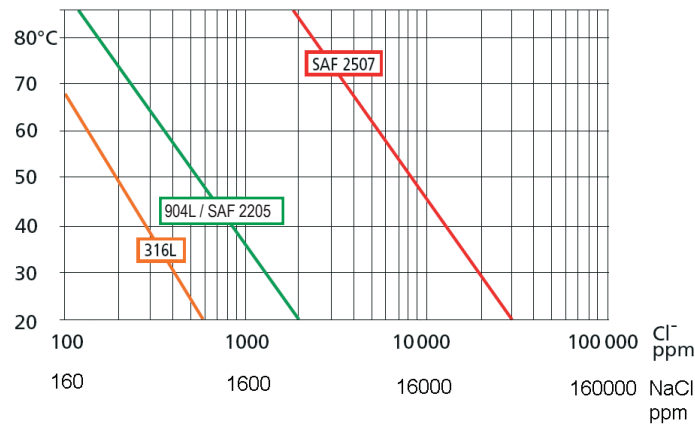
### 6.1 Operation:

- Fluid temperature: +3°C to +50°C (+37.4°F to 122°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

### 6.2 Storage:

- Storage temperature: -40°C to +70°C (+37.4°F to 122°F) – provided that the pump is drained of fluid and stored "plugged".

Antefreeze 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.

## 7. Noise level

The noise from the APP21-26 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 dampers 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

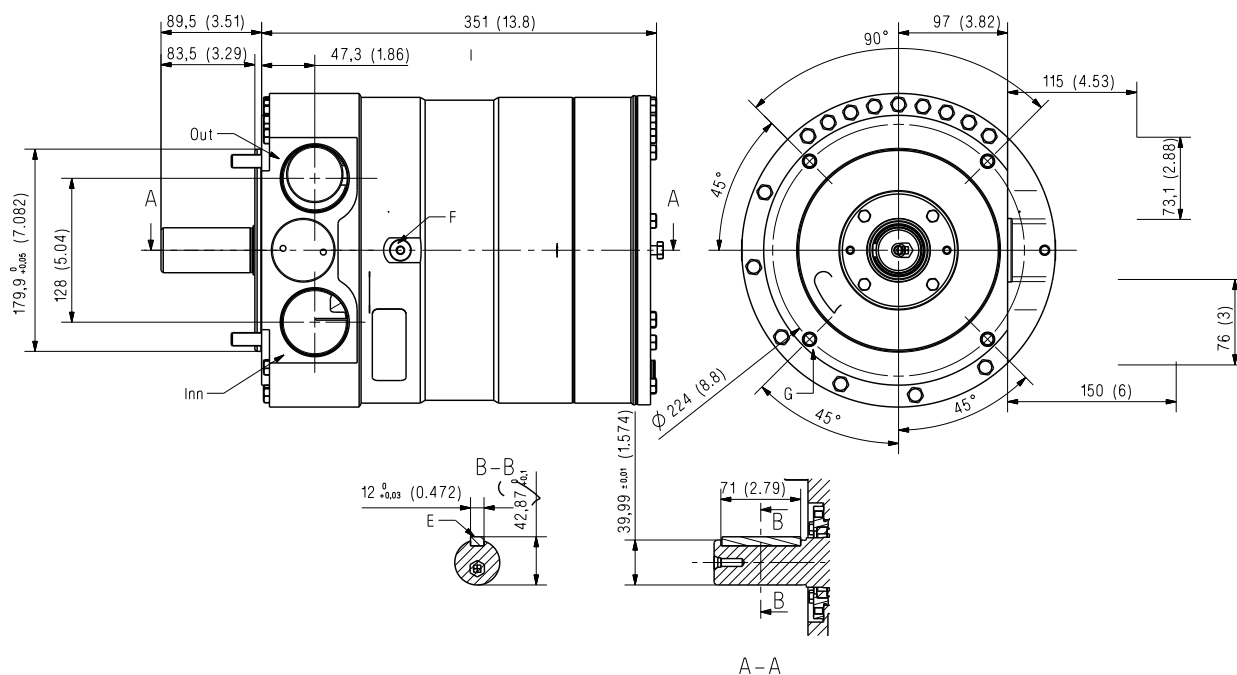
## 8. Filtration

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.  $\beta_{10} > 5000$  (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.

## 9. Dimensions

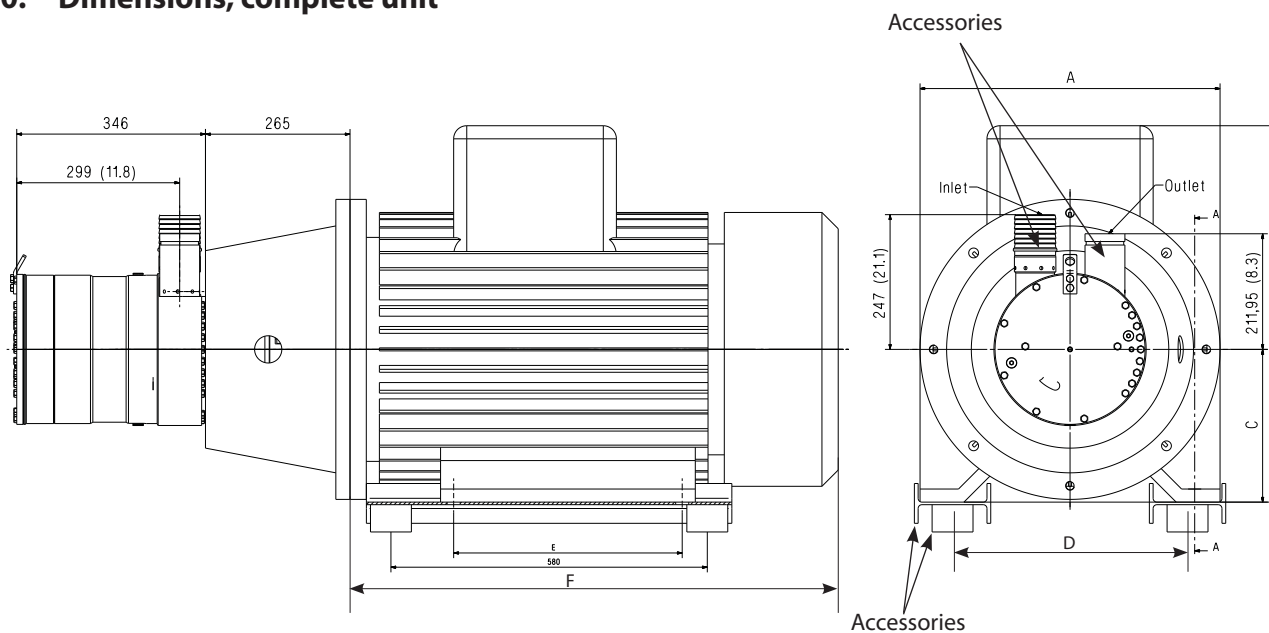


Description	APP21 - APP26
E Parallel key, DIN 6885, mm (in)	12 × 8 × 70 (0.47 × 0.31 × 2.76)
F Bleeding	G ¼", Hexagon AF = 8 mm
I Inlet port	M60 x 1.5; depth 24 mm
O Outlet port	M60 x 1.5; depth 24 mm
Pump mounting flange	180 B 4

Accessories	Type	Code number
Hose pipe (inlet)	3"	180B3630
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).

## 10. Dimensions, complete unit



Pump	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	IEC Electric motor
APP21-24	550	620	250	406	349	770	55 kW, FPC 250 M-4
APP24-26	550	920	280	457	368	845	75 kW, FPC 280 S-4

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

## 11. Installation

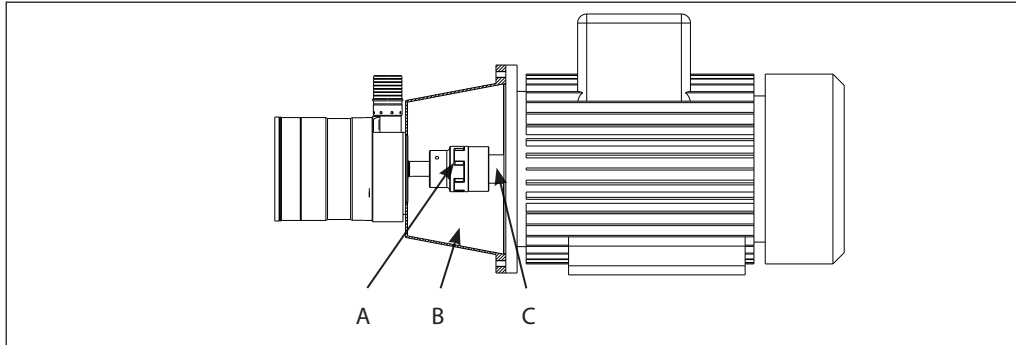
### 11.1 Mounting

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.

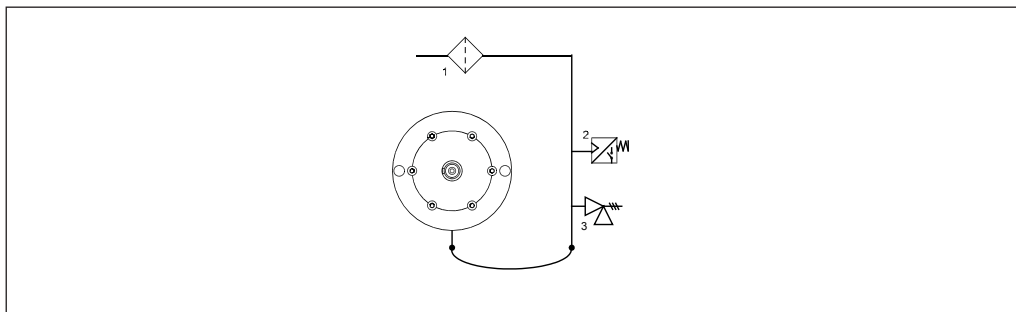
**Note: Any axial and radial loads on the shaft must be avoided.**



### 11.2 Open-ended system with direct water supply

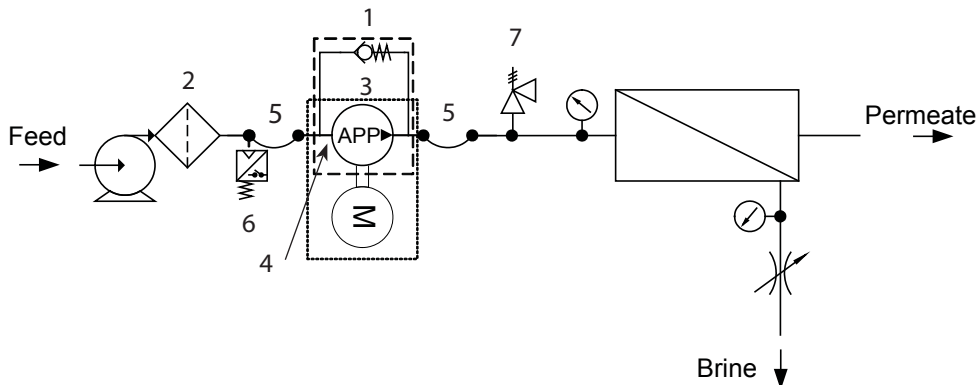
In order to eliminate the risk of cavitation, a positive inlet pressure is always to be maintained at min. 2 bar (29 psi) and max. 5 bar (72.5 psi).

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. 2 bar (29 psi) between filter and pump inlet. The monitoring switch must stop the pump at pressures lower than 2 bar. (29 psi).



### 11.3 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 an inlet filter (2) in front of the APP pump (3). Please consult section 9, "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. 2 bar between filter and pump inlet. The monitoring switch must stop the pump at pressures lower than 2 bar (29 psi).
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. 2 bar (29 psi) and max. 5 bar (72.5 psi).
6. Use flexible hoses (5) to minimize vibrations and noise.
7. Install a safety valve (7) in order to avoid system damage as the Danfoss APP pump creates pressure and flow immediately after start-up, regardless of any counter-pressure.



## 12. Service

Provided that the pump has been running according to the Danfoss specifications on pre-filtration, pressure, and rotation speed, Danfoss guarantees 8000 hours service-free operation, however max. 18 months from date of sale.

To prevent a total and disastrous breakdown, Danfoss recommends a pump inspection after 4000 hours – at which any worn out parts must be replaced.

**Note: It is always recommended to replace pistons and shaft sealing if another service-free period is to be obtained.**

If the pistons are not replaced, more frequent inspection is recommended.

The APP pump is made of duplex/super duplex materials with fine corrosion properties. However, **it is always recommended to flush the pump when the system is shut down.**

The shaft sealing in the APP pump is made of Hasteloy C. At high TDS and high water temperature, the service life of the shaft sealing will be reduced. For these applications it is recommended to replace the shaft sealing after approx. 4000 hours operation.

### 12.1 Periodic maintenance

Water acts as lubricant in the APP. Thus there is no oil in the pump.

By operation below the curve for SAF 2507 in the figure in section 6.1, no parts are expected to be replaced within the first 8000 hours of operation.

### 12.2 Repair

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

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