

Data sheet

APP Pumps

APP S 674 53 / APP S 674 65 /
APP S 674 78 / APP S 674 86



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1. Introduction

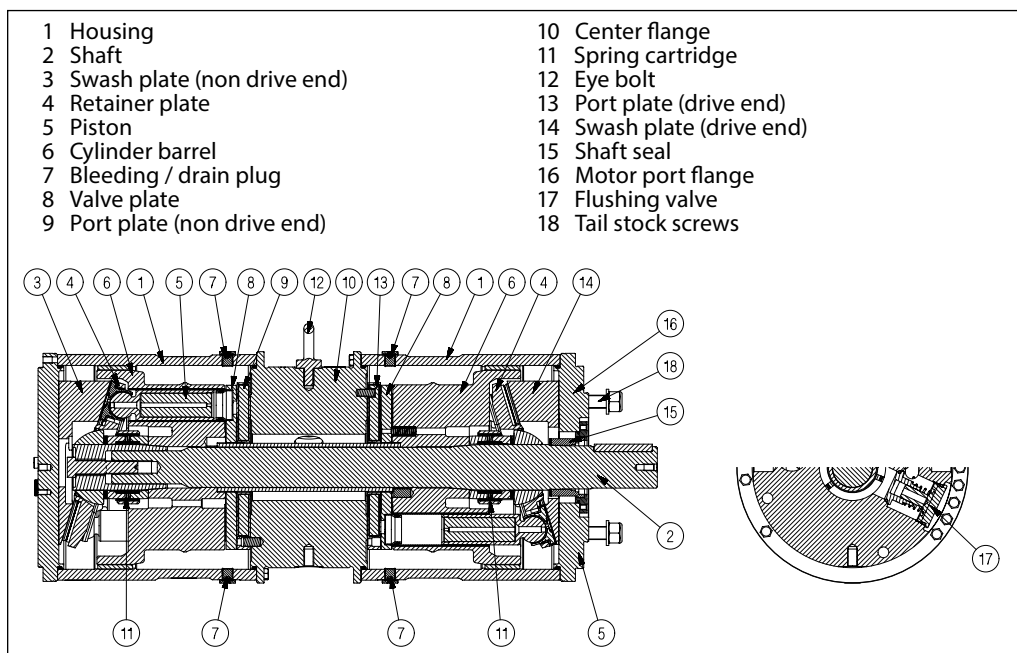
The Danfoss range of APP S high-pressure pumps are made according to API 674 3rd edition. The pump is designed for use in RO applications with low viscosity and corrosive fluids such as sea water.

Danfoss APP S pumps are positive displacement pumps with axial pistons that move a fixed amount of water in each cycle. Flow is proportional to the number of input shaft revolutions (rpm).

Unlike centrifugal pumps, they produce the same flow at a given speed no matter what the discharge pressure.

The pumps are supplied with an integrated flushing valve that allows the saltwater to flow from inlet to outlet, when the pump is not running. The pumps are made for flange connections. 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 sectional drawing below illustrates the main components of the APP S 674 53-86 pump range.



2. Benefits

- **Zero risk of lubricant contamination:**
Oil lubricants are replaced with the pumped medium, seawater or brackish water, so SWRO and BWRO applications are completely free of any contamination risk from the pump.
- **Low maintenance costs:**
Efficient design and all Super Duplex stainless steel construction ensure exceptionally long life. When Danfoss specifications are met, service intervals up to 8,000 hours can be expected.
- **Low energy costs:**
The highly efficient axial piston design provides the lowest power consumption of any comparable pump on the market.
- **Easy configuration:**
 - The lightest and most compact design available. Pump can be installed vertically and horizontally.
 - No pulsation dampeners necessary due to extremely "low pressure" pulsation.
 - Powered direct by electric motor or combustion engine.
- Pump can be delivered with all types of flange connections.
- **Certified quality:**
 - Pump is designed according to API 674, 3rd edition.
 - Super Duplex stainless steel M-630 from NORSOK M-650 certified foundries.
 - Full traceability and material certificates on pressure containing parts.
 - Pump available as ATEX certified, category 2, zone 1 or category 3, zone 2.

3. Application examples

Danfoss APP S 674 pumps are used in RO systems for production of fresh water. This water can be used for drinking or as process water, e.g. as water used for injection into wells. APP S 674 pumps are not only applicable for offshore applications but can also be used for refineries or in processes where API 674 is

required. As the APP S pumps are made in Super Duplex stainless steel, it makes them suitable for rough offshore applications. Apart from that the small and compact pumps are a perfect choice for applications where component size really matters.

4 Technical data

4.1 APP S 53-78

Pump size		APP S 674 53	APP S 674 65	APP S 674 78	APP S 674 86
Code number		On request	On request	On request	On request
Geometric displacement	cm ³ /rev.	616	778	616	888
	in ³ /rev.	37,6	47,3	37,6	54,2
Pressure					
"Outlet min. pressure, continuous ¹⁾	barg	30	30	30	30
	psig	435	435	435	435
Max. outlet pressure (MAWP) ²⁾	barg	80	80	80	70
	psig	1160	1160	1160	1015
Inlet operating pressure ³⁾	barg	2.0-5.0	2.0-5.0	2.0-5.0	2.5-5.0
	psig	29-145	29-145	29-145	36-145
Max. inlet operating pressure	barg	5	5	5	5
	psig	73	73	73	73
Max. inlet pressure peak	barg	10	10	10	10
	psig	145	145	145	145
Speed					
Min. speed continuous	rpm	700	700	700	700
Max. speed continuous	rpm	1500	1500	1500	1700
Flow					
Min. flow	m ³ /h	24	32	36	36
	gpm	106	141	158	158
700 rpm at max. pressure	m ³ /h	24	32	36	36
	gpm	106	141	158	158
1000 rpm at max. pressure	m ³ /h	35	45	52	52
	gpm	154	198	228	228
1200 rpm at max. pressure	m ³ /h	42	54	62	62
	gpm	187	238	275	275
1500 rpm at max. pressure	m ³ /h	53	68	78	78
	gpm	235	299	345	345
1700 rpm at max. pressure	m ³ /h				88
	gpm				387
Efficiency					
1000 rpm ⁴⁾	%	88	88	89	89
1200 rpm ⁴⁾	%	89	89	90	89
1500 rpm ⁴⁾	%	88	89	89	88
1700 rpm ⁴⁾	%				88

Pump size		APP S 674 53	APP S 674 65	APP S 674 78	APP S 674 86
Code number		On request	On request	On request	On request
Technical specifications					
Media temperature	°C	2-50	2-50	2-50	2-50
	°F	36-122	36-122	36-122	36-122
Ambient temperature	°C	0-50	0-50	0-50	0-50
	°F	32-122	32-122	32-122	32-122
Weight (dry)	kg	196	196	196	196
	lb	432	432	432	432
Weight (operation with water)	kg	204	204	204	204
	lb	450	450	450	450
Footprint with IE3 motor ⁵⁾	m ²	1.49	1.49	1.50	1.50
	Foot ²	16.0	16.0	16.1	16.1
Typical motor size					
Max. speed at max. pressure ⁶⁾	kW	132	160	160	200
	HP	200	250	250	300
Max. rpm at max. outlet pressure ⁶⁾	Nm	836	1059	1201	1207
	lbf-ft	617	782	886	890
Noise					
Sound pressure level LPA, 1m ⁷⁾	dB(A)	84-95	84-95	84-93	84-96

¹⁾ For lower and higher pressure, please contact Danfoss High Pressure Pumps.

²⁾ Maximum allowable working pressure at continuous operation. The pump is designed to withstand hydrostatic test pressure (HTP) of 1.5 x MAWP

³⁾ For higher speed, please contact Danfoss High Pressure Pumps

⁴⁾ Typical efficiency at max. pressure after a system has been commissioned and run in

⁵⁾ Maximum area covered with recommended IE3 motor configurations (excl. of space to service the pump)

⁶⁾ IE3 and NEMA, motors, 4-pole, current-insulated ND end bearing

⁷⁾ A-weighted sound pressure level at 1 meter from the pump unit surfaces (reference box) acc. to EN ISO 20361 section 6.2. The noise measurements are performed acc. to EN ISO 3744: 2010 on a motor-pump-unit from min. to max pressure and speed.

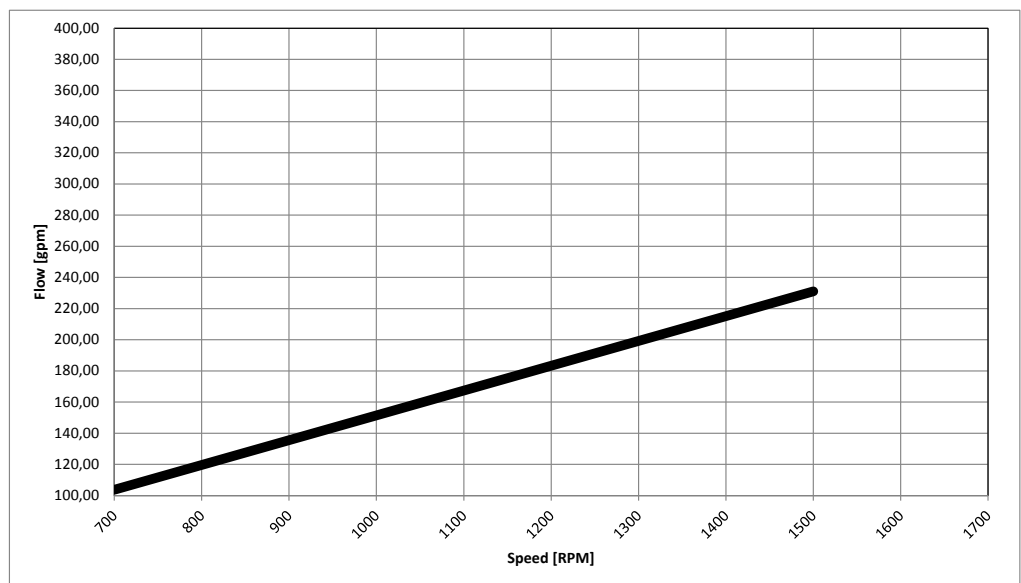
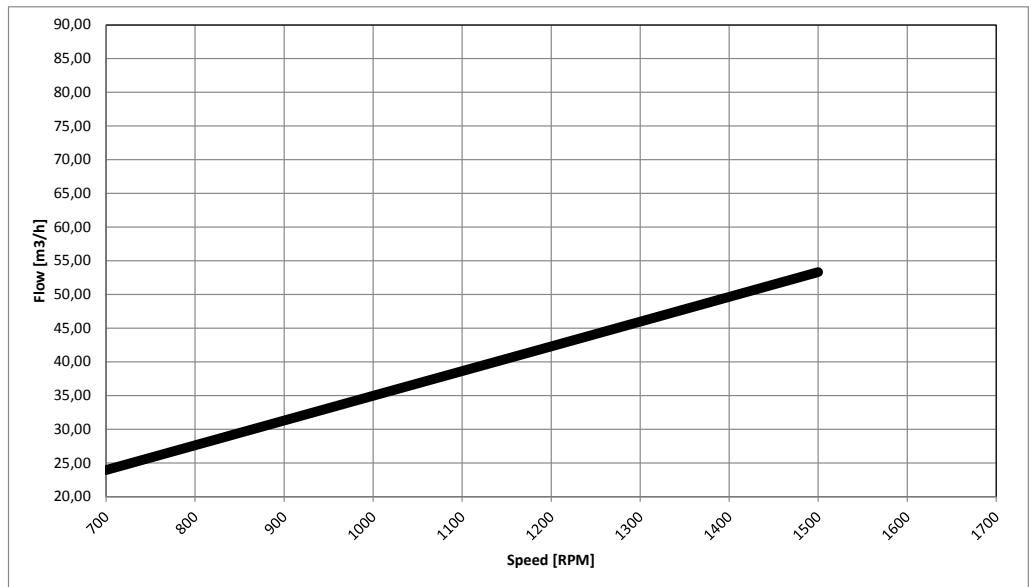
5. Performance curves

If the flow required and the rotation speed (rpm) of the pump is known, it is easy to select the pump, fitting the application best, by using the diagram below.

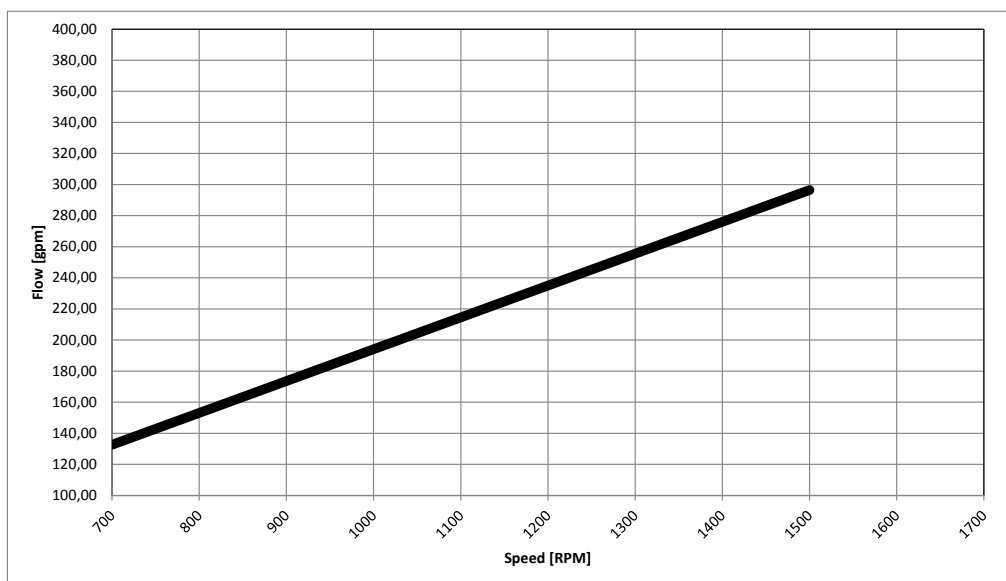
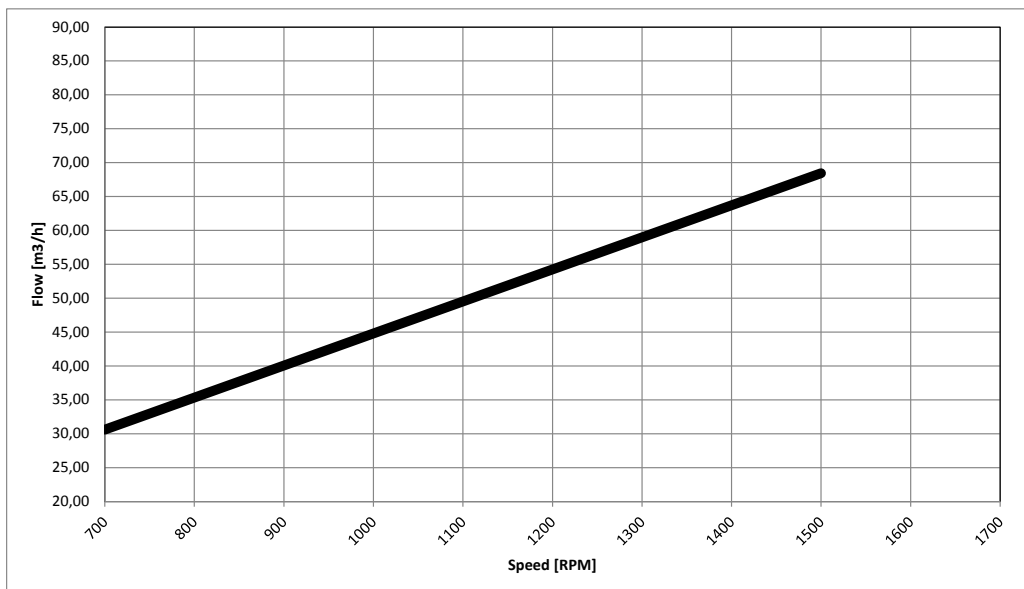
Furthermore, this diagram shows that the flow can be changed by changing the rotation speed of the pump. The flow/rpm ratio is constant, and the "required" flow can be obtained by changing the rotation speed to a corresponding value. Thus, the required rpm can be determined as:

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

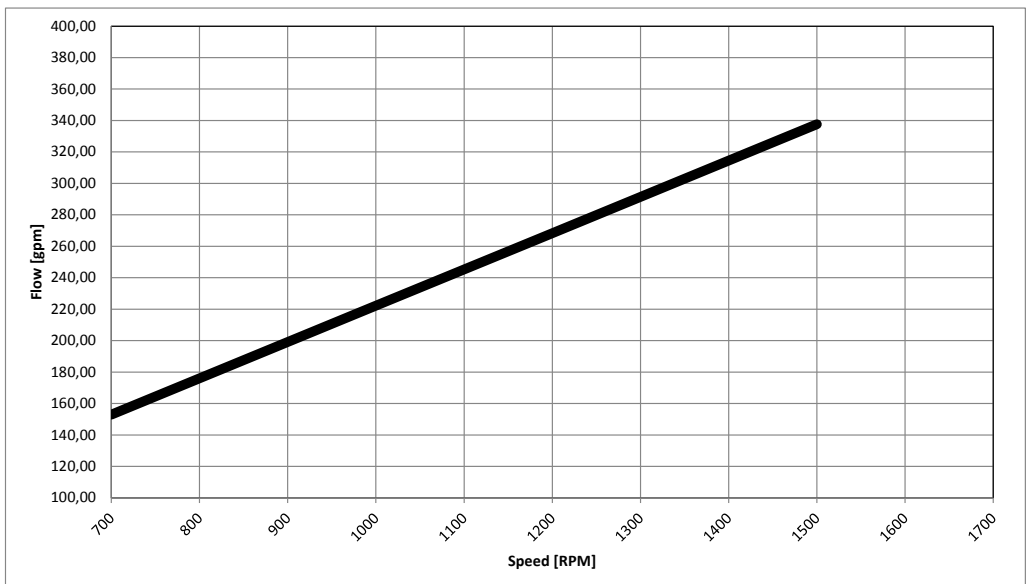
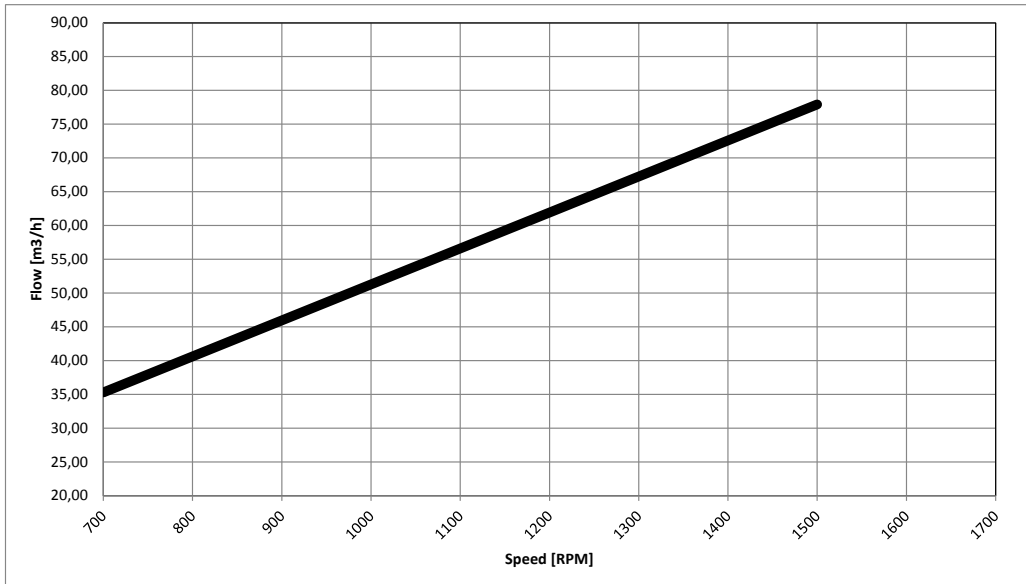
5.1 APP S 674 53 flow at different rpm



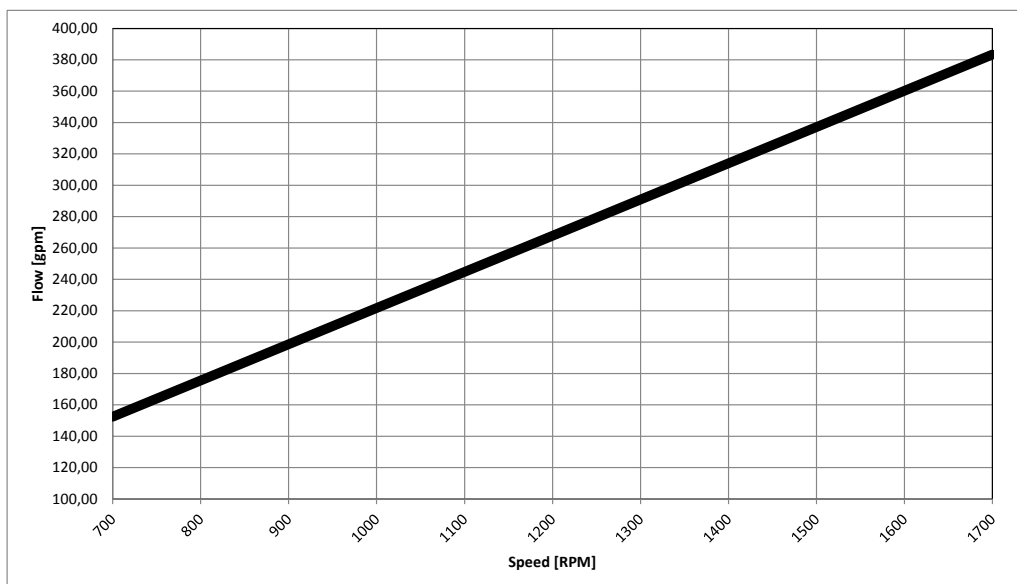
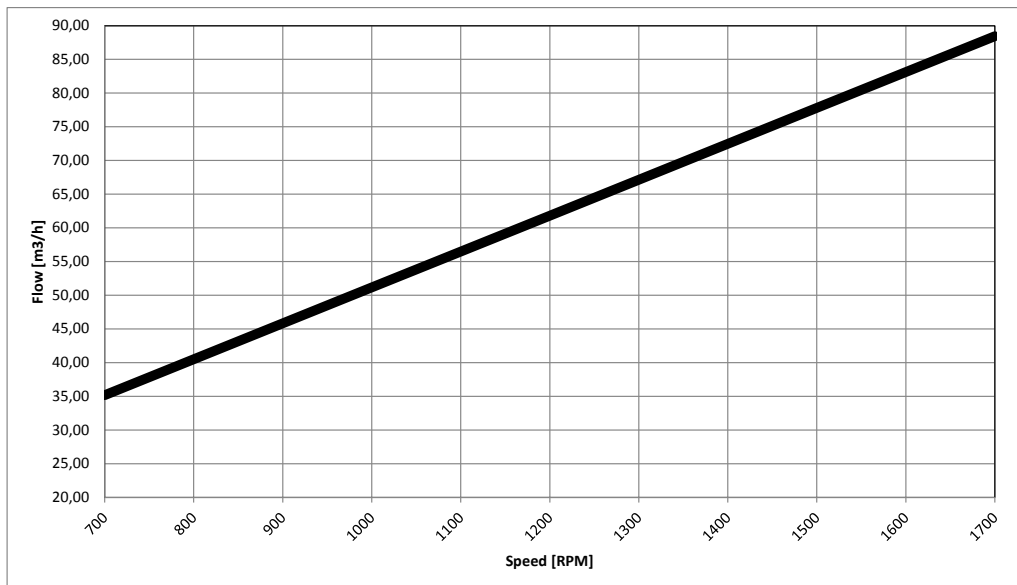
5.2 APP S 674 65 flow at different rpm



5.3 APP S 674 78 flow at different rpm

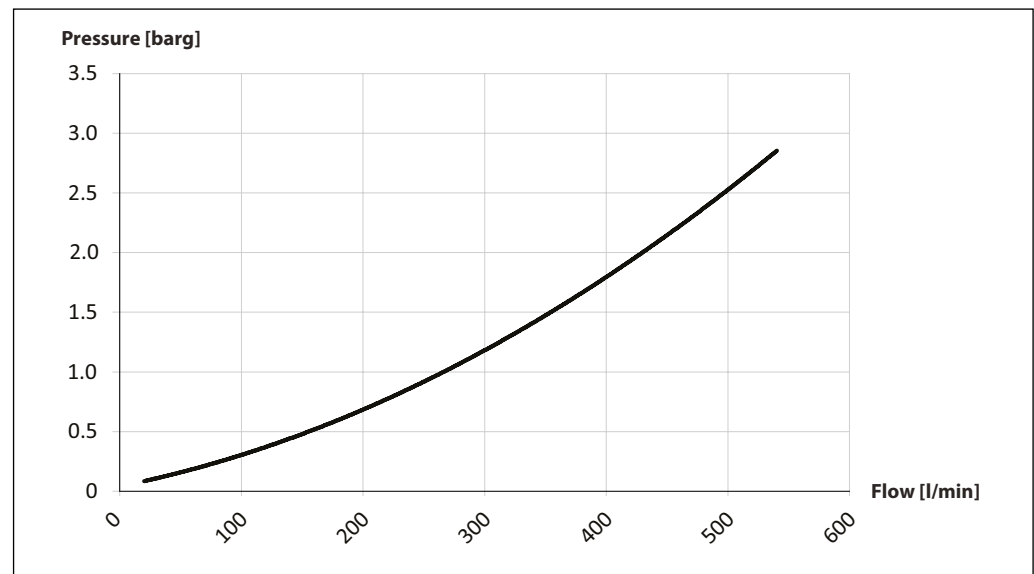


5.3 APP S 674 86 flow at different rpm



6. Flushing valve curves

6.1 APP S 674 53-86 integrated flushing valve



7. Motor requirements

The power requirements can be determined using one of the following guiding equations:

$$\text{Required power} = \frac{\text{l/min} \times \text{barg}}{\text{Calc. factor}} \text{ [kW]} \text{ or } \frac{16.7 \times \text{m}^3/\text{h} \times \text{barg}}{\text{Calc. factor}} \text{ [kW]} \text{ or } \frac{0.26 \times \text{gpm} \times \text{psig}}{\text{Calc. factor}}$$

1 hp	=	0.75 kW
1 gpm	=	3.79 l/min
1 m ³ /h	=	4.40 gpm
1 kW	=	1.34 hp
1 l/min	=	0.26 gpm
1 gpm	=	0.23 m ³ /h

7.1 Calculation factor at 60 barg / 870 psig for APP S 674 53-86

Name	rpm	Calculation factor
APP S 674 53	1500	528
APP S 674 65	1500	534
APP S 674 78	1500	534
APP S 674 86	1700	528

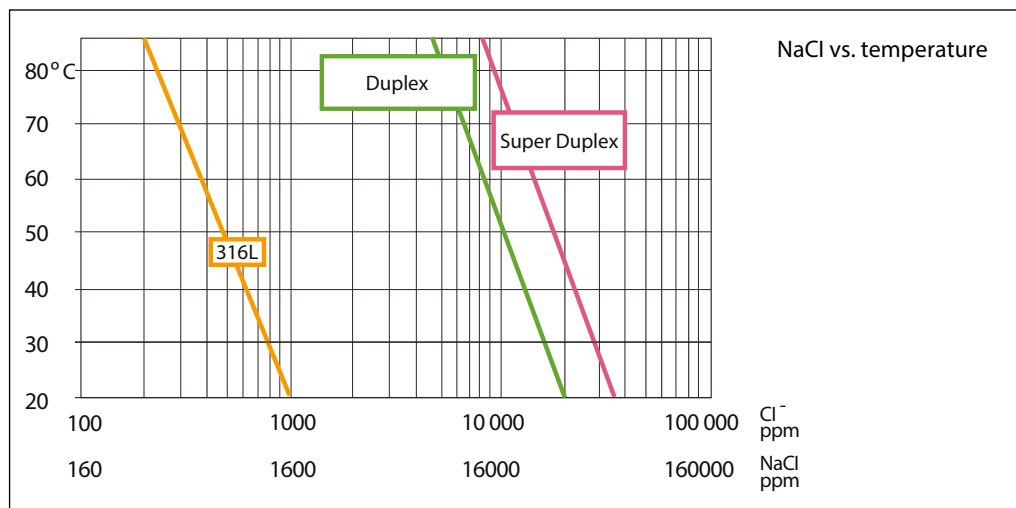
8. Temperature and corrosion

8.1 Operation

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

If the water pump is operated at high salinity always flush the water pump with fresh water at operation stop in order to minimize the risk of crevice corrosion.

All wetted parts of the APP S pump are made of Super Duplex.

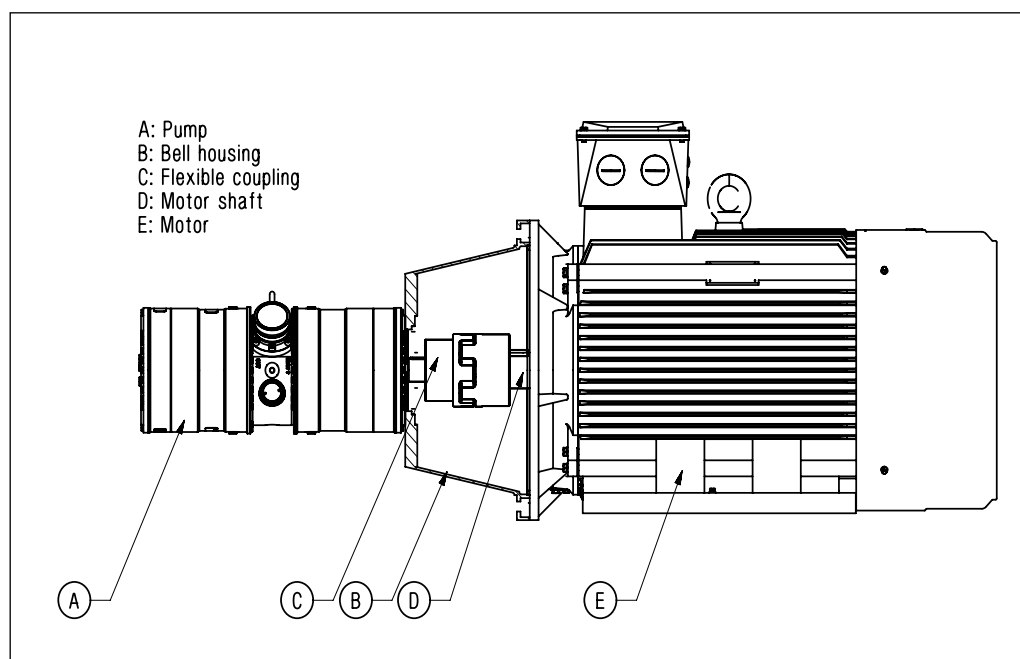


9. Installation

See example below on how to mount the pump and connect it to an electric motor or combustion engine (special coupling).

If alternative mounting is required, please contact your Danfoss sales representative for further information.

Note: Do not add any axial or radial loads to the pump shaft.



9.1 Filtration

Proper filtration is crucial for the performance, maintenance and warranty of your pump.

Protect your pump, and the application in which it is installed, by always ensuring that all filtration specifications are met, and by always changing filter cartridges according to schedule.

Since water has very low viscosity, Danfoss APP pumps have been designed with very narrow clearances in order to control internal leakage rates and improve component performance.

To minimize wear on the pump, it is therefore essential to filter inlet water properly.

The main filter must have a filtration efficiency of 99.98% at 10 µm. We strongly recommend that you always use precision depth filter cartridges rated 10µm abs. $\beta_{10} \geq 5000$.

Please note that we do not recommend bag filters or string-wound filter cartridges, which typically have only 50% filtration efficiency. This means that out of the 100,000 particles that enter such filters, 50,000 particles pass right through; compare this to precision depth filters that are 99.98% efficient, and only allow 20 of the same 100,000 particles to pass through.

For more information on the importance of proper filtration, including explanation of filtration principles, definitions and guidance on how to select the right filter for your pump, please consult our Filtration information and specifications (Danfoss document number 521B1009).

9.2 Noise

Since the pump unit is typical mounted on a frame or bell housing the overall noise level can only be determined for a complete system. To minimize vibrations and noise throughout the system, it is therefore very important to mount the pump unit correctly on a frame with anti-vibration-dampeners, and to use flexible hoses rather than metal pipes where possible.

The noise level is influenced by:

- **Pump speed:**
High rpm generates more fluid/structure borne pulsations/vibrations than low rpm, because of higher frequency.
- **Discharge pressure:**
High pressure generates more noise than low pressure.
- **Pump mounting:**
Rigid mounting generates more noise than flexible mounting, because of structure-borne vibrations. Be sure to use dampeners when mounting.
- **Connections to pump:**
Pipes connected directly to the pump make more noise than flexible hoses, because of structure-borne vibrations.

- **Variable frequency drives (VFD):**
Motors regulated by VFDs can produce more noise if the VFD does not have the right settings.

9.3 RO system with direct supply:

Inlet line:

- a) Dimension the inlet line to obtain minimum pressure loss (large flow, minimum pipe length, minimum number of bends/connections, and fittings with low or no pressure losses) .

Inlet filter:

- b) Install an inlet filter (1) in front of the APP S 674 pump (2). Please consult section 9.1, "Filtration" for guidance on how to select the right filter. Thoroughly clean pipes and flush system prior to start-up.

Inlet pressure:

- c) In order to eliminate the risk of cavitation and other pump damage, pump inlet pressure must always be maintained according to specifications described in item 4 about technical data.

Low pressure relief valve:

- d) Install a low pressure relief valve (9) in order to avoid system or pump damage in case the pump stops momentarily or is spinning backwards.

Monitoring pressure switch:

- e) Install a monitoring pressure switch (2) between the filter (1) and the pump inlet. Set the minimum inlet pressure according to specifications described in item 4 about technical data. If the inlet pressure is lower than the minimum pressure set, the monitoring pressure switch must prevent the pump from starting or from running.

Hoses:

- f) Always use flexible hoses (4) to minimize vibrations and noise. Please consult the Danfoss Hoses and hose fittings data sheet (521B0909) for guidance.

Flushing valve:

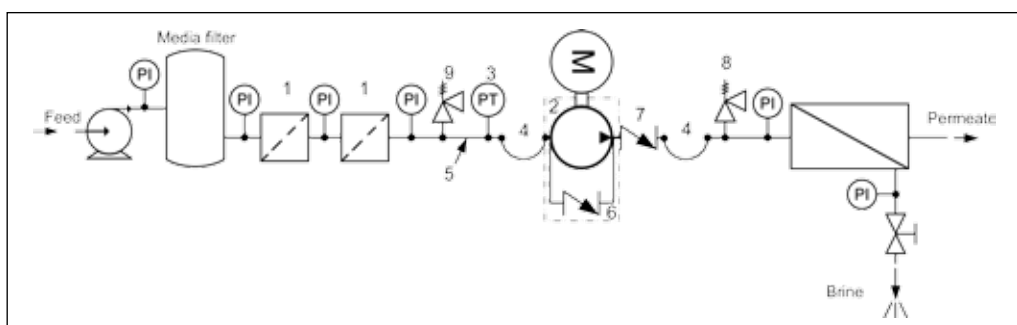
- g) For easy system filling and flushing, an integrated flushing valve (6) is in the APP S 674 pump.

Non-return valve:

- h) 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 the pump stops momentarily.

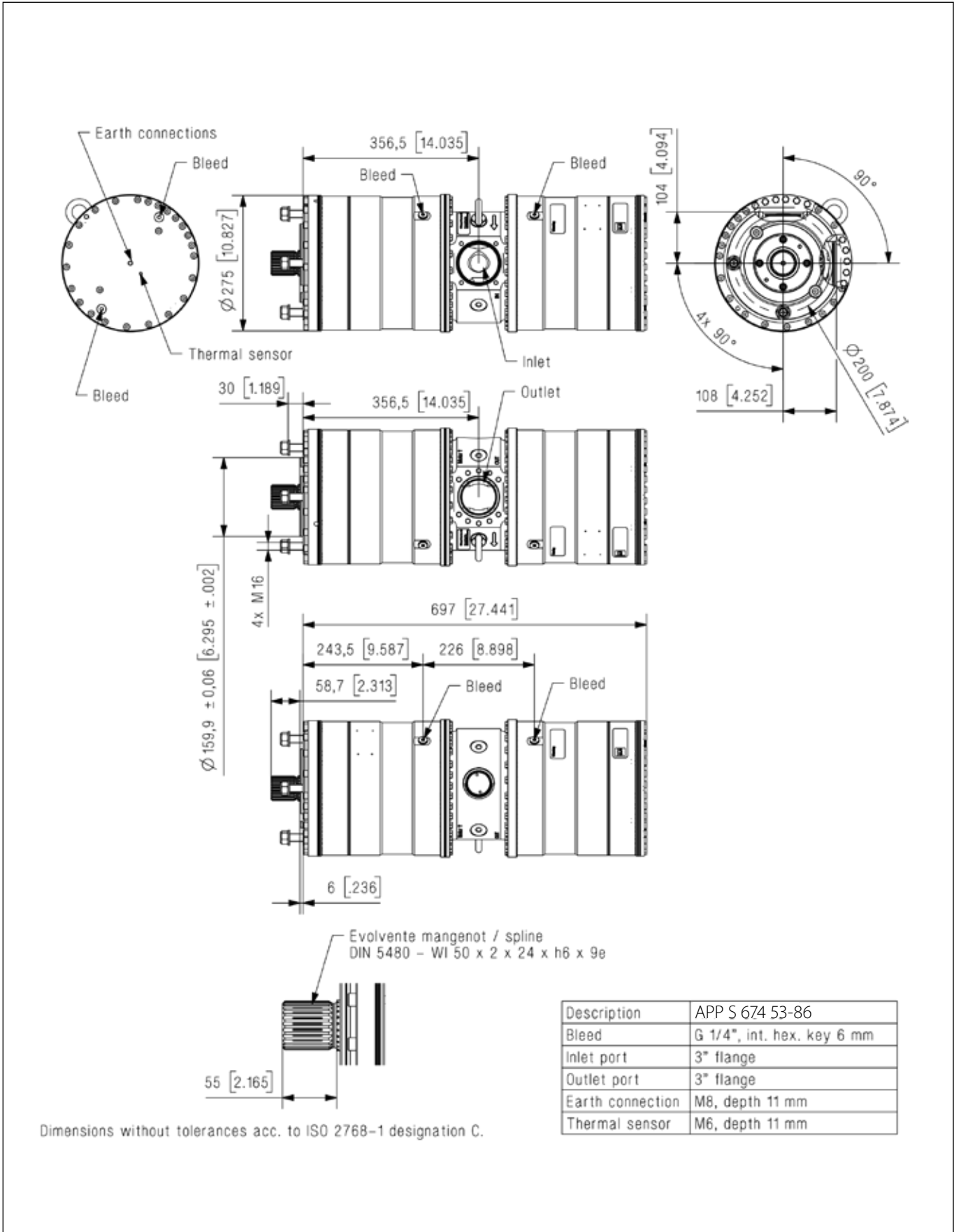
- High pressure safety or relief valve:**
- i) As the Danfoss APP S 674 pump begins to create pressure and flow immediately after start-up and regardless of any counter pressure, a safety or pressure relief valve (8) should be installed after the non-return valve to prevent system damage and to avoid high pressure peaks.

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

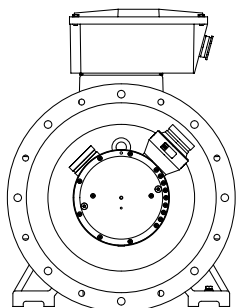


10. Dimensions and connections

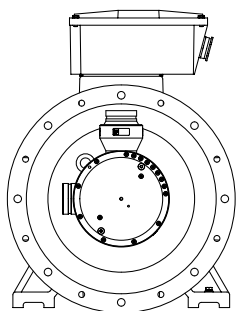
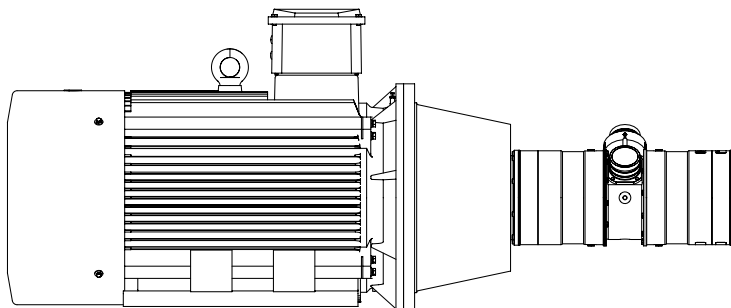
10.1 APP S 674 53-86



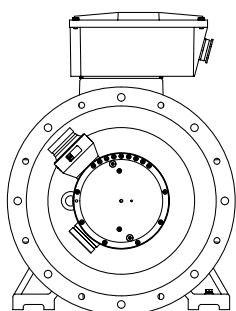
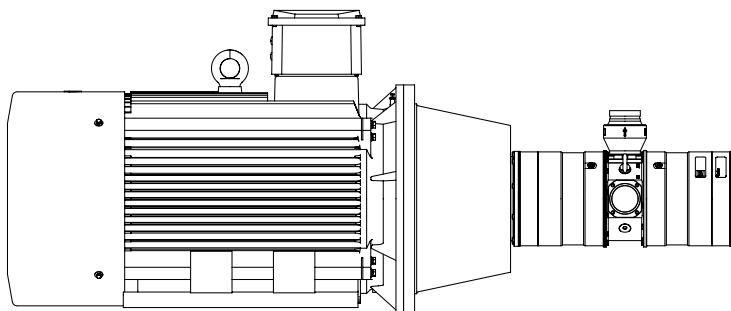
The APP S 674 53-86 connections (inlet and outlet) can be adjusted in intervals of 45 degrees. Please see typical installations in the drawing below.



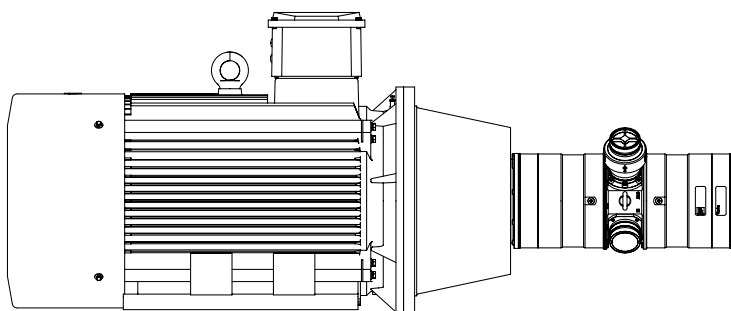
Standard configuration



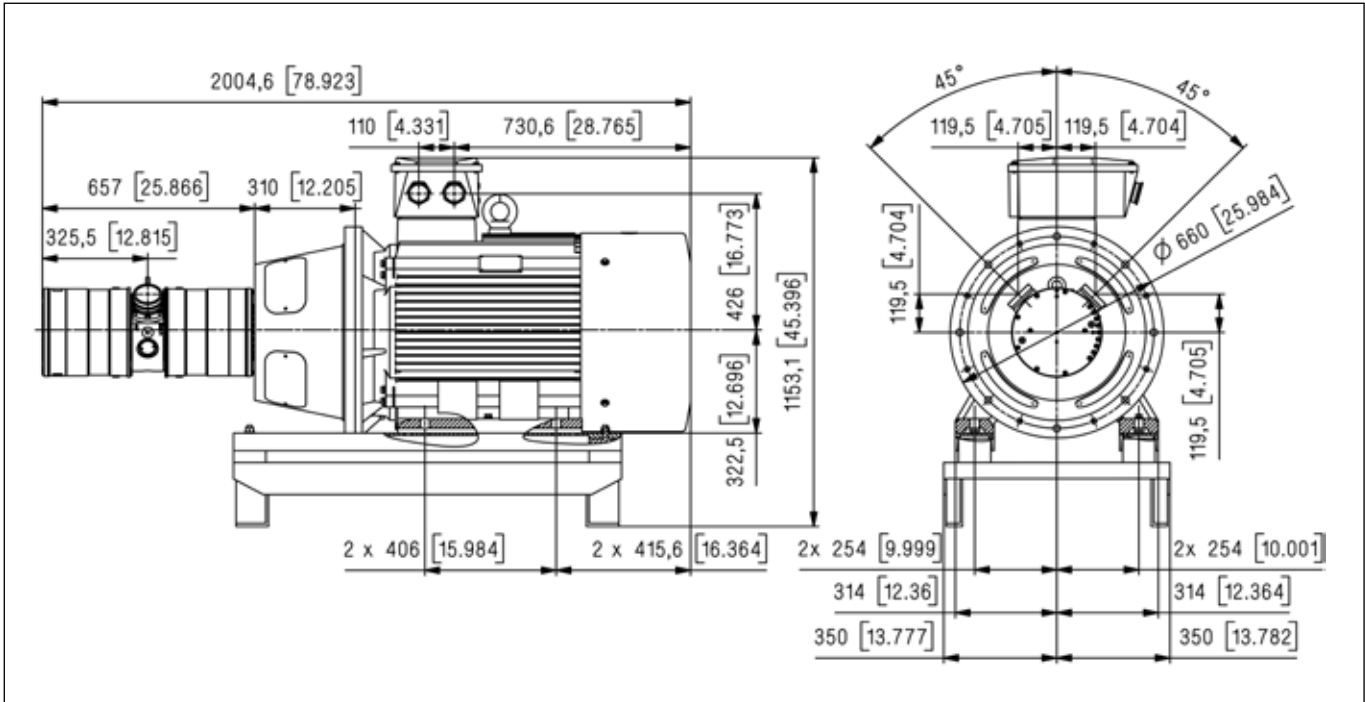
On request from factory or adjusted on site



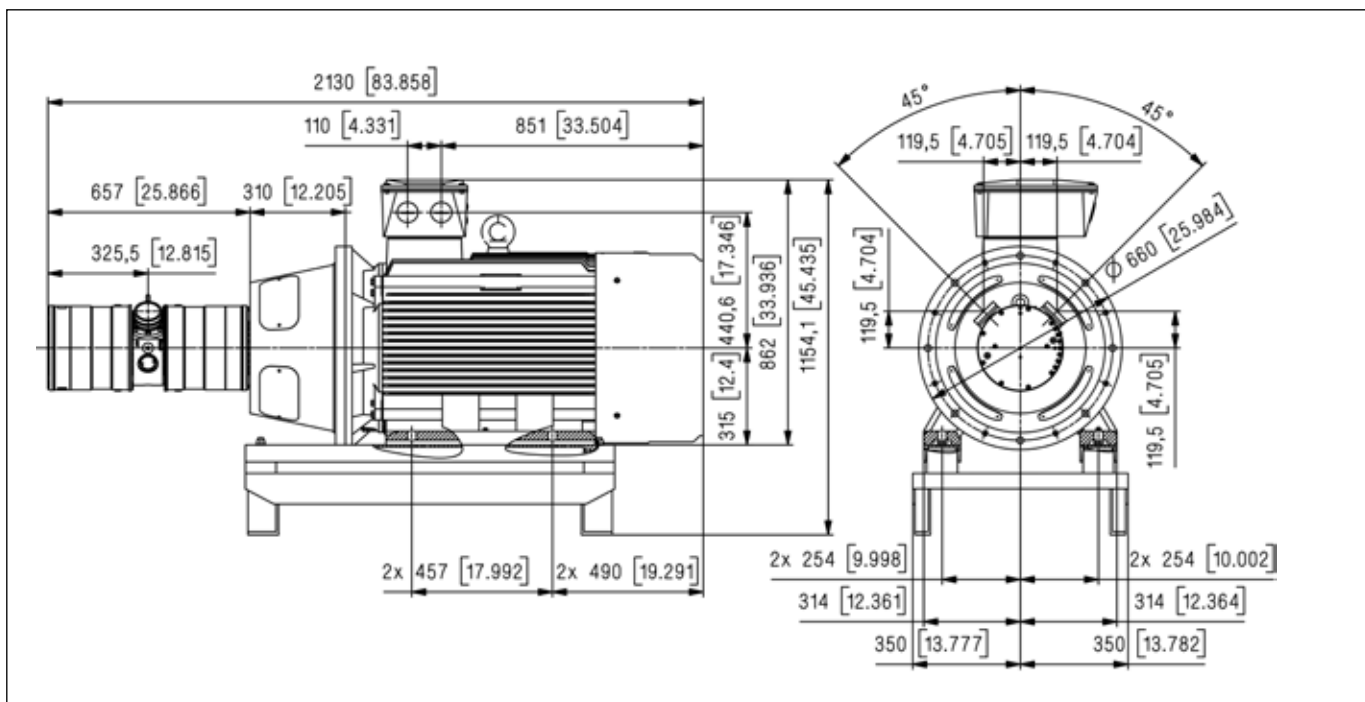
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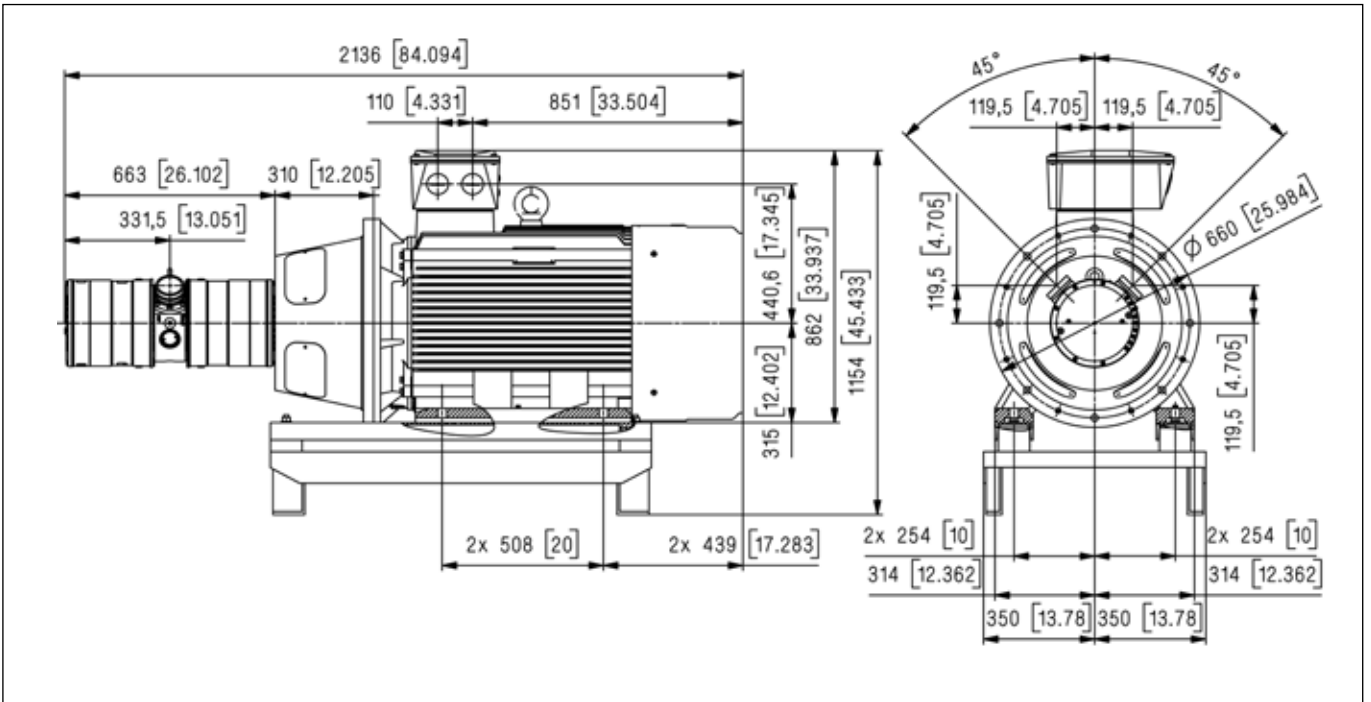
10.2 APP S 674 53-86 with IEC motor 110 kW



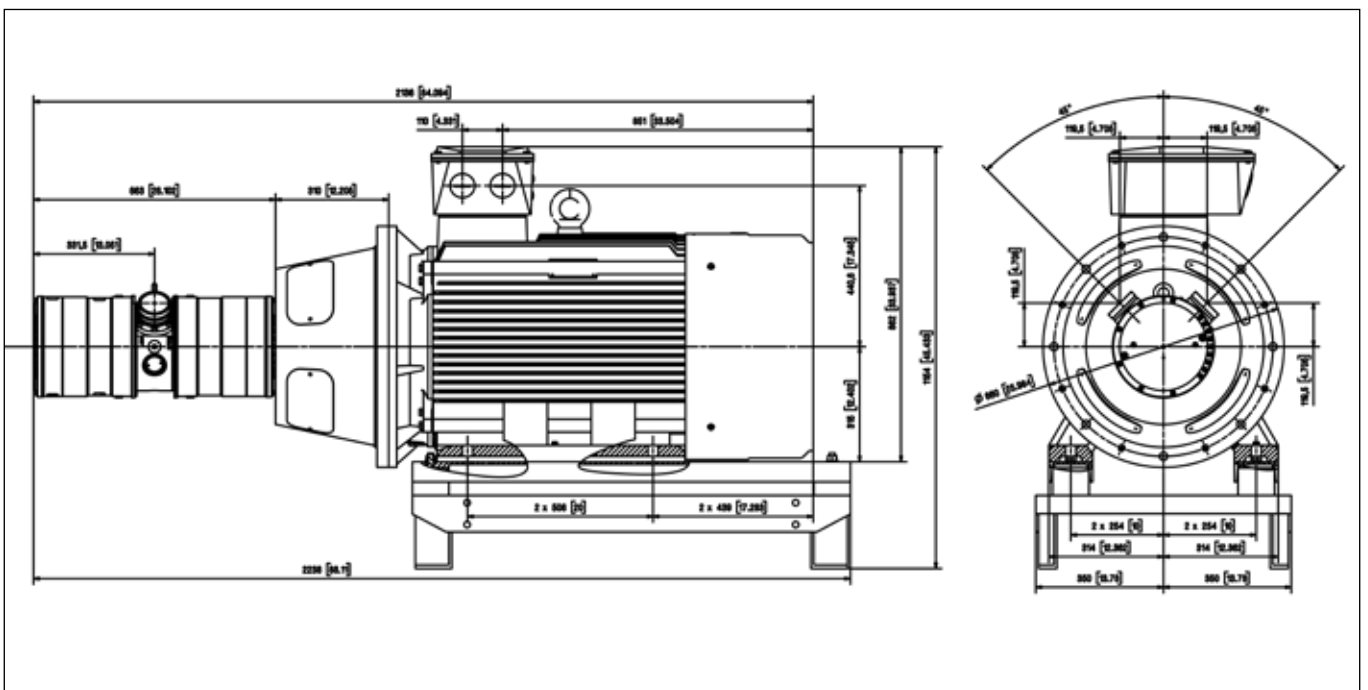
10.3 APP S 674 53-86 with IEC motor 132 kW



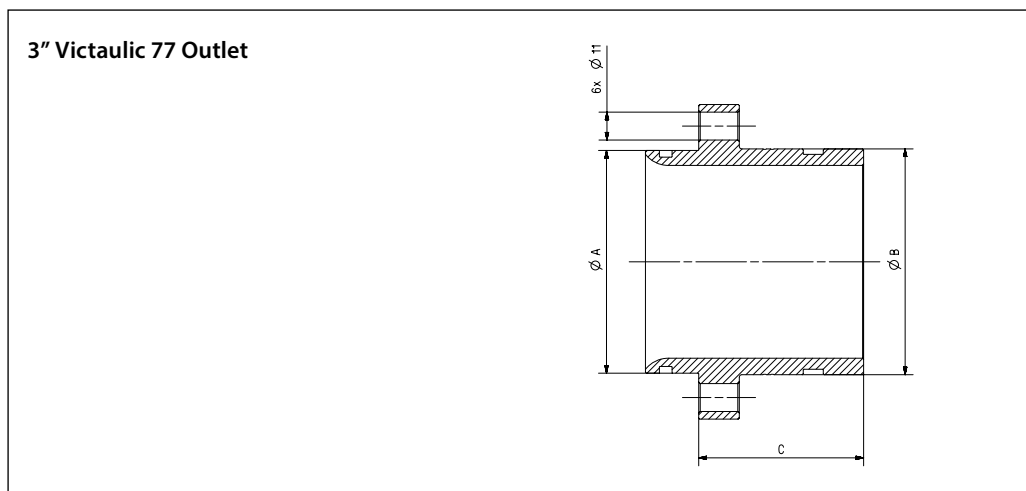
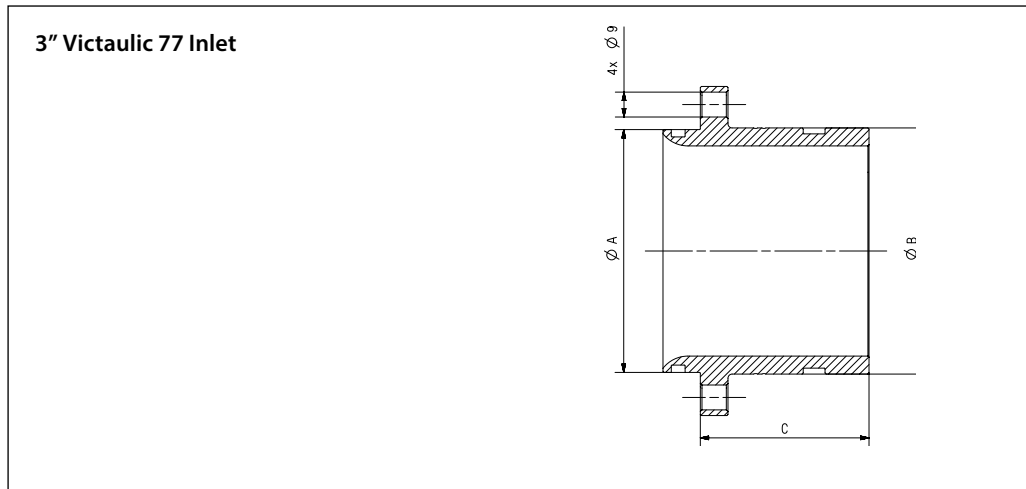
10.4 APP S 674 53-86 with IEC motor 160 kW



10.5 APP S 674 53-86 with IEC motor 200 kW



11. Pump connections



Connection	Diameter (A)	Victaulic (B)	Length (C)	Material	Max. Pressure	Code number
3" Inlet connector	87.8 mm	3" Victaulic	61.0 mm (2.40")	Super Duplex	10 barg (1450 psig)	180Z0654
3" outlet connector	87.8 mm	3" Victaulic	65.0 mm (2.56")	Super Duplex	80 barg (1160 psig)	180Z0655

12. Accessories

Accessories	Type	Code number
3" Inlet hose kit - 2 m (79") 6 barg	3" Victaulic	180Z0144
3" Outlet hose - 1 m (39.4") 80 barg	3" Victaulic	180Z0611
Coupling APP 53 - APP 86	Softex 80H7-50H7	180Z0659
Coupling kit APP 53 - APP 86 incl. bell housing	ø660/310	180Z0660
Base frame incl. vibration dampeners	IEC 315	180Z0661

13. Service**Warranty**

Danfoss APP S 674 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 S 674 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 S 674 pumps are made of Super Duplex materials with excellent corrosion properties. It is, however, always recommended to flush the pump with freshwater when the system is shut down.

Repair

In case of irregular function of the APP S 674 pump, please contact Danfoss High Pressure Pumps.

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