



Pump

APP 53-92 pumps

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

Description

The Danfoss range of APP high-pressure pumps is designed according to EN 809 for use in RO applications with low viscosity and corrosive fluids such as sea water.

Danfoss APP 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 sectional drawing below illustrates the main components of the APP 53-92 pump range.

Features & benefits

- Zero risk of lubricant contamination
 - Oil lubricants are replaced with the pumped medium, water, so there is no contamination risk from the pump
- Low maintenance costs
 - Efficient design and all-stainless steel construction ensure exceptionally long life. When Danfoss specifications are met, service intervals of 8,000 hours can be expected. Service is easy, and can be carried out on-site due to the simple design and few parts
- Low energy costs
 - The highly efficient axial piston design provides the lowest energy consumption of any comparable pump on the market
- Easy installation
 - No pulsation dampeners necessary due to extremely low pressure pulsation
 - Powered directly by electric motors or combustion engines (with special coupling)
 - All pumps are supplied with an integrated flushing valve that allows the fluid to flow from inlet to the outlet, when the pump is not running
- High reliability
 - All parts are made of high corrosion resistant materials e.g. Duplex (EN1.4462/ UNS S31803) and Super Duplex (EN1.4410/UNS S32750) stainless steel and carbon reinforced PEEK
- Certified quality
 - ISO 9001, ISO 14001, IAFT 16949
 - ATEX certification available for APP S (all Super Duplex) and APP S 674 (API)

Applications

Danfoss APP pumps are built into a broad range of RO desalination plants around the world:

- Containerized solutions for hotels, resorts and residences on islands and in coastal regions
- Mobile systems for humanitarian and military organizations
- Onboard systems for ships and yachts
- Offshore platforms for the oil and gas industry
- Municipal and regional waterworks

Ordering

Product code numbers

APP 53-92

Pump size		APP 53/1500	APP 65/1500	APP78 /1500	APP 86/1700	APP 92/1780
Code number		180B7806	180B7807	180B7808	180B7809	180B7810
Geometric displacement	cm ³ /rev.	617	778	888	888	888
	in ³ /rev.	37.7	47.3	54.2	54.2	54.2
Pressure						
Max. outlet ¹⁾ pressure (MAWP)	barg	83	83	83	70	70
	psig	1,200	1,200	1,200	1,015	1,015
Min. inlet operating pressure	barg	2	2	2	2.5	3.5
	psig	29	29	29	36	50
Max. inlet operating pressure	barg	5	5	5	5	5
	psig	73	73	73	73	73
Max. inlet pressure peak	barg	10	10	10	10	10
	psig	145	145	145	145	145
Min. outlet pressure	barg	30	30	30	30	30
	psig	435	435	435	435	435
Speed						
Min. speed continuous	rpm	700	700	700	700	700
Max. speed continuous	rpm	1,500	1,500	1,500	1,700	1,780
Flow						
Min. flow	m ³ /h	24	32	36	36	36
	gpm	106	141	158	158	158
700 rpm at max. pressure	m ³ /h	24	32	36	36	36
	gpm	106	141	158	158	158
1000 rpm at max. pressure	m ³ /h	35	45	52	52	52
	gpm	154	198	228	228	228
1200 rpm at max. pressure	m ³ /h	42	54	62	62	62
	gpm	187	238	275	275	275
1500 rpm at max. pressure	m ³ /h	53	68	78	78	78
	gpm	235	299	345	345	345
1700 rpm at max. pressure	m ³ /h				88	88
	gpm				387	387
1780 rpm at max. pressure	m ³ /h					92
	gpm					405
Efficiency						
1000 rpm ³⁾	%	88	88	89	89	89
1200 rpm ³⁾	%	89	89	90	89	89
1500 rpm ³⁾	%	88	89	89	88	88
1700 rpm ³⁾	%				88	88
1780 rpm ³⁾	%					87

Pump size		APP 53/1500	APP 65/1500	APP 78/1500	APP 86/1700	APP 92/1780
Code number		180B7806	180B7807	180B7808	180B7809	180B7810
Technical specifications						
Media ²⁾ temperature	°C	2 – 50	2 – 50	2 – 50	2 – 50	2 – 50
	°F	36 – 122	36 – 122	36 – 122	36 – 122	36 – 122
Ambient temperature	°C	0 – 50	0 – 50	0 – 50	0 – 50	0 – 50
	°F	32 – 122	32 – 122	32 – 122	32 – 122	32 – 122
Weight (dry)	kg	196	196	196	196	196
	lb	432	432	432	432	432
Weight (operation) ⁶⁾	kg	204	204	204	204	204
	lb	450	450	450	450	450
Sound pressure level	db(A)	84 – 95	84 – 95	84 – 93	84 – 96	84 – 96
Footprint with IE3 motor ⁴⁾	m ²	1.49	1.49	1.5	1.5	1.5
	Foot ²	16	17	16.1	16.1	16.1
Typical motor size						
Max. speed at max. pressure ⁵⁾	kW	132	160	160	200	200
	HP	200	250	250	300	300

¹⁾ Max. allowable working pressure at continuous operation. The pump is designed according to EN809, i.e. to withstand hydrostatic test pressure (HTP) of 1.3 x MAWP. For lower and higher pressure, please contact Danfoss.

²⁾ Dependent on the NaCl concentration.

³⁾ Typical efficiency at max. pressure after a system has been commissioned and run in.

⁴⁾ Maximum area covered with recommended IE3 motor configurations (excl. of space to service pump).

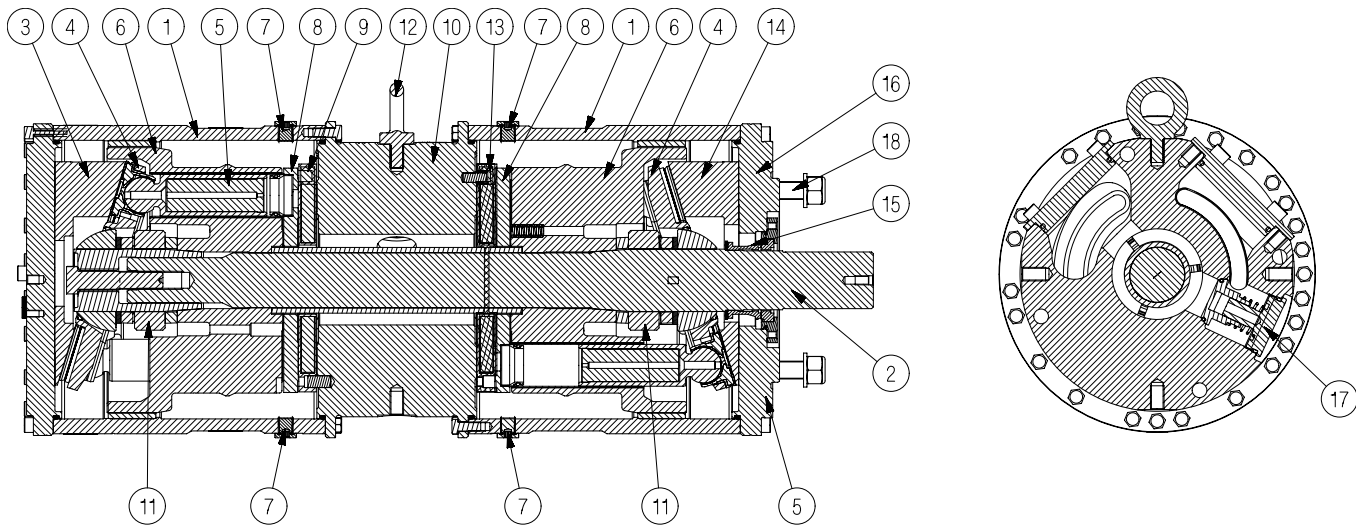
⁵⁾ IE3 and NEMA motors, 4-pole, current insulated ND non drive end bearing.

⁶⁾ Operating with water.



Product details

General data



1.	Housing
2.	Shaft
3.	Swash plate (non drive end)
4.	Retainer plate
5.	Piston
6.	Cylinder barrel
7.	Bleeding / drain plug
8.	Valve plate
9.	Port plate (non drive end)
10.	Center flange
11.	Spring cartridge
12.	Eye bolt
13.	Port plate (drive end)
14.	Swash plate (drive end)
15.	Shaft seal
16.	Motor flange
17.	Flushing valve
18.	Tail stock screws

Pressure and temperature data

Motor requirements

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

$$\text{Required power} = \frac{l/\text{min} \times \text{barg}}{\text{Calc. factor}} \text{ [KW]} \text{ or } \frac{16.7 \times \text{m}^3/\text{h} \times \text{barg}}{\text{Calc. factor}} \text{ [KW]} \text{ or } \frac{0.35 \times \text{gpm} \times \text{psig}}{\text{Calc. factor}} \text{ [HP]}$$

- 1 hp = 0.75 kW
- 1 gpm = 3.79 l/min
- 1 m³/h = 4.40 gpm
- 1 kW = 1.34 hp
- 1 l/min = 0.26 gpm
- 1 gpm = 0.23 m³/h



Calculation factor at 60 barg / 870 psig for APP 53-92

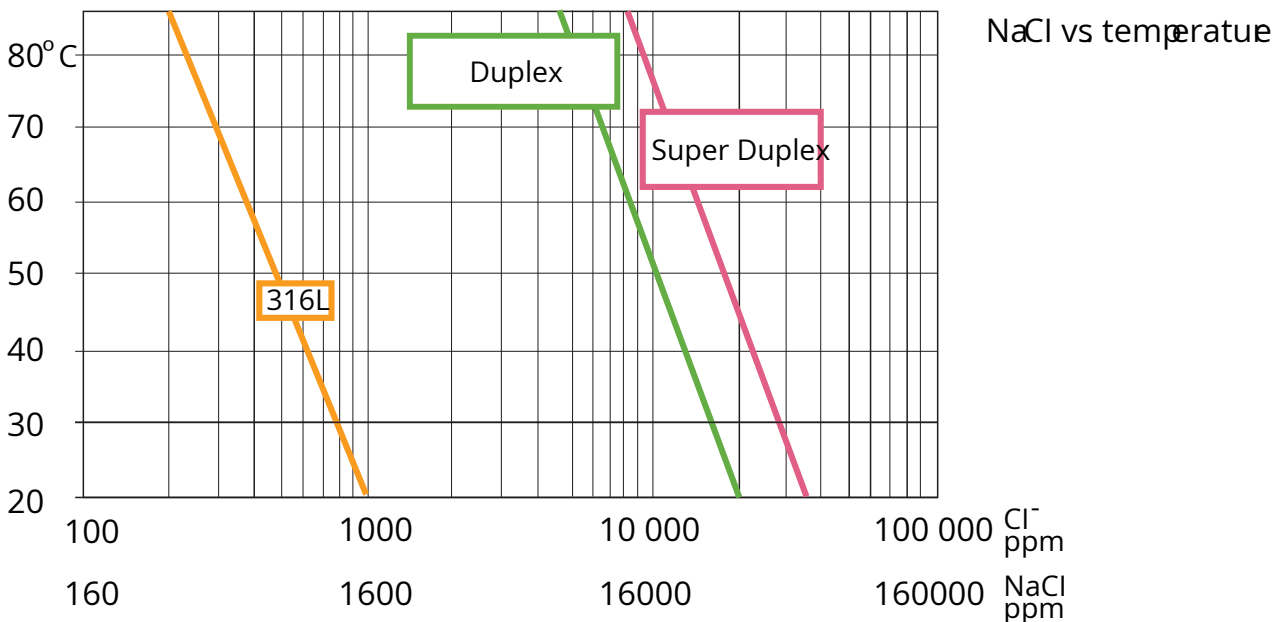
Name	rpm	Calculation factor
APP 53	1500	528
APP 65	1500	534
APP 78	1500	534
APP 86	1700	528
APP 92	1780	522

Temperature and corrosion

Operation

The chart below illustrates the corrosive resistance of different types of stainless steel related to NaCl concentration and temperature. All wetted parts of the APP pump are made of Duplex or Super Duplex.

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.



Performance and environmental conditions

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:

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



Figure: APP 53 flow at different rpm

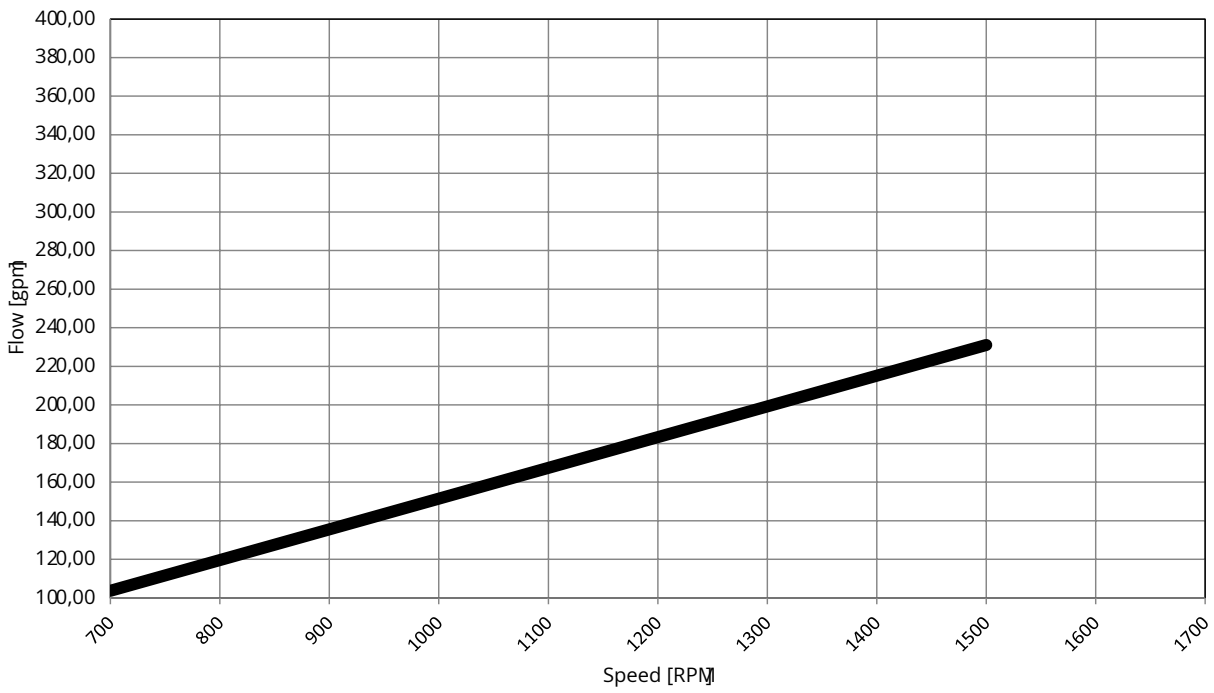
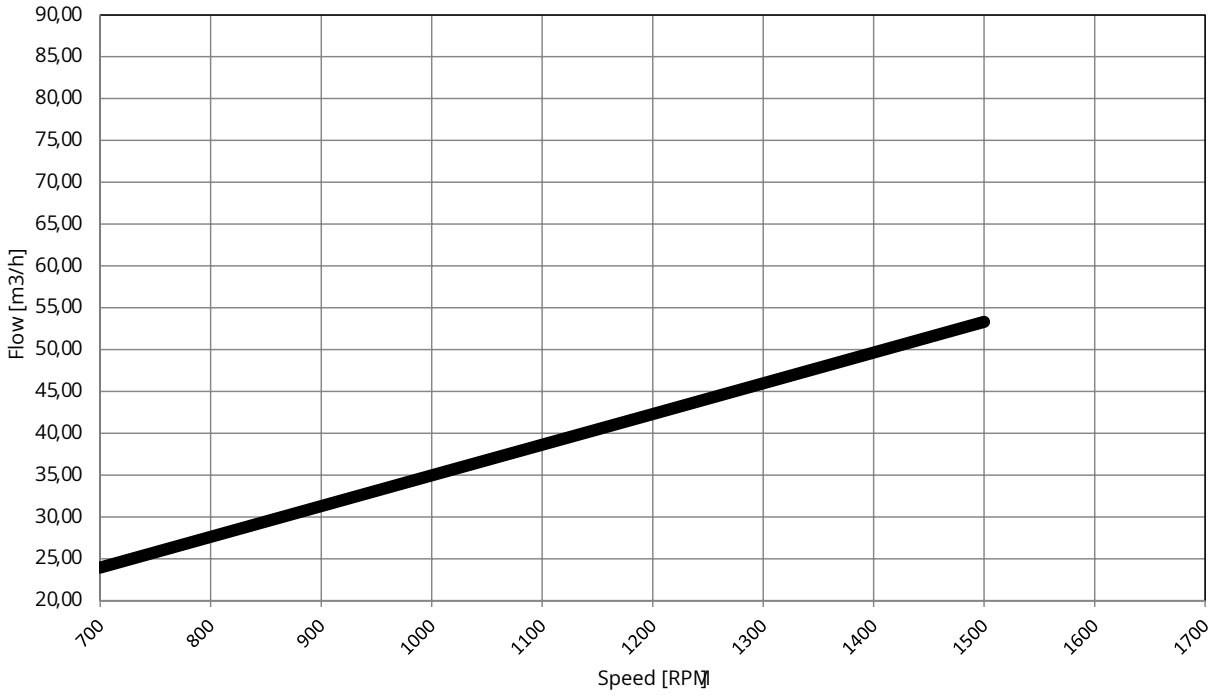


Figure: APP 65 flow at different rpm

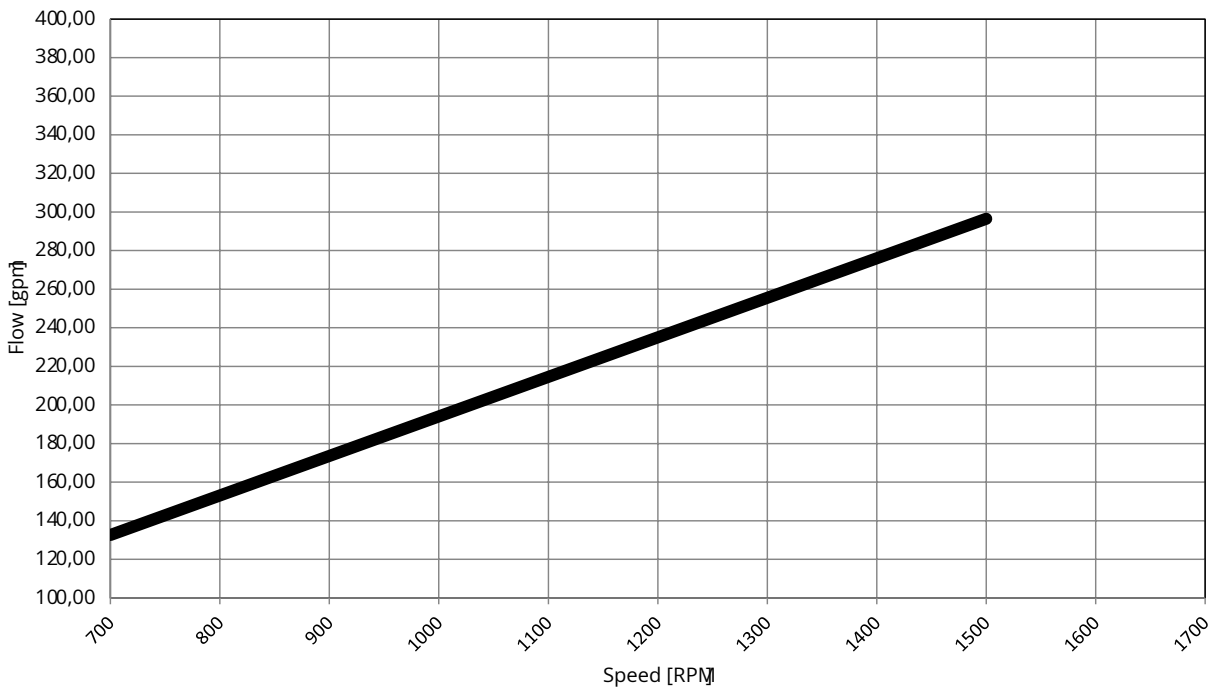
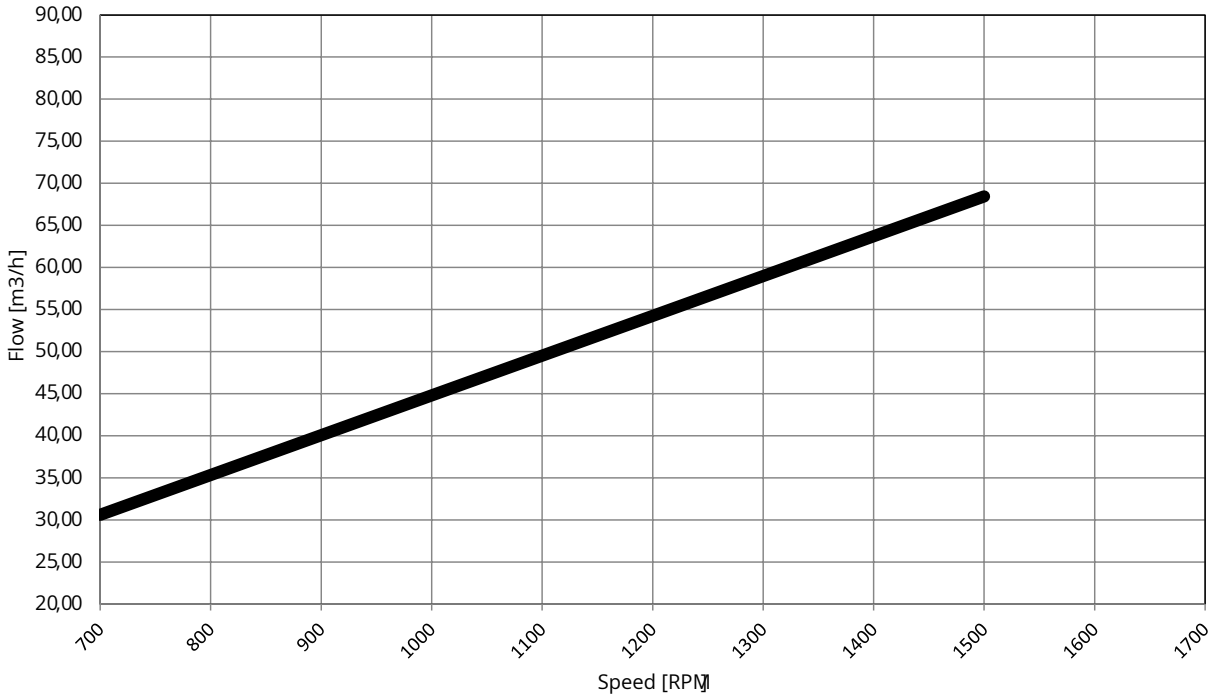




Figure: APP 78 flow at different rpm

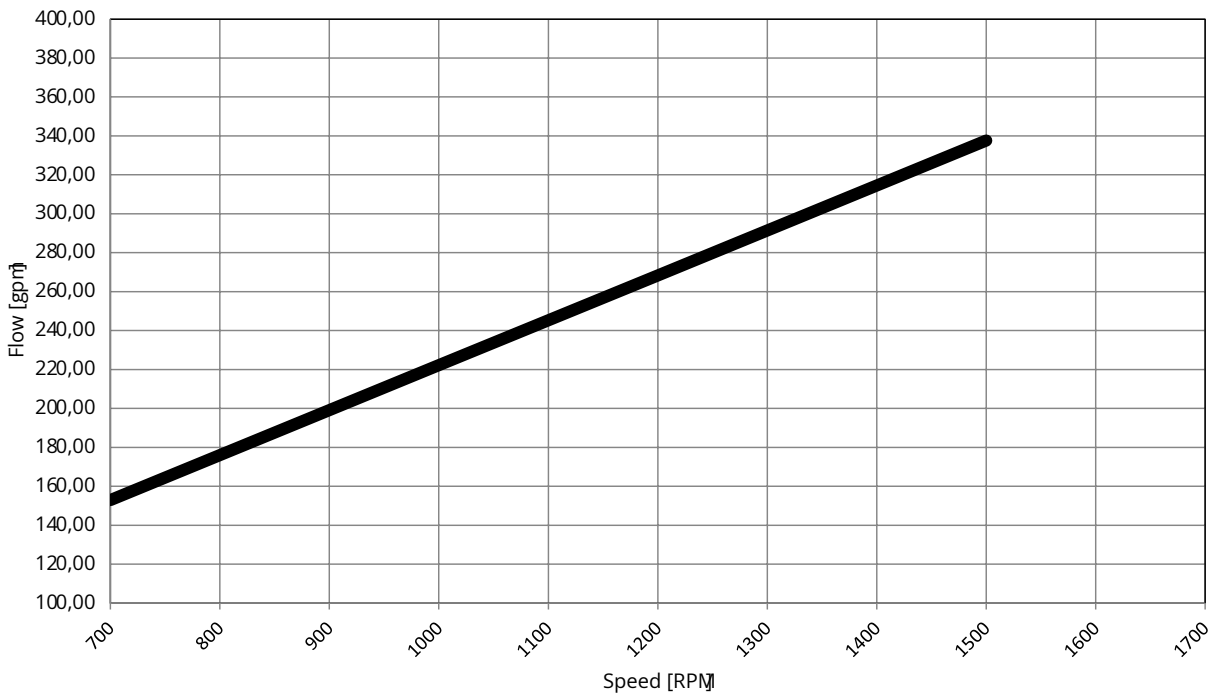
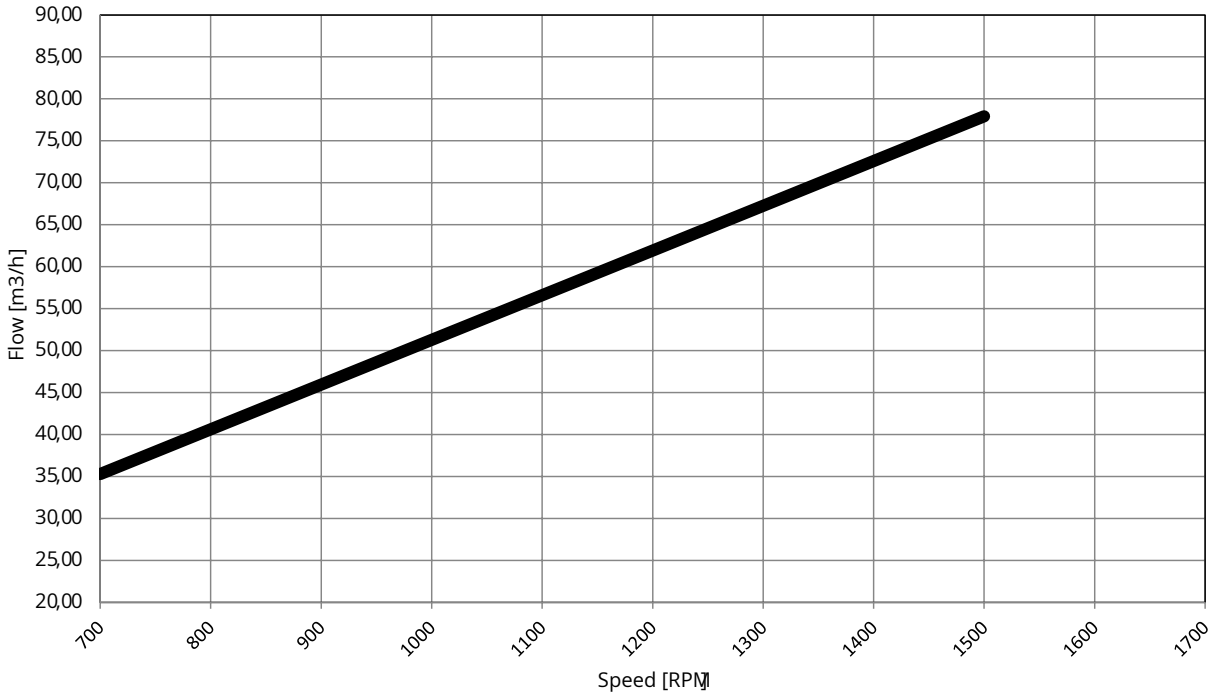




Figure: APP 86 flow at different rpm

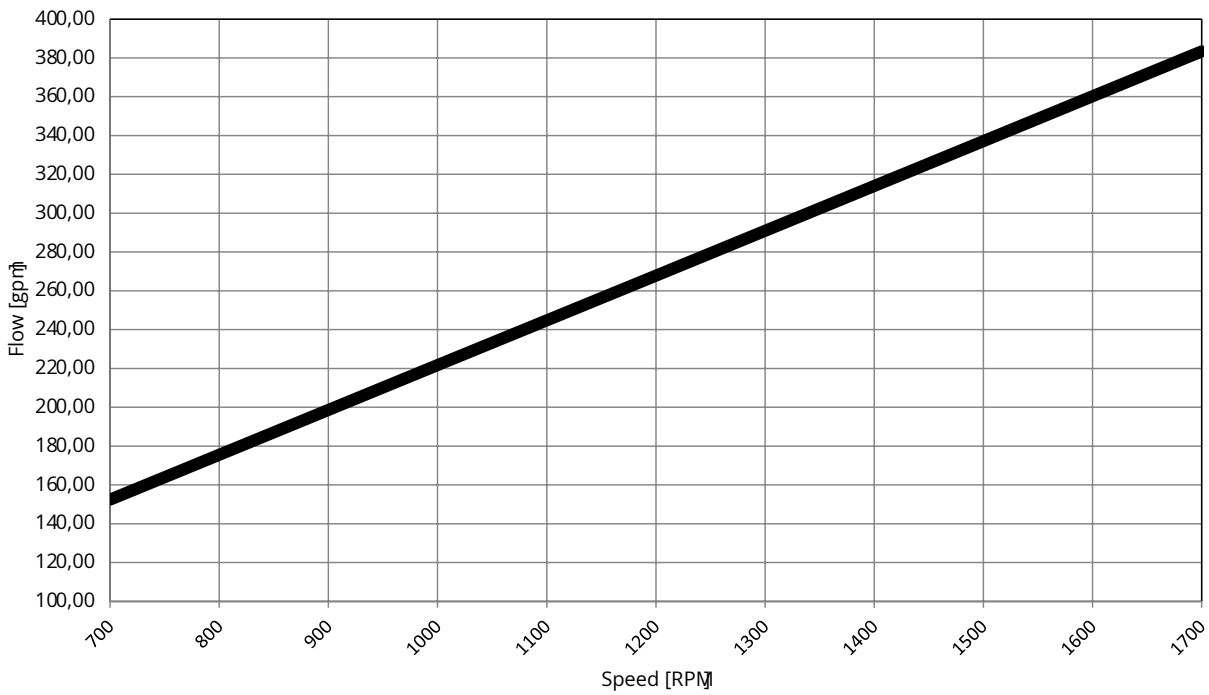
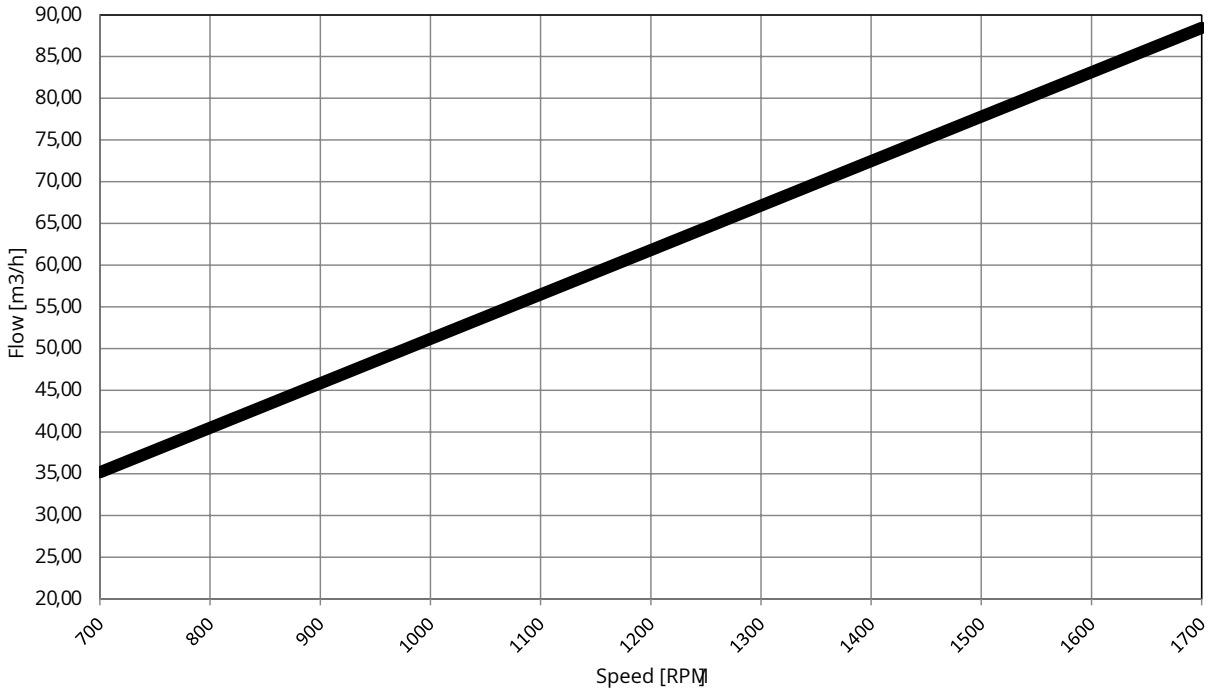
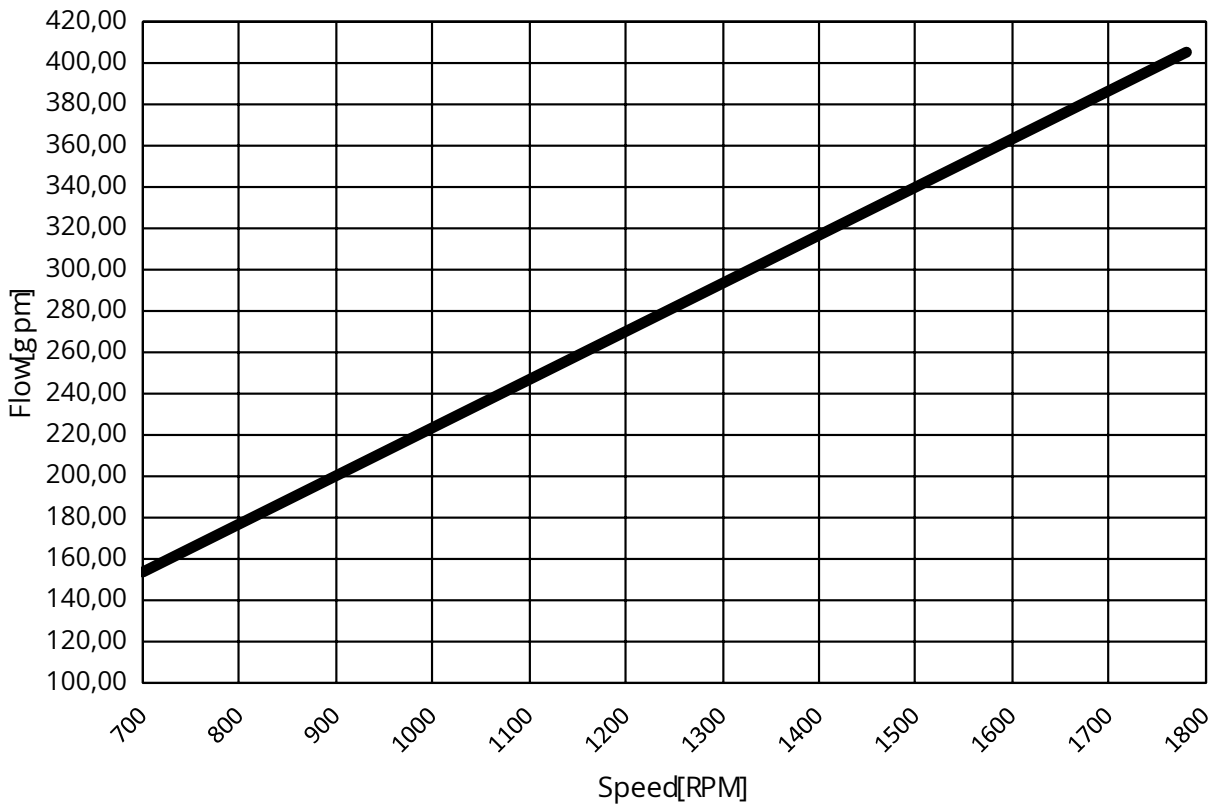
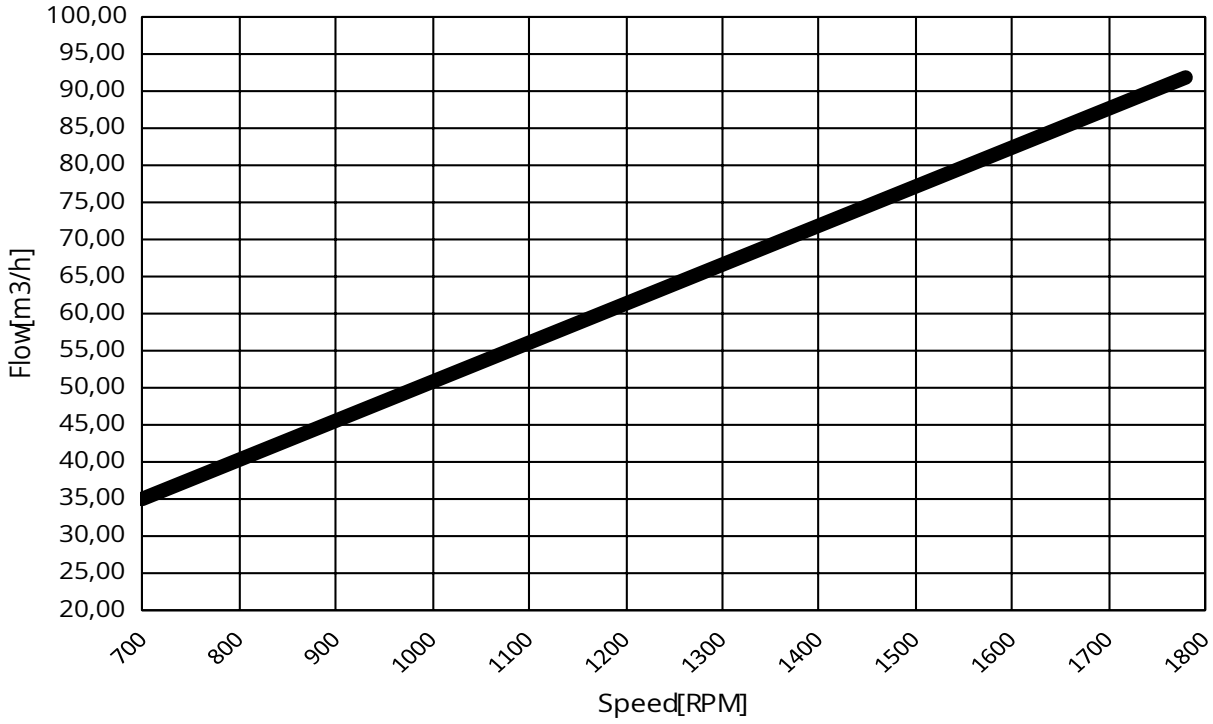


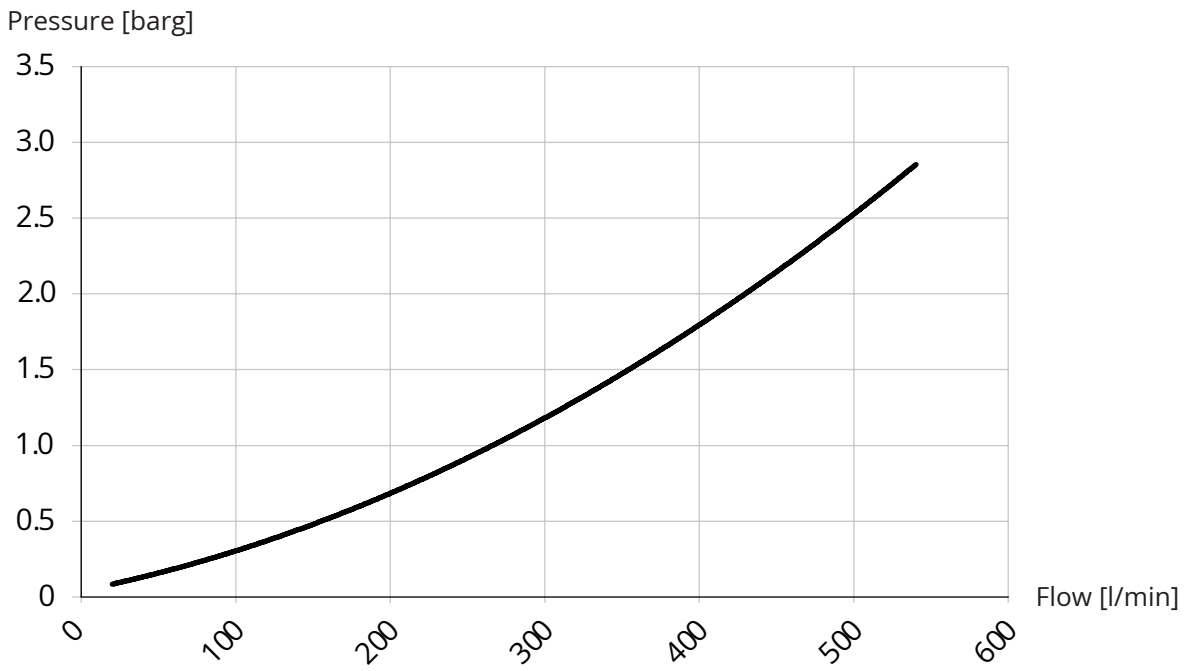
Figure: APP 92 flow at different rpm





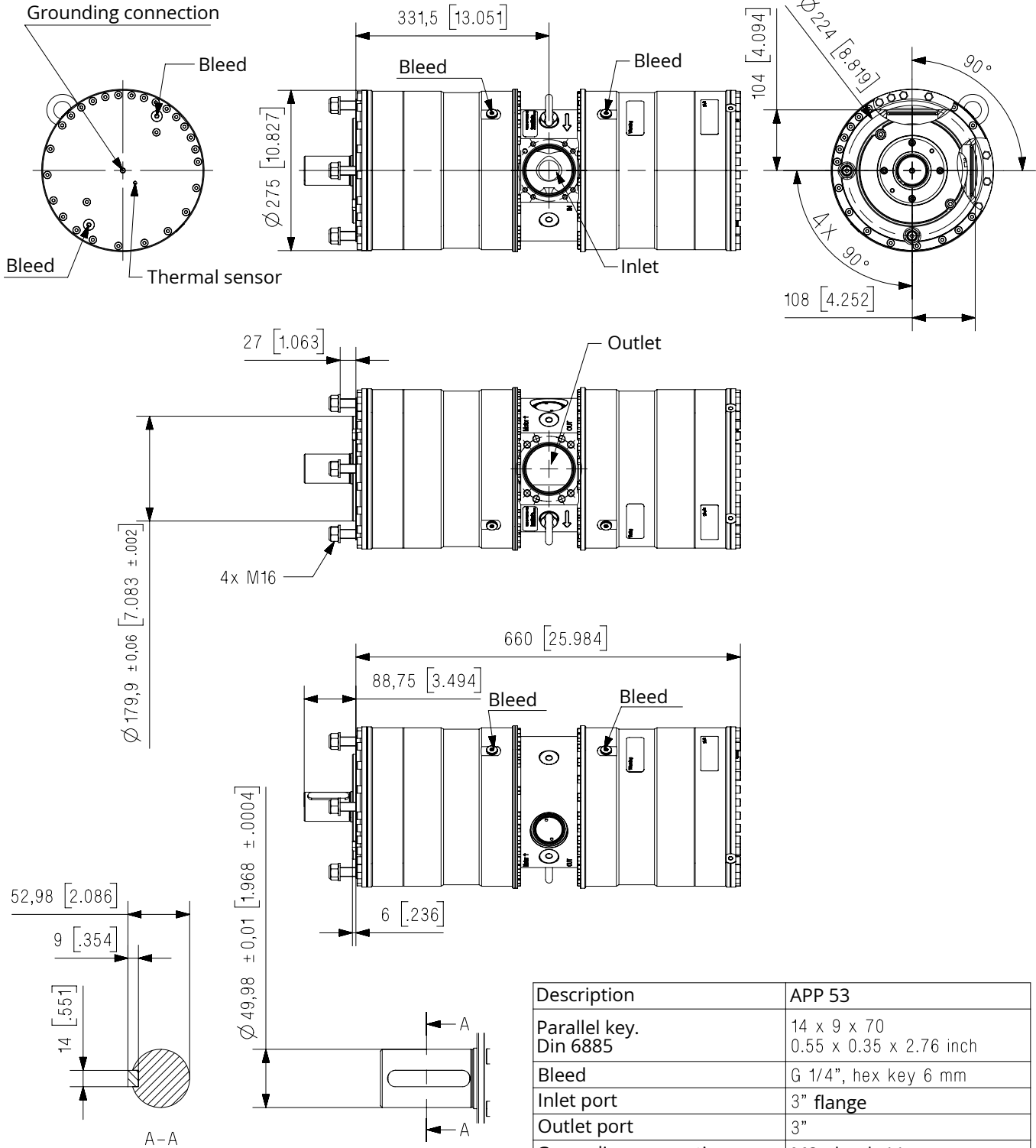
Flushing valve curves

Figure: APP 53-92 integrated flushing valve



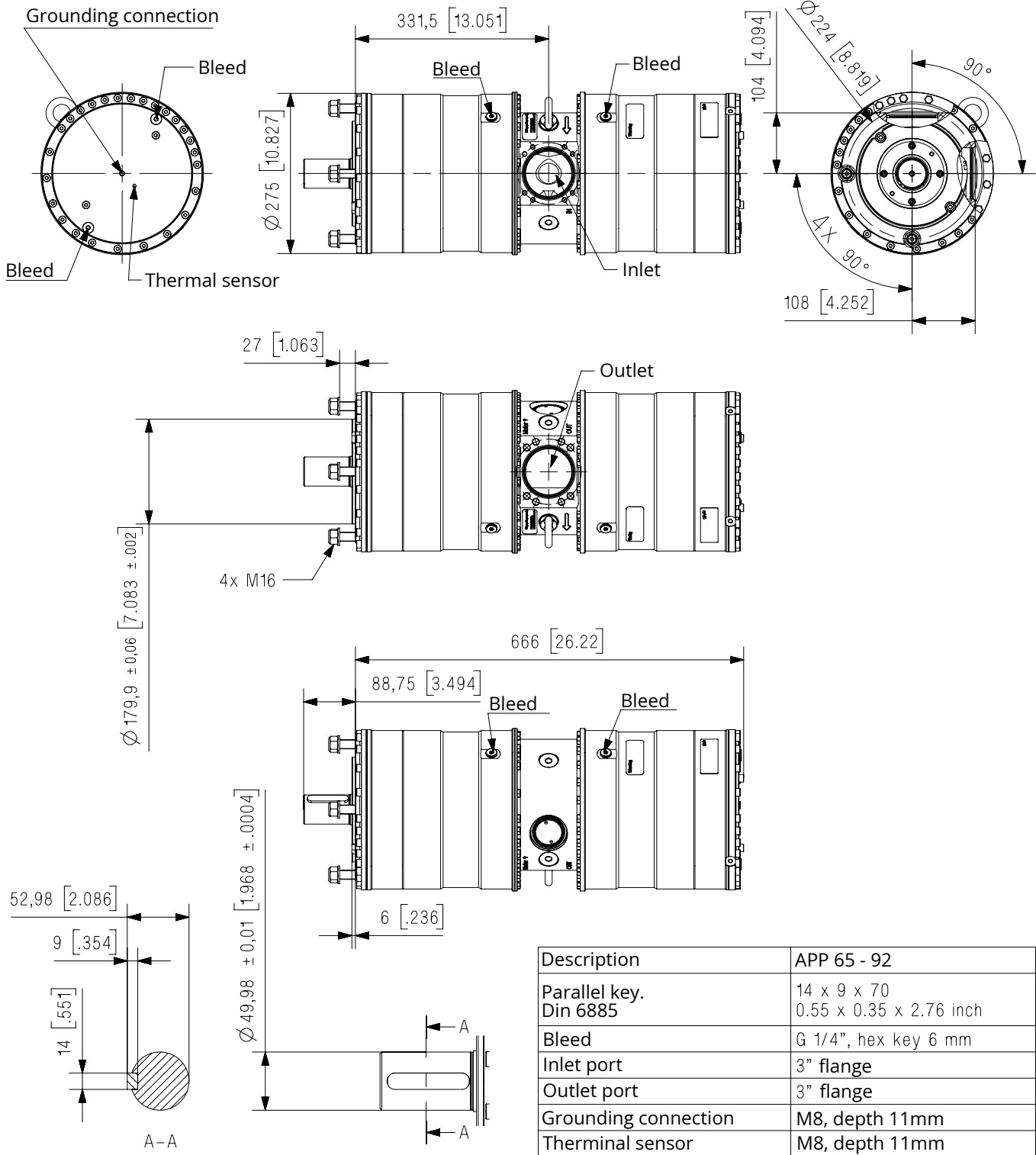
Dimensions

APP 53



Dimensions without tolerances acc. to ISO 2768-1 designation C.

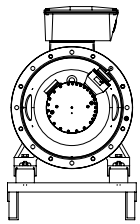
APP 65 - 92



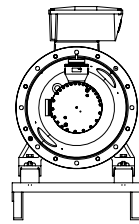
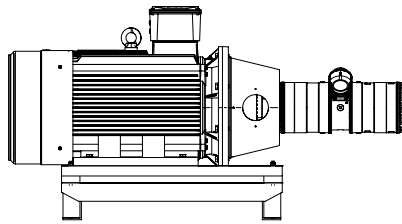
Dimensions without tolerances acc. to ISO 2768-1 designation C.

The APP 53-92 connections (inlet and outlet) can be adjusted in intervals of 45 degrees.

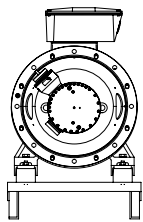
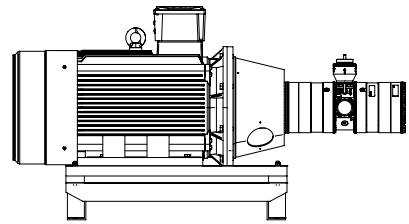
Please see typical installations with check valve VCM 92 mounted in the outlet port in the drawing below. Non-standard configurations are available on request. For adjustment on site, please see Installation, Operation and Maintenance Manual or contact Danfoss.



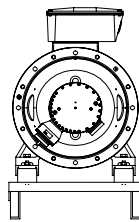
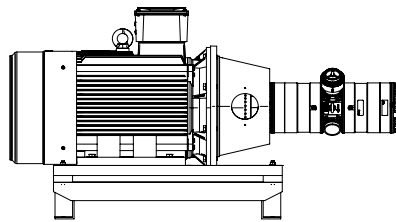
Standard configuration



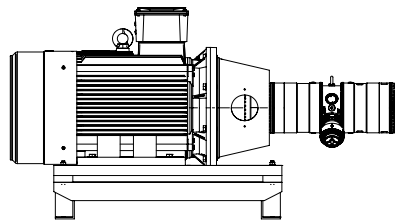
Non-standard configuration, Standard configuration turned 45 degrees left.



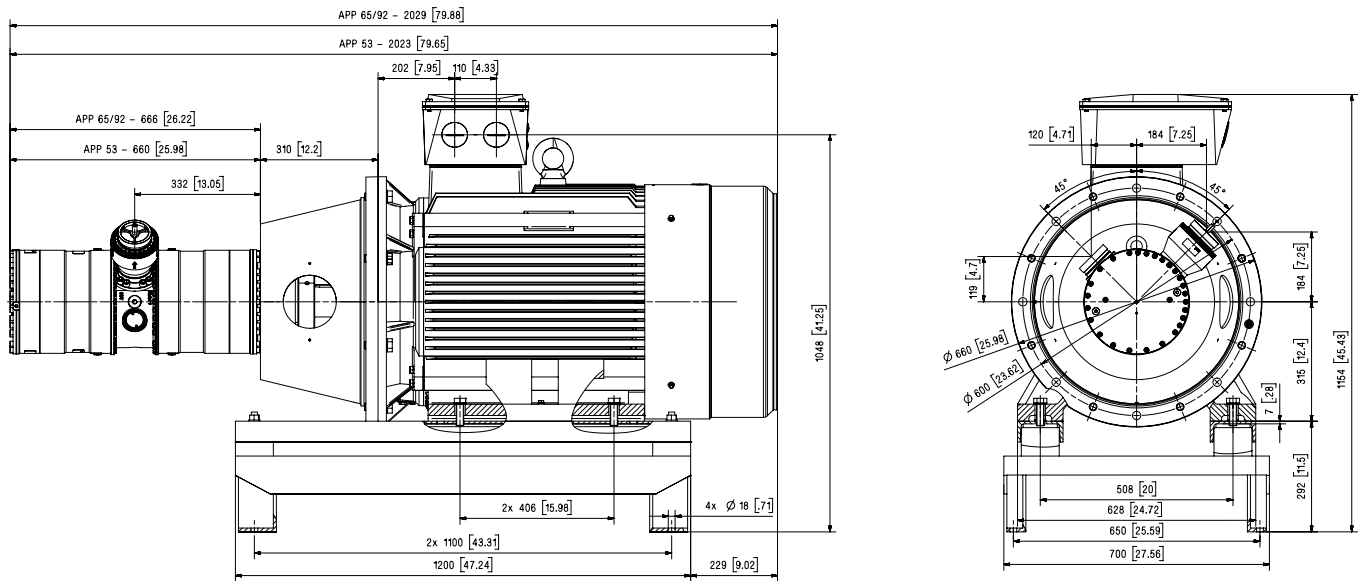
Non-standard configuration, turned 90 degrees left.



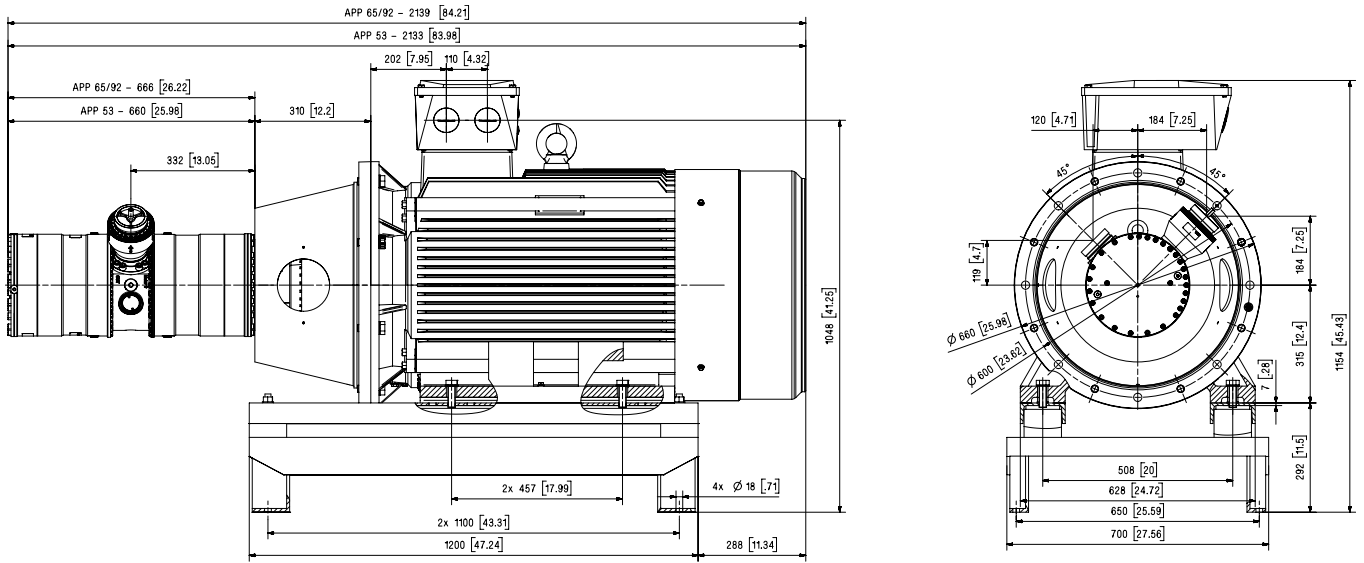
Non-standard configuration, turned 180 degrees .



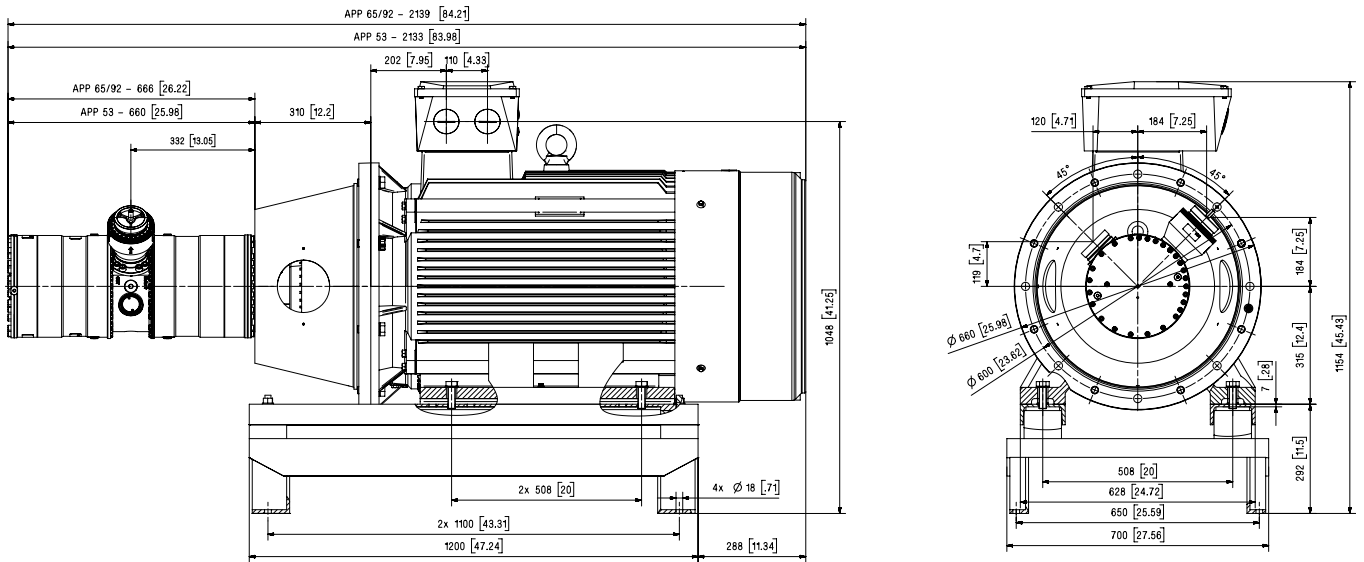
APP 53-92 with IE3 motor, IEC 315S - 4



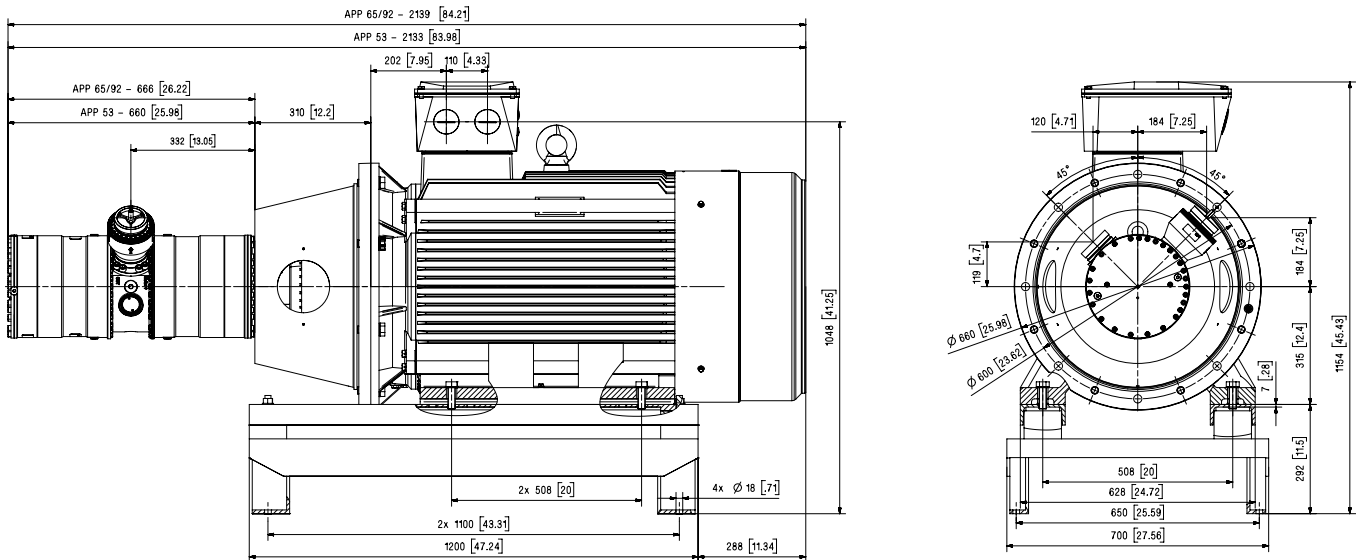
APP 53-92 with IE3 motor, IEC 315M - 4



APP 53-92 with IE3 motor, IEC 315L 1-4



APP 53-92 with IE3 motor, IEC 315L 2 - 4

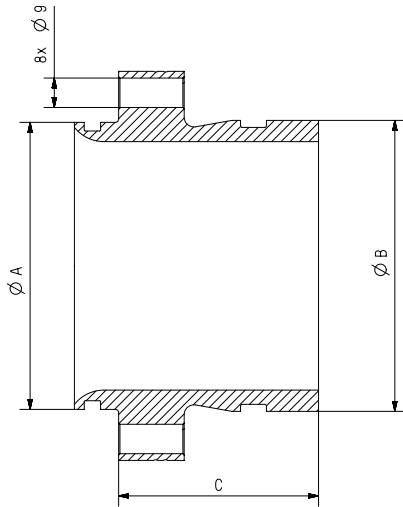


Connections

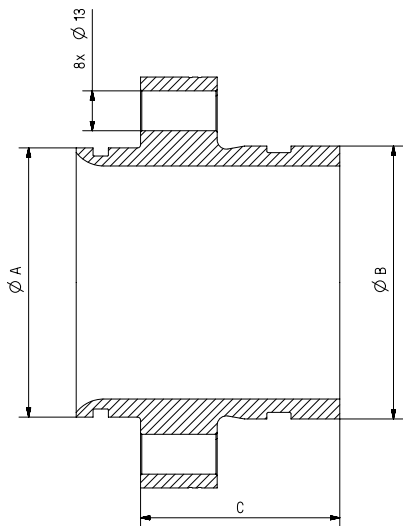
APP 53 - 92

Use only Style 77DX coupling or equivalent.

3" Victaulic OSG LP Inlet



3" Victaulic OSG HP Outlet



Connection	Diameter (A)	Victaulic ¹⁾ (B)	Length (C)	Material	Max. Pressure	Code number
3" Inlet connector	87.8 mm (3.46 inch)	3" Vic. OSG	61.0 mm (2.40")	Super Duplex	10 barg (145 psig)	180Z1991
3" outlet connector	87.8 mm (3.46 inch)	3" Vic. OSG	65.0 mm (2.56")	Super Duplex	80 barg (1160 psig)	180Z1992

¹⁾ The installation instruction for Style 77DX is located in the Victaulic document I-100 Field Installation Handbook (<http://static.victaulic.com>)

VCM 3" Victaulic

The non-return valve is designed for use in Seawater Reverse Osmosis (SWRO) membrane systems. In case the high-pressure pump stops momentarily, the volume of water in the membrane vessel may work as an accumulator and will send flow backwards.

When using multiple pumps in parallel, the non-return valve prevents the water from one pump to run into the parallel-coupled pumps at start-up. The VCM 92 is prepared for easy installation on the high pressure outlet of APP 53-92, series 08 or higher.

Use only Style 77DX coupling or equivalent.

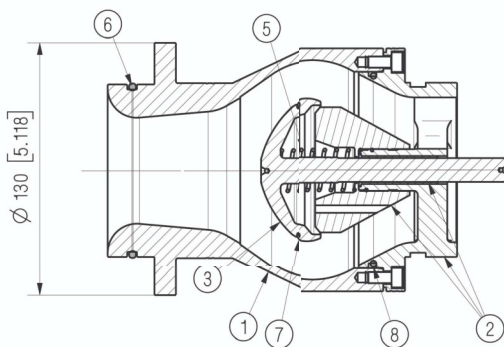
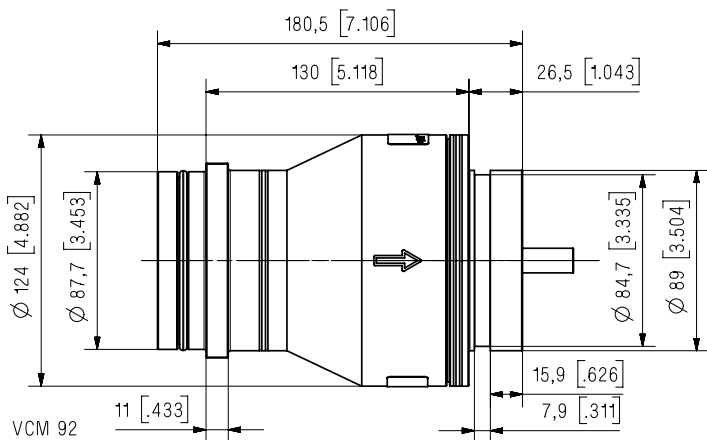
Type	Connection ¹⁾	Diameter mm (inch)	Victaulic ³⁾ (outlet connection)	Length mm (inch)	Material ²⁾	Max. pressure barg (psig)	Code number
VCM 92	3" outlet check valve)	87.7 (3.45)	3"Vic. OSG	180.5 (7.10)	Super Duplex	83 (1.200)	180H0058

¹⁾The check valve is mounted directly in the outlet port with a flange with 8 screws M12 x 25.

²⁾Wetted parts materials: Super Duplex, PEEK, PP, Hasteloy; FKM, NBR

³⁾The installation instnction for Style 77DX is located in the Victaulic document I-100 Field Installation Handbook (<http://static.victaulic.com>)

VCM		VCM 92	
Min. flow continuously	m ³ /h	20	
	gpm	88	
Max. flow continuously	m ³ /h	92	
	gpm	405	
Max pressure MAWP	barg	83	
	psig	1200	
Opening pressure	barg	0.05- 0.08	
	psig	0.73-1.16	
Pressure loss at max. flow	barg	< 0.45	
	psig	< 6.5	

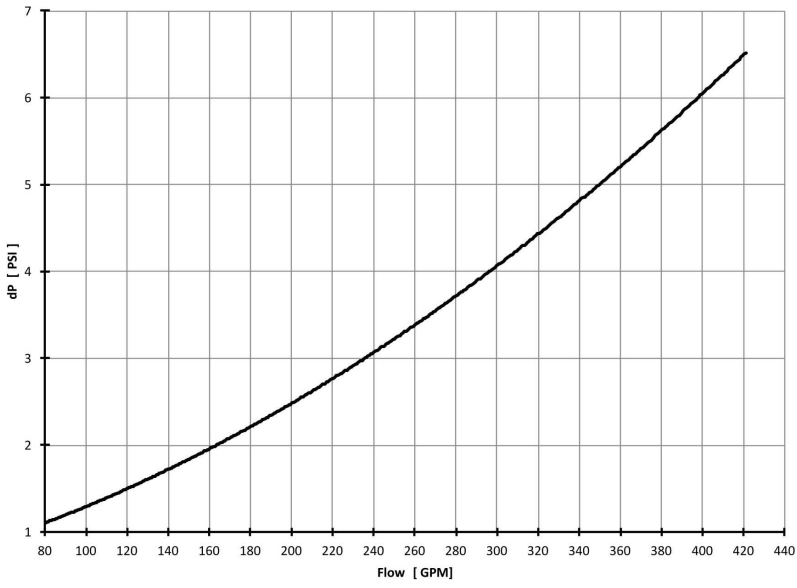


1.	Valve housing (Super Duplex)
2.	Valve guide and valve stop (Super Duplex, PEEK and PP)
3.	Valve Cone (Super Duplex)
5.	Spring (Hasteloy)
6.	O-ring (NBR)
7.	O-ring (FKM 75)
8.	O-ring (NBR)

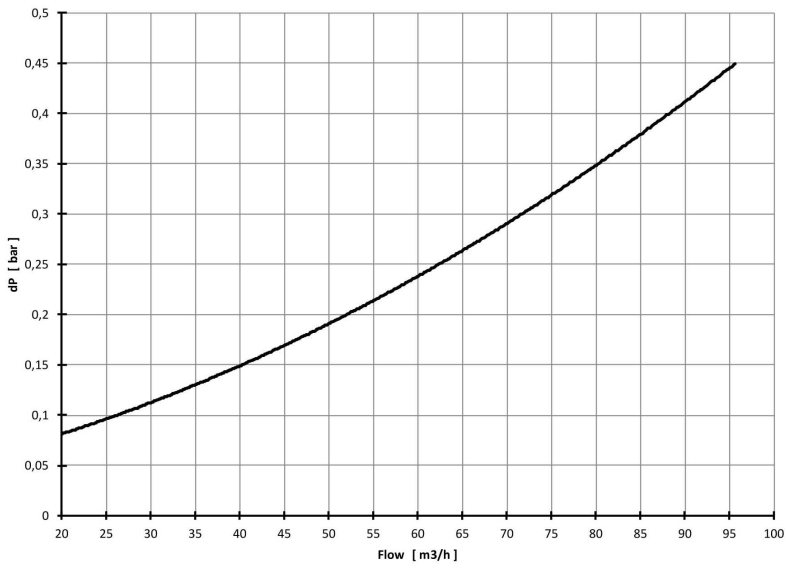


Flow versus pressure Pressure drop curves for check valve VCM 92

Flow versus pressure for VCM 92



Flow versus pressure for VCM 92



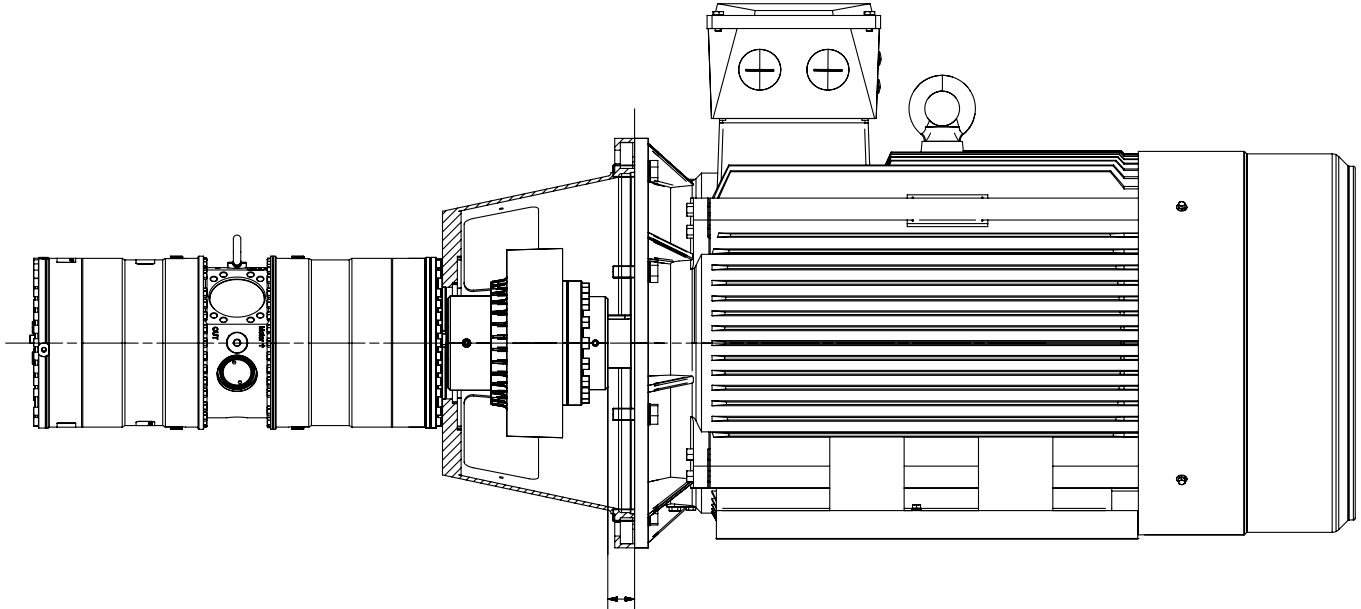
Installation

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

For further instruction on installation of coupling see APP Pump Instruction 180R9368.

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.



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).

Noise

Since the pump unit is typically 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.

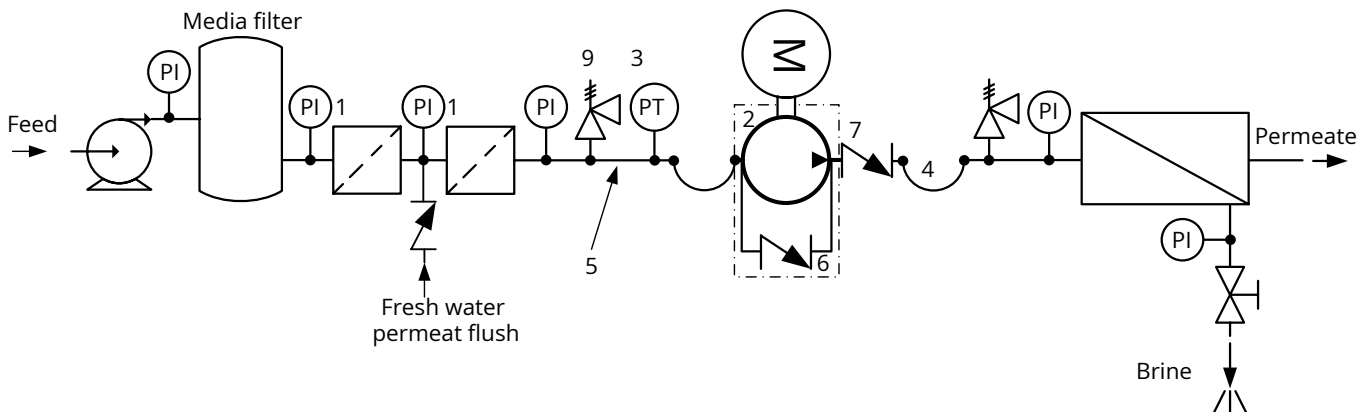
RO system with direct supply

- Inlet line: Dimension the inlet line to minimize pressure loss (large flow, minimum pipe length, minimum bends/connections, low-pressure-loss fittings).
- Inlet filter: Install an inlet filter (1) before the APP pump (2). Refer to section 9.1, "Filtration," for filter selection. Thoroughly clean pipes and flush the system before startup.
- Inlet pressure: Maintain pump inlet pressure according to item 4 specifications to prevent cavitation and pump damage.
- Low pressure relief valve: Install a low-pressure relief valve (9) to prevent system/pump damage if the pump stops or reverses.
- Monitoring pressure switch: Install a monitoring pressure switch (3) between the filter (1) and pump inlet. Set minimum inlet pressure per item 4 specifications. The switch must prevent pump operation if inlet pressure is below the minimum.
- Hoses: Use flexible hoses (4) to minimize vibration and noise. Refer to Danfoss Hoses and hose fittings data sheet (521B0909).
- Flushing valve: The APP pump has an integrated valve (6) for system filling and flushing.
- Non-return valve: A non-return valve (7) at the outlet may prevent pump backspin. The membrane vessel's water volume acts as an accumulator, potentially causing backflow if the pump stops.

High-pressure safety/relief valve

Install a safety or pressure relief valve (8) after the non-return valve to prevent system damage from high-pressure peaks, as the Danfoss APP pump generates pressure and flow immediately upon startup, regardless of counter-pressure.

Note: If an inlet non-return valve is used, a low-pressure relief valve is also needed between the valve and pump to protect against high-pressure peaks.



Service

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.

If the recommendations in the manual are not followed, Danfoss reserves the right to void the warranty.

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 for 10 sec. Flushing through the flushing 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 instruction and operational manual).

Repair

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

Accessories

Accessories	Type	Code number
Coupling APP 53 - APP 92 IEC 315	Diameter: motor Ø80 mm, pump Ø50	180Z4066
Coupling APP 53 - APP 92 IEC 280	Diameter: motor Ø75 mm, pump Ø50	180Z4081
Coupling kit APP 53 - APP 92 incl. bell housing IEC 315	Ø80/Ø50. IEC 315 Ø660/310	180Z4083
Coupling kit APP 53 - APP 92 incl. bell housing IEC 280	Ø75/Ø50. IEC280 Ø550/265	180Z4082
Base frame incl. vibration dampeners	IEC 315	180Z0661

Certificates, declarations and approvals

The list contains all certificates, declarations, and approvals for this product type. Individual code number may have some or all of these approvals, and certain local approvals may not appear on the list.

When you click on the link you will be directed to the latest version of the 'Declaration of Conformity'. Products developed and sold before this date of issue conform to the directives/standards in force at the time of their sale.

Approval type	Title	Certification body	Approval topic
Manufacturer's Declaration	Danfoss MD 180R8303.AA	Danfoss	China RoHS
Manufacturer's Declaration	Danfoss MD 180R8305.AE	Danfoss	Pressure



EU Declaration	Danfoss EU 180R8002.AG	Danfoss	MD
Export Control Declaration	High Pressure pump	Danfoss	

Contact details

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