



Energy Recovery Device

**APM 0.8 - 2.9 / APM S 9.7 /
APM S 22-40**

Description

APM are designed for energy recovery systems together with two types of configurations

1. An APP pump and an APM Motor both connected to a double shaft electric motor.
2. An APP pump with its dedicated electric motor and APM motor with its dedicated electric motor acting as electric generator.

This data sheet is valid for APM hydraulic motors. APM hydraulic motors are designed to operate in brine water and are based on the axial piston principle with fixed displacement, enabling a very light and compact design. Lubrication of the moving parts is provided by the water itself. Shaft speed is proportional to the input flow.

APM motor is not guaranteed to start at any pressure. The pressure where the APM starts rotating can vary depending on the position the APM was stopped in. It is therefore recommended to have a rotational force, turning the APM during the startup.

Features & benefits

- Constant torque over a wide speed range
- Compact design
- Easy to install
- Long life under severe operating conditions
- Few wear parts and low maintenance costs
- No oil lubrication
- Non-corroding materials
- Made for RO applications.





Naming Structure

The naming structure is used for identification only. The name indicates the key specifications for the Motor.

Design	Material type	Capacity m ³ /h	Max rpm	Special Certificates	Seal material	Pressure range	Filtration
APM	D: Duplex/Super Duplex steel	0.8	1200	01*: 3.1 Inspection certificate according to EN 10204 type 3.1	A: FKM	1: 30 – 83 Bar inlet @ 0.5 - 5 Bar outlet	A: Level 1 (10µ ABS)
	S: Super Duplex	1.0	1500	02: 2.2 Material certificates for pressure containing parts	B: EPDM	2: 80 – 124 Bar inlet @ 0.5 – 5 Bar outlet	
		1.2	1800	03: 2.2 Certificates for wetted parts	C: NBR		
		1.8	3000	04: NSF 61 certified			
		2.0	3450	05: API 674			
		2.5		06: FDA material compliance			
		2.9		07: EN1935 xxxxxxxx			
		9.7		08: PMI of wetted parts			
		22		09: API 674 Atex			
		26		10: Atex			
		32		11: Water Regulations Approval Scheme			
		40		12: American Bureau of Shipping			
				13: Bureau Veritas			
				14: China Classification Society			
				15: Registro Italiano Navale			
				16: Lloyd's Register			
				17: Det Norske Veritas, Germanis-cher Lloyd			
				18: 2.2 Cert. for Pressure Cont. Parts + PMI på wetted parts + Hydrostatisk test			
				19: 2.2 Cert. for Pressure Cont. Parts + FAT test			
				20: 2.2 Cert. for wetted Parts + Hydrostatisk test			
				21: FAT test			
				22: 2.2 Cert. for Pressure Cont. Parts + PMI på wetted parts			

Motor
 Type **APM S 26/1200 01 C1A**
 Code No. **180F1011**
 Serial No. **88364101-373**


 MADE IN DENMARK



Danfoss A/S, 6430 Nordborg, Denmark

Ordering

Product code numbers

APM 0.8 - 2.9

Motor size		APM D 0.8/3450 01 xxx	APM D 1.0/3450 01 XXX	APM D 1.2/3450 01 xxx	APM D 1.8/3450 01 xxx	APM D 2.0/3450 01 XXX	APM D 2.5/3450 01 xxx	APM D 2.9/3000 01 xxx
Code number APM CCW		180F1000	180F1001	180F1002	180F1100	180F1101	180F1102	180F1103
Geometric displacement	cm ³ / rev.	4.07	5.08	6.3	9.31	10.0	12.5	15.3
	in ³ /rev.	0.25	0.31	0.38	0.57	0.61	0.76	0.93
Pressure								
Max. inlet ¹⁾ pressure continuous	barg	83	83	83	83	83	83	83
	psig	1200	1200	1200	1200	1200	1200	1200
Min. inlet ¹⁾ pressure continuous	barg	10	10	10	10	10	10	10
	psig	145	145	145	145	145	145	145
Outlet pressure	barg	0.5 – 5	0.5 – 5	0.5 – 5	0.5 – 5	0.5 – 5	0.5 – 5	0.5 – 5
	psig	7.3 – 72.5	7.3 – 72.5	7.3 – 72.5	7.3 – 72.5	7.3 – 72.5	7.3 – 72.5	7.3 – 72.5
Speed								
Min. speed	rpm	700	700	700	700	700	700	700
Max. speed continuous	rpm	3450	3450	3450	3450	3450	3450	3000
Typical flow -flow curves available in item 5								
Flow at Max. speed	m ³ /h	0.92	1.12	1.37	2.03	2.18	2.69	2.83
Flow at Max. Speed	gpm	4	4.9	6.1	9	9.6	11.8	12.5
Typical electrical motor / generator size								
Max. power of electric generator at max. speed cont. and max. pressure	kW	1.7	2.1	2.6	3.9	4.2	5.3	5.6
rpm at max. pressure	HP	2.3	2.8	3.5	5.2	5.7	7.1	7.6
Max. torque of hydraulic motor at max. pressure	Nm	4.7	5.8	7.2	10.8	11.7	14.7	18
	lbf-ft	3.4	4.3	5.3	8	8.6	10.8	13.2

Technical specifications								
Media ²⁾ temperature	°C	2 – 50	2 – 50	2 – 50	2 – 50	2 – 50	2 – 50	2 – 50
	°F	35.6 – 122	35.6 – 122	35.6 – 122	35.6 – 122	35.6 – 122	35.6 – 122	35.6 – 122
Ambient temperature	°C	0 – 50	0 – 50	0 – 50	0 – 50	0 – 50	0 – 50	0 – 50
	°F	32 – 122	32 – 122	32 – 122	32 – 122	32 – 122	32 – 122	32 – 122
Weight (dry)	kg	5.2	5.2	5.2	8.6	8.6	8.6	8.6
	Lb	11.5	11.5	11.5	19	19	19	19
Sound pressure level ³⁾	dB(A)	74	74	74	77	77	77	81
Footprint with IEC motor ⁴⁾	m ²	0.1	0.1	0.14	0.15	0.16	0.21	0.21

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

2) Dependent on the NaCl concentration - see chapter 6.

3) A-weighted sound pressure level at 1 m 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 at max. pressure and speed.

4) Max. area covered with recommended motor configuration (excl. of space to service pump)

APM 9.7

Motor size		APM S 9.7/1800 01 C1A	APM S 9.7/1800 01 C2A
Code number APM CCW		180F1114	180F1154
Geometric displacement	cm ³ /rev.	90	90
	in ³ /rev.	5.49	5.49
Pressure			
Max. inlet ¹⁾ pressure continuous	barg	83	124
	psig	1200	1800
Min. inlet ¹⁾ pressure continuous	barg	30	80
	psig	435	1160
Outlet pressure	barg	3 – 6	3 – 6
	psig	43.5 – 87	43.5 – 87
Speed			
Min. speed	rpm	700	700
Max. speed continuous	rpm	1800	1800
Typical flow -flow curves available in item 5			
Flow at Max. Speed	m ³ /h	9.7	9.7
Flow at Max. Speed	gpm	43	43
Typical electrical motor / generator size			
Max. power of electric generator at max. speed cont. and max. pressure	kW	30	37
1200 rpm at max. pressure	HP	40	50
Max. torque of hydraulic motor at max. pressure	Nm	126	190
	lbf-ft	93	142
Technical specifications			
Media ²⁾ temperature	°C	2 – 50	2 – 50
	°F	35.6 – 122	35.6 – 122
Ambient temperature	°C	0 – 50	0 – 50
	°F	32 – 122	32 – 122
Weight (dry)	kg	30	30
	Lb	66	66
Sound pressure level ³⁾	dB(A)	85	85
Footprint with IEC motor ⁴⁾	m ²	0.35	0.43

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

2) Dependent on the NaCl concentration - see chapter 6.

3) A-weighted sound pressure level at 1 m 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 at max. pressure and speed.

4) Max. area covered with recommended motor configuration (excl. of space to service pump)

APM 22- 40

Motor size		APM S 22/1500 01 C1A	APM S 26/1200 01 C1A	APM S 32/1200 01 C1A	APM S 40/1500 01 C1A	APM S 26/1200 01 C2A
Code number APM CCW		180F1015	180F1011	180F1013	180F1014	180F1018
Geometric displacement	cm ³ /rev.	256	362	444	444	362
	in ³ /rev.	15.62	22.09	27.09	27.09	22.09
Pressure						
Max. inlet ¹⁾ pressure continuous	barg	83	83	83	83	124
	psig	1200	1200	1200	1200	1800
Min. inlet ¹⁾ pressure continuous	barg	30	30	30	30	80
	psig	435	435	435	435	1160
Outlet pressure	barg	3 – 6	3 – 6	3 – 6	3 – 6	3 – 6
	psig	43.5 – 87	43.5 – 87	43.5 – 87	43.5 – 87	43.5 – 87
Speed						
Min. speed	rpm	700	700	700	700	700
Max. speed continuous	rpm	1500	1200	1200	1500	1200
Typical flow -flow curves available in item 5						
Flow at Max. Speed	m ³ /h	22	26	32	40	26
Flow at Max. Speed	gpm	97	114	141	176	114
Typical electrical motor / generator size						
Max. power of electric generator at max. speed cont. and max. pressure	kW	75	55	75	110	110
1200 rpm at max. pressure	HP	100	73	100	100	147.5
Max. torque of hydraulic motor at max. pressure	Nm	355	436	460	616	663
	lbf-ft	262	321	340	455	489
Technical specifications						
Media ²⁾ temperature	°C	2 – 50	2 – 50	2 – 50	2 – 50	2 – 50
	°F	35.6 – 122	35.6 – 122	35.6 – 122	35.6 – 122	35.6 – 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	105	105	105	105	105
	Lb	231	231	231	231	231
Sound pressure level ³⁾	dB(A)	85	85	85	85	85
Footprint with IEC motor ⁴⁾	m ²	0.76	0.80	0.83	0.83	0.83

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

2) Dependent on the NaCl concentration - see chapter 6.

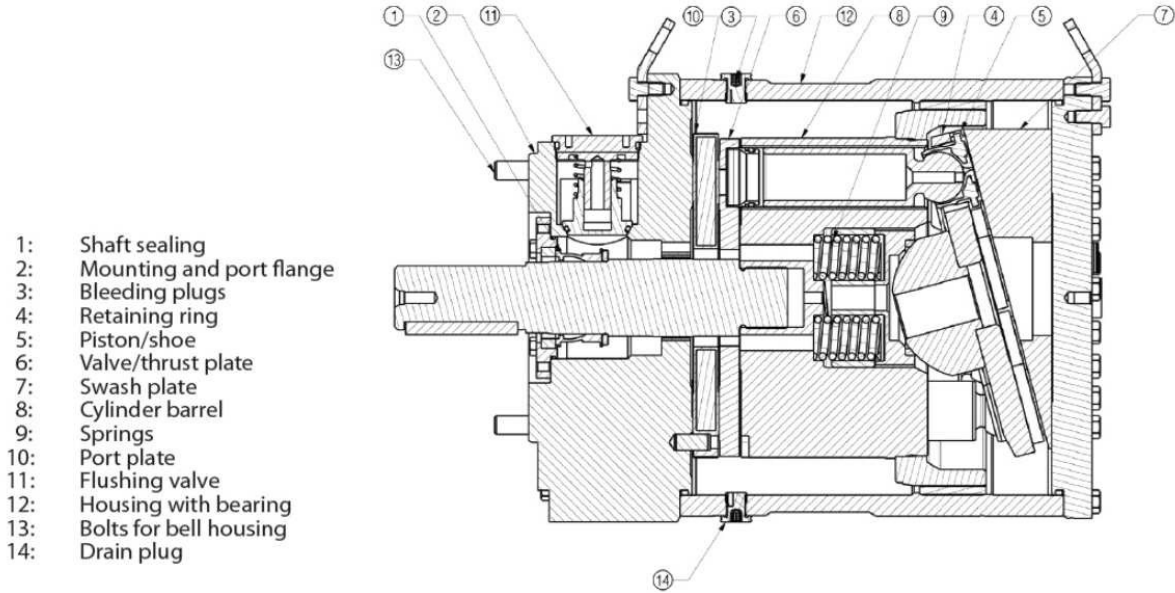
3) A-weighted sound pressure level at 1 m from the pump unit surfaces (reference box) acc. to EN ISO 20361 section 6.2. The noise measurements are performed acc. to EN ISO 3744:2010 on a motor-pump unit at max. pressure and speed.

4) Max. area covered with recommended motor configuration (excl. of space to service pump)

Product details

General data

Below a sectional drawing as an example of an APM motor



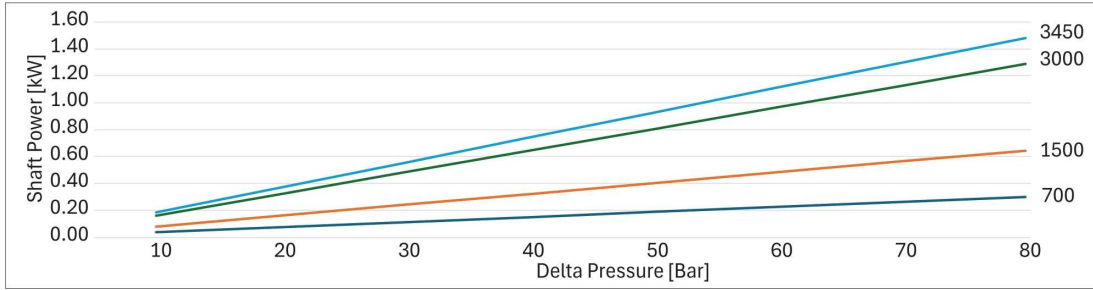
- 1: Shaft sealing
- 2: Mounting and port flange
- 3: Bleeding plugs
- 4: Retaining ring
- 5: Piston/shoe
- 6: Valve/thrust plate
- 7: Swash plate
- 8: Cylinder barrel
- 9: Springs
- 10: Port plate
- 11: Flushing valve
- 12: Housing with bearing
- 13: Bolts for bell housing
- 14: Drain plug

Energy consumption vs pressure

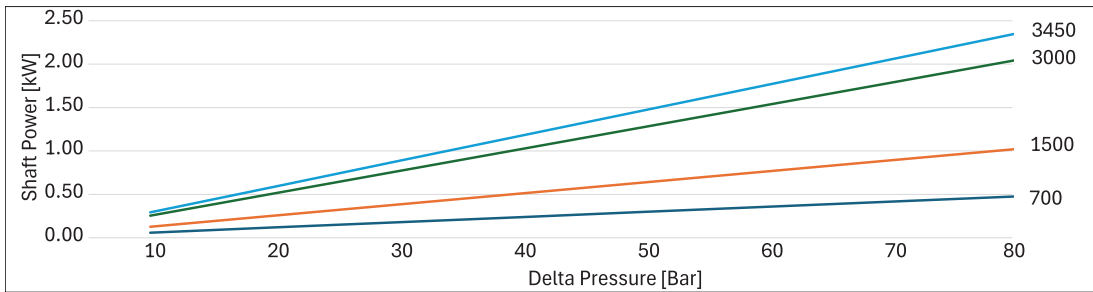
A variation of up to 20% may occur depending on the rpm and the efficiencies of the pump and the motor.

Shaft power vs pressure for APM S 26/1200, APM S 32/1200, APM S 22/1200, APM S 26, APM S 32/1200, APM S 40.

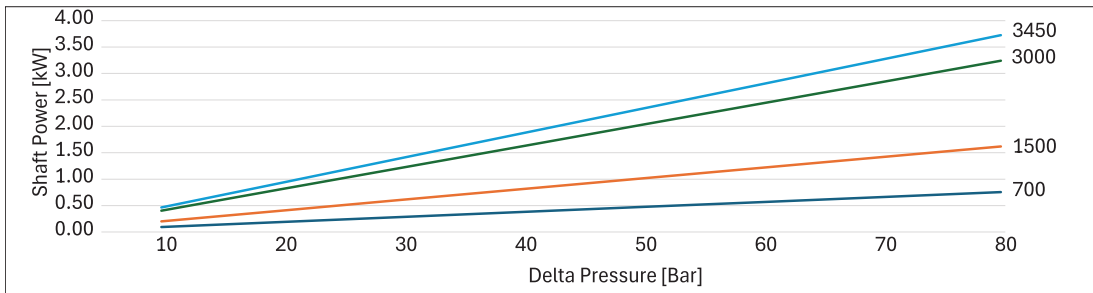
This chart is specific for APM S 0.8



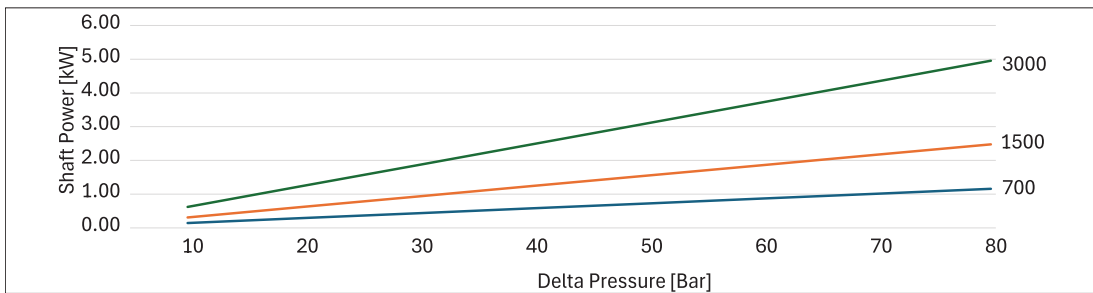
This chart is specific for APM S 1.2



This chart is specific for APM S 2.0

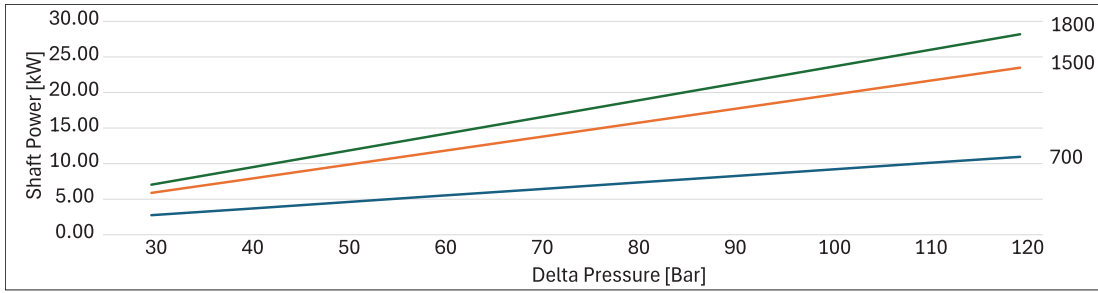


This chart is specific for APM S 2.9

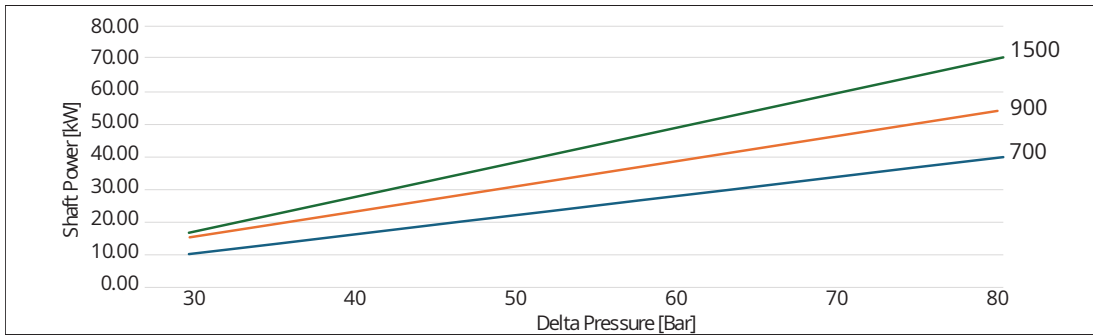




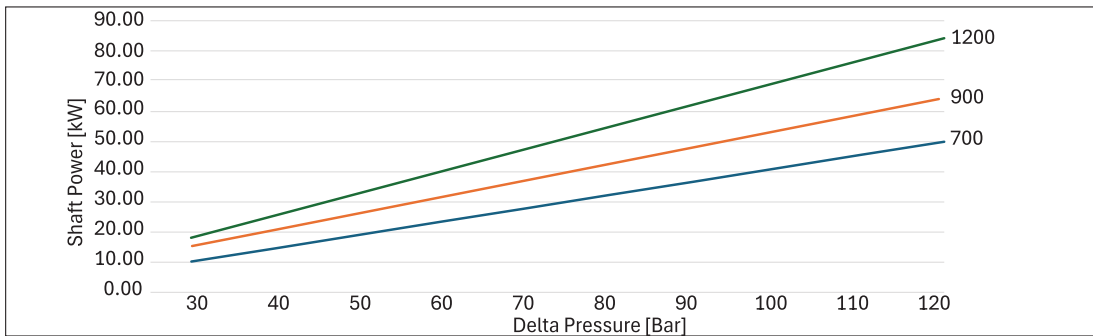
This chart is specific for APM S 9.7



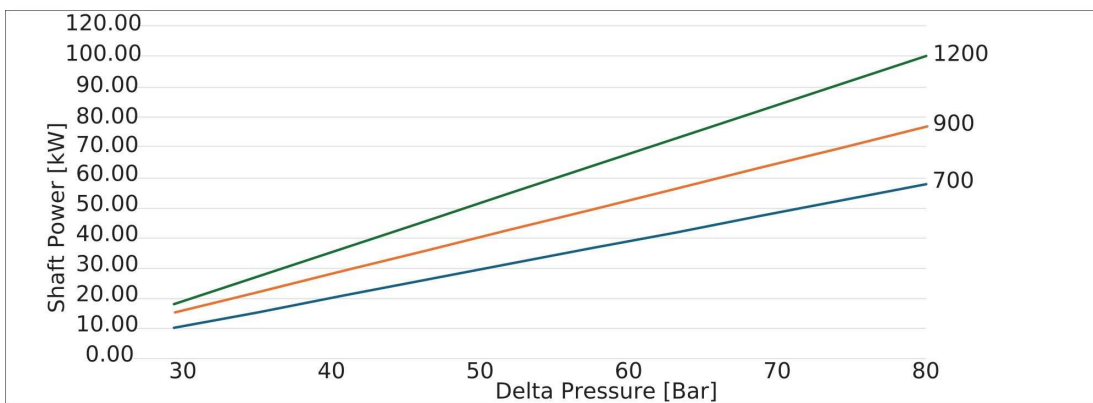
This chart is specific for APM S 22/1500



This chart is specific for APM S 26/1200



This chart is specific for APM S 32/1200.



Direction of rotation

The motor ports are labeled HP (High Pressure) and LP (Low Pressure).

The HP port serves as the inlet.

The LP port serves as the outlet.

Warning: Applying high pressure to the LP port can cause permanent damage to the motor. The shaft of the motor will only rotate counter-clock wise CCW.

Note: Connections and direction of rotation are indicated on the product label affixed to the motor. Detailed view can be found on the dimensional drawing for the specific model.

Design

APM 9.7/1800



Pressure and temperature data

Fluid temperature:

Min. +2 °C to max. +50 °C (Min. +35.6 °F to max. +122 °F)

Ambient temperature:

Min. 0 °C to max. +50 °C (Min. +32 °F to max. +122 °F)

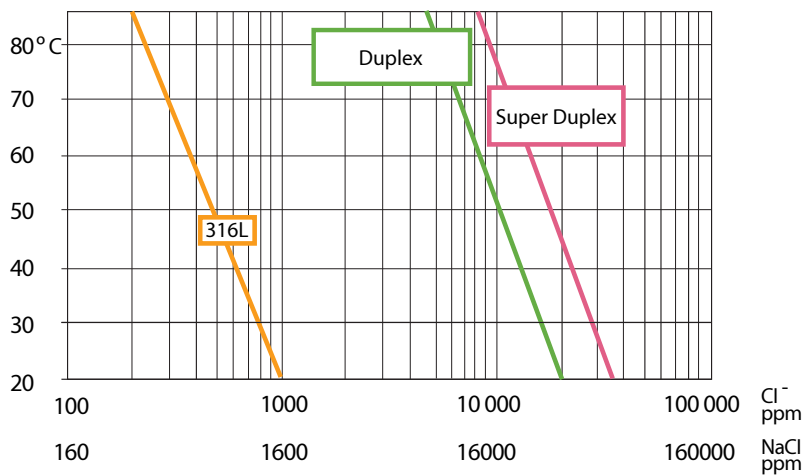
Storage temperature:

Min. -40 °C to + 70 °C - provided that the APM is drained of fluid and stored "plugged".

Antifreeze protection is required at temperatures below 0 °C.

Danfoss recommends using Dowcal N from Dow Chemical Company or Chillsafe mono propylene glycol from Arco Chemical Company.

The chart below illustrates the corrosive resistance of different types of stainless steel related to NaCl concentration and temperature. All critical parts of the APM motors are made of Duplex and Super Duplex. If the APM motor is operated above the Duplex line, always flush the APM with fresh water at operation stop to minimize the risk of crevice corrosion.



NaCl vs. temperature

Performance and environmental conditions

Noise level

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

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

It is therefore very important that the energy recovery unit 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/motor. High rpm creates more noise than low rpm
- Rigid mounting of the pump/motor generates more noise than flexible mount
- Pipe mounting direct to the pump/motor increases the noise level compared to a flexible hose

Filtration

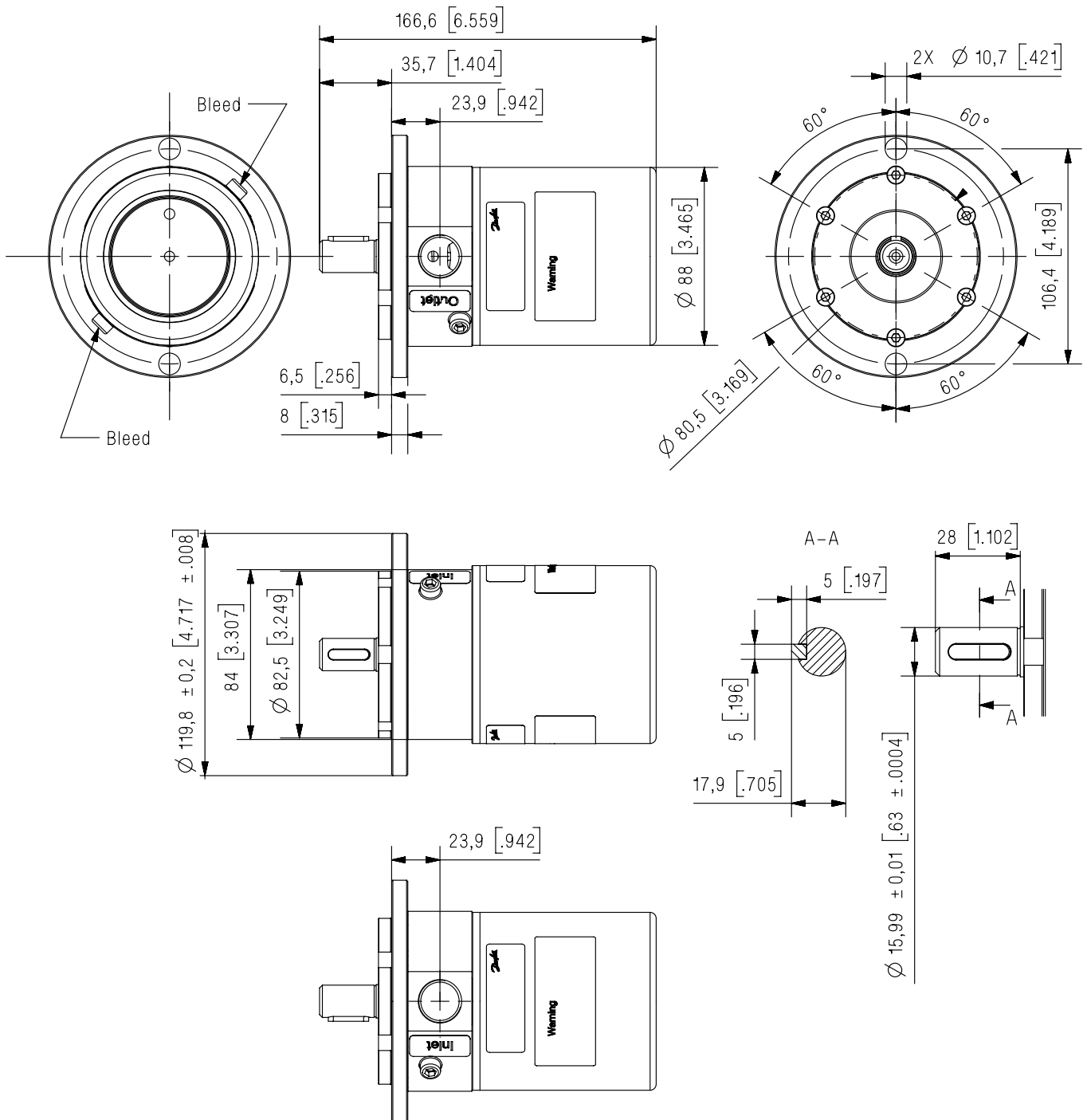
Proper filtration is crucial for the performance maintenance and warranty.

The water supplied must be filtered: 10 µm absolute, β10-value > 5000 filter is recommended.

For further information on filters, please contact Danfoss High Pressure Pumps sales department.

Dimensions

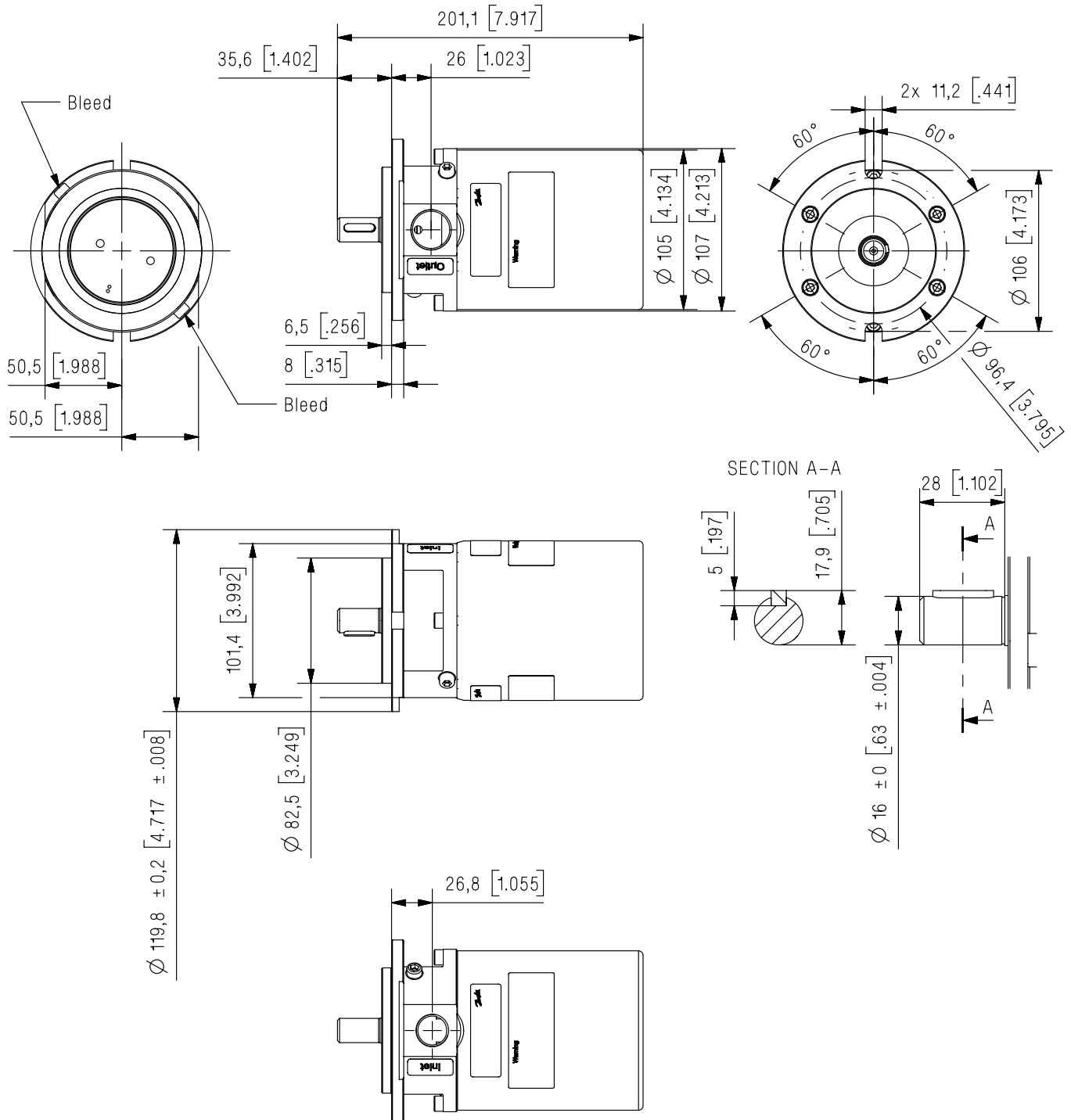
APM 0.8-1.2



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

Description	APM 0.8-1.2
Parallel key	5 x 5 x 20 mm
DIN 6885	0.2 x 0.2 x 0.79 inch
Bleed	M6 hex key 5 mm
HP Port	G 1/2"; depth 15 mm
LP Port	G 1/2"; depth 15 mm

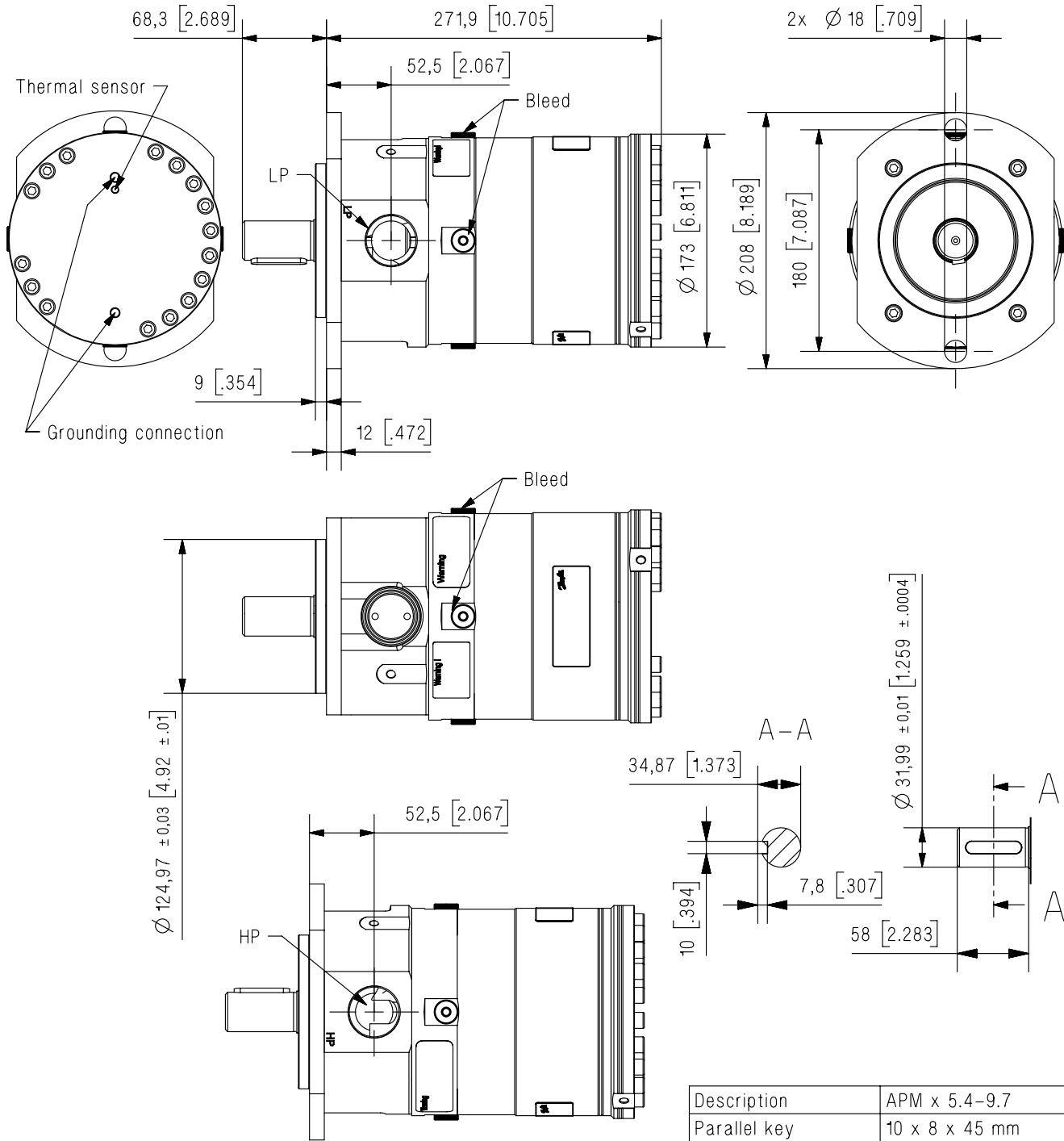
APM 1.8-2.9



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

Description	APM 1.8-2.9
Parallel key DIN 6885	5 x 5 x 20 mm 0.2 x 0.2 x 0.79 inch
Bleed	M6 hex key 5 mm
HP port	G 3/4"; depth 16.8 mm
LP port	G 1/2"; depth 16 mm

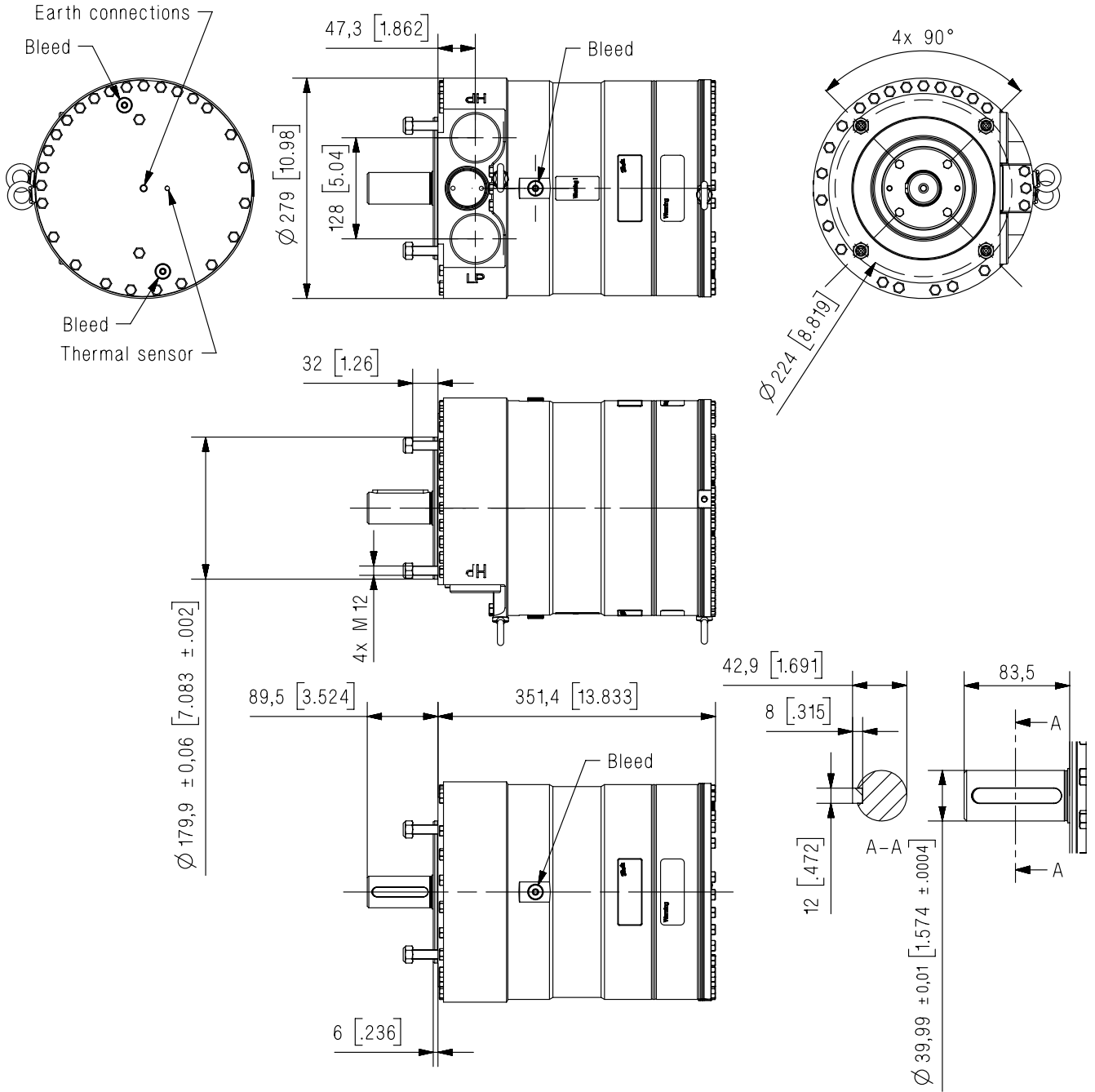
APM 5.4-9.7



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

Description	APM x 5.4-9.7
Parallel key DIN 6885	10 x 8 x 45 mm 0,39 x 0,31 x 1,77 inch
Bleed	G 1/4"; hex key 6 mm
HP port	M42x1,5; depth 23 mm
LP port	M42x1,5; depth 23 mm
Grounding connection	2 x M8; depth 11 mm
Thermal sensor	M6; depth 11 mm
Mounting flange	ISO 3019-2 125A2HW

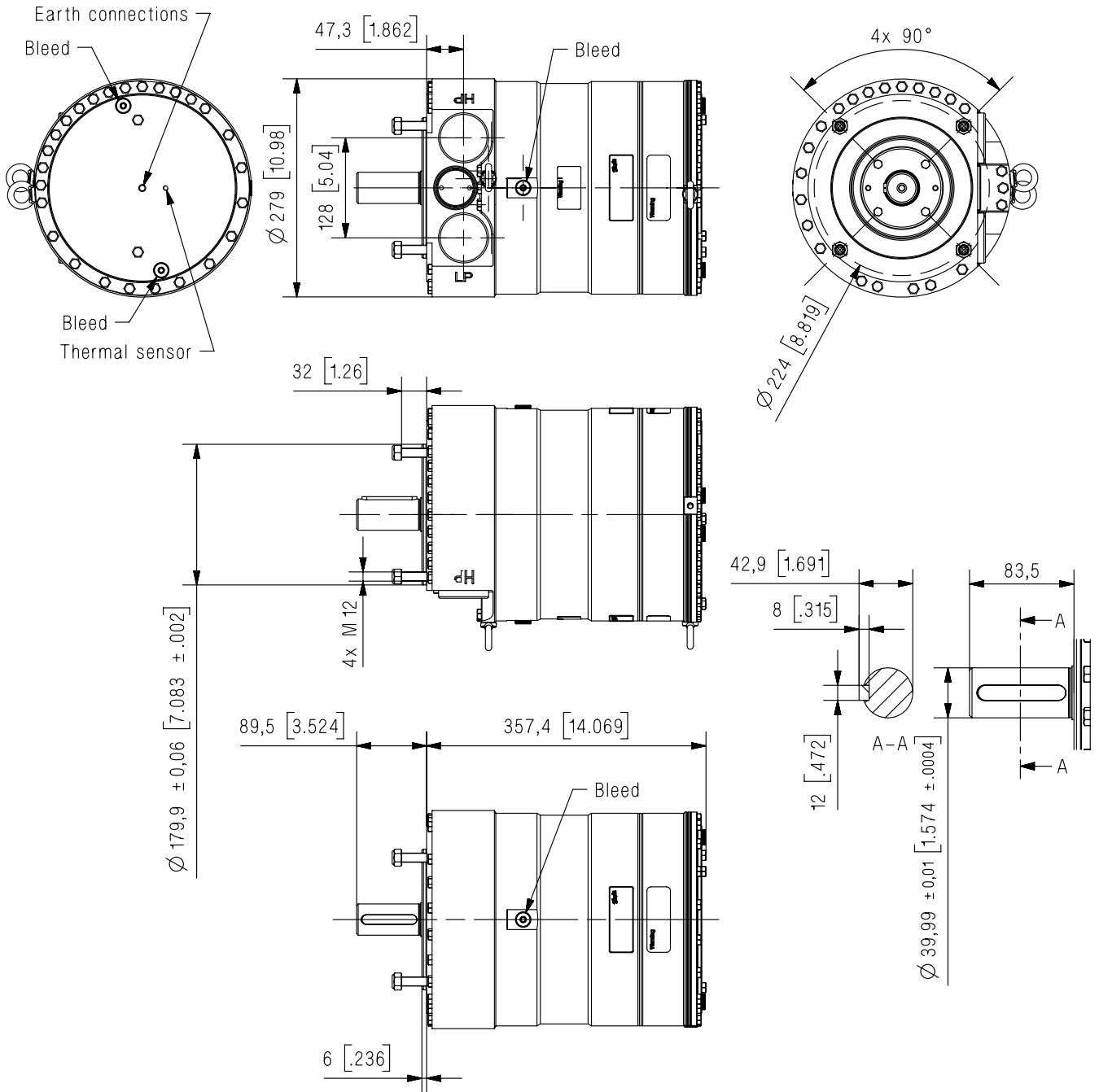
APM 24-26



Description	APM x 22-31
Parallel key, DIN 6885	12 x 8 x 70 mm 0.47 x 0.31 x 2.76 inch
Bleed	G 1/4", hex key 6 mm
HP port	M60x1.5; depth 23 mm
LP port	M60x1.5; depth 23 mm
Earth connection	M8, depth 11 mm
Thermal sensor	M6, depth 11 mm

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

APM 32-40



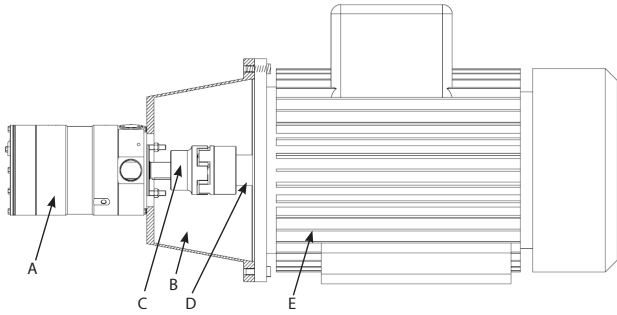
Dimensions without tolerances acc. To ISO 2768-1 designation C.

Description	APM x 32-40
Parallel key, DIN 6885	12 x 8 x 70 mm 0.47 x 0.31 x 2.76 inch
Bleed	G 1/4", hex key 6 mm
HP port	M60x1.5; depth 23 mm
LP port	M60x1.5; depth 23 mm
Earth connection	M8, depth 11 mm
Thermal sensor	M6, depth 11 mm

Installation

See the example below for correct mounting of the motor and connection to an electric motor / generator.

It is recommended to use a flexible coupling and ensure that the gap between the two metal parts of the coupling is at least 3 mm.

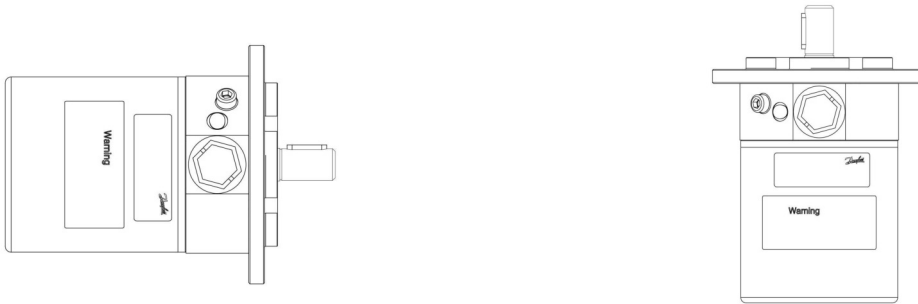


A	Pump
B	Bell housing
C	Flexible coupling
D	Motor shaft
E	Motor

Orientation

The drawing shows preferred acceptable, and not acceptable orientations of the motor.

Preferred



Not acceptable



Filtration

Proper filtration is crucial for the performance, maintenance, and warranty of your motor. Protect your motor and the application in which it is installed by always ensuring that all filtration specifications are met, and by replacing filter cartridges according to the recommended schedule.

Since water has very low viscosity, Danfoss APM motors are designed with very narrow internal clearances to control leakage rates and improve component performance.

To minimize wear on the motor, 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 using precision depth filter cartridges rated 10 µm absolute, $\beta_{10} \geq 5000$.

We do not recommend bag filters or string-wound filter cartridges, which typically have only 50% filtration efficiency. This means that out of 100,000 particles entering such filters, 50,000 particles pass straight through. In comparison, precision depth filters with 99.98% efficiency allow only 20 of the same 100,000 particles to pass.

For more information on the importance of proper filtration—including explanations of filtration principles, definitions, and guidance on selecting the right filter for your motor—please consult our Filtration Information and Specifications (Danfoss document number 521B1009).

Noise

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

Factors influencing noise level:

Motor speed

Higher RPM generates more fluid-borne and structure-borne pulsations/vibrations than lower RPM due to higher frequency.

Discharge pressure

Higher pressure generates more noise than lower pressure.

Motor unit mounting

Rigid mounting produces more noise than flexible mounting due to structure-borne vibrations. Always use dampers when mounting.

Connections to APM motor

Pipes connected directly to the APM motor transmit more noise than flexible hoses due to structure-borne vibrations.

Variable Frequency Drives (VFDs)

Electrical Motors/generator regulated by VFDs can produce more noise if the VFD is not configured with optimal settings.

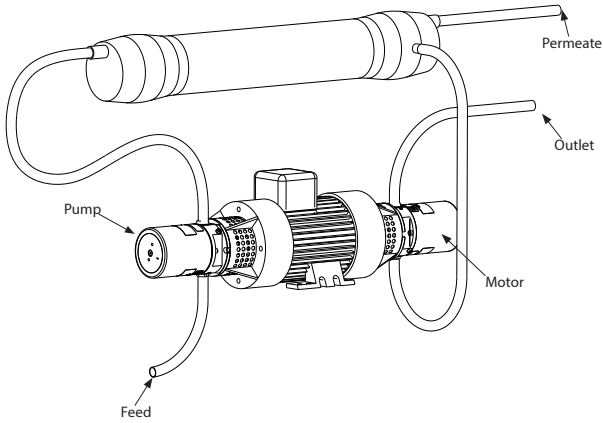
Shaft load

No axial and/or radial loads on the shaft is allowed. Danfoss recommends to use a fixed bellhousing and softex coupling type.

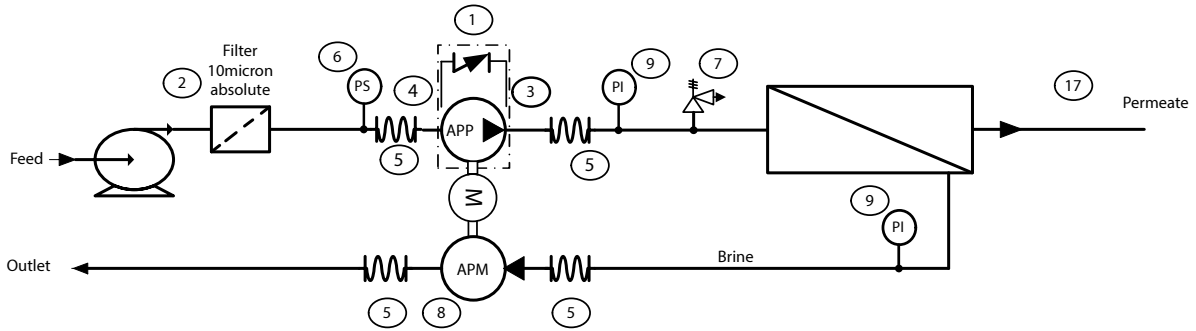
Preferred system design

The Axial Piston Motor (APM) is working as a energy recovery device by converting hydraulic energy from brine flow into rotational shaft power. There are two way for harnessing this shaft power

Type 1 configuration



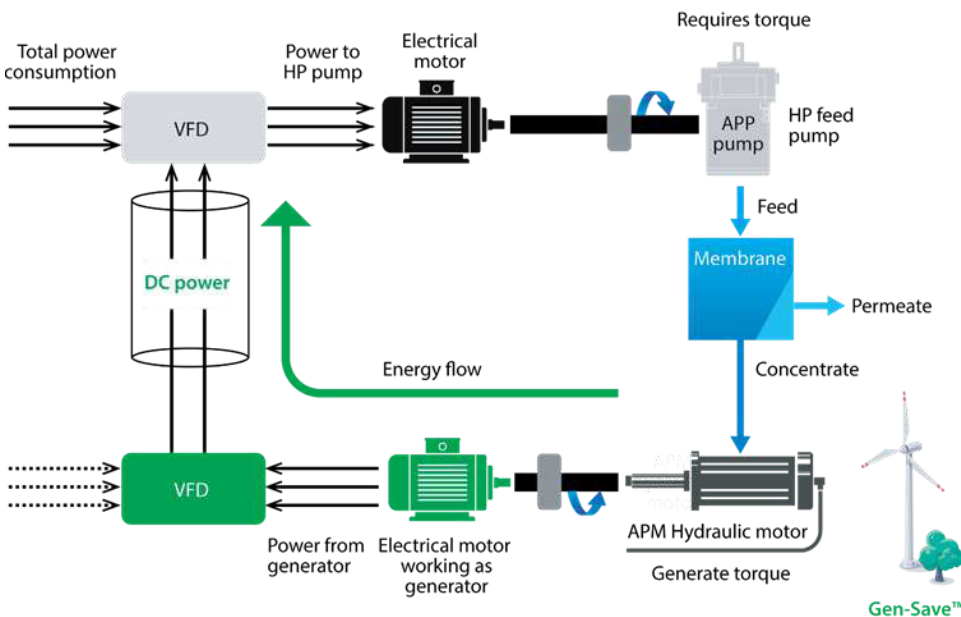
The APM can be connected to a double shafted electrical motor, reducing the power required to rotate the pump.



When directly coupled to the motor driving the Axial Piston Pump (APP), careful selection of pump and motor flows is essential, as they determine the system's recovery rate.

Note: That the recovery rate is fixed once the capacities are selected and cannot be adjusted later.

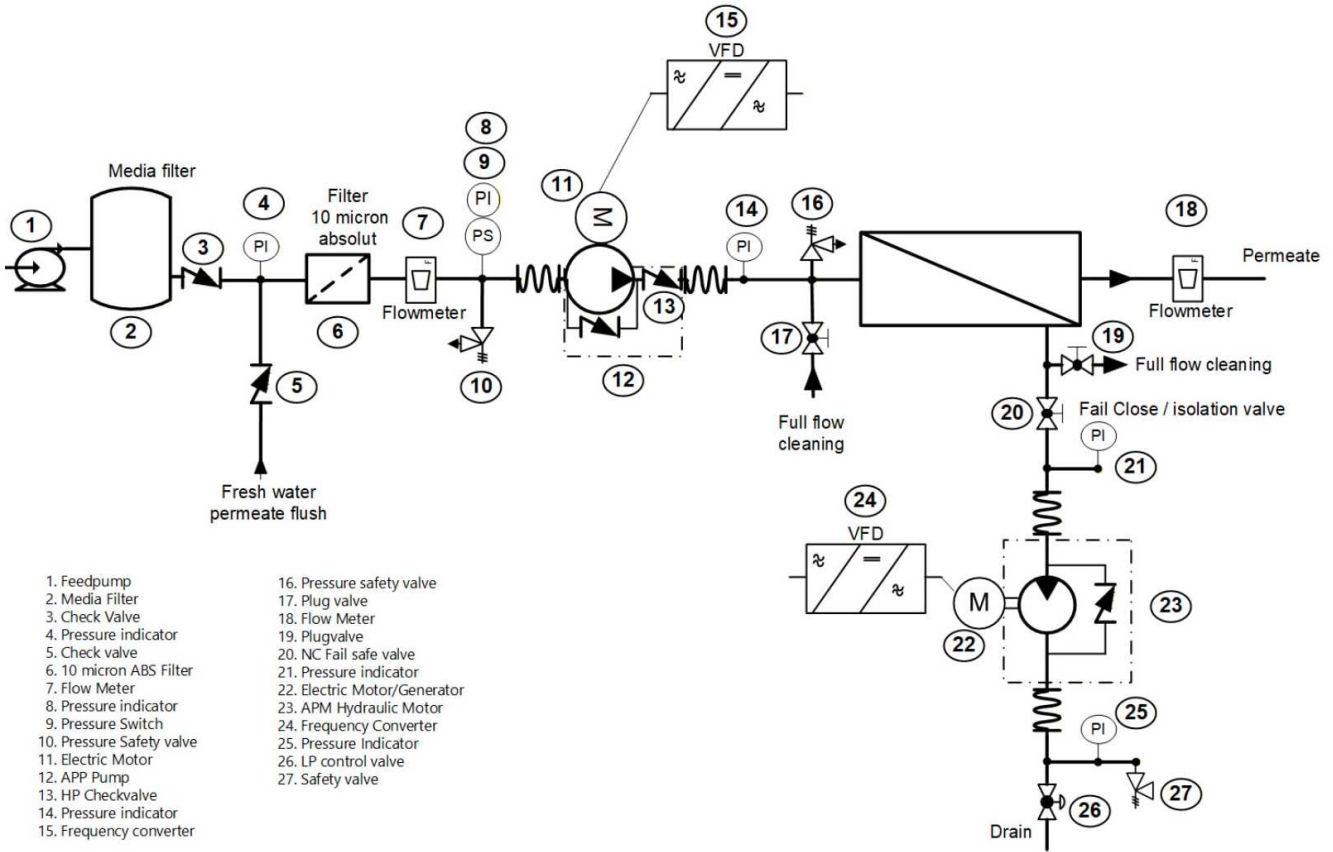
Second option is to install the APM to an individual electric motor that operates as a generator.



The APM can be connected directly to an electric motor with a frequency drive.

In this setup, the motor and drive act as a generator, supplying power to the High Pressure Pump's frequency drive, thereby reducing its energy consumption.

These configurations allow for efficient utilization of the shaft power generated by the APM by minimizing energy consumption for pump operation.



Service

Warranty

Danfoss APM motors are designed for long operation, low maintenance and reduced lifecycle costs.

Provided that the motor 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 APM motors. Other factors that affect motor performance and lifetime include:

- Running the motor at speed outside specifications.
- Supplying the motor with water at temperature higher than recommended.
- Running the motor at inlet pressure outside specifications.
- Running the motor at outlet pressure outside the specifications.

Maintenance

Periodic inspections are required to ensure worn parts (if any), are replaced in due time. Operational conditions such as water quality should be taken into consideration when determining the frequency of the inspections. Danfoss recommends yearly inspections. It is recommended to order the purpose designed tool kit.

Motor shutdown:

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

When stopping the motor for more than 1 day flush the motor with permeate by rotating the motor for 10 sec. The motor can be flushed with biocide like the membranes. The biocide must be compatible with the materials used in our motors.

Repair assistance

In case of irregular function of the APM motor, please contact Danfoss High Pressure Pumps.

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

Accessories

APM 9.7

Accessories	Type	Code No.
1" High Pressure hose- 0.66m (26")	1 ½" Victaulic	180Z0228
1" High Pressure hose- 1.16m (45.7")	1 ½" Victaulic	180Z0229
1 ½" High Pressure hose - 1.16m (45.7")	1 ½" Victaulic	180Z0167
1 ½" inlet Vic. Duplex	M42 – 1 ½" Victaulic	180F4234
2" Low Pressure hose kit - 2m (79")	2" Victaulic	180Z0298
2" inlet Vic. Super Duplex	M42 - 2" Victaulic	180F4235

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Accessories	Type	Code No.
3" Low Pressure Hose kit 2m (79")	3" Victaulic	180Z0144
2" High Pressure hose 124bar Max.	1.78m (70")	180Z0263
	1m (39.4")	180Z0280
2 ½" High Pressure Hose 124bar Max.	1m (39.4")	180Z1009
	1.78m (70")	180Z1008
2 ½" Victaulic connector to M60 x 1.5 124 bar Max.	M60- 2½" Victaulic	180B3206
3" Victaulic Connector to M60x1.5 10 bar Max.	M60- 3" Victaulic	180B3208

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
Export Control Declaration	Energy Recover Device (ERD)	Danfoss	
Export Control Declaration	Energy Recovery Device (ERD)	Danfoss	
EU Declaration	Danfoss EU 033F0685.AZ	Danfoss	Pressure, EMC, PED

Contact details

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