MAKING MODERN LIVING POSSIBLE

Data sheet

PAHT pumps

PAHT 2-12.5 / PAHT 20-32
PAHT 50-90 / PAHT 256-308

danfoss.high-pressurepumps.com

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1. Introduction

The Danfoss range of PAHT high-pressure pumps is specifically designed for use with technical water such as:

- Ultra-pure water that has undergone multiple reverse osmosis processes
- De-ionized water
- Demineralized water

Danfoss PAHT 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.

2. 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 up to 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 electricity consumption of any comparable pump on the market.
- **Easy installation:**
  - The lightest and most compact design available.
  - Pump can be installed horizontally or vertically.
  - No pulsation dampeners necessary due to extremely low-pressure pulsation.
  - Powered by electric motors or combustion engines.
  - Suitable for both boosted inlet pressure and water supply from a tank.
  - No need for cooling circuits due to very high mechanical efficiency.
- **Certified quality:**
  - Fulfills the stringent hygiene requirements, VDI 6022, HACCP.
  - Certificates: ATEX, API, ISO 9001, ISO 14001.

3. Application examples

- High-pressure cleaning with ultra-pure water, as used in the manufacturing of flat-panel displays and other electronic products.
- High-pressure cleaning with ultra-pure water, as used in the manufacturing of parts for the automobile industry.
- Adiabatic cooling systems to replace or supplement standard A/C systems in server rooms and factories.
- Humidification in office buildings, electronic component manufacturing, dairies, greenhouses, etc.
- Dust suppression and odor control systems, for example in paper, textile and wood production.
- Reduction of NOx emissions in diesel engines.

4. Technical data

4.1 PAHT 2-12.5

Pump size		PAHT 2	PAHT 3.2	PAHT 4	PAHT 6.3	PAHT 10	PAHT 12.5
Code number		180B0031	180B0077	180B0030	180B0029	180B0032	180B0033
Geometric displacement	cm^3/rpm	2	3.2	4	6.3	10	12.5
	in^3/rpm	0.12	0.20	0.24	0.38	0.61	0.76
Pressure							
Max. outlet pressure, continuous	barg	100	100	100	100	140	140
	psig	1450	1450	1450	1450	2031	2031
Min. outlet pressure	barg	30	30	30	30	30	30
	psig	435	435	435	435	435	435
Inlet pressure, continuous	barg	0-4	0-4	0-4	0-4	0-4	0-4
	psig	0-58	0-58	0-58	0-58	0-58	0-58
Max. inlet pressure, peak	barg	4	4	4	4	4	4
	psig	58	58	58	58	58	58
Speed							
Min. speed, continuous	rpm	1000	1000	1000	1000	1000	1000
Max. speed, continuous	rpm	3000	3000	3000	3000	2400	2400
Typical flow							
1000 rpm at max. pressure	l/min	0.9	2.3	3.1	5.5	8.0	10.5
1500 rpm at max. pressure	l/min	1.9	3.8	5.1	8.6	12.8	16.5
1200 rpm at max. pressure	gpm	1.3	2.9	3.9	6.7	9.9	13.0
1800 rpm at max. pressure	gpm	2.5	4.9	6.3	10.4	15.8	20.2
Typical motor size							
1500 rpm at max. pressure	kW	0.75	1.1	1.5	2.2	4.0	5.5
1800 rpm at max. pressure	hp	1.0	1.5	2.0	3.0	7.5	7.5
Torque at max. outlet pressure	Nm	4.4	6.7	8.1	12.4	25.6	31.7
	lbf-ft	3.2	4.9	6.0	9.2	18.9	23.4
Media temperature	°C	3-50	3-50	3-50	3-50	3-50	3-50
	°F	37-104	37-104	37-104	37-104	37-104	37-104
Ambient temperature	°C	0-50	0-50	0-50	0-50	0-50	0-50
	°F	32-104	32-104	32-104	32-104	32-104	32-104
Sound pressure level*	dB(A)	76	76	76	76	75	75
Weight	kg	4.4	4.4	4.4	4.4	7.7	7.7
	lb	9.7	9.7	9.7	9.7	17.0	17.0

* Measurements according to EN ISO 3744: 2010 / dB(A) [$L_{PA,\ 1m}$] values are calculated. Measured at max pressure and rpm.

4.2 PAHT 20-32

Pump size		PAHT 20	PAHT 25	PAHT 32
Code number		180B0019	180B0020	180B0021
Geometric displacement	cm^3/rpm	20	25	32
	in^3/rpm	1.22	1.53	1.95
Pressure				
Max. outlet pressure, continuous	barg	80	160	160
	psig	1160	2321	2321
Min. outlet pressure	barg	30	30	30
	psig	435	435	435
Inlet pressure, continuous	barg	3-6	3-6	3-6
	psig	43-87	43-87	43-87
Max. inlet pressure, peak	barg	15	15	15
	psig	218	218	218
Speed				
Min. speed, continuous	rpm	700	700	700
Max. speed, continuous	rpm	2400	2400	2400
Typical flow				
1000 rpm at max pressure	l/min	12.3	13.2	18.5
1500 rpm at max pressure	l/min	27.7	33.4	45.0
1200 rpm at max. pressure	gpm	4.2	4.8	6.6
1800 rpm at max. pressure	gpm	9.0	10.8	14.3
Typical motor size				
1500 rpm at max. pressure	kW	5.5	11.0	15.0
1800 rpm at max. pressure	hp	7.5	20.0	20.0
Torque at max. outlet pressure	Nm	21.0	69.2	89.0
	lbf-ft	15.5	51.1	65.7
Media temperature	°C	3-50	3-50	3-50
	°F	37-104	37-104	37-104
Ambient temperature	°C	0-50	0-50	0-50
	°F	32-104	32-104	32-104
Sound pressure level*	dB(A)	79	79	79
Weight	kg	19	19	19
	lb	42	42	42

* Measurements according to EN ISO 3744: 2010 / dB(A) [$L_{PA, 1m}$] values are calculated. Measured at max pressure and rpm.

4.3 PAHT 50-90

Pump size		PAHT 50	PAHT 63	PAHT 70	PAHT 80	PAHT 90
Code number		180B0085	180B0086	180B0087	180B0088	180B0089
Geometric displacement	cm^3/rpm	50	63	70	80	90
	in^3/rpm	3.05	3.84	4.27	4.88	5.49
Pressure						
Max. outlet pressure, continuous	barg	80	160	160	160	160
	psig	1160	2321	2321	2321	2321
Min. outlet pressure	barg	30	30	30	30	30
	psig	435	435	435	435	435
Inlet pressure, continuous	barg	3-6	3-6	3-6	3-6	3-6
	psig	43-87	43-87	43-87	43-87	43-87
Max. inlet pressure, peak	barg	15	15	15	15	15
	psig	218	218	218	218	218
Speed						
Min. speed, continuous	rpm	700	700	700	700	700
Max. speed, continuous	rpm	1800	1800	1800	1800	1800
Typical flow						
1000 rpm at max. pressure	l/min	28.6	32.4	39.0	44.8	52.3
1500 rpm at max. pressure	l/min	68.7	83.1	92.2	109.2	124.3
1200 rpm at max. pressure	gpm	10.2	11.9	14.0	16.1	18.6
1800 rpm at max. pressure	gpm	22.1	27.0	30.7	35.2	40.0
Typical motor size						
1500 rpm at max. pressure	kW	11	30	30	37	45
1800 rpm at max. pressure	hp	20	50	50	60	75
Torque at max. outlet pressure	Nm	68.5	172.6	191.8	219.8	246.6
	lbf-ft	50.6	127.4	141.5	162.2	182.0
Media temperature	°C	3-50	3-50	3-50	3-50	3-50
	°F	37-104	37-104	37-104	37-104	37-104
Ambient temperature	°C	0-50	0-50	0-50	0-50	0-50
	°F	32-104	32-104	32-104	32-104	32-104
Sound pressure level*	dB(A)	80	80	80	80	81
Weight	kg	34	34	34	34	34
	lb	75	75	75	75	75

* Measurements according to EN ISO 3744: 2010 / dB(A) [$L_{PA, 1m}$] values are calculated. Measured at max pressure and rpm.

4.4 PAHT 256-308

Pump size		PAHT 256	PAHT 308
Code number		180B1001	180B1002
Geometric displacement	cm^3/rpm	256	308
	in^3/rpm	15.6	18.8
Pressure			
Max. outlet pressure, continuous	barg	120	120
	psig	1740	1740
Min. outlet pressure	barg	30	30
	psig	435	435
Inlet pressure, continuous	barg	3-6	3-6
	psig	43-87	43-87
Max inlet pressure, peak	barg	15	15
	psig	218	218
Speed			
Min. speed, continuous	rpm	450	450
Max. speed, continuous	rpm	1250	1250
Typical flow			
1000 rpm at max. pressure	l/min	78	101
1500 rpm at max. pressure	l/min	282	338
1200 rpm at max. pressure	gpm	20.6	26.7
1800 rpm at max. pressure	gpm	74.5	89.3
Typical motor size			
1500 rpm at max. pressure	kW	55	75
1800 rpm at max. pressure	hp	100	125
Torque at max. outlet pressure	Nm	549.6	661.3
	lbf-ft	405.6	448.0
Media temperature	°C	3-50	3-50
	°F	37-104	37-104
Ambient temperature	°C	0-50	0-50
	°F	32-104	32-104
Sound pressure level*	dB(A)	82	82
Weight	kg	105	105
	lb	231	231

* Measurements according to EN ISO 3744: 2010 / dB(A) [$L_{PA, 1m}$] values are calculated. Measured at max pressure and rpm.

5. Flow

The flow (Q_{eff}) at less than max. pressure (p_{max}) can be calculated with the following equation:

$$Q_{eff} = Q_{(th)} - [(Q_{(th)} - Q(p_{max})) \times (p / p_{max})]$$

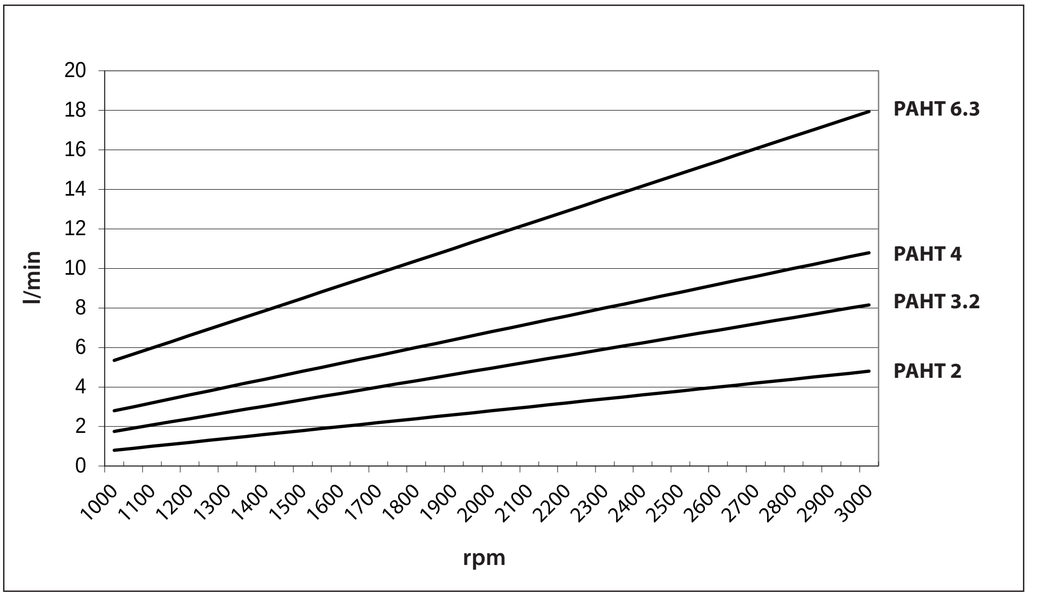
The theoretical flow can be calculated with the following equation:

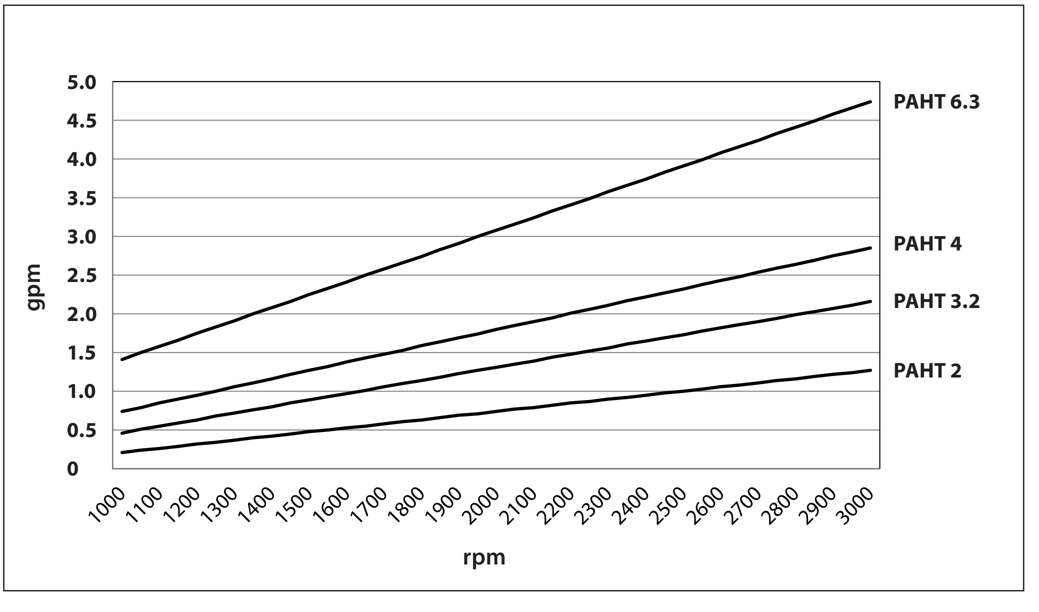
$$Q_{(th)} = \frac{V \times n}{1000}$$

At zero pressure the true flow equals the theoretical flow $Q_{(th)}$.

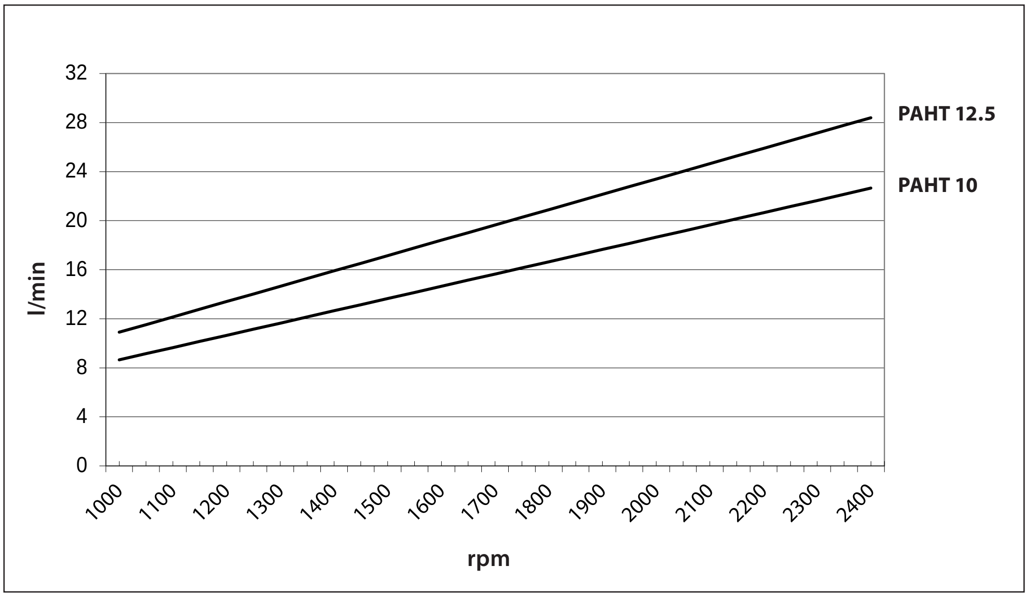
$Q_{(th)}$:	Theoretical flow (l/min)
$Q(p_{max})$:	Flows at max. pressure (l/min), see 4.1-4.4
p_{max}:	Max pressure (bar)
p:	Pressure (bar)
V:	Displacement (ccm/rev.)
n:	Motor speed (rpm)

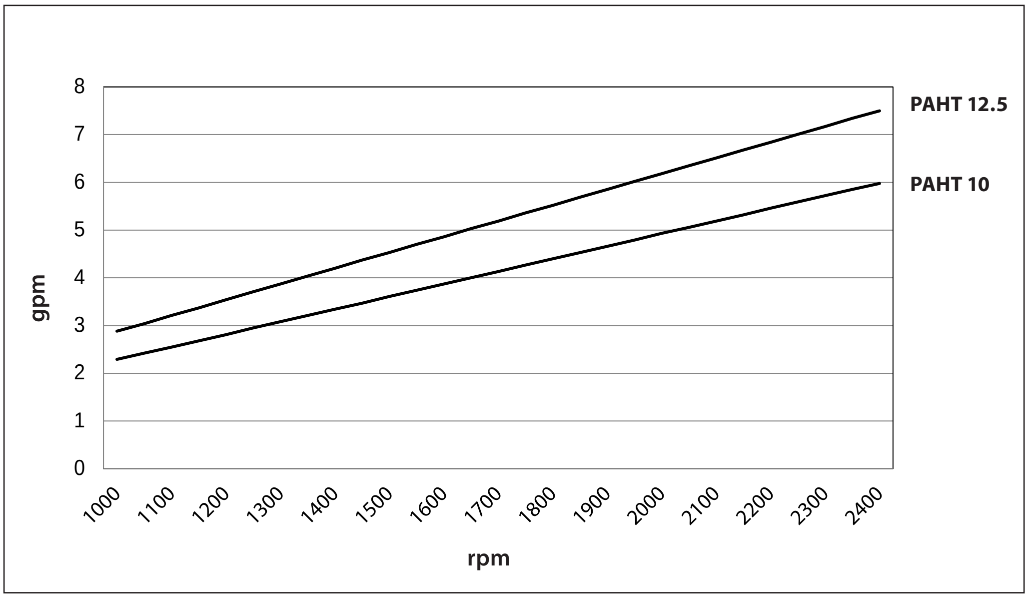
5.1 PAHT 2-6.3 flow curves at max pressure



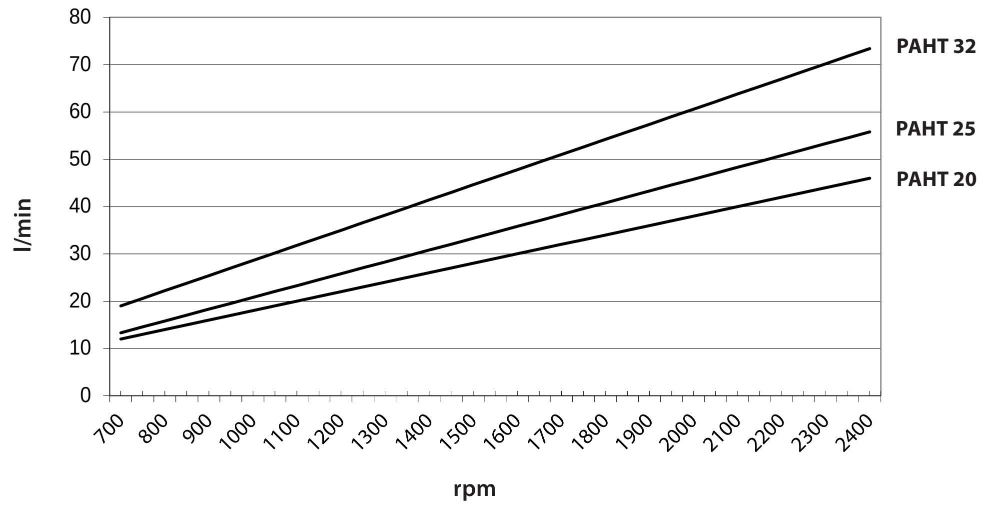


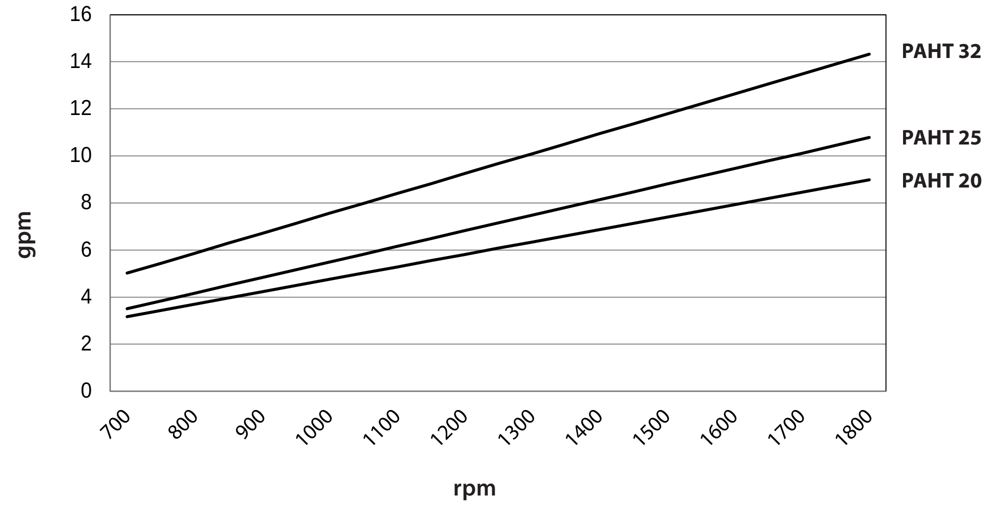
5.2 PAHT 10-12.5 flow curves at max pressure



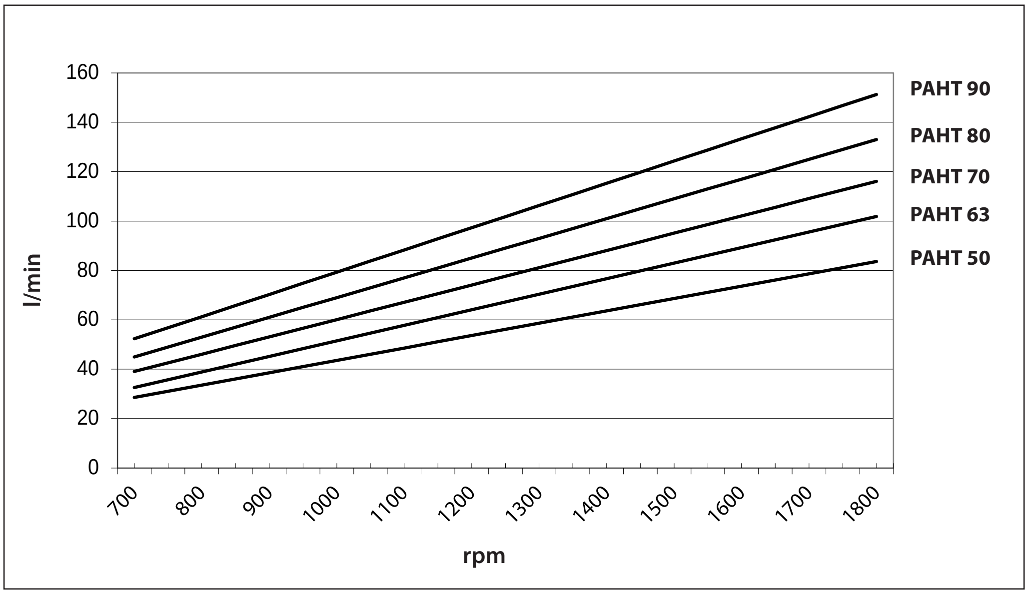


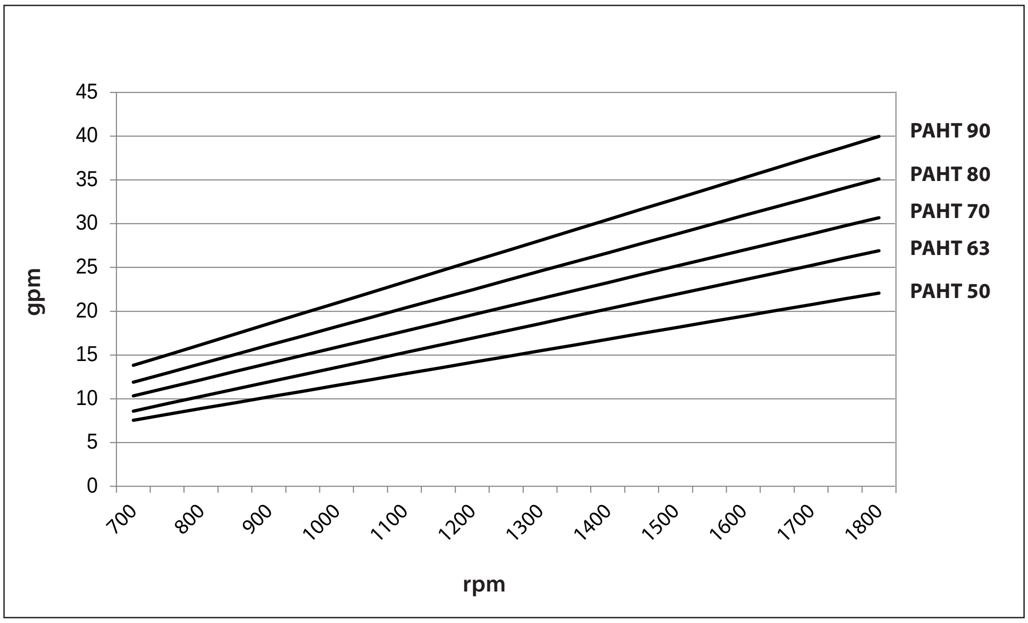
5.3 PAHT 20-32 flow curves at max pressure



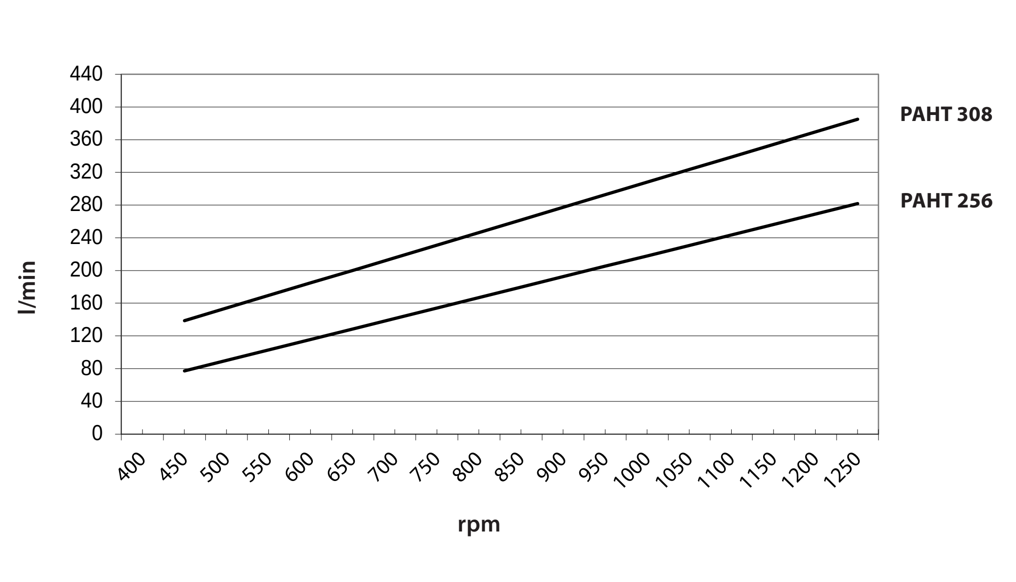


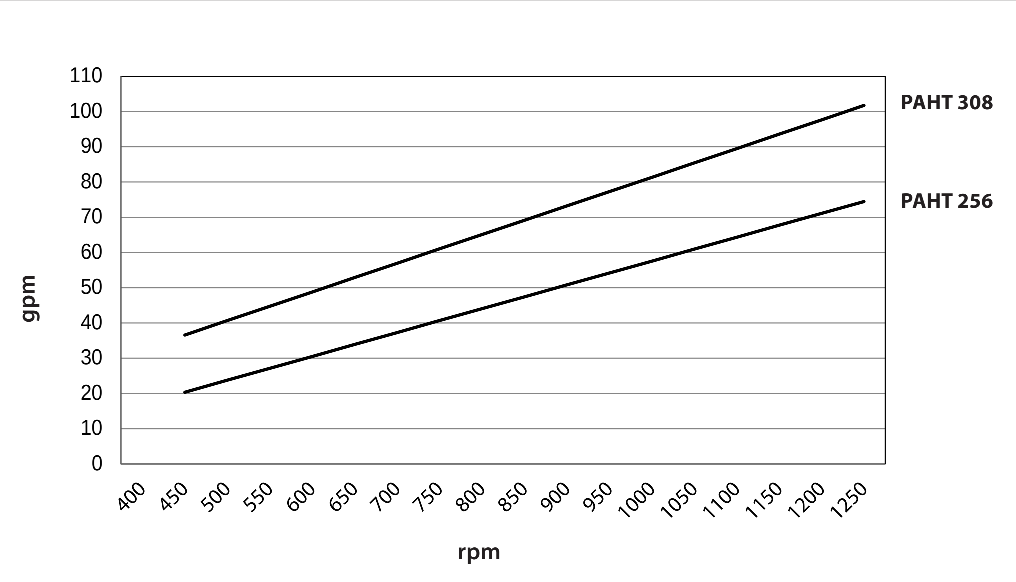
5.4 PAHT 50-90 flow curves at max pressure





5.5 PAHT 256-308 flow curves at max pressure





6. Motor requirements

The required motor power can be calculated by using the following equation:

$$P = \frac{n \times V \times p}{600.000 \times \eta}$$

P:	Power (kW)
M:	Torque (Nm)
η:	Mechanical efficiency
p:	Pressure (bar)
n:	Motor speed (rpm)
V:	Displacement (ccm/rev.)

From the flow curves in item 5, you can determine the rpm of the pump at the desired flow.

The required torque is calculated as follows:

$$M = \frac{V \times p}{62.8 \times \eta}$$

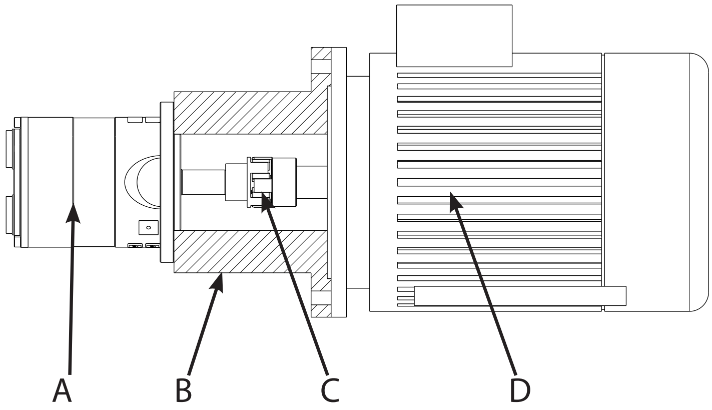
To determine the correct motor size, both the power and torque requirement must be verified.

The mechanical efficiency of the pump, at max pressure, is as follows:

PAHT 2, 3.2, 4, 6.3	0.8
PAHT 10, 12.5	0.9
PAHT 20, 25, 32, 50, 63, 70, 80, 90	0.95
PAHT 256, 308	0.95

7. Installation

See the figure below for instructions on how to mount the pump and connect it to an electric motor or combustion engine.



A: Pump
B: Bell housing
C: Coupling
D: Motor

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.

7.1 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 PAHT 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 10 µm abs. ß10>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 100,000 particles that enter such filters, 50,000 particles pass right through them; 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).

7.2 Noise

Since the pump unit is mounted on a frame, 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 dampers and to use flexible hoses rather than metal pipes where possible.

The noise level is influenced by:

- **Pump speed:**
  High RPM makes more noise than low RPM.
- **Discharge pressure:**
  High pressure makes more noise than low pressure.
- **Pump mounting:**
  Rigid mounting makes more noise than flexible mounting. Be sure to use dampers when mounting.
- **Connections to pump:**
  Pipes connected directly to the pump make more noise than flexible hoses.
- **Variable frequency drives (VFDs):**
  Motors regulated by VFDs can produce more noise.

7.3 Open-system design

A Inlet line:
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).

B Inlet filter:
Install the inlet filter (3) in front of the PAHT pump (4). Please consult the Danfoss filter data sheet for guidance on how to select the right filter.

C Monitoring pressure switch:
Install the monitoring pressure switch (5) between the filter (3) and the pump inlet. Set the minimum inlet pressure according to specifications described in item 4, technical data. The monitoring pressure switch stops the pump if inlet pressure is lower than the set minimum pressure.

D Monitoring temperature switch:
Install the monitoring temperature switch (6) between the filter and the pump, on either side of the monitoring pressure switch. Set the temperature value to 50°C/122°F. The monitoring temperature switch stops the pump if inlet temperature is higher than the set value.

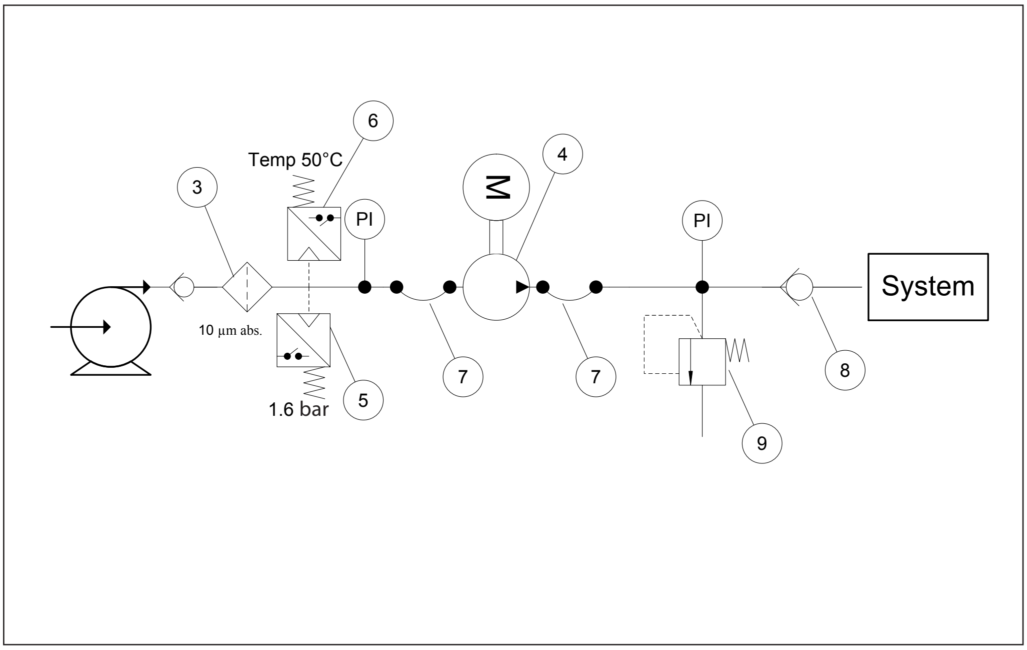
E Hoses:
Always use flexible hoses (7) to minimize vibrations and noise.

F Inlet pressure:
In order to eliminate the risk of cavitation and other pump damage, pump inlet pressure must be maintained according to specifications described in item 4, technical data.

G Non-return valve (8):
Should be installed after the outlet to prevent pump backspin, which may ruin the pump.

H Pressure relief valve:
As the Danfoss PAHT pump begins to create pressure and flow immediately after start-up regardless of any counter pressure, a pressure relief valve (9) should be installed to prevent system damage.

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 the pump to protect against high-pressure peaks.



7.4 Closed-system design

A Inlet line:
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).

B Inlet filter:
Install the inlet filter (3) before the tank (4). Please consult the Danfoss filter data sheet for guidance on how to select the right filter.

C Monitoring pressure switch:
Install the monitoring pressure switch (5) before the filter (3). Set the maximum inlet pressure to 2 bar (29.0 psi). The monitoring pressure switch will stop the pump if inlet pressure is higher than 2 bar (29.0 psi), indicating that the filter element must be changed.

D Monitoring temperature switch:
Install the monitoring temperature switch (6) in the tank. Set the temperature value to 50°C/122°F. The monitoring temperature stops the pump if inlet temperature is higher than the set value.

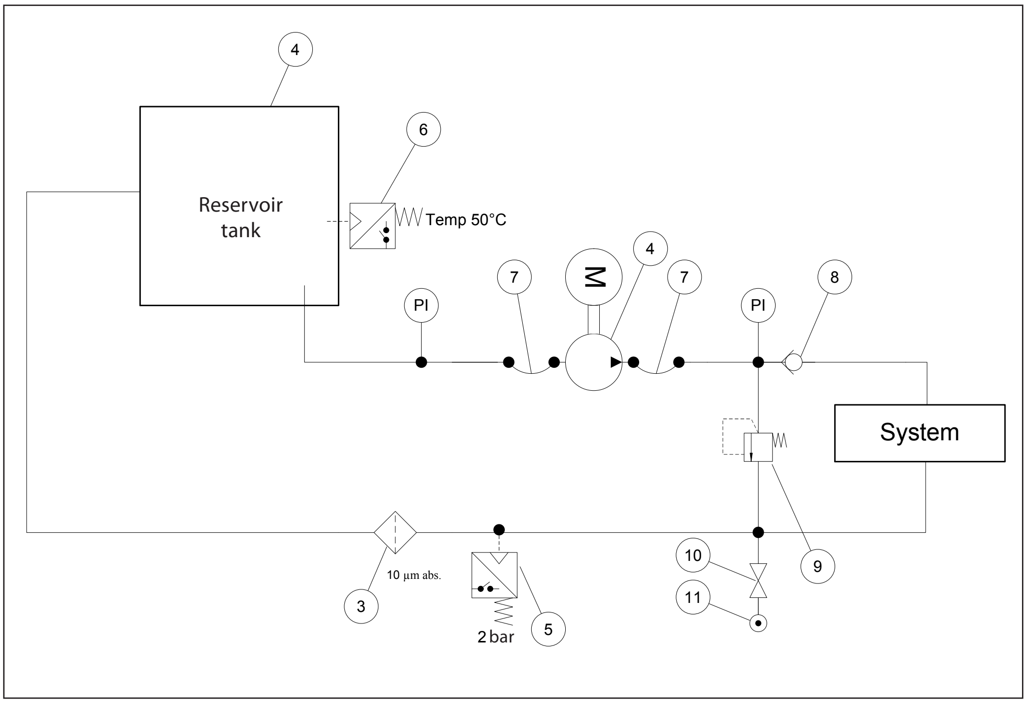
E Hoses:
Always use flexible hoses (7) to minimize vibrations and noise.

F Inlet pressure:
In order to eliminate the risk of cavitation and other pump damage, pump inlet pressure must be maintained according to specifications described in item 4, technical data.

G Non-return valve (8):
Should be installed after the outlet to prevent pump backspin, which may ruin the pump.

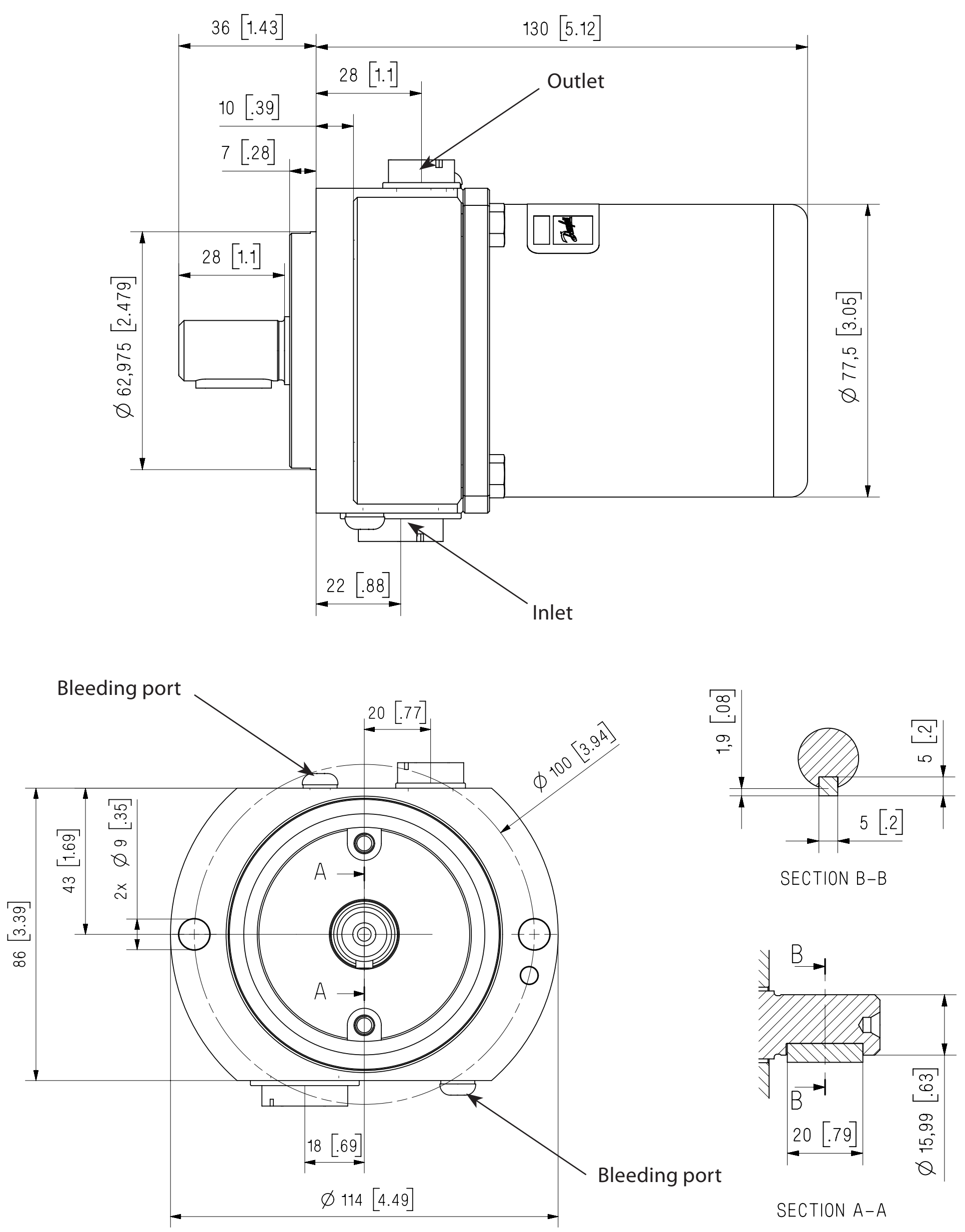
H Pressure relief valve:
As the Danfoss PAHT pump begins to create pressure and flow immediately after start-up regardless of any counter pressure, a pressure relief valve (9) should be installed to prevent system damage.

I System water filling:
To ensure proper filtration of new water (11) supplied to the system, always use the filling valve (10).



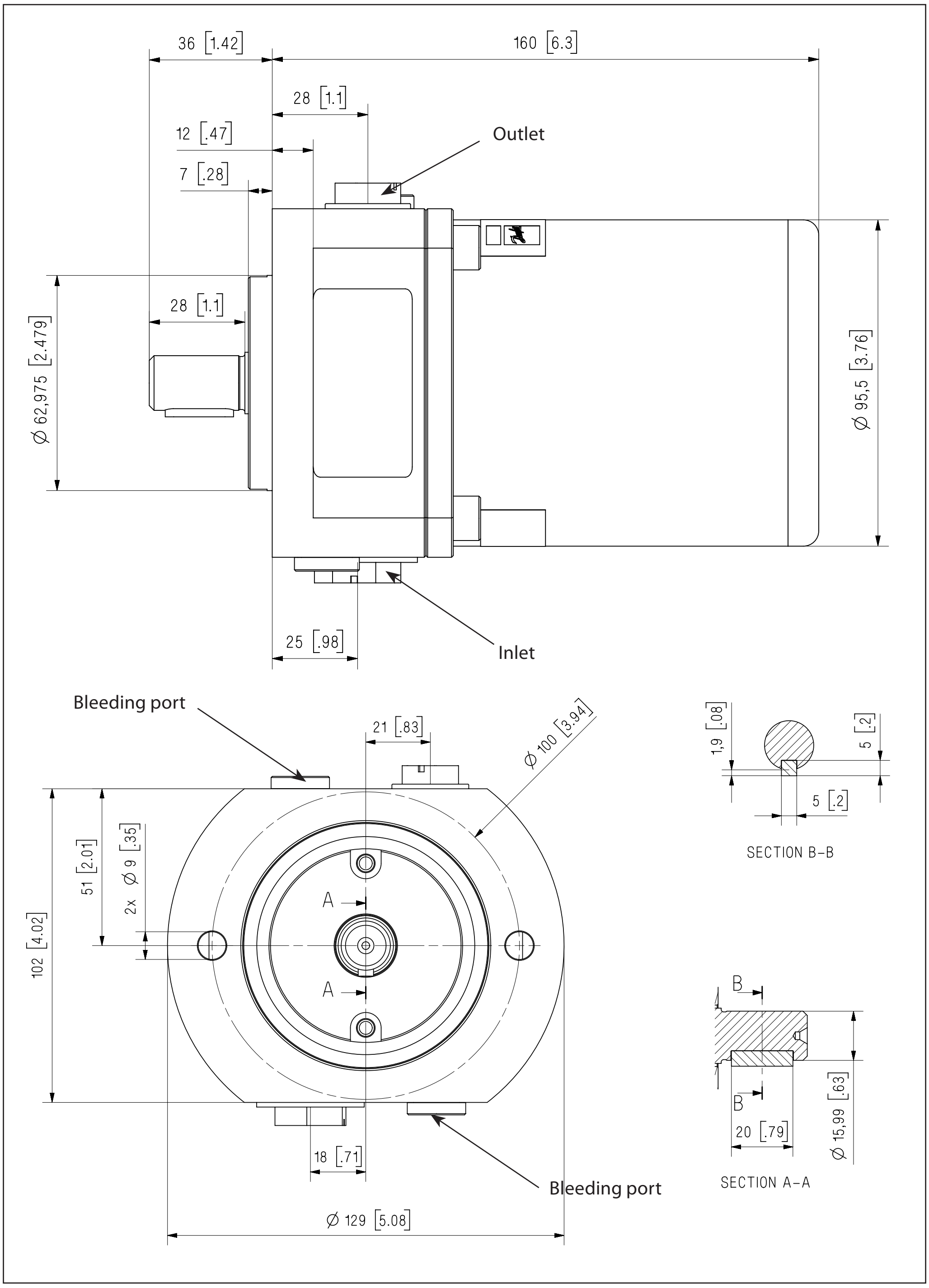
8. Dimensions and connections

8.1 PAHT 2-6.3



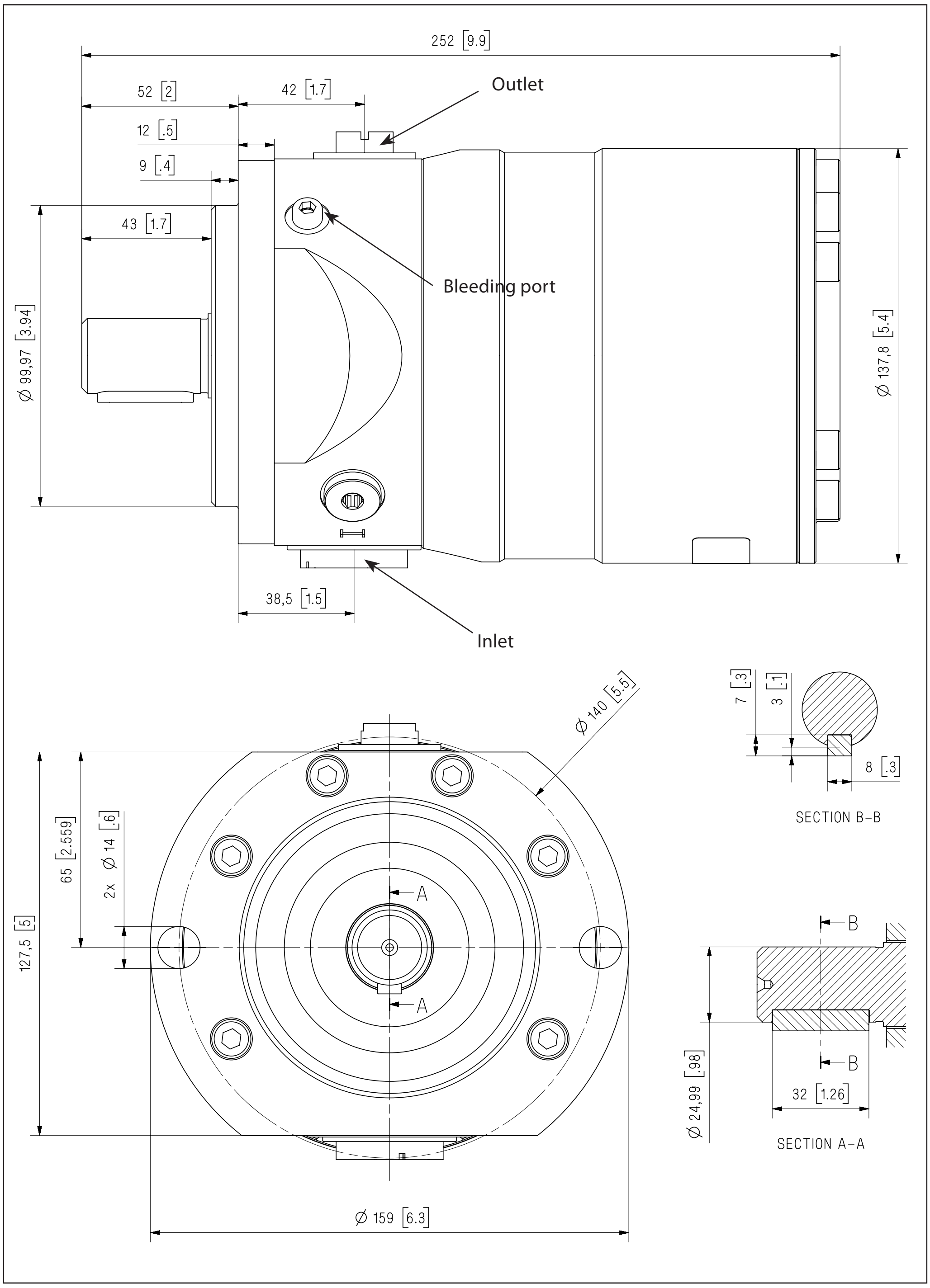
Description		PAHT 2-6.3
Parallel key, DIN 6885	mm	5 × 5 × 20
	in	0.20 × 0.20 × 0.79
Bleeding		M6; hex key 4 mm
Inlet port		G ½" BSPP; depth 15 mm
Outlet port		G ¼" BSPP; depth 11 mm

8.2 PAHT 10-12.5



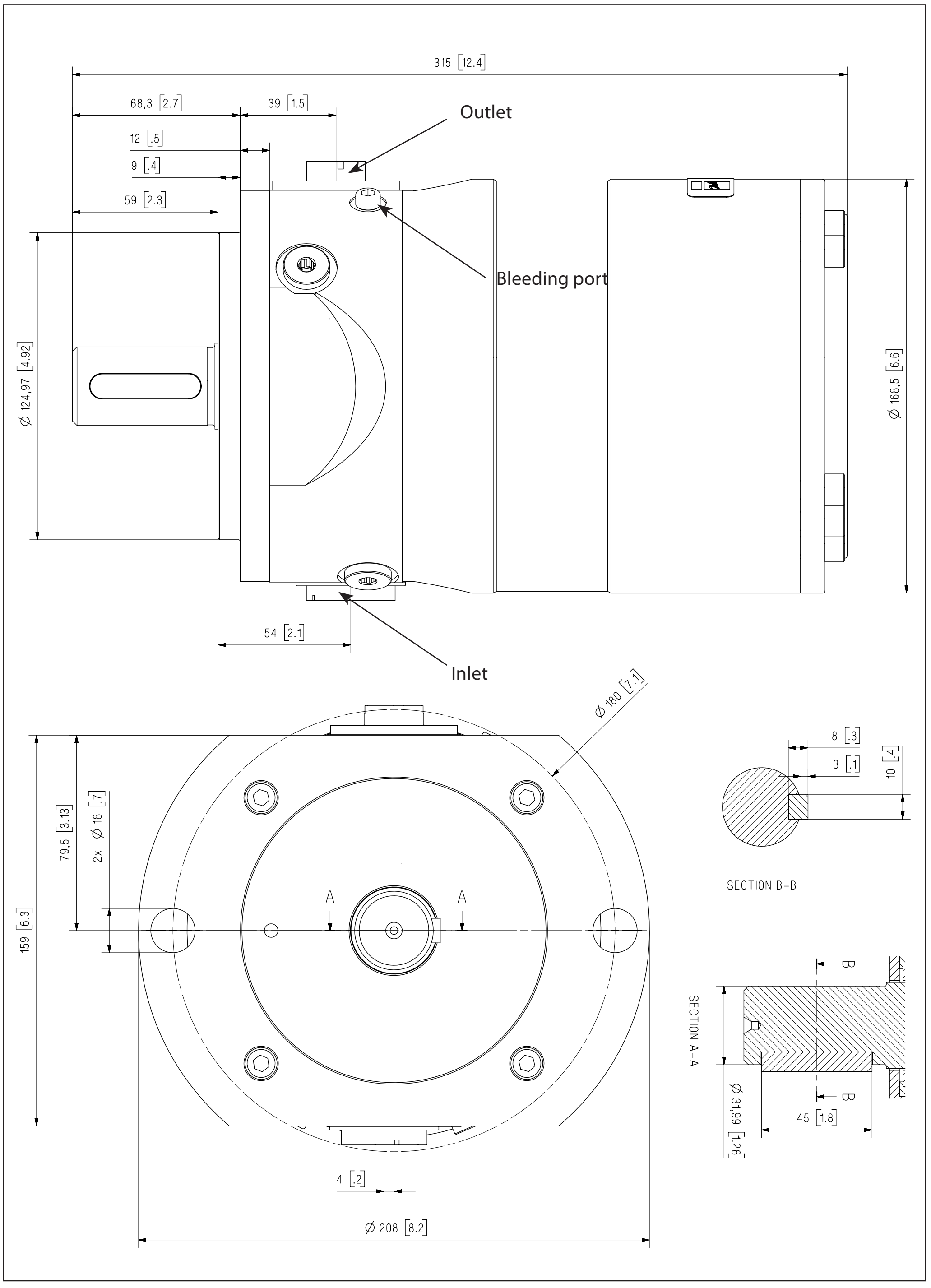
Description		PAHT 10-12.5
Parallel key, DIN 6885	mm	5 × 5 × 20
	in	0.20 × 0.20 × 0.79
Bleeding		G ¼" BSPP; hex key 6 mm
Inlet port		G ¾" BSPP; depth 17 mm
Outlet port		G ⅜" BSPP; depth 15 mm

8.3 PAHT 20-32



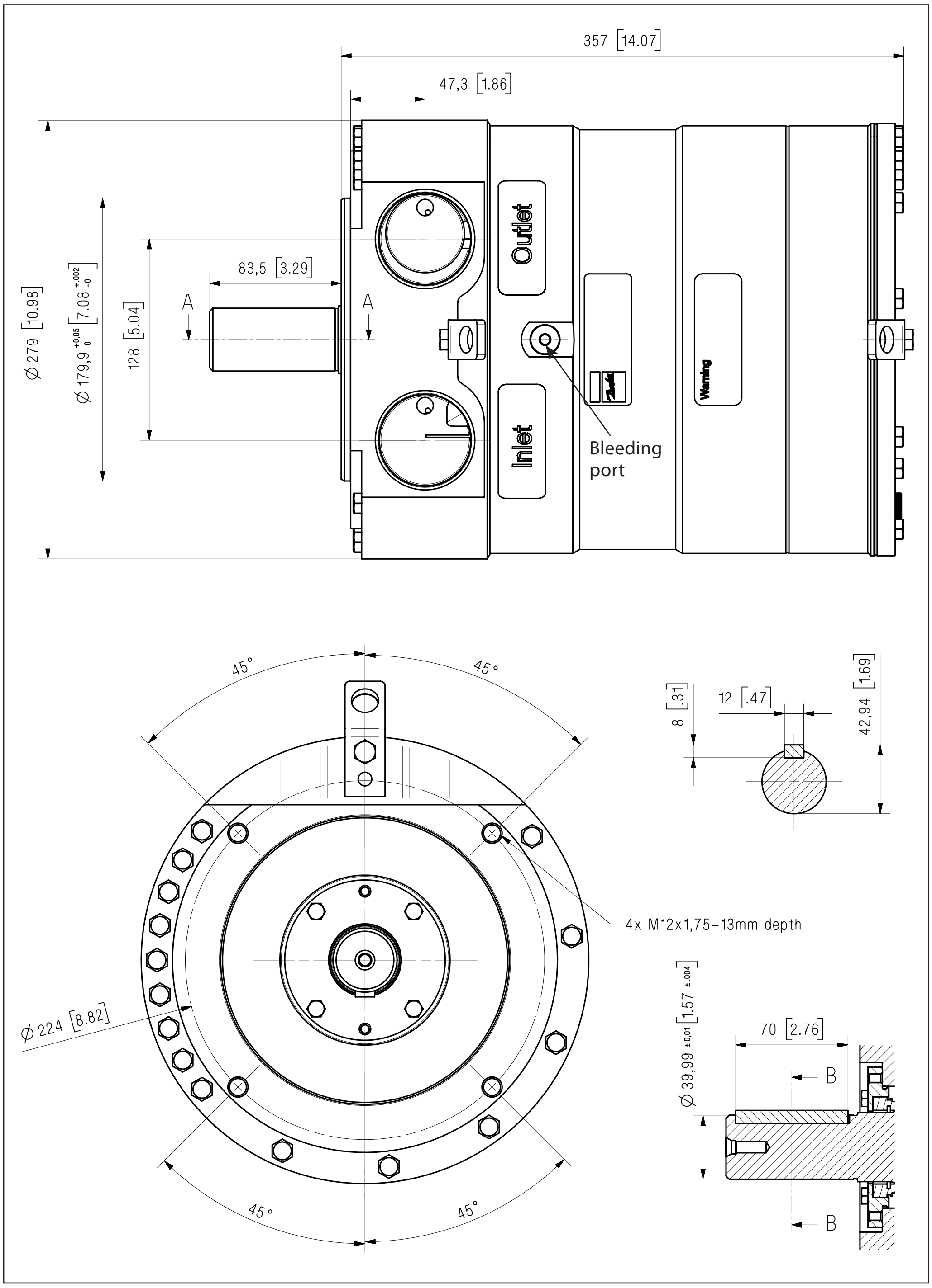
Description		PAHT 20-32
Parallel key, DIN 6885	mm	8 × 7 × 32
	in	0.31 × 0.28 × 1.26
Bleeding		M6; hex key 5 mm
Inlet port		G 1” BSPP; depth 16 mm
Outlet port		G ¾” BSPP; depth 18 mm

8.4 PAHT 50-90



Description		PAHT 50-90
Parallel key, DIN 6885	mm	10 × 8 × 45
	in	0.39 × 0.31 × 1.77
Bleeding		M6; hex key 5 mm
Inlet port		G 1½" BSPP; depth 24 mm
Outlet port		G 1" BSPP; depth 24 mm

8.5 PAHT 256-308



Description		PAHT 265-308
Parallel key, DIN 6885	mm	12 × 8 × 70
	in	0.47 × 0.31 × 2.76
Bleeding		M6; hex key 5 mm
Inlet port		M60 x 1.5; depth 24 mm
Outlet port		M60 x 1.5; depth 24 mm

9. Service

Danfoss PAHT pumps are designed for long periods of service-free operation to provide customers with low maintenance and life cycle costs. Provided that the pump is installed and operated according to Danfoss specifications, Danfoss PAHT pumps typically run 8,000 hours between service routines. However, the service schedule for your Danfoss PAHT pump may vary according to the application and other factors.

The life of a pump may be greatly shortened if Danfoss recommendations concerning system design and operation are not followed.

In our experience, poor filtration is the number one cause of pump damage.

Other factors that affect pump performance and lifetime include:

- running the pump at speeds outside specifications
- supplying the pump with water at temperatures higher than recommended
- running the pump at inlet pressures outside specifications
- running the pump at outlet pressures outside the specifications.

We recommend that you inspect your pump after 8,000 hours of operation even if it is running without any noticeable problems. Replace any worn parts as necessary, including pistons and shaft seals, to keep your pump running efficiently and to prevent breakdown. If worn parts are not replaced, then our guidelines recommend more frequent inspection.

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