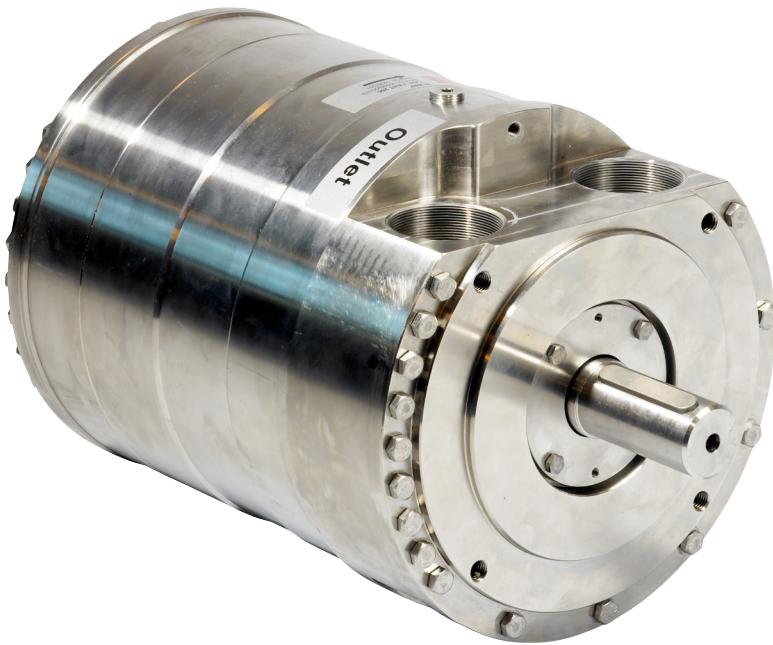


High pressure pumps for technical water type PAHT



**Generally**

The Danfoss High-Pressure water pumps are specifically designed for operation on technical water. Nine pump sizes with displacements from 20 to 256 ccm/rev are available providing flow in the range from 9-282 l/min. (2-74 GPM)

The axial piston principle provides very high efficiency, small and compact design and long service life. The Danfoss pumps are water lubricated and do not involve any other lubricant making this unique pump maintenance free over its entire service life.

Benefits

- Maintenance free due to water lubrication and direct drive (no belt or gearbox)
- Very high efficiency compared to any other pump on the market
- Small, compact and light design
- Negligible pressure pulsation, no need for pulsation dampeners
- Extreme recirculation capability without overheating (up to 90% flow at 20° C)
- Wide speed control range
- Stainless steel design AISI 316 (W. No. 1.4401).
- Fulfils most stringent hygiene requirements, i.e. VDI 6022, HACCP
- Suitable for both boosted inlet pressure and water supply from a tank
- Available as ATEX certified
- Can be powered by a Combustion engine
- 3.2 approvals available according to EN10204 (ABS, Lloydsore costumer request)

Application examples

- Adiabatic cooling systems
- Dust suppression and odour control systems
- Turbine industry:
 - Inlet fogging
 - Wet compression
 - NOx-control
 - Fire suppression
 - Compressor wash
- NOx-control in Diesel engines
- High-pressure cleaning functions with DI/RO water

Code numbers

PAHT 20	180B0019
PAHT 25	180B0020
PAHT 32	180B0021
PAHT 50	180B0085
PAHT 63	180B0086
PAHT 70	180B0087
PAHT 80	180B0088
PAHT 90	180B0089
PAHT 256	180B1001

For ATEX approved pump code numbers, please contact Danfoss High-Pressure Pumps sales dept.

Technical data

Pump size		20	25	32	50	63	70	80	90	256
Geometric displacement	cm ³ /rev	20	25	32	50	63	70	80	90	256
Max. continuous discharge pressure	bar/psi	80/1160	160/2320	160/2320	80/1160	160/2320	160/2320	160/2320	160/2320	120/1740
Min. speed	rpm	700	700	700	700	700	700	700	700	450
Max. speed	rpm	2400	2400	2400	1800	1800	1800	1800	1800	1250
Typical flow at: 450 rpm @ 120 bar 1250 rpm @ 120 bar	- l/min	NA 23	NA 27,8	NA 37,5	NA 57,2	NA 69,25	NA 79	NA 91	NA 103,6	78 282
700 rpm @ 160 bar 1500 rpm @ 160 bar	- l/min	12,3* 27,7*	13,2 33,4	18,5 45,0	28,6* 68,7*	32,4 83,1	39,0 95,2	44,8 109,2	52,3 124,3	NA NA
450 rpm @ 1740 psi 1250 rpm @ 1740 psi	GPM	NA 6,0	NA 7,34	NA 9,9	NA 15,1	NA 18,3	NA 20	NA 24	NA 27,4	20,6 74,5
900 rpm @ 2320 psi 1800 rpm @ 2320 psi	GPM	4,2* 9,0*	4,8 10,8	6,6 14,3	10,2* 22,1*	11,9 27,0	14,0 30,7	16,1 35,2	18,6 40,0	NA NA
Typical motor size: at max. pressure @ 980 rpm at max. pressure @ 1180 rpm at max. pressure @ 1500 rpm at max. pressure @ 1800 rpm	kW HP	3 5,5	7,5 15	11 15	7,5 15	18,5 30	22 30	30 40	30 50	55 100
Weight	kg/lb	19/42	19/42	19/42	34/75	34/75	34/75	34/75	34/75	105

* At 80 bar (1160 psi)

Flow

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

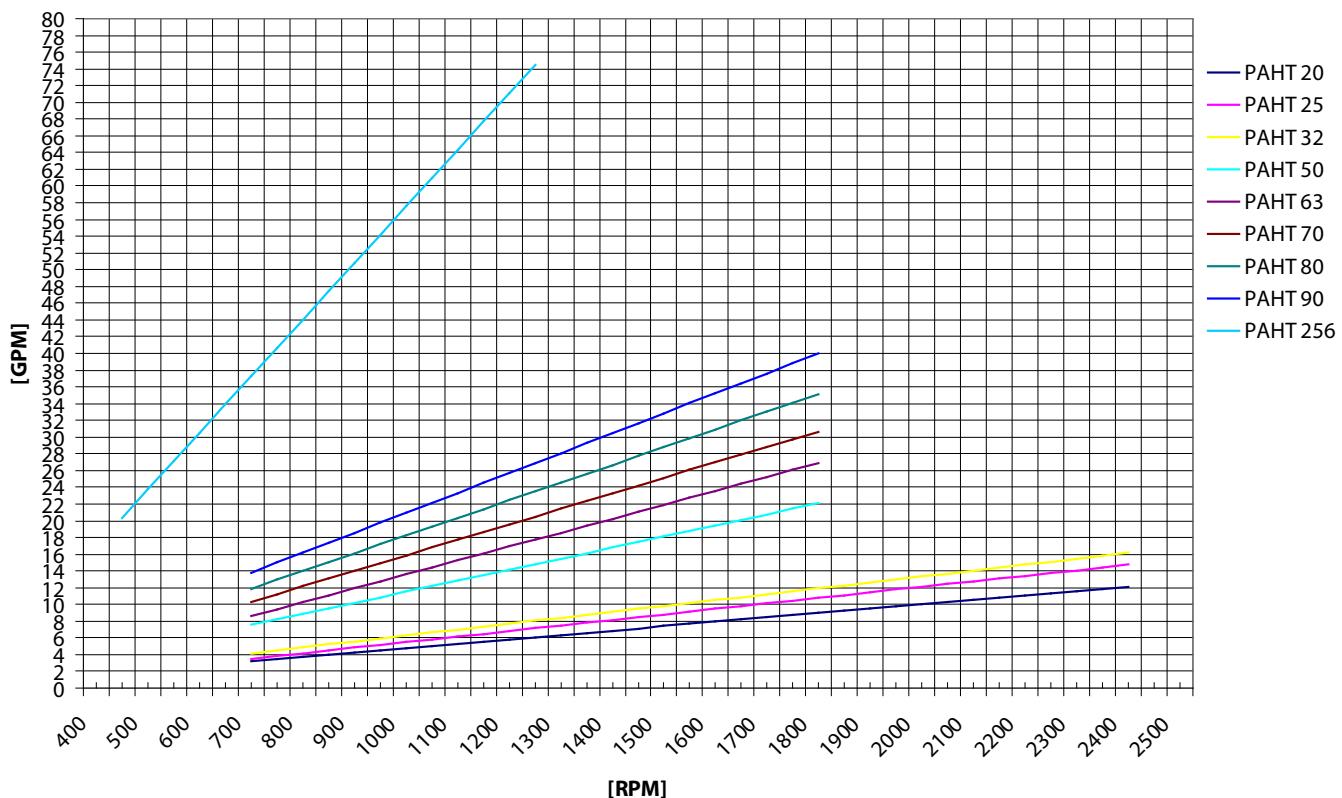
Q_(th) [l/min] = pump displacement in cm³ × rpm/1000
The flow at max. pressure Q (p_{max}) is shown in the "Techincal data" table

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

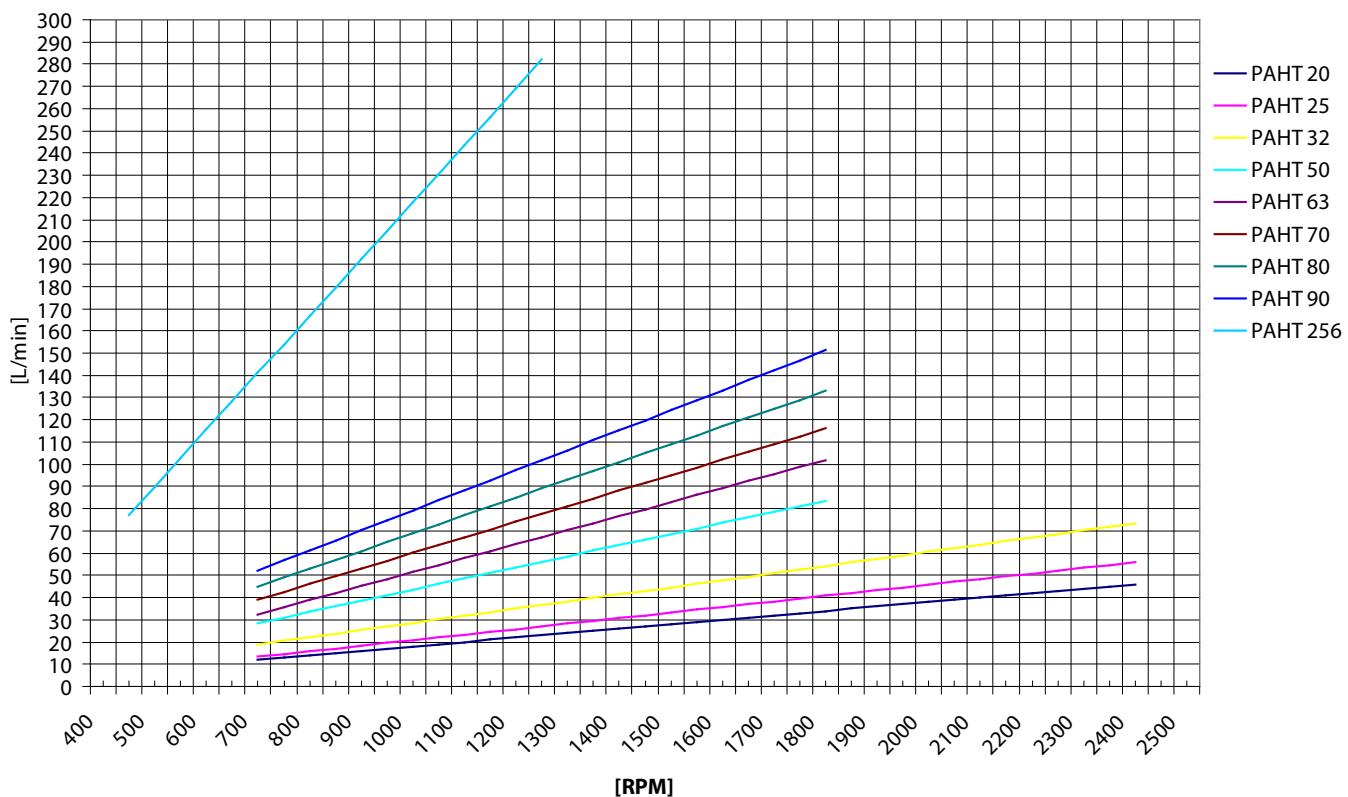
$$Q_{eff} = Q_{(th)} - [(Q_{(th)} - Q_{(p_{max})}) \times (p / p_{max})]$$

Pump flows gallons/min.

Flow curve @max pressure


Pump flows litres/min.

Flow curve @max pressure



Motor dimensioning

Required motor power:

From the following table you can determine the rpm of the pump at the desired flow. Calculate as follows:

$$P \text{ [in kW]} = \frac{\text{Speed [in rpm]} \times \text{displacement per rev [in ccm]} \times \text{pressure [in bar]}}{600.000 \times \eta_{\text{mech}} \text{ (mechanical efficiency)}}$$

The required torque is calculated as follows:

$$M \text{ [in Nm]} = \frac{\text{Displacement [in ccm]} \times \text{pressure [in bar]}}{62.8 \times \eta_{\text{mech}} \text{ (mechanical efficiency)}}$$

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

The mechanical efficiency of the pump is estimated as follows:

PAHT 20, 25, 32, 50, 63, 70, 80, 90	0.95
PAHT 256	0,95

**Operation conditions,
PAHT 20-90**

Inlet pressure:

PAHT 20-90 is designed to operate under boosted pressure supply conditions. The boost pressure is to be between 3-6 bar (43-87 psi) (4-7 bar (58 - 87 psi) abs).

Please make use of the integrated 1/4" gauge ports (inlet) with appropriate pressure switches for monitoring the supply pressure accordingly.

Flooded suction must always be made from a tank placed above the pump min. inlet pressure is 0 bar atm. In case of doubt please contact Danfoss High-Pressure Pumps sales organization.

The maximum inlet peak pressure is 15 bar (290psi).

If it is unknown what the peak inlet pressure can be, then there should be a 10 bar (145 psi) safety relief valve on the inlet side of the pump.

Temperature:

Water temperature:

- Min. +3°C/37.4°F, max. 50°C/122°F at max. discharge pressure

Ambient temperature:

- Min. 0°C/32°F to max. 50°C/122°F

Storage temperature:

- Min. -40°C/-40°F to max. 70°C/158°F (with factory antifreeze preservation)

**Operation conditions,
PAHT 256**

Inlet pressure:

PAHT 256 is designed to operate under boosted pressure supply conditions. The boost pressure is to be between 3-6 bar (43-87 psi) (4-7 bar (58 - 87 psi) abs).

Please make use of the integrated 1/4" gauge ports (inlet) with appropriate pressure switches for monitoring the supply pressure accordingly.

In case of doubt please contact Danfoss High-Pressure Pumps sales organization.

The maximum inlet peak pressure is 15 bar (290psi).

If it is unknown what the peak inlet pressure can be, then there should be a 10 bar (145 psi) safety relief valve on the inlet side of the pump.

Temperature:

Water temperature:

- Min. +3°C/37.4°F, max. 50°C/122°F at max. discharge pressure

Ambient temperature:

- Min. 0°C/32°F to max. 50°C/122°F

Storage temperature:

- Min. -40°C/-40°F to max. 70°C/158°F (with factory antifreeze preservation)

Noise level

Since the pump typically is mounted on a bell housing or frame, the noise level can only be determined for the complete unit (system). It is therefore very important that the pump is mounted correctly on a frame with dampers to minimize vibrations and noise. Furthermore the pump discharge should be connected with the application ie with a flexible high-pressure hose.

The noise level is influenced by:

- The speed of the pump, high rpm create more noise than low rpm
- The discharge pressure, high pressure generates more noise than low pressure
- Rigid mounting of the pump generates more noise than flexible mounting
- Pipe mounting direct to the pump increases the noise level compared to a flexible hose

Filtration

The water must be filtered through a 10 µm absolute filter with a β_{10} -value > 5000 (or better). For further filter details, please contact the Danfoss High-Pressure Pump sales organization.

Technical water

Technical water may be divided into 3 groups:

- Softened water (cation exchanged).
- Demineralized water
(Demineralized/de-ionized water)
- Water processed according to the reverse osmosis principle (RO-water)

Softened* and demineralized* water are not to be used for drinking water in most European countries as the chemicals used for the processes are harmful/hazardous to human beings .

*only applying to units being regenerative.

Descriptions of the specific processes are always enclosed with the systems for making softened, demineralized and reverse osmosis-water.

When using other fluids like HFA, HFC etc., please contact Danfoss High-Pressure Pump sales organization.

Corrosion and antifreeze protection

If the pump is exposed to temperatures below freezing, it must be protected against freezing. See also paragraph on *Operation Conditions*.

Danfoss recommends DOWCAL N or CHILLSAFE antifreezes both being a biologically degradable Mono Propylene Glycol.

(DOWCAL N is produced by POLO).
(CHILLSAFE is produced by ATCO).

Producers of DOWCAL N and CHILLSAFE recommend a mixture ratio of min. 30% DOWCAL N/CHILLSAFE to prevent biofilm occurrence in the system due to DOWCAL N and CHILLSAFE being biologically degradable.

Corrosion protection

If the system is decommissioned for more than 4 weeks or in transportation, the pump must be preserved against corrosion. Never just drain the pump!

See instructions delivered with the pump

Service

The PAHT pumps are maintenance free over their entire service life. To achieve the maximum service life, proper water supply and filtration are mandatory.

Maintenance:

Danfoss recommends a visual and auditory observation on regular intervals.

After 8.000 hours of operation it is recommended to inspect the pump and change any worn parts, e.g. pistons and shaft seal.

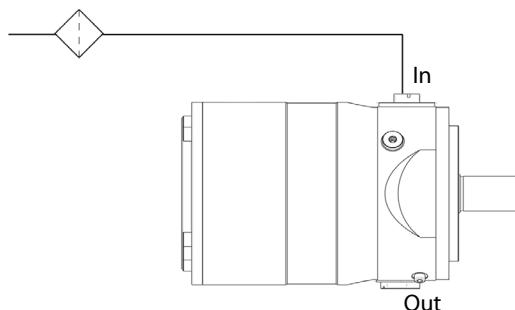
This is done in order to prevent a potential breakdown of the pump.

Standstill:

The pumps are made of materials with excellent corrosion properties. It is however, always recommended to activate the pump if it has been inactive more than 30 days.

Installation to direct water supply, PAHT 20-256

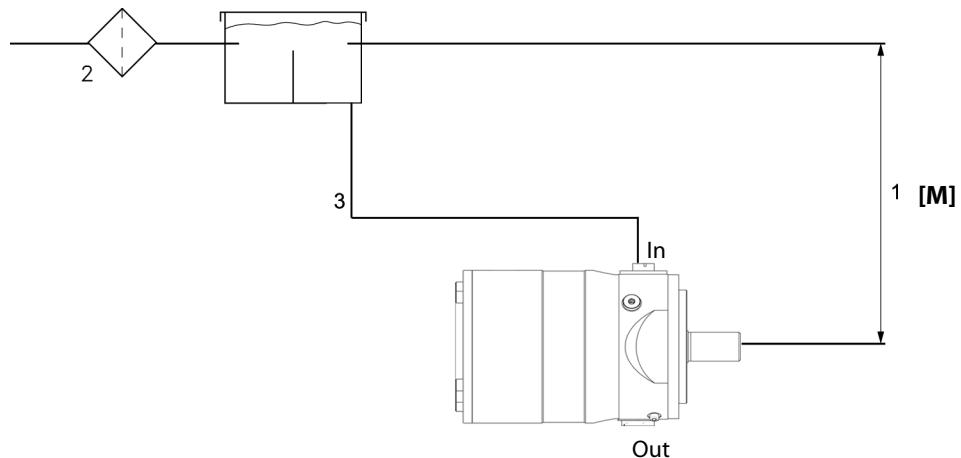
The pump is fed with water direct from the water supply or from a booster pump. We recommend to use a 2 bar pressure switch at the inlet to ensure proper supply.

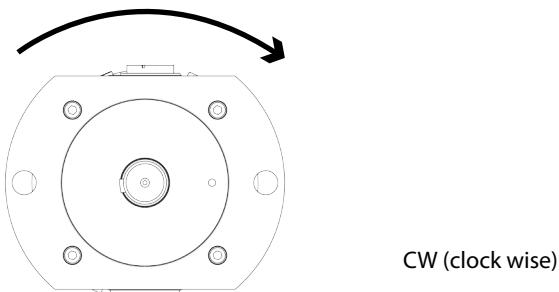

Installation to tank supply, PAHT 20-90

(The numbers 1-3 refer to the drawing below)

In order to eliminate the risk of cavitation, always ensure a minimum inlet pressure of 0 bar (0 psi) (1 bar (14,5 psi) abs), by observing the following guidelines:

- 1) Place the tank above the pump (water level in the tank should always be above the pump).
- 2) Place the inlet filter before the tank.
- 3) Dimension the inlet line to obtain minimum pressure loss (large flow area, minimum pipe length, minimum number of bends/connections, fittings with small pressure losses).



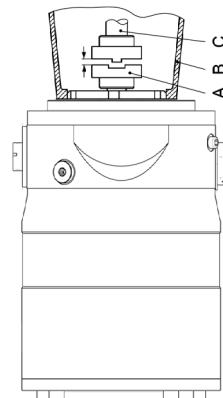
Direction of rotation

Motor connection

The pump must not be exposed to axial nor radial loads. We therefore recommend the use of a flexible coupling for connection to an electric motor or a combustion engine.

Below figure illustrates how to mount the pump and connect it to electric motor/combustion engine.

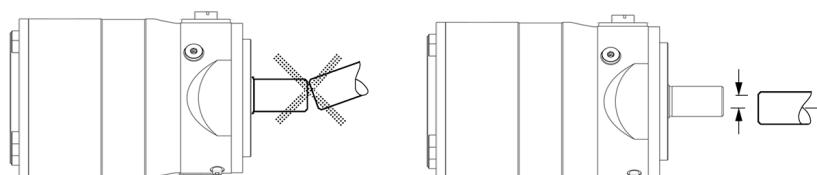
- A: Flexible coupling
- B: Bell housing
- C: Motor shaft

If an alternative mounting is required, please contact Danfoss High-Pressure Pumps sales organization for further information.



To ensure easy mounting of the flexible coupling without using tools, the tolerances must be dimensioned accordingly.

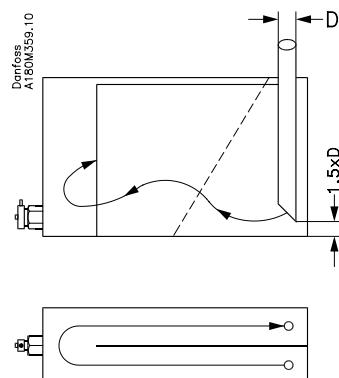
Make sure to observe the recommended mounting tolerances for the flexible coupling used, as any axial load on the shaft must be avoided. Danfoss offers bell housing and coupling-kits. Please contact the Danfoss High-Pressure Pumps sales organization.


Tank

The function of the water tank is to continuously supply clean water, divert heat, remove air and to allow for variations of the water volume.

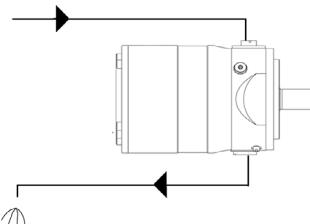
Minimum tank capacity is dimensioned according to the volume required for water cooling, and for water expansion. Normally, a tank capacity of $>0,7$ times the pump flow (per min.) will be sufficient as long as there is a water renewal of $>15\%$ of the pump flow.

Direct the suction line to the pump bottom, approx. 1.5 times the suction line diameter "D" above the bottom to prevent precipitated impurities from being sucked in. Always keep all tank connections (suction, drain and return) below water level in the tank. Drain and return lines to be placed as far from the suction line as possible and preferably separated by a dividing plate in the tank. Additionally, the suction, drain, and return lines must be cut at a 45° angle (see example)



Operation, PAH 20-256**Start-up:**

The system has to be flushed prior to start-up to remove possible impurities from pipes, hoses etc.



Before starting the pump, the top bleeding plug "C" is loosened. When water appears from the bleeding plug, the pump is filled with water, and the plug is retightened. Make sure that rotation direction of the pump is correct.

With its suction line connected to the water supply or the tank, the pump is now started with open outlet port.

At the initial start of the system, the pump should be run without pressure for about 5 minutes to remove possible impurities from pipes, hoses, etc.

Systems must be flushed with water for min. 30 minutes (please see Instructions for "Cleaning of Water Hydraulic Systems"). When the flushing is completed the filter element must be changed.

Safeguarding of pump during operation:

When running, the pump must always be connected to the water supply to prevent the pump from running dry.

In systems with water tank it is recommended to build in a level gauge which will make the pump stop at too low water level.

If it is unknown what the peak inlet pressure can be, then there should be a 10 bar (218 psi) safety relief valve on the inlet side of the pump.

For all systems it is recommended to install a temperature gauge for stopping the pump when the water temperature exceeds 50°C/122°F.

Filter:

After start-up it is recommended to change filter element after 1-10 hours' operation.

The filter element must be changed when "clogged filter" is indicated = too low pressure after the filter.

Disconnection:

If the inlet line to the pump port is disconnected from the water supply, the pump will be emptied of water.

Before starting the pump again, the starting procedure described in the Start-up-paragraph must be followed.

Transport and storage precautions

If emptied of water, the system must be protected against corrosion with a glycol mixture (minimum 35% monopropylene glycol).

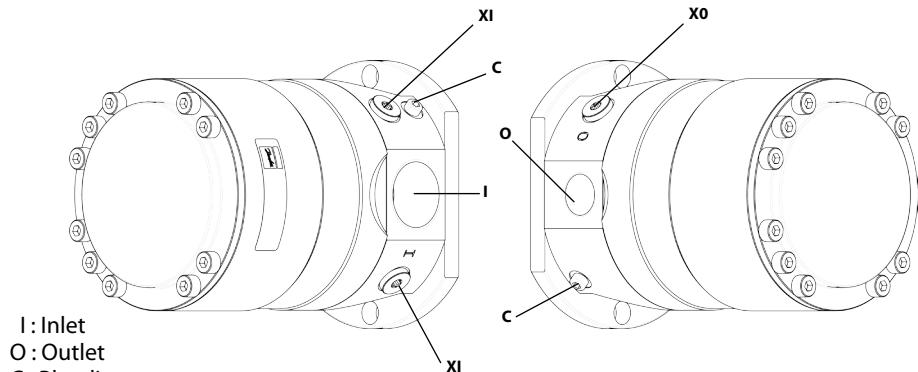
The protection must be made within 2 days after the emptying.

If there is risk of exposure to temperatures below the freezing point during transport or storage, the system likewise has to be flushed with a glycol mixture (minimum 35% monopropylene glycol).

For further information on anti-freeze media, please contact Danfoss High-Pressure Pumps sales organization.

Recommended procedure:

1. Disconnect the water supply to the pump/system.
2. Empty the pump through the lower bleeding plug. Retighten the plug when the pump is empty.
3. Connect the pump to a tank with anti-freeze additive. Connect a hose to the pump P-port and the other end of the hose back to tank.
4. Quickly start and stop the pump. Make sure that the pump does not run dry.
5. Empty pump of anti-freeze medium (through the lower bleeding plug). Remount and retighten the bleeding plug, when the pump is empty.
6. The pump is now protected against internal corrosion and frost.

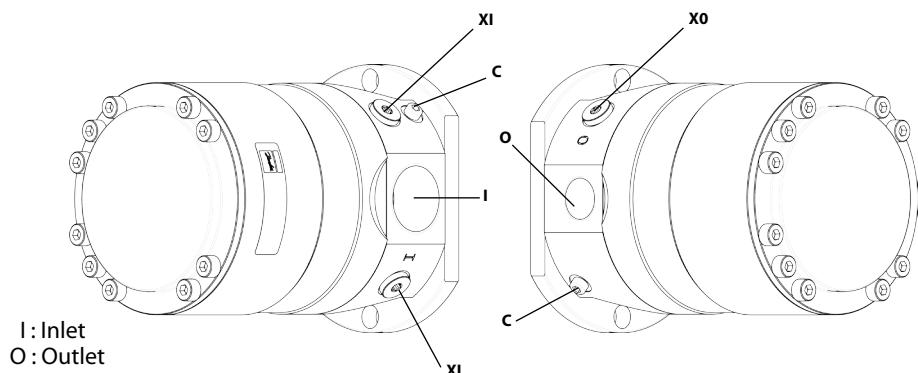
Connections for PAHT 20-32


*There are two 1/4" ports on the inlet side for optional mounting of ie switches for low pressure and temperature.
 There is one 1/4" port on the outlet for optional mounting of ie pressure transducer.

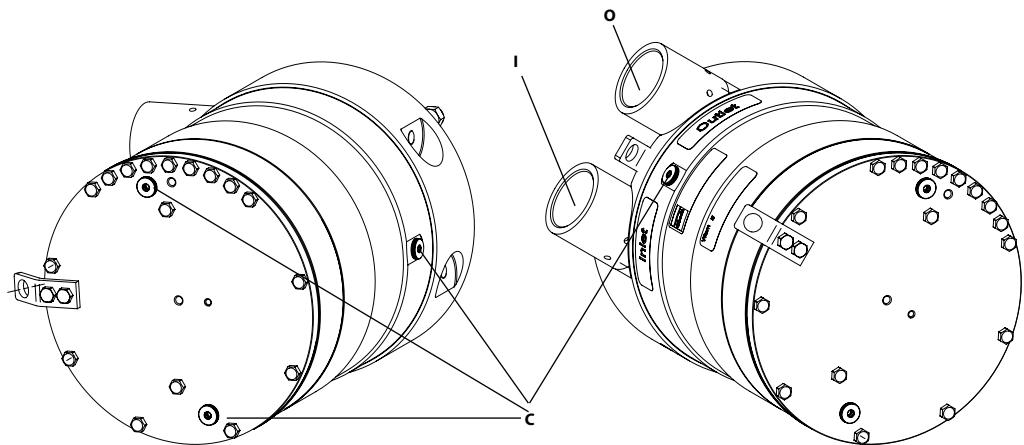
	PAHT 20			
	Outlet (O)	Inlet (I)	Bleeding (C)	Gauge 1/4" ports
Thread, ISO	3/4"BSPP with 16 mm long thread	1" BSPP with 18mm long thread	M6 (width across flat = 5mm)	1/4"BSPP with 15mm long thread
Max tightening torque	90 Nm* (66 lb (f) ft)	120 Nm* (110 lb (f) ft)	4 Nm* (3 lb (f) ft)	15 Nm* (11 lb (f) ft)

	PAHT 25/32			
	Outlet (O)	Inlet (I)	Bleeding (C)	Gauge 1/4" ports
Thread, ISO	3/4"BSPP with 16 mm long thread	1 1/4"BSPP with 20mm long thread	M6 (width across flat = 5mm)	1/4"BSPP with 15mm long thread
Max tightening torque	90 Nm* (66 lb (f) ft)	150 Nm* (110 lb (f) ft)	4 Nm* (3 lb (f) ft)	15 Nm* (11 lb (f) ft)

* Recommended torque values refer to steel washers containing a rubber sealing element.

Connections for PAHT 50-90


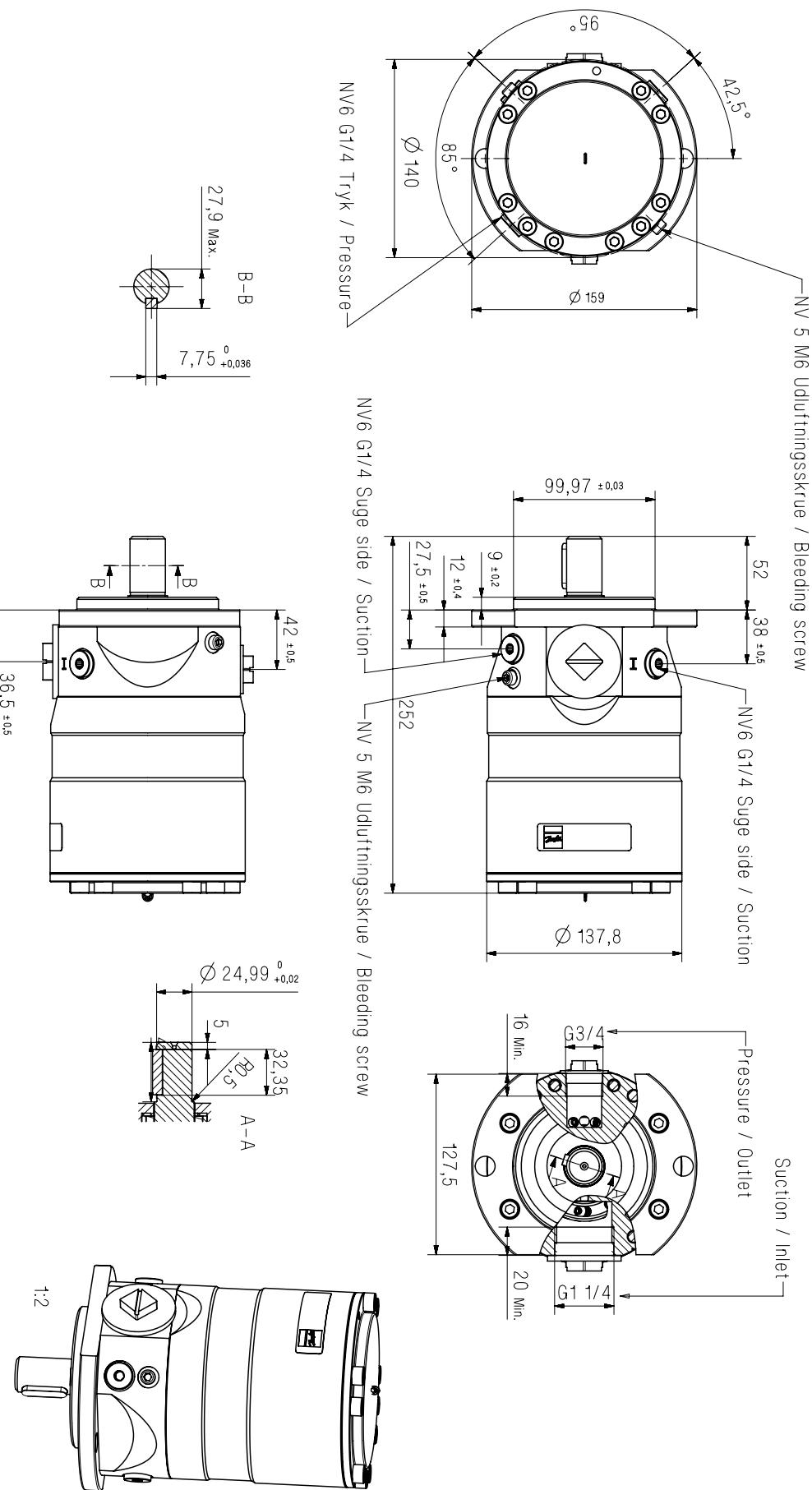
	PAHT 50-90			
	Outlet (O) 1"	Inlet (I) 1,5"	Bleeding (C)	Gauge 1/4" ports
Thread, ISO	1"BSPP with 24 mm long thread	1,5"BSPP with 24mm long thread	M6 (width across flat = 5mm)	1/4"BSPP with 15mm long thread
Max tightening torque	90 Nm* (66 lb (f) ft)	120 Nm* (110 lb (f) ft)	4 Nm* (3 lb (f) ft)	15 Nm* (11 lb (f) ft)

Connections for PAHT 256


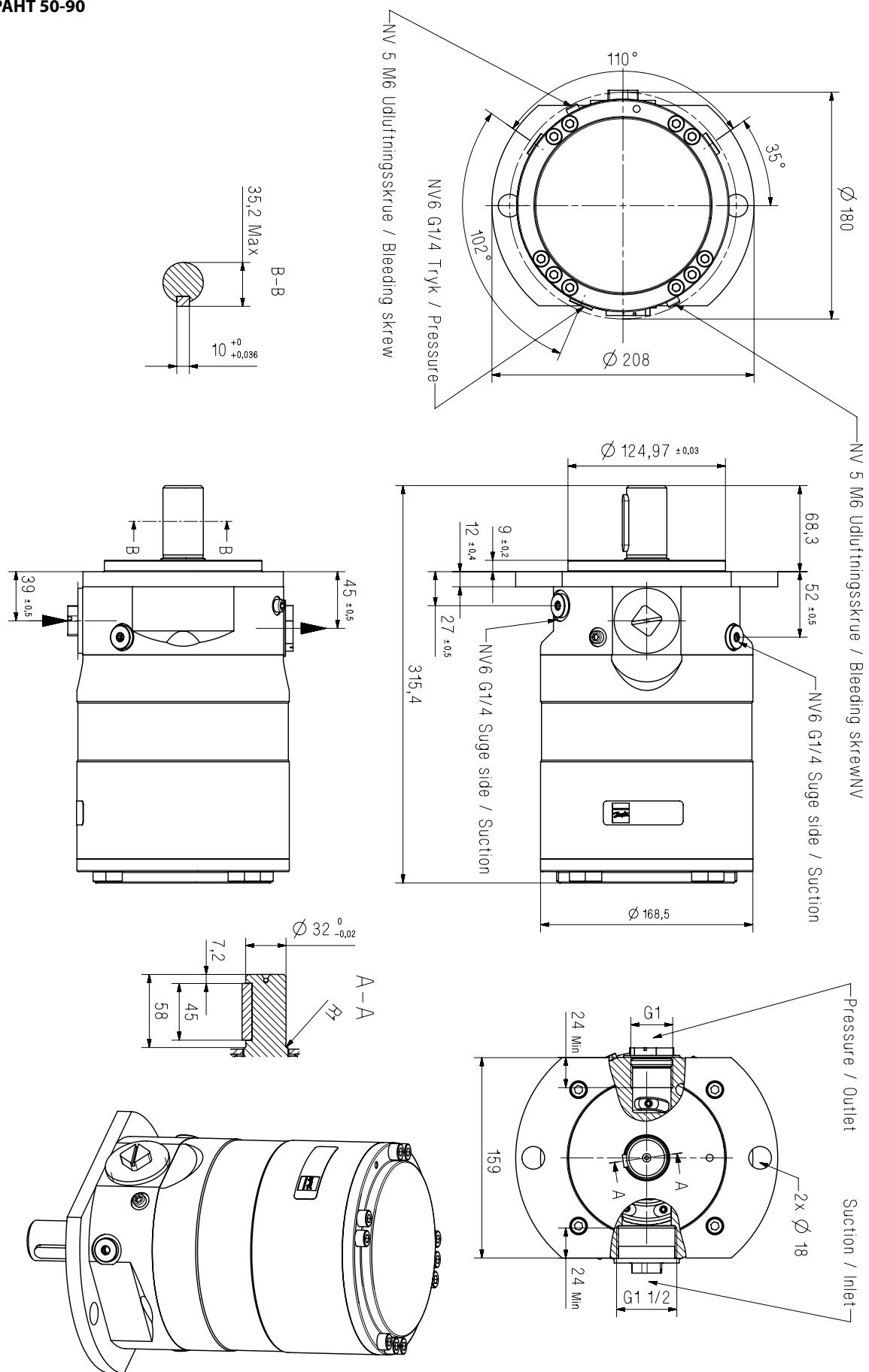
I : Inlet
 O : Outlet
 C : Bleeding

Parallel key:
 PAHT 256 12 x 8 x 70 DIN 6885

	PAHT 256		
	Outlet (O) 2"	Inlet (I) 2"	Bleeding (C)
Thread, ISO	2" BSPP with 24 mm long thread	2" BSPP with 24mm long thread	M6 (width across flat = 5mm)
Max tightening torque	90 Nm* (66 lb (f) ft)	120 Nm* (110 lb (f) ft)	4 Nm* (3 lb (f) ft)

Dimensions for PAHT 20-32


Dimensions PAHT 50-90



Dimensions PAHT 256

