Data sheet

PAH 2/4/6.3, PAH 10/12.5, PAH 20/25/32 and PAH 50/63/70/80/100



danfoss.high-pressurepumps.com
521B0835 / DKCFN.PD.011.A9.02



General information

PAH 2/4/6.3, PAH 10/12.5, PAH 20/25/32 and PAH 50/63/70/80/100 are pumps designed to supply water flow under high pressure. The pumps are based on the axial piston principle enabling a very light and compact design.

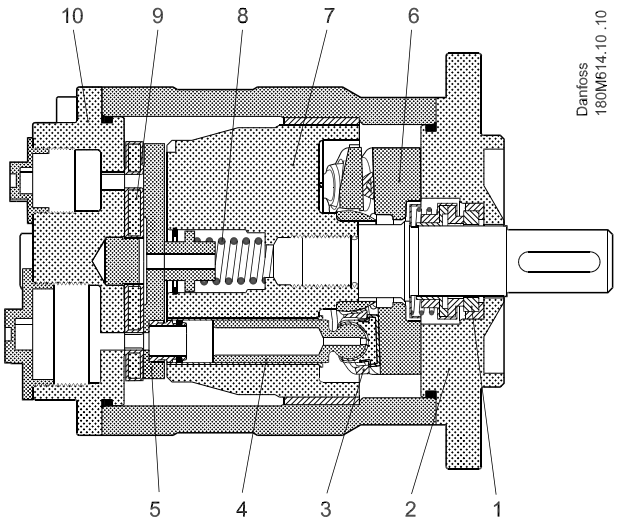
The pumps are designed so that lubrication of the moving parts in the pumps is provided by the water itself. No oil lubrication is thus required.

All parts included in the pumps are designed to provide long service life, i.e. long service life with a constantly high efficiency and mininum of service required.

The pumps are fixed displacement pumps where the flow is proportional to the number of revolutions of the input shaft and the pump displacement.

PAH 20/25/32 cross-section

1: Shaft sealing
2: Mounting flange/ housing with bearing
3: Retaining ring
4: Piston/shoe
5: Valve/thrust plate
6: Swash plate
7: Cylinder barrel
8: Spring
9: Port plate
10: Connecting flange



Features

- Very compact and light pump
  (can be installed with direct coupling to an electric motor/combustion engine.)
- Generates insignificant pulsations in the pressure line.
- No preventive maintenance required
  (no periodic service like e.g. change of lubricant and wear parts).
- Long service life
- All parts of the pump are made of non-corrosive material and the surface is easy to clean
- Few wearing parts
- Available as ATEX certificate

Technical data

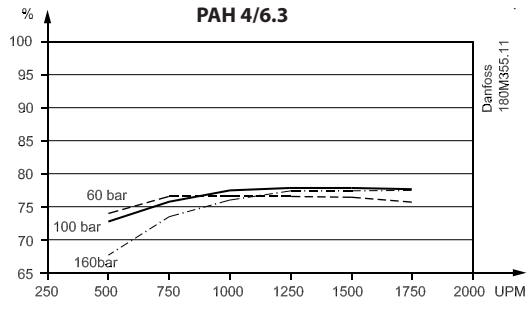
PAH pumps, standard version		2	4	6.3	10	12.5	20	25	32	50	63	70	80	100
Geometric displacement	$cm^3/rev.$	2	4	6.3	10	12.5	20	25	32	50	63	70	80	100
Max. pressure. cont. [1]	bar	140	140	140	160	160	80	160	160	80	160	160	160	80
Max. pressure. intermittent [2]	bar	160	160	160	180	180	100	180	180	100	180	180	180	100
Max. pressure. peak [3]	bar	200	200	200	220	220	140	220	220	140	220	220	220	140
Max. speed cont. [4]	rpm	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1500
Min. speed cont. [4]	rpm	700	700	700	700	700	700	700	700	700	700	700	700	700
Max. flow. cont. at 1500 rpm [5]	l/min	2	5	8.5	13.5	17	27	35	45	72	87	97	112	138
Max. power requirement at 1500 rpm	kW	0.9	1.7	2.5	4.3	5.3	5	10.5	13.5	11	26	29	33	25
Weight, stainless	kg	4.4	4.4	4.4	7.7	7.7	16	16	16	31	31	31	31	31

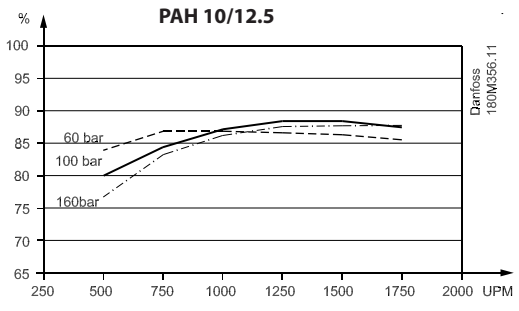
1) For higher pressure, please contact Danfoss Sales Organization.
2) Intermittent pressure is <10 % every minute.
3) Peak pressure is <1 % every minute.
4) For higher or lower speed, please contact Danfoss Sales Organization.
5) Flow at max. pressure continuously.

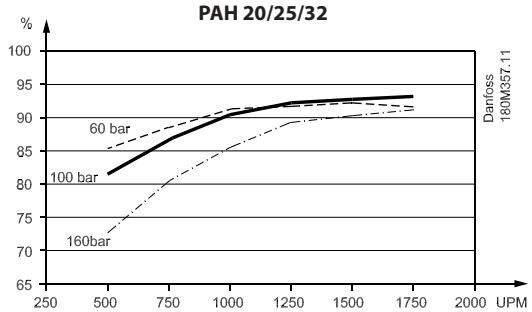
Application examples

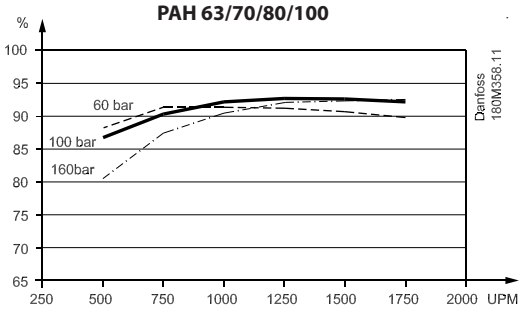
- Stationary and mobile hydraulic systems
- High pressure systems
- Fire fighting
- Flushing and cleaning processes
- Humidification systems

Total efficiencies, standard pumps









Suction pressure

Water supply to the pump is either made from a tank placed above the pump or directly from the mains. The pressure at the pump inlet (T) must be in the range: 0-4 bar (atm).
If higher boost pressure is required, please contact Danfoss Sales Organization for Water Hydraulics.

Temperature

Fluid temperature:
- Min. +3°C to max. +50°C at max. cont. pressure
- Min. +3°C to max. +60°C at max. 100 bar.

Ambient temperature:
- Min. +0°C to max. +50°C.

Storage temperature:
- Min. -40°C to max. +70°C.

For operation at lower temperatures than +3°C, please see the paragraph on antifreeze protection and contact Danfoss Sales Organization for Water Hydraulics.

For operation at higher temperatures please contact Danfoss Sales Organization for Water Hydraulics.

Shaft load

The pump is neither to be exposed to axial nor radial loads. We therefore recommend to use a flexible coupling for connection to the electric motor or the combustion engine.

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 i.e. 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

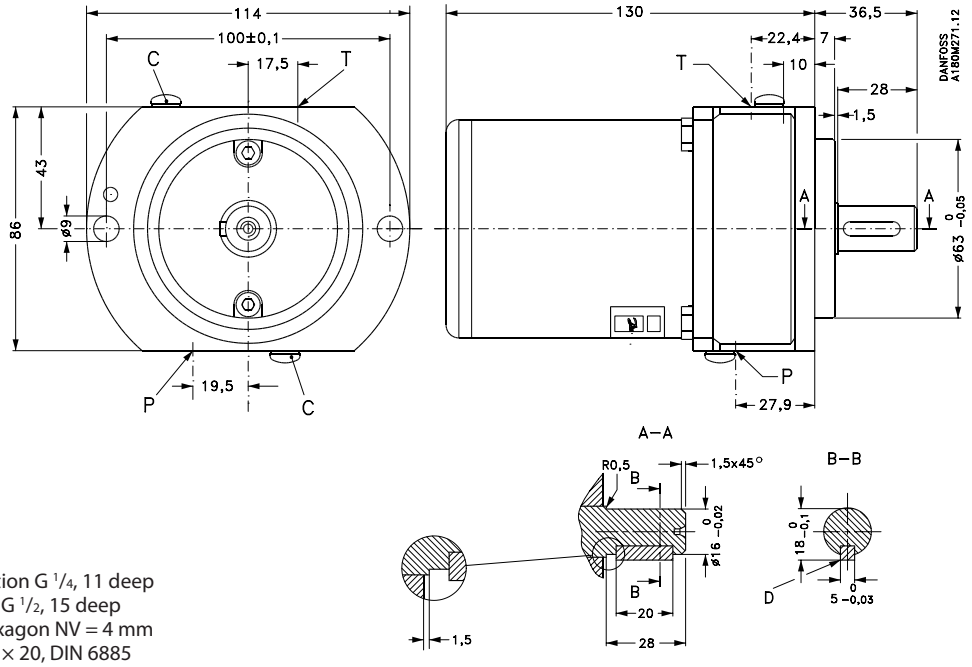
The applied water must be filtered through a 10 µm abs., β_{10} -value > 5000 filter.
In closed systems (hydraulic systems), where the water is led back to tank for recirculation, the filter must be placed in the return line.
In open-ended systems (continuous supply of "fresh" water) the filter must be placed before the pump or the tank to ensure continuous filtration.
For further filter details, please contact the Danfoss Sales Organization.

Code numbers

Pump size	Stainless steel
PAH 2	180B0024
PAH 4	180B0022
PAH 6.3	180B0023
PAH 10	180B0008
PAH 12.5	180B0007
PAH 20	180B0079
PAH 25	180B0036
PAH 32	180B0037
PAH 50	180B0047
PAH 63	180B0040
PAH 70	180B0042
PAH 80	180B0041
PAH 100	180B0076

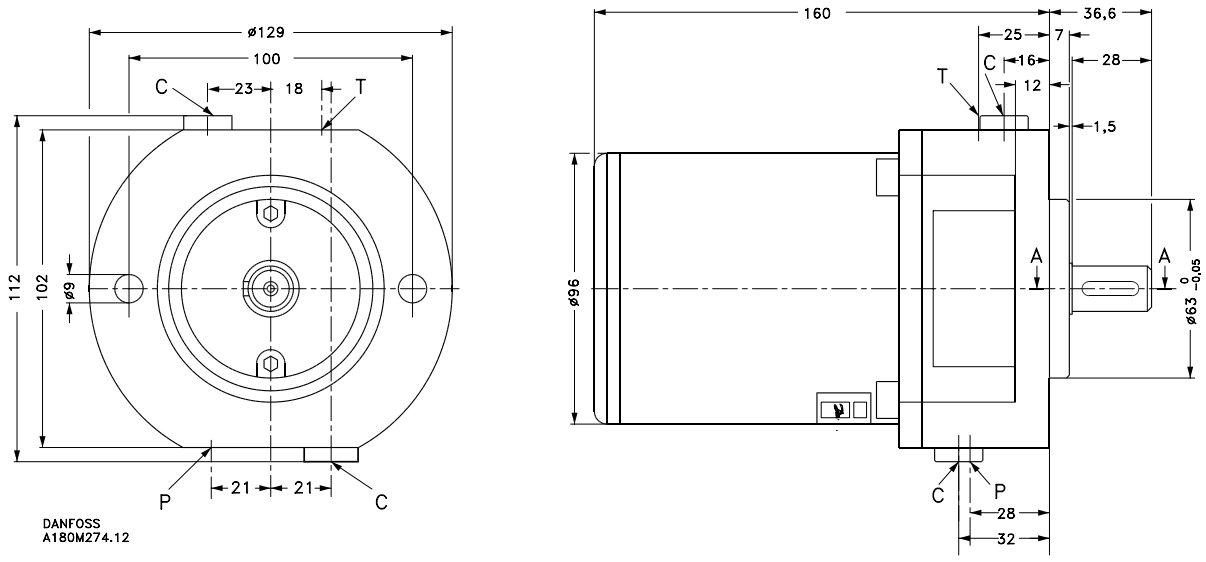
ATEX - for ATEX ordering and related informations, consult the document "Pumps intended for use in ATEX classified areas" 521B1102

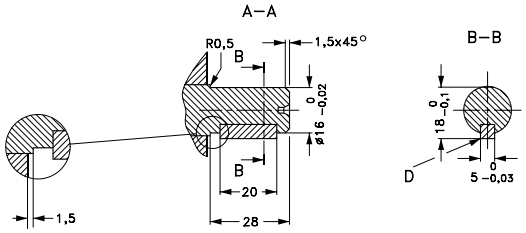
Dimensions for PAH 2, PAH 4 and PAH 6.3



P: Pressure connection G 1/4, 11 deep
T: Tank connection G 1/2, 15 deep
C: Bleeding M6, Hexagon NV = 4 mm
D: Parallel key 5 × 5 × 20, DIN 6885

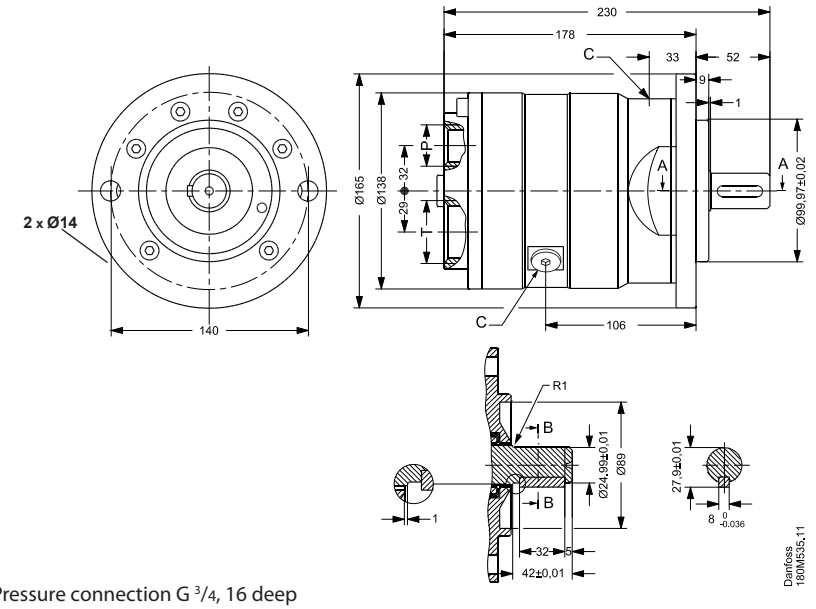
Dimensions for PAH 10 and PAH 12.5





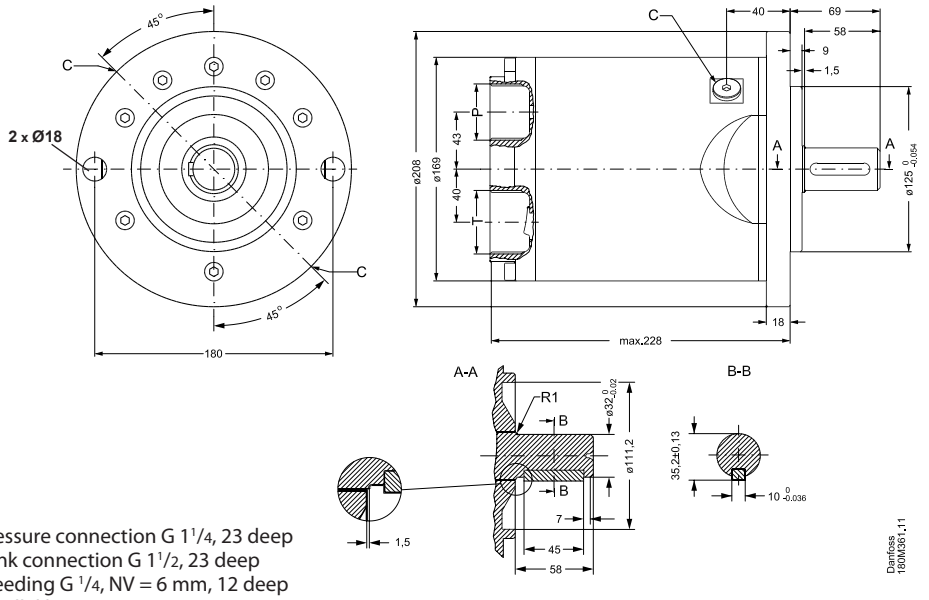
P: Pressure connection G 3/8, 15 deep
T: Tank connection G 3/4, 17 deep
C: Bleeding G 1/4, NV = 6 mm, 14 deep
D: Parallel key 5 × 5 × 20, DIN 6885

Dimensions for PAH 20, PAH 25 and PAH 32



P: Pressure connection G 3/4, 16 deep
T: Tank connection G 1 1/4, 20 deep
C: Bleeding G 1/4, NV = 6 mm, 12 deep
D: Parallel key 8 × 7 × 32, DIN 6885

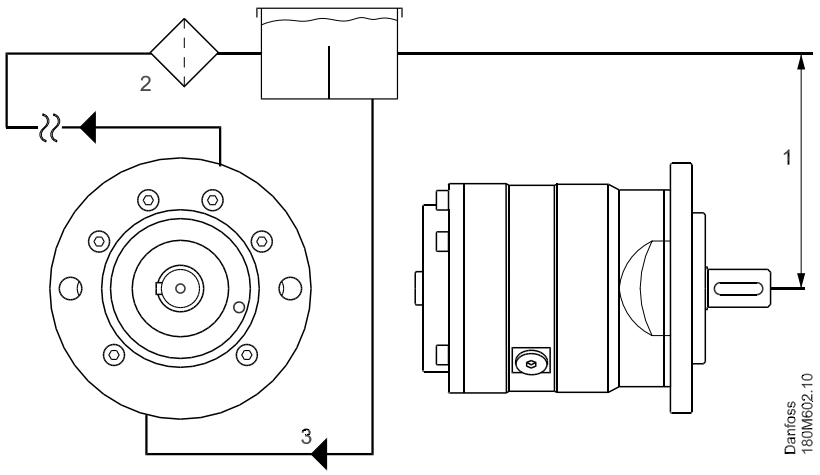
Dimensions for PAH 50, PAH 63, PAH 70, PAH 80 and PAH 100



P: Pressure connection G 1 1/4, 23 deep
T: Tank connection G 1 1/2, 23 deep
C: Bleeding G 1/4, NV = 6 mm, 12 deep
D: Parallel key 10 × 8 × 45, DIN 6885

Installation

1. Closed hydraulic systems, recirculating water via tank.



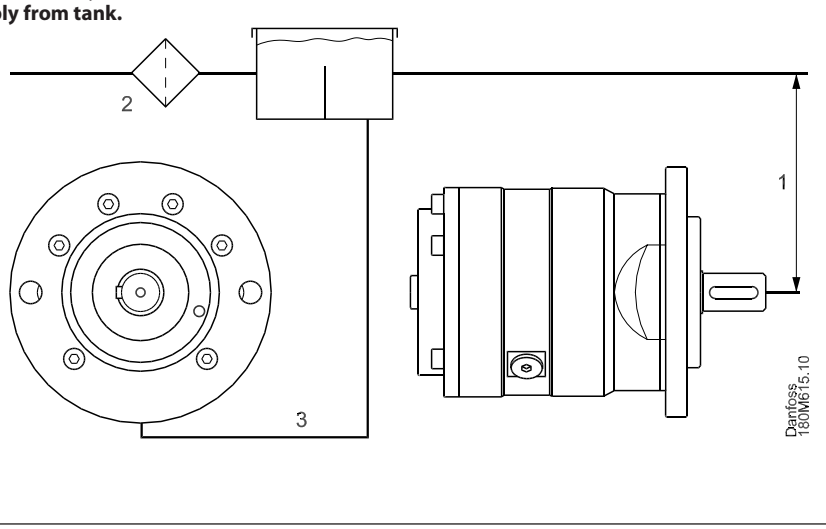
In order to eliminate the risk of cavitation, a positive inlet pressure should always be maintained by observing the following guidelines:

1) Place the tank above pump inlet (water level in the tank should always be above the pump).

2) Place filter in the return line and not in the suction line.

3) Dimension the inlet line with minimum pressure drop (large internal diameter, minimum length of pipe, avoid bends, and fittings with small internal diameter.)

2. Open-ended systems with water supply from tank.



In order to eliminate the risk of cavitation, a positive inlet pressure should always be maintained by observing the following guidelines:

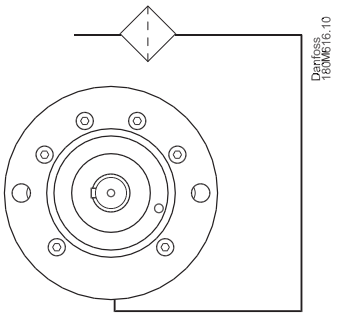
1) Place the tank above pump inlet (water level in the tank should always be above the pump).

2) Place filter in the water supply line before the tank.

3) Dimension the inlet line with minimum pressure drop (large internal diameter, minimum length of pipe, avoid bends, and fittings with small internal diameter.)

Installation

3. Open-ended systems with direct water supply



In order to eliminate the risk of cavitation, a positive inlet pressure is always to be maintained at min. 0.9 bar abs. and max. 5 bar abs.

1) Place the filter in the water supply line before the pump.

2) Place a monitoring pressure switch set at min. 0,9 bar abs. between filter and pump inlet. The monitoring switch must stop the pump at lower pressure than min. 0.9 bar abs.

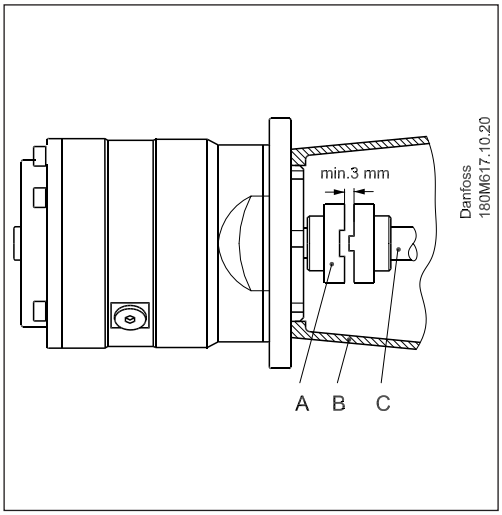
Below figure illustrates how to mount the pump and connect it to electric motor/ combustion engine.

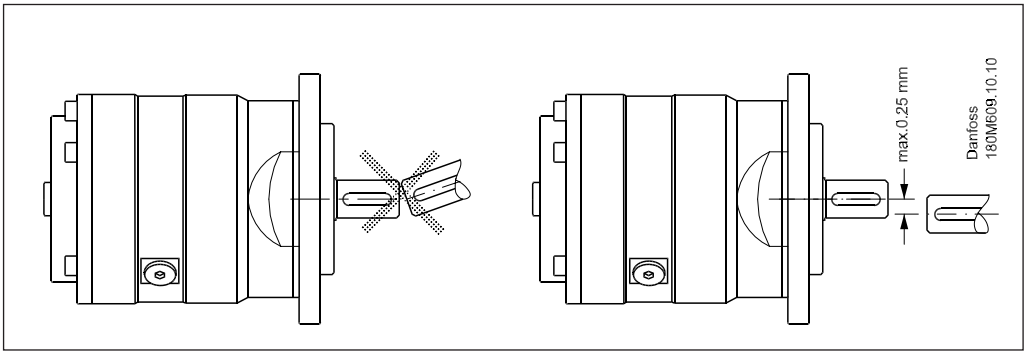
A: Flexible coupling
B: Bell housing
C: Motor shaft

If alternative mounting is required, please contact Danfoss 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.





Water

Water quality regarding purity and chemical/microbiological composition depends on the origin of the water as described below.

Water quality for hydraulic systems is recommended to be of at least the same quality as is required for drinking water.

Classification of water:
Water used in tap water hydraulic systems may typically be classified into 3 main groups:

A) Raw water
Raw water is most often water collected directly from borings & wells. Usually, water is exposed to a "simple" process, such as filtration. The quality of raw water may vary a lot. In some cases/places it is almost of drinking water quality, whereas water in other cases/ places may contain large amounts of ochre, humus & plant remnants .

Therefore, it is most important to analyse raw water intended for a certain application.
Typical applications where raw water can be used are:

- Fire-fighting equipment
- High pressure cleaner

The filter capacity is an important parameter for these applications, as the water may contain large amounts of particles, sand, ochre etc.

B) Drinking water
Drinking water is exposed to a much more complex cleaning process compared to raw water. Drinking water is either produced on basis of ground water or surface water (rivers and lakes).
Local authorities are in charge of controlling the water quality.

Ground Water:
The quality of ground water is normally very fine and thus only minimum of processing is required. Typically, only filtration and ventilation is applied to remove aggressive carbon dioxide, iron and manganese.

Surface Water (Lakes and Rivers):
In addition to the above process for ground water, it is essential to disinfect and process this water further, as surface water is either chemically or micro-biologically contaminated. Typically, compounds of chlorine are used to disinfect the water which may give the drinking water the characteristic after-taste of chlorine.
Furthermore, UV-light may be used to substitute or supplement the chlorine processing.

NB!
Always use drinking water from the cold-water tap to minimize the risk of microbiological contamination of the water.

C) 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 the systems for making softened, de-mineralized and reverse osmosis-water.

When using other fluids like HFA, HFC etc., please contact Danfoss Sales Organization.

Pumps for Technical water are listed in a separate Data sheet

Antifreeze protection

If a system requires antifreeze protection, Danfoss recommends DOWCAL N or CHILLSAFE antifreezes both being a biologically degradable Mono Propylene Glycol.

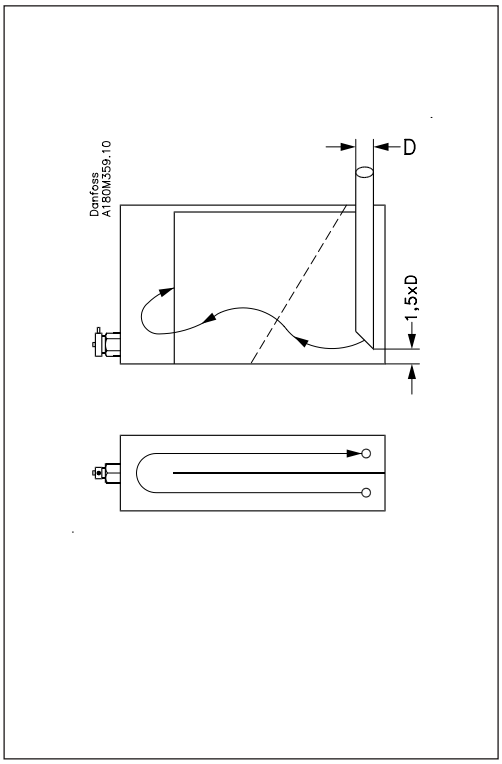
(DOWCAL N is produced by POLO).
(CHILLSAFE is produced by ATCO).
Producers of DOWCAL N and CHILLSAFE recommend a mixture ratio of min. 30% DOWCAL N/CHILLSAFE to prevent biofilm occurrence in the system due to DOWCAL N and CHILLSAFE being biologically de-gradable.

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, volume required for cylinders, and request for water expansion. Normally, a tank capacity of 1-3 times the pump flow (per min.) will be sufficient for closed systems. For open-ended systems the requirement is >0.7 times the pump flow (per min.) as long as there is a water renewal of >15 % of the pump flow.

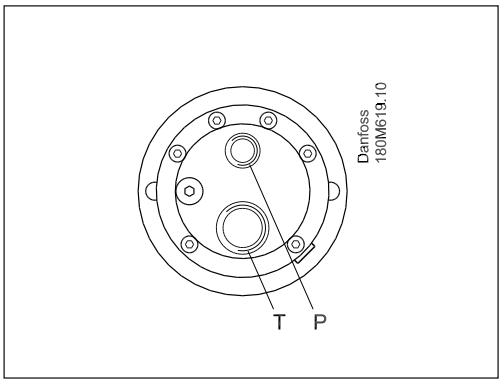
Direct the suction line to the pump bottom, approx. 1.5 times the suction line diameter "D" above the bottom to prevent precipitated impurities from being sucked in. Always keep all tank connections (suction, drain and return) below water level in the tank. Drain and return lines to be placed as far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



Direction of rotation

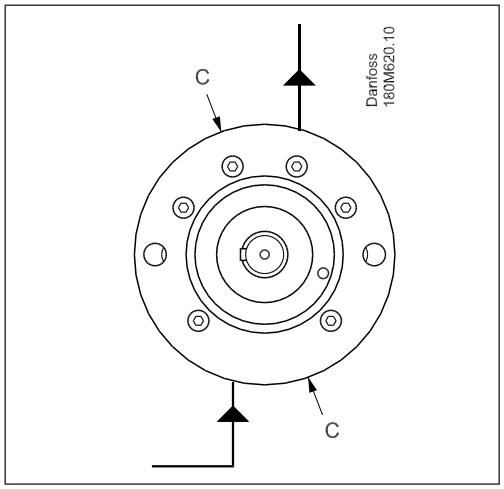
Clockwise (CW) seen from the pump shaft end (illustrated by a PAH 10/12.5).

For CCW rotation please contact Danfoss Sales Organization for Water Hydraulics.



Operation

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 inlet line connected to the water supply or the tank, the pump is now started with open outlet P-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.

Hydraulic systems must be flushed with a 3% cleaning agent-solution for min. 60 minutes. Then the solution is discharged from the system which is subsequently cleaned with pure water for min. 30 minutes (please see instructions for "Cleaning of Water Hydraulic Systems". Finally the filter is 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.

In open-ended systems without tank it is recommended to build in a pressure switch between filter and pump T-port to make the pump stop at min. 0.9 bar abs to prevent the pump from running dry.

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

Filter:
After start-up it is recommended to change filter element after 1-10 hours' operation. Subsequently, the filter element is changed when 'clogged filter' is indicated.

Disconnection:
If the inlet line to the pump T-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 Sales Organization.

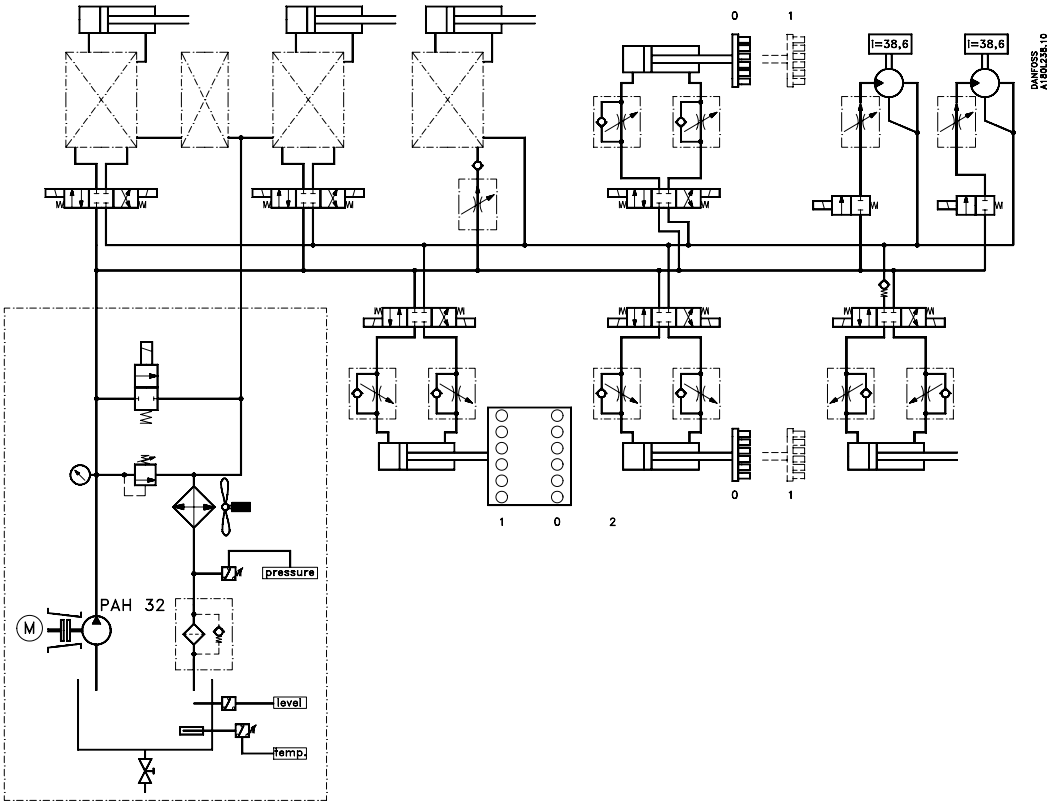
Recommended procedure:

1. Closed hydraulic systems with recirculating water and open-ended systems with water supply from tank:
   - 1.1 Empty the system of water
   - 1.2 Fill glycol mixture onto the system through a 10 µm abs. filter
   - 1.3 Start up the system. Remember to bleed the pump, if required.
   - 1.4 Required functions are activated to be flushed with the glycol mixture
   - 1.5 Surplus glycol is emptied off the system
   - 1.6 The pump is now protected against internal corrosion and frost.

2. Open-ended systems with direct water supply:
   - 2.1 Disconnect the water supply to the pump/system.
   - 2.2 Empty the pump through the lower bleeding plug. Retighten the plug when the pump is empty.
   - 2.3 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.
   - 2.4 Quickly start and stop the pump. Make sure that the pump does not run dry.
   - 2.5 Empty pump of anti-freeze medium (through the lower bleeding plug). Remount and retighten the bleeding plug, when the pump is empty.
   - 2.6 The pump is now protected against internal corrosion and frost.

Examples of water hydraulic systems

Stationary water hydraulic system



Mobile water hydraulic system

