

Guideline

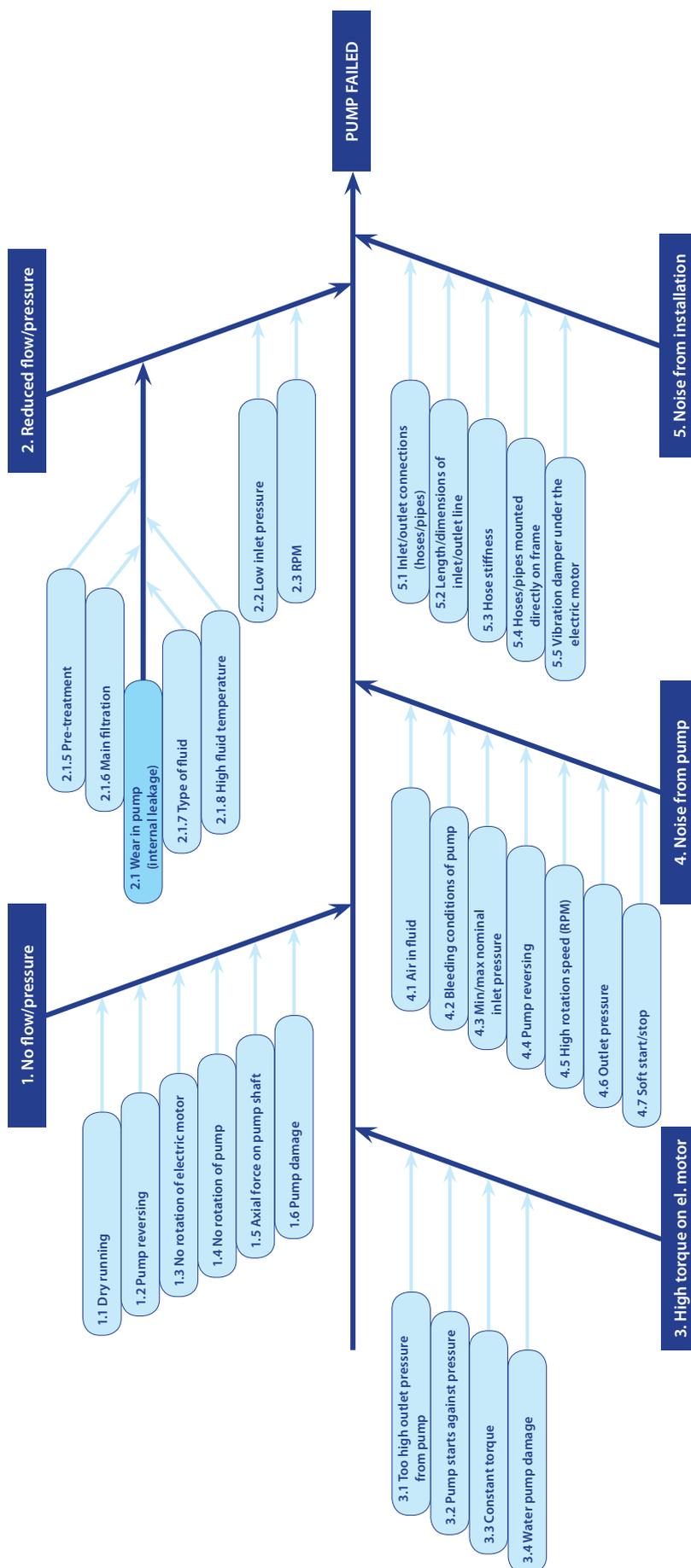
Trouble shooting guide for PAH / PAHT / PAHT G / PAHT 674 and PAH F pumps



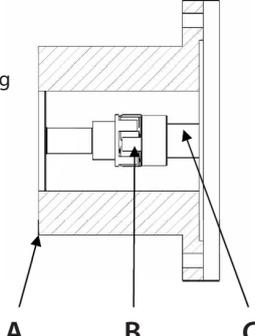
Guideline **Trouble shooting guide for PAH, PAHT, PAHT G, PAHT 674 and PAH F pumps**

Table of Contents	Trouble shooting fish bone chart	3
	1. No flow/no pressure	4
	2. Reduced flow/reduced pressure	5
	3. High torque on electric motor	6
	4. Noise from pump	7
	5. Noise from installation	8
	6. Typical signs of wear	9
	6.1 Valve plate	9
	6.2 Port plate	10
	6.3 Swash plate	10

Trouble shooting fish bone chart



1. No flow/no pressure

Cause	Remedy	Comments
1.1 Dry running (no water supply to the pump)	If no water comes out of the pump: 1.1.1 Check that inlet valve is open. 1.1.2 Check that booster pump is running.	Mount a low pressure switch in front of the pump and check its set point/ function. The low pressure switch ensures that the pump does not start until the inlet pressure has reached-minimum inlet pressure (see Data sheet).
1.2 Pump reversing (electric motor is running the wrong direction, i.e. counter-clockwise)	1.2.1 Change the phase on the electric motor to make it run clockwise. WARNING: - The pump must not run without water for more than a few seconds. - If the pump takes in water from the high-pressure outlet line, it builds up pressure in pump housing and will eventually break down.	Rotation direction for the pump is shown by an arrow on the label on the pump.
1.3 No rotation of electric motor	1.3.1 Check that main switch is switched on. 1.3.2 Check the electricity at the facility. 1.3.3 Ensure that motor relay is switched on. 1.3.4 Ensure that fuse is not blown. 1.3.5 Ensure that booster pump is started. 1.3.6 Check that the monitor switches are working correctly. 1.3.7 Disconnect pump from electric motor and check that the motor is capable of running with no load.	If motor-type relay or the electrical fuse is blown, check that electric motor is sized correctly.
1.4 No rotation of pump	1.4.1 Ensure that coupling between electric motor and pump is connected. 1.4.2 Check if coupling is damaged. 1.4.3 Check that electric motor is sized correctly. 1.4.4 Check that the electrical installation is correctly sized. 1.4.5 Contact Danfoss Sales office for guidelines in how to troubleshoot internal pump parts.	
1.5 Axial load on pump shaft (may cause high internal leakage) Only applying to PAH 2-12.5 PAHT 2-308 PAH F 20-40 PAHT G 2-308	1.5.1 Ensure that the air gap between the two coupling parts is min 5 mm. It should always be possible to move the plastic part on the coupling at least 3 mm.	To ensure easy mounting of the flexible coupling without using tools, the tolerances must be dimensioned accordingly. WARNING: Any axial and/or radial loads on the shaft must be avoided. Any axial or radial load will cause breakdown. A - Bell housing B - Flexible coupling C - Motor shaft 
1.6 Pump damage (the internal parts may be damaged)	1.6.1 Contact Danfoss sales office for guidelines in how to troubleshoot internal pump parts.	Instructions on internal elements are available on www.danfoss.high-pressurepumps.com

2. Reduced flow/reduced pressure

Cause	Remedy	Comments
<p>2.1 Wear on pump Large internal leakage due to:</p>	<p>2.1.1 Dismantle the pump. 2.1.2 Check valve plate. Valve plate has marks/scratches on the surface facing the port plate. Minor wear on valve plate can cause large internal leakage. See Index 6.1. 2.1.3 Check port plate. Port plate has marks/scratches on the surface facing the valve plate. Minor wear on port plate can cause large internal leakage. See Index 6.2. 2.1.4 Check cylinder barrel. Liners in cylinder barrel may be scratched or worn. Insert a piston in the liner and check the fit. If there is any space (clearance) between liner and piston, liner or piston is worn. 2.1.5 Pre-treatment: Analyse fluid for content of particles. - Check that filters are OK and working correctly. 2.1.6 Main filtration: Check that the correct filter type is used (particles in fluid must not exceed 10 µm). Danfoss High Pressure Pumps supplies filters, please contact the sales office. 2.1.7 Fluid type: The PAH/PAH F (tapwater) and PAHT/PAHT G (ultra pure water) pumps are designed for water operation; for any other fluid, please contact Danfoss High Pressure Pumps sales office for further help. 2.1.8 High fluid temperature: If fluid temperature is above 50°C, stop the pump immediately. - Check internal parts (see above).</p>	<p>Typical signs of wear: Polished surface all over the swash plate. Normally, only half of the swash plate = the pressure side is polished. See index 6.3. If the ring is missing, the piston is very worn. The filters can be bypassed, even if they are correctly mounted. Some filters can create channelling where particles can pass through the filter in tunnels. String wounded filters are typically channelling filters. A string wound filter may have a filtration efficiency of only 50%, which will cause internal wear and must always be followed by a main filter. Insufficient filtration means that too many or too large hard particles can pass the main filter because it is damaged, bypassed or simply too poor. Filtration efficiency must be 99.98% (Beta = 5000) at 10 µm to prevent abnormal wear of the pump. Temperature > 50°C will cause wear on internal pump parts. Mount a temperature switch and check its set point / function. The temperature switch will ensure that the pump stops at fluid temperatures > 50°C.</p>
<p>2.2 Low inlet pressure</p>	<p>2.2.1 Check that booster pump supplies the right pressure/flow. 2.2.2 Check if filters require replacement.</p>	<p>If the pressure drop across the filters is too high, the booster pump does not deliver sufficient flow/pressure. No pressure or low pressure results in cavitation and insufficient internal lubrication causing wear on internal pump parts. Mount a low-pressure switch in front of the pump and check its set point/ function. The low-pressure switch ensures that the pump does not start until the inlet pressure has reached 1 bar.</p>
<p>2.3 Rotation speed (rpm)</p>	<p>2.3.1 If VFD-operated, check frequency. 2.3.2 Check that rotation speed of the electric motor is as stated on name plate on electric motor. Check that the motor rotor winding is not damaged.</p>	<p>Speeds below minimum limit (see Data sheet) result in insufficient internal lubrication causing wear on the internal pump parts.</p>

Guideline **Trouble shooting guide for PAH, PAHT, PAHT G, PAHT 674 and PAH F pumps**

3. High torque on electric motor

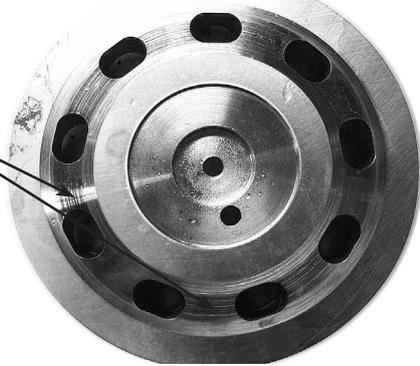
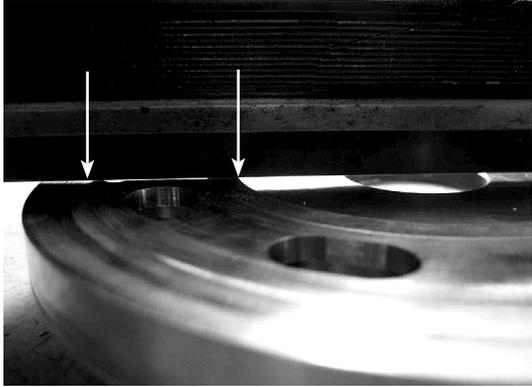
Cause	Remedy	Comments
3.1 Too high outlet pressure from pump	3.1.1 Check for blocked nozzles or a faulty adjusted relief valve.	Pressure changes due to flow restrictions. This will also cause high motor torque.
3.2 Pump starts against pressure	3.2.1 Check that electric motor is correctly sized. 3.2.2 Check internal parts (see item 2.1). 3.2.3 Systems with more than one electric motor installed: Start motors simultaneously.	Pumps run in parallel with cascade start, may switch off the motor relay due to too high torque caused by high outlet pressure.
3.3 Constant torque	3.3.1 Please contact Danfoss High Pressure Pumps sales office.	If the electric motor is too small for the pump, it cannot provide sufficient torque.
3.4 Water pump damage	3.4.1 Dismantle pump and check for wear.	Too heavy damage in the pump will increase friction causing a high torque (see item 6, Typical signs of wear).

4. Noise from pump

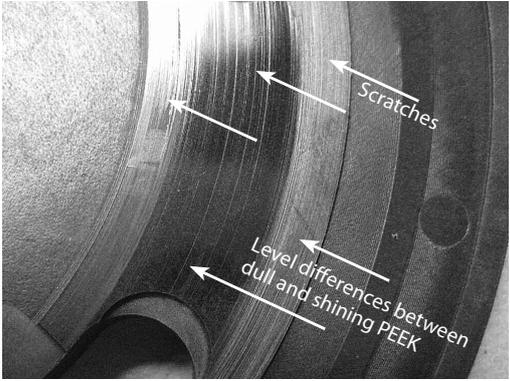
Cause	Remedy	Comments
4.1 Air in fluid	4.1.1 Ensure that the entire inlet line is bled before starting up the system. 4.1.2 Ensure that air cannot enter into the inlet line.	Small air bubbles will accumulate and create large bubbles causing internal cavitation and thus making the pump very noisy. WARNING: The pump can only run few minutes with air in the fluid without being damaged.
4.2 Bleeding conditions of pump	4.2.1 Follow the instructions "Initial start-up" supplied with the new pump. 4.2.2 Ensure that the pump is completely bled before start-up.	The pump and the inlet line must be completely bled before start-up, otherwise the pump will cavitate and make high noise. WARNING: The pump can only run few minutes with air in the fluid without being damaged.
4.3 Min/max nominal inlet pressure	4.3.1 Ensure that inlet pressure is within the limits specified in the Data sheet. 4.3.2 Check the pump for internal damage.	Too high inlet pressure causes too high pressure inside the pump damaging the pistons and eventually the pump. Inlet pressure below min. limit causes cavitation and insufficient internal lubrication resulting in wear on internal pump parts. Mount a low-pressure switch in front of the pump and check its set point/ function. The low-pressure switch will ensure that the pump does not start until the minimum inlet pressure has been reached.
4.4 Pump reversing	4.4.1 Dismantle pump and check if anything is broken or worn (See "1. No flow", item 1.2 Pump reversing"). WARNING: The pump must not run without water for more than a few seconds. If the pump takes in water from the high-pressure outlet line, it builds up pressure and will eventually be damaged.	If pump rotates in wrong direction, it will take in water from the high-pressure outlet line. Pressure will be built up inside the pump and it will eventually be damaged.
4.5 High rotation speed (rpm)	4.5.1 If electric motor rpm is too high, dismantle pump and check for damage. 4.5.2 If the rpm is within the specified range of the pump data sheet and abnormal noise remains, dismantle pump and check for damage.	Higher rpm than specified in the pump data sheet results in wear of the pistons, i.e. pistons may be damaged. High rpm will also increase pressure pulsations from the pump, and the noise level will increase. If rpm is changed, noise frequency will also change.
4.6 Outlet pressure	4.6.1 If outlet pressure is too low, check set point of outlet pressure valve. 4.6.2 If outlet pressure is lower than mentioned in the pump data sheet, please contact Danfoss High Pressure Pumps technical support. 4.6.3 If outlet pressure has exceeded its maximum, check set point of outlet pressure valve. 4.6.4 Check internal parts for wear/damage.	At too low outlet pressure, the pump will create higher pressure pulsations and thus make noise. Too low pressure also causes insufficient internal lubrication and wear on internal parts. Pump may eventually be damaged. Too high outlet pressure may damage the pump.
4.7 Soft start/stop	4.7.1 Check if noise is normal when the pump is running at operation speed. 4.7.2 If noise is abnormal at operation speed, check internal parts (see above).	Noise frequency changes during soft start-up/ stop.

6. Typical signs of wear

6.1 Valve plate

<p>Picture 1</p> 	<p>A normally worn valve plate has no marks/scratches but only a slightly polished surface.</p> <p>No scratches or marks should be felt. The surface must be flat and level.</p>
<p>Picture 2</p> <p>Scratches</p> 	<p>A worn valve plate has scratches, and/or a polished surface. Even small scratches will give a loss of flow.</p>
<p>Picture 3</p> 	<p>A good way to identify a worn valve plate is to hold a straight knife edge over the valve plate. When holding it up to the light, it will be possible to see any space between the knife edge and the valve plate. See picture 3.</p> <p>If any light can be seen between the two arrows on the picture, the valve plate is worn.</p> <p>If any scratches or marks can be felt by running a fingernail over the surface, the valve plate is worn.</p> <p>The valve plate on picture 3 is highly damaged.</p>

6.2 Port plate

<p>Picture 1</p>  <p>Scratches</p> <p>Level differences between dull and shining PEEK</p>	<p>If the port plate has scratches, level differences or both between the arrows, the port plate must be replaced.</p> <p>Even small scratches or wear will cause loss of flow.</p> <p>To check: See item 6.1, picture 3</p>
--	--

6.3 Swash plate

<p>Picture 1</p> 	<p>If the swash plate is polished 360°, it is an indication of insufficient filtration.</p> <p>The surface of the swash plate must be plane and even at same level all over. To check this, please see item 6.1, picture 3.</p> <p>If the surface has any marks/scratches, it is worn/damaged and a new one is required.</p> <p>Please contact Danfoss High Pressure Pumps sales office for further information.</p>
---	--

Danfoss A/S
 High Pressure Pumps
 DK-6430 Nordborg
 Denmark

Danfoss can accept no responsibility for possible errors in catalogues, brochures and other printed material. Danfoss reserves the right to alter its products without notice. This also applies to products already on order provided that such alterations can be made without subsequential changes being necessary in specifications already agreed. All trademarks in this material are property of the respective companies. Danfoss and the Danfoss logotype are trademarks of Danfoss A/S. All rights reserved.