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High-Pressure DI water solutions for LCD, wafer and semi conductor cleaning

Danfoss PAHT high-pressure pump for cleaning processes in the semi conductor industry

How to achieve extremely low total cost of ownership and avoid contamination risk



Facts about high-pressure DI water supply for LCD, wafer and semi conductor cleaning process

Basic requirements:

- Ultra pure DI water with very low conductivity used as cleaning fluid
- Clean room environment for production process
- Optimal washing processes are basics for enhanced quality and improved productivity
- Contamination risk during cleaning process is not acceptable
- Limited space available for the pump unit
- The supplier must be able to supply the whole pump unit including valves and control equipment
- Low noise requirements must be met
- Reducing the environmental impact

Features with Danfoss solution:

- Danfoss PAHT high-pressure pump is designed for continuously operation in DI water using the water as lubricant. No oil lubrication required
- Long service life, no oil change, maintenance free stainless steel housing for clean room environment
- The combination of variable speed control with Danfoss FCM electric motor and direct feed back with pressure sensor enables closed loop control of the pressure
- Danfoss high-pressure pump is an axial piston design (5 to 9 pistons) with few moving parts and is the most compact pump design for high-pressure systems
- The Danfoss pump unit is optimized to take up the least amount of space and the interfaces (water and electrical connections) can be adapted for each cleaning equipment
- Danfoss can supply complete custom-made pump units
- Pump design ensures low vibration, minimum pulsation and airborne noise
- High total pump efficiency reduces energy consumption

Benefits:

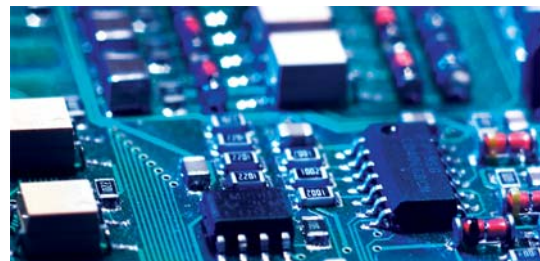
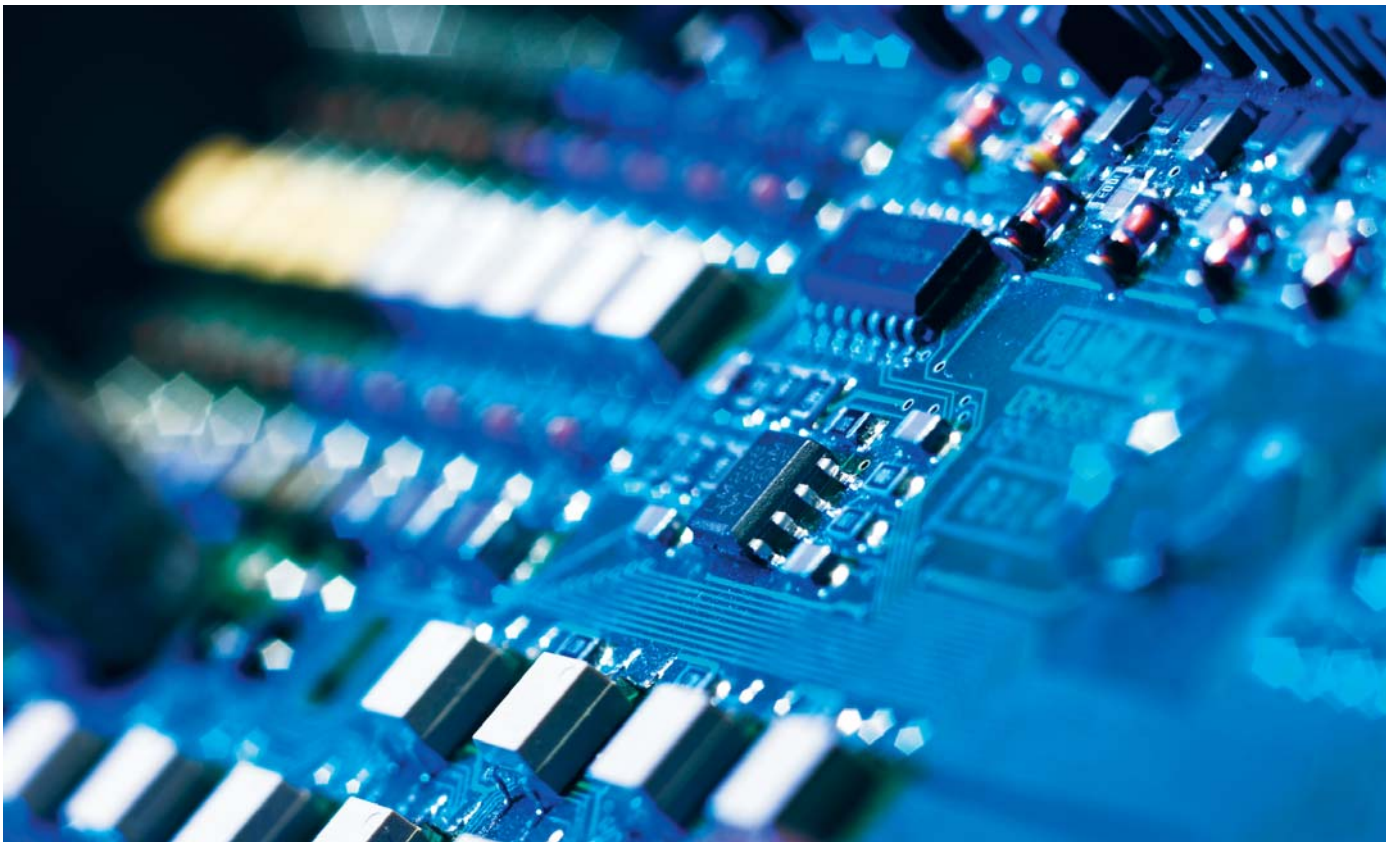
- High reliability, long service life and extremely low maintenance cost – minimum preventive service required, less environmental impact
- Automatic pressure control keeping flushing flow constant, easy to operate, tamper proof setup and minimized energy consumption
- Reliable and constant cleaning fluid supply improves productivity
- Extremely low number of wear particles extending the service life of pressure filters
- Compact design, simple interface – plug and perform capability, easy-to-service
- Single source supplier
- Better work environment increases staff satisfaction
- High efficiencies contribute to cost reductions and increase the green company profile

Ultra cleaning processes and clean room applications

Danfoss PAHT high-pressure pumps for DI water are the preferred choice for well-known companies in the LCD and wafer production business.

The clean exterior, stainless steel, no oil lubrication, extremely low number of wear particles and long service life are paramount parameters for this environment.

With the high quality standard of the Danfoss PAHT high-pressure pumps all these parameters are fulfilled.



Market known oil lubricated piston pump technology compared to Danfoss high-pressure axial piston pump technology influencing service requirements

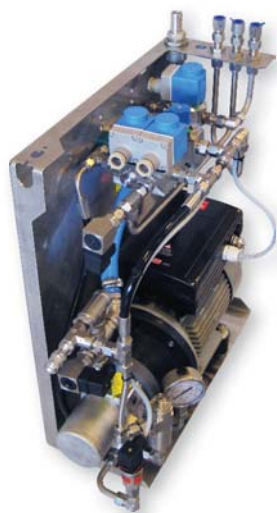
Technology issue/parameter	Oil lubricated piston pumps (Plunger/Triplex)	Danfoss PAHT axial piston pumps
Lubrication	Oil lubricated -> contamination risk in case of sealing wear	Pure DI water lubricated
No. of parts and consequences	High no. of parts, more complex <ul style="list-style-type: none"> • 18 dynamic parts • 5 bearings • contaminating water with wear particles 	Few components <ul style="list-style-type: none"> • 7 to 11 dynamic parts • 2 bearings • Extremely low wear content
Seals	Seals on each piston <ul style="list-style-type: none"> • 6 to 18 dynamic seals 	Only one dynamic shaft seal
Service issues		
Start up precautions	Crankcase to be filled with oil	No oil needed at all Pump to be bled
50 hours	Change initial oil fill	No service activity
Every 500 hours or 3 month	Oil change	No service activity
Preventive maintenance check		
at 1500 hours	Seal change -> check for wear	No service activity
at 3000 hours	Valves to be changed	No service activity
.....		
at 8000 hours	<ul style="list-style-type: none"> • 17 oil services done • 5 seal services done • 2 valve services done 	1 st service to be executed Wear check

Conclusion

When operating inside the specification, the Danfoss PAHT high-pressure pumps are maintenance free over the entire service interval of 8000 hours.

Often even increased service life may be experienced when the mandatory parameters: proper water supply, filtration and operation have been fulfilled.

Products typically used within LCD and wafer cleaning processes



Power Packs/Pump Units

- Complete turnkey pump units, standard or custom-designed
- Inlet filter and high-pressure filter on request
- Modular valve system to suit individual installations
- Automatic shutdown protection in case of missing water supply
- Designed for DI water using non-corrosive materials
- Low noise and pulsation
- Optional:
 - Danfoss FCM frequency controlled motor for speed control
 - Danfoss pressure transmitter for autarkic closed loop with FCM
 - Pre-wired control box

Typical parameter range for LCD cleaning equipment

• Flow rate:	12 - 80 l/min	3.2 - 21.1 GPM
• Pressure range:	up to 160 bar	2320 PSI
• Motor size:	21.3 kW	28.6 HP



High-pressure pumps, type PAHT

- High-pressure pump based on the axial piston principle (5 to 9 pistons)
- Designed for pure DI water operation with a conductivity $<0,055 \mu\text{S}/\text{cm}$ ($>18 \text{ Mohm cm}$)
- Extremely long service life (8000 hours)
- Lubrication of all moving parts by the water itself
- Very low wear -> less contamination particles to contaminate the DI water
- Considerably low maintenance cost
- High total efficiency
- Directly supplied from tank or pressurized water supply

General technical data:

• Geometric displacement:	2 - 90 cm ³ /rev.	
• Flow range:	0.9 - 151 l/min	0.24 - 40 GPM
• Pressure range:	up to 160 bar	2320 PSI
• Power:	up to 35 kW	

Valves

- Comprehensive stainless steel valve range available for DI water operation
- All valves are designed for a high no. of actuations



General technical data:

• Pressure levels:	up to 210 bar	3050 PSI (depending on type)
• Relief valves:	30, 60 and 120 l/min	8, 16 and 32 GPM
• Solenoid valves on/off:	2, 30, 60, 120 and 150 l/min	0.5, 8, 16, 32 and 40 GPM
• Proportional flow control valves:	30 l/min	8 GPM
• Flow control valves, check valves:	30 to 120 l/min	8 - 32 GPM



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DKCFN.PB.010.D1.02 / 521B1078