Product overview

- **Energy efficient**
- **Reliable**
- **Very long service intervals**

Application examples:

Fire fighting:
Using high-pressure water mist for fire fighting systems is the most efficient way to extinguish fires. The low quantity of water required means consumption can be reduced to one seventh of the volume used by conventional sprinkler systems.

This makes high-pressure water mist fire fighting very attractive in areas where space is limited (eg ship engine room) and where conventional sprinkler systems can cause significant water damage during a fire (eg historic buildings).

The Danfoss pumps are designed for high-pressure fire-fighting installations with high reliability and a very compact design.

Reverse osmosis:
Reverse osmosis is the process of turning sea water into drinking water. Typical desalination applications are on yachts and remote areas (eg islands).

The Danfoss duplex/super duplex pumps generate the pressure needed to send the incoming salt water through the membranes and as a result drinkable water is separated from the salt water.

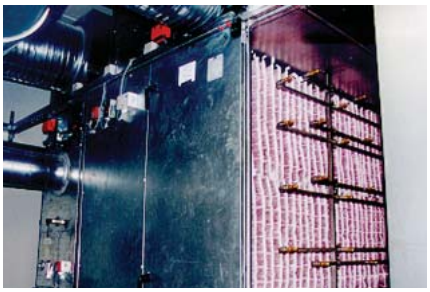
Wood processing:
Using high-pressure water mist to lubricate and to cool saw blades in a saw mill prevents resin from sticking to the blades and reduces friction, which means increased productivity and lower energy cost. Sawdust levels are reduced too, resulting in a better working environment. High-pressure water mist is also used for humidity controls in drying kilns.

In comparison with steam humidification in drying kilns, the high-pressure water mist gives a better wood quality and savings as the steam is costly to generate. In comparison with low-pressure water mist systems, the high-pressure water mist generates much smaller water droplets and therefore the high-pressure water mist evaporates instantly, resulting in faster drying time and better wood quality.

Humidification:
High-pressure water mist can be used in a variety of humidification applications, such as humidification in open space, in air handling units and for adiabatic cooling.

The systems are also used in greenhouses, for dust binding and odor controls in animal farm buildings, and even in theme parks for special effects.

The Danfoss pumps are designed for long service life when used with technical water like DI/RO water.



NO_x control and turbine efficiency:
High-pressure DI water mist can be sprayed into the air intake of diesel engines for ships or gas turbines for power generation to reduce the NO_x pollution and to increase the efficiency of the turbine.

Industrial cleaning:
Solenoid valves for general usage are used in a number of industrial cleaning applications like automatic car wash systems, stationary high-pressure washers, snow-making machines and parts cleaning.

Pumps are the heart of the pump units for intensive industrial high-pressure cleaning systems, especially when the cleaning is done with DI/RO water.

Water hydraulics:
Cylinder and motor functions can be performed with ordinary tap water as the hydraulic fluid.

The same power density is obtained as that in oil hydraulic systems but without the risk of oil contamination.

Danfoss high-pressure pumps based on the positive displacement axial piston principle

- Tap water pumps

- Technical water pumps (DI/RO water)

- Salt water pumps

Benefits for all three types of pumps:

- Very high efficiency (up to 95%)
- Low pulsation (5-9 pistons in the pump and swash plate technology)
- Compact design
- Lubricated by the water passing through the pump (no contamination risk from lubrication oil)
- High reliability
- Minimum service (minimum 8000 hours of operation between service)
- Corrosion resistant

Technical data

PAH tap water pumps:

- Geometric displacement 2-80 cm^3/rev
- Pressure up to 160 bar (2320 psi) continuously - peak pressure up to 210 bar (3000 psi)
- AISI 304 stainless steel design

4 pump groups:

Pump type	Number of pistons	rpm range	Flow range at 140 bar and min-max rpm		
PAH 2-6.3	5	700-3000	1.0-18 l/min	0.06-1.08 m^3/h	0.26-4.76 US gpm
PAH 10-12.5	5	700-3000	6.0-36 l/min	0.36-2.16 m^3/h	1.59-9.51 US gpm
PAH 20-32	9	700-2400	13-74 l/min	0.78-4.44 m^3/h	3.43-19.5 US gpm
PAH 50-80	9	700-1800	32-140 l/min	1.92-8.40 m^3/h	8.45-37.0 US gpm

PAH technical water pumps for DI/RO water:

- Geometric displacement 2-80 cm^3/rev
- Maximum pressure 140 bar continuously
- AISI 304 stainless steel design with increased clearances and special parts inside the pump to withstand the aggressive DI/RO water

4 pump groups:

Pump type	Number of pistons	rpm range	Flow range at 70 bar and min-max rpm		
PAH 2-6.3	5	1000-3000	0.9-16 l/min	0.054-0.96 m^3/h	0.24-4.23 US gpm
PAH 10-12.5	5	1000-2400	7.8-25 l/min	0.468-1.50 m^3/h	2.06-6.60 US gpm
PAH 25-32	9	1000-2400	21-51 l/min	1.26-3.06 m^3/h	5.55-13.5 US gpm
PAH 50-80	9	1000-1800	41-130 l/min	2.46-7.80 m^3/h	10.8-34.3 US gpm

APP salt water pumps:

- Geometric displacement 2-300 cm^3/rev
- Maximum pressure 80 bar continuously
- Duplex and super duplex stainless steel design

5 pump groups:

Pump type	Number of pistons	rpm range	Flow range at 80 bar and min-max rpm		
APP0.6-1.0	5	700-3450	2.4-16.7 l/min	0.144-1.0 m^3/h	0.63-4.40 US gpm
APP1.5-2-5	5	700-3450*	5.8-41.7 l/min	0.348-2.5 m^3/h	1.53-11.0 US gpm
APP3.0-3.5	7	700-3000	10-58.3 l/min	0.60-3.5 m^3/h	2.64-15.4 US gpm
APP5.1-10.2	9	700-1800	32-170 l/min	1.92-10.2 m^3/h	8.45-44.9 US gpm
APP21-26	9	700-1200	195-433 l/min	11.7-26 m^3/h	51.5-114 US gpm

*: Max speed for APP2.5 is 3000 rpm

Danfoss high-pressure systems offers different types of pump units / sub-systems:

Motor pump combination
(motor, pump bell housing and coupling)

Pump unit with reservoir

Pump unit without reservoir

The pump units are complete with all safety devices needed to make sure that the pump unit protects itself from situations in which the pump otherwise would be damaged.

Safety devices include switches for low inlet pressure and high temperature, inlet filters, relief valves, check valves and gauges.

The electric motors can be both with or without frequency drives to regulate the flow. Output valves (2/2 or 3/2- ways solenoid valves) can also be mounted on the pump skid.

Water motors:

The water motor program consists of the MAH and APM motors.

MAH motors for high-speed applications are based on the axial piston principle. The MAH motor has a coated aluminimum housing with stainless internal parts.

Motor type	MAH
Geometric displacement	4-12.5 cm^3/rev
Speed range	300-4000 rpm
Max torque	8-25 Nm
Max pressure	140 bar

The APM salt water motors are based on the axial piston principle and they are designed to be used for energy recovery in desalination applications. The APM housing is made of duplex stainless steel.

MAH motors
High-speed axial piston water motors

APM motors
High-speed axial piston motors for seawater energy recovery applications.

Valves:

I) Solenoid valves:

Used for sending the flow in different directions at different times.

a) General purpose VDHT 2/2 ways valves:

- Pressure up to 210 bar (3000 psi)
- Flow 1-150 l/min (0.25-40 US gpm)
- Stainless steel design with either NBR or FKM seals
- Both single valves and integrated valve manifolds
- Wide range of electrical coils

b) VDHT 2/2-ways valves with manual bypass:

- Pressure up to 140 bar (2000 psi)
- Flow 10-150 l/min (3-40 US gpm)
- Valves can be manually opened in case of electrical failure
- Wide range of electrical coils

c) Zone-drain 3/2 ways valves for humidification applications:

- Pressure up to 140 bar (2000 psi)
- Flow 0.5-30 l/min (0.1-8 US gpm)
- Stainless steel design with NBR seals
- Both single valves and flange on version (CETOP style)
- Wide range of electrical coils

d) Water hydraulic solenoid valves:

- 2/2 ways and 4/3 ways valves used to control the direction of water motor and cylinder
- Max 140 bar (2000 psi)
- 1-120 l/min (0.25-30 US gpm)
- Stainless steel design with NBR seals
- Both single valves and flange on version (CETOP style)
- Wide range of electrical coils
- Designed for several million cycles (but require very clean water)

II) Relief valves:

Used to limit system pressure, protect components against overload and for bypass of water if there at times is only a limited need for water mist in an open-ended system.

- Pressure up to 210 bar (3000 psi)
- Flow up to 120 l/min (30 gpm)

III) Check valves:

Used to allow flow in one direction only.

- Pressure up to 210 bar (3000 psi)
- Flow up to 120 l/min (30 gpm)

IV) Flow control valves:

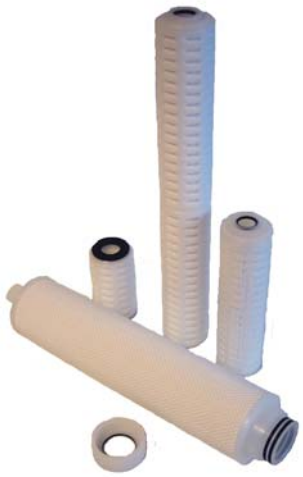
Used to throttle the water to the wanted flow rate. The valves are available with manual as well as electric activation.

- Pressure up to 140 bar (2000 psi)
- Flow up to 2-30 l/min (0.5-8 gpm)

Accessories:

Danfoss offers several accessories to facilitate designing complete systems:

- Filters
- Nozzles and nozzle adaptors
- Bell housing with flexible coupling
- Danfoss frequency drives
- Danfoss pressure transmitters
- Stainless cylinders suitable for water as the fluid



Filters

Filter housings

Anti-drip nozzles and nozzle adaptors

Water mist nozzles

Cylinders

Danfoss A/S is one of the largest industrial companies in Denmark, with net sales of around EURO 3 billion.
We employ more than 22,500 people, and 6,500 of them work in Denmark in 15 different locations.

www.nessie.danfoss.com

Danfoss is an international group and a leader in research, development and production for a wide spectrum of different industries. We produce about 250,000 components each day at our 59 factories in 25 countries. The Group's primary aim is to create quality of life for our stakeholders and to be a leader in refrigeration, heating and motion controls.

Our work is based on our Core Values: Trust, Passion for Technology, Reliability, Global Perspective with Local Commitment and Environmental and Social Responsibility.

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