Data sheet

APP W HC Pumps
APP W HC 15 - 30
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1. **Introduction**

This data sheet is valid for APP W HC pumps. The Danfoss range of APP W HC high-pressure pumps is designed according to EN 809 for use in water applications like:

- High pressure RO
- Zero liquid discharge (ZLD)
- Minimal liquid discharge (MLD)

Danfoss APP pumps are positive displacement pumps with axial pistons that move a fixed amount of water in each cycle.

Flow is proportional to the number of input shaft revolutions (rpm). Unlike centrifugal pumps, they produce the same flow at a given speed no matter what the discharge pressure.

Below sectional drawing is an example of an APP pump. The sectional drawing for the specific pump sizes are to be found in the pump instruction.

2. **Benefits**

- **Zero risk of lubricant contamination:**
  - Oil lubricants are replaced with the pumped medium, water, so there is no contamination risk from the pump.

- **Low maintenance costs:**
  - Efficient design and all-stainless steel construction ensure exceptionally long life. When Danfoss specifications are met, service inspections of 8,000 hours can be expected. Service is easy, and can be carried out on-site due to the simple design and few parts.

- **Low energy costs:**
  - The highly efficient axial piston design provides the lowest energy consumption of any comparable pump on the market.

- **Easy installation:**
  - The most compact and lightest design available.
  - The pump can be installed vertically and horizontally.
  - No pulsation dampeners necessary due to extremely low pressure pulsation.

- Powered directly by electric motors or combustion engines (with special coupling).
- All pumps are supplied with an integrated flushing valve that allows the fluid to flow from inlet to the outlet, when the pump is not running.

- **High reliability:**
  - All parts are made of high corrosion resistant materials e.g. Duplex (EN1.4462/ UNS S31803) and Super Duplex (EN1.4410/UNS S32750) stainless steel and carbon reinforced PEEK.

- **Certified quality:**
  - Positive Material Identification (PMI) report available on request.
  - IATF 16949, ISO 9001, ISO 14001.

3. **Application examples**

Danfoss APP pumps are designed or use in a broad range of plants around the world for:

- High pressure reverse osmosis
- Zero liquid discharge (ZLD)
- Minimal liquid discharge (MLD)
## 4.1 APP W HC 15 - 30

<table>
<thead>
<tr>
<th>Pump size</th>
<th>APP W HC 15/750</th>
<th>APP W HC 21/1000</th>
<th>APP W HC 24/1200</th>
<th>APP W HC 30/1200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code number APP</td>
<td>18085000</td>
<td>18085001</td>
<td>18085002</td>
<td>18085003</td>
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<tr>
<td>Geometric displacement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cm³/rev.</td>
<td>362</td>
<td>362</td>
<td>362</td>
<td>444</td>
</tr>
<tr>
<td>in³/rev.</td>
<td>22.09</td>
<td>22.09</td>
<td>22.09</td>
<td>27.09</td>
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<tr>
<td>Pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. outlet (^1) pressure continuous</td>
<td>barg 120</td>
<td>barg 120</td>
<td>barg 120</td>
<td>barg 120</td>
</tr>
<tr>
<td></td>
<td>psig 1740</td>
<td>psig 1740</td>
<td>psig 1740</td>
<td>psig 1740</td>
</tr>
<tr>
<td>Min. outlet (^2) pressure</td>
<td>barg 30</td>
<td>barg 30</td>
<td>barg 30</td>
<td>barg 30</td>
</tr>
<tr>
<td></td>
<td>psig 435</td>
<td>psig 435</td>
<td>psig 435</td>
<td>psig 435</td>
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<tr>
<td>Inlet pressure continuous</td>
<td>barg 2 - 5</td>
<td>barg 2 - 5</td>
<td>barg 2 - 5</td>
<td>barg 2 - 5</td>
</tr>
<tr>
<td></td>
<td>psig 29 - 72.5</td>
<td>psig 29 - 72.5</td>
<td>psig 29 - 72.5</td>
<td>psig 36 - 72.5</td>
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<td>Max. inlet pressure peak</td>
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<td>barg 10</td>
<td>barg 10</td>
<td>barg 10</td>
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<tr>
<td></td>
<td>psig 145</td>
<td>psig 145</td>
<td>psig 145</td>
<td>psig 145</td>
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<tr>
<td>Speed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min. speed continuous</td>
<td>rpm 500</td>
<td>rpm 500</td>
<td>rpm 500</td>
<td>rpm 500</td>
</tr>
<tr>
<td>Max. speed continuous</td>
<td>rpm 750</td>
<td>rpm 1000</td>
<td>rpm 1200</td>
<td>rpm 1200</td>
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<tr>
<td>Typical flow - Flow curves available in item 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500 rpm at max. pressure</td>
<td>m³/h 11</td>
<td>m³/h 11</td>
<td>m³/h 11</td>
<td>m³/h 13</td>
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<tr>
<td>750 rpm at max. pressure</td>
<td>m³/h 15</td>
<td>m³/h 15</td>
<td>m³/h 15</td>
<td>m³/h 20</td>
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<td>1000 rpm at max. pressure</td>
<td>m³/h 21</td>
<td>m³/h 21</td>
<td>m³/h 21</td>
<td>m³/h 27</td>
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<td>1200 rpm at max. pressure</td>
<td>m³/h 25</td>
<td>m³/h 31</td>
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<td>m³/h 31</td>
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<td>Media (^3) temperature</td>
<td>°C 2 - 50</td>
<td>°C 2 - 50</td>
<td>°C 2 - 50</td>
<td>°C 2 - 50</td>
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<tr>
<td></td>
<td>°F 36 - 122</td>
<td>°F 36 - 122</td>
<td>°F 36 - 122</td>
<td>°F 36 - 122</td>
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<td>Ambient temperature</td>
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<td>°C 0-50</td>
<td>°C 0-50</td>
<td>°C 0-50</td>
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<tr>
<td></td>
<td>°F 32 - 122</td>
<td>°F 32 - 122</td>
<td>°F 32 - 122</td>
<td>°F 32 - 122</td>
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<tr>
<td>Weight (dry)</td>
<td>kg 105</td>
<td>kg 105</td>
<td>kg 105</td>
<td>kg 105</td>
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<tr>
<td></td>
<td>lb 231</td>
<td>lb 231</td>
<td>lb 231</td>
<td>lb 231</td>
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<tr>
<td>Max. sound pressure level (^4)</td>
<td>dBA 85</td>
<td>dBA 85</td>
<td>dBA 85</td>
<td>dBA 85</td>
</tr>
<tr>
<td>Footprint with IEC motor (^5)</td>
<td>m² 0.76</td>
<td>m² 0.83</td>
<td>m² 1.10</td>
<td>m² 1.10</td>
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<tr>
<td></td>
<td>foot² 8.18</td>
<td>foot² 8.93</td>
<td>foot² 11.84</td>
<td>foot² 11.84</td>
</tr>
<tr>
<td>Typical motor size</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. speed at max. pressure</td>
<td>kW 75</td>
<td>kW 90</td>
<td>kW 110</td>
<td>kW 110</td>
</tr>
<tr>
<td></td>
<td>HP 100</td>
<td>HP 125</td>
<td>HP 150</td>
<td>HP 150</td>
</tr>
<tr>
<td>Torque at max. outlet pressure</td>
<td>Nm 740</td>
<td>Nm 740</td>
<td>Nm 740</td>
<td>Nm 761</td>
</tr>
<tr>
<td></td>
<td>lbf-ft 546</td>
<td>lbf-ft 546</td>
<td>lbf-ft 546</td>
<td>lbf-ft 561</td>
</tr>
</tbody>
</table>

\(^1\) For lower and higher pressure, please contact Danfoss.  
\(^2\) Depending on the NaCl concentration - see chapter 8.  
\(^3\) For lower and higher pressure, please contact Danfoss.  
\(^4\) A-weighted sound pressure level at 1 m from the pump unit surfaces (reference box) acc. to EN ISO 20361 section 6.2. The noise measurements are performed acc. to EN ISO 3744:2010 on a motor-pump unit at max. pressure and speed.  
\(^5\) Max. area covered with recommended motor configuration (excl. of space to service pump)
5. **Flow at different rpm**

If the flow required and the rotation speed (rpm) of the pump is known, it is easy to select the pump fitting the application best by using the diagrams below.

Furthermore, these diagrams show that the flow can be changed by changing the rotation speed of the pump. The flow/rpm ratio is constant, and the "required" flow can be obtained by changing the rotation speed to a corresponding value. Thus, the required rpm can be determined as:

\[
\text{Required rpm} = \frac{\text{Required flow} \times \text{Rated rpm}}{\text{Rated flow}}
\]

**5.1 APP W HC 15 - 24 flow curves measured at 120 barg (1740 psig)**

![Flow curves diagram](image-url)
5.2  APP W HC 30 flow curves measured at 110 barg (1595 psig)

![Flow curves graph](image-url)
6 Flushing valve curves

All pumps are supplied with an integrated flushing valve that allows the fluid to flow from inlet to the outlet, when the pump is not running.

6.1 APP W HC 15 - 30 integrated flushing valve

7 Motor requirements

The power requirements can be determined using one of the following guiding equations:

Required power = \( \frac{l/min \times \text{barg}}{	ext{Calc. factor}} \) or \( \frac{16.7 \times \text{m}^3/\text{h} \times \text{barg}}{	ext{Calc. factor}} \) or \( \frac{0.26 \times \text{gpm} \times \text{psig}}{	ext{Calc. factor}} \) [hp]

1 hp = 0.75 kW
1 gpm = 3.79 l/min
1 m\(^3\)/h = 4.40 gpm
1 kW = 1.34 hp
1 l/min = 0.26 gpm
1 gpm = 0.23 m\(^3\)/h

7.1 Calculation factor for APP W HC 15 - 30 @ 110 barg

<table>
<thead>
<tr>
<th>Name</th>
<th>rpm</th>
<th>Calculation factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>APP W HC 15</td>
<td>750</td>
<td>545</td>
</tr>
<tr>
<td>APP W HC 21</td>
<td>1000</td>
<td>558</td>
</tr>
<tr>
<td>APP W HC 24</td>
<td>1200</td>
<td>562</td>
</tr>
<tr>
<td>APP W HC 30</td>
<td>1200</td>
<td>545</td>
</tr>
</tbody>
</table>
8. Temperature and corrosion

### 8.1 Temperature

<table>
<thead>
<tr>
<th>Fluid temperature:</th>
<th>Min. +2°C to max. +50°C (Min. +35.6°F to max. +122°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature:</td>
<td>Min. +2°C to max. +50°C (Min. +35.6°F to max. +122°F)</td>
</tr>
</tbody>
</table>

In case of lower operating temperatures, please contact Danfoss High Pressure Pumps.

### 8.2 Corrosion

The chart below illustrates the corrosive resistance of different types of stainless steel related to NaCl concentration and temperature. The APP water pump is made of Duplex and Super Duplex. If the water pump is operated above the Duplex line, always flush water pump with fresh water at operation stop in order to minimize the risk of crevice corrosion.

9. Installation

See example below on how to mount the pump and connect it to an electric motor or combustion engine (special coupling).

If alternative mounting is required, please contact your Danfoss sales representative for further information.

Note: Do not add any axial or radial loads to the pump shaft.
9.1 Filtration
Proper filtration is crucial for the performance, maintenance and warranty of your pump.

Protect your pump, and the application in which it is installed, and by always ensuring that all filtration specifications are met, and by always changing filter cartridges according to schedule.

Since water has very low viscosity, Danfoss APP pumps have been designed with very narrow clearances in order to control internal leakage rates and improve component performance.

To minimize wear on the pump, it is therefore essential to filter inlet water properly.

The main filter must have a filtration efficiency of 99.98% at 10 μm. We strongly recommend that you always use precision depth filter cartridges rated 10μm abs. β₁₀≥5000.

Please note that we do not recommend bag filters or string-wound filter cartridges, which typically have only 50% filtration efficiency. This means that out of the 100,000 particles that enter such filters, 50,000 particles pass right through; compare this to precision depth filters that are 99.98% efficient, and only allow 20 of the same 100,000 particles to pass through.

For more information on the importance of proper filtration, including explanation of filtration principles, definitions and guidance on how to select the right filter for your pump, please consult our Filtration information and specifications (Danfoss document number 521B1009).

Noise
Since the pump unit is typical mounted on a frame or bell housing the overall noise level can only be determined for a complete system. To minimize vibrations and noise throughout the system, it is therefore very important to mount the pump unit correctly on a frame with anti-vibration-dampeners, and to use flexible hoses rather than metal pipes where possible.

The noise level is influenced by:

- **Pump speed:**
  High rpm generates more fluid/structure borne pulsations/vibrations than low rpm, because of higher frequency.

- **Discharge pressure:**
  High pressure generates more noise than low pressure.

- **Pump mounting:**
  Rigid mounting generates more noise than flexible mounting, because of structure-borne vibrations. Be sure to use dampers when mounting.

- **Connections to pump:**
  Pipes connected directly to the pump make more noise than flexible hoses, because of structure-borne vibrations.

- **Variable frequency drives (VFD):**
  Motors regulated by VFDs can produce more noise if the VFD does not have the right settings.

9.2 System with direct supply:

**Inlet line:**

- a) Dimension the inlet line to obtain minimum pressure loss (large flow, minimum pipe length, minimum number of bends/connections, and fittings with low or no pressure losses). If relevant, please consult “Parallel coupled pumps and iSaves” (180R93549).

**Inlet filter:**

- b) Install an inlet filter (1) in front of the APP pump (2). Please consult section 9.1, “Filtration” for guidance on how to select the right filter. Thoroughly clean pipes and flush system prior to start-up.

**Low pressure relief valve:**

- c) Install a low pressure relief valve (9) in order to avoid system or pump damage in case the pump stops momentarily or is spinning backwards.

**Monitoring pressure switch:**

- d) Install a monitoring pressure switch (3) between the filter (1) and the pump inlet. Set the minimum inlet pressure according to specifications described in item 4 about technical data. If the inlet pressure is lower than the minimum pressure set, the monitoring pressure switch must prevent the pump from starting or from running.

**Hoses:**

- e) Use flexible hoses (4) to minimize vibrations and noise.

**Inlet pressure:**

- f) In order to eliminate the risk of cavitation and other pump damage, pump inlet pressure must always be maintained according to specifications described in item 4 about technical data.

**Flushing valve:**

- g) For easy system filling and flushing, an integrated flushing valve (6) is in the APP pump.

**Non-return valve:**

- h) A non-return valve (7) in outlet can be installed in order to avoid backspin of the pump. The volume of water in the membrane vessel works as an accumulator and will send flow backwards in case of the pump stops momentarily.
High pressure safety or relief valve:

i) As the Danfoss APP pump begins to create pressure and flow immediately after start-up and regardless of any counter pressure, a safety or pressure relief valve (B) should be installed after the non-return valve to prevent system damage and to avoid high pressure peaks.

Note: If a non-return valve is mounted in the inlet line, a low-pressure relief valve is also required between the non-return valve and pump as protection against high-pressure peaks.

Preferred design - see section 9.2
10. Dimensions and connections

10.1 APP W HC 15 - 30

Accessories see section 12. For more details on the accessories, please contact the Danfoss High Pressure Pumps sales organisation.

Dimensions without tolerances acc. To ISO 2768-1 designation C.
11. Dimensions with motor unit

The examples of assemblies with motor are only for IEC motors and couplings. Please make sure to check required motor power and dimensions when selecting size of pump and motor. For advice and calculation tool, please contact Danfoss.

<table>
<thead>
<tr>
<th>Pump</th>
<th>A mm (inch)</th>
<th>B mm (inch)</th>
<th>C mm (inch)</th>
<th>D mm (inch)</th>
<th>E mm (inch)</th>
<th>F mm (inch)</th>
<th>IEC Electric motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>APP W HC 15-24</td>
<td>351 (13.833)</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>APP W HC 15-24</td>
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<td></td>
</tr>
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<td>APP W HC 21</td>
<td>351 (13.833)</td>
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<td></td>
<td></td>
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<tr>
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<td>90 kW, IEC 280M-4</td>
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<td>861 (33.90)</td>
<td>315 (12.40)</td>
<td>508 (20.00)</td>
<td>406 (15.98)</td>
<td>1038 (40.87)</td>
<td>110 kW, IEC 315S-4</td>
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</tbody>
</table>
12. Accessories

12.1 Accessories for APP W HC 15 - 30

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Type</th>
<th>Code No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3” inlet hose kit - 2m (79”)</td>
<td>3” Victaulic</td>
<td>180Z0144</td>
</tr>
<tr>
<td>2½” outlet high pressure hose 120 barg</td>
<td>2 ½” Victaulic 1 m</td>
<td>180Z1009</td>
</tr>
<tr>
<td>2½” outlet high pressure hose 120 barg</td>
<td>2 ½” Victaulic 1.78 m</td>
<td>180Z1008</td>
</tr>
<tr>
<td>3” inlet connector</td>
<td>M60 - 3” Victaulic</td>
<td>180B3208</td>
</tr>
<tr>
<td>Non-return valve (outlet) Super Duplex</td>
<td>M60 - 2 ½” Victaulic</td>
<td>180H0055</td>
</tr>
</tbody>
</table>


13. Service

Warranty and chemicals disclaimer
Danfoss APP W HC pumps are designed for long operation, low maintenance and reduced lifecycle costs.

Provided that the pump has been running according to the Danfoss specifications, Danfoss guarantees 8,000 hours service-free operation, however, max. 18 months from date of production.

All pumps come with NBR seals and shaft seal, ideal for water. When pumping water mixed with chemicals, we recommend assessing or testing the impact from the chemicals on the pump materials (see Part List for full overview of materials). Danfoss product warranty doesn’t cover cases where chemicals are the root cause of the failure or claim. Additionally, use of certain chemicals may lead to increased wear and require part replacement more often than the Recommended Service Intervals, which are based on water.

If Danfoss recommendations concerning system-design are not followed, it will strongly influence the life of the APP pumps. Other factors that affect pump performance and lifetime include:
- Running the pump at speed outside specifications.
- Supplying the pump with water at temperature higher than recommended.
- Running the pump at inlet pressure outside specifications.
- Running the pump at outlet pressure outside the specifications.

Maintenance
Periodic inspections are required to ensure worn parts (if any), are replaced in due time. Operational conditions such as water quality should be taken into consideration when determining the frequency of the inspections. Danfoss recommends yearly inspections. It is recommended to order the purpose-designed tool kit.

Pump shutdown:
The APP W HC pumps are made of Duplex/Super Duplex materials with excellent corrosion properties. It is, however, always recommended to flush the pump with freshwater when the system is shut down.

Repair assistance
In case of irregular function of the APP W HC pump, please contact Danfoss High Pressure Pumps.