Technical Information

Series T90
Axial Piston Pumps
General Description

Series T90 Family of Pumps

Danfoss provides **Series T90** as an advanced type of axial piston variable displacement pumps for concrete mixers, the development of which is based on more than 30 years of our experience in applying our products in the global market. The new T90 axial piston variable displacement pumps are derived from the sophisticated earlier type of S90 pumps, and are suitable for extended concrete mixer applications.

**Series T90 variable displacement pumps** are compact, high power density units. All models utilize the parallel axial piston/slipper concept in conjunction with a tiltable swashplate to vary the pump’s displacement. Reversing the angle of the swashplate reverses the flow of oil from the pump and thus reverses the direction of rotation of the motor output.

**Series T90 pumps** include an integral charge pump which is manually controlled to provide system replenishing and cooling oil flow, as well as control fluid flow.

- Series T90 axial piston pumps are designed with the most advanced technology
- With optional sizes 055, 075, 100
- Installation: SAE standard flange
- Axial piston design of high efficiency
- Proved reliability and excellent performance
- Compact, light weight
- Worldwide sales and services
- Metric standard threads for main ports (A and B)
General Description

Design

Series T90 pump cross-section
General Description

This configuration shows a hydrostatic transmission using a Series T90 axial piston variable displacement pump and a Series 90 fixed displacement motor.

System Schematic
### Technical Specifications

#### Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Unit</th>
<th>055</th>
<th>075</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>cm³</td>
<td>55</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>[in³]</td>
<td>[3.35]</td>
<td>[4.59]</td>
<td>[6.10]</td>
</tr>
<tr>
<td>Flow at rated speed (theoretical)</td>
<td>l/min</td>
<td>215</td>
<td>236</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>[US gal/min]</td>
<td>[57]</td>
<td>[62]</td>
<td>[79]</td>
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<tr>
<td>Torque at maximum displacement (theoretical)</td>
<td>N·m/bar</td>
<td>0.88</td>
<td>1.19</td>
<td>1.59</td>
</tr>
<tr>
<td></td>
<td>[lbf•in/1000 psi]</td>
<td>[530]</td>
<td>[730]</td>
<td>[970]</td>
</tr>
<tr>
<td>Mass moment of inertia of rotating components</td>
<td>kg·m²</td>
<td>0.0060</td>
<td>0.0100</td>
<td>0.0171</td>
</tr>
<tr>
<td></td>
<td>[slug•ft²]</td>
<td>[0.0044]</td>
<td>[0.0074]</td>
<td>[0.0126]</td>
</tr>
<tr>
<td>Weight (with control opt. MA)</td>
<td>kg [lb]</td>
<td>40 [88]</td>
<td>49 [108]</td>
<td>68 [150]</td>
</tr>
</tbody>
</table>

#### Operating Parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Unit</th>
<th>055</th>
<th>075</th>
<th>100</th>
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</thead>
<tbody>
<tr>
<td>Input speed</td>
<td>min⁻¹ (rpm)</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>Minimum</td>
<td></td>
<td>3900</td>
<td>3150</td>
<td>3000</td>
</tr>
<tr>
<td>Maximum</td>
<td></td>
<td>4250</td>
<td>3350</td>
<td>3200</td>
</tr>
<tr>
<td>System pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuous</td>
<td>bar [psi]</td>
<td>400 [5800]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>bar [psi]</td>
<td>420 [6090]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum low loop pressure</td>
<td>bar [psi]</td>
<td>10 [650]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suction port pressure (charge pump inlet)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>bar [abs]</td>
<td>0.7 [9]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum (cold start)</td>
<td>[in. Hg vac]</td>
<td>0.2 [24]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuous</td>
<td>bar [psi]</td>
<td>3.0 [44]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum (cold start)</td>
<td>bar [psi]</td>
<td>5.0 [73]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Technical Specifications

Fluid Specifications

<table>
<thead>
<tr>
<th>Viscosity mm²/sec (cSt) [SUS]</th>
<th></th>
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<tbody>
<tr>
<td>Minimum</td>
<td>7 [49]</td>
</tr>
<tr>
<td>Recommended range</td>
<td>12-80 [70-370]</td>
</tr>
<tr>
<td>Maximum</td>
<td>1600 [7500]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature range °C [°F]</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>-40 [-40]</td>
</tr>
<tr>
<td>Rated</td>
<td>104 [220]</td>
</tr>
<tr>
<td>Maximum intermittent</td>
<td>115 [240]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Filtration</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleanliness</td>
<td>22/18/13 or higher standard ISO 4406</td>
</tr>
<tr>
<td>Efficiency (suction line filtration)</td>
<td>$\beta_{10} &gt; 75 \ (\beta_{10} \geq 2) $</td>
</tr>
</tbody>
</table>
Operating Parameters

Overview

This section defines the operating parameters and limitations for Series T90 pumps with regard to input speeds and pressures. For actual parameters, refer to the Operating parameters for each displacement on page 7.

Input Speed

**Minimum speed** is the lowest input speed recommended during engine idle condition. Operating below minimum speed limits the pump’s ability to maintain adequate flow for lubrication and power transmission.

**Rated speed** is the highest input speed recommended at full power condition. Operating at or below this speed should yield satisfactory product life.

**Maximum speed** is the highest operating speed permitted. Exceeding maximum speed reduces product life and can cause loss of hydrostatic power and braking capacity. Never exceed the maximum speed limit under any operating conditions.

System Pressure

**System pressure** is the differential pressure between high pressure system ports. It is the dominant operating variable affecting hydraulic unit life. High system pressure, which results from high load, reduces expected life. Hydraulic unit life depends on the speed and normal operating, or weighted average, pressure that can only be determined from a duty cycle analysis.

**Application pressure** is the high pressure relief or pressure limiter setting normally defined within the order code of the pump. This is the applied system pressure at which the drive-line generates the maximum calculated pull or torque in the application.

**Maximum working pressure** is the highest recommended Application pressure. Maximum working pressure is not intended to be a continuous pressure. Propel systems with application pressures at, or below, this pressure should yield satisfactory unit life given proper component sizing.

**Maximum pressure** is the highest allowable Application pressure under any circumstance. Application pressures above maximum working Pressure will only be considered with duty cycle analysis and factory approval.

Pressure spikes are normal and must be considered when reviewing maximum working pressure.

**Minimum low loop pressure** must be maintained under all operating conditions to avoid cavitation.

All pressure limits are differential pressures referenced to low loop (charge) pressure. Subtract low loop pressure from gauge readings to compute the differential.

Case Pressure

Under normal operating conditions, the rated case pressure must not be exceeded 3 bar (44 psi). During cold start case pressure must be kept below maximum intermittent case pressure 5 bar (73 psi). Size drain plumbing accordingly.
## Fluid Selection

Ratings and performance data are based on operating with hydraulic fluids containing oxidation, rust and foam inhibitors. These fluids must possess good thermal and hydrolytic stability to prevent wear, erosion, and corrosion of motor components. Never mix hydraulic fluids of different types.

Fire resistant fluids are also suitable at modified operating conditions. Please see *Hydraulic Fluids and Lubricants Technical Information*, 520L0465, for more information.

The following hydraulic fluids are suitable:
- Hydraulic Oil DIN 51 524-2 - HLP
- Hydraulic Oil DIN 51 524-3 - HVLP
- SAE J183 API CD, CE and CF

## Temperature and Viscosity

The high temperature limits apply at the hottest point in the transmission, which is normally the motor case drain. The system should generally be run at or below the quoted rated temperature. The maximum intermittent temperature is based on material properties and should never be exceeded.

Cold oil will generally not affect the durability of the transmission components, but it may affect the ability of oil to flow and transmit power; therefore temperatures should remain 16 °C [30 °F] above the pour point of the hydraulic fluid. The minimum temperature relates to the physical properties of component materials. Size heat exchangers to keep the fluid within these limits. Danfoss recommends testing to verify that these temperature limits are not exceeded.

For maximum efficiency and bearing life, ensure the fluid viscosity remains in the recommended range. The minimum viscosity should be encountered only during brief occasions of maximum ambient temperature and severe duty cycle operation. The maximum viscosity should be encountered only at cold start.
**Filtration System**

To prevent premature wear, ensure only clean fluid enters the hydrostatic transmission circuit. A filter capable of controlling the fluid cleanliness to ISO 4406 class 22/18/13 (SAE J1165) or better, under normal operating conditions, is recommended. These cleanliness levels can not be applied for hydraulic fluid residing in the component housing/case or any other cavity after transport.

The selection of a filter depends on a number of factors including the contaminant ingression rate, the generation of contaminants in the system, the required fluid cleanliness, and the desired maintenance interval. Filters are selected to meet the above requirements using rating parameters of efficiency and capacity.

Filter efficiency can be measured with a Beta ratio\(^1\) (\(\beta_X\)). For simple suction-filtered closed circuit transmissions and open circuit transmissions with return line filtration, a filter with a \(\beta\)-ratio within the range of \(\beta_{35-45} = 75 (\beta_{25} \geq 2)\) or better has been found to be satisfactory.

Because each system is unique, only a thorough testing and evaluation program can fully validate the filtration system. Please see Design Guidelines for Hydraulic Fluid Cleanliness Technical Information, 520L0467 for more information.

**Reservoir**

The hydrostatic system reservoir should accommodate maximum volume changes during all system operating modes and promote de-aeration of the fluid as it passes through the tank. A suggested minimum total reservoir volume is \(\frac{5}{8}\) of the maximum charge pump flow per minute with a minimum fluid volume equal to \(\frac{1}{2}\) of the maximum charge pump flow per minute. This allows 30 seconds fluid dwell for removing entrained air at the maximum return flow. This is usually adequate to allow for a closed reservoir (no breather) in most applications.

Locate the reservoir outlet (charge pump inlet) above the bottom of the reservoir to take advantage of gravity separation and prevent large foreign particles from entering the charge inlet line. Position the reservoir inlet (fluid return) to discharge below the normal fluid level, toward the interior of the tank. A baffle (or baffles) will further promote de-aeration and reduce surging of the fluid.

**Case Drain**

All single T90 pumps are equipped with multiple drain ports. Port selection and case drain routing must enable the pump housing to maintain a volume of oil not less than half full and normal operating case pressure limits of the unit are maintained. Case drain routing and design must consider unit case pressure ratings.

A case drain line must be connected to one of the case outlets (L1 or L2) to return internal leakage to the system reservoir.

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\(1\) Filter\(\beta\) is a measure of filter efficiency defined by ISO 4572. It is defined as the ratio of the number of particles greater than a given diameter ("\(x\)" in microns) upstream of the filter to the number of these particles downstream of the filter.
## System Design Parameters

### Sizing Equations

The following equations are helpful when sizing hydraulic pumps. Generally, the sizing process is initiated by an evaluation of the machine system to determine the required motor speed and torque to perform the necessary work function. Refer to *Selection of drive line components*, BLN-9885, for a more complete description of hydrostatic drive line sizing. First, the motor is sized to transmit the maximum required torque. The pump is then selected as a flow source to achieve the maximum motor speed.

**SI Units**

Output flow \( Q = \frac{V_g \cdot n \cdot \eta_v}{1000} \) (l/min)

Input torque \( M = \frac{V_g \cdot \Delta \rho}{20 \cdot \pi \cdot \eta_m} \) (N-m)

Input power \( P = \frac{M \cdot n \cdot \pi}{30000} = \frac{Q \cdot \Delta \rho}{600 \cdot \eta_t} \) (kW)

**US Units**

Output flow \( Q = \frac{V_g \cdot n \cdot \eta_v}{231} \) (US gal/min)

Input torque \( M = \frac{V_g \cdot \Delta \rho}{2 \cdot \pi \cdot \eta_m} \) (lbf-in)

Input power \( P = \frac{M \cdot n \cdot \pi}{198000} = \frac{Q \cdot \Delta \rho}{1714 \cdot \eta_t} \) (hp)

\( V_g = \) Displacement per revolution (cm³/rev)

\( \Delta \rho = p_o - p_i \) (system pressure) (bar)

\( n = \) Speed (min⁻¹ (rpm))

\( \eta_v = \) Volumetric efficiency

\( \eta_m = \) Mechanical efficiency

\( \eta_t = \) Overall efficiency (\( \eta_v \cdot \eta_m \))

\( M = \) Input torque (lbf•in)

\( Q = \) Output flow (US gal/min)

\( \Delta \rho = \) Input torque (psi)

\( \eta_v = \) Volumetric efficiency

\( \eta_m = \) Mechanical efficiency

\( \eta_t = \) Overall efficiency (\( \eta_v \cdot \eta_m \))
Shaft Loads

The table below indicates the bearing life in $B_{10}$ hours. These data are based on the condition where the pump is operated with system pressure at 240 bar [3500 psi], input speed at 1800 RPM, with max. displacement and no external thrust/radial shaft loads. Nearly equal amounts of forward vs. reverse swashplate operation is experienced. The charge pump is of standard displacement and is a standard charge pressure pump.

T90 piston pumps are designed with bearings that can accept some external radial and thrust loads. The external shaft radial load limits are a function of the load position and orientation, and operating conditions of the motor.

The maximum allowable radial load (Re) is based on the maximum external moment (Me) and the distance (L) from the mounting flange to the load. It may be determined using the following table and formula.

Formula: 

\[
Re = \frac{Me}{L}
\]

All external shaft loads affect bearing life. In applications where external shaft loads cannot be avoided, minimize the impact by positioning the load at 90° or 270° as shown in the figure.

Contact your Danfoss representative for an evaluation of unit bearing life, if:

- you have continuously applied external loads exceeding 25% of the maximum allowable radial load (Re)
- or the pump swashplate is positioned on one side of center all or most of the time.
- bearing life $B_{10}$ is critical.

Use of tapered output shafts or clamp-type couplings is recommended where radial shaft loads are present.

### Allowable external shaft load

<table>
<thead>
<tr>
<th>Parameters</th>
<th>055</th>
<th>075</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>External moment (Me) N·m [lbf·in]</td>
<td>101 [893]</td>
<td>118 [1043]</td>
<td>126 [1115]</td>
</tr>
</tbody>
</table>
Shaft Availability and Torque Ratings

<table>
<thead>
<tr>
<th>Shaft description</th>
<th>055</th>
<th>075</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 teeth</td>
<td>1130</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>16/32 pitch spline</td>
<td>[10 000]</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>23 teeth</td>
<td>—</td>
<td>1580</td>
<td>1580</td>
</tr>
<tr>
<td>16/32 pitch spline</td>
<td>—</td>
<td>[14 000]</td>
<td>[14 000]</td>
</tr>
</tbody>
</table>

Filtration

Suction filtration

The suction filtration is placed in the circuit between the reservoir and inlet to the charge pump, as shown below.

Filter with block alarm is recommended

Multi-Function Valves

Diagram of Multi-Function Valves

Diagram of Suction Filtration
Features

Charge Pump

Charge flow is required on all Series T90 pumps applied in closed circuit installations. The charge pump provides flow to make up internal leakage, maintain a positive pressure in the main circuit, provide flow for cooling and filtration, replace any leakage losses from external valving or auxiliary systems, and to provide flow and pressure for the control system.

Many factors influence the charge flow requirements and the resulting charge pump size selection. These factors include system pressure, pump speed, pump swashplate angle, type of fluid, temperature, size of heat exchanger, length and size of hydraulic lines, control response characteristics, auxiliary flow requirements, hydrostatic motor type, etc. When initially sizing and selecting hydrostatic units for an application, it is frequently not possible to have all the information necessary to accurately evaluate all aspects of charge pump size selection.

Unusual application conditions may require a more detailed review of charge pump sizing. Charge pressure must be maintained at a specified level under all operating conditions to prevent damage to the transmission. Danfoss recommends testing under actual operating conditions to verify this.

*Recommend charge pump sizes and speed limits*

<table>
<thead>
<tr>
<th>Charge pump size cm³ [in³]</th>
<th>Rated speed min⁻¹ (rpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 [1.20]</td>
<td>3600</td>
</tr>
</tbody>
</table>
Control

Manual Displacement Control (MDC)

Operation
The manual displacement control converts a mechanical input signal to a hydraulic signal that tilts the cradle swashplate through an angular rotation varying the pump's displacement from full displacement in one direction to full displacement in the opposite direction.

The manual displacement control has a mechanical feedback mechanism which moves a servo valve in the proper relationship to the input signal and the angular position of the swashplate. The control is designed so that the angular rotation of the swashplate is proportional to the mechanical input signal. The control is designed with an internal override mechanism which allows the mechanical input to be moved at a faster rate than the movement of the swashplate without damage to the control.

Features and benefits of the manual displacement control:
- Precision parts provide repeatable, accurate displacement settings with a given input signal.
- The manual displacement control is a high gain control: With only small movement of the control handle (input signal), the servo valve moves to full open position porting maximum flow to the servo cylinder. This is a high response system with low input force.
- The integral override mechanism allows rapid changes in input signal without damaging the control mechanism.
- The double-acting servo piston is coupled to a spring centering mechanism. The servo control valve is spring centered such that with no input signal the servo valve is open centered and thus no fluid is ported to the servo cylinder.
- Benefits:
  - Pump returns to neutral after prime mover shuts down.
  - Pump returns to neutral if external control linkage fails at the control handle or if there is a loss of charge pressure.

Manual displacement control schematic

Cross-section
Control

**Manual Displacement Control (MDC) (continued)**

**External control handle requirements**

- Torque required to move handle to maximum displacement is 0.68 to 0.9 N·m [6 to 8 lbf·in].
- Torque required to hold handle at given displacement is 0.34 to 0.57 N·m [3 to 5 lbf·in].
- Torque required to overcome the override mechanism is 1.1 to 2.3 N·m [10 to 20 lbf·in] with the maximum torque required for full forward to full reverse movement.
- Maximum allowable input torque is 17 N·m [150 lbf·in].

**Pump displacement vs. control lever rotation**

**Control lever rotation range**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>0.5° - 4.5°</td>
</tr>
<tr>
<td>b</td>
<td>24° - 30°</td>
</tr>
</tbody>
</table>

Volumetric efficiencies of the system will have impacts on the start- and end input commands.

**Pump output flow direction and control lever rotation**

<table>
<thead>
<tr>
<th>Input shaft rotation</th>
<th>CW</th>
<th>CCW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handle rotation</td>
<td>A CCW</td>
<td>B CW</td>
</tr>
<tr>
<td>Port A flow (M1)</td>
<td>Out</td>
<td>In</td>
</tr>
<tr>
<td>Port B flow (M2)</td>
<td>In</td>
<td>Out</td>
</tr>
<tr>
<td>Servo cylinder</td>
<td>MS</td>
<td>M4</td>
</tr>
</tbody>
</table>

Refer to *Installation drawings* for handle connection requirements.
Control

High Current Electric Displacement Control (HCEDC) Option PH and PJ

Operation
The HCEDC uses two solenoid operated, proportional-pressure reducing valves to control the pilot pressure to a 4-way servo valve, which ports hydraulic pressure to either side of a double acting servo piston. The servo piston tilts the cradle swashplate, thus varying the pump’s displacement from full displacement in one direction to full displacement in the opposite direction. Each solenoid valve acts independently for forward or reverse operation; therefore, the electronic controller must be able to accommodate two independent pilot valve signal outputs.

The control has a mechanical feedback mechanism which moves the servo valve in relation to the input signal and the angular position of the swashplate. The electrical displacement control is designed so the angular rotation of the swashplate (pump displacement) is proportional to the electrical input signal. Swashplate position changes due to load variation are sensed by feedback linkage system connected to the swashplate and control valve. This will activate the valve and supply pressure to the servo piston, maintaining the swashplate in its commanded position. The solenoids are equipped with manual override capability thereby allowing the pump to be commanded to maximum angle in either direction. This is done by depressing the plunger on the top of the solenoid. Manual operation of the control override is intended for system troubleshooting only.

High current electric displacement control schematic

<table>
<thead>
<tr>
<th>Electric Characteristics</th>
<th>(CCW) AS SEEN FROM SHAFT</th>
<th>(CW) AS SEEN FROM SHAFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Solenoid</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Pressurized port</td>
<td>X1</td>
<td>X2</td>
</tr>
<tr>
<td>System port A flow</td>
<td>In</td>
<td>Out (M1)</td>
</tr>
<tr>
<td>System port B flow</td>
<td>Out (M2)</td>
<td>In</td>
</tr>
<tr>
<td>Servo port active</td>
<td>2 (M5)</td>
<td>1 (M4)</td>
</tr>
<tr>
<td>Options</td>
<td>PH</td>
<td>PJ</td>
</tr>
<tr>
<td>Starting current “a”</td>
<td>350mA</td>
<td>178mA</td>
</tr>
<tr>
<td>Maximum current “b”</td>
<td>850mA</td>
<td>440mA</td>
</tr>
</tbody>
</table>
High Current Electric Displacement Control (HCEDC) Option PH and PJ - Continued

The Option PJ coils have an IP 69 K environmental protection rating. The coils include a uni-directional, polarity diode which protects downstream electronic components from power surges originating from the coil. Therefore, care must be taken to not reverse the “+” and “−” terminals. Failure to do so will damage the diode and render the coil unusable. The coils have a “1” and “2” molded in the connector for proper identification of the poles.

<table>
<thead>
<tr>
<th></th>
<th>PH</th>
<th>PJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum current</td>
<td>850mA</td>
<td>440mA</td>
</tr>
<tr>
<td>PWM frequency</td>
<td>100 - 200 Hz</td>
<td></td>
</tr>
<tr>
<td>Coil resistance @ 20 ºC</td>
<td>9.0 Ω</td>
<td>35.6 Ω</td>
</tr>
</tbody>
</table>

The Option PH (12V) and Option PJ (24V) controls can be distinguished by the color of the shroud. The 24V Option PJ has a yellow shroud while the 12V Option PH has a blue shroud.
Technical Information Series T90 Axial Piston Pumps

Installation Drawings

Size 055

Manual Displacement Control (MDC), endcap twin ports

View "Y"

Split flange boss

Ports A and B

1-100 - 6000 psi

Per ISO 6162

M12 x 1.75

Minimum full thread 24mm

Gauge port M2

system pressure B

9/16-18UNF-2B

Case drain L1

1-1/16-12UN-2B

Coupling must not protrude beyond this point

Approximate center of gravity

Ø 33.8

[Ø 1.33]

Ø 127

[Ø 5]

0

-0.05

[+0.00]

[-0.02]

"Z"

View "Y"

Gauge port M4

servo pressure

9/16-18UNF-2B

Gauge port M5

servo pressure

9/16-18UNF-2B

"X"

View "X"

Charge pressure relief valve

Gauge port M2

Charge pressure B

9/16-18UNF-2B

Gauge port M3

Charge pressure

9/16-18UNF-2B

Gauge port M1

Charge pressure A

9/16-18UNF-2B

Manual displacement control handle dimensions

A-A

Maximum displacement

B

Neutral position

A

Maximum displacement

Ø 50.8±0.3

[Ø 2.0±0.01]

Ø 6.73±0.13

[Ø 0.265±0.005]

Ø 25.8±0.3

[Ø 1.0±0.01]

Ø 41.3±0.3

[Ø 1.6±0.01]
Control

Size 075

Manual Displacement Control (MDC), endcap twin ports

1.00 - 6000 psi
Per ISO 6162
bolt M21 x 1.75
Minimum full thread 24mm

Coupling must not protrude beyond this point

Approximate center of gravity

Spline data:
Pitch diameter = 36.513 [1.4375]
Pressure Angle = 30°
Number of teeth = 23
Pitch = 16/32
ANSI B92.1-1970, class 5, fillet root, side fit

Maximum displacement

Neutral position

Approximate center of gravity

Manual displacement control handle dimensions
A-A

Ø 50.8±0.1
[Ø 2.0±0.01]

Maximum displacement

Ø 67.3±0.13
[Ø 2.6±0.01] 3x

Maximum displacement

Ø 25.4±0.3
[Ø 1.0±0.01] 3x

Approximate center of gravity

View "Y"
Size 100

Manual displacement control (MDC) endcap twin ports

Installation Drawings

Gauge port M2
system pressure B
9/16-18UNF-2B

Case drain L1
1-1/16-12UN-2B

"Y"

Approximate center of gravity

Gauge port M2
Charge pressure B
9/16-18UNF-2B

Approximate center of gravity

Gauge port M4
servo pressure
9/16-18UNF-2B

"Z"

Charge pressure relief valve

Gauge port M5
servo pressure
9/16-18UNF-2B

"X"

Charge pressure relief valve

Port S:
Charge pump inlet
1-5/8-12UN-2B

Gauge port M3
Charge pressure A
9/16-18UNF-2B

Gauge port M1
Charge pressure A
9/16-18UNF-2B

Port S:
Charge pump inlet
1-5/8-12UN-2B

1-1/16-12UN-2B

Per ISO 6162
M12 x 1.75
Minimum full thread 24mm

Pitch data:
Pitch diameter = 36.513 [1.4375]  
Pressure Angle = 30°  
Number of teeth = 23  
Pitch = 16/32  
ANSI B92.1-1970, class 5, fillet root, side fit

Spline data:
Pitch diameter = 36.513 [1.4375]  
Pressure Angle = 30°  
Number of teeth = 23  
Pitch = 16/32  
ANSI B92.1-1970, class 5, fillet root, side fit

Approximate center of gravity

Coupling must not protrude beyond this point

Manual displacement control handle dimensions

Neutral position

Maximum displacement

Approximate center of gravity
Danfoss Power Solutions is a global manufacturer and supplier of high-quality hydraulic and electronic components. We specialize in providing state-of-the-art technology and solutions that excel in the harsh operating conditions of the mobile off-highway market. Building on our extensive applications expertise, we work closely with our customers to ensure exceptional performance for a broad range of off-highway vehicles.

We help OEMs around the world speed up system development, reduce costs and bring vehicles to market faster. Danfoss – Your Strongest Partner in Mobile Hydraulics.

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