Sauer-Danfoss a world leader in hydraulic power systems has developed a family of axial piston motors.

Sauer-Danfoss axial pistons fixed displacement motors are of swash plate design with preset displacement suitable for hydrostatic transmissions with closed loop circuit. The output speed is proportional to the motor’s input flow. The output torque is proportional to the differential pressure applied to the main pressure ports. The direction of motor (output) shaft rotation depends on flow input to the main pressure ports.

Sauer-Danfoss axial piston fixed displacement motors are well engineered and easy to handle. The full-length shaft with a highly efficient tapered roller bearing arrangement offers a high loading capacity for external radial forces. High case pressures can be achieved without leakage even at the lowest temperatures by using suitable shaft seals.

Sauer-Danfoss axial piston units are designed for easy servicing. Complete dismantling and reassembly can be carried out with standard hand tools, and all components or sub-assemblies are replaceable. Axial piston fixed displacement motors of the Sauer-Danfoss pattern are made by licensed producers worldwide, providing consistent service and fully inter-changeable parts.

Typical Markets

- Industrial
- Mining
- Transit Mixer
- Utility Vehicles

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Series 20 – Axial Piston Motors

Technical Information

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System Circuit Description

PUMP AND MOTOR CIRCUIT DESCRIPTION

Above figure shows schematically the function of a hydrostatic transmission using an axial piston variable displacement pump and a fixed displacement motor.

**Motor Circuit Schematic**

<table>
<thead>
<tr>
<th>Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fixed displacement motor</td>
</tr>
<tr>
<td>2</td>
<td>Purge relief valve</td>
</tr>
<tr>
<td>3</td>
<td>Shuttle valve</td>
</tr>
<tr>
<td>4</td>
<td>High pressure relief valve</td>
</tr>
</tbody>
</table>

**Ports:**

- A, B = Main pressure ports (working loop)
- \( L_1, L_2 \) = Drain ports
- \( M_A \) = Gauge port for port A
- \( M_B \) = Gauge port for port B
- \( M \) = Gauge port - charge pressure
Series 20 – Axial Piston Motors
Technical Information
Technical Specification

TECHNICAL PARAMETERS

Design
Axial piston motor with fixed displacement and swash plate design.

Type of mounting
SAE four bolt flanges.

Pipe connections
Main pressure ports: SAE split flange
Remaining ports: SAE O-ring boss

Direction of rotation and flow
Clockwise or counterclockwise (viewing from the output shaft).

<table>
<thead>
<tr>
<th>Direction of rotation</th>
<th>Port A</th>
<th>Port B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clockwise (R)</td>
<td>Output</td>
<td>Input</td>
</tr>
<tr>
<td>Counterclockwise (L)</td>
<td>Input</td>
<td>Output</td>
</tr>
</tbody>
</table>

Installation position
Optional; motor housing must be always filled with hydraulic fluid.

External drain fluid loss

![Graph showing external drain fluid loss vs. driveshaft speed (rpm)]

Typical values for 350 bar [5076 psi] and 18° swashplate angle
**System pressure range, input $p_1$**
Pressure on port A or B:

- Max. operating pressure $\Delta p = 420$ bar [6092 psi]
- Max. high pressure setting $\Delta p = 460$ bar$^1$ [6672 psi]

$^1$only with POR-valve

**System pressure range, output $p_2$**
Normal setting for configuration MS and MR: 11.0 - 12.5 bar [160 - 181 psi] above case pressure.

Minimum: 8 bar, intermittent only

**Case pressure**
- Max. rated pressure = 2.5 bar [36.3 psi]
- Intermittent = 5.0 bar [72.5 psi]

**Hydraulic fluid**
Refer to Sauer-Danfoss publication *Hydraulic Fluids and Lubricants* and *Experience with Bio Fluids* for biodegradable hydraulic fluids.

**Hydraulic fluid temperature range**

$\theta_{\text{min}} = -40$ °C [-40 °F]
$\theta_{\text{max}} = 95$ °C [203 °F]

**Viscosity range**

$\nu_{\text{min}} = 7$ mm$^2$/s [49 SUS$^*$]
$\nu_{\text{max}} = 1000$ mm$^2$/s [4630 SUS$^*$] (intermittent cold start)
Recommended viscosity range: 12 - 60 mm$^2$/s [66 - 278 SUS$^*$]

$^*$SUS (Saybolt Universal Second)

**Filtration**
Required cleanliness level: ISO 4406-1999 Code 22/18/13 or better.
Refer to Sauer-Danfoss publication *Hydraulic Fluids and Lubricants* and *Design Guideline for Hydraulic Fluid Cleanliness*.

**Shaft load**
The pump will accept radial and axial loads on its shaft, the maximum capacity being determined by direction and point of application of the load.
Please contact your Sauer-Danfoss representative.
Technical data

<table>
<thead>
<tr>
<th></th>
<th>Frame size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>070</td>
</tr>
<tr>
<td>Max. displacement</td>
<td>cm³</td>
</tr>
<tr>
<td></td>
<td>[in³]</td>
</tr>
<tr>
<td>Rated speed 1</td>
<td>min⁻¹ (rpm)</td>
</tr>
<tr>
<td>Theoretical torque</td>
<td>Nm/bar</td>
</tr>
<tr>
<td></td>
<td>[in lb/1000 psi]</td>
</tr>
<tr>
<td>Mass moment of inertia of</td>
<td>kg m² • 10⁻⁴</td>
</tr>
<tr>
<td>rotating group</td>
<td>[lbf•ft² • 10⁻³]</td>
</tr>
</tbody>
</table>

¹ for higher speeds contact your Sauer-Danfoss representative

Determination of nominal motor size

<table>
<thead>
<tr>
<th>Unit:</th>
<th>Metric System:</th>
<th>Inch System:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input flow</td>
<td>Qₑ = ( \frac{V₉ \cdot n}{1000 \cdot \eta_v} ) l/min</td>
<td>Qₑ = ( \frac{V₉ \cdot n}{231 \cdot \eta_v} ) [gpm]</td>
</tr>
<tr>
<td>Output torque</td>
<td>Mₑ = ( \frac{V₉ \cdot \Delta p \cdot \eta_m}{20 \cdot \pi} ) Nm</td>
<td>Mₑ = ( \frac{V₉ \cdot \Delta p \cdot \eta_m}{2 \cdot \pi} ) [lbf•in]</td>
</tr>
<tr>
<td>Output power</td>
<td>Pₑ = ( \frac{Qₑ \cdot \Delta p \cdot \eta_t}{600} ) kW</td>
<td>Pₑ = ( \frac{V₉ \cdot n \cdot \Delta p \cdot \eta_t}{396 000} ) [hp]</td>
</tr>
<tr>
<td>Speed</td>
<td>n = ( \frac{Qₑ \cdot 1000 \cdot \eta_v}{V₉} ) min⁻¹</td>
<td>n = ( \frac{Qₑ \cdot 231 \cdot \eta_v}{V₉} ) (rpm)</td>
</tr>
</tbody>
</table>

Efficiency characteristic curves available on request.

- \( V₉ \) = Motor displacement per revolution cm³ [in³]
- \( n \) = Motor speed min⁻¹ (rpm)
- \( \Delta p \) = Hydraulic pressure differential bar [psid]
- \( \eta_v \) = Motor volumetric efficiency
- \( \eta_m \) = Motor mechanical efficiency
- \( \eta_t \) = Motor total efficiency
- \( p_{HD} \) = High pressure bar [psid]
- \( p_{ND} \) = Low pressure bar [psid]
**Series 20 – Axial Piston Motors**  
**Technical Information**  
**Dimensions – Frame Size 070 and 089 cm³**

**OUTLINE DRAWING, CONFIGURATION MS**

- **Coupling may not protrude beyond L mm maximum length of full spline**
- **Port “L1”: Case drain port (use highest port as outlet)**
- **Approx. centre of gravity**
- **Purge relief valve**
- **Shuttle valve (both sides)**
- **Port “A”**
- **Port “L2”: Case drain port**
- **Shaft spline data:**
  - Pitch Ø = S
  - Pressure angle = 30°
  - Number of teeth = T
  - Pitch = U
- **Flange design 2/070**
- **Gauge port “MA”**
- **Gauge port “M”**
- **Charge pressure**
- **Gauge port “MB”**
- **Port “A”**
- **Port “B”**
- **Port “L”**: Case drain port
- **Port “AL”: Case drain port (use highest port as outlet)**

```
<table>
<thead>
<tr>
<th>Frame size</th>
<th>Port A and B</th>
<th>Port L1 and L2</th>
<th>Port M and M1</th>
<th>Port M</th>
</tr>
</thead>
</table>
| 070        | SAE flange, size 1  
SAE split flange boss  
5000 psi  
4 threads  
3/8-16 UNC-2B  
18 deep | 7/8-14 UNF-2B  
SAE straight thread  
O-ring boss | 7/16-20 UNF-2B  
SAE straight thread  
O-ring boss |
| 089        | SAE flange, size 1  
SAE split flange boss  
5000 psi  
4 threads  
3/8-16 UNC-2B  
18 deep | 7/8-14 UNF-2B  
SAE straight thread  
O-ring boss | 7/16-20 UNF-2B  
SAE straight thread  
O-ring boss |
```

* Shaft spline data: spline shaft with involute spline, according to SAE handbook, 1963, class 1, fillet root side fit.
Series 20 – Axial Piston Motors
Technical Information
Dimensions – Frame Size 070 and 089 cm³

OUTLINE DRAWING, CONFIGURATION MS (continued)

|------------|--------|--------|--------|--------|--------|--------|--------|---------|--------|--------|--------|--------|

|------------|----------|----------|----------|----------|----------|--------|--------|--------|--------|-------------------------------|-----------------|

For further dimensions see previous pages.

OUTLINE DRAWING, BASIC MODEL

Dimensions

<table>
<thead>
<tr>
<th>Frame size</th>
<th>A [mm] [in]</th>
<th>B [mm] [in]</th>
<th>C [mm] [in]</th>
<th>D [mm] [in]</th>
<th>Weight [kg] [lb]</th>
</tr>
</thead>
<tbody>
<tr>
<td>070</td>
<td>290 [11.417]</td>
<td>30 [1.181]</td>
<td>12 [0.472]</td>
<td>2 [0.079]</td>
<td>34 [75]</td>
</tr>
<tr>
<td>089</td>
<td>307 [12.087]</td>
<td>44 [1.732]</td>
<td>6 [0.236]</td>
<td>1 [0.079]</td>
<td>41 [90]</td>
</tr>
</tbody>
</table>

For further dimensions see previous pages.

OUTLINE DRAWING, MOTOR CONFIGURATION AM 01000

Dimensions

<table>
<thead>
<tr>
<th>Frame size</th>
<th>A [mm] [in]</th>
<th>Weight [kg] [lb]</th>
</tr>
</thead>
<tbody>
<tr>
<td>070</td>
<td>315 [12.402]</td>
<td>36 [79]</td>
</tr>
<tr>
<td>089</td>
<td>332 [13.071]</td>
<td>43 [95]</td>
</tr>
</tbody>
</table>

1 Light weight and short options available on request

For further dimensions see previous pages.
Series 20 – Axial Piston Motors
Technical Information
Dimensions – Frame Size 070 and 089 cm³

OUTLINE DRAWING, MOTOR CONFIGURATION MR

Dimensions

<table>
<thead>
<tr>
<th>Frame size</th>
<th>A [mm] [in]</th>
<th>B [mm] [in]</th>
<th>Weight [kg] [lb]</th>
<th>Port Mₐ and Mₑ</th>
<th>Port M</th>
</tr>
</thead>
</table>

For further dimensions see previous pages.
Series 20 – Axial Piston Motors
Technical Information
Dimensions – Frame Size 070 and 089 cm³

CIRCUIT DIAGRAMS

Configuration MR

Basic model and motor configuration AM 01000

Designation:
1 = Fixed displacement motor
2 = Purge relief valve
3 = Shuttle valve
4 = High pressure relief valve
5 = Bypass valve

Ports:
A, B = Main pressure ports (working loop)
L₁, L₂ = Drain ports
Mₐ = Gauge port for port A
Mₐ = Gauge port for port B
M = Gauge port - charge pressure
Series 20 – Axial Piston Motors
Technical Information
Dimensions – Frame Size 227 and 334 cm³

OUTLINE DRAWING, CONFIGURATION MS

* Shaft spline data: spline shaft with involute spline, according to SAE handbook, 1963, class 1, fillet root side fit.
### Dimensions – Frame Size 227 and 334 cm³

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>227</td>
<td>498</td>
<td>410</td>
<td>346</td>
<td>228.5</td>
<td>139.7</td>
<td>134.9</td>
<td>152</td>
<td>264</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>[19.606]</td>
<td>[16.142]</td>
<td>[13.622]</td>
<td>[8.996]</td>
<td>[5.500]</td>
<td>[5.311]</td>
<td>[5.984]</td>
<td>[10.394]</td>
<td>[1.063]</td>
</tr>
<tr>
<td>334</td>
<td>537</td>
<td>449</td>
<td>389</td>
<td>278</td>
<td>154</td>
<td>143.</td>
<td>161</td>
<td>292</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>[21.142]</td>
<td>[17.677]</td>
<td>[15.315]</td>
<td>[10.945]</td>
<td>[6.063]</td>
<td>[5.650]</td>
<td>[6.339]</td>
<td>[11.496]</td>
<td>[1.496]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frame size</th>
<th>M [mm]</th>
<th>Ø N [mm]</th>
<th>Ø O [mm]</th>
<th>Ø P [mm]</th>
<th>Ø R [mm]</th>
<th>Ø S [mm]</th>
<th>T [mm]</th>
<th>U [mm]</th>
<th>V [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>227</td>
<td>38.4</td>
<td>165.1</td>
<td>110</td>
<td>44.03 (+0.07) [-1.733]</td>
<td>11.80</td>
<td>42.863</td>
<td>27</td>
<td>16/32</td>
<td>143.7</td>
</tr>
<tr>
<td></td>
<td>[1.512]</td>
<td>[6.500]</td>
<td>[4.331]</td>
<td>[1.733]</td>
<td>[0.465]</td>
<td>[1.688]</td>
<td>[1.063]</td>
<td>[5.657]</td>
<td></td>
</tr>
<tr>
<td>334</td>
<td>46.2</td>
<td>177.8</td>
<td>114</td>
<td>64.66 (+0.16) [2.546]</td>
<td>14.35</td>
<td>63.500</td>
<td>40</td>
<td>16/32</td>
<td>158.7</td>
</tr>
<tr>
<td></td>
<td>[1.819]</td>
<td>[7.000]</td>
<td>[4.488]</td>
<td>[2.546]</td>
<td>[0.565]</td>
<td>[2.500]</td>
<td>[1.575]</td>
<td>[6.248]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frame size</th>
<th>W [mm]</th>
<th>X [mm]</th>
<th>Y [mm]</th>
<th>Z [mm]</th>
<th>AA [mm]</th>
<th>BB [mm]</th>
<th>CC [mm]</th>
<th>Diameter for shaft coupling [mm]</th>
<th>Weight [kg (lb)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>227</td>
<td>156</td>
<td>160</td>
<td>265</td>
<td>317.5</td>
<td>20.6 ± 0.4</td>
<td>13</td>
<td>41.28 ± 0.062</td>
<td>152</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[6.142]</td>
<td>[6.329]</td>
<td>[10.433]</td>
<td>[12.500]</td>
<td>[0.811 ± 0.0157]</td>
<td>[0.512]</td>
<td>[1.625 ± 0.0024]</td>
<td>[335]</td>
<td></td>
</tr>
<tr>
<td>334</td>
<td>176</td>
<td>174</td>
<td>298</td>
<td>350</td>
<td>27.0 ± 0.15 [1.063 ± 0.0019]</td>
<td>18</td>
<td>61.93 ± 0.024</td>
<td>197</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[6.929]</td>
<td>[6.850]</td>
<td>[11.732]</td>
<td>[13.780]</td>
<td>[0.709]</td>
<td>[2.438 ± 0.0029]</td>
<td>[434]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### OUTLINE DRAWING, CONFIGURATION MS

**Dimensions**

- **Port A and B**: SAE flange, size 1 1/2
- **Port L, and L₂**: SAE split flange boss
- **Port M**: 6000 psi
- **Port M₁ and M₂**: 4 threads 5/8-11 UNC-2B
- **Port M**: 35 deep
- **Port L**: 1 7/8-12 UNF-2B
- **Port L₂**: SAE straight thread
- **Port M₁ and M₂**: O-ring boss
- **Port M**: O-ring boss
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