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
Series 20 – Axial Piston Motors
Technical Information

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AXIAL PISTON FIXED DISPLACEMENT MOTOR

- Purge relief valve
- Cylinder block assembly
- Shaft seal
- Valve block
- Shuttle valve
- Swashplate
- High pressure relief valves (adjustable)
- Output shaft
Above figure shows schematically the function of a hydrostatic transmission using an axial piston variable displacement pump and a fixed displacement motor.

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

**Ports:**
A, B = Main pressure ports (working loop)  
L₁, L₂ = Drain ports  
Mₐ = Gauge port for port A  
Mₐₙ = 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](image-url)

Typical values for 350 bar [5076 psi] and 18° swashplate angle
Series 20 – Axial Piston Motors
Technical Information
Technical Specification

HYDRAULIC PARAMETERS

System pressure range, input \( p_1 \),
Pressure on port A or B:

- Max. operating pressure \( \Delta p = 420 \text{ bar} [6092 \text{ psi}] \)
- Max. high pressure setting \( \Delta p = 460 \text{ bar} \, ^1 [6672 \text{ psi}] \)

\(^1\) 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
\( \vartheta_{\text{min}} = -40 \, ^\circ\text{C} [-40 \, ^\circ\text{F}] \)
\( \vartheta_{\text{max}} = 95 \, ^\circ\text{C} [203 \, ^\circ\text{F}] \)

Viscosity range
\( \nu_{\text{min}} = 7 \text{ mm}^2/\text{s} [49 \text{ SUS}^*] \)
\( \nu_{\text{max}} = 1000 \text{ mm}^2/\text{s} [4630 \text{ SUS}^*] \) (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>Frame Size</th>
<th>070</th>
<th>089</th>
<th>227</th>
<th>334</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Displacement</td>
<td>cm³</td>
<td>69.8</td>
<td>89.0</td>
<td>227.3</td>
</tr>
<tr>
<td></td>
<td>[in³]</td>
<td>[4.26]</td>
<td>[5.43]</td>
<td>[13.87]</td>
</tr>
<tr>
<td>Rated Speed 1</td>
<td>min⁻¹ (rpm)</td>
<td>3200</td>
<td>2900</td>
<td>2100</td>
</tr>
<tr>
<td>Mass Moment of Inertia of Rotating Group</td>
<td>kg m² • 10⁻³ [lbf•ft² • 10⁻³]</td>
<td>12.34 [292.8]</td>
<td>17.77 [421.7]</td>
<td>86.80 [2059.8]</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>( Q_e = \frac{V_g \cdot n}{1000 \cdot \eta_v} ) l/min</td>
<td>( Q_e = \frac{V_g \cdot n}{231 \cdot \eta_v} ) [gpm]</td>
</tr>
<tr>
<td>Output Torque</td>
<td>( M_e = \frac{V_g \cdot \Delta p \cdot \eta_m}{20 \cdot \pi} ) Nm</td>
<td>( M_e = \frac{V_g \cdot \Delta p \cdot \eta_m}{2 \cdot \pi} ) [lbf•in]</td>
</tr>
<tr>
<td>Output Power</td>
<td>( P_e = \frac{Q_e \cdot \Delta p \cdot \eta_t}{600} ) kW</td>
<td>( P_e = \frac{V_g \cdot n \cdot \Delta p \cdot \eta_t}{396000} ) [hp]</td>
</tr>
<tr>
<td>Speed</td>
<td>( n = \frac{Q_e \cdot 1000 \cdot \eta_v}{V_g} ) min⁻¹</td>
<td>( n = \frac{Q_e \cdot 231 \cdot \eta_v}{V_g} ) (rpm)</td>
</tr>
</tbody>
</table>

Efficiency characteristic curves available on request.

- \( V_g \) = 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

Flange design 2/070
Gauge port "M" charge pressure
Gauge port "Mₙ" charged pressure
Port "A" and "B"
Port "L₁": Case drain port (use highest port as outlet)
Port "L₂": Case drain port
Port "A" and "Mₙ"
Port "M" charge pressure
Port "A" and "M"
Port "M₁" charge pressure
Port "B"

Shaft spline data:*
- Pitch Ø = S
- Pressure angle = 30°
- Number of teeth = T
- Pitch = U

Approx. centre of gravity
Purge relief valve
Shuttle valve (both sides)

* Shaft spline data: spline shaft with involute spline, according to SAE handbook, 1963, class 1, fillet root side fit.

<table>
<thead>
<tr>
<th>Frame size</th>
<th>Port A and B</th>
<th>Port L₁ and L₂</th>
<th>Port M₁ and M₂</th>
<th>Port M</th>
</tr>
</thead>
</table>
Series 20 – Axial Piston Motors
Technical Information
Dimensions – Frame Size 070 and 089 cm³

OUTLINE DRAWING, CONFIGURATION MS (continued)
OUTLINE DRAWING, CONFIGURATION MS (continued)

Dimensions

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

Dimensions

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

For further dimensions see previous pages.

OUTLINE DRAWING, BASIC MODEL

Dimensions

<table>
<thead>
<tr>
<th>Frame size</th>
<th>A [mm]</th>
<th>B [mm]</th>
<th>C [mm]</th>
<th>D [mm]</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>41 [90]</td>
<td></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]</th>
<th>Weight [1] [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.
### OUTLINE DRAWING, MOTOR CONFIGURATION MR

#### Partial View A-A

- **Bypass valve opened**
- **Bypass valve closed**
- **3 x Ø 6.5**
- **50.8**
- **58.55**
- **100.5**
- **25.4**

#### 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 M&lt;sub&gt;s&lt;/sub&gt; and M&lt;sub&gt;b&lt;/sub&gt;</th>
<th>Port M</th>
</tr>
</thead>
</table>

For further dimensions see previous pages.
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
MB = Gauge port for port B
M = Gauge port - charge pressure
**Series 20 – Axial Piston Motors**

**Technical Information**

Dimensions – Frame Size 227 and 334 cm³

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**OUTLINE DRAWING, CONFIGURATION MS**

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* 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

#### OUTLINE DRAWING, CONFIGURATION MS

(continued)

<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>E [mm] [in]</th>
<th>F [mm] [in]</th>
<th>G [mm] [in]</th>
<th>Ø H [mm] [in]</th>
<th>J [mm] [in]</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Frame size</th>
<th>M [mm] [in]</th>
<th>Ø N [mm] [in]</th>
<th>Ø O [mm] [in]</th>
<th>Ø P [mm] [in]</th>
<th>Ø R [mm] [in]</th>
<th>Ø S [mm] [in]</th>
<th>T [mm] [in]</th>
<th>U [mm] [in]</th>
<th>V [mm] [in]</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Frame size</th>
<th>W [mm] [in]</th>
<th>X [mm] [in]</th>
<th>Y [mm] [in]</th>
<th>Z [mm] [in]</th>
<th>AA [mm] [in]</th>
<th>BB [mm] [in]</th>
<th>CC [mm] [in]</th>
<th>Diameter for shaft coupling [mm] [in]</th>
<th>Weight [kg] [lb]</th>
</tr>
</thead>
<tbody>
<tr>
<td>227</td>
<td>156 [6.142]</td>
<td>160 [6.300]</td>
<td>265 [10.433]</td>
<td>265 [10.433]</td>
<td>317.5 [12.500]</td>
<td>20.6 ± 0.4 [0.811 ± 0.0157]</td>
<td>13 [0.512]</td>
<td>41.28 ± 0.062 [1.625 ± 0.024]</td>
<td>152 [335]</td>
</tr>
</tbody>
</table>

#### Frame size

<table>
<thead>
<tr>
<th>Port A and B</th>
<th>Port L₁ and L₂</th>
<th>Port Mₐ and Mₖ</th>
<th>Port M</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAE flange, size 1 1/2&lt;br&gt;SAE split flange boss&lt;br&gt;6000 psi&lt;br&gt;4 threads&lt;br&gt;5/8-11 UNC-2B&lt;br&gt;35 deep</td>
<td>1 7/8-12 UNF-2B&lt;br&gt;SAE straight thread&lt;br&gt;O-ring boss</td>
<td>7/16-20 UNF-2B&lt;br&gt;SAE straight thread&lt;br&gt;O-ring boss</td>
<td></td>
</tr>
</tbody>
</table>
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– Market Leaders Worldwide

Sauer-Danfoss is a comprehensive supplier providing complete systems to the global mobile market.

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