Series 45 open circuit pumps can be applied with other products in a system to transfer and control hydraulic power.

Series 45 pumps provide an infinitely variable flow rate between zero and maximum.

Series 45 variable displacement pumps are compact, high power density units, using the axial piston concept in conjunction with a tiltable swashplate to vary the pump displacement.

Series 45 pumps use a cradle swashplate design. A hydraulic control piston sets the swashplate angle. Control of the displacement piston is provided through a built-in pressure compensator valve. This valve will vary the swashplate angle from its maximum to its minimum position when the set pressure is reached. Controls are also available for remote compensating and load sensing systems. An available displacement limiter (frame G and H units only) allows adjustment of maximum flow to match system requirements. The Series 45 pump controls are designed for low hysteresis and responsive performance.

Series 45 open circuit pumps cover a displacement range from 25cc [1.53 in³] to 90cc [5.49 in³] and a continuous pressure rating range from 210 bar [3045 psi] to 310 bar [4495 psi] with peak pressure ratings to 400 bar [5800 psi]*. Each pump in the series is optimized to a specific pressure rating. The chart above shows how the displacements are arranged with respect to pressure rating.

*Refer to Technical Data, pages 13 through 15 for specific ratings. For more information on pressure ratings see Pressure Rating, page 8 and Pressure Limits, page 16.
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Series 45 Axial Piston Open Circuit Pumps
Technical Information

Technical Features

A COMPLETE FAMILY TO MEET MARKET NEEDS

• 25 cc [1.53 in³]  57 cc [3.48 in³]
• 30 cc [1.83 in³]  74 cc [4.52 in³]
• 38 cc [2.32 in³]  75 cc [4.57 in³]
• 45 cc [2.74 in³]  90 cc [5.47 in³]
• Additional displacements under development
• Wide range of installation options
• Control system flexibility - pressure compensated, load sensing, and remote pressure compensated controls
• High power auxiliary drives for multiple pump configurations
• Open circuit installations

THE LATEST TECHNOLOGY

• Maximum controllability in all modes of operation
• High power density
• Designed to lower installation costs
• Designed to reduce operating costs
• Designed using the proven methods of quality function deployment (QFD) and design for manufacturability (DFM)
• Unique assembly methods increase reliability

HIGH PERFORMANCE

• Speeds to 3600 min⁻¹ (rpm)
• Pressure to 310 bar [4495 psi] continuous
• High overall efficiency
• Fast response times
• Fast recovery times
• Low noise levels

RELIABILITY / DURABILITY

• Designed to rigorous standards
• Proven in the laboratory and in the field
• Manufactured to rigid quality standards
• Long service life
• Significantly fewer parts
• No gasketed joints
• Robust input shaft bearings handle large external shaft loads

GLOBAL PRODUCT

• Designed for worldwide markets
• Identical product available worldwide
• Mobile, industrial, and stationary markets

WORLDWIDE SUPPORT

• Sales and technical support in all industrialized countries of the world
• Serviced by a worldwide network of authorized service centers
This illustration shows an open circuit hydraulic system using a Series 45-57 cc Axial Piston Open Circuit Pump with a load sensing, pressure compensating control providing flow in parallel to a modulating fan control valve and a PVG 32 directional flow control valve.
To support the growing family of Sauer-Danfoss variable displacement open circuit piston pumps, the option ordering code was altered in 2000.

Previously, the order code appeared as follows:
4SL057 LS 20 20 NN A 3 S1C2 A1N NNN NNN NNN

The new order code appears like this:
HRL 057B LS 20 20 NN A 3 S1C2 A1N NNN NNN NNN

The highlighted area of the new code provides the flexibility to incorporate multiple pump displacements in the same pump design. In the above example:
- H = pump design type (referred to as frame)
- R = open circuit
- L = counter clockwise (CCW) input rotation
- 057 = maximum displacement (cc)
- B = pressure rating

Each pump displacement in the Series 45 product family has a specific maximum and continuous pressure rating. This allows the product selection to be tailored to the flow and pressure requirements of the application. Currently, three pressure ratings exist:

<table>
<thead>
<tr>
<th>Pressure Rating Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>D</td>
</tr>
</tbody>
</table>

Refer to pages 13, 14, 15, and 16 for further information on the pressure ratings for the various pump displacements and definitions of maximum and minimum pressure.

Operating characteristics of the application must be identified to insure proper selection of the pump displacement and pressure rating. Exceeding the pressure rating of the pump will result in reduced component life. Contact your Sauer-Danfoss representative if there is a question regarding the operating pressures of your application.
**Series 45 Axial Piston Open Circuit Pumps**

**Technical Information**

**Technical Specifications**

**DESIGN**

**Mounting**
SAE flange, Size C (SAE J744) on frame G and H pumps
SAE flange, Size B on frame L and K pumps, optional on 57cc frame H pumps

**Auxiliary Mounting Pad Options**
SAE flange, Size A, B, B-B, or C

**Control Options**
PC: Pressure Compensator
LS: Load Sensing (with Pressure Compensator)
See Controls, pages 20 through 23.

**Port Connections**
Inlet and pressure ports: SAE Flange Ports (Code 61) or SAE O-ring boss
Axial (end) ports or radial (side) ports
Remaining ports: SAE straight thread O-ring boss
Metric port options available

**Direction of Rotation**
Clockwise or counterclockwise

**Installation Position**
Installation position discretionary.

**HYDRAULIC PARAMETERS**

**Inlet Pressure**
Minimum pressure, continuous = 0.8 bar absolute [23.2 in Hg]
(Refer to Inlet Pressure Vs. Speed curves, pages 27 through 34)
Minimum pressure, cold start = 0.5 bar absolute [14.8 in Hg]

**Pressure Compensator Valve Setting**
Minimum pressure: 100 bar [1450 psi]
Maximum pressure: 310 bar [4495 psi]

**Case Pressure**
Maximum continuous: 0.5 bar [7 psi] Above inlet
Intermittent: 2 bar [29 psi] Cold start

**Temperature Range***
Intermittent, cold start = - 40° C [- 40° F]
Continuous = 82° C [180° F]
Maximum = 104° C [220° F]
(at the hottest point, i.e. drain line)

**Fluid Viscosity Limits**

<table>
<thead>
<tr>
<th>ν mm²/s (cSt)</th>
<th>SUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>v min = 9</td>
<td>58  minimum (continuous)</td>
</tr>
<tr>
<td>ν min = 6.4</td>
<td>47  intermittent</td>
</tr>
<tr>
<td>v max = 110</td>
<td>500 maximum (continuous)</td>
</tr>
<tr>
<td>ν max = 1000</td>
<td>4700 intermittent (cold start)</td>
</tr>
</tbody>
</table>

* Hydraulic fluid viscosity must be maintained within the prescribed limits.
Filtration

It is imperative that only clean oil be allowed to enter the pump in order to prevent premature wear. System filtration capable of controlling the fluid cleanliness to ISO 4406 class 18/13 or better is required.

Due to changes in pump inlet conditions, system aeration, and duty cycle, suction line filters are not recommended. Instead, a 125 µm (150 mesh) strainer located in the reservoir or in the pump inlet line is recommended to protect the pump from coarse particles.

The selection of a return filter depends on a number of factors including contamination ingress rate and the desired maintenance interval. Filters are selected to meet the above requirements using rating parameters of efficiency and capacity.

Filter efficiency may be measured using a Beta ($\beta$) ratio*. A filter with a $\beta$-ratio within the range of $\beta_{10} = 10$ or better is typically required.

Since each system is unique, the filtration requirement for that system will be unique and must be determined by test in each case. It is essential that monitoring of prototypes and evaluation of components and performance throughout the test program be the final criteria for judging the adequacy of the filtration system. See Sauer-Danfoss publication BLN-9887 or 697581 and ATI-E 9201 for more information.

---

* Filter $\beta x$-ratio 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 size ($x$) upstream of the filter to number of particles greater than the same size downstream of the filter. The $\beta x$-ratio applies to a specific particle size, measured in microns.
Reservoir
The function of the reservoir is to provide clean fluid, dissipate heat, remove entrained air, and allow for fluid volume changes associated with fluid expansion and cylinder differential volumes.

Minimum reservoir capacity depends on the volume needed to cool the oil, hold the oil from all retracted cylinders, and allow expansion due to temperature changes. Normally, a capacity of 1 to 3 times the pump output flow (per minute) is satisfactory.

The reservoir outlet (to pump inlet) should be near the bottom of the reservoir, but far enough above the bottom to take advantage of gravity separation of foreign particles. It must always be covered with fluid. The reservoir inlet (fluid return) from the system should be below the fluid level and be as far away as possible from the outlet port.

The reservoir oil levels must be maintained to allow adequate time for the entrained air to escape. A dwell time of 30 to 60 seconds is normally adequate.

\[
\text{Dwell time} = \frac{\text{Reservoir Capacity}}{\text{Flow Rate}}
\]

Case Pressure
Case flow is affected by the pump's volumetric efficiency and control flow (under steady state and transient conditions).

Under normal operating conditions, the maximum continuous case pressure must not be greater than 0.5 bar [7 psi] above the pump inlet pressure. Case pressure must never exceed 2 bar [30 psi] gauge pressure.

Temperature Limits
Maximum and continuous allowable temperature limits for petroleum based fluids are found on page 8. These temperature limits apply at the hottest point in the unit, which is normally the case drain.
**PUMP INSTALLATION**

The pump housing must be filled with clean fluid during installation. The case drain line should be connected to the uppermost case drain port (L1 or L2) in order to keep the housing full of fluid during operation.

The case drain line should be a separate line to allow unrestricted flow to the reservoir. It should connect at the lowest point in the reservoir (below the minimum reservoir fluid level) and as far away from the reservoir outlet (pump inlet) connection as possible. The case drain line plumbing should be sized to limit case pressure to the values specified on page 7.

Pump inlet line plumbing must be designed so that the inlet pressure (vacuum) is within the values listed on page 7. Inlet line losses must be considered. Methods for estimating these losses are shown in the following formulae.

**EQUATIONS FOR ESTIMATING INLET LINE LOSSES**

\[ P_{\text{total}} = P_1 + P_2 + P_3 \]

where:
- \( P_1 \) = Acceleration loss, bar [psi]
- \( P_2 \) = Static head loss, bar [psi]
- \( P_3 \) = Line losses, bar [psi]

\[ P_1 \text{ bar} = \frac{l \cdot sg \cdot Dv}{100 \cdot Dt} \]

\[ P_1 \text{ psi} = \frac{l \cdot sg \cdot Dv}{74 \cdot Dt} \]

where:
- \( l \) = Line length, m [ft]
- \( sg \) = Specific gravity
- \( Dv \) = Change in fluid velocity, m/s [ft/s]
- \( Dt \) = Time interval for Dv, seconds

\[ P_2 \text{ bar} = \frac{sg \cdot h}{10.19} \]

\[ P_2 \text{ psi} = \frac{sg \cdot h}{2.31} \]

where:
- \( sg \) = Specific gravity
- \( h \) = Elevation change, m [ft]

\( P_3 \) = Line losses due to hose friction, bends, fittings, etc.
### Frame K and L Technical Specifications

<table>
<thead>
<tr>
<th></th>
<th>Units</th>
<th>Displacement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>L25C</td>
</tr>
<tr>
<td><strong>Displacement</strong></td>
<td>cm³</td>
<td>[1.53]</td>
</tr>
<tr>
<td><strong>Input Speed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>min⁻¹ (rpm)</td>
<td>500</td>
</tr>
<tr>
<td>Rated*</td>
<td>min⁻¹ (rpm)</td>
<td>3200</td>
</tr>
<tr>
<td>Maximum*</td>
<td>min⁻¹ (rpm)</td>
<td>3600**</td>
</tr>
<tr>
<td><strong>Flow at Rated Speed</strong></td>
<td>l/min</td>
<td>76.2 [20.3]</td>
</tr>
<tr>
<td>Theoretical Input Torque at Maximum Displacement</td>
<td>Nm/bar</td>
<td>0.395 [243]</td>
</tr>
<tr>
<td></td>
<td>[lbf-in/1000 psi]</td>
<td></td>
</tr>
<tr>
<td><strong>Mass Moment of Inertia of the Internal Rotating Parts</strong></td>
<td>kg·m²</td>
<td>0.0016 [0.037]</td>
</tr>
<tr>
<td></td>
<td>[lbf·ft²]</td>
<td></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Refer to Speed Ratings, page 16.

** With pressurized Inlet.

---

**Cross-section, pump control**

**Cross-section, pump**
**Frame H Technical Specifications**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Displacement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HS7B</td>
</tr>
<tr>
<td>Displacement</td>
<td>cm³ [in³]</td>
</tr>
<tr>
<td>Input Speed Minimum</td>
<td>min⁻¹ (rpm)</td>
</tr>
<tr>
<td>Rated*</td>
<td>min⁻¹ (rpm)</td>
</tr>
<tr>
<td>Maximum*</td>
<td>min⁻¹ (rpm)</td>
</tr>
<tr>
<td>Maximum (Peak) Working Pressure</td>
<td>bar [psi]</td>
</tr>
<tr>
<td>Flow at Rated Speed</td>
<td>l/min [US gal/min]</td>
</tr>
<tr>
<td>Theoretical Input Torque at Maximum Displacement</td>
<td>Nm/bar [lbf/in/1000 psi]</td>
</tr>
<tr>
<td>Mass Moment of Inertia of the Internal Rotating Parts</td>
<td>kg·m² [lbf·ft²]</td>
</tr>
<tr>
<td>Weight Axial Ported Units</td>
<td>kg [lb]</td>
</tr>
<tr>
<td>Radial Ported Units</td>
<td>kg [lb]</td>
</tr>
</tbody>
</table>

* Refer to Speed Ratings, page 16.
** With pressurized Inlet.

---

**Cross-section, pump control**

**Cross-section, pump**
### Frame G Technical Specifications

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Displacement</th>
<th>G748</th>
<th>G90C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>cm³ [in³]</td>
<td>74 [4.52]</td>
<td>90 [5.49]</td>
</tr>
<tr>
<td>Input Speed Minimum</td>
<td>min⁻¹ (rpm)</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Input Speed Rated*</td>
<td>min⁻¹ (rpm)</td>
<td>2400</td>
<td>2200</td>
</tr>
<tr>
<td>Input Speed Maximum*</td>
<td>min⁻¹ (rpm)</td>
<td>2800**</td>
<td>2600**</td>
</tr>
<tr>
<td>Flow at Rated Speed l/min [US gal/min]</td>
<td>177.6 [47.4]</td>
<td>198.0 [52.8]</td>
<td></td>
</tr>
<tr>
<td>Theoretical Input Torque at Maximum Displacement Nm/bar [lb-ft/1000 psi]</td>
<td>1.178 [720]</td>
<td>1.432 [874]</td>
<td></td>
</tr>
<tr>
<td>Mass Moment of Inertia of the Internal Rotating Parts kg·m² [lb-ft²]</td>
<td>0.0063 [0.1500]</td>
<td>0.0063 [0.1500]</td>
<td></td>
</tr>
<tr>
<td>Weight Axial Ported Units kg [lb]</td>
<td>29 [63]</td>
<td>29 [63]</td>
<td></td>
</tr>
<tr>
<td>Weight Radial Ported Units kg [lb]</td>
<td>36 [80]</td>
<td>36 [80]</td>
<td></td>
</tr>
</tbody>
</table>

* Refer to Speed Ratings, page 16.
** With pressurized Inlet.

---

**Cross-section, pump control**

---

**Cross-section, pump**
DEFINITIONS

**Speed Ratings**

**Rated speed** is the maximum speed recommended under full power conditions at which normal life can be expected.

The rated speed is valid for an inlet pressure of 1 bar (14.5 psi) absolute. All other operating conditions (e.g. fluid viscosity and temperature) must be within recommended limits.

**Maximum speed** is the highest operating speed recommended and cannot be exceeded without reduction in the life of the product or risk of premature failure and loss of hydraulic power. Reductions in pump outlet flow and/or a pressurized inlet are required to achieve max speed.

**Pressure Limits**

System pressure is a dominant operating variable affecting hydraulic unit life.

**Maximum (peak) working pressure** is the highest pressure allowed and is controlled by the system relief valve. This pressure is determined by the maximum machine load demand. Exceeding this pressure will reduce pump life.

**Continuous working pressure** is the average regularly occurring operating pressure that should yield satisfactory product life. For all applications, the load should move below this pressure.

In order for Sauer-Danfoss representatives to calculate an appropriate design pressure, it is desirable to have a machine duty cycle with the percentage of time at various flows, pressures, and pump speeds. This method of selecting operating pressure is recommended whenever duty cycle information is available.

### Hydraulic Equations for Pump Selection

<table>
<thead>
<tr>
<th>Unit:</th>
<th>Metric System:</th>
<th>Inch System:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump output flow</td>
<td>( Q = \frac{V_g \cdot n \cdot \eta_v}{1000} ) l/min</td>
<td>( Q = \frac{V_g \cdot n \cdot \eta_v}{231} ) US gal/min</td>
</tr>
<tr>
<td>Input torque</td>
<td>( M = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_m} ) Nm</td>
<td>( M = \frac{V_g \cdot \Delta p}{2 \cdot \pi \cdot \eta_m} ) lb·in</td>
</tr>
<tr>
<td>Input power</td>
<td>( P = \frac{V_g \cdot n \cdot \Delta p}{600 000 \cdot \eta_m} ) kW</td>
<td>( P = \frac{V_g \cdot n \cdot \Delta p}{396 000 \cdot \eta_m} ) hp</td>
</tr>
</tbody>
</table>

**Description:**

- \( V_g \) = Pump displacement per rev. cm³ [in³]
- \( n \) = Pump speed min⁻¹ (rpm)
- \( \Delta p \) = Hydraulic pressure differential bar [psi]
- \( \eta_v \) = Pump volumetric efficiency
- \( \eta_m \) = Pump mechanical efficiency
AUXILIARY MOUNTING PADS

Auxiliary mounting pads are available for all radial ported Series 45 pumps. These pads are typically used for mounting auxiliary hydraulic pumps.

Since the auxiliary pad operates under case pressure, an O-ring must be used to seal the auxiliary pump mounting flange to the pad. The drive coupling is lubricated by oil from the main pump case.

Spline sizes and torque ratings are shown in the accompanying table. Continuous ratings are based on spline tooth wear. Maximum ratings are based on shaft strength; do not exceed them.

- All mounting pads meet SAE J744 Specifications.
- The combination of auxiliary pad shaft torque, plus the main pump torque must not exceed the maximum pump input shaft rating shown in the Shaft Availability and Torque Ratings table on page 17.
- All torque values assume a 58 Rc shaft spline hardness on the mating pump shaft.
- Applications subject to severe vibratory or high-G loading may require an additional structural support to prevent possible mounting flange damage. Refer to Mounting Flange Loads, page 25, for additional information.

<table>
<thead>
<tr>
<th>Mounting Pad Size</th>
<th>Internal Spline Engagement</th>
<th>Minimum Spline Engagement</th>
<th>Torque Ratings Nm (lb•in)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Maximum</td>
</tr>
<tr>
<td>SAE A</td>
<td>9 Tooth 16/32 Pitch</td>
<td>13.5 mm 0.53 in</td>
<td>107*</td>
</tr>
<tr>
<td>SAE A (SPECIAL)</td>
<td>11 Tooth 16/32 Pitch</td>
<td>13.5 mm 0.53 in</td>
<td>147*</td>
</tr>
<tr>
<td>SAE B</td>
<td>13 Tooth 16/32 Pitch</td>
<td>14.2 mm 0.56 in</td>
<td>249*</td>
</tr>
<tr>
<td>SAE B-B</td>
<td>15 Tooth 16/32 Pitch</td>
<td>16.1 mm 0.63 in</td>
<td>280*</td>
</tr>
</tbody>
</table>

* Contact your Sauer-Danfoss representative if auxiliary torque approaches these limits.

<table>
<thead>
<tr>
<th>Mounting Pad Size</th>
<th>Internal Spline Engagement</th>
<th>Minimum Spline Engagement</th>
<th>Torque Ratings Nm (lb•in)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Maximum</td>
</tr>
<tr>
<td>SAE A</td>
<td>9 Tooth 16/32 Pitch</td>
<td>13.5 mm 0.53 in</td>
<td>107</td>
</tr>
<tr>
<td>SAE A (SPECIAL)</td>
<td>11 Tooth 16/32 Pitch</td>
<td>15.0 mm 0.59 in</td>
<td>147</td>
</tr>
<tr>
<td>SAE B</td>
<td>13 Tooth 16/32 Pitch</td>
<td>14.2 mm 0.56 in</td>
<td>249</td>
</tr>
<tr>
<td>SAE B-B</td>
<td>15 Tooth 16/32 Pitch</td>
<td>18.9 mm 0.74 in</td>
<td>339</td>
</tr>
<tr>
<td>SAE C</td>
<td>14 Tooth 12/24 Pitch</td>
<td>18.3 mm 0.72 in</td>
<td>339</td>
</tr>
</tbody>
</table>
AUXILIARY MOUNTING PADS (continued)

Pump mounting flanges and shafts with the dimensions noted in the accompanying drawing are compatible with the auxiliary mounting pads on the Series 45 pumps.

### Mating Auxiliary Pumps

<table>
<thead>
<tr>
<th>Flange</th>
<th>&quot;P&quot;</th>
<th>&quot;B&quot;</th>
<th>&quot;C&quot;</th>
<th>&quot;D&quot;</th>
<th>&quot;E&quot;</th>
<th>&quot;F&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAE A</td>
<td>82.55 [3.250]</td>
<td>6.350 [0.250]</td>
<td>12.70 [0.500]</td>
<td>58.20 [2.290]</td>
<td>15.00 [0.590]</td>
<td>13.50 [0.530]</td>
</tr>
<tr>
<td>SAE B</td>
<td>101.60 [4.000]</td>
<td>9.650 [0.380]</td>
<td>15.20 [0.600]</td>
<td>53.10 [2.090]</td>
<td>17.50 [0.690]</td>
<td>14.20 [0.560]</td>
</tr>
<tr>
<td>SAE C</td>
<td>127.00 [5.000]</td>
<td>12.70 [0.500]</td>
<td>23.37 [0.920]</td>
<td>55.60 [2.190]</td>
<td>30.50 [1.200]</td>
<td>18.30 [0.720]</td>
</tr>
</tbody>
</table>

Dimensions in mm [in]
INPUT SHAFTS

Series 45 pumps are available with a variety of splined, parallel, and tapered end shafts. Nominal shaft sizes and torque ratings are shown in the accompanying table.

Continuous torque ratings for splined shafts are based on spline tooth wear, and assume the mating spline has a minimum full spline depth hardness of 55 Rc and good lubrication. Torque ratings of spline shafts are based on no external radial loads.

<table>
<thead>
<tr>
<th>Shaft Options</th>
<th>Rating Nm [lbf-in]</th>
<th>Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2 D2</td>
<td>Maximum Continuous</td>
<td>K and L: 275 [2435], 100 [885], 282 [2495], 102 [900]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G: Not Available</td>
</tr>
<tr>
<td>S1</td>
<td>Maximum Continuous</td>
<td>K and L: Not Available</td>
</tr>
<tr>
<td>C3 D3</td>
<td>Maximum Continuous</td>
<td>K and L: 400 [3540], 210 [1850], 362 [3200], 192 [1700]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G: Not Available</td>
</tr>
<tr>
<td>S2</td>
<td>Maximum Continuous</td>
<td>K and L: Not Available</td>
</tr>
<tr>
<td>T1</td>
<td>Maximum</td>
<td>K and L: Not Available</td>
</tr>
<tr>
<td>T2</td>
<td>Maximum</td>
<td>K and L: Not Available</td>
</tr>
</tbody>
</table>

Note: Recommended mating splines for Series 45 splined input shafts should be in accordance with ANSI B92.1 class 5. Sauer-Danfoss external splines are modified class 5 filet root side fit. The external spline major diameter and circular tooth thickness dimensions are reduced in order to assure a clearance fit with the mating spline.

DISPLACEMENT LIMITER

Series 45 - H57, H75, G74, and G90 pumps are available with an optional mechanical maximum displacement (stroke) limiter. The maximum displacement of the pump can be limited to any value from maximum to 75% displacement.

Series 45 - K38, K45, L25, L30 pumps only have fixed displacement limiters. Consult the model code or price list for option availability.
**PRESSURE COMPENSATOR (PC) CONTROL**

The pressure compensator control is designed to limit the maximum pressure in the hydraulic circuit by varying the output flow of the pump. This type of control is typically used with closed center valves.

When system pressure at the pump outlet drops below the compensator setting, the control will increase the pump displacement to maximum (maximum output flow). Once system pressure reaches the compensator setting, the control regulates pump displacement to produce an output flow which limits system pressure to the compensator setting. Control response (off-stroke) and recovery (on-stroke) times are shown in the table below.

<table>
<thead>
<tr>
<th>PC Control Response/Recovery Time</th>
<th>25</th>
<th>30</th>
<th>38</th>
<th>45</th>
<th>57</th>
<th>74</th>
<th>75</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>35</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>Recovery</td>
<td>90</td>
<td>100</td>
<td>105</td>
<td>110</td>
<td>125</td>
<td>130</td>
<td>130</td>
<td>140</td>
</tr>
</tbody>
</table>

The pressure compensator setting is externally adjustable. The setting range for the pressure compensator is shown in the table below.

<table>
<thead>
<tr>
<th>PC Control Setting Range</th>
<th>25</th>
<th>30</th>
<th>38</th>
<th>45</th>
<th>57</th>
<th>74</th>
<th>75</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Maximum</td>
<td>260</td>
<td>210</td>
<td>260</td>
<td>210</td>
<td>310</td>
<td>310</td>
<td>210</td>
<td>260</td>
</tr>
</tbody>
</table>

**REMOTE PC CONTROL**

A remote pressure compensator control can be added to the system by connecting an appropriate external pressure control valve to the load sense port (port X). This will allow the pressure compensator setting to be controlled mechanically or electrically below the setting of the integral pressure compensator pilot valve. The external valve and its plumbing should be sized for a pilot oil flow of 3.8 l/min [1 US gal/min].

A low standby pressure can be provided by venting the remote compensator port to reservoir through an external 2-way on – off valve (not shown). When this valve is open, the pump standby pressure will be 15 to 20 bar [215 to 300 psi].

For additional system protection, install a relief valve in the pump outlet line.
Ports:
B = Main pressure line
S = Suction line
L1, L2 = Case drain lines
M2 = Gauge port for port B
M4 = Gauge port - servo pressure
1 = Gain orifice

Ports:
B = Main pressure line
S = Suction line
L1, L2 = Case drain lines
M2 = Gauge port for port B
M4 = Gauge port - servo pressure
1 = Gain orifice
2 = Pilot orifice

Ports:
B = Main pressure line
S = Suction line
L1, L2 = Case drain lines
X = Load sensing pressure port
M2 = Gauge port for port B
M4 = Gauge port - servo pressure
1 = Gain orifice
2 = Pilot orifice
3 = Bleed orifice (optional)
LOAD SENSING (LS) CONTROL

The load sensing control is designed to match pump outlet flow with system demand. This control option is typically used with closed center, load sensing directional control valves.

When the control valve is centered, the load sensing port on the pump is drained to the reservoir through the a bleed orifice located either in the control valve or the pump control. This maintains a standby pressure at the pump outlet equal to the load sensing setting.

When the control valve is actuated, the load sensing port (port ‘X’) is connected to load pressure. The control then adjusts the pump output flow to maintain a constant pressure drop – equal to the load sensing setting – across the control valve. The pump thereby provides flow to the load as demanded by the control valve position. Control response (off-stroke) and recovery (on-stroke) times are shown in the table below.

<table>
<thead>
<tr>
<th>Load Sensing Control Response/Recovery Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ms)</td>
</tr>
<tr>
<td>Response</td>
</tr>
<tr>
<td>Recovery</td>
</tr>
</tbody>
</table>

A pressure compensator valve is built into the load sensing control. When the pump outlet pressure reaches the pressure compensator setting, the pump reduces its displacement to limit the system pressure. Operation of the pressure compensator valve is similar to the PC control.

The load sensing setting is externally adjustable. The setting range for the load sensing control is shown in the table below.

<table>
<thead>
<tr>
<th>Load Sensing Control Setting Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>bar [psi]</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
</tbody>
</table>

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Series 45 Axial Piston Open Circuit Pumps
Technical Information
Controls

**LS CONTROL SCHEMATIC DIAGRAMS**

Load Sensing Control Schematic Diagram
Frames L, K, and G

Ports:
- B = Main pressure line
- S = Suction line
- L1, L2 = Case drain lines
- X = Load sensing pressure port
- M2 = Gauge port for port B
- M4 = Gauge port - servo pressure
- 1 = Gain orifice
- 3 = Bleed orifice (optional)

Load Sensing Control Schematic Diagram
Frame H

Ports:
- B = Main pressure line
- S = Suction line
- L1, L2 = Case drain lines
- X = Load sensing pressure port
- M2 = Gauge port for port B
- M4 = Gauge port - servo pressure
- 2 = Pilot orifice
- 3 = Bleed orifice (optional)
BEARING LIFE

Normal bearing $B_{10}$ life in hours is indicated in the table below. These values are calculated using a weighted average pressure, 1800 rpm shaft speed, and no external shaft side load.

<table>
<thead>
<tr>
<th>Bearing Life $B_{10}$ Hours</th>
<th>Displacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>at 140 bar [2030 psi] 49100</td>
<td>24600</td>
</tr>
<tr>
<td>at 210 bar [3045 psi] 14100</td>
<td>7230</td>
</tr>
<tr>
<td>at 260 bar [3770 psi] 6590</td>
<td>-</td>
</tr>
<tr>
<td>at 310 bar [4495 psi] -</td>
<td>-</td>
</tr>
</tbody>
</table>

SHAFT LOADS

Series 45 pumps are designed with bearings that can accept external some radial and thrust loads. The external radial shaft load limits are a function of the load position and orientation, and the operating conditions of the pump.

The maximum allowable radial side load (Re), based on the maximum external moment (Me) and the distance (L) from the mounting flange to the load, may be determined from the table and diagram below. Thrust (axial) load limits are also shown.

Maximum Allowable Radial Side Load, $Re = \frac{Me}{L}$

All external shaft loads will have an effect on bearing life. In applications where external shaft loads can not be avoided, bearing life may be maximized by orientating the load between the 150 and 210 degree positions, as shown.

Tapered input shafts or clamp-type couplings are recommended for applications where radial shaft side loads are present.

![Diagram showing shaft load orientation](image-url)

<table>
<thead>
<tr>
<th>Maximum Allowable External Shaft Loads</th>
<th>Displacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load Type</td>
<td>25</td>
</tr>
<tr>
<td>External Moment (M) – Nm [lbfs-in]</td>
<td>61</td>
</tr>
<tr>
<td>Maximum Shaft Thrust In (T_in) – N [lbf]</td>
<td>1000</td>
</tr>
<tr>
<td>Maximum Shaft Thrust Out (T_out) – N [lbf]</td>
<td>1000</td>
</tr>
</tbody>
</table>
MOUNTING FLANGE LOADS

Adding tandem mounted auxiliary pumps and/or subjecting pumps to high shock loads may result in excessive loading of the mounting flange. The overhung load moment for multiple pump mounting may be estimated as shown in the accompanying figure.

ESTIMATING OVERHUNG LOAD MOMENTS

\[
\begin{align*}
W &= \text{Weight of pump} \\
L &= \text{Distance from mounting flange to pump center of gravity (refer to pump installation drawings)} \\
M_s &= G_s (W_1L_1 + W_2L_2 + \ldots + W_nL_n) \\
M_c &= G_c (W_1L_1 + W_2L_2 + \ldots + W_nL_n) \\
\end{align*}
\]

Where:
- \( M_s \) = Shock load moment
- \( M_c \) = Continuous load moment
- \( G_s \) = Maximum shock acceleration (gs)
- \( G_c \) = Continuous (vibratory) acceleration (gs)

Allowable overhung load moment values are shown in the accompanying table. Exceeding these values will require additional pump support.

<table>
<thead>
<tr>
<th>Frame</th>
<th>Flange</th>
<th>Continuous Moment (M_s) [Nm]</th>
<th>Shock Load Moment (M_s) [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>K and L</td>
<td>All</td>
<td>1005 [8900]</td>
<td>3550 [31400]</td>
</tr>
<tr>
<td>H</td>
<td>All</td>
<td>880 [10000]</td>
<td>3090 [35000]</td>
</tr>
<tr>
<td></td>
<td>Modified B flange</td>
<td>740 [6500]</td>
<td>2600 [23000]</td>
</tr>
<tr>
<td></td>
<td>Standard B flange</td>
<td>740 [6500]</td>
<td>2600 [23000]</td>
</tr>
<tr>
<td>G</td>
<td>All</td>
<td>1580 [14000]</td>
<td>5650 [50000]</td>
</tr>
</tbody>
</table>
Sound Levels

The accompanying table includes sound levels measured in dB(A) at 1.52 meter [5 ft.] from the pump in a semi-anechoic chamber. Anechoic levels can be estimated by subtracting 3 dB(A) from these values.

<table>
<thead>
<tr>
<th>Sound Levels dB (A)</th>
<th>210 bar [3045 psi]</th>
<th>260 bar [3770 psi]</th>
<th>310 bar [4495 psi]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1800 rpm</td>
<td>Rated</td>
<td>1800 rpm</td>
</tr>
<tr>
<td>25</td>
<td>68</td>
<td>72</td>
<td>69</td>
</tr>
<tr>
<td>30</td>
<td>69</td>
<td>73</td>
<td>-</td>
</tr>
<tr>
<td>38</td>
<td>69</td>
<td>73</td>
<td>70</td>
</tr>
<tr>
<td>45</td>
<td>70</td>
<td>74</td>
<td>-</td>
</tr>
<tr>
<td>57</td>
<td>72</td>
<td>75</td>
<td>73</td>
</tr>
<tr>
<td>74</td>
<td>78</td>
<td>81</td>
<td>77</td>
</tr>
<tr>
<td>75</td>
<td>74</td>
<td>77</td>
<td>-</td>
</tr>
<tr>
<td>90</td>
<td>77</td>
<td>79</td>
<td>78</td>
</tr>
</tbody>
</table>

Noise is unwanted sound. Fluid power systems create noise. There are many techniques available to minimize noise. Understanding how it’s generated and transmitted is necessary to apply these methods effectively.

Noise energy is transmitted as fluid borne noise (pressure ripple) or structure borne noise. Pressure ripple is the result of the number of pumping elements (pistons) delivering oil to the outlet and the pump’s ability to gradually change the volume of each pumping element from low to high pressure. Pressure ripple is affected by the compressibility of the oil as each pumping element discharges into the outlet of the pump. Pressure pulsations travel along hydraulic lines at the speed of sound (about 1400 m/s in oil) until there is a change in the system (such as an elbow fitting). Thus, the pressure pulsation amplitude varies with overall line length and position.

Structure borne noise may be transmitted wherever the pump casing is connected to the rest of the system.

The way circuit components respond to excitation depends on their size, form, and mounting. Because of this, a system line may actually have a greater noise level than the pump. To minimize noise, use:

- flexible hoses (if you must use steel plumbing, clamp the lines)
- flexible (rubber) mounts
Series 45 Axial Piston Open Circuit Pumps
Technical Information
Performance Graphs - 25cc

Output Flow vs Speed (Theoretical)

Input Power vs Pressure (Theoretical)

Overall Efficiency

Volumetric Efficiency

Maximum Speed versus Displacement

Inlet Pressure versus Speed
Series 45 Axial Piston Open Circuit Pumps
Technical Information
Performance Graphs - 30cc

Output Flow vs Speed (Theoretical)

Input Power vs Pressure (Theoretical)

Overall Efficiency

Volumetric Efficiency

Maximum Speed versus Displacement

Inlet Pressure versus Speed

Recommended Operating Range
(Non-pressureized inlet)

Additional Operating Range
at 80% Displacement

Recommended Operating Range
at 100% Displacement
Output Flow vs Speed (Theoretical)

Input Power vs Pressure (Theoretical)

Overall Efficiency

Volumetric Efficiency

Maximum Speed versus Displacement

Inlet Pressure versus Speed
Series 45 Axial Piston Open Circuit Pumps
Technical Information
Performance Graphs - 57cc

Output Flow vs Speed (Theoretical)

Input Power vs Pressure (Theoretical)

Overall Efficiency

Volumetric Efficiency

Maximum Speed versus Displacement

Inlet Pressure versus Speed

Recommended Operating Range (Non-pressurized inlet)

Recommended Operating Range at 100% Displacement

Additional Operating Range at 80% Displacement
Series 45 Axial Piston Open Circuit Pumps
Technical Information
Performance Graphs - 74cc

Output Flow vs Speed (Theoretical)

Input Power vs Pressure (Theoretical)

Overall Efficiency

Volumetric Efficiency

Maximum Speed versus Displacement

Inlet Pressure versus Speed
Series 45 Axial Piston Open Circuit Pumps
Technical Information
Performance Graphs - 75cc

Output Flow vs Speed (Theoretical)

Input Power vs Pressure (Theoretical)

Overall Efficiency

Volumetric Efficiency

Maximum Speed versus Displacement

Inlet Pressure versus Speed
Series 45 Axial Piston Open Circuit Pumps

Technical Information

Performance Graphs - 90cc

Output Flow vs Speed (Theoretical)

Input Power vs Pressure (Theoretical)

Overall Efficiency

Volumetric Efficiency

Maximum Speed versus Displacement

Inlet Pressure versus Speed

Recommended Operating Range
(Non-pressureized inlet)

Additional Operating Range
at 80% Displacement
All SAE straight thread O-ring ports per SAE J514.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.

Dimensions in mm [in]
All SAE straight thread O-ring ports per SAE J514.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.

Dimensions in mm [in]
DIMENSIONS
FRAMES K AND L
25, 30, 38, AND 45CC
(continued)

SAE B Flange with Radial Porting

SYSTEM PRESSURE GAGE PORT 'M2'
SAE J1926/1

SYSTEM PRESSURE GAGE PORT 'M2'
SAE J1926/1

CASE DRAIN PORT 'L2'
SPOTFACE DEPTH

CASE DRAIN PORT 'L1'
SPOTFACE DEPTH

SYSTEM PORT 'S'
SPOTFACE DEPTH

SYSTEM PORT 'B'
SPOTFACE DEPTH

VIEW IN DIRECTION Y

VIEW IN DIRECTION Z
REAR VIEW

LEFT SIDE VIEW
RH (CW) ROTATION SHOWN

* Dimension to center of port is equal for LH (CCW) or RH (CW) rotation.

All SAE straight thread O-ring ports per SAE J514.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.

Dimensions in mm [in]
All SAE straight thread O-ring ports per SAE J514.

Shaft rotation is determined by viewing pump from input shaft end.

Contact your Sauer-Danfoss representative for specific installation drawings.

Dimensions in mm [in]

* Dimension to center of port is equal for LH (CCW) or RH (CW) rotation.

All SAE straight thread O-ring ports per SAE JS14.

Shaft rotation is determined by viewing pump from input shaft end.

Contact your Sauer-Danfoss representative for specific installation drawings.
All SAE straight thread O-ring ports per SAE J514.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.
Dimensions in mm [in]
All SAE straight thread O-ring ports per SAE J514.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.

Dimensions in mm [in]
All SAE straight thread O-ring ports per SAE J514.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.

Dimensions in mm [in]

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All SAE straight thread O-ring ports per SAE J514.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.

Dimensions in mm [in]
Series 45 Axial Piston Open Circuit Pumps
Technical Information
Installation Drawings

DIMENSIONS
FRAME H
57 AND 75cc
(continued)

SAE C Flange with Radial Porting

All SAE straight thread O-ring ports per SAE JS14.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.

Dimensions in mm [in]
All SAE straight thread O-ring ports per SAE J514.

Shaft rotation is determined by viewing pump from input shaft end.

Contact your Sauer-Danfoss representative for specific installation drawings.
All SAE straight thread O-ring ports per SAE J514.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.
All SAE straight thread O-ring ports per SAE J514.

Shaft rotation is determined by viewing pump from input shaft end.

Contact your Sauer-Danfoss representative for specific installation drawings.

Dimensions in mm [in]
All SAE straight thread O-ring ports per SAE JS14.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.
SAE B Flange with Radial Porting (continued)

-left side view for LH (CCW) rotation-

-left side view for RH (CW) rotation-

All SAE straight thread O-ring ports per SAE J514.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.

Dimensions in mm [in]
**Series 45 Axial Piston Open Circuit Pumps**

**Technical Information**

**Installation Drawings**

**DIMENSIONS**

**FRAME H**

57 AND 75cc (continued)

<table>
<thead>
<tr>
<th>COUPLING - SAE A-9T</th>
<th>COUPLING - SAE A-11T</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>21.1 [0.83]</td>
</tr>
<tr>
<td>SAE C</td>
<td>268.8 [10.58]</td>
</tr>
<tr>
<td></td>
<td>16.1 [0.63]</td>
</tr>
<tr>
<td>SAE B</td>
<td>298.8 [11.76]</td>
</tr>
</tbody>
</table>

**Auxiliary Mounting Flanges**

**SAE A AUXILIARY MOUNTING FLANGE WITH SAE A-9T AND SAE A-11T COUPLINGS**

<table>
<thead>
<tr>
<th>COUPLING - SAE B-13T</th>
<th>COUPLING - SAE B-B-15T</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>20.7 [0.81]</td>
</tr>
<tr>
<td>SAE C</td>
<td>264.4 [10.41]</td>
</tr>
<tr>
<td></td>
<td>12.7 [0.50]</td>
</tr>
<tr>
<td>SAE B</td>
<td>294.4 [11.59]</td>
</tr>
</tbody>
</table>

**SAE B AUXILIARY MOUNTING FLANGE WITH SAE B-13T AND SAE B-B-15T COUPLINGS**

All SAE straight thread O-ring ports per SAE J514.

Shaft rotation is determined by viewing pump from input shaft end.

Contact your Sauer-Danfoss representative for specific installation drawings.

Dimensions in mm [in]

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Technical Information

All SAE straight thread O-ring ports per SAE J514.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.

Dimensions in mm [in]

<table>
<thead>
<tr>
<th>SAE C</th>
<th>SAE B</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>264.4 [10.41]</td>
</tr>
</tbody>
</table>

SAE C AUXILIARY MOUNTING FLANGE WITH SAE C-14T COUPLING

Dimensions in mm [in]

Frame H
57 AND 75cc
(continued)

Installation Drawings
All SAE straight thread O-ring ports per SAE J514.
Shard rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.
Dimensions in mm [in]

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All SAE straight thread O-ring ports per SAE J514.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.
Dimensions in mm [in]
All SAE straight thread O-ring ports per SAE JS14.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.

Dimensions in mm [in]
All SAE straight thread O-ring ports per SAE J514.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.

Dimensions in mm [in]
All SAE straight thread O-ring ports per SAE J514.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.
All SAE straight thread O-ring ports per SAE JS14.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.
### Dimensions

**FRAME G**

**74 AND 90cc**

(continued)

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### Auxiliary Mounting Flanges

<table>
<thead>
<tr>
<th>COUPLING - SAE A-9T</th>
<th>COUPLING - SAE A-11T</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 21.1 [0.83]</td>
<td>16.1 [0.63]</td>
</tr>
</tbody>
</table>

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**SAE A AUXILIARY MOUNTING FLANGE WITH SAE A-9T AND SAE A-11T COUPLINGS**

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**SAE B AUXILIARY MOUNTING FLANGE WITH SAE B-13T AND SAE B-B-15T COUPLINGS**

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All SAE straight thread O-ring ports per SAE J514.

Shaft rotation is determined by viewing pump from input shaft end.

Contact your Sauer-Danfoss representative for specific installation drawings.

Dimensions in mm [in]

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BLN-10128 • Revision B • June 2001
All SAE straight thread O-ring ports per SAE J514.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.
Dimensions in mm [in]
All SAE straight thread O-ring ports per SAE J514.
Shaft rotation is determined by viewing pump from input shaft end.
Contact your Sauer-Danfoss representative for specific installation drawings.

Dimensions in mm [in]
Sauer-Danfoss Hydraulic Power Systems
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