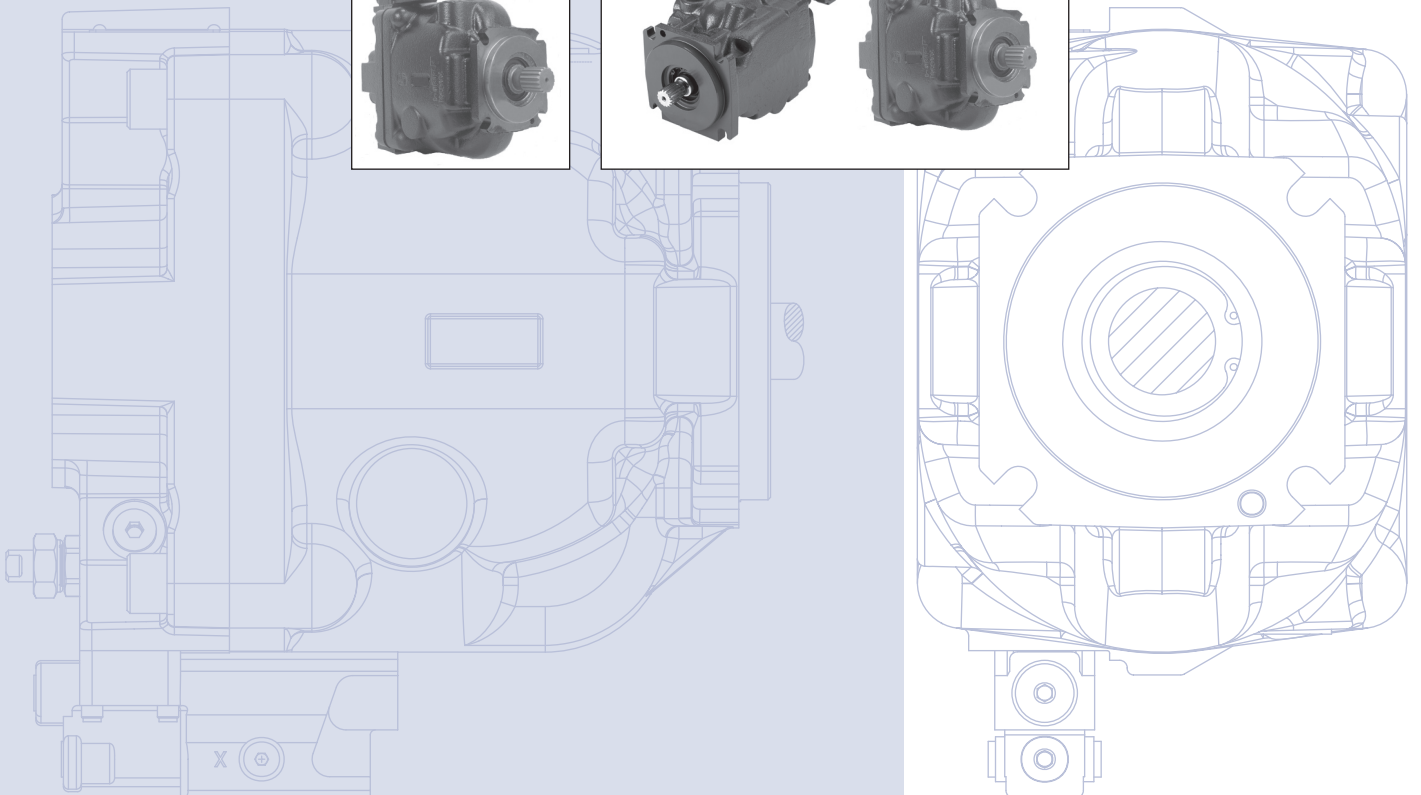
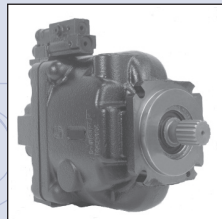
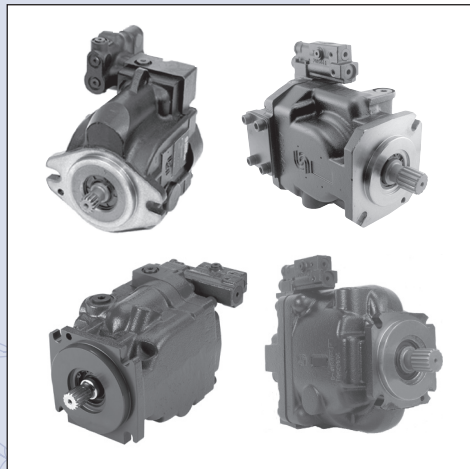
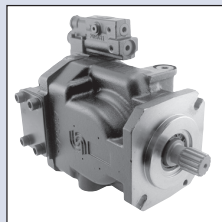
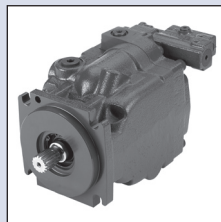
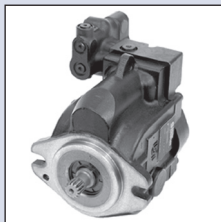




Series 45  
Axial Piston  
Open Circuit Pumps

Technical  
Information



**HISTORY OF REVISIONS**

*Table of Revisions*

Date	Page	Changed	Rev.
March 2009	various	add fitting depth warning to LS port X	FL
October 2008	62, 65	add SAE-C two bolt housing	FK
September 2008	58-62	dimension changes for Frame J	FJ
June 2008	78, 93, 94, 95	various minor edits, removed S5 shaft from Frame E	FI
May 2008	32, 74, 75, 92	correction to schematics drawings	FH
April 2008	76	correction to S2 spline width (inch measurement only)	FG
April 2008	52, 53	correction to schematics drawings	FG
April 2008	27, 50, 72, 89	add Load sensing - RP and BP must be 20 bar	FF
April 2008	76	Correction to S2 shaft - Class 6 and 37.91 mm length	FF
March 2008	4	Correction to TOC	FE
February 2008	Various	Add LS setting to specifications for each frame	FD
December 2007	Various	Relocate F and E sections, add displacement limiter info.	FC
November 2007	50	Change load sensing setting - bar increments	FB
September 2007	Various	Add Frame F, remove Frame G, and many edits	FA
November 2006	51, 52, 53	Revised schematics information	E
August 2005	-	Removed Frame H, added Frame J	D
April 2003		Added Frame E	C
May 2001	-	Added Frame H and Frame G	B
May 1999	-	First printing	A

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**GENERAL INFORMATION**

Overview .....6  
 Design .....6  
 Typical applications .....6  
   High performance .....6  
   Latest technology .....6  
   Reliability .....6  
 The Series 45 product family .....7  
   Basic units .....7  
 Load sensing open circuit system .....8  
 Pressure compensated controls .....9  
   Operation .....9  
   Pressure compensated system characteristics .....9  
   Typical applications for pressure compensated systems .....9  
 Remote pressure compensated controls .....10  
   Remote pressure compensated system characteristics .....10  
   Typical applications for remote pressure compensated systems .....10  
 Load sensing controls .....11  
   Operation .....11  
   Load sensing system characteristics .....11  
   Typical applications for load sensing systems .....11  
 Electrical on/off pressure compensated controls .....12  
 Operating parameters .....13  
   Fluids .....13  
   Viscosity .....13  
   Temperature .....13  
   Inlet pressure .....13  
   Case pressure .....13  
   Pressure ratings .....14  
   Speed ratings .....14  
   Duty cycle and pump life .....14  
   Speed, flow, and inlet pressure .....14  
 Design parameters .....15  
   Installation .....15  
   Filtration .....15  
   Reservoir .....15  
   Fluid velocity .....16  
   Shaft loads .....16  
   Bearing life .....16  
   Mounting flange loads .....17  
   Auxiliary mounting pads .....18  
   Input shaft torque ratings .....18  
   Understanding and minimizing system noise .....19  
 Sizing equations .....20

**FRAMES L AND K**

Design .....21  
 Specifications .....22  
 Performance L25C .....23  
 Performance L30D .....24  
 Performance K38C .....25  
 Performance K45D .....26  
 Order code .....27

**FRAMES L AND K  
 (continued)**

Controls.....	29
Pressure compensated control (PC) .....	29
Remote PC control (RP).....	29
Load sensing control (LS).....	30
Load sensing control with internal bleed orifice (LB) .....	30
Normally closed on/off electric PC control (ED) .....	31
Normally open on/off electric PC control (AA) .....	31
Electric proportional control (EJ) (Normally closed) .....	32
Input shafts.....	33
Auxiliary mounting pads .....	35
SAE-A auxiliary mounting pad.....	35
SAE-B auxiliary mounting pad .....	35
SAE-A Auxilliary Pad.....	36
Mounting pads at 90 degrees .....	36
Running cover.....	36
Special SAE-A 11 tooth .....	36
Displacement limiter.....	37
Installation drawings.....	38
Axial ported endcap .....	38
Radial ported endcap.....	40
Electric on/off control.....	42

**FRAME J**

Design .....	43
Specifications.....	44
Performance J45B .....	45
Performance J51B .....	46
Performance J60B .....	47
Performance J65C .....	48
Performance J75C .....	49
Order code.....	50
Controls.....	52
Pressure compensated control (PC, BC).....	52
Remote PC control (RP, BP) .....	52
Load sensing control (LS, BS) .....	53
Load sensing control with internal bleed orifice (LB, BB) .....	53
Normally closed on/off electric PC control (AG) .....	54
Normally open on/off electric PC control (AF) .....	54
Input shafts.....	55
Auxiliary mounting pads .....	58
SAE-A auxiliary mounting pad (non-integral) .....	58
SAE-B auxiliary mounting pad .....	58
Displacement limiter.....	59
SAE-C auxiliary mounting pad .....	60
Running cover.....	60
Installation drawings.....	61
Axial ported endcap .....	61
Radial ported endcap.....	64
Electric on/off control/Radial endcap .....	66

**FRAME F**

Design .....	68
Specifications.....	69
Performance F74B.....	70
Performance F90C.....	71
Order code.....	72
Controls.....	74
Pressure compensated control (PC).....	74
Remote PC Control (RP).....	74
Load sensing control with internal bleed orifice (LB) .....	75
Load sensing control (LS).....	75
Input shafts.....	76
Auxiliary mounting pads .....	77
SAE-A auxiliary mounting pad .....	77
SAE-B auxiliary mounting pad .....	77
Displacement limiter.....	78
SAE-C auxiliary mounting pad .....	78
Adjustable displacement limiter and running cover.....	79
Axial ported endcap.....	80
Radial ported endcap .....	82

**FRAME E**

Design .....	84
Specifications.....	85
Performance E100B .....	86
Performance E130B .....	87
Performance E147C .....	88
Order code.....	89
Controls.....	91
Pressure compensated control (PC).....	91
Remote PC control (RP).....	91
Load sensing control (LS).....	92
Load sensing control with internal bleed orifice (LB) .....	92
Input shafts.....	93
Auxiliary mounting pads .....	95
SAE-A auxiliary mounting pad .....	95
SAE-B auxiliary mounting pad .....	95
SAE-C auxiliary mounting pad .....	96
Running cover.....	96
Displacement limiters.....	97
Installation drawings.....	98
Axial ported endcap, clockwise rotation .....	98
Axial ported endcap, counterclockwise rotation .....	100
Radial ported endcap, clockwise rotation.....	102
Radial ported endcap, counterclockwise rotation .....	104

#### OVERVIEW

Series 45 is a complete family of variable displacement, axial piston pumps for open circuit applications. Each frame within the Series 45 family is uniquely designed to optimize performance, size, and cost, matching the work function requirements of the demanding mobile equipment marketplace.

#### DESIGN

##### High performance

- Displacements from 25 cm<sup>3</sup> - 147 cm<sup>3</sup> [1.53 - 8.97 in<sup>3</sup>/rev]
- Speeds up to 3600 rpm
- Pressures up to 310 bar [4495 psi] continuous, and 400 bar [5800 psi] peak
- Variety of control system options including load sensing and pressure compensated
- Through-drive capability for multi-circuit systems
- Range of mounting flanges, shafts, and porting options for ease of installation

##### Latest technology

- Customer-driven using quality function deployment (QFD) and design for manufacturability (DFM) techniques
- Optimized valve plates for maximum efficiency and quiet operation
- Computer-modeled castings to optimize inlet conditions for maximum pump speed
- Compact package size minimizing installation space requirements
- Heavy-duty tapered roller bearings for long life
- Single piece rigid housing to reduce noise and leak paths
- Integrated controls for high speed response and system stability

##### Reliability

- Designed to rigorous standards
- Proven in both laboratory and field
- Manufactured to rigid quality standards
- Long service life
- Significantly fewer parts
- No gasketed joints
- Robust input shaft bearings to handle large external shaft loads
- Integrated gauge ports for monitoring operating conditions

#### TYPICAL APPLICATIONS

- Cranes
- Telescopic handlers
- Forklift trucks
- Wheel loaders
- Sweepers
- Backhoe loaders
- Forestry and agricultural machinery
- Fan drives
- Other uses

#### THE SERIES 45 PRODUCT FAMILY

#### Basic units

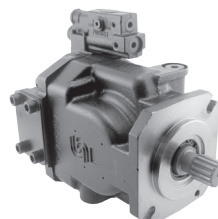
The series 45 family of open circuit, variable piston pumps, offers a range of displacements from 25 to 147 cm<sup>3</sup>/rev [1.53 to 8.97 in<sup>3</sup>/rev]. With maximum speeds up to 3600 rpm and continuous operating pressures up to 310 bar [4495 psi], you can tailor product selection to the flow and pressure requirements of your individual application.



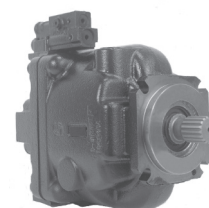
K/L Frame



J Frame



F Frame



E Frame

#### General performance specifications for the series 45 pump family

Pump	Displacement		Speed			Pressure				Theoretical flow (at rated speed)		Mounting
			Continuous	Max.	Min.	Continuous	Maximum	bar	psi			
Model	cm <sup>3</sup>	in <sup>3</sup>	min <sup>-1</sup> (rpm)	min <sup>-1</sup> (rpm)	min <sup>-1</sup> (rpm)	bar	psi	bar	psi	US gal/min	l/min	Flange
<b>Frame L</b>												<i>See page 21</i>
L25C	25	1.53	3200	3600	500	260	3770	350	5075	21.0	80.0	SAE B - 2 bolt
L30D	30	1.83	3200	3600	500	210	3045	300	4350	25.4	96.0	SAE B - 2 bolt
<b>Frame K</b>												<i>See page 21</i>
K38C	38	2.32	2650	2800	500	260	3770	350	5075	26.6	100.7	SAE B - 2 bolt
K45D	45	2.75	2650	2800	500	210	3045	300	4350	31.5	119.3	SAE B - 2 bolt
<b>Frame J</b>												<i>See page 43</i>
J45B	45	2.75	2800	3360	500	310	4495	400	5800	33.3	126.0	SAE B 2-bolt SAE C 2 and 4-bolt
J51B	51	3.11	2700	3240	500	310	4495	400	5800	36.4	137.7	SAE B 2-bolt SAE C 2 and 4-bolt
J60B	60	3.66	2600	3120	500	310	4495	400	5800	41.2	156.0	SAE B 2-bolt SAE C 2 and 4-bolt
J65C	65	3.97	2500	3000	500	260	3770	350	5075	42.9	162.6	SAE B 2-bolt SAE C 2 and 4-bolt
J75C	75	4.58	2400	2880	500	260	3770	350	5075	47.5	180.0	SAE B 2-bolt SAE C 2 and 4-bolt
<b>Frame F</b>												<i>See page 68</i>
F74B	74	4.52	2400	2800	500	310	4495	400	5800	46.9	177.6	SAE B 2-bolt SAE C 4-bolt
F90C	90	5.49	2200	2600	500	260	3770	350	5075	52.3	198	SAE B 2-bolt SAE C 4-bolt
<b>Frame E</b>												<i>See page 84</i>
E100B	100	6.10	2450	2880	500	310	4495	400	5800	64.7	245.0	SAE C 4-bolt
E130B	130	7.93	2200	2600	500	310	4495	400	5800	75.5	286.0	SAE C 4-bolt
E147C	147	8.97	2100	2475	500	260	3770	350	5075	81.5	308.7	SAE C 4-bolt

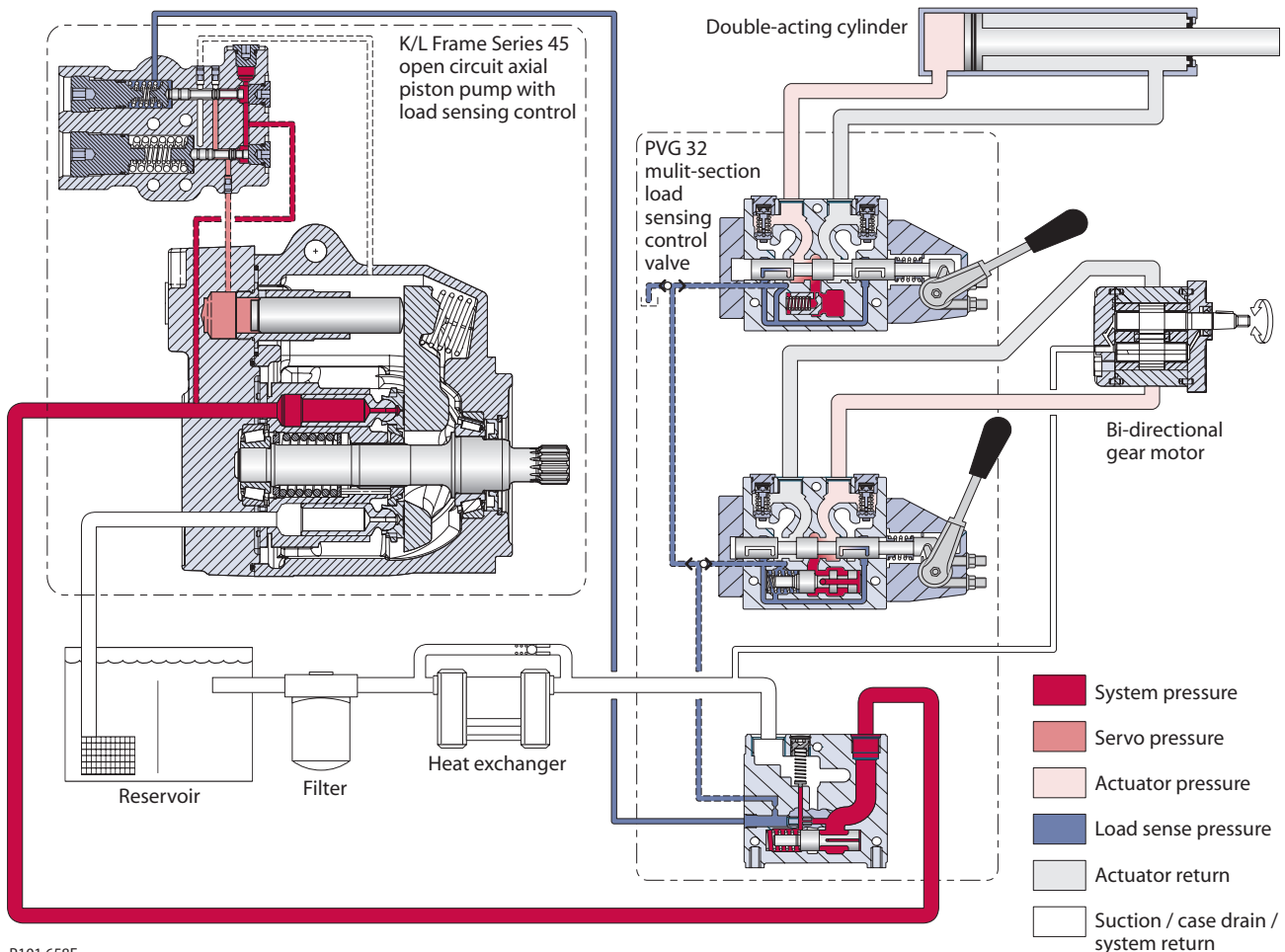
**LOAD SENSING OPEN  
 CIRCUIT SYSTEM**

The pump receives fluid directly from the reservoir through the inlet line. A screen in the inlet line protects the pump from large contaminants. The pump outlet feeds a PVG-32 multi-section, load sensing, directional control valve. The PVG valve directs pump flow to the cylinder and gear motor. A heat exchanger cools the fluid returning from the valve. A filter cleans the fluid before it returns to the reservoir.

Flow in the circuit determines the speed of the actuators. The position of the PVG valve determines the flow demand. A hydraulic pressure signal (LS signal) communicates demand to the pump control. The pump control monitors the pressure differential between pump outlet and the LS signal, and regulates servo pressure to control the swashplate angle. Swashplate angle determines pump flow.

Actuator load determines system pressure. The pump control monitors system pressure and will decrease the swashplate angle to reduce flow if system pressure reaches the PC setting. A system relief valve in the PVG valve acts as a back-up to control system pressure.

*Pictorial circuit diagram*



P101 658E

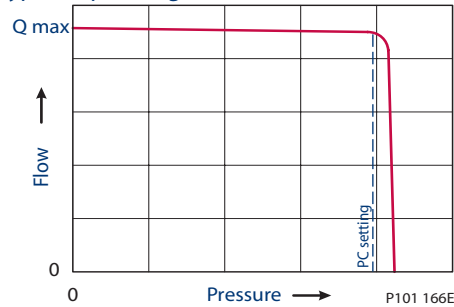


**PRESSURE  
 COMPENSATED  
 CONTROLS**

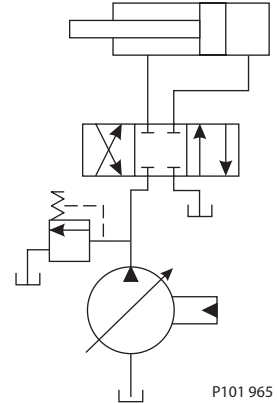
**Operation**

The PC control maintains constant system pressure in the hydraulic circuit by varying the output flow of the pump. Used with a closed center control valve, the pump remains in high pressure standby mode at the PC setting with zero flow until the function is actuated. This condition is often called a **dead head** condition.

*Typical operating curve*



*Simple closed-center circuit*



Once the closed center valve is opened, the PC control senses the immediate drop in system pressure and increases pump flow by increasing the swashplate angle. The pump continues to increase flow until system pressure reaches the PC setting. If system pressure exceeds the PC setting, the PC control reduces the swashplate angle to maintain system pressure by reducing flow. The PC control continues to monitor system pressure and changes swashplate angle to match the output flow with the work function pressure requirements.

If the demand for flow exceeds the capacity of the pump, the PC control directs the pump to maximum displacement. In this condition, actual system pressure depends on the actuator load.

---

For additional system protection, install a relief valve in the pump outlet line.

---

Each section includes control schematic diagrams, setting ranges, and response / recovery times for each control available. **Response** is the time (in milliseconds) for the pump to reach zero displacement when commanded by the control. **Recovery** is the time (in milliseconds) for the pump to reach full displacement when commanded by the control. Actual times can vary depending on application conditions.

**Pressure compensated system characteristics**

- Constant pressure and variable flow
- High pressure standby mode when flow is not needed
- System flow adjusts to meet system requirements
- Single pump can provide flow to multiple work functions
- Quick response to system flow and pressure requirements

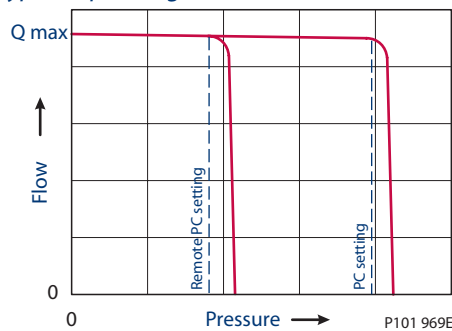
**Typical applications for pressure compensated systems**

- Constant force cylinders (bailers, compactors, refuse trucks)
- On/off fan drives

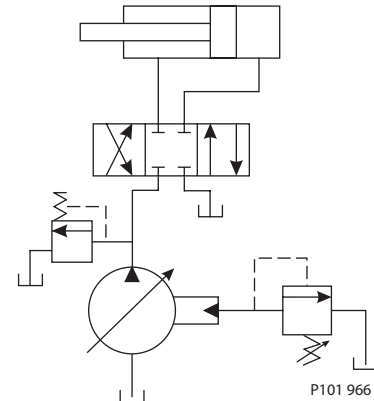
**REMOTE PRESSURE  
 COMPENSATED  
 CONTROLS**

The remote PC control is a two-stage control that allows multiple PC settings. Remote PC controls are commonly used in applications requiring low and high pressure PC operation.

*Typical operating curve*



*Closed center circuit with remote PC*



The remote PC control uses a pilot line connected to an external hydraulic valve. The external valve changes pressure in the pilot line, causing the PC control to operate at a lower pressure. When the pilot line is vented to reservoir, the pump maintains a low standby pressure of 15 to 20 bar [215 to 300 psi]. When pilot flow is blocked, the pump maintains pressure at the PC setting. An on-off solenoid valve can be used in the pilot line to create a low-pressure standby mode. A proportional solenoid valve, coupled with a microprocessor control, can produce an infinite range of operating pressures.

Each section includes control schematic diagrams, setting ranges, and response / recovery times for each control available. **Response** is the time (in milliseconds) for the pump to reach zero displacement when commanded by the control. **Recovery** is the time (in milliseconds) for the pump to reach full displacement when commanded by the control. Actual times can vary depending on application conditions.

---

Size the external valve and plumbing for a pilot flow of 3.8 l/min [1 US gal/min]. For additional system protection, install a relief valve in the pump outlet line.

---

**Remote pressure compensated system characteristics**

- Constant pressure and variable flow
- High or low pressure standby mode when flow is not needed
- System flow adjusts to meet system requirements
- Single pump can provide flow to multiple work functions
- Quick response to system flow and pressure requirements

**Typical applications for remote pressure compensated systems**

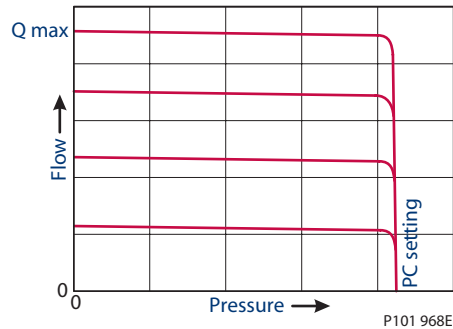
- Modulating fan drives
- Anti-stall control with engine speed feedback
- Front wheel assist

**LOAD SENSING  
 CONTROLS**

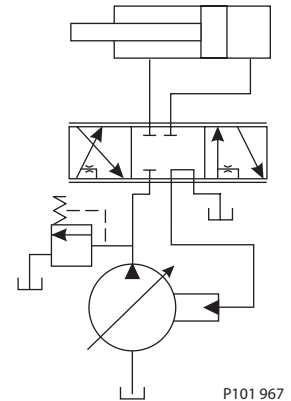
**Operation**

The LS control matches system requirements for both pressure and flow in the circuit regardless of the working pressure. Used with a closed center control valve, the pump remains in low-pressure standby mode with zero flow until the valve is opened. The LS setting determines standby pressure.

*Typical operating curve*



*Load sensing circuit*



Most load sensing systems use parallel, closed center, control valves with special porting that allows the highest work function pressure (LS signal) to feed back to the LS control. **Margin pressure** is the difference between system pressure and the LS signal pressure. The LS control monitors margin pressure to read system demand. A drop in margin pressure means the system needs more flow. A rise in margin pressure tells the LS control to decrease flow.

*LS control with bleed orifice*

The load sense signal line requires a bleed orifice to prevent high-pressure lockup of the pump control. Most load-sensing control valves include this orifice. An optional internal bleed orifice is available, if needed.

*Integral PC function*

The LS control also performs as a PC control, decreasing pump flow when system pressure reaches the PC setting. The pressure compensating function has priority over the load sensing function.

---

For additional system protection, install a relief valve in the pump outlet line.

---

Each section includes control schematic diagrams, setting ranges, and response / recovery times for each control available. **Response** is the time (in milliseconds) for the pump to reach zero displacement when commanded by the control. **Recovery** is the time (in milliseconds) for the pump to reach full displacement when commanded by the control. Actual times can vary depending on application conditions.

**Load sensing system characteristics**

- Variable pressure and flow
- Low pressure standby mode when flow is not needed
- System flow adjusted to meet system requirements
- Single pump can supply flow and regulate pressure for multiple circuits
- Quick response to system flow and pressure requirements

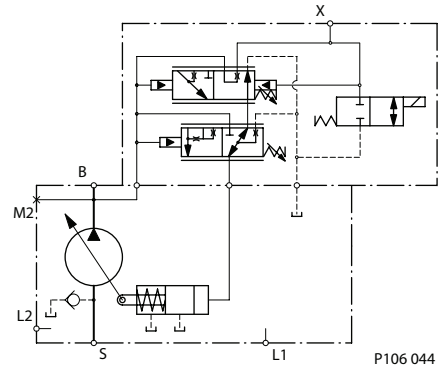
**Typical applications for load sensing systems**

- Priority steering
- Load independent flow control for boom lift, tilt, and rotation

**ELECTRICAL ON/  
 OFF PRESSURE  
 COMPENSATED  
 CONTROLS**

The electrical on/off pressure compensated control allows the pump to operate as a PC type control under normal operating conditions. A solenoid valve overrides the PC control allowing the pump to operate in a low-pressure standby mode. This function provides reduced horsepower and torque loss in certain situations. It may be particularly useful to reduce loads on a system during engine start.

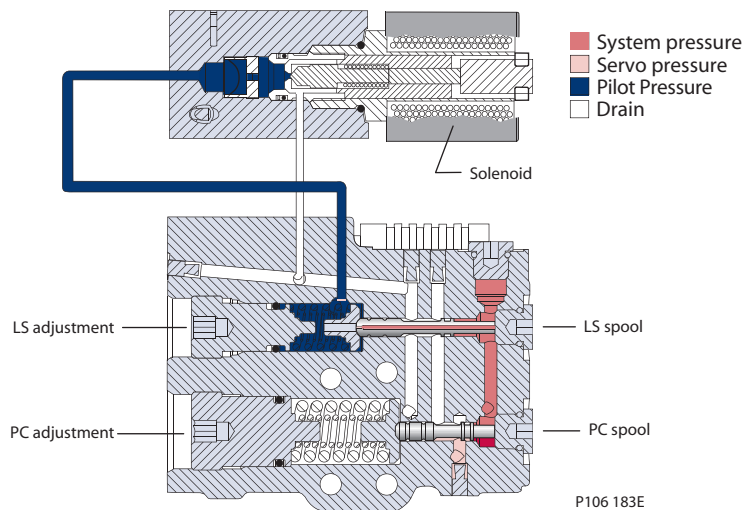
*ED schematic (normally closed)*



When closed, the solenoid valve prevents flow across the LS spool gain orifice, defeating the LS spool. The pump then functions as a PC control pump. When open, the solenoid valve allows flow across the LS spool gain orifice to reservoir. This flow generates a pressure differential across the LS spool that shifts the spool and de-strokes the pump. The pump then operates in a low-pressure standby condition. The solenoid valve is available in a normally closed or normally open configuration.

ED is the nomenclature for a normally closed on/off control for the L and K frame pumps. Other frame sizes and configurations have different order code designations.

*(ED) Electric control cross-section*



**OPERATING  
 PARAMETERS**

**Fluids**

Ratings and performance data for Series 45 products are based on operating with premium hydraulic fluids containing oxidation, rust, and foam inhibitors. These include premium turbine oils, API CD engine oils per SAE J183, M2C33F or G automatic transmission fluids (ATF), Dexron II (ATF) meeting Allison C-3 or Caterpillar T0-2 requirements, and certain specialty agricultural tractor fluids. For more information on hydraulic fluid selection, see Sauer-Danfoss publications **520L0463 *Hydraulic Fluids and Lubricants, Technical Information***, and **520L0465 *Experience with Biodegradable Hydraulic Fluids, Technical Information***.

**Viscosity**

Maintain fluid viscosity within the recommended range for maximum efficiency and bearing life. **Minimum viscosity** should only occur during brief occasions of maximum ambient temperature and severe duty cycle operation. **Maximum viscosity** should only occur at cold start: Limit speeds until the system warms up.

*Fluid viscosity limits*

Condition		mm <sup>2</sup> /s (cSt)	SUS
v min.	continuous	9	58
	intermittent	6.4	47
v max.	continuous	110	500
	intermittent (cold start)	1000	4700

**Temperature**

Maintain fluid temperature within the limits shown in the table. **Minimum temperature** relates to the physical properties of the component materials. Cold oil will not affect the durability of the pump components. However, it may affect the ability of the pump to provide flow and transmit power. **Maximum temperature** is based on material properties. Don't exceed it. Measure maximum temperature at the hottest point in the system. This is usually the case drain.

*Temperature limits*

<b>Minimum (intermittent, cold start)</b>	- 40° C [- 40° F]
<b>Continuous</b>	82° C [180° F]
<b>Maximum</b>	104° C [220° F]

---

Ensure fluid temperature and viscosity limits are concurrently satisfied.

---

**Inlet pressure**

Maintain inlet pressure within the limits shown in the table. Low inlet pressure (vacuum) may limit maximum pump speed and cause cavitation. Refer to *Inlet pressure vs. speed* charts for each displacement.

*Inlet pressure limits*

<b>Minimum (continuous)</b>	0.8 bar absolute [6.7 in. Hg vac.] (at reduced maximum speed)
<b>Minimum (cold start)</b>	0.5 bar absolute [15.1 in. Hg vac.]

**Case pressure**

Maintain case pressure within the limits shown in the table. The housing must always be filled with hydraulic fluid.

*Case pressure limits*

<b>Maximum (continuous)</b>	0.5 bar [7 psi] above inlet
<b>Intermittent (cold start)</b>	2 bar [29 psi] above inlet

**⚠ Caution**

---

Operating outside of inlet and case pressure limits will damage the pump. To minimize this risk, use full size inlet and case drain plumbing, and limit line lengths.

---

**OPERATING  
 PARAMETERS  
 (continued)**

**Pressure ratings**

The specification tables in each section give maximum and continuous pressure ratings for each displacement. Not all displacements within a given frame operate under the same pressure limits. Definitions of the operating pressure limits appear below.

**System pressure** is the differential pressure between the outlet and inlet ports. It is the dominant operating variable affecting hydraulic unit life. High system pressure, which results from high load, reduces expected life. System pressure must remain at or below rated pressure during normal operation to achieve expected life.

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

**Maximum (peak) working pressure** is the highest intermittent pressure allowed. Maximum machine load should never exceed this pressure.

**Speed ratings**

The specification tables in each section give minimum, maximum, and rated speeds for each displacement. Not all displacements within a given frame operate under the same speed limits. Definitions of these speed limits appear below.

**Rated speed** is the maximum recommended operating speed at full displacement and 1 bar abs. [0 in Hg vac] inlet pressure. Operating at or below this speed should yield satisfactory product life.

**Maximum speed** is the highest recommended operating speed at full power conditions. Operating at or beyond maximum speed requires positive inlet pressure and/or a reduction of pump outlet flow. Refer to *Inlet pressure vs. speed* charts for each displacement.

**Minimum speed** is the lowest operating speed allowed. Operating below this speed will not yield satisfactory performance.

**Duty cycle and pump life**

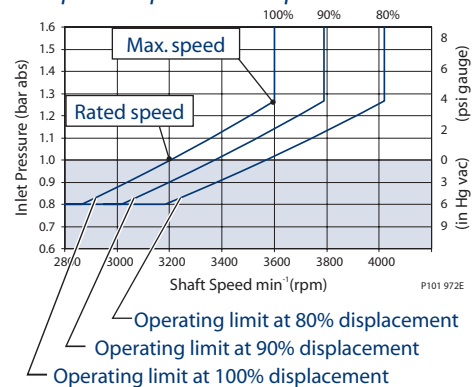
Knowing the operating conditions of your application is the best way to ensure proper pump selection. With accurate duty cycle information, your Sauer-Danfoss representative can assist in calculating expected pump life.

**Speed, flow, and inlet pressure**

*Inlet pressure vs. speed* charts in each section show the relationship between speed, flow, and inlet pressure for each displacement. Use these charts to ensure your application operates within the prescribed range.

The charts define the area of inlet pressures and speeds allowed for a given displacement. Operating at lower displacements allows greater speed or lower inlet pressure.

*Sample inlet pressure vs. speed chart*



**DESIGN PARAMETERS****Installation**

Series 45 pumps may be installed in any position. To optimize inlet conditions, we recommend installing the pump at an elevation below the minimum reservoir fluid level. Design inlet plumbing to maintain inlet pressure within prescribed limits (see *Inlet pressure limits*, page 13)

Fill the pump housing and inlet line with clean fluid during installation. Connect the case drain line to the uppermost drain port (L1 or L2) to keep the housing full during operation.

To allow unrestricted flow to the reservoir, use a dedicated drain line. Connect it below the minimum reservoir fluid level and as far away from the reservoir outlet as possible. Use plumbing adequate to maintain case pressure within prescribed limits (see *Case pressure limits*, page 13).

**Filtration**

To prevent damage to the pump, including premature wear, fluid entering the pump inlet must be free of contaminants. Series 45 pumps require system filtration capable of maintaining fluid cleanliness at ISO 4406-1999 class 22/18/13 or better.

Sauer-Danfoss does not recommend suction line filtration. Suction line filtration can cause high inlet vacuum, which limits pump operating speed. Instead we recommend a 125  $\mu\text{m}$  (150 mesh) screen in the reservoir covering the pump inlet. This protects the pump from coarse particle ingestion.

Return line filtration is the preferred method for open circuit systems. Consider these factors when selecting a system filter:

- Cleanliness specifications
- Contaminant ingress rates
- Flow capacity
- Desired maintenance interval

Typically, a filter with a beta ratio of  $\beta_{10} = 10$  is adequate. However, because each system is unique, only a thorough testing and evaluation program can fully validate the filtration system. For more information, see Sauer-Danfoss publication **520L0467** *Design Guidelines for Hydraulic Fluid Cleanliness*.

**Reservoir**

The reservoir provides clean fluid, dissipates heat, and removes entrained air from the hydraulic fluid. It allows for fluid volume changes associated with fluid expansion and cylinder differential volumes. Minimum reservoir capacity depends on the volume needed to perform these functions. Typically, a capacity of one to three times the pump flow (per minute) is satisfactory.

Locate the reservoir outlet (suction line) near the bottom, allowing clearance for settling foreign particles. Place the reservoir inlet (return lines) below the lowest expected fluid level, as far away from the outlet as possible.

**DESIGN PARAMETERS**  
 (continued)

**Fluid velocity**

Choose piping sizes and configurations sufficient to maintain optimum fluid velocity, and minimize pressure drops. This reduces noise, pressure drops, and overheating. It maximizes system life and performance.

*Recommended fluid velocities*

<b>System lines</b>	6 to 9 m/sec [20 to 30 ft/sec]
<b>Suction line</b>	1 to 2 m/sec [4 to 6 ft/sec]
<b>Case drain</b>	3 to 5 m/sec [10 to 15 ft/sec]

**Typical guidelines; obey all pressure ratings.**

*Velocity equations SI units*

Q = flow (l/min)  
 A = area (mm<sup>2</sup>)

$$\text{Velocity} = \frac{16.67 \cdot Q}{A} \quad (\text{m/sec})$$

*US units*

Q = flow (US gal/min)  
 A = area (in<sup>2</sup>)

$$\text{Velocity} = \frac{0.321 \cdot Q}{A} \quad (\text{ft/sec})$$

**Shaft loads**

Series 45 pumps have tapered roller bearings capable of accepting external radial and thrust loads. The external radial shaft load limits are a function of the load position, orientation, and the operating conditions of the pump.

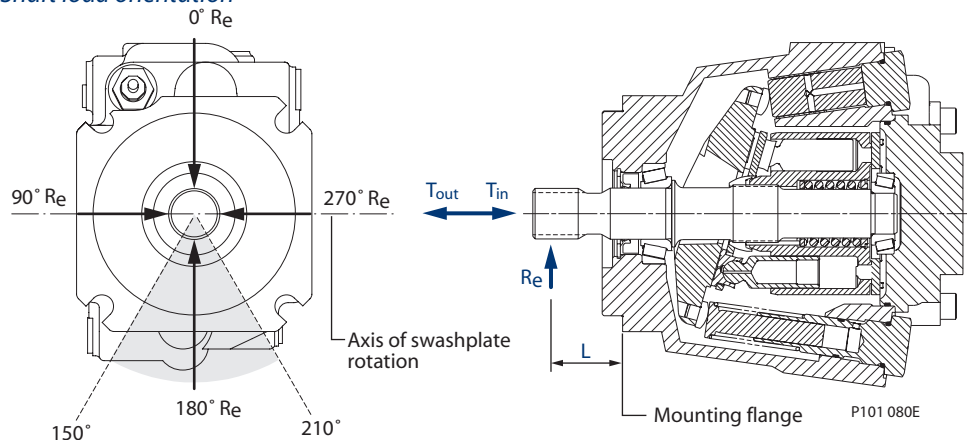
The maximum allowable radial load ( $R_e$ ) is based on the maximum external moment ( $M_e$ ) and the distance ( $L$ ) from the mounting flange to the load. Compute radial loads using the formula below. Tables in each section give maximum external moment ( $M_e$ ) and thrust load ( $T_{in}$ ,  $T_{out}$ ) limits for each pump frame size and displacement.

*Radial load formula*

$$M_e = R_e \cdot L$$

- L = Distance from mounting flange to point of load
- $M_e$  = Maximum external moment
- $R_e$  = Maximum radial side load

*Shaft load orientation*



**Bearing life**

All shaft loads affect bearing life. In applications where external shaft loads can not be avoided, maximize bearing life by orientating the load between the 150° and 210° positions, as shown. We recommend tapered input shafts or clamp-type couplings for applications with radial shaft loads. Tables in each section give  $B_{10}$  bearing life for each pump frame size and displacement.



**DESIGN PARAMETERS**  
 (continued)

**Mounting flange loads**

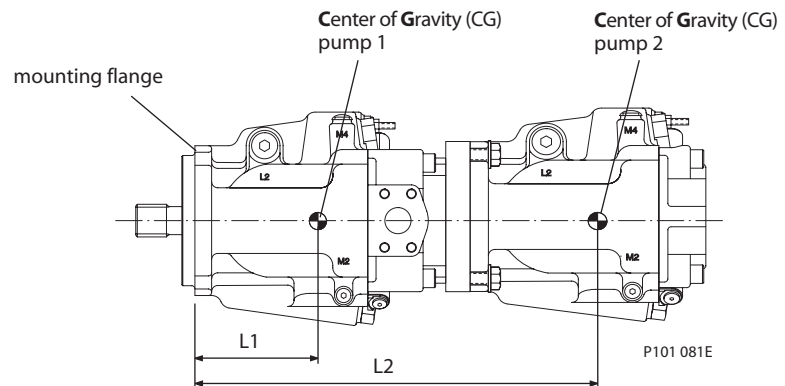
Adding auxiliary pumps and/or subjecting pumps to high shock loads may overload the pump mounting flange. Tables in each section give allowable continuous and shock load moments for each frame size. Applications with loads outside allowable limits require additional pump support.

- **Shock load moment** ( $M_s$ ) is the result of an instantaneous jolt to the system.
- **Continuous load moments** ( $M_c$ ) are generated by the typical vibratory movement of the application.

*Estimating overhung load moments*

Use the equations below to estimate the overhung load moments for multiple pump mounting. See installation drawings in each section to find the distance from the mounting flange to the center of gravity for each frame size. Refer to the technical specifications in each section to find pump weight.

*Overhung load example*



*Shock load formula*  $M_s = G_s \cdot K \cdot (W_1 \cdot L_1 + W_2 \cdot L_2 + \dots + W_n \cdot L_n)$

*Continuous load formula*  $M_c = G_c \cdot K \cdot (W_1 \cdot L_1 + W_2 \cdot L_2 + \dots + W_n \cdot L_n)$

*SI units*

- $M_s$  = Shock load moment (N•m)
- $M_c$  = Continuous (vibratory) load moment (N•m)
- $G_s$  = Acceleration due to external shock (G's)
- $G_c$  = Acceleration due to continuous vibration (G's)
- $K$  = Conversion factor = 0.00981
- $W_n$  = Mass of  $n^{\text{th}}$  pump (kg)
- $L_n$  = Distance from mounting flange to  $n^{\text{th}}$  pump CG (mm)

*US units*

- $M_s$  = Shock load moment (lbf•in)
- $M_c$  = Continuous (vibratory) load moment (lbf•in)
- $G_s$  = Acceleration due to external shock (G's)
- $G_c$  = Acceleration due to continuous vibration (G's)
- $K$  = Conversion factor = 1
- $W_n$  = Weight of  $n^{\text{th}}$  pump (lb)
- $L_n$  = Distance from mounting flange to  $n^{\text{th}}$  pump CG (in)

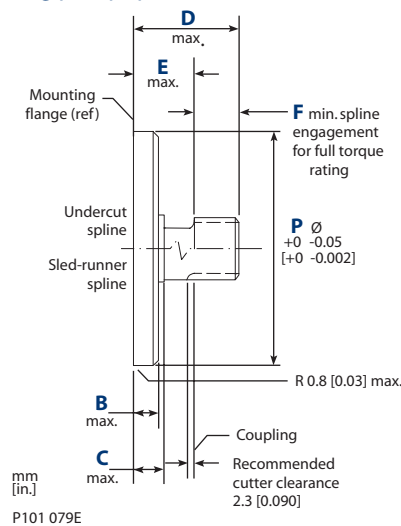
**DESIGN PARAMETERS**  
 (continued)

**Auxiliary mounting pads**

Auxiliary mounting pads are available for all radial ported Series 45 pumps. Since the auxiliary pad operates under case pressure, use an O-ring to seal the auxiliary pump mounting flange to the pad. Oil from the main pump case lubricates the drive coupling.

- All mounting pads meet SAE J744 Specifications.
- The combination of auxiliary shaft torque and main pump torque must not exceed the maximum pump input shaft rating. Tables in each section give input shaft torque ratings for each frame size.
- Applications subject to severe vibratory or shock loading may require additional support to prevent mounting flange damage. Tables in each section give allowable continuous and shock load moments for each frame size.
- The drawing and table below give mating pump dimensions for each size mount. Refer to installation drawings in each section for auxiliary mounting pad dimensions.

*Mating pump specifications*



*Dimensions*

	SAE A	SAE B	SAE C
<b>P</b>	82.55 [3.250]	101.60 [4.000]	127.00 [5.000]
<b>B</b>	6.35 [0.250]	9.65 [0.380]	12.70 [0.500]
<b>C</b>	12.70 [0.500]	15.20 [0.600]	23.37 [0.920]
<b>D</b>	58.20 [2.290]	53.10 [2.090]	55.60 [2.190]
<b>E</b>	15.00 [0.590]	17.50 [0.690]	30.50 [1.200]
<b>F</b>	13.50 [0.530]	14.20 [0.560]	18.30 [0.720]

**Input shaft torque ratings**

Input shaft tables in each section give maximum torque ratings for available input shafts. Ensure that your application respects these limits.

**Maximum torque** ratings are based on shaft strength. Do not exceed them.

Coupling arrangements that are not oil-flooded provide a reduced torque rating. Contact your Sauer-Danfoss representative for proper torque ratings if your application involves non oil-flooded couplings.

Sauer-Danfoss recommends mating splines adhere to ANSI B92.1-Class 5. Sauer-Danfoss external splines are modified class 5 fillet root side fit. The external major diameter and circular tooth thickness dimensions are reduced to ensure a good clearance fit with the mating spline. Tables in each section give full spline dimensions and data.

**DESIGN PARAMETERS**  
(continued)**Understanding and minimizing system noise**

Tables in each section give sound levels for each frame size and displacement. Sound level data are collected at various operating speeds and pressures in a semi-anechoic chamber. Many factors contribute to the overall noise level of any application. Here is some information to help understand the nature of noise in fluid power systems, and some suggestions to help minimize it.

Noise is transmitted in fluid power systems in two ways: as fluid borne noise, and structure borne noise.

**Fluid-borne noise** (pressure ripple or pulsation) is created as pumping elements discharge oil into the pump outlet. It is affected by the compressibility of the oil, and the pump's ability to transition pumping elements from high to low pressure. Pulsations travel through the hydraulic lines at the speed of sound (about 1400 m/s [4600 ft/sec] in oil) until there is a change (such as an elbow) in the line. Thus, amplitude varies with overall line length and position.

**Structure-borne noise** is transmitted wherever the pump casing connects to the rest of the system. The way system components respond to excitation depends on their size, form, material, and mounting.

System lines and pump mounting can amplify pump noise. Follow these suggestions to help minimize noise in your application:

- Use flexible hoses.
- Limit system line length.
- If possible, optimize system line position to minimize noise.
- If you must use steel plumbing, clamp the lines.
- If you add additional support, use rubber mounts.
- Test for resonants in the operating range, if possible avoid them.

### SIZING EQUATIONS

Use these equations to help choose the right pump size and displacement for your application:

#### Based on SI units

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

*Torque* Input torque  $M = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_m}$  (N·m)

*Power* Input power  $P = \frac{M \cdot n \cdot \pi}{30\,000} = \frac{Q \cdot \Delta p}{600 \cdot \eta_t}$  (kW)

#### Based on US units

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

Input torque  $M = \frac{V_g \cdot \Delta p}{2 \cdot \pi \cdot \eta_m}$  (lbf·in)

Input power  $P = \frac{M \cdot n \cdot \pi}{198\,000} = \frac{Q \cdot \Delta p}{1714 \cdot \eta_t}$  (hp)

#### Variables SI units [US units]

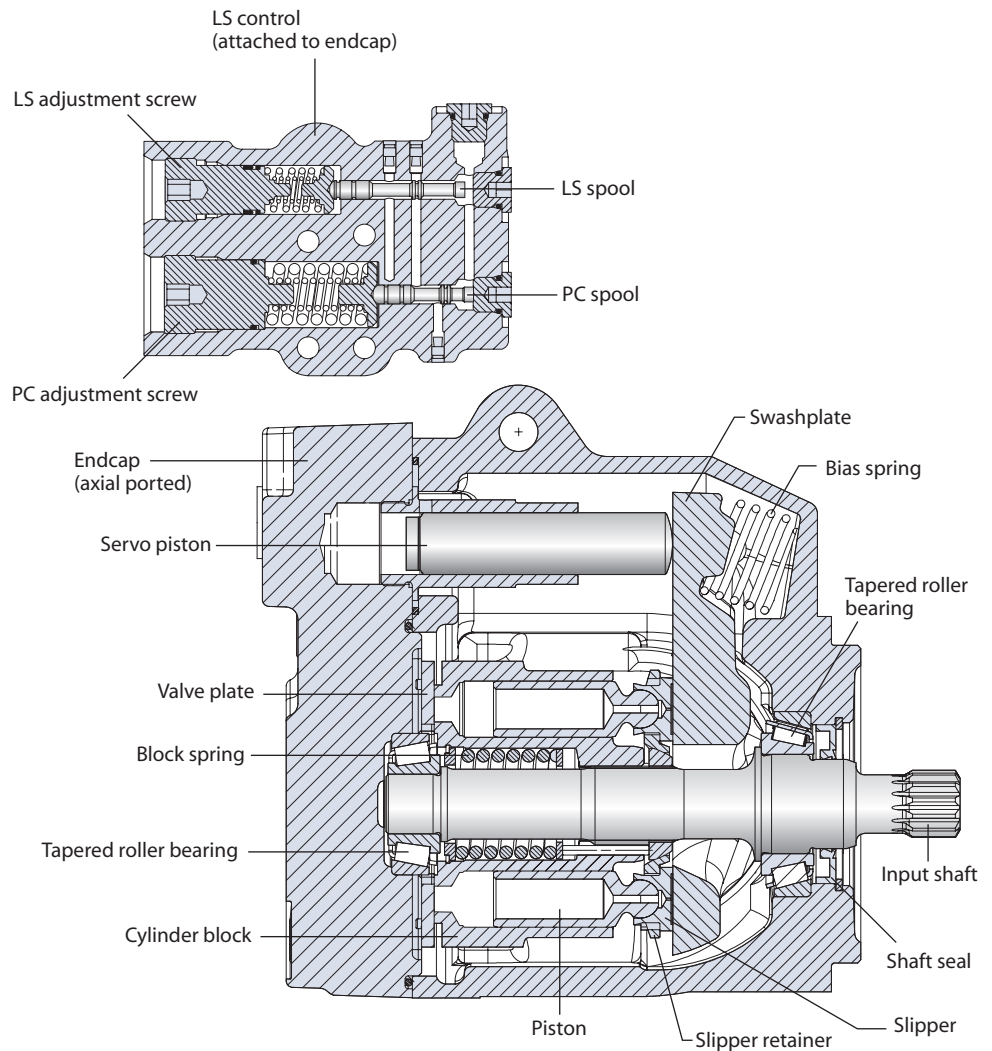
$V_g$	= Displacement per revolution	cm <sup>3</sup> /rev [in <sup>3</sup> /rev]
$p_o$	= Outlet pressure	bar [psi]
$p_i$	= Inlet pressure	bar [psi]
$\Delta p$	= $p_o - p_i$ (system pressure)	bar [psi]
$n$	= Speed	min <sup>-1</sup> (rpm)
$\eta_v$	= Volumetric efficiency	
$\eta_m$	= Mechanical efficiency	
$\eta_t$	= Overall efficiency ( $\eta_v \cdot \eta_m$ )	

**DESIGN**

Series 45 Frame L and K pumps have a single servo piston design with a cradle-type swashplate set in polymer-coated journal bearings. A bias spring and internal forces increase swashplate angle. The servo piston decreases swashplate angle. Nine reciprocating pistons displace fluid from the pump inlet to the pump outlet as the cylinder block rotates on the pump input shaft. The block spring holds the piston slippers to the swashplate via the slipper retainer. The cylinder block rides on a bi-metal valve plate optimized for high volumetric efficiency and low noise. Tapered roller bearings support the input shaft and a viton lip-seal protects against shaft leaks.

An adjustable one spool (PC only, not shown) or two spool (LS and remote PC) control senses system pressure and load pressure (LS controls). The control ports system pressure to the servo piston to control pump output flow.

*Frame K/L cross section*



P101 659E

### SPECIFICATIONS

For general operating parameters, including fluid viscosity, temperature, and inlet and case pressures, [see page 13](#). For system design parameters, including installation, filtration, reservoir, and line velocities, [see page 15](#).

Features and options		Model			
		L25C	L30D	K38C	K45D
Feature	Unit				
Maximum Displacement	cm <sup>3</sup> [in <sup>3</sup> ]	25 [1.53]	30 [1.83]	38 [2.32]	45 [2.75]
Flow at rated speed (theoretical)	l/min [US gal/min]	80 [21]	96 [25.4]	100.7 [26.6]	119.3 [31.5]
Input torque at maximum displacement (theoretical)	N•m/bar [lbf•in/1000 psi]	0.398 [243]	0.477 [291]	0.605 [369]	0.716 [438]
Mass moment of inertia of internal rotating components	kg•m <sup>2</sup> [slug•ft <sup>2</sup> ]	0.00169 [0.00125]	0.00161 [0.00119]	0.00184 [0.00135]	0.00203 [0.00150]
Weight	Axial ports	19 [42]			
	Radial ports				
		24 [53]			
Rotation		Clockwise, Counterclockwise			
Mounting		SAE-B			
Auxiliary mounting ( <a href="#">See page 35</a> )		SAE-A, SAE-B, SAE-BB			
System ports (type)		SAE O-ring boss			
System ports (location)		Axial, Radial			
Control types ( <a href="#">See page 29</a> )		EP, ED, AA, PC, Remote PC, LS, LS with internal bleed			
Shafts ( <a href="#">See page 33</a> )	Splined	13 tooth, 15 tooth			
	Tapered	Ø 25.4 mm [1 in], 1:8 taper Ø 22.23 mm [0.875 in], 1:8 taper			
	Straight	Ø 22.23 mm [0.875 in] (short)		Ø 22.23 mm [0.875 in] (long)	
Displacement limiters ( <a href="#">See page 37</a> )		Optional, adjustable			

For definitions of pressure and speed ratings, [see page 14](#). For more information on external shaft loads, [see page 16](#); mounting flange loads, [see page 17](#).

Ratings			Model			
			L25C	L30D	K38C	K45D
Input speed <sup>1</sup>	minimum	min <sup>-1</sup> (rpm)	500	500	500	500
	continuous		3200	3200	2650	2650
	maximum		3600	3600	2800	2800
Working pressure	continuous	bar [psi]	260 [3770]	210 [3045]	260 [3770]	210 [3045]
	maximum		350 [5075]	300 [4350]	350 [5075]	300 [4350]
External shaft loads	External moment (M <sub>e</sub> )	N•m [lbf•in]	61 [540]	61 [540]	76 [673]	76 [673]
	Thrust in (T <sub>in</sub> ), out (T <sub>out</sub> )	N [lbf]	1000 [225]	1000 [225]	1200 [270]	1200 [270]
Bearing life	at 140 bar [2030 psi]	B <sub>10</sub> hours	49 100	24 600	35 300	19 600
	at 210 bar [3045 psi]		14 100	7230	11 400	6200
	at 260 bar [3770 psi]		6590	—	5870	—
Mounting flange load moments	Vibratory (continuous)	N•m [lbf•in]	1005 [8895]			
	Shock (max)		3550 [31 420]			

1. Input speeds are valid at 1 bar absolute [0 in Hg vac] inlet pressure. See [Inlet pressure vs. speed](#) charts.

### Sound levels<sup>2</sup>

For more information on noise levels, [see page 19](#).

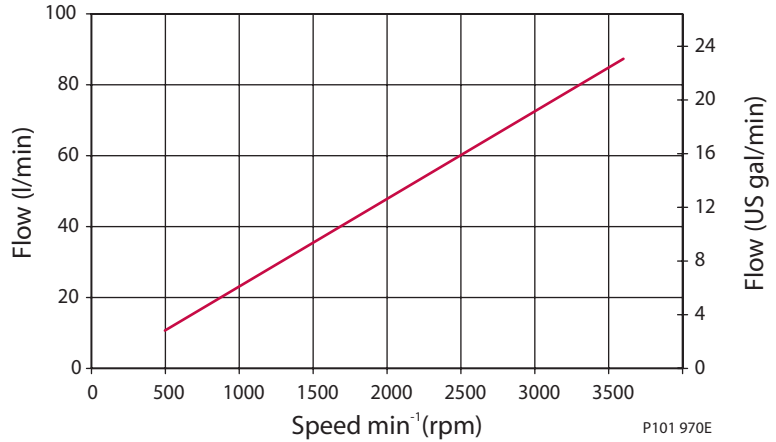
dB(A)	210 bar [3045 psi]		260 bar [3770 psi]	
	1800 min <sup>-1</sup> (rpm)	Rated speed	1800 min <sup>-1</sup> (rpm)	Rated speed
L25C	65	69	66	70
L30D	66	70	—	—
K38C	65	70	66	71
K45D	66	71	—	—

2. Sound data was collected in a *semi-anechoic* chamber. Values have been adjusted (-3 dB) to reflect *anechoic* levels.

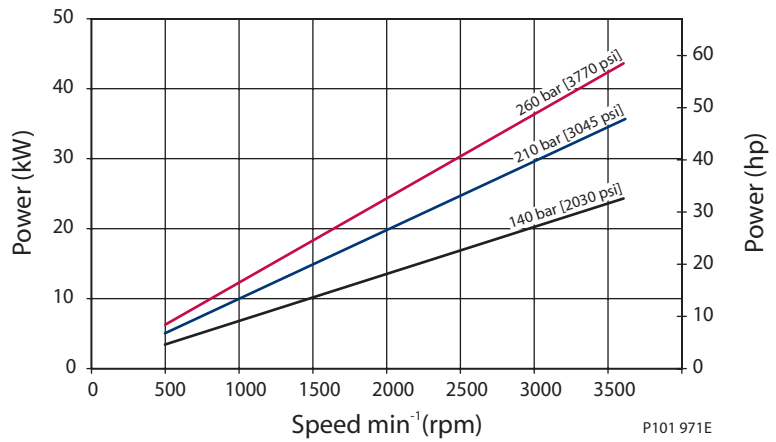
**PERFORMANCE**  
**L25C**

Flow and power data valid at 49°C [120°F] and viscosity of 17.8 mm<sup>2</sup>/sec [88 SUS].

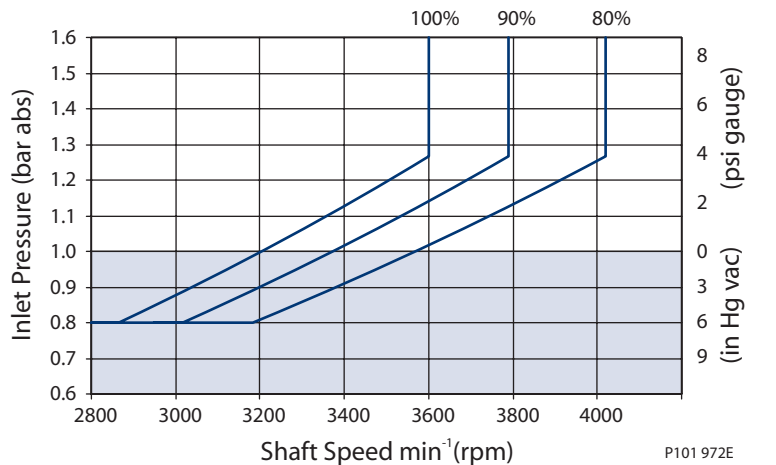
*Flow vs. speed*



*Input power vs. speed*



*Inlet pressure vs. speed*

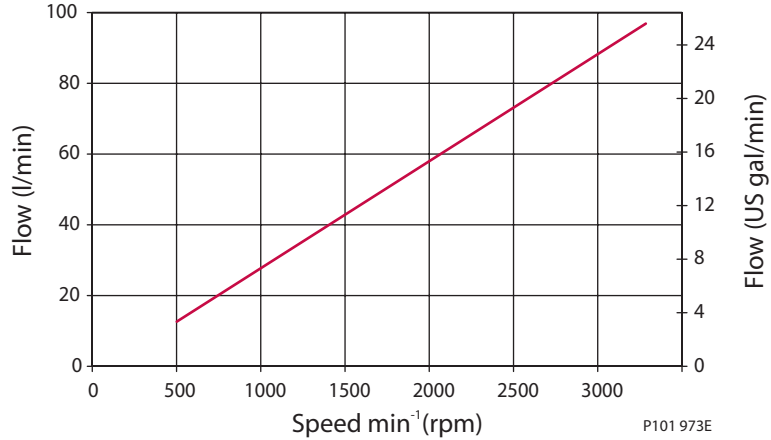


The chart on the right shows allowable inlet pressure and speed at various displacements. Greater speeds and lower inlet pressures are possible at reduced displacement. Operating outside of acceptable limits reduces pump life.

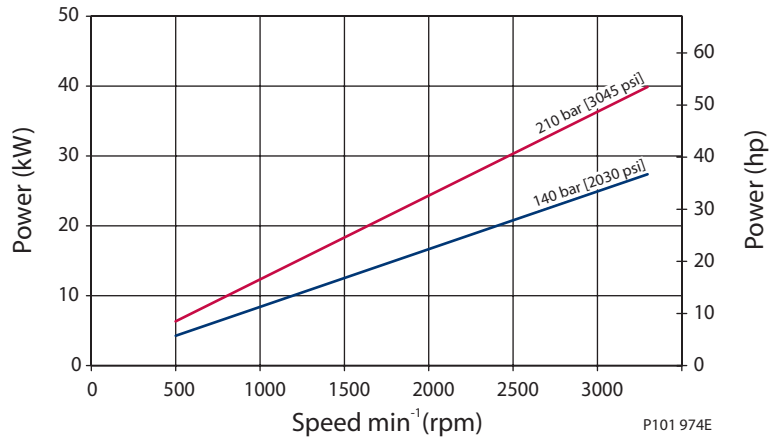
**PERFORMANCE**  
**L30D**

Flow and power data valid at 49°C [120°F] and viscosity of 17.8 mm<sup>2</sup>/sec [88 SUS].

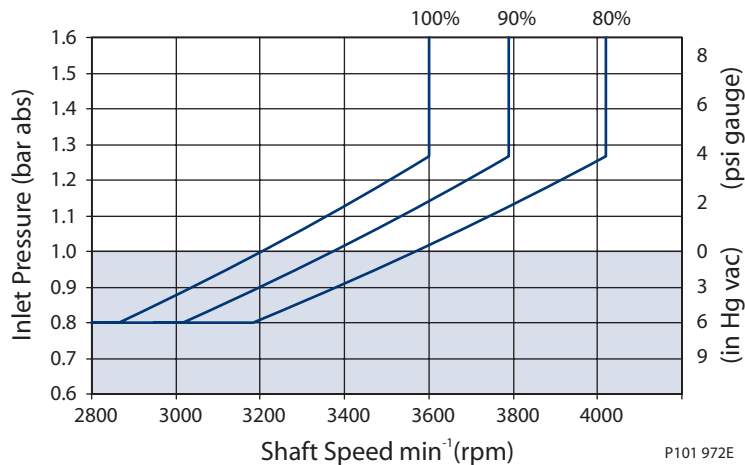
*Flow vs. speed*



*Input power vs. speed*



*Inlet pressure vs. speed*



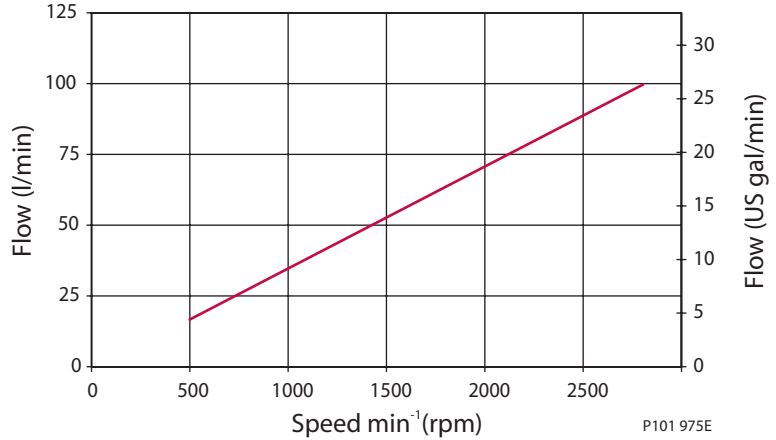
The chart on the right shows allowable inlet pressure and speed at various displacements. Greater speeds and lower inlet pressures are possible at reduced displacement. Operating outside of acceptable limits reduces pump life.



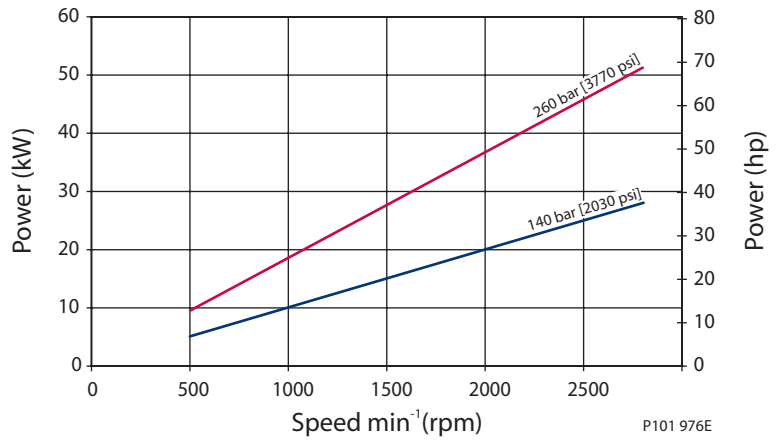
**PERFORMANCE**  
**K38C**

Flow and power data valid at 49°C [120°F] and viscosity of 17.8 mm<sup>2</sup>/sec [88 SUS].

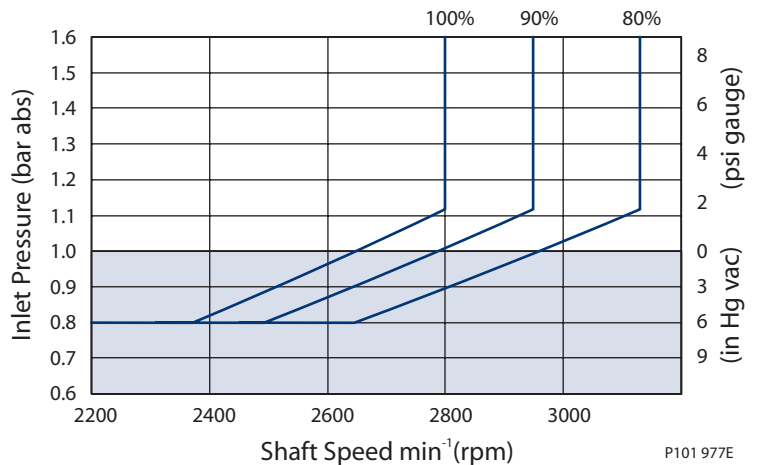
*Flow vs. speed*



*Input power vs. speed*



*Inlet pressure vs. speed*

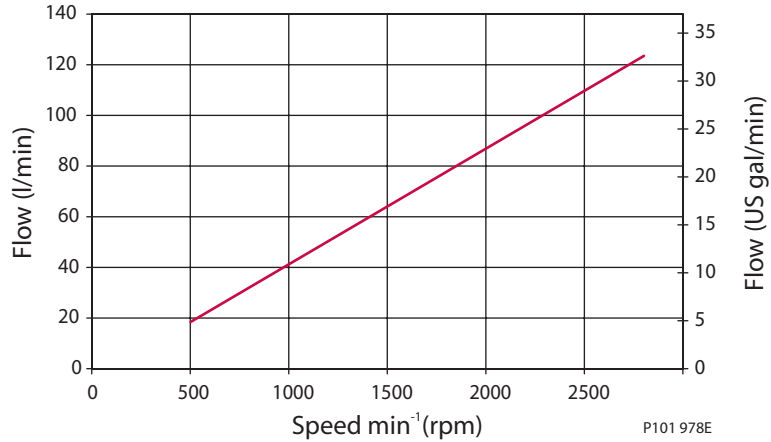


The chart on the right shows allowable inlet pressure and speed at various displacements. Greater speeds and lower inlet pressures are possible at reduced displacement. Operating outside of acceptable limits reduces pump life.

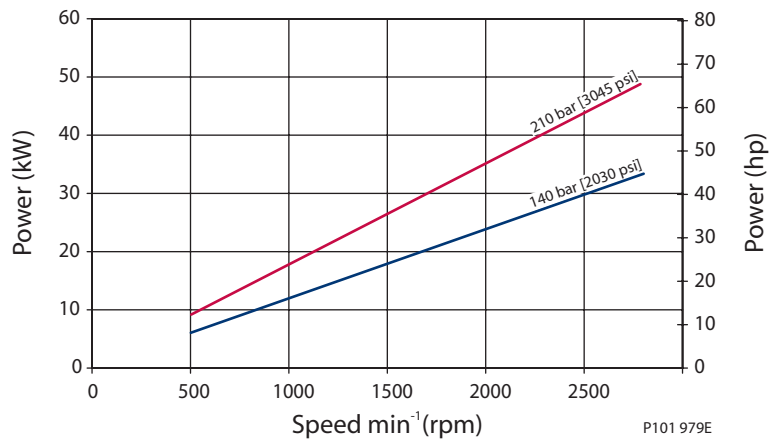
**PERFORMANCE**  
**K45D**

Flow and power data valid at 49°C [120°F] and viscosity of 17.8 mm<sup>2</sup>/sec [88 SUS].

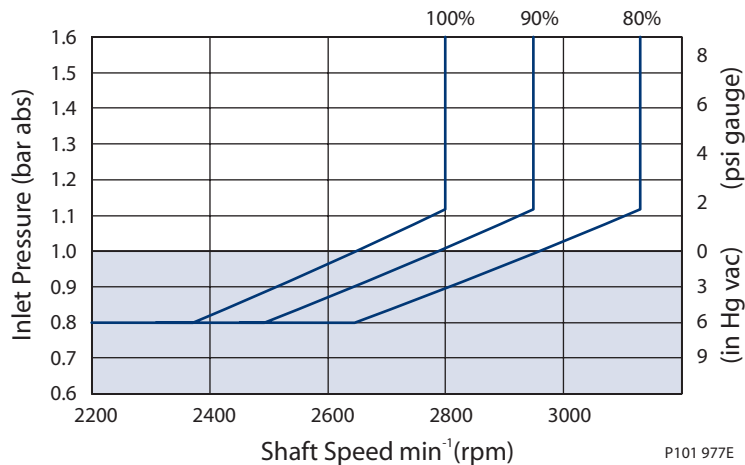
*Flow vs. speed*



*Input power vs. speed*



*Inlet pressure vs. speed*



The chart on the right shows allowable inlet pressure and speed at various displacements. Greater speeds and lower inlet pressures are possible at reduced displacement. Operating outside of acceptable limits reduces pump life.

ORDER CODE



**R Product**

<b>KR</b>	K Frame, variable displacement open circuit pump
<b>LR</b>	L Frame, variable displacement open circuit pump

**S Rotation**

<b>L</b>	Left hand (counterclockwise)
<b>R</b>	Right hand (clockwise)

**P Displacement and pressure rating**

<b>025C</b>	025 cm <sup>3</sup> /rev [1.53 in <sup>3</sup> /rev], 260 bar [3770 psi] continuous working pressure
<b>030D</b>	030 cm <sup>3</sup> /rev [1.83 in <sup>3</sup> /rev], 210 bar [3045 psi] continuous working pressure
<b>038C</b>	038 cm <sup>3</sup> /rev [2.32 in <sup>3</sup> /rev], 260 bar [3770 psi] continuous working pressure
<b>045D</b>	045 cm <sup>3</sup> /rev [2.75 in <sup>3</sup> /rev], 210 bar [3045 psi] continuous working pressure

**C Control type**

<b>PC</b>	Pressure compensated control
<b>RP</b>	Remote pressure compensated control
<b>LS</b>	Load sensing / pressure compensating control
<b>LB</b>	Load sensing / pressure compensating control with internal bleed orifice
<b>ED</b>	Normally closed on/off electric PC control
<b>EP</b>	Normally closed electric proportional control (fan drive applications)
<b>AA</b>	Normally open on/off electric PC control

**D PC setting (2 digit code, 10 bar increments)**

<b>Example</b>	10 = 100
<b>10-26</b>	100 to 260 bar [1450 to 3770 psi] (025C and 038C)
<b>10-21</b>	100 to 210 bar [1450 to 3045 psi] (030D and 045D)

**E Load sensing setting (2 digit code, 1 bar increments)**

<b>Example</b>	20 = 20 bar
<b>12-40</b>	12 to 40 bar [174 to 580 psi]
<b>NN</b>	Not applicable (use with PC and RP controls)
<b>RP</b>	Must be 20 bar

**F Not used**

<b>NN</b>	Not applicable
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**G Pilot orifice**

<b>N</b>	None (standard)
----------	-----------------

**H Gain orifice**

**ORDER CODE**  
 (continued)



<b>3</b>	Standard orifice
----------	------------------

**J1** *Input shaft*

<b>C2</b>	13 tooth, 16/32 pitch (ANSI A92.1 1970 - Class 5)
<b>C3</b>	15 tooth, 16/32 pitch (ANSI A92.1 1970 - Class 5)
<b>T1</b>	Ø 25.4 mm [1 in], 1:8 taper
<b>T2</b>	Ø 22.23 mm [0.875 in], 1:8 taper
<b>K1</b>	Ø 22.23 mm [0.875 in] (short)
<b>K2</b>	Ø 22.23 mm [0.875 in] (long)

**J2** *Auxiliary mounting flange*

<b>N</b>	None
<b>R</b>	Running cover
<b>A</b>	SAE-A, 9-tooth output spline
<b>T</b>	SAE-A, 11-tooth output spline
<b>G</b>	SAE-A, 11 tooth rotated 90 degrees
<b>B</b>	SAE-B, 13-tooth output spline
<b>V</b>	SAE-BB, 15-tooth output spline

**J3** *System port size and location*

Code	Location	Port type	Inlet size	Outlet size
<b>K</b>	Radial	4 bolt split flange	38.1 mm [1.5 in]	25.4 mm [1 in]
<b>M</b>	Axial	4 bolt split flange	31.8 mm [1.25 in]	25.4 mm [1 in]
<b>F</b>	Axial	O-ring boss	1 7/8 in.	1 5/16 in.
<b>G</b>	Radial	O-ring boss	1 7/8 in.	1 5/16 in.

**K1** *Shaft seal*

<b>A</b>	Single lip seal, viton
----------	------------------------

**K2** *Mounting flange and housing port style*

<b>6</b>	SAE-B 2-bolt, SAE O-ring boss housing ports
----------	---

**K3** *Not used*

<b>N</b>	Not applicable
----------	----------------

**L** *Displacement limiter*

<b>KNB</b>	None
<b>PLB</b>	Endcap machined and plugged
<b>AAA</b>	Adjustable, factory set at max angle

**M** *Special hardware*

<b>NNN</b>	None
------------	------

**N** *Special features*

<b>NNN</b>	None
------------	------

**CONTROLS**

**Pressure compensated control (PC)**

*Specifications* **PC control setting range**

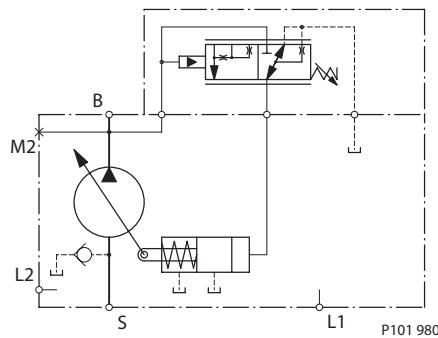
Model	bar	psi
L25C	100–260	1450–3770
L30D	100–210	1450–3045
K38C	100–260	1450–3770
K45D	100–210	1450–3045

*Response/recovery times\**

(ms)	Response	Recovery
L25C	30	90
L30D	30	100
K38C	30	105
K45D	30	110

\* For definitions, see page 9

*Schematic diagram* **PC schematic**



*Legend*

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- M2 = System pressure gauge port

**Remote PC control (RP)**

*Specifications* **PC control setting range**

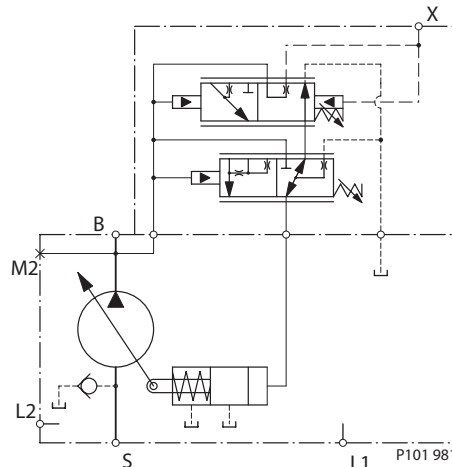
Model	bar	psi
L25C	100–260	1450–3770
L30D	100–210	1450–3045
K38C	100–260	1450–3770
K45D	100–210	1450–3045

*Response/recovery times\**

(ms)	Response	Recovery
L25C	30	90
L30D	30	100
K38C	30	105
K45D	30	110

\* For definitions, see page 10.

*Schematic diagram* **Remote PC schematic**



*LS setting*

Model	bar	psi
All	20	290

*Legend*

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- M2 = System pressure gauge port
- X = Remote PC port

**CONTROLS**  
 (continued)

*Specifications*

**Load sensing control (LS)**

*PC setting range*

Model	bar	psi
L25C	100–260	1450–3770
L30D	100–210	1450–3045
K38C	100–260	1450–3770
K45D	100–210	1450–3045

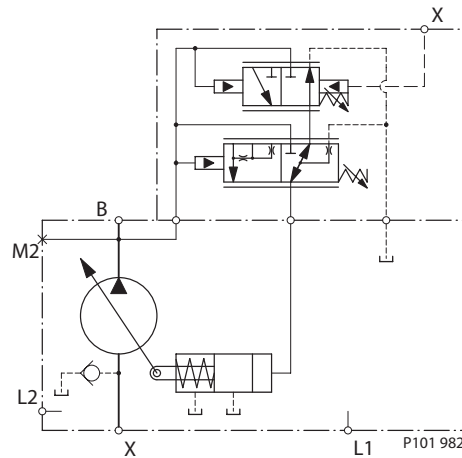
*Response/recovery times\**

(ms)	Response	Recovery
L25C	30	70
L30D	30	70
K38C	30	80
K45D	30	80

\* For definitions, see page 11.

*Schematic diagram*

*LS Schematic*



*LS setting range*

Model	bar	psi
All	12–40	174–580

*Legend*

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- M2 = System pressure gauge port
- X = LS signal port

**Load sensing control with internal bleed orifice (LB)**

*Specifications*

*PC setting range*

Model	bar	psi
L25C	100–260	1450–3770
L30D	100–210	1450–3045
K38C	100–260	1450–3770
K45D	100–210	1450–3045

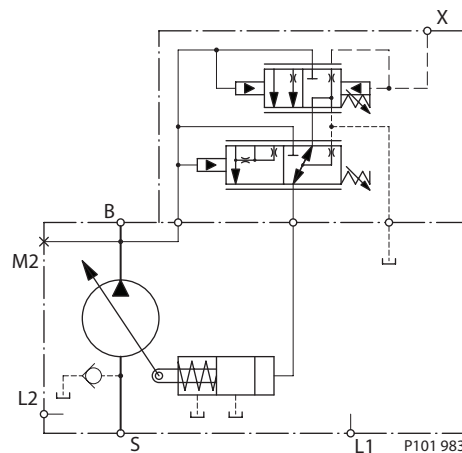
*Response/recovery times\**

(ms)	Response	Recovery
L25C	30	70
L30D	30	70
K38C	30	80
K45D	30	80

\* For definitions, see page 11.

*Schematic diagram*

*LB Schematic*



*LS setting range*

Model	bar	psi
All	12–40	174–580

*Legend*

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- M2 = System pressure gauge port
- X = LS signal port

**CONTROLS**  
 (continued)

**Normally closed on/off electric PC control (ED)**

*Specifications* **PC control setting range**

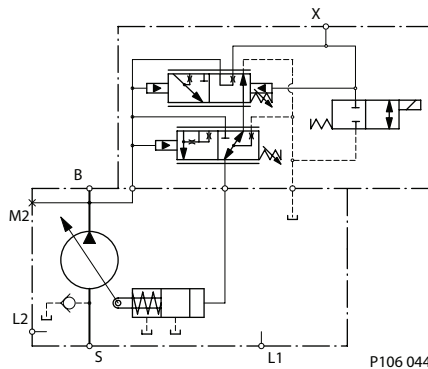
Model	bar	psi
L25C, K38C	100-240 bar	[1450-3480 psi]
L30D, K45D	100-210 bar	[1450-3045 psi]

*Response/recovery times\**

(ms)	Response	Recovery
L25C	30	90
L30D	30	100
K38C	30	105
K45D	30	110

\* For definitions, see page 11.

*Schematic diagram* **ED schematic**



*LS setting range*

Model	bar	psi
All	12-40	174-580

*Legend*

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- M2 = System pressure gauge port
- X = Remote PC port

**Normally open on/off electric PC control (AA)**

*Specifications* **PC control setting range**

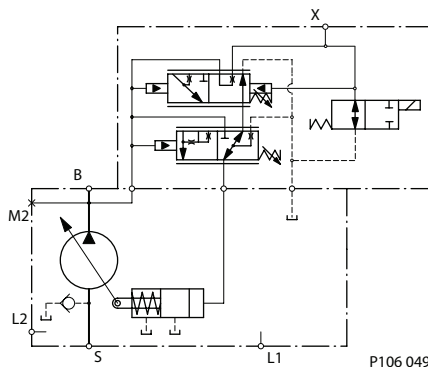
Model	bar	psi
L25C, K38C, L30D, K45D	100-210 bar	[1450-3045 psi]

*Response/recovery times\**

(ms)	Response	Recovery
L25C	30	90
L30D	30	100
K38C	30	105
K45D	30	110

\* For definitions, see page 11.

*Schematic diagram* **AA schematic**



*LS setting range*

Model	bar	psi
All	12-40	174-580

*Legend*

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- M2 = System pressure gauge port
- X = Remote PC port

Evaluate the system to decide if normally open on/off (failsafe) control is necessary.

**CONTROLS**  
 (continued)

**Electric proportional control (EJ) (Normally closed)**

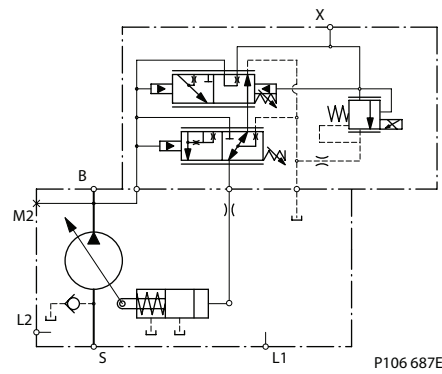
*Specifications* *PC control setting range*

Model	bar	psi
L25C, K38C	100-260 bar	1450-3370
L30D, K45D	100-210 bar	1450-3045

*LS setting range*

Model	bar	psi
All	12-40	174-580

*Schematic diagram* *EJ schematic*



*Legend*

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- M2 = System pressure gauge port
- X = Remote PC port



**INPUT SHAFTS**

Code	Description	Maximum torque rating <sup>1</sup> N·m [lbf·in]	Drawing
C2	13 tooth spline 16/32 pitch (ANSI A92.1 1970 - Class 5)	288 [2546]	
C3	15 tooth spline 16/32 pitch (ANSI A92.1 1970 - Class 5)	404 [3575]	
T1	Ø 25.4 mm [1 in] 1:8 taper (SAE J501)	362 [3200]	

1. See *Input shaft torque ratings*, page 18 for an explanation of maximum torque.

**INPUT SHAFTS**  
 (continued)

Code	Description	Maximum torque rating <sup>1</sup> N•m [lbf•in]	Drawing
T2	Ø 22.23 mm [0.875 in] 1:8 taper (SAE J501)	305 [2700]	
K1	Ø 22.23 mm [0.875 in] 33 mm [1.3 in]	305 [2700]	
K2	Ø 22.23 mm [0.875 in] 63 mm [2.48 in] long	305 [2700]	

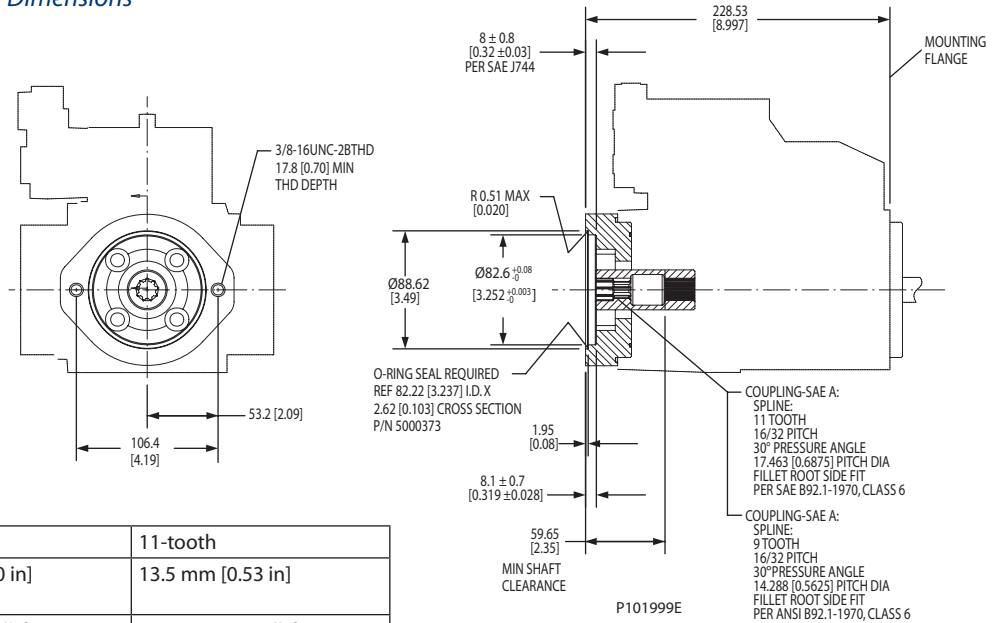
1. See *Input shaft torque ratings*, page 18 for an explanation of maximum torque.

#### AUXILIARY MOUNTING PADS

See page 18 for mating pump pilot and spline dimensions.

#### SAE-A auxiliary mounting pad

##### Dimensions



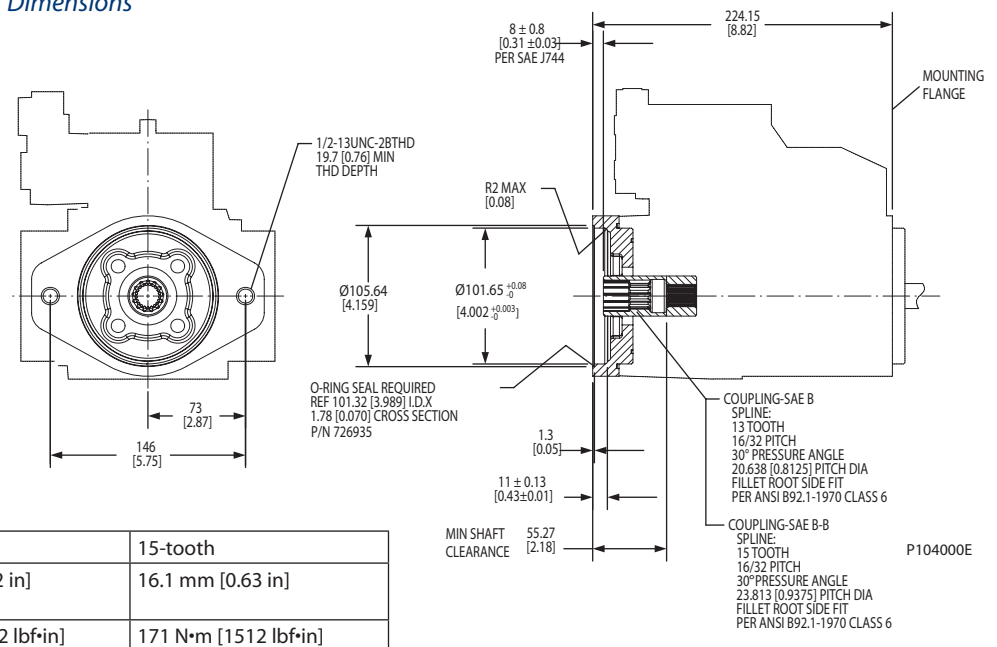
#### Specifications

Coupling	9-tooth	11-tooth
Spline minimum engagement	12.6 mm [0.50 in]	13.5 mm [0.53 in]
Maximum torque	107 N·m [950 lbf·in]	147 N·m [1300 lbf·in]

#### SAE-B auxiliary mounting pad

##### Dimensions

See page 18 for mating pump pilot and spline dimensions.

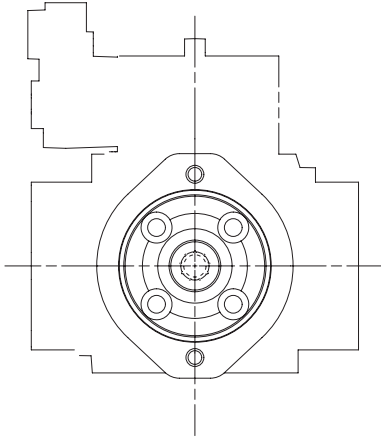


#### Specifications

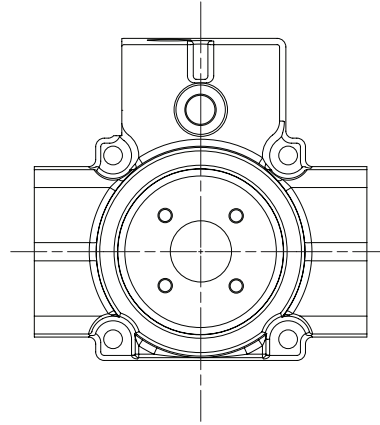
Coupling	13-tooth	15-tooth
Spline minimum engagement	13.2 mm [0.52 in]	16.1 mm [0.63 in]
Maximum torque	171 N·m [1512 lbf·in]	171 N·m [1512 lbf·in]

**AUXILLIARY MOUNTING  
 PADS (continued)**

**Mounting pads at 90 degrees**



P106 076E

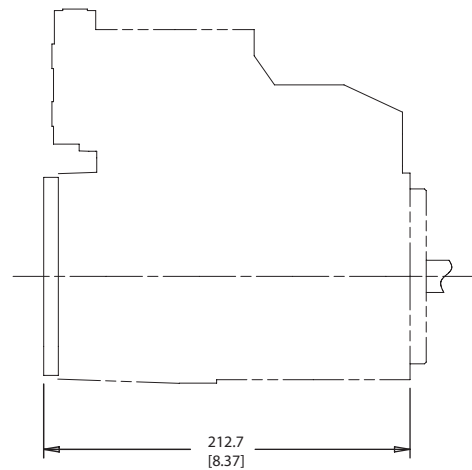
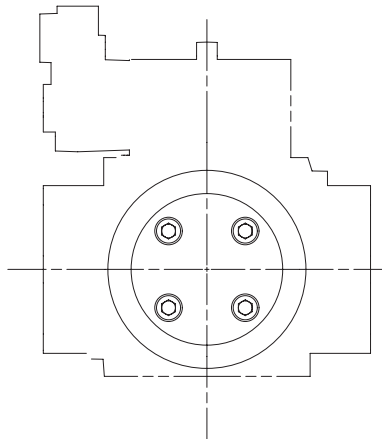


P106 644E

**SAE-A Auxilliary Pad**

**Special SAE-A 11 tooth**

**Running cover  
 Dimensions**



P106 077E

**DISPLACEMENT LIMITER**

L and K Frame open circuit pumps are available with an optional adjustable displacement limiter. This adjustable stop limits the pump's maximum displacement.

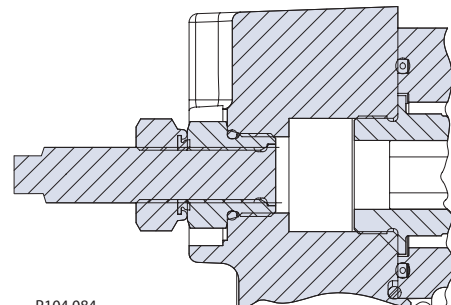
*Setting range*

<b>L25C</b>	0 to 25 cm <sup>3</sup> [0 to 1.53 in <sup>3</sup> ]
<b>L30D</b>	0 to 30 cm <sup>3</sup> [0 to 1.83 in <sup>3</sup> ]
<b>K38C</b>	0 to 38 cm <sup>3</sup> [0 to 2.32 in <sup>3</sup> ]
<b>K45D</b>	0 to 45 cm <sup>3</sup> [0 to 2.75 in <sup>3</sup> ]

*Displacement per turn*

<b>L25C</b>	1.20 cm <sup>3</sup> /rev [0.07 in <sup>3</sup> /rev]
<b>L30D</b>	1.43 cm <sup>3</sup> /rev [0.09 in <sup>3</sup> /rev]
<b>K38C</b>	1.81 cm <sup>3</sup> /rev [0.11 in <sup>3</sup> /rev]
<b>K45D</b>	2.15 cm <sup>3</sup> /rev [0.13 in <sup>3</sup> /rev]

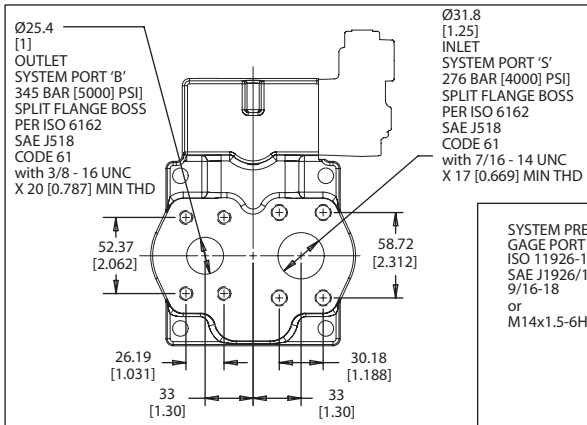
*Displacement limiter cross-section*



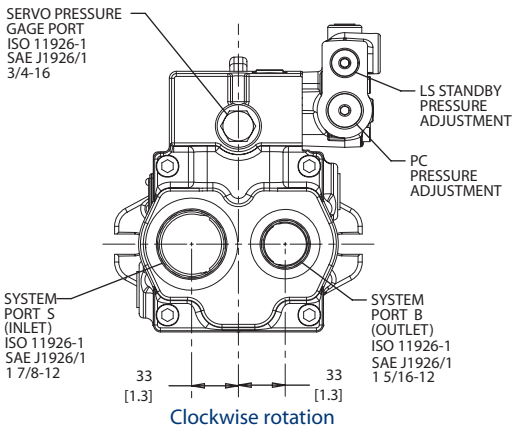
P104 084

**INSTALLATION  
 DRAWINGS**

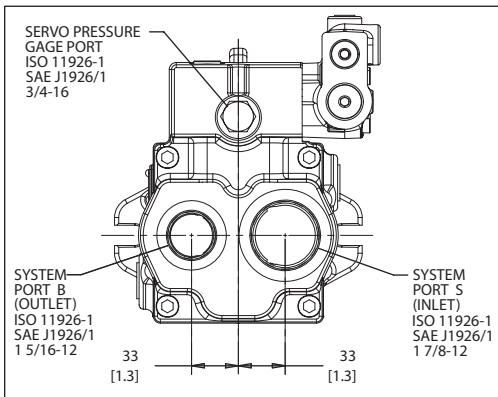
**Axial ported endcap**



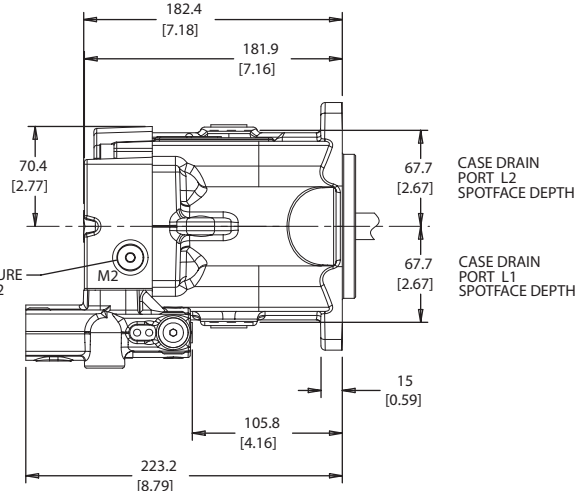
Split flange axial ports - counterclockwise rotation



Clockwise rotation

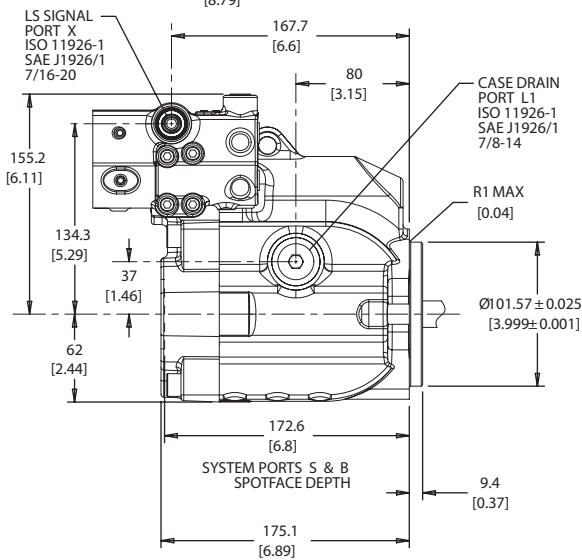


Counterclockwise rotation



CASE DRAIN PORT L2 SPOTFACE DEPTH

CASE DRAIN PORT L1 SPOTFACE DEPTH



CASE DRAIN PORT L1 ISO 11926-1 SAE J1926/1 7/8-14

R1 MAX [0.04]

$\varnothing 101.57 \pm 0.025$  [3.999 ± 0.001]

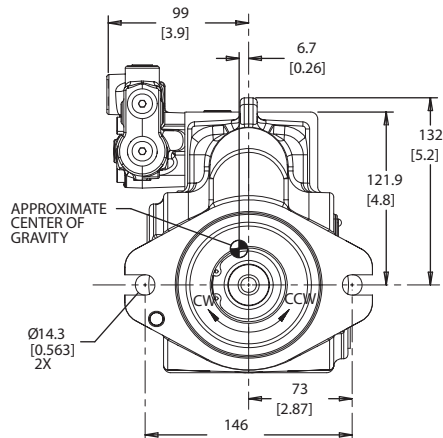
SYSTEM PORTS S & B SPOTFACE DEPTH

P106170E

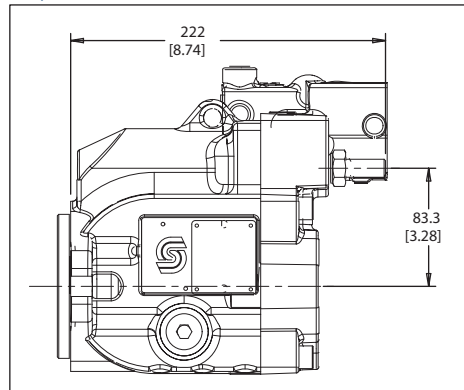
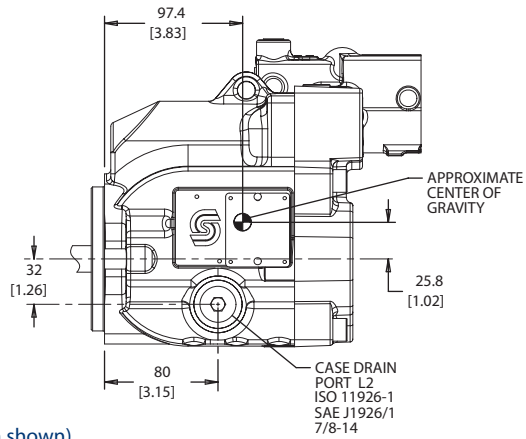


**INSTALLATION  
DRAWINGS  
(continued)**

**Axial ported endcap (continued)**

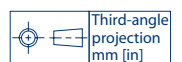


Split flange axial endcap (counterclockwise rotation shown)



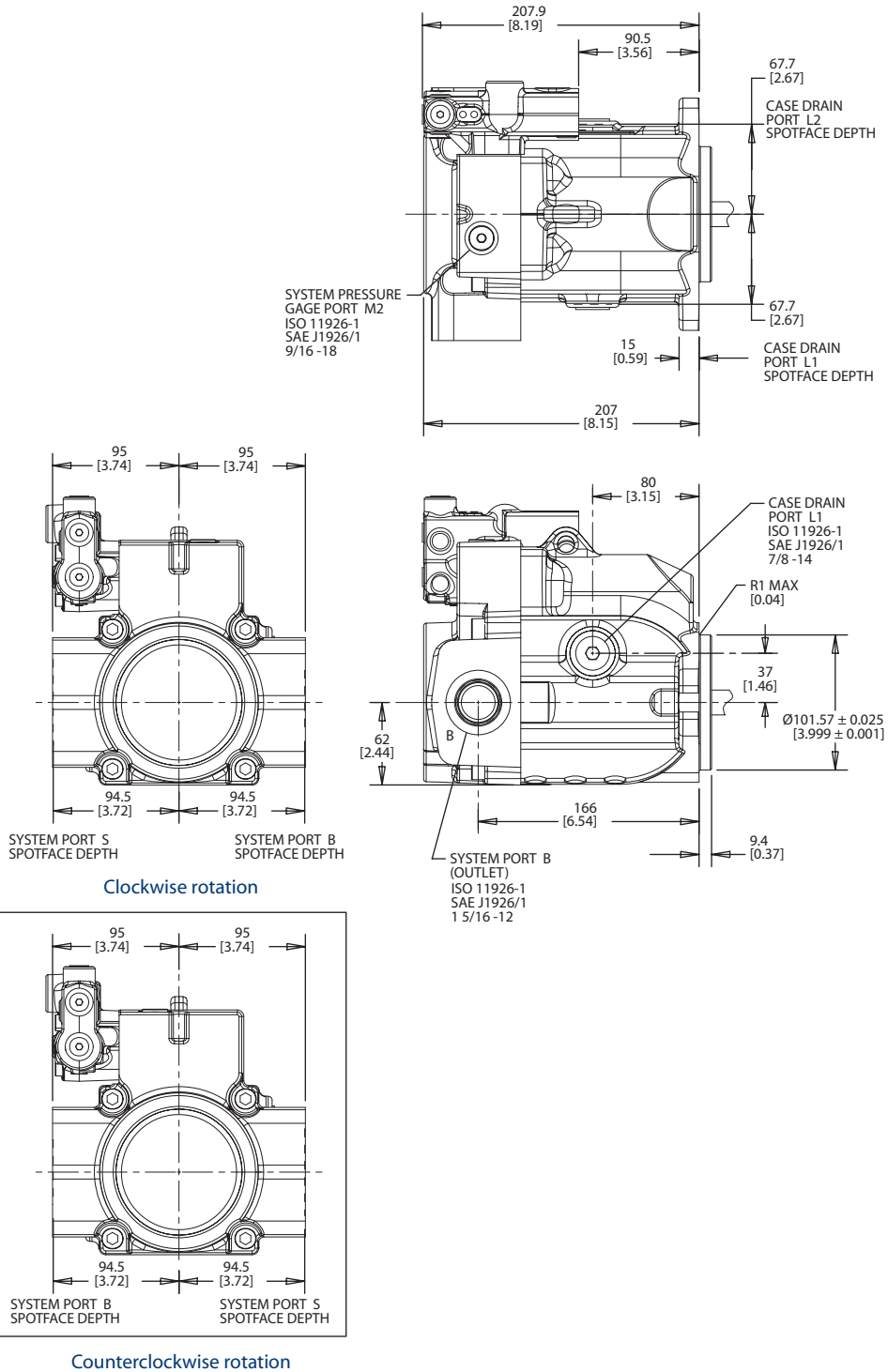
Adjustable displacement limiter

P104064E



**INSTALLATION  
DRAWINGS  
(continued)**

**Radial ported endcap**



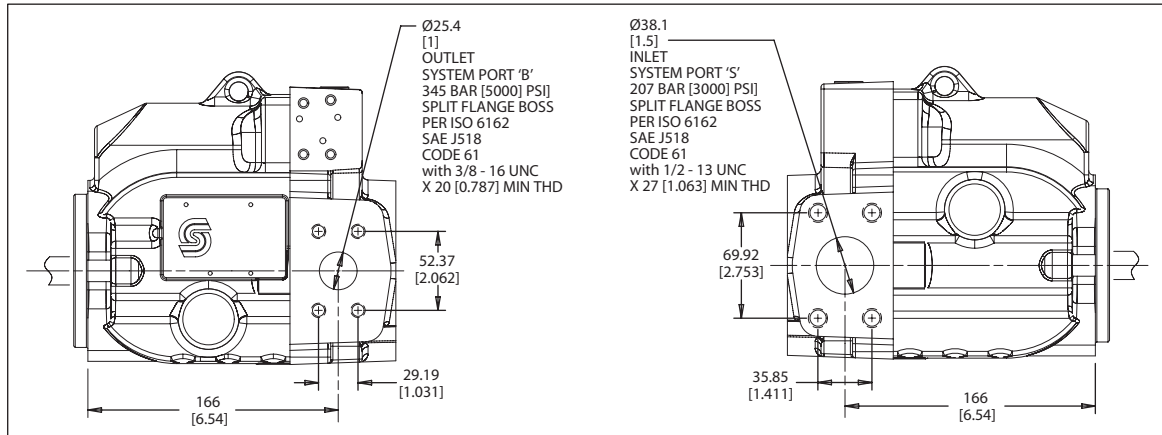
P106 171E



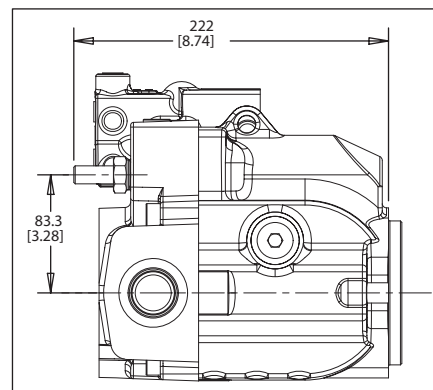
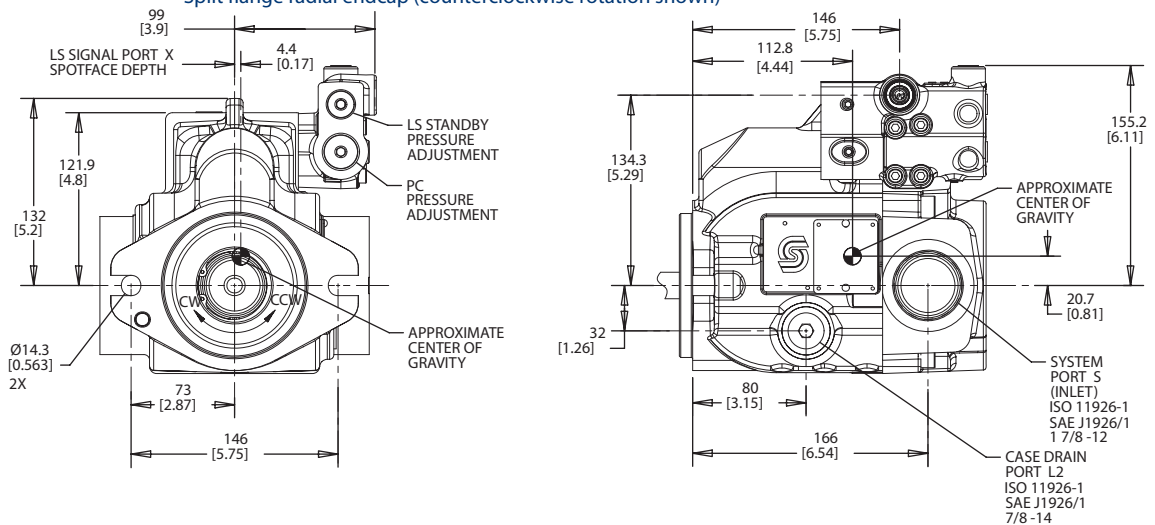


**INSTALLATION  
DRAWINGS  
(continued)**

**Radial ported endcap (continued)**



**Split flange radial endcap (counterclockwise rotation shown)**



P104 065E

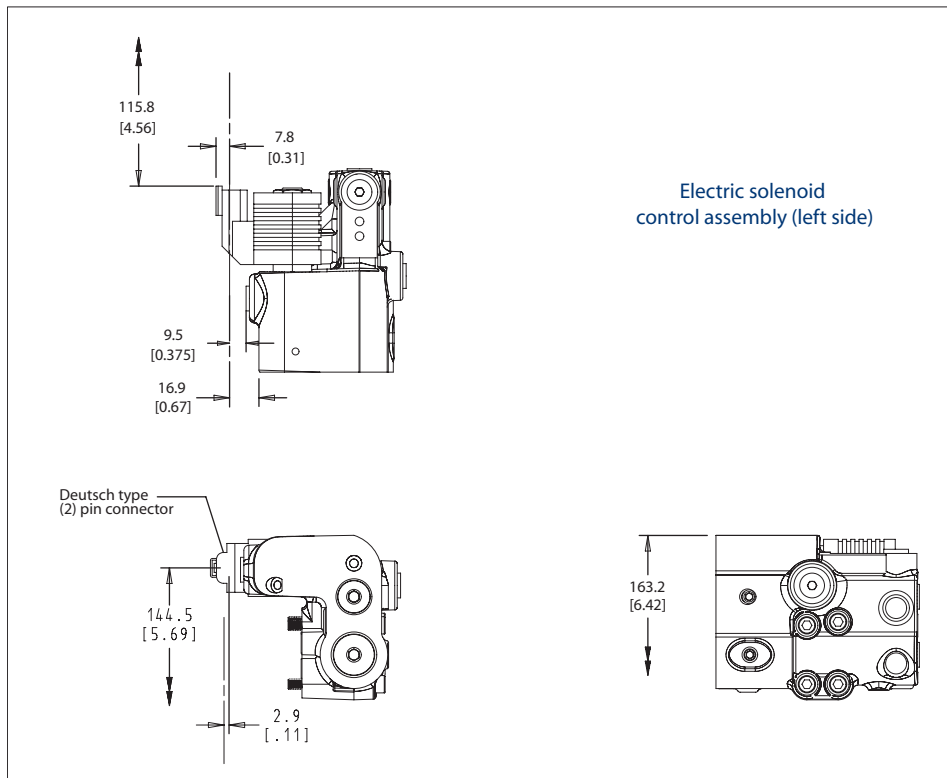
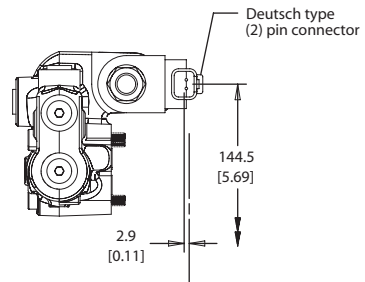
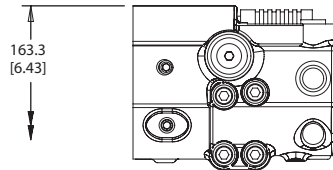
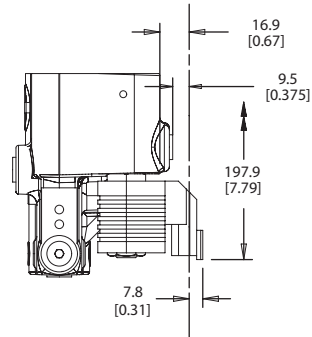
Adjustable displacement limiter



**INSTALLATION  
DRAWINGS  
(continued)**

**Electric on/off control**

Electric solenoid  
control assembly (right side)



Electric solenoid  
control assembly (left side)

P106 190E

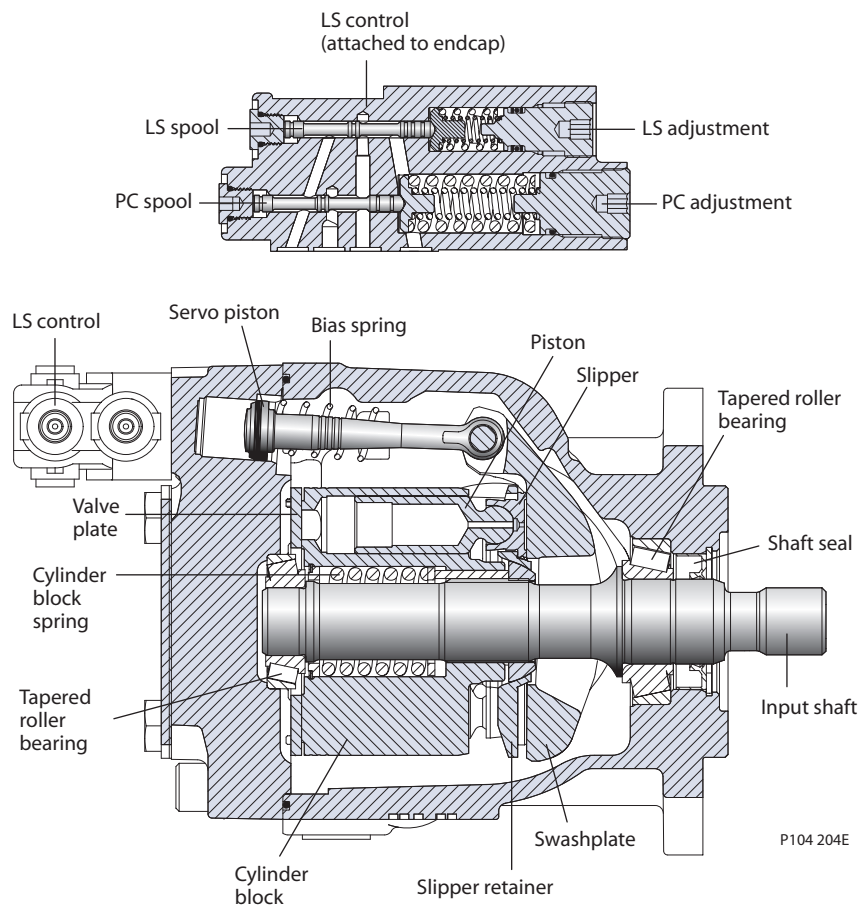


**DESIGN**

Series 45 Frame J pumps have a single servo piston design with a cradle-type swashplate set in polymer-coated journal bearings. A bias spring and internal forces increase swashplate angle. The servo piston decreases swashplate angle. Nine reciprocating pistons displace fluid from the pump inlet to the pump outlet as the cylinder block rotates on the pump input shaft. The block spring holds the piston slippers to the swashplate via the slipper retainer. The cylinder block rides on a bi-metal valve plate optimized for high volumetric efficiency and low noise. Tapered roller bearings support the input shaft and a viton lip-seal protects against shaft leaks.

An adjustable one spool (PC only, not shown) or two spool (LS and PC) control senses system pressure and load pressure (LS controls). The control ports system pressure to the servo piston to control pump output flow.

*Frame J cross section*



### SPECIFICATIONS

For general operating parameters, including fluid viscosity, temperature, and inlet and case pressures, [see page 13](#). For system design parameters, including installation, filtration, reservoir, and line velocities, [see page 15](#).

Features and options		Model				
		J45B	J51B	J60B	J65C	J75C
Feature	Unit					
Maximum Displacement	cm <sup>3</sup> [in <sup>3</sup> ]	45 [2.75]	51 [3.11]	60 [3.66]	65 [3.97]	75 [4.58]
Flow at rated speed (theoretical)	l/min [US gal/min]	126.0 [33.3]	137.7 [36.4]	156.0 [41.2]	162.6 [42.9]	180.0 [47.5]
Input torque at maximum displacement (theoretical)	N•m/bar [lbf•in/1000 psi]	0.716 [436.9]	0.811 [495.1]	0.956 [583.6]	1.035 [631.4]	1.193 [728.1]
Mass moment of inertia of internal rotating components	kg•m <sup>2</sup> [slug•ft <sup>2</sup> ]	0.00455 [0.00336]	0.00455 [0.00336]	0.00455 [0.00336]	0.00433 [0.00319]	0.00433 [0.00319]
Weight	Axial ports	23.13 [51]				
	Radial ports					
		26.65 [58.8]				
Rotation	Clockwise, Counterclockwise					
Mounting	2 bolt SAE-B and SAE-C, 4 bolt SAE-C					
Auxiliary mounting ( <a href="#">See page 58</a> )	SAE-A, SAE-B, SAE-BB, SAE-C					
System ports (type)	SAE O-ring boss. 4-bolt split flange					
System ports (location)	Axial, Radial					
Control types ( <a href="#">See page 52</a> )	AG, AF, PC, Remote PC, LS, LS with internal bleed					
Shafts ( <a href="#">See page 55</a> )	Splined	13 tooth, 14 tooth, 15 tooth				
	Tapered	Ø 31.75 mm [1.25 in], 1:8 taper				
	Straight	Ø 31.75 mm [1.25 in]				
Displacement limiters	Optional, adjustable					

For definitions of pressure and speed ratings, [see page 14](#). For more information on external shaft loads, [see page 16](#); mounting flange loads, [see page 17](#).

Ratings			Model				
			J45B	J51B	J60B	J65C	J75C
Input speed <sup>1</sup>	minimum	min <sup>-1</sup> (rpm)	500	500	500	500	500
	continuous		2800	2700	2600	2500	2400
	maximum		3360	3240	3120	3000	2880
Working pressure	continuous	bar [psi]	310 [4495]	310 [4495]	310 [4495]	260 [3770]	260 [3770]
	maximum		400 [5800]	400 [5800]	400 [5800]	350 [5075]	350 [5075]
External shaft loads	External moment (M <sub>e</sub> )	N•m [lbf•in]	226 [2000]	226 [2000]	226 [2000]	226 [2000]	226 [2000]
	Thrust in (T <sub>in</sub> ), out (T <sub>out</sub> )	N [lbf]	2200 [495]	2200 [495]	2200 [495]	2200 [495]	2200 [495]
Bearing life	at 140 bar [2030 psi]	B <sub>10</sub> hours	29 712	29 712	29 712	10 755	10 755
	at 210 bar [3045 psi]		6834	6834	6834	2474	2474
	at 260 bar [3770 psi]		3151	3151	3151	—	—
	at 310 bar [4495 psi]		1666	1666	1666	—	—
Mounting flange load moments	Vibratory (continuous)	N•m [lbf•in]	SAE-C: 1500 [14 000], SAE-B: 735 [6500]				
	Shock (max)		SAE-C: 5600 [50 000], SAE-B: 2600 [23 000]				

1. Continuous input speeds are valid at 1 bar absolute [0 in Hg vac] inlet pressure. Maximum input speeds require changing the inlet pressure or reducing pump displacement. See [Inlet pressure vs. speed](#) charts.

### Sound levels<sup>2</sup>

For more information on noise levels, [see page 19](#).

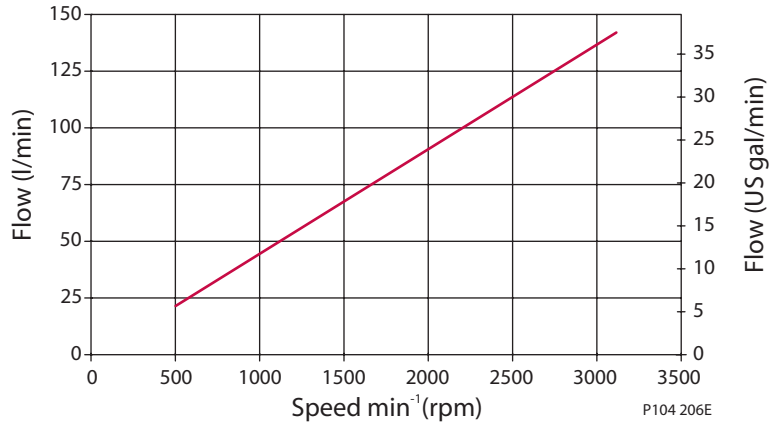
dB(A)	210 bar [3045 psi]		260 bar [3770 psi]		310 bar [4495 psi]	
	Model	1800 min <sup>-1</sup> (rpm)	Rated speed	1800 min <sup>-1</sup> (rpm)	Rated speed	1800 min <sup>-1</sup> (rpm)
J45B	75	79	77	80	76	80
J51B	75	79	77	78	77	78
J60B	75	79	77	79	76	79
J65C	75	78	77	77	—	—
J75C	77	78	77	77	—	—

2. Sound data was collected in a *semi-anechoic* chamber. Values have been adjusted (-3 dB) to reflect *anechoic* levels.

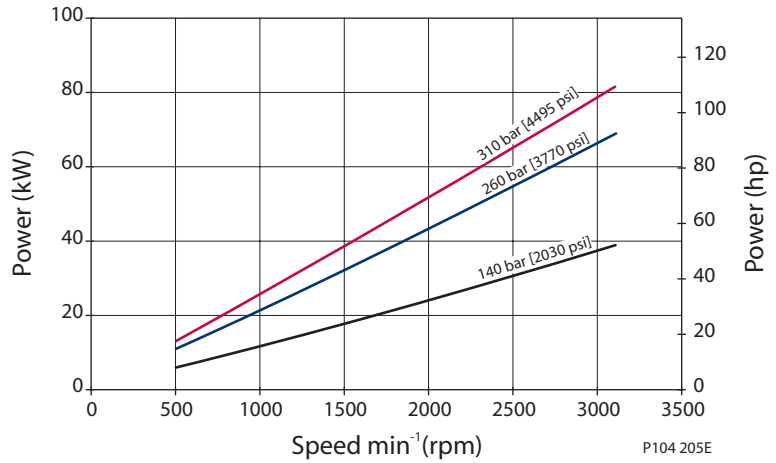
**PERFORMANCE**  
**J45B**

Flow and power data valid at 49°C [120°F] and viscosity of 17.8 mm<sup>2</sup>/sec [88 SUS].

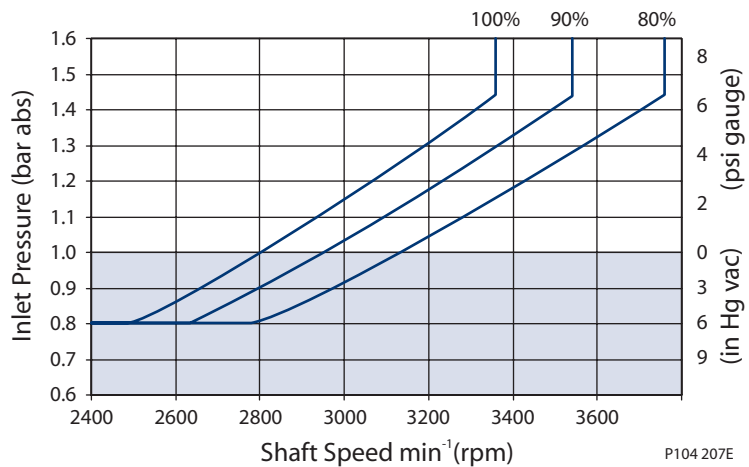
*Flow vs. speed*



*Input power vs. speed*



*Inlet pressure vs. speed*

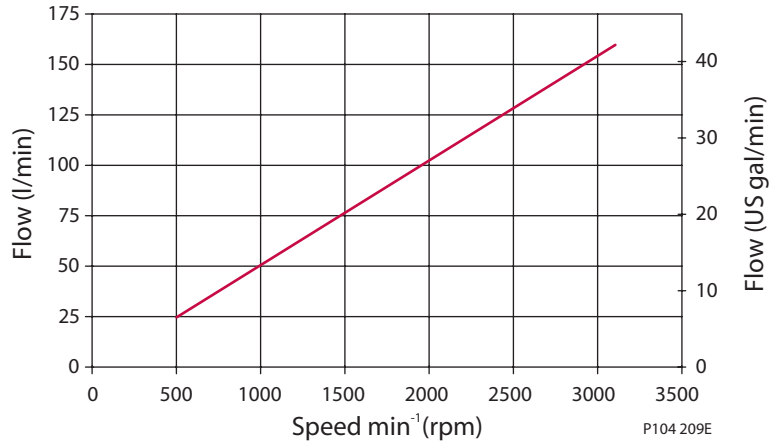


The chart on the right shows allowable inlet pressure and speed at various displacements. Greater speeds and lower inlet pressures are possible at reduced displacement. Operating outside of acceptable limits reduces pump life.

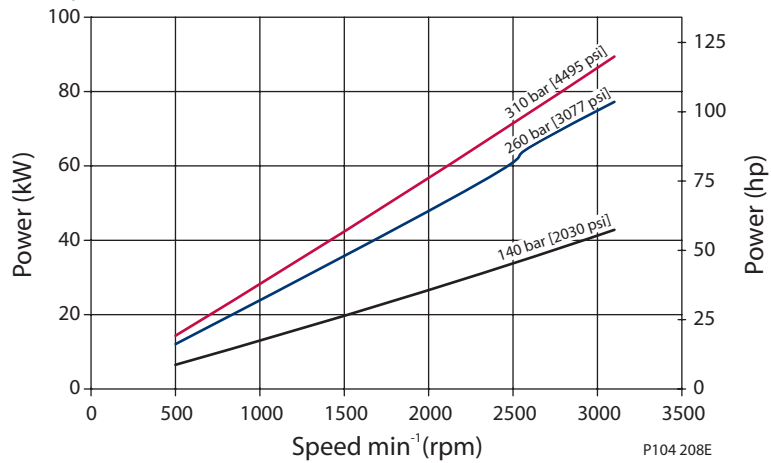
**PERFORMANCE**  
**J51B**

Flow and power data valid at 49°C [120°F] and viscosity of 17.8 mm<sup>2</sup>/sec [88 SUS].

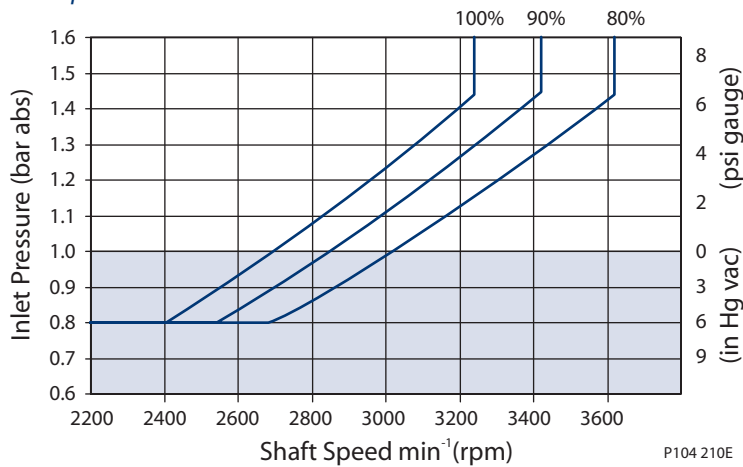
*Flow vs. speed*



*Input power vs. speed*



*Inlet pressure vs. speed*

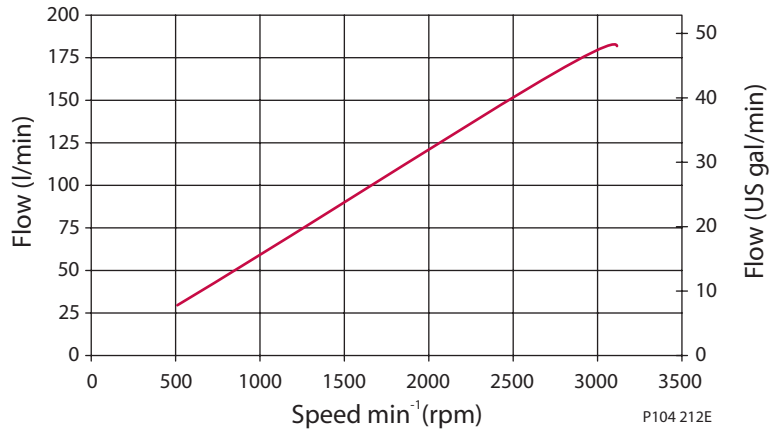


The chart on the right shows allowable inlet pressure and speed at various displacements. Greater speeds and lower inlet pressures are possible at reduced displacement. Operating outside of acceptable limits reduces pump life.

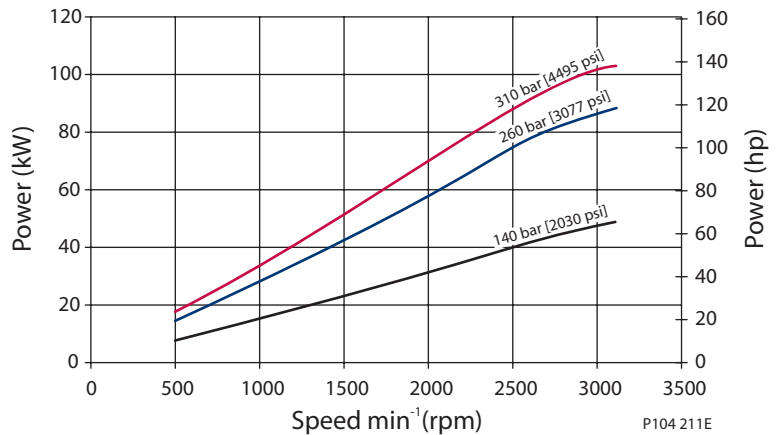
**PERFORMANCE**  
**J60B**

Flow and power data valid at 49°C [120°F] and viscosity of 17.8 mm<sup>2</sup>/sec [88 SUS].

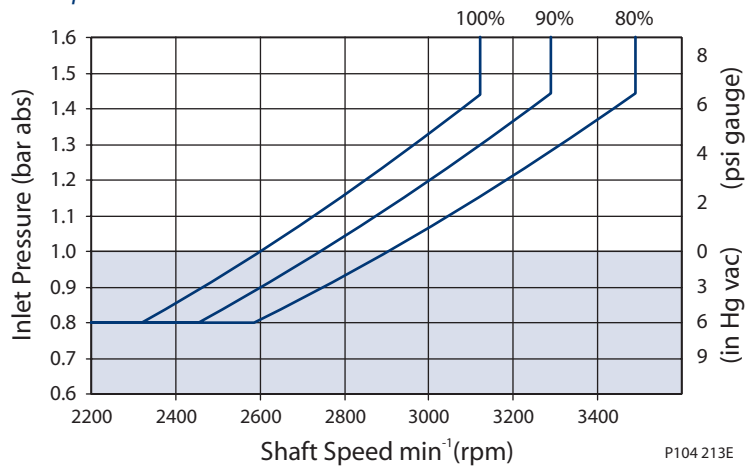
*Flow vs. speed*



*Input power vs. speed*



*Inlet pressure vs. speed*

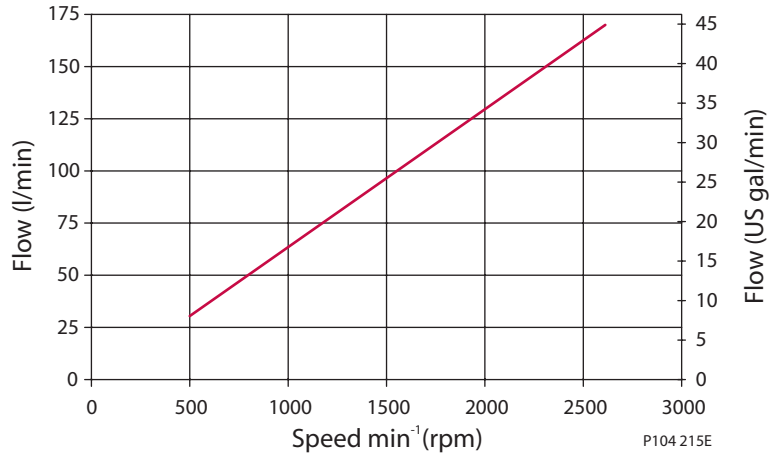


The chart on the right shows allowable inlet pressure and speed at various displacements. Greater speeds and lower inlet pressures are possible at reduced displacement. Operating outside of acceptable limits reduces pump life.

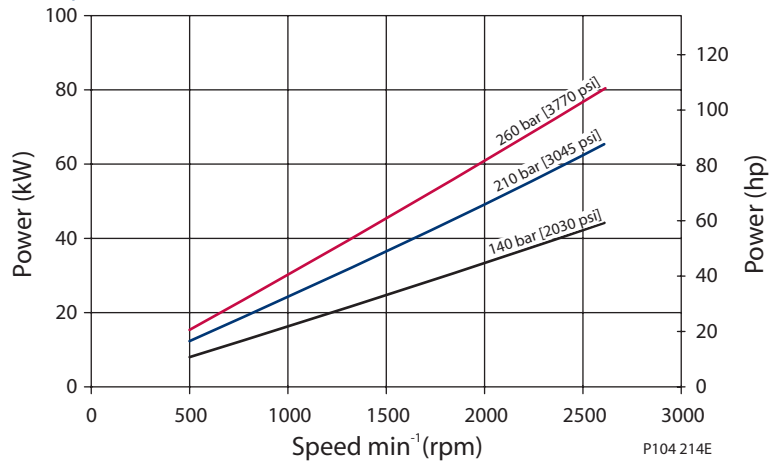
**PERFORMANCE**  
**J65C**

Flow and power data valid at 49°C [120°F] and viscosity of 17.8 mm<sup>2</sup>/sec [88 SUS].

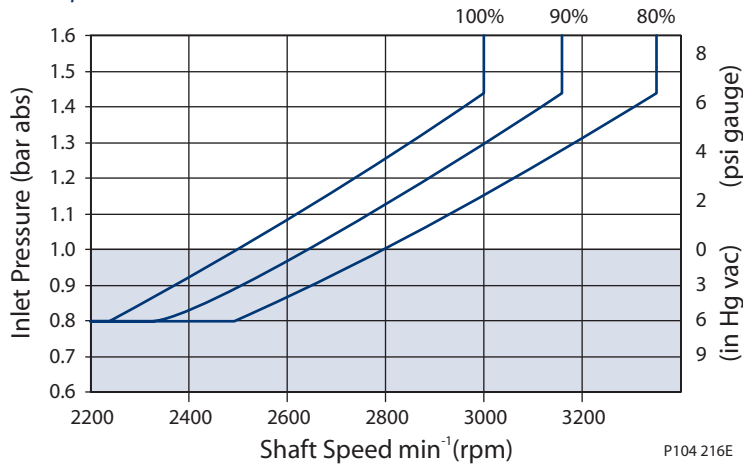
*Flow vs. speed*



*Input power vs. speed*



*Inlet pressure vs. speed*



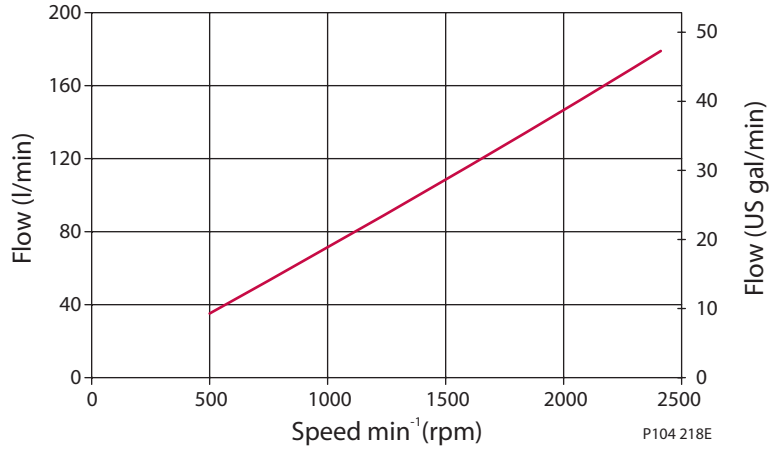
The chart on the right shows allowable inlet pressure and speed at various displacements. Greater speeds and lower inlet pressures are possible at reduced displacement. Operating outside of acceptable limits reduces pump life.



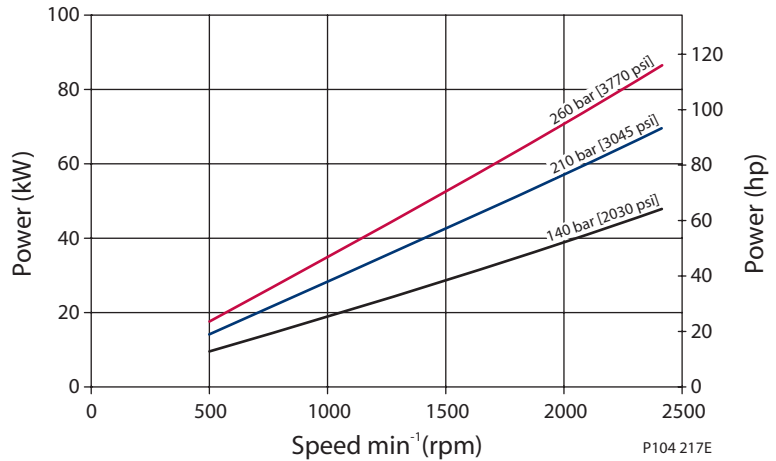
**PERFORMANCE**  
**J75C**

Flow and power data valid at 49°C [120°F] and viscosity of 17.8 mm<sup>2</sup>/sec [88 SUS].

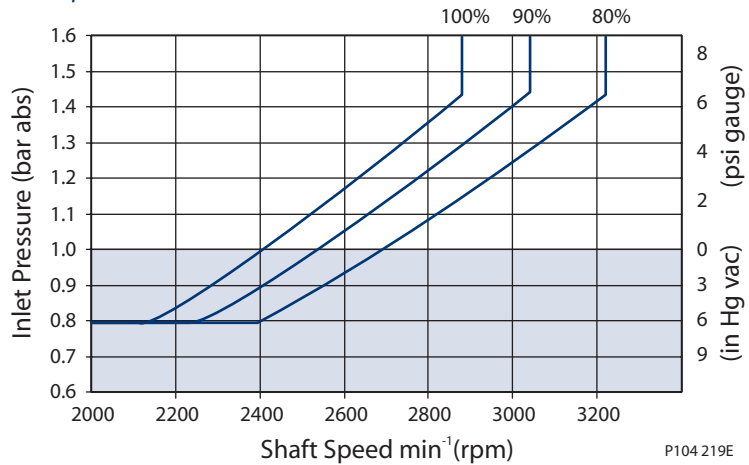
*Flow vs. speed*



*Input power vs. speed*



*Inlet pressure vs. speed*



The chart on the right shows allowable inlet pressure and speed at various displacements. Greater speeds and lower inlet pressures are possible at reduced displacement. Operating outside of acceptable limits reduces pump life.

ORDER CODE



**R Product**

<b>JR</b>	J Frame, variable displacement open circuit pump
-----------	--

**S Rotation**

<b>L</b>	Left hand (counterclockwise)
<b>R</b>	Right hand (clockwise)

**P Displacement and pressure rating**

<b>045B</b>	045 cm <sup>3</sup> /rev [2.75 in <sup>3</sup> /rev], 310 bar [4495 psi] continuous working pressure
<b>051B</b>	051 cm <sup>3</sup> /rev [3.11 in <sup>3</sup> /rev], 310 bar [4495 psi] continuous working pressure
<b>060B</b>	060 cm <sup>3</sup> /rev [3.66 in <sup>3</sup> /rev], 310 bar [4495 psi] continuous working pressure
<b>065C</b>	065 cm <sup>3</sup> /rev [3.97 in <sup>3</sup> /rev], 260 bar [3077 psi] continuous working pressure
<b>075C</b>	075 cm <sup>3</sup> /rev [4.58 in <sup>3</sup> /rev], 260 bar [3077 psi] continuous working pressure

**C Control type**

<b>PC</b>	Pressure compensated control 100-280 bar [1450-4060 psi]
<b>BC*</b>	Pressure compensated control 290-310 bar [4205-4495 psi]
<b>RP</b>	Remote pressure compensated control 100-280 bar [1450-4060 psi]
<b>BP*</b>	Remote pressure compensated control 290-310 bar [4205-4495 psi]
<b>LS</b>	Load sensing / pressure compensating control 100-280 bar [1450-4060 psi]
<b>BS*</b>	Load sensing / pressure compensating control 290-310 bar [4205-4495 psi]
<b>LB</b>	Load sensing / pressure compensating control with internal bleed orifice 100-280 bar [1450-4060 psi]
<b>BB*</b>	Load sensing / pressure compensating control with internal bleed orifice 290-310 bar [4205-4495 psi]
<b>AG</b>	Pressure compensated control with electric on/off solenoid operated 2-way valve (normally closed)
<b>AF</b>	Pressure compensated control with electric on/off solenoid operated 2-way valve (normally open)

\* Use only with 45, 51, and 60 cm<sup>3</sup> displacements.

**D PC setting (2 digit code, 10 bar increments)**

<b>Example</b>	10 = 100 bar
<b>10-26</b>	100 to 260 bar [1450 to 3770 psi] (065C and 075C)
<b>10-31</b>	100 to 310 bar [1450 to 4495 psi] (045B, 051B and 060B)

**E Load sensing setting (2 digit code, 1 bar increments)**

<b>Example</b>	20 = 20 bar
<b>10-40</b>	10 to 40 bar [145 to 580 psi]
<b>NN</b>	Not applicable (use with PC controls)
<b>RP and BP</b>	Must be 20 bar

**F Not used**

<b>NN</b>	Not applicable
-----------	----------------

**G Pilot orifice**

<b>N</b>	None (standard)
----------	-----------------

**H Gain orifice**

<b>3</b>	Standard orifice
----------	------------------

**ORDER CODE**  
 (continued)



**J1 Input shaft**

<b>C2</b>	13 tooth, 16/32 pitch (ANSI A92.1 1970 - Class 5)
<b>C3</b>	15 tooth, 16/32 pitch (ANSI A92.1 1970 - Class 5)
<b>S1</b>	14 tooth, 12/24 pitch (ANSI A92.1 1970 - Class 5)
<b>K4</b>	Ø 31.75 mm [1.25 in] straight key
<b>TO</b>	Ø 31.75 mm [1.25 in], 1:8 taper

**J2 Auxiliary mounting flange type and coupling**

<b>N</b>	None (Use with axial ported endcap options 3 and 4 below)
<b>A</b>	SAE-A, 9-tooth output spline
<b>B</b>	SAE-B, 13-tooth output spline
<b>C</b>	SAE-C, 14-tooth output spline
<b>T</b>	SAE-A, 11-tooth output spline
<b>V</b>	SAE-BB, 15-tooth output spline
<b>R</b>	Running cover (Radial ported endcap machined for aux. pad. Pad and coupling sold separately.)
<b>G</b>	Special SAE-A, 11 tooth, rotated 90 degrees

**J3 Endcap option (system port size and location)**

Code	Port location	Port type	Inlet size	Outlet size
<b>2</b>	Radial	4-bolt split flange	50.8 mm [2.0 in]	25.4 mm [1.0 in]
<b>3</b>	Axial	O-ring boss	1 7/8 in.	1 5/16 in.
<b>4</b>	Axial	4-bolt split flange	50.8 mm [2.0 in]	25.4 mm [1.0 in]
<b>V*</b>	Radial	4-bolt split flange	50.8 mm [2.0 in]	25.4 mm [1.0 in]
<b>W**</b>	Axial	4-bolt split flange	50.8 mm [2.0 in]	25.4 mm [1.0 in]

\* must have auxiliary mounting flange or running cover

\*\* must have displacement limiter FFF

**K1 Shaft seal**

<b>A</b>	Single lip seal, viton
----------	------------------------

**K2 Mounting flange and housing port style**

<b>2</b>	SAE-C 4-bolt, SAE O-ring boss housing ports
<b>8</b>	SAE-B 2-bolt, SAE O-ring boss housing ports
<b>9</b>	SAE-C 2-bolt, SAE O-ring boss housing ports

**K3 Not used**

<b>N</b>	Not applicable
----------	----------------

**L Displacement limiter**

<b>NNN</b>	None
<b>FFF*</b>	Adjustable, factory set at maximum angle

\* can only be used with **V** and **W** endcap options

**M Special hardware**

<b>NNN</b>	None
------------	------

**N Special features**

<b>NNN</b>	None
------------	------

**CONTROLS**

*Specifications*

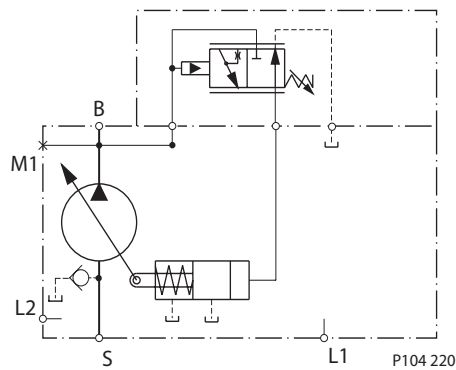
**Pressure compensated control (PC, BC)**

*PC control setting range*

Model	PC	BC
J45B, J51B, J60B	100-280 bar [1450-4060 psi]	290-310 bar [4205-4495 psi]
J65C, J75C	100-260 bar [1450-3770 bar]	N/A

*Schematic diagram*

*PC schematic*



*Response/recovery times\**

(ms)	Response	Recovery
J45B	33	140
J51B	33	150
J60B	39	170
J65B	45	140
J75B	45	150

\* For definitions, see page 9.

*Legend*

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- M1\* = System pressure gauge port
- \* M1 port is available on axially ported endcaps only

**Remote PC control (RP, BP)**

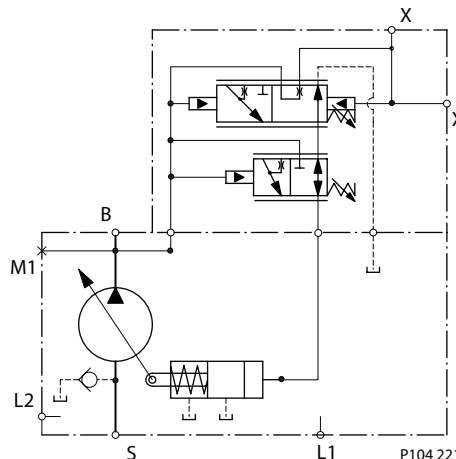
*Specifications*

*PC control setting range*

Model	RP	BP
J45B, J51B, J60B	100-280 bar [1450-4060 psi]	290-310 bar [4205-4495 psi]
J65C, J75C	100-260 bar [1450-3770 bar]	N/A

*Schematic diagram*

*Remote PC schematic*



*Response/recovery times\**

(ms)	Response	Recovery
J45B	33	140
J51B	33	150
J60B	39	170
J65B	45	140
J75B	45	150

\* For definitions, see page 10

*LS setting*

Model	bar	psi
All	20	290

*Legend*

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- X = Remote PC port
- M1\* = System pressure gauge port
- \* M1 port is available on axially ported endcaps only

Attach remote PC valve at port X. Size the external valve and plumbing for a pilot flow of 3.8 l/min [1 US gal/min].

**CONTROLS**  
 (continued)

*Specifications*

**Load sensing control (LS, BS)**

*PC control setting range*

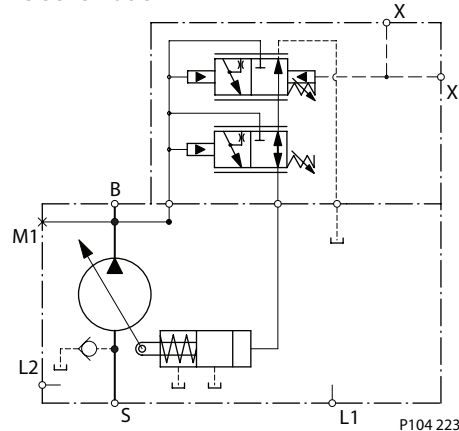
Code	LS	BS
J45B, J51B, J60B	100-280 bar [1450-4060 psi]	290-310 bar [4205-4495 psi]
J65C, J75C	100-260 bar [1450-3770 bar]	N/A

*Response/recovery times\**

(MS)	J45B	J51B	J60B	J65B	J75B
<b>Response</b>	28	30	33	43	45
<b>Recovery</b>	111	125	140	101	140

\* For definitions, see page 11.

*Schematic diagram* **LS Schematic**



*LS setting range*

Model	bar	psi
All	10-40	145-580

*Legend*

- B = Outlet
  - S = Inlet
  - L1, L2 = Case drain
  - X = LS signal port
  - M1\* = System pressure gauge port
- \* M1 port is available on axially ported endcaps only

**Load sensing control with internal bleed orifice (LB, BB)**

*Specifications*

*PC control setting range*

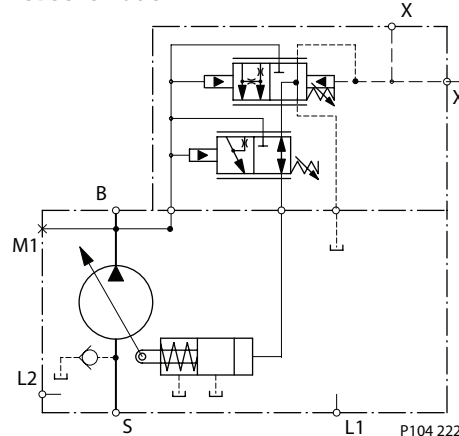
Code	LB	BB
J45B, J51B, J60B	100-280 bar [1450-4060 psi]	290-310 bar [4205-4495 psi]
J65C, J75C	100-260 bar [1450-3770 bar]	N/A

*Response/recovery times\**

(MS)	J45B	J51B	J60B	J65B	J75B
<b>Response</b>	28	30	33	43	45
<b>Recovery</b>	111	125	140	101	140

\* For definitions, see page 11.

*Schematic diagram* **LSBSchematic**



*LS setting range*

Model	bar	psi
All	10-40	145-580

*Legend*

- B = Outlet
  - S = Inlet
  - L1, L2 = Case drain
  - X = LS signal port
  - M1\* = System pressure gauge port
- \* M1 port is available on axially ported endcaps only

**CONTROLS**  
 (continued)

**Normally closed on/off electric PC control (AG)**

*Specifications* **PC control setting range**

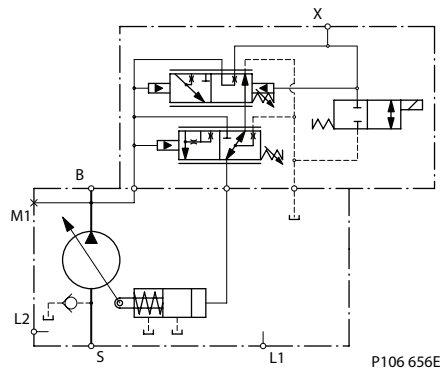
Code	AG
J45B, J51B, J60B	100-280 bar [1450-4060 psi]
J65C, J75C	100-260 bar [1450-3770 bar]

*Response/recovery times\**

(ms)	J45B	J51B	J60B	J65B	J75B
<b>Response</b>	33	33	39	45	45
<b>Recovery</b>	140	150	170	140	150

\* For definitions, see page 12.

*Schematic diagram* **AG schematic**



*LS setting range*

Model	bar	psi
<b>All</b>	10-40	145-580

*Legend*

- B = Outlet
  - S = Inlet
  - L1, L2 = Case drain
  - X = Remote PC port
  - M1\* = System pressure gauge port
- \* M1 port is available on axially ported endcaps only

**Normally open on/off electric PC control (AF)**

*Specifications* **AF control setting range**

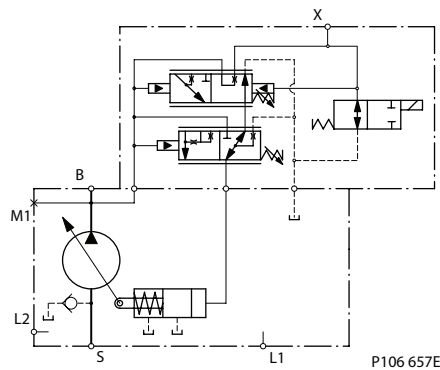
Code	AF
J45B, J51B, J60B	100-280 bar [1450-4060 psi]
J65C, J75C	100-260 bar [1450-3770 bar]

*Response/recovery times\**

(ms)	J45B	J51B	J60B	J65B	J75B
<b>Response</b>	33	33	39	45	45
<b>Recovery</b>	140	150	170	140	150

\* For definitions, see page 12.

*Schematic diagram* **AF schematic**



*LS setting range*

Model	bar	psi
<b>All</b>	10-40	145-580

*Legend*

- B = Outlet
  - S = Inlet
  - L1, L2 = Case drain
  - X = Remote PC port
  - M1\* = System pressure gauge port
- \* M1 port is available on axially ported endcaps only

Evaluate your system to decide if normally open or normally closed control override is required for failsafe operation.

**INPUT SHAFTS**

Code	Description	Maximum torque rating <sup>1</sup> N•m [lbf•in]	Drawing
C2	13 tooth spline 16/32 pitch (ANSI A92.1 1970 - Class 5)  <i>For use with SAE-B</i>	288 [2546]	
C3	15 tooth spline 16/32 pitch (ANSI A92.1 1970 - Class 5)  <i>For use with SAE-B</i>	404 [3575]	

1. See *Input shaft torque ratings*, page 18 for an explanation of maximum torque.

**INPUT SHAFTS**  
**(continued)**

Code	Description	Maximum torque rating <sup>1</sup> N•m [lbf•in]	Drawing
<b>S1</b>	14 tooth spline 12/24 pitch (ANSI A92.1 1970 - Class 5)  <i>For use with SAE-C</i>	734 [6495]	<p>14 TOOTH 12/24 PITCH 30° PRESSURE ANGLE 29.634 [1.167] PITCH FILLET ROOT SIDE FIT COMPATIBLE WITH ANSI B92.1-1970 CLASS 5 ALSO MATES WITH FLAT ROOT SIDE FIT</p> <p>COUPLING MUST NOT PROTRUDE BETOND THIS POINT</p> <p>P104 226E</p>
<b>K4</b>	Ø 31.75 mm [1.25 in] straight key  <i>For use with SAE-C</i>	655 [5797]	<p>COUPLING MUST NOT PROTRUDE BETOND THIS POINT</p> <p>P104 227E</p>

1. See *Input shaft torque ratings*, page 18 for an explanation of maximum torque.



**INPUT SHAFTS**  
 (continued)

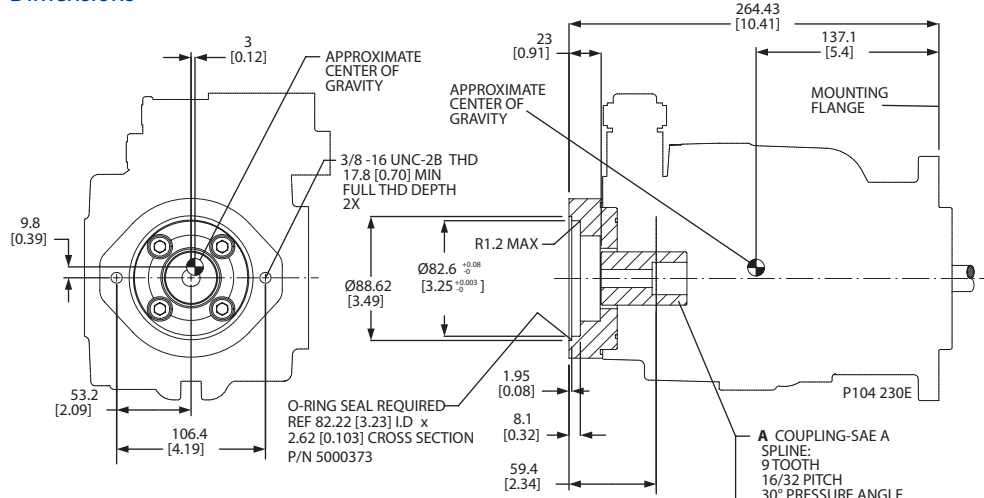
Code	Description	Maximum torque rating <sup>1</sup> N•m [lbf•in]	Drawing
TO	Ø 31.75 mm [1.25 in] 1:8 taper  <i>For use with SAE-C</i>	734 [6495]	<p> <math>42.92^{+0.8}_{-1.1}</math> [1.69]  <math>30.96 \pm 0.25</math> [1.219] ± 0.01  <math>7.887^{+0.025}_{-0}</math> [0.3105] ± 0.001            X Dia. 31.8 <math>^{+0}_{-0.010}</math> [1.25] ± 0.25            WOODRUFF KEY            1.00-20 UNF-2A THD  <math>22.4 \pm 0.3</math> [0.88 ± 0.01] GAUGE            Ø30.1625 [1.19] GAUGE            125 TAPER PER METER            COMPATIBLE WITH SAE J501            31.8 [1.25] NOMINAL SHAFT DIAMETER            COUPLING MUST NOT PROTRUDE BEYOND THIS POINT  <math>8 \pm 0.8</math> [0.31 ± 0.03]            P104 228E         </p>

1. See *Input shaft torque ratings*, page 18 for an explanation of maximum torque.

**AUXILIARY MOUNTING PADS**

See page 18 for mating pump pilot and spline dimensions.

**SAE-A auxiliary mounting pad (non-integral)**  
 Dimensions



*Specifications*

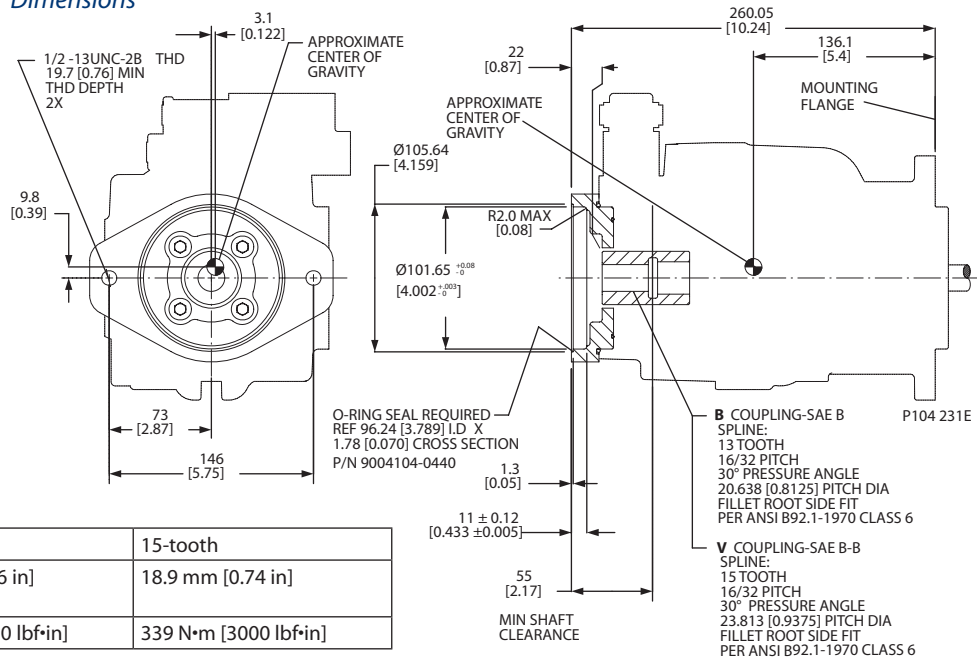
Coupling	9-tooth	11-tooth
Spline minimum engagement	13.5 mm [0.53 in]	15 mm [0.59 in]
Maximum torque	107 N·m [950 lbf·in]	147 N·m [1300 lbf·in]

**A COUPLING-SAE A**  
 SPLINE:  
 9 TOOTH  
 16/32 PITCH  
 30° PRESSURE ANGLE  
 14.288 [0.5625] PITCH DIA  
 FILLET ROOT SIDE FIT  
 PER ANSI B92.1-1970 CLASS 6

**T COUPLING-SAE A**  
 SPLINE:  
 11 TOOTH  
 16/32 PITCH  
 30° PRESSURE ANGLE  
 17.463 [0.6875] PITCH DIA  
 FILLET ROOT SIDE FIT  
 PER ANSI B92.1-1970 CLASS 6

**SAE-B auxiliary mounting pad**  
 Dimensions

See page 18 for mating pump pilot and spline dimensions.



*Specifications*

Coupling	13-tooth	15-tooth
Spline minimum engagement	14.2 mm [0.56 in]	18.9 mm [0.74 in]
Maximum torque	249 N·m [2200 lbf·in]	339 N·m [3000 lbf·in]

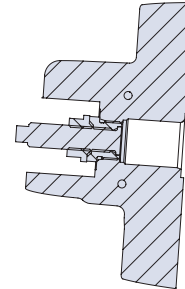
**B COUPLING-SAE B**  
 SPLINE:  
 13 TOOTH  
 16/32 PITCH  
 30° PRESSURE ANGLE  
 20.638 [0.8125] PITCH DIA  
 FILLET ROOT SIDE FIT  
 PER ANSI B92.1-1970 CLASS 6

**V COUPLING-SAE B-B**  
 SPLINE:  
 15 TOOTH  
 16/32 PITCH  
 30° PRESSURE ANGLE  
 23.813 [0.9375] PITCH DIA  
 FILLET ROOT SIDE FIT  
 PER ANSI B92.1-1970 CLASS 6

**DISPLACEMENT LIMITER**

J Frame open circuit pumps are available with an optional adjustable displacement limiter. This adjustable stop limits the pump's maximum displacement.

*Displacement limiter cross-section*



P106 727E

*Setting range*

<b>J45B</b>	8.4 to 45 cm <sup>3</sup> [0.51 to 2.75 in <sup>3</sup> ]
<b>J51B</b>	13.7 to 51 cm <sup>3</sup> [0.84 to 3.11 in <sup>3</sup> ]
<b>J60B</b>	16.8 to 60 cm <sup>3</sup> [1.03 to 3.66 in <sup>3</sup> ]
<b>J65B</b>	25.4 to 65 cm <sup>3</sup> [1.55 to 3.97 in <sup>3</sup> ]
<b>J75B</b>	28.4 to 75 cm <sup>3</sup> [1.73 to 4.58 in <sup>3</sup> ]

*Displacement per turn*

<b>J45B</b>	6.2 cm <sup>3</sup> /rev [0.38 in <sup>3</sup> /rev]
<b>J51B</b>	6.2 cm <sup>3</sup> /rev [0.38 in <sup>3</sup> /rev]
<b>J60B</b>	6.2 cm <sup>3</sup> /rev [0.38 in <sup>3</sup> /rev]
<b>J65B</b>	7.2 cm <sup>3</sup> /rev [0.44 in <sup>3</sup> /rev]
<b>J75B</b>	7.2 cm <sup>3</sup> /rev [0.44 in <sup>3</sup> /rev]

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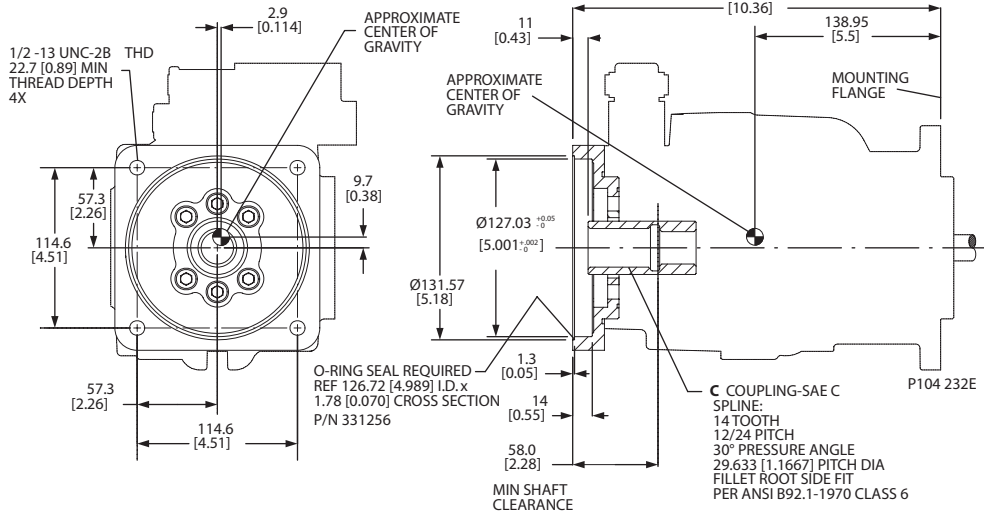
Displacement limiters are only available for endcap options V and W.

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**AUXILIARY MOUNTING PADS (continued)**

See page 18 for mating pump pilot and spline dimensions.

**SAE-C auxiliary mounting pad**  
 Dimensions

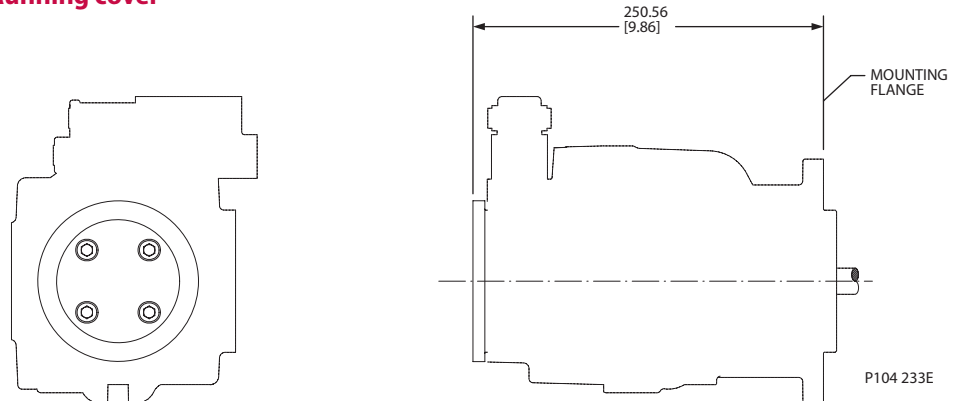


*Specifications*

<b>Coupling</b>	14-tooth
<b>Spline minimum engagement</b>	18.3 mm [0.72 in]
<b>Maximum torque</b>	339 N·m [3000 lbf·in]

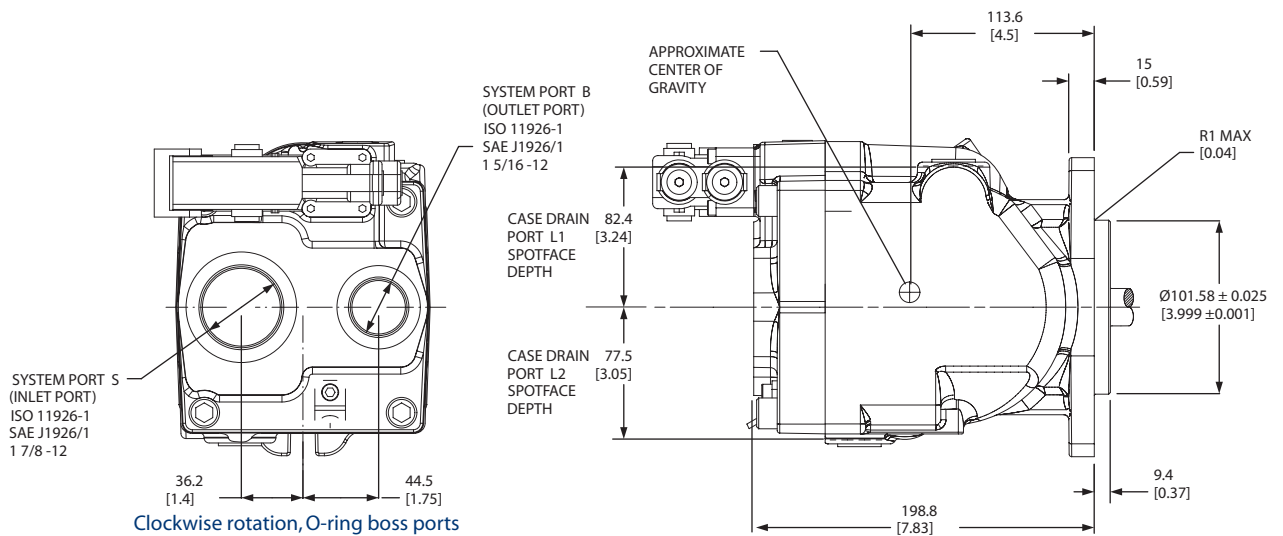
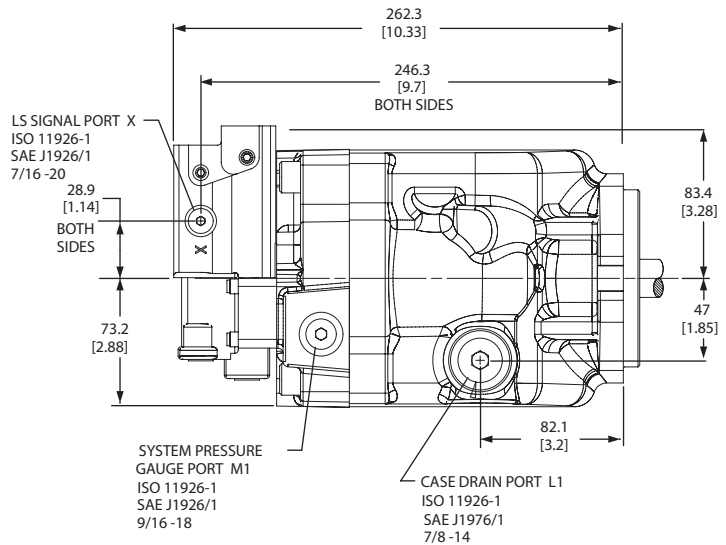
**Running cover**

Endcap and shaft machined to accommodate auxiliary mounting pads; pad and coupling not included. Conversion kits are available for installation in the field.

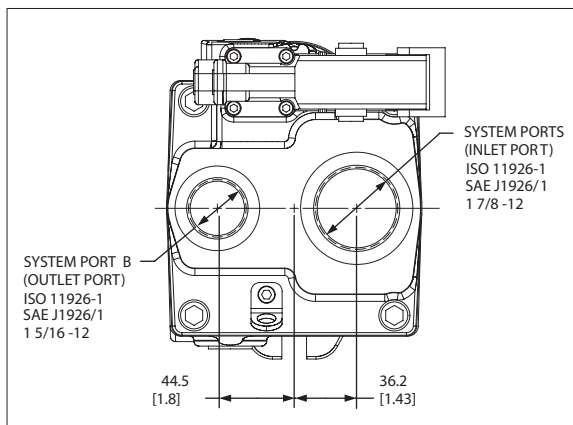


**INSTALLATION  
DRAWINGS**

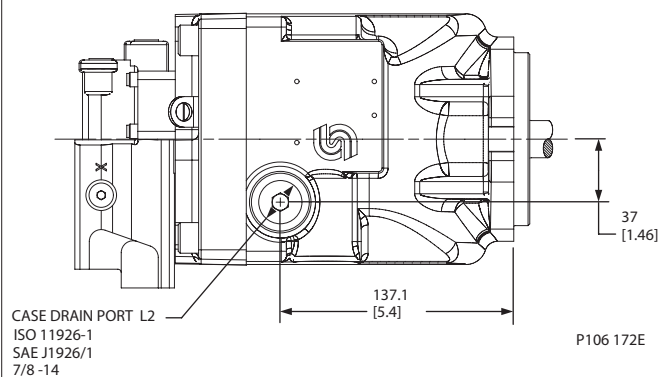
**Axial ported endcap**



Clockwise rotation, O-ring boss ports



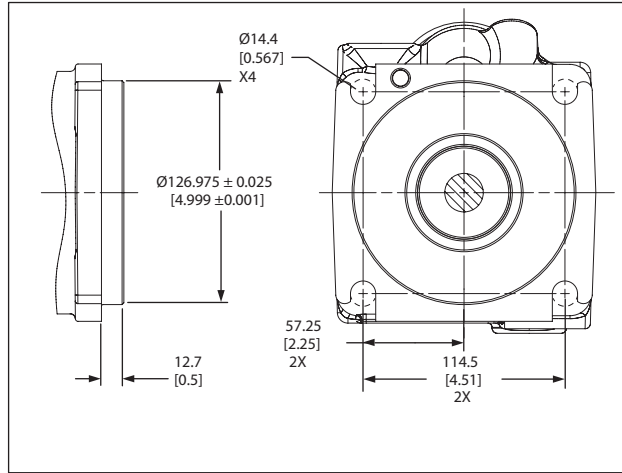
Counterclockwise rotation, O-ring boss ports



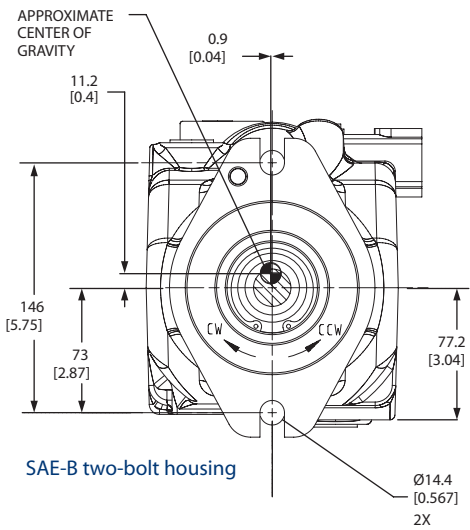
**INSTALLATION  
DRAWINGS  
(continued)**

**Axial ported endcap (continued)**

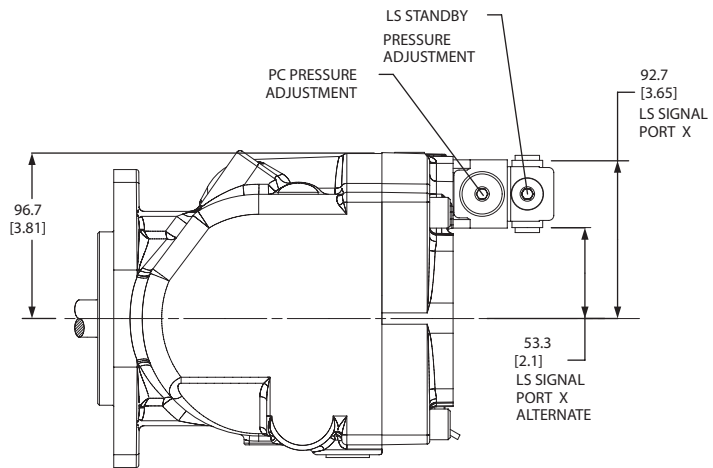
The drawings on these pages show a pump with two-bolt SAE-B and SAE-C mounting flanges. This pump is also available with a four-bolt SAE-C mounting flange. The differences are detailed in the drawing to the right. All other dimensions are common.



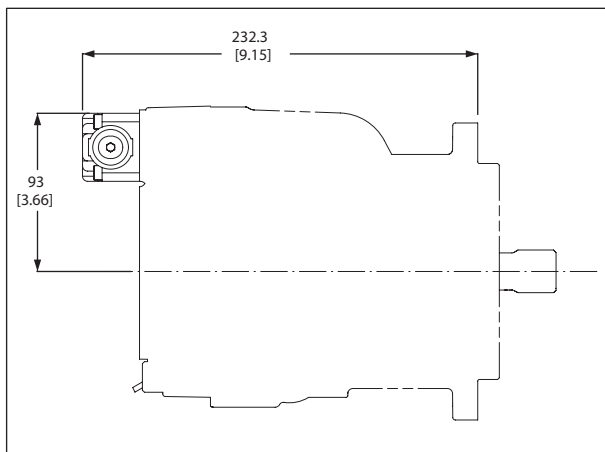
SAE-C four-bolt housing



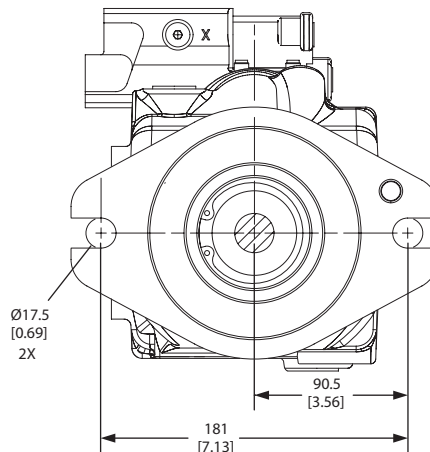
SAE-B two-bolt housing



SAE-C two-bolt housing



PC only control

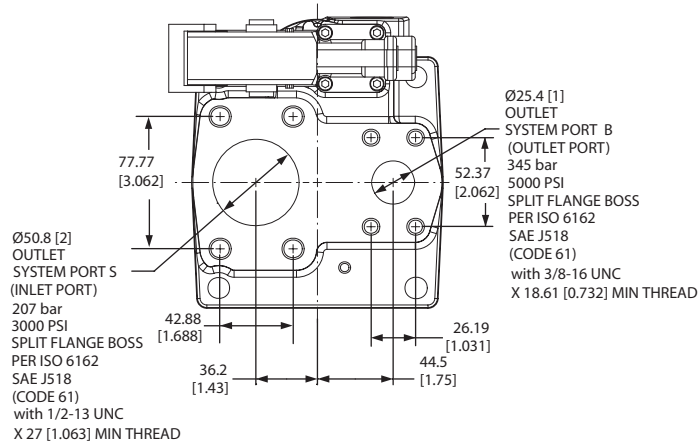


P104 234E

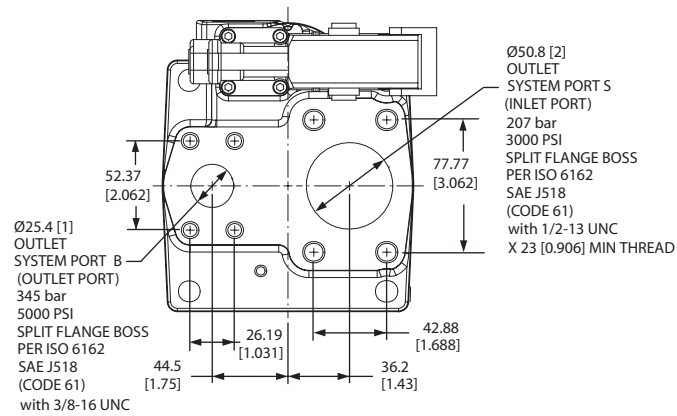


**INSTALLATION  
DRAWINGS  
(continued)**

**Axial ported endcap (continued)**



Clockwise rotation, split-flange ports

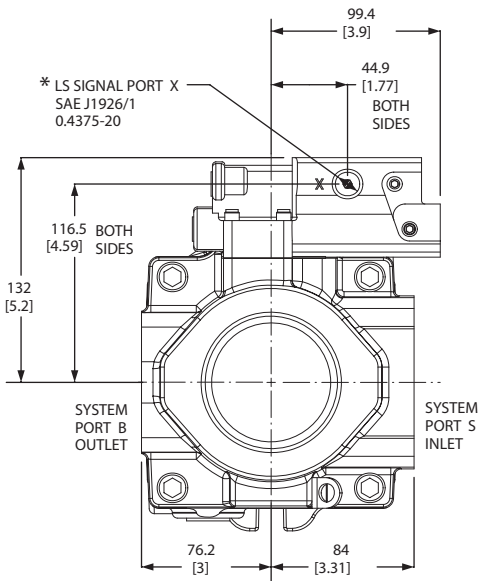


Counter clockwise rotation, split-flange ports

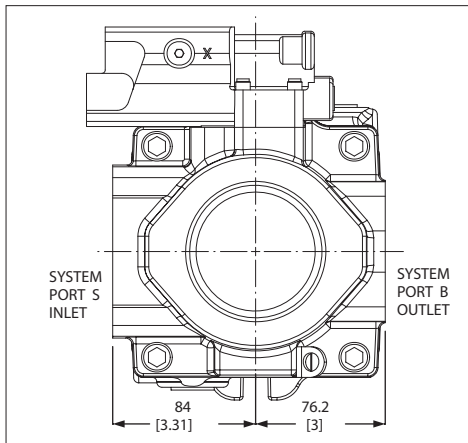
**INSTALLATION  
DRAWINGS**

**Radial ported endcap**

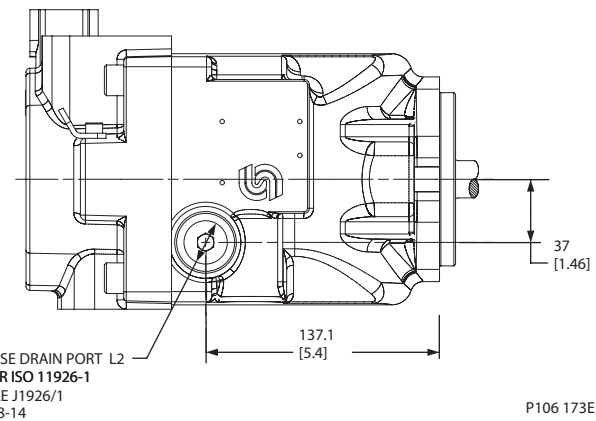
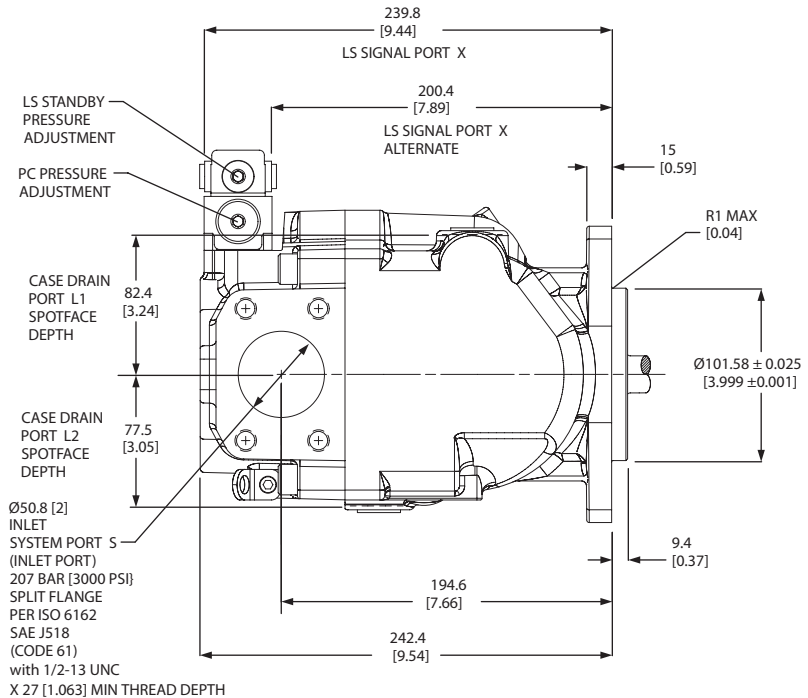
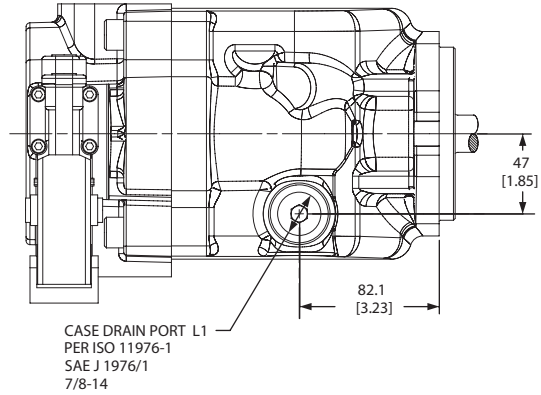
\* Interference with internal components will occur if fitting depth in port X is greater than 9.26 mm [0.365 in]



Counterclockwise rotation



Clockwise rotation



P106 173E

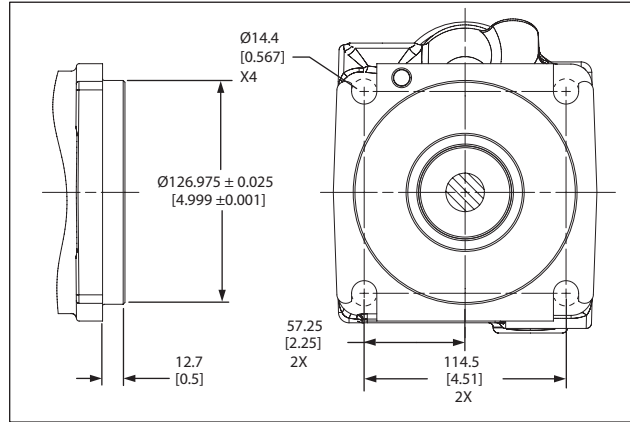




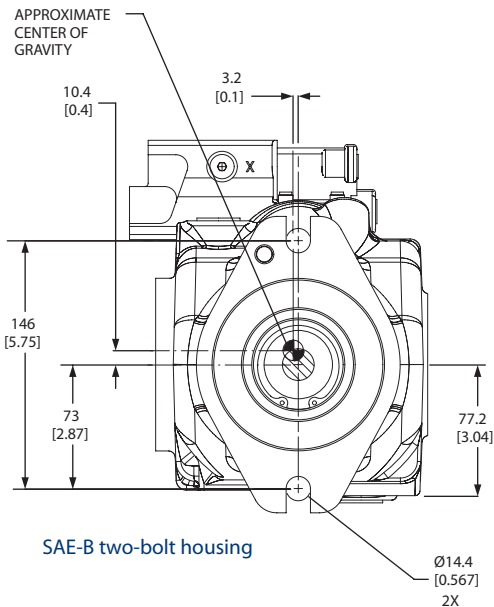
**INSTALLATION  
DRAWINGS  
(continued)**

**Radial ported endcap (continued)**

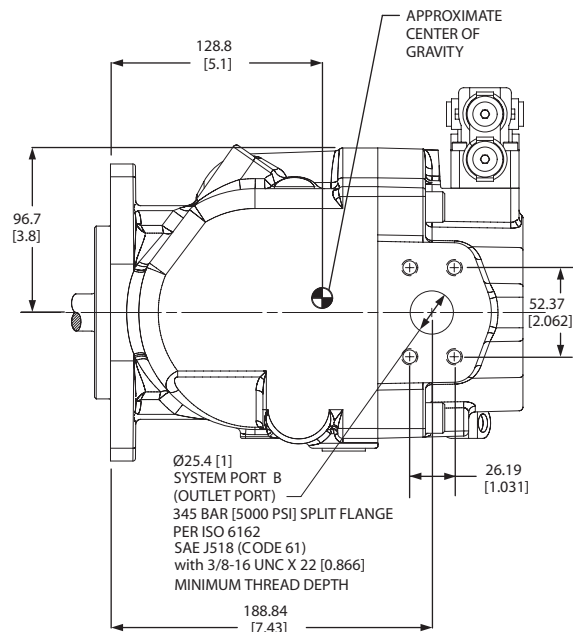
The drawings on these pages show a pump with two-bolt SAE-B and SAE-C mounting flanges. This pump is also available with a four-bolt SAE-C mounting flange. The differences are detailed in the drawing to the right. All other dimensions are common.



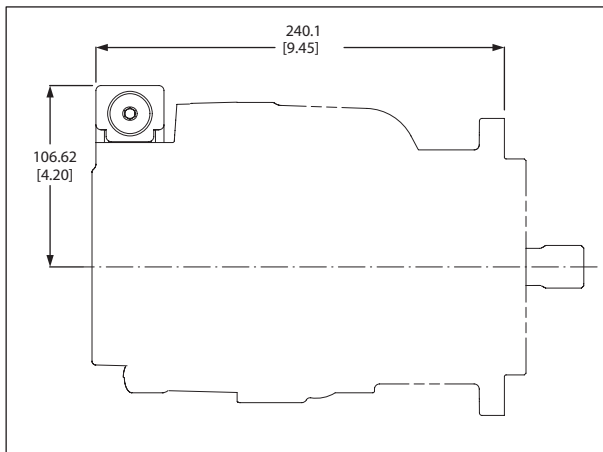
SAE-C four-bolt housing



SAE-B two-bolt housing

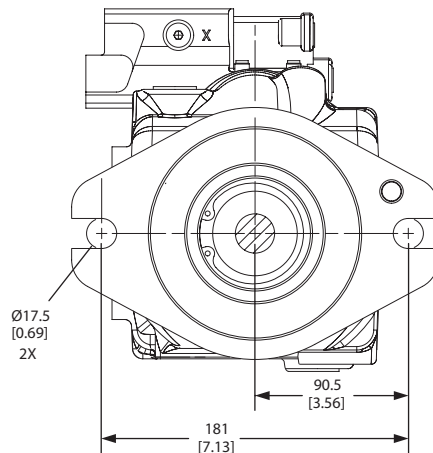


SAE-C two-bolt housing



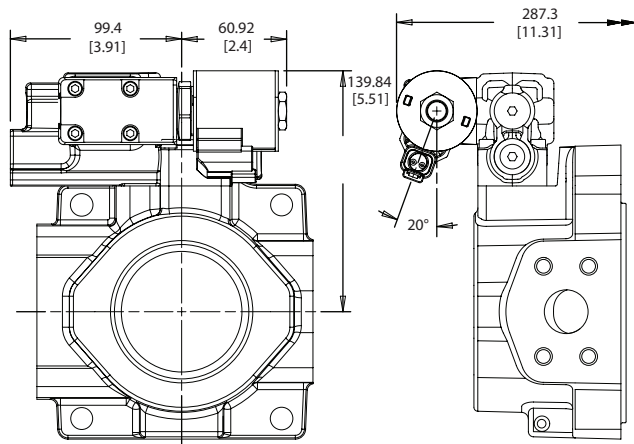
PC only control

P104 236E

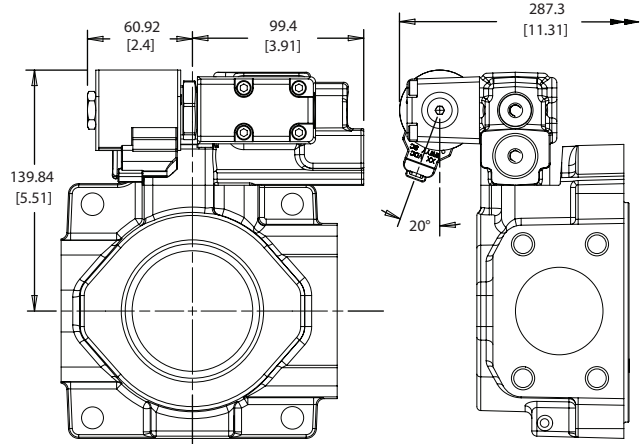


**INSTALLATION  
DRAWINGS  
(continued)**

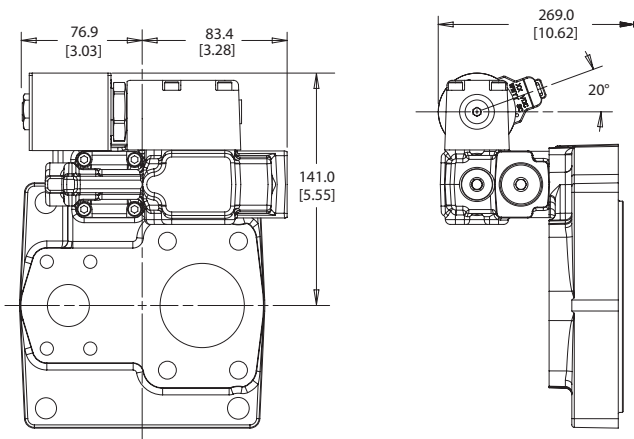
**Electric on/off control/Radial endcap**



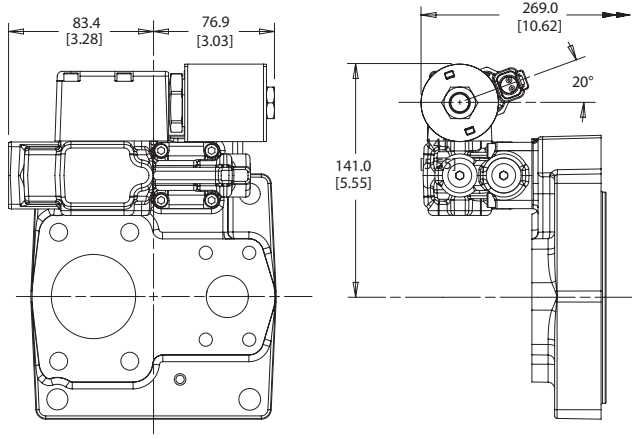
Radial endcap with electric on/off right control (clockwise)



Radial endcap with electric on/off left control (counterclockwise)



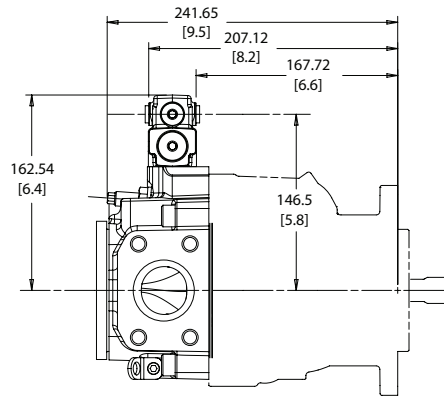
Axial endcap with electric on/off right control (counterclockwise)



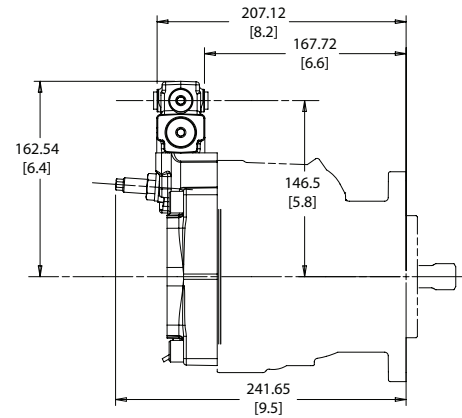
Axial endcap with electric on/off left control (clockwise)

P106 191E

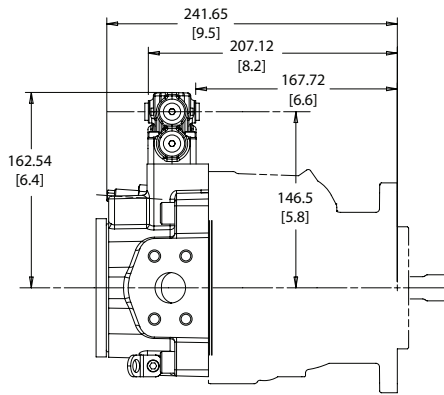
**DISPLACEMENT LIMITER  
 ENDCAPS**



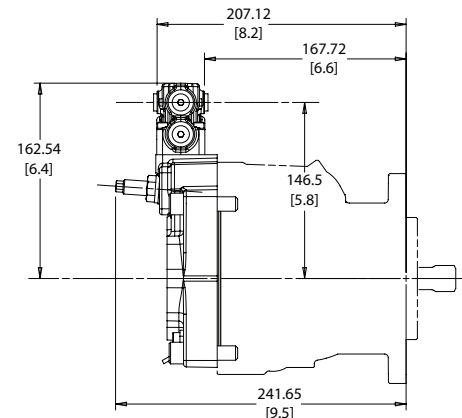
Radial endcap - counterclockwise



Axial endcap - counterclockwise



Radial endcap - clockwise



Axial endcap - clockwise

P106 728E

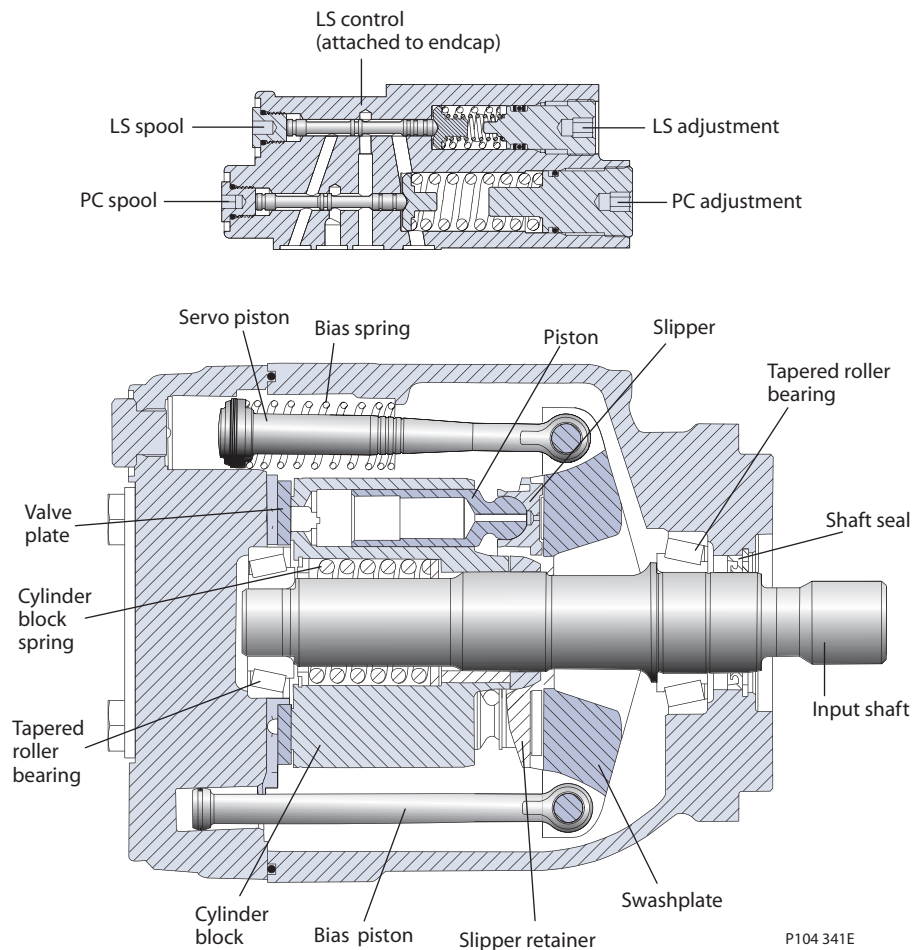


**DESIGN**

Series 45 Frame F pumps have a dual servo piston design with a cradle-type swashplate set in polymer-coated journal bearings. The bias piston increases swashplate angle. The servo piston decreases swashplate angle. At equal pressure, the larger diameter servo piston overpowers the bias piston. Nine reciprocating pistons displace fluid from the pump inlet to the pump outlet as the cylinder block rotates on the pump input shaft. The block spring holds the piston slippers to the swashplate via the slipper retainer. The cylinder block rides on a bi-metal valve plate optimized for high volumetric efficiency and low noise. Tapered roller bearings support the input shaft and a viton lip-seal protects against shaft leaks.

An adjustable one spool (PC only, not shown) or two spool (LS) control senses system pressure and load pressure (LS controls). The control ports system pressure to the servo piston to control pump output flow.

*Frame F cross section*



#### SPECIFICATIONS

For general operating parameters, including fluid viscosity, temperature, and inlet and case pressures, [see page 13](#). For system design parameters, including installation, filtration, reservoir, and line velocities, [see page 15](#).

#### Features and options

Feature		Unit	Model	
			F74B	F90C
Maximum Displacement		cm <sup>3</sup> [in <sup>3</sup> ]	74 [4.52]	90 [5.49]
Flow at rated speed (theoretical)		l/min [US gal/min]	177.6 [46.9]	198 [52.3]
Input torque at maximum displacement (theoretical)		N•m/bar [lbf•in/1000 psi]	1.178 [719]	1.432 [874]
Mass moment of inertia of internal rotating components		kg•m <sup>2</sup> [slug•ft <sup>2</sup> ]	0.00630 [0.00465]	0.00650 [0.00480]
Weight	Axial ports	kg [lb]	29 [64]	
	Radial ports		31.8 [70.1]	
Rotation			Clockwise, Counterclockwise	
Mounting			SAE B 2 bolt, SAE-C 4 bolt	
Auxiliary mounting ( <a href="#">See page 77</a> )			SAE-A, SAE-B, SAE-BB, SAE-C	
System ports (type)			4-bolt split flange	
System ports (location)			Axial, Radial	
Control types ( <a href="#">See page 74</a> )			PC, Remote PC, LS, Electric	
Shafts ( <a href="#">See page 76</a> )	Splined		14 tooth, 17 tooth	
	Straight		Ø 31.75 mm [1.25 in]	
Displacement limiters ( <a href="#">See page 78</a> )			Optional, adjustable	

#### Ratings

Rating			Model	
			F74B	F90C
Input speed <sup>1</sup>	minimum	min <sup>-1</sup> (rpm)	500	500
	continuous		2400	2200
	maximum		2800	2600
Working pressure	continuous	bar [psi]	310 [4495]	260 [3770]
	maximum		400 [5800]	350 [5075]
External shaft loads	External moment (M <sub>e</sub> )	N•m [lbf•in]	300 [2655]	
	Thrust in (T <sub>in</sub> ), out (T <sub>out</sub> )	N [lbf]	2900 [650]	
Bearing life	at 150 bar [2175 psi]	B <sub>10</sub> hours	31300	17400
	at 200 bar [2900 psi]		11100	5700
	at 250 bar [3625 psi]		4810	2490
	at 280 bar [4060 psi]		3080	1636
Mounting flange load moments	Vibratory (continuous)	N•m [lbf•in]	3730 [33000]	
	Shock (max)		13220 [117000]	

1. Input speeds are valid at 1 bar absolute [0 in Hg vac] inlet pressure. See [Inlet pressure vs. speed](#) charts next page.

#### Sound levels<sup>2</sup>

dB(A)	140 bar [2030 psi]		210 bar [3045 psi]		260 bar [3770 psi]		
	Model	1800 min <sup>-1</sup> (rpm)	Rated speed	1800 min <sup>-1</sup> (rpm)	Rated speed	1800 min <sup>-1</sup> (rpm)	Rated speed
F74B		72	76	74	78	75	79
F90C		76	77	76	77	79	79

2. Sound data was collected in a *semi-anechoic* chamber. Values have been adjusted (-3 dB) to reflect *anechoic* levels.

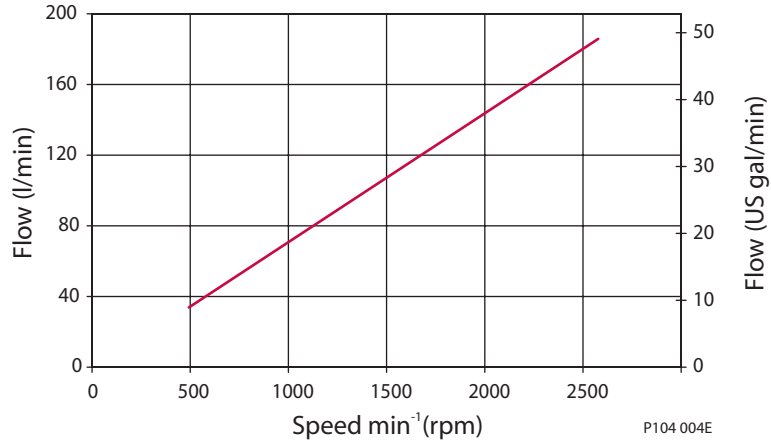
For definitions of pressure and speed ratings, [see page 14](#). For more information on external shaft loads, [see page 16](#); mounting flange loads, [see page 17](#).

For more information on noise levels, [see page 19](#).

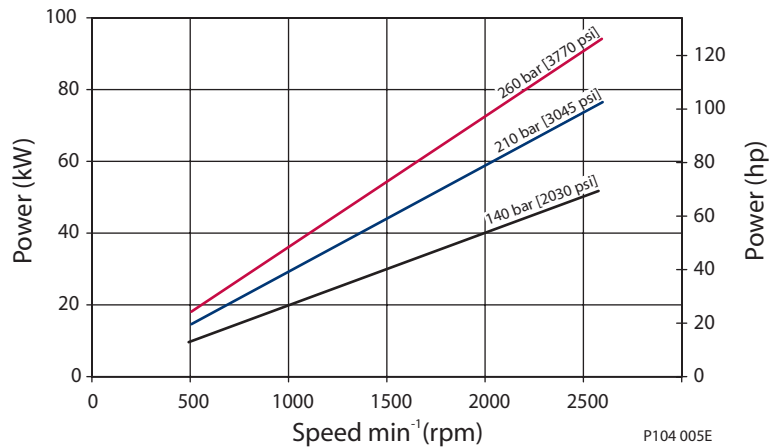
**PERFORMANCE F74B**

*Flow vs. speed*

Flow and power data valid at 49°C [120°F] and viscosity of 17.8 mm<sup>2</sup>/sec [88 SUS].

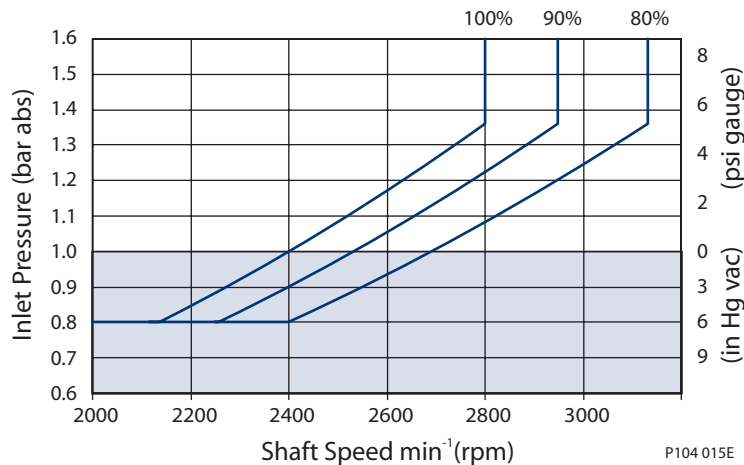


*Input power vs. speed*



*Inlet pressure vs. speed*

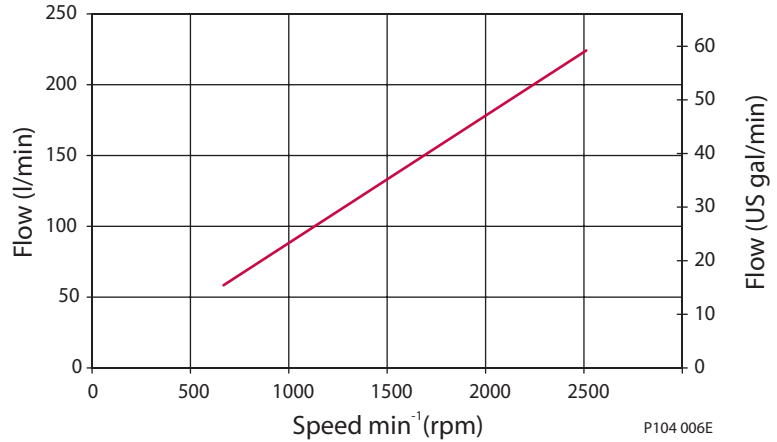
The chart on the right shows allowable inlet pressure and speed at various displacements. Greater speeds and lower inlet pressures are possible at reduced displacement. Operating outside of acceptable limits reduces pump life.



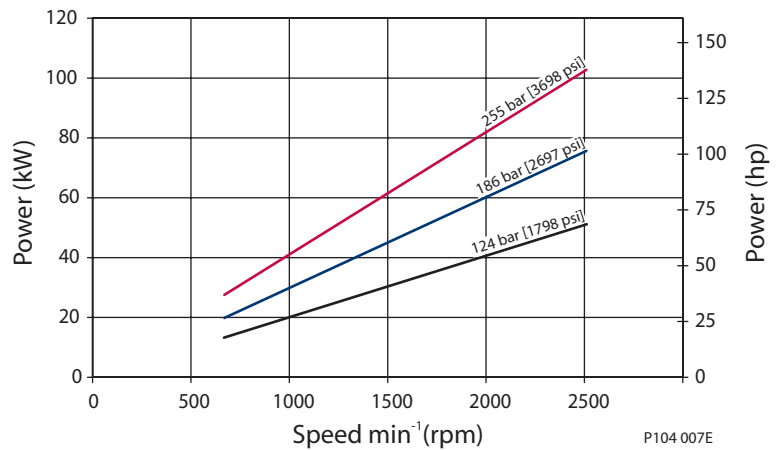
**PERFORMANCE F90C**

Flow and power data valid at 49°C [120°F] and viscosity of 17.8 mm<sup>2</sup>/sec [88 SUS].

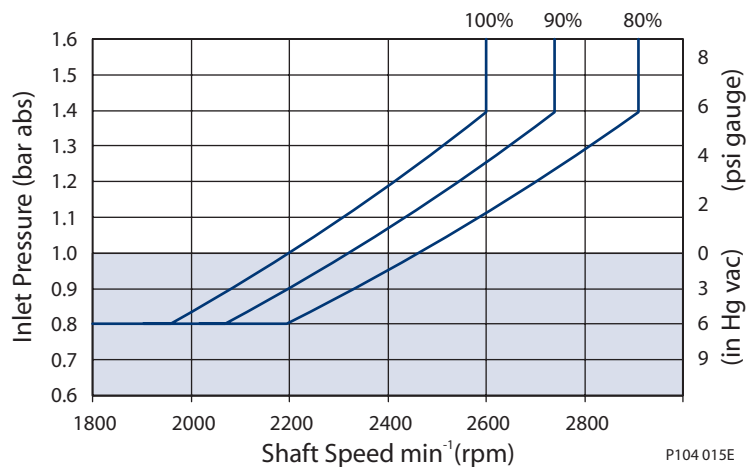
*Flow vs. speed*



*Input power vs. speed*



*Inlet pressure vs. speed*



The chart on the right shows allowable inlet pressure and speed at various displacements. Greater speeds and lower inlet pressures are possible at reduced displacement. Operating outside of acceptable limits reduces pump life.

**ORDER CODE**



**R Product**

<b>FR</b>	F Frame, variable displacement open circuit pump
-----------	--

**S Rotation**

<b>L</b>	Left hand (counterclockwise)
<b>R</b>	Right hand (clockwise)

**P Displacement and pressure rating**

<b>074B</b>	074 cm <sup>3</sup> /rev [4.52 in <sup>3</sup> /rev], 310 bar [4495 psi] continuous working pressure
<b>090C</b>	090 cm <sup>3</sup> /rev [5.49 in <sup>3</sup> /rev], 260 bar [3770 psi] continuous working pressure

**C Control type**

<b>PC</b>	Pressure compensated control 100-280 bar [1450-4060 psi]
<b>BC</b>	Pressure compensated control 290-310 bar [4205-4495 psi]
<b>RP</b>	Remote pressure compensated control 100-280 bar [1450-4060 psi]
<b>BP</b>	Remote pressure compensated control 290-310 bar [4205-4495 psi]
<b>LS</b>	Load sensing / pressure compensating control 100-280 bar [1450-4060 psi]
<b>BS</b>	Load sensing / pressure compensating control 290-310 bar [4205-4495 psi]
<b>LB</b>	Load sensing / pressure compensating control with internal bleed orifice 100-280 bar [1450-4060 psi]
<b>BB</b>	Load sensing / pressure compensating control with internal bleed orifice 290-310 bar [4205-4495 psi]

**D PC setting (2 digit code, 10 bar increments)**

<b>Example</b>	10 = 100 bar
<b>10-31</b>	100 to 310 bar [1450 to 4495 psi] (074B)
<b>10-26</b>	100 to 260 bar [1450 to 3770 psi] (090C)

**E Load sensing setting (2 digit code, 1 bar increments)**

<b>Example</b>	20 = 20 bar
<b>10-30</b>	10 to 30 bar [145 to 435 psi]
<b>NN</b>	Not applicable (use with PC controls)
<b>RP and BP</b>	Must be 20 bar

**F Not used**

<b>NN</b>	Not applicable
-----------	----------------

**G Choke orifice**

<b>N</b>	None (standard for PC control)
----------	--------------------------------



**ORDER CODE**  
 (continued)



**H Gain orifice**

<b>3</b>	Standard
----------	----------

**J1 Input shaft**

<b>S1</b>	14 tooth, 12/24 pitch (ANSI B92.1 1970 - Class 5)
<b>S2</b>	17 tooth, 12/24 pitch (ANSI B92.1 1970 - Class 5)
<b>K4</b>	Ø 31.72 mm [1.25 in], straight keyed

**J2 Auxiliary mounting flange**

<b>N</b>	None
<b>A</b>	SAE-A, 9-tooth coupling
<b>T</b>	SAE-A, 11-tooth coupling
<b>B</b>	SAE-B, 13-tooth coupling
<b>V</b>	SAE-BB, 15-tooth coupling
<b>C</b>	SAE-C, 14-tooth coupling

**J3 System port size and location**

Code	Location	Port type	Inlet size	Outlet size
<b>2</b>	Radial	4-bolt split-flange	2 in.	1 in.
<b>4</b>	Axial	4-bolt split-flange	2 in.	1 in.

**K1 Shaft seal**

<b>A</b>	Single lip seal, viton
----------	------------------------

**K2 Mounting flange and housing port style**

<b>1</b>	SAE-C 4-bolt, SAE O-ring boss housing ports
<b>3</b>	SAE-B 2-bolt, SAE O-ring boss housing ports

**K3 Not used**

<b>N</b>	Not applicable
----------	----------------

**L Displacement limiter**

<b>NNN</b>	None
<b>AAA</b>	Adjustable, factory set at max angle

**M Special hardware**

<b>NNN</b>	None
------------	------

**N Special features**

<b>NNN</b>	None
------------	------

**CONTROLS**

**Pressure compensated control (PC)**

*Specifications* *PC control setting range*

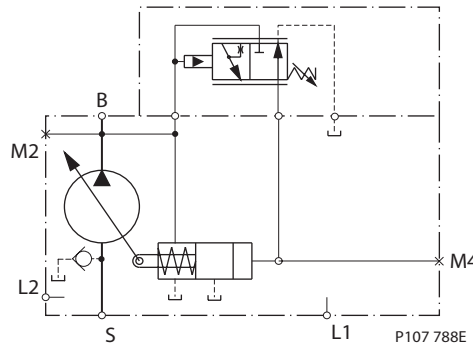
Model	bar	psi
F74B	100–310	1450–4495
F90C	100–260	1450–3770

*Response/recovery times\**

(ms)	Response	Recovery
F74B	35	120
F90C	35	135

\* For definitions, *see page 9.*

*Schematic diagram* *PC schematic*



*Legend*

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- M2 = System pressure gauge port
- M4 = Servo pressure gauge port

**Remote PC Control (RP)**

*Specifications* *PC control setting range*

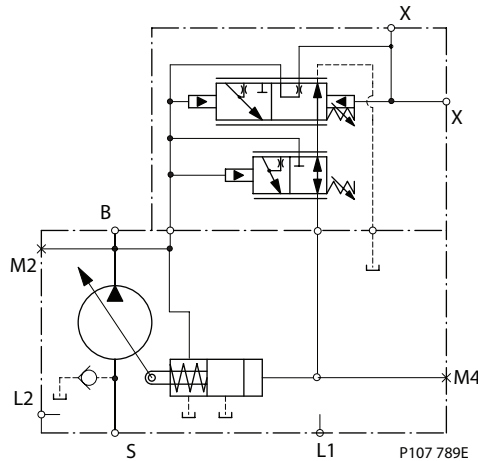
Model	bar	psi
F74B	100–310	1450–4495
F90C	100–260	1450–3770

*Response/recovery times\**

(ms)	Response	Recovery
F74B	35	120
F90C	35	135

\* For definitions, *see page 10.*

*Schematic diagram* *Remote PC schematic*



*LS setting*

Model	bar	psi
All	20	290

*Legend*

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- M2 = System pressure gauge port
- M4 = Servo pressure gauge port
- X = Remote PC port

**CONTROLS**  
 (continued)

*Specifications*

**Load sensing control with internal bleed orifice (LB)**

*PC setting range*

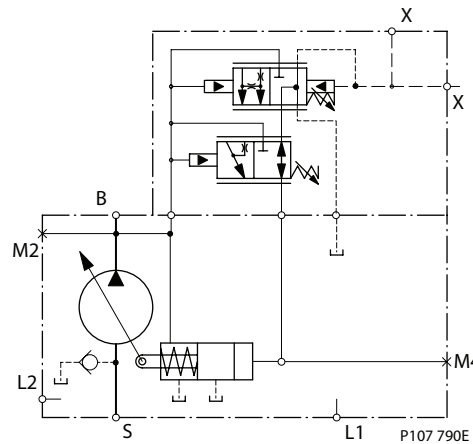
Model	bar	psi
F74B	100–310	1450–4495
F90C	100–260	1450–3770

*Response/recovery times\**

(ms)	Response	Recovery
F74B	35	135
F90C	45	135

\* For definitions, see page 11.

*Schematic diagram* **LB Schematic**



*LS setting range*

Model	bar	psi
All	10–30	145–435

*Legend*

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- M2 = System pressure gauge port
- M4 = Servo pressure gauge port
- X = LS signal port

**Load sensing control (LS)**

*Specifications*

*PC setting range*

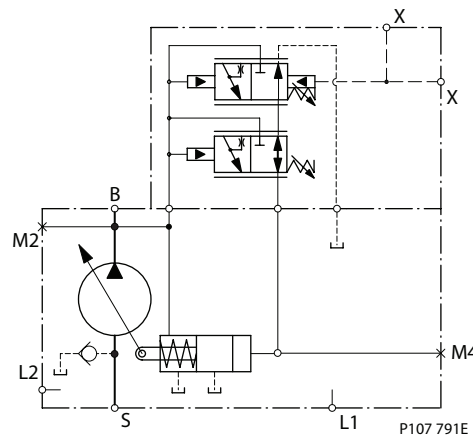
Model	bar	psi
F74B	100–310	1450–4495
F90C	100–260	1450–3770

*Response/recovery times\**

(ms)	Response	Recovery
F74B	35	135
F90C	40	135

\* For definitions, see page 11.

*Schematic diagram* **LS Schematic**



*LS setting range*

Model	bar	psi
All	10–30	145–435

*Legend*

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- M2 = System pressure gauge port
- M4 = Servo pressure gauge port
- X = LS signal port

**INPUT SHAFTS**

*Shaft data*

Code	Description	Maximum torque rating <sup>1</sup> N·m [lbf·in]	Drawing
S1	14 tooth spline 12/24 pitch (ANSI B92.1 1970 - Class 5)	594 [5257]	
S2	17 tooth spline 12/24 pitch (ANSI B92.1 1970 - Class 5)	1044 [9240]	
K4	Ø 31.75 mm [1.25 in] Straight keyed	734 [6495]	

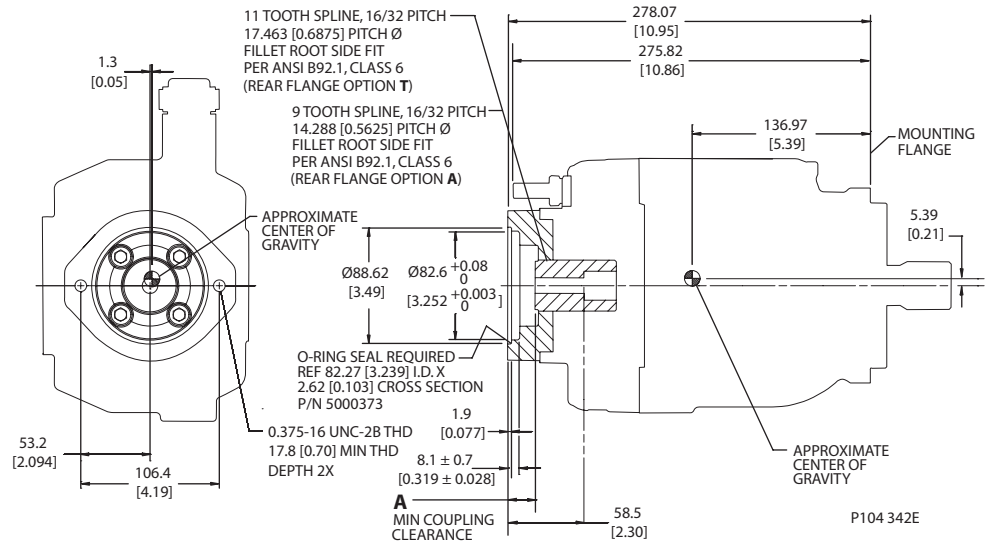
1. See *Input shaft torque ratings*, page 18 for an explanation of maximum torque.

#### AUXILIARY MOUNTING PADS

See page 18 for mating pump pilot and spline dimensions.

#### SAE-A auxiliary mounting pad

##### Dimensions



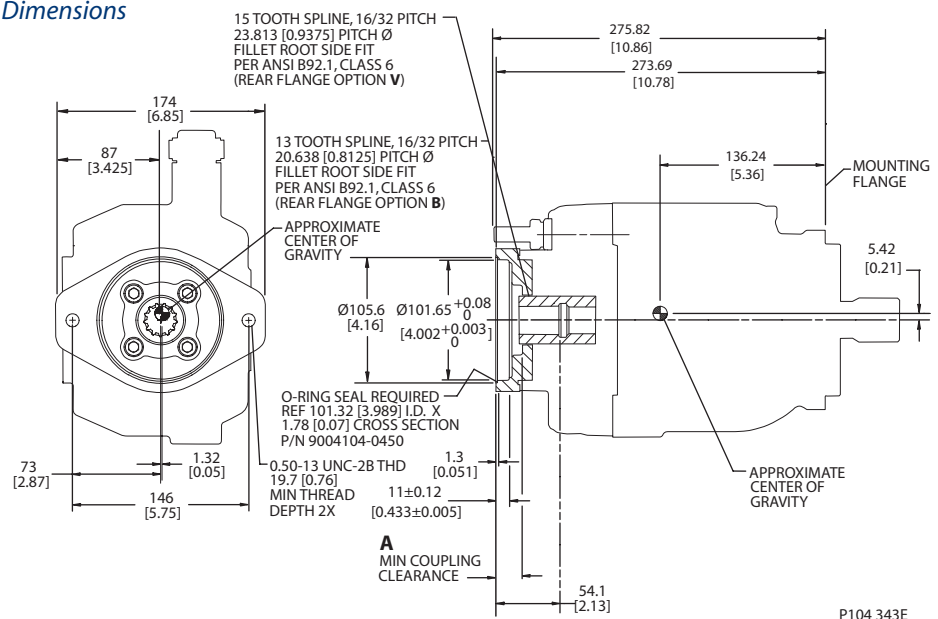
#### Specifications

Coupling	9-tooth	11-tooth
Spline minimum engagement	13.5 mm [0.53 in]	15 mm [0.59 in]
Maximum torque	107 N•m [950 lbf•in]	147 N•m [1300 lbf•in]
Dimension A	14.9 mm [0.59 in]	16.1 mm [0.63 in]

#### SAE-B auxiliary mounting pad

##### Dimensions

See page 18 for mating pump pilot and spline dimensions.



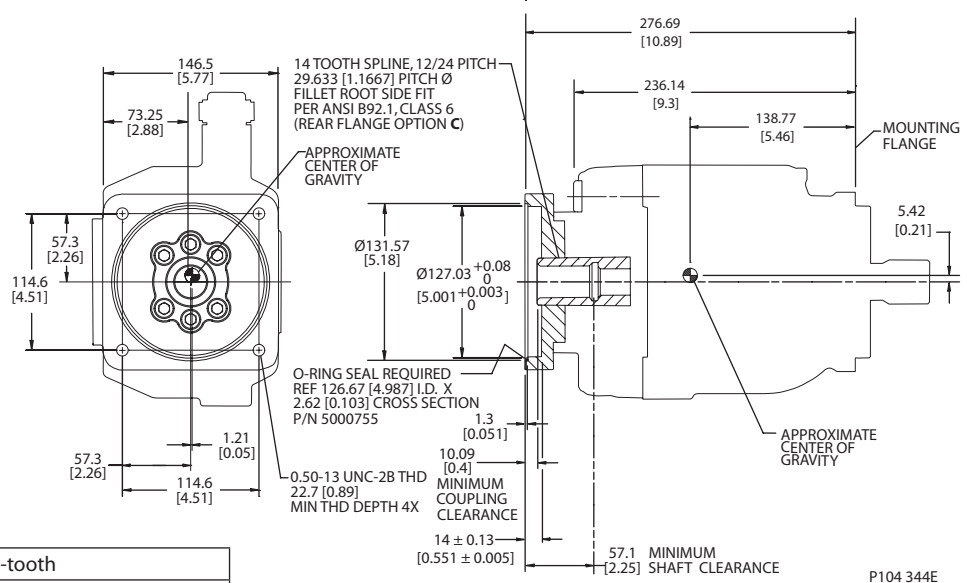
#### Specifications

Coupling	13-tooth	15-tooth
Spline minimum engagement	14.2 mm [0.56 in]	18.9 mm [0.74 in]
Maximum torque	249 N•m [2200 lbf•in]	339 N•m [3000 lbf•in]
Dimension A	20.7 mm [0.81 in]	12.7 mm [0.5 in]

**AUXILIARY MOUNTING PADS (continued)**

See page 18 for mating pump pilot and spline dimensions.

**SAE-C auxiliary mounting pad**  
 Dimensions



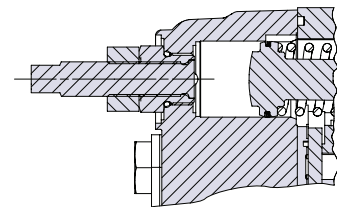
*Specifications*

<b>Coupling</b>	14-tooth
<b>Spline minimum engagement</b>	18.3 mm [0.72 in]
<b>Maximum torque</b>	339 N•m [3000 lbf•in]

**DISPLACEMENT LIMITER**

Series 45 F90C and F74B open circuit pumps are available with an optional adjustable displacement limiter. This adjustable stop limits the pump's maximum displacement.

*Displacement limiter cross-section*



*Setting range*

<b>F90C</b>	45.6 to 90 cm <sup>3</sup> [2.78 to 5.49 in <sup>3</sup> ]
<b>F74B</b>	34.1 to 74 cm <sup>3</sup> [1.92 to 4.52 in <sup>3</sup> ]

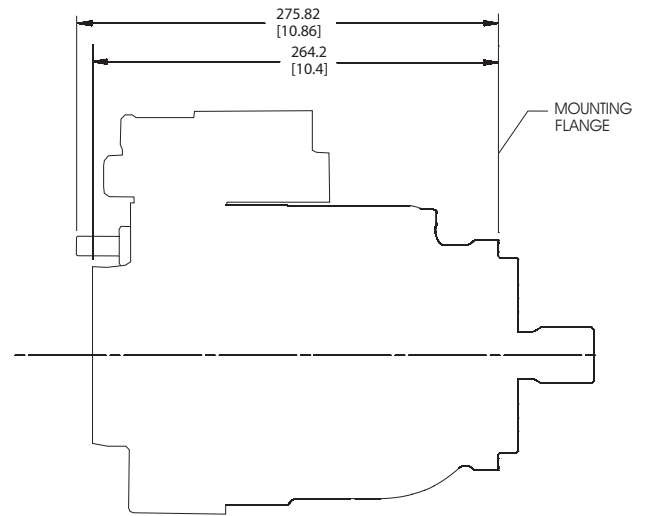
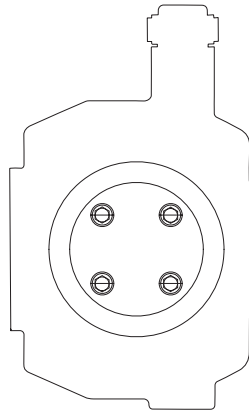
*Displacement per turn*

<b>F90C</b>	6.8 cm <sup>3</sup> /rev [0.41 in <sup>3</sup> /rev]
<b>F74B</b>	6.1 cm <sup>3</sup> /rev [0.37 in <sup>3</sup> /rev]

**ADJUSTABLE  
DISPLACEMENT LIMITER  
AND RUNNING COVER**

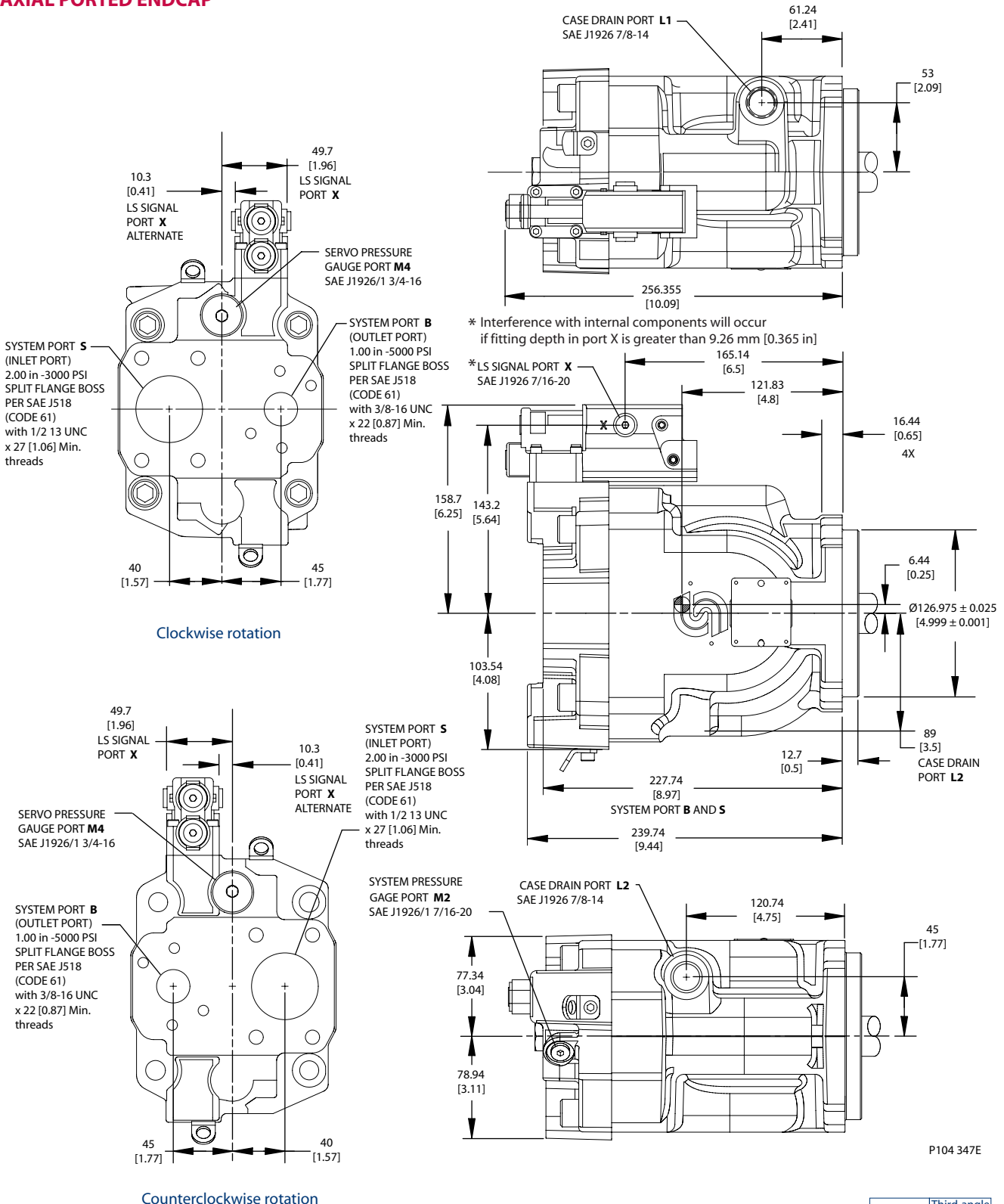
*Dimensions*

Endcap and shaft machined to accommodate auxiliary mounting pads; pad and coupling not included. Conversion kits are available for installation in the field.



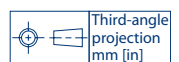
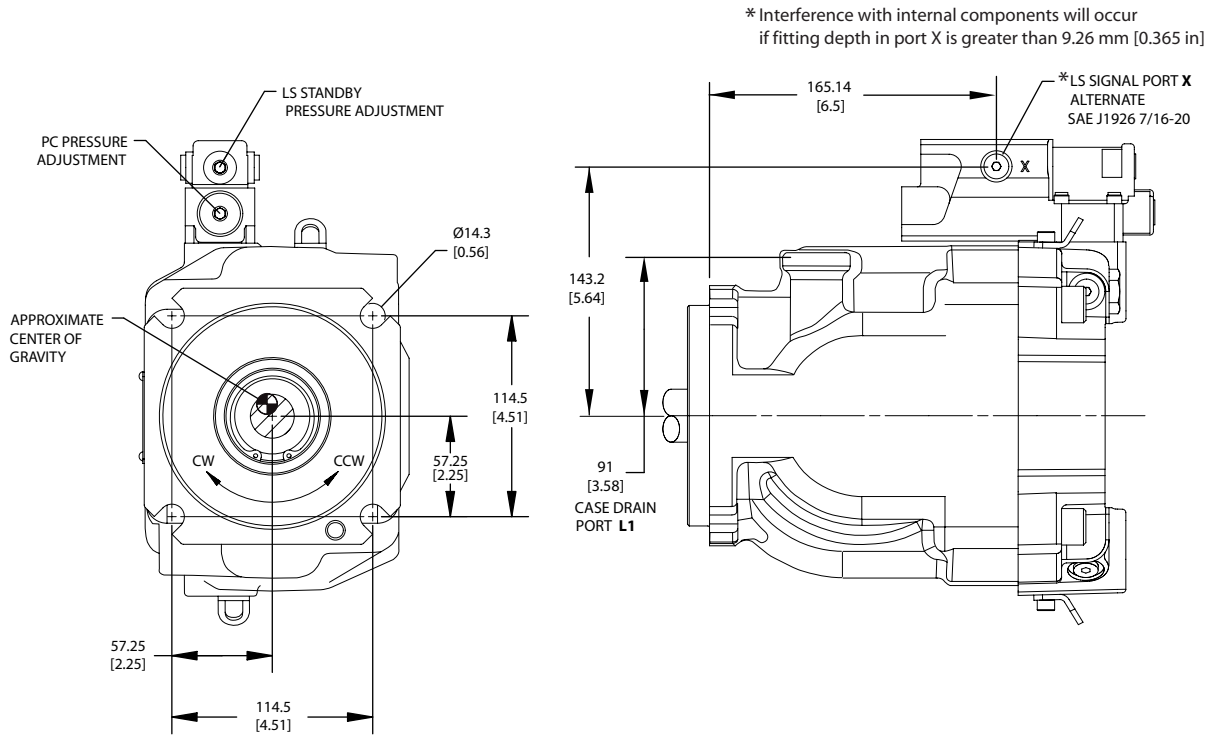
P104 346E

**AXIAL PORTED ENDCAP**

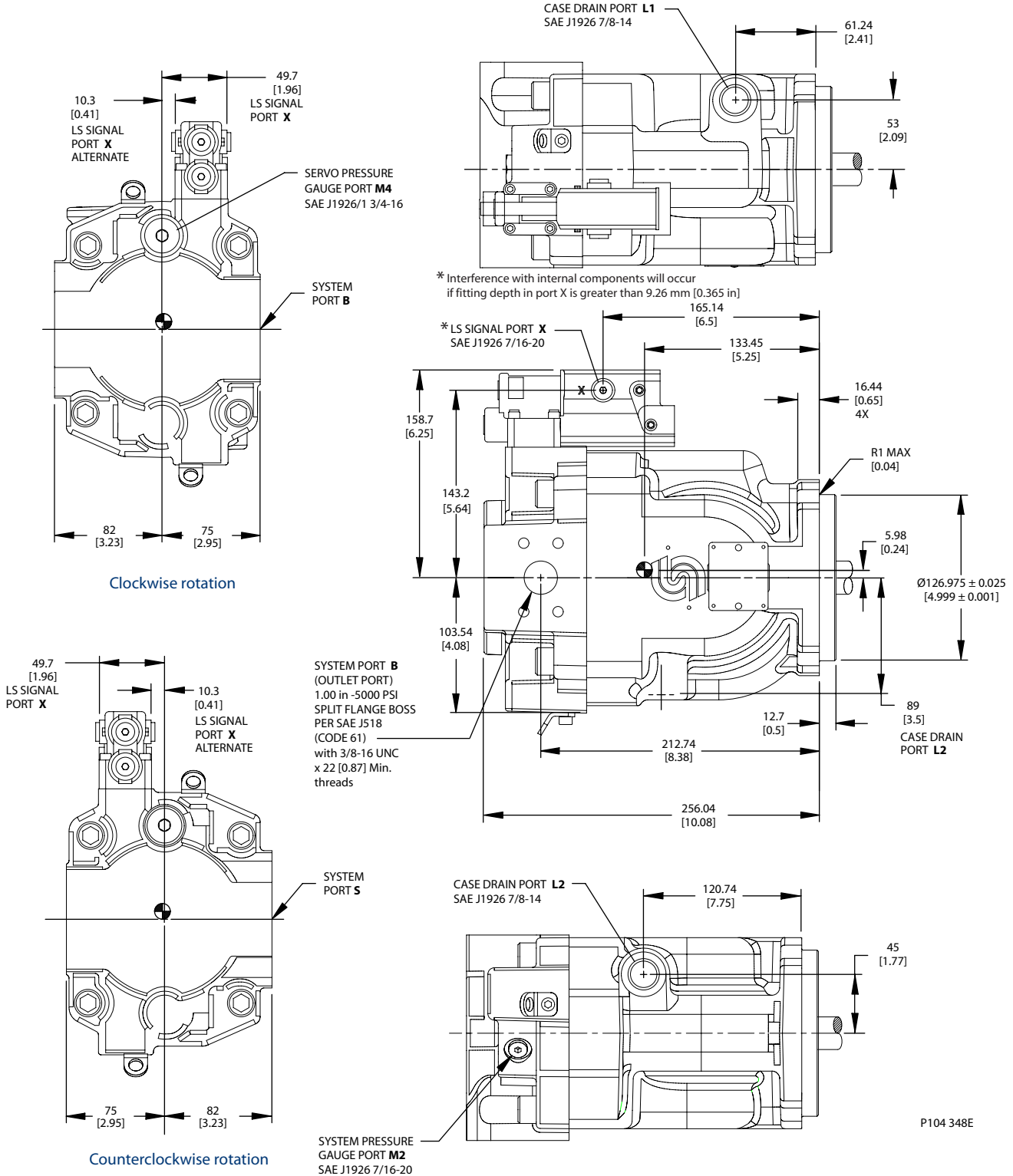




**AXIAL PORTED ENDCAP  
 (continued)**



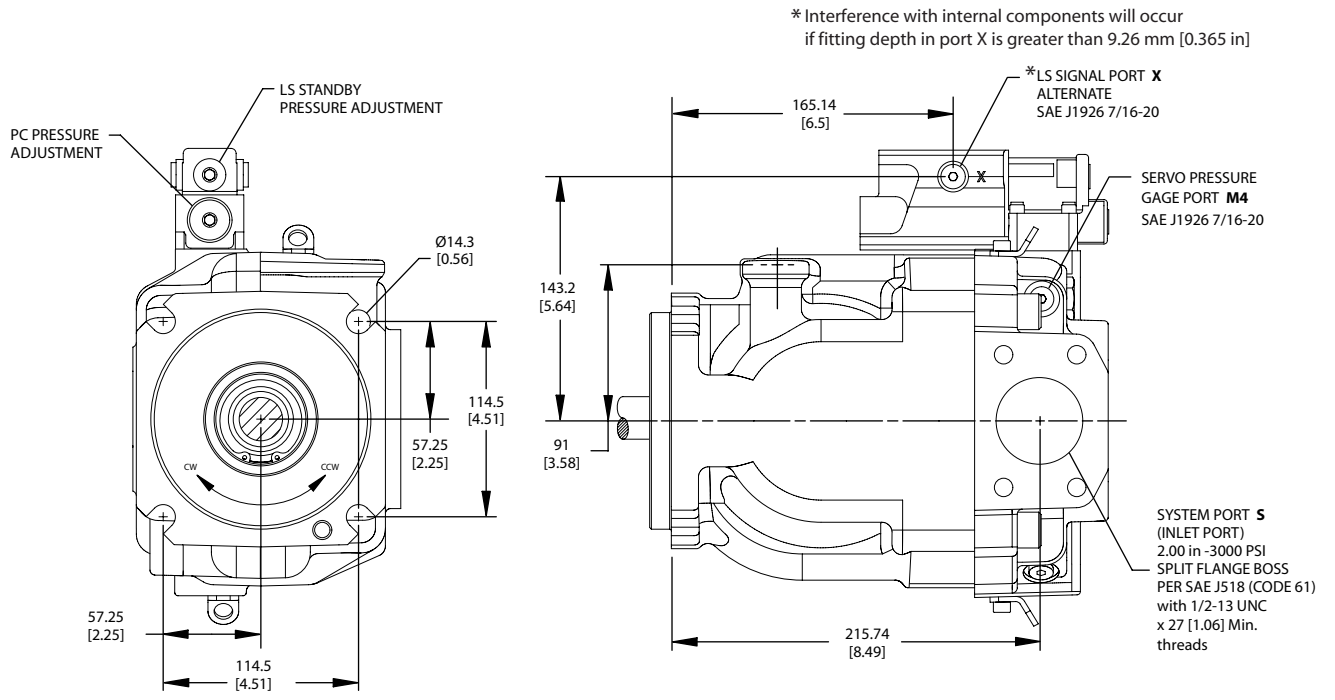
**RADIAL PORTED ENDCAP**



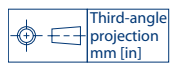
P104 348E



**RADIAL PORTED ENDCAP**  
**(continued)**



P106 629F

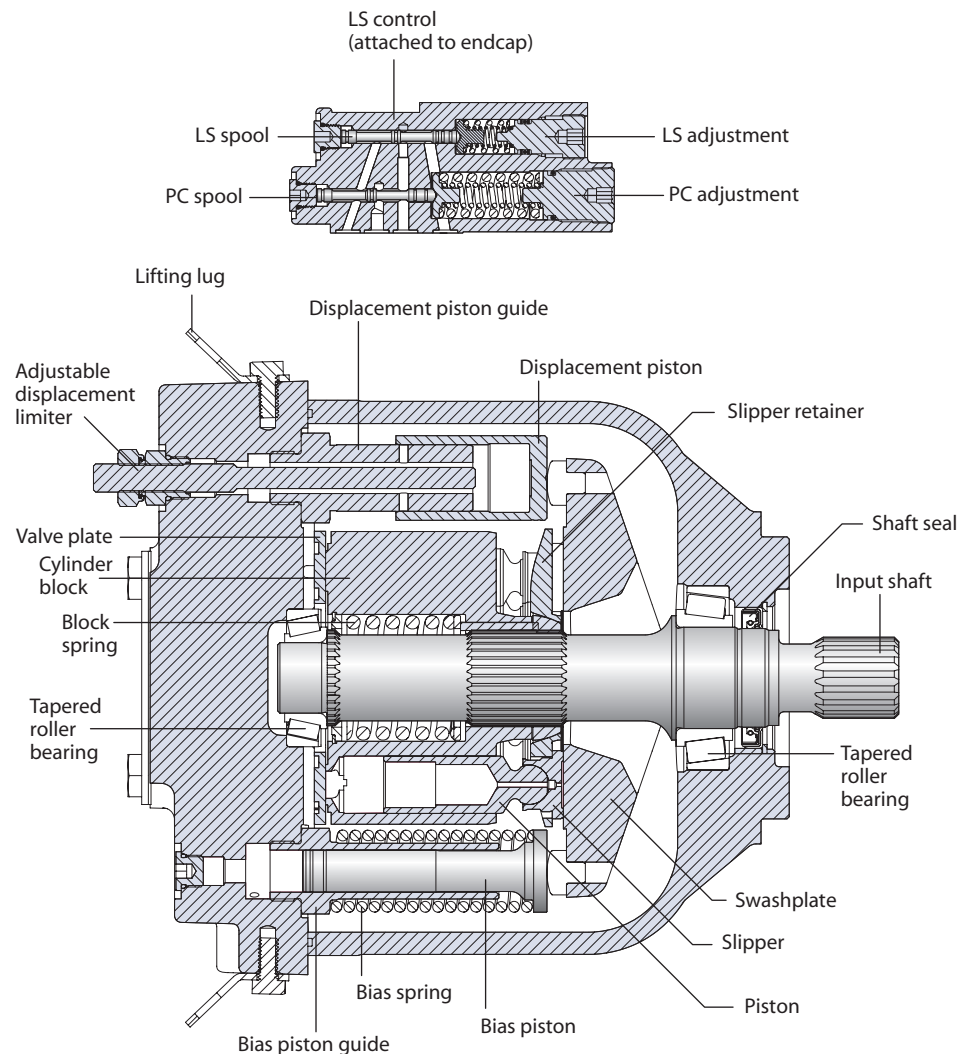


**DESIGN**

Series 45 Frame E pumps have a dual servo piston design with a cradle-type swashplate set in polymer-coated journal bearings. The bias piston increases swashplate angle. The displacement piston decreases swashplate angle. At equal pressure, the larger diameter displacement piston overpowers the bias piston. Nine reciprocating pistons displace fluid from the pump inlet to the pump outlet as the cylinder block rotates on the pump input shaft. The block spring holds the piston slippers to the swashplate via the slipper retainer. The cylinder block rides on a bi-metal valve plate optimized for high volumetric efficiency and low noise. Tapered roller bearings support the input shaft and a viton lip-seal protects against shaft leaks.

An adjustable one spool (PC only, not shown) or two spool (LS) control senses system pressure and load pressure (LS controls). The control ports system pressure to the displacement piston to control pump output flow.

*Frame E cross section*



P104 001E

#### SPECIFICATIONS

For general operating parameters, including fluid viscosity, temperature, and inlet and case pressures, [see page 13](#). For system design parameters, including installation, filtration, reservoir, and line velocities, [see page 15](#).

Features and options		Model		
		E100B	E130B	E147C
Feature	Unit			
Maximum Displacement	cm <sup>3</sup> [in <sup>3</sup> ]	100 [6.10]	130 [7.93]	147 [8.97]
Flow at rated speed (theoretical)	l/min [US gal/min]	245 [64.7]	286 [75.6]	309 [81.6]
Input torque at maximum displacement (theoretical)	N•m/bar [lbf•in/1000 psi]	1.592 [972]	2.069 [1263]	2.340 [1428]
Mass moment of inertia of internal rotating components	kg•m <sup>2</sup> [slug•ft <sup>2</sup> ]	0.0128 [0.0094]	0.0128 [0.0094]	0.0128 [0.0094]
Weight	Axial ports	52 [114]		
	Radial ports			
		56 [123.5]		
Rotation		Clockwise, Counterclockwise		
Mounting		SAE-C		
Auxiliary mounting ( <a href="#">See page 95</a> )		SAE-A, SAE-B, SAE-BB, SAE-C, SAE-CC		
System ports (type)		4-bolt split flange		
System ports (location)		Axial, Radial		
Control types ( <a href="#">See page 91</a> )		PC, Remote PC, LS, LS with internal bleed		
Shafts ( <a href="#">See page 93</a> )	Splined	13-tooth, 14-tooth, 17-tooth		
	Straight	Ø 38.08 mm [1.5 in]		
Displacement limiters ( <a href="#">See page 97</a> )		Optional, adjustable		

For definitions of pressure and speed ratings, [see page 14](#). For more information on external shaft loads, [see page 16](#); mounting flange loads, [see page 17](#).

Ratings			Model		
			E100B	E130B	E147C
Rating		Units			
Input speed <sup>1</sup>	minimum	min <sup>-1</sup> (rpm)	500	500	500
	continuous		2450	2200	2100
	maximum		2880	2600	2475
Working pressure	continuous	bar [psi]	310 [4495]	310 [4495]	260 [3770]
	maximum		400 [5800]	400 [5800]	350 [5075]
External shaft loads	External moment (M <sub>e</sub> )	N•m [lbf•in]	455 [4030]	360 [3190]	396 [3500]
	Thrust in (T <sub>in</sub> ), out (T <sub>out</sub> )	N [lbf]	2846 [640]	1735 [390]	2113 [475]
	Thrust out (T <sub>out</sub> )		7740 [1740]	6672 [1500]	7117 [1600]
Bearing life	at 140 bar [2030 psi]	B <sub>10</sub> hours	77 200	32 700	21 600
	at 210 bar [3045 psi]		19 800	8400	5500
	at 260 bar [3770 psi]		9700	4116	2700
	at 310 bar [4495 psi]		5400	2300	—
Mounting flange load moments	Vibratory (continuous)	N•m [lbf•in]	1920 [17 000]		
	Shock (max)		6779 [60 000]		

1. Input speeds are valid at 1 bar absolute [0 in Hg vac] inlet pressure. See [Inlet pressure vs. speed](#) charts.

#### Sound levels<sup>2</sup>

For more information on noise levels, [see page 19](#).

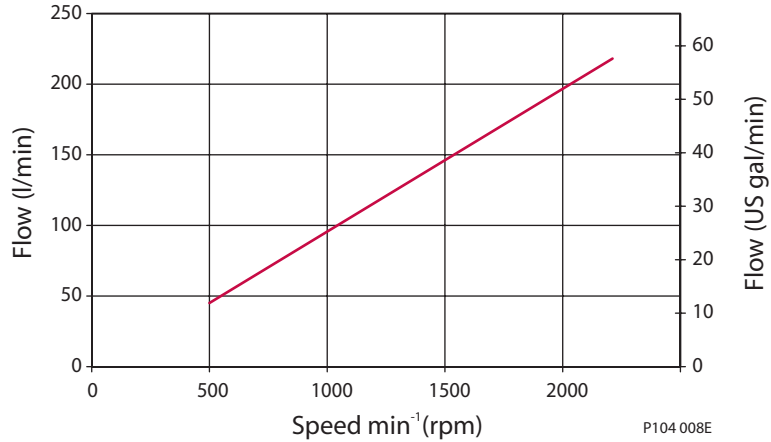
dB(A)	210 bar [3045 psi]		260 bar [3770 psi]		310 bar [4495 psi]		
	Model	1800 min <sup>-1</sup> (rpm)	Rated speed	1800 min <sup>-1</sup> (rpm)	Rated speed	1800 min <sup>-1</sup> (rpm)	Rated speed
E100B		75	77	77	78	77	80
E130B		77	81	78	81	78	81
E147C		77	78	78	78	—	—

2. Sound data was collected in a *semi-anechoic* chamber. Values have been adjusted (-3 dB) to reflect *anechoic* levels.

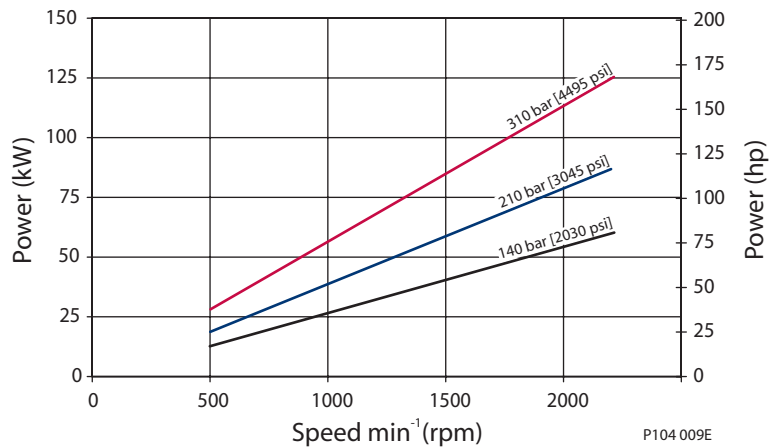
**PERFORMANCE**  
**E100B**

Flow and power data valid at 49°C [120°F] and viscosity of 17.8 mm<sup>2</sup>/sec [88 SUS].

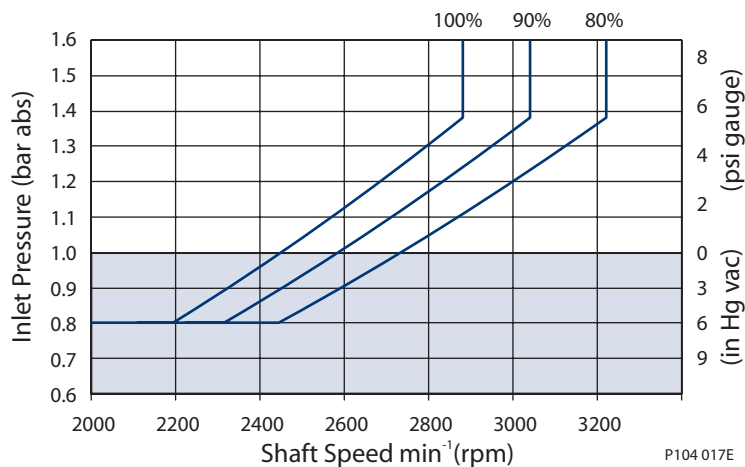
*Flow vs. speed*



*Input power vs. speed*



*Inlet pressure vs. speed*

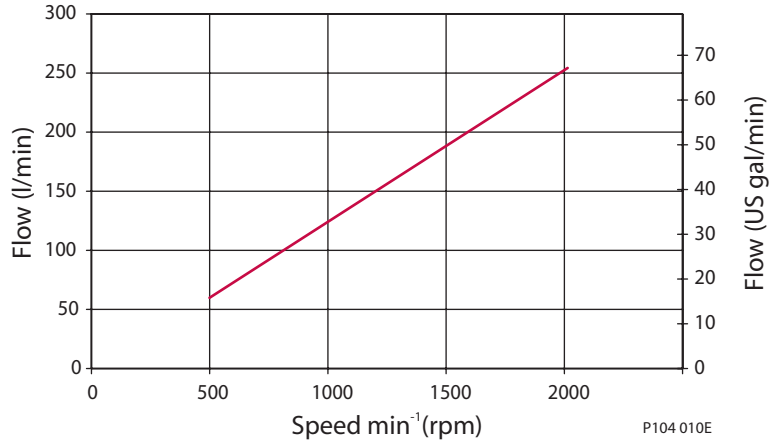


The chart on the right shows allowable inlet pressure and speed at various displacements. Greater speeds and lower inlet pressures are possible at reduced displacement. Operating outside of acceptable limits reduces pump life.

**PERFORMANCE**  
**E130B**

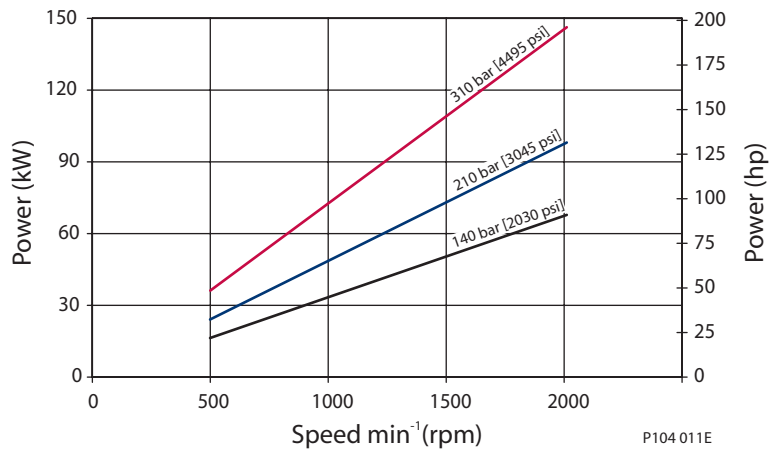
Flow and power data valid at 49°C [120°F] and viscosity of 17.8 mm<sup>2</sup>/sec [88 SUS].

*Flow vs. speed*



P104 010E

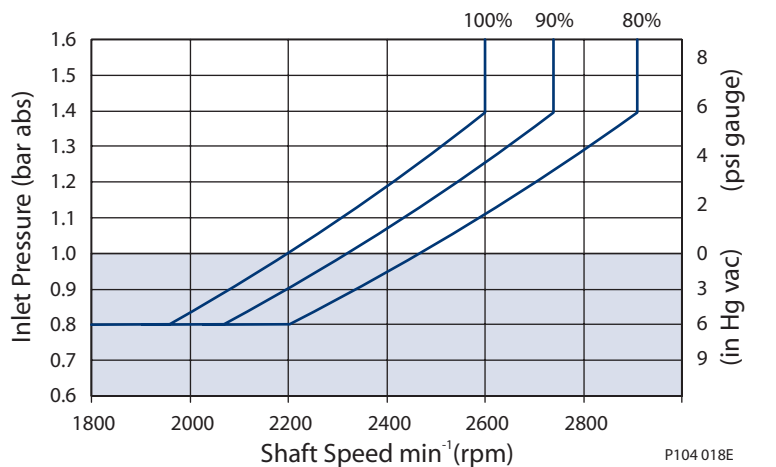
*Input power vs. speed*



P104 011E

The chart on the right shows allowable inlet pressure and speed at various displacements. Greater speeds and lower inlet pressures are possible at reduced displacement. Operating outside of acceptable limits reduces pump life.

*Inlet pressure vs. speed*

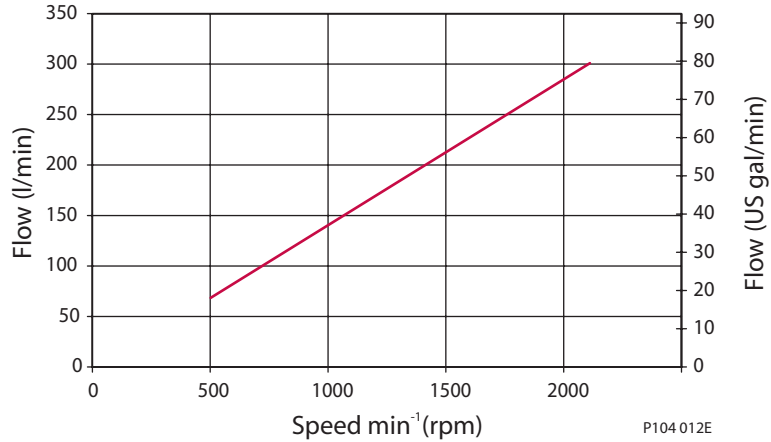


P104 018E

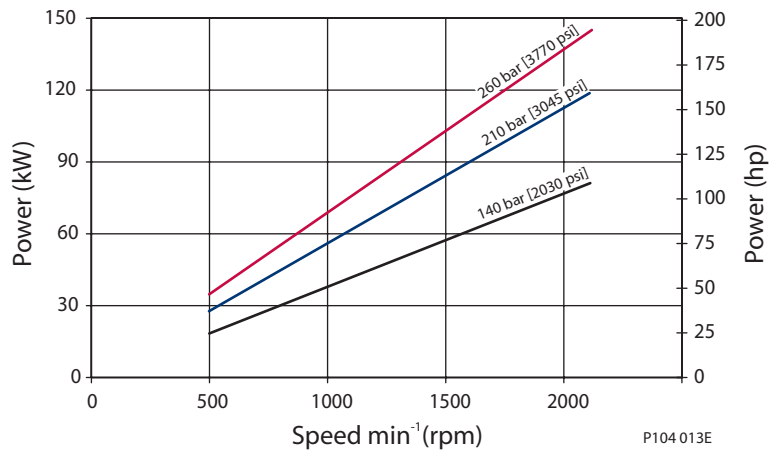
**PERFORMANCE  
E147C**

Flow and power data valid at 49°C [120°F] and viscosity of 17.8 mm<sup>2</sup>/sec [88 SUS].

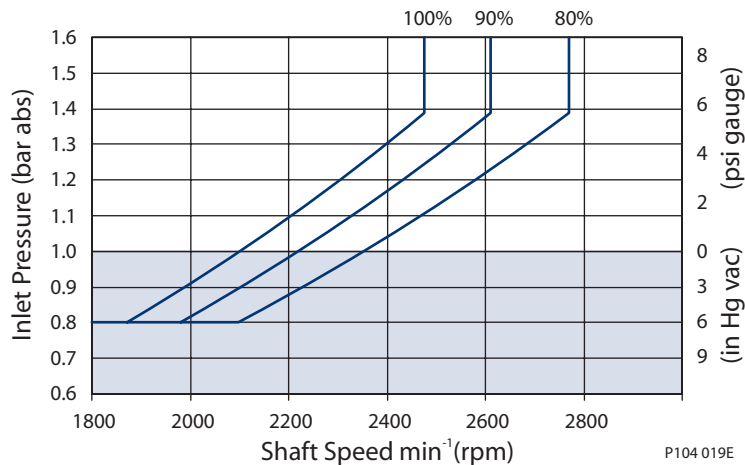
*Flow vs. speed*



*Input power vs. speed*



*Inlet pressure vs. speed*



The chart on the right shows allowable inlet pressure and speed at various displacements. Greater speeds and lower inlet pressures are possible at reduced displacement. Operating outside of acceptable limits reduces pump life.



ORDER CODE



**R Product**

<b>ER</b>	E Frame, variable displacement open circuit pump
-----------	--

**S Rotation**

<b>L</b>	Left hand (counterclockwise)
<b>R</b>	Right hand (clockwise)

**P Displacement and pressure rating**

<b>100B</b>	100 cm <sup>3</sup> /rev [6.10 in <sup>3</sup> /rev], 310 bar [4495 psi] continuous working pressure
<b>130B</b>	130 cm <sup>3</sup> /rev [7.93 in <sup>3</sup> /rev], 310 bar [4495 psi] continuous working pressure
<b>147C</b>	147 cm <sup>3</sup> /rev [8.97 in <sup>3</sup> /rev], 260 bar [3770 psi] continuous working pressure

**C Control type**

<b>PC</b>	Pressure compensated control 100-280 bar [1450-4060 psi]
<b>BC*</b>	Pressure compensated control 290-310 bar [4205-4495 psi]
<b>RP</b>	Remote pressure compensated control 100-280 bar [1450-4060 psi]
<b>BP*</b>	Remote pressure compensated control 290-310 bar [4205-4495 psi]
<b>LS</b>	Load sensing / pressure compensating control 100-280 bar [1450-4060 psi]
<b>BS*</b>	Load sensing / pressure compensating control 290-310 bar [4205-4495 psi]
<b>LB</b>	Load sensing / pressure compensating control with internal bleed orifice 100-280 bar [1450-4060 psi]
<b>BB*</b>	Load sensing / pressure compensating control with internal bleed orifice 290-310 bar [4205-4495 psi]

\* Use only with 100, and 130 cm<sup>3</sup> displacements.

**D PC setting (2 digit code, 10 bar increments)**

<b>Example</b>	10 = 100 bar
<b>10-31</b>	100 to 310 bar [1450 to 4495 psi] (100B, 130B)
<b>10-26</b>	100 to 260 bar [1450 to 3770 psi] (147C)

**E Load sensing setting (2 digit code, 1 bar increments)**

<b>Example</b>	20 = 20 bar
<b>10-30</b>	10 to 30 bar [145 to 435 psi]
<b>NN</b>	Not applicable (use with PC controls)
<b>RP and BP</b>	Must be 20 bar

**F Not used**

<b>NN</b>	Not applicable
-----------	----------------

ORDER CODE  
 (continued)



**G Pilot orifice**

<b>N</b>	None (standard)
----------	-----------------

**H Gain orifice**

<b>3</b>	Standard orifice
----------	------------------

**J1 Input shaft**

<b>S1</b>	14-tooth, 12/24 pitch (ANSI B92.1 1970 - Class 5)
<b>S2</b>	17-tooth, 12/24 pitch (ANSI B92.1 1970 - Class 5)
<b>S4</b>	13-tooth, 8/16 pitch (ANSI B92.1 1970 - Class 5)
<b>K5</b>	Ø 38.08 mm [1.5 in], straight keyed
<b>S5</b>	14-tooth spline 12/24 pitch (ANSI B92.1 1970 - Class 5 (not available for units with auxiliary mounting pads)

**J2 Auxiliary mounting flange**

<b>N</b>	None
<b>A</b>	SAE-A, 9-tooth coupling
<b>T</b>	SAE-A, 11-tooth coupling
<b>B</b>	SAE-B, 13-tooth coupling
<b>V</b>	SAE-BB, 15-tooth coupling
<b>C</b>	SAE-C, 14-tooth coupling
<b>W</b>	SAE-CC, 17-tooth coupling

**J3 System port size and location**

Code	Location	Port type	Inlet size	Outlet size
<b>P</b>	Radial	4-bolt split-flange	2 ½ in.	1 ¼ in.
<b>L</b>	Axial	4-bolt split-flange	2 ½ in.	1 ¼ in.

**K1 Shaft seal**

<b>A</b>	Single lip seal, viton
----------	------------------------

**K2 Mounting flange and housing port style**

<b>1</b>	SAE-C 4-bolt, SAE O-ring boss housing ports
----------	---

**K3 Not used**

<b>N</b>	Not applicable
----------	----------------

**L Displacement limiter**

<b>NNN</b>	None
<b>AAA</b>	Adjustable, factory set at max angle

**M Special hardware**

<b>NNN</b>	None
------------	------

**N Special features**

<b>NNN</b>	None
------------	------

**CONTROLS**

**Pressure compensated control (PC)**

*Specifications* *PC control setting range*

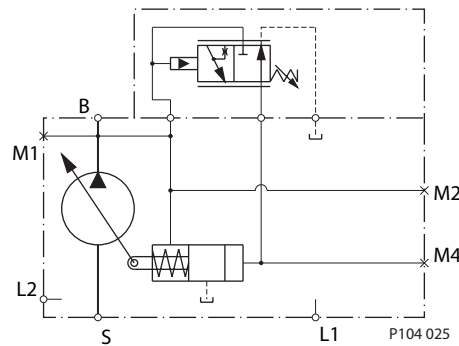
Model	bar	psi
E100B	100–310	1450–4495
E130B	100–310	1450–4495
E147C	100–260	1450–3770

*Response/recovery times\**

(ms)	Response	Recovery
E100B	45	175
E130B	55	175
E147C	60	190

\* For definitions, *see page 9.*

*Schematic diagram* *PC schematic*



**Legend**

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- M2 = System pressure gauge port
- M4 = Servo pressure gauge port

**Remote PC control (RP)**

*Specifications* *PC control setting range*

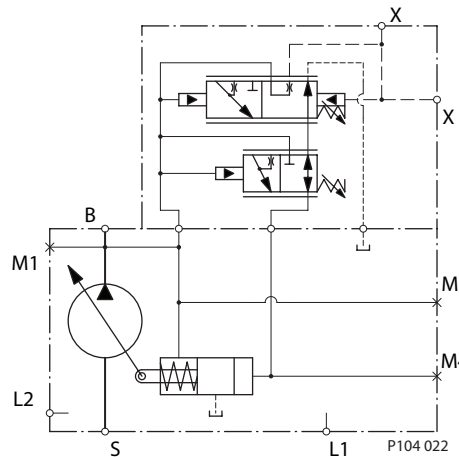
Model	bar	psi
E100B	100–310	1450–4495
E130B	100–310	1450–4495
E147C	100–260	1450–3770

*Response/recovery times\**

(ms)	Response	Recovery
E100B	45	175
E130B	55	175
E147C	60	190

\* For definitions, *see page 10.*

*Schematic diagram* *Remote PC schematic*



**LS setting**

Model	bar	psi
All	20	290

**Legend**

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- M2 = System pressure gauge port
- M4 = Servo pressure gauge port
- X = Remote PC port

**CONTROLS**  
 (continued)

**Load sensing control (LS)**

*Specifications* *PC setting range*

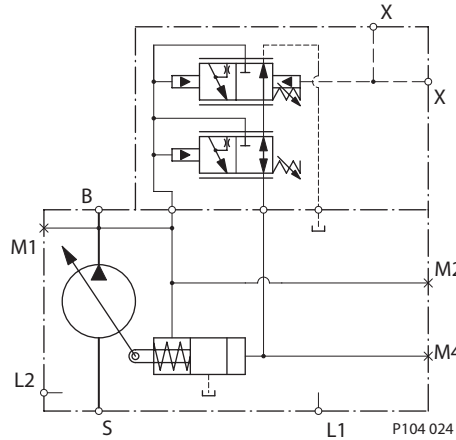
Model	bar	psi
E100B	100–310	1450–4495
E130B	100–310	1450–4495
E147C	100–260	1450–3770

*Response/recovery times\**

(ms)	Response	Recovery
E100B	45	200
E130B	50	200
E147C	60	200

\* For definitions, *see page 11*.

*Schematic diagram* *LS Schematic*



*LS setting range*

Model	bar	psi
All	10–30	145–435

**Legend**

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- M2 = System pressure gauge port
- M4 = Servo pressure gauge port
- X = LS signal port

**Load sensing control with internal bleed orifice (LB)**

*Specifications* *PC setting range*

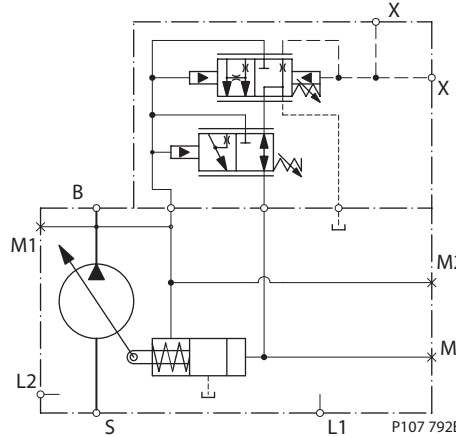
Model	bar	psi
E100B	100–310	1450–4495
E130B	100–310	1450–4495
E147C	100–260	1450–3770

*Response/recovery times\**

(ms)	Response	Recovery
E100B	45	200
E130B	50	200
E147C	60	200

\* For definitions, *see page 11*.

*Schematic diagram* *LB Schematic*



*LS setting range*

Model	bar	psi
All	10–30	145–435

**Legend**

- B = Outlet
- S = Inlet
- L1, L2 = Case drain
- M2 = System pressure gauge port
- M4 = Servo pressure gauge port
- X = LS signal port

**INPUT SHAFTS**

*Shaft data*

Code	Description	Maximum torque rating <sup>1</sup> N·m [lbf·in]	Drawing
S1	14-tooth spline 12/24 pitch (ANSI B92.1 1970 - Class 5)	1093 [9675]	<p>14 TOOTH 12/24 PITCH 30° PRESSURE ANGLE 29.634 [1.167] PITCH FILLET ROOT SIDE FIT COMPATIBLE WITH ANSI B92.1-1970 CLASS 5 ALSO MATES WITH FLAT ROOT SIDE FIT</p> <p>Ø31.14 ± 0.08 [1.226 ± 0.003]</p> <p>33.7 ± 0.5 [1.33 ± 0.02]</p> <p>48 [1.89]</p> <p>8 ± 0.8 [0.31 ± 0.03]</p> <p>COUPLING MUST NOT PROTRUDE BEYOND THIS POINT</p> <p>P104 038E</p> <p>MAXIMUM FULL SPLINE ENGAGEMENT SAUER-DANFOSS RECOMMENDS USING A COUNTER-BORE IN THE COUPLING TO ENSURE SPLINES DO NOT ENGAGE BEYOND THIS POINT.</p>
S2	17-tooth spline 12/24 pitch (ANSI B92.1 1970 - Class 5)	1044 [9240]	<p>17 TOOTH 12/24 PITCH 30° PRESSURE ANGLE 35.983 [1.417] PITCH DIA FILLET ROOT SIDE FIT COMPATIBLE WITH ANSI B92.1-1970 CLASS 5 ALSO MATES WITH FLAT ROOT SIDE FIT</p> <p>Ø30.75 [1.211] MAX</p> <p>Ø36.66 ± 0.08 [1.443 ± 0.003]</p> <p>34 ± 0.15 [1.339 ± 0.006]</p> <p>54 [2.126]</p> <p>8 ± 0.8 [0.31 ± 0.03]</p> <p>COUPLING MUST NOT PROTRUDE BEYOND THIS POINT</p> <p>P104 036E</p>
S4	13-tooth spline 8/16 pitch (ANSI B92.1 1970 - Class 5)	1551 [13 730]	<p>13 TOOTH 8/16 PITCH 30° PRESSURE ANGLE 41.28 [1.625] PITCH DIA FILLET ROOT SIDE FIT COMPATIBLE WITH ANSI B92.1-1970 CLASS 5 ALSO MATES WITH FLAT ROOT SIDE FIT</p> <p>Ø34.25 [1.348] MAX</p> <p>Ø43.94 ± 0.08 [1.73 ± 0.003]</p> <p>42 ± 0.15 [1.654 ± 0.006]</p> <p>67 [2.638]</p> <p>8 ± 0.8 [0.31 ± 0.03]</p> <p>COUPLING MUST NOT PROTRUDE BEYOND THIS POINT</p> <p>P104 035E</p>

1. See *Input shaft torque ratings*, page 18 for an explanation of maximum torque.

**INPUT SHAFTS**  
**(continued)**

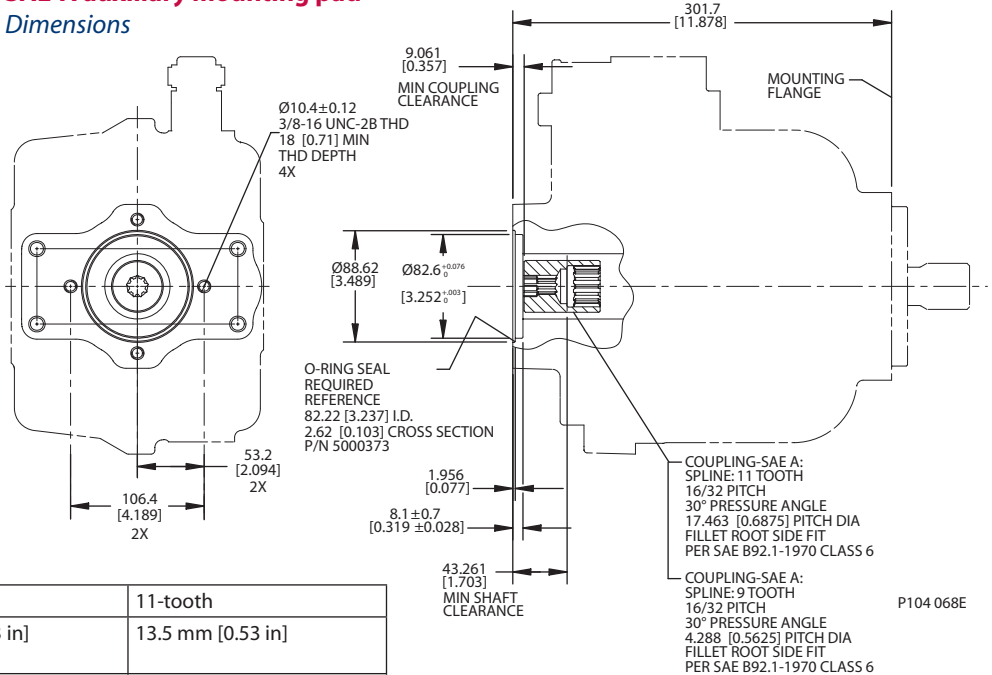
Code	Description	Maximum torque rating <sup>1</sup> N•m [lbf•in]	Drawing
K5	Ø 38.08 mm [1.5 in] Straight keyed	1161 [10 270]	<p>9.525 [0.375] X 38.1 [1.5] LONG SQUARE KEY</p> <p>Ø38.075 ± 0.025 [1.5 ± 0.0009]</p> <p>Ø42.26 ± 0.125 [1.664 ± 0.005]</p> <p>54 [2.13]</p> <p>8 ± 0.8 [0.31 ± 0.03]</p> <p>COUPLING MUST NOT PROTRUDE BEYOND THIS POINT</p> <p>P104 037E</p>

1. See *Input shaft torque ratings*, page 18 for an explanation of maximum torque.

**AUXILIARY MOUNTING PADS**

See page 18 for mating pump pilot and spline dimensions.

**SAE-A auxiliary mounting pad**  
 Dimensions

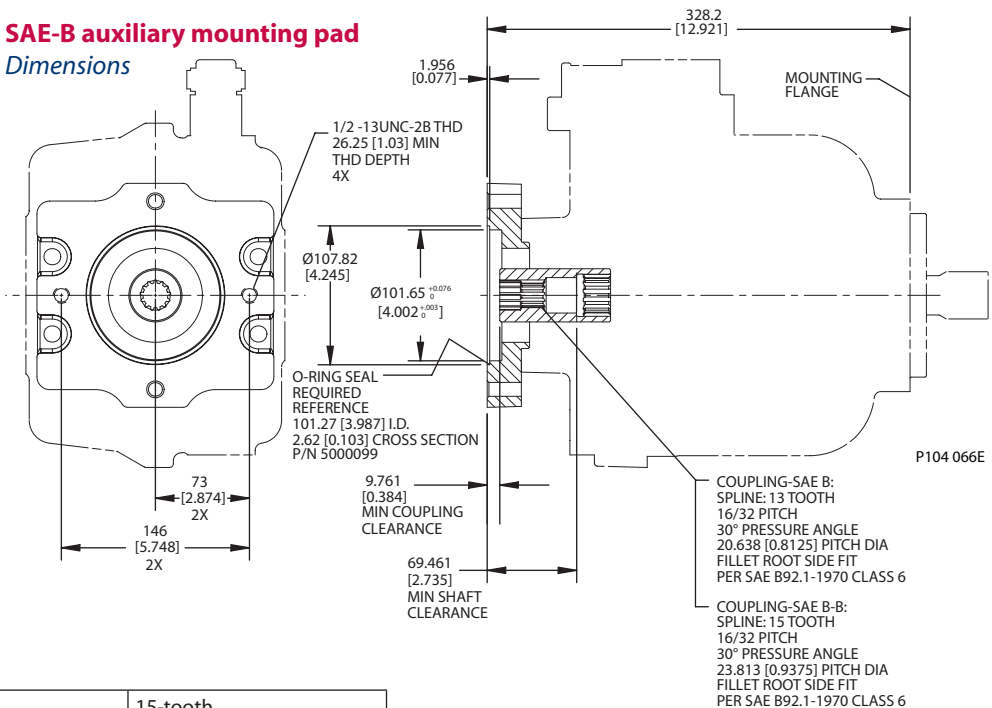


**Specifications**

Coupling	9-tooth	11-tooth
Spline minimum engagement	13.5 mm [0.53 in]	13.5 mm [0.53 in]
Maximum torque	107 N·m [950 lbf·in]	147 N·m [1300 lbf·in]

**SAE-B auxiliary mounting pad**  
 Dimensions

See page 18 for mating pump pilot and spline dimensions.



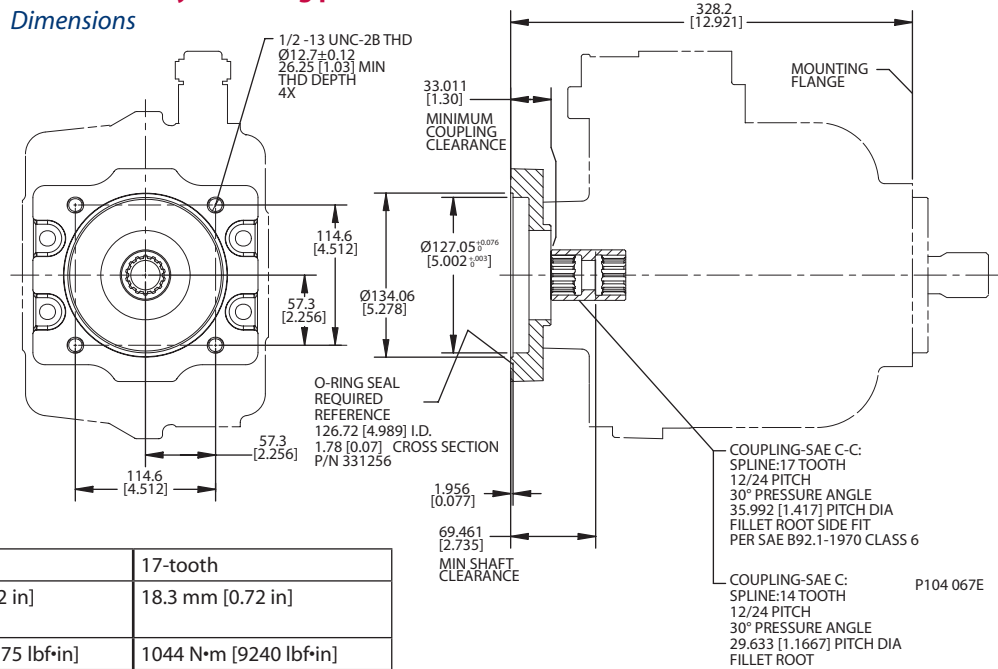
**Specifications**

Coupling	13-tooth	15-tooth
Spline minimum engagement	14.2 mm [0.56 in]	16.1 mm [0.63 in]
Maximum torque	249 N·m [2200 lbf·in]	339 N·m [3000 lbf·in]

**AUXILIARY MOUNTING PADS (continued)**

See page 18 for mating pump pilot and spline dimensions.

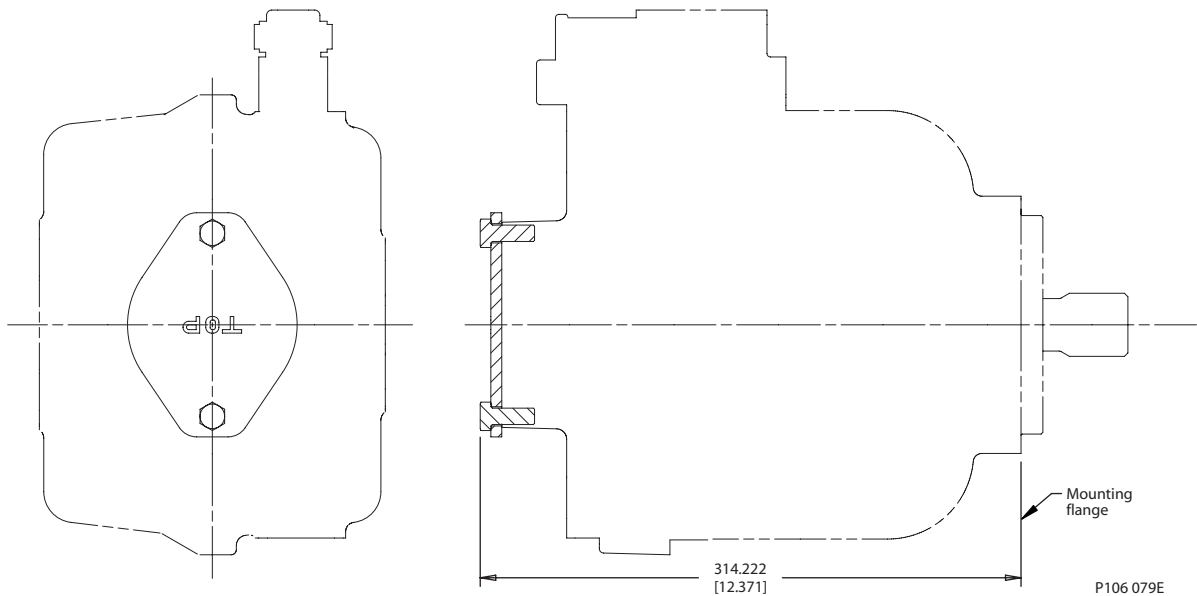
**SAE-C auxiliary mounting pad**  
 Dimensions



**Specifications**

Coupling	14-tooth	17-tooth
Spline minimum engagement	18.3 mm [0.72 in]	18.3 mm [0.72 in]
Maximum torque	1093 N·m [9675 lbf·in]	1044 N·m [9240 lbf·in]

**Running cover**  
 Dimensions

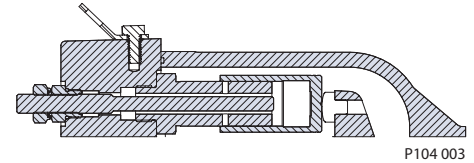




**DISPLACEMENT LIMITERS**

E Frame open circuit pumps are available with an optional adjustable displacement limiter. This adjustable stop limits the pump's maximum displacement.

*Displacement limiter cross-section*



P104 003

*Setting range*

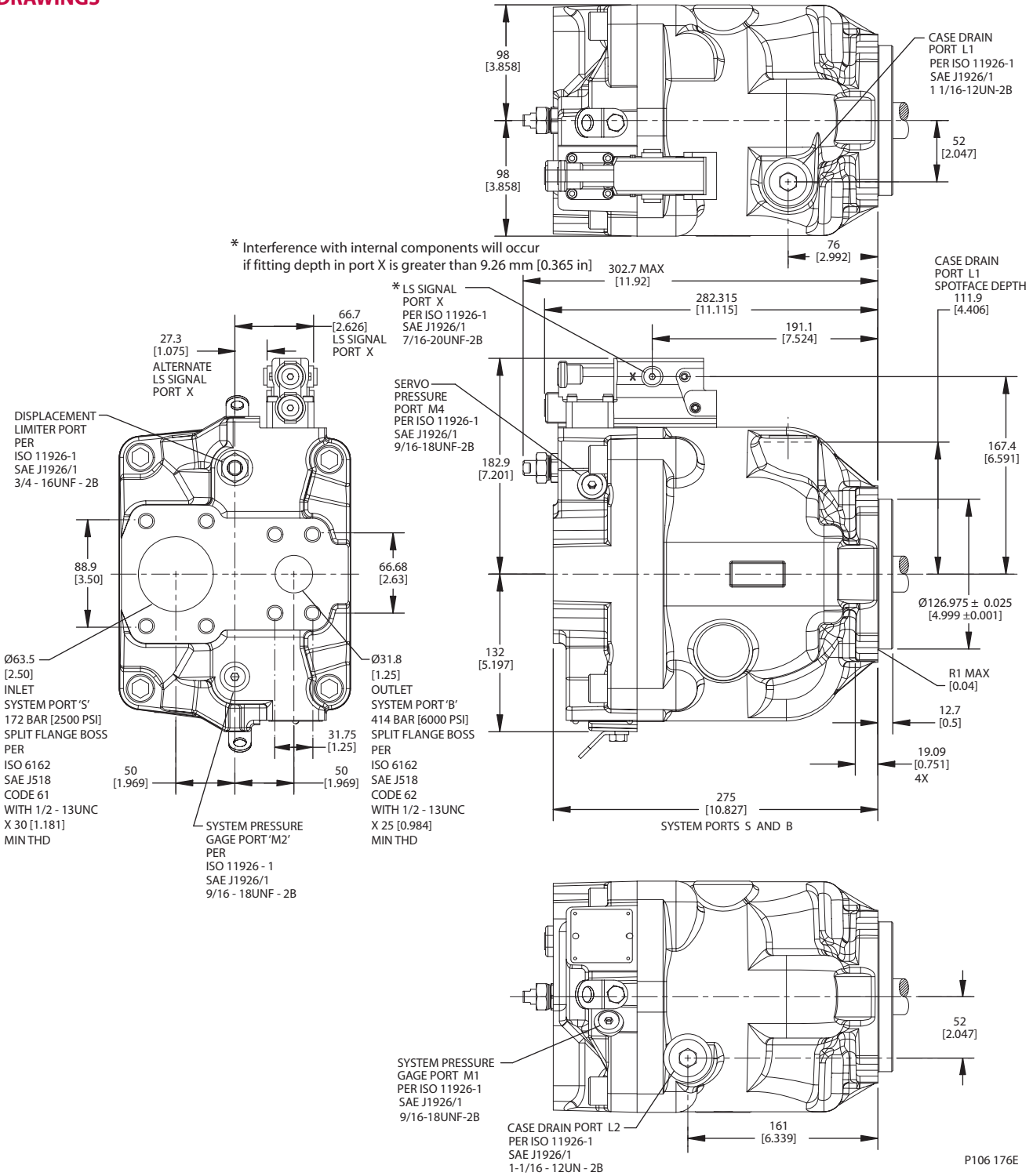
<b>E100B</b>	40 to 100 cm <sup>3</sup> [2.44 to 6.1 in <sup>3</sup> ]
<b>E130B</b>	70 to 130 cm <sup>3</sup> [4.27 to 7.93 in <sup>3</sup> ]
<b>E147C</b>	87 to 147 cm <sup>3</sup> [5.31 to 8.97 in <sup>3</sup> ]

*Displacement per turn*

<b>E100B</b>	8.4 cm <sup>3</sup> /rev [0.51 in <sup>3</sup> /rev]
<b>E130B</b>	8.4 cm <sup>3</sup> /rev [0.51 in <sup>3</sup> /rev]
<b>E147C</b>	8.4 cm <sup>3</sup> /rev [0.51 in <sup>3</sup> /rev]

**INSTALLATION  
DRAWINGS**

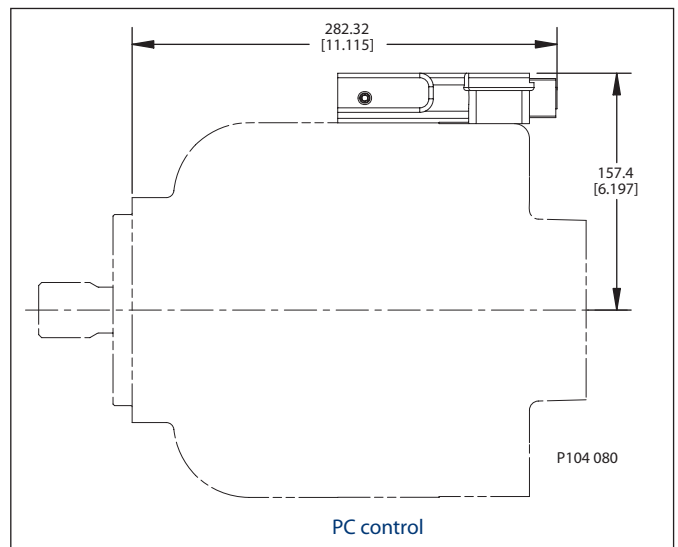
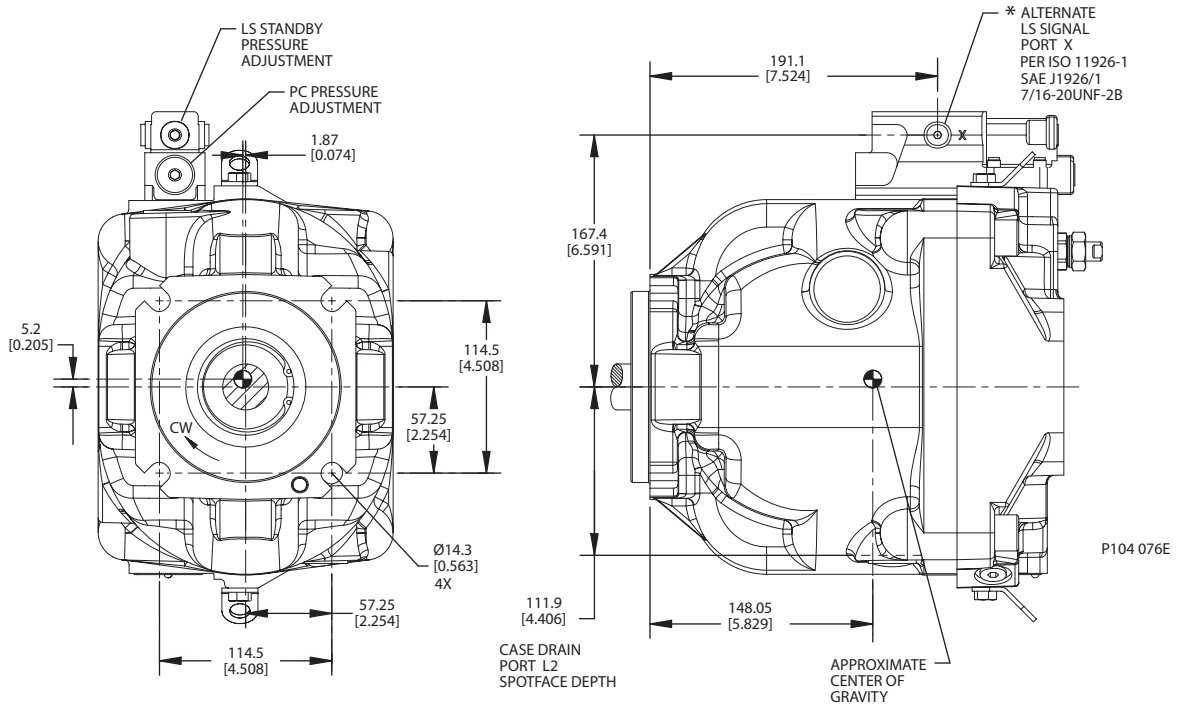
**Axial ported endcap, clockwise rotation**



**INSTALLATION  
DRAWINGS  
(continued)**

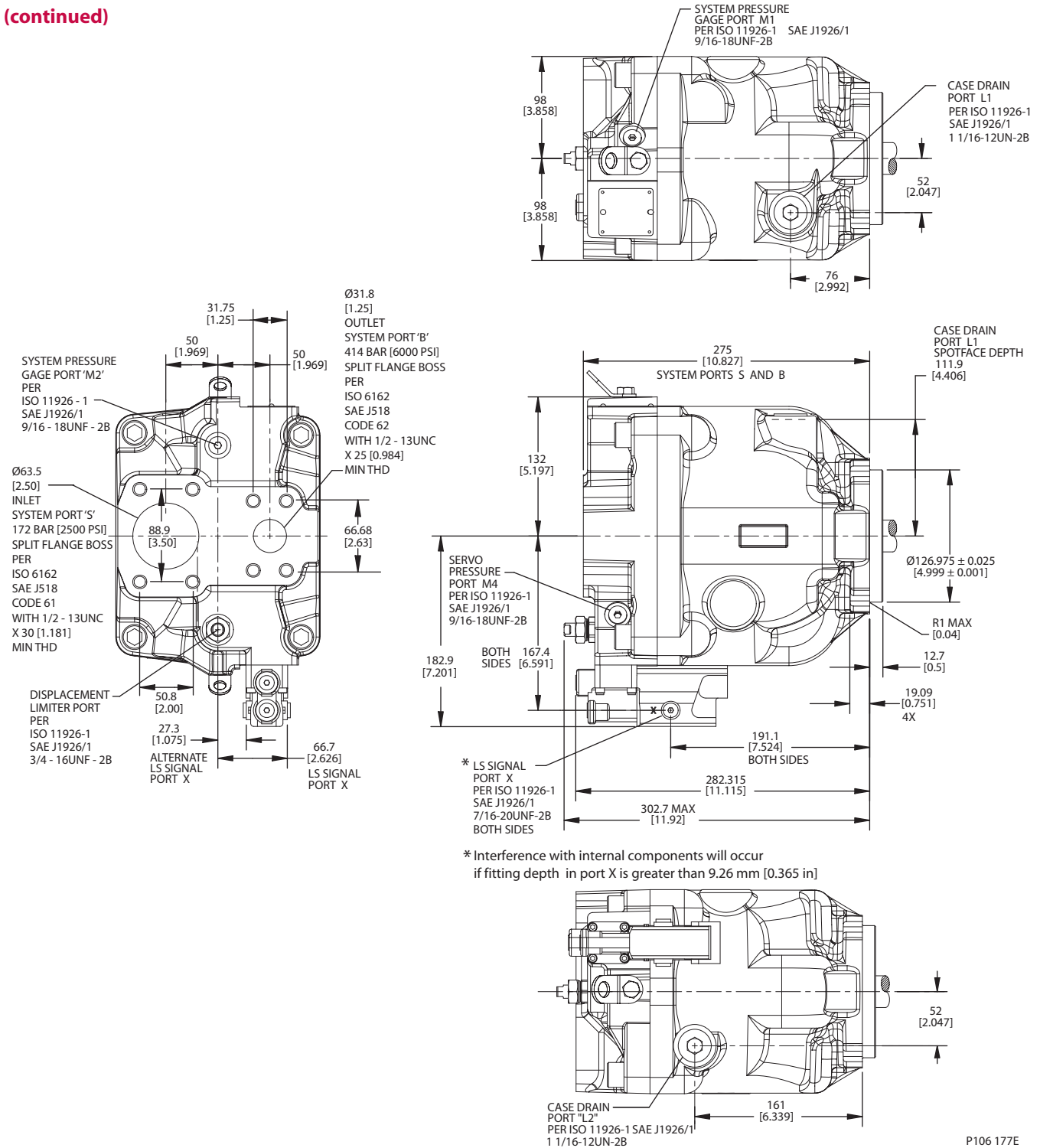
**Axial ported endcap, clockwise rotation (continued)**

\* Interference with internal components will occur if fitting depth in port X is greater than 9.26 mm [0.365 in]



**INSTALLATION  
 DRAWINGS  
 (continued)**

**Axial ported endcap, counterclockwise rotation**

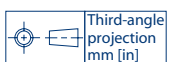
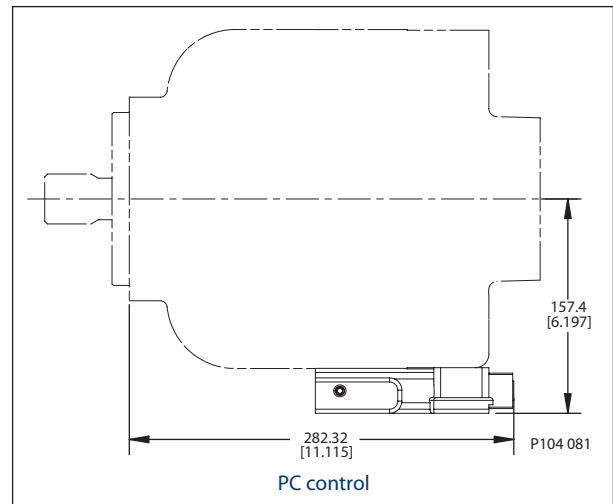
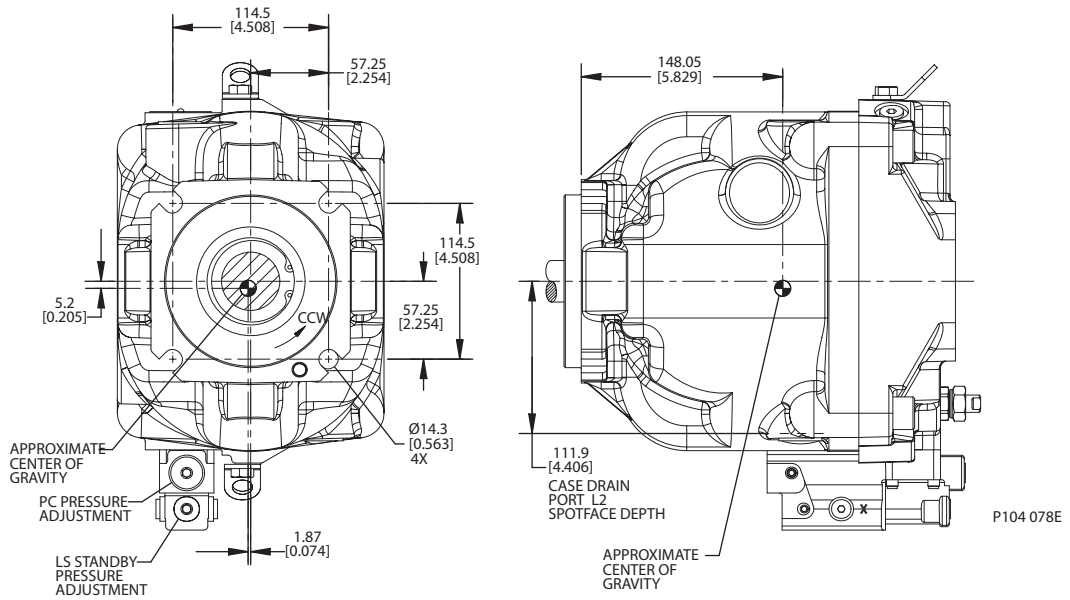


P106 177E



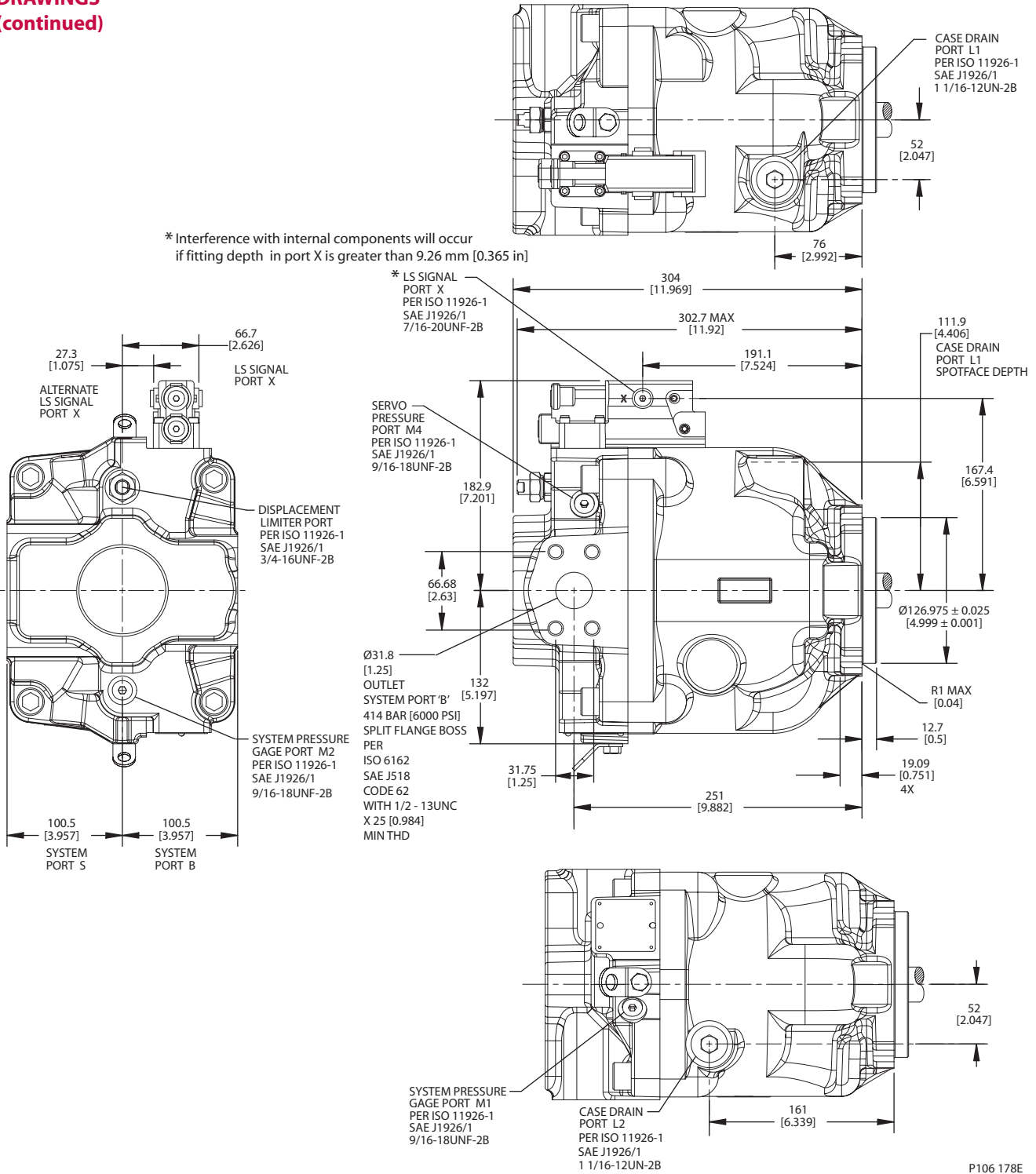
**INSTALLATION  
DRAWINGS  
(continued)**

**Axial ported endcap, counterclockwise rotation (continued)**



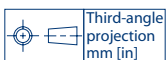
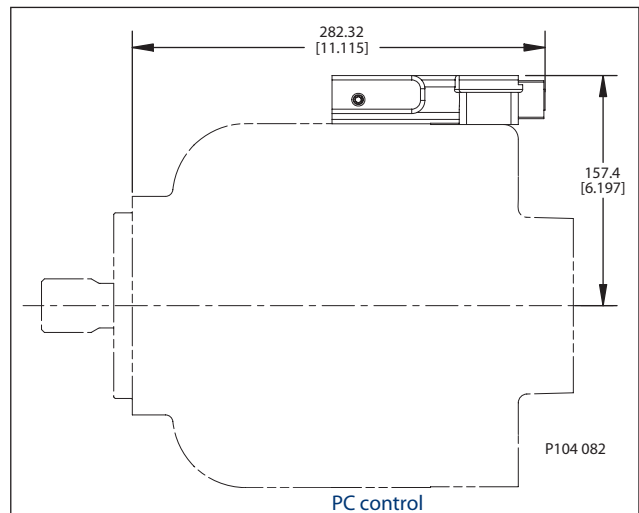
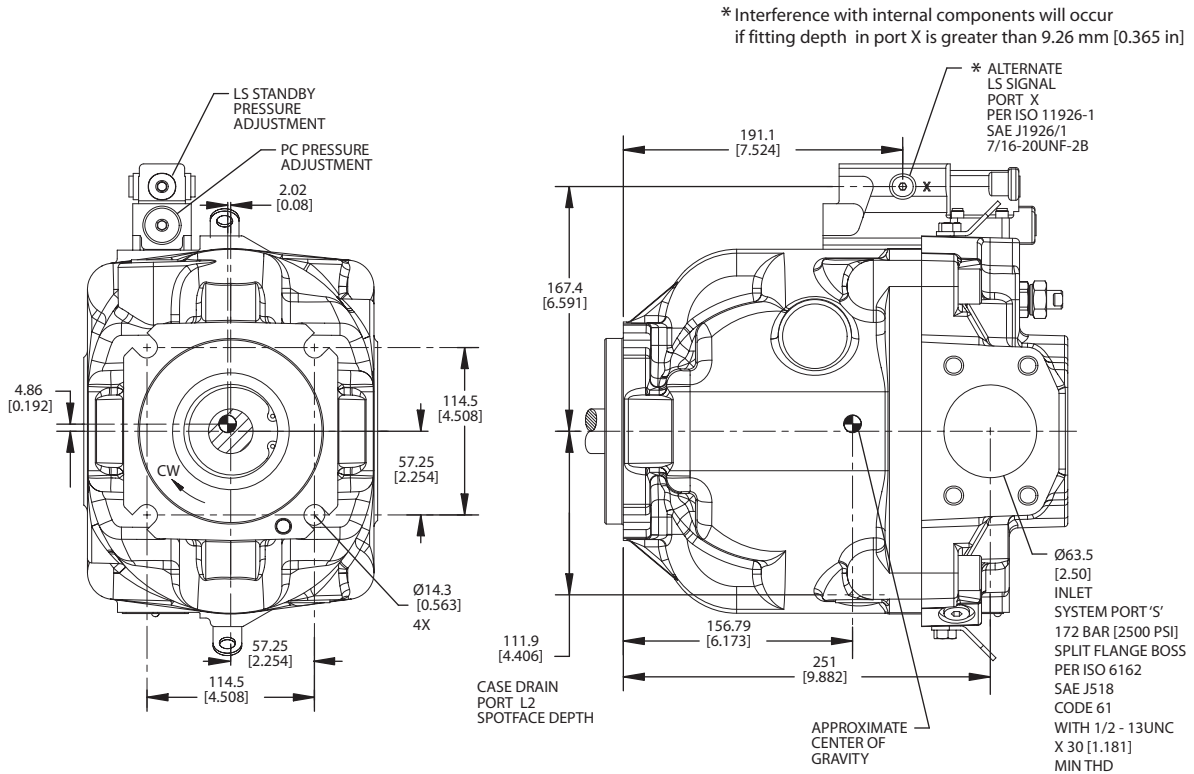
**INSTALLATION  
DRAWINGS  
(continued)**

**Radial ported endcap, clockwise rotation**



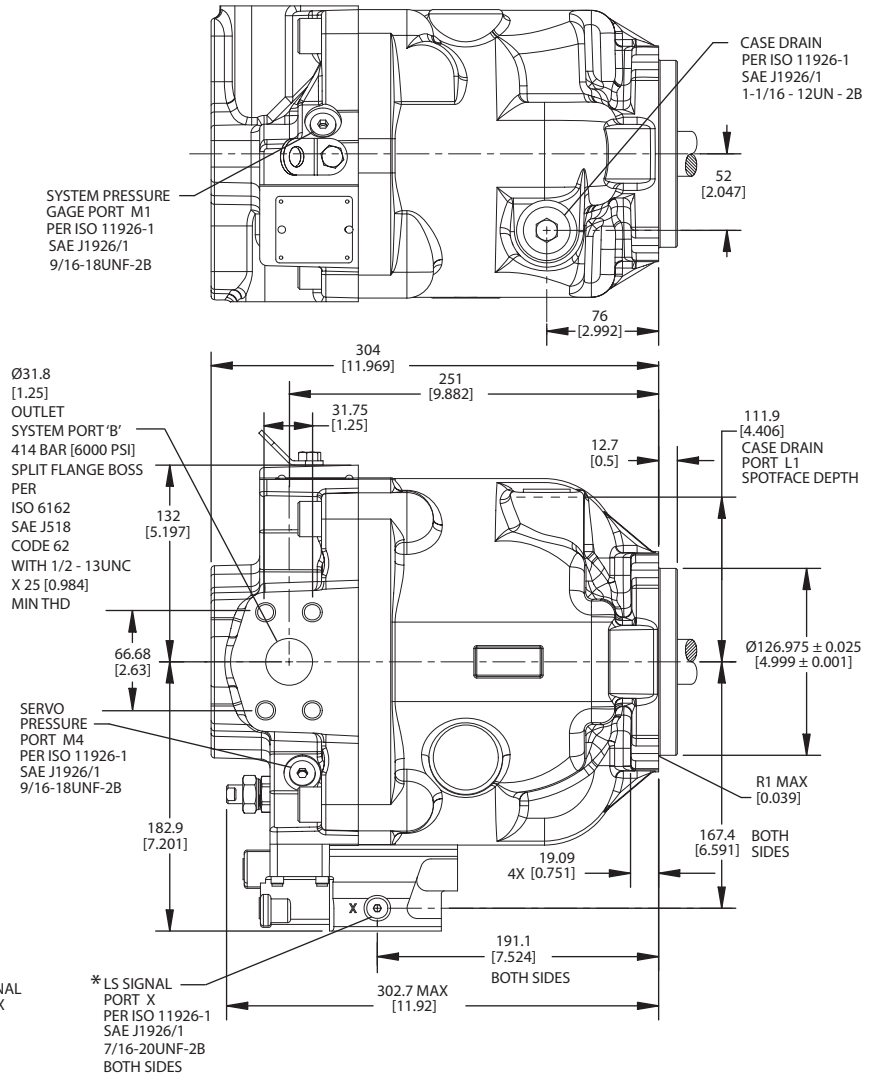
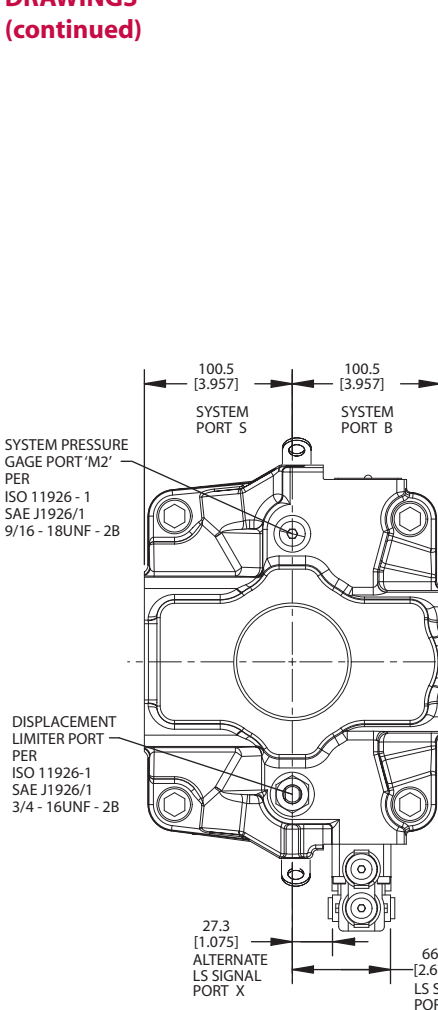
**INSTALLATION  
DRAWINGS  
(continued)**

**Radial ported endcap, clockwise rotation (continued)**

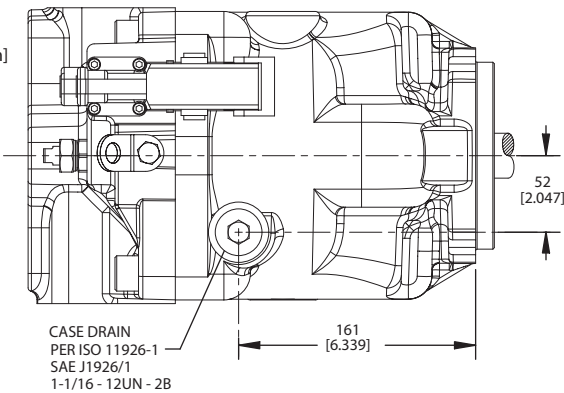


**INSTALLATION  
DRAWINGS  
(continued)**

**Radial ported endcap, counterclockwise rotation**



\* Interference with internal components will occur if fitting depth in port X is greater than 9.26 mm [0.365 in]



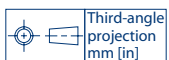
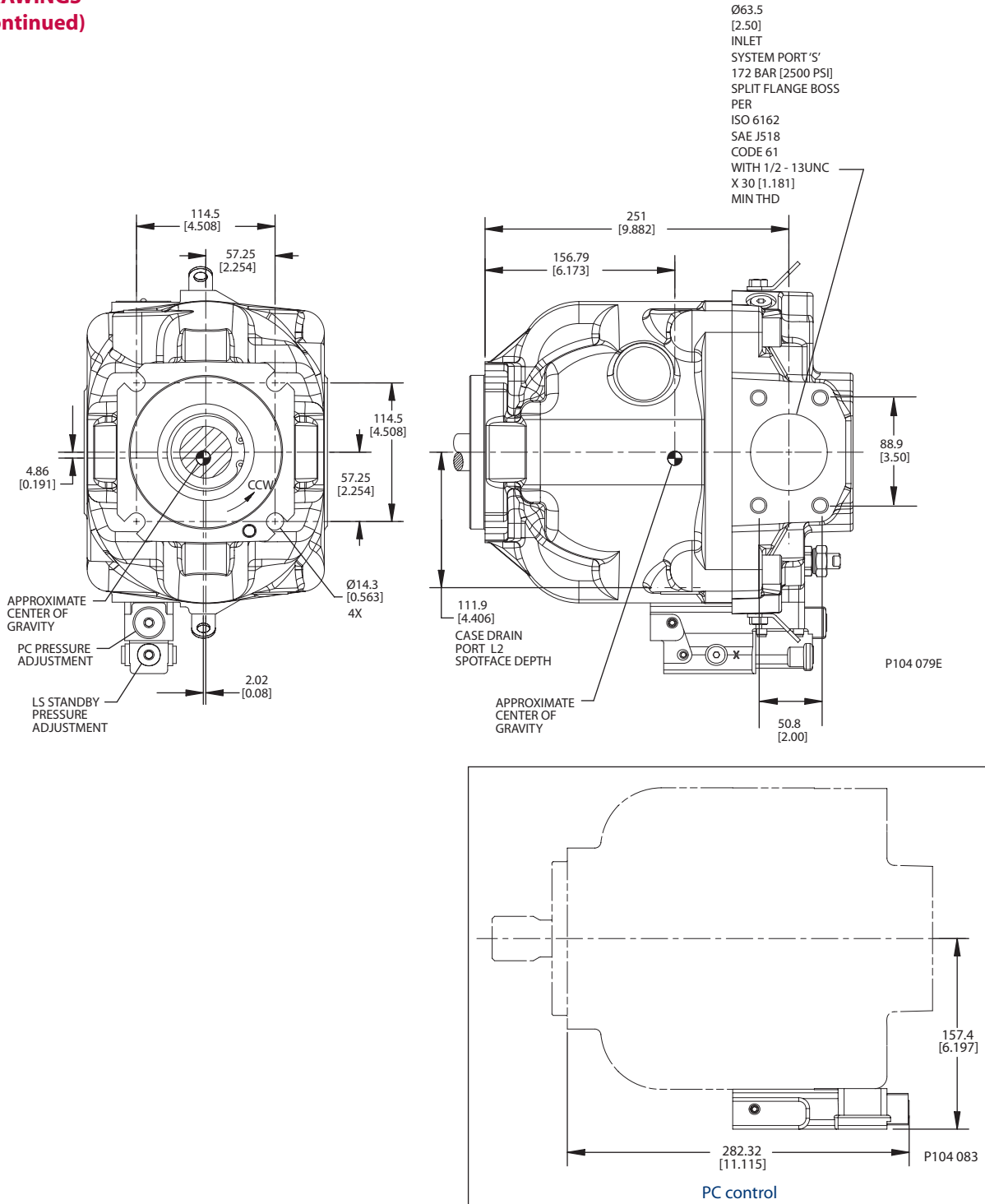
P106 179E





**INSTALLATION  
DRAWINGS  
(continued)**

**Radial ported endcap, counterclockwise rotation (continued)**





Series 45 Axial Piston Open Circuit Pumps  
Technical Information  
Notes



Series 45 Axial Piston Open Circuit Pumps  
Technical Information  
Notes



## Our Products

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Proportional valves

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Local address:

Sauer-Danfoss (US) Company  
2800 East 13th Street  
Ames, IA 50010, USA  
Phone: +1 515 239-6000  
Fax: +1 515 239-6618

Sauer-Danfoss GmbH & Co. OHG  
Postfach 2460, D-24531 Neumünster  
Krokamp 35, D-24539 Neumünster, Germany  
Phone: +49 4321 871-0  
Fax: +49 4321 871 122

Sauer-Danfoss ApS  
DK-6430 Nordborg, Denmark  
Phone: +45 7488 4444  
Fax: +45 7488 4400

Sauer-Danfoss-Daikin LTD  
Sannomiya Grand Bldg. 8F  
2-2-21 Isogami-dori, Chuo-ku  
Kobe, Hyogo 651-0086, Japan  
Phone: +81 78 231 5001  
Fax: +81 78 231 5004