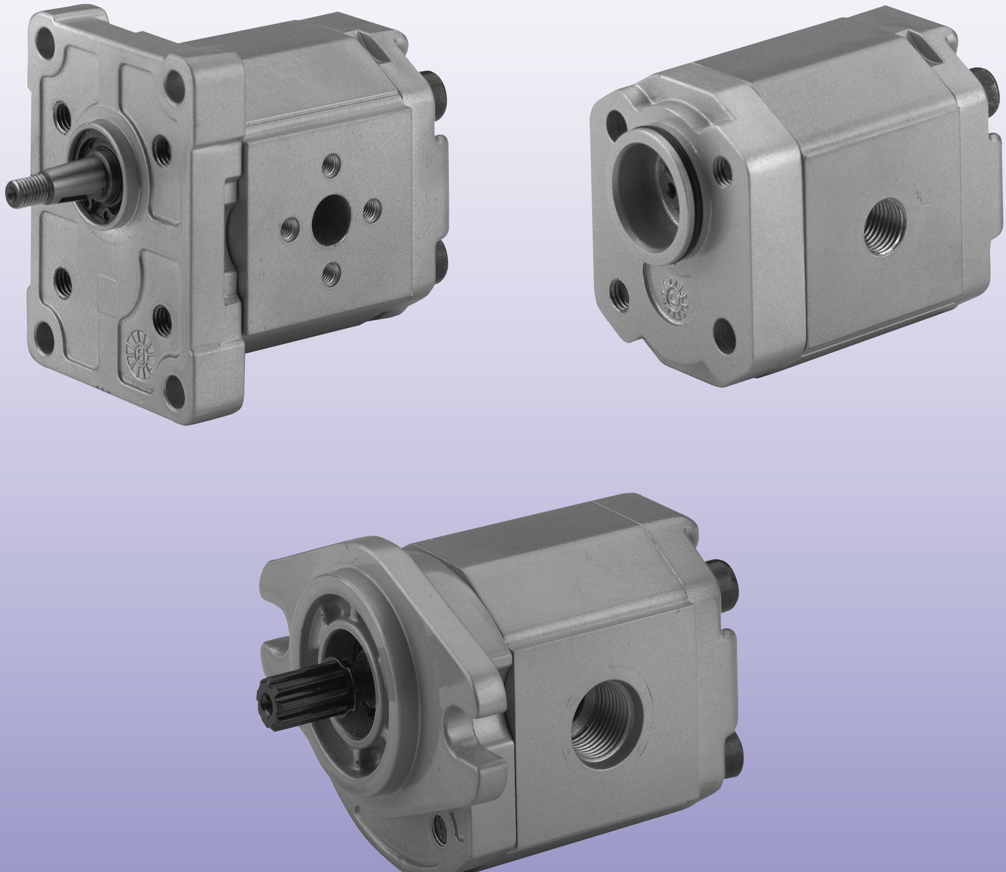
BACK

SAUER DANFOSS

Group 1



Gear Pumps

Technical Information

Group 1 Family of Gear Pumps

SAUER-SUNDSTRAND High performance gear pumps are fixed displacement pumps which consist of the pump housing, drive gear, driven gear, DU bushings, rear cover and front flange, shaft seal, and inner / outer seals. The pressure balanced design of the pumps provides high efficiency for the entire series.

The standard SNP 1 pumps are offered throughout the given range of displacements. There are also one special versions, the SKP 1. The SKP 1 is designed to accommodate an SAE 9T 20/40 DP tooth splined shaft for higher torque applications.

- **Large Displacement Range from 1.2 to 12 cm^3/rev**
- **High Performance at Low Cost**
- **Efficient Pressure Balanced Design**
- **Proven Reliability and Performance**
- **Optimum Product Configurations**
- **Full Range of Auxiliary Features**
- **Compact, Lightweight**
- **Modular Product Design**
- **Quiet Operation**
- **Worldwide Sales and Service**

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Technical Data

Specifications for Group 1 pumps are listed on these two pages.

For definition and explanation of the various terms, see page 7.

Pump Model		1,2	1,7	2,2	2,6	3,2	3,8	4,3	6	7,8	10	12
Displacement	cm^3/rev [in^3/rev]	1.18 [.072]	1.57 [.096]	2.09 [.128]	2.62 [.160]	3.14 [.192]	3.66 [.223]	4.19 [.256]	5.89 [.359]	7.59 [.463]	9.94 [.607]	12 [.732]
SNP 1	**01 and 03 configuration**											
Peak Pressure	bar [psi]	270 [3916]	270 [3916]	270 [3916]	270 [3916]	270 [3916]	270 [3916]	270 [3916]	210 [3048]	170 [2467]		
Rated Pressure	bar [psi]	250 [3626]	250 [3626]	250 [3626]	250 [3626]	250 [3626]	250 [3626]	250 [3626]	190 [2758]	150 [2177]		
Minimum Speed at 0-150 bar	min^{-1} (rpm)	800	800	600	600	600	600	500	500	500		
Minimum Speed at 150 bar to rated pressure	min^{-1} (rpm)	1200	1200	1000	1000	1000	1000	800	800	800		
Maximum Speed	min^{-1} (rpm)	4000	4000	4000	4000	4000	4000	3000	3000	3000		
SEP 1	**01 and 03 configuration**											
Peak Pressure	bar [psi]	230 [3336]	230 [3336]	230 [3336]	230 [3336]	230 [3336]	230 [3336]	230 [3336]	190 [2758]	160 [2322]		
Rated Pressure	bar [psi]	210 [3046]	210 [3046]	210 [3046]	210 [3046]	210 [3046]	210 [3046]	210 [3046]	170 [2467]	140 [2032]		
Minimum Speed at 0-150 bar	min^{-1} (rpm)	800	800	600	600	600	600	500	500	500		
Minimum Speed at 150 bar to rated pressure	min^{-1} (rpm)	1200	1200	1000	1000	1000	1000	800	800	800		
Maximum Speed	min^{-1} (rpm)	4000	4000	4000	4000	4000	4000	3000	3000	3000		
SKP 1	**02 and 06 configuration**											
Peak Pressure	bar [psi]	270 [3916]	270 [3916]	270 [3916]	270 [3916]	270 [3916]	270 [3916]	270 [3916]	250 [3626]	220 [3191]	170 [2467]	140 [2032]
Rated Pressure	bar [psi]	250 [3626]	250 [3626]	250 [3626]	250 [3626]	250 [3626]	250 [3626]	250 [3626]	230 [3336]	200 [2901]	150 [2177]	120 [1742]
Minimum Speed at 0-150 bar	min^{-1} (rpm)	800	800	800	800	800	800	600	600	600	600	600
Minimum Speed at 150 bar to rated pressure	min^{-1} (rpm)	1200	1200	1000	1000	1000	1000	800	800	800	800	-
Maximum Speed	min^{-1} (rpm)	4000	4000	4000	4000	4000	4000	3000	3000	3000	2000	2000
ALL												
Weight	kg [lb]	1.02 [2.26]	1.05 [2.31]	1.09 [2.40]	1.11 [2.45]	1.14 [2.51]	1.18 [2.60]	1.20 [2.65]	1.30 [2.87]	1.39 [3.06]	1.55 [3.42]	1.65 [3.64]
Moment of Inertia of rotating components	x10^{-6} kg m^2 [x10^{-6} lbf ft^2]	3.2 [77]	3.7 [89]	4.4 [105]	5.1 [120]	5.7 [136]	6.4 [152]	7.1 [168]	9.3 [220]	11.4 [271]	14.6 [347]	17.1 [407]
Theoretical Flow at Maximum Speed	l / min [US gal / min]	4.72 [1.25]	6.28 [1.66]	8.36 [2.21]	10.48 [2.77]	12.56 [3.32]	14.64 [3.87]	12.57 [3.32]	17.67 [4.67]	22.77 [6.02]	19.88 [5.25]	24 [6.34]

Caution: Allowable pressure may be limited by shaft torque capability. Refer to page 21.

System Specifications

Inlet Pressure - bar absolute	
Recommended Range	0.8 to 3.0
Minimum (cold start)	0.6

T102 001E

Fluid Viscosity -mm²/s (cSt) [SUS]	
Minimum	10 [60]
Recommended Range	12 to 60 [66 to 290]
Maximum (cold start)	1000 [4600]

T102 002E

Temperature - °C [°F]	
Minimum (cold start)	-20 [-4]
Maximum Continuous	80 [176]
Peak (intermittent)	90 [194]

T102 003E

Fluid Cleanliness Level and β_x Ratio	
Fluid Cleanliness Level (per ISO 4406)	Class 18/13 or better
β_x Ratio (Suction Filtration)	$\beta_{35\text{-}45}$=75 and β_{10}=2
β_x Ratio (Pressure or Return Filtration)	β_{10}=75
Recommended Inlet Screen Size	100-125µm

T102 004E

Model Code

A B C D E F / H L M N P R S

Type

SNP 1	=	Standard Gear Pump
SKP 1	=	High Torque Gear Pump
SEP 1	=	Medium Pressure Gear Pump
SNI 1	=	Gear Pump with Internal Drain Relief Valve

Valve (omit when not used)

Displacement

		cm³/rev	/	[(in³/rev]
1,2	=	1.18	/	[0.072]
1,7	=	1.57	/	[0.096]
2,2	=	2.09	/	[0.128]
2,6	=	2.62	/	[0.160]
3,2	=	3.14	/	[0.192]
3,8	=	3.66	/	[0.223]
4,3	=	4.19	/	[0.256]
6,0	=	5.89	/	[0.359]
7,8	=	7.59	/	[0.463]
10	=	9.94	/	[0.607]
12	=	12	/	[0.732]

Direction of Rotation

D	=	Right (Clockwise)
S	=	Left (Anti-clockwise)

Input Shaft / Mounting Flange / Port Configuration

CO Tapered shafts, 1:5 or 1:8

CO01	=	1:8 tapered shaft / European four bolt flange / European flanged ports
CO02	=	1:5 tapered shaft / German four bolt PTO flange / German standard ports

CI Parallel shafts, 12mm or 12,7mm

CI02	=	12mm [0.47]
CI06	=	12,7mm [.500 in] parallel shaft / SAE A-A flange / SAE O-ring boss ports

SC Splined shafts,

SC02	=	splined shaft
SC06	=	SAE splined shaft / SAE A-A flange / SAE O-ring boss ports

FR Sauer-Sundstrand tang shaft

FR03	=	Sauer-Sundstrand tang shaft / flanged for multiple configuration / German standard ports

A	B	C	D	E	F	/	H		L	M			N	P			R	S

Variant Code (Three letter code describes valve settings or other variants to standard configuration) — P

LAN=FR03 Configuration without shaft seal

V** **Integral relief valve**

Pressure setting [bar] / (psi)

A	=	No setting		**O**	=	[90]	(1305)
B	=	No valve		**P**	=	[100]	(1450)
C	=	[18]	(261)	**Q**	=	[110]	(1595)
D	=	[25]	(363)	**R**	=	[120]	(1740)
E	=	[30]	(435)	**S**	=	[130]	(1885)
F	=	[35]	(508)	**T**	=	[140]	(2030)
G	=	[40]	(580)	**U**	=	[160]	(2320)
K	=	[50]	(725)	**V**	=	[170]	(2465)
L	=	[60]	(870)	**W**	=	[180]	(2611)
M	=	[70]	(1015)	**X**	=	[210]	(3045)
N	=	[80]	(1160)	**Z**	=	[250]	(3626)

Pump speed for relief valve setting (min^{-1} (rpm))

A	=	Not defined
C	=	500
E	=	1000
F	=	1250
G	=	1500
K	=	2000
I	=	2250
L	=	2500
M	=	2800
N	=	3000
O	=	3250

Version (Value representing a change to the initial project) — R

.	=	Initial project
1..9 A..Z	=	Reserved to

Port Type (If other than standard) — S

.	=	Standard port for the flange type specified
B	=	Flanged port with threaded holes in "X" pattern (German standard ports), centered on the body
C	=	Flanged port with threaded holes in "+" pattern (European Standard)
E	=	Threaded SAE o-ring boss port
F	=	Threaded Gas port (BSP)

Standard Formulae for Determination of Nominal Pump Size

The formulas below will aid in determining the nominal pump size for a specific application.

Metric System

Output Flow $Q = \dfrac{Vg \bullet n \bullet \eta_v}{1\,000}$ (l/min)

Input Torque $M = \dfrac{Vg \bullet \Delta p}{20 \bullet \pi \bullet \eta_m}$ (Nm)

Input Power $P = \dfrac{M \bullet n \bullet \pi}{30\,000} = \dfrac{Q \bullet \Delta p}{600 \bullet \eta_t}$ (kW)

Vg = Displacement per revolution (cm^3)

p_o = Outlet Pressure (bar)

p_i = Inlet Pressure (bar)

Δp = $p_o - p_i$ (bar) (system pressure)

n = Speed (min^{-1} [rpm])

η_v = Volumetric efficiency

η_m = Mechanical efficiency

η_t = $\eta_v \bullet \eta_m$ = Overall efficiency

S102 000E
S102 001E

Inch System

Output Flow $Q = \dfrac{Vg \bullet n \bullet \eta_v}{231}$ (US gal/min)

Input Torque $M = \dfrac{Vg \bullet \Delta p}{2 \bullet \pi \bullet \eta_m}$ (lbf•in)

Input Power $P = \dfrac{M \bullet n \bullet \pi}{396\,000} = \dfrac{Q \bullet \Delta p}{1714 \bullet \eta_t}$ (HP)

Vg = Displacement per revolution (in^3)

p_o = Outlet Pressure (psi)

p_i = Inlet Pressure (psi)

Δp = $p_o - p_i$ (psi) (system pressure)

n = Speed (min^{-1} [rpm])

η_v = Volumetric efficiency

η_m = Mechanical efficiency

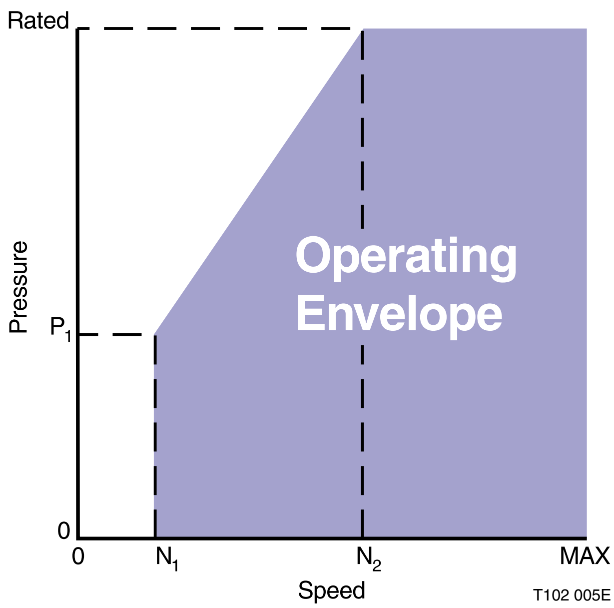
η_t = $\eta_v \bullet \eta_m$ = Overall efficiency

S102 002E
S102 003E

Definition and Explanation of Technical Terms

Maximum speed is the speed limit recommended when operating at rated pressure. It is the highest speed at which normal life can be expected.

Minimum Speed is the lower limit of operating speed. It is the lowest speed at which normal bearing life can be expected. It is important to note that the minimum speed increases as operating pressure increases. When operating under higher pressures, a higher minimum speed must be maintained (see graph below).



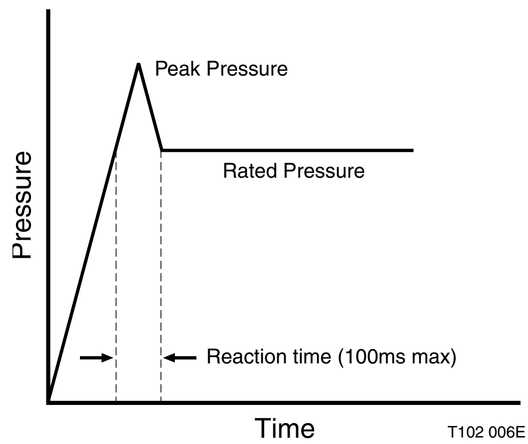
T102 005E

Where:
N_1 = Minimum speed at 150 bar
N_2 = Minimum speed at rated pressure

System pressure is the differential of pressure between the outlet and inlet ports. It is a 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.

Rated pressure is the average, regularly occurring operating pressure that should yield satisfactory product life. It can be determined by the maximum machine load demand. For all systems the load should move below this pressure.

Peak pressure is the highest intermittent pressure allowed, and is determined by the relief valve over shoot (reaction time). Peak pressure is assumed to occur for less than 100 ms in duration.



T102 006E

Inlet pressure must be controlled in order to achieve expected life and performance. A continuous inlet pressure less than those shown in the table below would indicate inadequate inlet design or a restricted inlet screen. Lower inlet pressures during cold start should be expected, but should improve quickly as the fluid warms.

Inlet Pressure - bar absolute	
Recommended Range	0.8 to 3.0
Minimum (cold start)	0.6

T102 001E

System Requirements

Hydraulic Fluid

Ratings and data for Group 1 gear pumps are based on operation with premium hydraulic fluids containing oxidation, rust, and foam inhibitors. These fluids must possess good thermal and hydrolytic stability to prevent wear, erosion, and corrosion of internal components.

These include:

- Hydraulic fluids per DIN 51524, part 2 (HLP) and part 3 (HVLP)
- API CD engine oils per SAE J183
- M2C33F or G automatic transmission fluids
- Dexron II, IIE, and III meeting Allison C3 or Caterpillar TO-2
- Certain agricultural tractor fluids

For more information on fluid selection, see Sauer-Sundstrand publication BLN-9887 or 697581. For information relating to biodegradable fluids, see Sauer-Sundstrand publication ATI-E 9101.

Never mix hydraulic fluids.

Temperature and Viscosity

Temperature and viscosity requirements must be concurrently satisfied. The data shown assumes petroleum / mineral based fluids. The high temperature limits apply at the inlet port to the pump. The pump should generally be run at or below the **maximum continuous temperature**. The **peak temperature** is based on material properties and should never be exceeded. Cold oil will generally not affect the durability of the pump components, but it may affect the ability to flow oil and transmit power; therefore temperatures should remain 16°C (30°F) above the pour point of the hydraulic fluid. The **intermittent (minimum) temperature** relates to the physical properties of component materials. For maximum unit efficiency and bearing life the fluid viscosity should remain in the **recommended viscosity range**. The **minimum viscosity** should be encountered only during brief occasions of maximum ambient temperature and severe duty cycle operation. The **maximum viscosity** should be encountered only at cold start. During this condition speeds should be limited until the system warms up. Heat exchangers should be sized to keep the fluid within these limits. Testing is recommended to verify that these temperature and viscosity limits are not exceeded.

Fluid Viscosity -mm^2/s (cSt) [SUS]	
Minimum	10 [60]
Recommended Range	12 to 60 [66 to 290]
Maximum (cold start)	1000 [4600]

T102 002E

Temperature - °C [°F]	
Minimum (cold start)	-20 [-4]
Maximum Continuous	80 [176]
Peak (intermittent)	90 [194]

T102 003E

Fluids and Filtration

To prevent premature wear, it is imperative that only clean fluid enter the pump and hydraulic circuit. A filter capable of controlling the fluid cleanliness to Class 18/13 per ISO 4406 or better under normal operating conditions is recommended.

The filter may be located on the pump outlet (pressure filtration), inlet (suction filtration), or the reservoir return (return line filtration).

The selection of a filter depends on a number of factors including the contaminant ingression rate, the generation of contaminants in the system, the required fluid cleanliness, and the desired maintenance interval. Contaminant ingression rate is determined (among other things) by the type of actuators used in the system. Hydraulic cylinders normally cause higher levels of contamination to enter the system.

Fluid Cleanliness Level and β_x Ratio	
Fluid Cleanliness Level (per ISO 4406)	Class 18/13 or better
β_x Ratio (Suction Filtration)	β_{35-45}=75 and β_{10}=2
β_x Ratio (Pressure or Return Filtration)	β_{10}=75
Recommended Inlet Screen Size	100-125µm

T102 004E

Filters are selected to meet these requirements using rating parameters of efficiency and capacity. Filter efficiency may be measured with a Beta ratio[1] (β_X). For suction filtration, with controlled reservoir ingression, a filter with β_{35-45} = 75 (and β_{10} = 2) or better has been found to be satisfactory. For return or pressure filtration, filters with an efficiency of β_{10} = 75 are typically required.

Since each system is unique, the filtration requirements for that system will be unique and must be determined by test in each case. Filtration system acceptability should be judged by monitoring of prototypes, evaluation of components, and performance throughout the test program.

See Sauer-Sundstrand publications BLN-9887 [697581] and ATI-E 9201 for more information.

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

Reservoir

The function of the reservoir is to provide clean fluid, dissipate heat, remove entrained air, and allow for fluid volume changes associated with fluid expansion and cylinder differential volumes.

The reservoir should be designed to accommodate maximum volume changes during all system operating modes and to promote deaeration of the fluid as it passes through the tank. The design should accommodate a fluid dwell time between 60 and 180 seconds to allow entrained air to escape.

Minimum reservoir capacity depends on the volume needed to cool the oil, hold the oil from all retracted cylinders, and allow expansion due to temperature changes. Normally, a fluid volume of 1 to 3 times the pump output flow (per minute) is satisfactory. The minimum reservoir capacity is recommended to be 125% of the fluid volume.

The suction line should be located above the bottom of the reservoir to take advantage of gravity separation and prevent large foreign particles from entering the line. A 100 -125 µm screen covering the suction line is recommended. To minimize vacuum at the pump inlet, it is recommended that the pump be located below the lowest expected fluid level.

The return line should be positioned to allow discharge below the lowest fluid level, and directed into the interior of the reservoir for maximum dwell and efficient deaeration.

A baffle (or baffles) between the return line and suction line will promote deaeration and reduce surging of the fluid.

Line Sizing

The choice of piping size and installation should always be consistent with maintaining minimum fluid velocity. This will reduce system noise, pressure drops and overheating, thereby maximizing system life and performance. Inlet piping should be designed to maintain continuous pump inlet pressures above 0.8 bar absolute during normal operation. The inlet line velocity should not exceed 2.5 m/s [8.2 ft/s]. Pump outlet line velocity should not exceed 5 m/s [16.4 ft/s]. System return lines should be limited to 3 m/s [9.8 ft/s].

Inlet Design

Hydraulic oil used in the majority of systems contains about 10% dissolved air by volume. Under conditions of high inlet vacuum, bubbles are released from the oil. These bubbles collapse when subjected to pressure, which results in cavitation which causes erosion of the adjacent material. Because of this, the greater the air content within the oil, and the greater the vacuum in the inlet line, the more severe will be the resultant erosion.

The main causes of over-aeration are air leaks on the inlet side of the pump, and flow line restrictions. These may include inadequate pipe sizes, sharp bends, or elbow fittings causing a reduction of flow line cross sectional area. Providing pump inlet vacuum and rated speed requirements are maintained, and reservoir size and location are adequate, no cavitation problems should occur.

Pump Drive

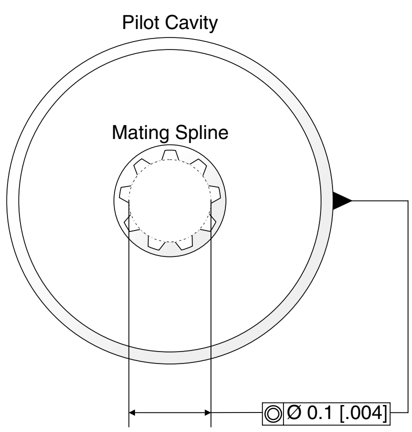
With a choice between tapered, splined, or parallel shafts, Sauer-Sundstrand gear pumps are suitable for a wide range of direct and indirect drive applications. Typically these applications use a plug-in, belt, or gear to drive the pump input shaft. Group 1 pumps are designed with bearings that can accept some incidental external radial and thrust loads.

For in-line drive applications, it is recommended that a three piece coupling be used to minimize radial or thrust shaft loads. Plug-in drives, acceptable only with spline shaft configurations, can impose severe radial loads on the pump shaft when the mating spline is rigidly supported. Increased spline clearance does not alleviate this condition. The use of plug in drives is permissible providing that the concentricity between the mating spline and pilot diameter is within 0.1 mm [.004 in]. The drive should be lubricated by flooding with oil.

The allowable **radial shaft loads** are a function of the load position, the load orientation, and the operating pressure of the hydraulic pump. All external shaft loads will have an effect on bearing life and may affect pump performance. In applications where external shaft loads cannot be avoided, the impact on the pump can be minimized by optimizing the orientation and magnitude of the load. A tapered input shaft is recommended for applications where radial shaft loads are present. Spline shafts are not recommended for belt or gear drive applications. For belt drive applications, a spring loaded belt tension device is recommended to avoid excessive belt tension.

Thrust (axial) loads in either direction should be avoided. If continuously applied external radial or thrust loads are known to occur, contact Sauer-Sundstrand for evaluation.

Contact your Sauer-Sundstrand representative for assistance when applying pumps with radial or thrust loads.



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Pump Drive Data Form

Photo copy this page and fax the completed form to your Sauer-Sundstrand representative for assistance in applying pumps with belt or gear drive.

Application Data		
Pump Displacement		cc/rev
Rated System Pressure		❑bar ❑psi
Relief Valve Setting		❑bar ❑psi
Pump Shaft Rotation		❑Left ❑Right
Pump Minimum Speed		min^{-1} (rpm)
Pump Maximum Speed		min^{-1} (rpm)
Drive Gear Helix Angle (gear drive only)		deg.
Belt Type (belt drive only)		❑V ❑Notch
Belt Tension (belt drive only) **P**		❑N ❑lbf
Angular Orientation of Gear or Belt to Inlet Port α		deg.
Pitch Diameter of Gear or Pulley d_w		❑mm ❑in
Distance from Flange to Center of Gear or Pulley **a**		❑mm ❑in

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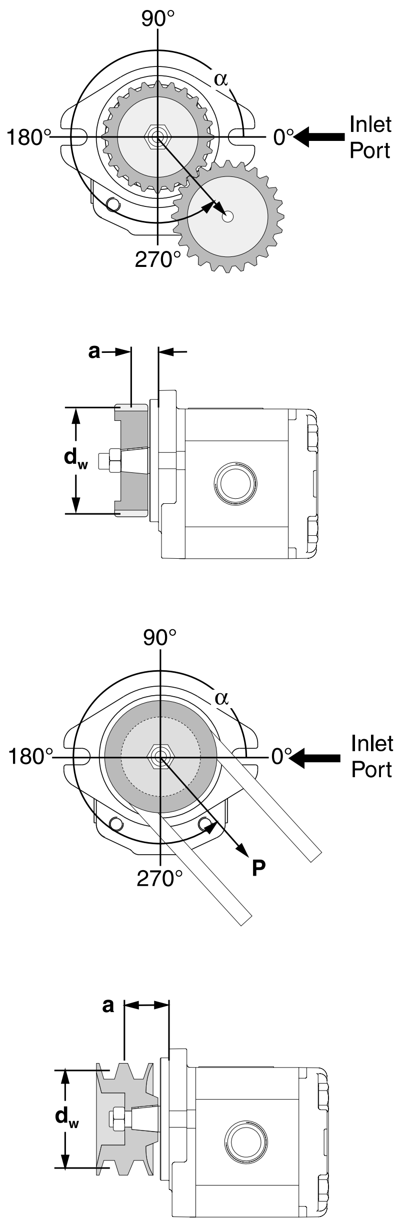


Anti-clockwise pump shown.

P102 003E

Pump Life

All Sauer-Sundstrand gear pumps utilize hydrodynamic journal bearings which have an oil film maintained between the gear / shaft and bearing surfaces at all times. If this oil film is sufficiently sustained through proper system maintenance and operating within recommended limits, long life can be expected.

NOTE: A B_{10} type life expectancy number is generally associated with rolling element bearings and does not exist for hydrodynamic bearings.

Pump life is defined as the life expectancy of the hydraulic components and is a function of speed, system pressure, and other system parameters such as oil cleanliness. High pressure, which results from high load, reduces expected life in a manner similar to many mechanical assemblies such as engines and gear boxes. When reviewing an application, it is desirable to have projected machine duty cycle data which includes percentages of time at various loads and speeds.

Prototype testing programs to verify operating parameters and their impact on life expectancy are strongly recommended prior to finalizing any system design.

Sound Levels

Fluid power systems are inherent generators of noise. As with many high power density devices, noise is an unwanted side affect. However, there are many techniques available to minimize noise from fluid power systems. To apply these methods effectively, it is necessary to understand how the noise is generated and how it reaches the listener.

The noise energy can be transmitted away from its source as either fluid borne noise (pressure ripple) or as structure borne noise.

Pressure ripple is the result of the number of pumping elements (gear teeth) delivering oil to the outlet and the pump's ability to gradually change the volume of each pumping element from low to high pressure. In addition, the pressure ripple is affected by the compressibility of the oil as each pumping element discharges into the outlet of the pump. Pressure pulsations will travel along the hydraulic lines at the speed of sound (about 1400m/s in oil) until affected by a change in the system such as an elbow fitting. Thus the pressure pulsation amplitude varies with overall line length and position.

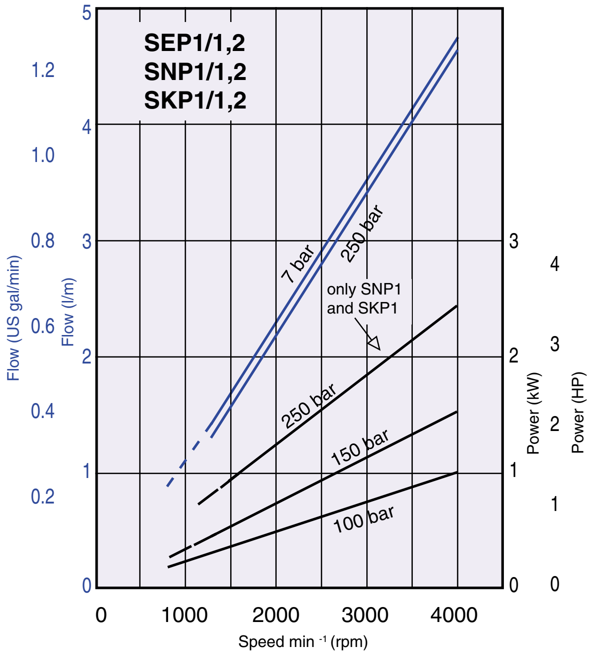
Structure borne noise may be transmitted wherever the pump casing is connected to the rest of the system.

The manner in which one circuit component responds to excitation will depend on its size, form, and manner in which it is mounted or supported. Because of this excitation, a system line may actually have a greater noise level than the pump. To reduce this excitation, use flexible hoses in place of steel plumbing. If steel plumbing must be used, clamping of lines is recommended. To minimize other structure borne noise, use flexible (rubber) mounts.

Contact your Sauer-Sundstrand representative for assistance with system noise control.

Pump Performance

The following performance graphs provide typical output flow and input power for Group 2 pumps at various working pressures. Data was taken using ISO VG46 petroleum / mineral based fluid at 50°C (viscosity = 28 mm^2/s [cSt]).



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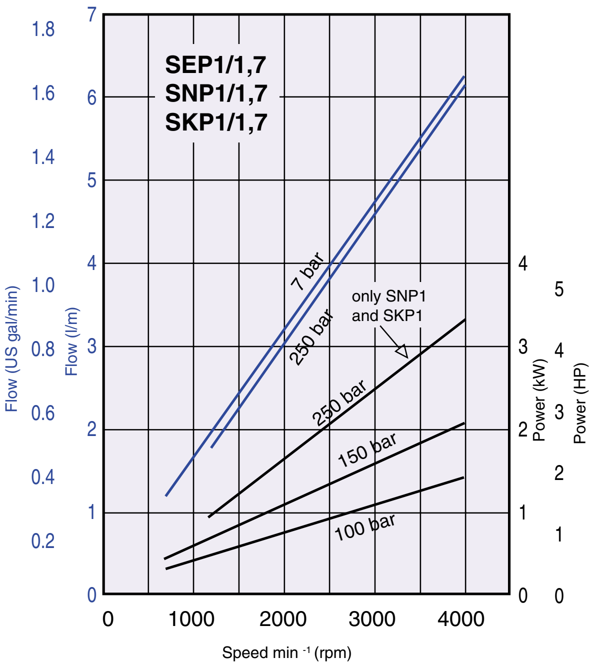

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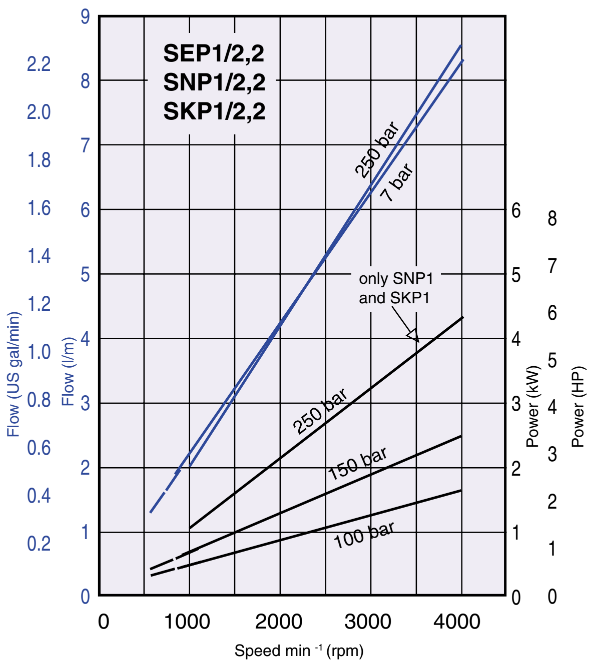

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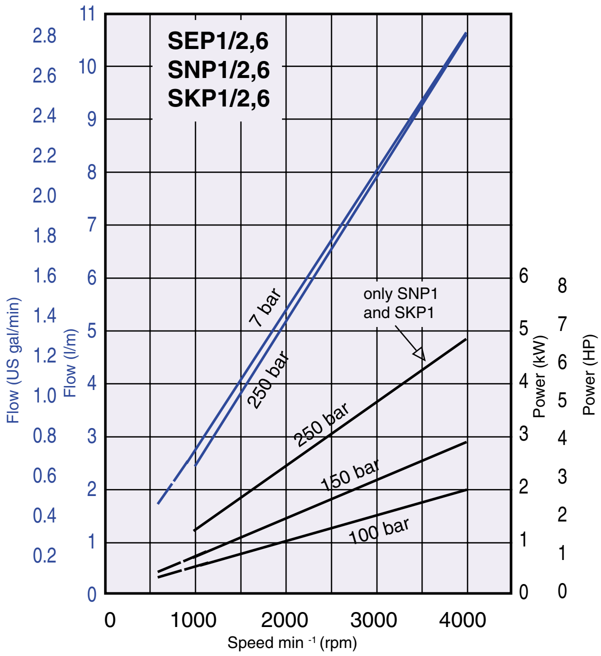

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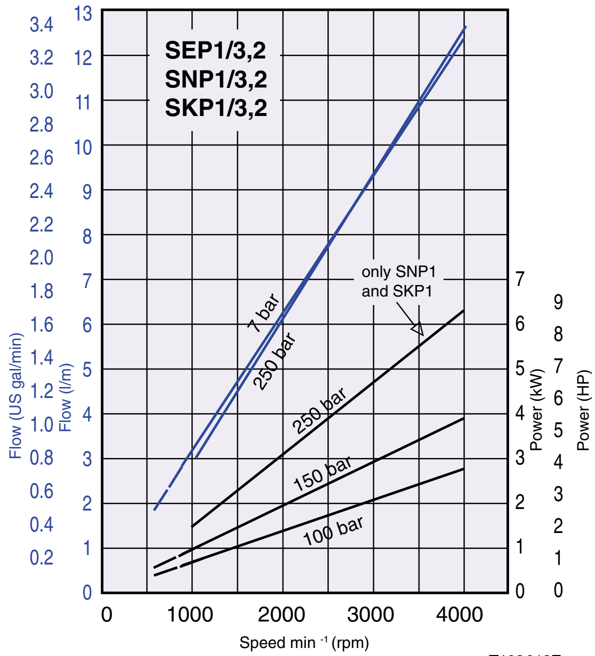

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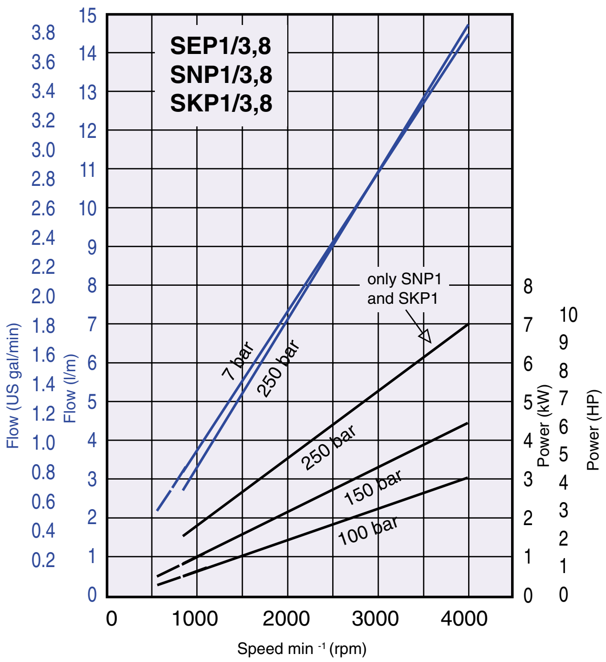

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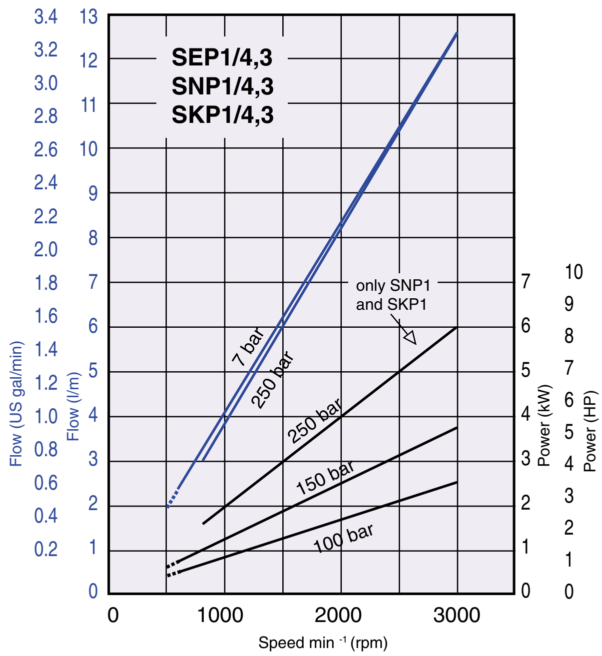
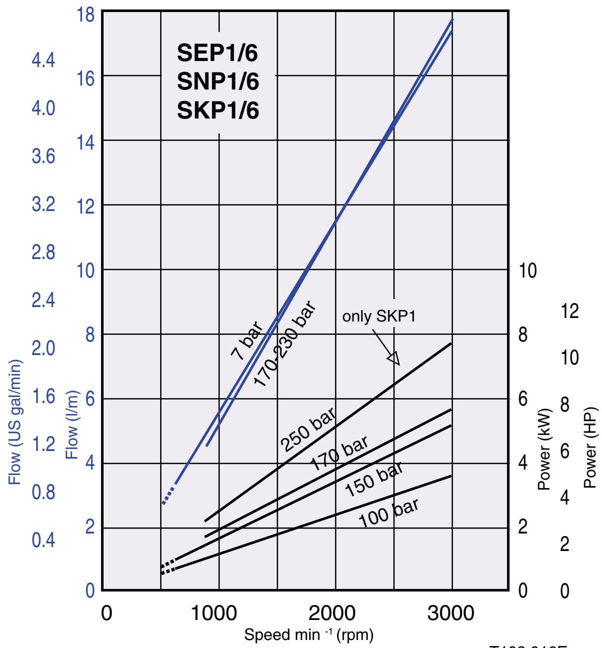
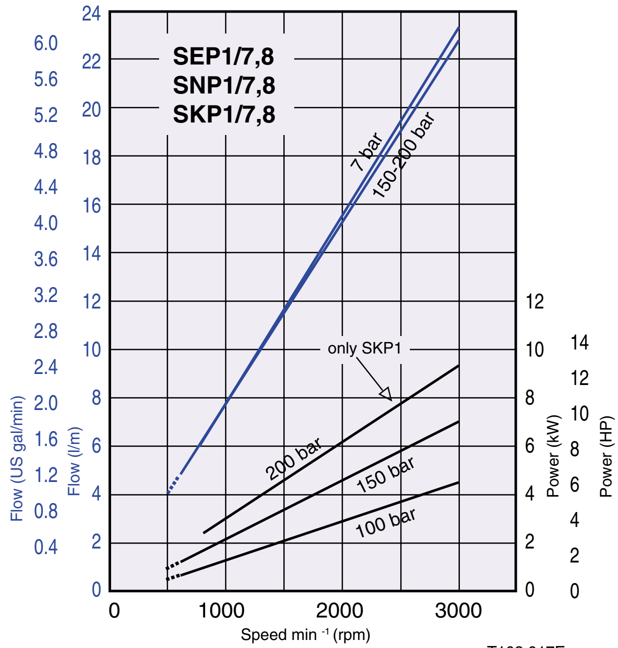


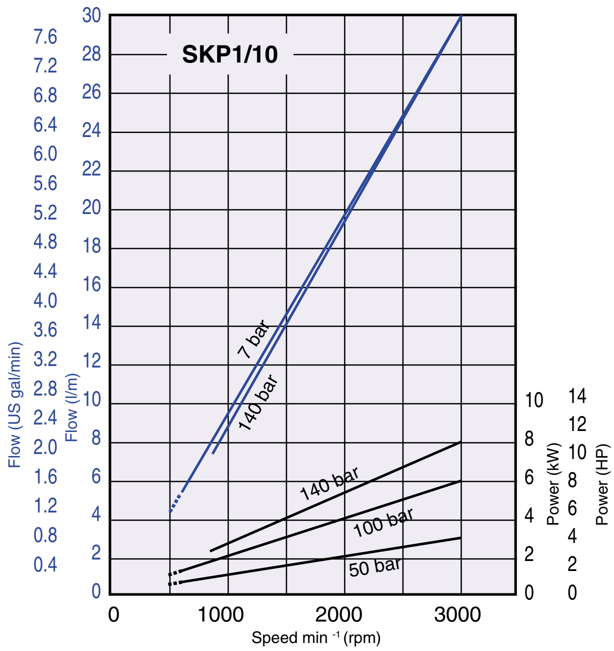
T102 015E



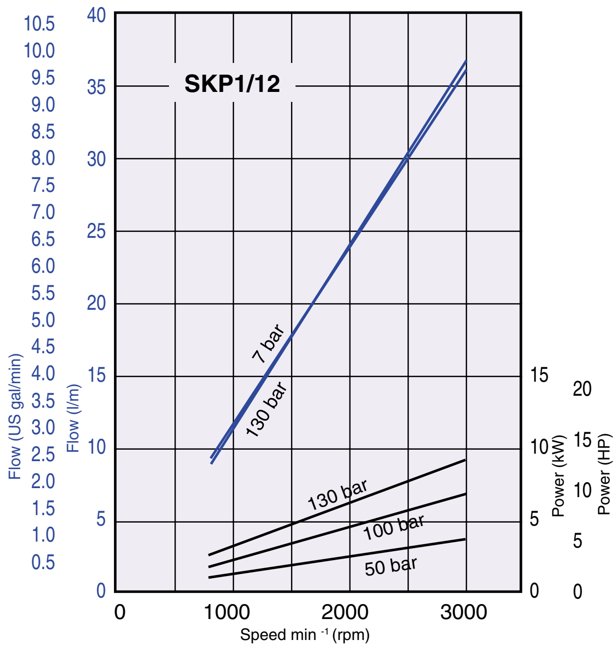
T102 016E



T102 017E



T102 018E



T102 019E

Product Options

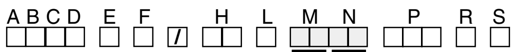
Shaft Options

Group 1 pumps are available with a variety of splined, parallel, and tapered shaft ends. Not all shaft styles are available with all flange styles. Valid combinations and nominal torque ratings are shown in the table below. Torque ratings assume no external radial loading. Applied torque must not exceed these limits regardless of pressure parameters stated earlier. Maximum torque ratings are based on shaft torsional fatigue strength.

Recommended mating splines for Group 1 splined output shafts should be in accordance with *SAE J498* or special spline. Sauer-Sundstrand external SAE splines are flat root side fit with circular tooth thickness reduced by 0.127 mm [.005 in] in respect to class 1 fit. These dimensions are modified in order to assure a clearance fit with the mating spline.

Other shaft options may exist. Contact your Sauer-Sundstrand representative for availability.

Shaft availability and torque capacity



Shaft		Mounting Flange Code Max Torque Nm[lbf · in]			
Description	**Code**	**01**	**02**	**03**	**06**
Taper 1:8	**CO**	25 [221]	50 [442]	-	-
Spline T=15 m=0.75 alfa=30°	**SC**	35 [310]	-	-	-
SAE Spline J 498-9T-20/40 DP	**SC**	-	-	-	34 [301]
Parallel 12mm	**CI**	-	24 [212]	-	-
Parallel 12.7mm	**CI**	-	-	-	32 [283]
Sauer-Sundstrand Tang	**FR**	-	-	14 [124]	-

T102 021E

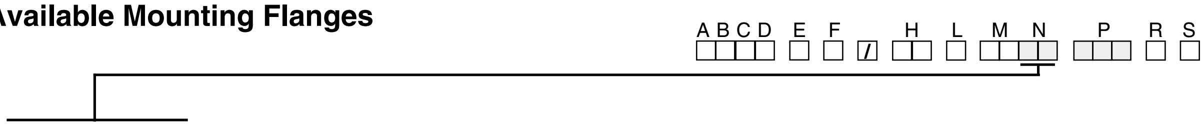
Mounting flanges

Many types of industry standard mounting flanges are available. The following table shows order codes for each mounting flange and its intended use.

See Product Dimensional Information (page 24) for outline drawings of pumps and the various mounting flanges.

Contact your Sauer-Sundstrand representative for more information on specific flanges.

Available Mounting Flanges



Flange Code	Intended Use
01	European four bolt
02	German PTO
03	Sauer-Sundstrand standard tang drive
06	SAE A-A

T102 022E

Nonstandard Port Configurations

Various port configurations are available on group 1 pumps including:

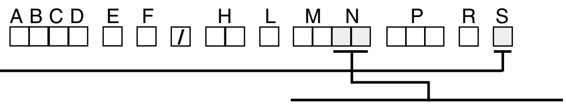
- European standard flanged port
- German standard flanged port
- Gas threaded port (BSPP)
- O-ring boss per *SAE J1926/1* [*ISO 11926-1*] (UNF threads)

Standard porting offered with each mounting flange type is listed in the table below. If porting other than standard is desired, use the order codes shown.

See Product Dimensional Information on page 29 for outline drawings and dimensions of the ports listed here.

Other ports are available on special order. *Contact your Sauer-Sundstrand representative for types and availability.*

Available Porting Options



Code	Description	This port configuration is standard on these flanges.
•	Standard port for the flange type specified	-
B	Flanged port with threaded holes in "X" pattern (German standard ports), centered on the body	non standard
C	Flanged port with threaded holes in "+" pattern (European Standard)	01, 02
D	Threaded metric port	non standard
D	Threaded metric port	03
E	Threaded SAE o-ring boss port	06
F	Threaded Gas port (BSPP)	non standard

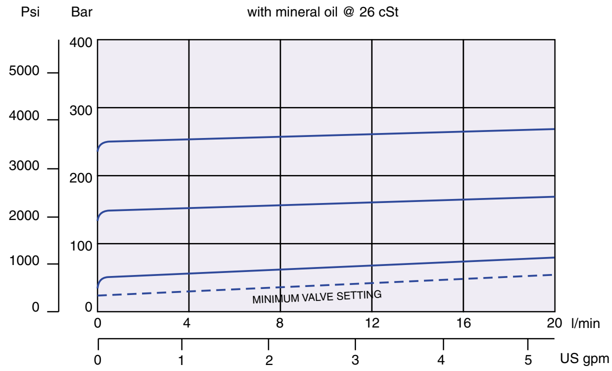
T102 023

⁎ Use only if porting is nonstandard for the flange type ordered.

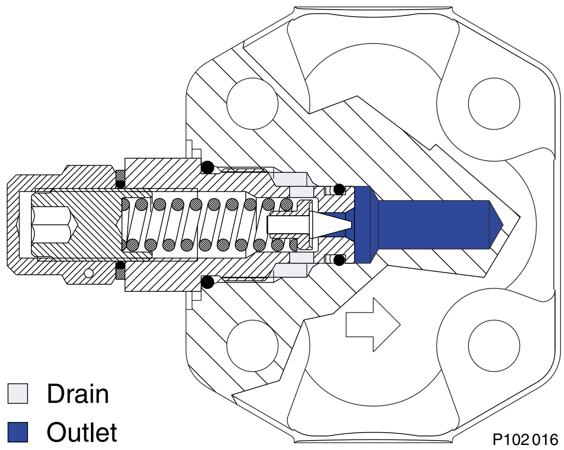
Integral Relief Valve (SNI 1)

Group 1 pumps are offered with an optional **integral relief valve** in the rear cover. This valve has an internal drain. This valve opens directing all flow from the pump outlet to the internal drain when the pressure at the outlet reaches the valve setting. This valve can be ordered preset to the pressures shown in the table below. Valve schematic, performance curve, and rear cover cross section are shown here.

CAUTION: When the relief valve is operating in bypass condition, rapid heat generation will occur. If this bypass condition is maintained, premature pump failure will result.
For pressures higher than 210 bar and lower than 50 bar apply to your Sauer-Sundstrand representative.



T102 030E

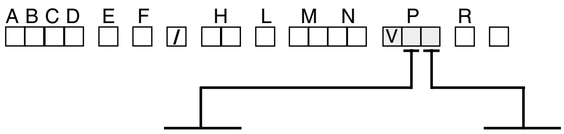


Drain

Outlet

P102 016

Variant Codes for Ordering Integral Relief Valve

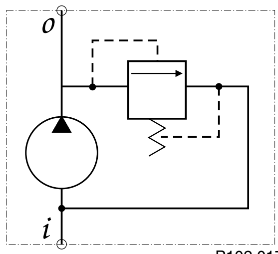


Pump Speed for RV Setting - min⁻¹ (rpm)	Code
Not Defined	A
500	C
1000	E
1250	F
1500	G
2000	K
2250	I
2500	L
2800	M
3000	N
3250	O

T102 028E

Pressure Setting bar [psi]	Code
No Setting	A
No Valve	B
18 [261]	C
25 [363]	D
30 [435]	E
35 [508]	F
40 [580]	G
50 [725]	K
60 [870]	L
70 [1015]	M
80 [1160]	N
90 [1305]	O
100 [1450]	P
110 [1595]	Q
120 [1740]	R
130 [1885]	S
140 [2030]	T
160 [2320]	U
170 [2465]	V
180 [2611]	W
210 [3045]	X
250 [3626]	Z

T102 029E



P102 017

i = Inlet

o = Outlet

The tables to the left show applicable variant codes for ordering pumps with integral relief valve. *Refer to the Model Code (page 6,7) for more information.*

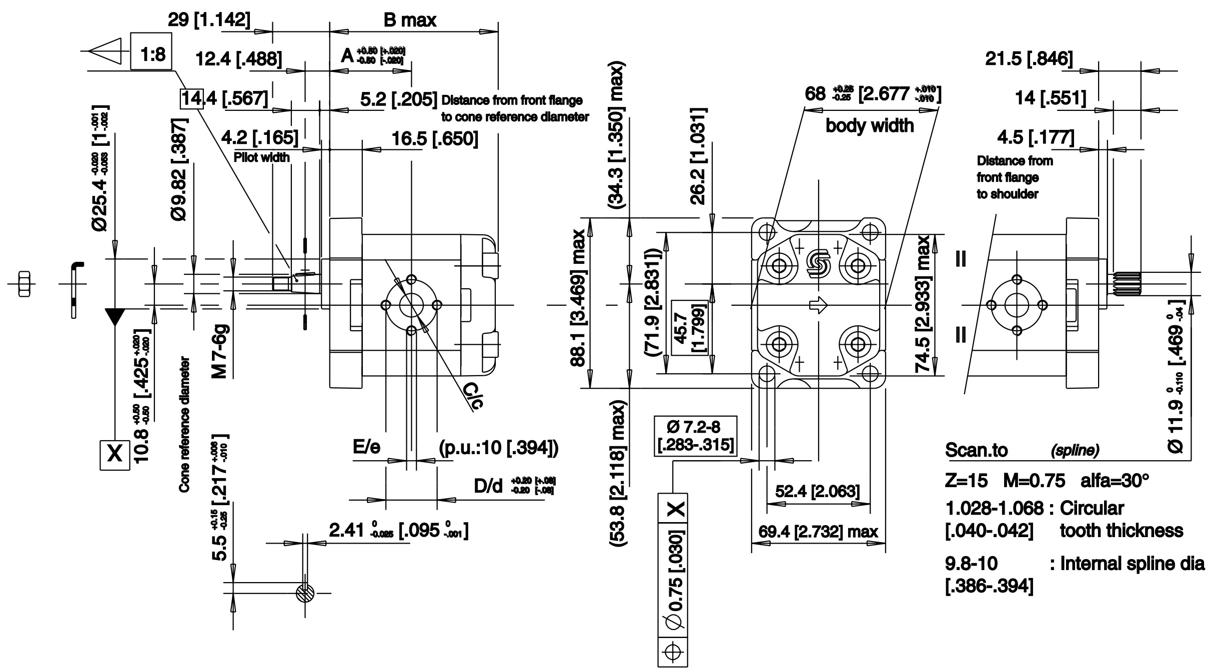
Product Dimensional Information

CO01 / SC01

Standard porting shown. *See page 29 for additional porting options. See page 28 for valve options.*

mm
[in]

CO01 SC01



P102 021E
T102 033E

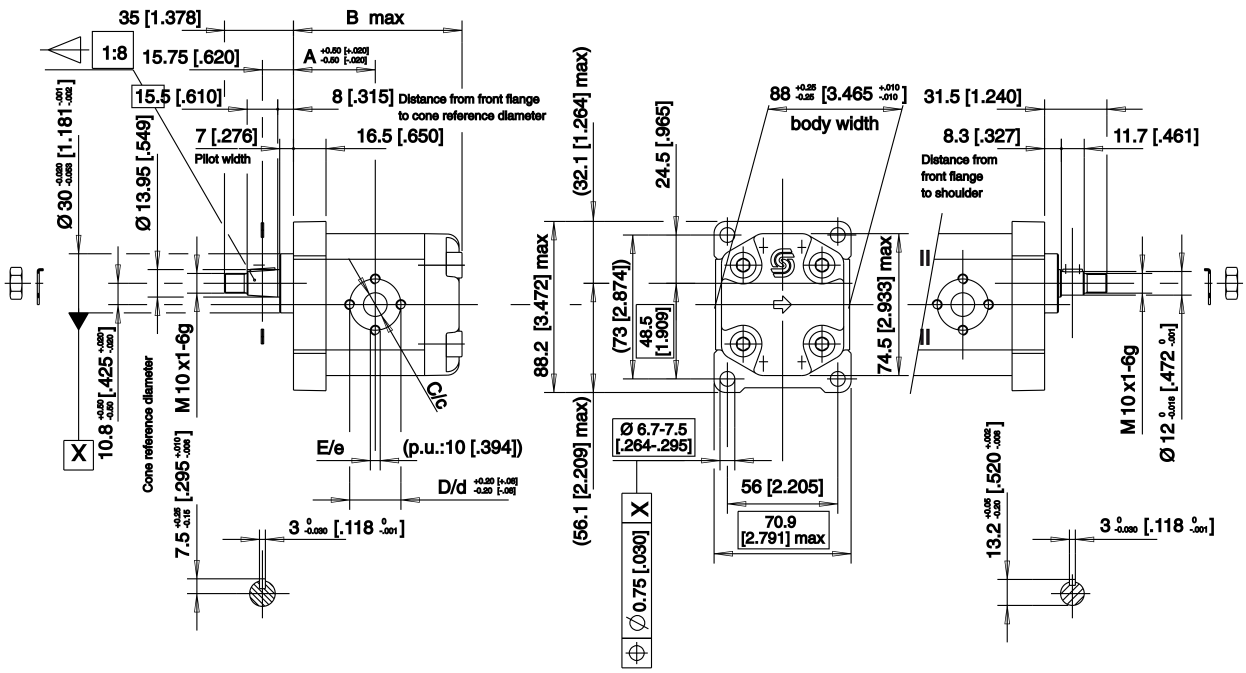
		Type (displacement)								
		1,2	1,7	2,2	2,6	3,2	3,8	4,3	6	7,8
Dimensions	A	37.75 [1.486]	38.5 [1.516]	39.5 [1.555]	40.5 [1.594]	41.5 [1.634]	42.5 [1.673]	43.5 [1.713]	46.75 [1.841]	50 [1.969]
	B	79.5 [3.130]	81 [3.189]	83 [3.268]	85 [3.346]	87 [3.425]	89 [3.504]	91 [3.583]	97.5 [3.839]	104 [4.094]
Inlet	C	12 [.472]								
	D	26 [1.024]								
	E	M5								
Outlet	c	12 [.472]								
	d	26 [1.024]								
	e	M5								

CO02 / CI02

Standard porting shown. *See page 29 for additional porting options. See page 28 for valve options.*

mm
[in]

CO02 CI02



P102 022E
T102 034E

		Type (displacement)										
		1,2	1,7	2,2	2,6	3,2	3,8	4,3	6	7,8	10	12
Dimensions	A	37.75 [1.486]	38.5 [1.516]	39.5 [1.555]	40.5 [1.594]	41.5 [1.634]	42.5 [1.673]	43.5 [1.713]	46.75 [1.841]	50 [1.969]	54.5 [2.146]	58.5 [2.303]
	B	79.5 [3.130]	81 [3.189]	83 [3.268]	85 [3.346]	87 [3.425]	89 [3.504]	91 [3.583]	97.5 [3.839]	104 [4.094]	113 [4.449]	121 [4.764]
Inlet	C	12 [.472]										
	D	26 [1.024]										
	E	M5										
Outlet	c	12 [.472]										
	d	26 [1.024]										
	e	M5										

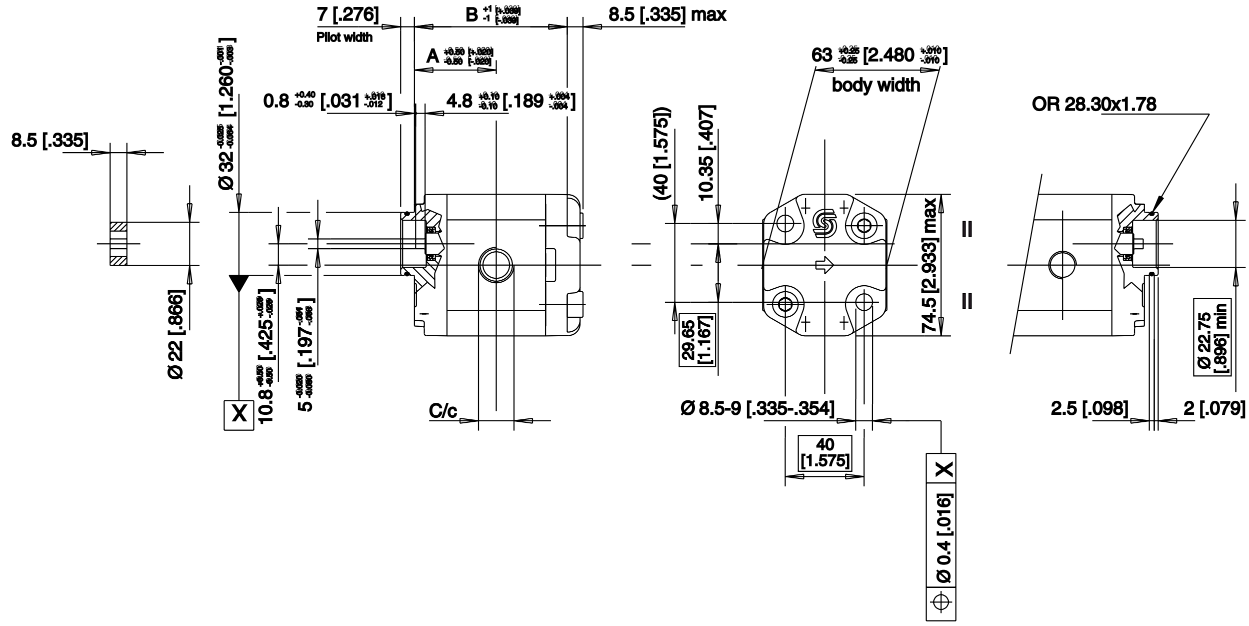
BACK

FR03

Standard porting shown. *See page 29 for additional porting options. See page 28 for valve options.*

mm
[in]

FR03



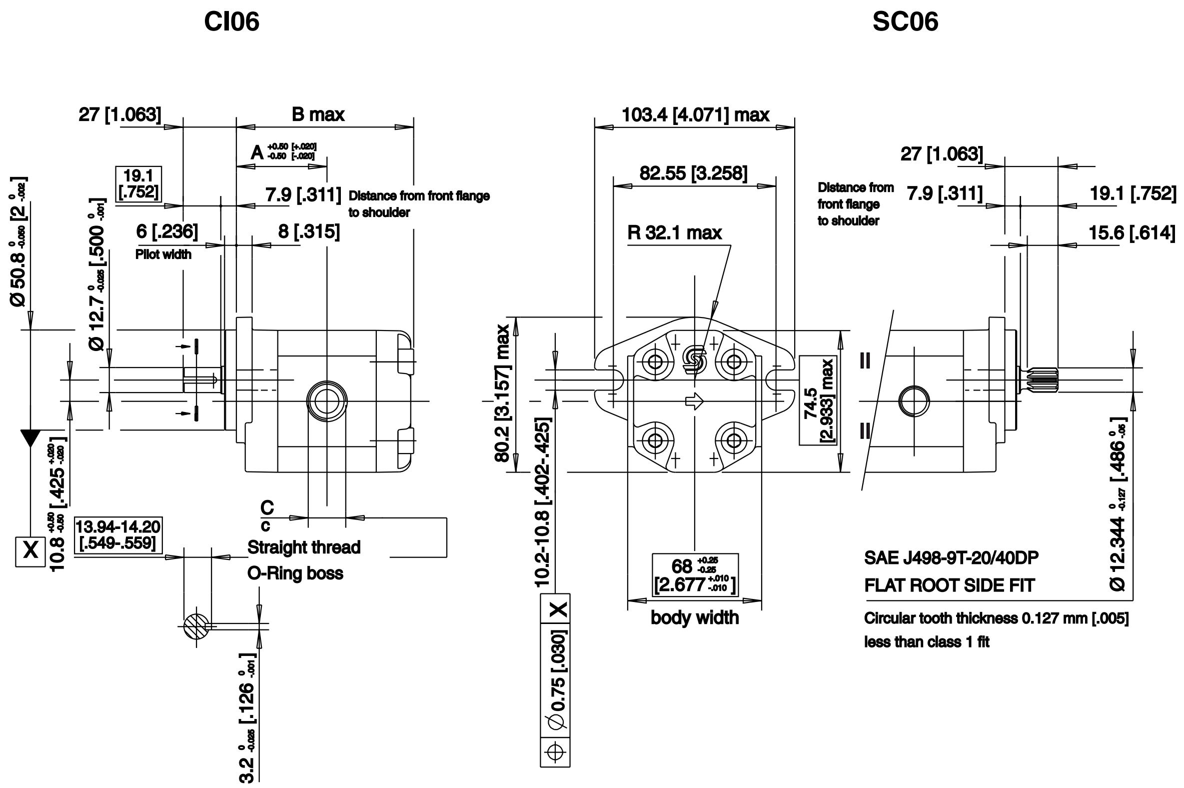
P102 023E
T102 035E

		Type (displacement)								
		1,2	**1,7**	**2,2**	**2,6**	**3,2**	**3,8**	**4,3**	**6**	**7,8**
Dimensions	**A**	37.75 [1.486]	38.5 [1.516]	39.5 [1.555]	40.5 [1.594]	41.5 [1.634]	42.5 [1.673]	43.5 [1.713]	46.75 [1.841]	50 [1.969]
	B	70 [2.756]	71.5 [2.815]	73.5 [2.894]	75.5 [2.972]	77.5 [3.051]	79.5 [3.130]	81.5 [3.209]	88 [3.465]	94.5 [3.720]
Inlet	**C**	M18x1.5 THD 12 mm [.472] deep								
Outlet	**c**	M14x1.5 THD 12 mm [.472] deep					M18x1.5 THD 12 mm [.472] deep			

CI06 / SC06

Standard porting shown. *See page 29 for additional porting options. See page 28 for valve options.*

mm
[in]



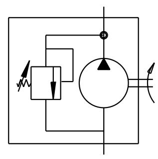
P102 024E
T102 036E

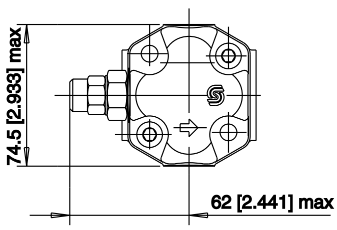
		Type (displacement)										
		1,2	1,7	2,2	2,6	3,2	3,8	4,3	6	7,8	10	12
Dimensions	A	42.25 [1.663]	43 [1.693]	44 [1.732]	45 [1.772]	46 [1.811]	47 [1.850]	48 [1.890]	51.25 [2.018]	54.5 [2.146]	59 [2.323]	63.5 [2.500]
	B	84 [3.307]	85.5 [3.366]	87.5 [3.445]	89.5 [3.524]	91.5 [3.602]	93.5 [3.681]	95.5 [3.760]	102 [4.016]	108.5 [4.272]	117.5 [4.626]	125.5 [4.941]
Inlet	C	3/4 [.750]-18UNF-2B THD 14.3 mm [.563] deep										
Outlet	c	9/16 [.563]-18UNF-2B THD 12.7 mm [.500] deep										

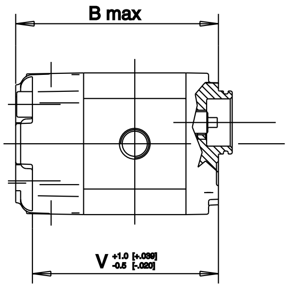
BACK

Integral Relief Valve Cover

mm
[in]







For configuration 03 only

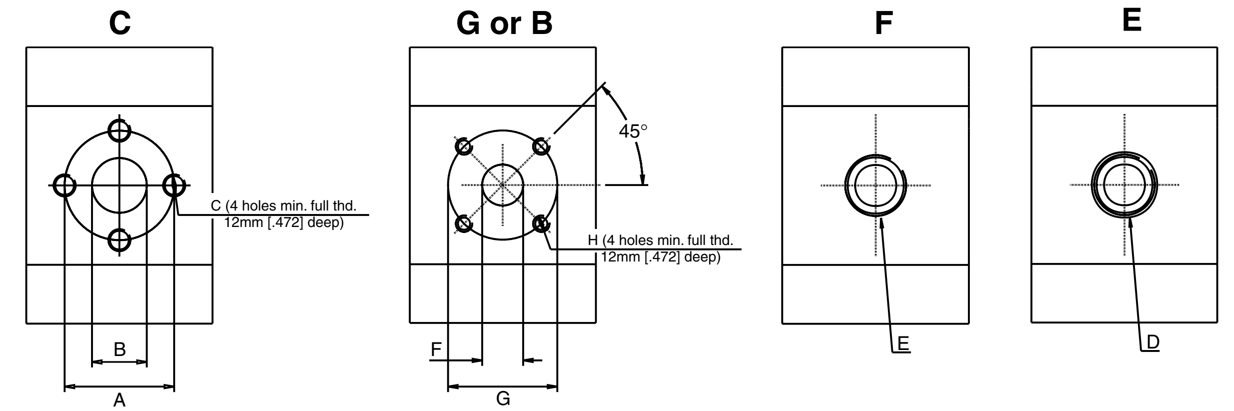
P102 025E
T102 037E

		Type (displacement)										
		1,2	1,7	2,2	2,6	3,2	3,8	4,3	6	7,8	10	12
Dimensions	B	95.5 [3.760]	97 [3.819]	99 [3.898]	101 [3.976]	103 [4.055]	105 [4.134]	107 [4.213]	113.5 [4.469]	120 [4.724]	129 [5.079]	137 [5.394]
	V	85 [3.346]	86.5 [3.406]	88.5 [3.484]	90.5 [3.563]	92.5 [3.642]	94.5 [3.720]	96.5 [3.799]	103 [4.055]	109.5 [4.311]	118.5 [4.665]	126.5 [4.980]

Note: for configuration 06 the dimensions B and V must be increased 4.5 mm [.177].

Nonstandard Port Configurations

mm
[in]



P102 029E
T102 042E

Dimensions											
Model Code *		**C**			**B**			**D**	**D**	**F**	**E**
Standard port for flange code		01/02			non standard (Ports centered on body)			non standard	03	non standard	06
Type (displacement)		**B**	**A**	**C**	**F**	**G**	**H**	**E**	**E**	**E**	**D**
1,2	**Inlet**	12 [.462]	26 [1.024]	M5	13 [.512]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.750 (3/4)-16UNF-2B
	Outlet	12 [.462]	26 [1.024]	M5	8 [.315]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.563 (9/16)-18UNF-2B
1,7	**Inlet**	12 [.462]	26 [1.024]	M5	13 [.512]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.750 (3/4)-16UNF-2B
	Outlet	12 [.462]	26 [1.024]	M5	8 [.315]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.563 (9/16)-18UNF-2B
2,2	**Inlet**	12 [.462]	26 [1.024]	M5	13 [.512]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.750 (3/4)-16UNF-2B
	Outlet	12 [.462]	26 [1.024]	M5	8 [.315]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.563 (9/16)-18UNF-2B
2,6	**Inlet**	12 [.462]	26 [1.024]	M5	13 [.512]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.750 (3/4)-16UNF-2B
	Outlet	12 [.462]	26 [1.024]	M5	8 [.315]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.563 (9/16)-18UNF-2B
3,2	**Inlet**	12 [.462]	26 [1.024]	M5	13 [.512]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.750 (3/4)-16UNF-2B
	Outlet	12 [.462]	26 [1.024]	M5	8 [.315]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.563 (9/16)-18UNF-2B
3,8	**Inlet**	12 [.462]	26 [1.024]	M5	13 [.512]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.750 (3/4)-16UNF-2B
	Outlet	12 [.462]	26 [1.024]	M5	8 [.315]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.563 (9/16)-18UNF-2B
4,3	**Inlet**	12 [.462]	26 [1.024]	M5	13 [.512]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.750 (3/4)-16UNF-2B
	Outlet	12 [.462]	26 [1.024]	M5	8 [.315]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.563 (9/16)-18UNF-2B
6	**Inlet**	12 [.462]	26 [1.024]	M5	13 [.512]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.750 (3/4)-16UNF-2B
	Outlet	12 [.462]	26 [1.024]	M5	8 [.315]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.563 (9/16)-18UNF-2B
7,8	**Inlet**	12 [.462]	26 [1.024]	M5	13 [.512]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.750 (3/4)-16UNF-2B
	Outlet	12 [.462]	26 [1.024]	M5	8 [.315]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.563 (9/16)-18UNF-2B
10	**Inlet**	12 [.462]	26 [1.024]	M5	13 [.512]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.750 (3/4)-16UNF-2B
	Outlet	12 [.462]	26 [1.024]	M5	8 [.315]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.563 (9/16)-18UNF-2B
12	**Inlet**	12 [.462]	26 [1.024]	M5	13 [.512]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.750 (3/4)-16UNF-2B
	Outlet	12 [.462]	26 [1.024]	M5	8 [.315]	30 [1.181]	M6	M18x1.5	M18x1.5	3/8 Gas (BSPP)	.563 (9/16)-18UNF-2B

* Mark only if desired porting is non standard for the flange code selected. Otherwise mark "."

Notes

Notes

BACK

SAUER DANFOSS

Hydraulic Power Systems

SAUER-SUNDSTRAND Hydraulic Power Systems - Market Leaders Worldwide

SAUER-SUNDSTRAND is a world leader in the design and manufacture of Hydraulic Power Systems. Research and development resources in both North America and Europe enable SAUER-SUNDSTRAND to offer a wide range of design solutions utilizing hydraulic power system technology.

SAUER-SUNDSTRAND specializes in integrating a full range of system components to provide vehicle designers with the most advanced total-design system.

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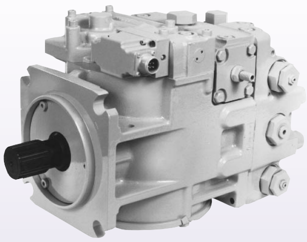
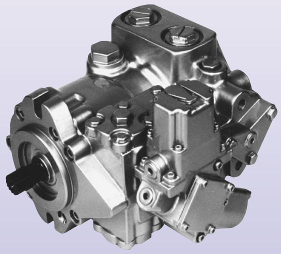


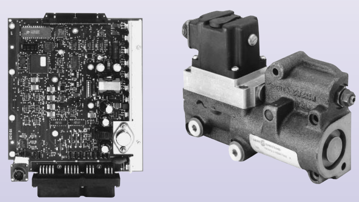
Heavy Duty Axial Piston Pumps and Motors

Heavy Duty Bent Axis Variable Motors

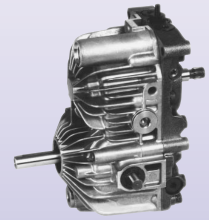
Cartridge Motors/ Compact Wheel Drives



Medium Duty Axial Piston Pumps and Motors

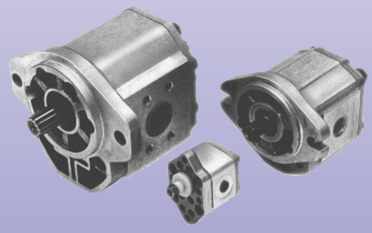


Microcontrollers and Electrohydraulic Controls

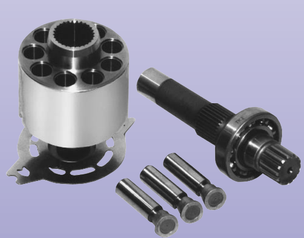


Hydrostatic Transmission Packages

Open Circuit Axial Piston Pumps



Gear Pumps and Motors



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