Available Configurations, Pumps

TFP 50 Pump
DIN Flanges & Shaft
5 models 0.25-1.27 cm³ (0.015-0.074 in³)
Speeds to 8000 rpm
Pressures to 200 bar (2900 psi)

TFP 100 Pumps
SAE "AA" & DIN Flanges & Shafts
7 models 1.20-7.8 cm³ (0.071-0.464 in³)
Speeds to 5000 rpm
Pressures to 210 bar (3000 psi)

SNP2 Pumps
SAE "A" & DIN Flanges & Shafts
11 models 3.4-25.2 cm³ (0.24-1.54 in³)
Speeds to 4000 rpm
Pressures to 250 bar (3600 psi)

SP2.5/250 Pumps
SAE "A" & "B" 2-Bolt Flanges
SAE "A" & "B" 11T & 13T spline shafts
SAE "A" & "B" .75" & .875" keyed shafts
8 models 20-45 cm³ (1.22-2.75 in³)
Speeds to 3000 rpm
Pressures to 250 bar (3600 psi)
Priority Flow Divider Covers

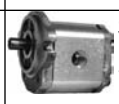
SNP3 Pumps
SAE "B" & DIN Flanges & Shafts
10 models 22.1-88.2 cm³ (1.35-5.38 in³)
Speeds to 3000 rpm
Pressures to 250 bar (3600 psi)
NOTE: The SEP3 is available in the 22.1-44.1cm³ (1.35-2.69 in³) displacements for applications not requiring the pressure capabilities of the SNP3 or CP180.

CP180 Pumps
SAE "B" Flanges & Shafts
11 models 31.79-95.7 cm³ (1.94-5.38 in³)
Speeds to 3200 rpm
Pressures to 250 bar (3600 psi)
Priority Flow Divider Covers

CP222 Pumps
SAE "C" 2 & 4-Bolt Flanges & Shafts
7 models 64.8-162.0 cm³ (3.95-9.89 in³)
Speeds to 3000 rpm
Pressures to 250 bar (3600 psi)

Available Configurations, Motors

TFM 100 Motors
DIN Flanges & Shafts
6 models 2.60-7.8 cm³ (0.158-0.464 in³)
Speeds to 3000 rpm
Pressures to 200 bar (2900 psi)



SNM2 Motors
SAE "A" & DIN Flanges & Shafts
10 models 6-25.2 cm³ (0.366-1.54 in³)
Speeds to 4000 rpm
Pressures to 250 bar (3600 psi)
NOTE: SNU2 Unidirectional motor available in 8.4-25.2 cm³ (0.513-1.54 in³)

TAM2290 Motors
SAE "B" & DIN Flanges & Shafts
9 models 22-90 cm³ (1.34-5.49 in³)
Speeds to 3000 rpm
Pressures to 210 bar (3000 psi)
NOTE: TAU2290 Unidirectional motor available in the same displacements

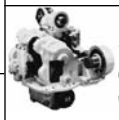
Fan Drive Systems

Available in 5 to 36 HP configurations
Fan speed modulated based temperature
Options for additional inputs
Contact Sauer-Sundstrand for details and specifications

Steering Pumps

Available in 8-45 cm³ (0.49-2.75 in³)
Special and or engine mount available (i.e. Perkins, Deutz, Kubota, etc.)
Flanges and shafts for several engines
Contact Sauer-Sundstrand for details and specifications

Custom Solutions



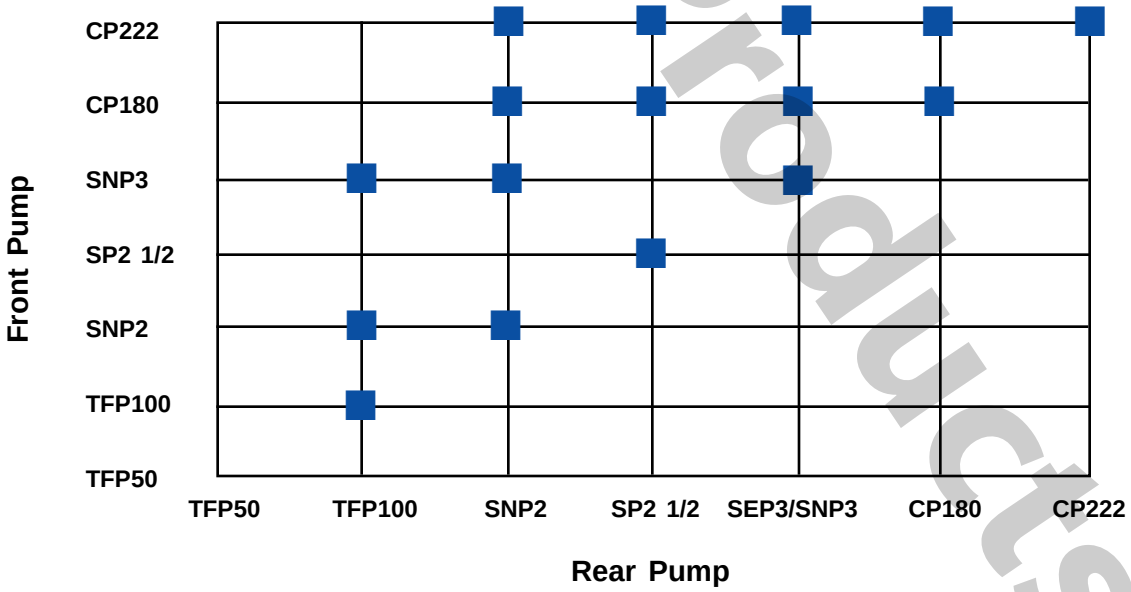
Sauer-Sundstrand's custom component capabilities are demonstrated by this "CCLS" hydraulic pump package, which includes gear pumps, a pressure / flow compensated axial piston pump, filter pads, and associated valves. This integrated unit was specifically designed for an agricultural tractor.

****NOTE:** All pumps can be incorporated into multiple pump configurations. Contact Sauer-Sundstrand for details and specifications.

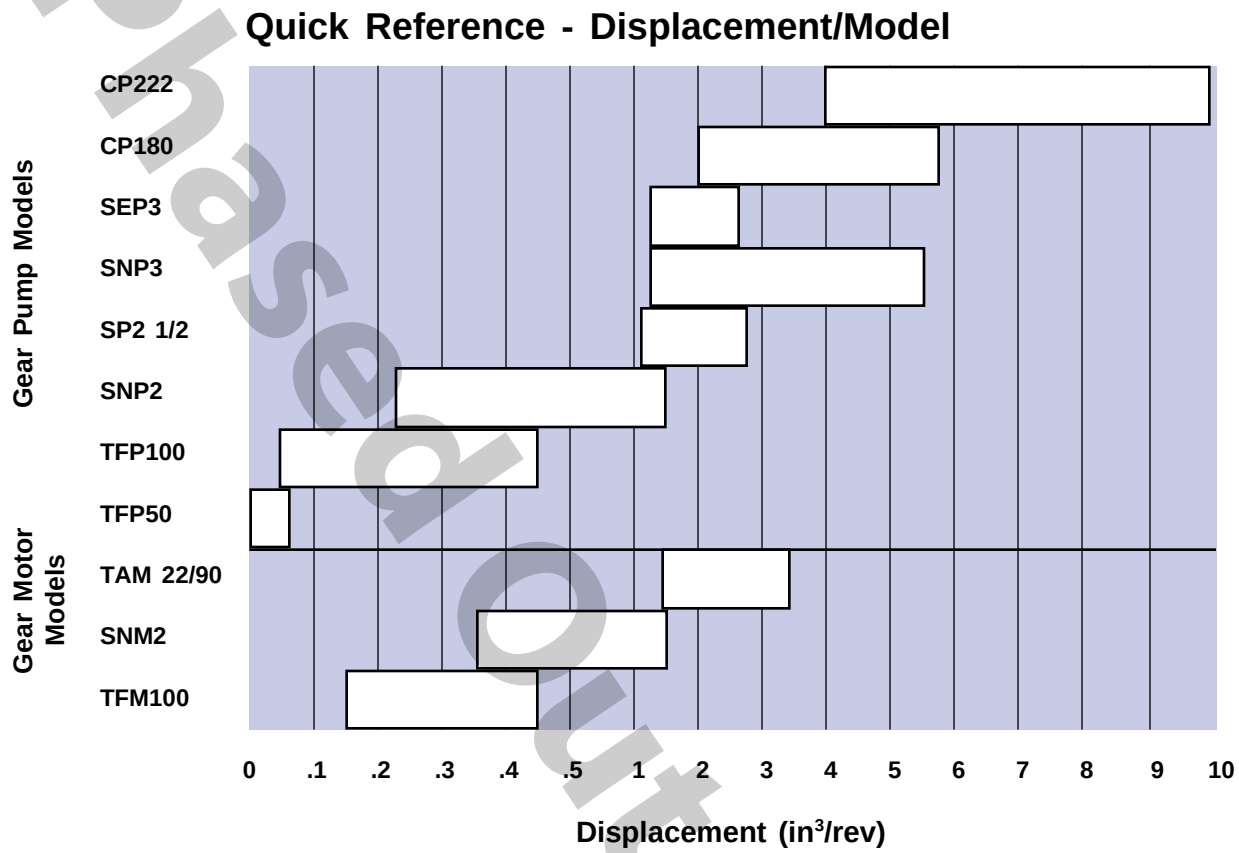
Sauer-Sundstrand Gear Pump and Motor Features

- Worldwide sales and service capabilities from the industry leader is part of the package for every Sauer-Sundstrand gear product customer.
- Proven reliability with over 45 years of experience in gear product design for mobile and industrial applications.
- System pressures to 4500 psi (310 bar) and speeds to 8,000 rpm allow high performance in system design.
- Pressure balanced design for high efficiency and long life.
- Low cost design and manufacturing for the requirements of fixed displacement systems.
- Variety of flexible installation options available:
  - SAE, Metric, and European flanges, shafts and ports
  - Convenient side or rear porting options
  - Auxiliary through drive SAE mounting pads
  - Integral relief valve, priority flow control, and priority flow divider covers
  - High temperature viton seals optional
  - Multiple pump configurations (refer to the Quick Reference chart below)

Quick Reference - Multiple Pump Configurations



A Complete Family of Sauer-Sundstrand Gear Pumps and Motors



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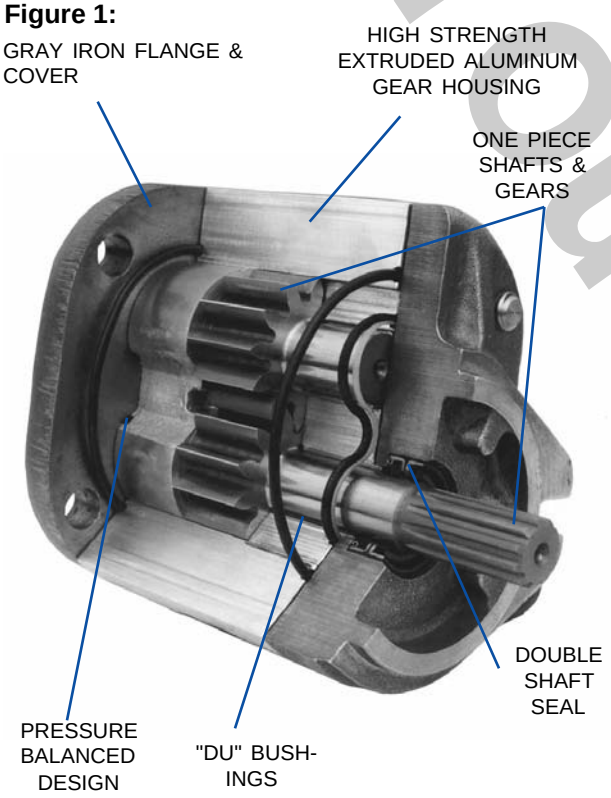
Technical Features

DESIGN

Sauer-Sundstrand gear pumps utilize an external spur gear, positive displacement, and pressure balanced design, providing superior efficiency. These high performance pumps are of a three-piece construction, utilizing a cast iron flange and cover with aluminum gear housings. The extruded aluminum housing provides the necessary strength while providing a very high power to weight ratio. Most importantly, the aluminum center section permits the gear teeth to create their own path into the gear housing (track in) for maximum radial tip seal and high volumetric efficiency.

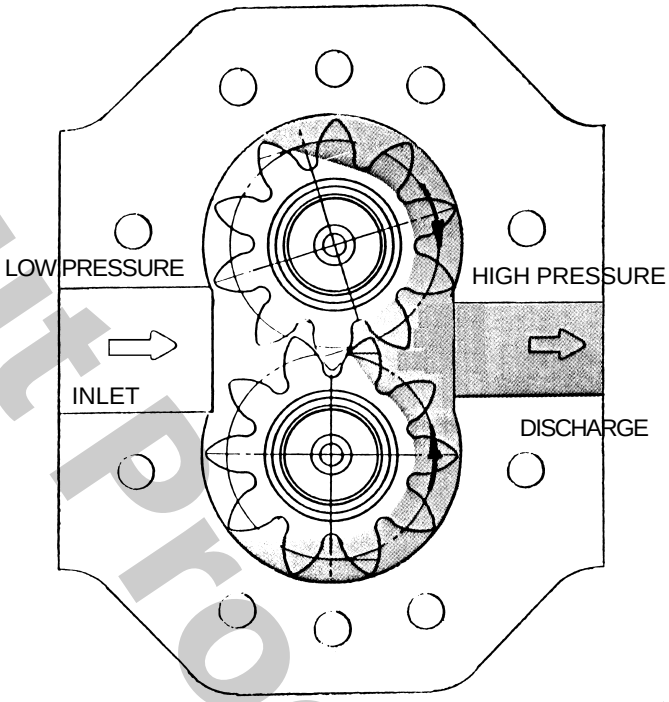
Figure 1:



ROBUST CONSTRUCTION

One piece gear/shaft construction provides both high strength and an accurate profile. Each integral gear/shaft is constructed of bearing quality hardened steel which is machined to precise tolerance for minimum leakage. The one piece design also eliminates the potential problems of stress fatigue often associated with two piece designs.

Figure 2:



PRECISE GEAR ALIGNMENT

Cast aluminum bearing blocks are fitted to the gear pockets for precise alignment. Since all parts are contained in the housing the possibility of misalignment is eliminated. The load is carried uniformly without stress being applied to either the end cap or the front cover. Teflon coated pressure lubricated bronze bushings in each bearing block ensure a long operating life.

LEAK PROTECTION

Various seals are available to meet specific applications. Standard are dual Buna seals to prevent leakage and migration of fluids from the hydraulic circuit to the gear box.

Technical Features, Continued

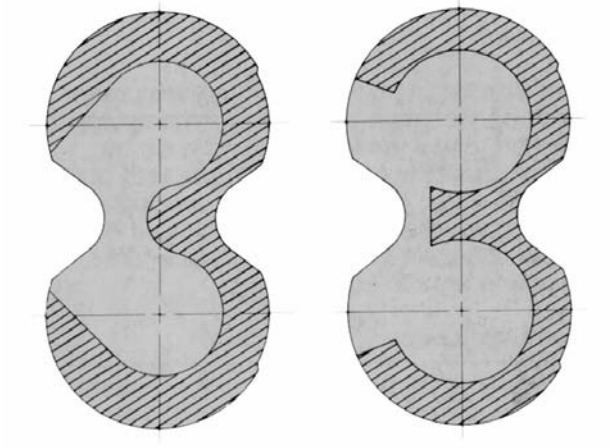
PRESSURE BALANCE

Pressure balance sealing on each side of the gears contributes to high volumetric efficiency and maximum sealing on all Sauer-Sundstrand pump and motor models.

The SP2.5/250 models are each equipped with pressure balance sealing that is incorporated into the bearing blocks. This design provides high efficiency at both low and high speed for maximum efficiency throughout the speed range. See Figure 3.

Accurately defined pressure zones at the rear faces of the bearing blocks receive oil under pressure which loads the bearing against the gear side face. Contact force between bearing face and gear is low and precisely controlled across wide speed, pressure and temperature ranges. The result is typical volumetric efficiencies in the range of 95% through effective sealing between gear and bearing faces—without causing undue wear or overheating between these faces.

Figure 3:



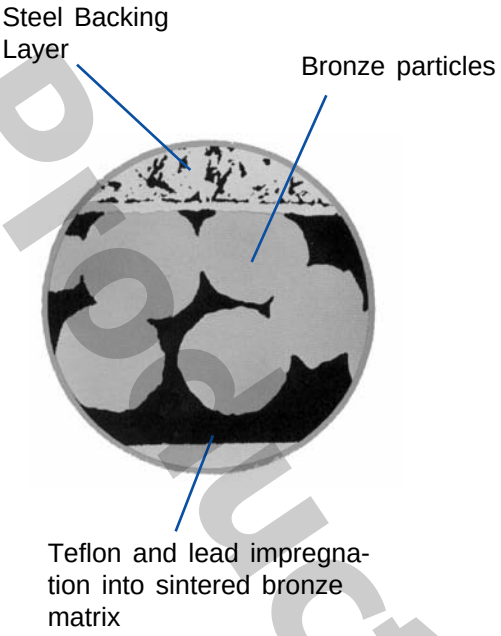
Area of pressure loading shaded (system pressure applied on rear faces of bearing blocks)

Area of separating force shaded (sealing surface between bearing surface and gears)

In order to prevent pressure trapping in between the meshing gear teeth, channels in the bearing blocks permit relief of the trapped fluid to the suction side of the pump. Running clearances are maintained tight enough to minimize leakage across the gear faces, yet sufficient to maintain the oil film between mating surfaces for minimum wear. As pressure increases, the sealing efficiency increases proportionally.

D.U. bushings on all pumps and motor models provide infinite life within the designed load range. Unlike antifriction bearings, D.U. bushings do not present a B10 life problem. Teflon and pressure lubrication contribute to an indefinite operating life as long as the system is properly maintained. See Figure 4.

Figure 4:
The DU® Bearing



DU® is a trademark of the Garlock Bearing Company

Technical Features, Continued

INLET OIL BUSHING LUBRICATION

The design of the SP2.5 series is such that cooler inlet oil is routed to "flood" the DU Bushings with oil. Lubricating "scrolls" in the bushing bores create a pumping action which eliminates the need to force high pressure leakage to the journals. This allows the pump to run cooler, with higher volumetric efficiency.

DRIVE CONDITIONS

With a choice between taper, splined, or parallel keyed shafts; Sauer-Sundstrand gear pumps are suitable for a wide range of direct or indirect drive applications.

For direct drive applications a flexible compensating three piece coupling is recommended to ensure no radial or axial loads are transmitted to the pump shaft.

When proposing to use belt or gear drive, details of the application should be submitted for our technical appraisal. For applications which exceed permitted limits, an outrigger bearing can be provided to protect the pump.

Plug-in spline drives can impose severe radial loads on the pump shaft when the mating female spline is rigidly supported. Undersize splines do not alleviate this condition. The use of plug-in drives is permissible providing that concentricity between the female spline and pilot diameter is within .004 in (0.10 mm). The drive should be lubricated by flooding with oil or by an oil mist.

Both concentricity and angular alignment of shafts are important to pump life. Misalignment can induce heavy side loads on bearing and seals, causing premature failure.

FILTRATION

A full flow 10 micron filter with no permanent bypass should be used in the system return line to trap all contaminants before they enter the reservoir. Additionally, a 125 micron screen is recommended to be used in the inlet line of SP2.5 series pumps.

FILTRATION continued

Since the filter must be changed at regular intervals, the filter housing should be located in an accessible area.

OPERATING TEMPERATURES

With Buna seals and normal operating conditions, the system temperature should not exceed 180° F (82°C) except for short periods to 200° F (93° C).

With optional Fluroelastomers (Viton) seals, the system may be operated at continuous temperatures up to 225° F (107° C) without damage to the pump. Care should be observed with Fluroelastomers as some lubricants are not compatible with them.

CAUTION: Operation in excess of 225° F may cause external leakage or premature unit failure.

FLUIDS

A mineral based fluid is recommended with additives to resist corrosion, oxidation and foaming. The oil should have the maximum viscosity commensurate with system pressure drop and pump suction levels. The viscosity at any running condition must be between 45 SSU minimum and 250 SSU maximum continuous.

Since the hydraulic fluid serves as a system lubricant as well as for power transmssion, careful selection is important for proper operation of the unit and satisfactory life of the pump and components.

SUCTION

For maximum pump life, the inlet vacuum should not exceed 6 inches (150 mm) Hg at the pump inlet. For cold start conditions, vacuum up to 12 inches (300 mm) Hg. is acceptable for short durations.

Cavitation and the possibility of aeration increase with higher inlet vacuum. In addition, oil

Technical Features, Continued

SUCTION continued

film lubrication is disrupted by high inlet vacuum.

Both factors, either singularly or combined, may contribute to reduced pump life.

CAUTION: Continuous operation at vacuums in excess of 6 inches Hg. may cause premature unit failure.

MINIMUM SPEED

Minimum recommended operating speed at 2500 psi is 600 RPM. Minimum speed is limited by volumetric efficiency. Contact Sauer-Sundstrand for assistance.If lower than recommended starting or operating speeds are required.

INPUT TORQUE RATINGS

The individual product dimensional configurations in this catalog list the maximum continuous input torques for various shaft options.

When applying pumps in tandem or multiple, observe that input torque limitations must be met for each section and cumulative sections.

CAUTION: Torques In excess of those shown may cause premature input shaft or unit failure.

PIPING

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 ensuring long system life and maximum performance.

Inlet piping should be designed to prevent continuous pump inlet vacuums in excess of 6 in. (150 mm) Hg. or 12 in. (300 mm) Hg. during start-up when measured at the inlet port.

RESERVOIR

The reservoir should be designed to accommodate maximum volume changes during all system operating modes and prevent aeration of the fluid as it passes through the tank. Return and inlet lines should be positioned below the reservoir low oil level and be located as far as possible from each other. A baffle plate located between the pump inlet and return line is desirable to allow the oil to deaerate before it enters the pump.

Reservoirs are normally sized for at least 2 to 4 times the pumps nominal flow for adequate oil deaeration and heat rejection.

COOLING

Depending on duty cycle and reservoir/line construction, an oil cooler may be required. This is sized based on typical power losses in the hydraulic circuit. The oil-to-air heat exchanger (cooler) is usually placed in the return line.

CAVITATION

Hydraulic oil used in the majority of systems contains about 10% dissolved air by volume. This air under certain conditions of vacuum within the system is released from the oil causing air bubbles. These air bubbles collapse if subjected to pressure, and this collapse creates erosion of the adjacent metal. Because of this, it becomes obvious that the greater the air content within the oil, or the greater the vacuum in the inlet line, the more severe will be the resultant erosion.

The main causes of over-aeration of the oil are air leaks, particularly on the inlet side of the pump, and flow line restrictions such as inadequate pipe sizes, elbow fittings and sudden changes in flow line cross sectional area. Providing pump inlet pressure and rated speed requirements are maintained, and reservoir size and location is adequate, no cavitation problems should occur with Sauer-Sundstrand pumps.

Technical Features, Continued

PRESSURE PROTECTION & RATINGS

The pump, as well as other system components, have pressure limitations. A relief valve must be installed in the system, preferably as close to the pump as possible, to protect it from excessive pressure. If the relief valve is set at or near the maximum pressure rating for the pump, the operating characteristics of the valve should be known so that relief valve overshoot does not allow system pressure to exceed the pump rating. This should not exceed pump continuous rated pressure any more than 10%. Contact Sauer-Sundstrand for pressures above those listed.

CAUTION: Failure to install this relief valve may result in premature unit failure.

LIFE EXPECTANCY

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 limits are adhered to, a high life can be expected.

NOTE: A B-10 type life expectancy number is generally associated with anti-friction bearings and does not exist for plain bearings.

Pump Sizing Calculations

Si System

$$\text{Output flow } Q_e = \frac{Vg \cdot n \cdot \eta_v}{1000} \quad \text{l/min}$$

$$\text{Input torque } M_e = \frac{Vg \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}} \quad \text{Nm}$$

$$\text{Input Power } P = \frac{M_e \cdot n}{9550} = \frac{Q_e \cdot \Delta p}{600 \cdot \eta_t} \quad \text{kW}$$

Vg = Displacement per revolution in cm^3
p_{HD} = High pressure, in bar
p_{ND} = Low pressure, in bar
Δp = $p_{HD} - p_{ND}$ bar (System pressure)

n = Speed rpm (min^{-1})
η_v = Volumetric efficiency, (%)
η_{mh} = Mechanic - hydraulic efficiency, (%)
η_t = Overall efficiency, (%)

English System

$$\text{Output flow } Q_e = \frac{Vg \cdot n \cdot \eta_v}{231} \quad \text{gal/min}$$

$$\text{Input torque } M_e = \frac{Vg \cdot \Delta p}{2 \cdot \pi \cdot \eta_{mh}} \quad \text{lbf in}$$

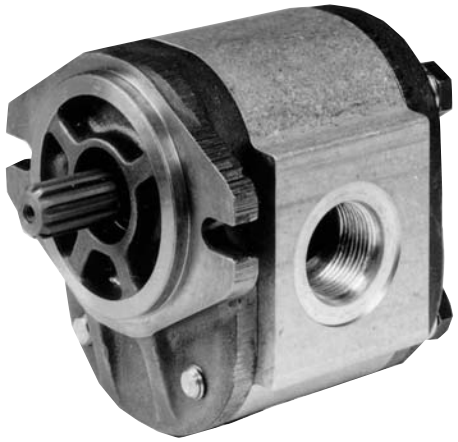
$$\text{Input Power } P = \frac{M_e \cdot n}{63025} = \frac{Q_e \cdot \Delta p}{1714 \cdot \eta_t} \quad \text{HP}$$

Vg = Displacement per revolution in in^3
p_{HD} = High pressure, in psi
p_{ND} = Low pressure, in psi
Δp = $p_{HD} - p_{ND}$ psi (System pressure)

n = Speed rpm (min^{-1})
η_v = Volumetric efficiency, (%)
η_{mh} = Mechanic - hydraulic efficiency, (%)
η_t = Overall efficiency, (%)

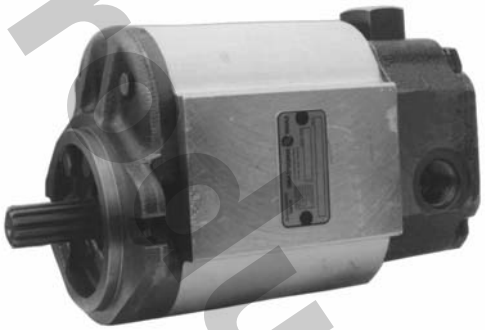
SP2.5/250 Single Gear Pumps

- 8 models 20-45 cm^3 (1.22-2.75 in^3)
- SAE "A" & "B" 2-Bolt Flanges
- SAE "A" & "B" 11T & 13T spline shafts
- SAE "A" & "B" .75" keyed shafts
- SAE O-Ring Boss Ports - Side and Rear
- "Nitrile" Seals - Standard, "Viton" Seals - Optional
- Clockwise or Counterclockwise Rotation
- Pressures to 4000 psi (275 Bar)
- Speeds to 3000 RPM



SP2.5/250 Gear Pumps with Priority Flow Divider (PFD)

- 8 models 20-45 cm^3 (1.22-2.75 in^3)
- SAE "A" & "B" 2-Bolt Flanges
- SAE "A" & "B" 11T & 13T spline shafts
- SAE "A" & "B" .75" keyed shafts
- SAE O-Ring Boss Ports - Side and Rear
- "Nitrile" Seals - Standard, "Viton" Seals - Optional
- Clockwise or Counterclockwise Rotation
- Pressures to 4000 psi (275 Bar)
- Speeds to 3000 RPM



SP2.5/250 Gear Pump Specifications

Table 1:

SP2.5/250	Dimension	Frame Size							
		20	22.4	25	28	31.5	35.5	40	45
Displacement	cu. in. / rev	1.22	1.37	1.53	1.71	1.92	2.17	2.44	2.75
	cc/rev	20.00	22.00	25.00	28.00	31.50	35.50	40.00	45.00
ontinuous Pressure	psi	3600	3600	3350	3350	3200	2900	2750	2550
	bar	250	250	230	230	220	200	190	175
	rpm	3000	3000	2800	2800	2800	2700	2500	2500
Peak Pressure	psi	3950	3950	3700	3700	3500	3250	2950	2650
	bar	275	275	255	255	245	225	205.00	185
Minimum Speed at 2500 psi	rpm	600	600	600	600	600	600	600	600
Weight	lbs	12.34	12.79	13.23	20.50	14.33	15.87	16.76	17.64
	kgs	5.60	5.80	6.00	6.50	6.80	7.20	7.60	8.00

Note: For applications requiring parameters beyond those listed above, contact Sauer-Sundstrand.

Table 2:

Theoretical Flow vs Speed, For Reference Only											
Frame Size	Speed	1200 RPM		1500 RPM		2000 RPM		2500 RPM		3000 RPM	
	Units	GPM	liters/min	GPM	liters/min	GPM	liters/min	GPM	liters/min	GPM	liters/min
20	Flow	6.34	23.99	7.92	29.99	10.56	39.98	13.20	49.98	15.84	59.98
22.4		7.12	26.94	8.90	33.68	11.86	44.90	14.83	56.13	17.79	67.35
25		7.95	30.09	9.94	37.61	13.25	50.14	16.56	62.68	19.87	75.22
28		8.88	33.63	11.10	42.03	14.81	56.04	18.51	70.05	22.21	84.07
31.5		9.97	37.76	12.47	47.19	16.62	62.93	20.78	78.66	24.94	94.39
35.5		11.27	42.67	14.09	53.34	18.79	71.12	23.48	88.90	28.18	106.68
40		12.68	47.98	15.84	59.98	21.13	79.97	26.41	99.96	31.69	119.95
45		14.29	54.08	17.86	67.60	23.81	90.13	29.76	112.66	35.71	135.19

SP2.5/250 Performance Curves, (Continued)

[ν = 34 mm²/s (160 SUS), ϑ = 49° C (120°F)]

Figure 5:

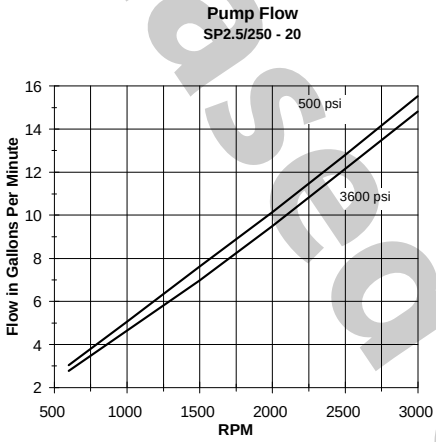
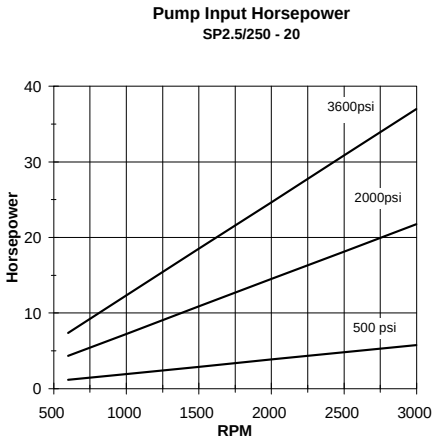


Figure 6:



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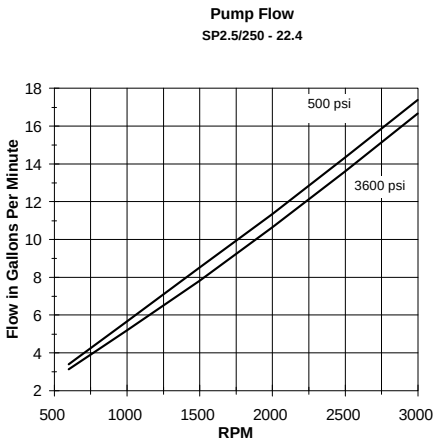
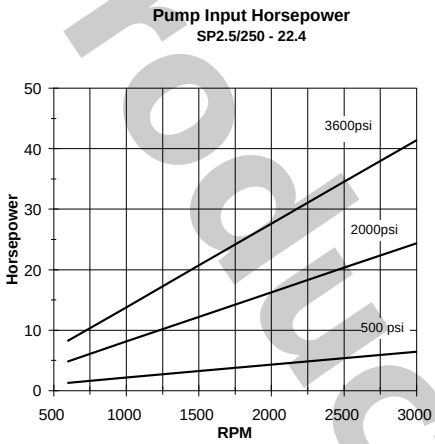


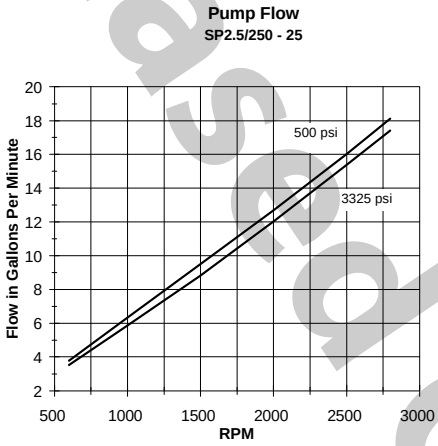
Figure 8:



SP2.5/250 Performance Curves, (Continued)

[ν = 34 mm²/s (160 SUS), ϑ = 49° C (120°F)]

Figure 9:



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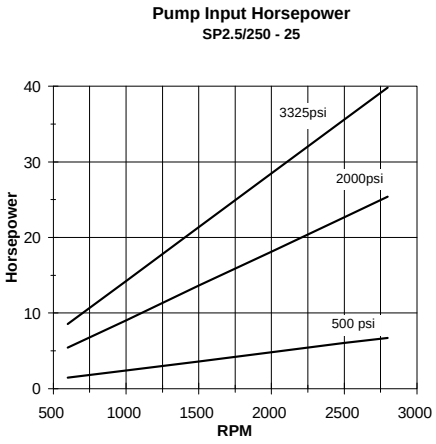


Figure 11:

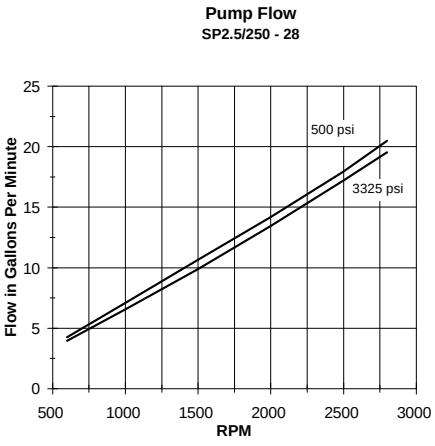
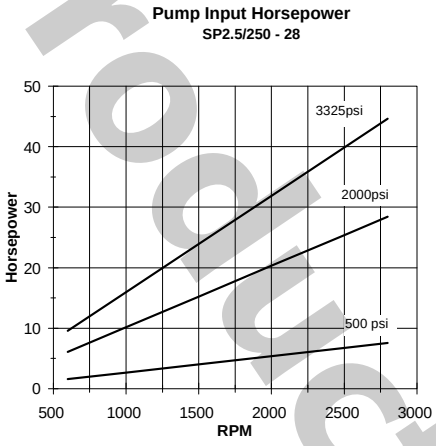


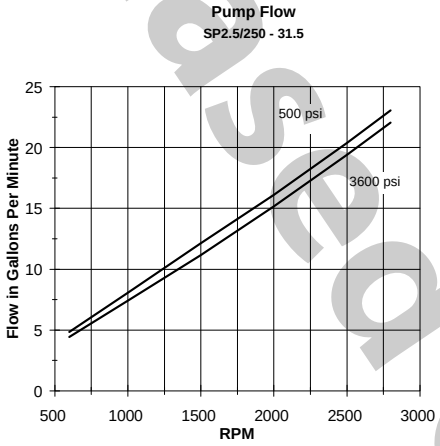
Figure 12:



SP2.5/250 Performance Curves, (Continued)

[ν = 34 mm²/s (160 SUS), ϑ = 49° C (120°F)]

Figure 13:



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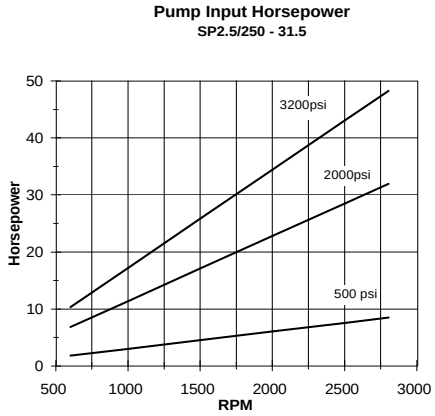


Figure 15:

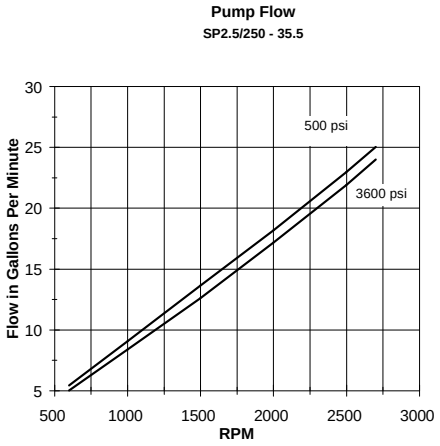
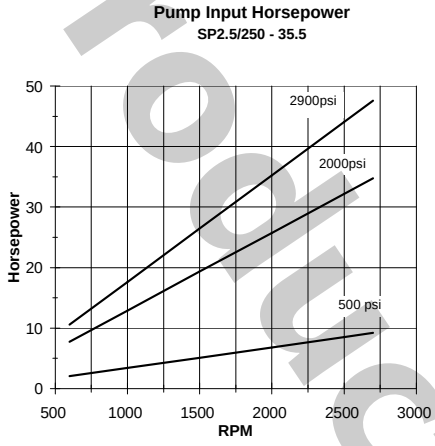


Figure 16:



SP2.5/250 Performance Curves, (Continued)

[ν = 34 mm²/s (160 SUS), ϑ = 49° C (120°F)]

Figure 17:

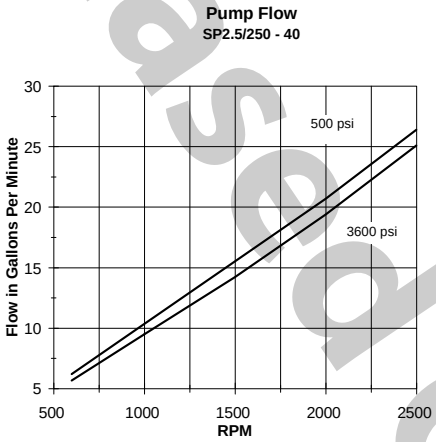


Figure 18:

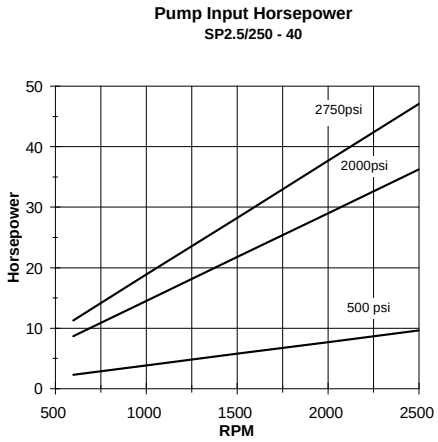


Figure 19:

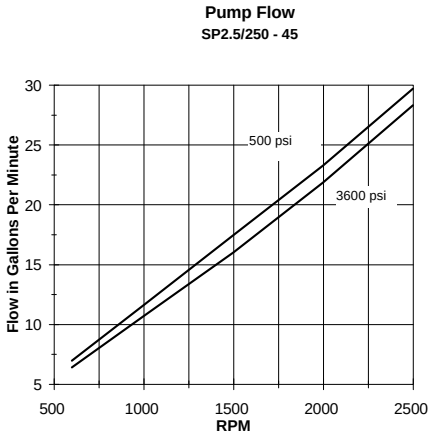
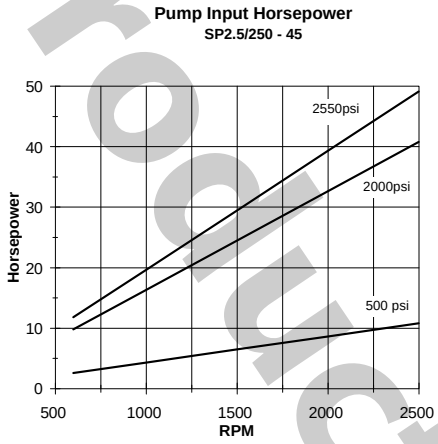


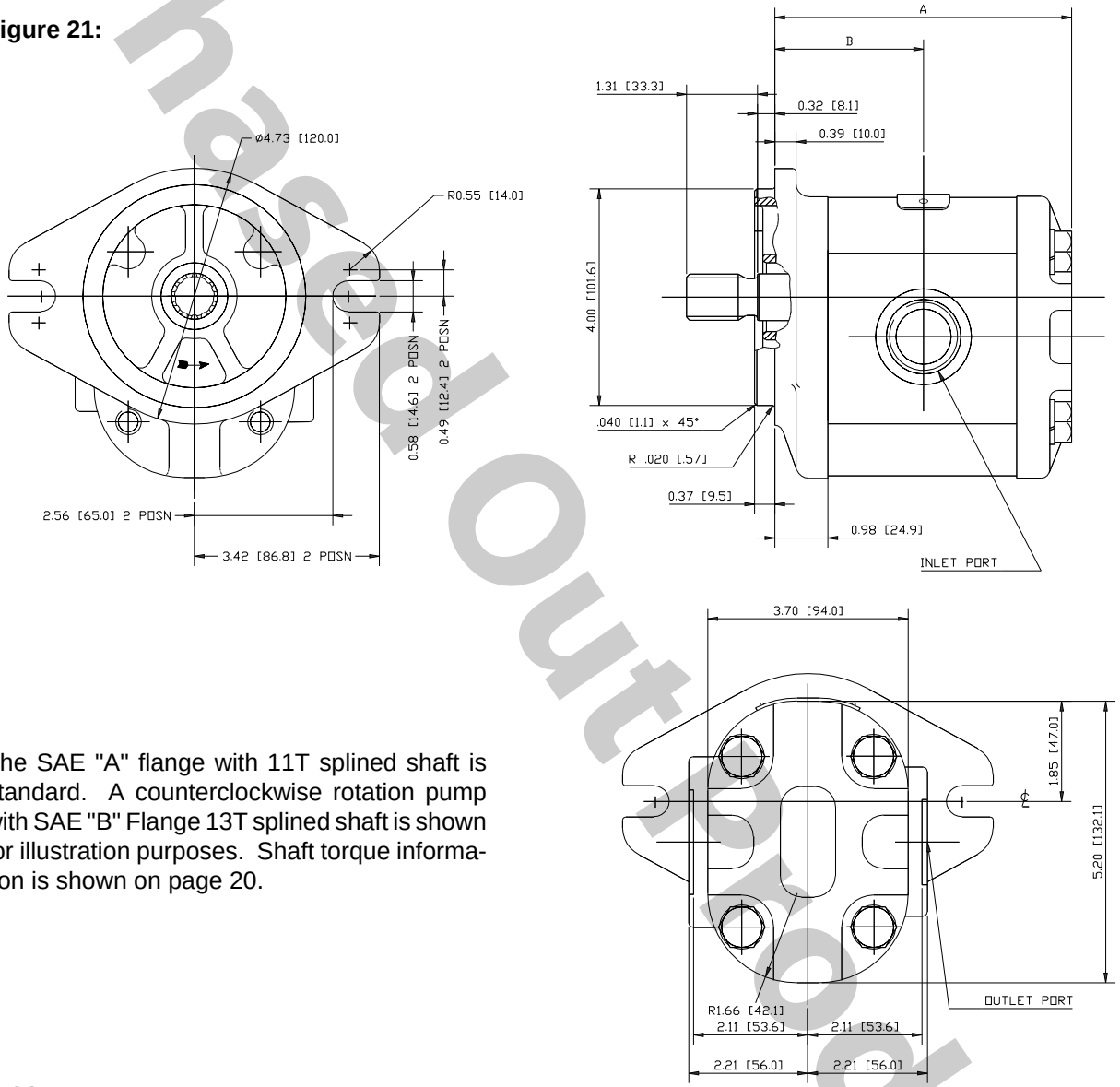
Figure 20:



SP2.5/250 Single Gear Pump with Side Ports

Dimensions shown in inches xx.xx with metric dimensions [millimeters] shown in brackets [xx.x].

Figure 21:



The SAE "A" flange with 11T splined shaft is standard. A counterclockwise rotation pump with SAE "B" Flange 13T splined shaft is shown for illustration purposes. Shaft torque information is shown on page 20.

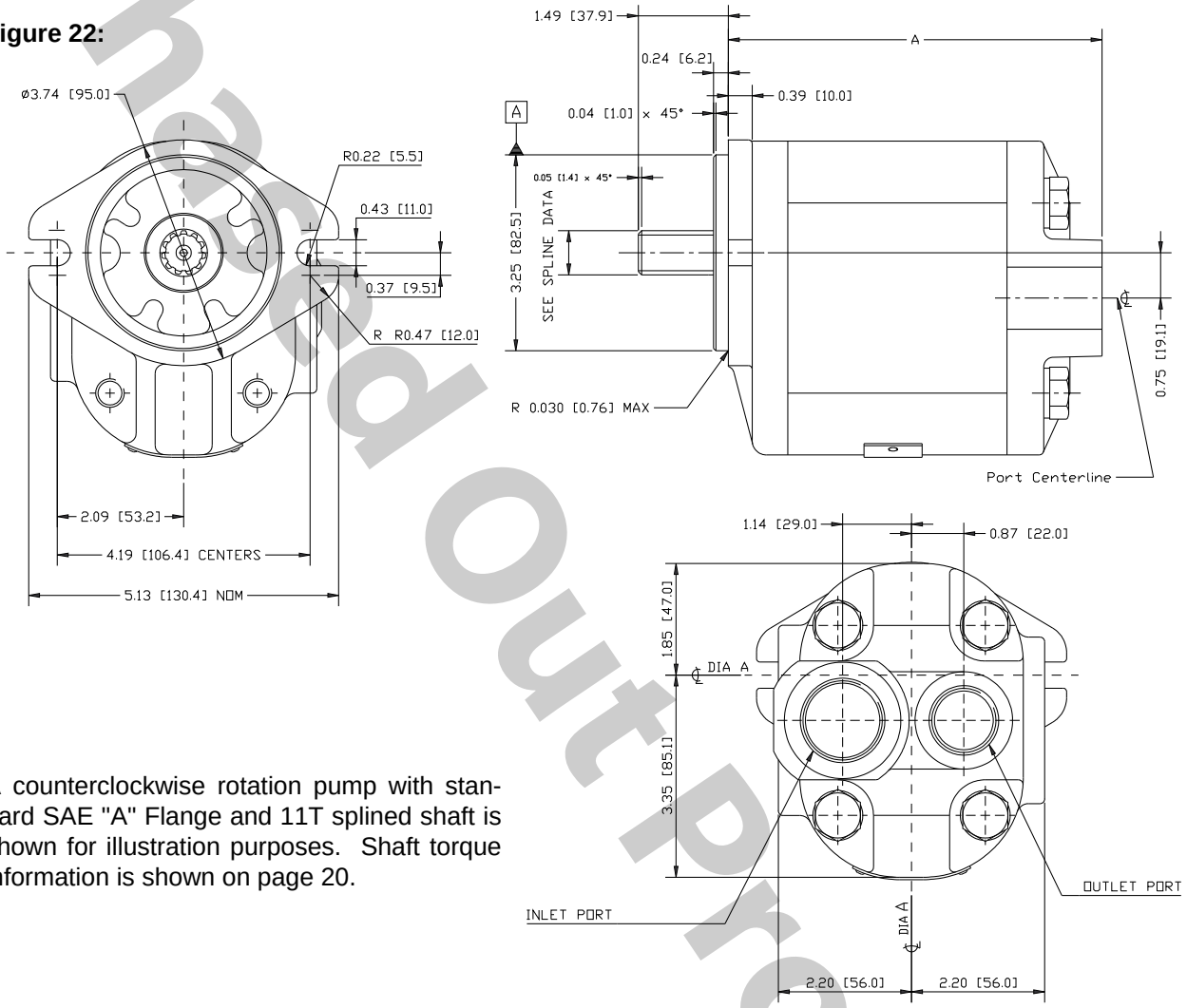
Table 3:

SP2.5/250 STANDARD PUMP DIMENSIONS						
Frame Size	"A"		"B"		INLET PORT	OUTLET PORT
	inches	mm	inches	mm		
20	4.62	117.4	2.26	57.4	1-5/16"-12UNF O-RING	1-1/16-12UNF O-RING
22.4	4.72	119.9	2.30	58.4		
25	4.83	122.6	2.34	59.4		
28	5.56	141.2	2.73	69.3		
31.5	5.70	144.8	2.73	69.3		
35.5	5.86	148.9	2.73	69.3		
40	6.05	153.6	2.73	69.3		
45	6.25	158.7	2.73	69.3		

SP2.5/250 Single Gear Pump With Rear Ports

Dimensions shown in inches xx.xx with metric dimensions [millimeters] shown in brackets [xx.x].

Figure 22:



A counterclockwise rotation pump with standard SAE "A" Flange and 11T splined shaft is shown for illustration purposes. Shaft torque information is shown on page 20.

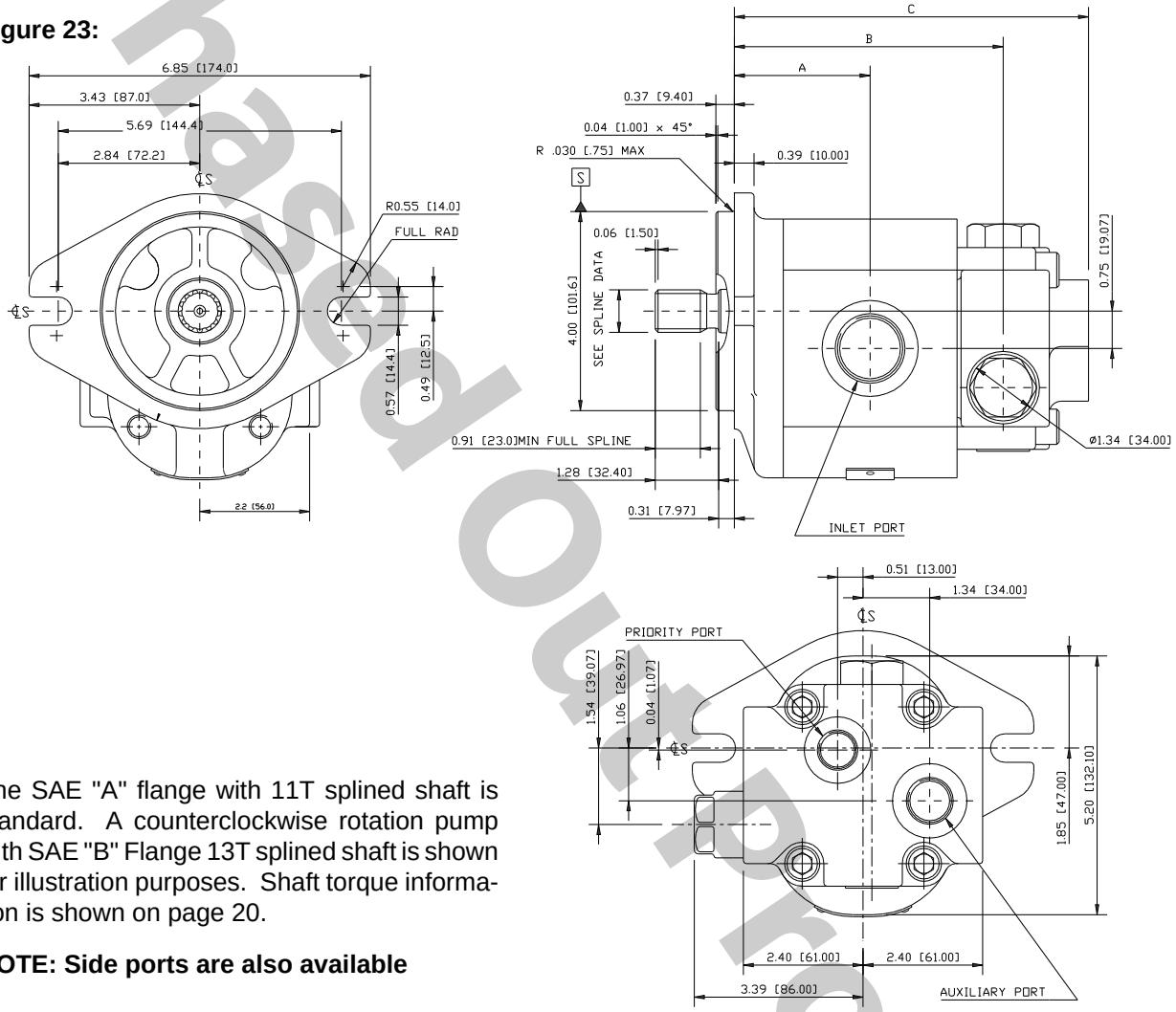
Table 4:

SP2.5/250 REAR PORTED PUMP DIMENSIONS				
Frame Size	"A"		INLET PORT	OUTLET PORT
	inches	mm		
20	5.11	129.8	1-5/16"-12UNF O-RING	1-1/16-12UNF O-RING
22.4	5.21	132.3		
25	5.31	134.9		
28	6.04	153.5		
31.5	6.19	157.2		
35.5	6.35	161.3		
40	6.53	165.9		
45	6.74	171.1		

SP2.5/250 Priority Flow Divider Pump Dimensions and Options

Dimensions shown in inches xx.xx with metric dimensions [millimeters] shown in brackets [xx.x].

Figure 23:



The SAE "A" flange with 11T splined shaft is standard. A counterclockwise rotation pump with SAE "B" Flange 13T splined shaft is shown for illustration purposes. Shaft torque information is shown on page 20.

NOTE: Side ports are also available

Table 5:

SP2.5/250 PFD DIMENSIONS									
Frame Size	"A"		"B"		"C"		INLET PORT	PRIORITY PORT	AUXILIARY PORT
	inches	mm	inches	mm	inches	mm			
20	2.26	57.4	4.46	113.3	6.17	156.8	1-5/16"-12UNF O-RING	3/4"-16UNF O-RING	7/8"-14UNF O-RING
22.4	2.26	57.4	4.56	115.8	6.27	159.3			
25	2.26	57.4	4.66	118.4	6.37	161.9			
28	2.73	69.3	5.39	137	7.11	180.5			
31.5	2.73	69.3	5.54	140.7	7.25	184.2			
35.5	2.73	69.3	5.70	144.8	7.41	188.3			
40	2.73	69.3	5.88	149.4	7.59	192.9			
45	2.73	69.3	6.09	154.6	7.80	198.1			

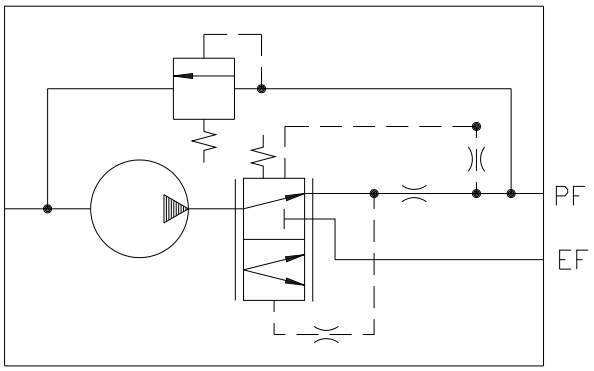
SP2.5/250 Priority Flow Divider Information

The SP2.5/250 Series pump is offered with the flow divider that include the following options:

- STD PFD - no RV
- STD PFD - with RV
- Load Sense PFD - Static
- Load Sense PFD - Dynamic

Symbolic Schematic of PFD with RV Option

Figure 24:



SP2.5/250 Shaft Torque Specifications, Straight Key Shaft Option

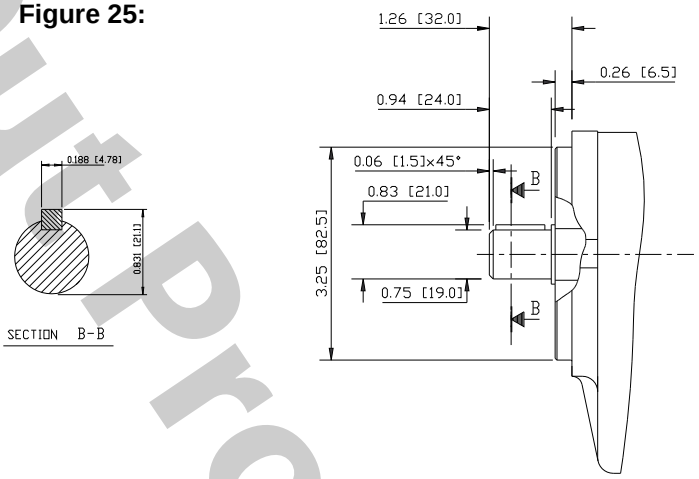
Shaft Torque Specifications:

11 Tooth SAE	1239 lbf-in [140NM]*
13 Tooth SAE	1796 lbf-in [203NM]*
3/4" Straight Key	1239 lbf-in [140NM]*

***Note: Torque limits must not exceed these levels regardless of pressure and speed parameters listed in Table 1 on page 11.**

The following 3/4" straight keyed shaft is optional with the SP2.5/250 series pump.

Figure 25:



SP2.5/250 Multiple Pump Option

SP2.5/250 pumps are available in multiple configurations. The sample shown here uses two SP2.5/250 units and other options are available. Contact Sauer-Sundstrand for assistance with this option.

Figure 26: