

HYDRAULIC VARIABLE PUMPS

EFFICIENT VARIABLE DELIVERY

Checkball pump delivery is controlled by variable inlet ports in each piston pumping chamber. In these hydraulic variable models, output is regulated by a variable low-pressure control signal, supplied to a control port in the pump cover.

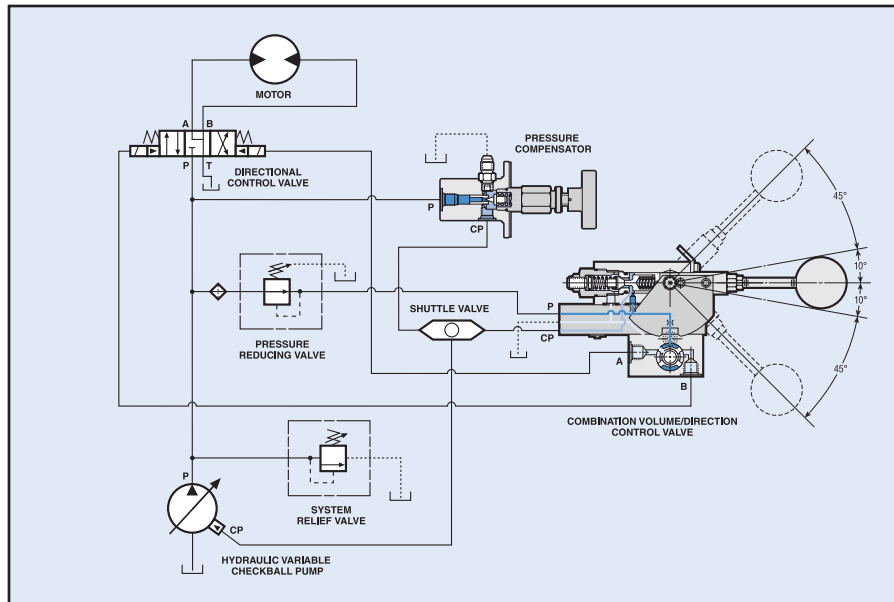
Fluid not needed to meet system requirements returns to tank at low pressure, typically 100 psi (7 bar). The result is efficient pump control, providing infinitely variable flow to the system.

Pump Volume Controls

Pump volume controls for PV6000 Series pumps, including a remote pressure compensator, improve the control and design flexibility of hydraulic circuits.

Typical Motor Circuit

A typical open loop circuit uses a combination volume/direction control valve to regulate the control signal. As the valve lever is moved to either side of center, the output pressure



from the "CP" port decreases, which is sensed at the pump control port "CP". This results in an increase in pump output. Simultaneously, flow from the "A" or "B" port travels to the

directional valve controlling the motor. This pilot supply hydraulically controls actuator direction, providing an over-center function at the motor.

HOW OUTPUT IS CONTROLLED

Pump output is regulated by variable inlet port checkballs in parallel with the outlet check valves of each piston pumping chamber.

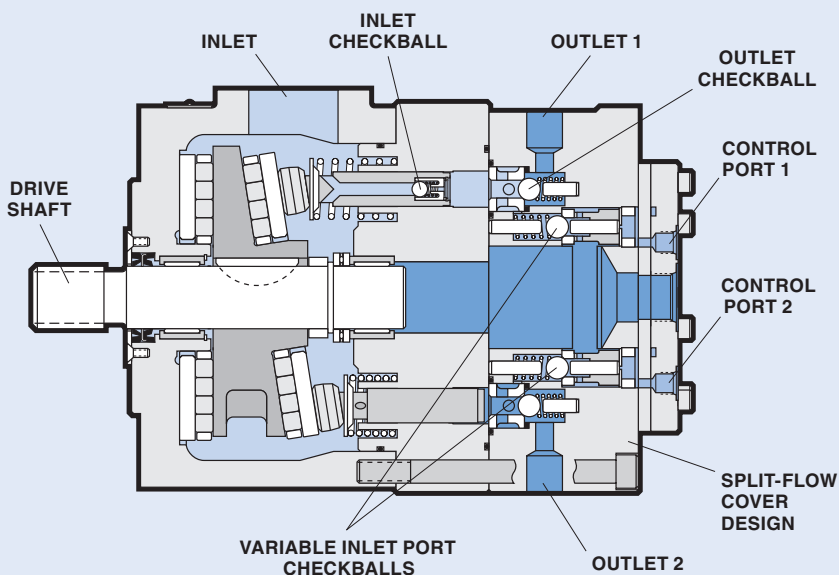
Pressure Signal Controls Output

These variable inlet checkballs are opened and closed by a variable control signal, 0 to 180 psi (0 to 12 bar), externally supplied to the control port in the pump cover.

When full flow is not required, the control signal unseats the variable inlet checkball at the start of the piston stroke. As the piston accelerates, the resulting flow forces across the checkball increase until the signal is overcome and the checkball seats.

Remaining Fluid is Pressurized

The fluid remaining in the pumping chamber then rises to system pressure. The outlet checkball then unseats. Piston outputs are



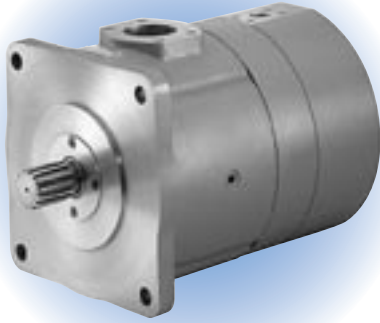
combined in the barrel and discharged from the pump outlet.

Increasing the control signal, for example, increases the duration during which the variable inlet port checkballs are unseated and decreases pump output.

Multiple Outlet Pumps

Split-Flow® pumps supply two independent flows to the circuit. The ten-piston pump provides five-piston output from each outlet port, regulated by the variable pressure signal supplied to its corresponding control port.

PV6000 HYDRAULIC VARIABLE



Specifications

Pump Models	Output Flow at 1500 rpm ^①		Output Flow at 1800 rpm ^①		Rated Pressure		Maximum Intermittent Pressure ^②		Rated Speed rpm	Maximum Speed rpm
	U.S. gpm	L/min	U.S. gpm	L/min	psi	bar	psi	bar		
<i>Standard S.A.E. 4-Bolt Flange Outlet Port:</i>										
PV6054-3065	29.5	111,6	35.4	134,0	6000	420	6000	420	1800	2400
PV6070-3066	39.6	150,1	47.6	180,1	6000	420	6000	420	1800	2300
PV6080-2923	45.0	170,3	54.0	204,4	5500	380	5500	380	1800	2200

① Output flow based on typical performance at rated pressure with pressurized inlet where required, as shown in the table below.

② Contact the sales department for applications requiring higher intermittent operating pressures.

PUMP DESCRIPTION

PV6000 Series checkball pumps supply infinitely variable flow. Output is regulated by an external low-pressure control signal supplied to a control port in the cover.

These pumps, with bi-directional shaft rotation, provide constant direction of output flow regardless of the direction of drive shaft rotation.

Mounting

S.A.E. E 4-bolt pattern with 0.25 inch (6,4 mm) pilot engagement.

Standard Spline Shaft

1.748/1.747 inch diameter standard S.A.E. 13 tooth, 8/16 D.P. 30° involute spline.

Outlet Port Options

Pattern for standard 1 inch S.A.E. 4-bolt flange. Refer to "Outlet Port Configurations" on page 7.

Inlet Conditions

Pumps may require pressurized inlet conditions at higher speeds. Failure to meet minimum inlet requirements will result in slight flow reduction. Refer to the table.

Seal Options

Standard seals are Buna-N (Nitrile). Options include Fluorocarbon (Viton® or Fluorel®) or EPR for use with some phosphate ester fluids.

Weight (Mass)

330 lb (150 kg)

Minimum Inlet Pressure^①

Pump Models	Operating Speed							
	1200 rpm		1500 rpm		1800 rpm		2400 rpm	
	psi	bar	psi	bar	psi	bar	psi	bar
PV6054	0	0	5	0,4	5	0,4	10	0,7
PV6070	0	0	5	0,4	10	0,7	10 ^②	0,7 ^②
PV6080	5	0,4	5	0,4	10	0,7	15 ^②	1,0 ^②

① Values shown are based on fluid viscosity of 100 SUS (20 cSt). All PV6000 Series pumps have a high-pressure shaft seal.

② Refer to maximum speeds indicated in the "Specifications" table.

PUMP SELECTION

The "Specifications" table lists the most commonly used standard models with standard spline shafts and high-pressure shaft seals.

Contact the sales department for model numbers with optional seals and other extraordinary operating requirements.

Regulating Pump Output

Pump volume controls, including remote pressure compensators, improve the flexibility of hydraulic circuits. Refer to "Typical Open Loop Circuit" on page 2 and contact the sales department for ordering information.

Fluid Guidelines

See page 6 for "Fluid Recommendations".

Some pump models may require reduced operating pressures when using low-lubricity fluids.

Because of the wide range of fluid characteristics, contact the sales department for a review of any application using non-petroleum based fluids.

Split-Flow® Provides Multiple Outlets

PV6000 Series models with split-flow covers efficiently supply flows for multiple function circuits. Piston outputs are grouped together in the cover, with this ten-piston pump providing five-piston output from each of two independent ports. See "Split-Flow® Output" on page 5.

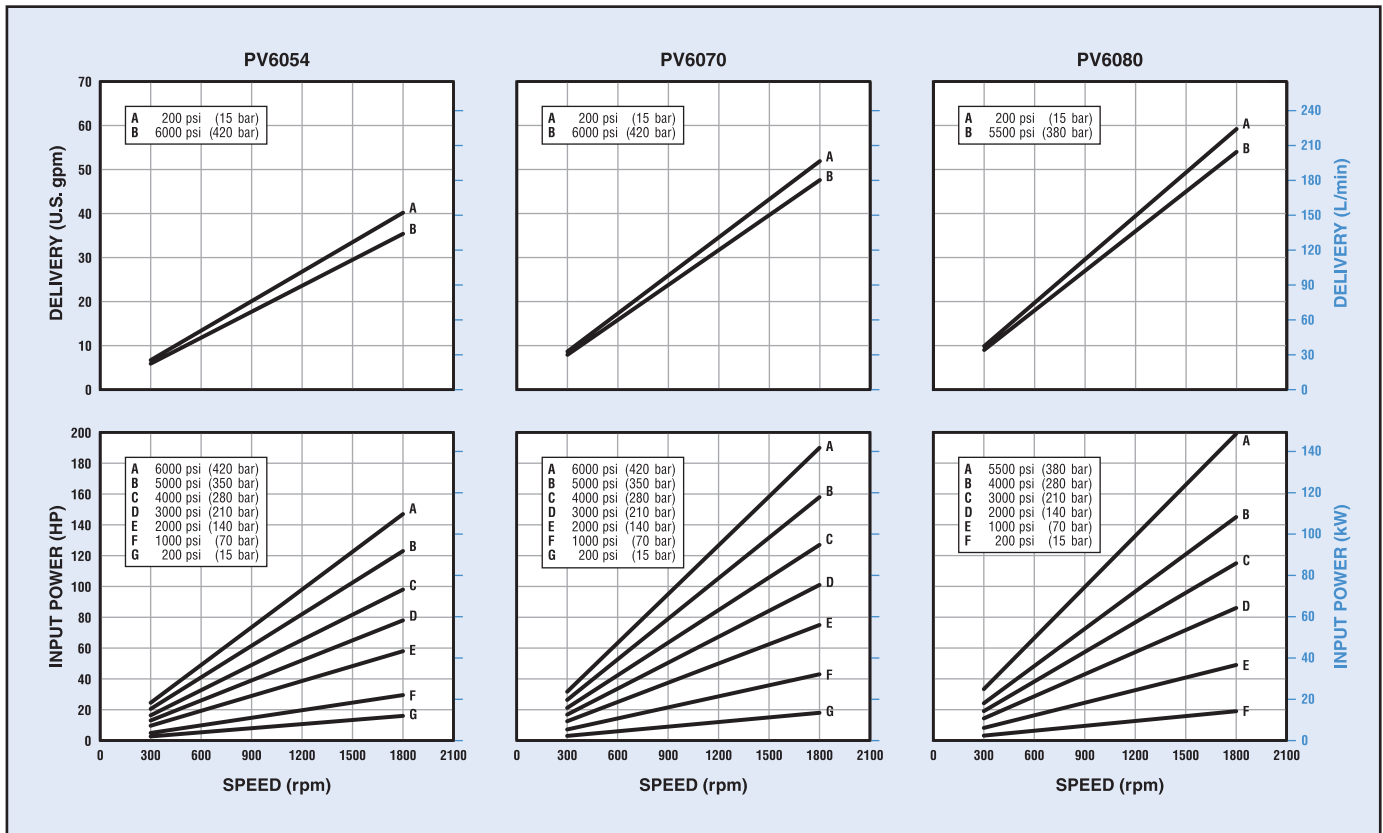
Tandem Pump Models

PV6000 Series pumps with thru-shaft configuration simplify circuits by eliminating separate dedicated pumps and drives, and reducing piping and installation time.

A tandem mounted pump is ideal for supplying auxiliary functions. Separate flows to multiple functions in a circuit can be supplied by one unit, driven by a common drive shaft.

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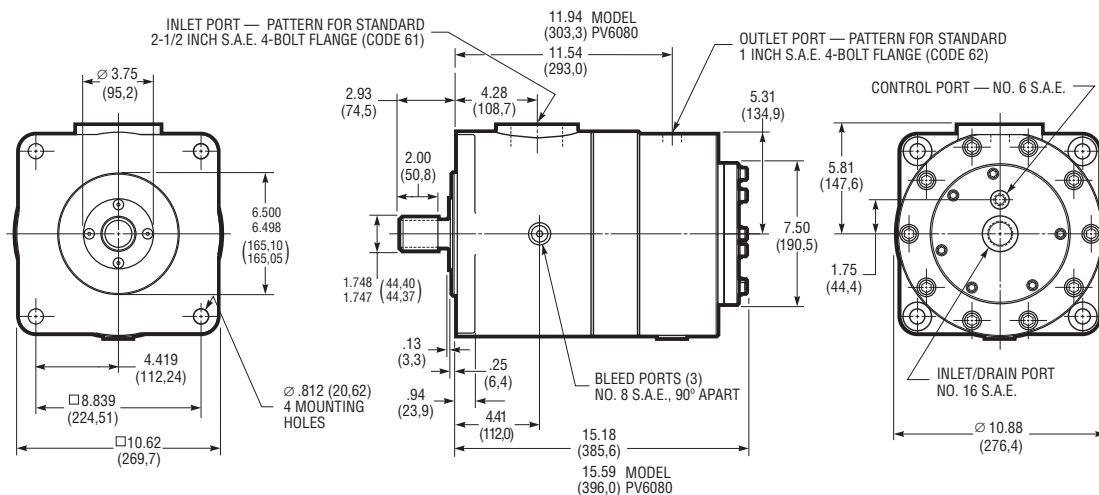
Typical Performance Curves



Typical performance curves are based on 100 SUS (20 cSt) mineral oil with pressurized inlet where required. Refer to the "Minimum Inlet Pressure" table on page 12.

INSTALLATION

All dimensions are shown in inches (millimeters in parentheses) and are nominal. Refer to Bulletin PSI.CB for general installation and operating recommendations.



PV6000 Series Standard Full-Flow Configuration

PV6000 HYDRAULIC VARIABLE

Pump Inlet/Drain Port

Note the location of the dual purpose inlet/drain port. Acting as an inlet, this port increases volumetric efficiency by improving the filling of the piston chamber.

Acting as a drain, the port diverts unused fluid at low pressure from the chamber, providing improved circulation which dissipates heat.

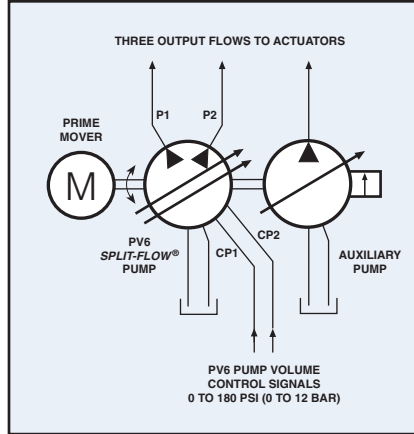
Split-Flow® Output

As shown in the circuit, the Split-Flow® PV6000 Series pump can supply two variable flows, or one fixed and one variable flow.

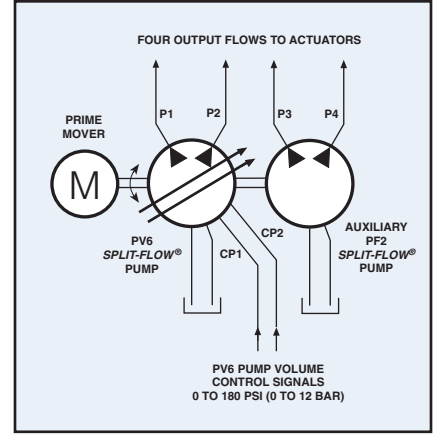
Each output (P1 and P2) is independently controlled by its own external control pressure signal (CP1 and CP2). See "How Output is Controlled" on page 2.

Tandem Pump Mounting

Any accessory pump with a standard S.A.E. B 2-bolt or 4-bolt pattern can be tandem mounted on the PV6000 Series Thru-Shaft pump. The internal coupling is a standard S.A.E. B spline.



This 10-piston Split-Flow® pump provides two 5-piston outputs, plus a third flow delivered from a tandem mounted auxiliary pump.



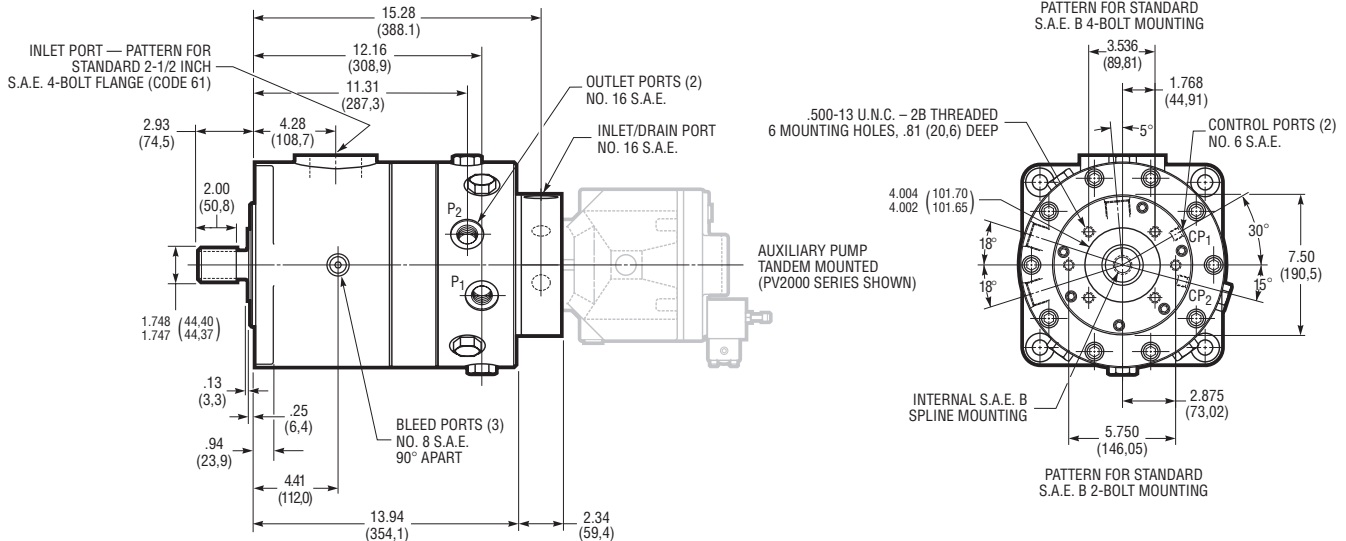
With a two-outlet Split-Flow® PF2000 Series pump as an accessory pump, one unit provides four separate flows driven by a single drive-shaft.

The tandem pump can determine the rotation of both pumps, because shaft rotation of the PV6000 Series is bi-directional, providing constant direction of output flow regardless of drive shaft rotation.

Refer to the installation drawing and the circuit drawings above.

The installation drawing shows a Split-Flow® pump with two independent variable delivery outlet ports (5 pistons output + 5 pistons output).

For complete model numbers and a review of the application, contact the sales department.



PV6000 Series Split-Flow® Thru-Shaft Configuration

FLUID RECOMMENDATIONS

Mineral Oil

A high-grade premium petroleum-based fluid should be used to assure long component and system life. The fluid should have a combination of anti-wear, demulsibility, rust protection, oxidation-resistant and foam-resistant properties.

Special Fluids

Various pump models are available for use with water-based fluids, diesel calibration fluids, phosphate ester fluids, machining coolant, brake fluid, various military fluids and other special fluids.

PF4300 Series pumps are compatible with a variety of water-based fluids. These models, which are specifically rated for use with low-lubricity fluids.

Some pump models may require reduced operating pressures when using low-lubricity fluids.

Because of the wide range of fluid characteristics, contact the sales department for a review of any application using non-petroleum based fluids.

Viscosity Specifications

Using fluid with the correct viscosity range is critical to achieving long component life.

Fluid conditions outside the "Optimum" range shown in the table may result in reduced pump output, requiring pressurized inlet conditions. For more information, contact the sales department.

Hydraulic Fluid Viscosity^①

Pump Models	Operating				Start-up ^②		Optimum		
	Minimum		Maximum		SUS	cSt	SUS	cSt	
	SUS	cSt	SUS	cSt					
<i>Fixed Displacement Pumps:</i>									
PF500-10	52	8	1911	413	3706	800	98 to 324	20 to 70	
PF1000-10	59	10	1911	413	3706	800	98 to 324	20 to 70	
PF2000	59	10	1911	413	1911	413	98 to 324	20 to 70	
PF2000 ^②	34	2,3	1911	413	1911	413	98 to 324	20 to 70	
PF3000-10	59	10	1911	413	3706	800	98 to 342	20 to 70	
PF4000-30	34	2,3	1911	413	1911	413	98 to 324	20 to 70	
PF4200-10	34	2,3	1911	413	1911	413	98 to 324	20 to 70	
PF4300-11	31	1,5	927	200	927	200	–	–	
PF6000	34	2,3	1911	413	1911	413	98 to 324	20 to 70	
<i>Mechanical Variable Delivery Pumps:</i>									
PV4000	34	2,3	1911	413	1911	413	98 to 324	20 to 70	
PV6000	34	2,3	1911	413	1911	413	98 to 324	20 to 70	
<i>Hydraulic Variable Delivery Pumps:</i>									
PV6000	34	2,3	1911	413	1911	413	98 to 324	20 to 70	

① Fluid conditions outside the "Optimum" range may result in reduced output, requiring pressurized inlet conditions. Contact the sales department.

② Models with special mounting.

MINIMUM FILTRATION LEVELS

Pump inlet: 150 μ nominal;

Pressure or return line: 25 μ nominal.

While finer filtration levels than these are desirable and will result in longer component life, restricting flow to the pump inlet should be avoided. Minimum recommended inlet conditions must be maintained.

If a system component fails resulting in fluid contamination, it is important to drain and clean the reservoir, all lines, filter screens and all components. Refill with new fluid.

INSTALLATION AND OPERATION

Refer to separate Bulletin PSI.CB for general installation and operating recommendations.

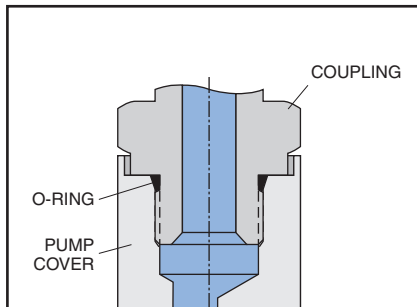
That brochure includes information on mounting, shaft loading, sizing inlet pipe and hose, air bleed procedures and initial start-up. Guidelines for maintenance, repair and trouble-shooting are also included.

PORT DESCRIPTIONS

Dynex pumps are available with outlet ports suitable for use at various pressure ranges. Refer to the appropriate "Specification Table" or "Typical Model Code" to specify the required port.

Contact the fitting manufacturer to ensure the selected fittings are rated for the maximum pump operating pressure.

S.A.E. Straight Thread Ports



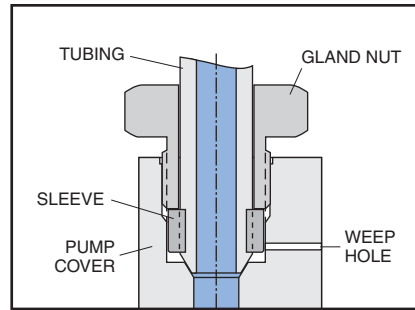
Typical S.A.E. Straight Thread port connection

The Straight Thread connection (S.A.E. J1926/1) is sometimes referred to as an S.A.E. O-ring Boss, or ORB. The port consists of a machined spotface surface, a tapered seal cavity and a straight thread port.

The fitting forms a seal by compressing the o-ring in the seal cavity with the underside of the flanged wrench flat. Some adjustable fittings, such as elbows and tees, use a locknut with a captive backup washer for compression.

S.A.E. Straight Thread ports are not recommended for operation above 8000 psi (560 bar). Also, the maximum pressure of pumps with No. 12 S.A.E. outlet ports may be limited by the pressure rating of the available fitting. Contact the fitting manufacturer for ratings.

Coned and Threaded Ports



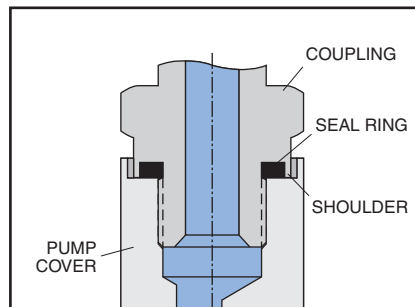
Typical Coned and Threaded port connection

High-pressure pumps are available with coned and threaded outlet ports, which use Autoclave Medium Pressure, Butech M/P, or equivalent fittings.

These fittings provide a metal-to-metal seal with an interference fit, not requiring an o-ring. The gland nut holds the sleeve and tubing against the cone surface.

A weep hole, visible on the outside of the pump cover, acts as an indicator of any abnormal leakage caused by system conditions (i.e., excessive pressure). It allows any fluid which does leak past the sealing surfaces to escape, preventing pressure build-up and possible damage.

British Standard Pipe Ports



Typical port connection with British Standard Pipe (Parallel) fitting with shoulder

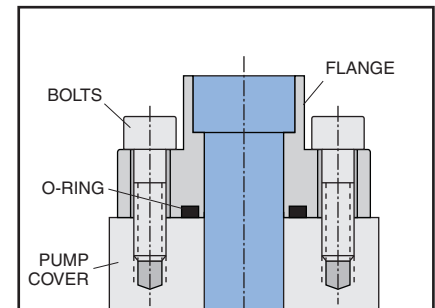
High-pressure pumps are available with flat face ports with British Standard Pipe (B.S.P.) parallel threads (BS 2779 or ISO 228), ideal for use on some European applications.

The fitting forms a seal by compressing a flat elastomer ring on a machined spotface surface. There are several sealing methods for these ports.

The recommended fitting has a recessed seal cavity formed by a shoulder on the underside of the flanged wrench flat (Voss "Peflex", Form B Shoulder Seal; or Parker Type E, "Elastic" Seal; or equivalent).

B.S.P. ports are not recommended for operation above 10 000 psi (700 bar). Contact the fitting manufacturer, to ensure the selected fittings are rated for the maximum pump operating pressure.

S.A.E. 4-Bolt Flange Ports



Typical S.A.E. 4-Bolt Flange port connection

Flange connections are often used for higher flows requiring larger diameter tubing. The port consists of an unthreaded port with four bolt holes in a rectangular pattern on a machined face around the port (S.A.E. J518).

A typical fitting consists of a flanged head with a welded tube and a captive flange with bolt holes. A seal is formed by an o-ring in the groove on the underside mounting surface of the flange head. As the flange bolts are alternately tightened, the o-ring is compressed between the flange head and the machined face on the pump.

To make mounting easier in tight spaces a two-piece split-flange is often used.