

User Guide

Vickers by Danfoss PVM Variable Displacement Piston Pump Design Code B

Up to 315 bar
45 - 50cc/rev
(2.75 - 3.05in³/rev)
Variable Speed Drive Ready

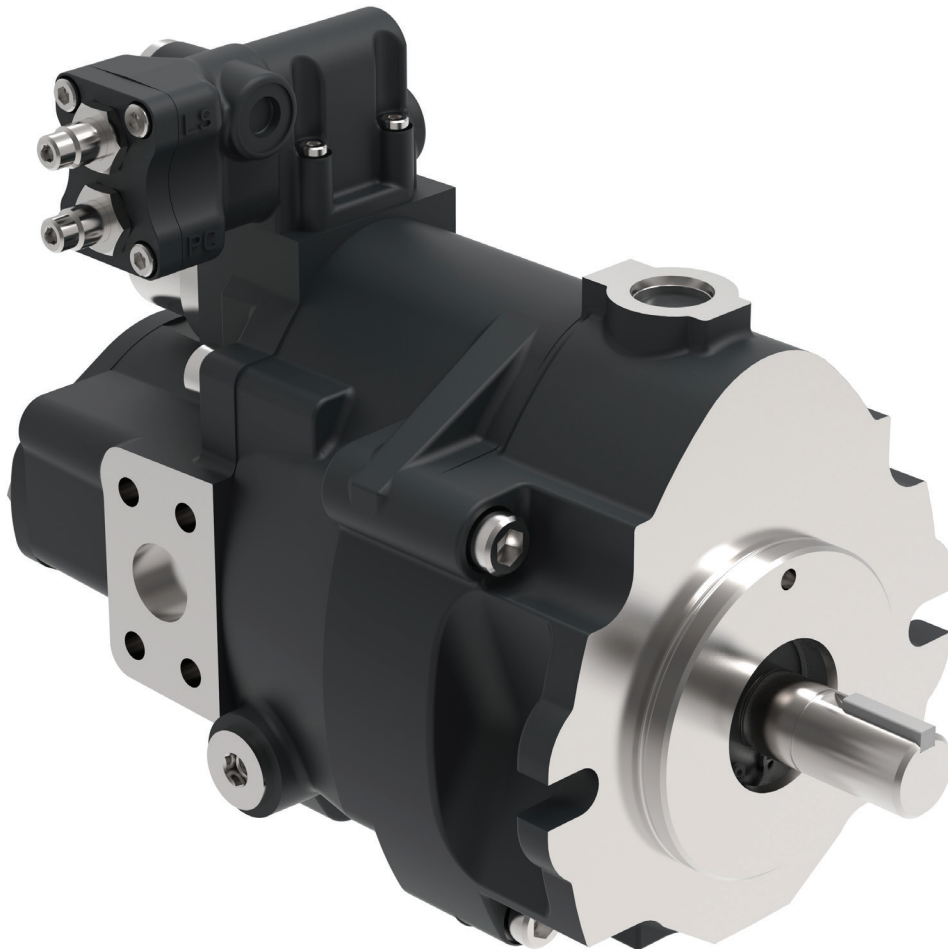


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Introduction

Vickers by Danfoss M Series pumps are open circuit, axial piston designs. A variety of control options allows the pumps to perform most efficiently in a specific application. Efficiency of the pump controls allows down-sizing of system cooling needs, saving up front cost in the machine. Alternatively, cooling capacity could be kept the same and the flow capability of the system increased, thus improving performance and customer satisfaction.

The M Series also contains a strong proven rotating group allowing the pumps to handle pressures up to 315 bar (4568 psi) continuous with less maintenance cost. High-load carrying capacity bearings and a stiff drive shaft help provide very long life at rated industrial conditions, reducing operating costs and extending operating life.

M Series pumps feature a saddle-type yoke with steel-backed polymer bearings. The stiff yoke reduces deflection and allows even loading of bearings, improving life. A single control piston reduces loading on the yoke, resulting in reduced pump size which allows installation in tighter locations.

M Series pumps operate at a level of quietness that exceeds the requirements of today's demanding work conditions. The pumps feature a unique three-piece envelope (flange, housing and valve block) specifically created for low fluid-borne and structure-borne noise levels. Another pump feature – a bimetal timing plate – improves pump filling characteristics which, in turn, reduce fluid-borne noise and extend pump life.

M Series pumps reduce, or in some cases remove, the need for damping barriers between the noise source and the operator. This saves money on the installed cost of the system while improving customer comfort.

An adjustable maximum stop provides a means of tuning flow to your system, while gauge ports allow monitoring of inlet and outlet conditions. These standard features reduce system complexity and cost.

Mounting flange is offered in SAE configurations, and ports are offered in SAE in both tube and flange versions.

Side- or end-ported models are available to facilitate plumbing and help fit the pump to your machine space needs. Multiple drain ports allow many mounting orientations, reducing installed costs.

M Series pumps are capable of operating with many



types of hydraulic fluids used in industrial systems. High-water-content and phosphate ester fluids can be accommodated, in addition to the typical petroleum based and synthetic fluids.

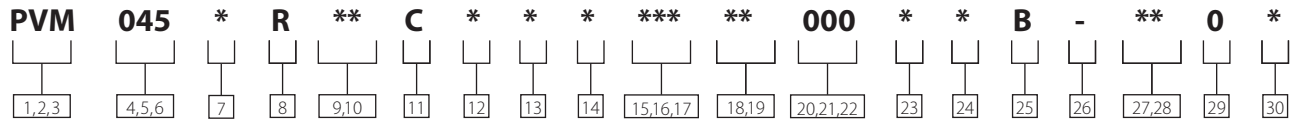
Typical Applications

- Mining machinery
- Injection molding machines
- Metal forming machines
- Oil and Gas Equipment
- Conveyor lines
- Primary metals
- Metal cutting equipment

Features and Benefits

- Tear drop shaped housing contains fluid borne sound and reduces operator fatigue
- Standard adjustable maximum volume screw and gage ports give the ultimate in flexibility to the engineer or service technician
- High overall efficiency reduces operating costs
- Robust shaft bearings extends operating life and lowers maintenance costs
- Multiple port types and locations aid in flexibility of machine design
- Very low pressure ripple reduces shock in the system resulting in less leakage

Model Code Selection



1,2,3 Product Series
PVM – M Series Variable Piston Pump

4,5,6 Displacement
045 45.1 cm³/r [2.75 in³/r] (315 bar MAX)
050 50.0 cm³/r [3.05 in³/r] (230 bar MAX)

7 Valve Plate
E - Quiet version, optimized for 1000-1800 rpm
M - Higher speed version. ref speed performance data for individual displacements

8 Input Rotation
R – Clockwise (Right hand)

9,10 Input Shaft
05 - SAE J744-22-1 SAE B STRAIGHT KEYED
06 - SAE J744-25-1 SAE B-B STRAIGHT KEYED
07 - SAE J744-22-4 SAE B 13T SPLINE
08 - SAE J744-25-4 SAE B-B 15T SPLINE

11 Mounting Flange
C – SAE B, 2-bolt

12 Main Port Location
E – End Ported
S – Side Ported

13 Main Port Type
1 - SAE J514 TUBE PORTS SAE AUXILIARY PORTS
2 - SAE J518 FLANGE PORTS SAE AUXILIARY PORTS

14 Control
0 – None
A – Pressure Compensator
B – Pressure and Flow Compensator with Bleed Orifice
C – Pressure and Flow Compensator with Plugged Orifice

15,16,17 Pressure Compensator Setting
000 – None
070 – 70 bar (Adjustable between 40 bar and 130 bar)
230 – 230 bar (Adjustable between 130 bar and 320 bar)
315 – 315 bar (Adjustable between 130 bar and 320 bar)

18,19 Flow Compensator Setting
00 – None
11 – 11 bar setting
20 – 20 bar setting

20,21,22 Power control Torque Limiter Setting
000 – None

23 Auxiliary Mounting Pad
0 - NONE (NON-THROUGH DRIVE)
1- AUXILIARY A-MOUNT WITH COVER PLATE AND NO COUPLER
A - SAE A 2-BOLT 9T SPLINE
B - SAE A 2-BOLT 11T SPLINE
C - SAE B 2-/4-BOLT 13T SPLINE
D - SAE B-B 2-/4-BOLT 15T SPLINE

24 Paint
0 – No paint
A – Standard black paint

25 Design Code
B – B

26 Differentiator
 - -

27,28 Pump Special Features
00 – Adjustable Max Displacement Stop

29 Compensator Special Features
0 – None

30 Customer Identification
0 – None
 (Contact Danfoss for options)

Specifications and Performance

High speed version (M)

Displacement, Pressure and Flow Ratings At 93°C (200°F), SAE 10W oil, 1 bar absolute (0 psig) inlet

Model Series	Geometric Displacement cm ³ /r (in ³ /r)	Maximum Pressure bar (psi)		Maximum Flow at 315 bar (4500 psi)	
		Nominal	Peak**	Flange Ports l/min (USgpm) @ 1 bar inlet	Tube Ports l/min (USgpm) @ 1 bar inlet
PVM045	45,1 (2.75)	315 (4568)	350 (5000)	115 (30) @ 2600 r/min	106 (28) @ 2400 r/min
PVM050	50,0 (3.05)	230 (3300)	280 (4000)	125 (33) @ 2600 r/min	116 (31) @ 2400 r/min

**Less than 0.5 second.

Speed, Input Power and Torque Ratings At 93°C (200°F), SAE 10W oil, 1 bar absolute (0 psig) inlet

Approximate Model Series	Operating Speed and Pressure r/min			Max. Input Power at Max. Speed and 280 bar (4000 psi) kW (hp)	Max. Torque at 280 bar (4000 psi) Nm (lb-ft)	Weight (dry) kg (lbs)
	1 bar Inlet Flange Ports	0,85 bar Inlet Tube Ports	0,85 bar Inlet Flange Ports			
PVM045	2600 r/min	2400 r/min	2200 r/min	56 (75)	198 (46)	24 (52)
				48 (64)		
	2600 r/min			51 (68)		
PVM050	2600 r/min	2400 r/min	2200 r/min	48 (64)	204 (150)	24 (52)
				44 (59)		
	2600 r/min			44 (59)		

Standard Response Times*

Model Series	On Stroke (msec)	Off Stroke (msec)
PVM045	140	40
PVM050	140	23

*Values with pressure compensator control.

Quiet version, optimized for 1000-1800 rpm (E)

Displacement, Pressure and Flow Ratings At 50°C (120°F), SAE 10W oil, 1 bar absolute (0 psig) inlet

Model Series	Maximum Geometric Displacement cm ³ /r (in ³ /r)	Maximum Pressure bar (psi)		Maximum Flow at 315 bar (4500 psi)* l/min (USgpm) – Average measured flow rate			
		Nominal	Peak**	@1800 r/min	@1500 r/min	@1200 r/min	@1000 r/min
PVM045	45,1 (2.75)	315 (4568)	350 (5000)	76 (20)	65 (17)	49 (13)	42 (11)
PVM050	50,0 (3.05)	230 (3300)	280 (4000)	87 (23)	75 (20)	62 (16)	49 (13)

**Momentary system pressure spikes only.

Speed, Input Power and Torque Ratings At 50°C (120°F), SAE 10W oil, 1 bar absolute (0 psig) inlet

Model Series	Maximum Operating Speed r/min	Maximum Input Power at 315 bar (4500 psi) kw (hp)*@88% M.E.				Maximum Torque at 315 bar (4500 psi)* Nm (lb-ft)	Approximate Weight kg (lb)
		@1800 r/min	@1500 r/min	@1200 r/min	@ 1000 r/min		
PVM045	1800	41 (55)	34 (46)	27 (37)	23 (31)	221 (163)	24 (52)
PVM050	1800	35 (47)	30 (40)	28 (38)	23 (31)	190 (140)	24 (52)

Standard Response Times*

Model Series	On Stroke (msec)	Off Stroke (msec)
PVM045	140	40
PVM050	140	40

* 3300 psi on overbore pumps

Specifications and Performance

Variable Speed Drive

Variable Speed Performance- System Pressure vs Speed

Model Series	Max Speed "E"*(rpm)	Max Speed "M"*(rpm)	Min Speed (rpm)	Nominal Pressure (bar)	Peak Pressure (bar) **	Inertia (kg-cm2)
PVM045	1800	2600	0	315	350	36.2
PVM050	1800	2600	0	230	280	33.9

* Valve plate type

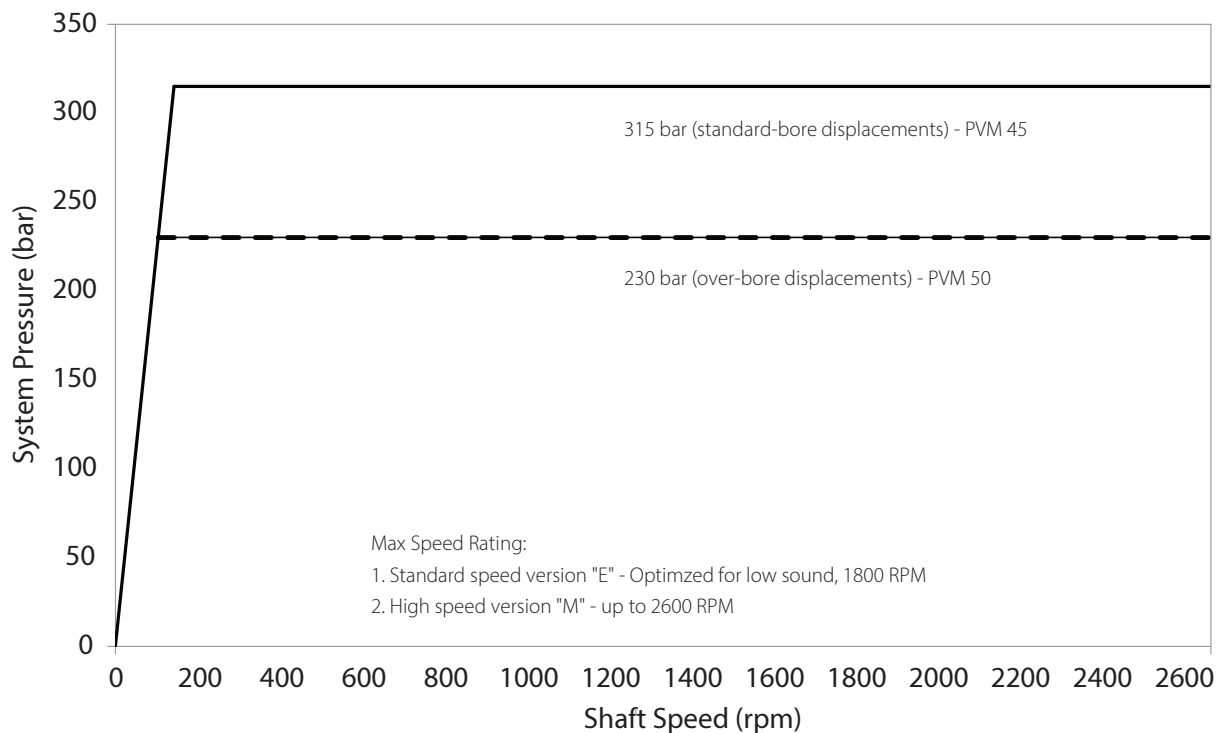
**Less than 0.5 second.

Note - For Variable Speed Drive applications, Modelcode Position 14 should be set at 0 and position 15, 16, 17 should be set to 000 to configure pump to "Fixed Displacement" type.

Moment of Inertia (single pump rotating group)

Model	Moment of Inertia	
	N-m (sec ²)	lbf-in (sec ²)
PVM045	0.0036	0.0320
PVM050	0.0034	0.0300

PVM System Pressure vs. Shaft Speed



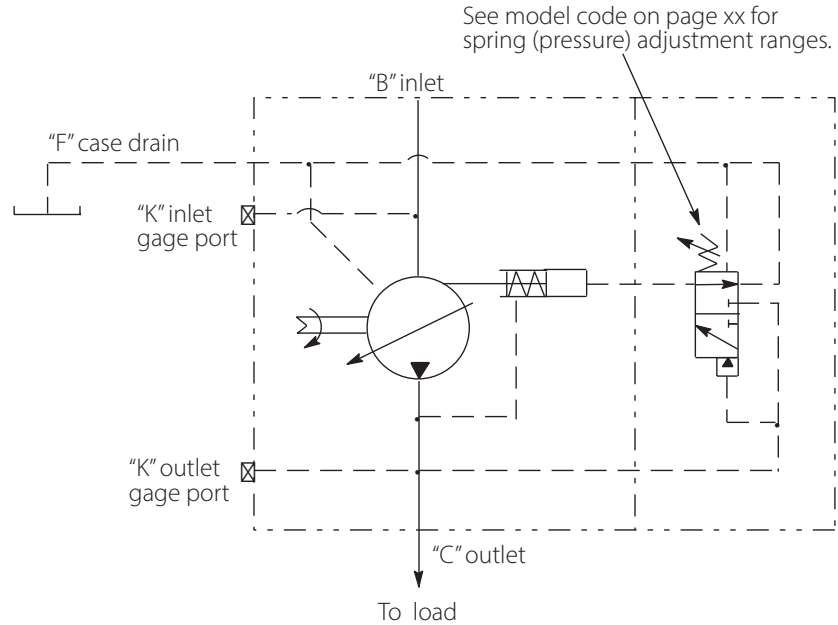
Test condition: Mineral oil SAE 10W, oil temperature 49° C (120° F), 1 bar absolute inlet pressure.

Control Options

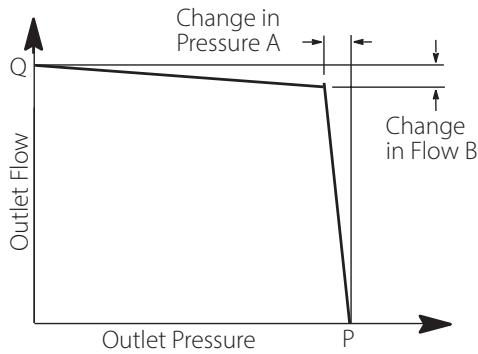
Pressure Compensator Control – Code A

The pump will provide a continuously modulated flow to meet changing load demands at a pre-adjusted compensator pressure. At pressures below the compensator setting, the pump will operate at maximum displacement.

Warning: The pressure compensator may be adjusted beyond the rated pressure of the pump. When adjusting the pressure limiter, install a 0-350 bar (0-5000 psi) gage in the outlet gage port and limit the pressure setting to the continuous rated pressure for the pump displacement.



Industrial Pressure Cut-off Characteristics of Code A Pressure Compensator Control at 50°C (120°F), static conditions.

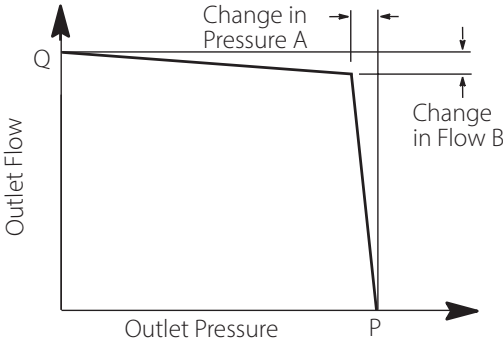


Pressure Cut-off Characteristics of Pressure Compensator Control @ 50°C (120°F), Static Conditions

Model Series	Max. Speed r/min	"Q" Outlet Flow l/min (USgpm)	"P" Outlet		
			Pressure bar (psi)	A bar (psi)	B L/min (USgpm)
PVM045	1800	76 (20)	315 (4568)	10 (150)	4,5 (1.2)
PVM050	1800	87 (23)	230 (3300)	10 (150)	4,5 (1.2)

Control Options

**Mobil Pressure Cut-off
Characteristics of Pressure
Compensator Control** at
93°C (200°F), static conditions.



Pressure Cut-off Characteristics of Pressure Compensator Control @ 93°C (200°F), Static Conditions

Model Series	Rated Speed r/min	"Q" Outlet Flow l/min (USgpm)	"P" Outlet Pressure		
			bar (psi)	A bar (psi)	B L/min (USgpm)
PVM045	2600	115 (30)	315 (4568)	10 (150)	4,5 (1.2)
PVM050	2600	125 (33)	230 (3300)	10 (150)	4,5 (1.2)

Control Options

Load Sensing and Pressure Compensator Control – Code B or C

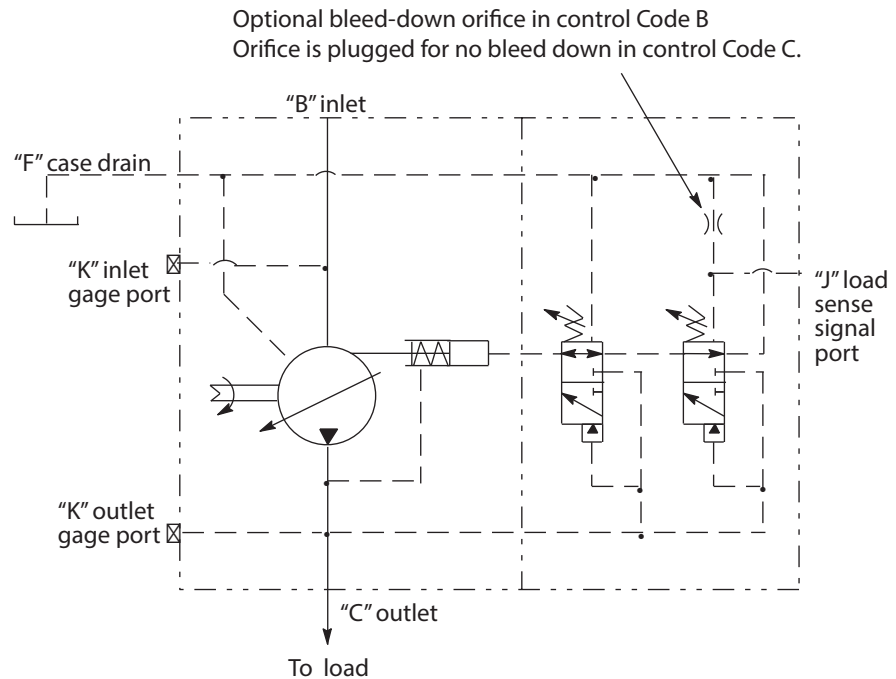
The pump will provide power matching of pump output to system load demand, maximizing efficiency and improving load metering characteristics of any directional control valve installed between the pump and the load.

Load sensing ensures that the pump always provides only the amount of flow needed by the load. At the same time, the pump operating pressure adjusts to the actual load pressure plus a pressure differential required for the control action. When the system is not demanding power, the load sense control will operate in an energy-saving stand-by mode.

Typically, the differential pressure is that between the pressure inlet and service port of a proportionally controlled directional valve, or a load sensing directional control valve.

If the load pressure exceeds the system pressure setting, the pressure compensator de-strokes the pump. The load sensing line must be as short as possible and can also be used for remote control or unloading of the pump pressure. For remote control purposes, it is recommended that you contact your Danfoss representative for the correct configuration of the control.

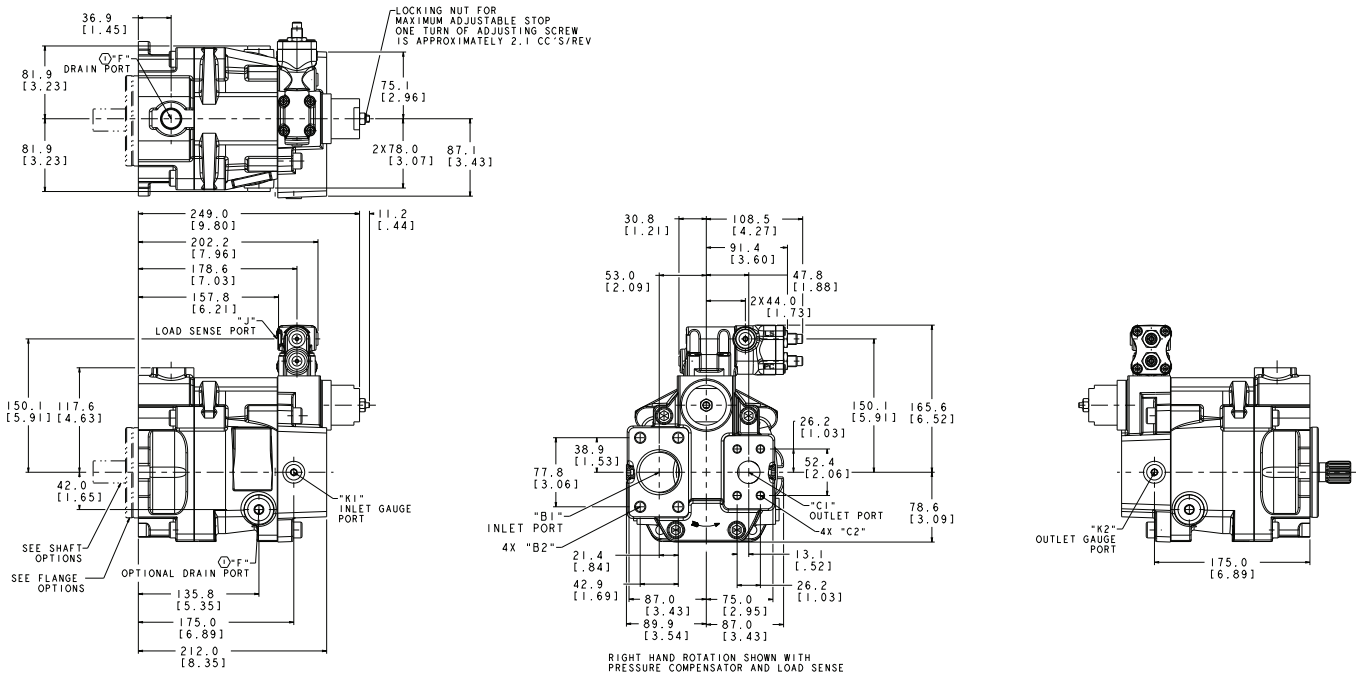
⚠ Warning: The pressure compensator may be adjusted beyond the rated pressure of the pump. When adjusting the pressure limiter, install a 0-350 bar (0-5000 psi) gage in the outlet gage port and limit the pressure setting to the continuous rated pressure for the pump displacement.



End-ported Models

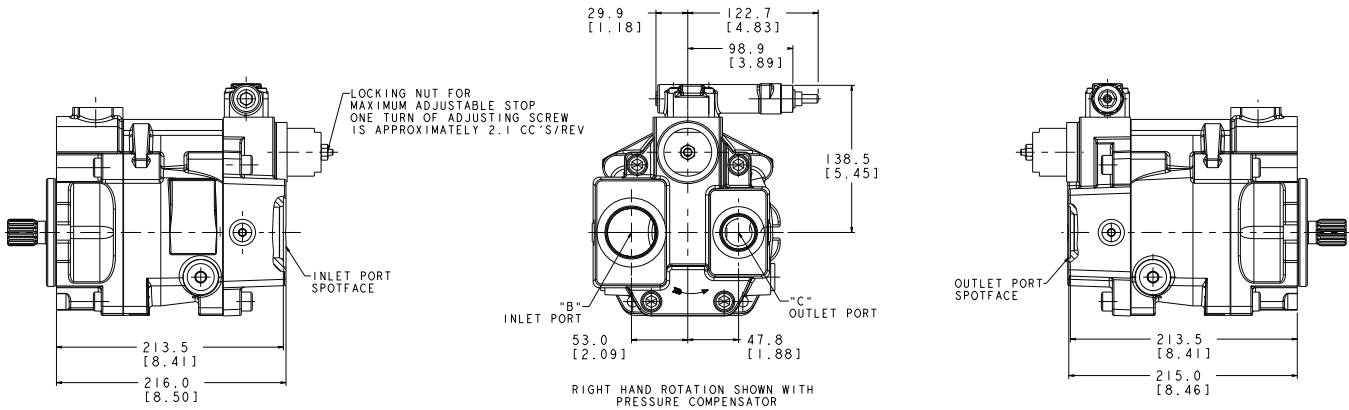
PVM045/050 Design Code B

Flange Ports



FLANGE PORTS	SAE PORT	B ¹	B ²	C ¹	C ²	F	J	K ¹	K ²
		Ø2.0 INLET PORT "B"	500-13 UNC-2B THREAD Ψ 1.06 MINIMUM	Ø1.0 OUTLET PORT "C"	375-16 UNC-2B THREAD Ψ .87 MINIMUM	SAE J514 O-RING BOSS PORT "F" FOR .625 O.D. TUBE .875-14 UNF-2B THREAD	SAE J514 O-RING BOSS PORT "J" FOR .250 O.D. TUBE .4375-20 UNF-2B THREAD	SAE J514 O-RING BOSS PORT "K1" FOR .375 O.D. TUBE .5625-18 UNF-2B THREAD	SAE J514 O-RING BOSS PORT "K2" FOR .375 O.D. TUBE .5625-18 UNF-2B THREAD

Tube Ports

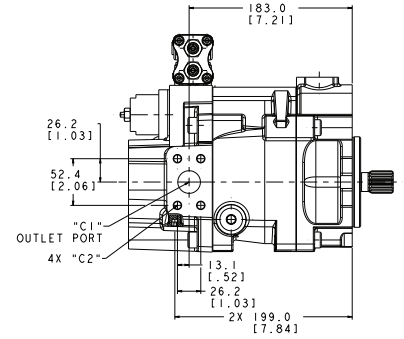
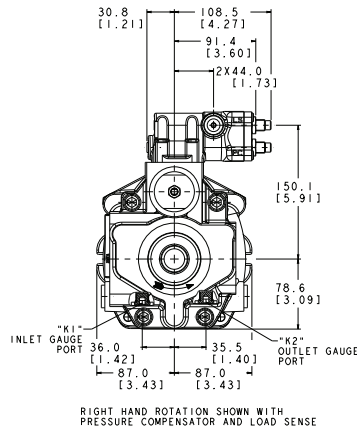
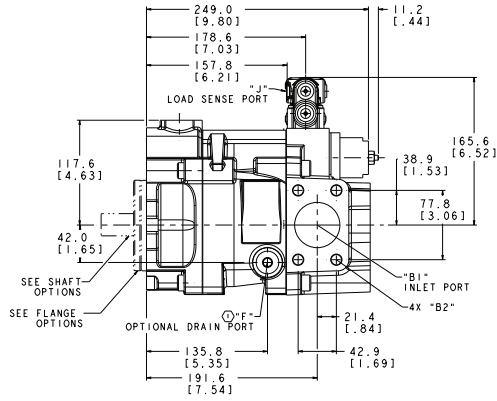
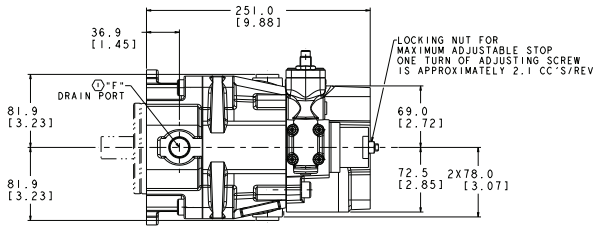


TUBE PORT	SAE PORT	B	C
		SAE J514 O-RING "B" FOR 1.50 O.D. TUBING 1.875-12 UN-2B THREAD	SAE J514 O-RING "C" FOR 1.0 O.D. TUBING 1.3125-12 UN-2B THREAD

Side-ported Models

PVM045/050 Design Code B

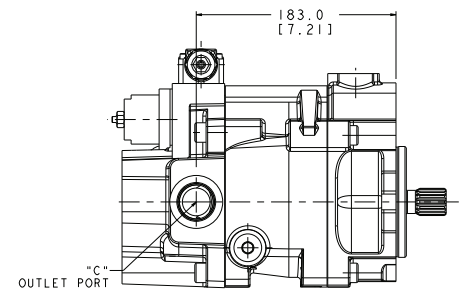
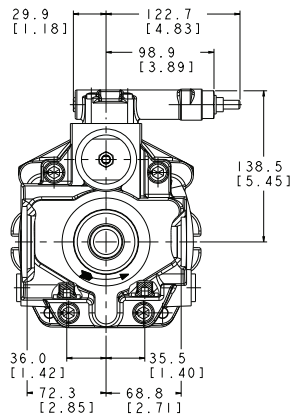
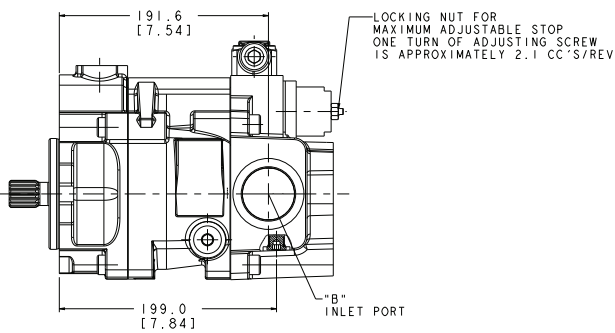
Flange Ports



RIGHT HAND ROTATION SHOWN WITH PRESSURE COMPENSATOR AND LOAD SENSE

FLANGE PORTS	SAE PORT	B1	B2	C1	C2	F	J	K1	K2
		Ø2.0 INLET PORT "B"	500-13 UNC-2B THREAD Ψ1.06 MINIMUM	Ø1.0 OUTLET PORT "C"	.375-16 UNC-2B THREAD Ψ.87 MINIMUM	SAE J514 O-RING BOSS PORT "F" FOR .625 O.D. TUBE .875-14 UNF-2B THREAD	SAE J514 O-RING BOSS PORT "J" FOR .250 O.D. TUBE .4375-20 UNF-2B THREAD	SAE J514 O-RING BOSS PORT FOR .375 O.D. TUBE .5625-18 UNF-2B THREAD	SAE J514 O-RING BOSS PORT FOR .375 O.D. TUBE .5625-18 UNF-2B THREAD

Tube Ports



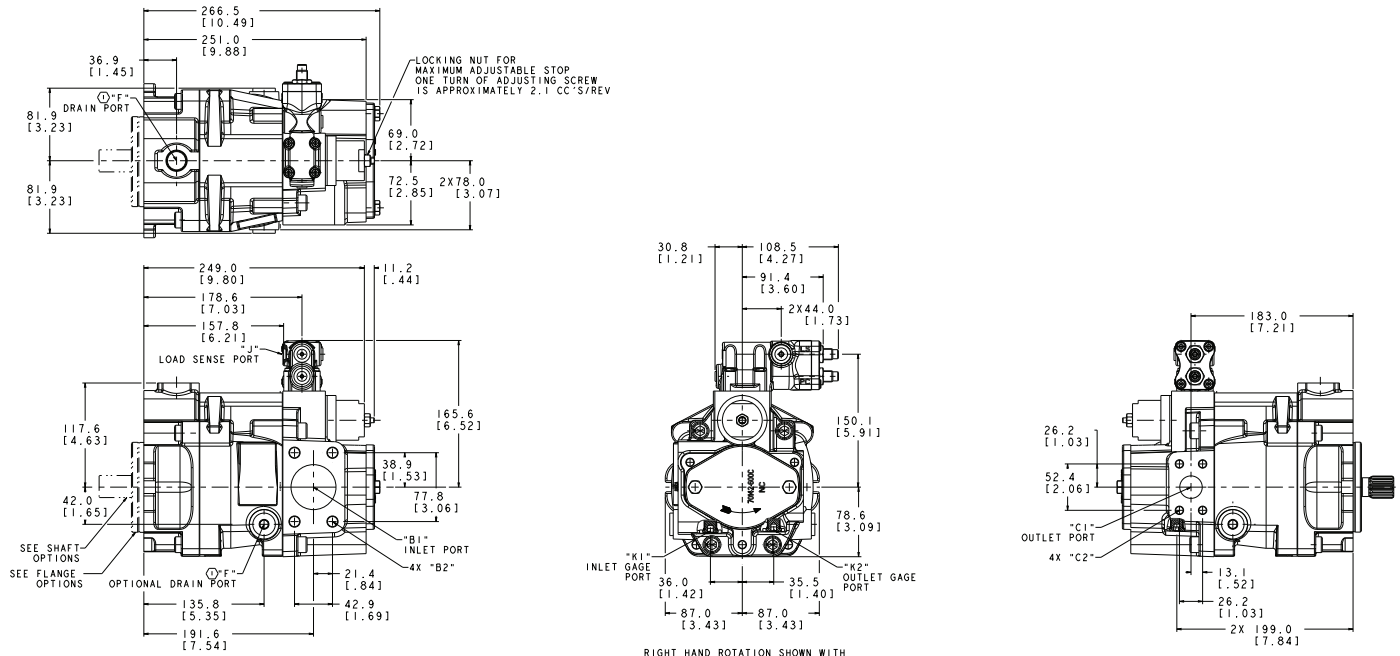
RIGHT HAND ROTATION SHOWN WITH PRESSURE COMPENSATOR

TUBE PORTS	SAE PORT	B	C
		SAE J514 O-RING FOR 1.50 O-RING TUBING 1.875-12 UNF-2B THREAD	SAE J514 O-RING FOR 1.0 O.D. TUBING 1.3125-12 UNF-2B THREAD

Thru-drive Models

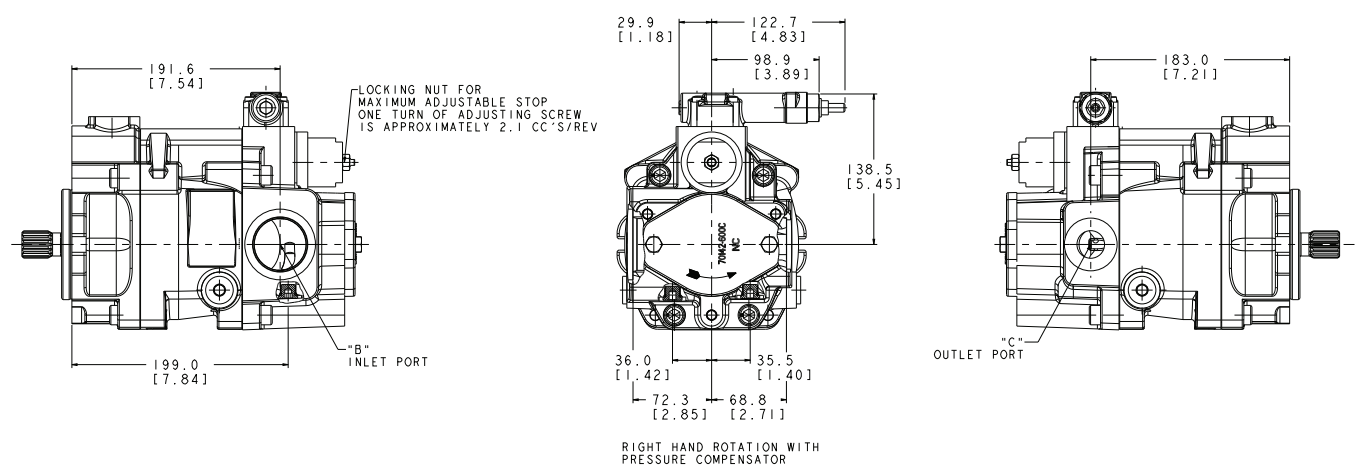
PVM045/050 Design Code B

Flange Ports



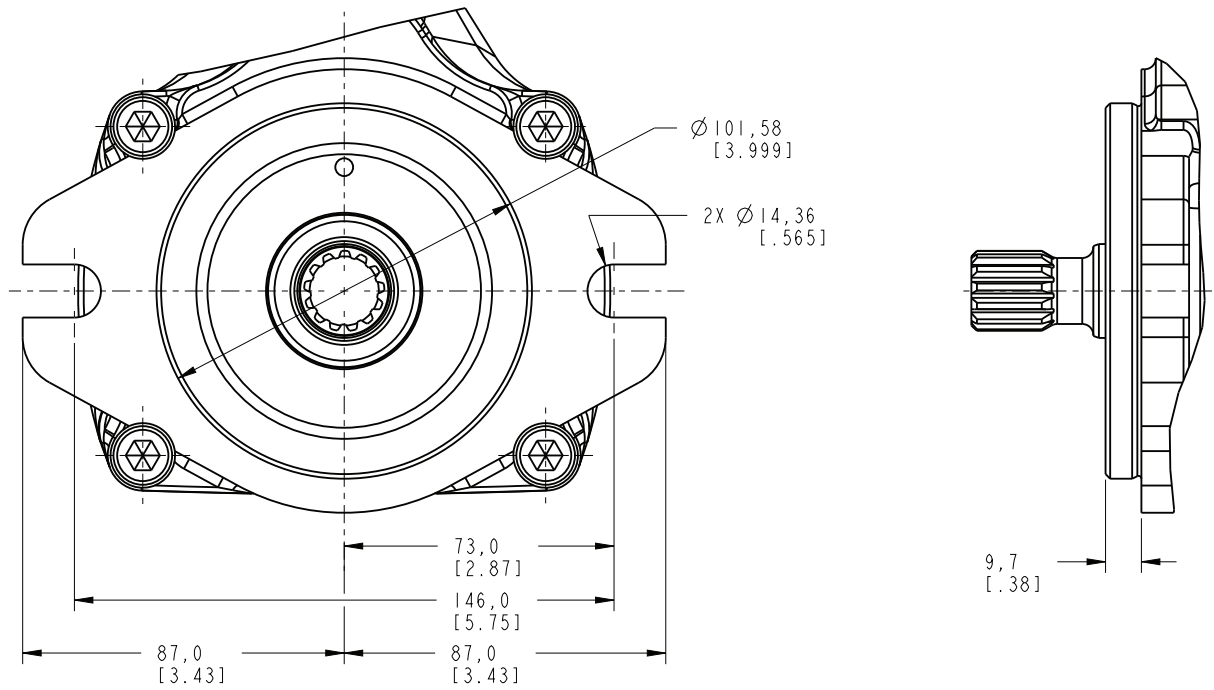
PORT	"B"	"B2"	"C"	"C2"	"F"	"J"	"K1"	"K2"
FLANGE PORT	Ø 2.0 INLET PORT "B"	500-13 UNC-2B THREAD ▽ 1.06 MINIMUM	Ø 1.0 OUTLET PORT "C"	.375-16 UNC-2B THREAD ▽ .87 MINIMUM	SAE J514 O-RING BOSS PORT "F" FOR .625 O.D. TUBE .875-14 UNF-2B THREAD	SAE J514 O-RING BOSS PORT "J" FOR .250 O.D. TUBE .4375-20 UNF-2B THREAD	SAE J514 O-RING BOSS PORT FOR .375 O.D. TUBE .5625-18 UNF-2B THREAD	SAE J514 O-RING BOSS PORT FOR .375 O.D. TUBE .5625-18 UNF-2B THREAD
SAE PORT	SAE J518C 4 BOLT FLANGE PORT STANDARD PRESSURE SERIES		SAE J518C 4 BOLT FLANGE PORT STANDARD PRESSURE SERIES					

Tube Ports



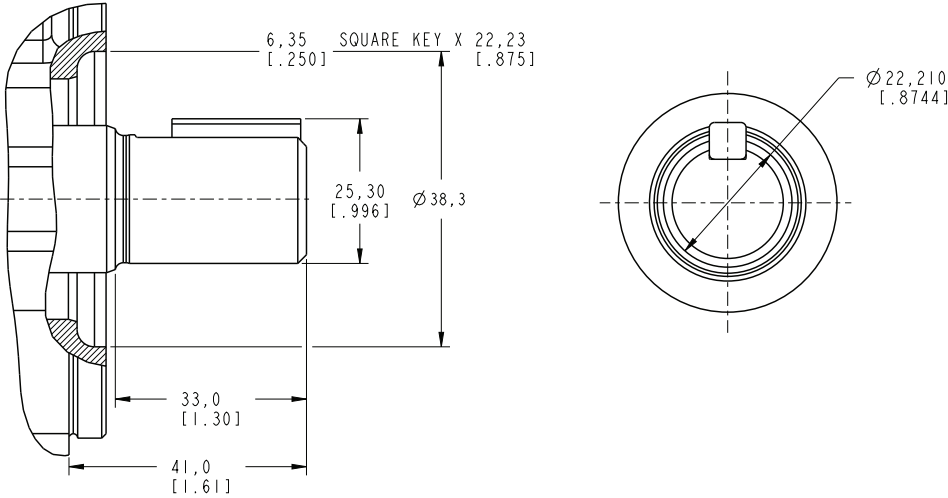
PORT	"B"	"C"
TUBE PORT	SAE J514 O-RING FOR 1.50 O-RING TUBING 1.875-12 UNF-2B THREAD	SAE J514 O-RING FOR 1.0 O.D. TUBING 1.3125-12 UNF-2B THREAD
SAE PORT		

Mounting Flange Options

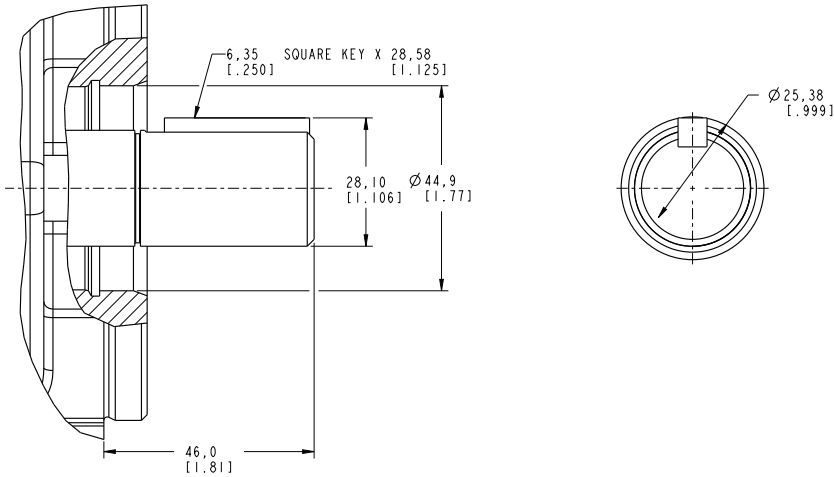


Shaft Options

05 - SAE J744-22-1 SAE B STRAIGHT KEYED

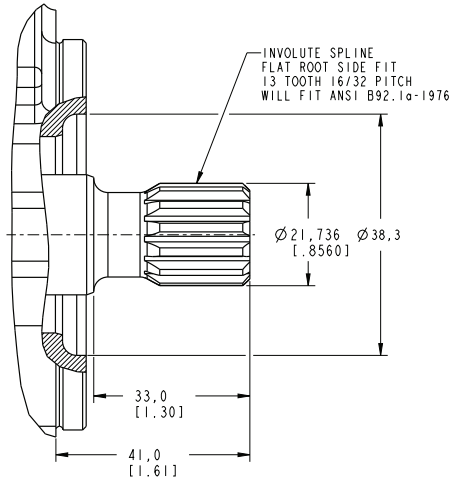


06 - SAE J744-25-1 SAE B-B STRAIGHT KEYED

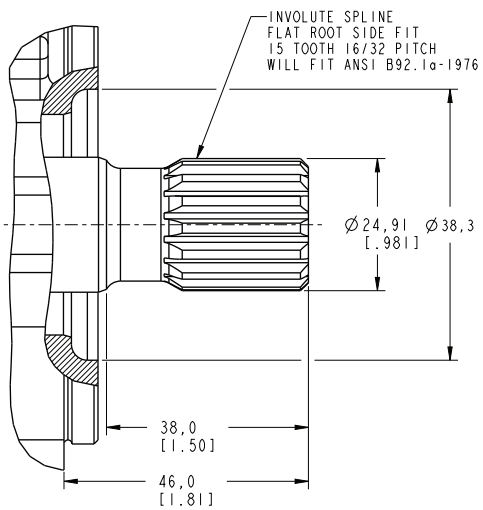


Shaft Options

07 - SAE J744-22-4 SAE B 13T SPLINE



08 - SAE J744-25-4 SAE B-B 15T SPLINE



Input Shaft Selection Data

SAE Splined Shafts

Model Series	Shaft Designation	Shaft Code	Max. Input Torque† Nm (lb. in.)	Max. Thru-drive Output Torque‡ Nm (lb. in.)
PVM045/050	SAE J744-22-4 (SAE "B," 13T)	07	208 (1850)	208 (1850)*
	SAE J744-25-4 (SAE "B-B," 15T)	08	337 (2987)	337 (2987)

SAE Keyed Shafts

Model Series	Shaft Designation	Shaft Code	Max. Input Torque† Nm (lb. in.)	Max. Thru-drive Output Torque‡ Nm (lb. in.)
PVM045/050	SAE J744-22-1 (SAE "B")	05	135 (1200)	135 (1200)*
	SAE J744-25-1 (SAE "B-B")	06	215 (1900)	215 (1900)*

†Maximum total torque of the thru-drive pump and the thru-driven pump(s).

‡Maximum torque that can be applied to the thru-driven pump(s).

*This value is limited by the maximum input torque.

Operating Requirements

Inlet Pressure, Case Pressure, and Operating Temperature Requirements

Inlet Pressure			Case Pressure			Operating Temperature	
Rated Absolute bar (psi)	Minimum bar, absolute (in. Hg)	Maximum Gauge bar (psi)	Maximum Continuous bar (psi)	Maximum Intermittent bar (psi)	Peak bar (psi)	Rated °C (°F)	Maximum Intermittent °C (°F)
1,0 (14.5)	0,85 (5)	3,5 (50)	0,5 (7)	2 (30)	3,5 (50)	82 (180)	104 (220)

Hydraulic Fluids

Fluid	Recommended Operating Viscosity Range cSt (SUS)	Maximum Viscosity at Startup cSt (SUS)	Minimum Viscosity @ Max. Intermittent Temperature of 104°C (220°F) cSt (SUS)
Use antiwear hydraulic oil, or automotive type crankcase oil (designations SC, SD, SE, or SF) per SAE J183 FEB80	16 to 40 (83 to 187)	1000 (4550)	10 (90)

For operation on other alternative or environmentally friendly fluids, please contact your Danfoss Representative.

Fluid Cleanliness

The M Series pumps are rated in anti-wear petroleum fluids with a contamination level of 20/18/13 (Danfoss) or ISO 18/13. Operation in fluids with levels more contaminated than this is not recommended. Fluids other than petroleum, severe service cycles, or temperature extremes are cause for adjustment of these codes. Please contact your Danfoss Representative for specific duty cycle recommendation.

Vickers by Danfoss M Series pumps, as with any variable displacement piston pumps, will operate with apparent satisfaction in fluids up to the rating specified here. Experience has shown, however, that pump and hydraulic system life is not optimized with high fluid contamination levels (high ISO cleanliness codes).

Proper fluid condition is essential for long and satisfactory

life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials, and additives for protection against wear of components, elevated viscosity and inclusion of air.

Specifications and Performance

Quiet version, optimized for 1000-1800 rpm (E) and Higher speed version (M)

Alternate fluids guide

Specifications and Performance

Fluid Type / Model Series	Petroleum Base	Motor Oil	Universal	Automatic	MI Spec Fluids	Environmentally Acceptable Fluids		Fire Resistant Fluids				Specialty Fluids	Food Grade Fluid	
	ZDDP		Tractor	Transmission Fluid		Vegetable Base	Synthetic Base	Synthetic Base		Water-Containing	Cutting Fluids	H1 - approved		
	AW (HM)		UTTO	ATF		HETG	HEES	Phosphate ester HFDR	Polyether polyol - HFDU	Water Glycol - HFC			Invert Emulsion - HFB	
1 Model series Quiet version *E* @ 1800 RPM Unless Noted														
PVM 45	NR	3625 PSI **	3625 PSI **	3625 PSI **	NR	3625 PSI **	3625 PSI 1800 RPM	3300 PSI **	3300 PSI **	NR	2500 PSI **	2250 PSI **	NR	3625 PSI **
PVM 50	NR	3250 PSI **	3250 PSI **	3250 PSI **	NR	3250 PSI **	3250 PSI 1800 RPM	3000 PSI **	3000 PSI **	NR	2250 PSI **	2000 PSI **	NR	3250 PSI **
2 Model Series Higher Speed Version (M)														
PVM 45	NR	3625 PSI ** 2600 RPM	3625 PSI ** 2600 RPM	3625 PSI ** 2600 RPM	NR	3625 PSI ** 2600 RPM	3625 PSI 1800 RPM	3300 PSI ** 1800 RPM	3300 PSI ** 1800 RPM	NR	2500 PSI ** 1800 RPM	2250 PSI ** 1800 RPM	NR	NR
PVM 50	NR	3250 PSI ** 2600 RPM	3250 PSI ** 2600 RPM	3250 PSI ** 2600 RPM	NR	3250 PSI ** 2600 RPM	3250 PSI 1800 RPM	3000 PSI ** 1800 RPM	3000 PSI ** 1800 RPM	NR	2250 PSI ** 1800 RPM	2000 PSI ** 1800 RPM	NR	NR

Installation and Start-up

⚠ Warning: Care should be taken that mechanical and hydraulic resonances are avoided in the application of the pump. Such resonances can seriously compromise the life and/or safe operation of the pump.

Drive Data

Mounting attitude can be either horizontal or vertical, using the appropriate case drain ports to ensure that the case remains full of fluid at all times. Consult your local Danfoss Representative if a different arrangement is required.

In those cases where geometric tolerances of mounting are critical, or where specific tolerance ranges are required and not specified, consult Danfoss Engineering for specific limits.

Direction of shaft rotation, viewed from the prime mover end, must be as indicated in the model designation on the pump – either right hand (clockwise) or left hand (counterclockwise).

Direct coaxial drive through a flexible coupling is recommended. If drives imposing radial shaft loads are considered, please consult your Danfoss Representative.

Start-up Procedure

Make sure the reservoir and circuit are clean and free of dirt/debris prior to filling with hydraulic fluid.

Fill the reservoir with filtered oil and fill to a level sufficient enough to prevent vortexing at the suction connection to pump inlet. It is good practice to clean the system by flushing and filtering, using an external slave pump.

Caution: Before the pump is started, fill the case through the uppermost drain port with hydraulic fluid of the type to be used. The case drain line must be connected directly to the reservoir and must terminate below the oil level.

Once the pump is started, it should prime within a few seconds. If the pump does not prime, check to make sure that there are no restrictions between the reservoir and the inlet to the pump, that the pump is being rotated in the proper direction, and that there are no air leaks in the inlet line and connections. Also check to make sure that trapped air can escape at the pump outlet.

After the pump is primed, tighten the loose outlet connections, then operate for five to ten minutes (unloaded) to remove all trapped air from the circuit.

If the reservoir has a sight gage, make sure the fluid is clear – not milky.

ENGINEERING
TOMORROW

Danfoss

VICKERS
by Danfoss

Danfoss Power Solutions, Nordborgvej 81, 6430 Nordborg, Denmark, Tel. +45 74 88 22 22, Fax +45 74 65 25 80

www.danfoss.com, E-mail: info@danfoss.com

Support E-mail: industrialpumpsmotorsupport@danfoss.com

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