

## Q Series Piston Pumps

Variable Displacement, Quiet Series for Industrial Applications

Technical Catalog

PVQ10

PVQ13

PVQ20

PVQ25

PVQ32

PVQ40

PVQ45



**VICKERS**<sup>®</sup>

# Introduction

PVQ piston pumps are in-line, variable displacement units and are available in nine sizes. Displacement is varied by means of pressure and/or flow compensator controls. An impressive assortment of control options offers maximum operating flexibility.

PVQs operate at quietness levels that meet today's demanding industrial conditions. The sound level of each unit approaches or is below that of the electric motor driving it. Sound is reduced by a patented timing arrangement that also produces low pressure "pulses" in the outlet flow. This leads to reduced tendencies for noise in systems using PVQs.

The PVQ series is capable of operating with many types of hydraulic fluid. Water-content and phosphate ester fluids can be accommodated, in addition to the typical petroleum based and synthetic fluids.

Many PVQ pumps are available in a thru-drive configuration to accommodate a multitude of application and installation requirements. Thru-drive models can be coupled to various types and sizes of fixed and variable displacement pumps, resulting in a compact and versatile package. Such a package offers lower installed cost by reducing the installation size and by requiring only one mounting pad on the prime mover.

Quiet PVQs have excellent operating characteristics, and the pumps' many control and mounting options allow choosing the optimum model for any application. Additionally, PVQs possess the same durability and long life characteristics expected of the best industrial products in today's marketplace. For over 75 years, the Eaton name has been synonymous with long trouble-free service.

## Operating Data

### Q Series Displacement, Speed, and Pressure Ratings

DISPLACEMENT, SPEED, AND PRESSURE RATINGS

Model Number System	Maximum Geometric Displacement cm <sup>3</sup> /r (in <sup>3</sup> /r)	Rated Speed r/min	Maximum Pressure bar (psi)
PVQ10	10,5 (0.643)	1800	210 (3000)
PVQ13	13,8 (0.843)	1800	140 (2000)
PVQ20	21,1 (1.290)	1800	210 (3000)
PVQ25	25,2 (1.540)	1800	210 (3000)
PVQ32	32,9 (2.010)	1800	140 (2000)
PVQ40	41,0 (2.500)	1800	210 (3000)
PVQ45	45,1 (2.750)	1800	186 (2700)

#### Application Data

- Fluid Cleanliness
- Hydraulic Fluids and Temperature Ranges
- Fire Resistant Fluids
- Installation and Start-up
- Ordering Procedure

# Model Number System PVQ20 and PVQ32

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
P	V	Q	2	0	A	2	R	A	9	S	E	1	S	2	1	C	*	2	1	V	*	1	1	B	D	1	2	S	*

Nos	Feature	Code	Description	Nos	Feature	Code	Description
1,2,3	Series PVQ	P V Q	Inline piston pump Variable volume Quiet series			CM**	Low pressure compensator. Standard model is CM7, indicating factory setting of 70 bar (1000 psi); range is 02-10 in tens of bar (350-2000 psi).
4,5	Displacement in cc/rev and pressure ratings	20 32	21,1 cc/rev (1.29 cir), 210 bar (3000 psi) 32,9 cc/rev (2.01 cir), 140 bar (2000 psi)			C**V**B	Pressure compensator C**, as above with load-sensing. Standard load-sensing setting is 11 bar (160 psi); range 10-17 bar (150-250 psi); with bleed-down orifice. Example: C21V11B indicates PVQ20 compensator with 210 bar pressure setting and 11 bar load-sense differential.
6,7	Mounting flange specifications	B2 MB	Flange SAE J744 101-2 (SAE B) Flange ISO 3019/2-100A2HW (available with N" drive shaft only)			C**V**P	Pressure compensator with load-sensing as C**V**B above, but with bleed-down orifice plugged.
8	Rotation viewed from shaft end	R L	Right hand (cw), standard Left hand (ccw), optional			C**VC**B	Pressure compensator with load-sensing. Compensator same as C** above. Standard load-sensing setting is 24 bar (350 psi), range 17-31 bar (250-450 psi). With bleed-down orifice.
9,10	Thru-drive without coupling (available	Blank A9 A11	No thru-drive SAE J744 82-2 (SAE A) w/9T spline with side ports only SAE J744 82-2 (SAE A) w/11T spline			C**VC**P	Pressure compensator with load-sensing. Same as C**VC**B above, but with bleed-down orifice plugged.
11,12	Ports, type and location	SE SS	SAE O-ring rear port, 1.625" inlet and outlet (standard) SAE O-ring side port, 1.625" inlet and outlet (optional)			CG	Pressure compensator modified for hydraulic remote control.
13	Shafts, input	1 3 N 28	Straight keyed SAE "B" modified, 2.31" long Splined SAE "B" modified, 13T 16/32 DP major dia. fit Shaft end ISO 3019/2 E25N (available with "MB" mount only) 26-tooth splined shaft (Eaton). Used in PVQ20/32 single to mount on PVQ40/45 "B26" thru-drive.			CD**	Electric dual range compensator. PVQ20: CD21 is standard 210 bar setting of high range (24-210 bar). PVQ32: CD14 is standard 140 bar setting of high range (24-140 bar). Both units require low range to be set by customer (20-100 bar).
14	Seals	S F	Buna N, standard Fluorocarbon, optional			UV	Unloading Valve for accumulator circuits. See installation details.
15,16	Pump design number	21	Design number subject to change. Installation dimensions remain unchanged for designs 10-19.				
17,18	Control type	C**	Pressure compensator. PVQ20: Standard model is C21, indicating setting of 210 bar (3000 psi); range is 02-21 in tens of bar (350-3000 psi). PVQ32: Standard model is C14, indicating factory setting of 138 bar (2000 psi); range is 02-14 in tens of bar (350-2000 psi).				

# Model Number System PVQ20 and PVQ32

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
P	V	Q	2	0	A	2	R	A	9	S	E	1	S	2	1	C	*	2	1	V	*	1	1	B	D	1	2	S	*

Nos	Feature	Code	Description	Nos	Feature	Code	Description
19,20	Pressure setting	21 14	210 bar (3000 psi) PVQ20 140 bar (2000 psi) PVQ32	27,28	Control design	12 12 13 21	C** and CM** C**D and CM**D C**V(C)**B and C**V(C)**P UV, CD** CG 30
21,22	Flow control option	Blank V VC	No flow control	29,30	Special pump option suffixes	S2 S3	Shaft up mounting British Standard Parallel Threads Counterbore Ports (ISO R288 threads). Contact Eaton for available configurations.
23,24	Load sense differential pressure setting	Blank	No flow control				Special CG compensator for use with electronically modulated relief valves
25	Flow control optional features	Blank B P	No flow control			S9	
26	Control option	Blank  D	Without adjustable maximum displacement stop (standard) Adjustable maximum displacement stop (optional)				

## RATINGS

Model Number System	Maximum Geometric Displacement cm <sup>3</sup> /r (in <sup>3</sup> /r)	Rated Speed r/min	Maximum Pressure bar (psi)	Input Power at Max. Pressure and Rated Speed kW (hp)	Approx. Weight kg (lb)
PVQ20	21,1 (1.290)	1800	210 (3000)	14,9 (20)	14 (31)
PVQ32	32,9 (2.010)	1800	140 (2000)	15,6 (21)	14 (31)

### Pressure Limits:

Case pressure – 0,35 bar (5 psig) maximum  
Inlet pressure – 0,2 bar (5 in. Hg) vacuum to 2 bar (30 psig)

# Controls

## Pressure Compensator Controls

The pressure compensator control automatically adjusts pump delivery to maintain volume requirements of the system at a preselected operating pressure. Maximum pump delivery is maintained to approximately 75 psi (PVQ20) or 100 psi (PVQ32) below the pressure setting before being reduced. The pressure compensator control operates on one side of center and has an adjustment range as designated in the model numbering system.

## Pressure Compensator Control with Adjustable Maximum Displacement Stop

The adjustable maximum stop pressure control enables the maximum pump delivery to be externally adjusted from 25% to 100% while maintaining all of the standard features of a pressure compensated pump. To assist initial priming, manual adjustment control setting must be at least 40% of maximum flow position.

## Remote Control Pressure Compensator

Exactly the same as the "C" (pressure compensation option) except the machine operator is able to change the compensator setting through the use of a remote pilot relief valve, such as Eaton C-175.

## Electric Dual Range Pressure Compensator Control

The dual range pressure compensator control automatically adjusts pump delivery to maintain volume requirements of the system at either of two preselected operating pressures.

Maximum pump delivery is maintained to approximately 75 psi (PVQ20) or 100 psi (PVQ32) below either pressure control setting before being reduced.

Control type and pressure range are designated in the model number system.

**Note:** Graphic symbols shown with external valve(s) and cylinder to illustrate typical usage.

## Load-sensing and Pressure Limiter Compensator Control

This compensator provides load-sensing control under all pressure conditions up to the desired maximum. It automatically adjusts pump flow in response to a remote pressure signal and maintains outlet pressure at a level slightly above load pressure. The integral pressure limiter overrides the load-sensing control, reducing pump displacement as the preset maximum operating pressure is reached.

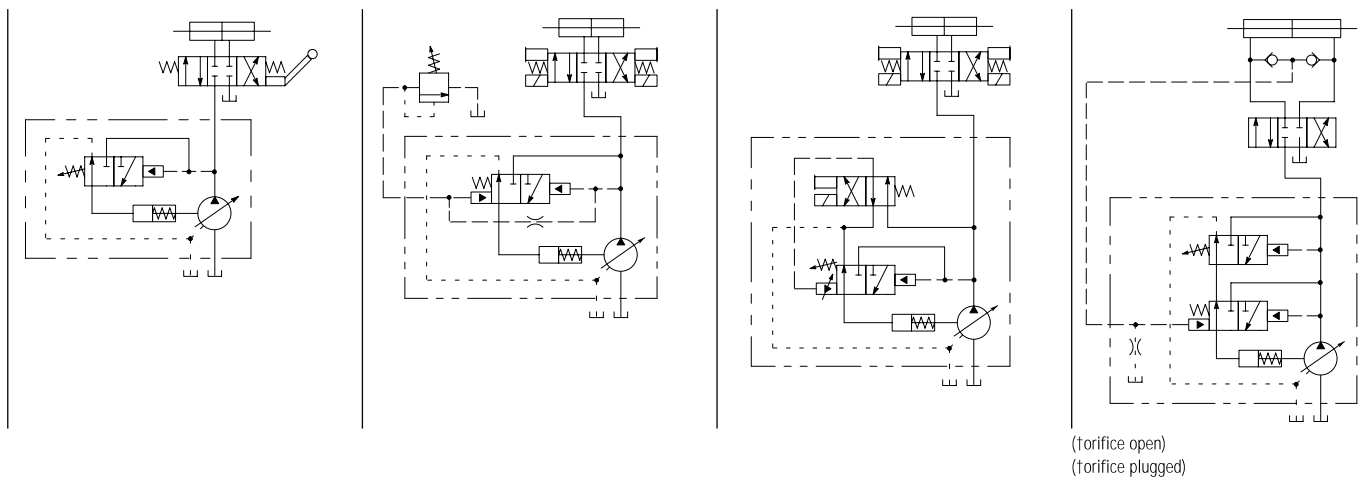
Standard load-sense differential pressure settings, by control type, follow. See model number system for setting range.

Standard load-sensing and pressure limiting control with 11 bar differential pressure (standard factory setting). Includes bleed-down orifice to exhaust load-sense signal for low-pressure standby condition.

Same as C\*\*V11B above, but with bleed-down orifice plugged.

Same as C\*\*V11B, but with factory differential pressure setting of 24 bar.

Same as C\*\*V11P, but with factory differential pressure setting of 24 bar.

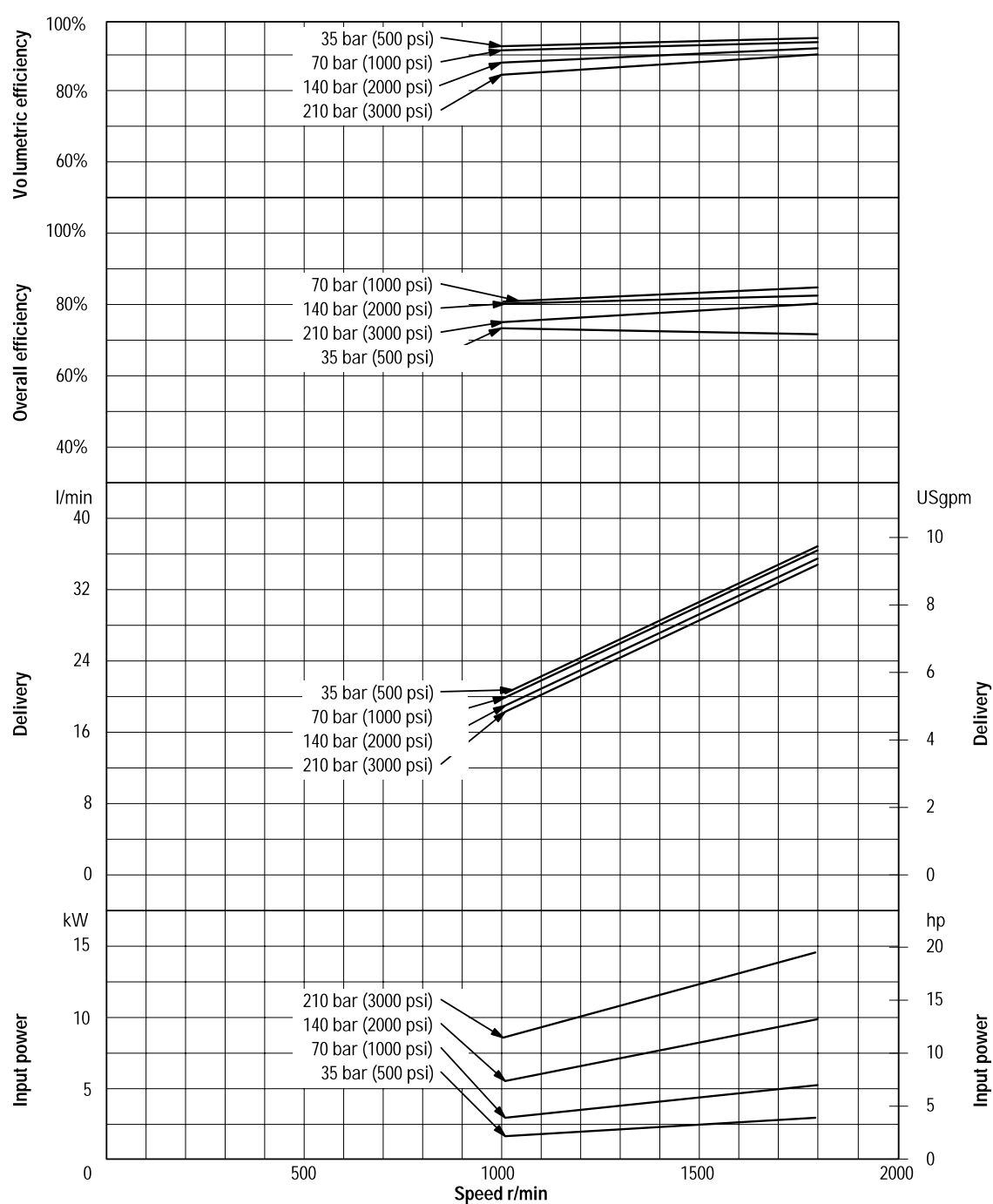


# Performance Curves

## PVQ20

Oil type: SAE 10W  
Oil temperature: 49°C (120°F)  
Inlet: 0.2 bar (5 in. Hg)

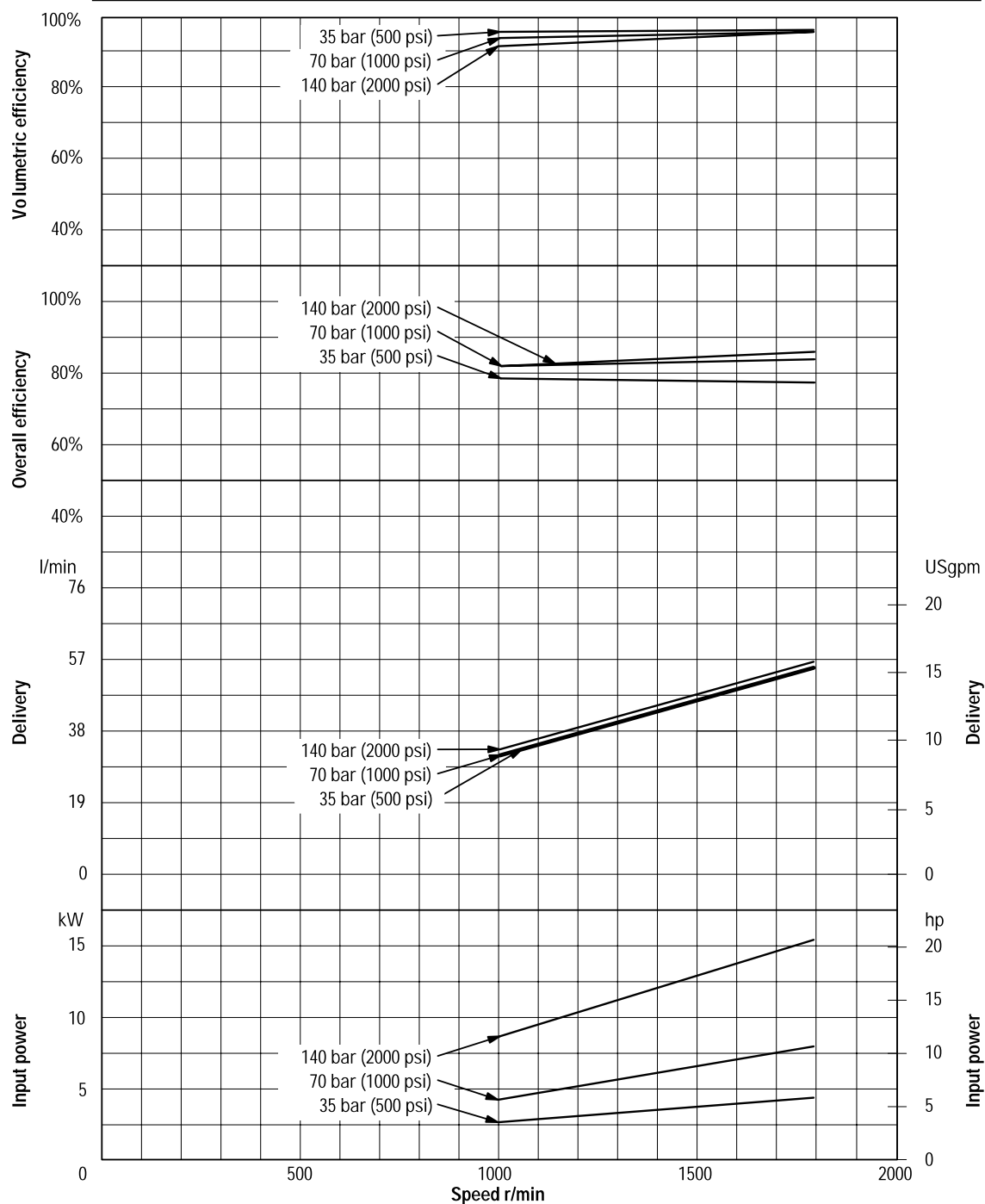
**Note:** To obtain full flow operation of pump, pressure compensator setting must be 14 bar (200 psi) above desired operating pressure. Full flow curves were obtained with compensator settings 14 bar (200 psi) above 210 bar (3000 psi) max. rated pressure.



# Performance Curves PVQ32

Oil type: SAE 10W  
Oil temperature: 49°C (120°F)  
Inlet: 0.2 bar (5 in. Hg)

**Note:** To obtain full flow operation of pump, pressure compensator setting must be 14 bar (200 psi) above desired operating pressure. Full flow curves were obtained with compensator settings 14 bar (200 psi) above 140 bar (2000 psi) max. rated pressure.



## Operating Data

### PVQ20 and PVQ32 Sound Data

Temperature: 50°C (120°F)  
Test Fluid: URSA-ED (10W)  
Inlet Pressure: Atmospheric  
(0 psig)

#### SOUND DATA

Speed r/min	Pressure bar (psi)	Sound Level dB(A)*			
		Full Stroke		Cutoff	
		PVQ20	PVQ32	PVQ20	PVQ32
1000	35 (500)	53	58	43	47
	70 (1000)	56	59	47	50
	140 (2000)	57	61	52	54
	210 (3000)	59	—	54	—
1200	35 (500)	55	61	43	47
	70 (1000)	58	62	48	51
	140 (2000)	59	63	52	54
	210 (3000)	61	—	55	—
1500	35 (500)	57	63	47	50
	70 (1000)	59	65	51	54
	140 (2000)	61	65	56	55
	210 (3000)	62	—	59	—
1800	35 (500)	60	66	50	53
	70 (1000)	62	67	53	56
	140 (2000)	63	68	58	62
	210 (3000)	64	—	58	—

\*Sound pressure data equivalent to NFPA Standard.

### PVQ20 and PVQ32 Response Data

Yoke response recorded at  
rated speed and pressure, 0 psi  
inlet, 82°C (180°F), SAE 10W oil.  
Pressure rise was 6900 bar  
(100,000 psi) per second.

#### RESPONSE DATA

Control Type	PVQ20		PVQ32	
	On stroke	Off stroke	On stroke	Off stroke
Pressure compensator	0.070 sec.	0.023 sec.	0.080 sec.	0.020 sec.
load-sense compensator	0.090 sec.	0.015 sec.	0.100 sec.	0.018 sec.



# Shaft Torque Data

PVQ20/32A9 and  
PVQ20/32A11

## Thru-drive Shaft Torque Data

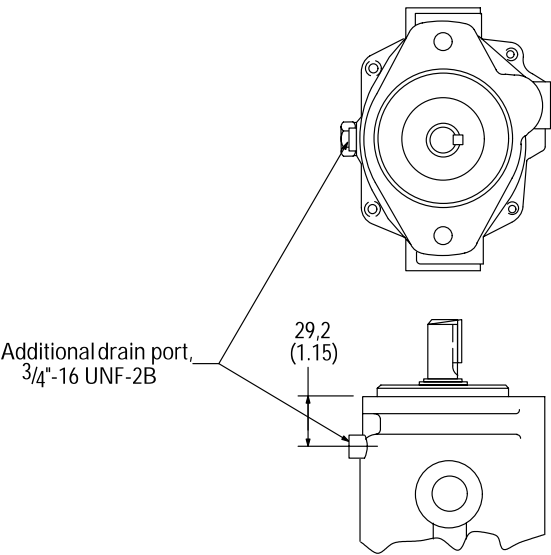
Any deviation from these maximum torque values must be approved by Eaton engineering.

THRU-DRIVE SHAFT TORQUE DATA			
Model Number System*	Input Shaft Code	Maximum Input Torque Total Nm (lb. in.)	Maximum Thru-drive Torque Output Nm (lb. in.)
PVQ20/32A9	1	135 (1200)	
	3	208 (1850)	58 (517)
	N	337 (2987)	
PVQ20/32A11	1	135 (1200)	
	3	208 (1850)	123 (1100)
	N	337 (2987)	

\*SAE "B" 4 inch thru-drive pilot not available in PVQ20/32 frame size.

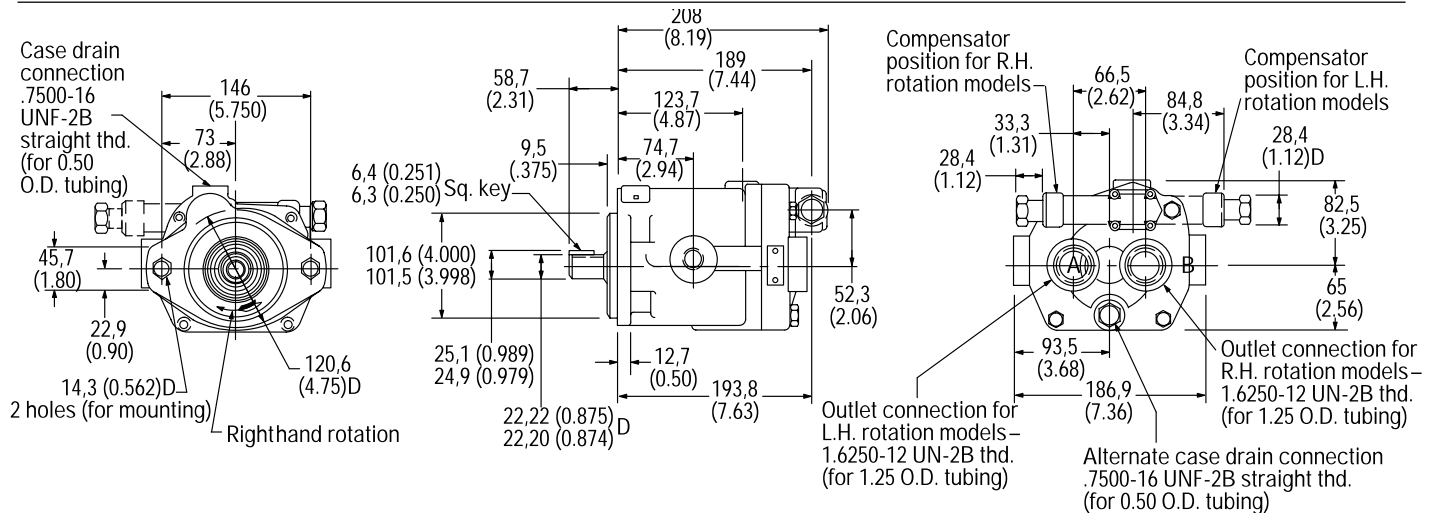
# Installation Dimensions

Vertical  
"Shaft-up"  
Installation –  
"S2" Drain Port  
Option



# Installation Dimensions

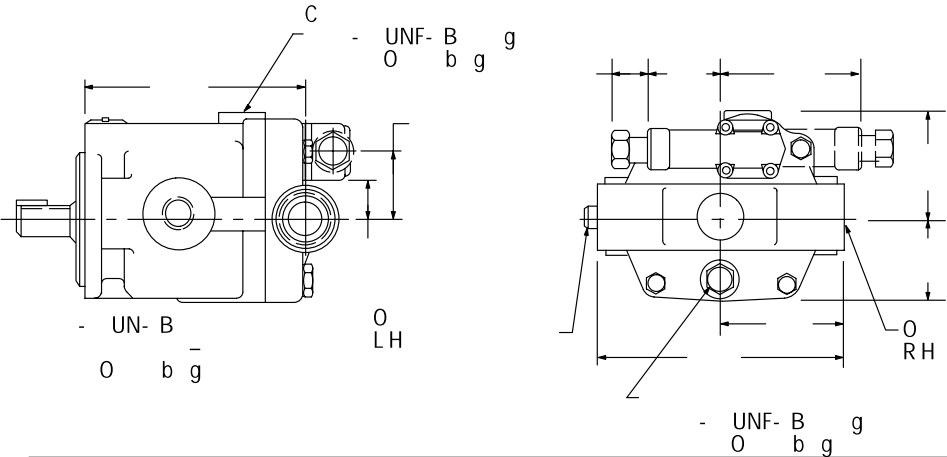
Rear Ports,  
"C" and "CM"  
Controls,  
No. 1 Shaft



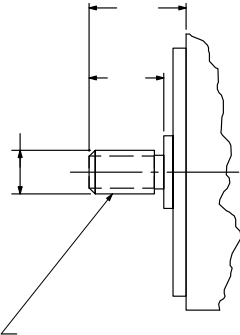
Caution – while pump is operating  
do not back compensator adjustment  
screw out beyond dimension shown.

Installation  
Dimensions

Side Ports

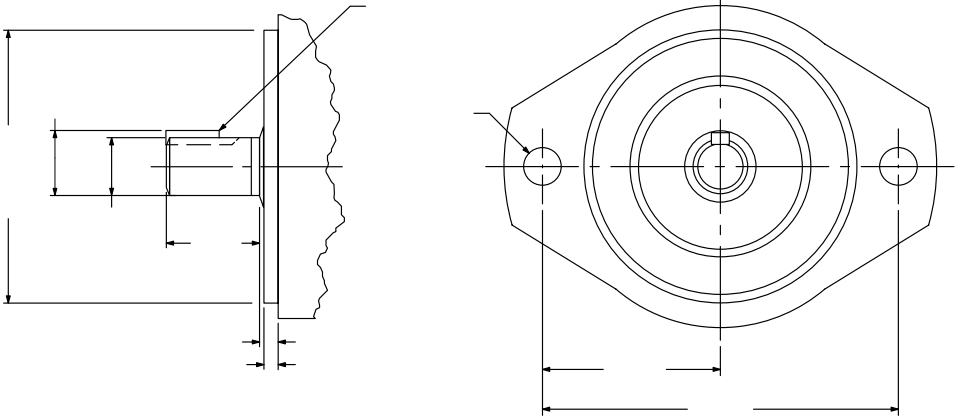


No. 3 Shaft



"N" Shaft with  
"MB" Flange

(Flange and shaft end ISO  
3019/21000A2HW-E25N)



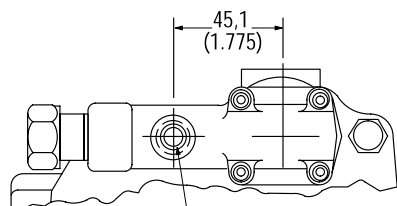
# Controls

## Remote Compensator

### Adjustment

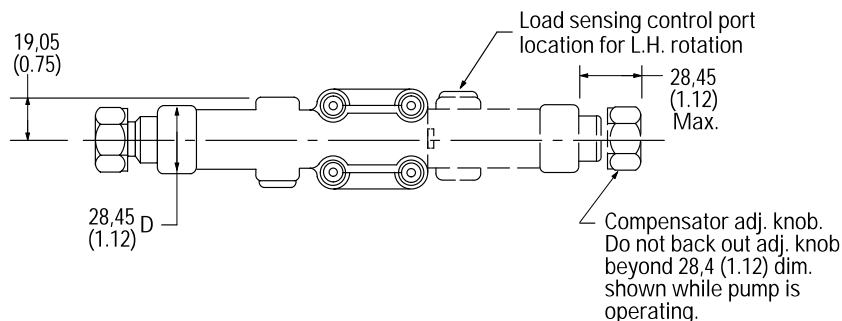
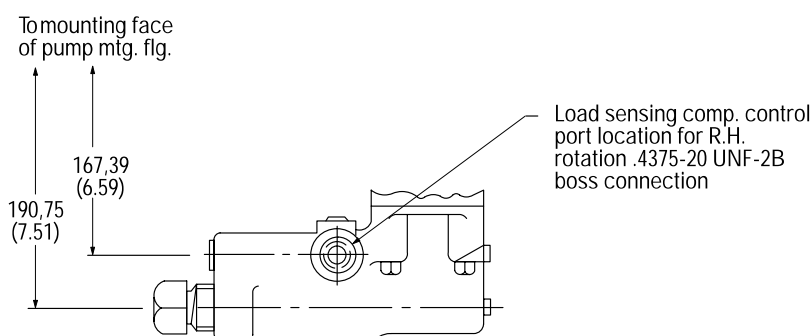
1. Turn pressure control (such as C-175) CCW to minimum setting.
2. Turn compensator adjustment plug to desired minimum pressure (17 bar, 250 psi or higher).
3. Full pressure range can now be obtained with pressure control.

**Caution:** Effective compensator pressure will be compensator control setting (17-69 bar, 250-1000 psig) plus remote relief valve setting.



Do not operate pump with this port plugged. Connect to pressure control, such as C-175. SAE O-ring boss connection .250 O.D. tubing

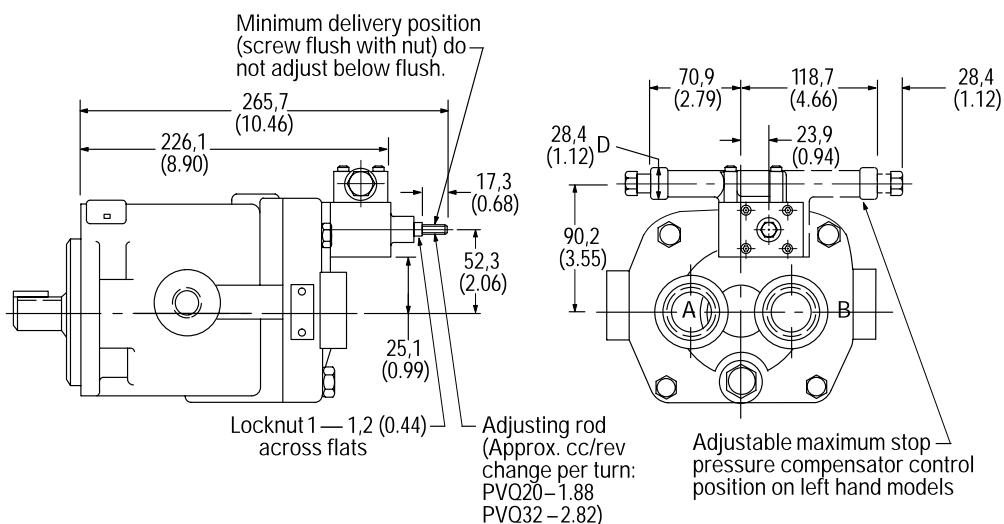
## Load-sensing with Pressure Limiter



## Pressure Compensator Control with Adjustable Max. Displacement Stop

### Adjustment

Loosen locknut on adjusting rod. Turn adjusting rod clockwise (CW) to decrease maximum pump delivery or counter-clockwise (CCW) to increase maximum pump delivery until desired setting is obtained. Secure this setting by tightening locknut.

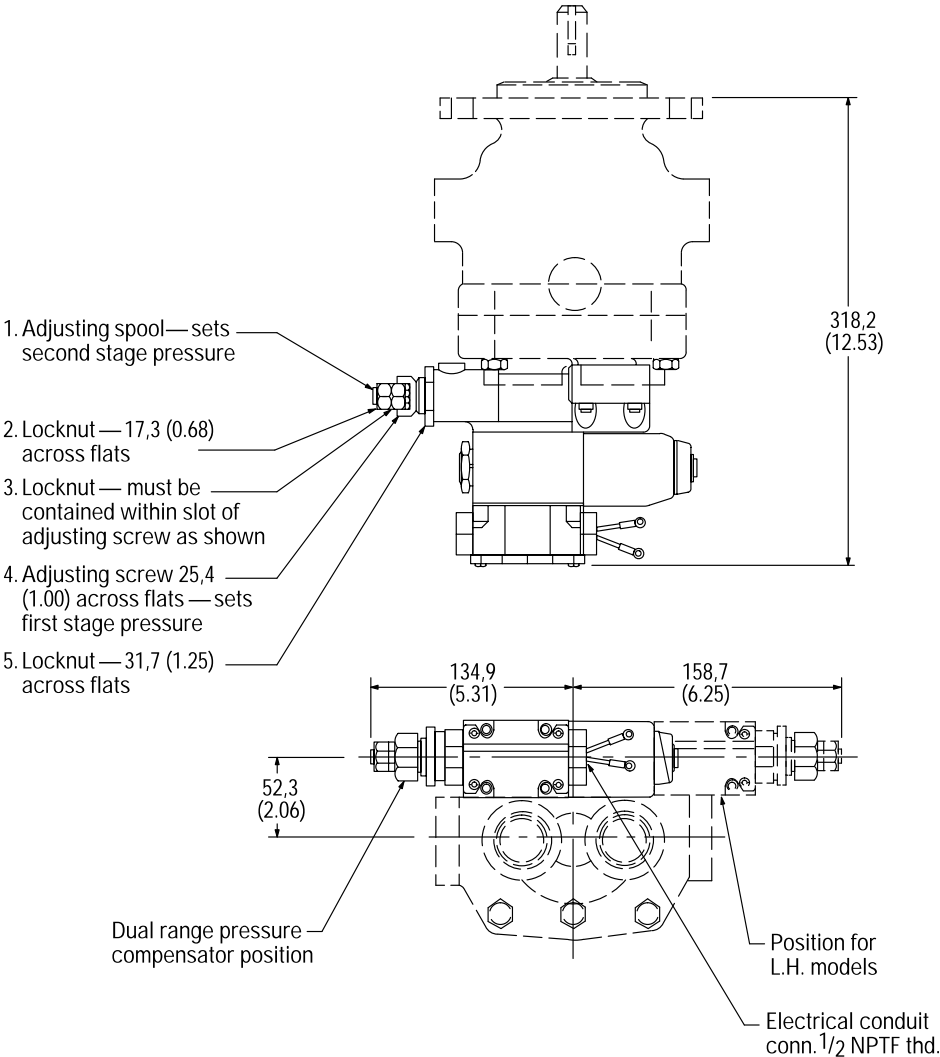


Controls

Electric Dual  
Range Pressure  
Compensator  
Control

Adjustment

- 1. With the directional valve de-energized, loosen locknut " 5" and turn the adjusting screw " 4" to the desired first stage pressure setting, then tighten locknut " 5".
- 2. With solenoid de-energized, turn adjusting spool " 1" counterclockwise (CCW) until nut " 3" is bottomed in adjusting screw slot. (Second stage setting is now equal to first stage pressure setting.) Turn adjusting spool clockwise (CW) to desired second stage pressure requirements. One complete turn of adjusting spool equals approximately 41 bar (600 psi). Energize solenoid and check pressure setting. De-energize solenoid and re-adjust if necessary. Secure this setting by tightening locknut " 2".



Solenoid Data  
(110V AC 50 Hz  
and 115/120V AC  
60 Hz)

Solenoid current	Inrush amps (R.M.S.)	Holding amps
115/120V AC 60 Hz – 110V AC 50 Hz	2.0	.54 .64*

\*Maximum peak inrush amps approximately 1.4 x R.M.S. value shown.  
Refer to catalog GB-C-2015B for additional solenoid valve data.

## Controls

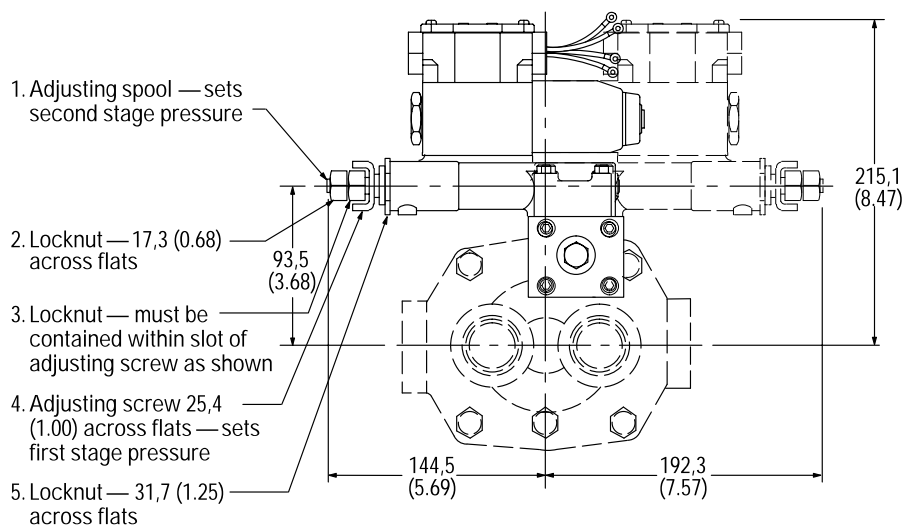
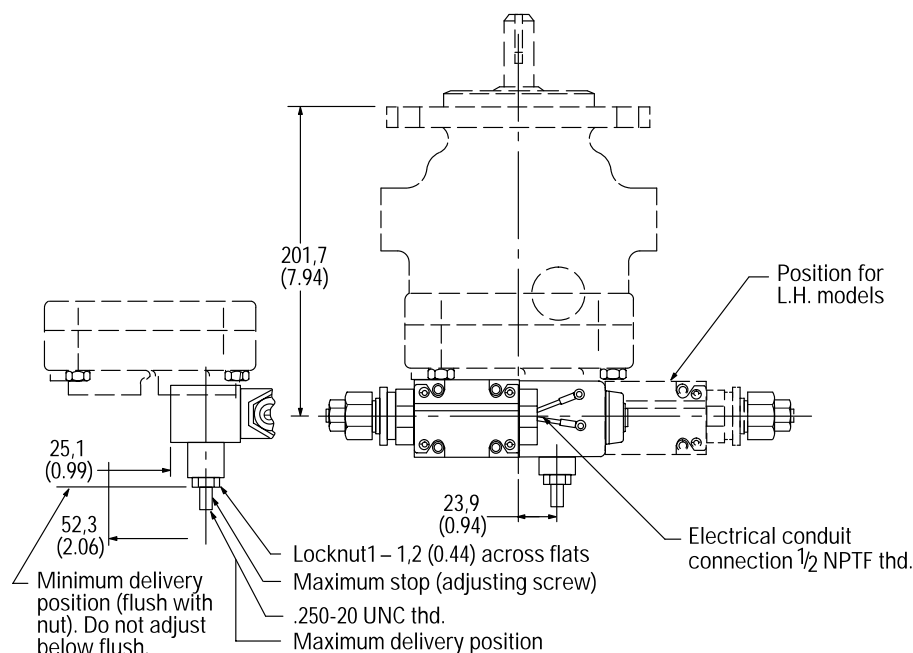
### Electric Dual Range Pressure Compensator with Maximum Displacement Stop

#### Maximum Flow Adjustment

With the system pressure below both compensator settings, loosen maximum stop adjusting screw locknut and adjust screw to desired flow position (turning screw clockwise decreases flow and turning screw counterclockwise increases flow). To lock screw in position, tighten locknut. To assist initial priming, adjust control setting to at least 40% of maximum flow position.

#### Compensator Control

1. With the directional valve de-energized, loosen locknut "5" and turn the adjusting screw "4" to the desired first stage pressure setting, then tighten locknut "5".
2. With directional valve de-energized, turn adjusting spool "1" counterclockwise until nut "3" is bottomed in adjusting screw slot. (Second stage setting is now equal to first stage pressure setting.) Turn adjusting spool clockwise to desired second stage pressure requirements. One complete turn of adjusting spool equals approximately 41 bar (600 psi). Energize solenoid and check pressure setting. De-energize solenoid and re-adjust if necessary. Secure this setting by tightening locknut "2".



## Controls

### Unloading Valve Control

With the unloading valve control the variable pump will unload at a preset pressure. The pump will maintain this no flow, low pressure (approximately 14 bar [200 psi]) standby condition, until system pressure drops to about 85% of the preset unloading pressure. The pump will then return on stroke and provide full flow until the preset unloading pressure is reached again.

With this control, an efficient accumulator charging circuit is obtained. The pump will provide full flow to fill the accumulator until the maximum charging pressure is reached. The pump then goes to a standby condition until the accumulator pressure drops to 85% of the desired maximum. The accumulator is then recharged as the cycle starts over again.

A separate right angle check valve must be provided to maintain the accumulator hydraulic charge and prevent back flow when the pump is unloaded. The check valve's internal leakage must not exceed five drops per minute. The control port must be connected to system pressure, downstream of the check valve.

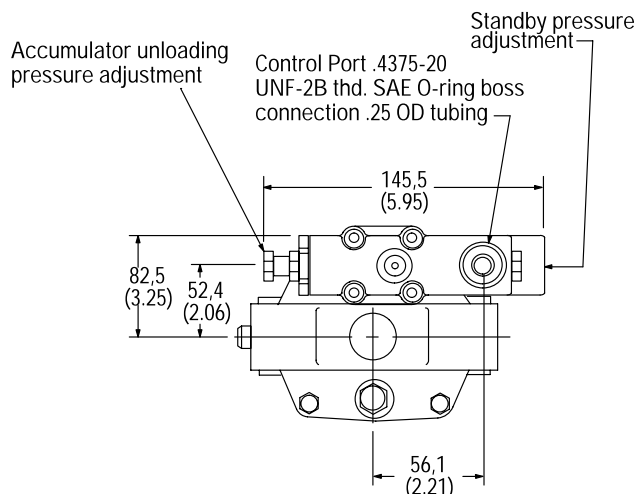
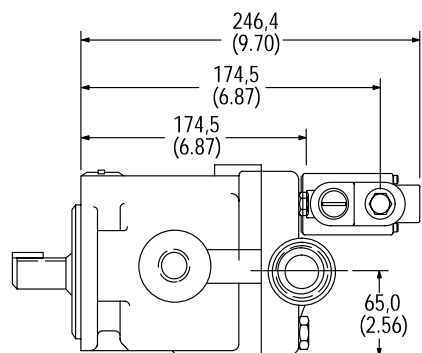
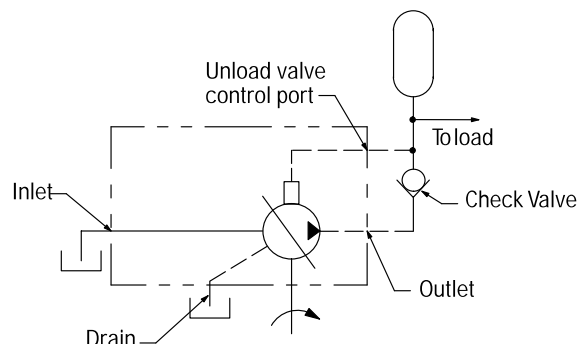
#### Adjustment range

PVQ20	100-210 bar (1500-3000 psi)
PVQ32	100-140 bar (1500-2000 psi)

Cut-in pressure is 85% of unloading pressure, minimum.

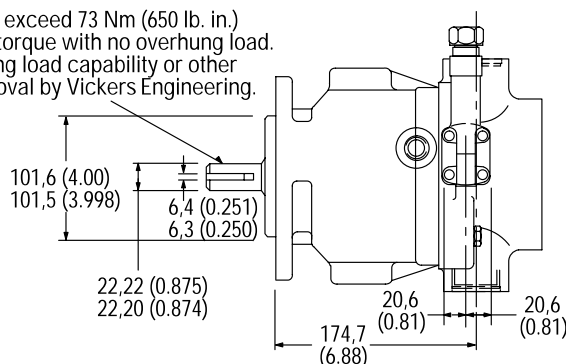
#### Setting Pressures

1. Back out accumulator unloading pressure adjustment screw to below desired unloading pressure.
2. Adjust desired standby pressure.
3. Set accumulator pressure by screwing in the accumulator unloading adjustment screw. Accumulator recharge (cut-in) pressure is a function of the maximum accumulator pressure and is not adjustable.
4. Check pressure settings and re-adjust if necessary.

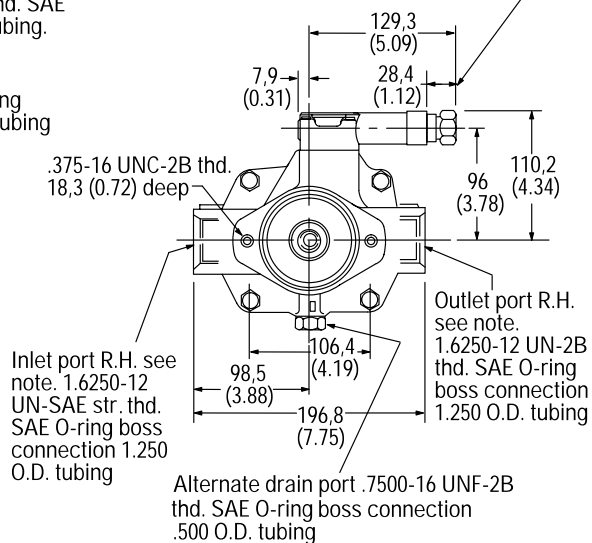
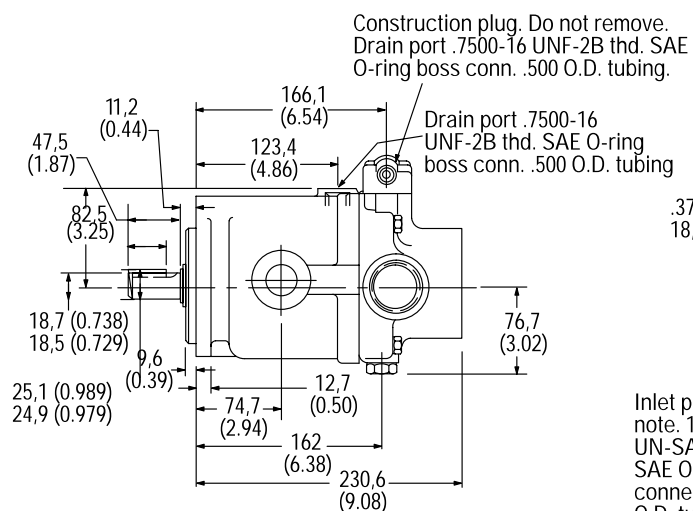


PVQ20/32  
"A9" and "A11"  
SAE "A"

**Note:** Ports are reversed for L.H. rotation.  
Control location same for both L.H. and  
R.H. rotation.

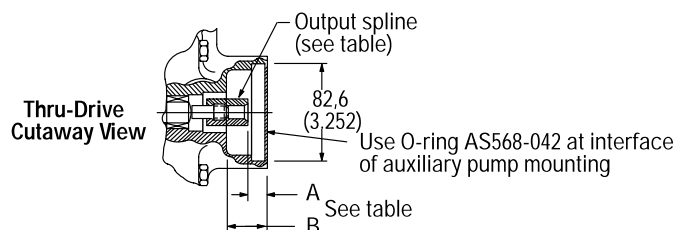


Caution: While pump is operating, do not back compensator adj. out beyond 28,4 (1.12) dim. shown. →





PVQ20/32  
"A9" and "A11"  
SAE "A"



PVQ20/32 "A9" AND "A11" SAE "A"

**Note:** O-ring included with pump. Coupling kit, cap screws, and washers must be ordered separately to mount rear pump.

### TYPICAL REAR PUMPS (WITH SHAFT CODES) FOR PVQ20/32 THRU-DRIVES

**Note:** "A11" (not listed above) is intended for special application only.