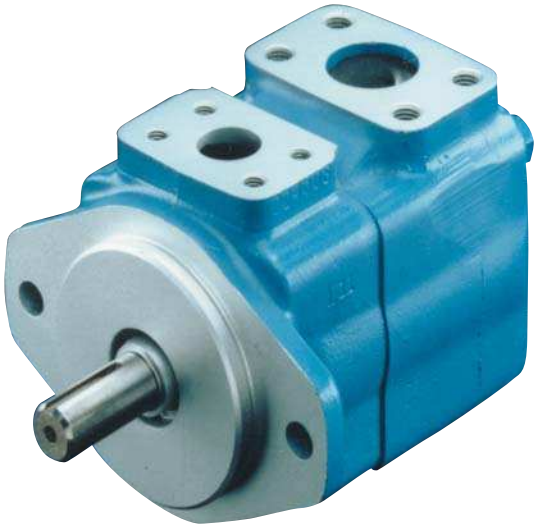
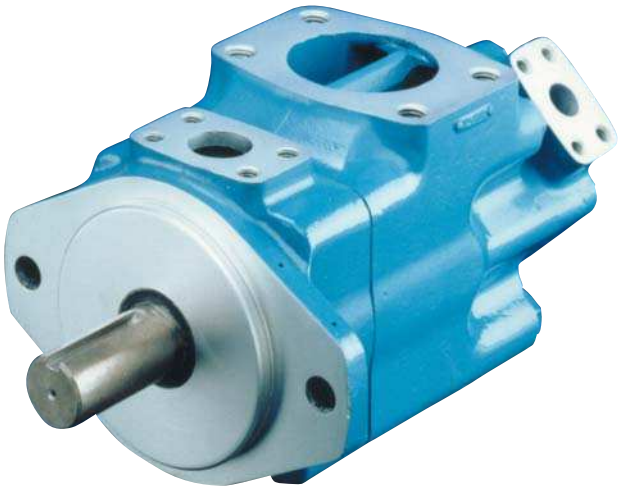
EATON | Vickers

3500 PSI Fixed Displacement Mobile Vane Pumps

VQH Series (Supplement to Catalog 353)



Single 35VQH



Double 3525VQH



Thru-Drive 35VQHT*S

VICKERS®

Single and Thru-Drive Pumps

VQH Series fixed displacement single and double vane pumps employ a new rotor design that enhances pressure capability and efficiency over the 20th design VQ pumps. VQH cartridge kits are interchangeable with those of VQ series. In order to accommodate high pressure requirements, the VQH pump housing is upgraded to ductile iron. The VQH installation dimensions are exactly the same as VQ pumps.

Available Pump Frame sizes are:

Single and Thru-Drive pumps: 25, 35, and 45

Double Pumps:

2520, 3520, 3525, 4520, 4525 and 4535

For installation dimensions, please refer to VQ pump section in Cat. 353 "Vane Pump and Motor Design Guide for Mobile Equipment."

FRAME SIZES	DELIVERY USGPM @1200 RPM 100 PSI	DISPL. CM3/R (IN3/R)	MAX. R/MIN	MAX. CONTINUOUS BAR (PSI)	MAX. PEAK BAR (PSI)	TYPICAL DEL. L/MIN (USGPM) @ MAX. SPEED & PRESSURE	TYPICAL INPUT KW (HP) @ MAX. SPEED & PRESSURE	WEIGHT KG (LB)
25VQH	12	40,2 (2.45)	2700	241 (3500)	262 (3800)	89 (24)	45 (60)	14,5 (32)
	14	45,4 (2.77)	2700	241 (3500)	262 (3800)	104 (28)	51 (69)	
	17	55,2 (3.37)	2500	241 (3500)	262 (3800)	120 (32)	57 (77)	
	19	61,3 (3.74)	2500	241 (3500)	262 (3800)	140,1 (37)	66 (88)	
	21	67,5 (4.12)	2500	241 (3500)	262 (3800)	159 (42)	73 (98)	
35VQH	25	81,6 (4.98)	2500	228 (3300)	248 (3600)	189,3 (50)	82 (110)	22,7 (50)
	30	97,7 (5.96)	2500	228 (3300)	248 (3600)	227,1 (60)	98 (132)	
	35	112,8 (6.88)	2400	228 (3300)	248 (3600)	255,5 (68)	106 (142)	
	38	121,6 (7.42)	2400	228 (3300)	248 (3600)	272,5 (72)	116 (155)	
45VQH	42	138,7 (8.46)	2200	228 (3300)	248 (3600)	282 (75)	123 (165)	34,1 (75)
	47	151,9 (9.27)	2200	228 (3300)	248 (3600)	315 (83)	137 (184)	
	50	162,3 (9.90)	2200	228 (3300)	248 (3600)	335 (89)	143 (192)	
	57	190,2 (11.61)	2200	228 (3300)	248 (3600)	382,3 (101)	165 (221)	
	60	193,4 (11.80)	2200	207 (3000)	248 (3600)	397,5 (105)	158 (212)	

Double Pumps

Performance Data

Shaft End Pump

MODEL SERIES	DELIVERY USGPM @1200 RPM 100 PSI	DISPL. CM3/R (IN3/R)	MAX. R/MIN	MAX. CONTINUOUS BAR (PSI)	TYPICAL DEL. L/MIN (USGPM) @ MAX. SPEED & PRESSURE	TYPICAL INPUT KW (HP) @ MAX. SPEED & PRESSURE
2520	12	40,2 (2.45)	2700	241 (3500)	89 (24)	45 (60)
	14	45,4 (2.77)	2700	241 (3500)	104 (28)	51 (69)
	17	55,2 (3.37)	2500	241 (3500)	120 (32)	57 (77)
	19	61,3 (3.74)	2500	241 (3500)	140,1 (37)	66 (88)
	21	67,5 (4.12)	2500	241 (3500)	159 (42)	73 (98)
3520	25	81,6 (4.98)	2500	228 (3300)	189,3 (50)	82 (110)
	30	97,7 (5.96)	2500	228 (3300)	227,1 (60)	98 (132)
	35	112,8 (6.88)	2400	228 (3300)	255,5 (68)	106 (142)
	38	121,6 (7.42)	2400	228 (3300)	272,5 (72)	116 (155)
3525	25	81,6 (4.98)	2500	228 (3300)	189,3 (50)	82 (110)
	30	97,7 (5.96)	2500	228 (3300)	227,1 (60)	98 (132)
	35	112,8 (6.88)	2400	228 (3300)	255,5 (68)	106 (142)
	38	121,6 (7.42)	2400	228 (3300)	272,5 (72)	116 (155)
4520	42	138,7 (8.46)	2200	228 (3300)	282 (75)	123 (165)
	47	151,9 (9.27)	2200	228 (3300)	315 (83)	137 (184)
	50	162,3 (9.90)	2200	228 (3300)	335 (89)	143 (192)
	57	190,2 (11.61)	2200	228 (3300)	382,3 (101)	165 (221)
	60	193,4 (11.80)	2200	207 (3000)	397,5 (105)	158 (212)
4525	42	138,7 (8.46)	2200	228 (3300)	282 (75)	123 (165)
	47	151,9 (9.27)	2200	228 (3300)	315 (83)	137 (184)
	50	162,3 (9.90)	2200	228 (3300)	335 (89)	143 (192)
	57	190,2 (11.61)	2200	228 (3300)	382,3 (101)	165 (221)
	60	193,4 (11.80)	2200	207 (3000)	397,5 (105)	158 (212)
4535	42	138,7 (8.46)	2200	228 (3300)	282 (75)	123 (165)
	47	151,9 (9.27)	2200	228 (3300)	315 (83)	137 (184)
	50	162,3 (9.90)	2200	228 (3300)	335 (89)	143 (192)
	57	190,2 (11.61)	2200	228 (3300)	382,3 (101)	165 (221)
	60	193,4 (11.80)	2200	207 (3000)	425 (112.4)	158 (212)

Double Pumps

Performance Data

Cover End Pump

MODEL SERIES	DELIVERY USGPM @1200 RPM 100 PSI	DISPL. CM3/R (IN3/R)	MAX. R/MIN	MAX. CONTINUOUS BAR (PSI)	TYPICAL DEL. L/MIN (USGPM) @ MAX. SPEED & PRESSURE	TYPICAL INPUT KW (HP) @ MAX. SPEED & PRESSURE	WEIGHT KG (LB)
2520	5	18,0 (1.10)	2700	228 (3300)	44,5 (12)	21 (28)	20,5 (45)
	8	27,4 (1.67)	2700	228 (3300)	68,5 (18)	31 (42)	
	11	36,4 (2.22)	2700	228 (3300)	93,9 (25)	42 (56)	
	12	39,5 (2.41)	2700	228 (3300)	103 (27)	44 (59)	
	14	45,9 (2.80)	2700	207 (3000)	121,9 (32)	51 (68)	
3520	5	18,0 (1.10)	2700	228 (3300)	44,5 (12)	21 (28)	34,0 (75)
	8	27,4 (1.67)	2700	228 (3300)	68,5 (18)	31 (42)	
	11	36,4 (2.22)	2700	228 (3300)	93,9 (25)	42 (56)	
	12	39,5 (2.41)	2700	228 (3300)	103 (27)	44 (59)	
	14	45,9 (2.80)	2700	207 (3000)	121,9 (32)	51 (68)	
3525	12	40,2 (2.45)	2700	241 (3500)	89 (24)	45 (60)	34,5 (76)
	14	45,4 (2.77)	2700	241 (3500)	104 (28)	51 (69)	
	17	55,2 (3.37)	2500	241 (3500)	120 (32)	57 (77)	
	19	61,3 (3.74)	2500	241 (3500)	140,1 (37)	66 (88)	
	21	67,5 (4.12)	2500	241 (3500)	159 (42)	73 (98)	
4520	5	18,0 (1.10)	2700	228 (3300)	44,5 (12)	21 (28)	43,0 (95)
	8	27,4 (1.67)	2700	228 (3300)	68,5 (18)	31 (42)	
	11	36,4 (2.22)	2700	228 (3300)	93,9 (25)	42 (56)	
	12	39,5 (2.41)	2700	228 (3300)	103 (27)	44 (59)	
	14	45,9 (2.80)	2700	207 (3000)	121,9 (32)	51 (68)	
4525	12	40,2 (2.45)	2700	241 (3500)	89 (24)	45 (60)	46,0 (101)
	14	45,4 (2.77)	2700	241 (3500)	104 (28)	51 (69)	
	17	55,2 (3.37)	2500	241 (3500)	120 (32)	57 (77)	
	19	61,3 (3.74)	2500	241 (3500)	140,1 (37)	66 (88)	
	21	67,5 (4.12)	2500	241 (3500)	159 (42)	73 (98)	
4535	25	81,6 (4.98)	2500	228 (3300)	189,3 (50)	82 (110)	53.5 (118)
	30	97,7 (5.96)	2500	228 (3300)	227,1 (60)	98 (132)	
	35	112,8 (6.88)	2400	228 (3300)	255,5 (68)	106 (142)	
	38	121,6 (7.42)	2400	228 (3300)	272,5 (72)	116 (155)	

Model Codes

Single Pump

(F3)-25VQH (S) 21 A (S)-11 C 30 (L)

1 2 3 4 5 6 7 8 9 10

1 F3 - Viton seals

Omit if not required.

2 Intravane pump series

Standard bearing
25VQH
35VQH
45VQH

3 Pilot designation

S – SAE per ISO 3019/1 (SAE J744)
Omit for standard pilot.

4 Geometric displacement

Code = SAE rating (USgpm) at 1200 r/min and 7 bar (100 psi

FRAME SIZE	CODE (USGPM)	CM^3/R	IN^3/R
25VQH	12	40,2	2.45
	14	45,4	2.77
	17	55,2	3.37
	19	61,3	3.74
	21	67,5	4.12
35VQH	25	81,6	4.98
	30	97,7	5.96
	35	112,8	6.88
	38	121,6	7.42
45VQH	42	138,7	8.46
	47	151,9	9.27
	50	162,3	9.90
	57	190,2	11.61
	60	193,4	11.80

5 Port Connections

SERIES	CODE	INLET	OUTLET
All	A	SAE 4-bolt flg.	SAE 4-bolt flg.
All	AM*	Metric 4-bolt flg.	Metric 4-bolt flg.
25VQH	B	SAE str. thd.	SAE str. thd.
25VQH	C	SAE 4-bolt flg.	SAE str.thd.
25VQH	D	SAE str. thd.	SAE 4-bolt flg.

* Same as code "A" port connections, except metric threads for fastening flanges.

6 Mounting & shaft seal assembly

F – Foot mounting with single shaft seal
S – Flange mount and double shaft seal
Omit for flange mount with single shaft seal.

7 Shaft type

With standard pilot, single shaft seal

1 – Straight keyed
11 – Splined
86 – Straight keyed, heavy duty

With standard pilot, double shaft seal

123 – Splined (not available on 45VQH)
130 – Splined (for 45VQH only)

With SAE pilot, single or double shaft seal

203 – Straight keyed, heavy duty
297 – Splined

8 Outlet positions

(Viewed from cover end of pump)
A – Opposite inlet
B – 90° CCW from inlet
C – In line with inlet
D – 90° CW from inlet

9 Design

10 Rotation

(Viewed form shaft end of pump)
L - Left hand (counterclockwise)
Omit for right hand.

Note: For options other than listed in the model code, i.e. shafts, ports, displacements and mountings, contact your Vickers representative.

Model Codes

Double Pump

(without integral valves)

(F3)-2520VQH (S) 12 A 11 (S)-123 CC 30 (L)

1 2 3 4 5 6 7 8 9 10 11

1 F3 - Viton seals

Omit if not required.

2 Intravane pump series

2520VQH
3525VQH
4525VQH
3520VQH
4520VQH
4535VQH

3 Pilot designation

S – SAE per ISO 3019/1 (SAE J744)

Omit for standard pilot.

4 Geometric displacement - Shaft end pump

Code = SAE rating (USgpm) at 1200 r/min and 7 bar (100 psi

FRAME SIZE	CODE (USGPM)	CM³R	IN³/R
25VQH	12	40,2	2.45
	14	45,4	2.77
	17	55,2	3.37
	19	61,3	3.74
	21	67,5	4.12
35VQH	25	81,6	4.98
	30	97,7	5.96
	35	112,8	6.88
	38	121,6	7.42
45VQH	42	138,7	8.46
	47	151,9	9.27
	50	162,3	9.90
	57	190,2	11.61
	60	193,4	11.80

5 Port connections

PUMP SERIES	CODE	INLET	OUTLET NO.1	OUTLET NO. 2
All	A	SAE 4-bolt flg	SAE 4-bolt flg.	SAE 4-bolt flg.
All	AM*	Metric 4-bolt flg.	Metric 4-bolt flg.	Metric 4-bolt flg.
2520VQH	C	SAE 4-bolt flg.	SAE str. thd.	SAE str. thd.
All but 4535VQH	E	SAE 4-bolt flg.	SAE 4-bolt flg.	SAE str. thd.
2520VQH	F	SAE 4-bolt flg.	SAE str. thd.	SAE 4-bolt flg.

*Same as code "A" port connections, except metric threads for fastening flanges.

6 Geometric displacement - cover end pump

Code= SAE rating (USgpm) at 1200 r/min and 7 bar (100 psi)

FRAME SIZE	CODE (USGPM)	CM³R	IN³/R
**20VQH	5	18,0	1.10
	8	27,4	1.67
	11	36,4	2.22
	12	39,5	2.41
	14	45,9	2.80
**25VQH	12	40,2	2.45
	14	45,4	2.77
	17	55,2	3.37
	19	61,3	3.74
	21	67,5	4.12
4535VQH	25	81,6	4.98
	30	97,7	5.96
	35	112,8	6.88
	38	121,6	7.42

7 Mounting & shaft seal assembly

S – Flange mount and double shaft seal

Omit for flange mount with single shaft seal.

8 Shaft type

With standard pilot, single shaft seal

1 – Straight keyed
11 – Splined
86 – Straight keyed, heavy duty

With standard pilot, double shaft seal

123 – Splined (not available on 45**VQ)
130 – Splined (for 45**VQ only)

With SAE pilot, single or double shaft seal

203 – Straight keyed, heavy duty
297 – Splined

9 Port orientation

(Viewed from cover end of pump)

All series except 4535VQ

With No.1 outlet opposite inlet:

AA - No. 2 outlet 135 CCW from inlet
AB - No. 2 outlet 45 CCW from inlet
AC - No. 2 outlet 45 CW from inlet
AD - No. 2 outlet 135 CW from inlet

With No.1 outlet 90 CCW from inlet:

BA - No. 2 outlet 135 CCW from inlet
BB - No. 2 outlet 45 CCW from inlet
BC - No. 2 outlet 45 CW from inlet
BD - No. 2 outlet 135 CW from inlet

With No.1 outlet inline with inlet:

CA - No. 2 outlet 135 CCW from inlet
CB - No. 2 outlet 45 CCW from inlet
CC - No. 2 outlet 45 CW from inlet
CD - No. 2 outlet 135 CW from inlet

With No.1 outlet 90 CW from inlet:

DA - No. 2 outlet 135 CCW from inlet
DB - No. 2 outlet 45 CCW from inlet
DC - No. 2 outlet 45 CW from inlet
DD - No. 2 outlet 135 CW from inlet

Series 4535VQ

With No.1 outlet opposite inlet:

AA - No. 2 outlet opposite inlet
AB - No. 2 outlet 90 CCW from inlet
AC - No. 2 outlet inline with inlet
AD - No. 2 outlet 90 CW from inlet

With No.1 outlet 90 CW from inlet:

BA - No. 2 outlet opposite inlet
BB - No. 2 outlet 90 CCW from inlet
BC - No. 2 outlet inline with inlet
BD - No. 2 outlet 90 CW from inlet

With No.1 outlet inline with inlet:

CA - No. 2 outlet opposite inlet
CB - No. 2 outlet 90 CCW from inlet
CC - No. 2 outlet inline inlet
CD - No. 2 outlet 90 CW from inlet

With No.1 outlet 90 CW from inlet:

DA - No. 2 outlet opposite inlet
DB - No. 2 outlet 90 CCW from inlet
DC - No. 2 outlet inline with inlet
DD - No. 2 outlet 90 CW from inlet

10 Design

11 Shaft rotation

(Viewed form shaft end of pump)

L - Left hand (counterclockwise)

Omit for right hand.

Note: For options other than listed in the model code, i.e. shafts, ports, displacements and mountings, contact your Vickers representative.

Model Codes

Double Pump

(with integral valves)

(F3)-2520VQH (S) F 12 E 11 (S)- 297 CC 6 D 30(L)

1 2 3 4 5 6 7 8 9 10 11 12 13 14

1 F3 - Viton seals

Omit if not required.

2 Intravane pump series

2520VQH
3520VQH
4520VQH

3 Pilot designation

S – SAE per ISO 3019/1 (SAE J744)

Omit for standard pilot.

4 Integral valve options

F – Flow control and relief
P – Priority valve and relief

5 Geometric displacement - shaft end pump

Code = SAE rating (USgpm) at 1200 r/min and 7 bar (100 psi)

FRAME SIZE	CODE (USGPM)	CM³R	IN³/R
2520VQH	12	40,2	2.45
	14	45,4	2.77
	17	55,2	3.37
	19	61,3	3.74
	21	67,5	4.12
35VQH	25	81,6	4.98
	30	97,7	5.96
	35	112,8	6.88
	38	121,6	7.42
45VQH	42	138,7	8.46
	47	151,9	9.27
	50	162,3	9.90
	57	190,2	11.61
	60	193,4	11.80

6 Port connections

PUMP SERIES	CODE	INLET	OUTLET NO.1	OUTLET NO. 2	TANK
2520VQ only	C	SAE 4-bolt flg.	SAE str. thd.	SAE str. thd.	SAE str. thd.
All pumps	E	SAE 4-bolt flg.	SAE 4-bolt flg	SAE str. thd.	SAE str. thd.

7 Geometric displacement - cover end pump

Code = SAE rating (USgpm) at 1200 r/min and 7 bar (100 psi)

FRAME SIZE	CODE (USGPM)	CM³R	IN³/R
**20VQ	5	18,0	1.10
	8	27,4	1.67
	11	36,4	2.22
	12	39,5	2.41
	14	45,9	2.80

8 Mounting & shaft seal assembly

S – Flange mount and double shaft seal

Omit for flange mount with single shaft seal.

9 Shaft type

With standard pilot, single shaft seal

1 – Straight keyed
11 – Splined
86 – Straight keyed, heavy duty

With standard pilot, double shaft seal

123 – Splined (not available on 4520VQH)
130 – Splined (for 4520VQH only)

With SAE pilot, single or double shaft seal

203 – Straight keyed, heavy duty
297 – Splined

10 Port orientation

(Viewed from cover end of pump)

With No.1 outlet opposite inlet:

AA - No. 2 outlet 135 CCW from inlet
AB - No. 2 outlet 45 CCW from inlet
AC - No. 2 outlet 45 CW from inlet
AD - No. 2 outlet 135 CW from inlet

With No.1 outlet 90 CCW from inlet:

BA - No. 2 outlet 135 CCW from inlet
BB - No. 2 outlet 45 CCW from inlet
BC - No. 2 outlet 45 CW from inlet
BD - No. 2 outlet 135 CW from inlet

With No.1 outlet inline with inlet:

CA - No. 2 outlet 135 CCW from inlet
CB - No. 2 outlet 45 CCW from inlet
CC - No. 2 outlet 45 CW from inlet
CD - No. 2 outlet 135 CW from inlet

With No.1 outlet 90 CW from inlet:

DA - No. 2 outlet 135 CCW from inlet
DB - No. 2 outlet 45 CCW from inlet
DC - No. 2 outlet 45 CW from inlet

11 Controlled flow rate USgpm

2, 4, 6, 7, 8, 10 or 12 USgpm

12 Relief valve setting - bar (psi)

C – 52 (750)
D – 70 (1000)
E – 86 (1250)
F – 100 (1500)
G – 121 (1750)
H – 140 (2000)
J – 155 (2250)
K – 175 (2500)

13 Design

(Viewed form shaft end of pump)
L - Left hand (counterclockwise)
Omit for right hand.

14 Shaft Rotation

(Viewed form shaft end of pump)
L - Left hand (counterclockwise)
Omit for right hand.

Note: For options other than listed in the model code, i.e. shafts, ports, displacements and mountings, contact your Vickers representative.

Model Codes

Thru-drive Single Pump

(F3)–25VQHT B S 21 A M S - 2 203 C A 20 R

1 2 3 4 5 6 7 8 9 10 11 12 13 14

1 F3 - Viton seals

Omit if not required.

2 Series designation

25VQHT Standard bearing
35VQHT
45VQHT

3 Thru-drive connection mounting adapter (2-bolt)

	SAE DESIGNATION	
Code	**J744C**	**J744 Oct83**
A	A	82-2
B	B	101-2
BP	Special mounting with spacer for Vickers PVE 12/19/21	
C	C (not available on 25VQT)	127-2

4 Front mounting flange

	SAE DESIGNATION	
Model Series	**J744C**	**J744 Oct83**
2*VQT	B	101-2
3*VQT	C	127-2
45VQT	C	127-2

5 Geometric displacement - shaft end pump

Code = SAE rating (USgpm) at 1200 rpm and 6,9 bar (100 psi)

PUMP SERIES	CODE	CM^3/R	IN^3/R
2*VQHT	12	40,2	2.45
	14	45,4	2.77
	17	55,2	3.37
	19	61,3	3.74
	21	67,5	4.12
3*VQHT	25	81, 6	4.98
	30	97, 7	5.96
	35	112, 8	6.88
	38	121, 6	7.42
45VQHT	42	138,7	8.46
	47	157,9	9.27
	50	162,3	9.90
	57	190.2	11.61
	60	193,4	11.80

6 SAE Port connections

4-bolt flange port connection

7 Metric threads on port connections

(Omit for inch threads)

8 Double shaft seal

S – Double shaft seal
– Single seal

9 Coupling for tandem pump

2 – SAE splined coupling included with pump

10 Shaft

203 – Heavy duty straight key
297 – Splined

11 Outlet positions

(Viewed from cover end of pump)
A – Opposite inlet
B – 90° CCW from inlet
C – In line with inlet
D – 90° CW from inlet

12 Adapter mounting orientation

(Viewed from cover end of pump)

CODE	"A" ADAPTER	"B" ADAPTER
A	Rotated 45° CW with respect to pump mtg. flg.	In line with pump mtg. flg.
B	Rotated 45° CCW with respect to pump mtg. flg.	Rotated 90° with respect to pumpmtg. flg.

13 Design

Subject to change. Installation dimensions remain the same for designs -20 through -29.

14 Shaft rotation

(Viewed from shaft end of pump)
L – Left hand (counterclockwise)
R – Right hand (clockwise)

Note: For options other than listed in the model code, i.e. shafts, ports, displacements and mountings, contact your Vickers representative.

Notes

Notes

Notes

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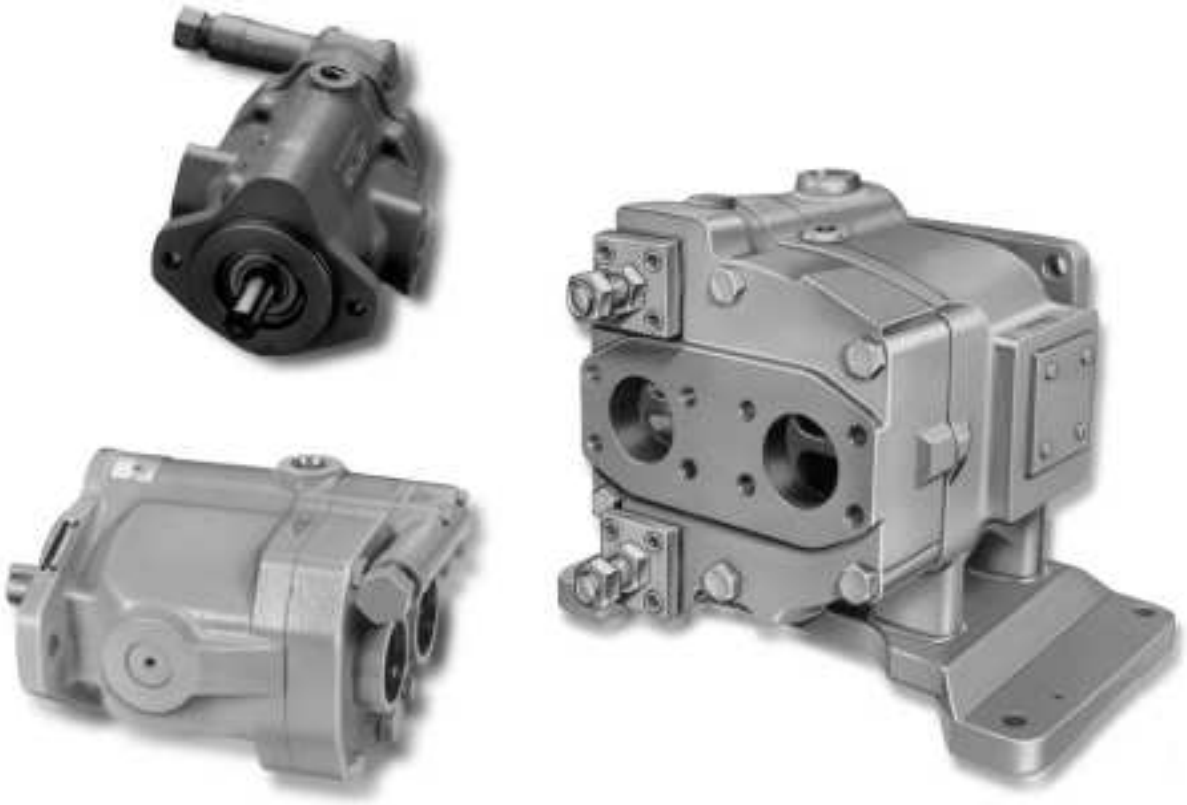
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Vickers®

Piston Pumps

Axial Piston Pumps

Fixed and Variable Displacement
PFB 5, PFB 10, PFB 20
PVB 5/6, PVB 10/15, PVB 20/29, PVB 45 and PVB 90 to SAE
PVB 5/6, PVB 10/15, PVB 20/29 to DIN/ISO 3019, Part 2



GB-2379B

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Installation data A.33

Basic Characteristics

Type . . . . . Axial piston pumps
Operating pressure . . . . . up to 210 bar (3000 psi)
Displacement . . . . . 10,5 to 197,5 cm^3/r (0.64 to 12 in^3/r)
Drive speed . . . . . up to 3600 r/min

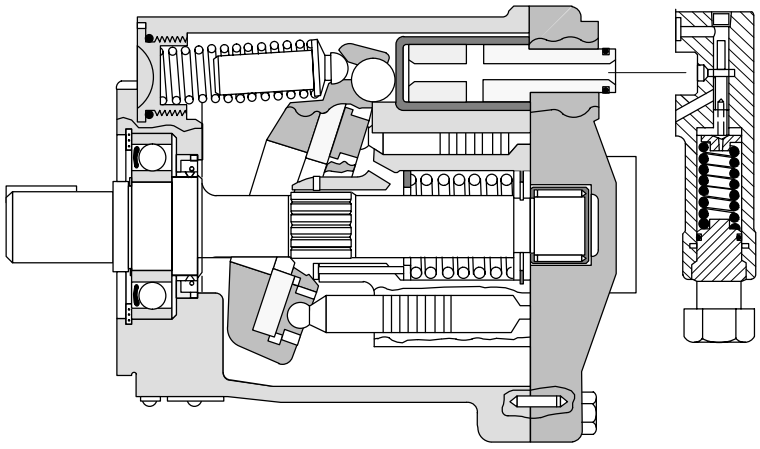
General Description

Both fixed and variable displacement models make up this range of axial piston pumps. Their high performance ratings and efficiencies are achieved with a variety of hydraulic fluids. Fixed displacement models are noted for their volumetric and mechanical efficiencies. Variable displacement models can closely match pressure and/or flow demand with a control selected from:

- Pressure compensator with or without a remote control facility.
- Pressure compensator with adjustable displacement control.
- Load sensing compensator.
- Mechanical (lever) control.
- Handwheel control

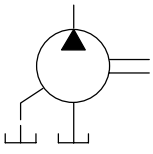
Typical Section

Variable displacement model with compensator control “C” or “CM”



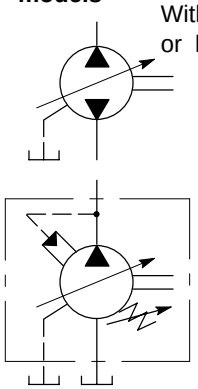
Functional Symbols

PFB
Fixed displacement models

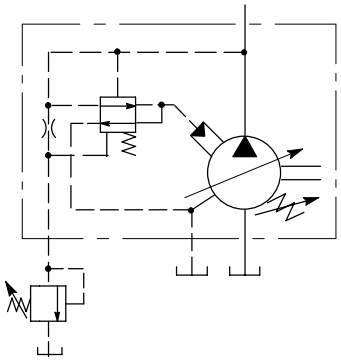


PVB
Variable displacement models

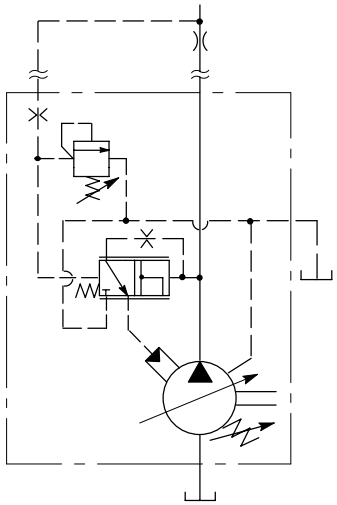
With handwheel, or lever.



With pressure compensator (C or CM) (simplified symbol)



With pressure compensator arranged for remote control C(M)G (detailed symbol)



With CVP load sensing and pressure limiter

Model Codes

P * B ** - (F) - (M) * * (F)(X) (*) - ** - ** - (C) - (G) - (L) - ** - **

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

1 Basic models

F = Fixed displacement type
V = Variable displacement type

2 Displacement

PFB and PVB models:
5 = 10,55 cm^3/r (0.64 in^3/r)
10 = 21,10 cm^3/r (1.29 in^3/r)
20 = 42,80 cm^3/r (2.61 in^3/r)
PVB models only:
6 = 13,81 cm^3/r (0.84 in^3/r)
15 = 33,00 cm^3/r (2.01 in^3/r)
29 = 61,60 cm^3/r (3.76 in^3/r)
45 = 94,50 cm^3/r (5.76 in^3/r)
90 = 197,50 cm^3/r (12.0 in^3/r)

3 Foot mounting option

F = Foot mounting option for PVB45 and PVB90 models.
Omit for flange mounting.
***Note**. For foot mounting brackets. for other models see bottom of page.*

4 Mounting flange

M = Metric, to DIN/ISO 3019, Part 2 and VDMA 24560, Part 1
Omit for SAE mounting flange

5 Shaft rotation

Viewed at shaft end
R = Clockwise
L = Anticlockwise (not avalable for PFB10 and PFB20)

6 Displacement zone

PVB models only.
S = One side of center (pressure compensated models only)
D = Both sides of center (Handwheel and lever controlled models only)
Omit for PFB models.

7 Flanged main ports

F = PVB45 and PVB90 models only.
Omit for P*B5 to 29 inclusive.

8 Thru shaft option

PVB5 to 29 only:
X = Thru shaft (with side entry ports)
Omit for PVB45 and PVB 90, or if not required.

9 Shaft type

N = Metric, to DIN/ISO 3019, Part 2 and VDMA 24560, Part 1
Y = SAE models P*B5 to 15 only.
Omit for 20 thru 90 models

10 Pump design number

10 = PFB20
30 = PFB10
31 = PVB10 and PVB15
20 = all other models

11 Displacement control options

PVB models only.
C = Pressure compensator. Pressure adjustment range:
PVB90: 19 to 210 bar (275 to 3000 psi)
All other models: 17 to 210 bar (250 to 3000 psi)
Also used as prefix for item 12
***Note**. For PVB6, 15 and 29 models, the user must ensure that the max. pressure setting never exceeds 140 or 100 bar (2000 or 1500 psi) dependent on the type of fluid being used.*

CM = Pressure compensator. Option for all sizes except PVB90. Pressure adjustment range:
PVB45: 10 to 100 bar (150 to 1500 psi)
All other sizes: (17 to 100 bar (250 to 1500 psi)
CVP = Load sensing with pressure limiter.

PVB5 to 15 only:
H = Handwheel control
M = Lever control
V = No control (As for “M” type but without lever.)
Omit for PFB models.

12 Maximum displacement adjustment

PVB5 to 29 models only:
C = “C” or “CM”compensator, and with 12
Omit when not required.

13 Pressure compensator variations

PVB5 to 29 models only:
G = Remotely adjustable pressure setting.
Omit when not required.

14 Control location

PVB5 to 15 models with “H”, “M” or “V” controls only:
L = Left hand, when viewed at shaft end.
Omit for right hand, or when a pressure compensator is fitted.

15 Control design number

PVB models only.
10 = “H” and “M”controls; also “C” control for PVB90
11 = “C” and “CM” controls.
12 = “CVP” control.
20 = “CG” control.

16 Special design options

For PFB5 and PVB5 to 29 only:.
S.30 = Extra drain port to permit vertical “shaft-up” installation.

For PVB5 to PVB29 pressure compensated models only:
GE1 = 10% minimum displacement. when pressure compensated.

For all models:
GEVS= Pressure setting knob with key lock.

Omit when not required.

Foot bracket mounting kits

Order separately if required. Kits include pump fixing bolts.

Model code	Part number	For pump sizes:
FB-A-10	422582	P*B5/6
FB-B-10	422583	P*B10/15 and PFB20
FB-C-10	422584	PVB20/29

Operating Data

Pressure and Speed Limits

Basic model designation	Geometric dispalcement, cm^3/r (in^3/r)	Maximum shaft speed (r/min)			Maximum outlet pressure, bar (psi)		
		Anti-wear hydraulic oil	Water-in–oil emulsion (40%/60%)	Water-glycol	Anti–wear hydraulic oil	Water glycol	Water-in–oil emulsion (40%/60%)
PFB5	10,55 (0.64)	3600			210 (3000)		
PFB10	21,10 (1.29)	3200	1800	1800	210 (3000)	175 (2500)	175 (2500)
PFB20	42,80 (2.61)	2400			175(2500)		
PVB5	10,55 (0.64)				210 (3000)	140 (2000)	140 (2000)
PVB6	13,81 (0.84)				140 (2000)	100 (1500)	100 (1500)
PVB10	21,10 (1.29)				210 (3000)	140 (2000)	140 (2000)
PVB15	33,00 (2.01)	1800	1800	1800	140 (2000)	100 (1500)	100 (1500)
PVB20	42,80 (2.61)				210 (3000)	140 (2000)	140 (2000)
PVB29	61,60 (3.76)				140 (2000)	100 (1500)	100 (1500)
PVB45	94,50 (5.76)				210 (3000)	140 (2000)	140 (2000)
PVB90	197,50 (12.0)	1800	1200	1200	210 (3000)	140 (2000)	140 (2000)

Maximum Inlet Pressure

All pumps except PVB5/6/10/15 with H, M or V controls . . . . . 1,0 bar (15 psi)
PVB5/6/10/15 with H, M or V controls . . . . . As “Max. outlet pressure” above for appropriate size.

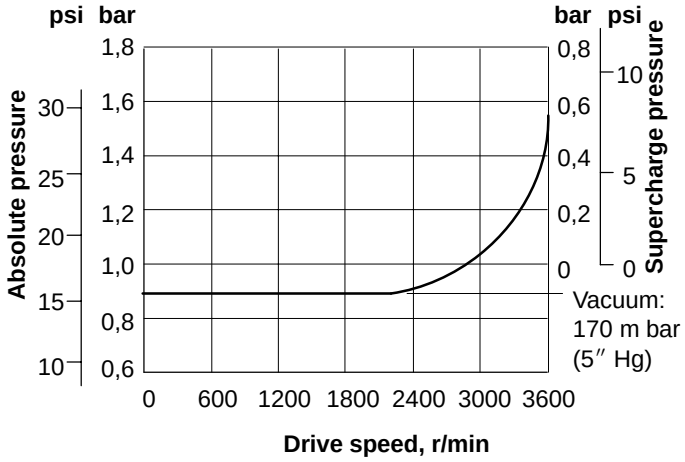
Case Drain Pressure

See “Installation data” section, on page A.33.

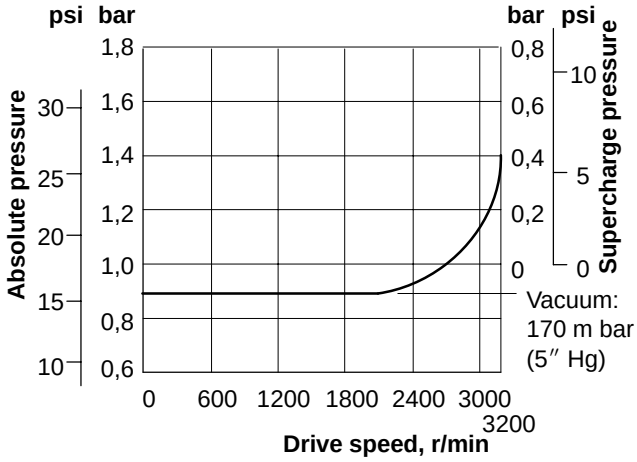
Minimum Inlet Pressure

See following graphs.
Based on oil viscosity of 21 cSt (102 SUS) and at 50°C (120°F).

PFB5 and PVB5

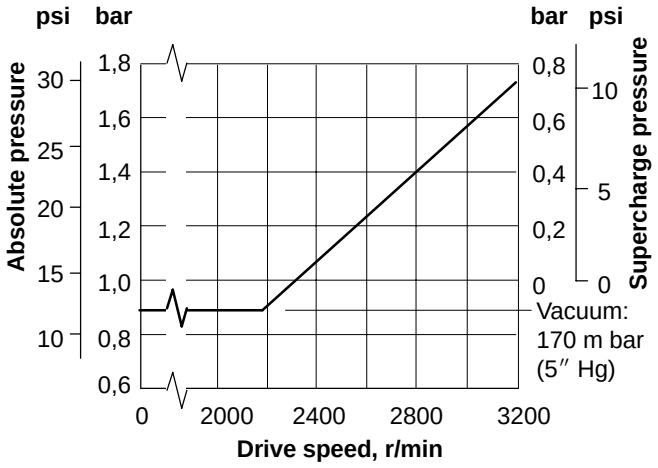


PVB6

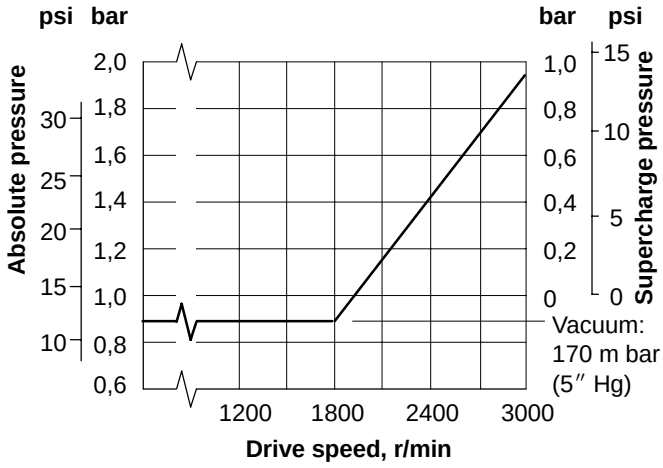


Operating Data Minimum Inlet Pressure (cont'd)

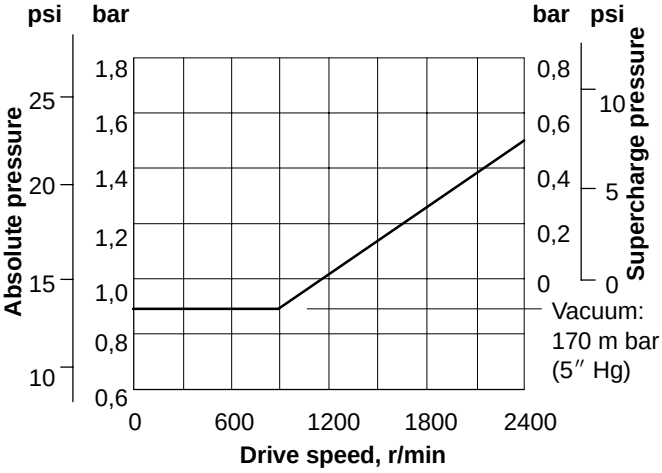
PFB10 and PVB10



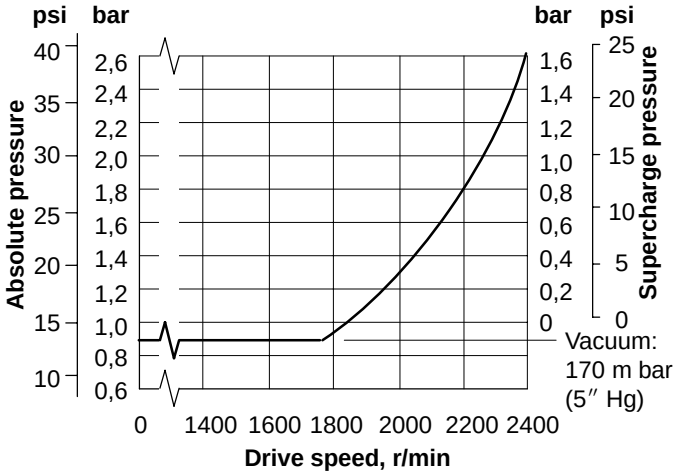
PVB15



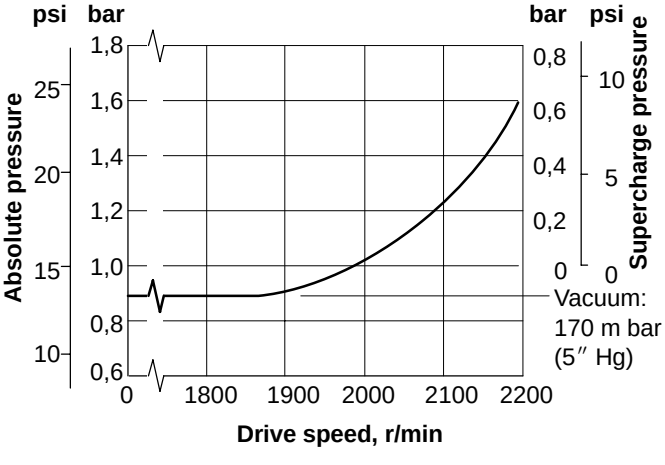
PFB20



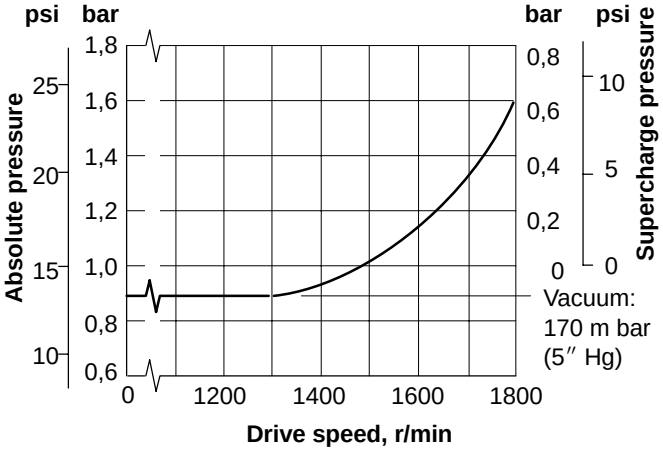
PVB20 and PVB29



PVB45



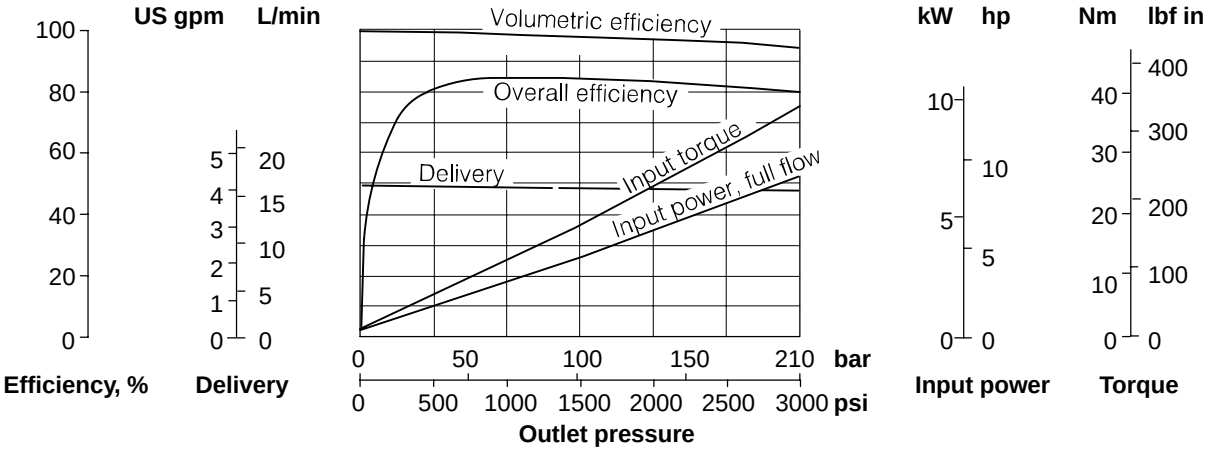
PVB90



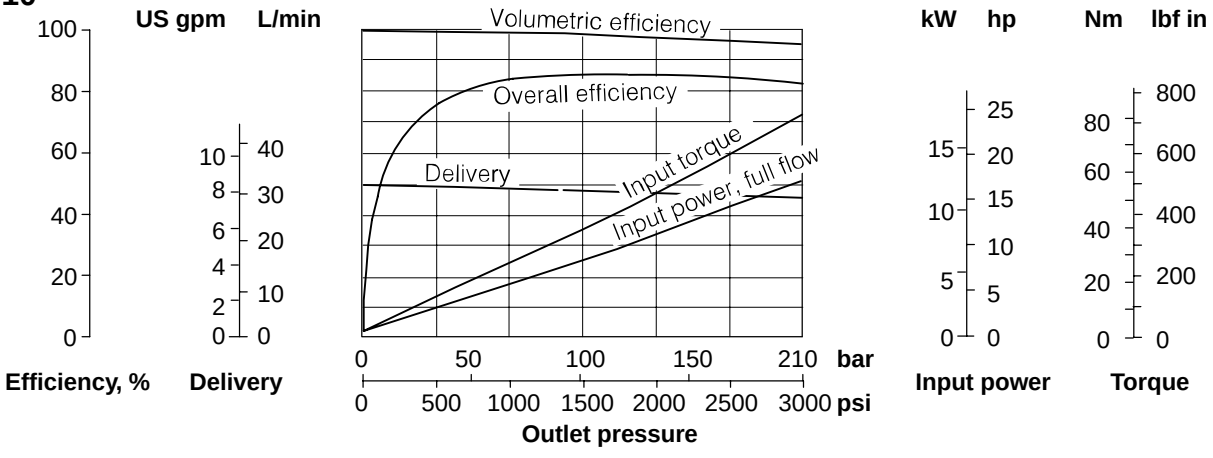
Performance Data at 1500 r/min Drive Speed

With oil at 21cSt (102 SUS) and at 49°C (120°F): Atmospheric inlet
For data at drive speed of 1800 r/min, see pages A.11 to A.14

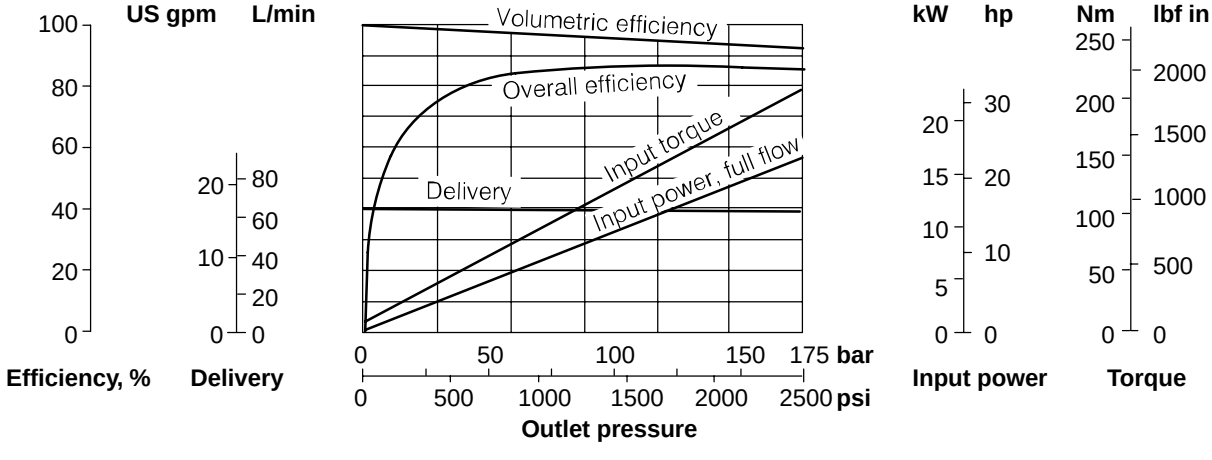
PFB5



PFB10



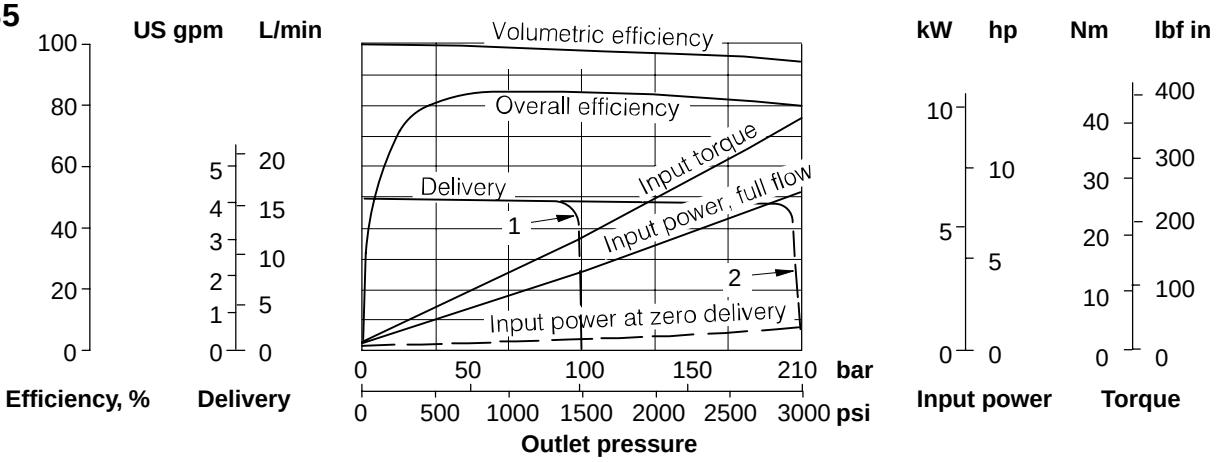
PFB20



Performance Data at 1500 r/min Drive Speed (cont'd)

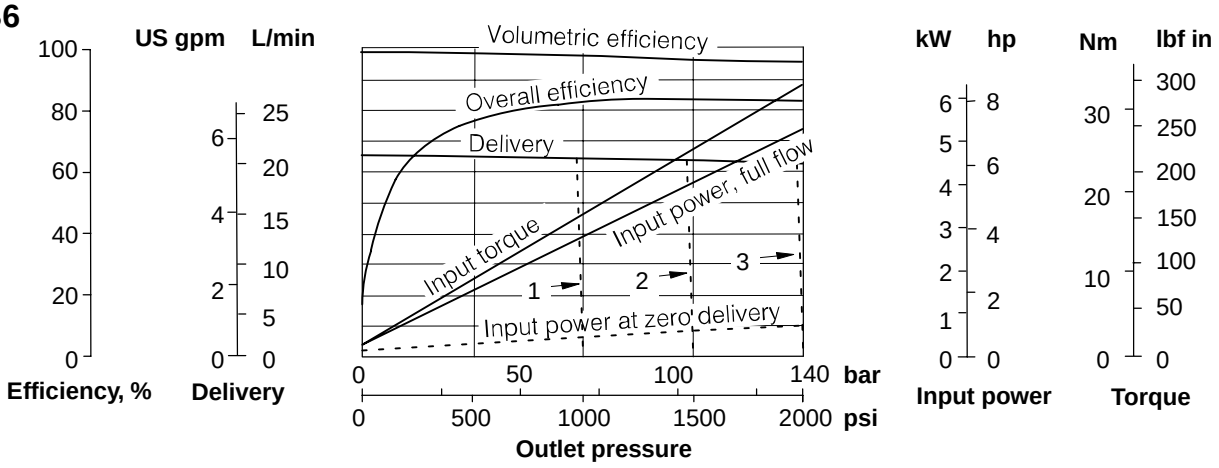
With oil at 21cSt (102 SUS) and at 49°C (120°F): Atmospheric inlet
For data at drive speed of 1800 r/min, see pages A.11 to A.14

PVB5



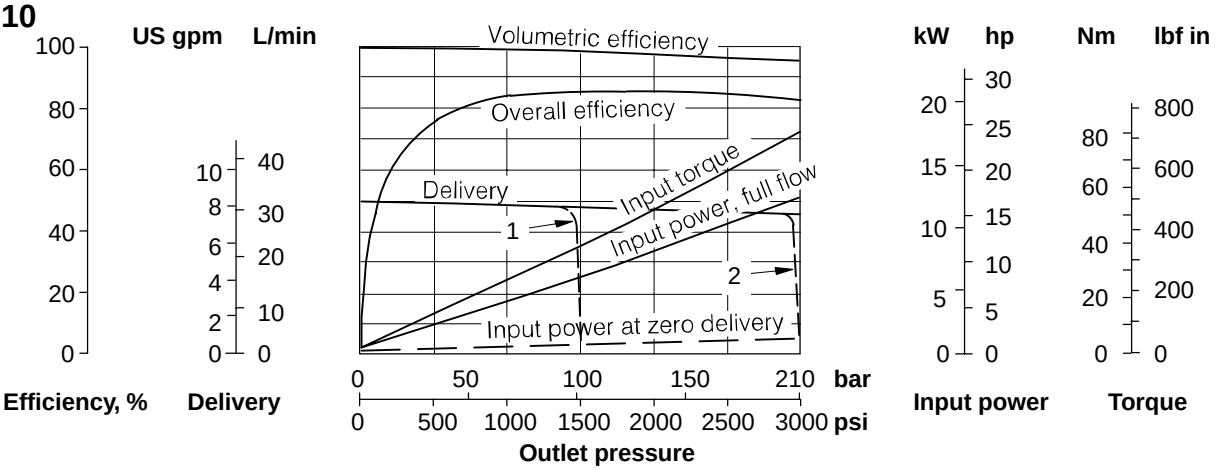
1 = Delivery with compensator setting of 100 bar (1500 psi)
2 = Delivery with compensator setting of 200 bar (3000 psi)

PVB6



1 = Delivery with compensator setting of 70 bar (1000 psi)
2 = Delivery with compensator setting of 100 bar (1500 psi)
3 = Delivery with compensator setting of 140 bar (2000 psi)

PVB10

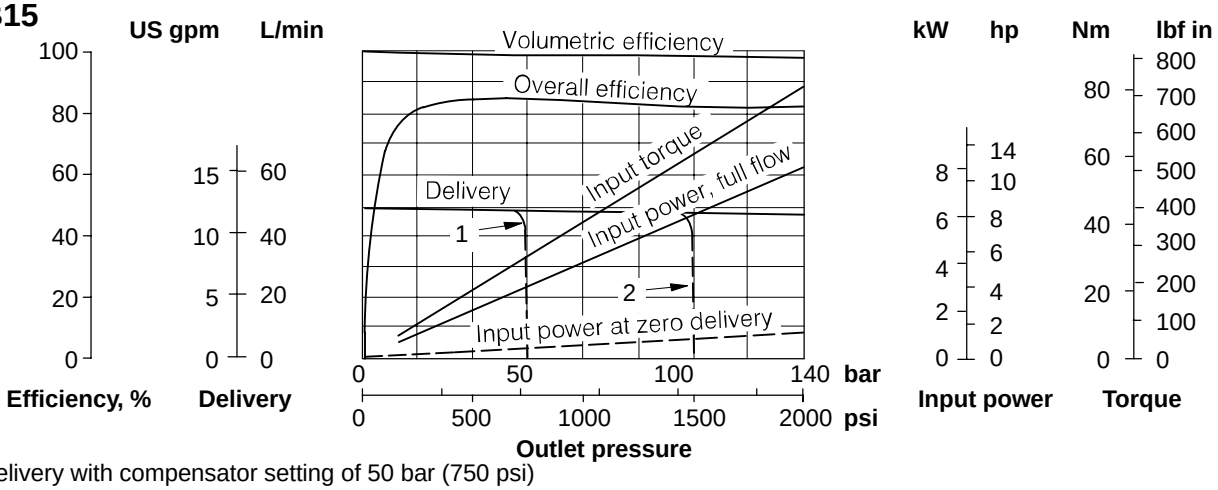


1 = Delivery with compensator setting of 100 bar (1500 psi)
2 = Delivery with compensator setting of 200 bar (3000 psi)

Performance Data at 1500 r/min Drive Speed (cont'd)

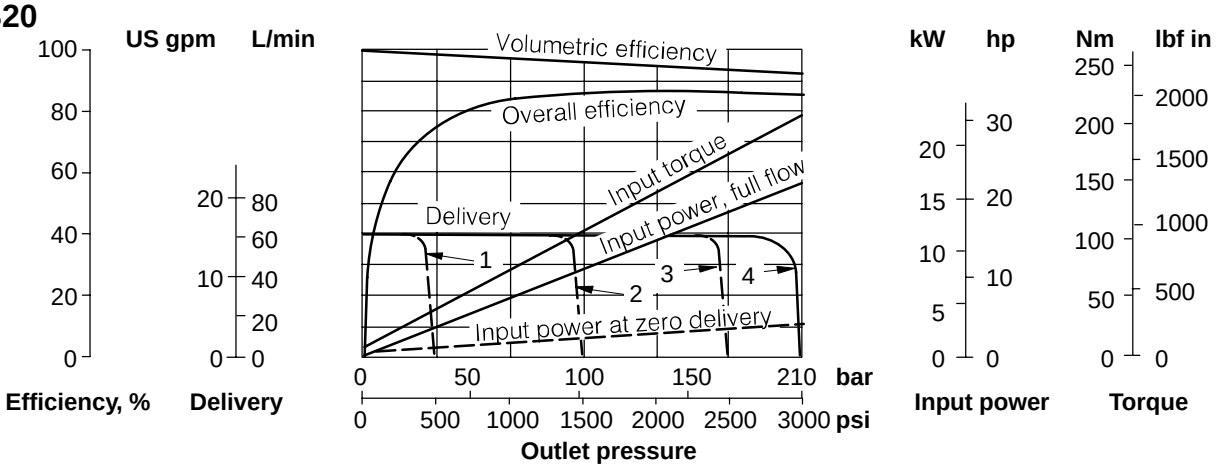
With oil at 21cSt (102 SUS) and at 49°C (120°F): Atmospheric inlet
For data at drive speed of 1800 r/min, see pages A.11 to A.14

PVB15



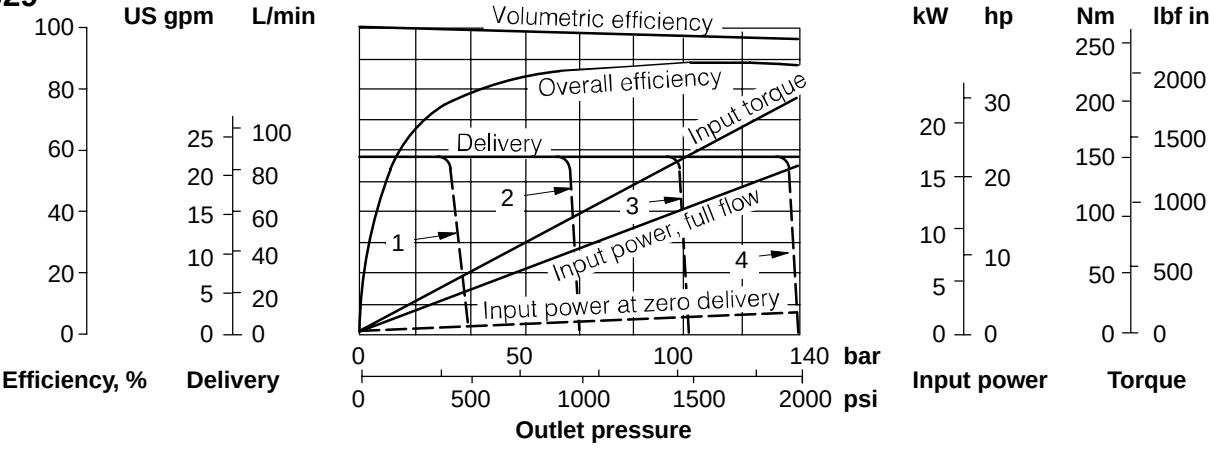
1 = Delivery with compensator setting of 50 bar (750 psi)
2 = Delivery with compensator setting of 100 bar (1500 psi)

PVB20



1 = Delivery with compensator setting of 35 bar (500 psi)
2 = Delivery with compensator setting of 100 bar (1500 psi)
3 = Delivery with compensator setting of 175 bar (2500 psi)
4 = Delivery with compensator setting of 200 bar (3000 psi)

PVB29

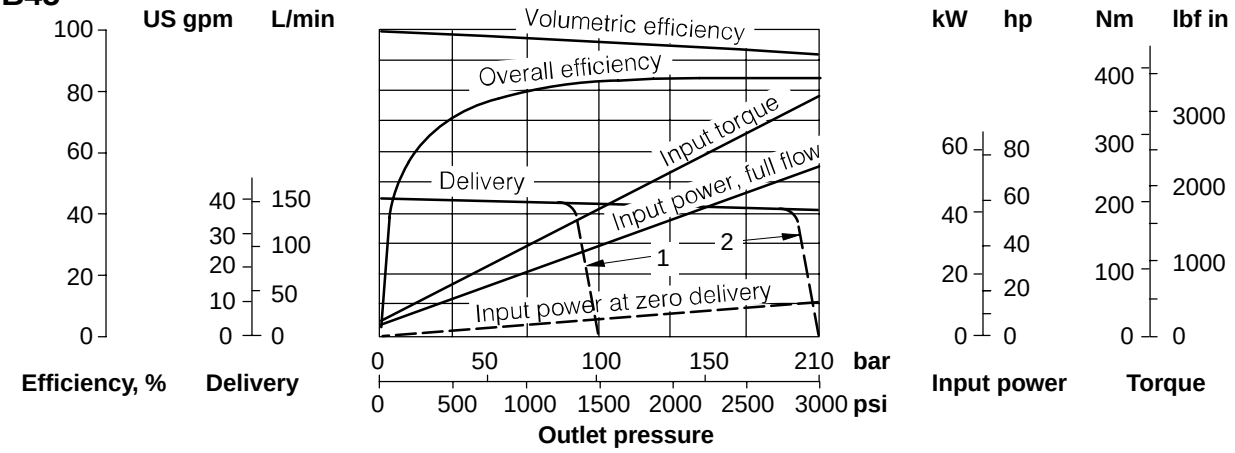


1 = Delivery with compensator setting of 35 bar (500 psi)
2 = Delivery with compensator setting of 100 bar (1500 psi)
3 = Delivery with compensator setting of 175 bar (2500 psi)
4 = Delivery with compensator setting of 200 bar (3000 psi)

Performance Data at 1500 r/min Drive Speed (cont'd)

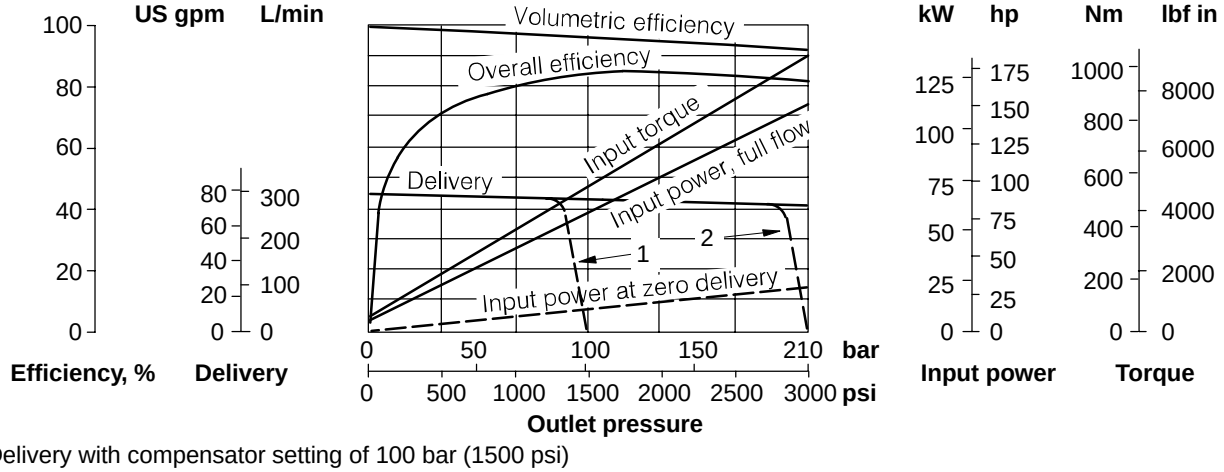
With oil at 21cSt (102 SUS) and at 49°C (120°F): Atmospheric inlet
For data at drive speed of 1800 r/min, see pages A.11 to A.14

PVB45



1 = Delivery with compensator setting of 100 bar (1500 psi)
2 = Delivery with compensator setting of 200 bar (3000 psi)

PVB90

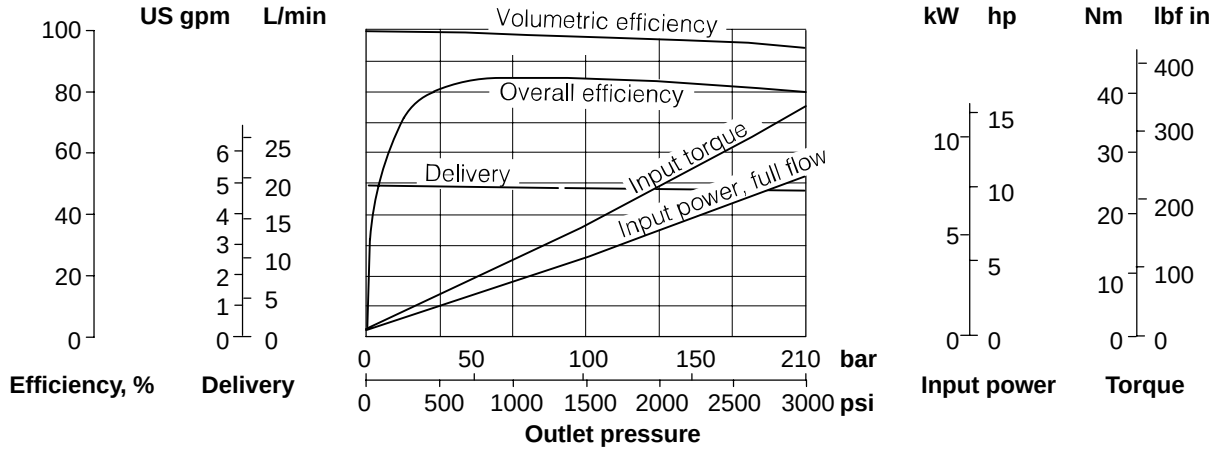


1 = Delivery with compensator setting of 100 bar (1500 psi)
2 = Delivery with compensator setting of 200 bar (3000 psi)

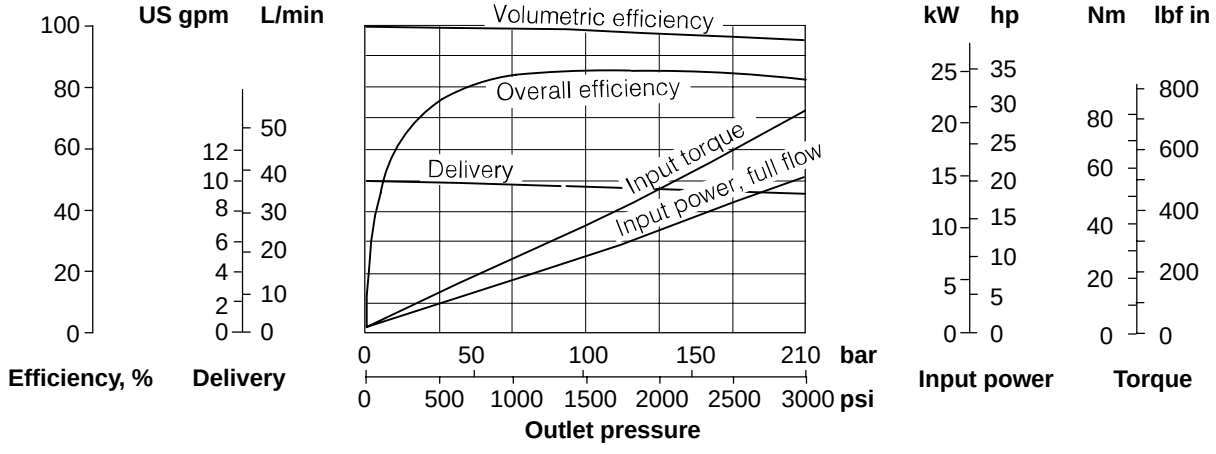
Performance Data at 1800 r/min Drive Speed

With oil at 21cSt (102 SUS) and at 49°C (120°F): Atmospheric inlet
For data at drive speed of 1500 r/min, see pages A.7 to A.10

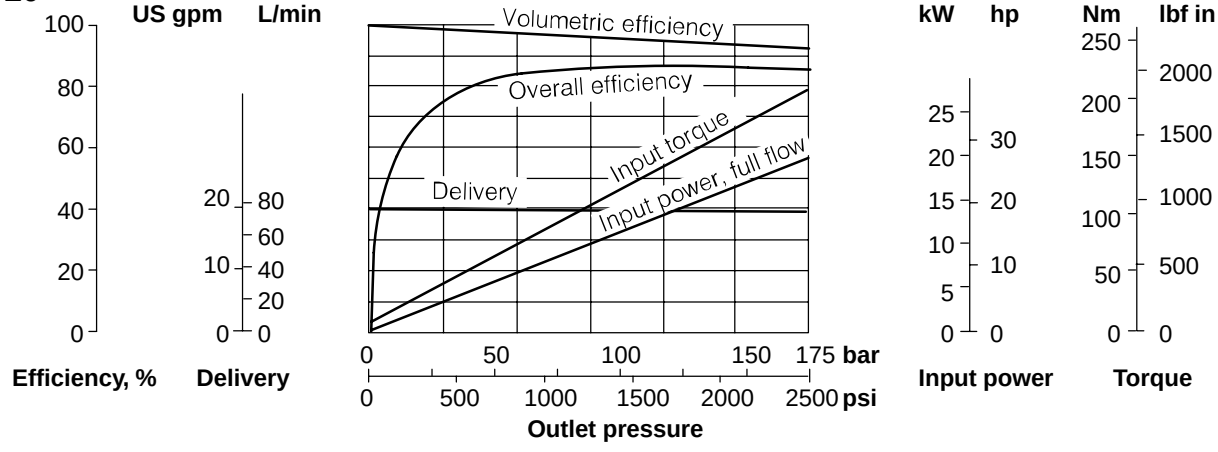
PFB5



PFB10



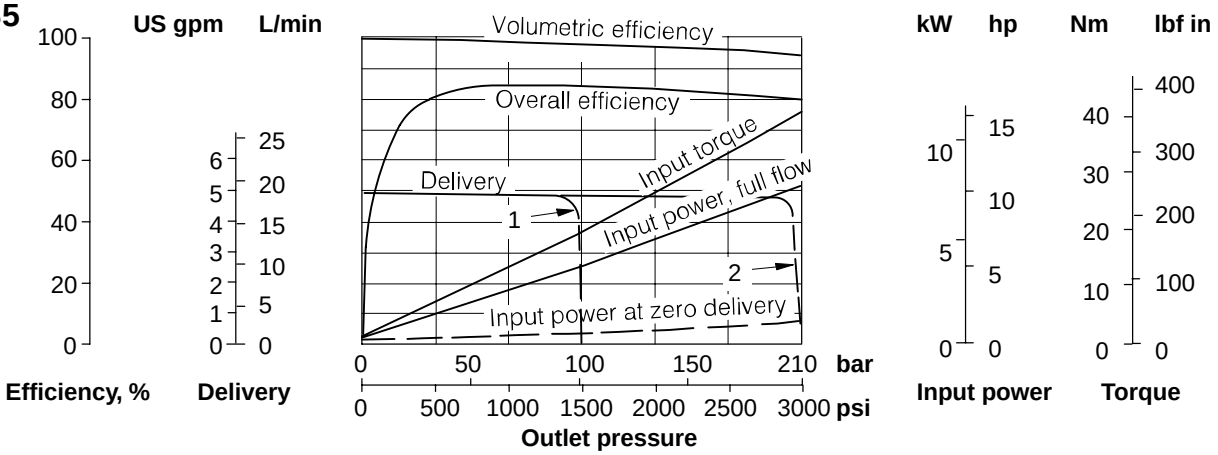
PFB20



Performance Data at 1800 r/min Drive Speed (cont'd)

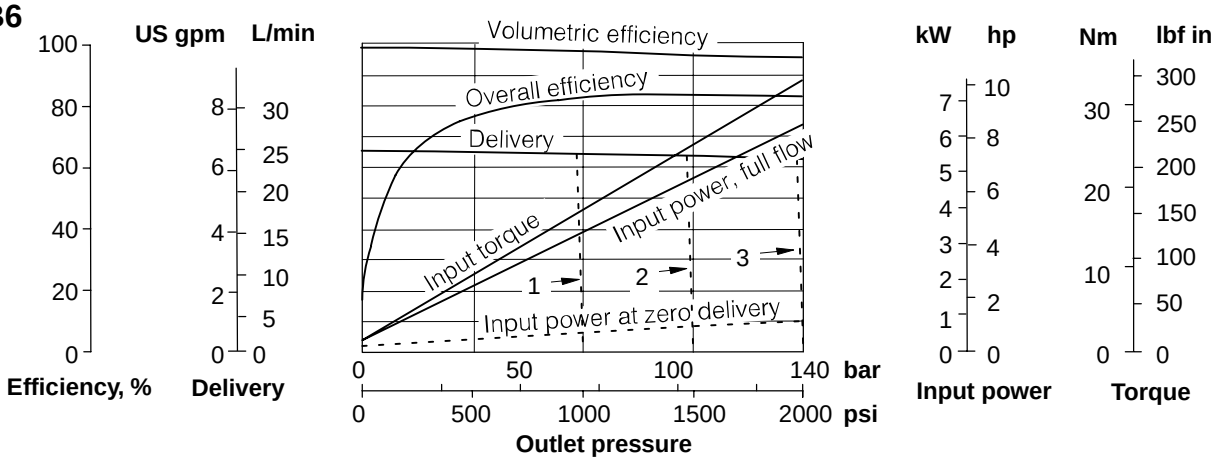
With oil at 21cSt (102 SUS) and at 49°C (120°F): Atmospheric inlet
For data at drive speed of 1500 r/min, see pages A.7 to A.10

PVB5



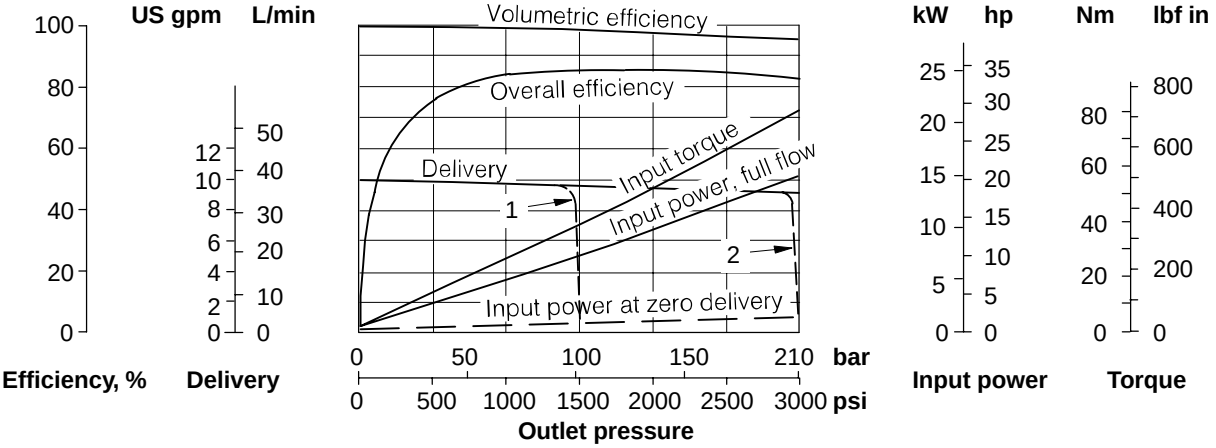
1 = Delivery with compensator setting of 100 bar (1500 psi)
2 = Delivery with compensator setting of 200 bar (3000 psi)

PVB6



1 = Delivery with compensator setting of 70 bar (1000 psi)
2 = Delivery with compensator setting of 100 bar (1500 psi)
3 = Delivery with compensator setting of 140 bar (2000 psi)

PVB10

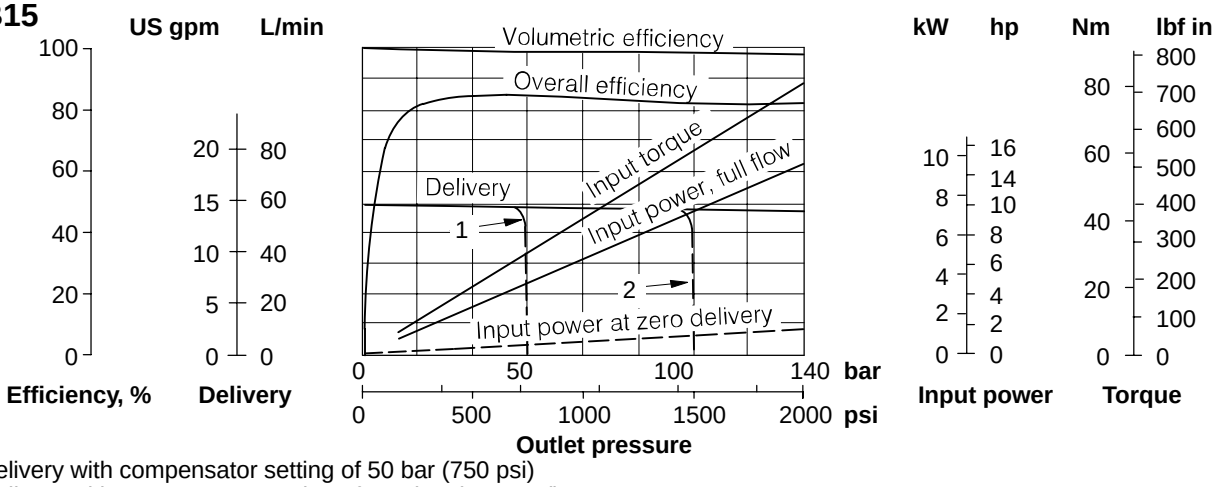


1 = Delivery with compensator setting of 100 bar (1500 psi)
2 = Delivery with compensator setting of 200 bar (3000 psi)

Performance Data at 1800 r/min Drive Speed (cont'd)

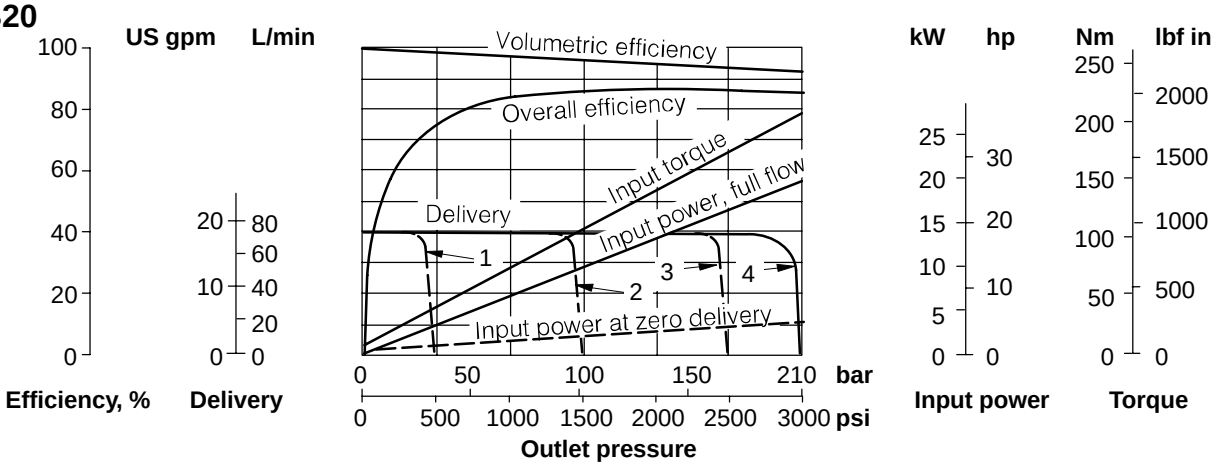
With oil at 21cSt (102 SUS) and at 49°C (120°F): Atmospheric inlet
For data at drive speed of 1500 r/min, see pages A.7 to A.10

PVB15



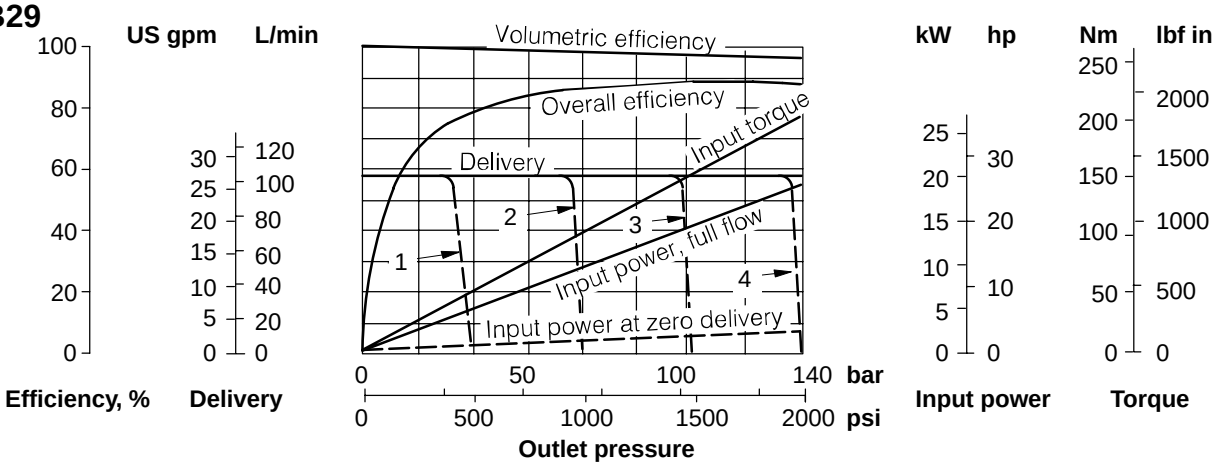
1 = Delivery with compensator setting of 50 bar (750 psi)
2 = Delivery with compensator setting of 100 bar (1500 psi)

PVB20



1 = Delivery with compensator setting of 35 bar (500 psi)
2 = Delivery with compensator setting of 100 bar (1500 psi)
3 = Delivery with compensator setting of 175 bar (2500 psi)
4 = Delivery with compensator setting of 200 bar (3000 psi)

PVB29



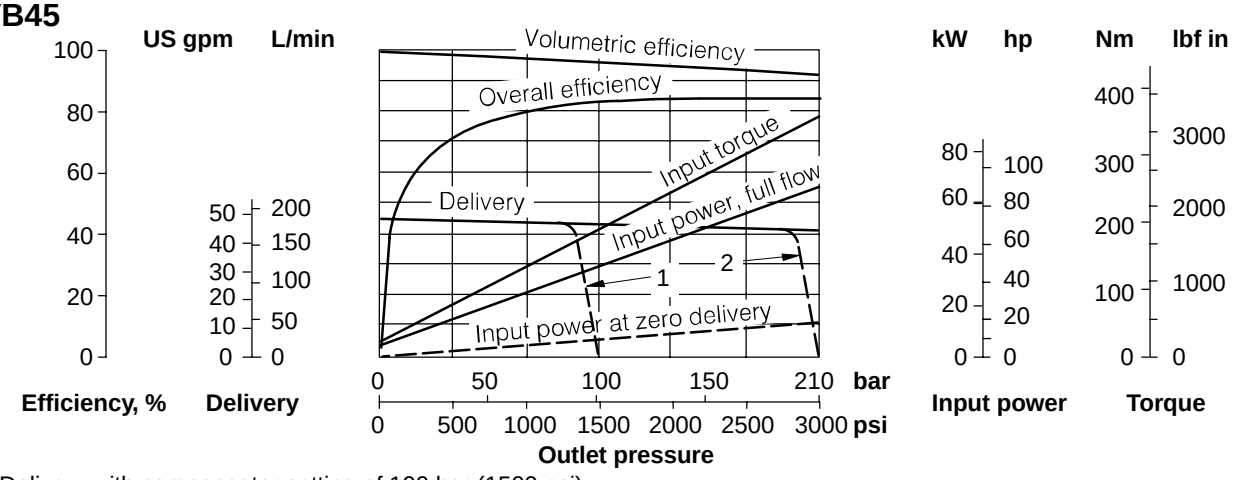
1 = Delivery with compensator setting of 35 bar (500 psi)
2 = Delivery with compensator setting of 100 bar (1500 psi)
3 = Delivery with compensator setting of 175 bar (2500 psi)
4 = Delivery with compensator setting of 200 bar (3000 psi)

Performance Data at 1800 r/min Drive Speed (cont'd)

With oil at 21cSt (102 SUS) and at 49°C (120°F): Atmospheric inlet

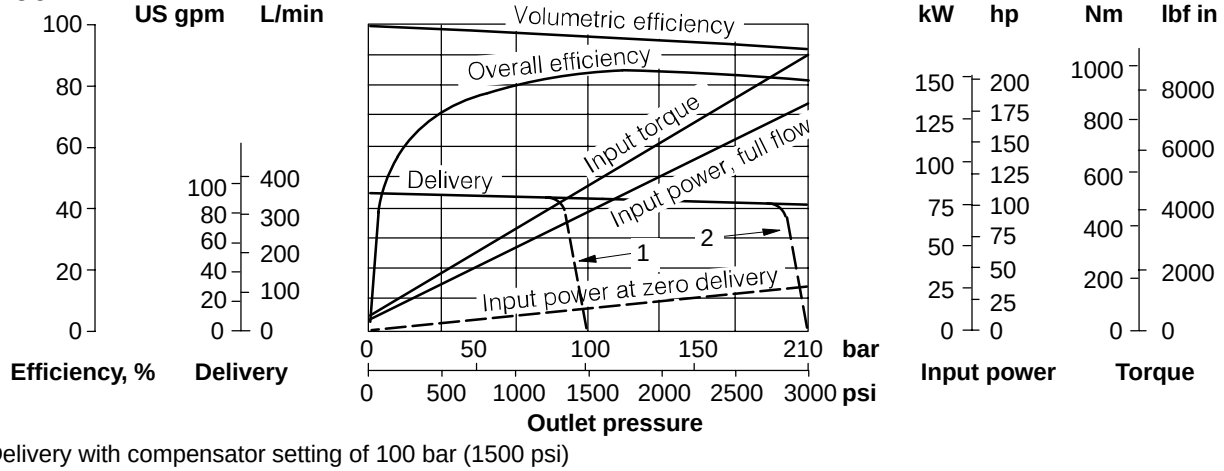
For data at drive speed of 1500 r/min, see pages A.7 to A.10

PVB45



1 = Delivery with compensator setting of 100 bar (1500 psi)
2 = Delivery with compensator setting of 200 bar (3000 psi)

PVB90



1 = Delivery with compensator setting of 100 bar (1500 psi)
2 = Delivery with compensator setting of 200 bar (3000 psi)

Control Data for PVB Pumps

Controls available as indicated in “Model Code” section.

“C” and “CM” Pressure Compensators
Automatically adjusts pump delivery at pre-adjusted pressure to match system demand. Delivery can decrease rapidly from maximum to zero through a pressure gradient typically 4 to 6 bar (60 to 90 psi) with normal circuit volumes.

For pressure adjustment ranges see “Model Code”.
Note:
1. When using PVB6, 15 or 29 pumps with “C” type compensators ther user must ensure that the maximum pressure setting never exceeds 140 or 100 bar (2000 or 1500 psi) dependent on the type of fluid being used.

   ***Caution**. It is possible to mechanically adjust the compensator up to 210 bar (3000 psi)*.
2. It is recommended that, as for other types of positive pump, a relief valve should be fitted externally as protection against overloads. Where a relatively large amount of fluid is directly subject to compensator pressure, it may be possible to omit the relief valve. Consult your Vickers representative.

“CC” and “CMC” Pressure Compensators with Adjustable Max. Displacement Stop
The pressure compensator section performs as described above. The adjustable stop allows the maximum pump delivery to be adjusted between 25 to 100%. To assist priming, adjust the stop setting to provide at least 40% of the maximum displacement.

“CG” Pressure Compensator, Remotely Controlled
Same as the “C” compensator, but arranged for remote pressure adjustment by suitable pilot controls. One or more pilot relief valves (e.g. C-175-*) and/or pilot directional valves, in series or in parallel, can provide many varied remote pilot systems.

Your Vickers representative will be pleased to advise on optimum arrangements for individual applications.

“CV” Load Sensing Comensator, Remotely Controlled
Automatically matches pump delivery to system demand at a pressure approximately 17 bar (250 psi) above load pressure. This pressure difference can be created by:
– a variable flow restrictor (non-compensated flow control) or the spool opening of a directional control valve.

Both forms can be used with fixed and variable speed pump drives. In the latter case a fixed restrictor can provide pre-set, near-constant pump flow independent of drive speed, provided that the speed exceeds that which gives the required flow at full displacement. An external pressure limiter must be added to prevent overloading the pump; see “Functional Symbols” page A.3.

The matching of pump pressure and delivery to system demands provides power matching and conservation by minimizing system power wastage.

“H” Handwheel Control
Provides manual variation or selection of pump delivery. The control can be operated on both sides of center permitting bi-directional flow characteristics.
Approximate change of displacement per one turn of handwheel is:
PVB5 . . . . . 2,6 cm^3 (0.16 in^3)
PVB6 . . . . . 3,4 cm^3 (0.21 in^3)
PVB10 . . . . . 5,2 cm^3 (0.32 in^3)
PVB15 . . . . . 8,2 cm^3 (0.5 in^3)

“M” Lever Control
Provides mechanical or manual variation of pump delivery in approximate proportion to the angular movement from the center position. This control may be operated on both sides of center permitting bi-directional flow characteristics. The pintle-mounted lever control must be secured by suitable linkage to maintain desired settings; both extremes of pintle travel are limited by internal stops to approx. 17.5° from center.

Control torques (approx. at 1500 r/min).
PVB5 . . . . . 3,8 Nm @ 210 bar (33 lbf in at 3000 psi)
PVB6 . . . . . 2,7 Nm @ 138 bar (24 lbf in at 2000 psi)
PVB10 and PVB15 . . 7,5 Nm @ 70 bar (66 lbf in at 1000 psi)

***Note:** Torque varies with pressure and speed.*

“GE1” Minimum Displacement Control
Option for C(M)(C) and CG(C) compensators to limit the minimum displacement, in the fully compensated mode, to nominally 10% of full displacement.

Hydraulic Fluids
All pumps can be used with anti-wear hydraulic oils, water glycols and water-in-oil (invert) emulsions. It is possible to use these pumps with high water base fluids (e.g. 5%/95% oil-in-water emulsion) at pressures up to 70 bar (1000 psi). However, first consult your Vickers representative.

The extreme operating viscosity range is from 220 to 13 cSt (1020 to70 SUS) for all pumps (except where 5%/95% emulsions are used). The recommended running range is 54 to 13 cSt. (245 to 70 SUS)

The viscosity of 5%/95% emulsions is near-constant at about 1 or 2 cSt (<35 SUS).

Temperature Limits
Minimum ambient . . . . . –20°C (–4°F)
Maximum ambient. . . +70°C (+158°F)

Fluid Temperatures

	Mineral oil	Water-containing
Mininmum	–20°C (–4°F)	+10°C (+50°F)
Maximum*	+80°C (+176°F)	+54°C (+129°F)

** To obtain maximum service life from both fluid and hydraulic system, 65°C (150°F) normally is the maximum temperature except for water-containing fluids. Whatever the actual temperature range, ensure that viscosities stay within the limits specified in "Hydraulic Fluids" section.*

Drive Requirements:
- Direction of Rotation
Clockwise or anti-clockwise (viewed at shaft end) to order; see also "Model Code", and "Installation Dimensions" sections.

- Drive Methods
Direct co-axial drive through a suitable flexible coupling is preferred. If an indirect drive is to be used, first consult your Vickers representative.

Filtration Requirements
20/18/14 or ISO 18/14..

Noise Levels

* Typical values equivalent to NFPA

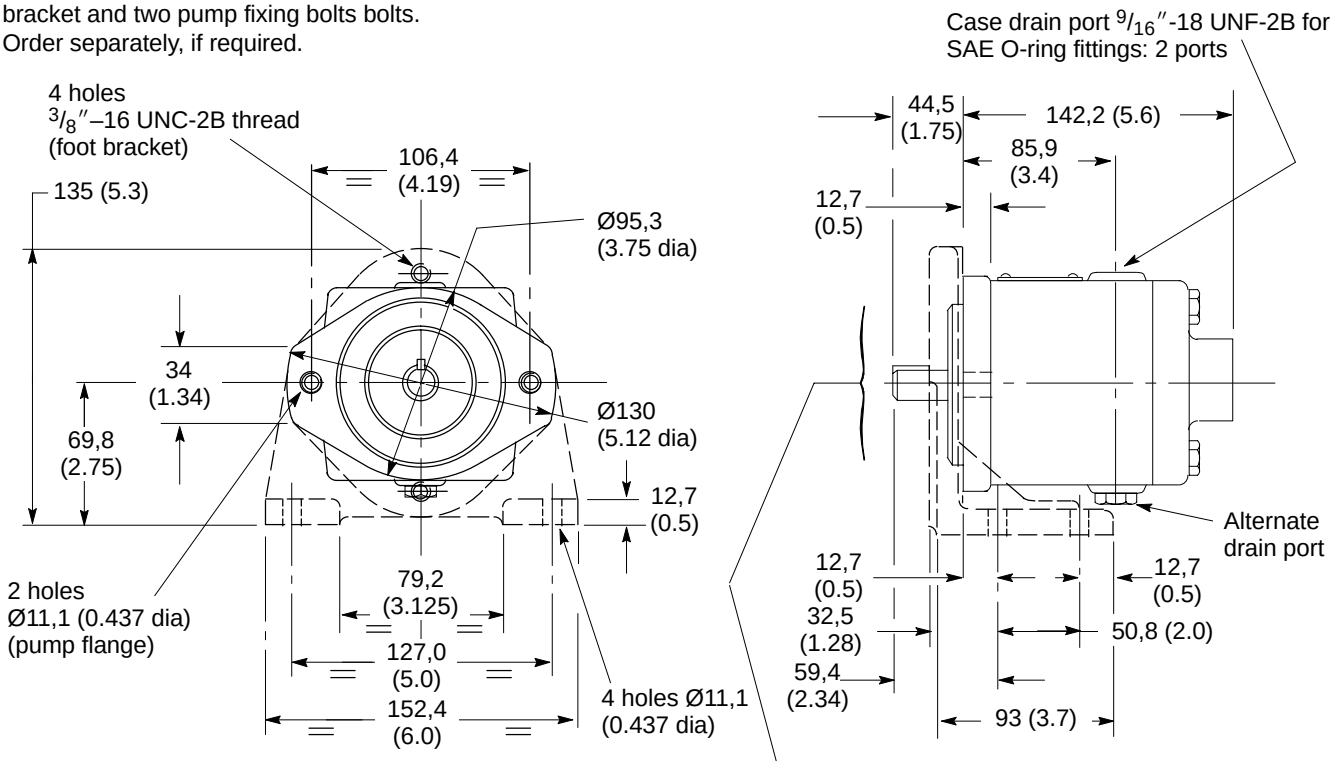
Speed r/min	Pressure bar (psi)	Stroke	Noise level – dB(A)*					
			PVB5	PVB6	PVB10	PVB15	PVB20	PVB29
1000	35 (500)	Full flow	51	52	54	58	–	–
		Cutoff	51	51	44	47	–	–
	70 (1000)	Full flow	54	55	56	60	–	–
		Cutoff	52	54	49	54	–	–
	140 (2000)	Full flow	56	57	60	62	–	–
		Cutoff	58	56	55	59	–	–
	210 (3000)	Full flow	60	–	61	–	–	–
		Cutoff	59	–	59	–	–	–
1200	35 (500)	Full flow	50	51	55	60	–	–
		Cutoff	52	51	48	51	–	–
	70 (1000)	Full flow	54	55	57	61	74	70
		Cutoff	56	57	51	54	–	–
	140 (2000)	Full flow	59	59	60	63	74	73
		Cutoff	59	60	54	58	69	76
	210 (3000)	Full flow	60	–	62	–	78	–
		Cutoff	61	–	56	–	–	–
1500	35 (500)	Full flow	54	54	58	63	–	–
		Cutoff	52	52	51	52	–	–
	70 (1000)	Full flow	58	58	60	64	–	–
		Cutoff	57	57	55	55	–	–
	140 (2000)	Full flow	61	62	62	66	–	–
		Cutoff	62	59	62	59	–	–
	210 (3000)	Full flow	64	–	65	—	–	–
		Cutoff	62	–	63	—	–	–
1800	35 (500)	Full flow	57	58	61	64	–	–
		Cutoff	55	57	55	56	–	–
	70 (1000)	Full flow	60	61	63	67	76	77
		Cutoff	59	58	59	60	–	–
	140 (2000)	Full flow	63	66	65	69	81	81
		Cutoff	62	63	62	64	75	81
	210 (3000)	Full flow	64	–	67	–	81	–
		Cutoff	64	–	65	–	–	–

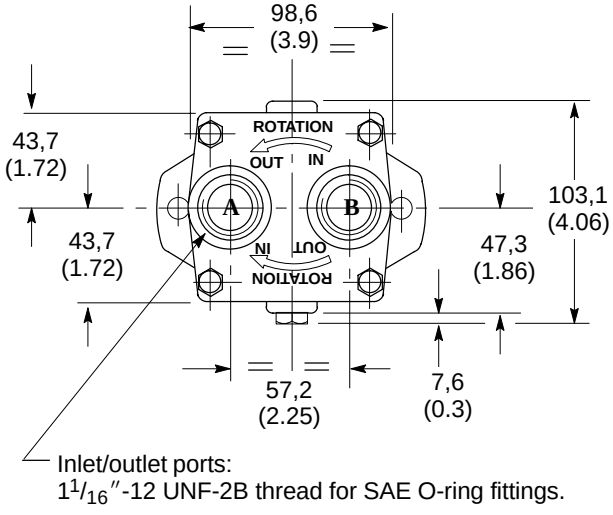
PFB5 SAE Flange Mounting

3rd angle projection

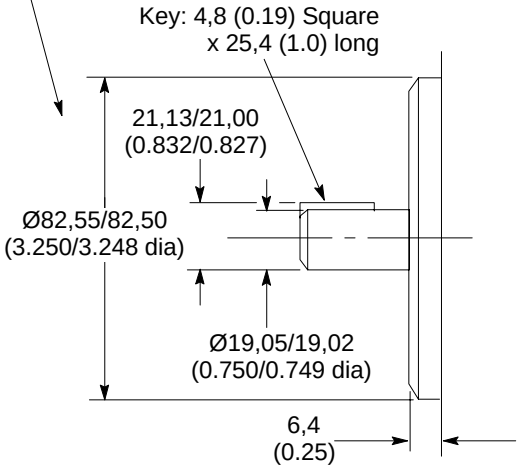
Installation Dimensions in mm (inches)

Optional foot bracket, shown in dashed outline; kit FB-A-10 comprises foot bracket and two pump fixing bolts bolts. Order separately, if required.





View on rear end of pump

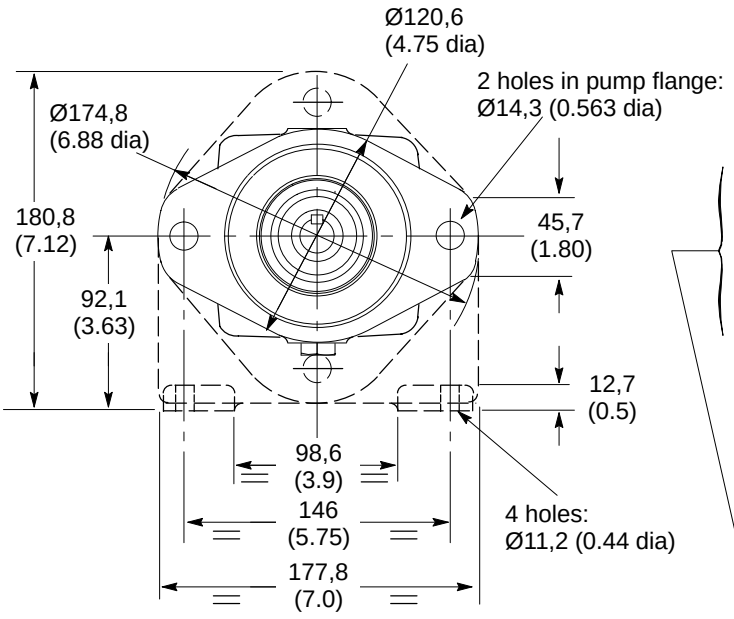


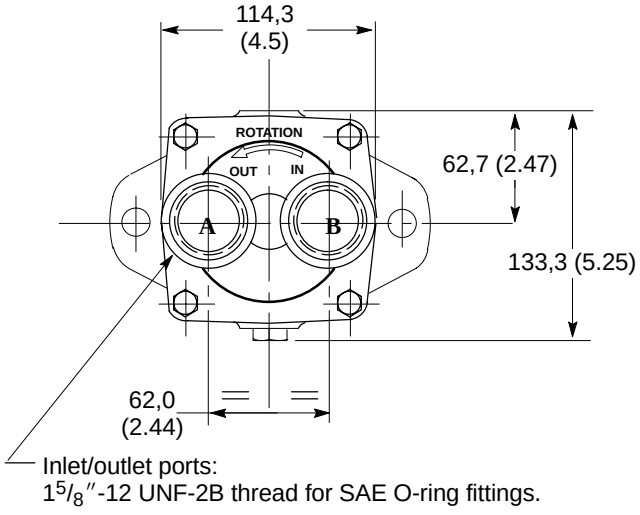
Detail of shaft, key and locating diameter

PFB10 SAE Flange Mounting

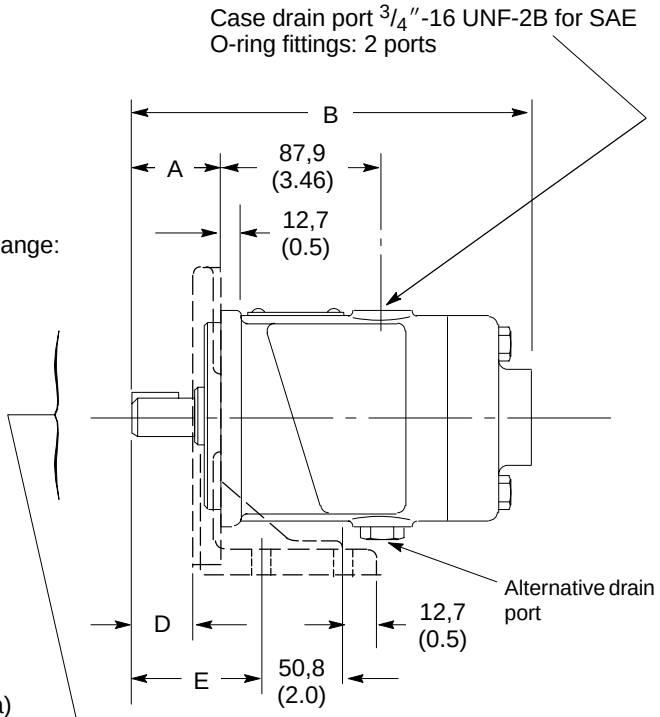
Installation Dimensions in mm (inches)

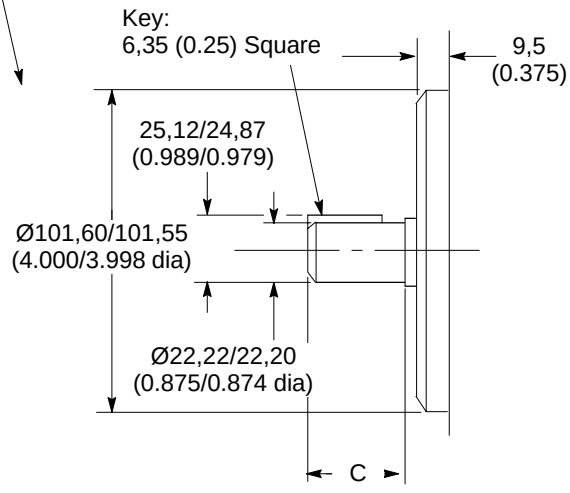
Optional foot bracket, shown in dashed outline; kit FB-B-10 comprises foot bracket and two pump fixing bolts bolts. Order separately, if required.





View on rear end of pump





Detail of shaft, key and locating diameter

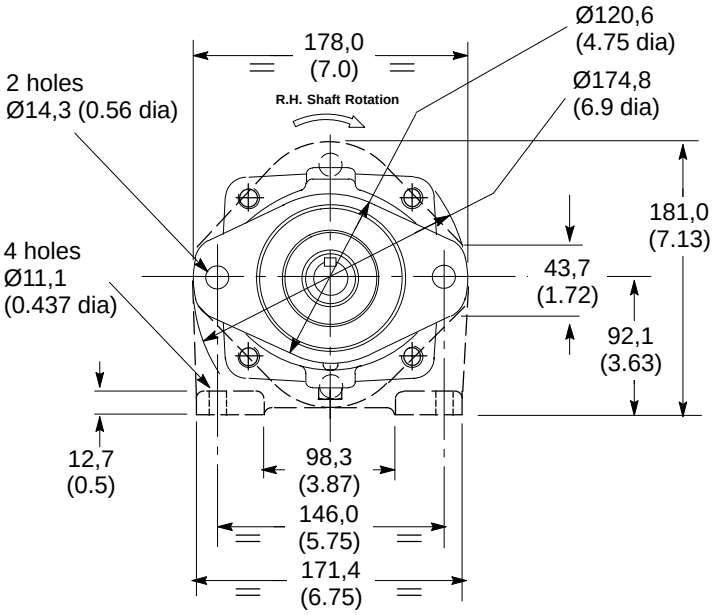
Pump type	A	B	C	D*	E*
PFB10-*-30	44,4 (1.75)	213,9 (8.42)	33,3 (1.31)	26,9 (1.06)	59,4 (2.34)
PFB10-***Y**-30	58,7 (2.31)	228,1 (8.98)	47,6 (1.87)	41,1 (1.62)	73,7 (2.9)

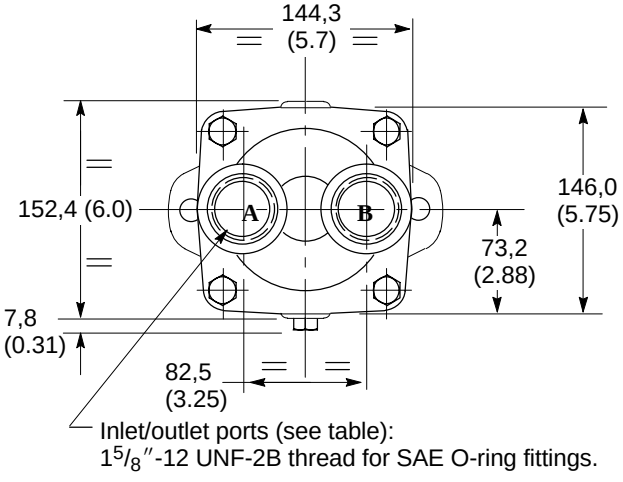
*Omit for foot bracket models)

PFB20 SAE Flange Mounting

Installation Dimensions in mm (inches)

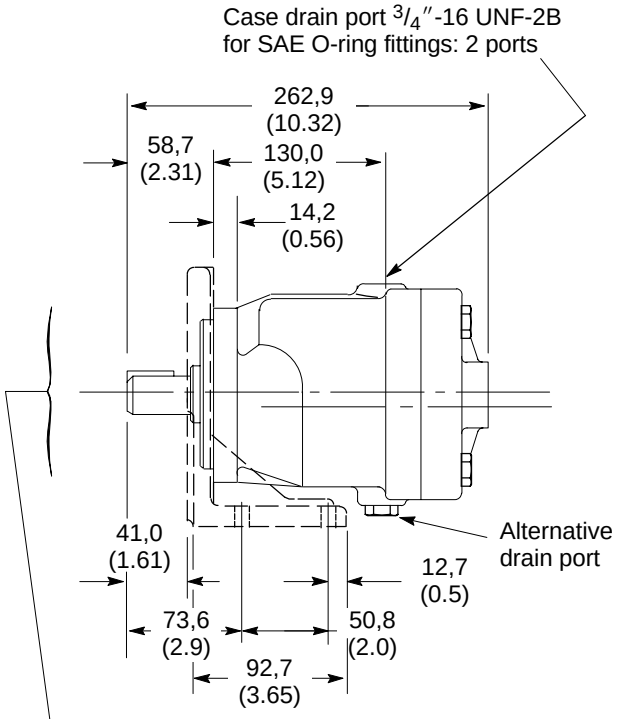
Optional foot bracket, shown in dashed outline; kit FB-B-10 comprises foot bracket and two pump fixing bolts bolts. Order separately, if required.

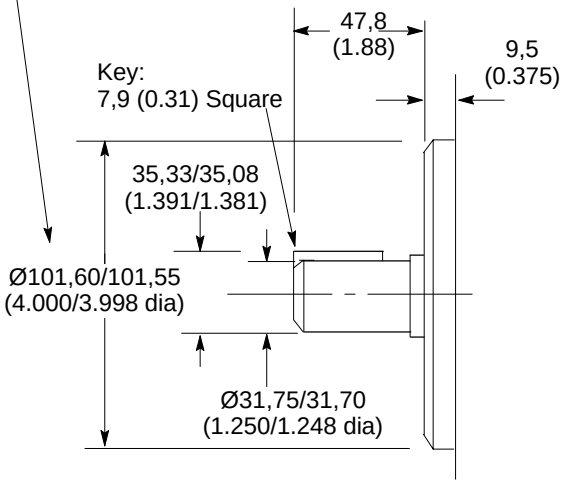




View on rear end of pump

Shaft rotation	Inlet port	Outlet port
RH	B	A
LH	A	B





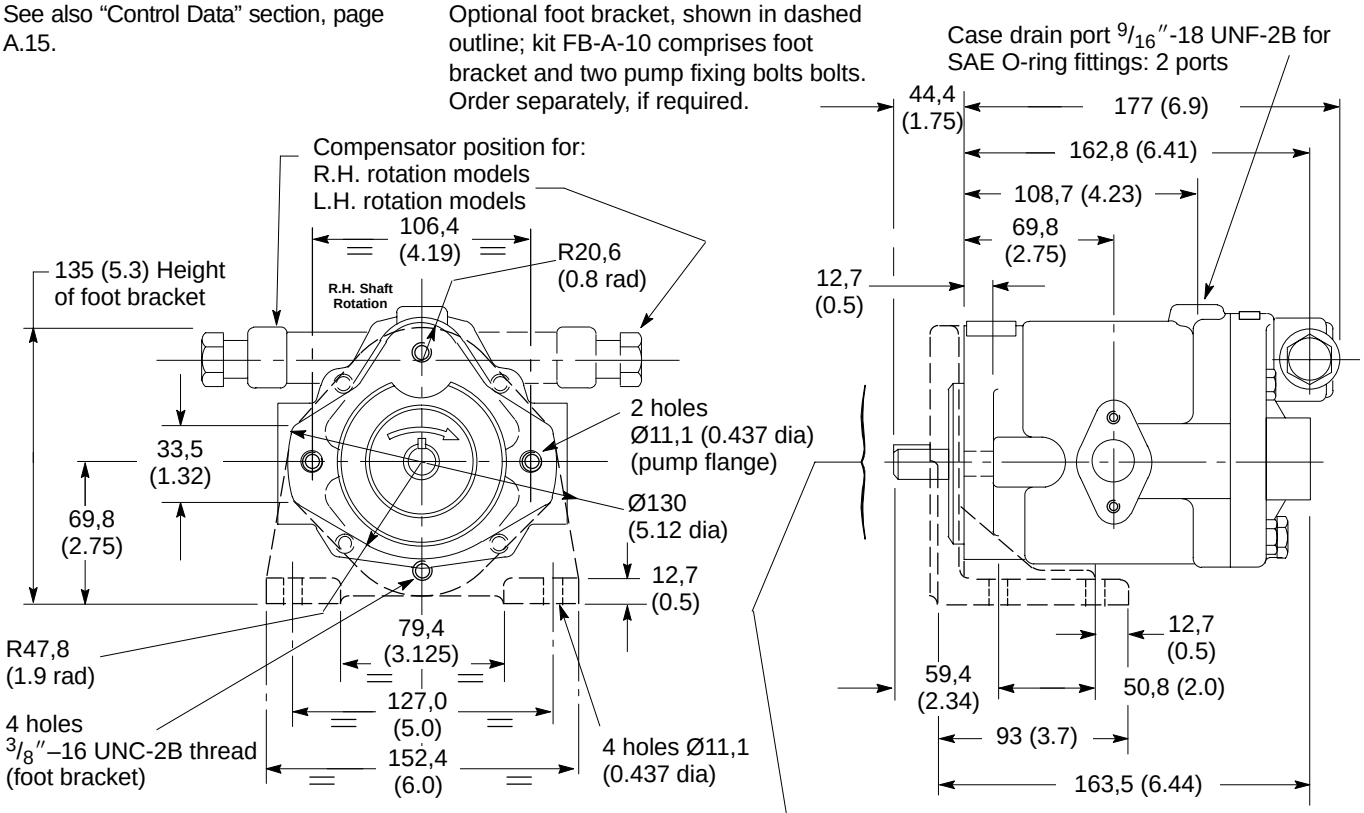
Detail of shaft, key and locating diameter

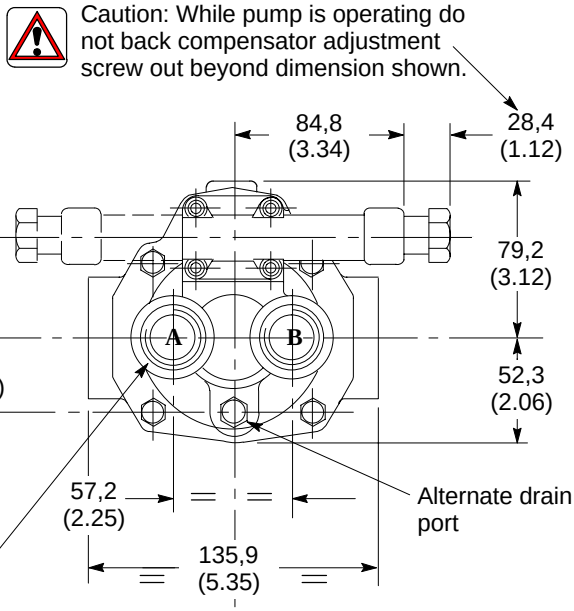
PVB5/6 SAE Flange Mounting:
Pressure Compensator Control - “C” and “CM”

Installation Dimensions in mm (inches)

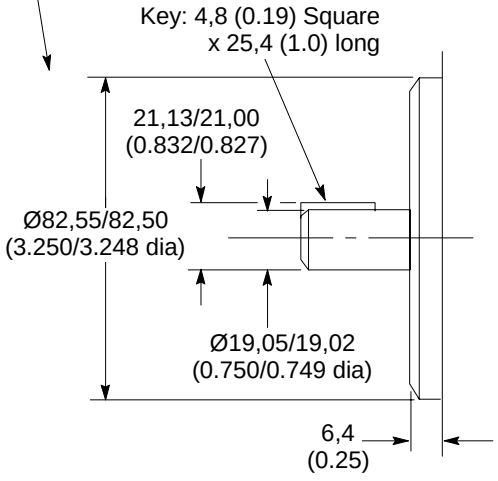
See also “Control Data” section, page A.15.

Optional foot bracket, shown in dashed outline; kit FB-A-10 comprises foot bracket and two pump fixing bolts bolts. Order separately, if required.





View on rear end of pump



Detail of shaft, key and locating diameter

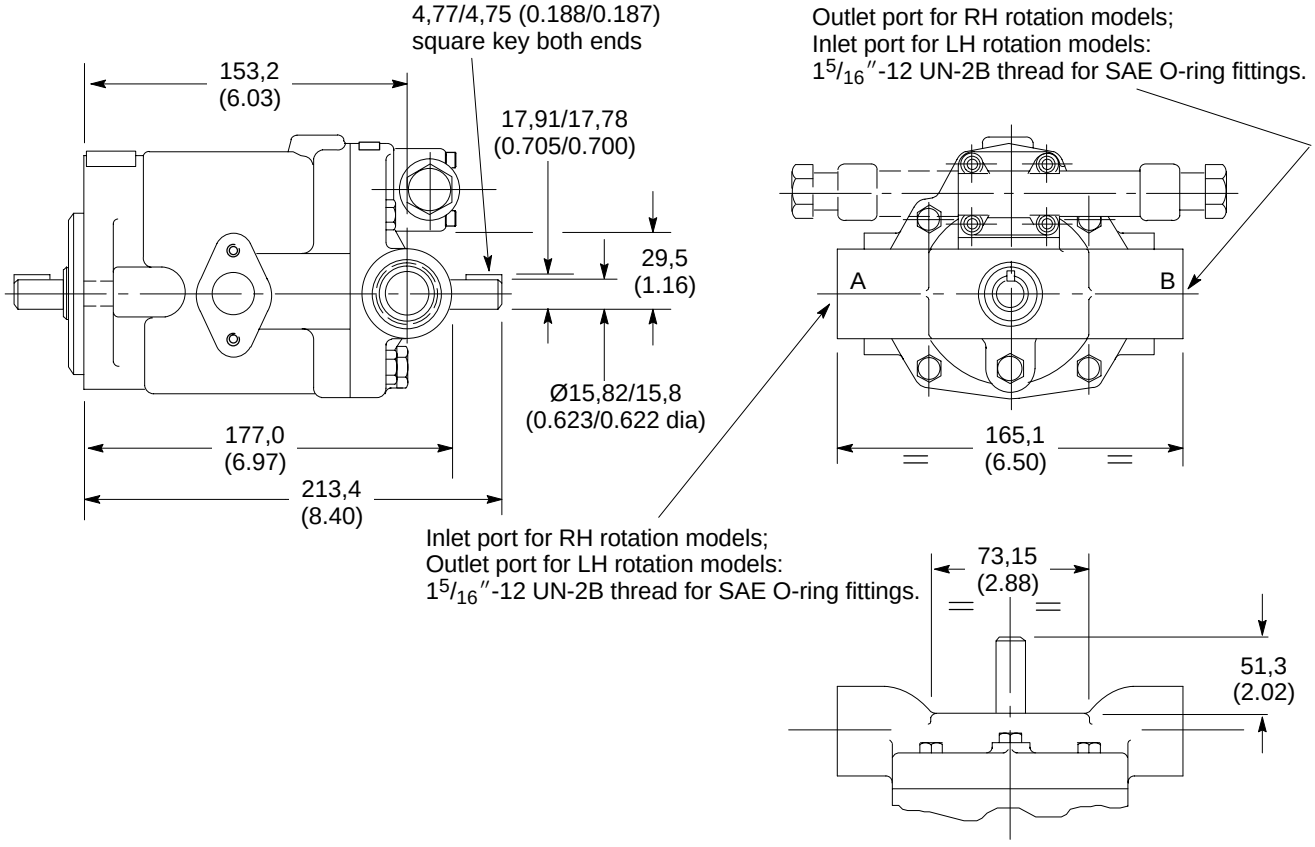
Shaft rotation	Inlet port	Outlet port
RH	A	B
LH	B	A

PVB5/6 Thru-Shaft Models (with Side Ports)

Installation Dimensions in mm (inches)

Maximum output torque is 40 Nm (354 lbf in), less unput torque at system pressure, see performance curves:
At 1500 r/min drive speed, page A.8.
At 1800 r/min drive speed, page A.12.

For other dimensions and installation data see page A.20.

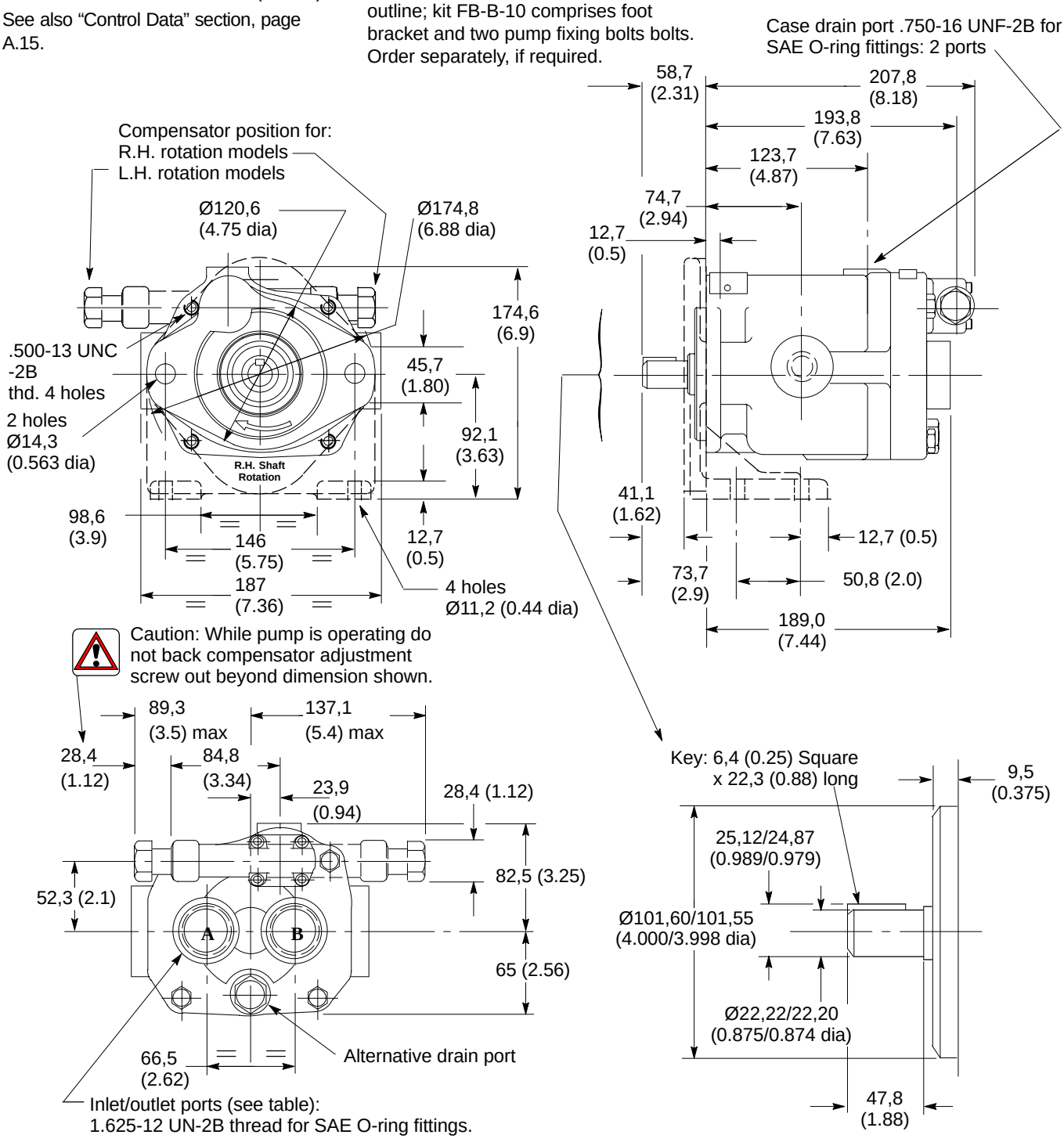


PVB10/15 SAE Flange Mounting
Pressure Compensator Control - “C” and “CM”

Installation Dimensions in mm (inches)

See also “Control Data” section, page A.15.

Optional foot bracket, shown in dashed outline; kit FB-B-10 comprises foot bracket and two pump fixing bolts bolts. Order separately, if required.



View on rear end of pump

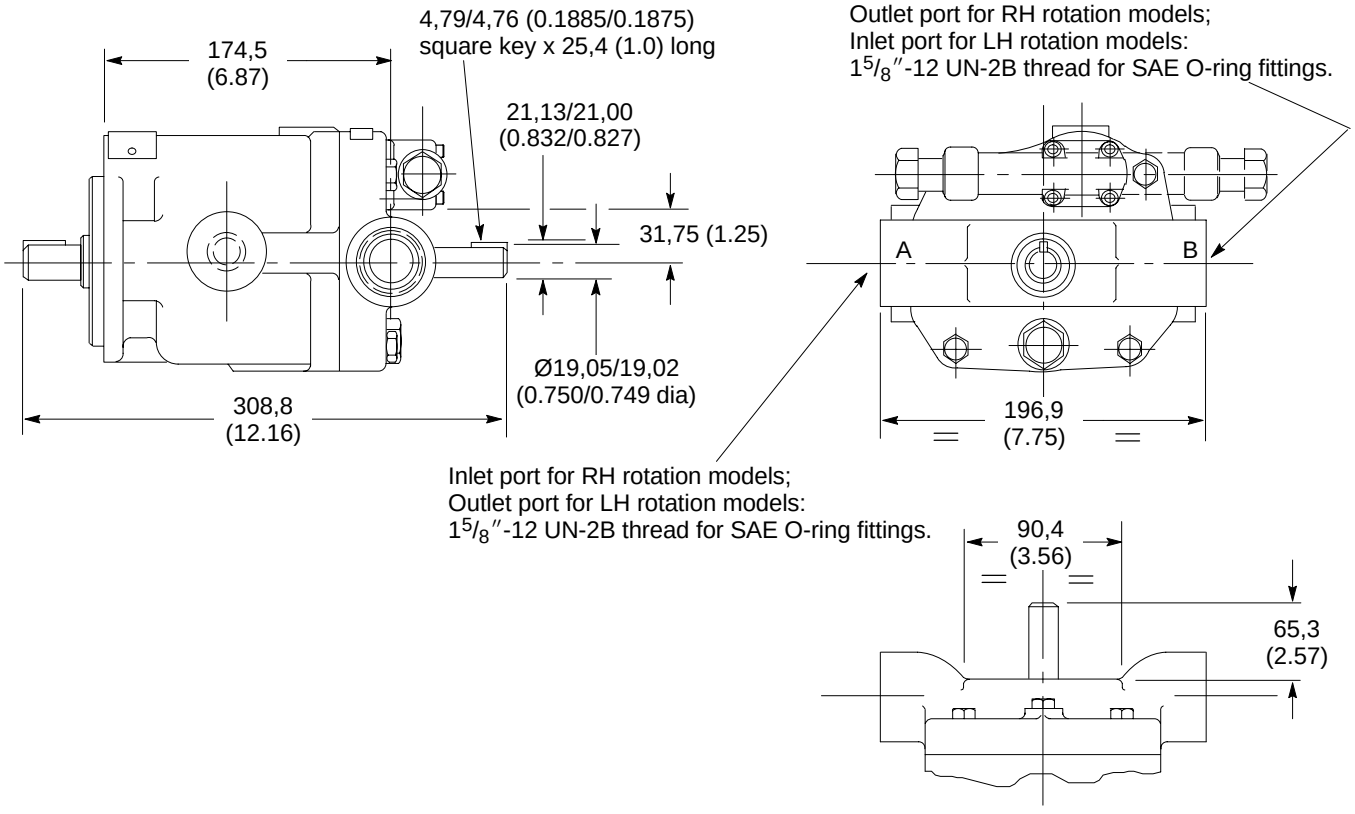
Detail of shaft, key and locating diameter

Shaft rotation	Inlet port	Outlet port
RH	A	B
LH	B	A

PVB10/15 Thru-Shaft Models (with Side Ports)

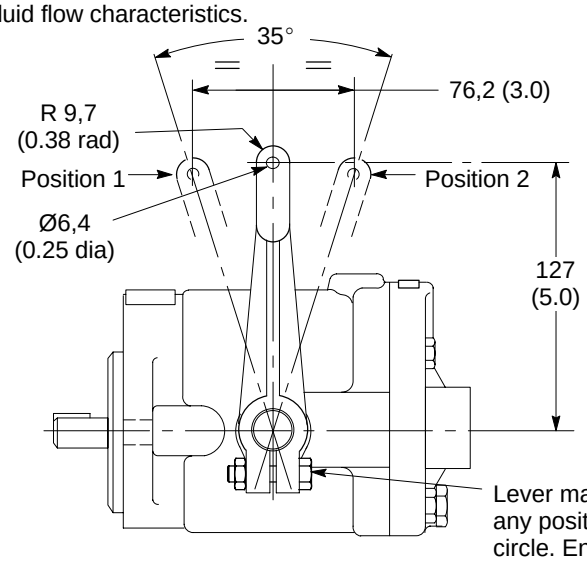
Maximum output torque is 83 Nm (735 lbf in), less unput torque at system pressure, see performance curves:
At 1500 r/min drive speed, pages A.8 & A.9.
At 1800 r/min drive speed, page A.12 & A.13.

For other dimensions and installation data see page A.22.

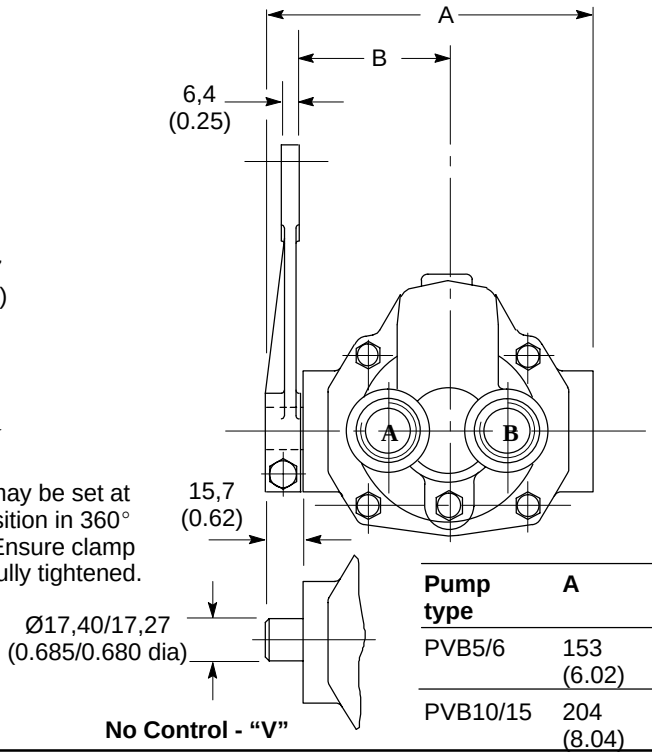


Lever Control - “M” and No Control - “V”

Units with this control may be operated on both sides of center permitting bi-directional fluid flow characteristics.



Shaft rotation	Lever position	Outlet port
RH	1	A
	2	B
LH	1	B
	2	A

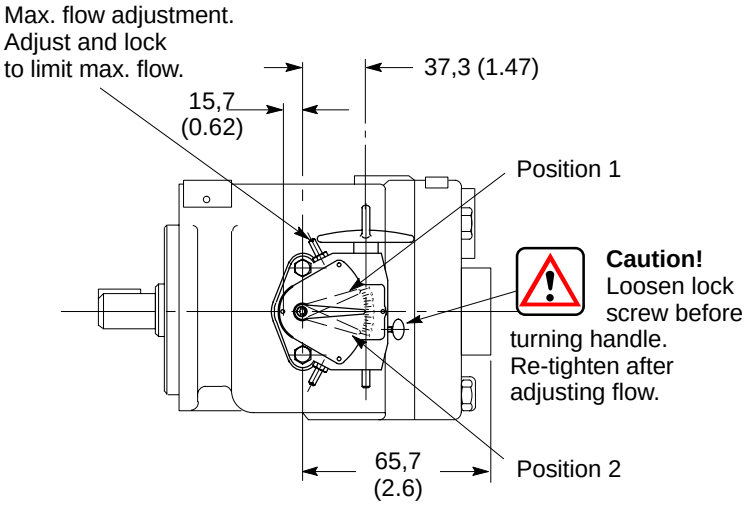


No Control - “V”

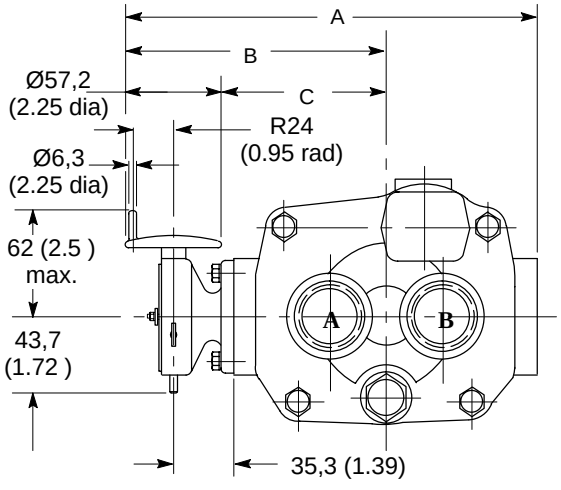
Pump type	A	B
PVB5/6	153 (6.02)	68,9 (2.7)
PVB10/15	204 (8.04)	99,9 (3.93)

Handwheel Control - “H”

Units with this control may be operated on both sides of center permitting bi-directional fluid flow characteristics.



Shaft rotation	Pointer position	Handwheel rotation from zero	Outlet port
RH	1	Clockwise	A
	2	Counter-clockwise	B
LH	1	Clockwise	B
	2	Counter-clockwise	A



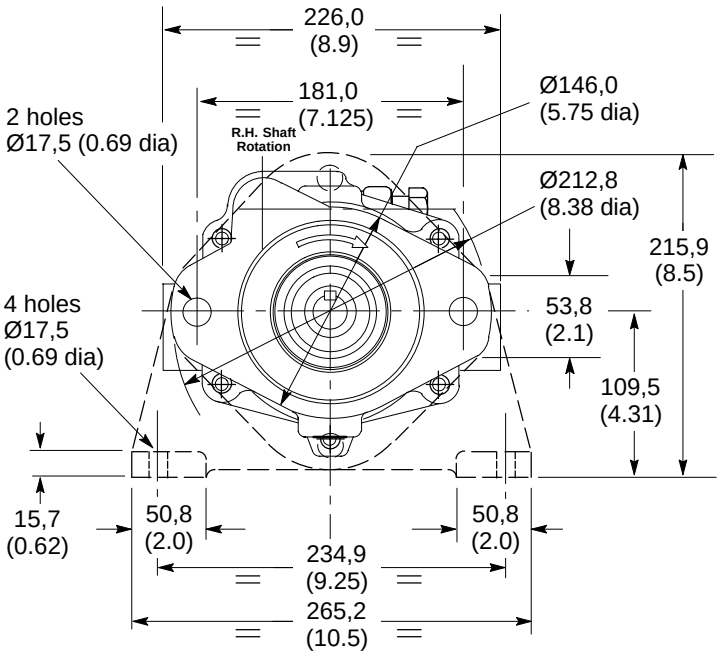
Pump type	A	B	C
PVB5/6	200 (7.87)	129 (5.08)	70,6 (2.78)
PVB10/15	250 (9.84)	140 (5.51)	93,5 (3.68)

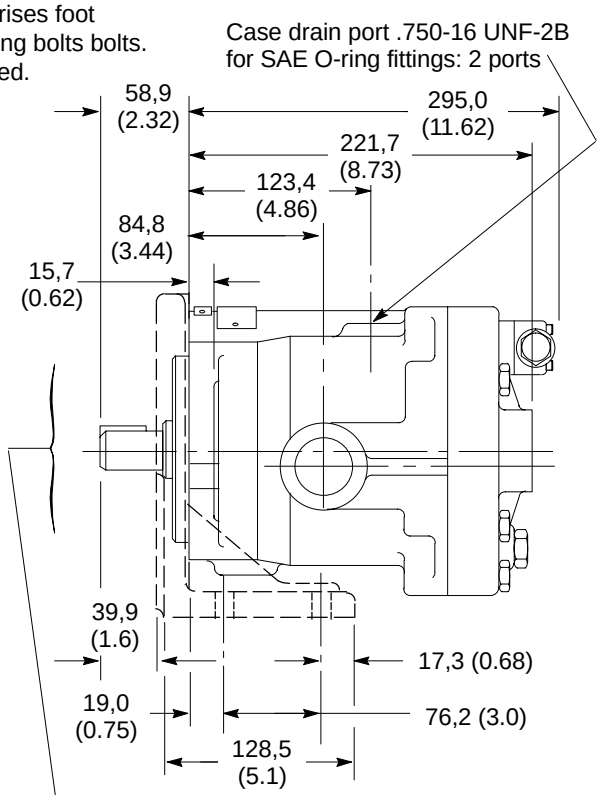
PVB20/29 SAE Flange Mounting
Pressure Compensator Control - “C” and “CM”

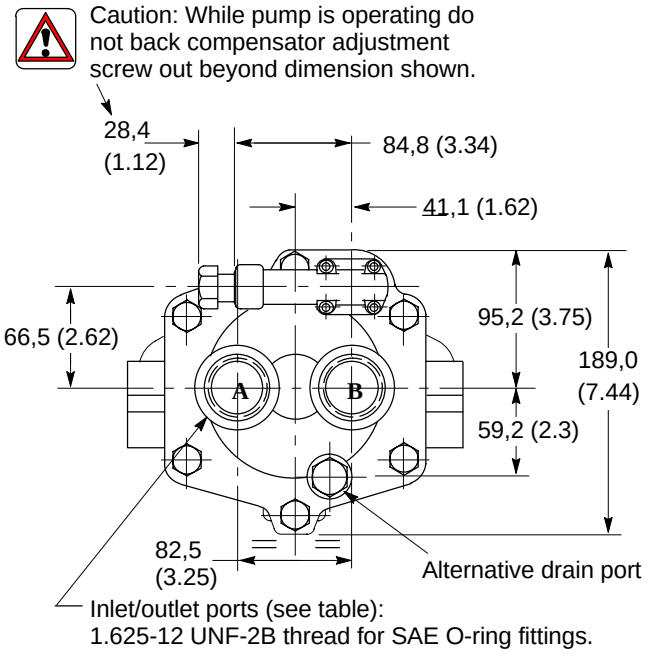
Installation Dimensions in mm (inches)

See also “Control Data” section, page A.15.

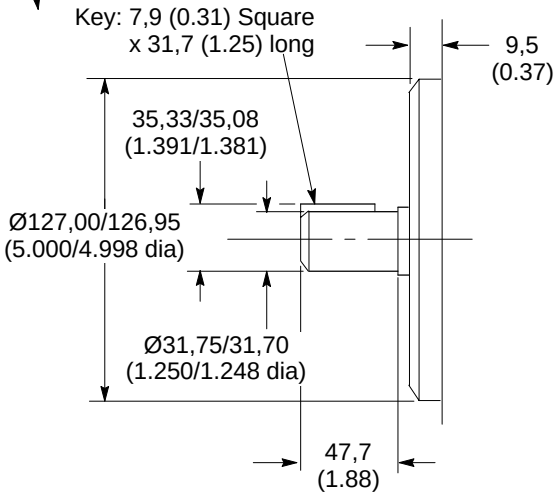
Optional foot bracket, shown in dashed outline; kit FB-C-10 comprises foot bracket and two pump fixing bolts bolts. Order separately, if required.







View on rear end of pump



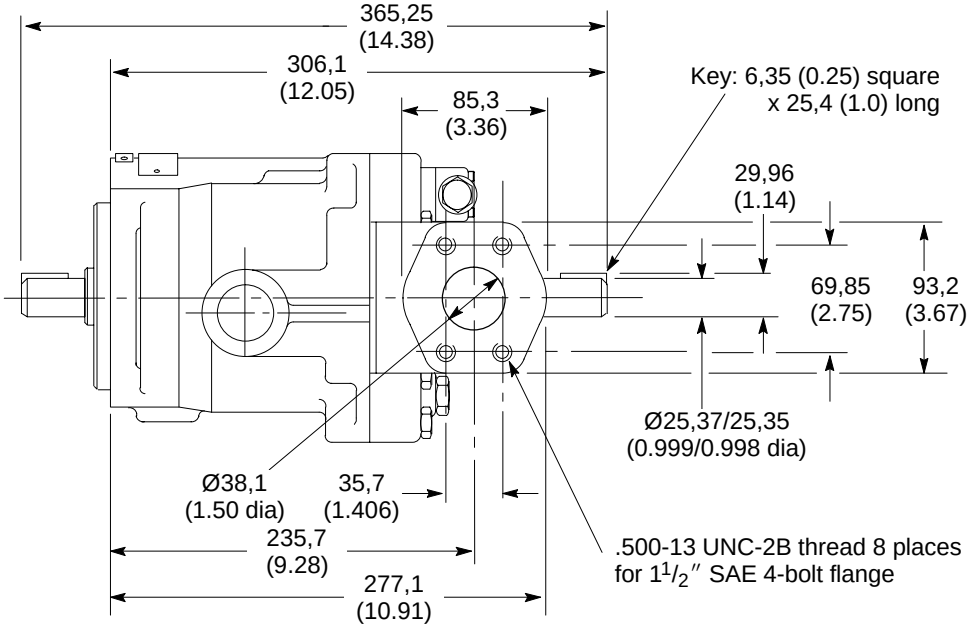
Detail of shaft, key and locating diameter

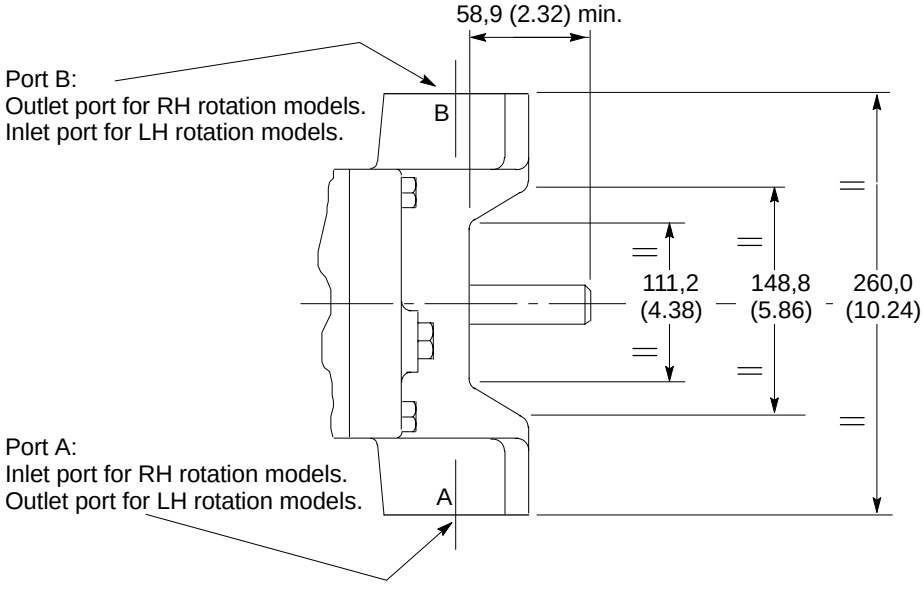
Shaft rotation	Inlet port	Outlet port
RH	A	B
LH	B	A

PVB20/29 Thru-Shaft Models (with Side Ports)

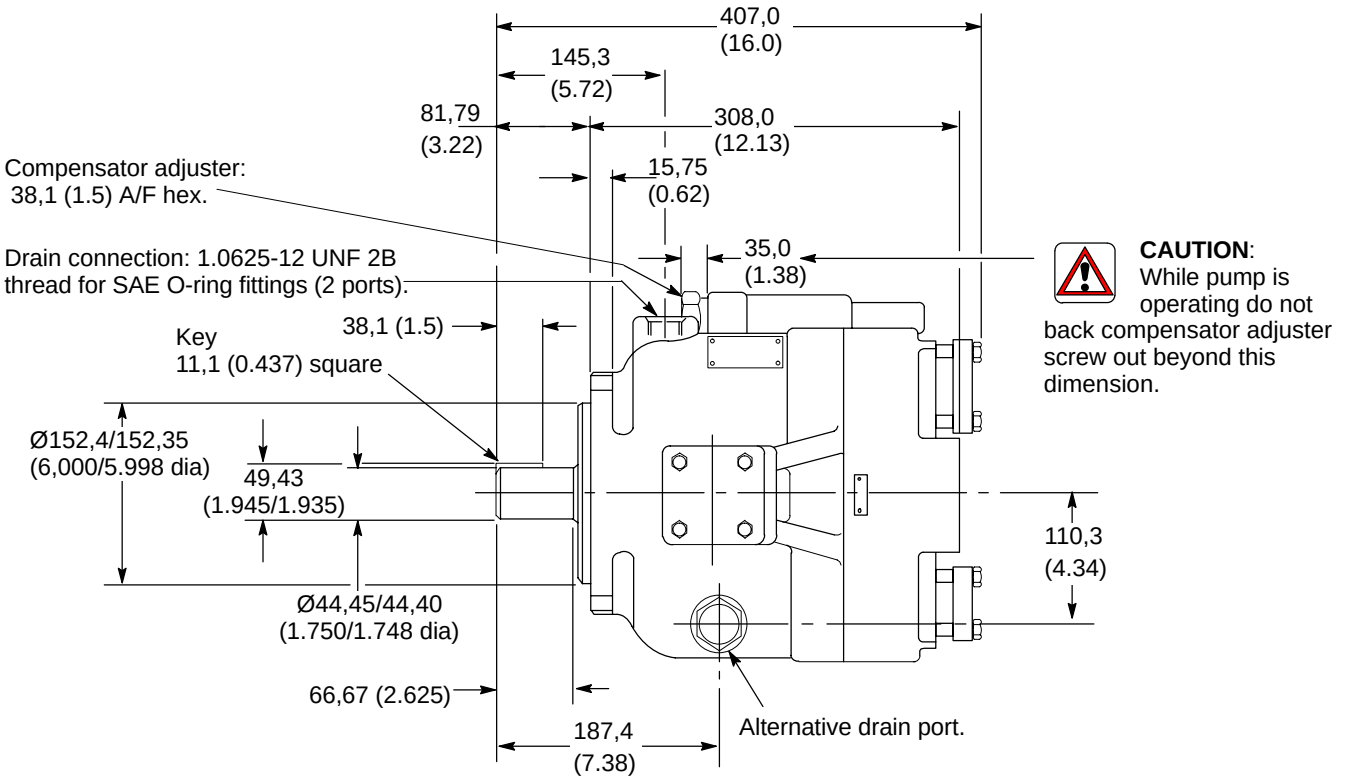
Maximum output torque is 159 Nm (1408 lbf in), less unput torque at system pressure, see performance curves:
At 1500 r/min drive speed, page A.9
At 1800 r/min drive speed, page A.13

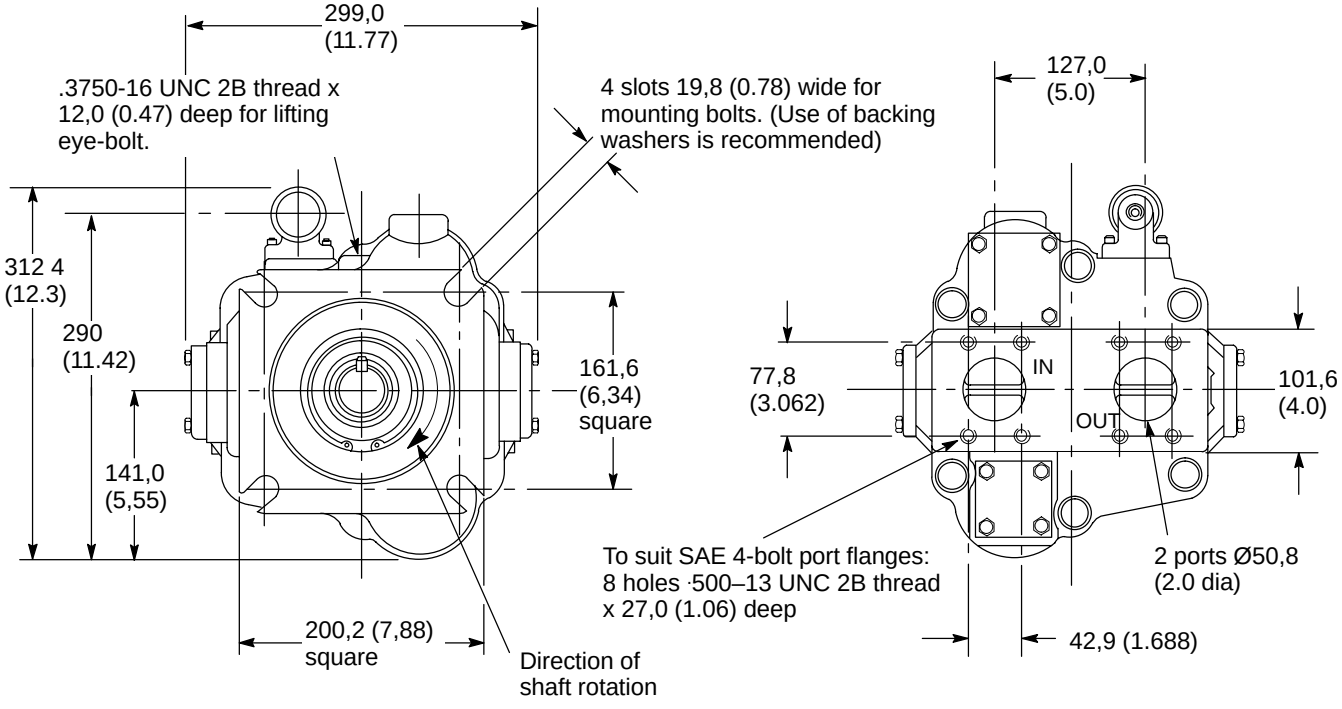
For other dimensions and installation data see page A.25.





PVB45 Flange-Mounted Model



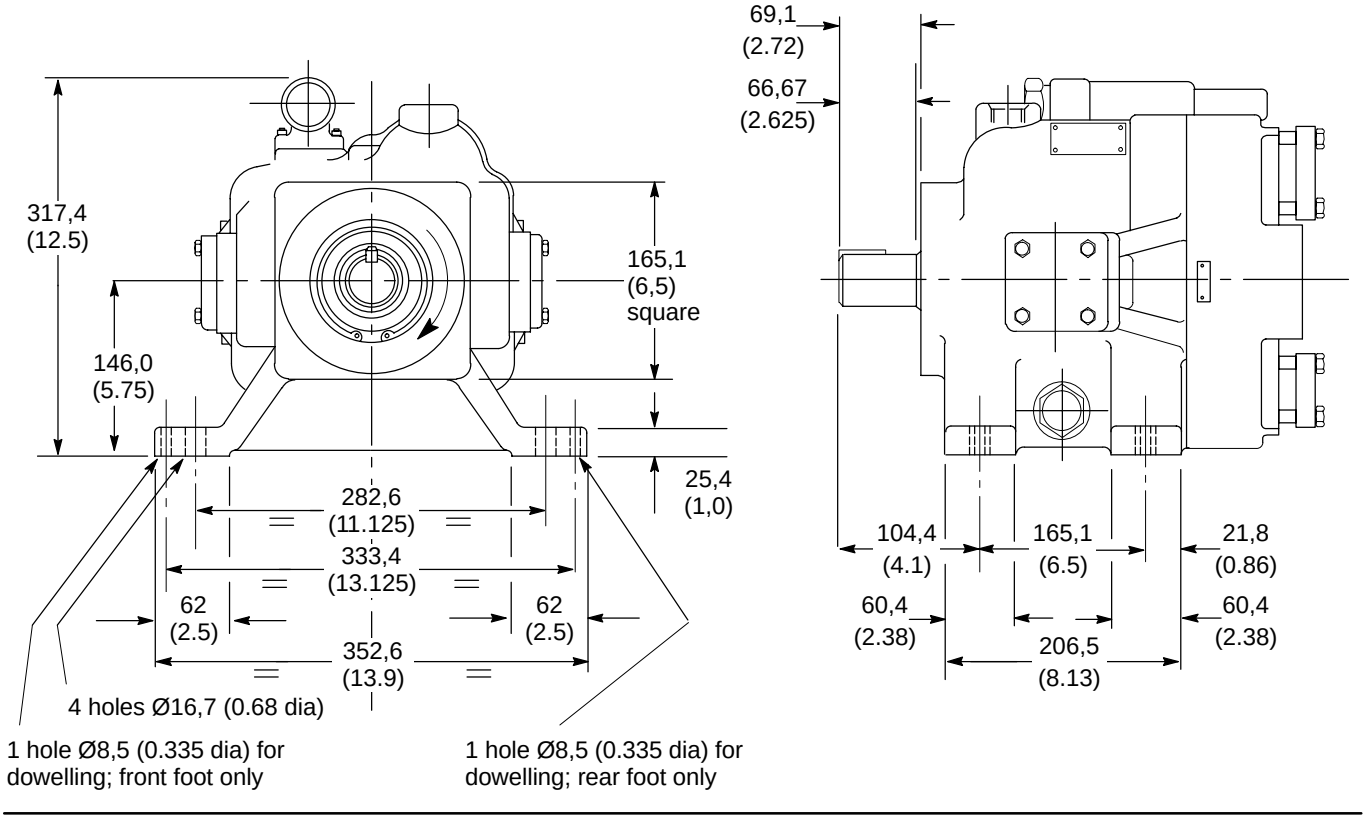


View on shaft end of pump

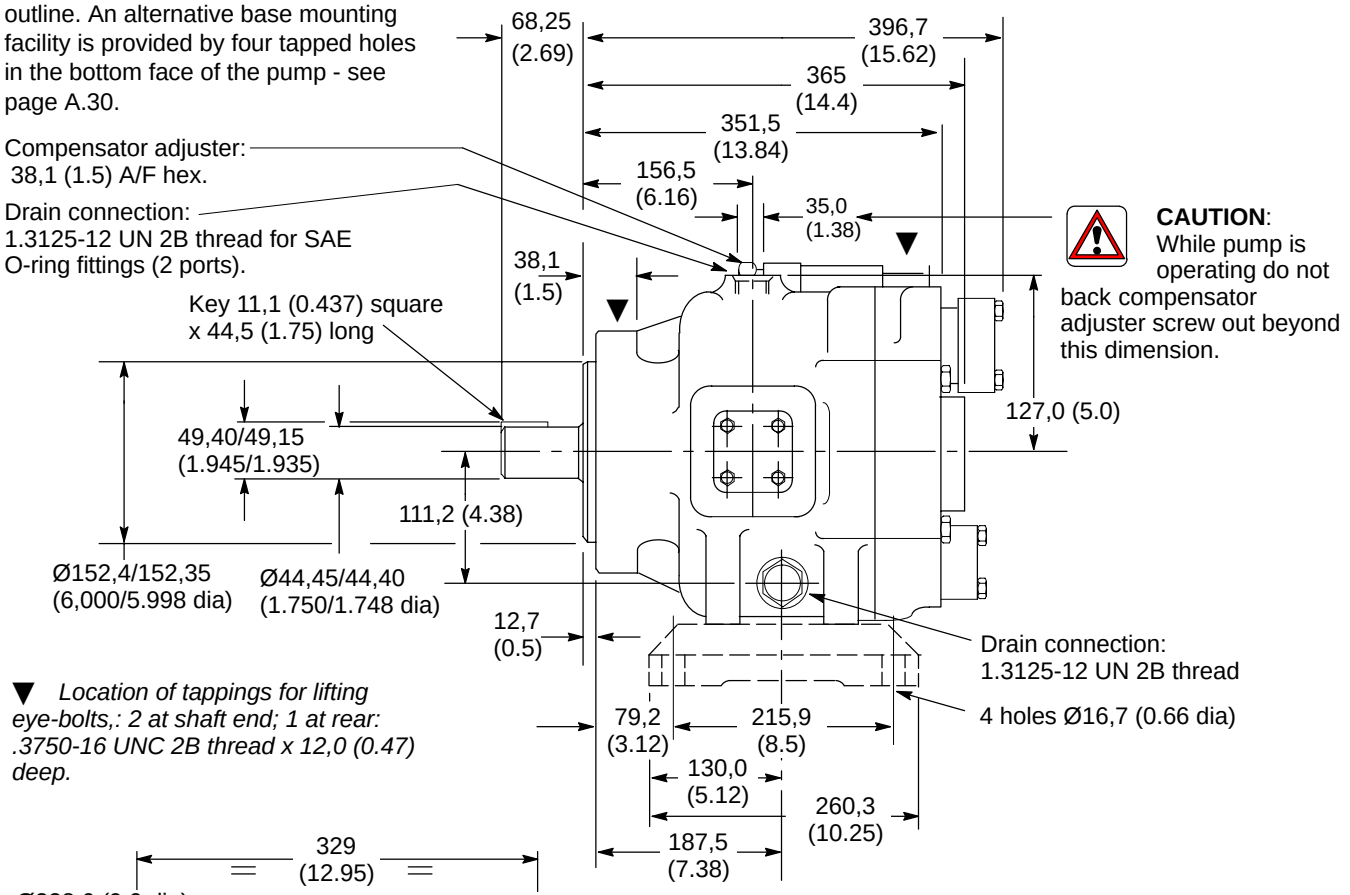
View on rear end of pump

PVB45 Foot-Mounted Model

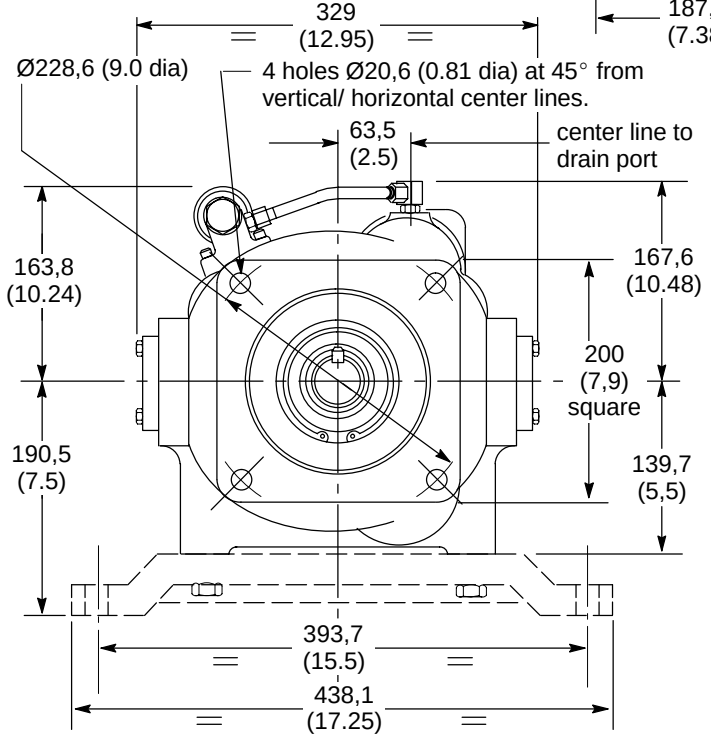
For other dimensions and installation data see page A.27 .



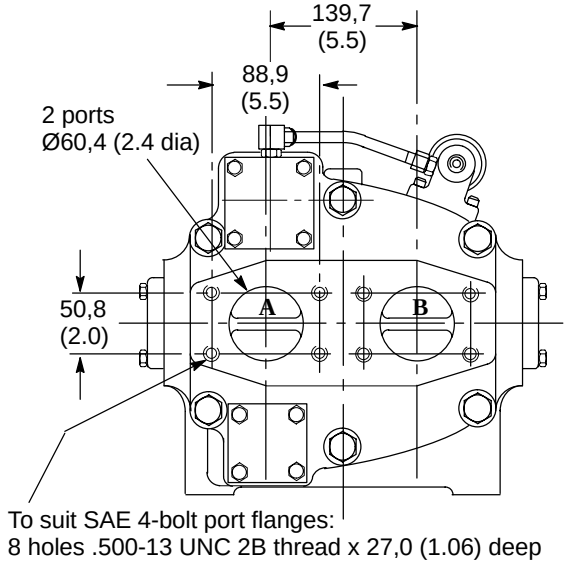
Foot mounting option (designated by Model Code [3] = “F”) is shown in dotted outline. An alternative base mounting facility is provided by four tapped holes in the bottom face of the pump - see page A.30.



▼ *Location of tappings for lifting eye-bolts,: 2 at shaft end; 1 at rear: .3750-16 UNC 2B thread x 12,0 (0.47) deep.*



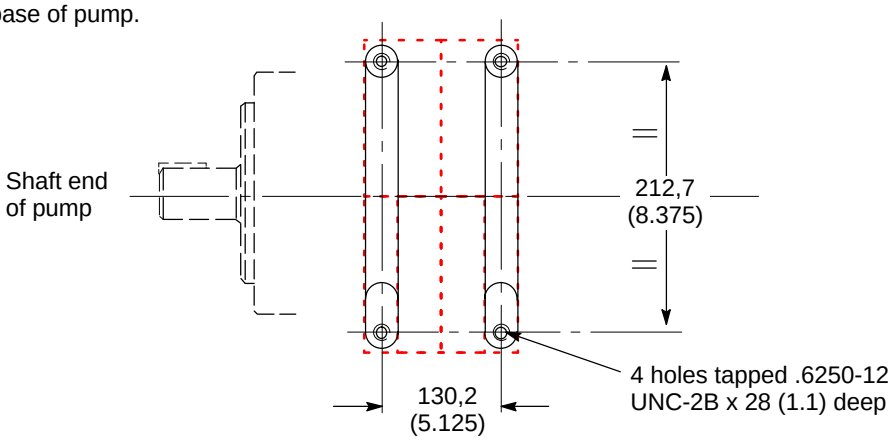
View on shaft end of pump



View on rear end of pump

Shaft rotation	Inlet port	Outlet port
RH	A	B
LH	B	A

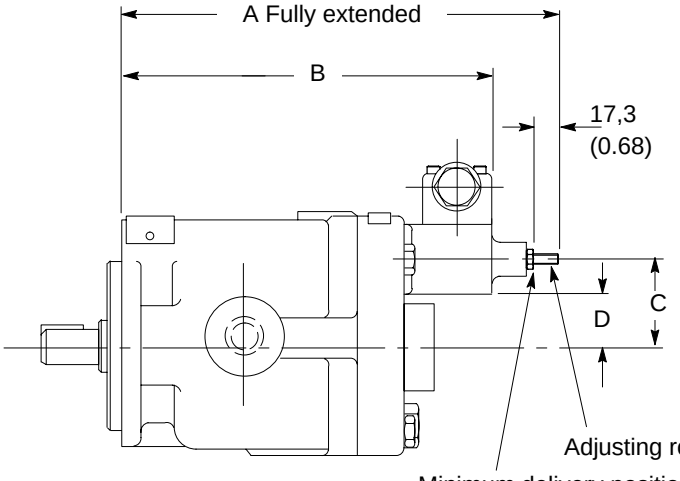
Detail of tappings in base of pump.



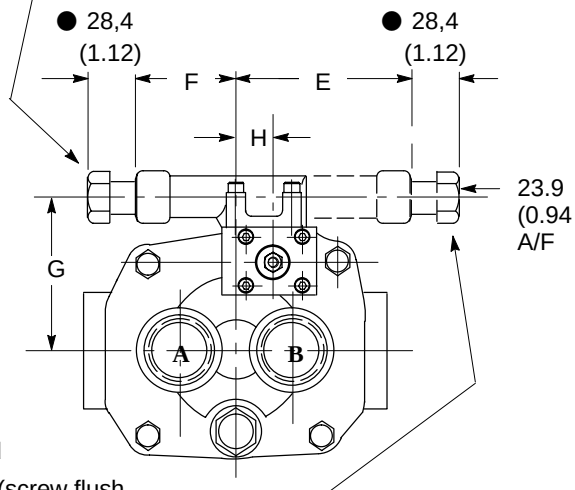
PVB5/6, PVB 10/15 and PVB20/29 with Pressure Compensator and Adjustable Maximum Displacement Stop: Control Types "CC" and "CMC"

For general dimensions and installation data of these pumps, see pages A.20, A.22 and A.25

Caution: While pump is operating do not back compensator adjustment screw out beyond dimension ● shown.



Note.
Compensator position for:
PVB5/6-*LSY (LH rotation models) and
PVB10/15 -*RSY (RH rotation models)
PVB20/29 -**SY (RH and LH rotation models)

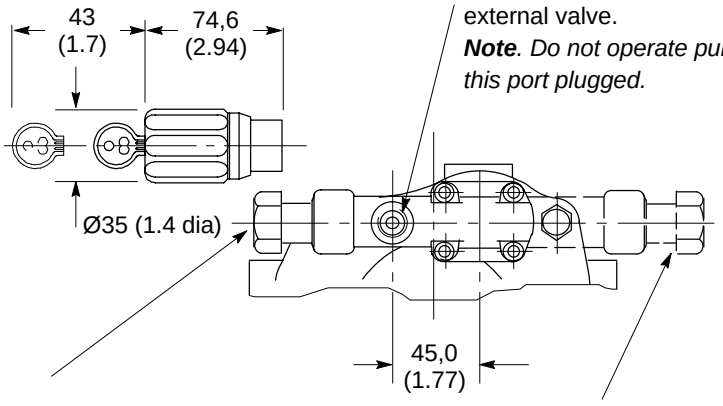


Note.
Compensator position for:
PVB5/6-*RSY (RH rotation models) and
PVB10/15 -*LSY (LH rotation models)

Pump type	A	B	C	D	E	F	G	H
PVB5/6	233 (9.17)	195 (7.68)	50 (1.97)	22,9 (0.9)	76,2 (3.0)	94,4 (3.72)	94,4 (3.72)	_
PVB10/15	266 (10.47)	226 (8.9)	52,3 (2.06)	25,1 (0.99)	118 (4.65)	70,8 (2.79)	90,2 (3.55)	23,8 (0.94)
PVB20/29	294 (11.56)	254 (10.0)	66,5 (2.62)	41,9 (1.65)	_	53,3 (2.1)	104,4 (4.11)	41,1 (1.62)

PVB5 to 29 with “CG” Remote Control of Compensator

Type “GEVS”



.4375-20UNF-2B thread for SAE “CG” control models, connect to external valve.
***Note**. Do not operate pump with this port plugged.*

Location as shown for:
PVB5/6 LH rotation models,
PVB10/15 RH rotation models and
PVB20/29 LH and RH rotation models.

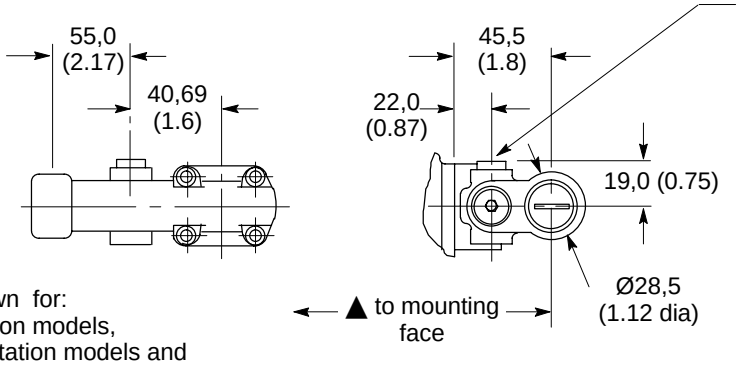
Location as shown in dotted outline for:
PVB5/6 RH rotation models and
PVB10/15 LH rotation models.

Caution: Effective compensator setting will be compensator control setting **plus** remote relief valve setting.

Adjustment procedure

1. Turn remote pressure control (such as C-175) anti-clockwise 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 remote pressure control.

“CVP” Load Sensing with Pressure Limiter

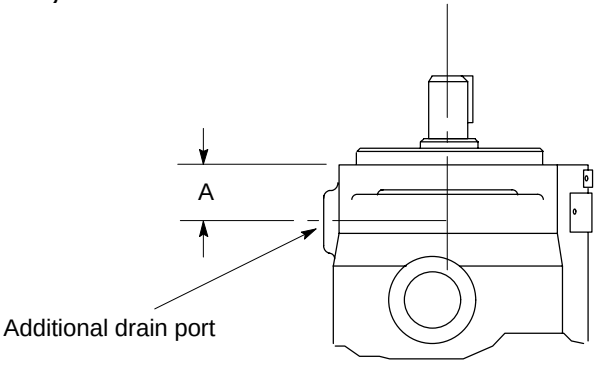


Load sensing control port:
.4375-20 UNF-2B thread
for SAE O-ring fittings.

Location as shown for:
PVB5/6 LH rotation models,
PVB10/15 RH rotation models and
PVB20/29 LH and RH rotation models.

▲ PVB5/6 . . . . . 191 (7.51)
PVB10/15 . . . . . 222 (8.75)
PVB20/29 . . . . . 250 (9.84)

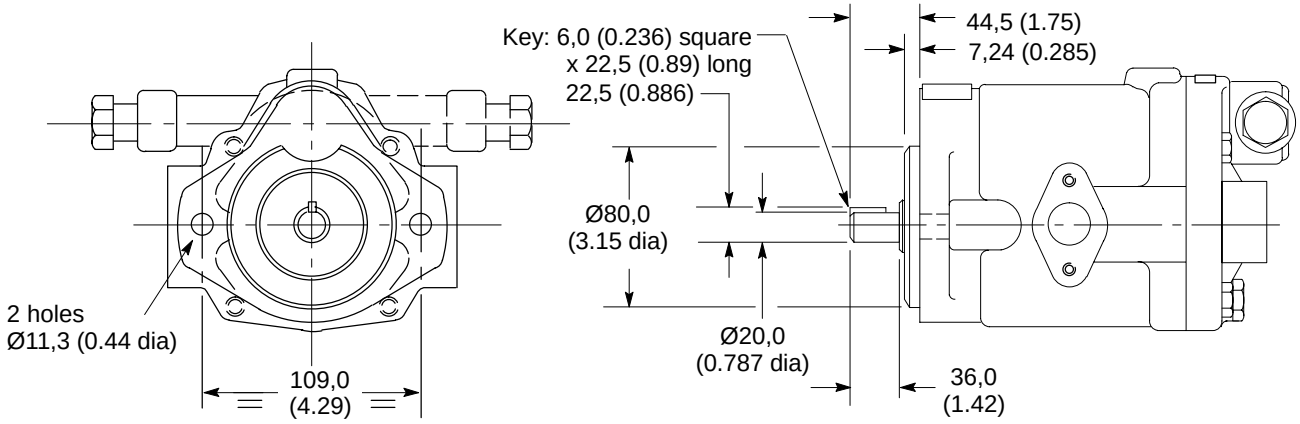
Vertical “Shaft-up” Installation - “S30” Drain Port Option, for PVB5 to 29



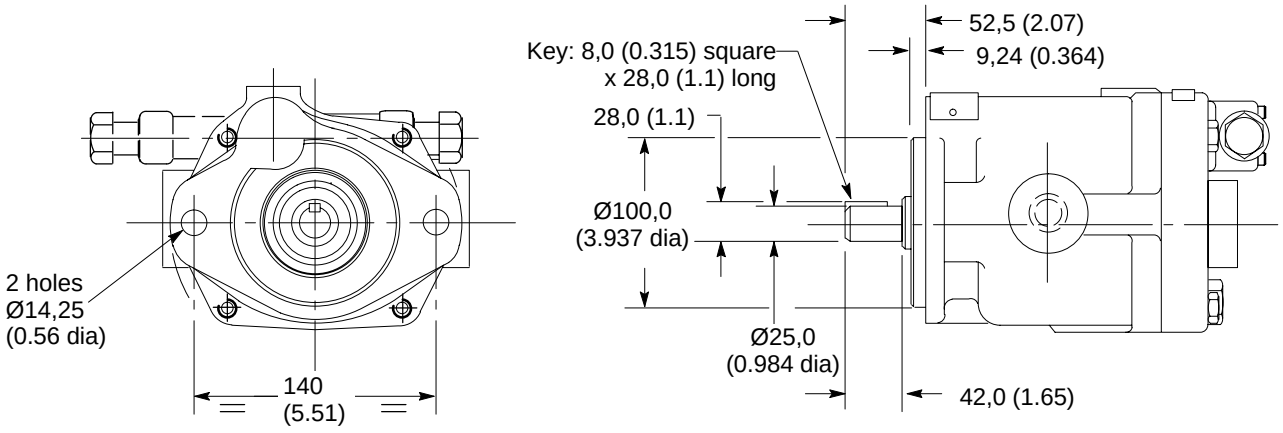
Pump type	Port tapping	A
PFB5	.562518UNF-2B	28,7 (3.85)
PVB5/6	.5625 18UNF-2B	19 (0.75)
PVB10/15	.7500 16UNF-2B	29,3 (1.15)
PVB20/29	.7500 16UNF-2B	38,9 (1.53)

For dimensions/data not shown refer to corresponding SAE models.

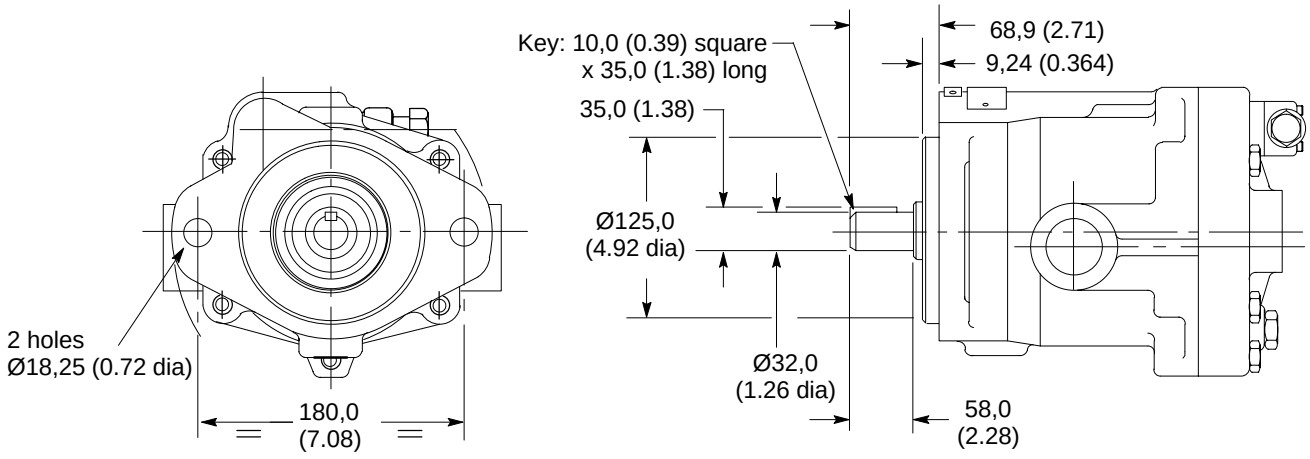
PVB5/6 – Pressure Compensated Control – “C” and “CM”



PVB10/15 – Pressure Compensated Control – “C” and “CM”



PVB20/29 – Pressure Compensated Control – “C” and “CM”



Mass, approx.

Flange Mounting Models

PFB5 . . . . . 5 kg (11 lb)
PFB10 . . . . . 10 kg (22 lb)
PFB20 . . . . . 19 kg (42 lb)
PVB5/6 . . . . . 8 kg (18 lb)
PVB10/15 . . . . . 15 kg (33 lb)
PVB20/29 . . . . . 26 kg (57 lb)
PVB45 . . . . . 96 kg* (211 lb)
PVB90s . . . . . 104 kg (230 lb)

** Also foot mounting models.*

▲ *Combined foot/flange mounting models.*

Foot Bracket Kits

FB-A-10 . . . . . 1,8 kg (4 lb)
FB-B-10 . . . . . 2,3 kg (5 lb)
FB-C-10 . . . . . 5,5 kg (12 lb)

Installation Data

Horizontal mounting is resommended to maintain necessary case fluid level. Vertical “shaft-up” installation is possible with pumps ordered to include the extra drain port denoted by the “S30” feature; see “Model Code”. In all cases the drain line must be full size, unrestricted and connected from the uppermost drain port directly to the reservoir in such a manner that the housing remains filled with fluid.

Piping of drain line must prevent siphoning. Pipe drain line so that it terminates below fluid level. No other lines are to be connected to this drain line.



Caution must be exercised to never exceed the following unit case pressures:

0,7 bar (10 psi) for PFB10 only.
0,35 bar (5psi) for all other models.

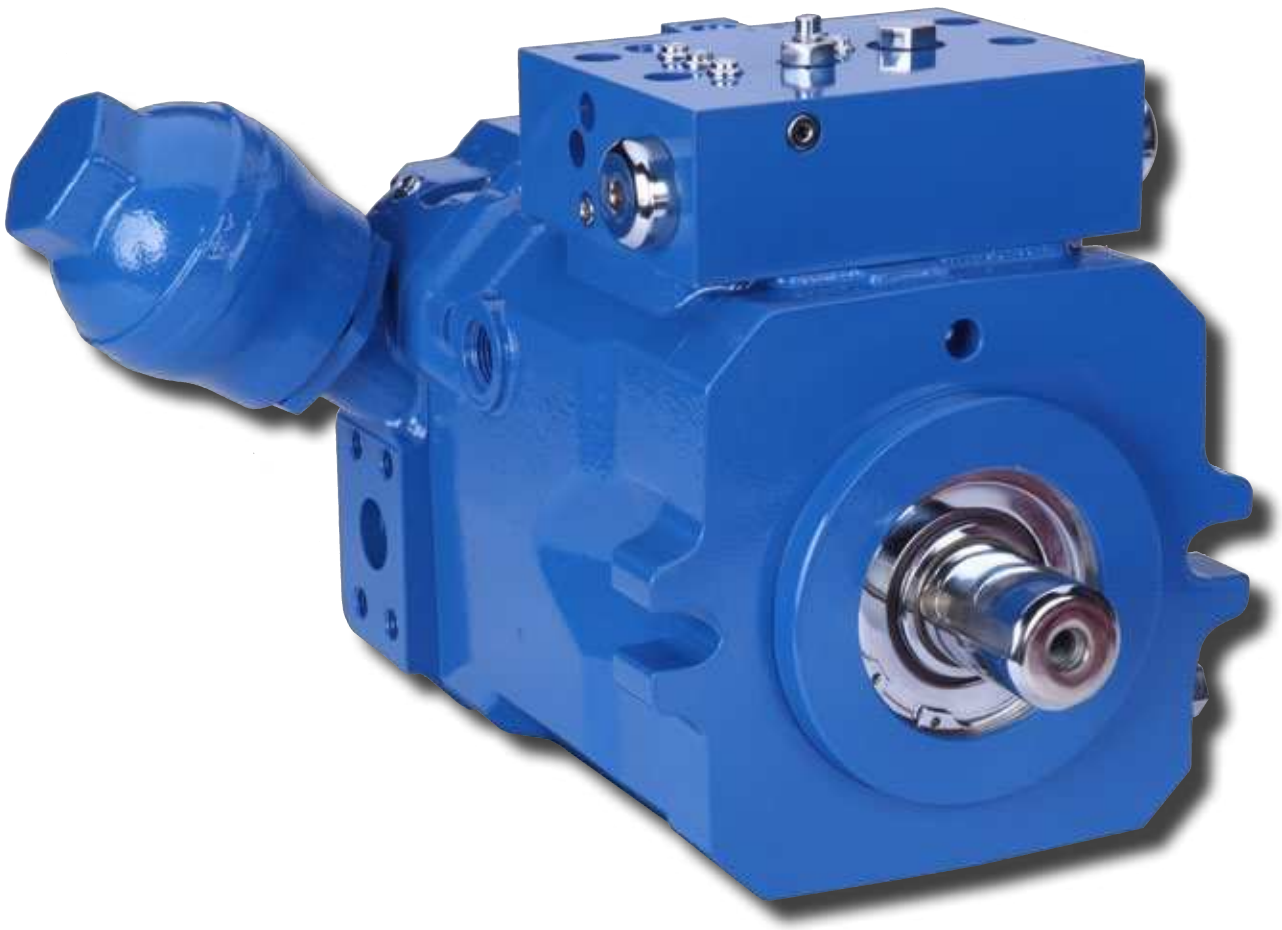
Starting

Before starting, fill case with system fluid through the uppermost drain port. Housing must be kept full at all times to provide internal lubrication.When first starting it may be necessary to bleed air from pump outlet to permit priming and to reduce noise. Bleed by loosening an outlet connection until a clear stream of fluid appears. An air bleed valve, ABS-03, is available for this purpose.

Ordering Procedure

Before ordering, check availability with your Vickers reprecentative.

DuraForce™ HPR
Self-regulating Pump for Open Loop Operation



Powering Business Worldwide

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1 **LS-Regulator**
Optimum utilisation of power

2 **Swash Plate**
Hydrostatic bearing

3 **Piston-Slipper Assembly**
21° swash angle

4 **Housing**
Monoshell for high rigidity

5 **Valve Plate Housing**
Highly integrated

6 **Actuator Piston**
Long-lived and precise

7 **Through Shaft**
For additional pumps

8 **Cylinder Barrel**
Compact due to 21° technology

9 **Suction Port**
Good suction capacity also without tank pressurization

10 **SPU**
Reduction of pressure pulsation over the entire range of operation, maintenance-free

Design Characteristics

- High pressure axial piston pump in swash plate design for open loop systems
- Clockwise or counter clockwise rotation
- Self-priming at high nominal speed
- Higher rotating speed by tank pressurization or swash angle reduction
- Adaptive noise optimization SPU
- Decompression fluid is drained via pump housing for suction side stability
- Exact and rugged load sensing controls
- SAE high pressure ports
- SAE mounting flange with ANSI or SAE spline shaft
- Through shaft SAE A, B, B-B, C, D and E
- Optional tandem and multiple pumps

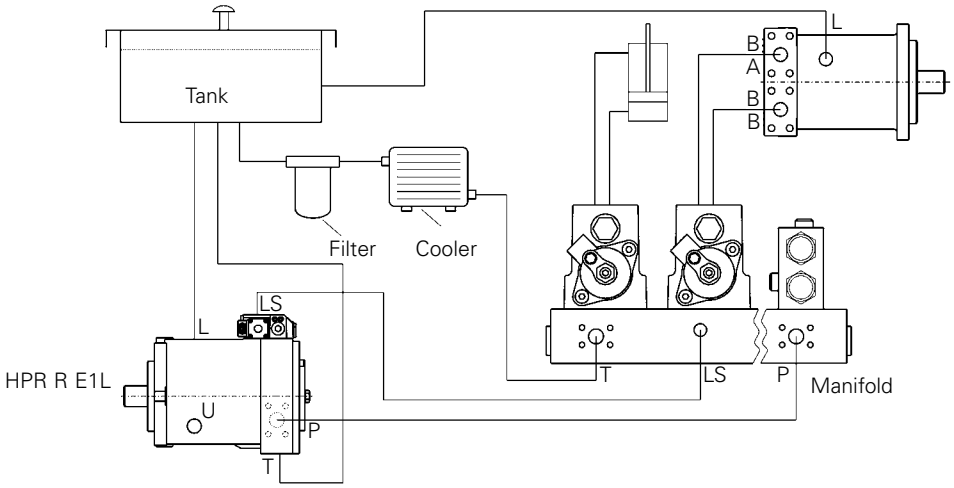
Product Advantages

- Energy saving operation by “flow on demand” control
- Dynamic response
- Excellent suction up to rated speed
- Noise optimization over the entire range of operation
- Optimum interaction with Eaton LSC-Directional Control Valves and LinTronic
- Compact design
- High power density
- High pressure rating
- High reliability
- Long working life

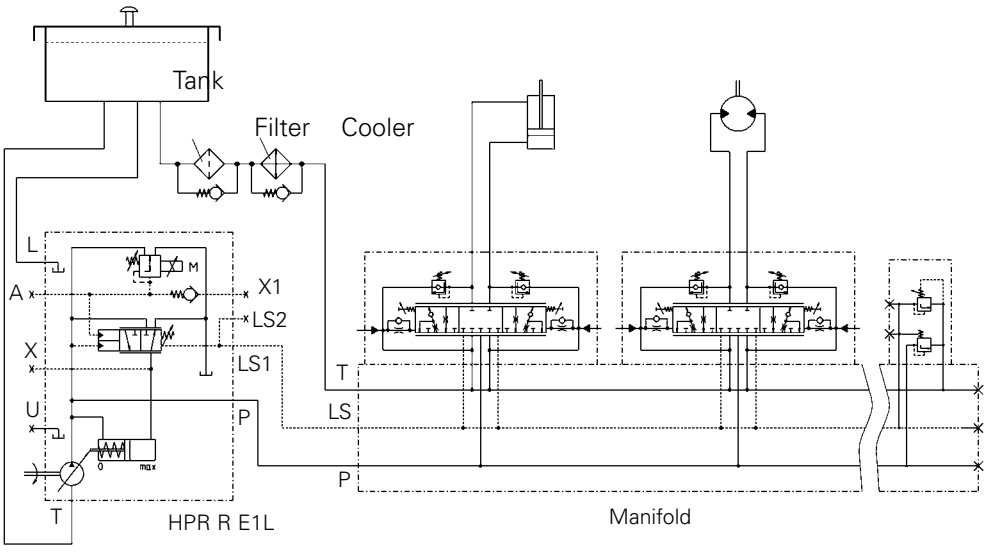
Open Loop

Representation of hydraulic components in an open loop circuit: HPR regulating pump with load sensing function for energy saving, flow on demand control and VW load sensing directional control valves for load-independent, synchronous movements of actuators without unintentional interaction. The system is complemented with proven Eaton products such as electronic controls, swing drives and hydraulic motors.

Function Diagram



Circuit Diagram



Specifications and Performance

The table shows the complete capacity range of the pumps, while the diagram below shows the recommended practical range for the different nominal sizes of the HPR pump with control limit between 200 bar Δp minimum and 280 bar Δp maximum. It enables initial selection of the required nominal pump size.

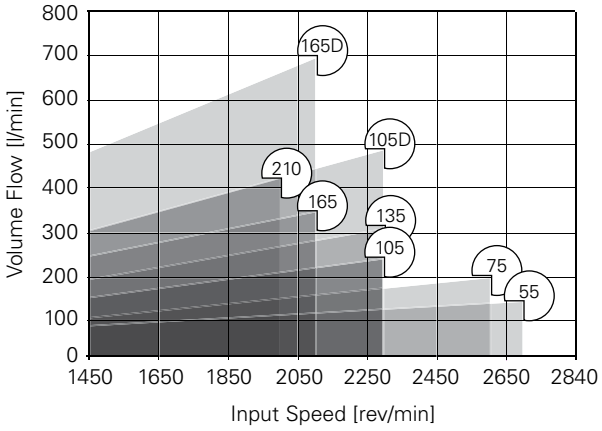
Specifications

Model		55	75	105	135	165	210	105D	165D
Rated Size									
Maximum Displacement	cm^3/rev	54.8	75.9	10.5	135.6	165.6	210	2x105	2x165.6
Speed*	min^{-1}	2700	2600	2300	2300	2100	2000	2300	2100
Volume Flow									
Max. oil flow	1/min	147.9	197.3	241.5	311.9	347.8	420	483	695.6
Pressure									
Nominal Pressure	bar	420	420	420	420	420	420	420	420
Peak Pressure	bar	500	500	500	500	500	500	500	500
Permissible Housing Pressure (absolute)	bar	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Input Torque									
Max. Input torque at max. operating pressure and Vmax	Nm	366	508	702	907	1106	1404	1090	2215
Response Times**									
Vmax -> Vmin swashing at	HP 100 bar ms	120	120	120	140	150	200	200	150
constant max. system pressure HP	HP 200 bar ms	70	70	70	70	130	170	170	130
Vmin -> Vmax swashing from stand-by	HP 100 bar ms	180	180	180	180	180	160	160	180
pressure and zero outlet flow to constant max. system pressure HP	HP 200 bar ms	160	180	160	160	160	130	130	160
Permissible Shaft Loads									
Axial	N	2000	2000	2000	2000	2000	2000	2000	2000
Radial	N	on request	on request	on request	on request	on request	on request	on request	on request
Perm. Housing Temperature									
Perm. Housing Temp. with min. perm. viscosity > 10 cST	°C	90	90	90	90	90	90	90	90
Weights									
HPR without oil (approximate)	kg	39	39	50	65	89	116	107	197
Maximum moment of inertia	$kgm^2 x 10^{-2}$	0.79	0.79	1.44	2.15	3.41	4.68	2.88	6.88

* Max. operating speed (rated speed) without tank pressurization Operating speed with tank pressurization see chapter operational parameters.

** Measured at fluid viscosity 20 cST and input speed 1500 rpm.

Performance Data



Model Code

HPR – Self-regulating Pump for Open Loop Operation

HPR	105	R	0	S1	M	A	AC	AC	000	0	0	0	0	AA	00	0	0	000	A	00	A	A	A
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 31 32	33	34 35	36	37	38

	55	75	105	135	165	210	280
1 2 3 Product							
HPR – Open Loop Variable Displacement Pump	●	●	●	●	●	●	●
4 5 6 Displacement							
055 – 55 cc/r	●						
075 – 75 cc/r		●					
105 – 105 cc/r			●				
135 – 135 cc/r				●			
165 – 165 cc/r					●		
210 – 210 cc/r						●	
280 – 280 cc/r							●
7 Rotation							
R – CW	●	●	●	●	●	●	●
L – CCW	•	•	•	•	•	•	
8 Mounting Flange							
0 – SAE J744 standard (size 105: LP;H1L;E1L only)	●	●	●	●		●	●
1 – SAE J744 standard / additional threads (sizes 105; 135; (*u))			●	●			
2 – SAE J744 standard / additional holes					●		
3 – ISO 30119-2 metric (TL2;ETP;LEP only)(*m)			●				●
4 – plug-in (LP;H1L;E1L only)/ (size 105; (*d))			•	•			
5 – Bell housing SAE 3 (LP;H1l;E1l only)/(sizes 105; (*d))			•	•			
6 – Bell housing SAE 4 (LP;H1l;E1l only)/(sizes 105; (*d))			•	•			
9 10 Input Driveshaft							
S1 – splined ANSI B92.1 12/24 - 14t (SAE C)/(size 105:(*w))	●	●	●				
S2 – splined ANSI B92.1 12/24 - 17t (SAE C-C)			●	●			
S3 – splined ANSI B92.1 8/16 - 13t (SAE D&E)				●	●		
S4 – splined ANSI B92.1 8/16 - 15t (SAE F)/(sizes 210; 280: (*t))						●	●
T1 – splined ANSI B92.1 16/32 - 21t (*t)		●					
T2 – splined ANSI B92.1 16/32 - 23t (*t)			●				
T3 – splined ANSI B92.1 16/32 - 27t (*t)				●	●	●	
K1 keyed ISO3019-2 / 40 mm (metric flange only (pos. 8))			●				
K2 – keyed ISO3019-2 / 60 mm							●
11 Porting							
M – ISO 6149 metric	●	●	●	●	●	●	●
D – DIN 3852	•	•	•	•			

	55	75	105	135	165	210	280
12 Pump Control							
A – LP:LS/pressure cut-off	●	●	●	●	●	●	●
B – H1L:LS/hydraulic override (*m)	●	●	●	●	●	●	●
C – E1L:LS/electric override (*m)	●	●	●	●	●	●	●
D – TL2:LS/power limiter (*m)/ (*r)			●	●		●	●
E – ETP:electro-proportional/ power limiter/PCO (*m)/ (*r)			●	●		●	●
F – LEP:LS/electric stroke limiter/PCO (*m)/(*r)			●	●		●	●
13 14 Pressure Compensator Setting							
00 – Not applicable (H1L; E1L; TL2)	•	•	•	•	•	•	•
AA – 250 bar	●	●	●	●	●	●	●
AB – 350 bar	●	●	●	●	●	●	●
AC – 420 bar	●	●	●	●	●	●	●
15 16 Load Sensing Differential Pressure							
00 – Not applicable (ETP)	•	•	•	•	•	•	•
AC – 20 bar	●	●	●	●	●	●	●
17 18 19 Power Limiter Setting							
000 – not applicable (LP; H1L; E1L; LEP)	●	●	●	●	●	●	●
value – 009 - 106 kW (numeric 3 digits)			●				
value – 012 - 136 kW (numeric 3 digits)				●			
value – 019 - 184 kW (numeric 3 digits)						●	
value – 032 - 221 kW (numeric 3 digits)							●
20 Pressure Limiter Remote Control							
0 – not applicable (LP; H1L; E1L;TL2)	●	●	●	●	●	●	●
D – disabled (ETP; LEP only)			●	●		●	●
R – enabled (ETP; LEP only)			●	●		●	●
21 Power Limiter Remote Control							
0 – not applicable (LP; H1L; E1L;LEP only)	●	●	●	●	●	●	●
1 – remote power uprating (default for TL2; ETP)			●	●		●	●
2 – remote power up- & downrating (TL2; ETP only)			●	●		●	●

• Available Option ● Preferred Option

♦ Separate Specification Required

(*d) DIN porting only (see position 11)

(*e) Availability depends on controller type (see position 12)

(*m) ISO metric porting only (see position 11)

(*r) CW rotation only (see position 7)

(*s) Second HPV/R unit has to be specified separately

(*t) Recommended if HPV/R unit is attached to PTO (see position 26,27)

(*u) Required for PTO flange size C (see position 26,27)

(*w) Not for tandem units (see position 26,27)

Model Code

HPR – Self-regulating Pump for Open Loop Operation

HPR	105	R	0	S1	M	A	AC	AC	000	0	0	0	0	AA	00	0	0	000	A	00	A	A	A
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 31 32	33	34 35	36	37	38

		55	75	105	135	165	210	280
22	**Control Solenoids**							
0	– not applicable (LP; H1L; TL2)	●	●	●	●	●	●	●
A	– AMP / 12V	●	●	●	●	●	●	●
B	– AMP / 24 V	●	●	●	●	●	●	●
C	– DIN / 12 V	•	•	•	•	•	•	•
D	– DIN / 24 V	•	•	•	•	•	•	•
E	– Deutsch / 12V	•	•	•	•	•	•	•
F	– Deutsch / 24V	•	•	•	•	•	•	•
23	**Noise Optimization Devices**							
0	– No Noise Reduction Device	●	●	●	•	•	•	
1	– With SPU primary noise reduction (sizes 55-105: (*r))	●	●	●	●	●	●	●
24 25	**Auxiliary Pad and Shaft Definition**							
0G	– to add gear pump see positions 26,27	•	•	•	•	•	•	•
AA	– SAE J744 A without shaft coupling (default)	●	●	●	●	●	●	●
AB	– SAE J744 A / ANSI B92.1 16/32-9 teeth (A)	●	●	●	●	●	●	
AC	– SAE J744 A / ANSI B92.1 16/32 - 11 teeth				•		•	
AD	– SAE J744 A / ANSI B92.1 16/32 - 13 teeth			•	•		•	•
AE	– SAE J744 B without shaft coupling	•	•	•	•	•	•	•
AF	– SAE J744 B / ANSI B92.1 16/32-13 teeth (B)	•	•	•	•	•	•	•
AG	– SAE J744 B / ANSI B92.1 16/32-15 teeth (B-B)	•	•	•	•			•
AH	– SAE J744 C without shaft coupling	•	•	•	•	•	•	•
AJ	– SAE J744 C / ANSI B92.1 12/24-14 teeth (C)	•	•	•	•	•	•	•
AK	– SAE J744 C / ANSI B92.1 16/32 - 21 teeth		•	•	•		•	
AL	– SAE J744 C / ANSI B92.1 16/32 - 23 teeth			•	•	•	•	
AM	– SAE J744 D without shaft coupling				•	•	•	•
AN	– SAE J744 D / ANSI B92.1 8/16-13 teeth (D)				•			
AP	– SAE J744 D / ANSI B92.1 12/24 - 17 teeth				•			
AQ	– SAE J744 D / ANSI B92.1 16/32 - 27 teeth				•	•	•	
AR	– SAE J744 E without shaft coupling						•	•
AS	– SAE J744 E / ANSI B92.1 16/32 - 27 teeth						•	
26 27	**Auxiliary Pump or Tandem Adapter**							
00	– without	●	●	●	●	●	●	●
BA	– internal gear pump 16cc	●	●	•	•			
BB	– internal gear pump 22,5cc	•	•	●	●			
BC	– internal gear pump tandem 16+16cc	•	•	•	•			
BD	– internal gear pump tandem 16+22,5cc	•	•	•	•			
BE	– internal gear pump tandem 22,5+16cc	•	•	•	•			
BF	– internal gear pump tandem 22,5+22,5cc	•	•	•	•			
BG	– external gear pump 31cc (*r)			•	•			
BH	– external gear pump 38cc			•	•		•	•
BJ	– external gear pump 44cc (*r)						•	•
BK	– external gear pump tandem 22,5+22,5 cc (*r)				•	•	•	•
BL	– HPV/R 55 mounting preparation (*s)	•	•	•	•	•	•	•
BM	– HPV/R 75 mounting preparation (*s)		•	•	•	•	•	•
BN	– HPV/R 105 mounting preparation (*s)			•	•	•	•	•
BP	– HPV/R 135 mounting preparation (*s)				•	•	•	
BQ	– HPV/R 210 mounting preparation (*s)						•	•
28	**Auxiliary Drive on Internal Gear Pump**							
0	– Without internal gear pump	●	●	●	●	●	●	●
A	– SAE J744 A / ANSI B92.1 16/32 - 9 teeth (A) (default)	●	●	●	●			
B	– SAE J744 B without shaft coupling	•	•	•	•			
C	– SAE J744 B/ANSI B92.1 16/32 - 13 teeth (B)	•	•	•	•			
D	– SAE J744 B/ANSI B92.1 16/32 - 15 teeth (B-B)	•	•	•	•			
E	– SAE J744 C without shaft coupling			•	•			
F	– SAE J744 C/ANSI B92.1 12/24 - 14 teeth (C)			•	•			
29	**Internal Gear Pump Supply**							
0	– Without internal gear pump	●	●	●	●	●	●	●
E	– External supply port	●	●	●	●			
30 31 32	**Maximum Displacement Setting**							
000	– Catalog Pump Rating	●	●	●	●	●	●	●
33	**Operating Speed**							
A	– Catalog Pump Rating	●	●	●	●	●	●	●
34 35	**Special Requirements**							
00	– Without special requirements (default)	●	●	●	●	●	●	●
36	**Surface Coating**							
0	– Anti rust conservation oil (default)	●	●	●	●	●	●	●
A	– Primer blue	●	●	●	●	●	●	●
37	**Unit Identification**							
A	– Eaton	●	●	●	●	●	●	●
38	**Type Code Release**							
A	– Revision Level A	●	●	●	●	●	●	●

• Available Option ● Preferred Option ♦ Separate Specification Required

Operational Parameters

Life Time Recommendations

Eaton high pressure units are designed for excellent reliability and long service life. The actual service life of a hydraulic unit is determined by numerous factors. It can be extended significantly through proper maintenance of the hydraulic system and by using high-quality hydraulic fluid.

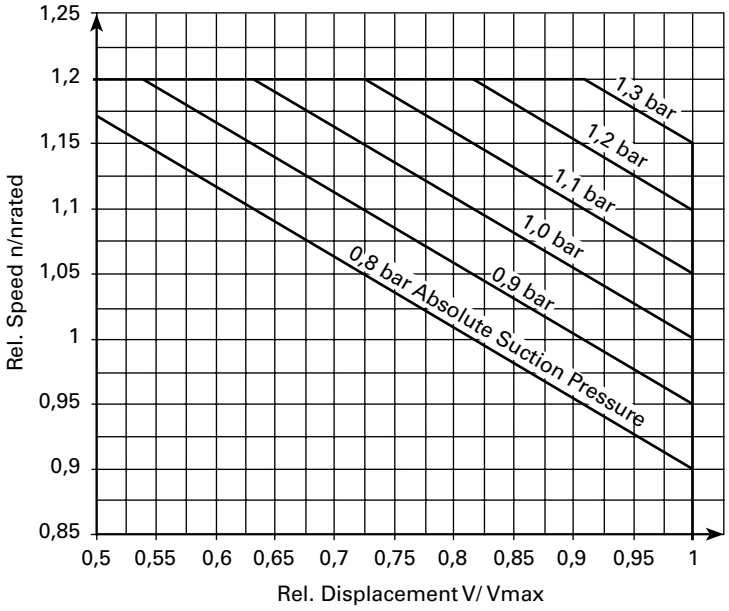
Beneficial Conditions for Long Service Life

Speed	Lower continuous maximum speed
Operating Pressure	Less tan 300 bar Δp on average
Max. Pressure	Only at reduced displacement
Viscosity	15...30 cSt
Power	Continuous power or lower
Purity of Fluid	18/16/13 in accordance with ISO 4406 or better

Adverse Factors Affecting Service Life

Speed	Between continuous maximum speed and intermittent maximum speed
Operating pressure	More than 300 bar Δp on average
Viscosity	Less than 10 cSt
Power	Continuous operation close to maximum power
Purity of fluid	Lower than 18/16/13 in accordance with ISO 4406

Operational Parameters. HPR Suction Speed



Operational Parameters

Tank connection

The leakage and decompression oil generated during pump operation is drained from the rotating group into the pump housing.

Excessive housing pressure must be avoided through suitably dimensioned piping between the housing and the tank.

Operational Parameters. Filtration

In order to guarantee long-term proper function and high efficiency of the hydraulic pumps the cleanliness level of the lubricant must comply with the following criteria according to Eaton Hydraulic Fluid Recommendation 03-401-2010. Maintaining the recommended cleanliness level can extend the service life of the hydraulic system significantly.

For reliable proper function and long service life

18/16/13 in accordance with ISO 4406 or better

Commissioning

The minimum cleanliness level requirement for the hydraulic oil is based on the most sensitive component. For commissioning we recommend a filtration in order to achieve the required cleanliness level.

Filling and operation of hydraulic systems

The required cleanliness level of the hydraulic oil must be ensured during filling or topping up. When drums, canisters, or large-capacity tanks are used the oil generally has to be filtered. We recommend the implementation of suitable filters to ensure that the required cleanliness level of the oil is achieved and maintained during operation.

International standard

Code Number According to ISO 4406
18/16/13

Operational Parameters

Pressure Fluids

In order to ensure the functional performance and high efficiency of the hydraulic pumps the viscosity and purity of the operating fluid should meet the different operational requirements. Eaton recommends using only hydraulic fluids which are confirmed by the manufacturer as suitable for use in high pressure hydraulic installations or approved by the original equipment manufacturer.

Permitted Pressure Fluids

- Mineral oil HLP to DIN 51 524-2
- Biodegradable fluids in accordance with ISO 15 380 on request
- Other pressure fluids on request

Eaton offers an oil testing service in accordance with VDMA 24 570 and the test apparatus required for in-house sesting. Prices available on request.

Recommended Viscosity Ranges

Pressure Fluid Temperature Range	**[°C]**	**-20 to +90**
Working viscosity range	[mm²/s] = [cSt]	10 to 80
Optimum working viscosity	[mm²/s] = [cSt]	15 to 30
Max. viscosity (short time start up)	[mm²/s] = [cSt]	1000

In order to be able to select the right hydraulic fluid it is necessary to know the working temperature in the hydraulic circuit. The hydraulic fluid should be selected such that its optimum viscosity is within the working temperature range (see tables).

The temperature should not exceed 90 °C in any part of the system. Due to pressure and speed influences the leakage fluid temperature is always higher than the circuit temperature. Please contact Eaton if the stated conditions cannot be met or in special circumstances.

Viscosity Recommendations

Working Temperature [°C]	**Viscosity [mm²/s] = [cSt] at 40 °C**
Approx. 30 to 40	22
Approx. 40 to 60	32
Approx. 60 to 80	46 or 68

Further information regarding installation can be found in the operating instructions.

LSC-System

The Synchron Control System (SC-System) for open loop hydraulic circuits enables demand-orientated pump volume control based on load sensing technology. A SC-System compensates the effect of varying loads, varying numbers of actuators and different load levels at different actuators. This happens automatically, thereby making machine operation more convenient since, unlike in other systems, continuous corrective action is no longer required. The SC-System enables high-efficiency hydraulic systems to be realized that are strictly orientated to the machine functions. Our application specialists will be happy to provide advice for individual machine configurations.

Functionality

- Demand-oriented pump control
- Excellent precision control characteristics without readjustment
- Exact reproducibility of machine movements through exact control of actuators
- Dynamic response characteristics
- Load-independent, synchronous movements of several actuators
- "Social" oil distribution even in the event of overload
- Automatic venting of directional control valve end caps
- Optimum movement continuity even for combined movements

Further Optional Functions Such As

- Priority control of individual actuators
- Output control
- High-pressure protection
- Regeneration function
- Combined function shuttle valve
- Load holding function

Machine Equipment

- Customized system design for optimum implementation of customer requirements
- Optimum utilization of the installed power with simultaneous improvement of energy consumption
- High flexibility through manifold plates
- Compact, integrated solutions
- Modular design of valve sections
- Add-on cylinder valves for direct and fast cylinder supply, no additional hose burst protection required
- Optimized piping

Benefits

- Perfect matching of the individual operating functions for customized machine characteristics
- Efficient and dynamic machine control for short operating cycles
- Optimized energy balance for reduced fuel consumption and enhanced handling performance
- Simple and safe machine operation for non-fatigue and efficient working
- Unsurpassed reliability even under harsh operating conditions
- Reduced installation times

Noise Reduction

SPU Silencer

In hydraulic systems pressure pulsations can lead to noise emission. These pressure pulsations are a result of the inherent non-uniformity of the volume flow in rotary piston pumps.

In open loop hydraulic circuits pressure pulsations primarily originate from within the hydraulic pump during the compression stroke, i.e. when a piston coming from the low-pressure side (suction side) enters the high-pressure side, where it is suddenly subjected to high pressure.

The higher the pump speed and the pressure difference between the low-pressure and high-pressure side, the more pulsation energy is added to the hydraulic system via the hydraulic fluid.

Pressure pulsations can cause components of the hydraulic system or the machine to oscillate, thereby generating noise that is perceivable for the human ear.

In principle noise emissions from machinery with hydraulic systems can be reduced in the following ways:

- Reduction of operating pressure and speed. This reduces the pulsation energy introduced into the hydraulic system
- Primary measures for optimizing the compression stroke in rotary piston machines with the aim of reducing pulsation
- Secondary measures such as vibration-optimized design and installation of machine components and sound-proofing for noise suppression

Noise Generation

Flow Ripple
▼
Pressure Ripple
▼
Fluid Borne Noise
▼
System Excitation
▼
Structure Borne Noise
▼
Noise Radiation

Noise Reduction. SPU Silencer

All Eaton hydraulic pumps are optimized with respect to pulsation characteristics and therefore noise generation.

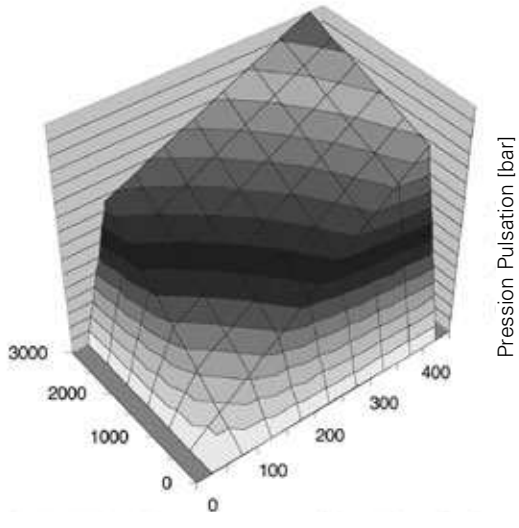
In addition to common primary measures such as exclusive use of pulsation-optimized port plates, Eaton offers the SPU silencer for HPR open loop pumps.

Without affecting the functionality and efficiency of the pump, this system reduces pressure pulsations by up to 70%, irrespective of pressure, speed or temperature.

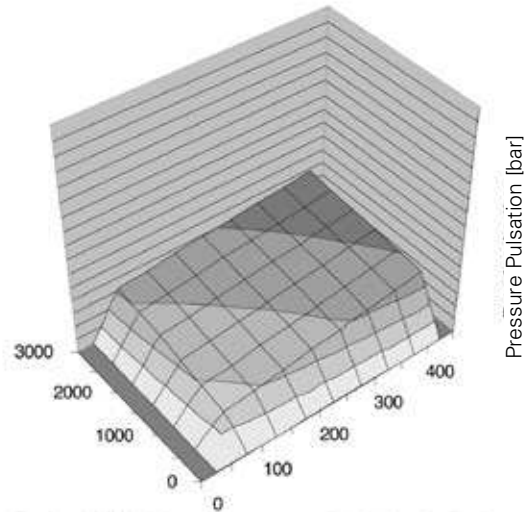
The SPU system is adaptive over the entire operating range. No setting up or maintenance is required.

Pressure Pulsations With and Without SPU

Conventional Commutation



SPU Commutation



Noise Reduction

SPU Silencer

SPU Silencer Function

- Reduction of pressure pulsations over the entire operating range
- Reduction of volume flow fluctuations
- No impairment of efficiency
- Ready for use immediately, no maintenance required
- Simple and rugged design
- Minimum increase in weight and volume

HPR with SPU

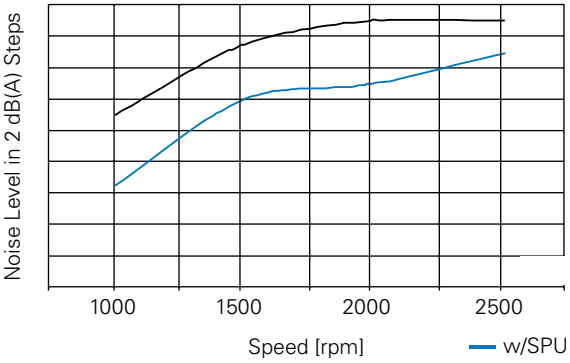


Noise Reduction SPU Silencer

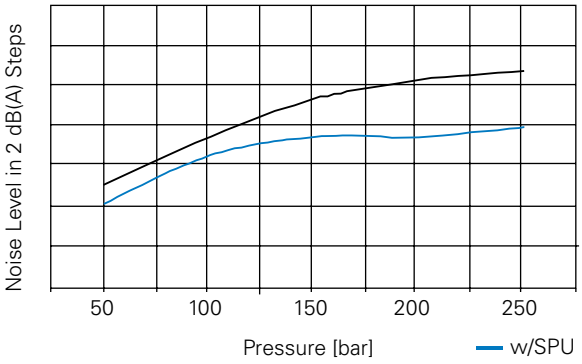
The following diagrams illustrate the immediate effect of pulsation level reduction via SPU on the sound pressure level and therefore the perceived noise emission.

Comparison of Sound Pressure Levels for a HPR 75-02 Pump With and Without SPU

At An Operating Pressure of 350 bar

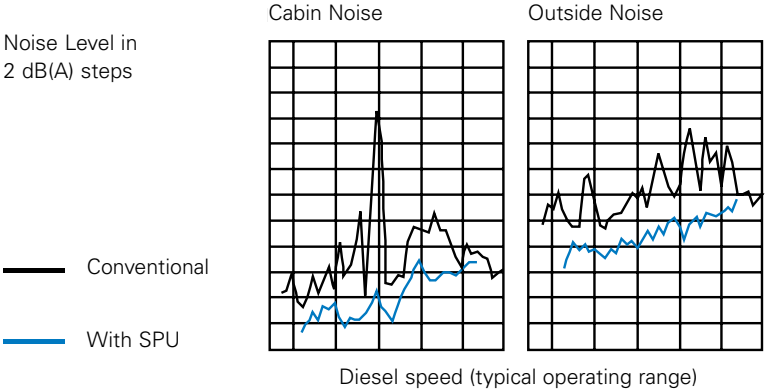


At a Speed of 2500 rpm



Comparison of Resulting Noise Emission

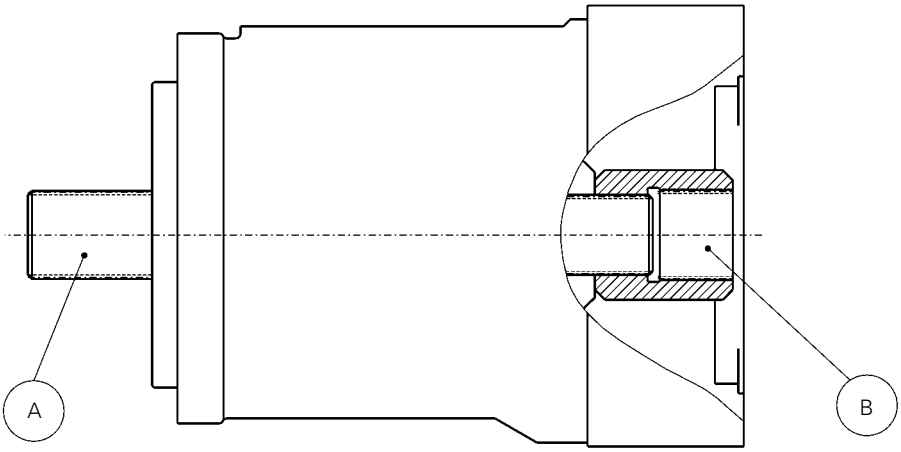
Shown in 2 dB(A) steps over a typical diesel engine operating speed range.



Torque Transmission

Depending on the selected components, different torques may be transferred. Please ensure that the load transfer components such as mounting flange, PTO-through shaft and additional pumps are designed adequately. Our sales engineers will be pleased to provide design advice.

Torque Transmission of HPR



This shows the input side (A) and PTO- / output side (B) of a HPR pump.

The information on the following pages refers to

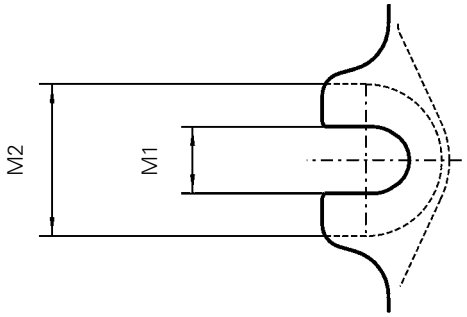
- Mounting flange and drive shaft (A)
- PTO flange and through shaft (B)

A) Flange Profile

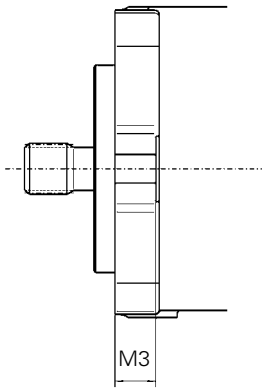
Rated Size HPR

Bolt Holt	Dimensions	55	75	105	135	165	210	105D 2-hole	105D Plug-in	105D SAE 3
M1 Inside Diameter	mm	17.5	17.5	17.5	21.5	21.5	22	17.5	14	11
M2 Outside Diameter	mm	34	34	34	40	40	42	40	20	22
M3 Bolt Hole Length	mm	20	20	20	20	25	26	20	20	12

Bolt Hole Diameter



Bolt Hole Length



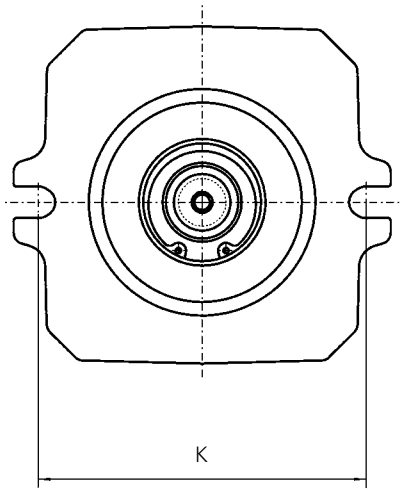
A) Mounting Flange Dimensions

Rated Size HPR

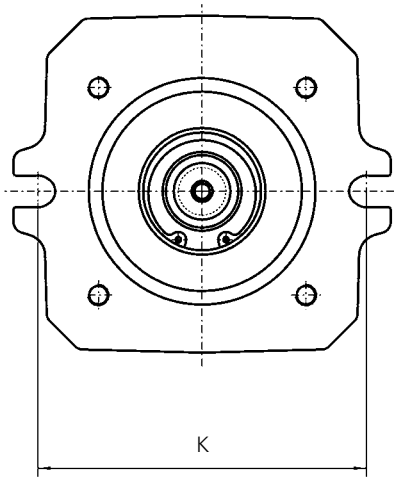
Mounting Flange Dimensions in Accordance with SAE J744	Dimensions K (mm)	55	75	105	135	165	210	105D
SAE C, C-C 2-hole	181.0	X	X	X				
SAE C, C-C 2-hole with additional thread holes	181.0			X				
SAE C, C-C 2 hole with additional bolt holes	181.0							X
SAE D 2-hole	228.6				X	X		
SAE E 4-hole	224.5						X	
Plug-in flange	251.8							X
SAE 3 bell-housing	428.6							X

A) Fixing Hole Distance K

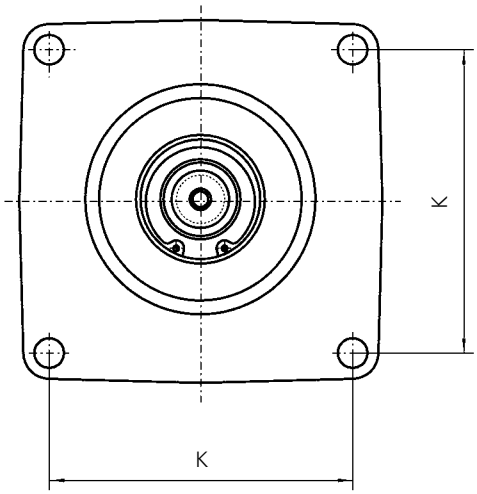
2-hole Flange



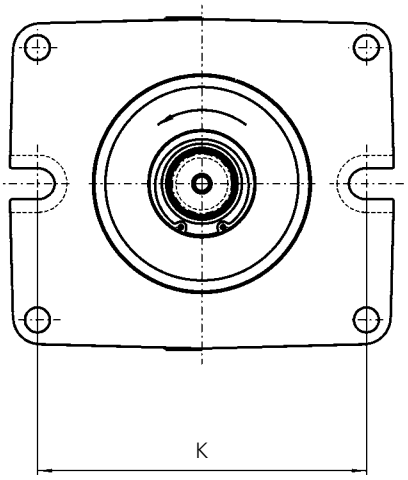
2-hole Flange with 4 Additional Threaded Holes



4-hole Flange



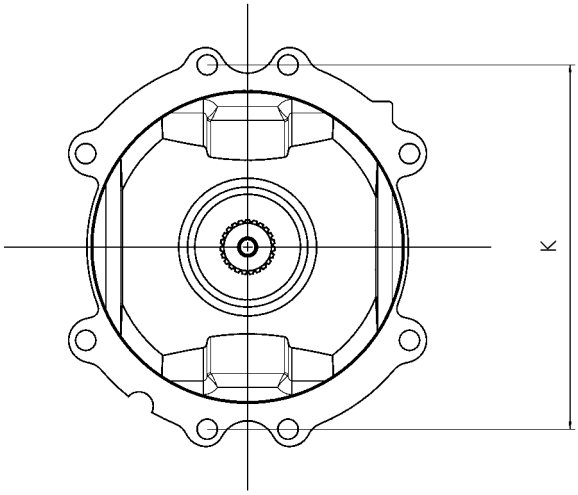
2-hole Flange with 4 Additional Bolt Holes



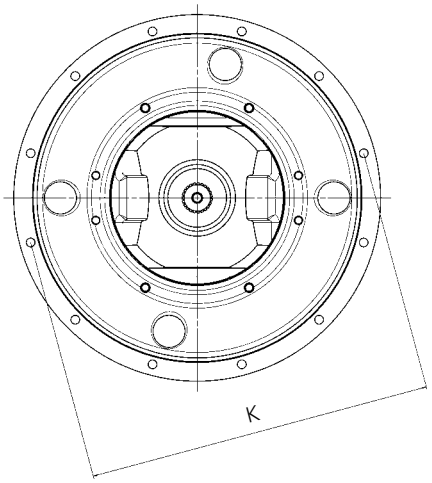
Torque Transmission

Mounting Flange

Plug-in Flange



SAE 3 Bell Housing



Torque Transmission

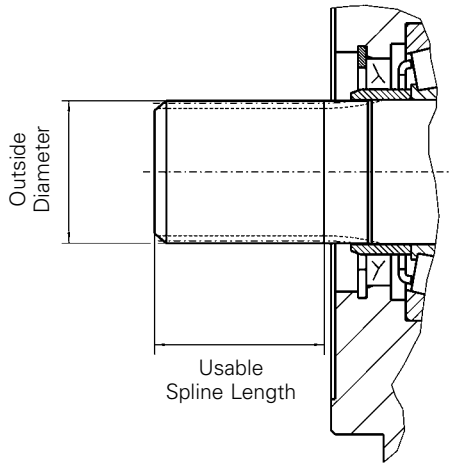
Drive Shaft

A) Dimensions Drive Shafts

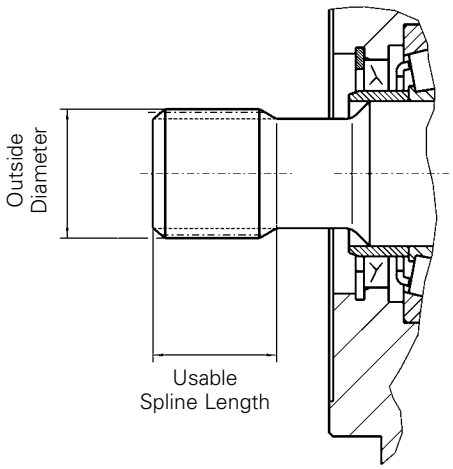
Shaft Spline in Accordance with ANSI B92.1	SAE J744 Code for Centring Shaft	Outside Diameter (mm)	Useable Spline Length (mm)	Shaft Length up to Bearing (mm)	Shaft Type	Available for Rated Size HPR						
						55	75	105	135	165	210	105D
16/32, 23Z		37.68	38.5	47.6	1			X				X
16/32, 27 Z		44.05	62	66.7	1				X	X	X	
12/24, 14 Z	C	31.22	30	47.5	2	X	X	X				
12/24, 17 Z	C-C	37.57	38	53.8	2			X	X			X
8/16, 13 Z	D	43.71	50	66.7	2				X	X		
8/16, 15 Z	F	50.06	58	66.7	1						X	

A) Hydraulics Shaft Types

Type 1. Without Undercut



Type 2. With Undercut



Torque Transmission

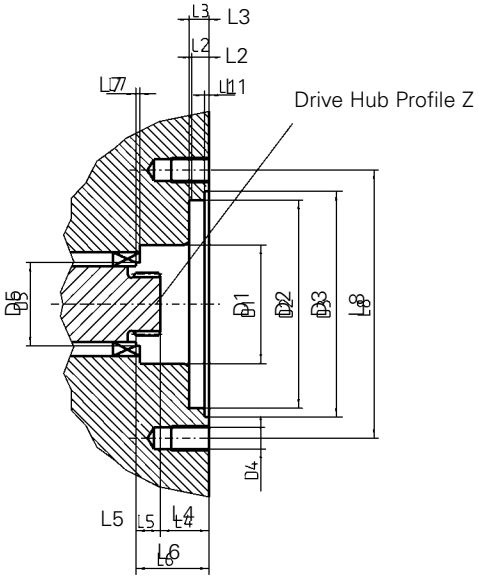
PTO through drive

Eaton pumps can be combined into tandem and multiple pumps. The combination options are determined by the permitted transfer torque. The following data refers to the PTO (pump output side, without further attachments).

B) Dimensions PTO

Rated Size	Dimensions (mm)	55	75	105	135	165	210
Z Drive Hub Profile in Accordance with ANSI B92.1		**16/32, 18 t**	**16/32, 18 t**	**16/32, 19 t**	**16/32, 21 t**	**16/32, 23 t**	**16/32, 24 t**
D1	mm	47	47	48	54	55	63
D2 Spigot Pilot Diameter	mm	82.55	82.55	82.55	82.55	82.55	82.55
D3	mm	89.5	89.5	89.5	89.5	89.5	89.5
D4		M10	M10	M10	M10	M10	M10
D5 Max. Bearing Clearance	mm	30	35	38	43	42	46
L1	mm	1.5	1.5	1.5	1.5	1.9	1.9
L2 Adapter Length	mm	7	7	7	7	8	8
L3	mm	9	9	9	9	9	9
L4 Minimum Distance	mm	35	39	33	35	57.8	46
L5 Usable Spline Length	mm	18	18	24	15.8	24.4	29.5
L6 Distance to Bearing	mm	48	48	52.7	5.2	83.3	46
L7 Min. Bearing Clearance	mm	3	3	3	3	5	5
L8 Hole Distance 2-hole	mm	106.4	106.4	106.4	106.4	106.4	106.4

B) Dimensions PTO



Torque Transmission

Output Shaft

B) Output Shaft Transfer Torque

Rated Size		55	75	105	135	165	210
Continuous Transfer Torque	Nm	220	305	420	540	540	840
Max. Transfer Torque	Nm	350	485	670	870	870	1340

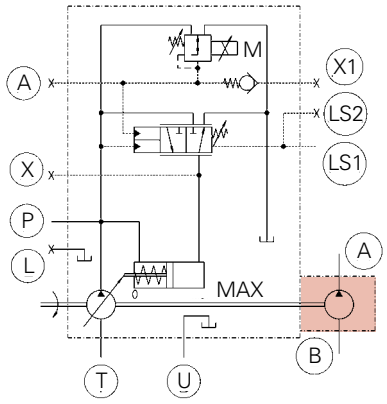
Gear Pumps

Two types of gear pumps are available: internal gear pump IGP and external gear pump EGP. The possible combinations of and with IGP and EGP are determined by the PTO option and the permitted shaft torque. Both types can be used for the control circuit and the cooling circuit. The suction limit of 0.8 bar min. (absolute) must be adhered to.

Technical Data

Max. Displacement Volume	**cm³/rev**	**16**	**22.5**	**31**	**38**	**44**
Type of Gear Pump		**IGP**	**IGP**	**EGP**	**EGP**	**EGP**
Mounting Flange and Drive Shaft Profile		SAE A 16/32 18 t	SAE A 16/32 18 t	SAE A 16/32 9 t	SAE A 16/32 13 t	SAE A 16/32 13 t
Type of Suction in Conjunction with HPR		External	External	External	External	
Max. Permissible Operating Pressure Observe Max. Permissible Rated Pressures for Filter and Color	bar	40	40	165	275	220
Standard PTO Flange and Shaft Spline		SAE A 16/32 9t	SAE A 16/32 9t			
Continuous Output Torque	Nm	175 75 Nm w/SAE A	175 75 Nm w/SAE A			
Max. Output Torque	Nm	250 107 Nm w/SAE A	250 107 Nm w/SAE A			
Cold Start Relief Valve		Integrated	Integrated			

External Gear Pump EGP

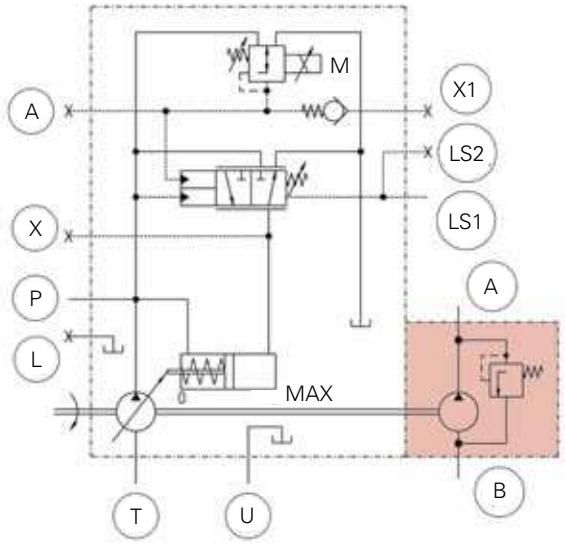




Gear Pumps

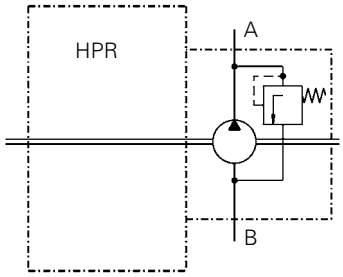
The IGP gear pumps include a cold start relief valve and a through drive for attaching additional pumps. In conjunction with an HPR regulating pump suction is always external. IGP types are available in rated sizes of 16 cm³/rev and 22.5 cm³/rev.

Internal Gear Pump IGP with External Suction





External Suction



External suction

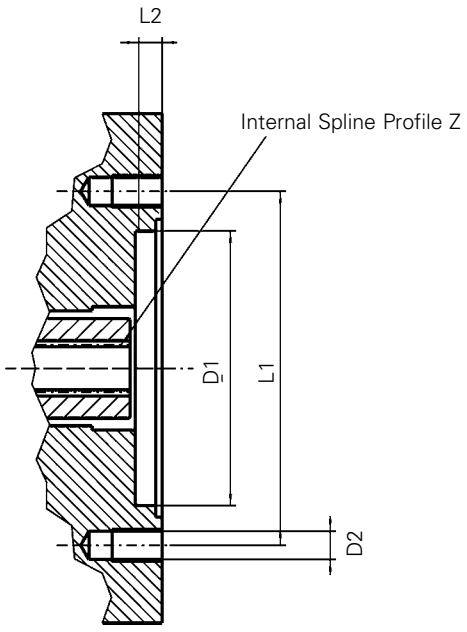
The gear pump supplies the main circuit with oil from the oil tank.

The internal connection is closed.

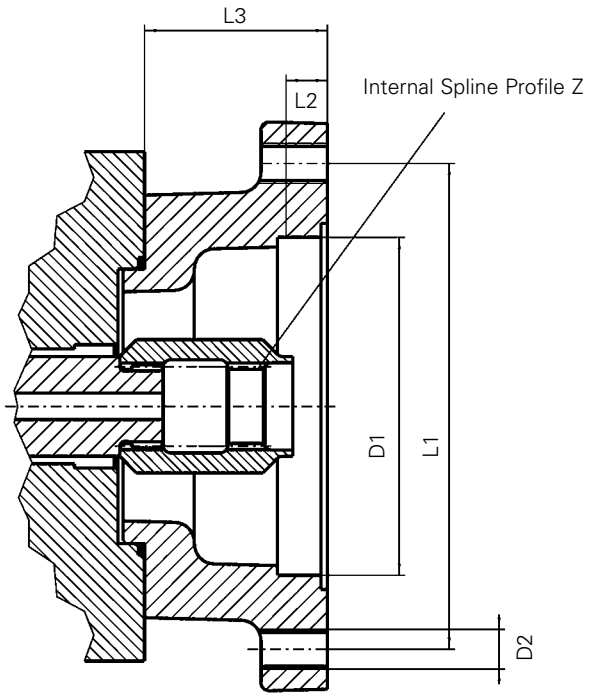
PTO Flange with IGP

Flange Profile 2-hole		SAE A	SAE B	SAE B-B	SAE C
Z Internal Spline Profile in Accordance with ANSI B92.1		16/32 9 t	16/32 13 t	16/32 15 t	12/24 14 t
D1 Spigot Pilot Diameter	mm	82.55	101.6	101.6	127
D2 Thread Size		M 10	M 12	M 12	M16
L1 Hole Distance	mm	106.4	146	146	181
L2 Adapter Length	mm	7	11	11	13
L3 Flange Length	mm	-	55	55	72
Continuous Transfer Torque	Nm	75	175	175	72
Maximum Transfer Torque	Nm	107	250	250	250

PTO SAE A with IGP



PTO SAE B, B-B, and C with IGP



Type of Control

The modular regulator unit enables a wide range of functional system requirements to be met. In all regulator unit versions, the regulating functions are integrated in a housing in order to ensure direct signal transfer without delays and with maximum compactness. All regulators equipped with load sensing function are fully compatible with the Eaton Synchron Control System (see section Eaton LSC-System).

Technical Data

Type of Control	Additional Option	Name of Regulator
Load Sensing	With Pressure Cut-off	LP
	With Power Limitation, Hyperbolic	TL2
	With Electric Override	E1L

LP-Regulator



TL2-Regulator



E1L-Regulator



HPR E1L

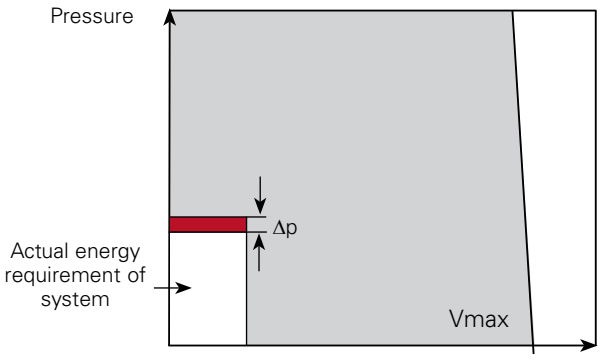


Type of Control

Load sensing LS

Eaton pumps with load sensing control enable the movement speed required of the selected actuator, e.g. of a boom, to be specified via the valve opening. The measured pump and load pressures are continuously balanced by the load sensing regulator of the hydraulic pump.

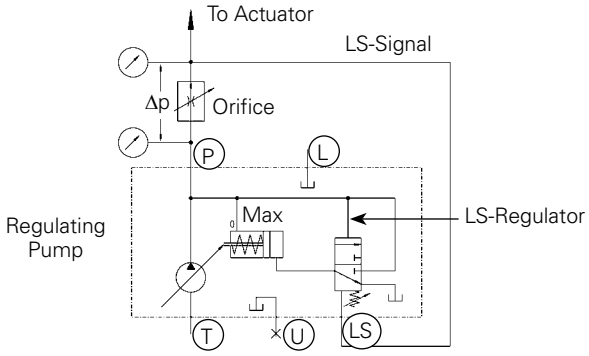
Load Sensing. Flow on Demand Control.



At the regulator a pressure gradient is set which is defined by the actuator requirements. The volume flow results from the orifice A of the control valve and the actual pressure gradient.

Due to the LS-regulator, the Δp corresponds to the setting value. If the required volume flow differs, the pump displacement is changed accordingly.

Regulating pump with LS-regulator and measure orifice (in valve)

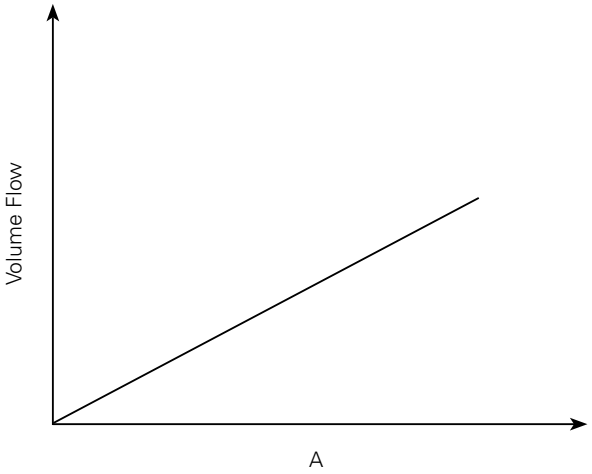


This happens automatically and reduces the effort required by the operator. Since varying loads and varying numbers of actuators are compensated automatically.

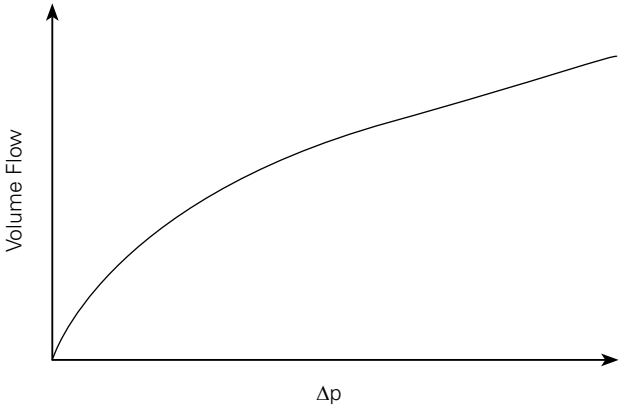
The Δp LS basic setting is possible from 16 to 27 bar with 20 bar as standard

(The LS differential pressure influences the response times of the pump system).

LS-Function at Δp = Constant



LS-Function at Area A = Constant



Benefits of LS-control

- Any volume flow below the pump`s maximum can be set
- Response speed of the machine can be defined
- OEM-specific machine response is possible
- Optimum precision control capability

Demand-oriented pump control offers the following benefits

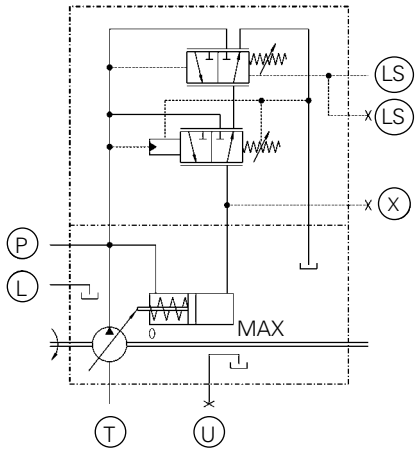
- Load-independent machine control
- Minimum heat generation
- Increased pump service life
- Low noise generation in the whole system
- Fewer components for the control mechansim
- Lower energy consumption, particularly with partial volume flow

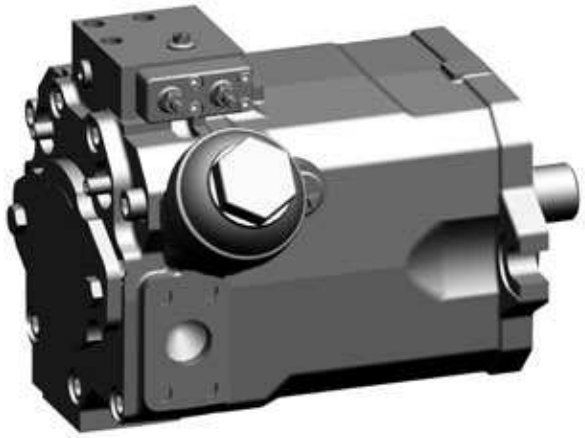
Type of Control

LS with Hydraulic Pressure Cut-off LP

In addition to the load sensing function the LP-regulator offers maximum pressure limitation. Once the system pressure reaches the set pressure of the pressure cut-off valve, the LS-regulator is overridden and the pump swashes back, whilst maintaining the system's regulating pressure. The hydraulic pump remains in this state until the system pressure falls below the set pressure. The hydraulic pump then returns to normal LS operation.

LP. LS with Hydraulic Pressure Cut-off





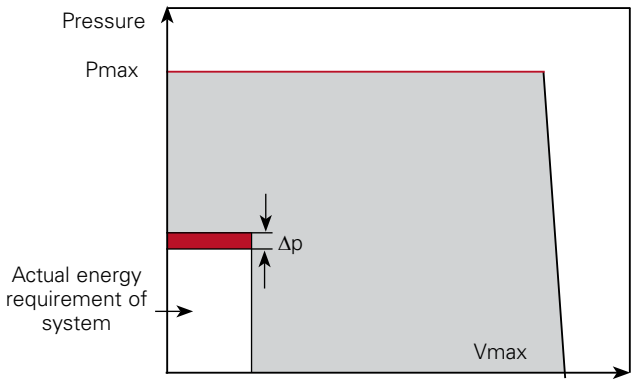
The maximum pressure cut-off valve prevents prolonged operation of pressure relief valves installed in the hydraulic system for protection. This has the following benefits for the hydraulic system:

- Operating pressure is maintained
- No operation in the overload range
- Any operating point under the power curve remains accessible
- Demand-oriented volume flow generation
- Minimum power loss
- Reduced heat and noise generation
- Longer service life of the pump and the entire hydraulic system
- Improved energy consumption of the overall system

Possible maximum pressure control setting ranges

- 125 - 230 bar
- 231 - 350 bar
- 351 - 420 bar

LP-Characteristic Curve



LP-Regulator

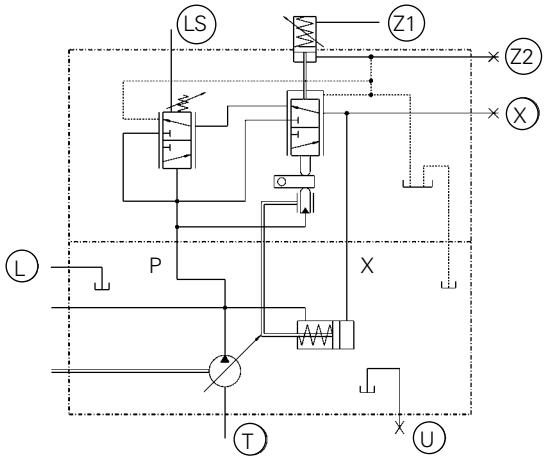


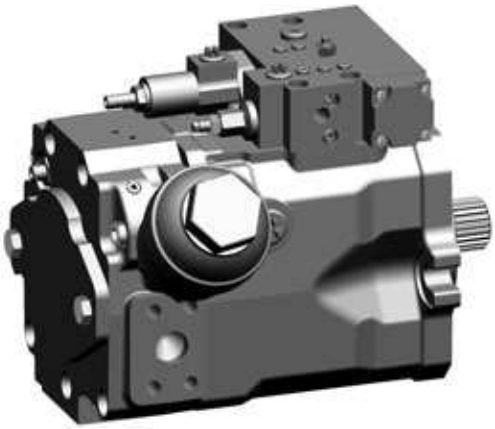
Type of Control

LS with Hyperbolic Power Limitation TL2

The control principle with power limitation is used to optimize power utilization of the prime mover in applications where less than the full power capacity is available for the hydraulic system. In addition to the load sensing function the HPR TL2 offers hyperbolic power limitation. The volume flow is limited when the set value is reached.

TL2. LS with Hyperbolic Power Limitation

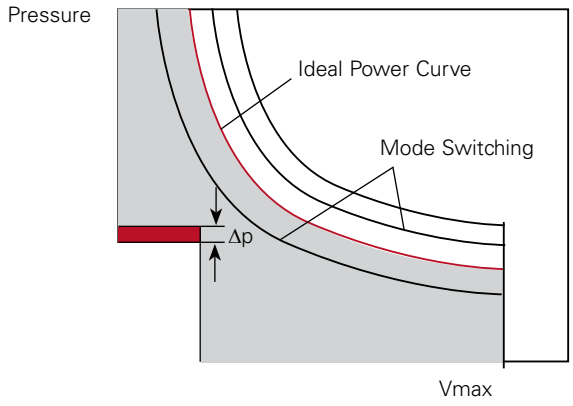




Starting from the set value, the characteristic power limit curve can be moved towards lower or higher power limits via a seperate control pressure connection (hydraulic mode switching).

Due to the ideal hyperbolic characteristics, the output of the prime mover can be utilized optimally, or the pump can be allocated a constant output.

TL2-Characteristic Curve



TL2-Regulator

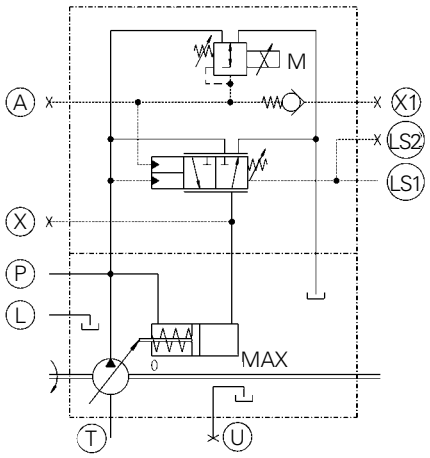


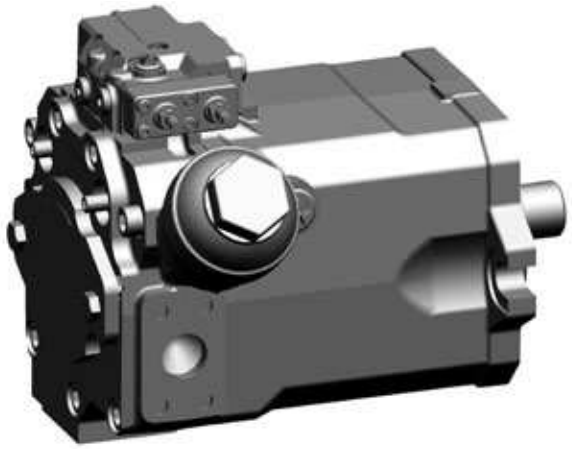
Type of Control

LS with Electric Override E1L

In addition to the load sensing function, the HPR E1L offers electric mode switching override for mode selection and power limit regulation (reduction control). The integration of all functions in the pump regulator enables direct signal transfer without delays. The regulator-specific data are independent of the nominal pump size.

E1L. LS with electric override



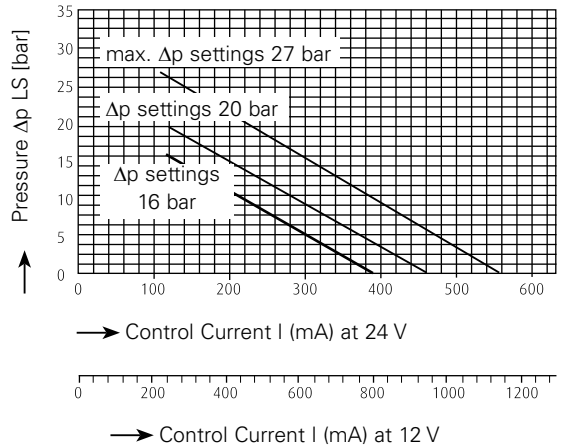


In the event of electric override of the LS-signal, a pressure reducing valve is activated via the proportional solenoid. The control pressure generated in this way acts proportionally against the LS-spring, and the electrical signal is modulated accordingly.

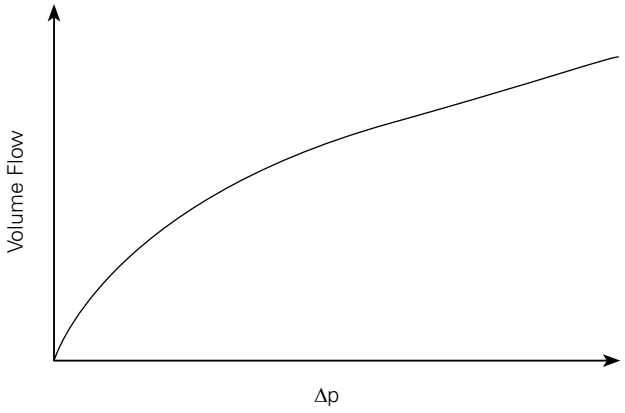
This causes the pump to swash back, thereby reducing its output. The operational availability of the pump control which is a typical Eaton feature, is based on an additional external control feature for the LS-axis.

This ensures that full pump capacity is available in the event of electronic management irregularities. The relationship between control current (I) at the control solenoid and the associated Δp LS value and the dependence of Δp LS of the pump at constant orifice are shown in the following diagrams.

Δp LS-Reduction



Pump Volume Flow at Fixed Orifice (e.g. Directional Control Valve Opening)



Type of Control

LS with Electric Override E1L

Connector Type	Hirschmann or AMP Junior Timer, 2-pole
Solenoid Voltage	12V or 24V
Supply	From on-board supply system (mobile applications) or external supply (usually stationary applications)
Standard Mounting Direction	See HPR E1L representation

E1L. Mode Switching

A mode switching (mode selection) modulates electrically the falling Δp LS-singal at an orifice (e.g. directional control valve). The current Δp LS value is reduced proportionally or in steps and the pump output adjusted via the pressure reducing valve (see the diagrams on previous page.)

In this way the volume flow of the pump can be reduced using the same orifice. In applications with proportional valves this leads to enhanced control resolution, enhabling particularly precise and sensitive actuator movenment.

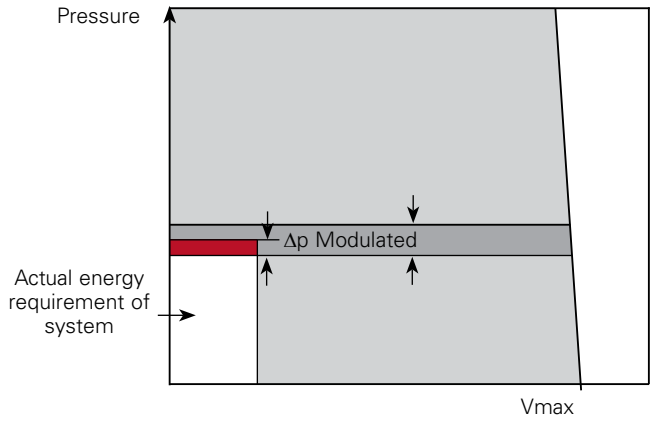
E1L. Power Limit Regulation

Any reduction in the prime mover speed is detected in conjunction with an electronic control unit, and the pump delivery volume is limited through modulation of the Δp LS value to ensure that the maximum power capacity is not exceeded. The volume reduction is the same for all actuators, so that the ratio remains unchanged. The maximum prime mover power is thus available at all times, irrespective of ambient influences and the number of actuators.

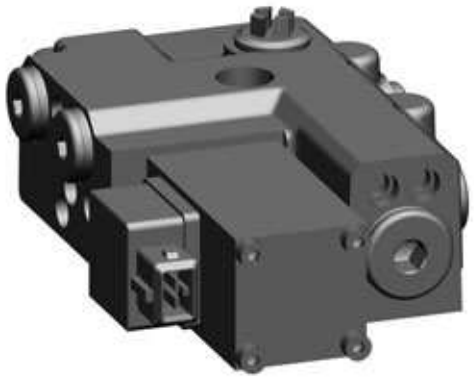
In principle, the Δp LS value acting at the LS-pilot can be modulated almost down to zero, whereas modified response times of the pump system should be expected in the operating range near zero.

E1L-Characteristic Curve

Δp= Δp LSmax with Δp LS = f(I)



E1L-Regulator



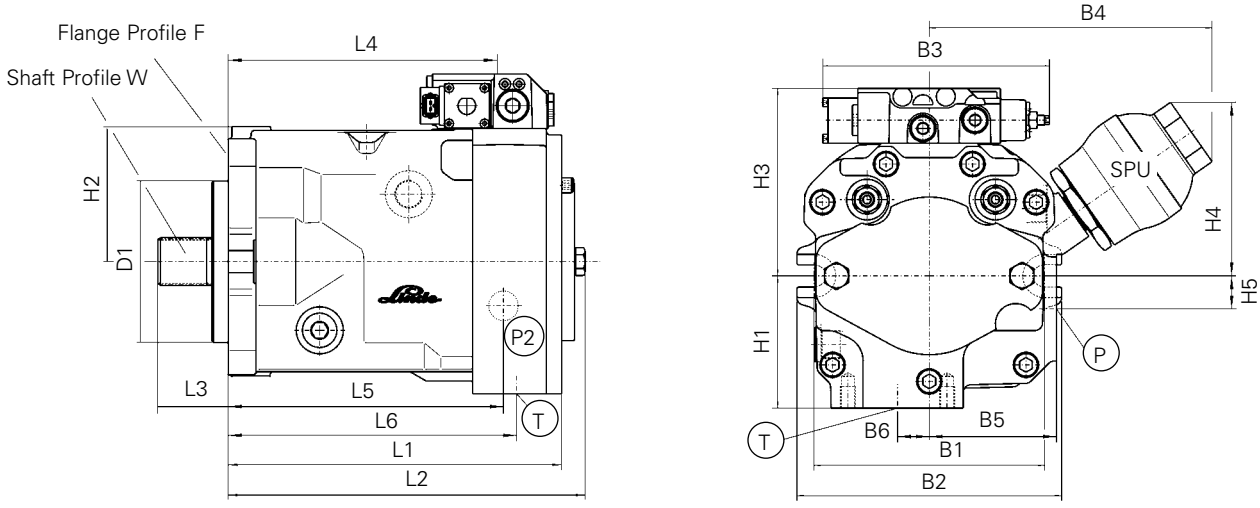
Dimensions

Single Pumps HPR

Port sizes and dimensions HPR Single Pumps

Size	55	75	105	135	165	210
F Flange Profile	SAE C	SAE C	SAE C	SAE D	SAE D	SAE E
Accordance w/ANSI B92.1	2-hole mtng flange	2-hole mtng flange	2-hole mtng flange	2-hole mtng flange	2-hole mtng flange	4-hole
W Shaft Profile in	12/24 Spline Pitch	12/24 Spline Pitch	16/32 Spline Pitch	16/32 Spline Pitch	16/32 Spline Pitch	16/32 Spline Pitch
Accordance w/ANSI B92.1	14 Teeth	14 Teeth	23 Teeth	27 Teeth	27 Teeth	27 Teeth
D1 (mm)	127	127	127	152.4	152.4	165.1
B1 (mm)	181	181	181	229	229	269
B2 (mm)	208	208	208	229	229	225
B3 (mm) LP-Regulator	140	140	140	140	140	140
B3 (mm) E1L-Regulator	178	178	178	178	178	178
B4 (mm)	-	215	222	236	253	262
B5 (mm) Port P	91	91	100	107	124	145
B6 (mm) Port T	21	21	25	40	0	57
H1 (mm)	94	94	104	120	120	145
H2 (mm)	100	93	106	100	116	135
H3 (mm) LP-Regulator	139	139	142	149	166	
H3 (mm) E1L-Regulator	145	145	148	155	172	178
H4 (mm)	-	147	137	146	153	145
H5 (mm) Port P	24	24	26	30	43	27
L1 (mm)	220	232	262	285	359	346
L2 (mm)	240	250	280	303	377	370
L3 (mm)	55	55	55	75	75	75
L4 (mm) SPU	-	192	215	236	256	278
L5 (mm) Port P	183	194	218	244	283	293
L6 (mm) Port T	190	201	227	250	286	296
P High Pressure (SAE)	3/4"	3/4"	1"	1 1/4"	1 1/4"	1 1/2""
T Standard (SAE)	1 1/2"	1 1/2"	2"	2"	2 1/2"	3"
L	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2
U	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2

Threads metric as per ISO 6149
Threads for SAE high pressure port metric as per ISO 261
Socket cap screw as per ISO 4762



Dimensions

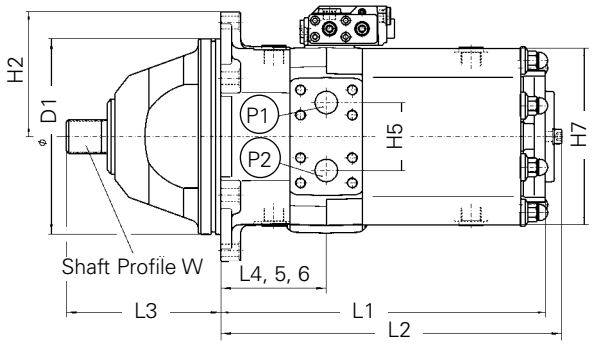
Double Pumps HPR D-02 Back-toBack

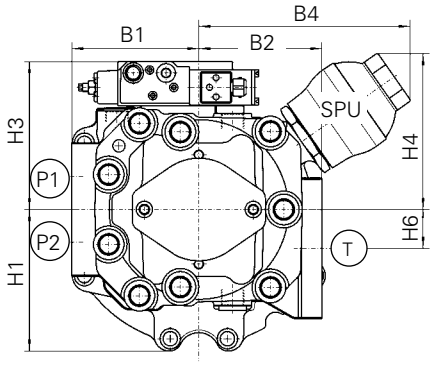
Port sizes and dimensions HPR D-02 Double Pumps

Size	105D	105D	165D
F Flange Profile	Plug-in Version	Plug-in Version	Standard Version
	-	Bell Housing	With SAE Flange
W Shaft Profile in	16/32 Spline Pitch	16/32 Spline Pitch	16/32 Spline Pitch
Accordance w/ANSI B92.1	23 Teeth	23 Teeth	27 Teeth
D1 (mm)	216	409.6	409.6
D2 (mm)	-	428.6	428.6
D3 (mm)	-	456	456
B1 (mm)	124	120	136
B2 (mm)	120	120	147
B3 (mm) LP-Regulator	176	176	176
B4 (mm)	222	222	162.3
H1 (mm)	141	141	168
H2 (mm)	141	141	168
H3 (mm) LP-Regulator	144	144	171
H4 (mm)	137	137	255
H5 (mm) Port P	75	75	80
H6 (mm) Port T	38	38	0
H7 (mm)	196	196	240
L1 (mm)	358	450	578
L2 (mm)	376	468	591
L3 (mm)	171	79	84
L4 (mm)	116	208	276 with SAE Bell Housing
L5 (mm) Port P	116	208	276
L6 (mm) Port T	-	208	276
P High Pressure (SAE)	2 x 1"	2 x 1"	2 x 1 1/4"
T Standard (SAE)	1 x 3"	1 x 3"	1 x 4"
L	M22x1.5	M22x1.5	M27x2
U	M22x1.5	M22x1.5	M27x2

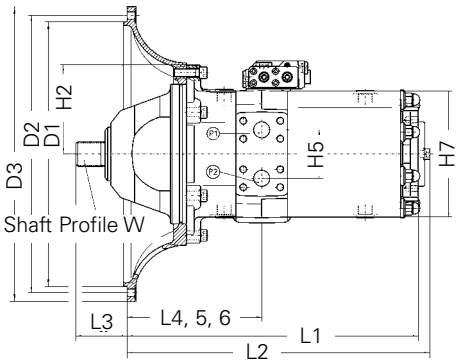
Threads metric as per ISO 6149
Threads for SAE high pressure port metric as per ISO 261
Socket cap screw as per ISO 4762

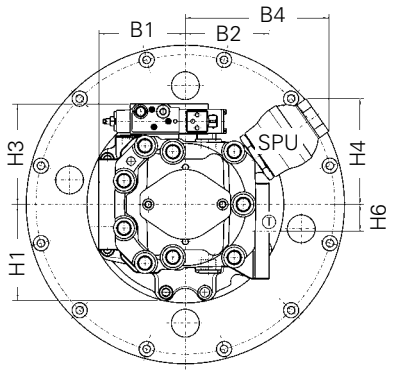
Plug-in Version





With SAE Bell Housing



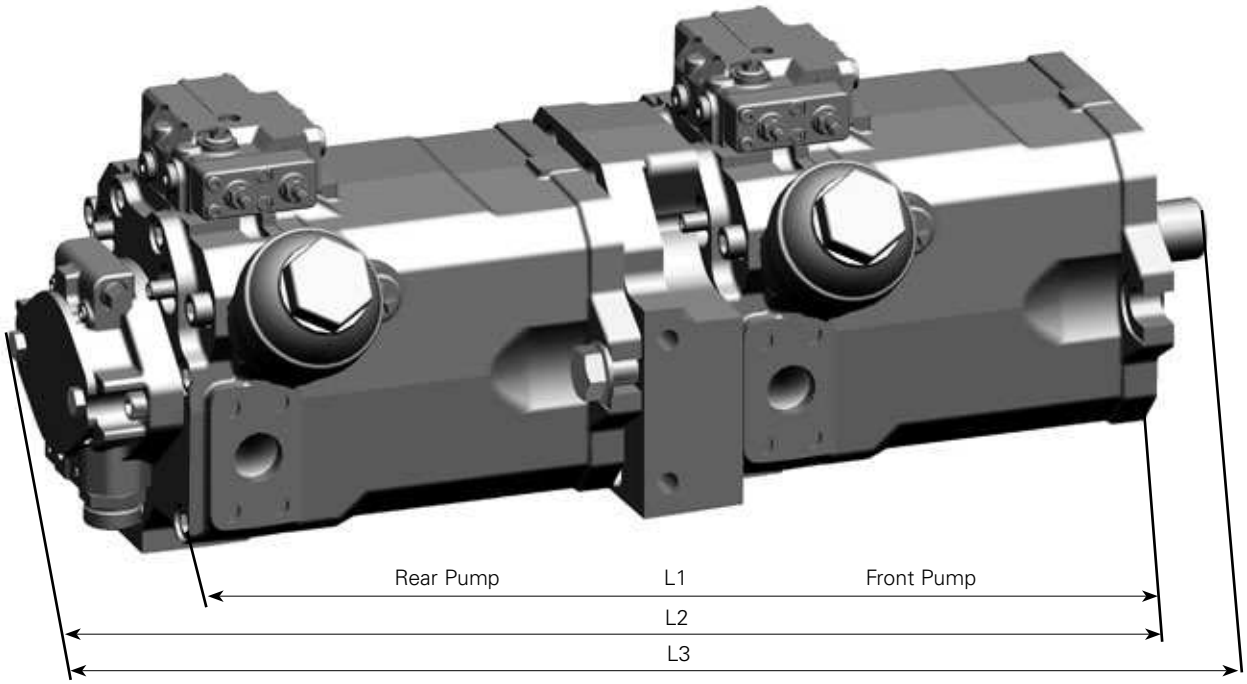


Dimensions

Multiple Pumps

Multiple pumps are created by connecting individual pump units in series, with the pumps arranged by capacity. Positioning the gear pump(s) at the end of the tandem ensures optimum space utilisation, output allocation and load distribution. The following table is based on the attached gear pump acting as a pilot pressure pump for the control circuit.

Multiple pump HPR-HPR



Overall Length of Multiple Pump HPR-HPR

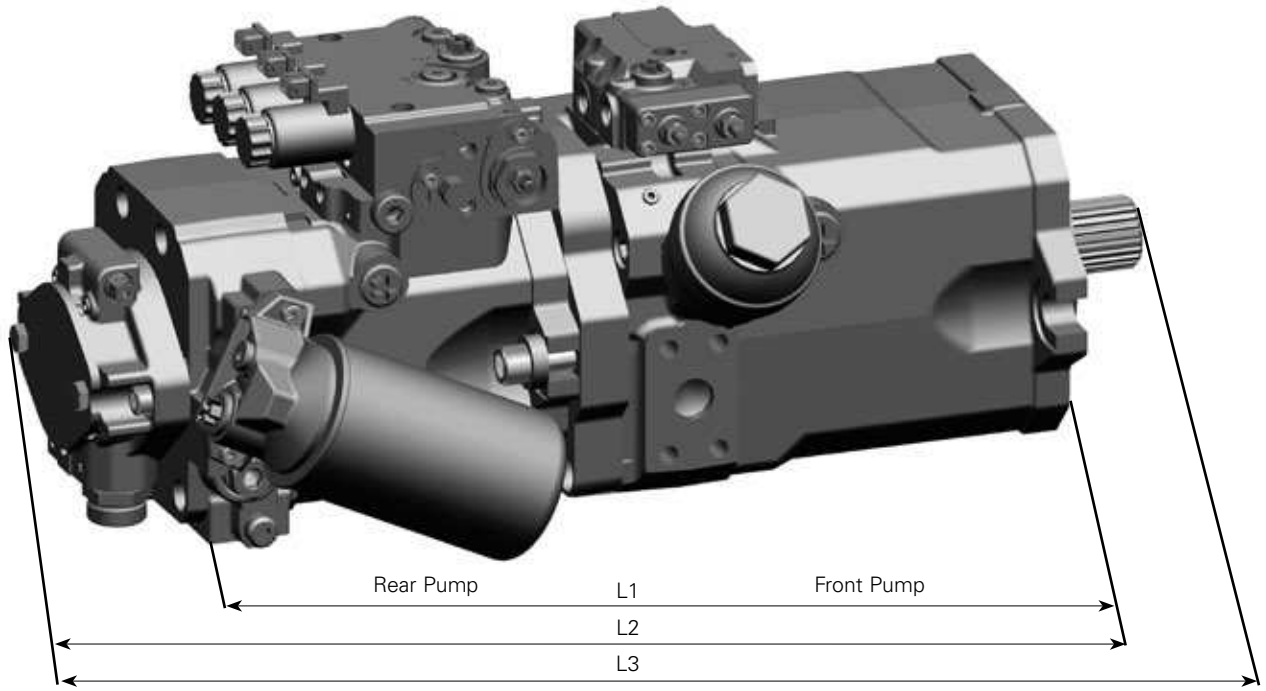
Size	Rear Pump	HPR 55 with gear pump 16 cm³	HPR 75 with gear pump 22,5 cm³	HPR 105 with gear pump 22,5 cm³	HPR 135 with gear pump 22,5 cm³	HPR 165 with gear pump 38 cm³	HPR 210 with gear pump 38 cm³
Front Pump	Lengths (mm)						
HPR 55	L1	488	-	-	-	-	-
	L2	560	-	-	-	-	-
	L3	614	-	-	-	-	-
HPR 75	L1	500	511	-	-	-	-
	L2	572	588	-	-	-	-
	L3	625	642	-	-	-	-
HPR 105	L1	520	531	562	-	-	-
	L2	592	608	624	-	-	-
	L3	646	662	677	-	-	-
HPR 135	L1	536	547	578	634	-	-
	L2	608	624	640	696	-	-
	L3	682	699	714	771	-	-
HPR 165	L1	579	589	621	661	709	-
	L2	636	651	683	723	879	-
	L3	711	726	758	797	954	-
HPR 210	L1	608	620	650	688	736	735
	L2	680	697	712	750	906	907
	L3	755	771	787	824	981	982

Dimensions

Multiple Pumps

Multiple pumps are created by combining individual pump units in series, with the pumps arranged by capacity. Positioning the gear pump(s) at the end of the unit ensures optimum space utilization, output allocation and load distribution. The following table is based on the gear pump acting as boost pump for the HPV variable pump.

Multiple pump HPR-HPV-02



Overall Length of Multiple Pump HPR-HPV

Size	Rear Pump	HPV 55 with gear pump 16 cm³	HPV 75 with gear pump 22,5 cm³	HPV 105 with gear pump 22,5 cm³	HPV 135 with gear pump 22,5 cm³	HPV 165 with gear pump 38 cm³	HPV 210 with gear pump 38 cm³
Front Pump	Lengths (mm)						
HPR 55	L1	492	-	-	-	-	-
	L2	549	-	-	-	-	-
	L3	603	-	-	-	-	-
HPR 75	L1	504	521	-	-	-	-
	L2	561	583	-	-	-	-
	L3	614	636	-	-	-	-
HPR 105	L1	524	541	567	-	-	-
	L2	581	603	629	-	-	-
	L3	635	657	682	-	-	-
HPR 135	L1	536	547	578	634	-	-
	L2	608	624	640	696	-	-
	L3	682	699	714	771	-	-
HPR 165	L1	584	600	626	664	639	-
	L2	640	662	688	726	709	-
	L3	715	675	763	800	784	-
HPR 210	L1	612	629	655	691	736	733
	L2	669	691	717	753	906	905
	L3	744	766	792	827	981	980

Modular System Features

The HPR is based on a modular system and offers the features listed below. This enables our distribution partners to configure the product according to your requirements. The modular system is expanded continuously. Please ask our sales department for the latest characteristics.

- Size
- Vmax
- Mounting flange
- Coupling flange
- Drive shaft
- Direction of rotation
- PTO-direct mounting
- Tandem pump
- Internal gear pump
- External gear pump
- Suction internal gear pump
- Direction of gear pump suction
- PTO-mounting on internal gear pump
- Port threads
- Silencer SPU
- Type of control
- Maximum pressure setting
- Electrical voltage
- Solenoid connector
- Arrangement of solenoid connector
- Power settings for TL-regulator
- Tamper proof for control
- Swash speed
- Drain port U + L
- Surface treatment
- Name plate

Notes

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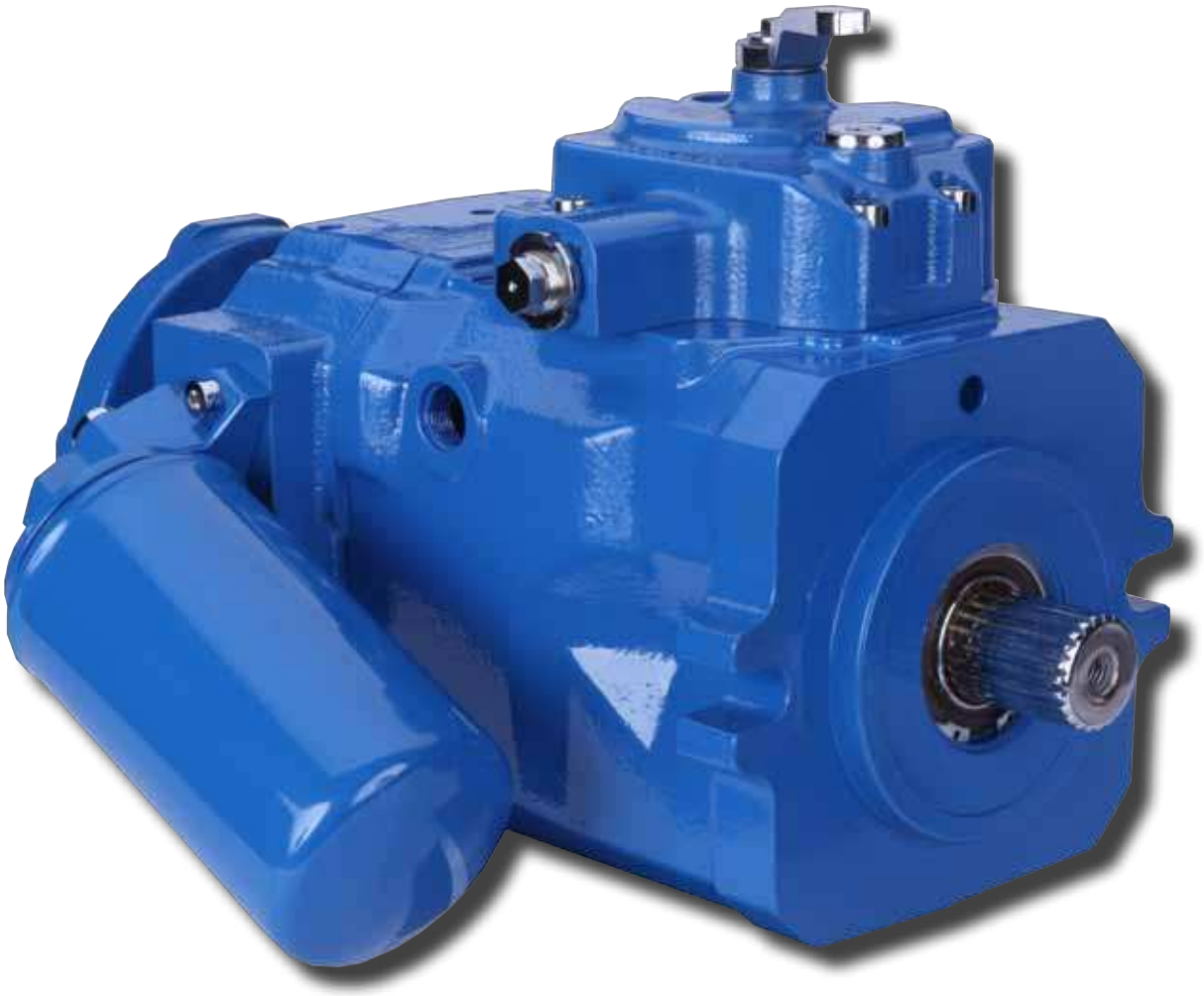
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Powering Business Worldwide

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Supersedes E-PUPI-MC008-E1
September 2011

DuraForce™ HPV
Variable Pumps for Closed Loop Operation



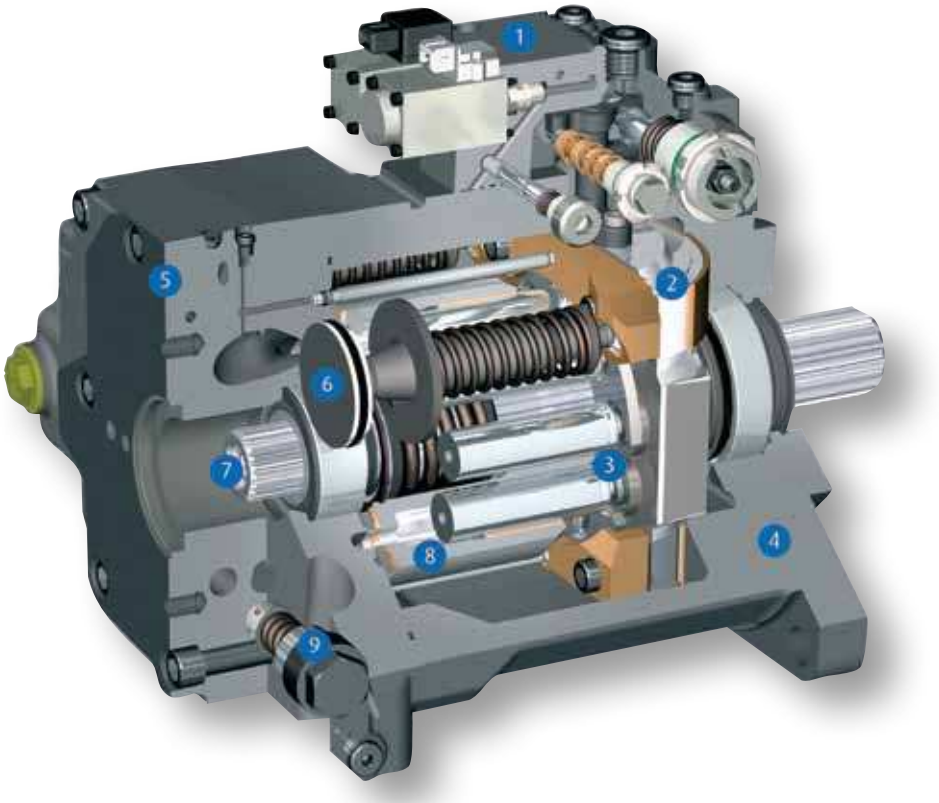
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Powering Business Worldwide

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1 **Control device**
Modular design, precise and load-independent

2 **Swash-plate**
Hydrostatic bearing

3 **Piston-slipper assembly**
21° swash angle

4 **Housing**
Monoshell for high rigidity

5 **Valve plate housing**
Highly integrated

6 **Control piston**
Integrated, hydraulically captured

7 **Through shaft**
For additional pumps

8 **Cylinder barrel**
Compact due to 21° technology

9 **Integrated pressure relief valves**
For system and boost pressure

10 **Optional PTO**
Pumps and motors are available with this torque transmission

Design characteristics

- Axial piston pump in swashplate design for high pressure closed loop systems
- Clockwise or counter clockwise rotation
- Exact and rugged servo control devices (mechanical, hydraulic, electro-hydraulic)
- Integrated high pressure relief valves with make-up function
- Integrated low pressure relief valves for boost, control and cooler circuits
- Replaceable cartridge filter
- SAE high pressure ports
- SAE mounting flange with ANSI or SAE spine shaft
- Through shaft SAE A, B, B-B, C, D and E
- Boost pressure pumps for internal and external suction, integrated cold start relief valve optional
- Hydrostatic bearings of the rotating group compensate for axial forces
- Optional tandem and multiple pumps

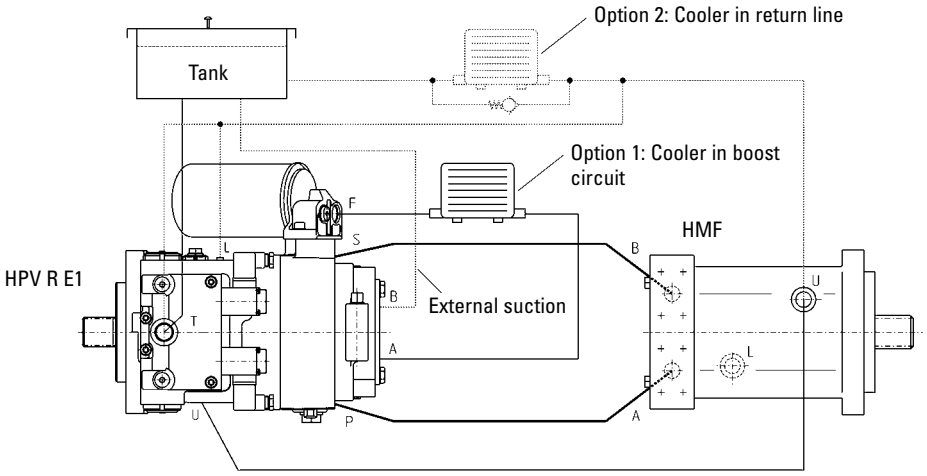
Product advantages

- Compact design
- High power density
- Dynamic response
- High reliability
- Long service life
- Noise-optimized
- Precise and load-independent servo control

The Closed Loop

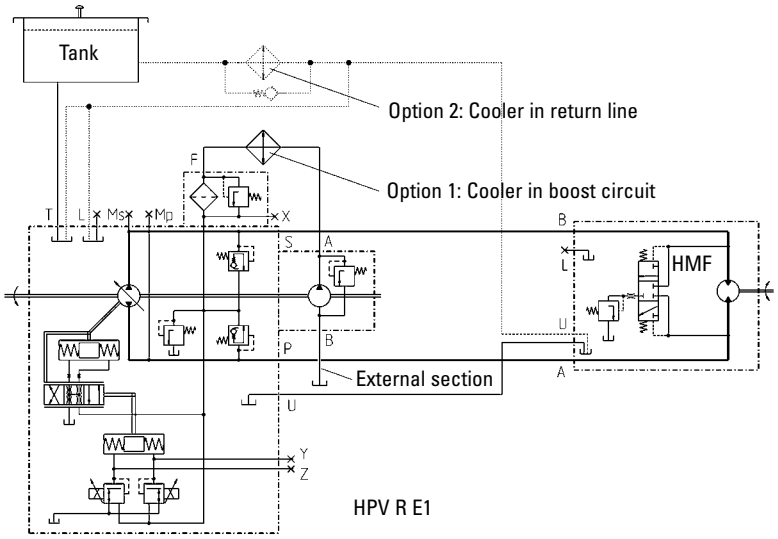
Representation of the hydraulic components of a closed loop hydrostatic drive: Variable electro-hydraulic controlled pump HPV E1 and fixed displacement motor HMF plus filter, cooler and oil tank. The function diagram and the circuit diagram show two types of cooling.

Function diagram



Circuit diagram

The boost pump is shown with external suction.



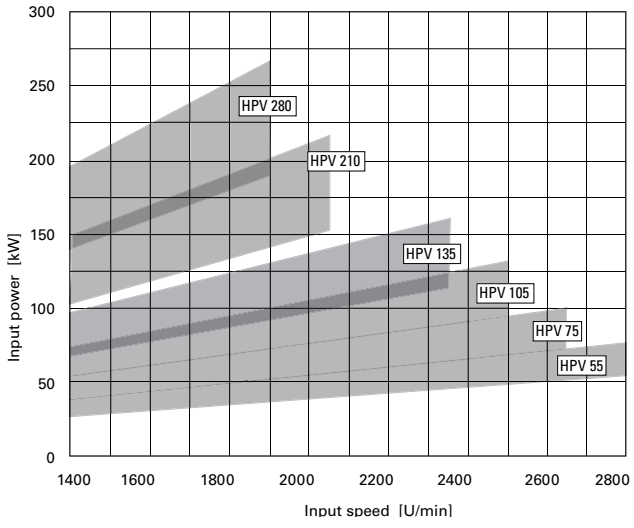
Specifications and Performance

The table shows the complete capacity range of the pumps, while the diagram below shows the recommended practical range for the different nominal sizes of the HPV pump with control limit between 200 bar Δpmin and 280 bar Δpmax. It enables initial selection of the required nominal pump size.

Specifications

			55	75	105	135	165	210	280
Rated size	Maximum displacement	cm^3/rev	54.8	75.9	105	135.6	165	210	280
Speed	Maximum continuous speed (at 100 % duty cycle)	min^{-1}	3300	3100	2900	2700	2500	2300	2000
	Maximum speed (intermittent) higher speed on request	min^{-1}	3700	3500	3200	2900	2700	2500	2200
	Minimum continuous speed	min^{-1}			500			500	500
Pressure	Maximum operating pressure	bar			420			420	420
	Maximum pressure (intermittent)	bar			500			500	500
	Continuous pressure (Δp)	bar			250			250	250
	Permissible housing pressure (absolute)	bar			2.5			2.5	2.5
Torque	Continuous input torque at continuous pressure	Nm	220	305	420	540	1100	840	1115
	Maximum input torque at max. operating pressure and 19 bar boost pressure	Nm	350	485	670	870	170	1340	1785
Power	Continuous power at max. continuous speed, continuous pressure	kW	75	98	127	153	275	201	234
	Maximum power at max. continuous speed, max. operating pressure and 19 bar boost pressure	kW	121	157	204	245	275	322	373
Permissible shaft loads	Axial	N			2000			2000	2000
	Radial	N			on request		on request		on request
Perm. housing temperature	Perm. housing temperature with								
	minimum perm. viscosity > 10 cSt	°C			90			90	90
Weights inclusive IGP (Size 55-135) or EGP (Size 210-280)	HPV with H1-control without oil (approx.)	kg	46	49	66	72	95	132	164
	Filling volume HPV housing with filter	dm^3	2.1	2.8	3.4	3.8	4.2	4.8	5.5
	Maximum moment of inertia	kgm^2x 10^{-2}	0.54	0.84	1.49	2.2	3.11	4.77	9.38

Recommended operating range of HPV



Model Code

HPV – Variable Pump for Closed Loop Operation

HPV	055	R	0	S1	M	E	1	E	E	L	1	1	0	0G	BA	A	E	000	000	00	A	A	A
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 31	32 33	34	35	36

		55	75	105	135	165	210	280
1 2 3	**Product**							
HPV	– Closed Loop Variable Displacement Pump	●	●	●	●	●	●	●
4 5 6	**Displacement**							
055	– 055 cc/r	●						
075	– 075 cc/r		●					
105	– 105 cc/r			●				
135	– 135 cc/r				●			
165	– 165 cc/r					●		
210	– 210 cc/r						●	
280	– 280 cc/r							●
7	**Rotation**							
R	– CW	●	●	●	●	●	●	●
L	– CCW	●	●	●	●	●	●	●
8	**Mounting Flange**							
0	– SAE J744 standard (size 135: (*d))	●	●	●	●		●	●
1	– SAE J744 standard / additional threads (sizes 105; 135: (*u))		•	•	•			
2	– SAE J744 standard / additional holes (sizes 135; 165: (*u) / size 135: (*d))				•	●		
9 10	**Input Driveshaft**							
S1	– splined ANSI B92.1 12/24- 14 teeth (SAE J744 C) (size 105: (*w))	●	●	•				
S2	– splined ANSI B92.1 12/24- 17 teeth (SAE J744 C-C)			●	•			
S3	– splined ANSI B92.1 8/16- 13 teeth (SAE J744 D&E)				●			
S4	– splined ANSI B92.1 8/16- 15 teeth (SAE J744 F) (sizes 210, 280: (*t))						●	●
T1	– splined ANSI B92.1 16/32- 21 teeth (*t)	●	●					
T2	– splined ANSI B92.1 16/32- 23 teeth (*t)			●				
T3	– splined ANSI B92.1 16/32- 27 teeth (*t)				●	●	●	
T4	– splined ANSI B92.1 16/32- 33 teeth (*t)							●
11	**Porting**							
M	– ISO 6149 metric	●	●	●	●	●	●	●
D	– DIN 3852	•	•	•	•			
12	**Pump Control**							
A	– M1: mechanical hydraulic	•	•	•	•	•	•	•
B	– H1: hydraulic proportional	●	●	●	●	●	●	●
C	– H1P: hydraulic proportional / pressure cut-off	●	●	●	●	●	●	●
D	– E1: electro-proportional (*y)	●	●	●	●	●	●	●
E	– E1P: electro-proportional / pressure cut-off (*y)	●	●	●	●	●	●	●
F	– E2: electro-proportional / shutt-off (*z)	•	•	•	•	•	•	•
G	E5: electric three position (*y)	•	•	•	•	•	•	•
H	CA: speed related hydraulic mechanical (*c)(*d)(*r)(*z)	♦	♦	♦	♦			
K	– E1T: electro-proportional / torque cut-off (*c)(*y)	♦						
13	**Control Pressure Range Hydraulic and Electric Controls**							
0	– not applicable (M1;CA)	•	•	•	•	•	•	•
1	– 4-10 bar	●	●	●	●	●	●	●
2	– 4-16 bar (not for E5)	•	•	•	•	•	•	•
14	**Control Solenoids**							
0	– not applicable (M1; H1; H1P)	●	●	●	●	●	●	●
A	– AMP / 12V	●	●	●	●	●	●	●
B	– AMP / 24 V	●	●	●	●	●	●	●
C	– DIN / 12 V	•	•	•	•	•	•	•
D	– DIN / 24 V	•	•	•	•	•	•	•
E	– Deutsch / 12V (E1; E1P; E2; CA)(*z)	•	•	•	•	•	•	•
F	– Deutsch / 24V (E1; E1P; E2; CA)(*z)	•	•	•	•	•	•	•
15	**Response Orifices**							
0	– without response orifices	●	●	●	●	●	●	●
C	– 0,8 mm (standard for M1, H1, H1P controls)	•	•	•	•	•	•	•
E	– 1,0 mm (standard for E1, E1P, E2 controls)	●	●	●	●	●	●	●
G	– 1,2 mm	•	•	•	•	•	•	•
J	– 1,5 mm	•	•	•	•	•	•	•
16	**System Relief Valves**							
A	– 150 bar	•	•	•	•	•	•	•
B	– 200 bar	•	•	•	•	•	•	•
C	– 250 bar	●	●	●	●	●	●	●
D	– 285 bar		•	•				
E	– 300 bar	•			•	•	•	•
F	– 305 bar		•	•				
G	– 350 bar	●	●	●	●	●	●	●
H	– 360 bar		•	•				
J	– 380 bar	•	•	•	•	•	•	•
K	– 400 bar		•	•				
L	– 420 bar	●	●	●	●	●	●	●
17	**Charge Relief Valves**							
0	– purge orifice	•	•	•	•	•	•	•
1	– 19 bar	●	●	●				
2	– 20 bar				●	●	●	●
3	– 22,5 bar	●	●	●				
4	– 23 bar				●	●	●	●
5	– 24 bar	●	●	●				
6	– 29 bar				●	●	●	●
7	– 17.5 bar (CA control only, CA default)	♦	♦	♦	♦			
18	**Filter Configuration**							
0	– No Filter–straight flange port (*d)	•	•	•				
1	– Filter flange with filter cartridge	●	●	●	●	●	●	●
2	– 90° charge port flange without filter	●	●	●	●	●	●	●

• Available Option ● Preferred Option

♦ Separate Specification Required

Model Code

HPV – Variable Pump for Closed Loop Operation

HPV	055	R	0	S1	M	E	1	E	E	L	1	1	0	0G	BA	A	E	000	000	00	A	A	A
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 31	32 33	34	35	36

		55	75	105	135	165	210	280
19	**Swash Angle Sensor**							
0	– Without swash angle sensor	●	●	●	●	●	●	●
S	– With swash angle sensor (*m)		•	•	•		•	•
20 21	**Auxiliary Pad and Shaft Definition**							
0G	– to add gear pump see positions 22,23	•	•	•	•	•	•	•
AA	– SAE J744 A Pad without shaft coupling (default)	•	•	•	•	•	•	•
AB	– SAE J744 A / ANSI B92.1 16/32 - 9 teeth (A)	•	•	•	•			
AC	– SAE J744 A / ANSI B92.1 16/32 - 11 teeth	•		•				
AD	– - SAE J744 A / ANSI B92.1 16/32 - 13 teeth				•			
AE	– SAE J744 B without shaft coupling	•	•	•	•	•	•	•
AF	– SAE J744 B / ANSI B92.1 16/32 - 13 teeth (B)	•	•	•	•	•	•	•
AG	– SAE J744 B / ANSI B92.1 16/32 - 15 teeth (B-B)	•	•	•	•		•	
AH	– SAE J744 C without shaft coupling	•	•	•	•	•	•	•
AJ	– SAE J744 C / ANSI B92.1 12/24 - 14 teeth (C)	•	•	•	•	•	•	•
AK	– SAE J744 C / ANSI B92.1 16/32 - 21 teeth	•	•	•	•			
AL	– SAE J744 C / ANSI B92.1 16/32 - 23 teeth			•	•		•	
AM	– SAE J744 D without shaft coupling				•	•	•	
AN	– SAE J744 D / ANSI B92.1 8/16 - 13 teeth (D)						•	
AP	– SAE J744 D / ANSI B92.1 12/24 - 17 teeth				•			
AQ	– SAE J744 D / ANSI B92.1 16/32 - 27 teeth				•	•	•	
AR	– SAE J744 E without shaft coupling						•	
AS	– SAE J744 E / ANSI B92.1 16/32 - 27 teeth						•	•
AT	– SAE J744 E / ANSI B92.1 16/32 - 33 teeth							•
22 23	**Charge Pump (Internal Gear) or Tandem Adapter**							
00	– without	●	●	●	●	●	●	●
BA	– Internal gear pump 16 cc	●	●	●	●			
BB	– Internal gear pump 22,5 cc	●	●	●	●			
BC	– Internal gear pump tandem 16+16 cc	•	•	•	•			
BD	– Internal gear pump tandem 16+22,5 cc	•	•	•	•			
BE	– Internal gear pump tandem 22,5+16 cc	•	•	•	•			
BF	– Internal gear pump tandem 22,5+22,5 cc	•	•	•	•		•	•
BG	– external gear pump 31 cc (*r)	•		•			•	
BH	– external gear pump 38 cc		•	•		•	•	•
BJ	– external gear pump 44 cc (*r)					•		•
BK	– HPV/R 55-02 mounting preparation (*s)	•	•	•	•	•	•	•
BL	– HPV/R 75-02 mounting preparation (*s)		•	•	•	•	•	•
BM	– HPV/R 105-02 mounting preparation (*s)			•	•	•	•	•
BN	– HPV/R 135-02 mounting preparation (*s)				•	•	•	
BP	– HPV/R 165-02 mounting preparation (*s)					•	•	
BQ	– HPV/R 210-02 mounting preparation (*s)						•	•
BR	– HPV/R 280-02 mounting preparation (*s)							•
24	**Auxiliary Drive on Gear Pump**							
0	– Without internal gear pump	•	•	•	•	●	•	•
A	– SAE J744 A / ANSI B92.1 16/32 - 9 teeth (A) (default)	●	●	●	●		●	●
B	– SAE J744 B without shaft coupling	•	•	•	•			
C	– SAE J744 B / ANSI B92.1 16/32 - 13 teeth (B)	•	•	•	•			
D	– SAE J744 B / ANSI B92.1 16/32 - 15 teeth (B-B)	•	•	•	•			
E	– SAE J744 C without shaft coupling	•	•	•	•			
F	– SAE J744 C / ANSI B92.1 12/24 - 14 teeth (C)	•	•	•	•			
25	**Gear Pump Supply**							
0	– without gear pump	●	●	●	●	●	●	●
E	– external supply port	●	●	●	●	●	●	●
26 27 28	**Displacement Setting – P Port**							
000	– Catalog Pump Rating	●	●	●	●	●	●	●
29 30 31	**Displacement Setting – S Port**							
000	– Catalog Pump Rating	●	●	●	●	●	●	●
32 33	**Special Requirements**							
00	– without special requirements (default)	●	●	●	●	●	●	●
34	**Surface Coating**							
0	– anti rust conservation oil (default)	●	●	●	●	●	●	●
A	– primer blue	●	●	●	●	●	●	●
35	**Unit Identification**							
A	– Eaton	●	●	●	●	●	●	●
36	**Type Code Release**							
A	– Revision Level	●	●	●	●	●	●	●

(*c) Always set option C in position 24
(*d) DIN porting only (see position 11)
(*e) Availability depends on controller type (see position 12)
(*m) ISO metric porting only (see position 11)
(*r) CW rotation only (see position 7)
(*s) Second HPV/R unit has to be specified separately
(*t) Recommended if HPV/R unit is attached to PTO (see position 22,23)
(*u) Required for PTO flange size C (see position 22,23)
(*w) Not for tandem units (see position 22,23)
(*y) Solenoids with square cross section
(*z) Solenoids with circular cross section

Operational Parameters

Life Time Recommendations

Eaton high pressure units are designed for excellent reliability and long service life. The actual service life of a hydraulic unit is determined by numerous factors. It can be extended significantly through proper maintenance of the hydraulic system and by using high-quality hydraulic fluid.

Beneficial Conditions For Long Service Life

Speed	Lower continuous maximum speed
Operating Pressure	Less than 300 bar on average
Max. Pressure	Only at reduced displacement
Viscosity	15 ... 30 cSt
Power	Continuous power or lower
Purity of Fluid	18/16/13 in ac. with ISO 4406 or better

Adverse Factors Affecting Service Life

Speed	Between continuous maximum speed and intermittent maximum speed
Operating Pressure	More than 300 bar on average
Viscosity	Less than 10 cSt
Power	Continuous operation close to max. power
Purity of Fluid	Lower than 18/16/13 in acc. with ISO 4406

Operational parameters. Filtration

In order to guarantee long-term proper function and high efficiency of the hydraulic pumps the cleanliness level of the lubricant must comply with the following criteria according to Eaton Hydraulic Fluid Recommendation 03-401-2010. Maintaining the recommended cleanliness level can extend the service life of the hydraulic system significantly.

For reliable proper function and long service life

18/16/13 in accordance with ISO 4406 or better

Commissioning

The minimum cleanliness level requirement for the hydraulic oil is based on the most sensitive component. For commissioning we recommend a filtration in order to achieve the required cleanliness level.

Filling and operation of hydraulic systems

The required cleanliness level of the hydraulic oil must be ensured during filling or topping up. When drums, canisters, or large-capacity tanks are used the oil generally has to be filtered. We recommend the implementation of suitable filters to ensure that the required cleanliness level of the oil is achieved and maintained during operation.

International standard

Code number according to ISO 4406
18/16/13

Available filter sizes

Filter size	55	75	105	135	165	210	280
No. 2	x						
No. 3	x	x	x	x	x	x	x

Operational Parameters

Pressure Fluids

In order to ensure the functional performance and high efficiency of the hydraulic pumps the viscosity and purity of the operating fluid should meet the different operational requirements. Eaton recommends using only hydraulic fluids which are confirmed by the manufacturer as suitable for use in high pressure hydraulic installations or approved by the original equipment manufacturer.

Permitted pressure fluids

- Mineral oil HLP to DIN 524-2
- Biodegradable fluids in accordance with ISO 15 380 on request
- Other pressure fluids on request

Eaton offers an oil testing service in accordance with VDMA 24 570 and the test apparatus required for in-house testing. Prices available on request.

Recommend viscosity ranges

Pressure fluid temperature range	**[°C]**	**-20 to +90**
Working viscosity range	[mm^2/s] = [cSt]	10 to 80
Optimum working viscosity	[mm^2/s] = [cSt]	15 to 30
Max. viscosity (short time start up)	[mm^2/s] = [cSt]	1000

In order to be able to select the right hydraulic fluid it is necessary to know the working temperature in the hydraulic circuit. The hydraulic fluid should be selected such that is optimum viscosity is within the working temperature range (see tables).

The temperature should not exceed 90 °C in any part of the system. Due to pressure and speed influences the leakage fluid temperature is always higher than the circuit temperature. Please contact Eaton if the stated conditions cannot be met in special circumstances.

Viscosity recommendations

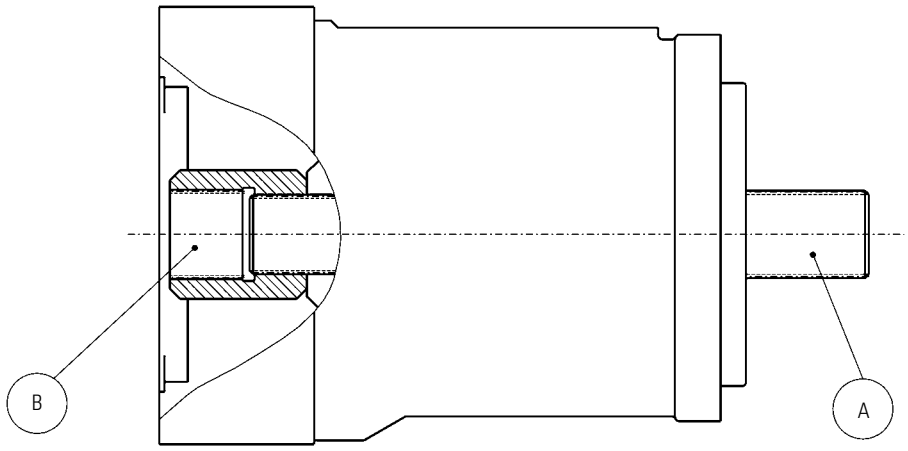
Working temperature [°C]	**Viscosity class [mm^2/s] = [cSt] at 40 °C**
Approx. 30 to 40	22
Approx. 40 to 60	32
Approx. 60 to 80	46 or 68

Further information regarding installation can be found in the operating instructions.

Torque Transmission

Depending on the selected components, different torques may be transferred. Please ensure that the load transfer components such as mounting flange, PTO-through shaft and additional pumps are designed adequately. Our sales engineers will be pleased to provide design advice.

Torque transmission of HPV



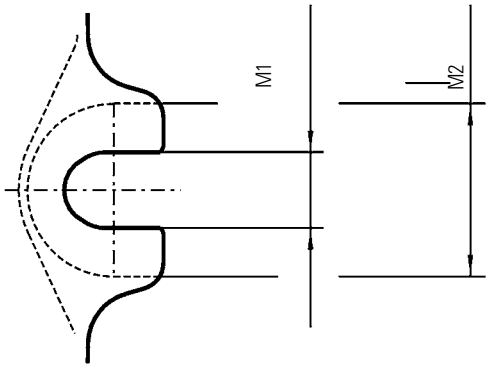
This shows the input side (A) und PTO-/output side (B) of a HPV pump. The information on the following pages refers to

- Mounting flange and drive shaft (A)
- PTO flange and through shaft (B).

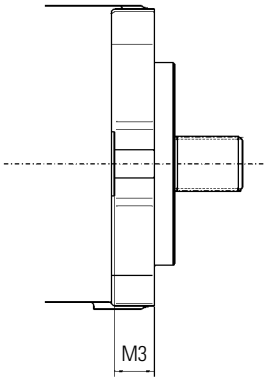
A) Flange profile

		Rated size HPV						
Bolt hole dimensions		**55**	**75**	**105**	**135**	**165**	**210**	**280**
M1 inside diameter	mm	17.5	17.5	17.5	21.5	21.5	22	22
M2 outside diameter	mm	34	40	34	40	40	38	39
M3 length	mm	20	20	25	20	28	30	30
Min. plate thickness	mm	6	6	6	6	(8)	(8)	(8)

Bolth hole diameter



Bolt hole length



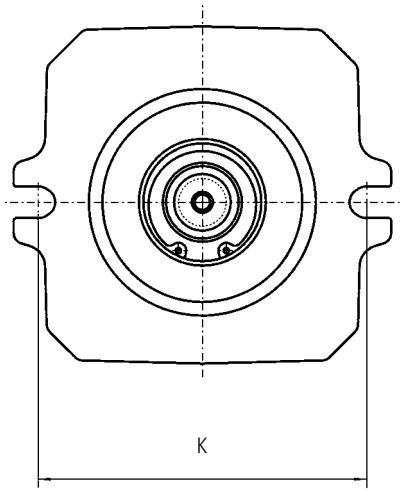
Torque Transmission

Mounting Flange

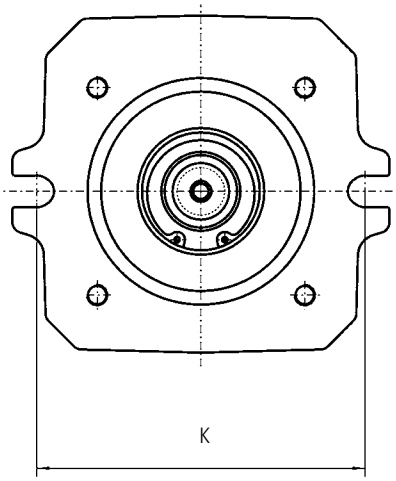
A) Mounting flange dimensions

Mounting flange dimensions in accordance with SAE J744	Dimension K [mm]	Rated size HPV						
		55	75	105	135	165	210	280
SAE C, C-C 2-hole	181.0	x	x	x				
SAE C, C-C 2-hole with 4 additional threaded holes	181.0		x	x				
SAE D 2-hole	228.6				x			
SAE C, C-C 2-hole with 4 additional bolt holes	228.6				x	x		
SAE E 4-hole	224.5						x	x

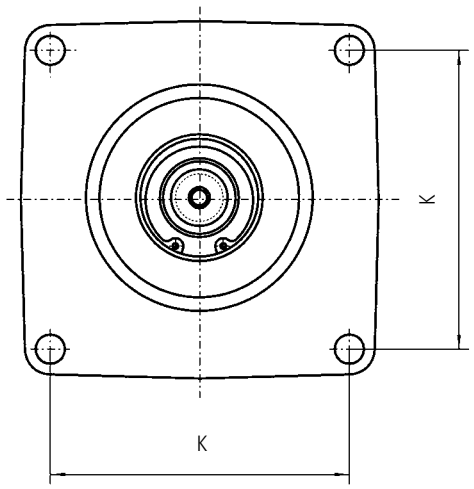
A) Fixing hole distance K 2-hole flange



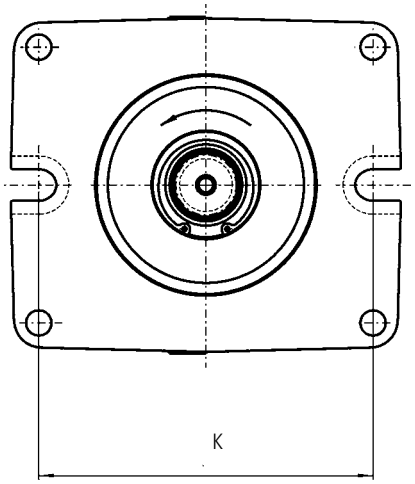
2-hole flange with 4 additional threaded holes



4-hole flange



2-hole flange with 4 additional bolt holes



Torque Transmission

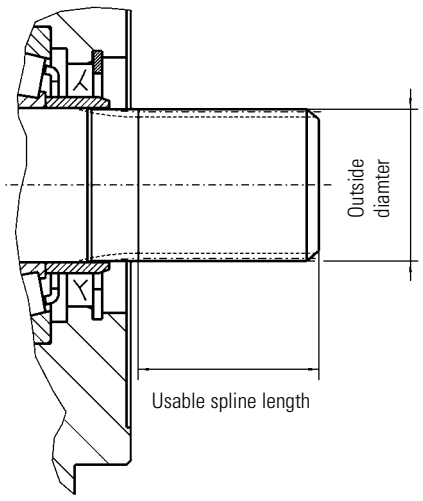
Drive Shaft

A) Dimensions ANSI and SAE drive shafts

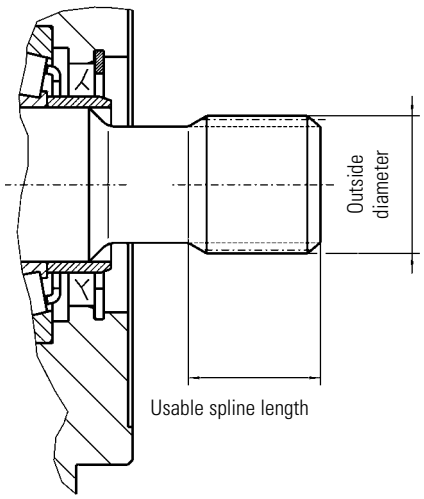
Shaft Spline in accordance with ANSI B92.1	SAE J744 code for centering and shaft	Outside diameter (mm)	Usable spline length (mm)	Shaft type	Available for rated size						
					55	75	105	135	165	210	280
16/32, 21 t		34.51	39.5	1	x	x					
16/32, 23 t		37.68	38.5	1			x				
16/32, 27 t		44.05	62	1				x	x	x	
16/32, 33 t		53.57	58	1							x
12/24, 14 t	C	31.22	30	2	x	x	x				
12/24, 17 t	C-C	37.68	30	2			x	x			
8/16, 13 t	D	43.71	50	2				x			
8/16, 15 t	F	50.06	58	1						x	

A) Eaton Hydraulics shaft types

Type 1. Without undercut



Type 2. With undercut



Torque Transmission

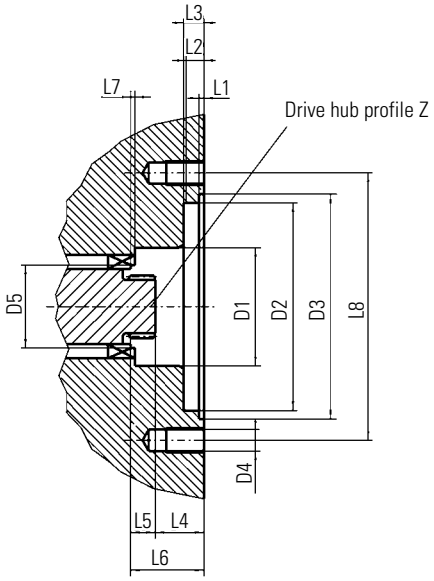
PTO Flange

Eaton pumps can be combined into tandem and multiple pumps. The combination options are determined by the permitted transfer torque. The following data refers to the PTO (pump output side, without further attachments).

B) PTO dimensions

Rated size		55	75	105	135	165	210	280
Z Drive hub profile in accordance with ANSI B92.1		16/32, 15 t	16/32, 18 t	16/32, 19 t	16/32, 21 t	16/32, 21 t	16/32, 24 t	16/32, 27 t
D1	mm	40	42	48	52	52	63	72
D2 spigot pilot diameter	mm			82.55		82.55	82.55	
D3	mm			88		88	89.5	
D4	mm			M 10		M10	M10	M12
D5 max. bearing clearance	mm	30	35	38	43	43	47	49
L1	mm			1.5		1.5	1.9	
L2 adapter length	mm			7		7	8	
L3	mm			9		9	9	
L4 minimum distance	mm	35	39	33	35	-	38.5	50.5
L5 usable spline length	mm	14	18	19	20	-	29	30.6
L6 distance to bearing	mm	51	57.5	53	55.9	-	68.3	83
L7 min. bearing clearance	mm	3	3	3	4	-	3	-
L8 hole distance 2-hole	mm			106.4		-	106.4	146

B) PTO dimensions



Torque transmission. Output shaft

B) Output shaft transfer torque

Rated size		55	75	105	135	165	210	280
Continuous transfer torque	Nm	220	305	420	540	660	840	1120
Max. transfer torque	Nm	350	485	670	870	1100	1340	1800

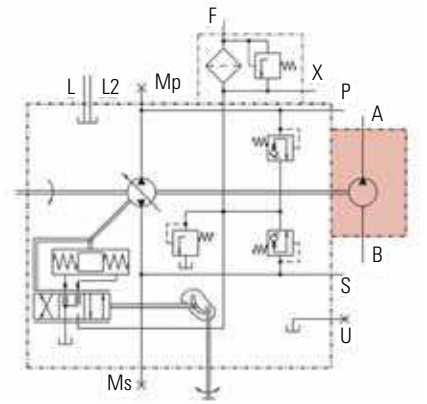
Gear Pumps

Two types of gear pumps are available: internal gear pump IGP and external gear pump EGP. The possible combinations of and with IGP and EGP are determined by the PTO option and the permitted shaft torque. Both types can be used as boost pump for the main circuit or the control and cooling circuit. The suction limit of 0.8 bar min. (absolute) must be adhered to. The boost pressure relief valves for the rated sizes 55-135 are integrated in the port plate housing, and for the rated sizes 210 and 280 in the charge pressure manifold of the HPV.

Technical data

Max. displacement volume	**cm³/rev**	**16**	**19**	**22,5**	**31**	**38**	**44**
Standard boost pump for HPV	Rated size	55		75-135		210	280
Type of gear pump		IGP	EGP	IGP	EGP	EGP	EGP
Mounting flange and drive shaft profile		SAE A 16/32, 18 t	SAE A 16/32, 9 t	SAE A 16/32, 18 t	SAE A 16/32, 9 t	SAE A 16/32, 13 t	SAE A 16/32, 13 t
Type of suction		internal, external	external	internal, external	external	external	external
Max. perm. operating pressure observe max. permissible rated pressures for filter and cooler	bar	40	250	40	165	275	220
Standard PTO flange and shaft spline		SAE A 16/32, 9 t	-	SAE A 16/32, 9 t	-	-	-
Continuous output torque	Nm	175			175		
		75 Nm with SAE A		-	75 Nm with SAE A		-
Max. output torque	Nm	250			250		
		107 Nm withSAE A		-	107 Nm with SAE A		-
Cold start relief valve		integrated	-	integrated	-	-	-

External gear pump EGP



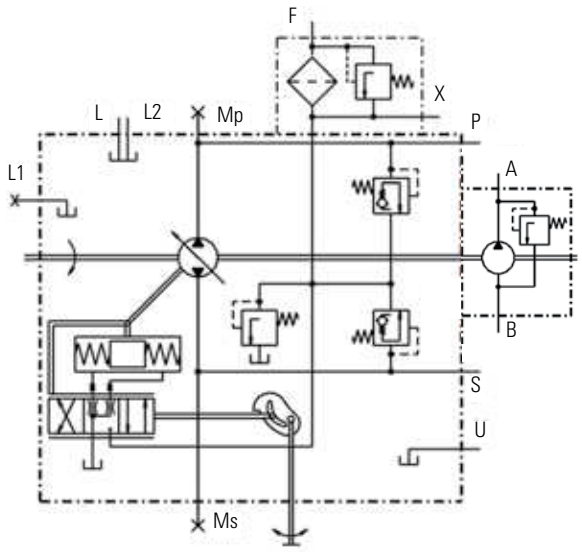


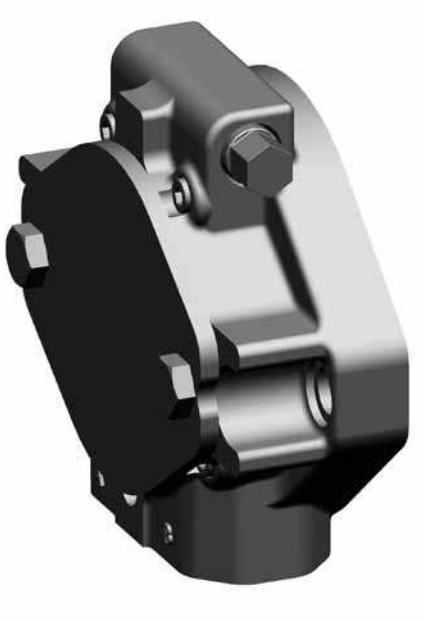
The EGP type features external suction.

Gear Pumps

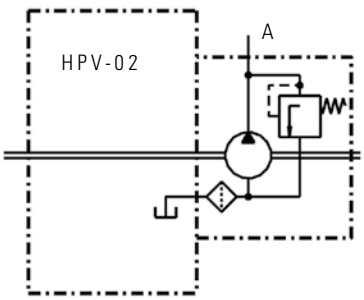
The IGP boost pumps include a cold start relief valve and a through drive for attaching additional pumps. The suction can be internal, external or combined. IGP types are available in rated sizes of 16 cm³/rev and 22.5 cm³/rev.

Internal gear pump IGP with external suction

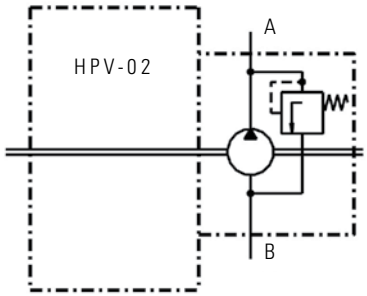




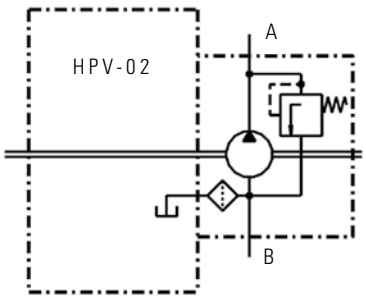
Internal suction



External suction



Combined suction



Internal suction

- The boost pump supplies the main ciruit with oil from the pump housing.
- External connection B is closed.

External suction

- The boost pump supplies the main circuit with oil from the oil tank.
- Ther internal connection is closed.

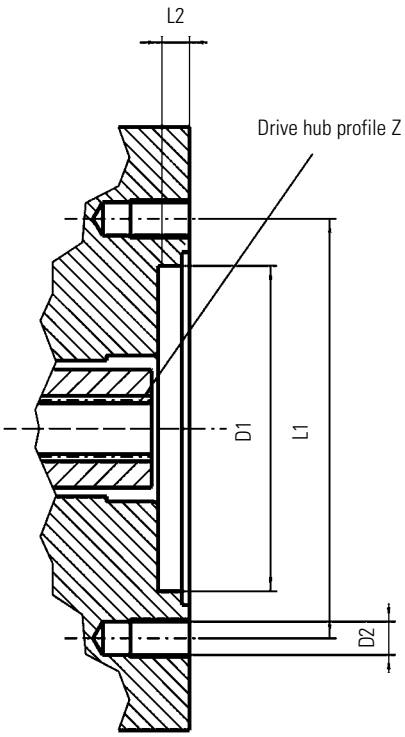
Combined suction

- The boost pump supplies the main circuit with oil from the pump housing and oil tank.
- This type of suction is a combination of internal and external suction.

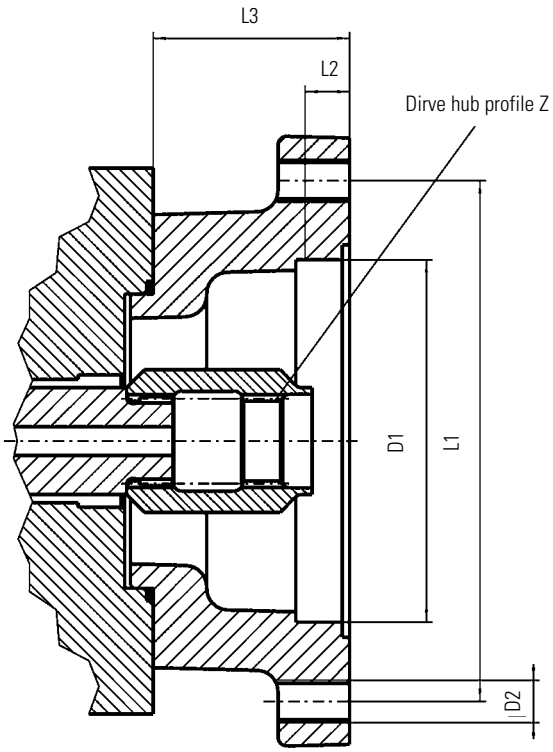
PTO flange with IGP

Flange profile 2-hole		SAE A	SAE B	SAE B-B	SAE C
Z Internal drive hub profile in accordance w/ ANSI B92.1		16/32, 9 t	16/32, 13 t	16/32, 15 t	12/24, 14 t
D1 Spigot pilot diameter	mm	82.55	101.6	101.6	127
D2 Thread size	mm	M 10	M 12	M 12	M 16
L1 Hole distance	mm	106.4	146	146	181
L2 Adapter length	mm	7	11	11	13
L3 Flange length	mm	-	55	55	72
Continuous transfer torque	Nm	75	175	175	175
Maximum transfer torque	Nm	107	250	250	250

PTO SAE A with IGP



PTO SAE B, B-B and C with IGP



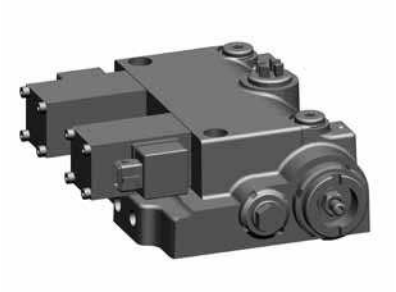
Controls

The modular control concept with standardised interface enables quick selection and adaptation for different customer and system requirements with mechanical, hydraulic or electronic control. All HPV controls feature an upstream signal circuit that is adapted to the respective control, and a standardised and load-independent servo control for simple and constantly available machine or vehicle control.

Technical data

Type of control	Additional option	Name of control
Mechanical		M1
Hydraulic		H1
	with pressure cut-off regulation	H1P
	speed dependent	CA
	torque-/power controlled	CA
	with additional safety function	CA
Electrical		E1
	with pressure cut-off regulation	E1P
	with additional safety function	E2

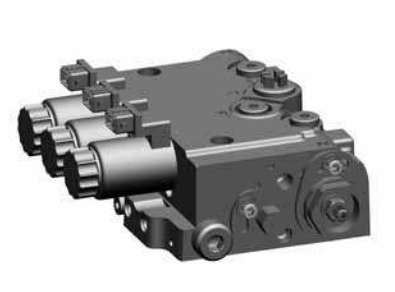
E1-control



E1P-control



E2-control



h1-control



H1P-control



CA-control



M1-control



HPV E2

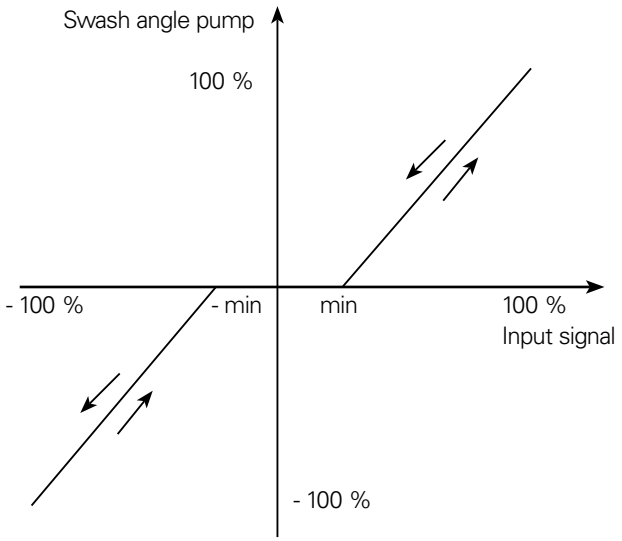


Controls

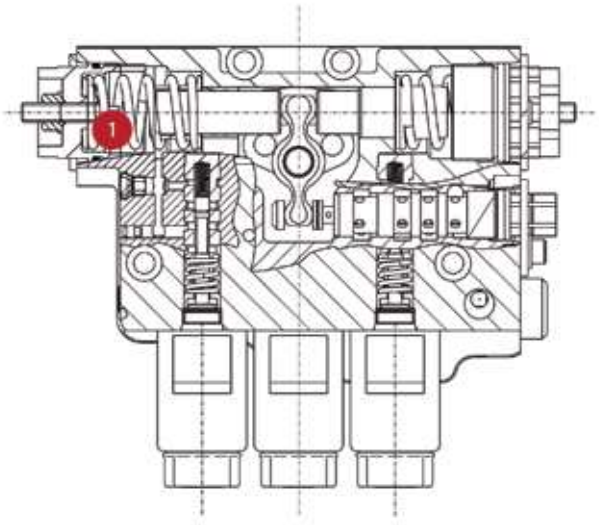
Control Accuracy

All HPV controls result in the same machine response for identical motion commands, irrespective of the control type. Corrective action by the operator is no longer required. The reliable control of the pump can easily be integrated into any kind of vehicle management control system.

Control accuracy of a HPV pump



E2-control

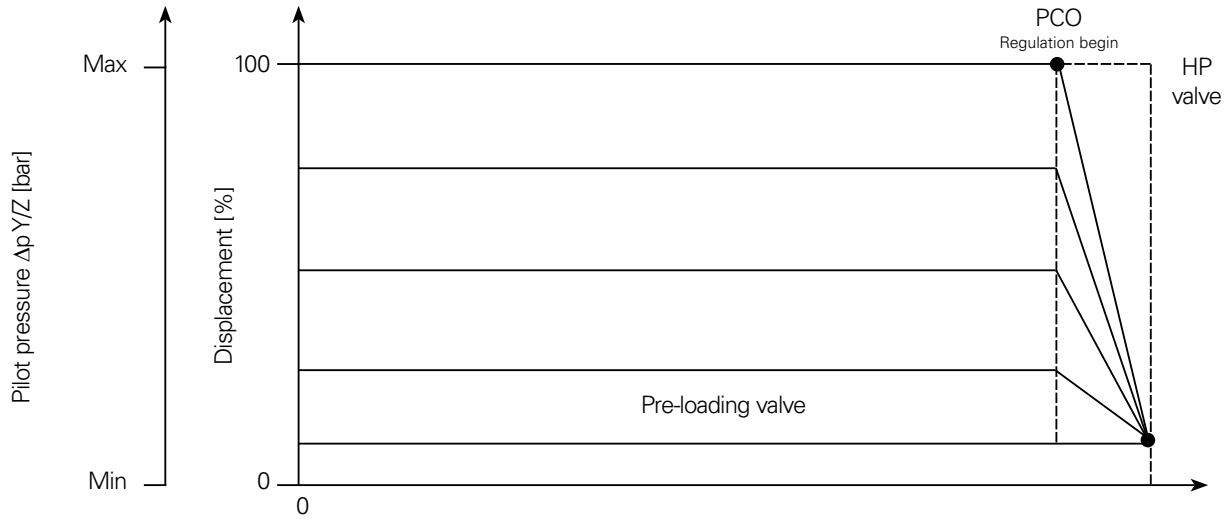


1. Setting the maximum displacement

Pressure cut-off regulation PCO

Special control elements deal with functions such as torque control or pressure cut-off regulation. Controls with pressure cut-off regulation (PCO) reduce pump flow when the cut-off pressure is reached. Because system pressure is maintained at low flow, the power consumption and thermal balance of the system are optimised.

Displacement relative to pilot pressure and pressure cut-off regulation for M-, H- and E-controls

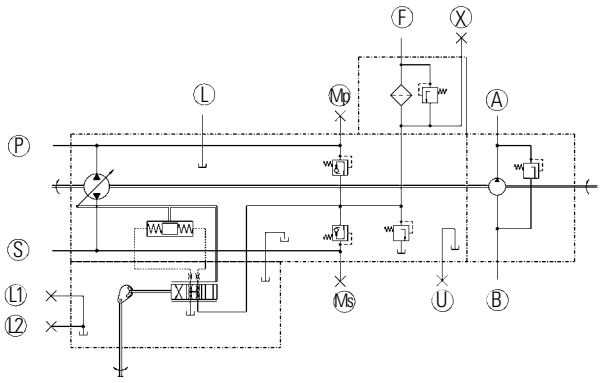


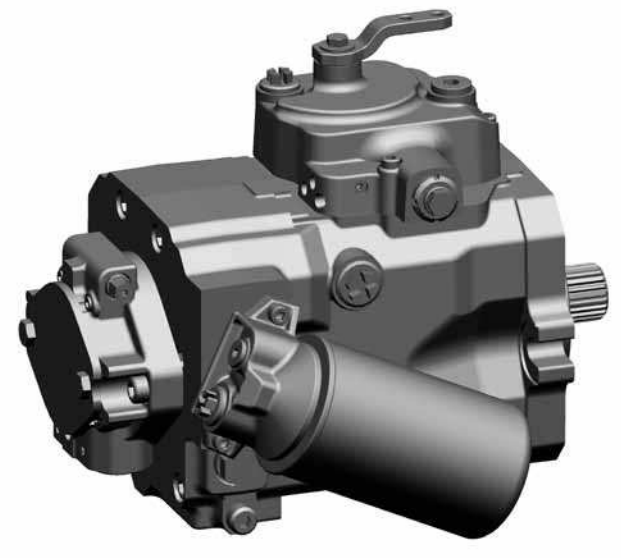
Controls

Mechanical-hydraulic M

The M1-pump control combines robustness with high precision for direct and reliable machine control. It is mechanically controlled and can be combined with a fixed, variable or regulating hydraulic motor. The control-specific data is independent of the nominal pump size.

M1. Mechanical control



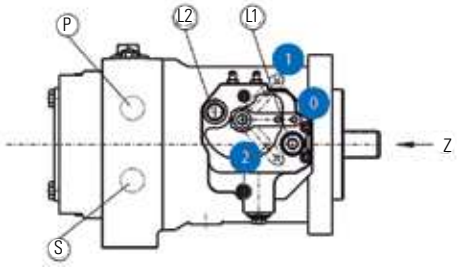


Flow direction

By turning the control lever the pump flow rate and direction of flow are controlled via a cam plate. The flow direction of the fluid depends on

- the pump direction of rotation
- the over centre direction of the swash plate.

High pressure outlet port

Cam lever direction	Shaft rotation (view on Z)	Right hand	Left hand
	0 → 1	P	S
	0 → 2	S	P

P, S	High pressure ports	**L, U**	Drain ports
A	Pressure port, boost pump	**L1, L2**	Vent ports
B	Suction port, boost pump		
F	Feed port, boost and control		
X	Test port, control pressure		
Ms, Mp	Test ports, high pressure		

Note for left hand rotation

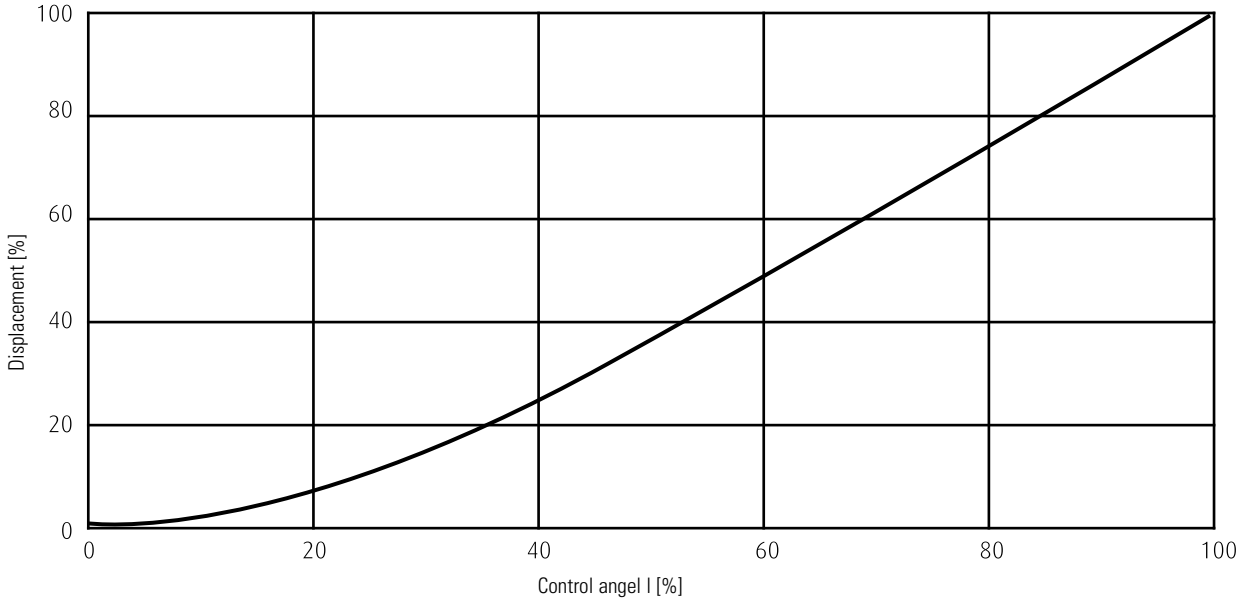
A	Suction port, boost pump
B	Pressure port, boost pump

Controls

Mechanical-hydraulic M

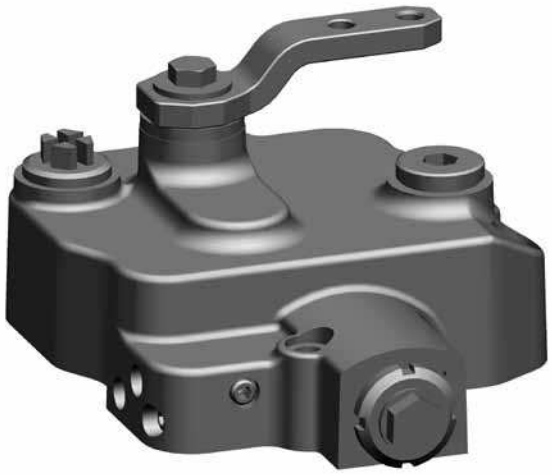
The cam plate offers a large control angle with progressive control characteristic and a wide neutral range. The resulting high resolution for movements from the neutral range (and vice versa) enables precise manoeuvring. Reliable and robust control of the displacement volume is achieved through position feedback.

Displacement relative to control angle

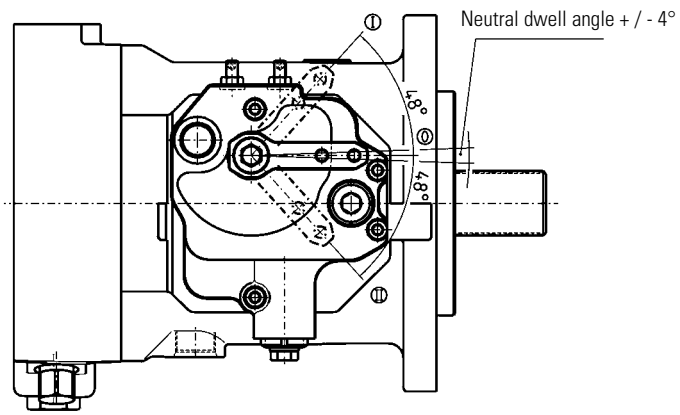


Control force with max. long lever radius r= 70 mm	17 N
Max. permissible control force (intermittent)	500 N
Control torque	1.2 Nm
Centred reset by external force	1.2 Nm
Control angle neutral range ... to end position	±4° ... ±48°
Minimum response time with standard restrictors	0.5 sec

M1-cam plate



Control range

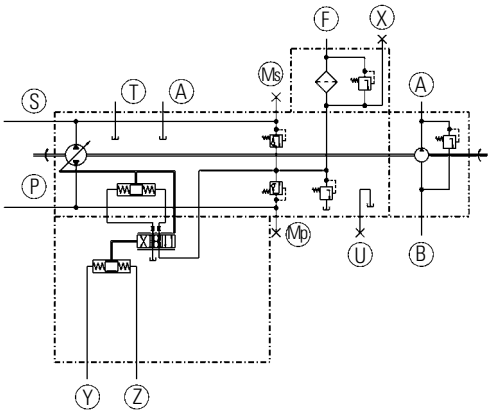


Controls

Hydraulic H

The HPV H1 features hydraulic control with a wide pilot pressure range for improved machine control. It can be combined with a fixed, variable or regulating hydraulic motor. The data is specific for hydraulic controls, and independent of the nominal pump size and pressure cut-off regulation PCO, unless specified otherwise otherwise (see section Controls. Control accuracy).

H1. Hydraulic control





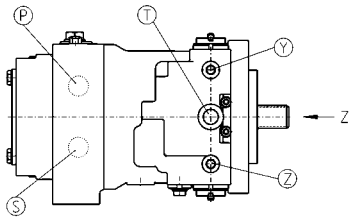
Flow direction

By an external hydraulic signal input at the pilot pressure ports (Y, Z) the pump flow rate and direction of flow are controlled.

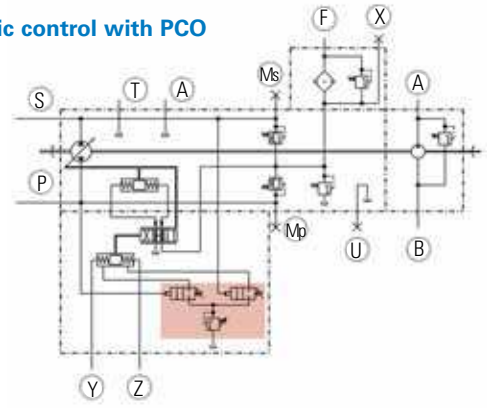
The flow direction of the fluid depends on

- the pump direction of rotation
- the over centre direction of the swash plate.

High pressure outlet port

Pilot pressure port		Shaft rotation (view on Z) Right hand	Left hand
	Y	P	S
	Z	S	P

H1P. Hydraulic control with PCO



P, S	High pressure ports
A	Pressure port, boost pump
B	Suction port, boost pump
F	Feed port, boost and control
X	Test port, pilot pressure
Ms, Mp	Test ports, high pressure
L, U	Drain ports
T	Vent port
Y, Z	Pilot pressure ports

Note for left hand rotation

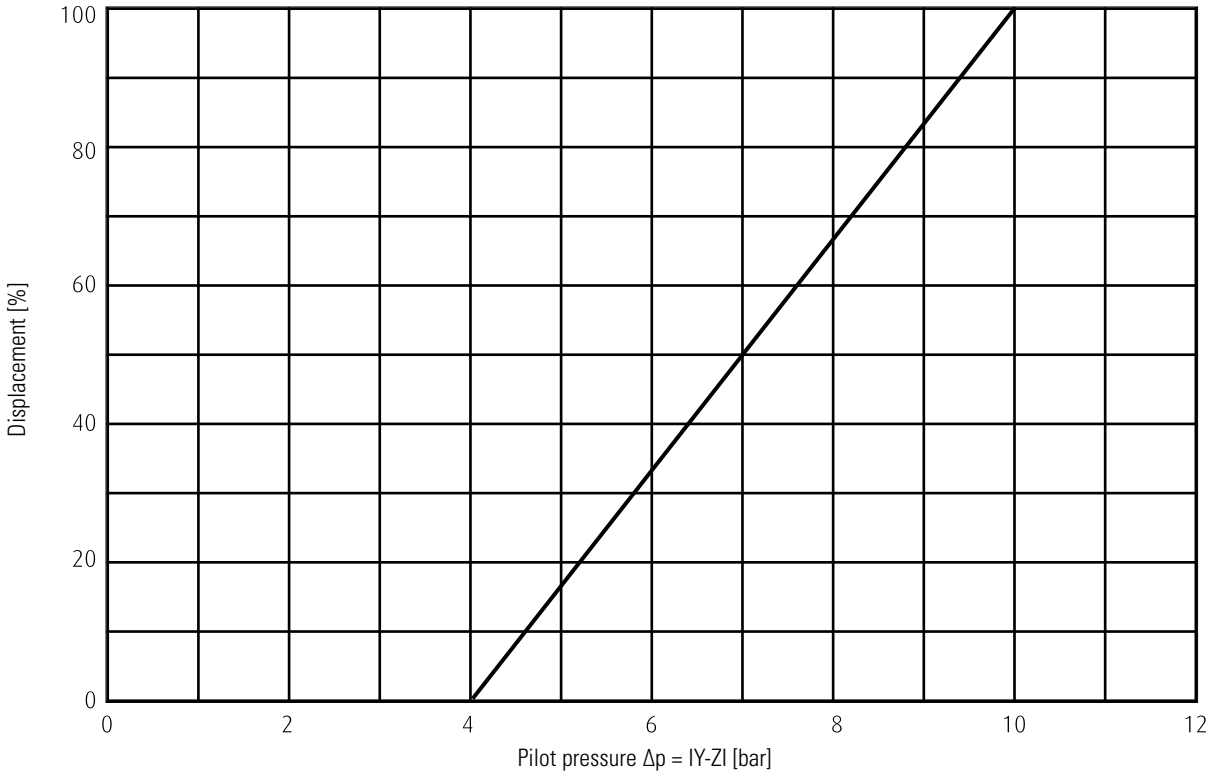
A	Suction port, boost pump
B	Pressure port, boost pump

Controls

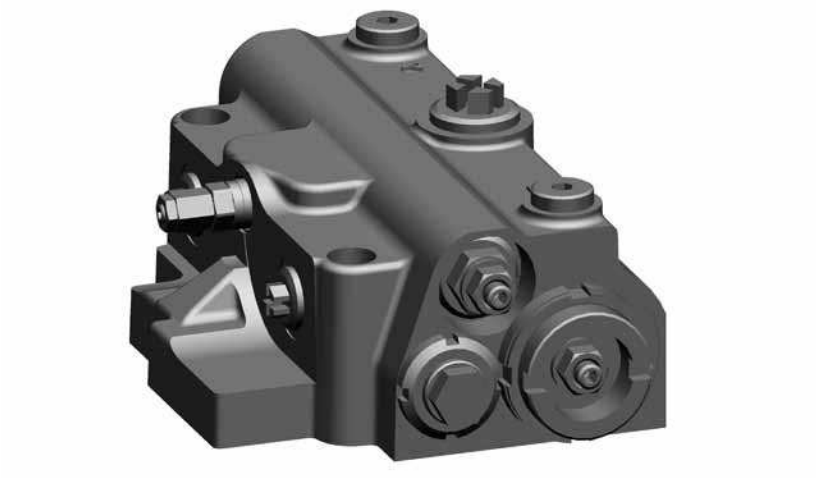
Hydraulic H

Pilot pressure range standard	4-10 bar differential pressure |Y-Z|
Maximum permissible pressure at Y or Z	30 bar
Minimum response time with standard orifices for one-way swashing between 0 and max	0.5 sec

Displacement relative to pilot pressure



H1P-control with PCO

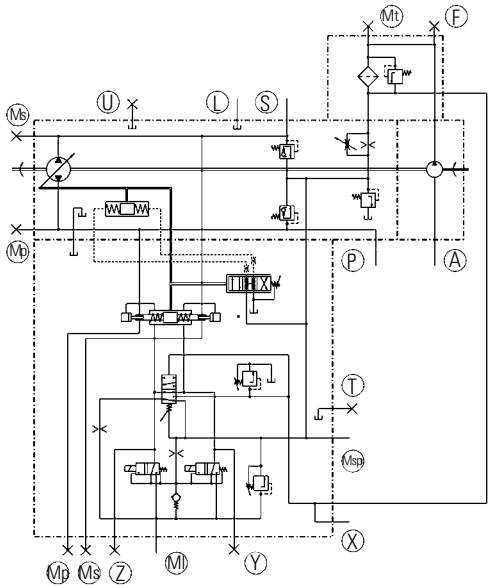


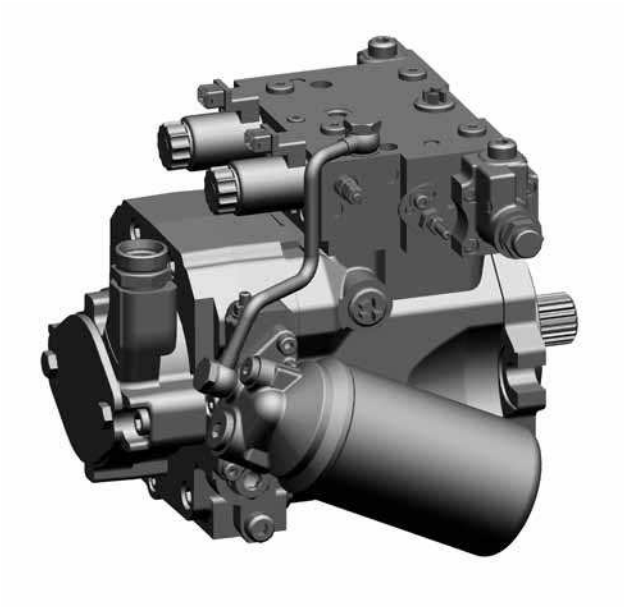
Controls

Hydraulic-mechancial CA

The HPV CA is a speed-dependent pump control with torque/power regulation. It can be combined with a hydraulic motor as fixed, variable or regulating motor or a variable motor with pressure regulator. The modular design offers a high degree of versatility in terms of function and control.

CA. Hydraulic-mechanical control



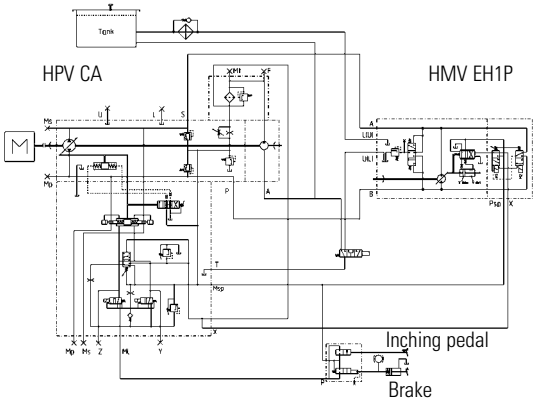


CA-control. Advantages

- pilot operated system
  - controlled load response
  - temperature independent
  - dynamics
  - precision
  - low hysteresis
  - high versatility (modular design)
  - various motor control possible
- simple adjusting
- direct control of torque and tractive force
- speed optimized inching function
- high safety standard
- hydrostatic deceleration

P,S	High pressure ports
A	Suction port, boost pump
F	Feed port, boost and control
Test ports	
Mt	Temperature
Ms, Mp	High pressure
Y, Z	Pilot pressure
MI	For power settings and inch pressure port
Msp	Boost pressure
X	Pilot pressure port HMV
L, U	Drain ports
L1, L2	Vent ports
T	Drain and vent port
Note for left hand rotation	
A	Suction port, boost pump

Drive with speed-dependent variable pump and variable motor with pressure override

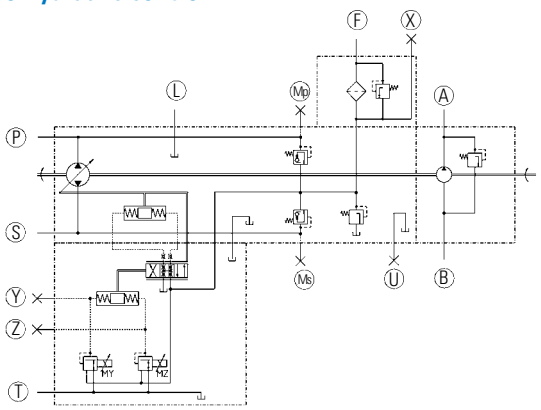


Controls

Electro-hydraulic E1

The HPV E1 has two proportional solenoids and through the upstream signal circuit it combines the flexibility of electronic vehicle management with the reliability of a pump control marked by its high operational availability. Precise and simple. Identical commands always call for the same response in the machine, so no corrective action is required by the operator or the electronic system.

E1. Electro-hydraulic control



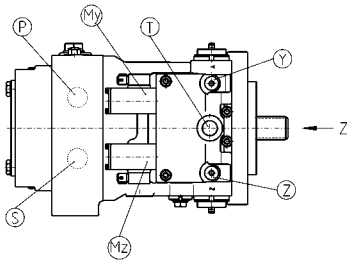


Flow direction

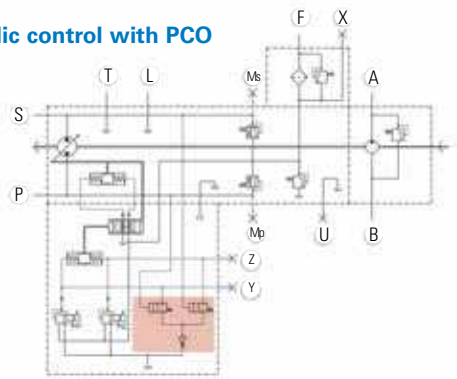
By an external electrical signal input at the solenoids (MY and MZ) the pump flow rate and direction of flow are controlled. The flow direction of the fluid depends on

- the pump direction of rotation
- the over centre direction of the swash plate.

High pressure outlet port

Active solenoid		Shaft rotation (view on Z) Right hand	Left hand
	MY		S
	MZ	S	

E1P. Electro-hydraulic control with PCO



P, S	High pressure ports
A	Pressure port, boost pump
B	Suction port, boost pump
F	Feed port, boost and control
X	Test port, pilot pressure
Ms, Mp	Test ports, high pressure
L, U	Drain ports
T	Vent ports

Note for left hand rotation

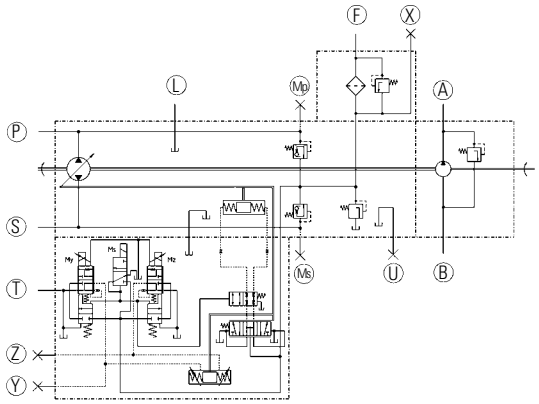
A	Suction port, boost pump
B	Pressure port, boost pump

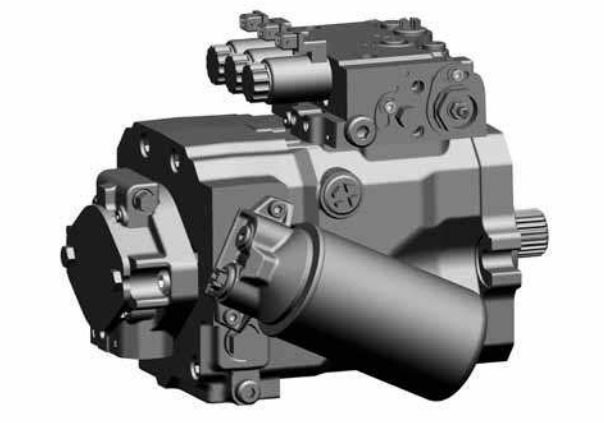
Controls

Electro-hydraulic E2

The HPV E2, with its additional release function, can easily be integrated in an electronic vehicle management control system like an E1-control. In addition it offers a safety standard that meets the stringent requirements for road traffic use. The E2-control features two proportional solenoids and a switching solenoid.

E2. Electro-hydraulic control





Flow direction

By an external electrical signal input at the solenoids (MY and MZ) the pump flow rate and direction of flow are controlled. The flow direction of the fluid depends on

- the pump direction of rotation
- the over centre direction of the swash plate.

High pressure outlet port (see section Control. Electro-hydraulic E1)

E2 with safety function

The electronic control unit compares the travel command to other machine signals. In case of a system fault (e.g. by cable break or short-circuit) the electronic control unit will deactivate the release solenoid of the E2-control and the pump is brought actively to neutral under full control. Upon this the vehicle is brought to rest in a smooth jerk-free manner - without endangering the driver.

Its use is recommended for mobile applications where specific criteria have to be met in terms of travel and coasting behaviour, e.g. road traffic use.

Product advantages of E2

- fulfils the rigorous demands for road traffic use
- active drive enable
- minimized susceptibility to interference
- with HMF: defined swashing back of pump for controlled deceleration and stop in case of system fault
- with HMV: diesel overspeed protection by fast swashing back of pump

P, S	High pressure ports
A	Pressure port, boost pump
B	Suction port, boost pump
F	Feed port, boost and control
X	Test port, control pressure
Ms, Mp	Test ports, high pressure
Y, Z	Test ports, control pressure
L, U	Drain ports
T	Vent port

Note for left hand rotation

A	Suction port, boost pump
B	Pressure port, boost pump

Controls

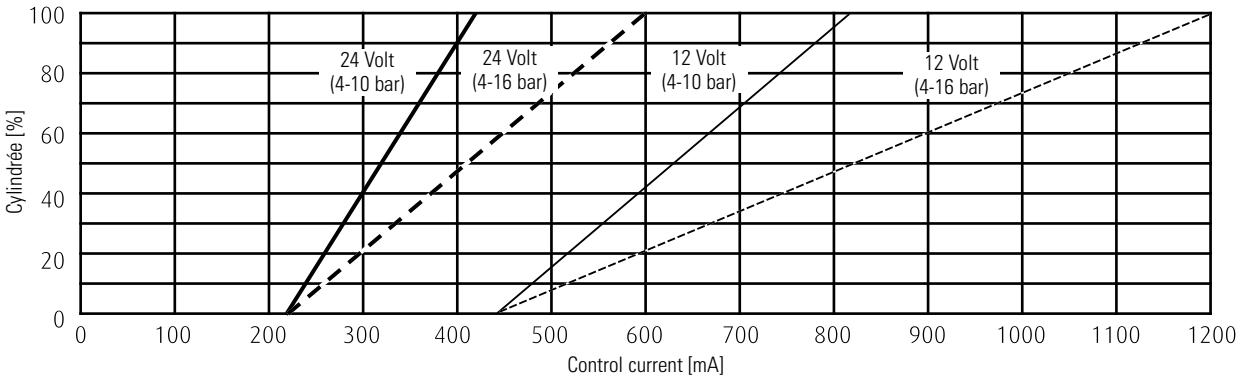
Electro-hydraulic E

The data is specific for electrical controls, and independent of the nominal pump size and PCO pressure cut-off regulation, unless specified otherwise (see section Controls. Control accuracy). Figures HPV E1 and HPV E2 (page 24, 25) show the standard mounting position for the respective E-control.

Control signal characteristics

Supply voltage = limiting voltage			**V**	**12**	**24**	
Connector type				Hirschmann (not for round solenoids) AMP-Junior-Timer, 2-pin		
Voltage type				Direct Current (D.C.)		
Power consumption			W	15.6	15.6	
Rated current = limiting current				mA	1300	650
Control current	Swash begin		mA	450±10	225 ±10	
	Swash end on request	pilot pressure range 4-10 bar	mA	810	410	
		pilot pressure range 4-16 bar	mA	1200	600	
Relative duty cycle			%	100	100	
Protection class				IP 6K6K, Teil 9	IP 6K6K, Teil 9	
Control types	digital control via Pulse Width Modulation PWM with Eaton transducers			100 Hz Rectangle, Pulse duty ratio variable over control range		
	analogue control with alternative transducers			Direct Current (with or without superimposed dither signal for stability and reducing hysteresis, dither: 125 mA, 32-40 Hz, pulse duty ratio 1:1)		
Minimum response time with standard orifices			s	0.5	0.5	

Displacement relative to control current



E2-electro-hydraulic control



E1P-electro-hydraulic control with PCO



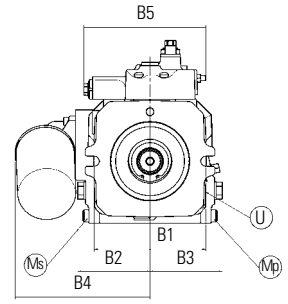
Dimensions

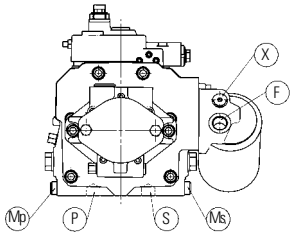
M-controls

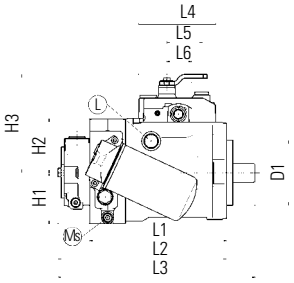
Control-specific dimensions for HPV with mechanical-hydraulic controls.

Port sizes and dimensions for M-controls

Rated size	55	75	105	135	165	210	280
Gear pump rated size [cm³]	16	22.5	22.5	22.5	38	38	44
F flange profile	2-hole mounting flange		2-hole mounting flange		4-hole mounting flange		
	SAE C	SAE C	SAE C	SAE D	SAE D	SAE E	SAE E
W shaft profile in accordance with ANSI B92.1	16 / 32 spline pitch				16 / 32	16 / 32	16 / 32
	21 teeth	21 teeth	23 teeth	27 teeth	27 teeth	27 teeth	33 teeth
D1 (mm)	127	127	127	152.4	152.4	165.1	165.1
B1 (mm)	181	181	181	228.6	228.6	224	225
B2 (mm)	101	116	116	141	138.5	142	155
B3 (mm)	101	116	116	141	127.5	135	-
B4 (mm)	192	216	216	219	223	240	246
B5 (mm)	194	194	194	194	194	194	194
L1 (mm)	225	242	267	288	327	346	392
L2 (mm)	282	304	329	350	490	516	571
L3 (mm)	335	359	385	425	564	591	646
L4 (mm)	151	151	151	151	151	151	151
L5 (mm)	70	70	70	70	70	70	70
L6 (mm)	48	48	48	48	48	48	48
H1 (mm)	88	93	99	106	120	134	152
H2 (mm)	95	103	105	112	-	133	150
H3 (mm)	184	188	193	198	-	226	238
P	SAE ¾“	SAE 1“	SAE 1“	SAE 1 ¼“	SAE 1 ¼“	SAE 1 ½“	SAE 1 ½“
S	SAE ¾“	SAE 1“	SAE 1“	SAE 1 ¼“	SAE 1 ¼“	SAE 1 ½“	SAE 1 ½“
A gear pump	M27x2	M27x2	M27x2	M27x2	-	SAE ¾“	SAE ¾“
B gear pump	M27x2	M27x2	M27x2	M27x2	-	SAE 1 ¼	SAE 1 ¼"
L	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2	M33x2
U	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2	M33x2
F	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2
X	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M14x1.5	M14x1.5	M14x1.5
Mp	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
Ms	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
L1	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5
L2	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5



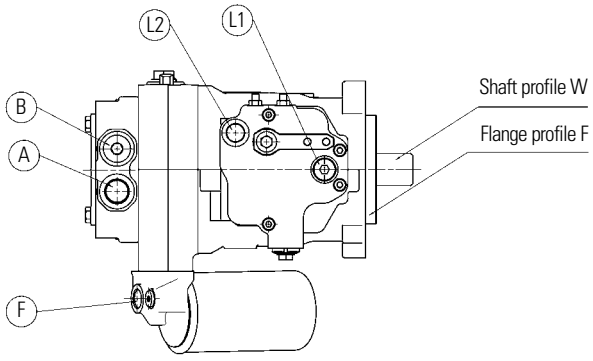




Threads metric in accordance with ISO 6149

Threads for SAE high pressure port metric in accordance with ISO 261

Socket cap screw in accordance with ISO 4762



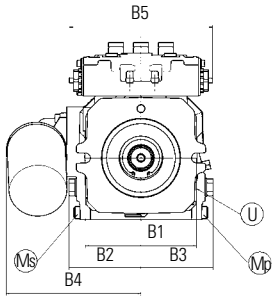
Dimensions

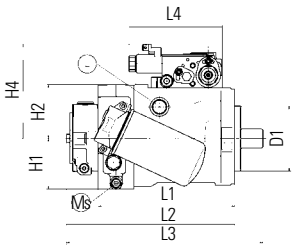
H-controls

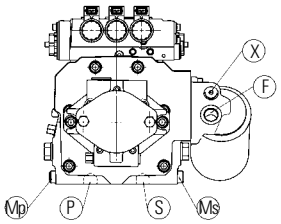
Control-specific dimensions for HPV with hydraulic controls.

Port sizes and dimensions for H-controls

Rated size	55	75	105	135	165	210	280
Gear pumps rated size (cm^3)	16	22.5	22.5	22.5	38	38	44
F flange profile	2-hole mounting flange		2-hole mounting flange		4-hole mounting flange		
	SAE C	SAE C	SAE C	SAE D	SAE D	SAE E	SAE E
W shaft profile in accordance with ANSI B92.1	16 / 32 spline pitch		16 / 32 spline pitch		16 / 32	16 / 32	16 / 32
	21 teeth	21 teeth	23 teeth	23 teeth	27 teeth	27 teeth	27 teeth
D1 (mm)	127	127	127	152.4	152.4	165.1	165.1
B1 (mm)	181	181	181	228.6	228.6	224	225
B2 (mm)	101	116	116	141	138.5	143	155
B3 (mm)	101	116	116	141	127.5	135	139
B4 (mm)	192	216	216	219	223	240	246
B5 (mm)	231	231	231	231	231	231	231
L1 (mm)	225	242	267	288	327	346	392
L2 (mm)	282	304	329	350	489.3	516	571
L3 (mm)	335	359	385	425	564	591	646
L4 (mm)	133	133	133	133	133	133	133
H1 (mm)	88	93	99	106	119	134	152
H2 (mm)	95	103	105	112	-	133	150
H3 (mm)							
w/o PCO	194	154	158	163	190	191	204
with PCO	185	190	194	199	200	201	214
P	SAE ¾"	SAE 1"	SAE 1"	SAE 1 ¼"	SAE 1 ¼"	SAE 1 ½"	SAE 1 ½"
S	SAE ¾"	SAE 1"	SAE 1"	SAE 1 ¼"	SAE 1 ¼"	SAE 1 ½"	SAE 1 ½"
A gear pump	M27x2	M27x2	M27x2	M27x2	-	SAE ¾"	SAE ¾"
B gear pump	M27x2	M27x2	M27x2	M27x2	-	SAE 1 ¼"	SAE 1 ¼"
L	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2	M33x2
U	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2	M33x2
F	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2
T	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5
X	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
Mp	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
Ms	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
Y	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
Z	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5



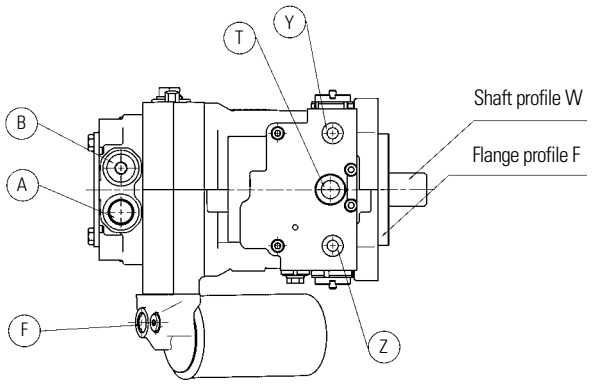




Threads metric in accordance with ISO 6149

Threads for SAE high pressure port metric in accordance with ISO 261

Socket cap screw in accordance with ISO 4762



Dimensions

CA-controls

Control-specific dimensions for HPV with hydraulic-mechanical controls.

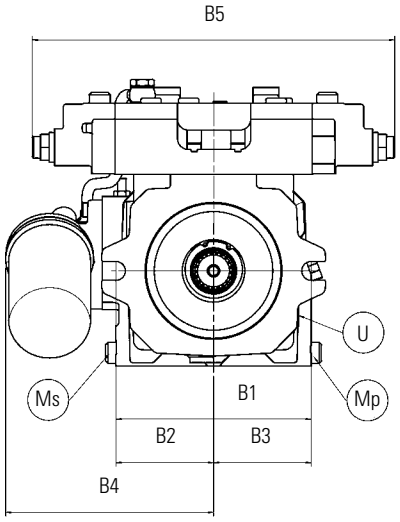
Port sizes and dimensions for CA-controls

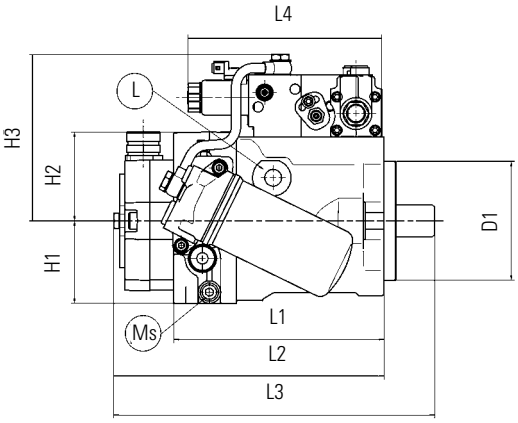
Rated size	55	75	105
Gear pumps rated size [ccm]	16	16	16
F flange profile	2-hole mounting flange		
	SAE C	SAE C	SAE C
	16 / 32 spline pitch		
	21 teeth	21 teeth	23 teeth
D1 [mm]	127	127	127
B1 [mm]	181	181	181
B2 [mm]	101	116	116
B3 [mm]	101	116	116
B4 [mm]	193	212	214
B5 [mm]	336	336	336
L1 [mm]	225	242	267
L2 [mm]	282	306	331
L3 [mm]	343	361	386
L4 [mm]	207	207	207
H1 [mm]	88	93	99
H2 [mm]	95	103	105
H3 [mm]	178	184	188
A gear pump	M36x2	M36x2	M36x2
P	SAE 1“	SAE 1“	SAE 1“
S	SAE 1“	SAE 1“	SAE 1“
L	M22x1.5	M22x1.5	M22x1.5
U	M22x1.5	M22x1.5	M22x1.5
F	M22x1.5	M22x1.5	M22x1.5
T	M22x1.5	M22x1.5	M22x1.5
X1	M14x1.5	M14x1.5	M14x1.5
Mp	M14x1.5	M14x1.5	M14x1.5
MI	M14x1.5	M14x1.5	M14x1.5
Ms	M14x1.5	M14x1.5	M14x1.5
Msp	M14x1.5	M14x1.5	M14x1.5
Mt	M14x1.5	M14x1.5	M14x1.5
Y, Z	M14x1.5	M14x1.5	M14x1.5
Z	M14x1.5	M14x1.5	M14x1.5

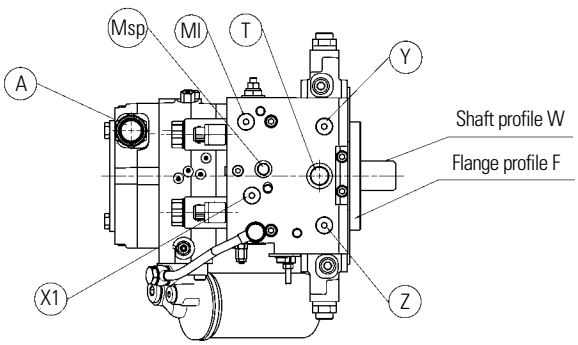
Threads metric in accordance with ISO 6149

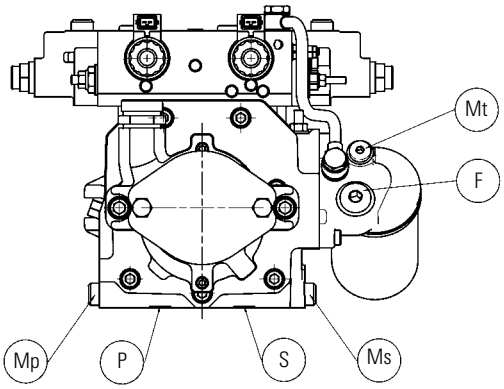
Threads for SAE HP port metric in accordance with ISO 261

Socket cap screw in accordance with ISO 4762









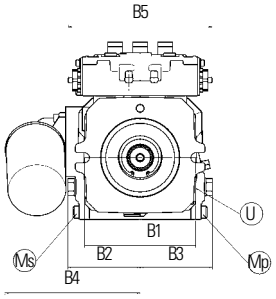
Dimensions

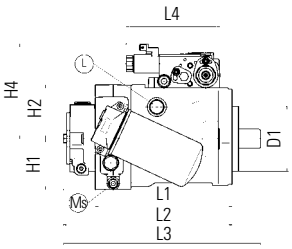
E-controls

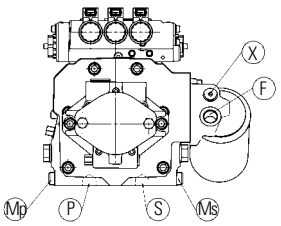
Control-specific dimensions for HPV with electro-hydraulic controls.

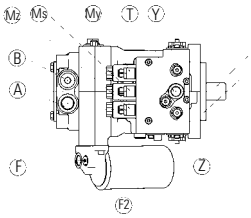
Port sizes and dimensions for E-controls

Rated size	55	75	105	135	165	210	280
Gear pumps rated size [cm³]	16	22.5	22.5	22.5	38	38	44
F flange profile	2-hole mounting flange		2-hole mounting flange		4-hole mounting flange		
	SAE C	SAE C	SAE C	SAE D	SAE D	SAE E	SAE E
W shaft profile in accordance with ANSI B92.1	16 / 32 spline pitch		16 / 32 spline pitch		16 / 32	16 / 32	16 / 32
	21 teeth	21 teeth	23 teeth	23 teeth	27 teeth	27 teeth	27 teeth
D1 (mm)	127	127	127	152.4	152.4	165.1	
B1 (mm)	181	181	181	228.6	228.6	224	225
B2 (mm)	101	116	116	141	138.5	143	155
B3 (mm)	101	116	116	141	127.5	135	139
B4 (mm)	192	216	216	219	223	240	246
B5 (mm) E1	226	226	226	226	226	226	226
B5 (mm) E2	230	230	230	230	230	230	230
L1 (mm)	225	242	267	288	327	346	392
L2 (mm)	282	304	329	350	-	516	571
L3 (mm)	335	359	385	425	-	591	646
L4 (mm)	183	183	183	183	-	183	183
H1 (mm)	88	93	99	106	119.5	134	152
H2 (mm)	95	103	105	112	-	133	150
H4 (mm) E1 / E2 with AMP-JT-connector	159	164	168	173	195	218	231
H4 [mm] E1 with Hirschmann-connector	195	200	204	209	(231)	254	(267)
P	SAE ¾"	SAE 1"	SAE 1"	SAE 1 ¼"	SAE 1 ¼"	SAE 1 ½"	SAE 1 ½"
S	SAE ¾"	SAE 1"	SAE 1"	SAE 1 ¼"	SAE 1 ¼"	SAE 1 ½"	SAE 1 ½"
Mp	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M 14x1.5	M 14x1.5
Ms	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M 14x1.5	M 14x1.5
A gear pump	M27x2	M27x2	M27x2	M27x2	-	SAE ¾"	SAE ¾"
B gear pump	M27x2	M27x2	M27x2	M27x2	-	SAE 1 ¼"	SAE 1 ¼"
L	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2	M33x2
U	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2	M33x2
F	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2
T	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5
X	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
Y	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
Z	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
F2	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
Ms E2-control round solenoids	AMP-JT, Deutsch						
My E1-control	Hirschmann, AMP-JT, Deutsch						
E2-control round solenoids	AMP-JT, Deutsch						
Mz E1-control	Hirschmann, AMP-JT, Deutsch						
E2-control round solenoids	AMP-JT, Deutsch						









Shaft profile W
Flange profile F

Threads metric in accordance with ISO 6149

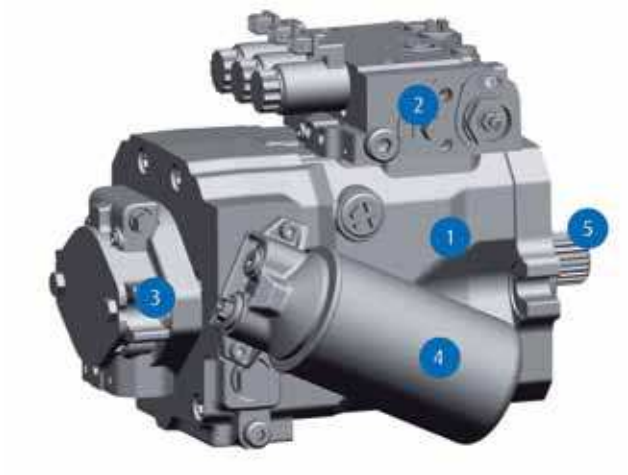
Threads for SAE high pressure port metric in accordance with ISO 261

Socket cap screw in accordance with ISO 4762

Dimensions

Modular System

The following data enable quick calculation of the overall maximum external dimensions. In each case only the relevant dimensions are shown so that length, width and height can simply be determined through addition. The actual fitting dimensions of the respective units are shown on the installation drawing.





External dimensions for addition

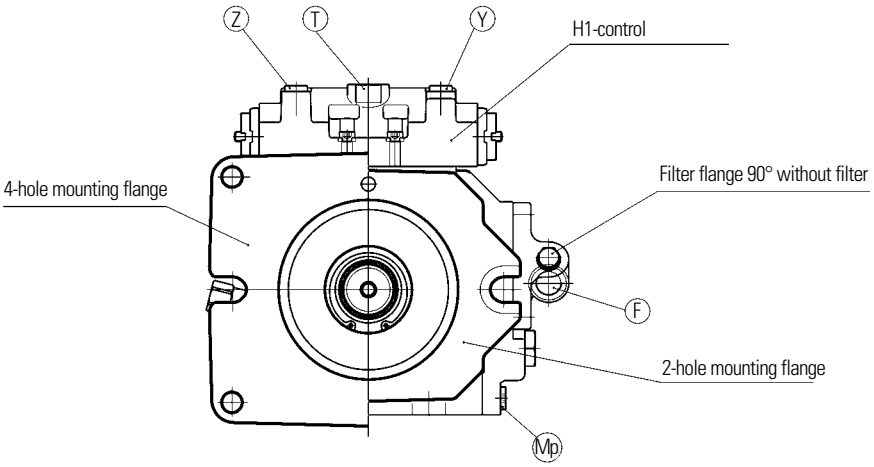
Component		Type	Length	Width	Height
1	Basic unit	55	230	210	185
		75	245	235	190
		105	270	235	210
		135	290	280	220
		165	327	285	245
		210	350	290	275
		280	395	315	305
2	Control	M1	-	10	95
		H1	-	5	55
		H1P	-	10	75
		CA	-	135	95
		E1	-	5	110
		E1P	-	10	110
		E2	-	15	110
3	Gear pump	16 cm³	60	-	-
		22,5 cm³	65	-	-
		31 cm³	135	-	-
		38 cm³	175	-	-
		44 cm³	180	-	-
4	Filter	No. 2	10 without gear pump	95	-
		No. 3	10 without gear pump	105	-
		F-port 90°	15	50	-
5	Coupling flange not shown		75	-	-
6	Intermediate flange Shown under Dimensions. Tandem pumps	SAE B, B-B	20	-	-
		SAE C size 55/75	50	-	-
		SAE C size 105	40	-	-
		SAE C, C-C, D	65	-	-

Dimensions

Modular System

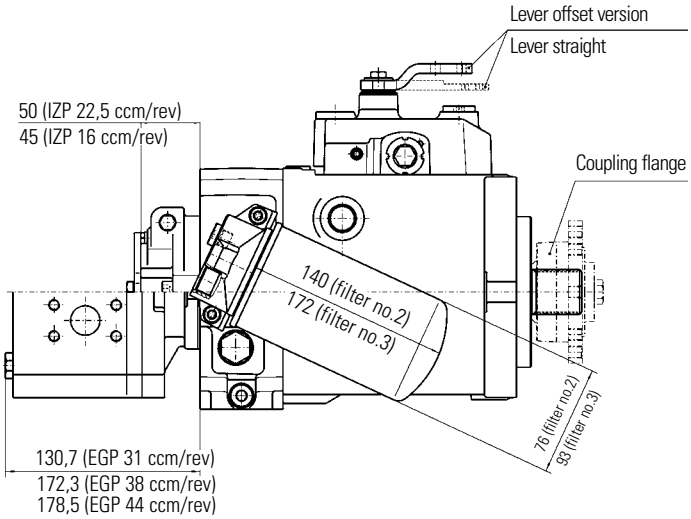
The following diagrams show the proportions of similar components.

View on mounting flange



- 4-hole mounting flange
- 2-hole mounting flange
- H1-control
- Filter flange 90° without filter

Side view



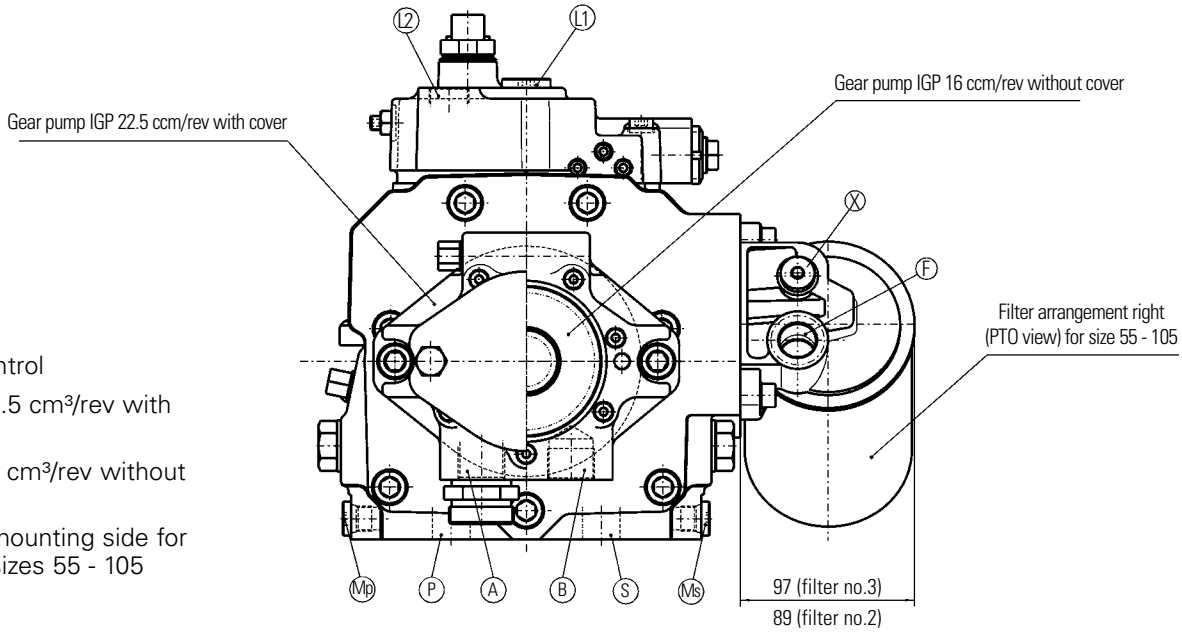
- M1-control lever geometry
- IGP
- EGP
- Filter
- Coupling flange

Dimensions

Modular System

The following diagrams show the proportions of similar components.

PTO view



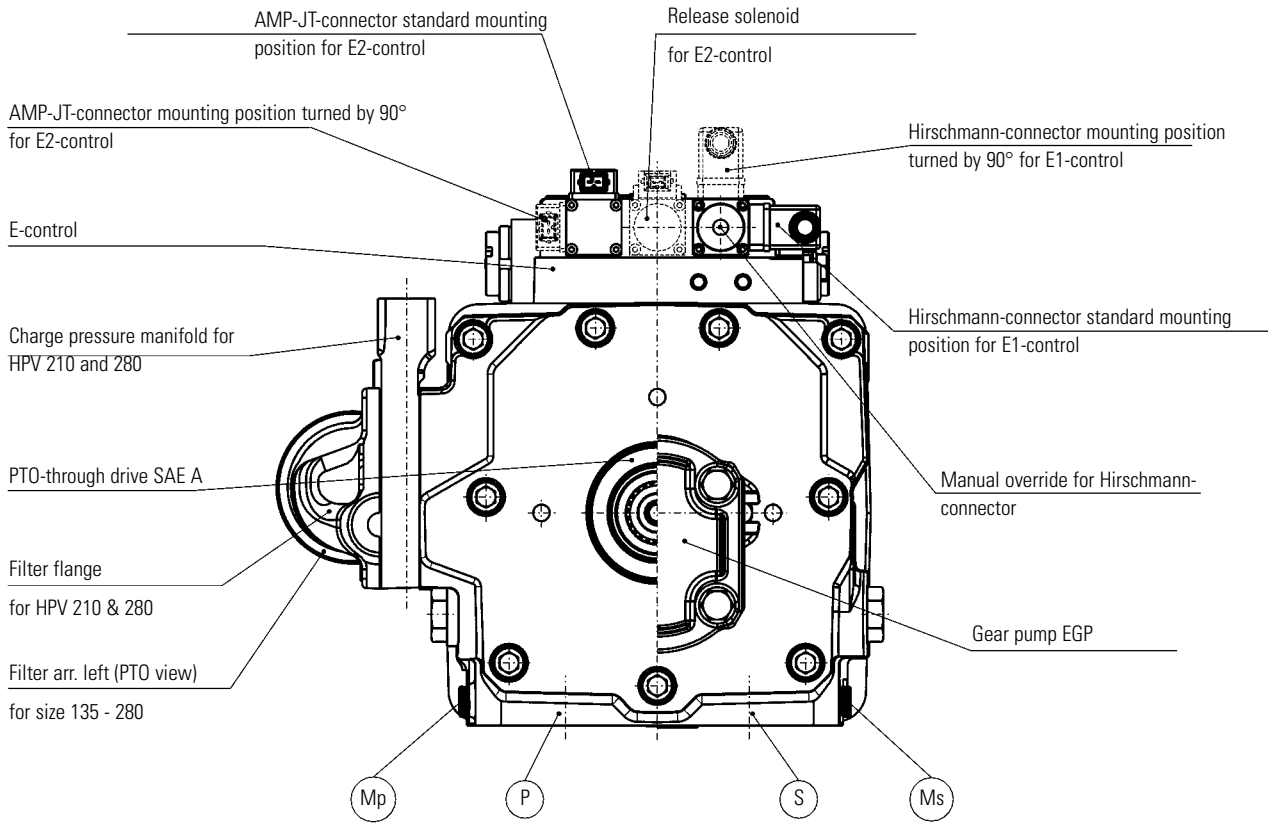
- M1-control
- IGP 22.5 cm³/rev with cover
- IGP 16 cm³/rev without cover
- Filter mounting side for rated sizes 55 - 105

Dimensions

Modular System

The following diagrams show the proportions of similar components.

PTO view



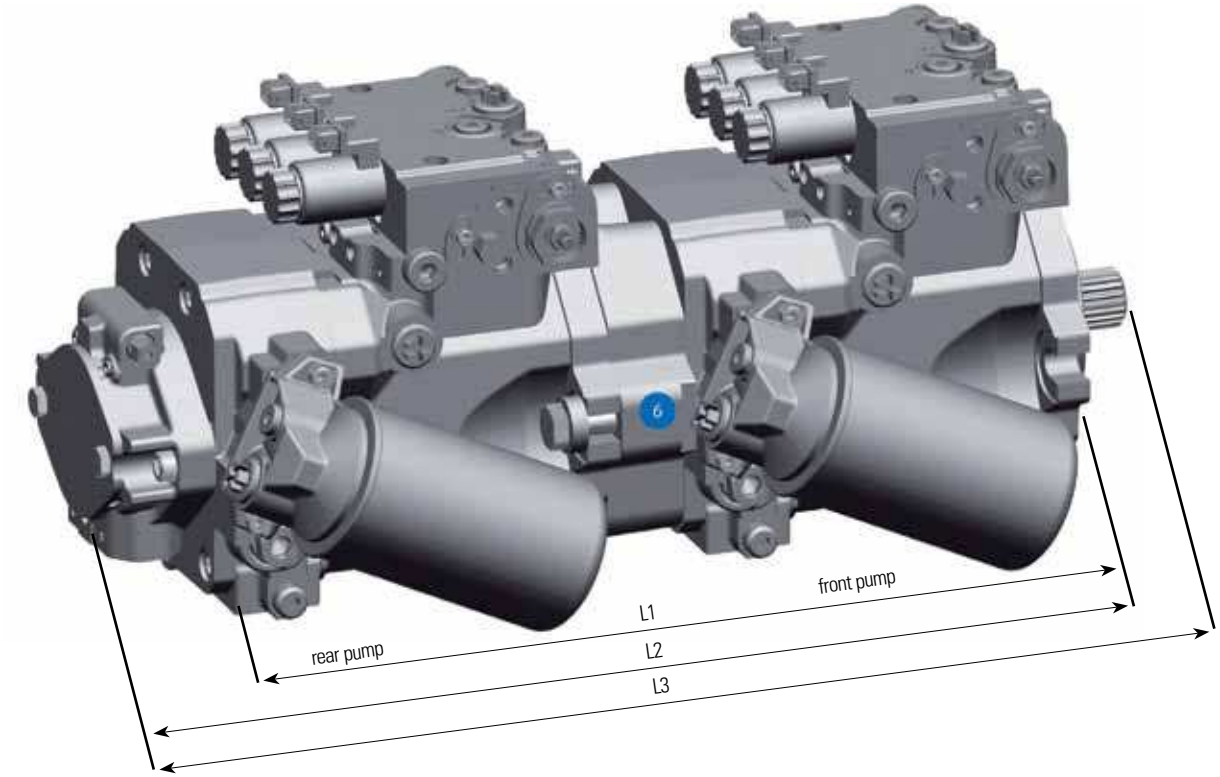
- E1-control with mounting position of solenoid connectors
- E2-control with mounting postition of solenoid connectors
- Manual override
- Hirschmann-connector
- AMP-JT-connector
- Filter mounting side for rated size 135 - 280
- Charge pressure manifold for rated size 210 and 280 without filter
- SAE A PTO-mounting flange
- EGP

Dimensions

Tandem Pumps

Tandem pumps are created by connecting individual HPV units in series, with the pumps arranged by capacity. Positioning the boost pump(s) at the end of the tandem ensures optimum space utilisation, output allocation and load distribution.

HPV tandem pump



Overall length of tandem pump

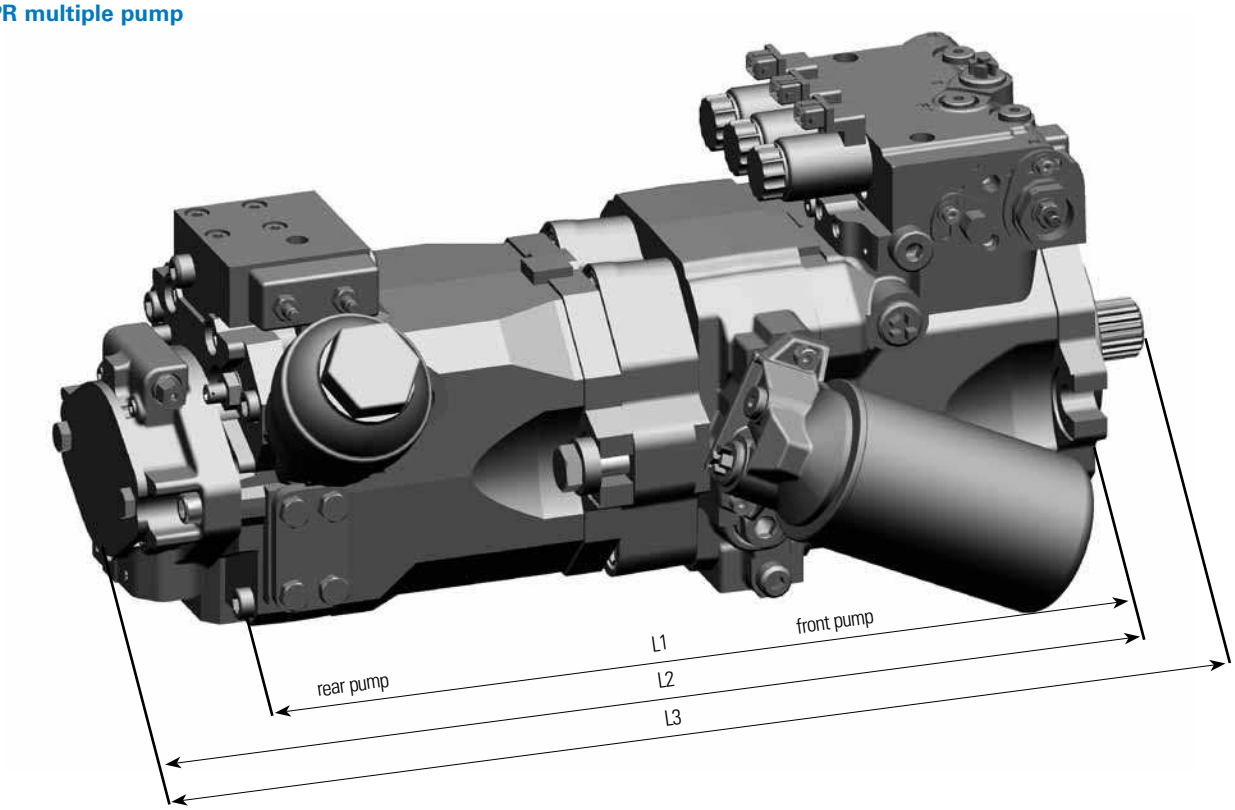
Rated size	Rear pump	HPV 55	HPV 75	HPV 105	HPV 135	HPV 210	HPV 280
Front pump	**Lengths (mm)**						
HPV 55	L1	496	-	-	-	-	-
with IGP 16 cm³	L2	553	-	-	-	-	-
at rear pump	L3	607	-	-	-	-	-
HPV 75	L1	513	530	-	-	-	-
with IGP 22.5 cm³	L2	575	592	-	-	-	-
at rear pump	L3	631	648	-	-	-	-
HPV 105	L1	529	546	572	-	-	-
with IGP 22.5 cm³	L2	591	608	634	-	-	-
at rear pump	L3	647	663	586	-	-	-
HPV 135	L1	543	560	586	640	-	-
with IGP 22.5 cm³	L2	605	622	648	702	-	-
at rear pump	L3	680	696	722	777	-	-
HPV 210	L1	610	627	653	689	731	-
wit EGP 38 cm³	L2	782	799	825	861	903	-
at rear pump	L3	857	874	900	935	978	-
HPV 280	L1	655	672	698	in development	777	823
with EGP 44 cm³	L2	834	851	877		956	1002
at rear pump	L3	909	925	951		1030	1076

Dimensions

Multiple Pumps

Multiple pumps are created by combining individual pump units in series, with the pumps arranged by capacity. Positioning the gear pump(s) at the end of the unit ensures optimum space utilization, output allocation and load distribution. The following table is based on the gear pump acting as boost pump for the HPV variable pump.

HPV-HPR multiple pump



Overall length of multiple pump

Rated size	Rear pump	HPV 55	HPV 75	HPV 105	HPV 135	HPV 210
Front pump	**Lengths (mm)**					
HPV 55	L1	492	-	-	-	-
with IGP 16 cm³	L2	549	-	-	-	-
at HPR	L3	603	-	-	-	-
HPV 75	L1	509	521	-	-	-
with IGP 22.5 cm³	L2	586	598	-	-	-
at HPR	L3	642	653	-	-	-
HPV 105	L1	525	536	567	-	-
with IGP 22.5 cm³	L2	602	613	629	-	-
at HPR	L3	657	669	684	-	-
HPV 135	L1	539	550	581	637	-
with IGP 22.5 cm³	L2	616	627	643	699	-
at HPR	L3	690	702	717	774	-
HPV 210	L1	606	618	648	686	733
wit EGP 38 cm³	L2	793	805	820	858	905
at HPR	L3	868	879	895	932	980
HPV 280	L1	651	663	693		779
with EGP 44 cm³	L2	845	856	872		958
at HPR	L3	919	931	946		1033

Modular System Features

The HPV is based on a modular system and offers the features listed below. This enables the product to be configured to your requirements. With the modular system being constantly extended, we ask you to contact our sales engineers for the latest system features.

- Size
- Vmax
- Mounting flange
- Coupling flange
- Drive Shaft
- Direction of Rotation
- PTO direct mounting
- Tandem pump
- Internal gear pump
- External gear pump
- Suction internal gear pump
- Direction of GP suction
- PTO mounting on IGP
- Port threads
- Control
- Pilot pressure range for H-/E-control
- Control lever geometry
- Position of control lever
- Voltage for E-controls
- Cut-off for E-controls
- Connectors for E-controls
- Arrangement of solenoids
- High pressure relief valve
- Boost pressure relief valve
- Cold start relief valve
- Drain port U + L
- Filter/charge pressure manifold
- Filter flange mounting
- Surface treatment
- Name plate

Notes

Notes

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September 2011

Gear Pumps and Motors

Technical Catalog

Series 26 Pumps
Series 26 Motors
Series L2 Pumps



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Series 26 Motors

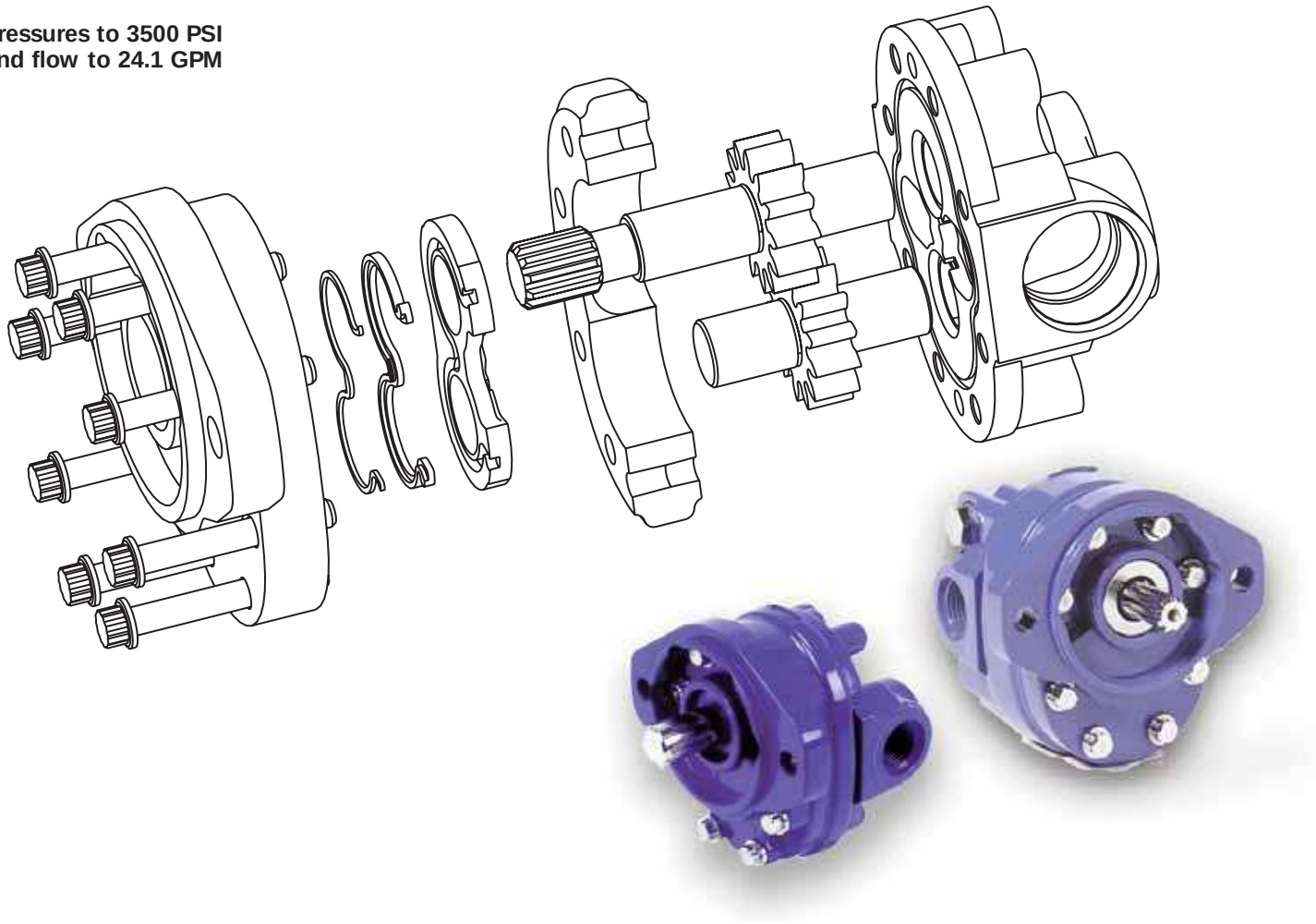
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Series L2 Pumps

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Series 26 Pump
Features

Pressures to 3500 PSI and flow to 24.1 GPM



Quiet Operation

- The 13-tooth gears, versus 10 teeth in previous pumps, minimizes the flow ripple. This reduces noise as well as vibration.
- The improved trap reliefs not only increase power, they also help keep oil flowing smoothly to reduce noise.

Improved Efficiency

- Improved bearing lubrication system uses inlet oil instead of high pressure oil, improving volumetric efficiency for more power output.
- The highly polished shaft and gears improve mechanical efficiency and reduce wear on these components, adding to the service life and reliability of the pump.
- The optimized trapped oil relief areas help reduce pressure ripple for quieter operation. This also decreases the input power requirements.

Field Reversible

- The innovative new wear plate permits simple field reversibility of the pump direction. Simply open the pump, switch the drive gear and idler gear, reposition the plug and reassemble. No extra parts are needed.

Interchangeability

- The Series 26 Gear Pump has been designed to retrofit equipment using the B1 and B2 Gear Pumps. Extra shafts, porting, and mounting configurations, as well as 13 available displacements, give you the choices you need for an easy conversion to this superior pump.

Series 26 Pump

General Specifications and Performance Data

Rotation	Field Reversible
Mounting Flange	SAE A 2 Bolt
Max. Continuous Pressure†	210 bar [3000 PSI]*
Max. Intermittent Pressure††	240 bar [3500 PSI]**
Minimum Speed at Continuous Pressure	750 RPM
Maximum Rotating Torque at 0 Pressure	4 Nm [36 lb-in]
Maximum Continuous Operating Temperature	105°C [220°F]
Minimum Continuous Oil Viscocity	5.7 cSt [45 SUS]
Minimum Operating Temperature	-29°C [-20°F]
Maximum Inlet Vacuum at Operating Condition	0,8 bar Abs. [11.6 psi Abs.]

† Continuous - pump may be run continuously at these ratings.

†† Intermittent - intermittent operation, 10% of every minute.

* 30.6 cm^3/rev. [1.87 in^3/rev.] displacement max. continuous pressure is 190 bar [2750 PSI].

** 30.6 cm^3/rev. [1.87 in^3/rev.] displacement max. intermittent pressure is 224 bar [3250 PSI].

For side load limits consult your Eaton representative.

Displacement cm^3/r [in^3/r]	6,6 [.40]	8,2 [.50]	9,5 [.58]	10,8 [.66]	13,8 [.84]	16,7 [1.02]	19,7 [1.20]
Max. Intermittent Pressure bar [PSI]	241 [3500]	241 [3500]	241 [3500]	241 [3500]	241 [3500]	241 [3500]	241 [3500]
Rated Speed (RPM)	3600	3600	3600	3600	3600	3600	3200
Minimum Output Flow at 207 bar [3000 PSI] and Rated Speed LPM [GPM]	20,1 [5.3]	25,0 [6.6]	29,5 [7.8]	33,7 [8.9]	43,5 [11.5]	55,3 [14.6]	57,9 [15.3]
Input Power at 207 bar [3000 PSI] and Rated Speed and Cont. Pressure kW [HP]	9,7 [13.0]	11,9 [15.9]	14,1 [18.9]	15,5 [20.8]	20,0 [26.8]	22,0 [29,4]	26,2 [35.2]

Displacement cm^3/r [in^3/r]	22,5 [1.37]	24,3 [1.48]	25,2 [1.54]	27,7 [1.69]	29,0 [1.77]	30,6 [1.87]
Max. Intermittent Pressure bar [PSI]	241 [3500]	241 [3500]	241 [3500]	241 [3500]	234 [3400]	224 [3250]
Rated Speed (RPM)	3000	3000	3000	3000	3000	3000
Minimum Output Flow at 207 bar [3000 PSI] and Rated Speed LPM [GPM]	62,1 [16.4]	67,0 [17.7]	69,7 [18.4]	76,5 [20.2]	79,9 [21.1]	84,4 [22.3]
Input Power at 207 bar [3000 PSI] and Rated Speed and Cont. Pressure kW [HP]	27,3 [36.6]	30,5 [40.9]	31,0 [41.6]	33,4 [44.8]	35,4 [47.4]	37,4 [50.1]

The performance data in the table above and the following graphs was collected using a mineral base oil with a viscosity of 133 SUS at 49°C [120°F].

Ordering Information

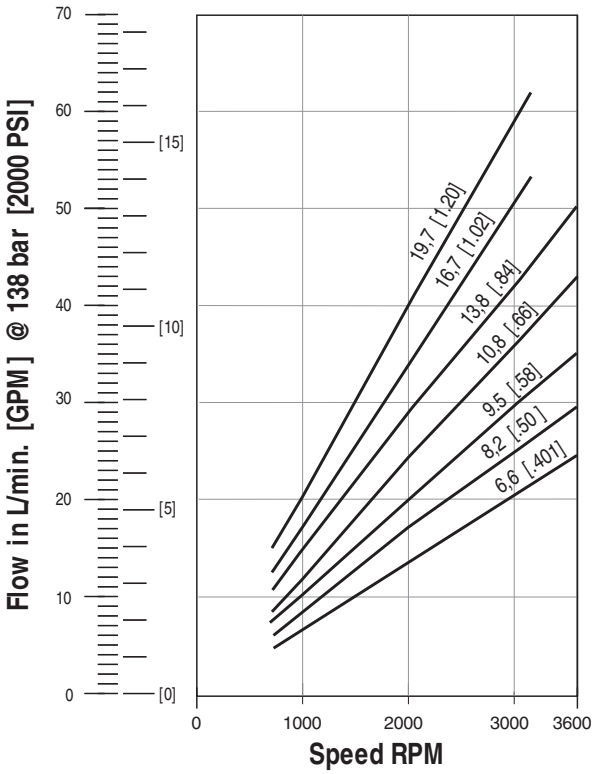
Catalog Assemblies Cross Reference

Standard catalog assemblies are built from high production parts and are the most economical pump assemblies available in this series. The standard assembly order number is a preassigned part number and may be used to order the specific standard assembly (see pages 10–13). The far right column lists the B1 or B2 pump replaced by the Series 26 pump.

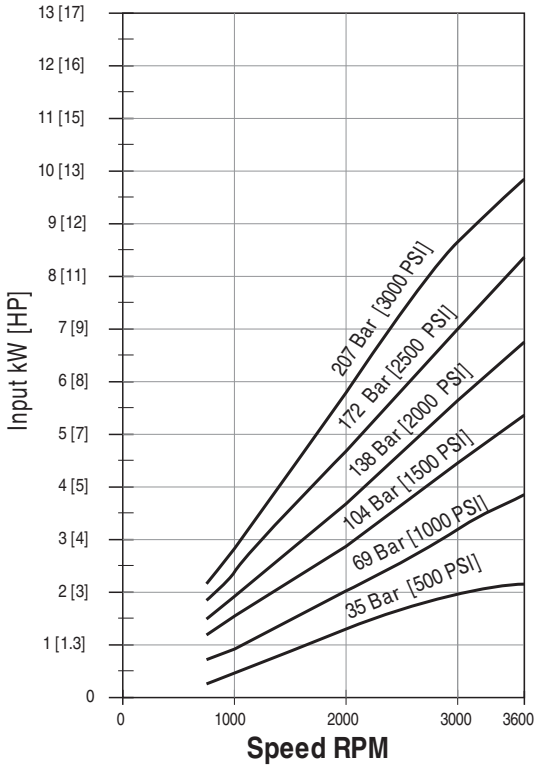
Series 26 Pump

Performance Data
Charts

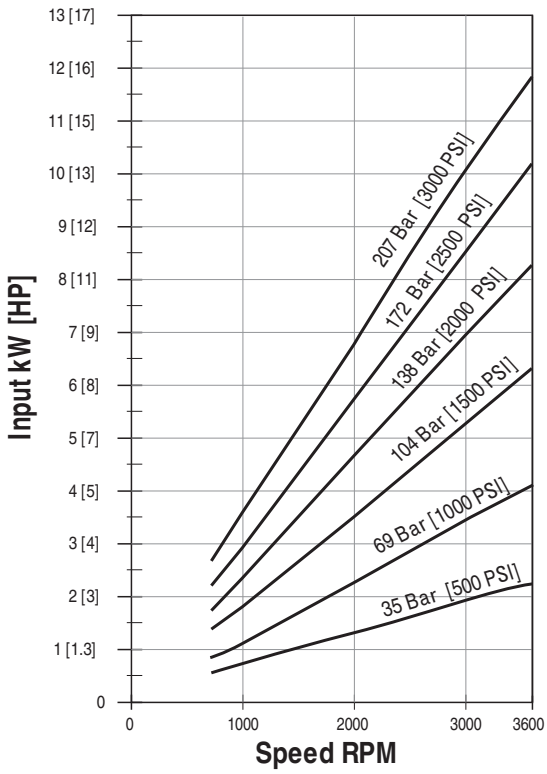
6,56–19,68 cm³/rev [.40–1.20 in³/rev]



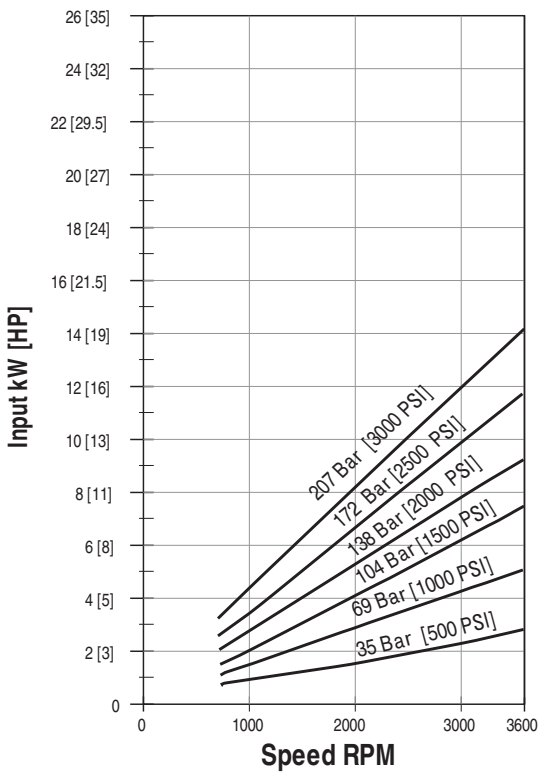
6,56 cm³/rev [.40 in³/rev]



8,20 cm³/rev [.50 in³/rev]



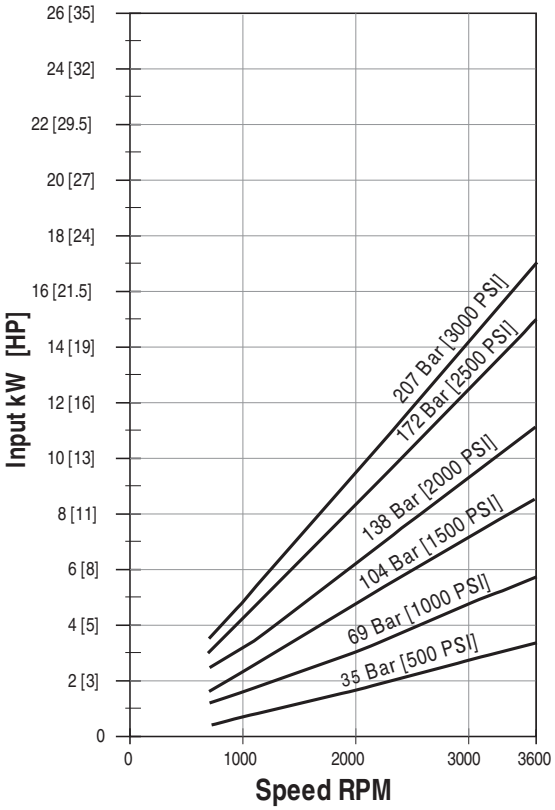
9,51 cm³/rev [.58 in³/rev



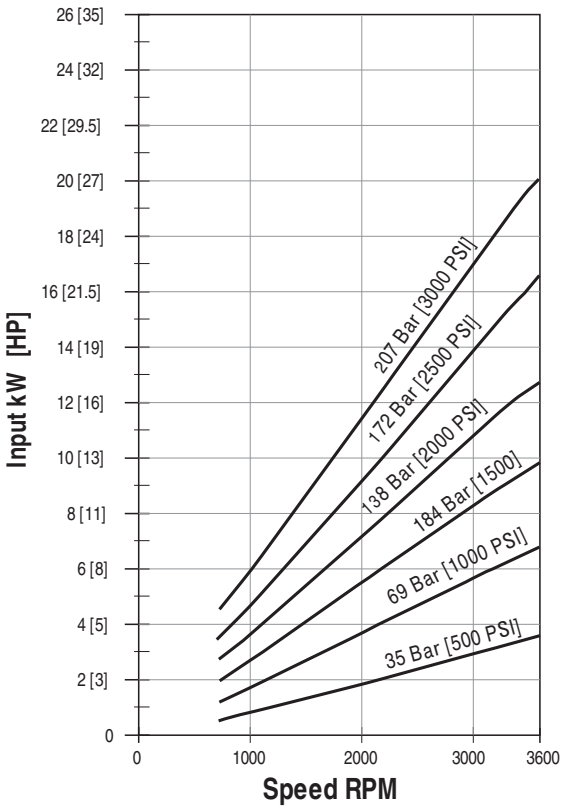
Series 26 Pump

Performance Data
Charts

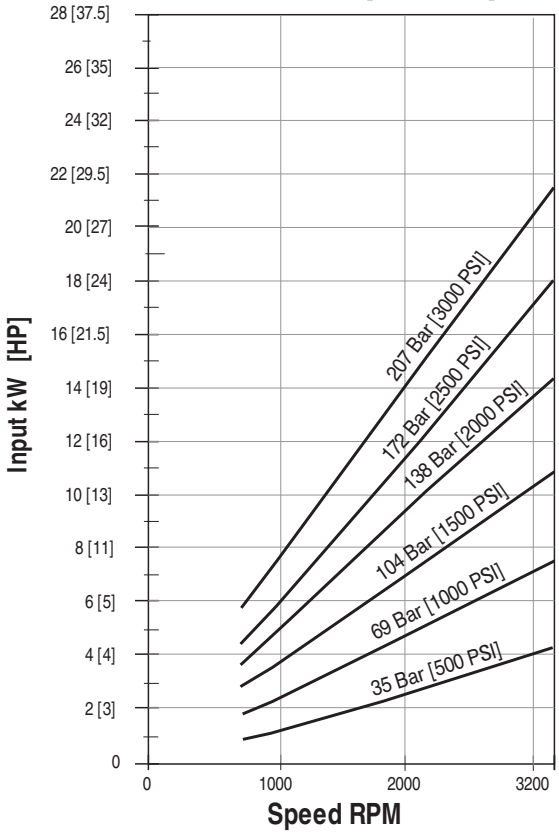
10,82 cm³/rev [.66 in³/rev]



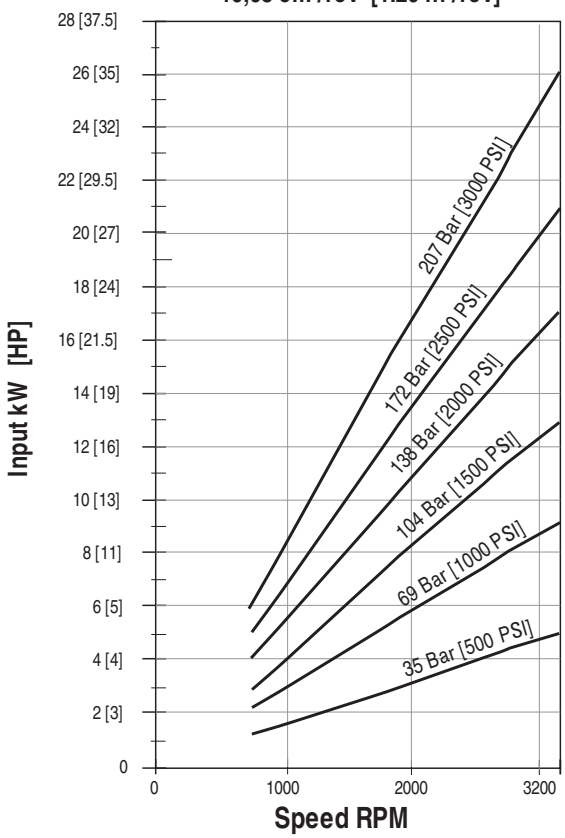
13,78 cm³/rev [.84 in³/rev]



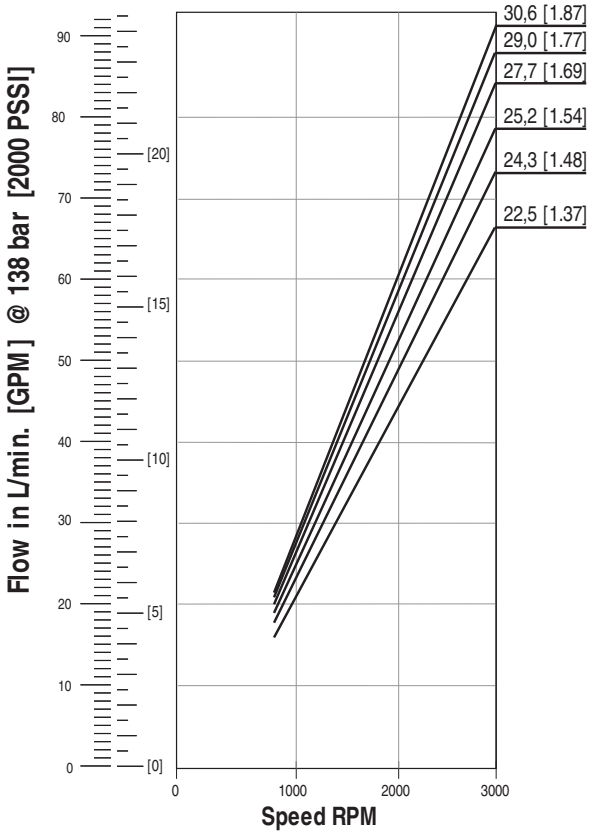
16,73 cm³/rev [1.02 in³/rev]



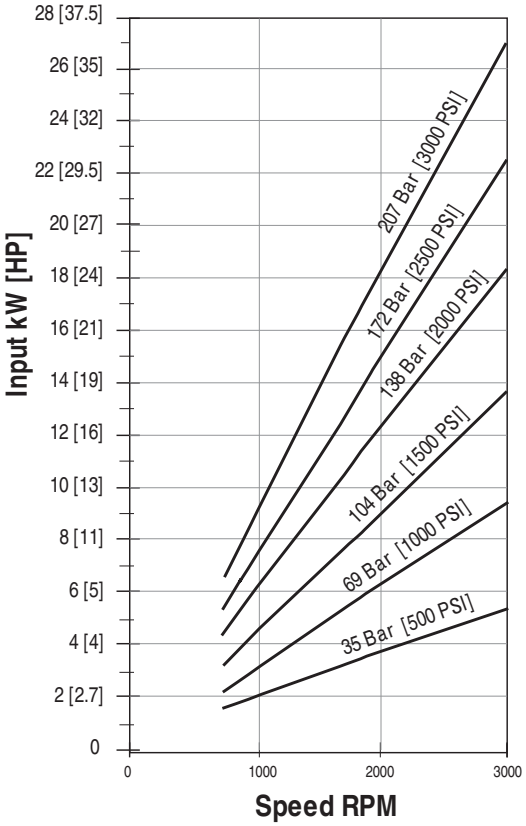
19,68 cm³/rev [1.20 in³/rev]



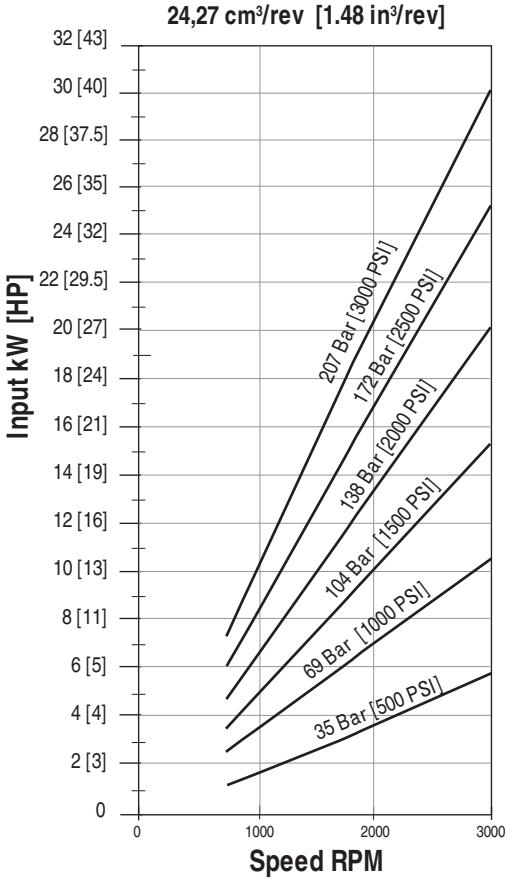
22,47–30,67 cm³/rev [1.37–1.87 in³/rev]



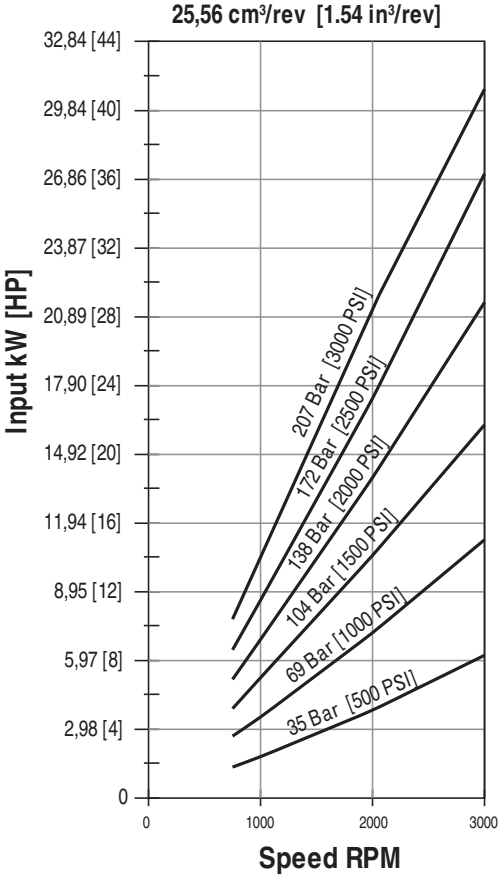
22,47 cm³/rev [1.37 in³/rev]



24,27 cm³/rev [1.48 in³/rev]

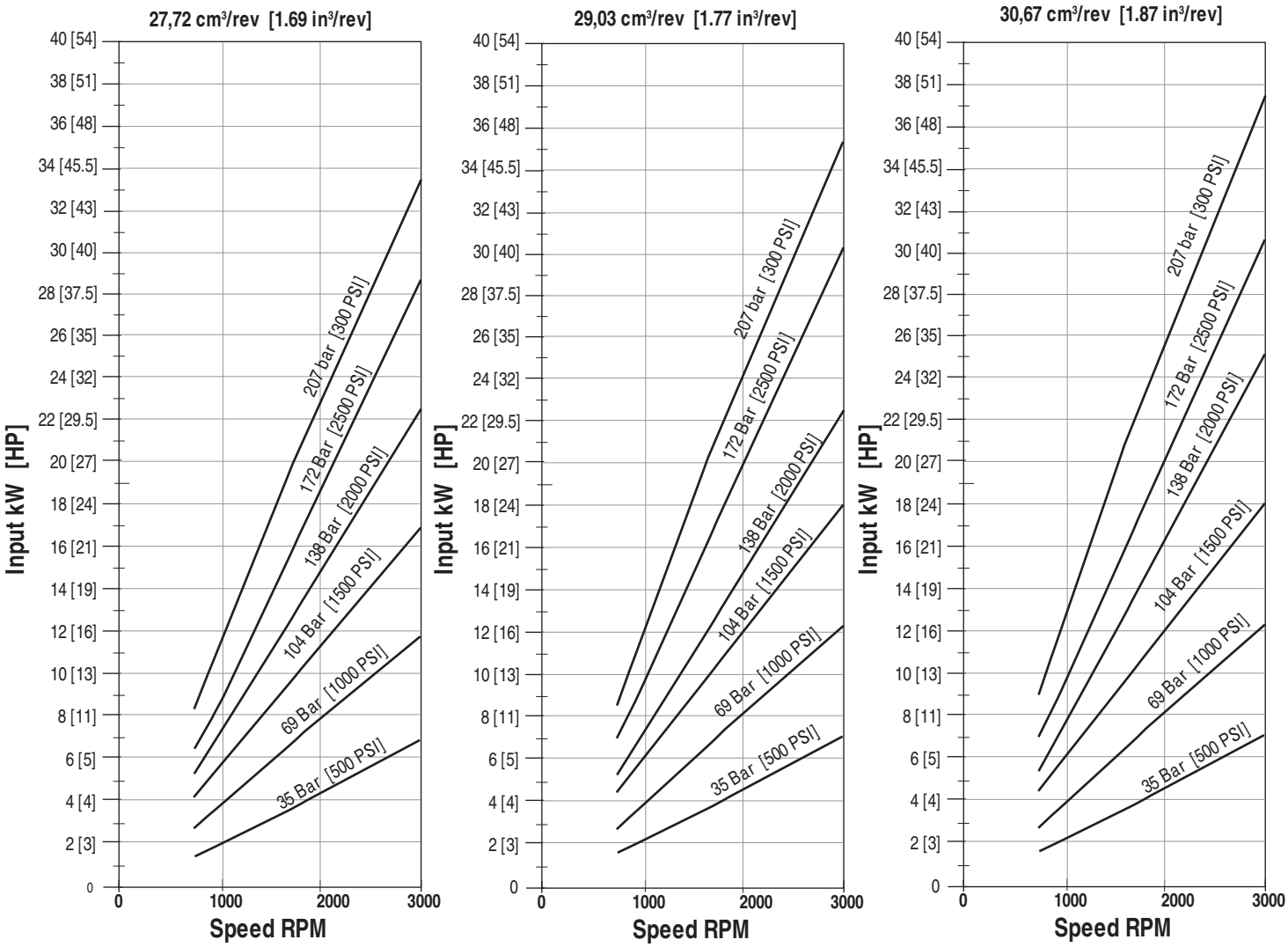


25,56 cm³/rev [1.54 in³/rev]



Series 26 Pump

Performance Data
Charts

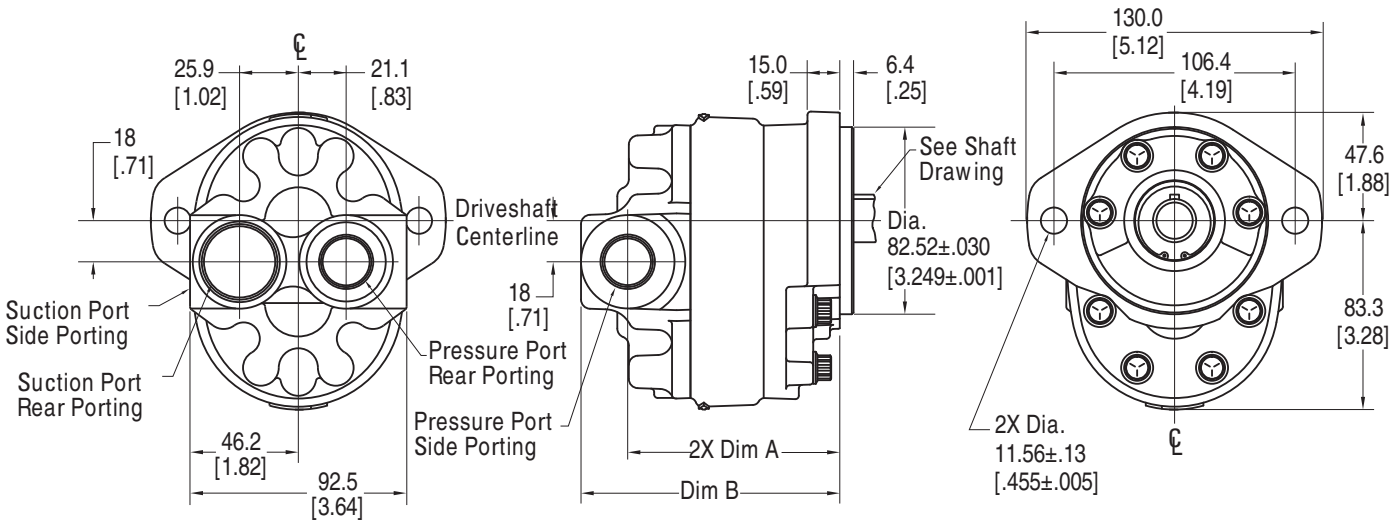


Series 26 Pump

Standard Catalog Assemblies - Dimensions

All dimensions are in mm [in].

*** Multiple pump input torque limitations:** the total torque for multiple pump displacements and pressure combinations cannot exceed the maximum input torque rating of the shaft. The proper formula is Pressure times Displacement divided by 6.28.

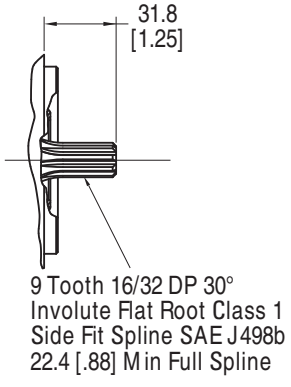


Left Hand Rotation Shown

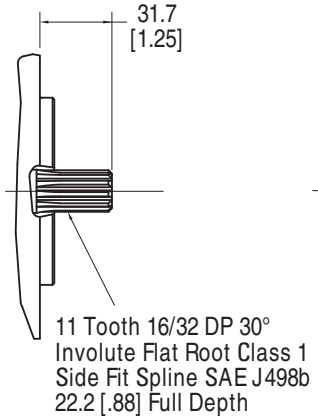
MODEL	26001	26002	26003	26004	26005	26006	26007
Displacement (cm^3/r [in^3/r])	6.6 [.40]	8.2 [.50]	9.5 [.58]	10.8 [.66]	13.8 [.84]	16.7 [1.02]	19.7 [1.20]
Dimension A (mm [in])	72.6 [2.86]	74.3 [2.93]	75.9 [2.99]	77.5 [3.05]	80.7 [3.18]	83.9 [3.30]	87.1 [3.43]
Dimension B (mm [in])	93.2 [3.67]	94.9 [3.74]	96.5 [3.80]	98.1 [3.86]	101.3 [3.99]	104.5 [4.11]	107.7 [4.24]

MODEL	26008	26009	26010	26011	26012	26013
Displacement (cm^3/r [in^3/r])	22.5 [1.37]	24.3 [1.48]	25.2 [1.54]	27.7 [1.69]	29.0 [1.77]	30.6 [1.87]
Dimension A (mm [in])	90.3 [3.56]	92.7 [3.65]	93.5 [3.68]	96.7 [3.81]	98.6 [3.88]	99.9 [3.93]
Dimension B (mm [in])	110.9 [4.37]	113.3 [4.46]	114.1 [4.49]	117.3 [4.62]	119.1 [4.69]	120.5 [4.74]

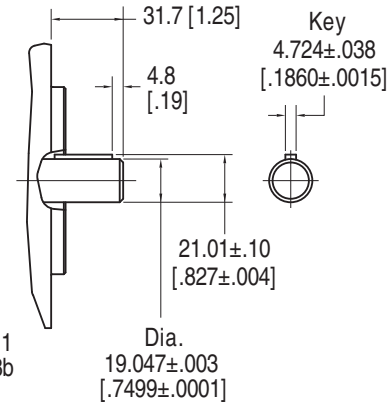
5/8 Inch 9 Tooth Spline
Maximum Input Torque
62 Nm [550 lb-in]



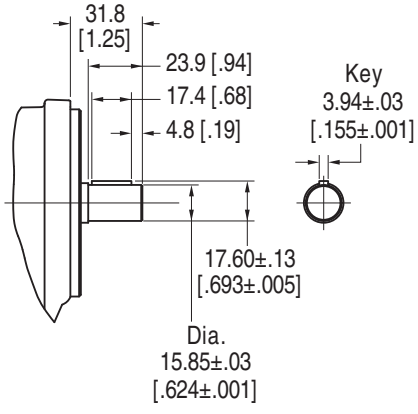
3/4 Inch 11 Tooth Spline
Maximum Input Torque
119 Nm [1050 lb-in]



3/4 Inch Straight Key
Maximum Input Torque
113 Nm [1000 lb-in]



5/8 Inch Straight Key
Maximum Input Torque
56 Nm [500 lb-in]



Series 26 Pump
Order Numbers

* 5/8 9 T Spline has a maximum allowable input torque of 62 Nm [550 lb-in].

** 5/8 Keyed shaft has a maximum allowable input torque of 56 Nm [500 lb-in].

RIGHT HAND ROTATION PRODUCT NO	LEFT HAND ROTATION PRODUCT NO	SHAFT	PORT LOCATION	SAE O-RING PRESSURE PORT SIZE	SAE O-RING SUCTION PORT SIZE	REPLACES
Model 26001 – 6,6 cm³/r [.40 in³/r] Displacement						
26001-RZG	26001-LZG	5/8 Keyed	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24300-RZA/LZA
26001-RZH	26001-LZH	5/8 Keyed	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24300-RZC/LZD
26001-RZJ	26001-LZJ	5/8 9 T Spline	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24300-RZB/LZA
26001-RZK	26001-LZK	5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24300-RZD/LZE
Model 26002 – 8,2 cm³/r [.50 in³/r] Displacement						
26002-RZA	26002-LZA	3/4 11T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25300-RSA/LSA
26002-RZB	26002-LZB	3/4 11T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25300-RSB/LSB
26002-RZC	26002-LZC	3/4 Keyed	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25300-RSC/LSC
26002-RZD	26002-LZD	3/4 Keyed	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25300-RSD/LSD
26002-RZE	26002-LZE	5/8 9 T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25300-RSE/LSE
26002-RZF	26002-LZF	5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25300-RSF/LSF
26002-RZG	26002-LZG	5/8 Keyed	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24301-RZC/LZA
26002-RZH	26002-LZH	5/8 Keyed	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24301-RZG/LZG
26002-RZJ	26002-LZJ	5/8 9 T Spline	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24301-RZD/LZB
26002-RZK	26002-LZK	5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24301-RZH/LZH
Model 26003 – 9,5 cm³/r [.58 in³/r] Displacement						
26003-RZG	26003-LZG	5/8 Keyed	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24302-RZB/LZB
26003-RZH	26003-LZH	5/8 Keyed	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24302-RZC/LZD
26003-RZJ	26003-LZJ	5/8 9 T Spline	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24302-RZA/LZA
26003-RZK	26003-LZK	5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24302-RZD/LZE
Model 26004 – 10,8 cm³/r [.66 in³/r] Displacement						
26004-RZA	26004-LZA	3/4 11T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25301-RSA/LSA
26004-RZB	26004-LZB	3/4 11T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25301-RSB/LSB
26004-RZC	26004-LZC	3/4 Keyed	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25301-RSC/LSC
26004-RZD	26004-LZD	3/4 Keyed	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25301-RSD/LSD
26004-RZE	26004-LZE	5/8 9 T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25301-RSE/LSE
26004-RZF	26004-LZF	5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25301-RSF/LSF
26004-RZG	26004-LZG	5/8 Keyed	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24303-RZB/LZB
26004-RZH	26004-LZH	5/8 Keyed	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24303-RZE/LZF
26004-RZJ	26004-LZJ	5/8 9 T Spline	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24303-RZD/LZA
26004-RZK	26004-LZK	5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24303-RZF/LZG
Model 26005 – 13,8 cm³/r [.84 in³/r] Displacement						
26005-RZA	26005-LZA	3/4 11T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25302-RSA/LSA
26005-RZB	26005-LZB	3/4 11T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25302-RSB/LSB
26005-RZC	26005-LZC	3/4 Keyed	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25302-RSC/LSC
26005-RZD	26005-LZD	3/4 Keyed	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25302-RSD/LSD
26005-RZE	26005-LZE	5/8 9 T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25302-RSE/LSE
26005-RZF	26005-LZF	5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25302-RSF/LSF
26005-RZG	26005-LZG	5/8 Keyed	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24304-RZC/LZA
26005-RZH	26005-LZH	5/8 Keyed	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24304-RZG/LZF
26005-RZJ	26005-LZJ	5/8 9 T Spline	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24304-RZD/LZB
26005-RZK	26005-LZK	5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24304-RZH/LZG
Model 26006 – 16,7 cm³/r [1.02 in³/r] Displacement						
26006-RZA	26006-LZA	3/4 11T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25303-RSA/LSA
26006-RZB	26006-LZB	3/4 11T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25303-RSB/LSB
26006-RZC	26006-LZC	3/4 Keyed	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25303-RSC/LSC
26006-RZD	26006-LZD	3/4 Keyed	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25303-RSD/LSD
26006-RZE	26006-LZE	5/8 9 T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25303-RSE/LSE
26006-RZF	26006-LZF	5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25303-RSF/LSF
26006-RZG	26006-LZG	5/8 Keyed	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24305-RZC/LZA
26006-RZH	26006-LZH	5/8 Keyed	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24305-RZG/-LZF
26006-RZJ	26006-LZJ	5/8 9 T Spline	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24305-RZD/LZB
26006-RZK	26006-LZK	5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24305-RZH/LZG

Series 26 Pump
Order Numbers

* 5/8 9 T Spline has a maximum allowable input torque of 62 Nm [550 lb-in].

** 5/8 Keyed shaft has a maximum allowable input torque of 56 Nm [500 lb-in].

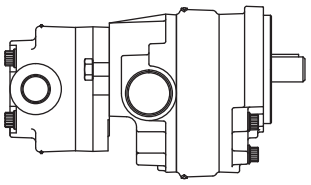
RIGHT HAND ROTATION PRODUCT NO	LEFT HAND ROTATION PRODUCT NO	SHAFT	PORT LOCATION	SAE O-RING PRESSURE PORT SIZE	SAE O-RING SUCTION PORT SIZE	REPLACES
Model 26007 – 19,7 cm³/r [1.20 in³/r] Displacement						
26007-RZA	26007-LZA	3/4 11T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25304-RSA/LSA
26007-RZB	26007-LZB	3/4 11T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25304-RSB/LSB
26007-RZC	26007-LZC	3/4 Keyed	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25304-RSC/LSC
26007-RZD	26007-LZD	3/4 Keyed	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25304-RSD/LSD
26007-RZE	26007-LZE	*5/8 9 T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25304-RSE/LSE
26007-RZF	26007-LZF	*5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25304-RSF/LSF
26007-RZG	26007-LZG	**5/8 Keyed	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24306-RZA/LZA
26007-RZH	26007-LZH	**5/8 Keyed	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24306-RZE/LZF
26007-RZJ	26007-LZJ	*5/8 9 T Spline	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24306-RZD/LZB
26007-RZK	26007-LZK	*5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24306-RZF/LZG
Model 26008 – 22,5 cm³/r [1.37 in³/r] Displacement						
26008-RZA	26008-LZA	3/4 11T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25305-RSA/LSA
26008-RZB	26008-LZB	3/4 11T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25305-RSB/LSB
26008-RZC	26008-LZC	3/4 Keyed	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25305-RSC/LSC
26008-RZD	26008-LZD	3/4 Keyed	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25305-RSD/LSD
26008-RZE	26008-LZE	*5/8 9 T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25305-RSE/LSE
26008-RZF	26008-LZF	*5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25305-RSF/LSF
Model 26009 – 24,3 cm³/r [1.48 in³/r] Displacement						
26009-RZG	26009-LZG	**5/8 Keyed	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24307-RZC/LZA
26009-RZH	26009-LZH	**5/8 Keyed	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24307-RZG/LZF
26009-RZJ	26009-LZJ	*5/8 9 T Spline	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24307-RZD/LZB
26009-RZK	26009-LZK	*5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24307-RZH/LZG
Model 26010 – 25,2 cm³/r [1.54 in³/r] Displacement						
26010-RZA	26010-LZA	3/4 11T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25306-RSA/LSA
26010-RZB	26010-LZB	3/4 11T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25306-RSB/LSB
26010-RZC	26010-LZC	3/4 Keyed	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25306-RSC/LSC
26010-RZD	26010-LZD	3/4 Keyed	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25306-RSD/LSD
26010-RZE	26010-LZE	*5/8 9 T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25306-RSE/LSE
26010-RZF	26010-LZF	*5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25306-RSF/LSF
Model 26011 – 27,7 cm³/r [1.69 in³/r] Displacement						
26011-RZA	26011-LZA	3/4 11T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25307-RSA/LSA
26011-RZB	26011-LZB	3/4 11T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25307-RSB/LSB
26011-RZC	26011-LZC	3/4 Keyed	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25307-RSC/LSC
26011-RZD	26011-LZD	3/4 Keyed	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25307-RSD/LSD
26011-RZE	26011-LZE	*5/8 9 T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25307-RSE/LSE
26011-RZF	26011-LZF	*5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25307-RSF/LSF
Model 26012 – 29,0 cm³/r [1.77 in³/r] Displacement						
26012-RZG	26012-LZG	**5/8 Keyed	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24308-RZA/LZA
26012-RZH	26012-LZH	**5/8 Keyed	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24308-RZE/LZF
26012-RZJ	26012-LZJ	*5/8 9 T Spline	Side	7/8-14 UNF-2B	1-1/16-12 UN-2B	24308-RZD/LZB
26012-RZK	26012-LZK	*5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-1/16-12 UN-2B	24308-RZF/LZG
Model 26013 – 30,6 cm³/r [1.87 in³/r] Displacement						
26013-RZA	26013-LZA	3/4 11T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25308-RZA/LZA
26013-RZB	26013-LZB	3/4 11T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25308-RZB/LZB
26013-RZC	26013-LZC	3/4 Keyed	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25308-RZC/LZC
26013-RZD	26013-LZD	3/4 Keyed	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25308-RZD/LZD
26013-RZE	26013-LZE	*5/8 9 T Spline	Side	7/8-14 UNF-2B	1-5/16-12 UN-2B	25308-RZE/LZE
26013-RZF	26013-LZF	*5/8 9 T Spline	Rear	7/8-14 UNF-2B	1-5/16-12 UN-2B	25308-RZF/LZF

Series 26 Pump
Optional Configurations

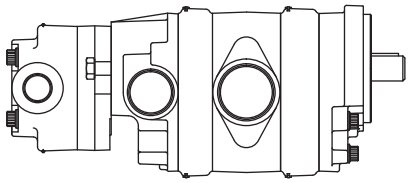
The Series 26 Gear Pump components can be assembled into many optional configurations. The versatile design allows you to assemble a pump to meet your specific needs.

Model codes for single and multiple pumps along with the component part dimension drawings are given on the following pages.

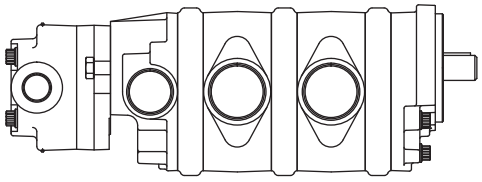
Single Gear Pump with Tandem Backplate



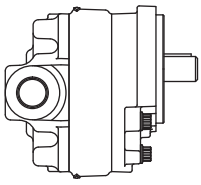
Double Gear Pump with Tandem Backplate



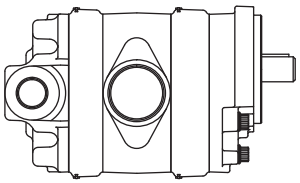
Triple Gear Pump with Two Suction Ports and Tandem Backplate



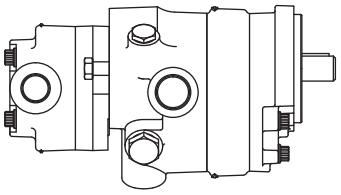
Single Gear Pump



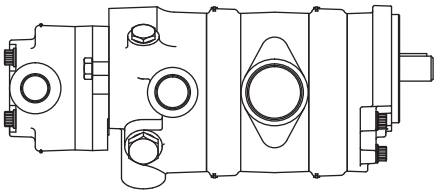
Double Gear Pump with Common Suction Port



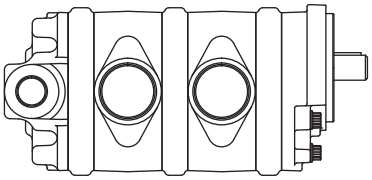
Single Gear Pump w/Tandem Flow Divider Backplate



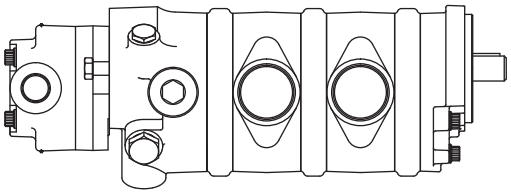
Double Gear Pump with Tandem Flow Divider Backplate



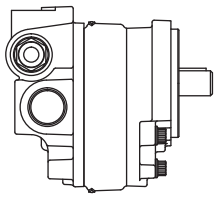
Triple Gear Pump with Two Suction Ports



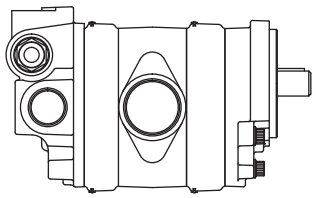
Triple Gear Pump with Two Suction Ports and Tandem Flow Divider Backplate



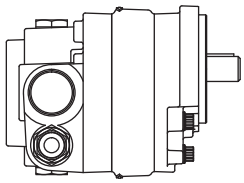
Single Gear Pump with Relief Valve



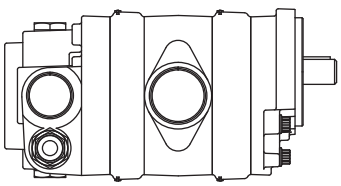
Double Gear Pump with Relief Valve



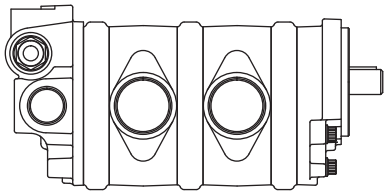
Single Gear Pump with Flow Divider and Relief Valve



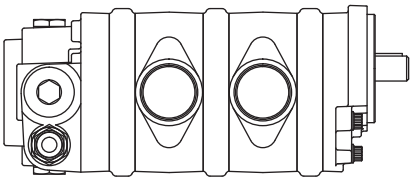
Double Gear Pump with Flow Divider and Relief Valve



Triple Gear Pump with Two Suction Ports and Relief Valve



Triple Gear Pump with Two Suction Ports, Flow Divider and Relief Valve



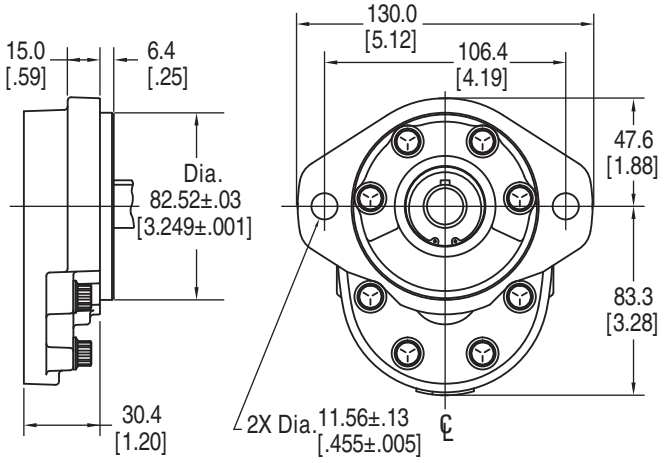
Series 26 Pump

Component Parts - Dimensions

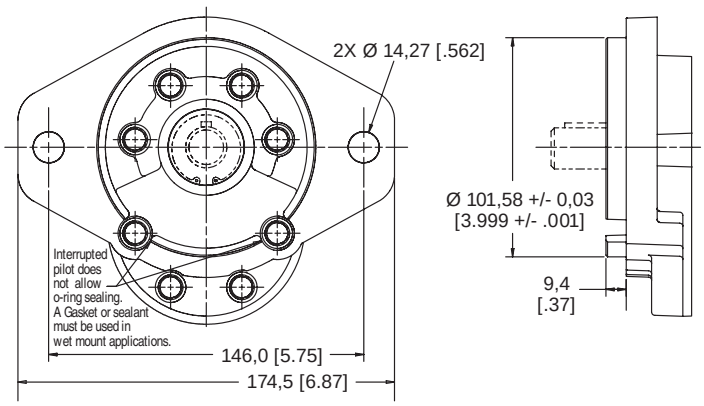
All dimensions are in mm [in].

Front Plate

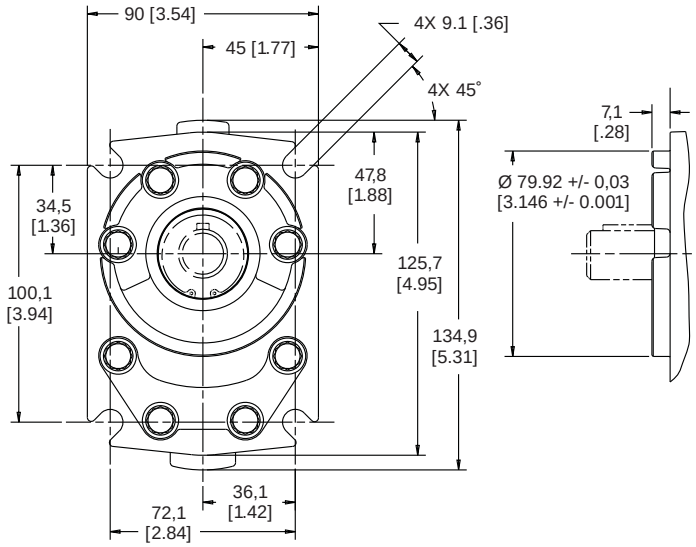
SAE A 2 Bolt Flange used on all Standard Catalog Assemblies



"B" Mount

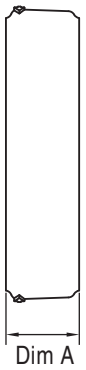


4 Bolt Euro Mount



Body

Used on Single and Multiple Pumps



Model	26001	26002	26003	26004	26005	26006	26007
Displacement (cm^3/r [in^3/r])	6.6 [.40]	8.2 [.50]	9.5 [.58]	10.8 [.66]	13.8 [.84]	16.7 [1.02]	19.7 [1.20]
Dimension A (mm [in])	14.4 [.57]	16.3 [.64]	17.7 [.70]	19.5 [.77]	22.7 [.89]	25.9 [1.02]	29.1 [1.15]

Model	26008	26009	26010	26011	26012	26013
Displacement (cm^3/r [in^3/r])	22.5 [1.37]	24.3 [1.48]	25.2 [1.54]	27.7 [1.69]	29.0 [1.77]	30.6 [1.87]
Dimension A (mm [in])	32.3 [1.27]	34.7 [1.36]	35.5 [1.40]	38.7 [1.52]	40.3 [1.59]	41.9 [1.65]

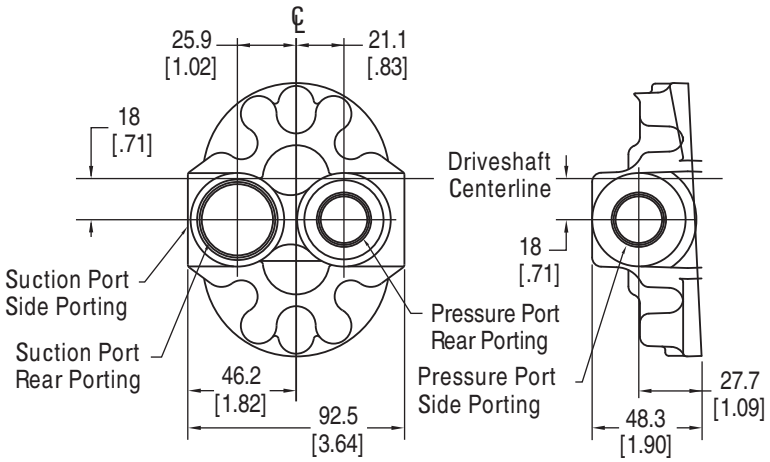
Series 26 Pump

Component Parts - Dimensions

All dimensions are in mm [in].

Backplate

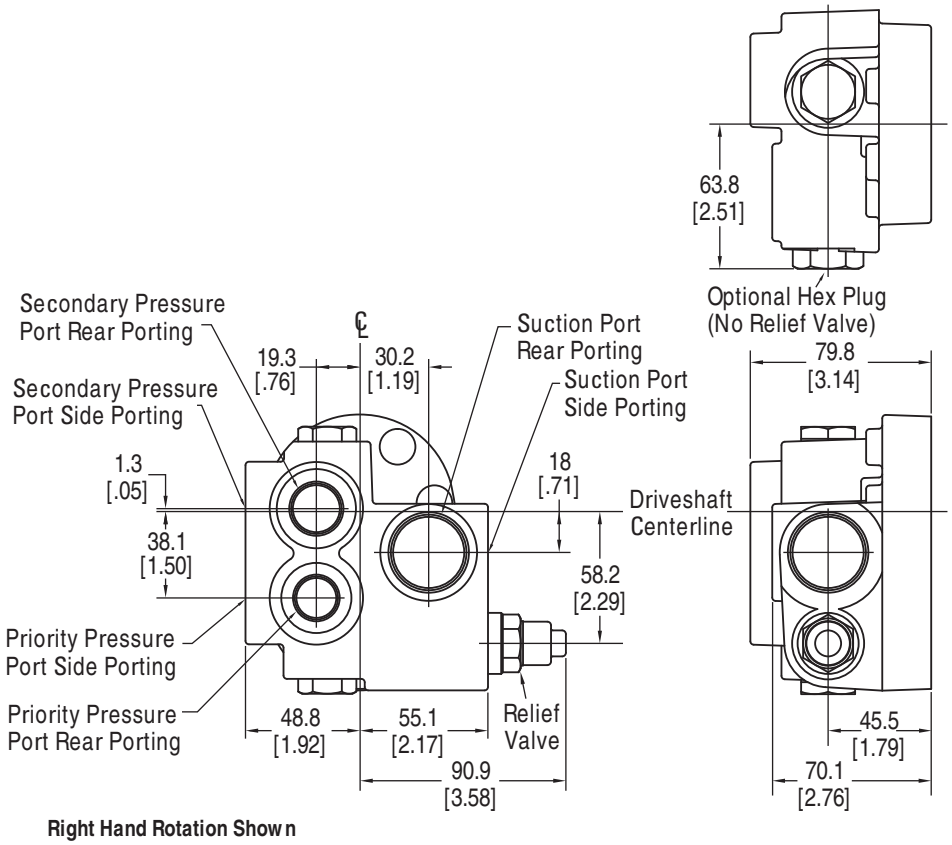
Used on Single and Multiple Pumps



Left Hand Rotation Shown

Flow Divider Backplate

Used on Single and Multiple Pumps



Right Hand Rotation Shown

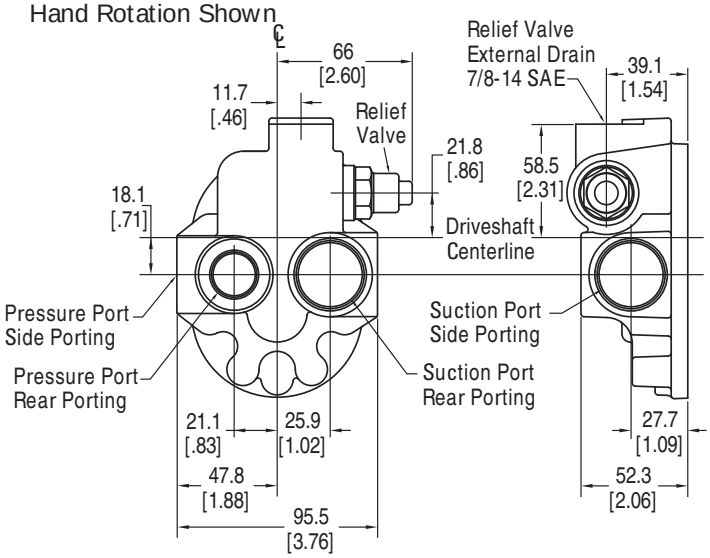
Series 26 Pump

Component Parts - Dimensions

All dimensions are in mm [in].

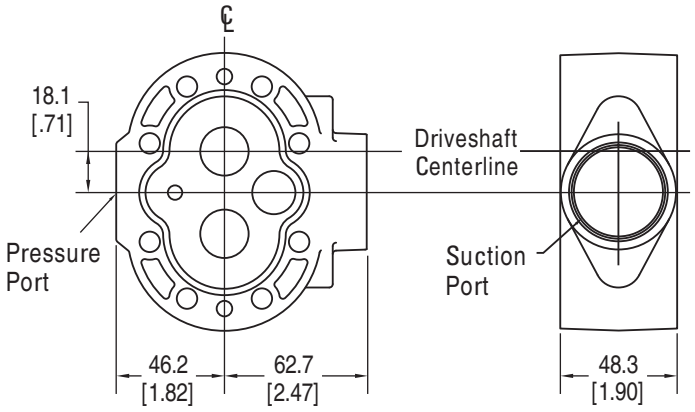
Relief Valve Backplate

Used on Single and Multiple Pumps - Right Hand Rotation Shown



Adaptor Plate

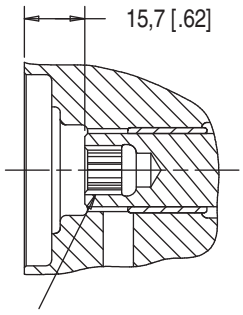
Used on Multiple Pumps - Right Hand Rotation Shown



Tandem Backplate

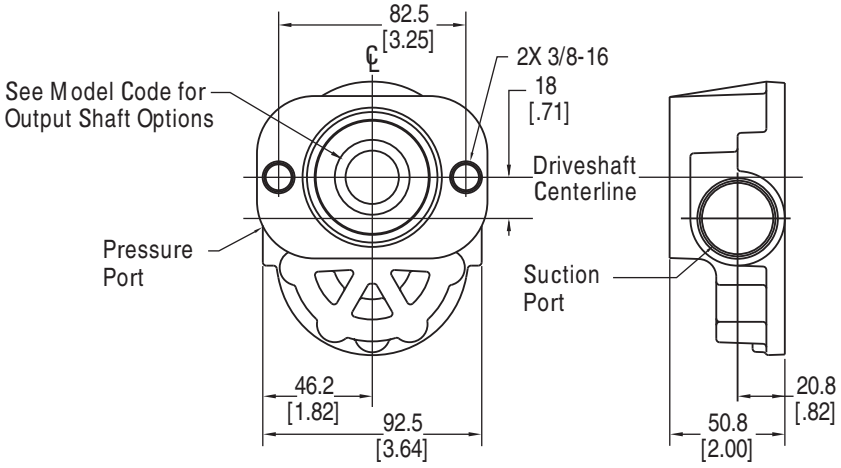
Used on Single and Multiple Pumps

SAE AA 2 Bolt Flange



9 tooth 20/40 DP 30˚
invlt flat root class I
side fit spline SAE J498b
9,7 [.38] min. full spline

Max Torque Rating: 29.5 Nm [261 lbf•in]



Right Hand Rotation Shown

Series 26 Pump

Model Code - Single

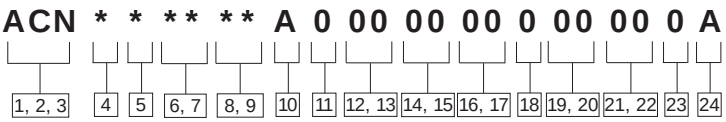
Series 26 Gear Pumps can be ordered by using the following Model Code.

A twenty-four digit coding system has been designed to identify the features presently available on single gear pumps. The characters and their relative positions within the code identify specific features.

Use the Model Code Matrix as an aid when assembling the model code for the pump with the features you desire. It may be helpful to photocopy the matrix and write the numbers and letters into the boxes as you select features.

All twenty-four digits of the code must be submitted when ordering.

All dimensions are in inches.



1, 2, 3 **26 Series**

ACN – Gear Pump - Single Unit

4 **Unit Type**

A – Plain
B – Flow Divider with/without Relief Valve (Pos. 14-15)
C – Relief Valve (Pos. 16-17)

5 **Input Rotation (viewed from input shaft end)**

L – Left-hand Rotation CCW
R – Right-hand Rotation CW

6, 7 **Displacement (cm^3/r [in^3/r])**

01 = 6.6 [.40]
02 = 8.2 [.50]
03 = 9.5 [.58]
04 = 10.8 [.66]
05 = 13.8 [.84]
06 = 16.7 [1.02]
07 = 19.7 [1.20]
08 = 22.5 [1.37]
09 = 24.3 [1.48]
10 = 25.2 [1.54]
11 = 27.7 [1.69]
12 = 29.0 [1.77]
13 = 30.6 [1.87]

8, 9 **Input Shaft**

AA = 5/8 Inch Dia. 9 Tooth Spline 16/32 Pitch Shaft Extension 31.8 [1.25]

AB = 3/4 Inch Dia. 11 Tooth Spline 16/32 Pitch Shaft Extension 31.8 [1.25]

AC = 3/4 Inch Dia. Straight Keyed, Keyway 4.8 x 25.4 [.19 x 1.00] Shaft Extension 31.8 [1.25]

AD = 5/8 Inch Dia. Straight Keyed, Keyway 4.1 X 18.3 [.16 X .72] Shaft Extension 31.8 [1.25]

10 **Mounting Features**

A = SAE 2-Bolt A Flange, Series 82-2

B = SAE 2-Bolt B Flange, Series 101-2

D = European 4-Bolt

11 **Auxiliary Mounting Features**

0 - No Rear Mounting

C - (2-Bolt AA) SAE Flange Series 50-2, with 9 Tooth Internal Spline 20/40 Pitch, Accepts 25.4 [1.00] Shaft Extension

12, 13 **Ports, Sizes and Location- Backplate**

01 = Plain: Suction Port 1.3125-12 UN-2B SAE O-ring Port; Pressure Port .875-14 UNF-2B SAE O-ring Port - Side Sports

02 = Plain: Suction Port 1.3125-12 UN-2B SAE O-ring Port; Pressure Port .875-14 UNF-2B SAE O-Ring Port - Rear Ports

03 = Plain: Suction Port 1.0625-12 UN-2B SAE O-ring Port; Pressure Port .875-14 UNF-2B SAE O-ring Port Accepts Fittings Per SAE J1926 - Side Ports

04 = Plain: Suction Port 1.0625-12 UN-2B SAE O-ring Port; Pressure Port .875-14 UNF-2B SAE O-ring Port Accepts Fittings Per SAE J1926 -Rear Ports

08 = Plain Thru Shaft: Suction Port 1.0625-12 UN-2B SAE O-ring Port; Pressure Port .875-14 UNF-2B SAE O-ring Port - Side Ports

15 = Relief Valve: Suction Port 1.0625-12 UN-2B SAE O-ring Port; Pressure Port .875-14 UNF-2B SAE O-ring Port - Side Ports; Drain Port .875-14 UNF-2B SAE O-ring Port

16 = Relief Valve: Suction Port 1.0625-12 UN-2B SAE O-ring Port; Pressure Port .875-14 UNF-2B SAE O-ring Port - Rear Ports; Drain Port .875-14 UNF-2B SAE O-ring Port

20 = Flow Divider: Suction Port 1.3125-12 UN-2B SAE O-ring Port; Priority Pressure Port .750-16 UNF-2B SAE O-ring Port; Secondary Pressure Port .875-14 UNF-2B SAE O-ring Port - Side Ports

21 = Flow Divider: Suction Port 1.3125-12 UN-2B SAE O-ring Port; Priority Pressure Port .750-16 UNF-2B SAE O-ring Port; Secondary Pressure Port .875-14 UNF-2B SAE O-ring Port - Rear Ports

14, 15 **Priority Flow Divider Setting (LPM [GPM])**

00 = No Flow Setting

AA = 3.8 [1.00]

AD = 7.6 [2.00]

AJ = 11.4 [3.00]

AL = 15.1 [4.00]

AN = 18.9 [5.00]

AR = 22.7 [6.00]

AS = 26.5 [7.00]

AT = 30.3 [8.00]

16, 17 **Relief Valve Full Flow Setting (bar [PSI])**

00 = No Relief Valve Setting

AA = 34.5 [500]

AB = 51.7 [750]

AC = 68.9 [1000]

AE = 86.2 [1250]

AF = 103.4 [1500]

AJ = 120.7 [1750]

AL = 137.9 [2000]

AN = 155.1 [2250]

AP = 172.4 [2500]

AR = 189.6 [2750]

AS = 206.8 [3000]

BR = 241.3 [3500]

BT = 224.1 [3250]

18 **Test Data**

0 - Generic

A - Unit Specific (required for flow divider and relief valve options.)

19, 20 **Special Features**

00 - No Special Features
AB - Viton Shaft Seal

21, 22 **Paint**

00 - None
0A - Red Primer
0B - Black

23 **Identification**

0 - Standard

24 **Design Code**

A - A

Series 26 Pump

Model Code - Multiple

Series 26 Gear Pumps can be ordered by using the following Model Code.

A thirty-two digit coding system has been designed to identify the features presently available on Multiple gear pumps.

The characters and their relative positions within the code identify specific features.

Use the Model Code Matrix as an aid when assembling the model code for the pump with the features you desire. It may be helpful to photocopy the matrix and write the numbers and letters into the boxes as you select features.

All thirty-two digits of the code must be submitted when ordering.

All dimensions are in inches.

ACM	*	*	**	**	**	**	**	**	**	00	00	A	0	0	00	00	0	B
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	31	32

[1, 2, 3] **26 Series**

ACM – Gear Pump - Multiple Unit

[4] **Unit Type**

A – Plain
B – Flow Divider with/without Relief Valve (Pos. 20-21)
C – Relief Valve

[5] **Input Rotation (viewed from input shaft end)**

L – Left-hand Rotation CCW
R – Right-hand Rotation CW

[6, 7] **Displacement - Front (cm^3/r [in^3/r])**

01 = 6.6 [.40]
02 = 8.2 [.50]
03 = 9.5 [.58]
04 = 10.8 [.66]
05 = 13.8 [.84]
06 = 16.7 [1.02]
07 = 19.7 [1.20]
08 = 22.5 [1.37]
09 = 24.3 [1.48]
10 = 25.2 [1.54]
11 = 27.7 [1.69]
12 = 29.0 [1.77]
13 = 30.6 [1.87]

[8, 9] **Displacement - Ctr. Triple Only (cm^3/r [in^3/r])**

01 = 6.6 [.40]
02 = 8.2 [.50]
03 = 9.5 [.58]
04 = 10.8 [.66]
05 = 13.8 [.84]
06 = 16.7 [1.02]
07 = 19.7 [1.20]
08 = 22.5 [1.37]
09 = 24.3 [1.48]
10 = 25.2 [1.54]
11 = 27.7 [1.69]
12 = 29.0 [1.77]
13 = 30.6 [1.87]
99 = No Center Displacement

[10, 11] **Displacement - Rear (cm^3/r [in^3/r])**

01 = 6.6 [.40]
02 = 8.2 [.50]
03 = 9.5 [.58]
04 = 10.8 [.66]
05 = 13.8 [.84]
06 = 16.7 [1.02]
07 = 19.7 [1.20]
08 = 22.5 [1.37]
09 = 24.3 [1.48]
10 = 25.2 [1.54]
11 = 27.7 [1.69]
12 = 29.0 [1.77]
13 = 30.6 [1.87]

[12, 13] **Input Shaft**

AA = 5/8 Inch Dia. 9 Tooth Spline 16/32 Pitch Shaft Extension 31.8 [1.25]

AB = 3/4 Inch Dia. 11 Tooth Spline 16/32 Pitch Shaft Extension 31.8 [1.25]

AC = 3/4 Inch Dia. Straight Keyed, Keyway 4.8 x 25.4 [.19 x 1.00] Shaft Extension 31.8 [1.25]

AD = 5/8 Inch Dia. Straight Keyed, Keyway 4.1 X 18.3 [.16 X .72] Shaft Extension 31.8 [1.25]

[14, 15] **Front Adapter Ports**

01 = Suction Port 1-5/8–12 UN-2B SAE O-ring Port; Pressure Port 7/8–14 UNF-2B SAE O-ring Port

05 = Suction Port 1-5/16–12 UN-2B SAE O-ring Port; Pressure Port 7/8–14 UNF-2B SAE O-ring Port

[16, 17] **Ports - Rear Adapter (Triple Units)**

00 = No Rear Adaptor

01 = Suction Port 1-5/8–12 UN-2B SAE O-ring Port; Pressure Port 7/8–14 UNF-2B SAE O-ring Port

05 = Suction Port 1-5/16–12 UN-2B SAE O-ring Port; Pressure Port 7/8–14 UNF-2B SAE O-ring Port

[18, 19] **Ports, Sizes and Location- Backplate**

01 = Plain: Suction Port 1-5/16–12 UN-2B SAE O-ring Port Size; Pressure Port 7/8–14 UNF-2B SAE O-ring Port–Side Ports

02 = Plain: Suction Port 1-5/16–12 UN-2B SAE O-ring Port Size; Pressure Port 7/8–14 UNF-2B SAE O-ring Port–Rear Ports

03 = Plain: Suction Port 1-1/16–12 UN-2B SAE O-ring Port Size; Pressure Port 7/8–14 UNF-2B SAE O-ring Port–Side Ports

04 = Plain: Suction Port 1-1/16–12 UN-2B SAE O-ring Port Size; Pressure Port 7/8–14 UNF-2B SAE O-ring Port–Rear Ports

08 = Plain Tandem: Suction Port 1.0625-12 UN-2B SAE O-ring Port; Pressure Port .875-14 UNF-2B SAE O-ring Port - Side Ports

14 = Plain: Suction Port 1-5/16–12 UN-2B SAE O-ring Port Size–(Plugged); Pressure Port 7/8–14 UNF-2B SAE O-ring Port–Side Ports, used with position 14 and 15–01 and 16 and 17–10

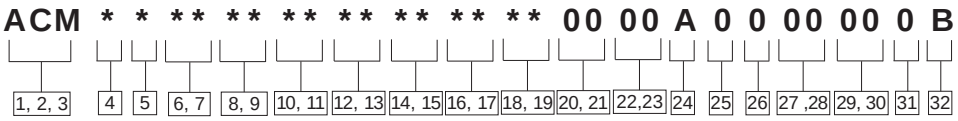
17 = Plain: Suction Port 1-5/16–12 UN-2B SAE O-ringPort Size–(Plugged); Pressure Port 7/8–14 UNF-2B SAE O-ring Port–Rear Ports, used with position 14 and 15–01 and 16 and 17–01

18 = Plain Tandem: Suction Port 1.0625-12 UN-2B SAE O-ring Port (Plugged); Pressure Port .875-14 UNF-2B SAE O-ring Port - Side Ports

Series 26 Pump

Model Code - Multiple

All dimensions are in inches.



19 = Plain: Suction Port 1.3125-12 UN-2B SAE O-ring Port (Plugged); Pressure Port 1.0625-12 UN-2B SAE O-ring Port - Side Ports

20 = Relief Valve: Suction Port 1.0625-12 UN-2B SAE O-ring Port; Pressure Port .875-14 UNF-2B SAE O-ring Port - SIDE Ports; DRAIN Port .875-14 UNF-2B SAE O-ring Port

21 = Relief Valve: Suction Port 1.0625-12 UN-2B SAE O-ring Port; Pressure Port .875-14 UNF-2B SAE O-ring Port - Rear Ports; DRAIN Port .875-14 UNF-2B SAE O-ring Port - TOP Port

27 = Flow Divider: Suction Port 1.3125-12 UN-2B SAE O-ring Port; Priority Pressure Port .750-16 UNF-2B SAE O-ring Port; Secondary Pressure Port .875-14 UNF-2B SAE O-ring Port - SIDE Ports

28 = Flow Divider: Suction Port 1.3125-12 UN-2B SAE O-ring Port; Priority Pressure Port .750-16 UNF-2B SAE O-ring Port; Secondary Pressure Port .875-14 UNF-2B SAE O-ring Port - Rear Ports

29 = Flow Divider: Suction Port 1.0625-12 UN-2B SAE O-ring Port; Priority Pressure Port .5625-18 UNF-2B SAE O-ring Port; Secondary Pressure Port .875-14 UNF-2B SAE O-ring Port - SIDE Ports

Consult your Eaton representative when requiring common inlet option.

20, 21 **Priority Flow Divider Setting (LPM [GPM])**

00 = No Flow Setting

AA = 3.8 [1.00]

AD = 7.6 [2.00]

AJ = 11.4 [3.00]

AL = 15.1 [4.00]

AN = 18.9 [5.00]

AR = 22.7 [6.00]

AS = 26.5 [7.00]

AT = 30.3 [8.00]

22,23 **Relief Valve Full Flow Setting (bar [PSI])**

00 = No Relief Valve Setting

AA = 34.5 [500]

AB = 51.7 [750]

AC = 68.9 [1000]

AE = 86.2 [1250]

AF = 103.4 [1500]

AJ = 120.7 [1750]

AL = 137.9 [2000]

AN = 155.1 [2250]

AP = 172.4 [2500]

AR = 189.6 [2750]

AS = 206.8 [3000]

24 **Mounting Features (Front)**

A = (2-Bolt A) SAE Flange, Series 82-3

C = (2-Bolt B) SAE Flange Series 82.3

G = (4-Bolt) European

25 **Auxiliary Mounting Features**

0 = No Rear Mounting

C = (2-Bolt AA) SAE Flange Series 50-2, with 9 Tooth Internal Spline 20/40 Pitch, Accepts 25.4 [1.00] Shaft Extension

26 **Test Data**

0 - Generic

A - Unit Specific (required for flow divider and relief valve options.)

27, 28 **Special Features**

00 - No Special Features

AB - Viton Shaft Seal

29, 30 **Paint**

00 - None
0A - Red Primer
0B - Black

31 **Identification**

0 - Standard

32 **Design Code**

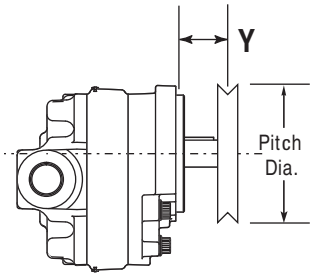
B - B

Series 26 Pump

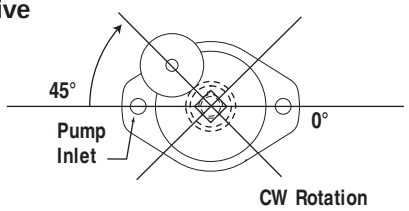
Side-Load Applications

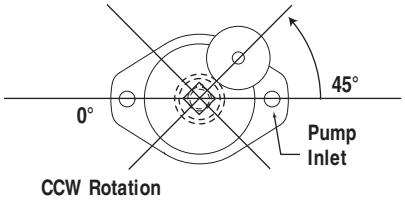
Maximum Allowable Operating Pressures

Ideal positions shown. Side load is acceptable within 90° of either side of the ideal position. Charts are based on 100% slack side tension. Max. speed per catalog. Max. operating pressure shown.

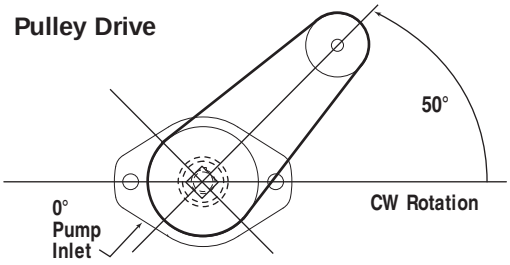


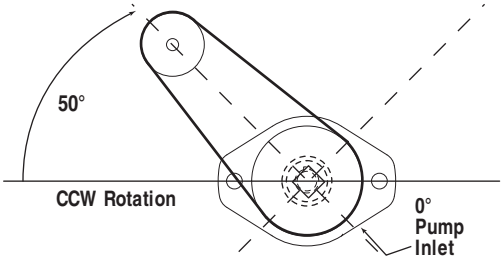
Gear Drive





Pulley Drive





0.40/0.50 CID

PULLEY ϕ	2	4	6	8	10	12
GEAR PITCH ϕ	1	2	3	4	5	6
Y Dimension						
2.0”	3000	3000	3000	3000	3000	3000
1.5”	3000	3000	3000	3000	3000	3000
1.0”	3000	3000	3000	3000	3000	3000
0.5”	3000	3000	3000	3000	3000	3000
0”	3000	3000	3000	3000	3000	3000

0.58/0.66 CID

PULLEY ϕ	2	4	6	8	10	12
GEAR PITCH ϕ	1	2	3	4	5	6
Y Dimension						
2.0”	2250	3000	3000	3000	3000	3000
1.5”	2250	3000	3000	3000	3000	3000
1.0”	2500	3000	3000	3000	3000	3000
0.5”	2500	3000	3000	3000	3000	3000
0”	2750	3000	3000	3000	3000	3000

.84 CID

PULLEY ϕ	2	4	6	8	10	12
GEAR PITCH ϕ	1	2	3	4	5	6
Y Dimension						
2.0”	1750	2500	3000	3000	3000	3000
1.5”	1750	2750	3000	3000	3000	3000
1.0”	2000	2750	3000	3000	3000	3000
0.5”	2000	3000	3000	3000	3000	3000
0”	2250	3000	3000	3000	3000	3000

1.02 CID

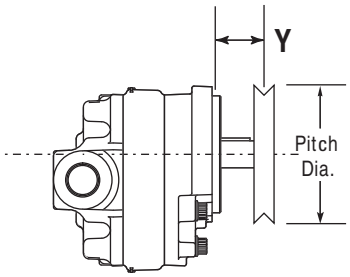
PULLEY ϕ	2	4	6	8	10	12
GEAR PITCH ϕ	1	2	3	4	5	6
Y Dimension						
2.0”	1250	2000	2250	2500	2750	3000
1.5”	1250	2000	2500	2750	3000	3000
1.0”	1250	2000	2500	2750	3000	3000
0.5”	1500	2250	2500	2750	3000	3000
0”	1500	2250	2750	3000	3000	3000

Series 26 Pump

Side-Load Applications

Maximum Allowable Operating Pressures

Ideal positions shown. Side load is acceptable within 90° of either side of the ideal position. Charts are based on 100% slack side tension. Max. speed per catalog. Max. operating pressure shown.



1.20 CID

PULLEY ϕ	2	4	6	8	10	12
GEAR PITCH ϕ	1	2	3	4	5	6
Y Dimension						
2.0”	N/R	1500	2000	2250	2250	2500
1.5”	N/R	1500	2000	2250	2500	2500
1.0”	N/R	1750	2000	2250	2500	2500
0.5”	1250	1750	2250	2250	2500	2750
0”	1250	1750	2250	2500	2750	3000

1.69 CID

PULLEY ϕ	2	4	6	8	10	12
GEAR PITCH ϕ	1	2	3	4	5	6
Y Dimension						
2.0”	N/R	N/R	1250	1500	1500	1750
1.5”	N/R	N/R	1250	1500	1500	1750
1.0”	N/R	N/R	1250	1500	1750	1750
0.5”	N/R	1250	1250	1500	1750	1750
0”	N/R	1250	1500	1750	1750	2000

1.37 CID

PULLEY ϕ	2	4	6	8	10	12
GEAR PITCH ϕ	1	2	3	4	5	6
Y Dimension						
2.0”	N/R	1250	1750	2000	2000	2250
1.5”	N/R	1250	1750	2000	2000	2250
1.0”	N/R	1500	1750	2000	2250	2250
0.5”	N/R	1500	1750	2000	2250	2250
0”	N/R	1500	1750	2000	2250	2500

1.77/1.87 CID

PULLEY ϕ	2	4	6	8	10	12
GEAR PITCH ϕ	1	2	3	4	5	6
Y Dimension						
2.0”	N/R	N/R	N/R	1250	1500	1500
1.5”	N/R	N/R	1250	1250	1500	1500
1.0”	N/R	N/R	1250	1250	1500	1500
0.5”	N/R	N/R	1250	1500	1500	1750
0”	N/R	N/R	1250	1500	1750	1750

1.48/1.54 CID

PULLEY ϕ	2	4	6	8	10	12
GEAR PITCH ϕ	1	2	3	4	5	6
Y Dimension						
2.0”	N/R	N/R	1250	1500	1750	2000
1.5”	N/R	1250	1500	1750	1750	2000
1.0”	N/R	1250	1500	1750	2000	2000
0.5”	N/R	1250	1500	1750	2000	2000
0”	N/R	1500	1750	2000	2000	2250

Series 26 Pump

Load Sensing Priority Valve

The Load Sensing PriorityValve is used with the open loop load sense systemsthat are typically used in steering and braking circuits. The load sense gear pump provides metered priorityflow (CF)on demand.

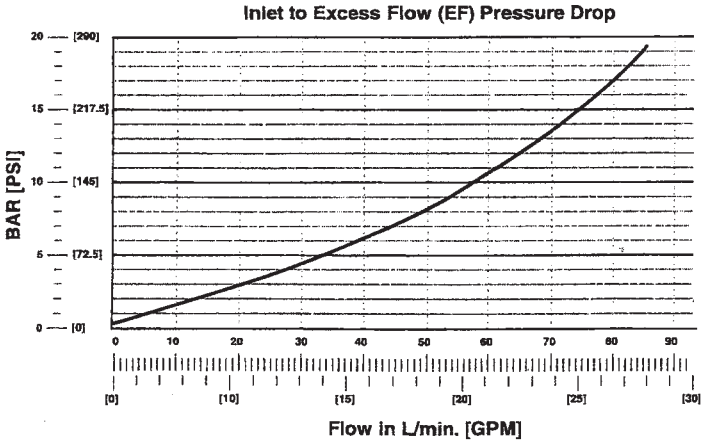
The excess flow (EF)is available for auxiliary circuits.The response time was selectedto insure that the operator will not sense a delay or steering " kick" during transient conditions.

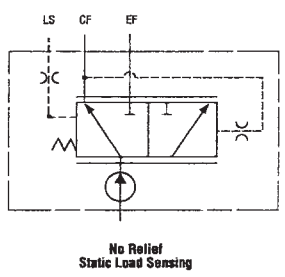
VALVE SPECIFICATIONS

Rated Pressure	207 BAR (3000PSI)
Rated Inlet Flow	108 L/m (28GPM)
Maximum Controlled Flow (CF)	33 L/m(8.5 GPM)
Bias Pressure	Dynamic - 10 bar (150 PSI) Std. Static - 6.9 bar (100 PSI) Std.
Relief Pressure	34.5-207 bar (500-3000 PSI)
Response Time	70 msec. max. (std. bias spring)
CF Flow Variation over full pressure range	+/- 10%

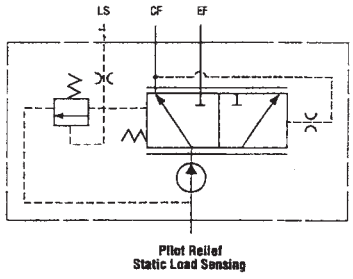
PUMP SPECIFICATIONS

Displacements	9 Available: 8.2cm³/r [.50 in³/r] thru 30.6 cm³/r [1.87in³/r]
Mounting	SAE 2-Bolt A Mount SAE 2-Bolt B Mount 4-Bolt European Mount (80mm Pilot)
Ports	Side or Rear
Type	Single or Multiple Configuration

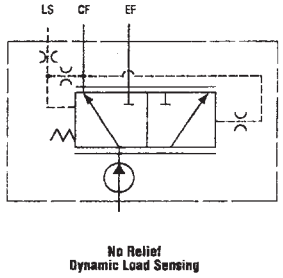




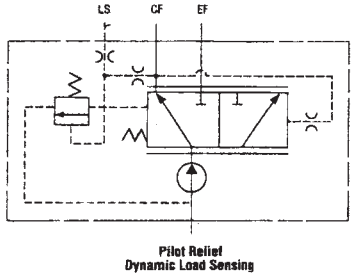
No Relief
Static Load Sensing



Pilot Relief
Static Load Sensing



No Relief
Dynamic Load Sensing



Pilot Relief
Dynamic Load Sensing

Series 26 Motor

General Specifications

Rotation	Bi-Rotation
Mounting Flange	SAE A 2 Bolt
Max. Continuous Pressure†	210 bar [3000 PSI]*
Max. Intermittent Pressure††	240 bar [3500 PSI]**
Minimum Speed at Continuous Pressure	750 RPM
Maximum Rotating Torque at 0 Pressure	4 Nm [36 lb-in]
Maximum Continuous Operating Temperature	105°C [220°F]
Minimum Continuous Oil Viscocity	5.7 cSt [45 SUS]
Minimum Operating Temperature	-29°C [-20°F]
Maximum Inlet Vacuum at Operating Condition	0,8 bar Abs. [11.6 psi Abs.]
Maximum Thrust Load	50 lbs.
Maximum Seal Pressure	150 PSI, 200 PSI @ 1500 RPM

† Continuous - motor may be run continuously at these ratings.

†† Intermittent - intermittent operation, 10% of every minute.

* 31.8 cm^3/rev. [1.94 in^3/rev.] displacement max. continuous pressure is 190 bar [2750 PSI].

** 31.8 cm^3/rev. [1.94 in^3/rev.] displacement max. intermittent pressure is 224 bar [3250 PSI].

For side load limits consult your Eaton representative.

Displacement cm^3/r [in^3/r]	7,0 [.43]	8,8 [.54]	10,1 [.62]	11,6 [.71]	14,5 [.88]	17,3 [1.06]	20,3 [1.24]
Max. Intermittent Pressure bar [PSI]	241 [3495]	241 [3495]	241 [3495]	241 [3495]	241 [3495]	241 [3495]	241 [3495]
Rated Speed (RPM)	3600	3600	3600	3600	3600	3200	3200
Minimum Output Flow at Continuous Rated Speed and Pressure LPM [GPM]	22,2 [5.9]	27,9 [7.4]	32,0 [8.5]	36,7 [9.7]	48,0 [12.7]	50,9 [13.5]	59,8 [15.8]
Input Power at Intermittent Rated Speed and Pressure kW [HP]	11,9 [16.0]	15,0 [20.1]	17,2 [23.0]	19,7 [26.5]	24,7 [33.1]	26,2 [35.1]	30,7 [41.2]

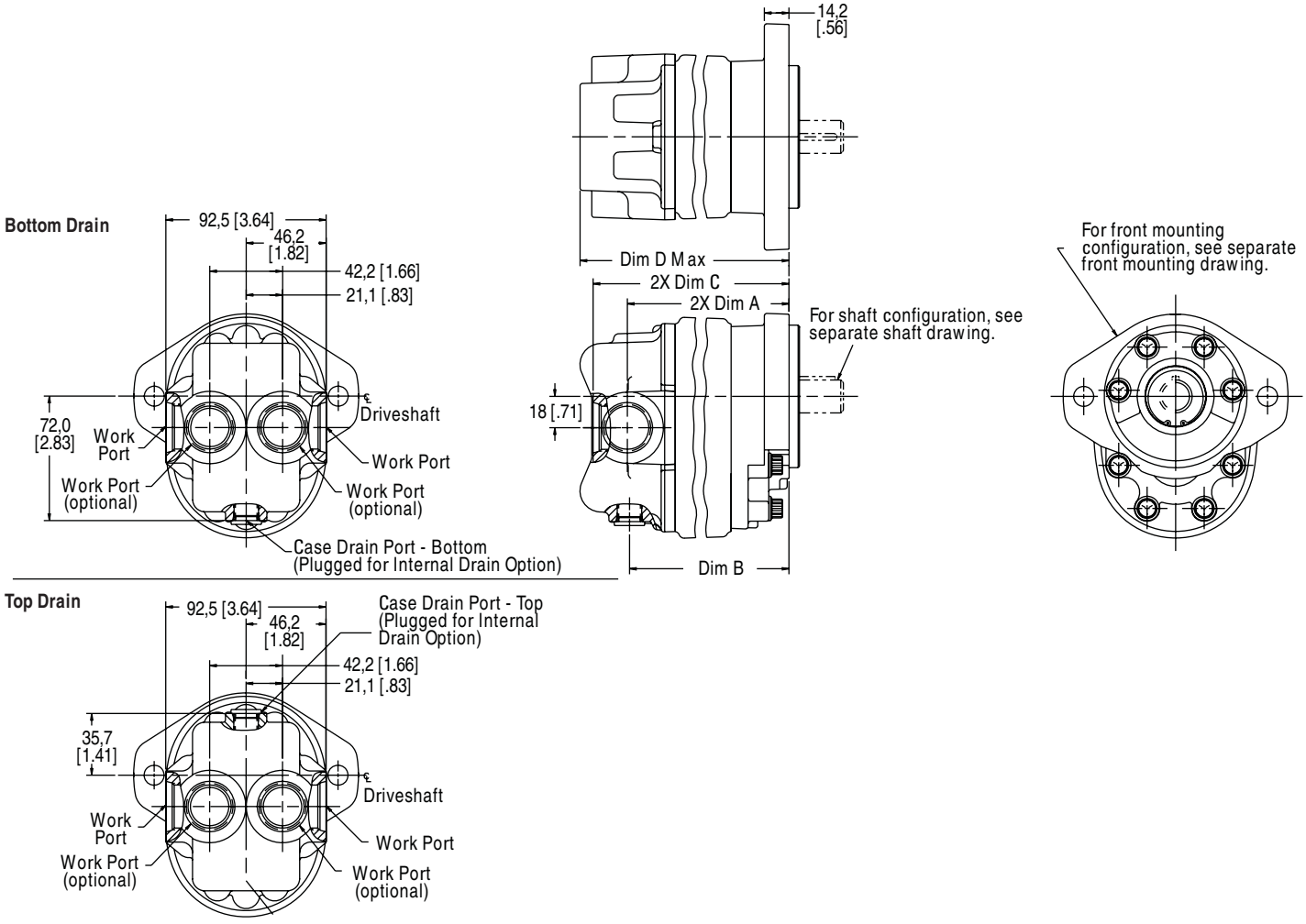
Displacement cm^3/r [in^3/r]	23,1 [1.41]	25,2 [1.54]	26,0 [1.59]	28,8 [1.76]	30,3 [1.85]	31,7 [1.93]
Max. Intermittent Pressure bar [PSI]	241 [3495]	241 [3495]	241 [3495]	241 [3495]	234 [3393]	224 [3248]
Rated Speed (RPM)	3000	3000	3000	3000	3000	3000
Minimum Output Flow at Continuous Rated Speed and Pressure LPM [GPM]	63,8 [16.8]	69,6 [18.4]	71,8 [19.0]	79,5 [21.0]	83,6 [22.1]	87,5 [23.1]
Input Power at Intermittent Rated Speed and Pressure kW [HP]	32,8 [43.9]	35,7 [47.9]	36,9 [49.4]	40,8 [54.8]	41,7 [55.9]	41,8 [56.0]

The performance data in the table above and the following graphs was collected using a mineral base oil with a viscosity of 133 SUS at 49°C [120°F].

Ordering Information

Catalog Assemblies Cross Reference

Standard catalog assemblies are built from high production parts and are the most economical pump assemblies available in this series. The standard assembly order number is a preassigned part number and may be used to order the specific standard assembly (see page 24).



DISPLACEMENT	FRONT MOUNT: 2 BOLT SAE A AND B DIM A	DIM B	DIM C	DIM D
cm3/r [in3/r]	**mm [in]**	**mm [in]**	**mm [in]**	**mm [in]**
7.0 [.43]	69.2 [2.72]	67.9 [2.67]	89.0 [3.50]	96.6 [3.80]
8.8 [.54]	71.1 [2.80]	69.8 [2.75]	90.9 [3.58]	98.5 [3.88]
10.2 [.62]	72.6 [2.86]	71.3 [2.81]	92.4 [3.64]	100.0 [3.94]
11.6 [.71]	74.3 [2.93]	73.0 [2.88]	94.1 [3.71]	101.7 [4.01]
12.5 [.76]	75.2 [2.96]	74.0 [2.91]	95.1 [3.74]	102.7 [4.04]
14.6 [.89]	77.5 [3.05]	76.2 [3.00]	97.3 [3.83]	104.9 [4.13]
17.4 [1.06]	80.7 [3.18]	79.4 [3.13]	100.5 [3.96]	108.1 [4.26]
20.3 [1.24]	83.9 [3.30]	82.6 [3.25]	103.7 [4.08]	111.3 [4.38]
23.1 [1.41]	87.1 [3.43]	85.8 [3.38]	106.9 [4.21]	114.5 [4.51]
26.1 [1.59]	90.3 [3.56]	89.0 [3.51]	110.1 [4.34]	117.7 [4.64]
28.8 [1.76]	93.5 [3.68]	92.2 [3.63]	113.3 [4.46]	120.9 [4.76]
31.8 [1.94]	96.7 [3.81]	95.4 [3.76]	116.5 [4.59]	124.1 [4.89]

Series 26 Motor

Model Code - Single

Series 26 Gear Motors can be ordered by using the following Model Code.

A twenty-four digit coding system has been designed to identify the features presently available on single gear pumps. The characters and their relative positions within the code identify specific features.

Use the Model Code Matrix as an aid when assembling the model code for the pump with the features you desire. It may be helpful to photocopy the matrix and write the numbers and letters into the boxes as you select features.

All twenty-four digits of the code must be submitted when ordering.

All dimensions are in inches.

ADM * * ** ** A 00 00 0 00 0 00 00 0 A

1, 2, 3	4	5	6, 7	8, 9	10	11, 12	13, 14	15	16, 17	18	19, 20	21, 22	23	24

[1, 2, 3] **26 Series**

ADM – Gear Motor

[4] **Unit Type**

A – Plain

[5] **Output Rotation**

D – Bi-Directional
L – Left-hand Rotation CCW
R – Right-hand Rotation CW

[6, 7] **Displacement (cm^3/r [in^3/r])**

01 = 7.0 [.43]
02 = 8.8 [.54]
03 = 10.2 [.62]
04 = 11.6 [.71]
05 = 14.6 [.89]
06 = 17.4 [1.06]
07 = 20.3 [1.24]
08 = 23.1 [1.41]
09 = 25.2 [1.54]
10 = 26.1 [1.59]
11 = 28.8 [1.76]
12 = 30.3 [1.85]
13 = 31.8 [1.94]

[8, 9] **Output Shaft**

AA = 9 Tooth Spline 16/32 Spline, Min. Full Spline 22.4 [.88], Shaft Extension 31.8 [1.25]

AB = 11 Tooth Spline 16/32 Spline, Min. Full Spline 22.4 [.88], Shaft Extension 31.8 [1.25]

AC = Straight Shaft Dia 19.05 [.750], Keyway 4.8 x 25.4 [.19 x 1.00], Shaft Extension 31.8 [1.25] (Key Included)

AD = Straight Shaft Dia 15.88 [.625], Keyway 4.1 x 18.3 [.16 x .72], Shaft Extension 31.8 [1.25] (Key Included)

AJ = Dia 15.88 [.625], Taper .125:1, .500-20 UNF-2A, Keyway 4.1 x 17.5 [.16 x .69], Shaft Extension 43.7 [1.72] (Key Included)

[10] **Mounting Features**

A = 2-Bolt A - SAE Flange Series 82-2

[11, 12] **Ports, Sizes and Location- Backplate**

01 = Inlet Port 1.0625-12 UN-2B SAE O-Ring Port; Outlet Port 1.0625-12 UN-2B SAE O-Ring Port - Side Ports

02 = Inlet Port 1.0625-12 UN-2B SAE O-Ring Port; Outlet Port 1.0625-12 UN-2B SAE O-Ring Port - Rear Ports

03 = Inlet Port .875-14 UN-2B SAE O-Ring Port; Outlet Port .875-14 UN-2B SAE O-Ring Port - Side Ports

04 = Inlet Port .875-14 UN-2B SAE O-Ring Port; Outlet Port .875-14 UN-2B SAE O-Ring Port - Rear Ports

[13, 14] **Case Drain**

00 = No Case Drain

AA = .5625-18 UNF-2B SAE O-Ring Port - Bottom

AB = .5625-18 UNF-2B SAE O-Ring Port - Top

AC = Internal with Bi-Directional Checks, .5625-18 UNF-2B SAE O-Ring Port - Plugged

AD = .5625-18 UNF-2B SAE O-Ring Port - Bottom-Plugged

AE = .5625-18 UNF-2B SAE O-Ring Port - Top-Plugged

[15] **Relief Valve Type**

0 = No Relief Valve

C = Cross-over

[16, 17] **Relief Valve Setting bar [lbf/in^2]**

00 = No Relief Valve Setting

AA = 117.2 [1700]

AB = 141.3 [2050]

AC = 31.0 [450]

[18] **Test Data**

0 - Generic

A - Unit Specific (Used with Relief Valve)

[19, 20] **Special Features**

00 - No Special Features

[21, 22] **Paint**

00 - None
0A - Primer per Spec 209-13A
0B - Black per Spec 209-13B

[23] **Identification**

0 - Standard

[24] **Design Code**

A - A

Series L2 Pump

General Specifications and Performance Data



Rotation	CCW or CW
Mounting Flange	SAE 2 Bolt B
Maximum Continuous† Pressure	248 bar [3600 PSI]*
Maximum Intermittent†† Pressure	276 bar [4000 PSI]**
Minimum Speed at Continuous Pressure	750 RPM
Maximum Continuous Inlet Temperature	107°C [225°F]
Minimum Operating Temperature	-29°C [-20°F]
Maximum Inlet Vacuum at 82°C [180°F] and Rated Speed	6.0 In. Hg

† Continuous - pump may be run continuously at these ratings.

†† Intermittent - Intermittent operation, 10% of every minute.

For side load limits consult your Eaton representative.

* 46.7 [2.85] displacement maximum continuous pressure is 224 bar [3250 PSI]
51.1 [3.12] displacement maximum continuous pressure is 207 bar [3000 PSI]
55.2 [3.37] displacement maximum continuous pressure is 190 bar [2750 PSI]

** 46.7 [2.85] displacement maximum intermittent pressure is 252 bar [3650 PSI]
51.1 [3.12] displacement maximum intermittent pressure is 234 bar [3400 PSI]
55.2 [3.37] displacement maximum intermittent pressure is 217 bar [3150 PSI]

MODEL	25500	25501	25502	25503	25504	25505	25506	25507	25508
Displacement cm^3/r [in^3/r]	21.3 [1.30]	25.4 [1.55]	29.2 [1.78]	33.6 [2.05]	38.2 [2.33]	42.8 [2.61]	46.7 [2.85]	51.1 [3.12]	55.2 [3.37]
Max. Continuous† Pressure bar [PSI]	248 [3600]	248 [3600]	248 [3600]	248 [3600]	248 [3600]	248 [3600]	224 [3250]	207 [3000]	190 [2750]
Max. Intermittent†† Pressure bar [PSI]	276 [4000]	276 [4000]	276 [4000]	276 [4000]	276 [4000]	276 [4000]	252 [3650]	234 [3400]	217 [3150]
Rated Speed (RPM)	3500	3000	3000	2750	2750	2500	2500	2500	2250
Minimum Output Flow at 207 bar [3000 PSI] and Rated Speed LPM [GPM]	61,3 [16.2]	64,7 [17.1]	78,0 [20.6]	83,3 [22.0]	94,6 [25.0]	96,1 [25.4]	105,2 [27.8]	115,1 [30.4]	112,0 [29.6]
Input Power at 207 bar [3000 PSI] and Rated Speed and Cont. Pressure kW [HP]	27.5 [36.9]	27.5 [36.9]	31.1 [41.7]	35.3 [47.3]	39.5 [53.0]	39.6 [53.1]	42.4 [56.8]	49.4 [66.2]	48.2 [64.7]

The performance data in the table above and the following graphs was collected using a mineral base oil with a viscosity of 133 SUS at 49° C [120° F]. The following performance graphs are representative of the series.

† Continuous - pump may be run continuously at these ratings.

†† Intermittent - Intermittent operation, 10% of every minute.

Ordering Information

Standard Catalog Assemblies

Standard Catalog Assemblies are built from high quality production parts and are the most economical pumps available in this series. Dimensions and order numbers for Standard Catalog Assemblies are given on pages 29-30.

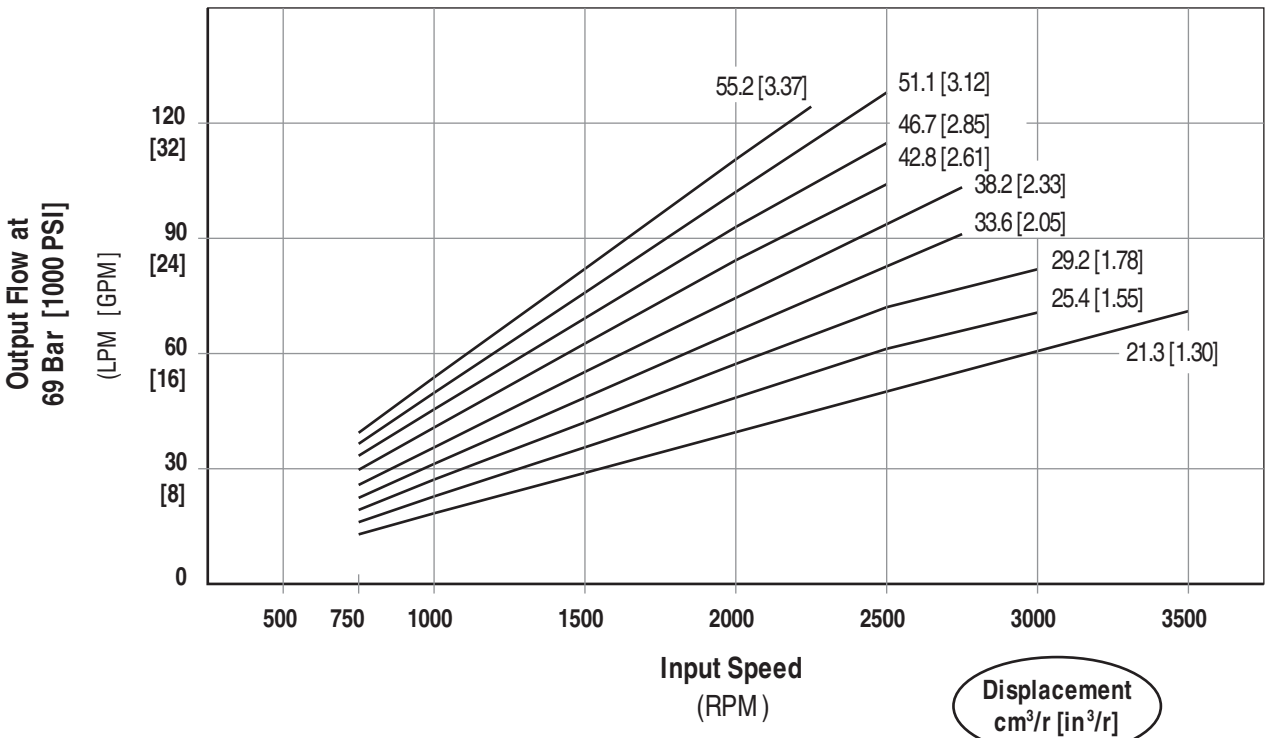
Optional Configurations

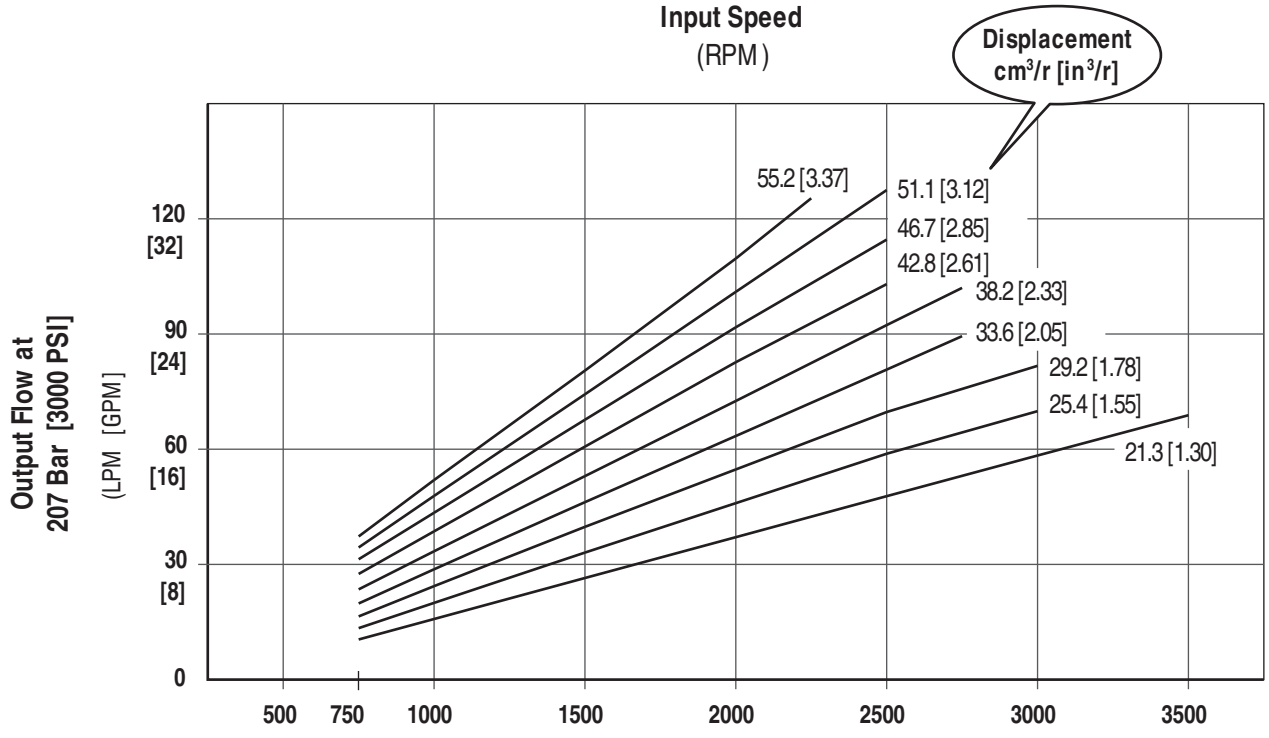
Besides the Standard Catalog Assemblies, the L2 Series has several optional features. Flow divider and tandem backplates are available. Multiple gear pumps can also be built. If a variation from the Standard Catalog Assemblies is required, use the model codes on pages 35-36.

Series L2 Pump

Performance Data
Charts

Output Flow vs Speed

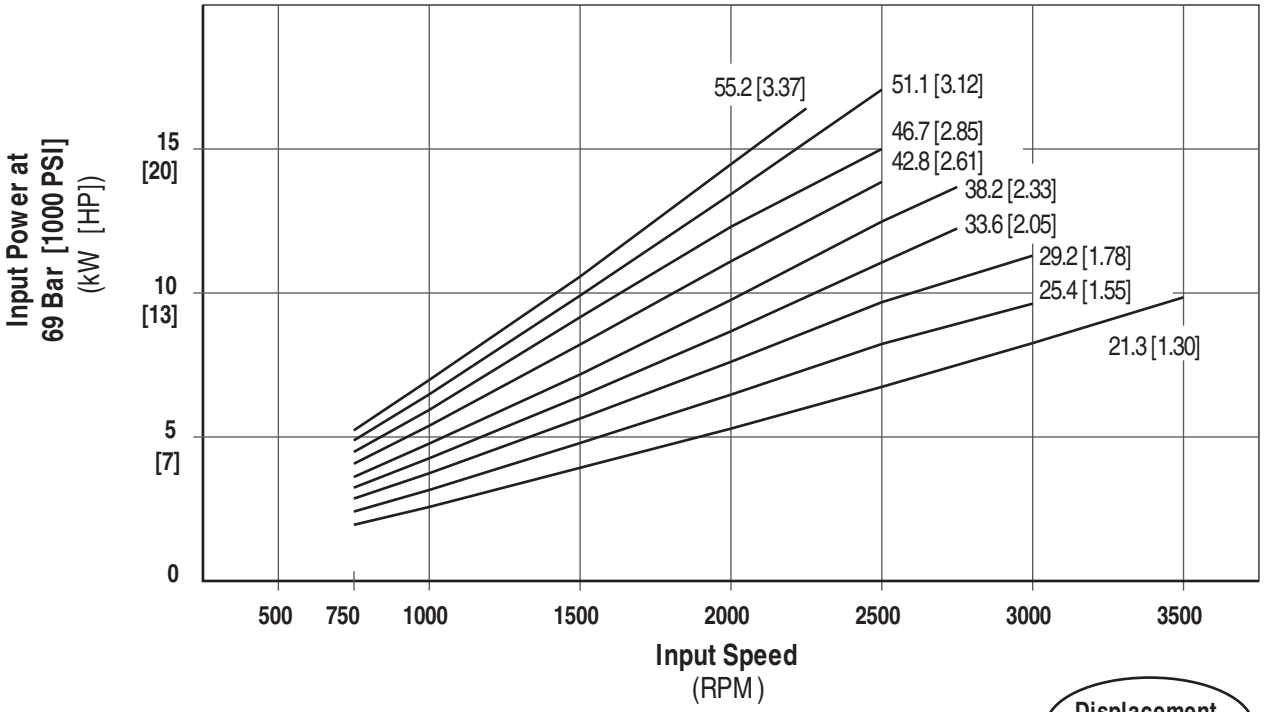


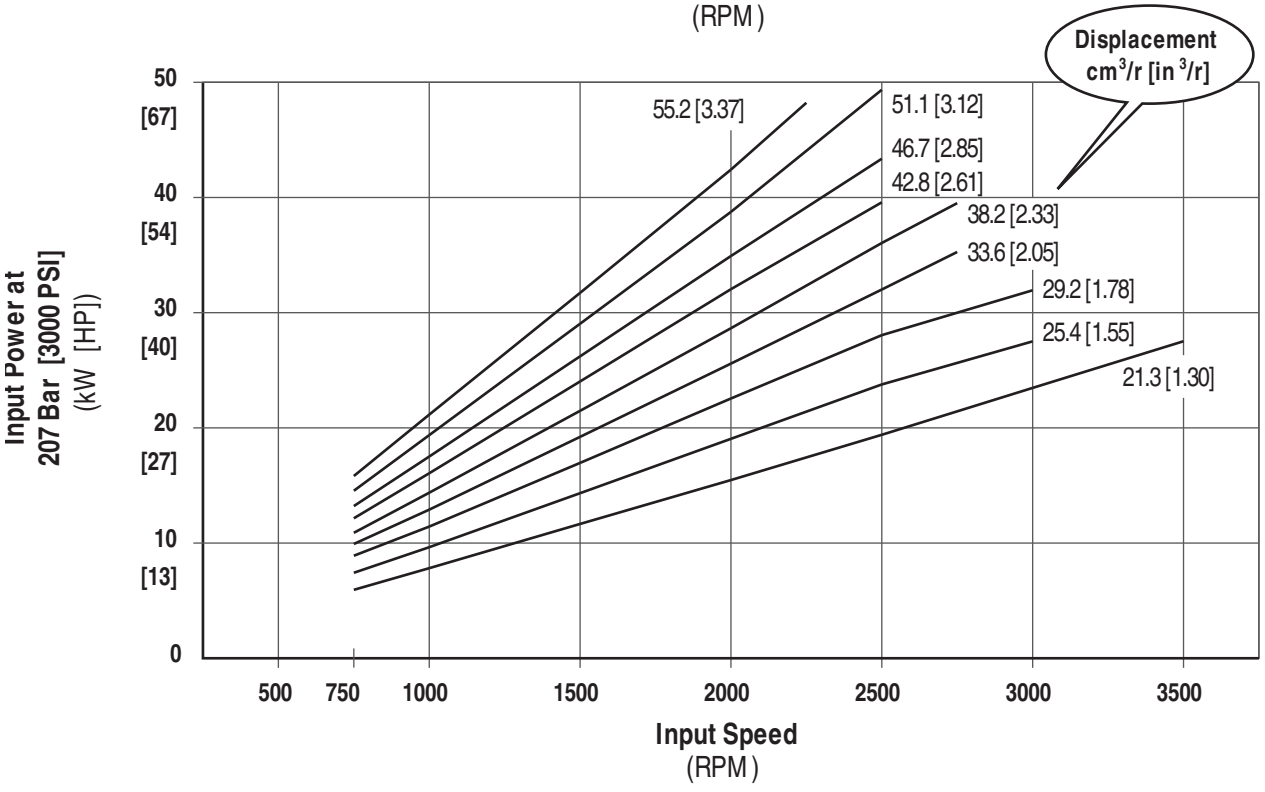


Series L2 Pump

Performance Data
Charts

Input Power vs Speed



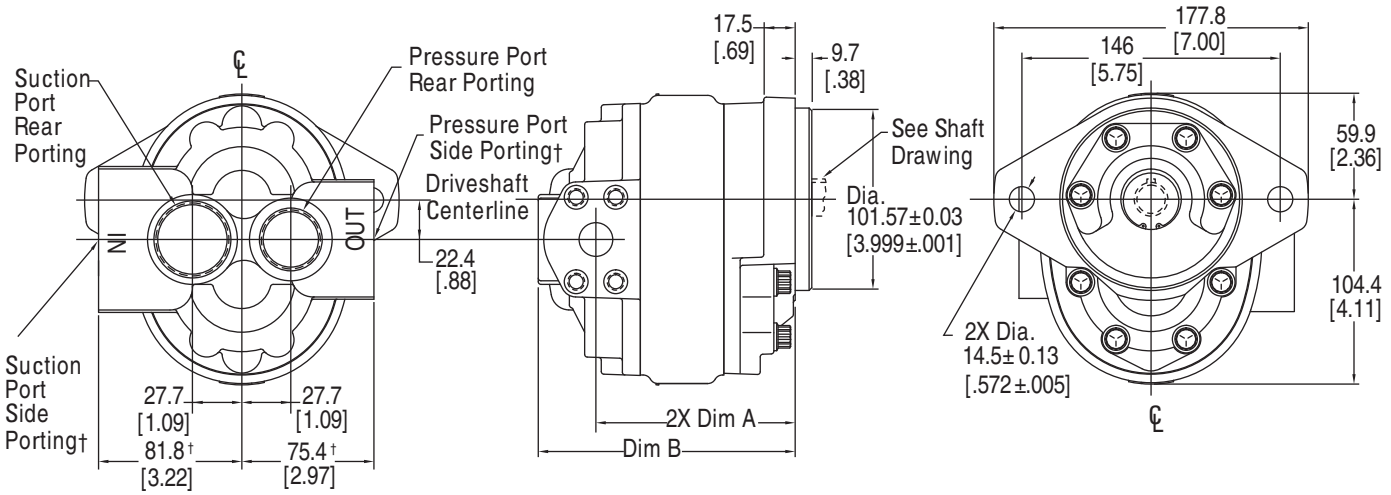


The performance data show in the graphs are representative of this series. Tests were performed per SAE specifications using mineral base oil with a viscosity of 133 SUS at 49° C [120° F].

Series L2 Pump

Standard Catalog Assemblies - Dimensions

All dimensions are in mm [in].



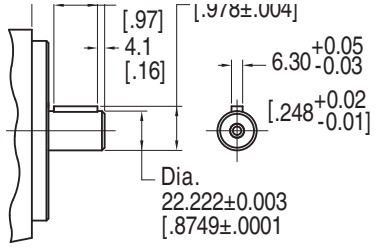
Left Hand Rotation Shown

† For split flange porting subtract .8 [.03], available in side porting only

MODEL	25500	25501	25502	25503	25504	25505	25506	25507	25508
Displacement (cm^3/r [in^3/r])	21.3 [1.30]	25.4 [1.55]	29.2 [1.78]	33.6 [2.05]	38.2 [2.33]	42.8 [2.61]	46.7 [2.85]	51.1 [3.12]	55.2 [3.37]
Dimension A (mm [in.])	84.8 [3.34]	88.2 [3.47]	91.7 [3.61]	95.1 [3.75]	98.6 [3.88]	102.0 [4.02]	105.3 [4.14]	109.0 [4.29]	112.4 [4.43]
Dimension B (mm [in.])	117.3 [4.62]	120.8 [4.75]	124.2 [4.89]	127.7 [5.03]	131.1 [5.16]	134.6 [5.30]	137.8 [5.42]	141.5 [5.57]	145.0 [5.71]

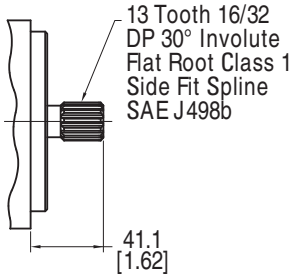
7/8 Inch Straight Key

Maximum Input Torque††
170 Nm [1500 lb-in]



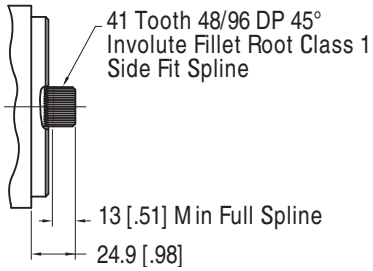
7/8 Inch 13 Tooth Spline

Maximum Input Torque††
209 Nm [1850 lb-in]



7/8 Inch 41 Tooth Spline

Maximum Input Torque††
316 Nm [2800 lb-in]



*** Multiple pump input torque limitations:**
The total torque for multiple pump displacements and pressure combinations cannot exceed the maximum input torque rating of the shaft. The proper formula is Pressure times Displacement divided by 6.28.

Series L2 Pump
Order Numbers

RIGHT HAND ROTATION PRODUCT NO	LEFT HAND ROTATION PRODUCT NO	SHAFT	PORT LOCATION	SAE PRESSURE PORT SIZE	SAE SUCTION PORT SIZE
Model 25500 – 21.3 cm3/r [1.30 in3/r] Displacement					
25500-RSA	25500-LSA	13 T Spline	Side	1-1/16-12	1-5/8-12
25500-RSB	25500-LSB	13 T Spline	Rear	1-1/16-12	1-5/8-12
25500-RSC	25500-LSC	7/8 Keyed	Side	1-1/16-12	1-5/8-12
25500-RSD	25500-LSD	7/8 Keyed	Rear	1-1/16-12	1-5/8-12
25500-RSE	25500-LSE	13 T Spline	Side	3/4 Split Flange	1-1/4 Split Flange
25500-RSF	25500-LSF	7/8 Keyed	Side	3/4 Split Flange	1-1/4 Split Flange
Model 25501 – 25.4 cm3/r [1.55 in3/r] Displacement					
25501-RSA	25501-LSA	13 T Spline	Side	1-1/16-12	1-5/8-12
25501-RSB	25501-LSB	13 T Spline	Rear	1-1/16-12	1-5/8-12
25501-RSC	25501-LSC	7/8 Keyed	Side	1-1/16-12	1-5/8-12
25501-RSD	25501-LSD	7/8 Keyed	Rear	1-1/16-12	1-5/8-12
25501-RSE	25501-LSE	13 T Spline	Side	3/4 Split Flange	1-1/4 Split Flange
25501-RSF	25501-LSF	7/8 Keyed	Side	3/4 Split Flange	1-1/4 Split Flange
Model 25502 – 29.2 cm3/r [1.78 in3/r] Displacement					
25502-RSA	25502-LSA	13 T Spline	Side	1-1/16-12	1-5/8-12
25502-RSB	25502-LSB	13 T Spline	Rear	1-1/16-12	1-5/8-12
25502-RSC	25502-LSC	7/8 Keyed	Side	1-1/16-12	1-5/8-12
25502-RSD	25502-LSD	7/8 Keyed	Rear	1-1/16-12	1-5/8-12
25502-RSE	25502-LSE	13 T Spline	Side	3/4 Split Flange	1-1/4 Split Flange
25502-RSF	25502-LSF	7/8 Keyed	Side	3/4 Split Flange	1-1/4 Split Flange
Model 25503 – 33.6 cm3/r [2.05 in3/r] Displacement					
25503-RSA	25503-LSA	13 T Spline	Side	1-1/16-12	1-5/8-12
25503-RSB	25503-LSB	13 T Spline	Rear	1-1/16-12	1-5/8-12
25503-RSC	25503-LSC	7/8 Keyed	Side	1-1/16-12	1-5/8-12
25503-RSD	25503-LSD	7/8 Keyed	Rear	1-1/16-12	1-5/8-12
25503-RSE	25503-LSE	13 T Spline	Side	3/4 Split Flange	1-1/4 Split Flange
25503-RSF	25503-LSF	7/8 Keyed	Side	3/4 Split Flange	1-1/4 Split Flange
Model 25504 – 38.2 cm3/r [2.33 in3/r] Displacement					
25504-RSA	25504-LSA	13 T Spline	Side	1-1/16-12	1-5/8-12
25504-RSB	25504-LSB	13 T Spline	Rear	1-1/16-12	1-5/8-12
25504-RSC	25504-LSC	7/8 Keyed	Side	1-1/16-12	1-5/8-12
25504-RSD	25504-LSD	7/8 Keyed	Rear	1-1/16-12	1-5/8-12
25504-RSE	25504-LSE	13 T Spline	Side	3/4 Split Flange	1-1/4 Split Flange
25504-RSF	25504-LSF	7/8 Keyed	Side	3/4 Split Flange	1-1/4 Split Flange

Series L2 Pump
Order Numbers

RIGHT HAND ROTATION PRODUCT NO	LEFT HAND ROTATION PRODUCT NO	SHAFT	PORT LOCATION	SAE PRESSURE PORT SIZE	SAE SUCTION PORT SIZE
Model 25505 – 42.8 cm3/r [2.61 in3/r] Displacement					
25505-RSA	25505-LSA	13 T Spline	Side	1-1/16-12	1-5/8-12
25505-RSB	25505-LSB	13 T Spline	Rear	1-1/16-12	1-5/8-12
25505-RSC	25505-LSC	7/8 Keyed	Side	1-1/16-12	1-5/8-12
25505-RSD	25505-LSD	7/8 Keyed	Rear	1-1/16-12	1-5/8-12
25505-RSE	25505-LSE	13 T Spline	Side	3/4 Split Flange	1-1/4 Split Flange
25505-RSF	25505-LSF	7/8 Keyed	Side	3/4 Split Flange	1-1/4 Split Flange
Model 25506 – 46.7 cm3/r [2.85 in3/r] Displacement					
25506-RSA	25506-LSA	13 T Spline	Side	1-1/16-12	1-5/8-12
25506-RSB	25506-LSB	13 T Spline	Rear	1-1/16-12	1-5/8-12
25506-RSC	25506-LSC	7/8 Keyed	Side	1-1/16-12	1-5/8-12
25506-RSD	25506-LSD	7/8 Keyed	Rear	1-1/16-12	1-5/8-12
25506-RSE	25506-LSE	13 T Spline	Side	3/4 Split Flange	1-1/4 Split Flange
25506-RSF	25506-LSF	7/8 Keyed	Side	3/4 Split Flange	1-1/4 Split Flange
Model 25507 – 51.1 cm3/r [3.12 in3/r] Displacement					
25507-RSA	25507-LSA	13 T Spline	Side	1-1/16-12	1-5/8-12
25507-RSB	25507-LSB	13 T Spline	Rear	1-1/16-12	1-5/8-12
25507-RSC	25507-LSC	7/8 Keyed	Side	1-1/16-12	1-5/8-12
25507-RSD	25507-LSD	7/8 Keyed	Rear	1-1/16-12	1-5/8-12
25507-RSE	25507-LSE	13 T Spline	Side	3/4 Split Flange	1-1/4 Split Flange
25507-RSF	25507-LSF	7/8 Keyed	Side	3/4 Split Flange	1-1/4 Split Flange
Model 25508 – 55.2 cm3/r [3.37 in3/r] Displacement					
25508-RSA	25508-LSA	13 T Spline	Side	1-1/16-12	1-5/8-12
25508-RSB	25508-LSB	13 T Spline	Rear	1-1/16-12	1-5/8-12
25508-RSC	25508-LSC	7/8 Keyed	Side	1-1/16-12	1-5/8-12
25508-RSD	25508-LSD	7/8 Keyed	Rear	1-1/16-12	1-5/8-12
25508-RSE	25508-LSE	13 T Spline	Side	3/4 Split Flange	1-1/4 Split Flange
25508-RSF	25508-LSF	7/8 Keyed	Side	3/4 Split Flange	1-1/4 Split Flange

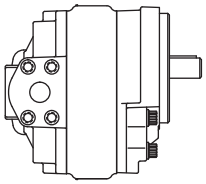
Series L2 Pump

Optional Configurations

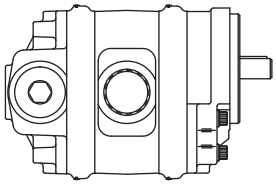
The L2 Series gear pump components can be assembled into many optional configurations. The versatile design allows you to assemble a pump to meet your specific needs.

Model codes for single and multiple pumps along with the component part dimension drawings are given on the following pages.

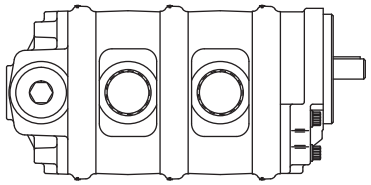
Single Gear Pump with Spilt- Flange Ports



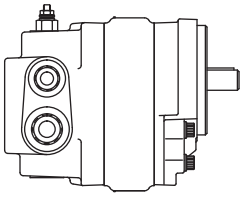
Double Gear Pump with Common Suction Port



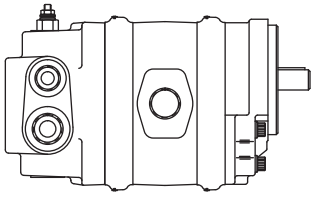
Triple Gear Pump with Two Suction Ports



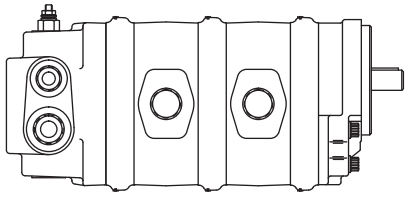
Single Gear Pump with Flow Divider



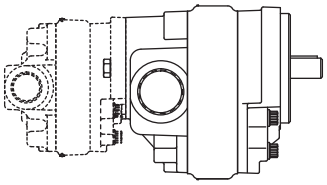
Double Gear Pump with Flow Divider



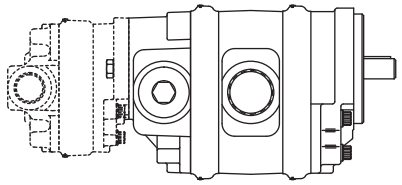
Triple Gear Pump with Flow Divider



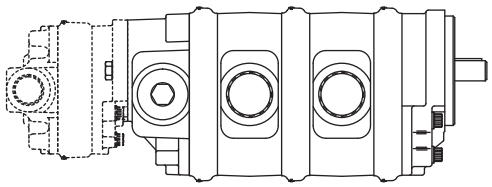
Single Gear Pump with SAE A Flange Auxiliary Mount



Double Gear Pump with Common Suction Port and SAE A Flange Auxiliary Mount



Triple Gear Pump with Two Suction Ports and SAE A Flange Auxiliary Mount

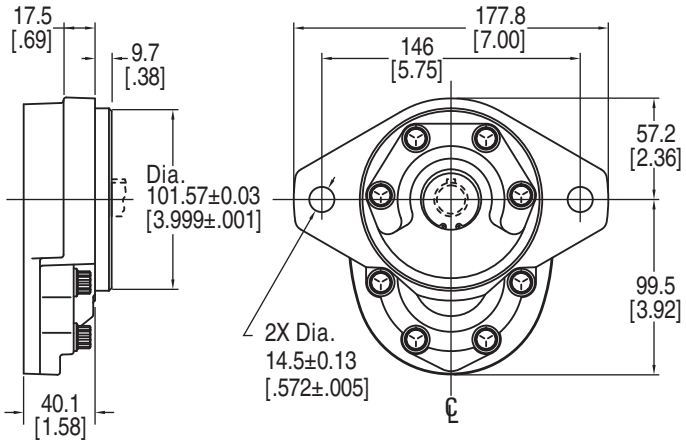


All dimensions are in mm [in].

Front Plate

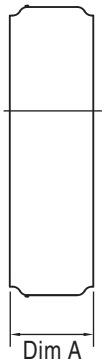
SAE 2 Bolt B Mount.

Used on all Standard Catalog Assemblies.



Body

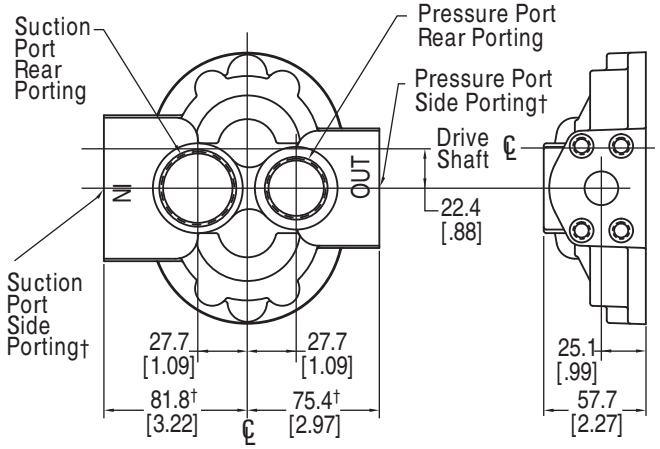
Used on Single and Multiple Pumps



Displacement cm³/r [in³/r]	Dimension A mm [in.]
21.3 [1.30]	19.8 [.78]
25.4 [1.55]	23.1 [.91]
29.2 [1.78]	26.7 [1.05]
33.6 [2.05]	30.0 [1.18]
38.2 [2.33]	1.32 [33.5]
42.8 [2.61]	37.1 [1.46]
46.7 [2.85]	1.59 [40.4]
51.1 [3.12]	43.9 [1.73]
55.2 [3.37]	47.5 [1.87]

Backplate

Used on Single and Multiple Pumps



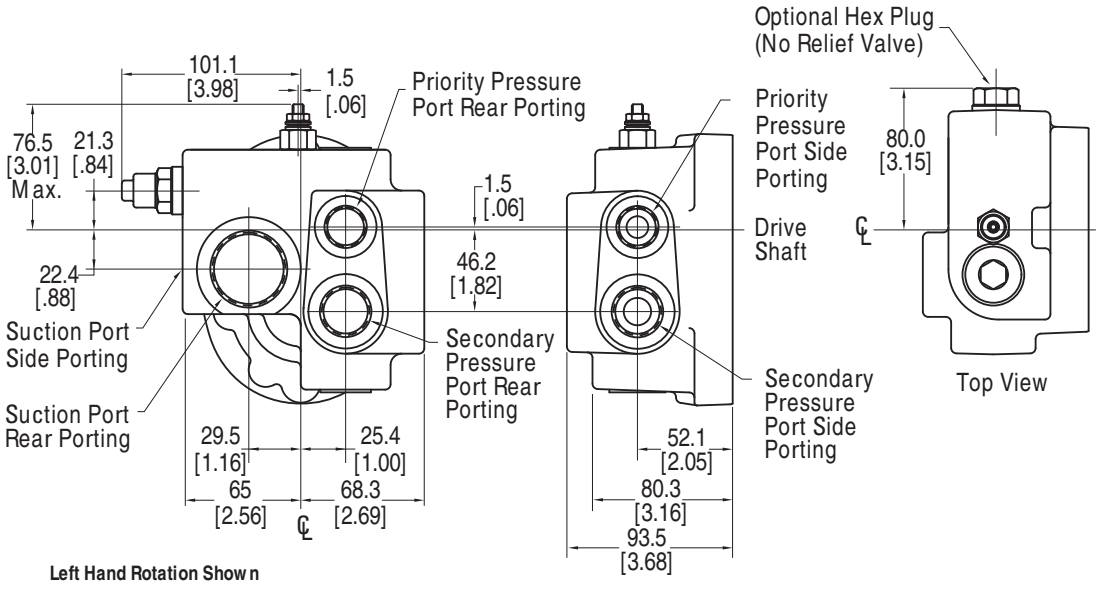
Left Hand Rotation Shown

† For split flange porting subtract .8 [.03], available in side porting only

All dimensions are in mm [in].

Flow Divider Backplate

Used on Single and Multiple Pumps

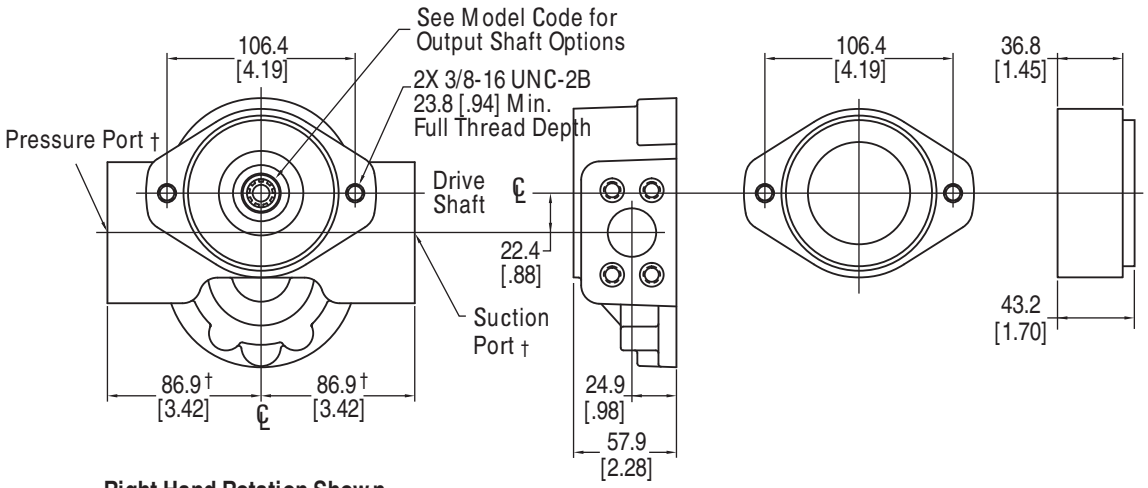


Left Hand Rotation Shown

All dimensions are in mm [in].

Tandem Backplate with SAE 2 Bolt A Flange

Used on Single and Multiple Pumps



Right Hand Rotation Shown

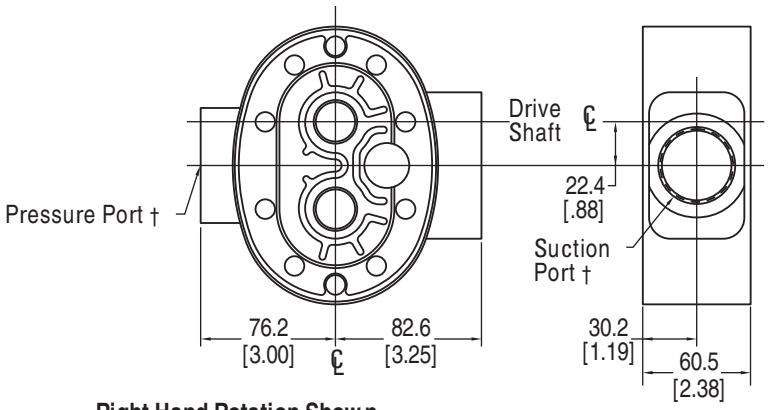
† For split flange porting subtract .8 [.03]

Spacer

Used with 11 Tooth Spline Output Shaft

Adaptor Plate

Used on Multiple Pumps



Right Hand Rotation Shown

† For split flange porting subtract .8 [.03]

Series L2 Pump

Model Code - Single

L2 gear pumps can be ordered by using the following Model Code.

A twenty-three digit coding system has been designed to identify all of the features available on L2 single gear pumps. The characters and their relative positions within the code identify specific features.

Use the Model Code Matrix as an aid when assembling the model code for the pump with the features you desire. It may be helpful to photocopy the matrix and write the numbers and letters into the boxes as you select features.

All twenty-three digits of the code must be submitted when ordering. The seven zeros at the end of the model code are for factory use, be sure to include them when ordering.

All dimensions are in inches.

ABF * * ** ** ** ** ** * 0 00 00 0 0

1, 2, 3 | 4 | 5 | 6, 7 | 8, 9 | 10, 11 | 12, 13 | 14, 15 | 16 | 17 | 18, 19 | 20, 21 | 22 | 23

1, 2, 3 L2 Series

ABF – Gear Pump - Single Unit

4 Unit Type

A – Plain
B – Flow Divider with/without Relief Valve (Pos. 14-15)

5 Input Rotation (viewed from input shaft end)

L – Left-hand Rotation CCW
R – Right-hand Rotation CW

6, 7 Displacement (cm^3/r [in^3/r])

00 = 21.3 [1.30]
01 = 25.4 [1.55]
02 = 29.2 [1.78]
03 = 33.6 [2.05]
04 = 38.2 [2.33]
05 = 42.8 [2.61]
06 = 46.7 [2.85]
07 = 51.1 [3.12]
08 = 55.2 [3.37]

8, 9 Input Shaft

AA = 7/8 Inch Dia. 13 Tooth Spline 16/32 Pitch Shaft Extension 41.1 [1.62]

AB = 7/8 Inch Dia. Straight Keyed, Keyway 6.4 X 25.4 [.25 X 1.00] Shaft Extension 41.1 [1.62]

AD = 7/8 Inch Dia. 41 Tooth Spline 48/96 Pitch Shaft Extension 24.9 [.98]

10, 11 Ports, Sizes and Location- Backplate

01 = 1 5/8-12 Suction; 1 1/16-12 Pressure SAE Straight Thread O-ring Ports - Side

02 = 1 5/8-12 Suction; 1 1/16-12 Pressure SAE Straight Thread O-ring Ports - Rear

03 = 1 1/4 Suction; 3/4 Pressure Split Flange Ports - Side

04 = 1 5/8-12 Suction; 7/8-14 Priority Pressure; 1 1/16-12 Secondary Pressure SAE Straight Thread O-ring Ports - Side

05 = 1 5/8-12 Suction; 7/8-14 Priority Pressure; 1 1/16-12 Secondary Pressure SAE Straight Thread O-ring Ports - Rear

12, 13 Priority Flow Divider Setting (LPM [GPM])

00 = No Flow Setting
AA = 3.8 [1.00]
AB = 5.7 [1.50]
AC = 7.6 [2.00]
AD = 9.5 [2.50]
AE = 11.4 [3.00]
AF = 13.3 [3.50]
AG = 15.1 [4.00]
AH = 17.0 [4.50]
AJ = 18.9 [5.00]
AK = 20.8 [5.50]
AL = 22.7 [6.00]
AN = 26.5 [7.00]
AP = 30.3 [8.00]
AR = 34.1 [9.00]
AS = 37.8 [10.00]

14, 15 Relief Valve Full Flow Setting (bar [PSI])

00 = No Relief Valve Setting
AA = 34.5 [500]
AB = 51.7 [750]
AC = 68.9 [1000]
AD = 86.2 [1250]
AE = 103.4 [1500]
AF = 120.6 [1750]
AG = 137.9 [2000]
AH = 155.1 [2250]
AJ = 172.4 [2500]
AK = 189.6 [2750]
AL = 206.8 [3000]

16 Auxiliary Rear Mount

0 = None

B = 2 Bolt A SAE Flange Series 82-2 Output Shaft Accepts 9 Tooth Spline 16/32 Pitch, Shaft Extension 31.8 [1.25]

C = 2 Bolt A SAE Flange Series 82-2, With 11 Tooth 16/32 Pitch External Spline Output Shaft, 17.5 [.69] Minimum Full Spline, Requires Spacer and Coupler to Accept 31.8 [1.25] Mating Shaft Extension

17 Test Data

0 - Generic

A - Unit Specific (required for flow divider and relief valve options.)

18, 19 Special Features

00 - No Special Features
AB - Viton Shaft Seal

20, 21 Paint

00 - None
0A - Red Primer
0B - Black

22 Identification

0 - Standard

23 Design Code

A - A

Series L2 Pump

Model Code - Multiple

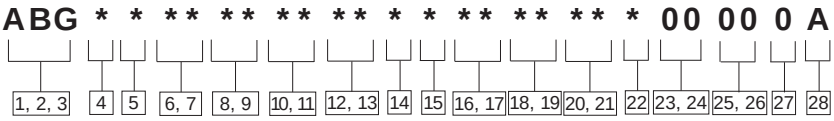
Multiple L2 gear pumps can be ordered by using the following Model Code.

A twenty-eight digit coding system has been designed to identify all of the features available on L2 double and triple gear pumps. The characters and their relative positions within the code identify specific features.

Use the Model Code Matrix as an aid when assembling the model code for the pump with the features you desire. It may be helpful to photocopy the matrix and write the numbers and letters into the boxes as you select features.

All twenty-eight digits of the code must be submitted when ordering. The six zeros at the end of the model code are for factory use, be sure to include them when ordering.

All dimensions are in inches.



[1, 2, 3] **L2 Series**

ABG – Gear Pump - Multiple Unit

[4] **Unit Type**

A – Plain
B – Flow Divider with/without Relief Valve (Pos. 20-21)

[5] **Input Rotation (viewed from input shaft end)**

L – Left-hand Rotation CCW
R – Right-hand Rotation CW

[6, 7] **Displacement (cm^3/r [in^3/r])**

00 = 21.3 [1.30]
01 = 25.4 [1.55]
02 = 29.2 [1.78]
03 = 33.6 [2.05]
04 = 38.2 [2.33]
05 = 42.8 [2.61]
06 = 46.7 [2.85]
07 = 51.1 [3.12]
08 = 55.2 [3.37]

[8, 9] **Displacement of Center Section (cm^3/r [in^3/r])**

00 = 21.3 [1.30]
01 = 25.4 [1.55]
02 = 29.2 [1.78]
03 = 33.6 [2.05]
04 = 38.2 [2.33]
05 = 42.8 [2.61]
06 = 46.7 [2.85]
07 = 51.1 [3.12]
08 = 55.2 [3.37]
99 = No Center Displacement

[10, 11] **Displacement of Rear Section (cm^3/r [in^3/r])**

00 = 21.3 [1.30]
01 = 25.4 [1.55]
02 = 29.2 [1.78]
03 = 33.6 [2.05]
04 = 38.2 [2.33]
05 = 42.8 [2.61]
06 = 46.7 [2.85]
07 = 51.1 [3.12]
08 = 55.2 [3.37]

[12, 13] **Input Shaft**

AA = 7/8 Inch Dia. 13 Tooth Spline 16/32 Pitch Shaft Extension 41.1 [1.62]

AB = 7/8 Inch Dia. Straight Keyed, Keyway 6.4 X 25.4 [.25 X 1.00] Shaft Extension 41.1 [1.62]

AE = 7/8 Inch Dia. 41 Tooth Spline 48/96 Pitch Shaft Extension 24.9 [.98]

[14] **Front Adaptor Ports**

1 = 1 5/8-12 Suction; 1 1/16-12 Pressure – SAE Straight Thread O-ring Ports
3 = 1 1/4 Suction; 3/4 Pressure Split Flange Ports, Common Suction

[15] **Rear Adaptor Ports (triple pumps)**

0 = No Rear Adaptor
1 = 1 5/8-12 Suction; 1 1/16-12 Pressure – SAE Straight Thread O-ring Ports
3 = 1 1/4 Suction; 3/4 Pressure Split Flange Ports, Common Suction

[16, 17] **Ports, Sizes and Location- Backplate**

03 = 1 5/8-12 Suction; 1 1/16-12 Pressure SAE Straight Thread O-ring Ports - Rear

05 = 1 5/8-12 Suction; 7/8-14 Priority Pressure; 1 1/16-12 Secondary Pressure SAE Straight Thread O-ring Ports - Side

06 = 1 5/8-12 Suction; 7/8-14 Priority Pressure; 1 1/16-12 Secondary Pressure SAE Straight Thread O-ring Ports - Rear

07 = 1 5/8-12 Suction (Plugged); 1 1/16-12 Pressure SAE Straight Thread O-ring Ports - Rear

08 = 1 1/4 Suction; 3/4 Pressure Split Flange Ports - Side

[18, 19] **Priority Flow Divider Setting (LPM [GPM])**

00 = No Flow Setting
AA = 3.8 [1.00]
AB = 5.7 [1.50]
AC = 7.6 [2.00]
AD = 9.5 [2.50]
AE = 11.4 [3.00]
AF = 13.3 [3.50]
AG = 15.1 [4.00]
AH = 17.0 [4.50]
AJ = 18.9 [5.00]
AK = 20.8 [5.50]
AL = 22.7 [6.00]
AN = 26.5 [7.00]
AP = 30.3 [8.00]
AR = 34.1 [9.00]
AS = 37.8 [10.00]

[20, 21] **Relief Valve Full Flow Setting (bar [PSI])**

00 = No Relief Valve Setting
AA = 34.5 [500]
AB = 51.7 [750]
AC = 68.9 [1000]
AD = 86.2 [1250]
AE = 103.4 [1500]
AF = 120.6 [1750]
AG = 137.9 [2000]
AH = 155.1 [2250]
AJ = 172.4 [2500]
AK = 189.6 [2750]
AL = 206.8 [3000]

[22] **Test Data**

0 - Generic
A - Unit Specific (required for flow divider and relief valve options.)

[23, 24] **Special Features**

00 - No Special Features
AA - Viton Shaft Seal
AE = 2 Bolt A SAE Flange Series 82-2 Output Shaft Accepts 9 Tooth Spline 16/32 Pitch, Shaft Extension 31.8 [1.25]
AF = 2 Bolt A SAE Flange Series 82-2, With 11 Tooth 16/32 Pitch External Spline Output Shaft, 17.5 [.69] Minimum Full Spline, Requires Spacer and Coupler to Accept 31.8 [1.25] Mating Shaft Extension

[25, 26] **Paint**

00 - None
0A - Red Primer
0B - Black

[27] **Identification**

0 - Standard

[28] **Design Code**

A - A

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Supersedes E-PUGE-MC001-E
March 2008

Series 2
Variable Displacement Piston Pump

ACL 64 -105cm³/r (3.9 - 6.4in³/r)



Powering Business Worldwide

Series 2 Variable Displacement Piston Pump

ACL



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The Eaton Series 2 Variable Displacement Piston Pump

The Advanced Series 2 heavy duty pump, with a cradle swashplate design, combines the time-tested reliability you expect from Eaton with compact packaging, exceptional control and quiet operation.

Features

- 430 bar pressure rating
- Speeds to 4510 rpm
- Accurate controllers
- Quiet operation
- Optional input shafts

Typical Applications:

- Road roller/compactor
- Harvesting equipment
- Lift truck
- Wheel loader
- Agricultural sprayer
- Auxiliary and industrial drives

The Series 2 single piece pump housing provides exceptional strength and soundproofing. Eaton's cast iron housing has only one major opening versus two openings for competitive pumps. This provides a stronger, more rigid pump housing and reduces the number of gasketed joints.

The high-strength, one-piece swashplate has the swashlever and servo-pin integrated into the swashplate, delivering increased reliability without adding extra weight.

A large diameter single servo piston permits pump operation at lower charge pressures, minimizing parasitic charge pump losses for increased overall pump efficiency. A large centering spring, housed within the servo piston, returns the pump to neutral in the event of control pressure loss.

The new integral gerotor type charge pump combines excellent suction/speed capabilities in a compact design. Several displacement options are available to suit the needs of every application, including tandem pumps.

A variety of available drive shaft configurations – straight keyed, splined, or tapered – ensures the proper shaft for your application.

The serviceable bi-metal bearing plate has steel for high pressure capability and a bronze bearing face for high speed capabilities.

SAE auxiliary mounts: "A," "B," "B-B" and "C" are available with and without charge pump. Excellent torque capability allows high horsepower to work circuits without multiple pump drives.

The main system ports – SAE code 61 and code 62 – are available with SAE or Metric threads. Opposite side and same side configurations are now available to accommodate a wide range of installations.

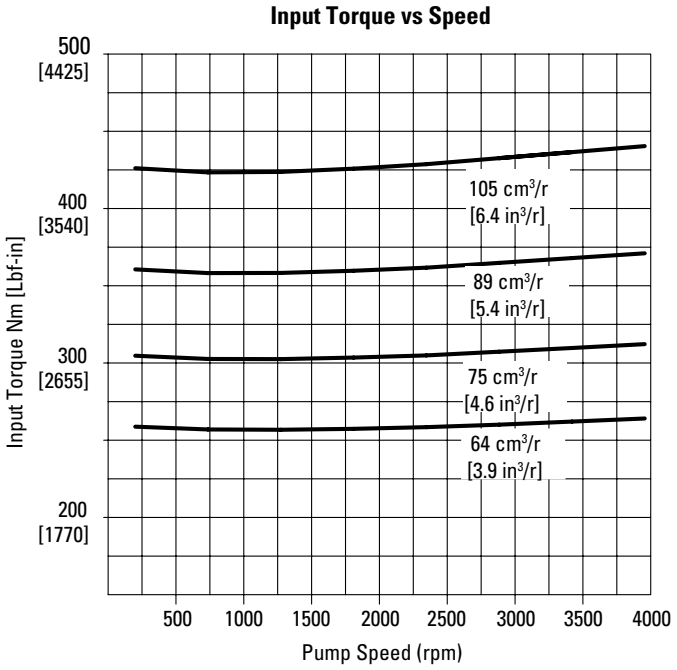
Specifications and Performance

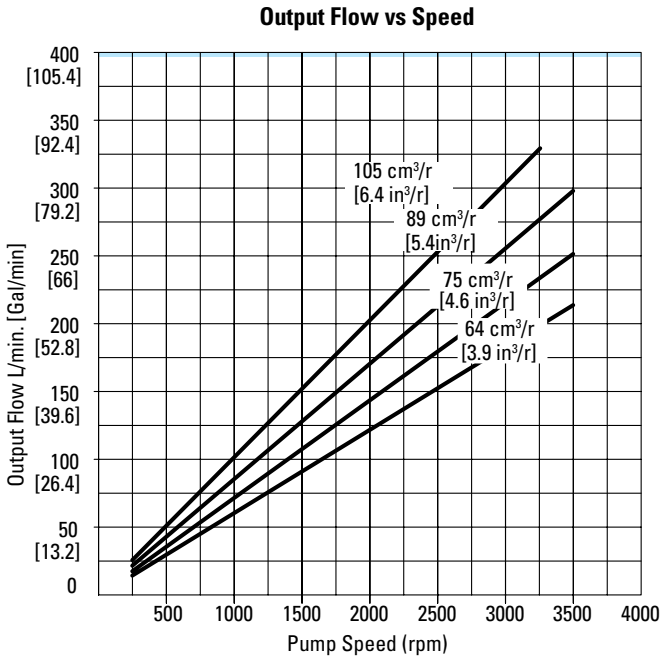
Model		64	75	89	105
Displacement cm^3/r (in^3/r)		64 (3.9)	75 (4.6)	89 (5.4)	105 (6.4)
Input Mounting Flange		SAE C	SAE C	SAE C	SAE C
Max. Shaft Speed* RPM @ Max. Displ.		4165	4165	3720	3720
Nominal Pressure* bar (psi)		430 (6250)	430 (6250)	430 (6250)	430 (6250)
Peak Pressure** bar (psi)		500 (7250)	500 (7250)	500 (7250)	500 (7250)
Case Pressure bar (psi)	Cont. Max.	2,25 (40) 13,8 (200)	2,25 (40) 13,8 (200)	2,25 (40) 13,8 (200)	2,25 (40) 13,8 (200)
Output Flow l/min @ 240bar gal/min @ 3500 psi		255 (67.2)	301 (79.5)	318 (84.1)	376 (99.4)
Input Torque					
N·m @ 240 bar lbf·in @ 3500 psi		256 (2278)	303 (2694)	358 (3189)	424 (3771)
Temperature Rating		82°C (180°F)	82°C (180°F)	82°C (180°F)	82°C (180°F)
Weight (opposite side porting)		58 kg (128 lbs)	58 kg (128 lbs)	81 kg (178 lbs)	81 kg (178 lbs)

* Nominal Pressure: Max delta system pressure at which component fatigue does not occur (pump life estimated by bearing life).

** Peak Pressure: Max operation pressure which is permissible for a short duration of time (t < 1 sec).

Performance Data





System pressure . . . . . 240 bar (3500 psi)
Oil viscosity . . . . . 10 cst (60 sus)
Temperature . . . . . 82°C (180°F)

Performance – Charge Pump

Eatons Series 2 pump offers a choice of five integral charge pump displacements. The Charge Pump design allows greater through-torque for tandem pumps and multiple motor applications. These charge pumps include a large standard suction port and a gauge/pilot pressure port. Charge pump pressure side filtration is also available (see page 29).

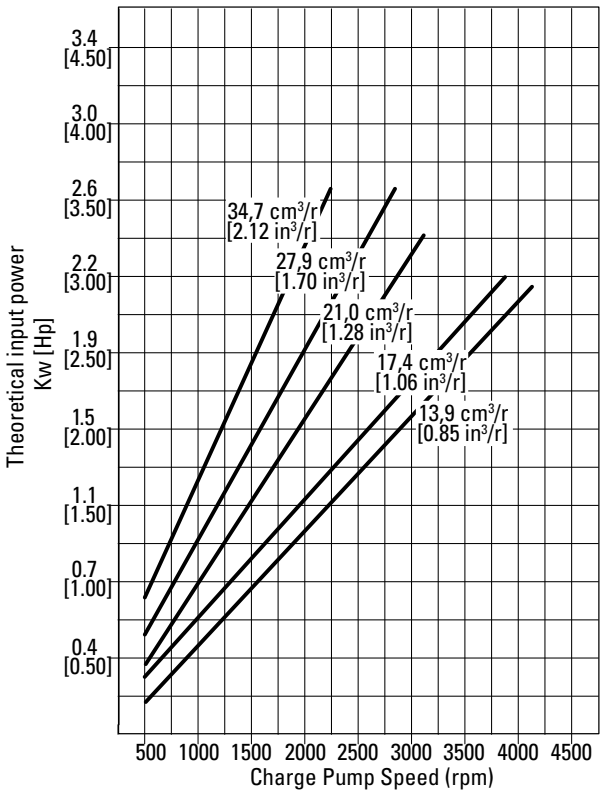
The charge pump generates a low pressure flow of oil to perform the following functions:

1. Keeps the closed loop circuit full of oil.
2. Provides control pressure to the pump's displacement control servo valve for easy control of the transmission's output speed.
3. Provides cool, clean oil from the reservoir to keep the transmission pump and motor well lubricated and cooled.
4. Supplies a positive boost pressure to the pistons of the piston pump and piston motor.

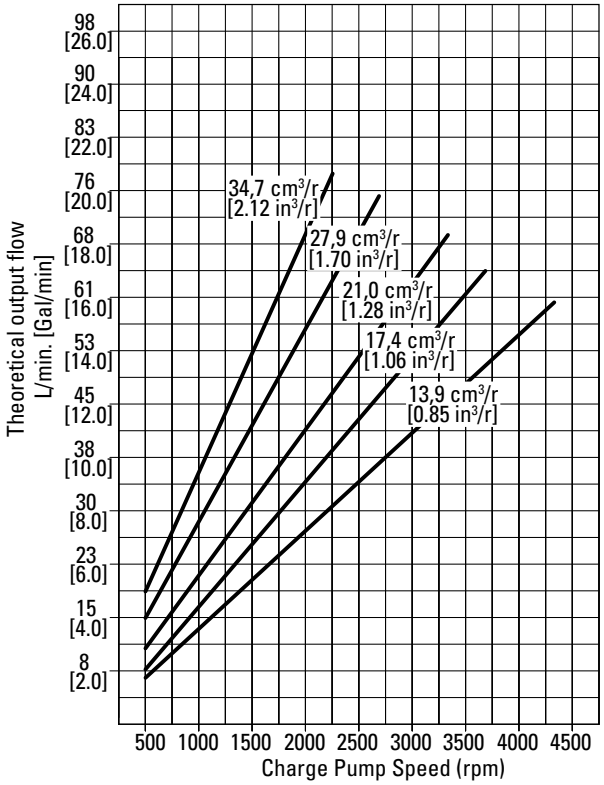
Charge Pump Performance

Charge Pump Displacement*	**cm^3/r**	13,9	17,4	21,0	27,9	34,7
	in^3/r	0.85	1.06	1.28	1.70	2.12
Maximum Shaft Speed	**rpm**	4300	3700	3300	2700	2250
Output Flow** at Max Speed Input	**l/min**	59,9	64,3	69,2	75,2	78,2
	gal/min	15.8	17.0	18.3	19.9	20.6
Horsepower** at Max Speed	**kW**	2,10	2,25	2,42	2,63	2,74
	HP	2.81	3.02	3.25	3.53	3.67
Series 2 Pump Displacement	64 cm^3/r (3.9 in^3/r) 75 cm^3/r (4.6 in^3/r) 89 cm^3/r (5.4 in^3/r)	Standard	Optional	Optional	Optional	N/A
	105 cm^3/r (6.4 in^3/r)	Optional	Standard	Optional	Optional	Optional

Charge Pump Power vs Speed



Charge Pump Flow vs Speed



Oil Viscosity . . . . . 10 cst (60 sus)
Temperature . . . . . 82° C (180°F)

Model Codes

The following 31-digit coding system has been developed to identify all of the configuration options for the Series 2 hydrostatic pump. Use this model code to specify a pump with the desired features. All 31-digits of the code must be present when ordering. You may want to photocopy the matrix below to ensure that each number is entered in the correct box.

ACL	054	02	L	0	B	TT	WW	12	EC	B	C	D	0	3	C	A	B	0	0	0	A
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	31

1, 2, 3 Pump Series

ACL – Hydrostatic-Heavy Duty Variable Pump (Series 2)

4, 5, 6 Displacement

064 – 64 cm^3/r (3.8 in^3/r)
075 – 75.3 cm^3/r (4.6 in^3/r)
089 – 89 cm^3/r (5.4 in^3/r)
105 – 105 cm^3/r (6.4 in^3/r)

7, 8 Input Shaft

03 – SAE C-C (1.50) diameter tapered with (.375) x (1.00) square key
14 – SAE C 14 tooth 12/24 pitch spline
21 – SAE C-C 21 tooth 16/32 pitch spline
23 – SAE C-C 23 tooth 16/32 pitch spline

9 Input Rotation

L – Counterclockwise (lefthand)
R – Clockwise (righthand)

10 Valve Plate

0 – V-groove
1 – Propel
3 – Quiet valve plate

11 Main Ports (Includes Gage Ports)

A – 25.4 (1.00) - code 61 per SAE J518
B – 25.4 (1.00) - code 62 per SAE J518
E – 25.4 (1.00) - code 62 per SAE J518 same side location
F – 25.4 (1.00) - code 61 per SAE J518 same side location

12,13 High Press Relief Valve Setting

Port A (Pos. 12)
Port B (Pos. 13)

0 – None
M – 207 bar (3000 psi) with 2 bar (29 psi) check valve spring
N – 241 bar (3500 psi) with 2 bar (29 psi) check valve spring
P – 276 bar (4000 psi) with 2 bar (29 psi) check valve spring
R – 310 bar (4500 psi) with 2 bar (29 psi) check valve spring
S – 345 bar (5000 psi) with 2 bar (29 psi) check valve spring
T – 379 bar (5500 psi) with 2 bar (29 psi) check valve spring
U – 414 bar (6000 psi) with 2 bar (29 psi) check valve spring
V – 431 bar (6250 psi) with 2 bar (29 psi) check valve spring
W – 448 bar (6500 psi) with 2 bar (29 psi) check valve spring
Y – 483 bar (7000 psi) with 2 bar (29 psi) check valve spring

14,15 Press Override Setting

Port A (Pos. 14)
Port B (Pos. 15)

0 – none
1 – 448 bar (6500 psi) adjustable range 379-448 bar (5500-6500 psi)
N – 103 bar (1500 psi) adjustable range 103-275 bar (1500-4000 psi)
P – 138 bar (2000 psi) adjustable range 103-275 bar (1500-4000 psi)
R – 172 bar (2500 psi) adjustable range 103-275 bar (1500-4000 psi)
S – 207 bar (3000 psi) adjustable range 103-275 bar (1500-4000 psi)
T – 241 bar (3500 psi) adjustable range 103-275 bar (1500-4000 psi)
U – 276 bar (4000 psi) adjustable range 241-345 bar (3500-5000 psi)
V – 310 bar (4500 psi) adjustable range 241-345 bar (3500-5000 psi)
W – 345 bar (5000 psi) adjustable range 310-414 bar (4500-6000 psi)
Y – 379 bar (5500 psi) adjustable range 310-414 bar (4500-6000 psi)
Z – 414 bar (6000 psi) adjustable range 379-448 bar (5500-6500 psi)

16,17 Special Pump Features

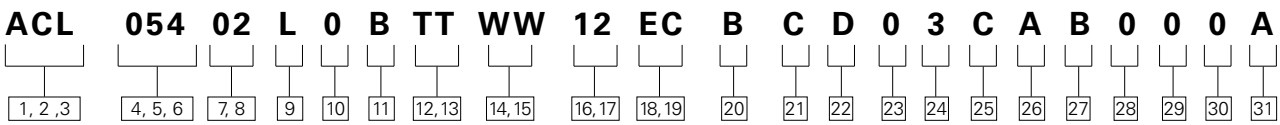
00 – No special features
01 – Plugged magnetic speed sensor port
02 – Magnetic speed sensor
12 – Rear pump unit for tandem assembly (no shaft seal)
13 – Servo piston with externally adjustable stops in both directions

18,19 Control

EC – Electronic proportional control 12 volt dc without electronic driver
ED – Electronic proportional control 24 volt dc without electronic driver
FR – Forward-neutral-reverse control 12v with 2 2-pin weatherpack connectors
FS – Forward-neutral-reverse control 24v with 2 2-pin weatherpack connectors
HA – Hydraulic remote control 5-15 bar (73-218 psi)
HB – Hydraulic remote control 2-14 bar (29-203 psi)
MA – Manual displacement control
MB – Manual displacement control with normally closed neutral lockout switch (wide band neutral)
MC – Manual displacement control with neutral detent (wide band neutral)
MG – Manual displacement control with normally open neutral lockout switch (wide band neutral)
ML – Manual displacement control with wide band neutral
SA – Solenoid control 12 Volt with non-contact feedback sensor with 4 pin Metri-pack connector
SB – Solenoid control 24 Volt with non-contact feedback sensor with 4 pin Metri-pack connector
SE – Solenoid control 12 volt with non-contact feedback sensor with electrical connectors per DIN 43650
SG – Solenoid control 24 volt with non-contact feedback sensor with electrical connectors per DIN 43650

Model Codes

The following 31-digit coding system has been developed to identify all of the configuration options for the Series 2 hydrostatic pump. Use this model code to specify a pump with the desired features. All 31-digits of the code must be present when ordering. You may want to photocopy the matrix below to ensure that each number is entered in the correct box.



20,21,22 **Control Orifice**
Supply P (Pos. 20)
Lower Servo S1 (Pos. 21)
Upper Servo S2 (Pos. 22)
0 – None
A – 0.53 (.021) diameter
B – 0.71 (.028) diameter
C – 0.91 (.036) diameter
D – 1.12 (.044) diameter
E – 1.22 (.048) diameter
F – 1.32 (.052) diameter
G – 1.45 (.057) diameter
H – 1.65 (.065) diameter
J – 1.85 (.073) diameter
K – 2.06 (.081) diameter
L – 2.39 (.094) diameter
M – 2.59 (.102) diameter

23 **Control Special Features**
0 – No control special features
1 – No manual control lever

24 **Charge Pump Displacement**
0 – None
1 – 13.9 cm^3/r (.85 in^3/r) (models 064-089)
2 – 17.4 cm^3/r (1.06 in^3/r) (models 064-105)
3 – 21.0 cm^3/r (1.28 in^3/r) (models 064-105)
4 – 27.9 cm^3/r (1.70 in^3/r) (models 064-105)
5 – 34.7 cm^3/r (2.12 in^3/r) (models 089-105)

25 **Auxiliary Mounting**
1 – None (models 064-105)
C – A-pad, dual 2 bolt mount, no shaft seal, 9 tooth 16/32 pitch spline
D – B-pad, dual 2 bolt mount, no shaft seal, 13 tooth 16/32 pitch spline
E – B-B-pad, dual 2 bolt mount, no shaft seal, 15 tooth 16/32 pitch spline
F – C-pad, 4 bolt mount, no shaft seal, 14 tooth 12/24 pitch spline
H – C-pad, integral to end cover (typically front pump of tandem), 4 bolt mount, no shaft seal, 27 tooth 24/48 pitch spline for units without charge pump
K – A-pad, dual 2 bolt mount, no shaft seal, 11 tooth 16/32 pitch spline

26 **Charge Pump Options**
0 – None
A – Remote filter ports
B – Intergral pressure side filter with 4 position mounting pad
F – Remote filter ports. labeled

27 **Charge Pressure Relief Valve Setting**
0 – None
A – 21 bar (305 psi) - standard
B – 23 bar (326 psi)
C – 24 bar (348 psi)
D – 26 bar (370 psi)
E – 27 bar (392 psi)
F – 29 bar (413 psi)
G – 30 bar (435 psi)
H – 23 bar (340 psi)
K – 22 bar (320 psi)

28 **Charge Pump Special Features**
0 – No charge pump special features

29 **Paint and Packaging**
0 – Painted primer blue (standard)

30 **Identification On Unit**
0 – Standard

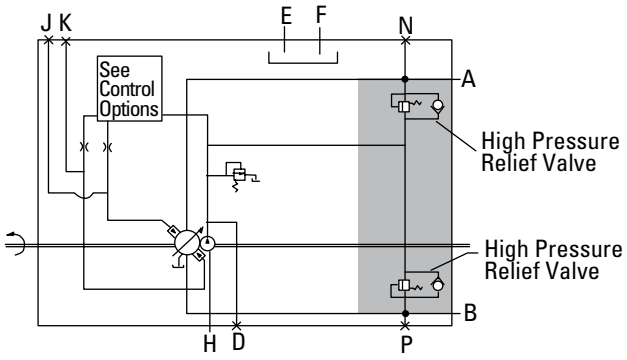
31 **Design Code**
A – A

Features and Options

Series 2 Pump

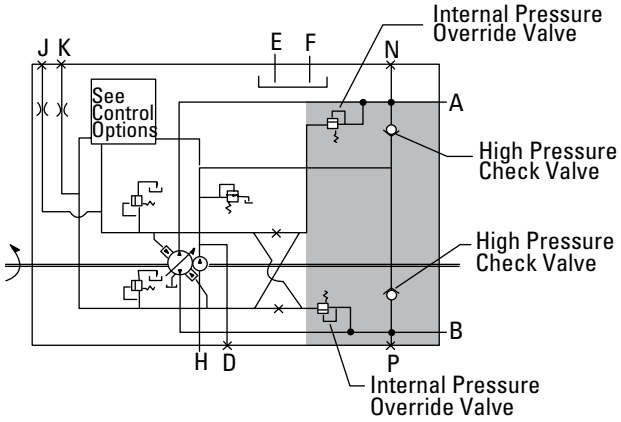
High Pressure Relief Valve
Model Code Position 12 & 13

The High Pressure Relief Valves for ports A and B activate whenever system pressure equals the relief valve setting. The valves are direct acting and help protect system components from excessive pressure spikes.

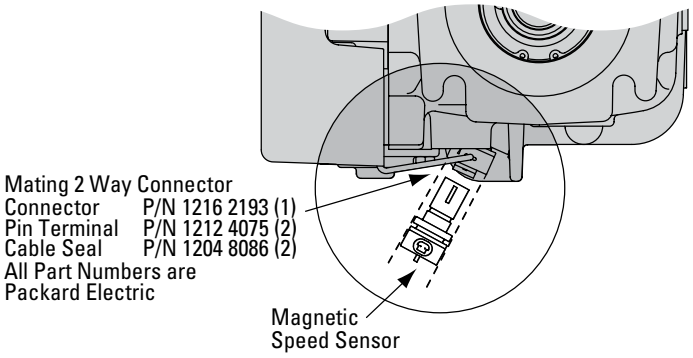


Pressure Override
Model Code Position 14 & 15

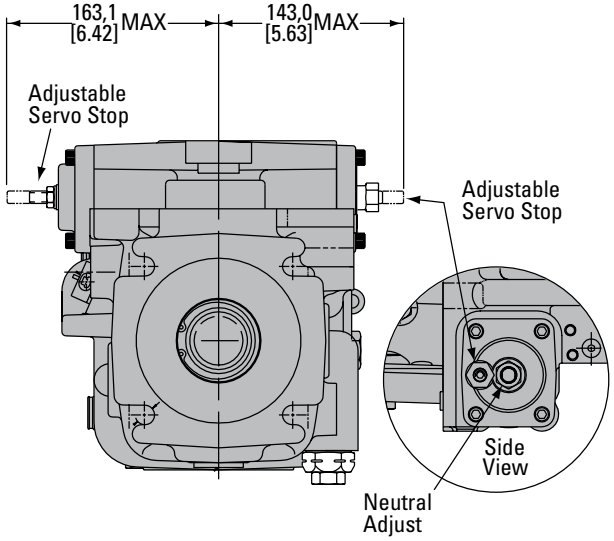
The Pressure Override Control (POR) is used in combination with the high pressure relief valves, to protect the transmission when operated for extended periods at overload pressures. If the system pressure reaches a preset limit, the pump destrokes and adjusts its displacement to the load. The POR is available in a number of pressure settings.



Special Pump Features
Model Code 02 in Position 16 & 17



Special Pump Features
Model Code 03, 13, or 14 in Position 16 & 17



Charge Pump Options

The Series 2 Hydrostatic Pump contains an integral charge pump that may be provided with various filtration options. A standard charge pump will use suction filtration where practical. This arrangement is detailed in the diagram on page 29 and followed by the filter recommendations on page 31. For applications where suction filtration is not practical, the option below may be selected.

Remote Filter Ports (Optional)
Model Code A in Position 26

Remote pressure filter ports allow you to mount a pressure side filter in a more easily accessible location. The filter ports accept 7/8-14 UNF-2B SAE O-ring fittings. The filter and lines must be able to withstand pressures up to 70 bar (1000 psi).

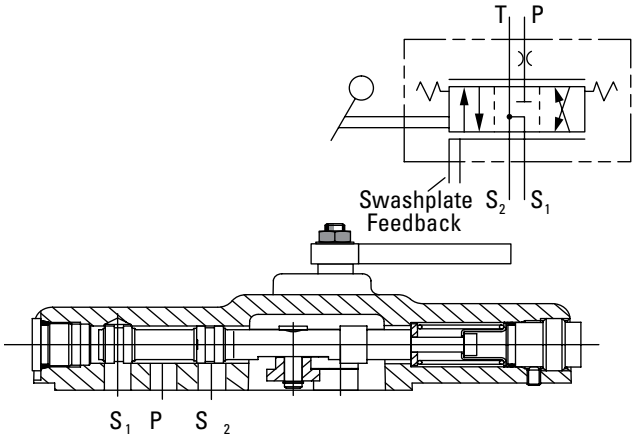
Control Options – Manual Control

Model Code Positions 18 & 19

The wide variety of available controls on the Eaton® Heavy Duty Series 2 Pump offers vehicle designers the control necessary for optimal vehicle performance. Many of these controls are combined as single control options; please refer to the model code for the specific option configuration. For combinations other than shown, contact an Eaton representative.

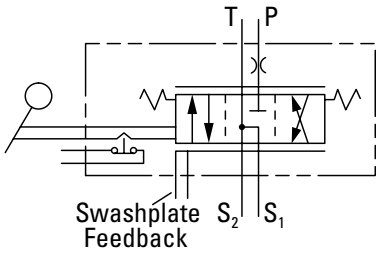
Standard Manual Displacement Control (MA)

The standard manual displacement control, the most common control option, typically connects directly with mechanical linkages or cables.



Manual Control with Neutral Lockout (MB)

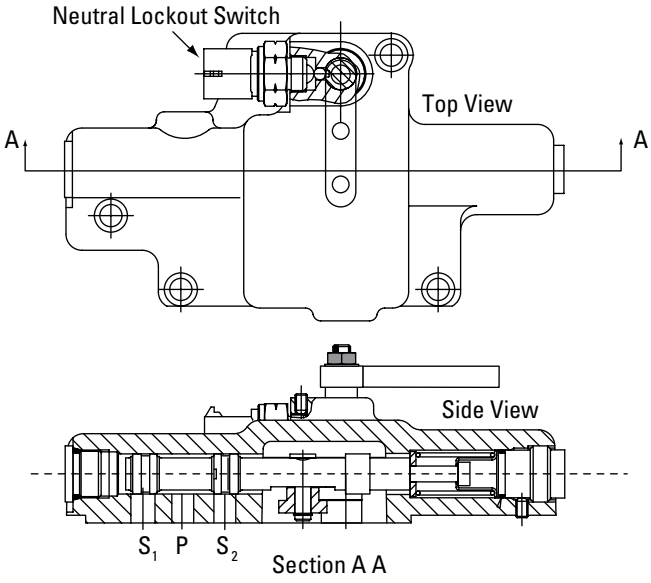
The neutral lock-out feature is an electrical switch that is closed or open when the transmission is in neutral. This switch can be used to prevent the activation of certain functions that require the pump to be in neutral. The lock-out feature is commonly used to prevent starting the prime mover or activating auxiliary functions. The electrical switch is available as normally open or normally closed.



(Normally Closed Switch Shown)

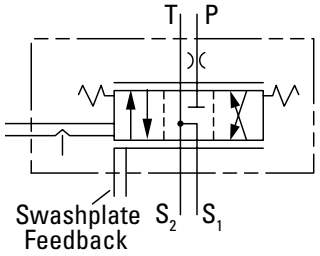
Manual Displacement Control with Wide Band Neutral Detent (ML)

This control is the same as the above with an increased neutral band.



Manual Control with Neutral Detent (MC)

The neutral detent feature provides a more positive feel when finding neutral. This option is ideal for transmissions with long control linkages or cables, or in other situations where there is a great deal of space between the operator station and the pump.



Mating Connector for MB

Connector	P/N 1201 5792 (1)
Terminal	P/N 1208 9040 (2)
Cable Seal	P/N 1201 5323 (2)

All Part Numbers are Packard Electric

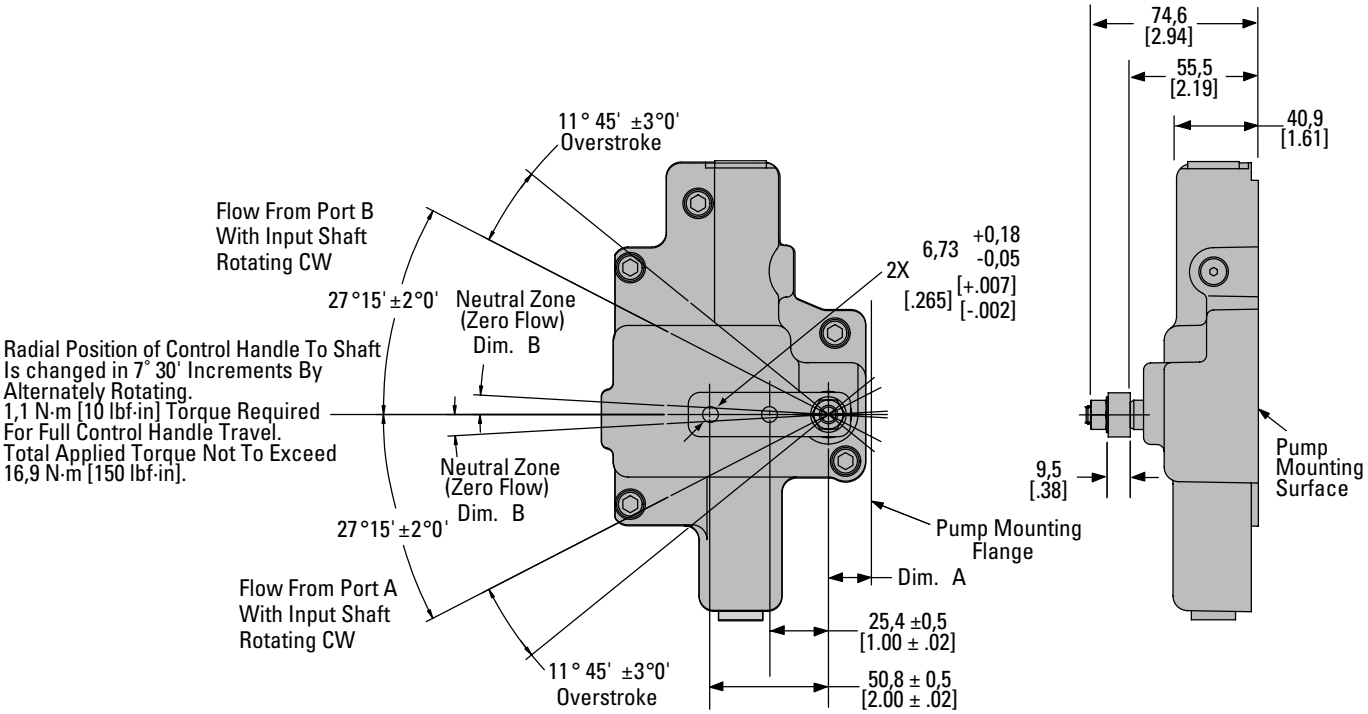
Control Options – Manual Control

Model Code Positions 18 & 19

Manual Controls – Dimensions

Displacement	Dim. A
64 cm³/r (3.9 in³/r)	18,5 (.73)
75 cm³/r (4.6 in³/r)	18,5 (.73)
89 cm³/r (5.4 in³/r)	107,3 (1.17)
105 cm³/r (6.4 in³/r)	107,3 (1.17)

Control Spool	Dim. B
Standard	2° 30' ±1° 45'
Wide Band	4° 15' ±1° 45'



Control Handle Detail

Control Options – Hydraulic Remote Control

Model Code HA in Position 18, 19

The hydraulic remote pump control makes it possible to control pump flow by changing pump displacement via a remote pilot pressure signal. The angle of the swashplate, that determines pump displacement, is proportional to the pilot pressure. Typical pressure requirements are 5-15 bar (72.5 -217.5 psi) with a swashplate angle from 0° to 18°.

The direction of flow, and therefore the direction of the vehicle, is reversed by applying the control pressure to the opposite inlet port of the hydraulic remote pump control.

The hydraulic remote pump control is readily adaptable in the following applications:

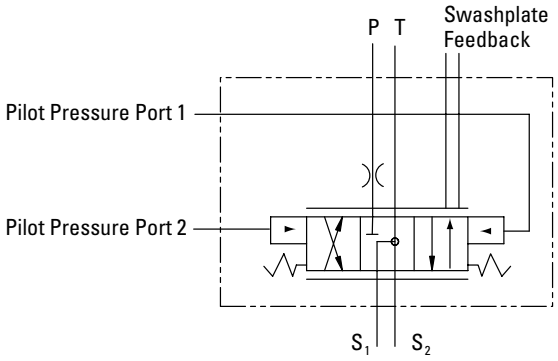
- Where remote transmission control is needed
- Where control cables or linkages are not feasible
- Where electronic controls cannot be used.

The Eaton hydraulic remote pump control is compatible with:

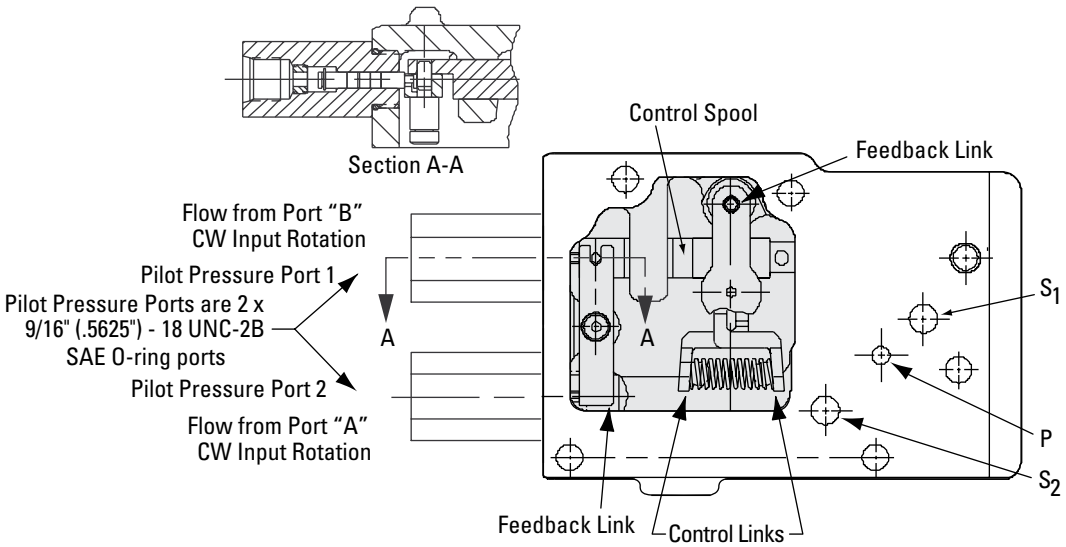
- All Eaton Series 2 Variable Pumps (Models 64-105)
- Other Eaton control options such as the destroke control, inching control, and pressure override
- Most commercially available hydraulic command stations

The hydraulic remote pump control is a three position, four-way closed center (spring centered) hydraulically activated servo control. This control, like the manual displacement control uses the feedback linkage connected directly to the swashplate.

The control spool is activated to position the swashplate by regulating the remote pilot pressure to the control piston. There are various manufacturers of command stations that can be used to supply this remote pilot pressure.



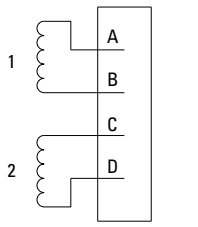
Hydraulic Remote Control



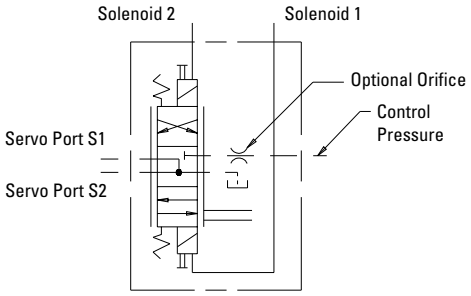
Control Options – Electronic Proportional Displacement Control

Model Code EC & ED Position 18,19

The Electronic Proportional (EP) displacement control is ideal for applications requiring electronic pump displacement control. The EP displacement control has been designed to withstand the rigors of off-highway equipment environmental conditions.



Solenoid Valve Schematic



EP Control Features

- Ease of installation
- Automotive style environmentally sealed Metri-Pack connectors
- Return to neutral for loss of power, or loss of command input signal
- Mechanical feedback of swashplate position for closed loop control
- External neutral adjustment
- Manual override capability

Matting 4 Way Connector Packard Electric**

Packard 4 Pin, Weatherpack

P/N 1218 6568 Connector,

Qty 1

P/N 1204 8074 PIN Terminal,

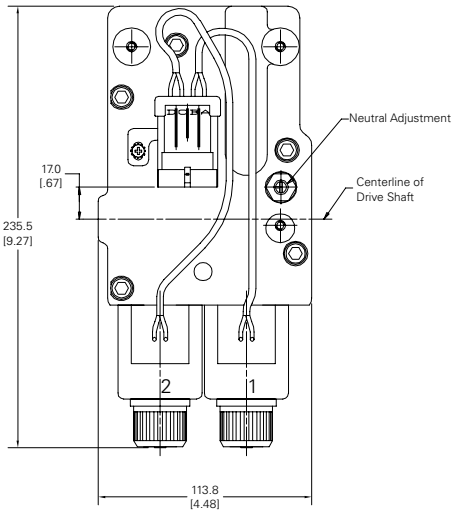
Qty 4

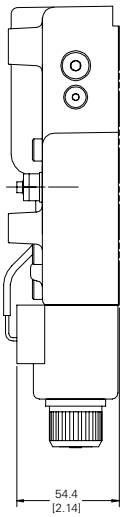
P/N 1204 8086 Cable Seal,

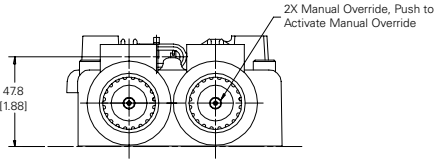
Qty 4

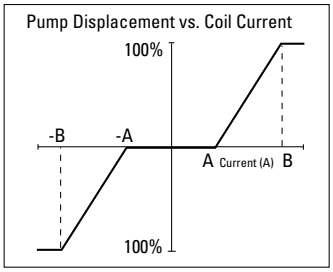
P/N 1204 7948 TPA,

Qty 1









Voltage	Coil Current (A) A	B
12V	0.5	1.25
24V	0.25	0.625

Note:
Coils have no internal Diodes. A-B Polarity and C-D Polarity Does Not affect operation

Modulation frequency flange for optimal performance is 75-200 Hz

Pin	Color	Signal
A	Yellow	Coil 1 PWM
B	White	Coil 1 Return
C	Orange	Coil 2 PWM
D	Black	Coil 2 Return

Input Shaft Rotation

	CCW		CW	
Solenoid Energized	1	2	1	2
Port A Flow	Out	In	In	Out
Port B Flow	In	Out	Out	In

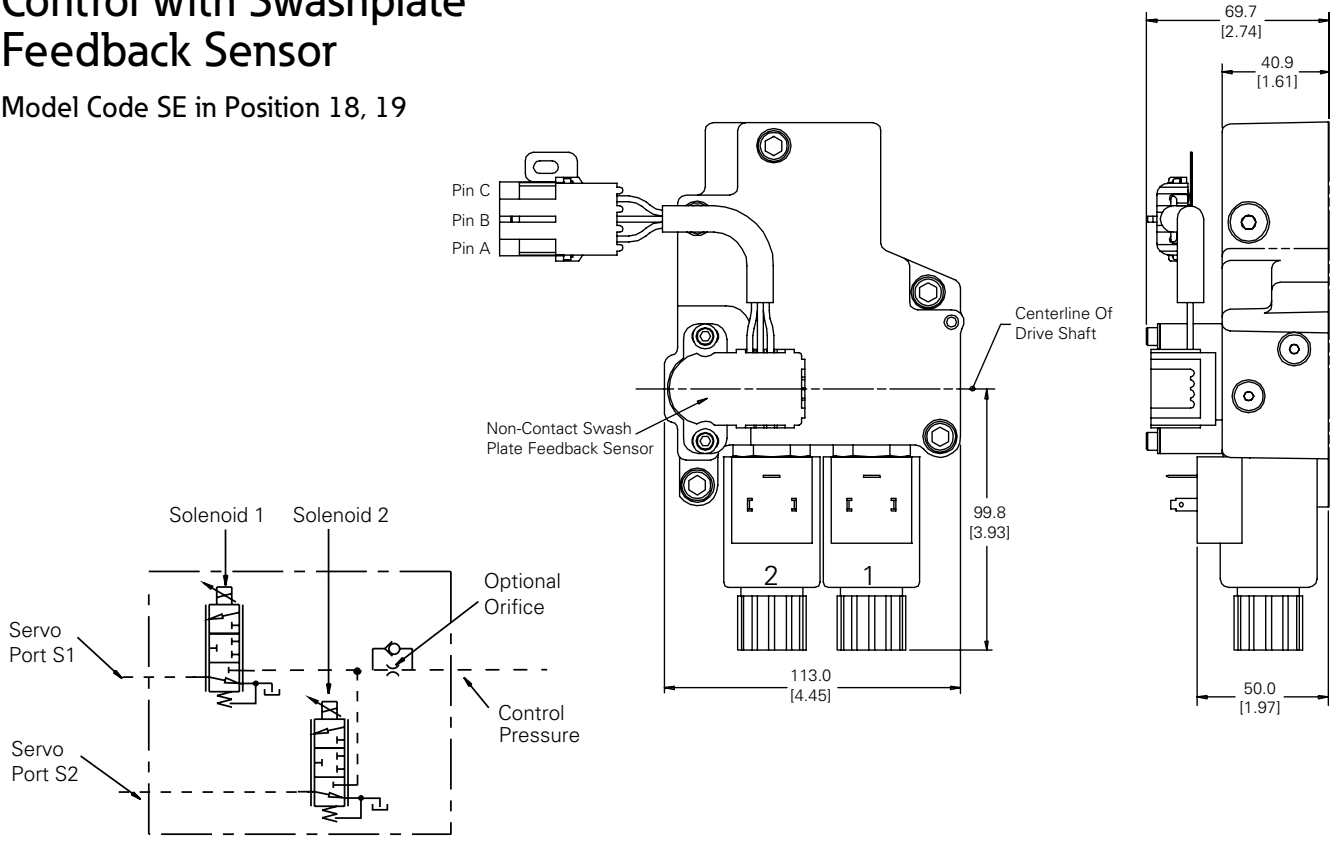
Proportional Valve Specification	EC	ED	Typical Electronic Controller
Voltage	12 VDC	24 VDC	Contact Eaton for TCA, Maestro, and EFX controller available from Eaton; or customer supplied controller.
Resistance	5.2 Ohms	20.8 Ohms	
Inductance	7.0 mH	27.7 mH	
Current	1500 mA	750 mA	
Threshold Current	200-600 mA	100-300 mA	
PWM Frequency*	70-200 Hz	70-200 Hz	
Dither Frequency	75 Hz	75 Hz	
Dither Amplitude	250 mA	125 mA	
Ambient Temperature	-65°F to 140°F (-54°C to 60°C)		
Coil Impedance	10 mH	42 mH	

* 100 Hz recommended when PWM driver does not have built-in dither capabilities
** Contact Eaton for other connector styles

PWM configuration: Closed loop current control (12/24 volts DC voltage cannot be applied to coil without exceeding continuous rated current)

Control Options – Solenoid Control with Swashplate Feedback Sensor

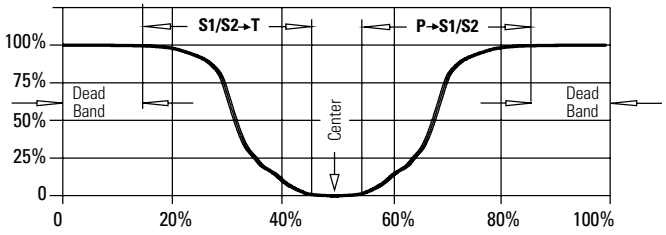
Model Code SE in Position 18, 19



Sensor Connector

Pin	Wire Color	Function
A	Black	Return
B	Blue	V Out (Signal)
C	Red	+ 5 VDC

% Servo Piston Flow vs Valve Coil Current



Input Shaft Rotation

	CCW		CW	
Solenoid Energized	1	2	1	2
Port A Flow	Out	In	In	Out
Port B Flow	In	Out	Out	In

Swashplate Sensor Electrical Data	
Supply Voltage	5±0.50 VDC
Supply Current	10mA
Sensor Gain	10°/V, CW Shaft rotation increases output
Angle Sweep	-20° at 0.5V; +20° at 4.5V; 0° (pump neutral) at 2.5V
Max Output Error*	±3%

*Error includes thermal linearity, and sensitivity drift

Mating Connector for Valve**

DIN 43650, Form A (IP65)

(Deutsch connector available upon request)

Mating Connector for Sensor (IP66)

Packard 3 Pin Weatherpack
P/N 12015793, Connector
Qty 1

P/N 12089188, PIN Terminal,
Qty 3

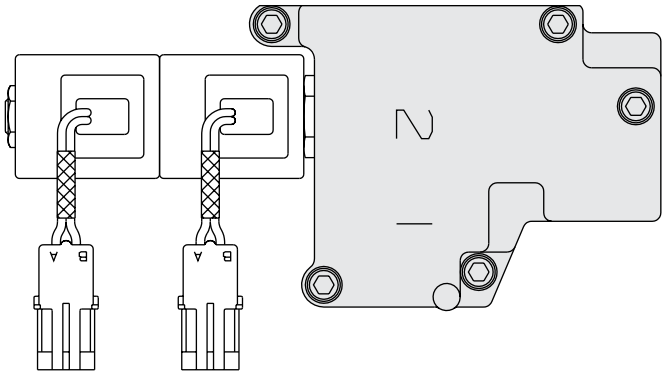
P/N 12015323, Cable Seal,
Qty 3

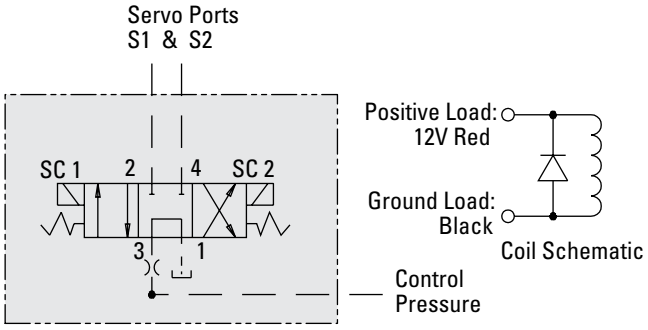
** Contact Eaton for other connector styles

Valve Specifications	SE	SG	Typical Electronic Controller
Voltage	12 VDC	24 VDC	Contact Eaton for Fx controllers or customer supplier controller.
Resistance	4.0 Ohms	16.0 Ohms	
Inductance	12.3 mH	49.4 mH	
Current	1750 mA	875 mA	
Ambient Temp	-65°F to 140°F (-54°C to 60°C)		

Control Options – Forward - Neutral - Reverse Control

Model Code FR, FS in Position 18, 19

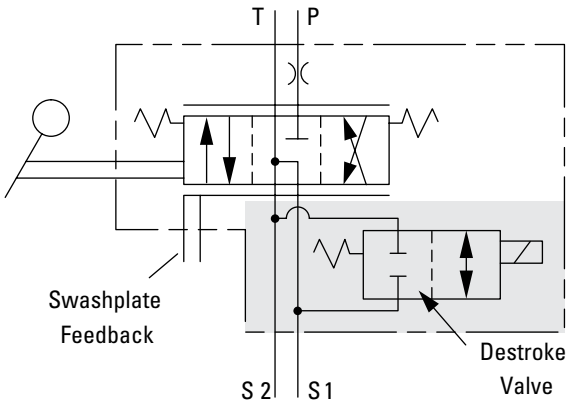




Control Special Features – Destroke Valve

Model Code 3 in Position 23

The destroke solenoid valve, when activated, causes the pump to destroke and go to zero displacement. This valve may be used as a safety device. Typically, the valve is activated by a seat switch detecting operator presence or by a remote emergency stop switch on the operator's console. It is available in 12 or 24 Vdc and either normally open or normally closed configurations.

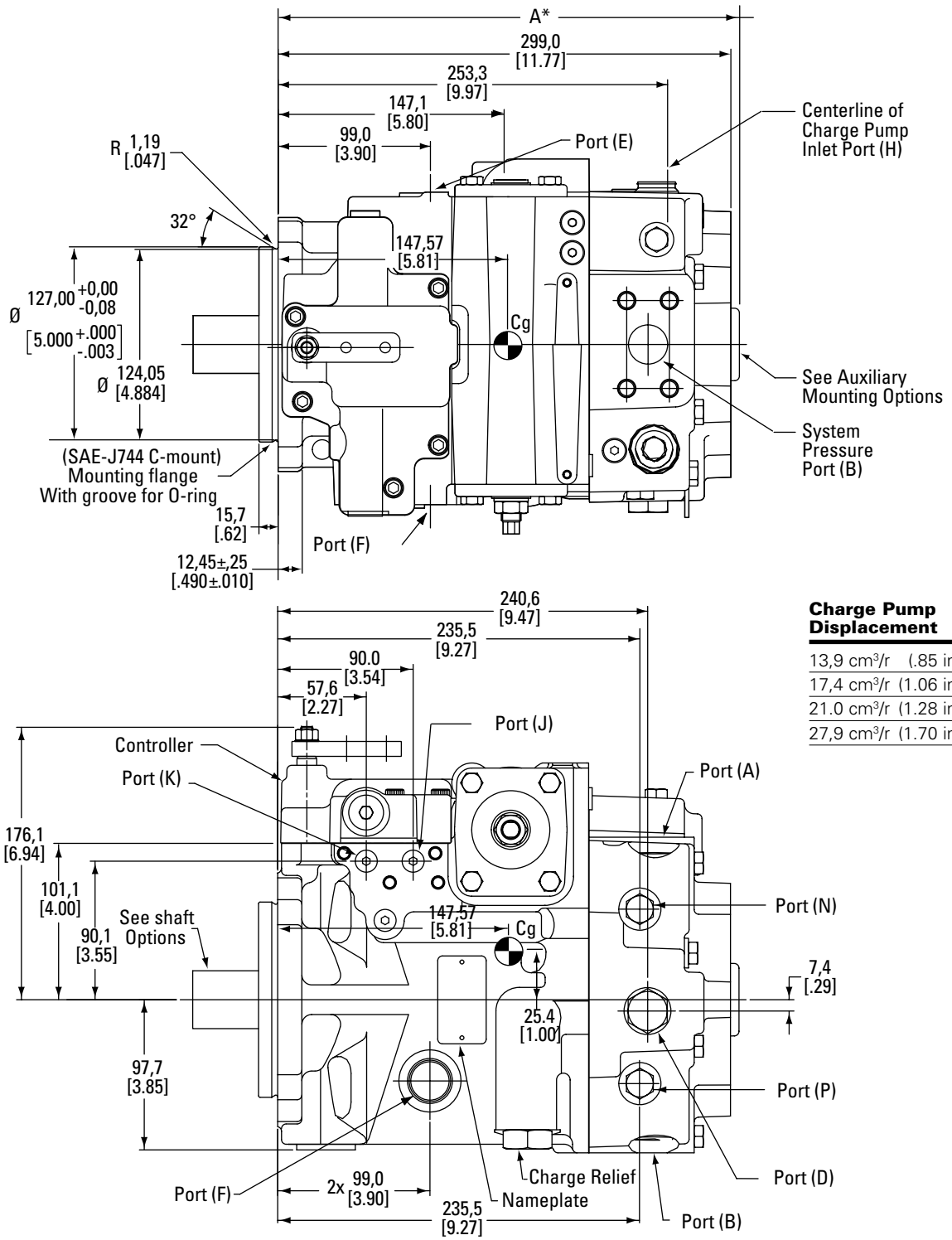


Pump Dimensions – Opposite Side Porting

Model Code 64, 75

64 cm³/r (3.9 in³/r)

75 cm³/r (4.6 in³/r)



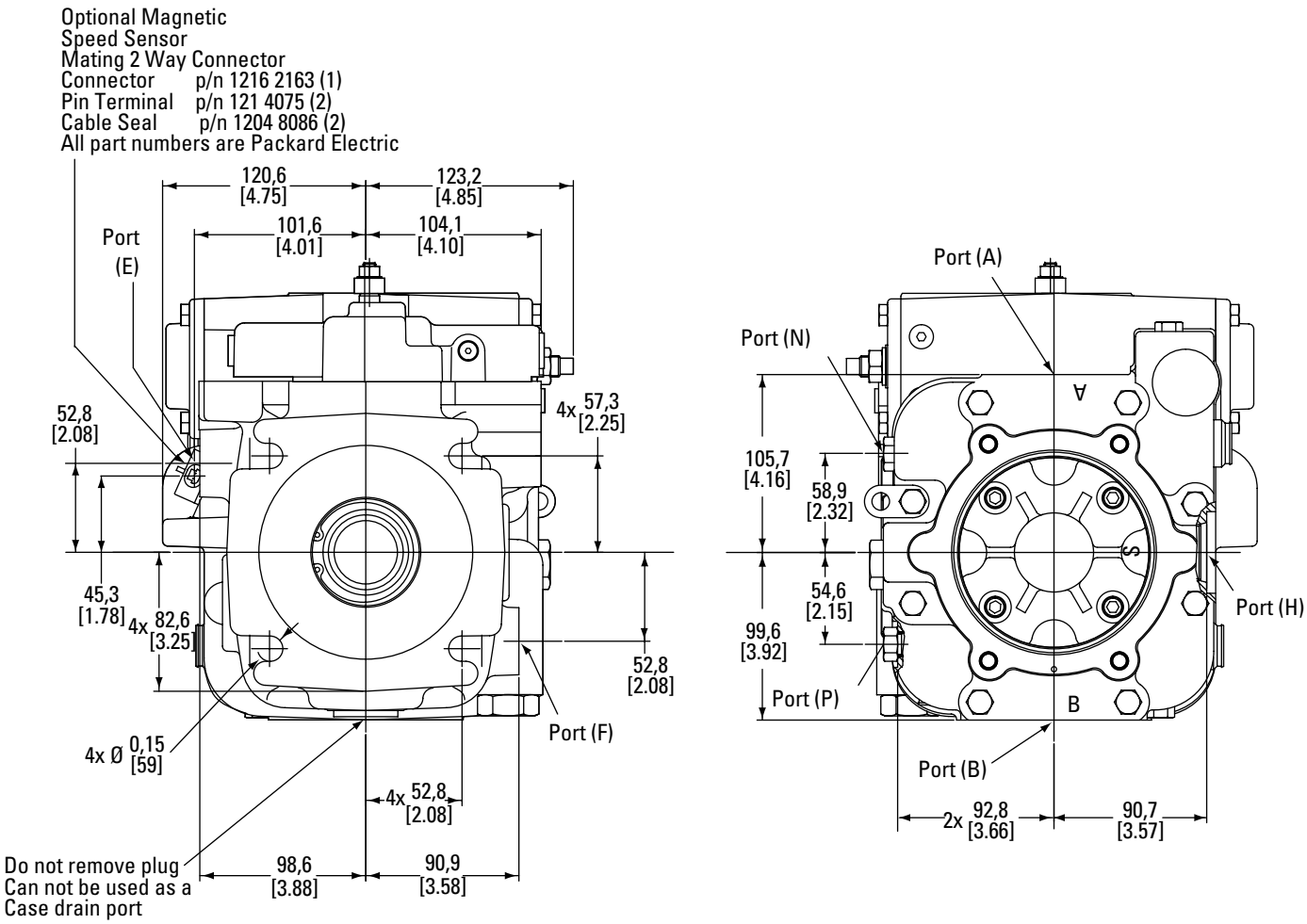
Charge Pump Displacement	*A Dimension
13,9 cm³/r (.85 in³/r)	300,3 (11.82)
17,4 cm³/r (1.06 in³/r)	303,7 (11.96)
21.0 cm³/r (1.28 in³/r)	307,2 (12.10)
27,9 cm³/r (1.70 in³/r)	314,1 (12.37)

Pump Dimensions – Opposite Side Porting

Model Code 64, 75

64 cm³/r (3.9 in³/r)

75 cm³/r (4.6 in³/r)

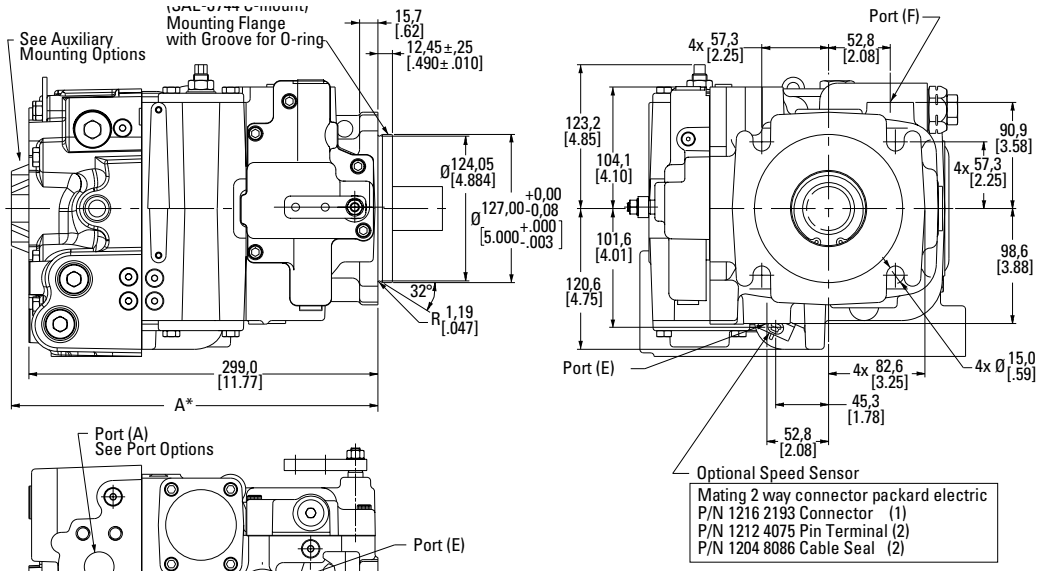


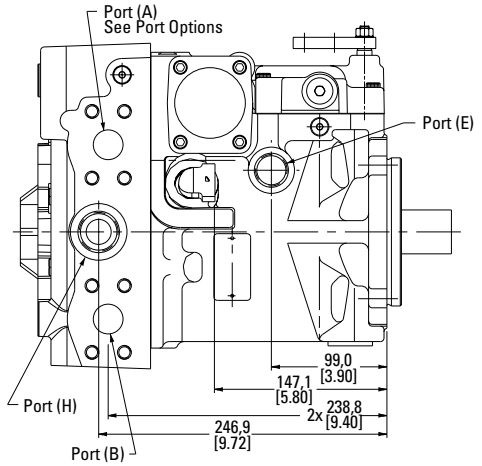
Weight
58 kg (128 lbs.)

Port	Description	S.A.E. O-ring Port Size
A	Main Port	1" per Code 61 per J518
B	Main Port	1" per Code 61 per J518
D	Charge Gauge Port	7/8-14 UN-2B
E	Case Drain Port	1-1/16-12 UN-2B
F	Case Drain Port	1-1/16-12 UN-2B
H	Charge Pressure Inlet Port	1-5/16-12 UN-2B
P	Gauge Port,System Port B	9/16-18 UNF-2B
N	Gauge Port,System Port A	9/16-18 UNF-2B
J	Gauge Port Servo 1	7/16-20 UNF-2B
K	Gauge Port Servo 2	7/16-20 UNF-2B

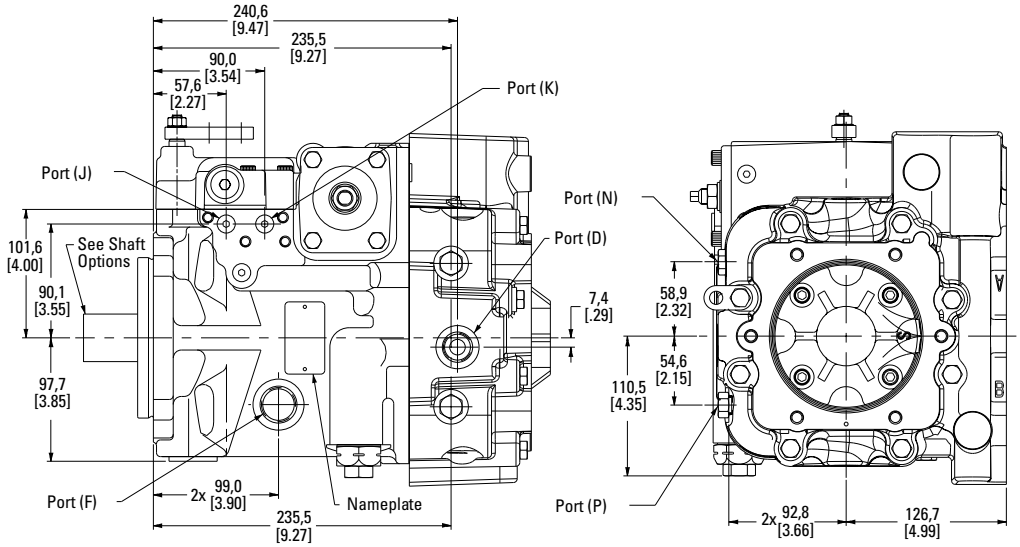
Pump Dimensions – Same Side Porting

Model Code 64, 75
64 cm³/r (3.9 in³/r)
75 cm³/r (4.6 in³/r)





Charge Pump Displacement	*A Dimension
13,9 cm³/r (.85 in³/r)	300,3 (11.82)
17,4 cm³/r (1.06 in³/r)	303,7 (11.96)
21,0 cm³/r (1.28 in³/r)	307,2 (12.10)
27,9 cm³/r (1.70 in³/r)	314,1 (12.37)



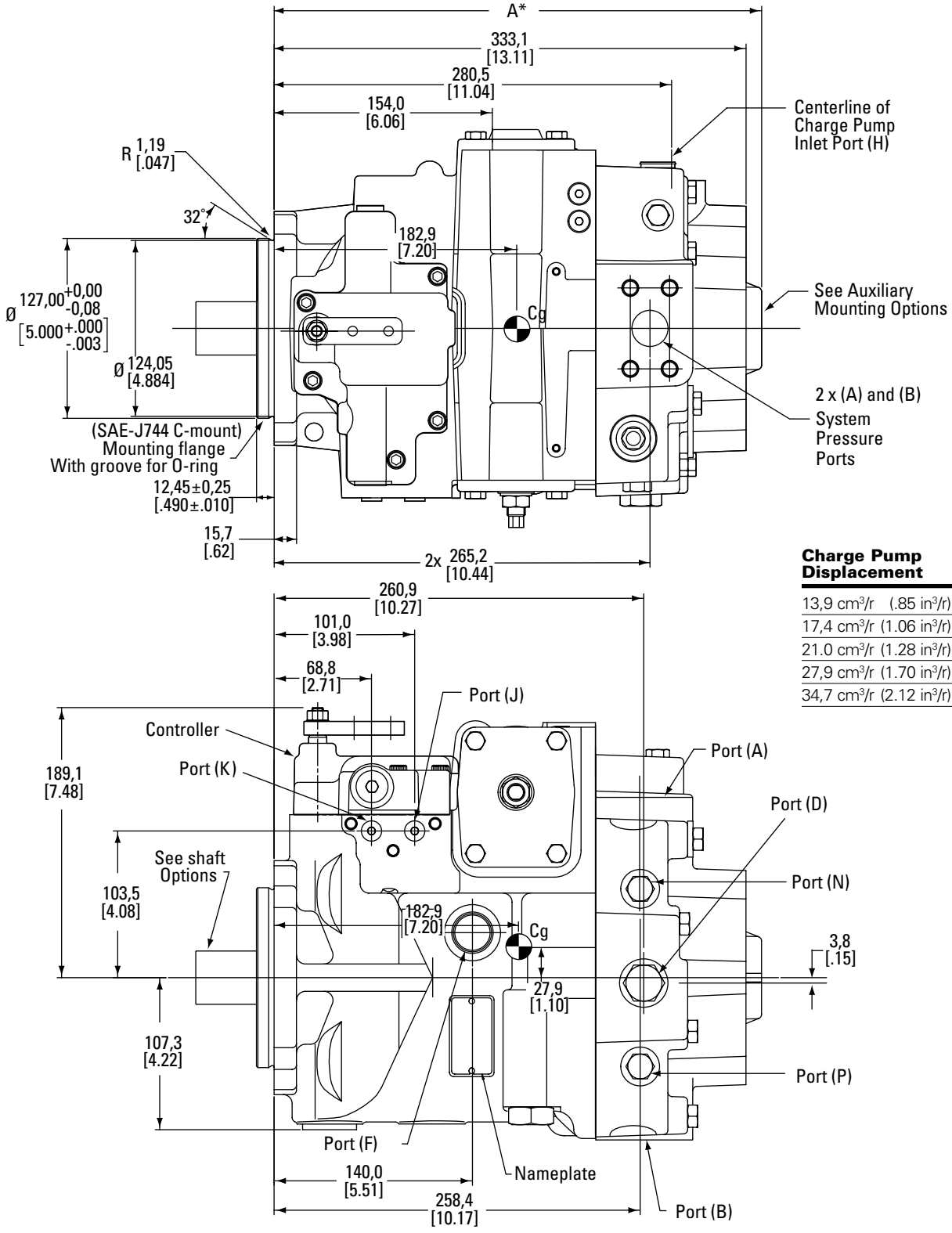
Port	Description	S.A.E. O-ring Port Size
A	Main Port	1" per Code 61 per J518
B	Main Port	1" per Code 61 per J518
D	Charge Gauge Port	7/8-14 UN-2B
E	Case Drain Port	1-1/16-12 UN-2B
F	Case Drain Port	1-1/16-12 UN-2B
H	Charge Pressure Inlet Port	1-5/16-12 UN-2B
P	Gauge Port,System Port B	9/16-18 UNF-2B
N	Gauge Port,System Port A	9/16-18 UNF-2B
J	Gauge Port Servo 1	7/16-20 UNF-2B
K	Gauge Port Servo 2	7/16-20 UNF-2B

Pump Dimensions – Opposite Side Porting

Model Code 89, 105

89 cm³/r (5.4 in³/r)

105 cm³/r (6.4 in³/r)



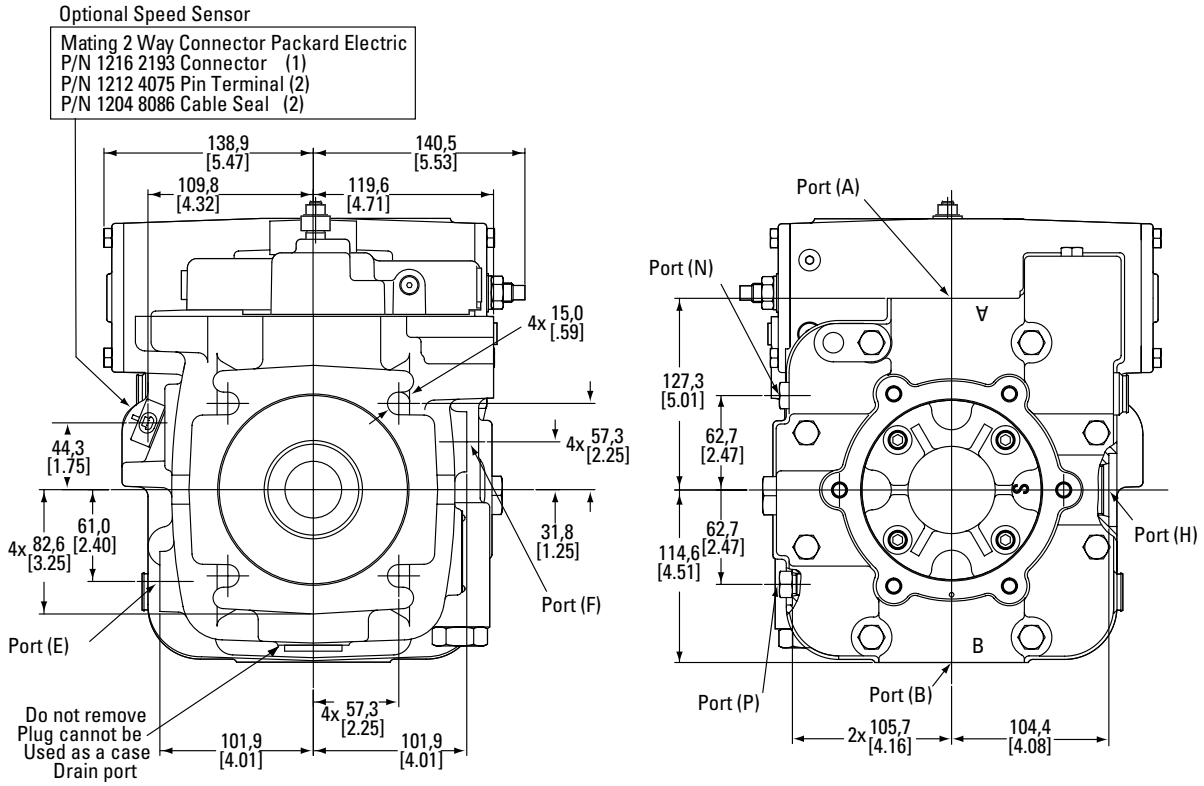
Charge Pump Displacement	*A Dimension
13,9 cm³/r (.85 in³/r)	337,1 (13.27)
17,4 cm³/r (1.06 in³/r)	340,5 (13.40)
21.0 cm³/r (1.28 in³/r)	344,0 (13.55)
27,9 cm³/r (1.70 in³/r)	350,9 (13.81)
34,7 cm³/r (2.12 in³/r)	357,7 (14.08)

Pump Dimensions – Opposite Side Porting

Model Code 89, 105

89 cm³/r (5.4 in³/r)

105 cm³/r (6.4 in³/r)

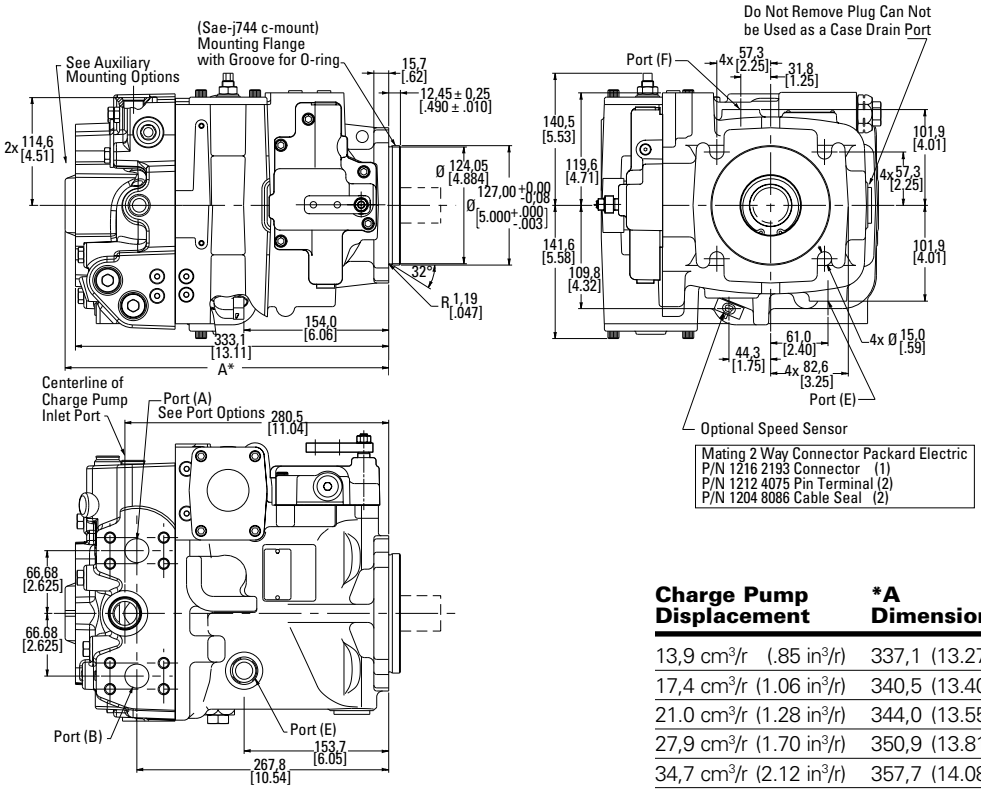


Weight
81 kg (178 lbs.)

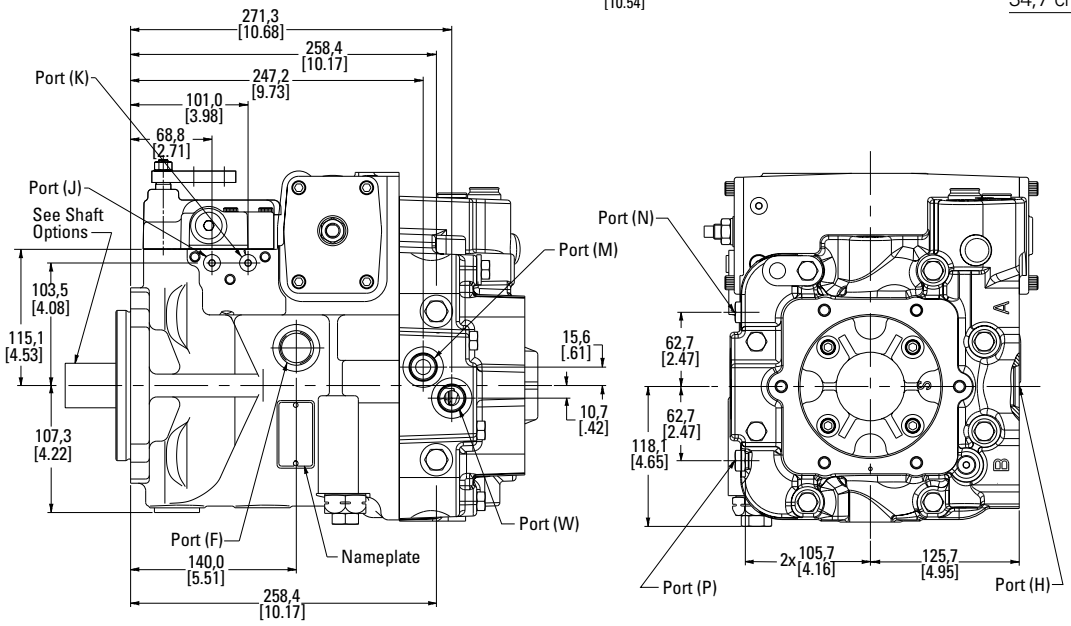
Port	Description	S.A.E. O-ring Port Size
A	Main Port	1" per Code 61 per J518
B	Main Port	1" per Code 61 per J518
D	Charge Gauge Port	7/8-14 UN-2B
E	Case Drain Port	1-1/16-12 UN-2B
F	Case Drain Port	1-1/16-12 UN-2B
H	Charge Pressure Inlet Port	1-5/16-12 UN-2B
P	Gauge Port, System Port B	9/16-18 UNF-2B
N	Gauge Port, System Port A	9/16-18 UNF-2B
J	Gauge Port Servo 1	7/16-20 UNF-2B
K	Gauge Port Servo 2	7/16-20 UNF-2B

Pump Dimensions – Same Side Porting

Model Code 89, 105
89 cm³/r (5.4 in³/r)
105 cm³/r (6.4 in³/r)



Charge Pump Displacement	*A Dimension
13,9 cm³/r (.85 in³/r)	337,1 (13.27)
17,4 cm³/r (1.06 in³/r)	340,5 (13.40)
21.0 cm³/r (1.28 in³/r)	344,0 (13.55)
27,9 cm³/r (1.70 in³/r)	350,9 (13.81)
34,7 cm³/r (2.12 in³/r)	357,7 (14.08)

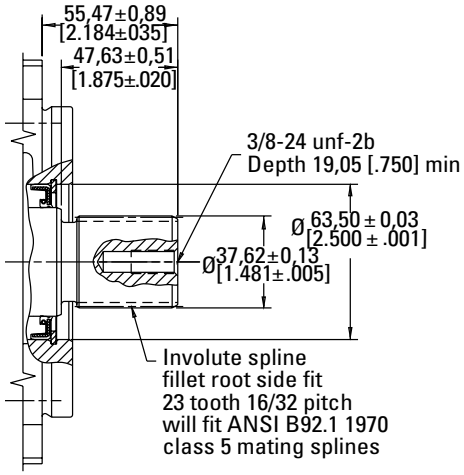


Port	Description	S.A.E. O-ring Port Size
A	Main Port	1" per Code 61 per J518
B	Main Port	1" per Code 61 per J518
D	Charge Gauge Port	7/8-14 UN-2B
E	Case Drain Port	1-1/16-12 UN-2B
F	Case Drain Port	1-1/16-12 UN-2B
H	Charge Pressure Inlet Port	1-5/16-12 UN-2B
P	Gauge Port, System Port B	9/16-18 UNF-2B
N	Gauge Port, System Port A	9/16-18 UNF-2B
J	Gauge Port Servo 1	7/16-20 UNF-2B
K	Gauge Port Servo 2	7/16-20 UNF-2B
M	Remote Filter Port, Outlet	7/8-14 UN-2B
W	Remote Filter Port, Intlet	7/8-14 UN-2B

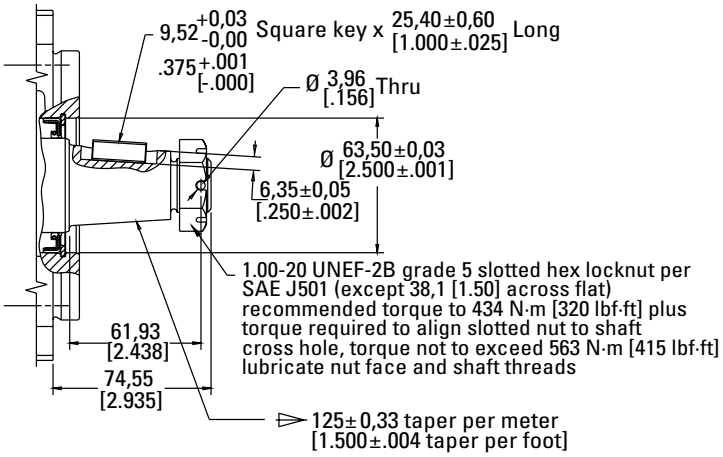
Input Shaft Options

Model Code Position 7, 8

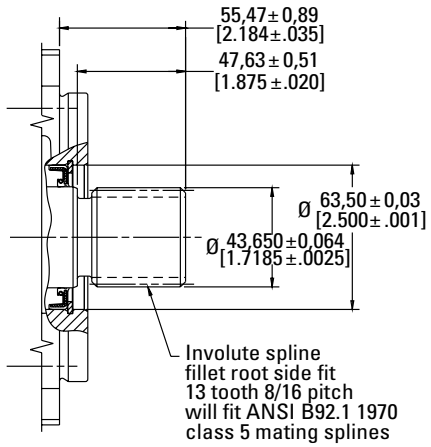
Model Code 02 - 23 Tooth
Torque: 1469 N·m (13.000 lbf·in)



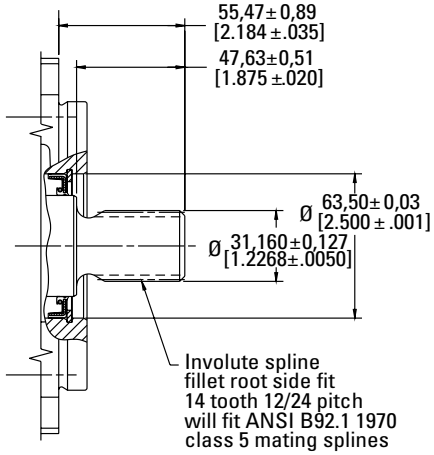
Model Code 03 - 1.50 Tapered
Torque: 836 N·m (7.400 lbf·in)



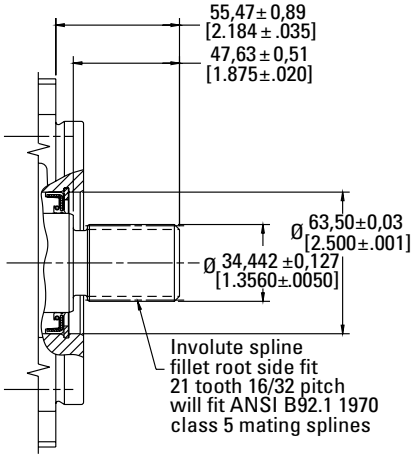
Model Code 13 - 13 Tooth
Torque: 1921 N·m (17.000 lbf·in)



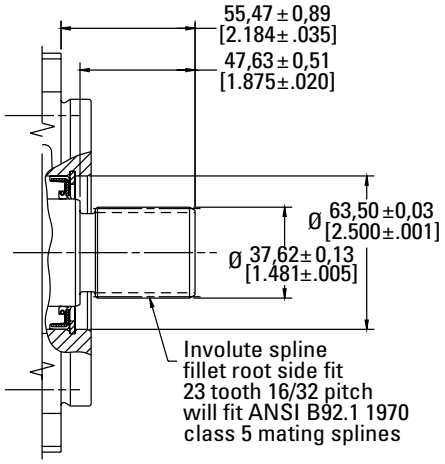
Model Code 14 - 14 Tooth
Torque: 791 N·m (7.000 lbf·in)



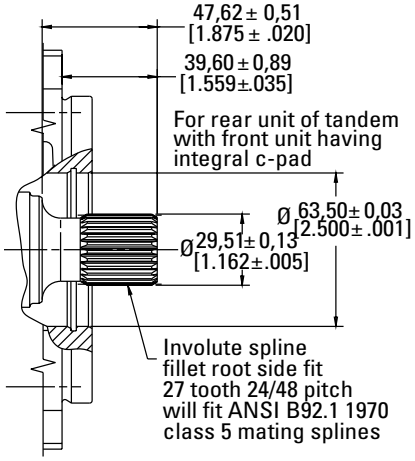
Model Code 21 - 21 Tooth
Torque: 1130 N·m (10.000 lbf·in)



Model Code 23 - 23 Tooth
Torque: 1469 N·m (13.000 lbf·in)



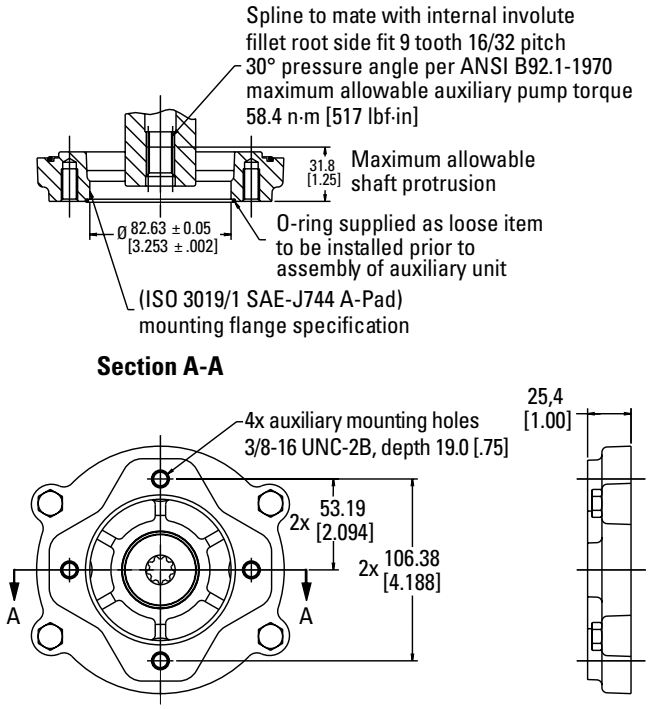
Model Code 28 - 27 Tooth
Torque: 734 N·m (6.500 lbf·in)



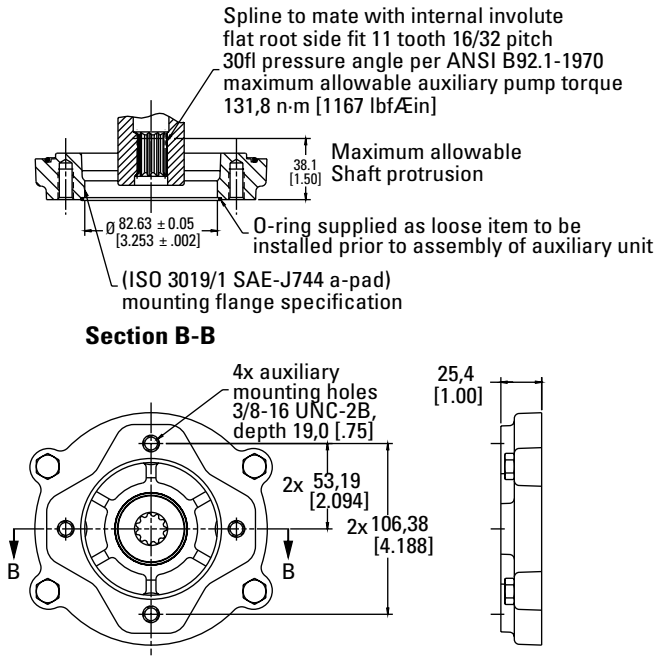
Auxiliary Mount Options

Position 25

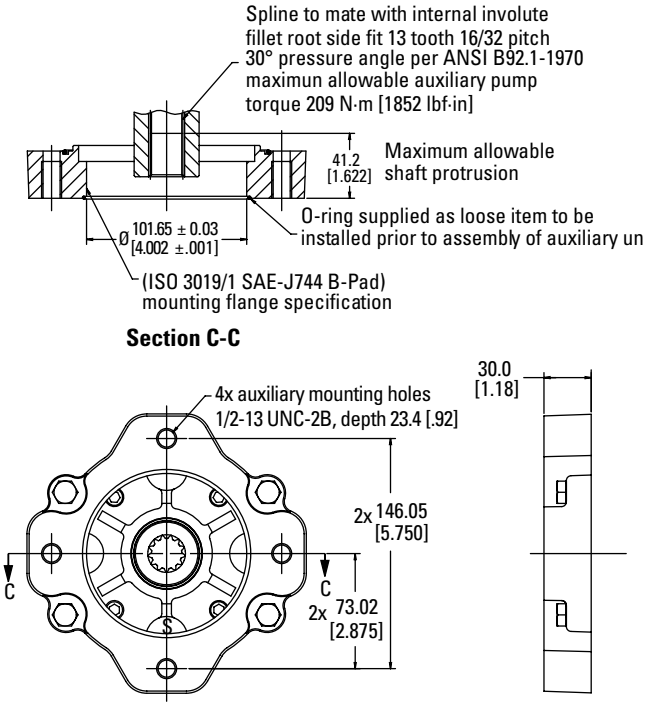
Model Code C - A-pad adapter with 9 tooth
Torque: 113 N·m (1.000 lbf·in)



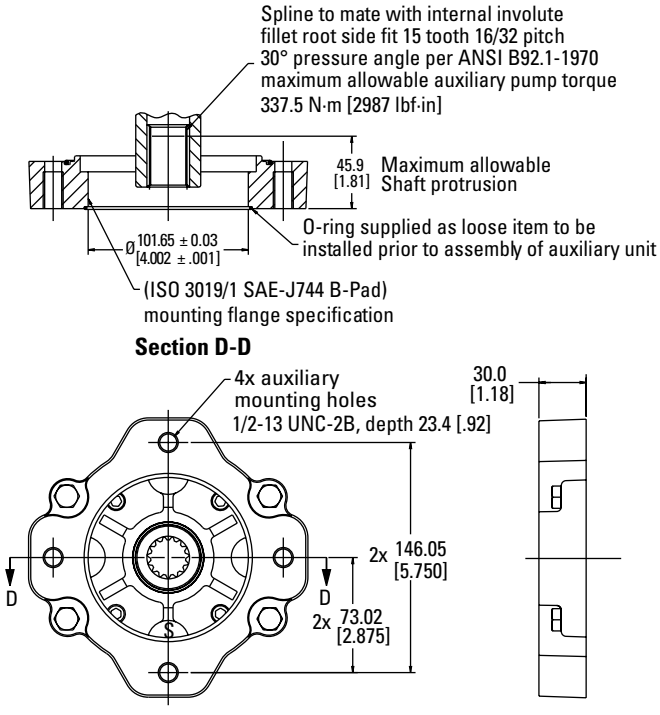
Model Code K - A-pad adapter with 11 tooth
Torque: 170 N·m (1.500 lbf·in)



Model Code D - B-pad adapter with 13 tooth
Torque: 283 N·m (2.500 lbf·in)



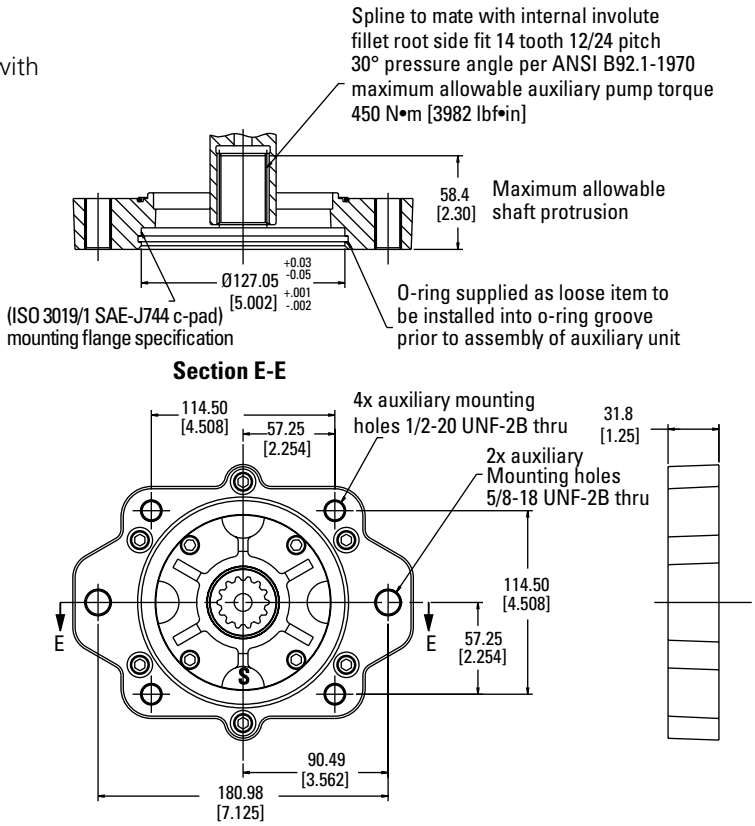
Model Code E - B-B pad adapter with 15 tooth
Torque: 407 N·m (3.600 lbf·in)



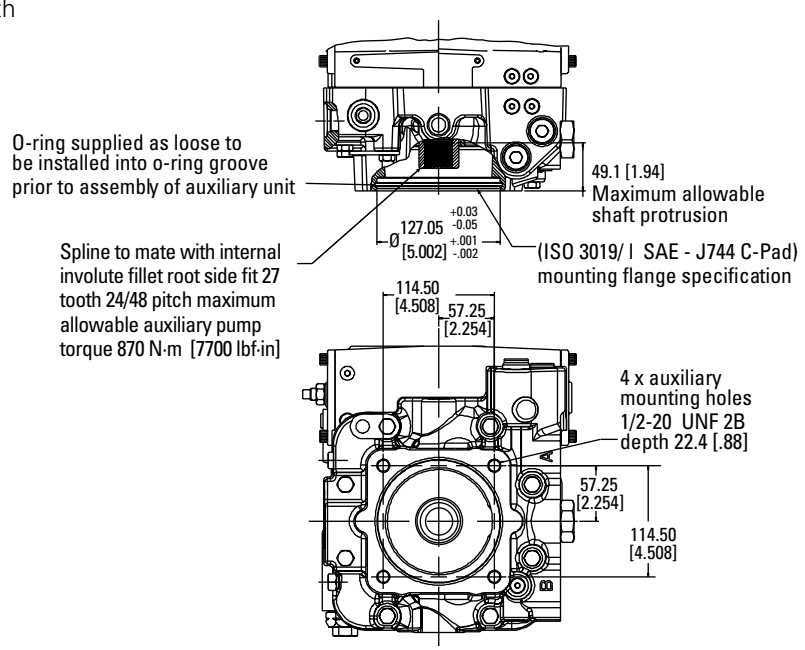
Auxiliary Mount Options

Position 25

Model Code F - C-pad adapter with
14 tooth and charge pump
Torque: 701 N·m (6.200 lbf·in)

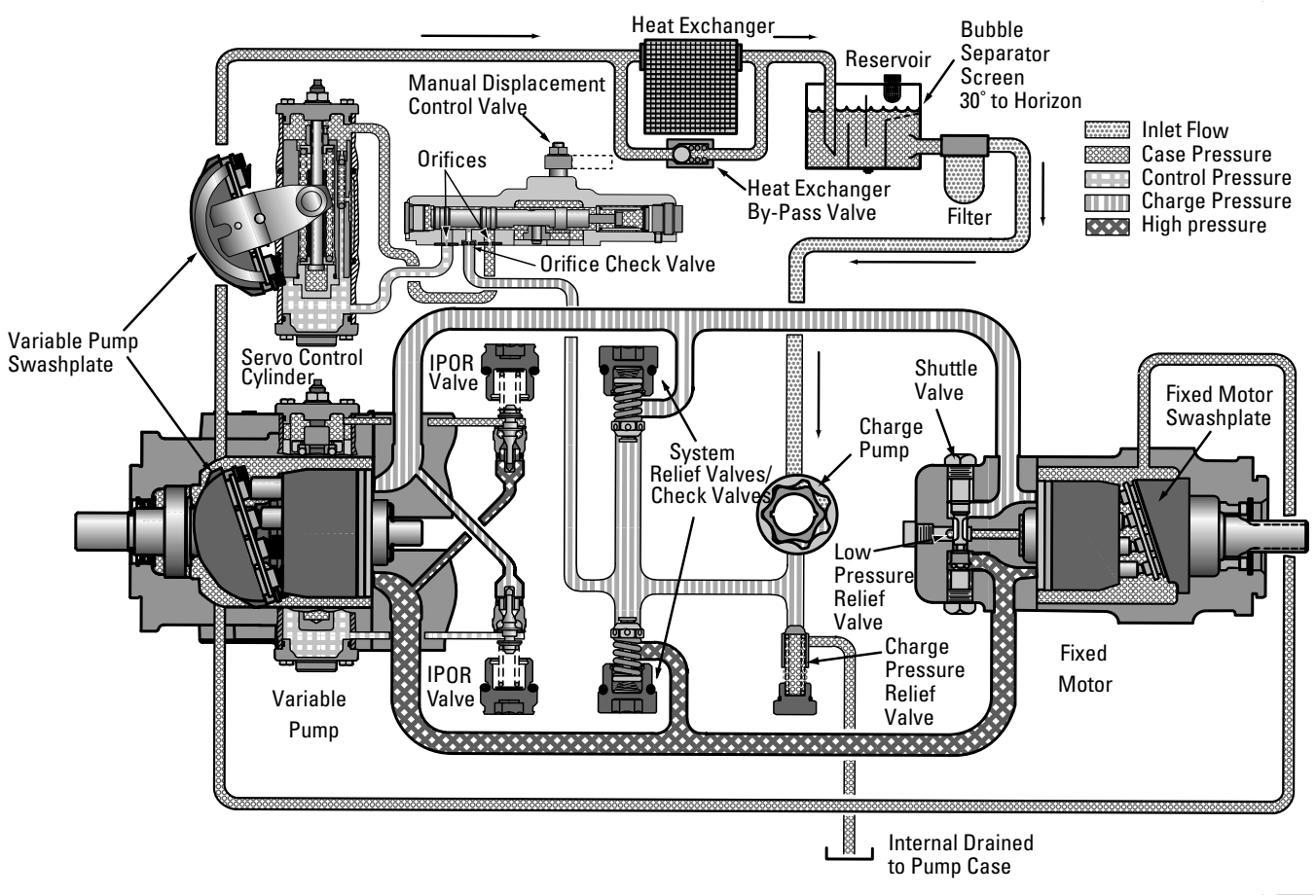


Model Code H - C-pad mount with
27 tooth w/out charge pump
Torque: 814 N·m (7.200 lbf·in)



Operational Diagram

Typical Series 2 Variable Displacement Pump/Fixed Displacement Motor Schematic



Note:

For ease of viewing, the Servo Control Cylinder, Swashplate, and Control Valve are shown removed from the pump.

Component Descriptions

The operational diagram on page 29 shows a typical heavy duty hydrostatic transmission. The axial piston pump and axial piston motor are the main components. The filter, reservoir, heat exchanger, and oil lines make up the rest of the system. The function of each of these components is described below:

A separate energy source, such as an electric motor or internal combustion engine, turns the input shaft of the pump.

Variable Displacement Axial Piston Pump

The variable displacement pump provides a flow of high pressure oil. Pump output flow can be varied to obtain the desired motor output speed. For example, when the pump's displacement is zero, no oil is pumped and the transmission's motor output shaft is stopped. Conversely, maximum pump displacement produces maximum motor shaft speed. The direction of high pressure flow can also be reversed; doing so reverses the direction the motor output shaft rotates.

A charge pump is integrated into the piston pump and driven by the shaft of the piston pump. The drawing illustrates a suction filtration circuit. Eaton recommends a suction filter without a bypass valve. The charge pump has a Low Pressure Relief Valve that regulates the output pressure.

Eaton's Series 2 Pump offers High Pressure Relief Valves and Pressure Override Control for system high pressure protection. (see page 29 for a description of these features).

Fixed Displacement Axial Piston Motor

The motor uses the high pressure oil flow from the pump to produce transmission output. The high pressure oil comes to the motor through one of the high pressure lines. It enters the motor, turns the output shaft, then returns to the pump. Eaton piston motors integrate an hot oil shuttle and low pressure relief valve into the end cover. The shuttle valve and low pressure relief valve direct excess charge pump flow into the motor case. The shuttle valve is activated by high pressure and directs excess charge pump flow over the low pressure relief valve. This flushing action allows the charge pump to provide clean, cool oil to the closed loop circuit.

Reservoir

The reservoir is an important part of the hydrostatic transmission system. It should provide adequate oil storage and allow easy oil maintenance.

The reservoir must hold enough oil to provide a continuous oil supply to the charge pump inlet. It must also have enough room for the hydraulic oil to expand as the system warms up. Consider charge pump flow when sizing the reservoir: One half (.5) minute times (X) the maximum charge pump flow should be the minimum oil volume in the reservoir. Maintaining this oil volume will give the oil a minimum of thirty (30) seconds in the reservoir. This will allow any entrained air to escape and contamination to settle out of the oil.

To allow for oil expansion, the reservoir's total volume should be at least six tenths (.6) minute times (X) the maximum charge pump flow.

The reservoir's internal structure should cut down turbulence and prevent oil aeration.

The line returning flow to the reservoir should be fitted with a diffuser to slow the incoming oil to 1 to 1.2 meters (3-4 feet) per second to help reduce turbulence. The return flow line should also be positioned so that returning oil enters the reservoir below the liquid surface. This will help reduce aeration and foaming of the oil.

The reservoir should have baffles between the return line and suction line. Baffles prevent return flow from immediately reentering the pump.

A sixty mesh screen placed across the suction chamber of the reservoir will act as a bubble separator. The screen should be placed at a thirty degree angle to the horizon.

The entrance to the suction line should be located well below the fluid surface so there is no chance of air being sucked into the charge pump inlet. However, the suction line entrance should not be located on the bottom of the reservoir where there may be a buildup of sediment. The suction line entrance should be flared and covered with a screen.

The reservoir should be easily accessible. The fill port should be designed to minimize the possibility of contamination during filling and to help prevent over filling. There should be a drain plug at the lowest point of the reservoir and it should also have a clean-out and inspection cover so the reservoir can be thoroughly cleaned after prolonged use. A vented reservoir should have a breather cap with a micronic filter.

Sealed reservoirs must be used at altitudes above 2500 feet. These reservoirs should be fitted with a two-way micronic filter pressure cap to allow for fluid expansion and contraction.

In both cases the caps must be designed to prevent water from entering the reservoir during bad weather or machine washing.

A hydrostatic transmission with a well designed reservoir will run quieter, stay cleaner and last longer.

Application Information

Filter

A filter must be used to keep the hydraulic fluid clean. Either a suction filter or a pressure side filter may be used. The filter must be a no-bypass type. A suction filter is shown in the operational diagram on page 29.

System oil particulate levels should not exceed ISO 18/13. Refer to Eaton Hydraulic Fluid Recommendations on page 33.

Recommended beta ratios for each filter type are listed below:

Suction Filter
$ß_{10}$ = 1.5 to 2.0

Pressure Side Filter
$ß_{10}$ = 10 to 20

When a suction filter is used, its flow capacity must be large enough to prevent an excessive pressure drop between the reservoir and charge pump inlet. The pressure at the charge pump inlet port must not be less than 0.8 bar (11.6 psi) absolute at normal continuous operating temperatures.

Charge Pump Inlet Line

The inlet line to the charge pump should be large enough to keep the pressure drop between the reservoir and charge pump inlet within the limits described in the filter section. Fittings will increase the pressure drop, so their number should be kept to a minimum. It is best to keep fluid velocities below 1,25 meters (4 feet) per second.

Fluid and temperature compatibility must be considered when selecting the inlet line.

Pump and Motor Case Drain Lines

The case drain lines should be large enough to limit the pump and motor case pressures to 2,8 bar (40 psi) at normal operating temperatures. Fluid and temperature compatibility must also be considered when selecting the case drain lines.

High Pressure Lines

The high pressure lines that connect the pump and motor must be able to withstand the pressures generated in the high pressure loop.

Heat Exchanger

Use of a heat exchanger is dependent on the transmission's duty cycle and on machine layout. The normal continuous operating fluid temperature measured in the pump and motor cases should not exceed 80°C (180°F) for most hydraulic fluids. The maximum fluid temperature should not exceed 105°C (220°F).

The heat exchanger should be sized to dissipate 25% of the maximum input power available to the transmission. It must also be sized to prevent the case pressures in the pump and motor from getting too high. Case pressure up to 2.8 bar (40 psi), at normal operating temperatures, are acceptable.

Heat Exchanger Bypass Valve

The heat exchanger bypass valve is a pressure and/or temperature valve in parallel with the heat exchanger. Its purpose is to prevent case pressures from getting too high. The heat exchanger bypass valve opens when the oil is thick, especially during cold starts.

Reservoir Return Line

The same general requirements that apply to case drain lines apply to the reservoir return line.

Shaft Couplings and Mounting Brackets

Shaft couplings must be able to with stand the torque that will be transmitted to the pump or motor. If the pump or motor is to be directly coupled to the drive, the misalignment should not exceed .050 mm (.002 in.) total indicator run-out for the combination of perpendicularity and concentricity measurements.

The hardness of the couplings connected to Eaton pump or motor shafts should be 35 Rc for tapered or straight keyed shafts and 50-55 Rc for splined shafts.

Pump Valve Plates

Eaton Heavy duty pumps may be fitted with either a V-groove valve plate or a propel valve plate. Propel valve plates should be used in applications where overrunning loads may be present.

Open Loop Circuits

Eaton heavy duty pumps and heavy duty motors may be used in open loop circuits under certain operating conditions.

Consult your Eaton representative for details.

Orientation

The mounting orientation of Eaton heavy duty pumps and motors is unrestricted. The case drain line that carries the flow leaving the pump or motor should be connected to the highest drain port on each of the units. This assures that the pump and motor cases remain full.

Multiple Pump or Motor Circuits

Multiple pumps or motors can be combined in the same circuit. When two pumps are used in a parallel circuit, their swashplate controls can be operated in phase or in sequence. The following precautions should be observed whenever multiple pumps and/or motors are connected in the same circuit:

1. Charge pump flow must be greater than the sum of the charge pump flow requirements of the individual units.
2. The possibility of motor overspeeding increases in multiple motor circuits. The parallel motor circuit will act as a frictionless differential. Should one of the motors stall the other could overspeed. The motors used in parallel circuits should, therefore, be sized to prevent overspeeding. Valves that will limit the flow to each of the motors may be used to prevent overspeeding. This will allow the use of smaller motors, however the flow limiting valves will create heat.
3. When using one pump with multiple motors, the case drain lines should be connected in series. The case flow should be routed from the most distant motor, through the remaining motors, to the pump, and finally back to the reservoir. The most distant motor should have the valve block or integral shuttle valve while the additional motors do not need a valve block or integral shuttle valve. A remote valve block is also available for multiple motor circuits. A series-parallel drain line circuit may be needed for the high case flow created in multiple pump circuits. In either case, each pump and motor should be checked for proper cooling when testing the prototype circuit.
4. Series circuits present a unique problem for axial piston motors. Pressure applied to the input port and discharge port are additive as regards to the load and life of the drive shaft and the drive shaft bearings. Please consult with your Eaton representative regarding series circuits.

Hydraulic Fluid Recommendations

Introduction

The ability of Eaton hydrostatic components to provide the desired performance and life expectancy depends largely on the fluid used. The purpose of this document is to provide readers with the knowledge required to select the appropriate fluids for use in systems that employ Eaton hydrostatic components.

One of the most important characteristics to consider when choosing a fluid to be used in a hydraulic system is viscosity. Viscosity choice is always a compromise; the fluid must be thin enough to flow easily but thick enough to seal and maintain a lubricating film between bearing and sealing surfaces. Viscosity requirements for Eaton's Heavy Duty Hydrostatic product line are specified later in this document.

Viscosity and Temperature

Fluid temperature affects viscosity. In general, as the fluid warms it gets thinner and its viscosity decreases. The opposite is true when fluid cools. When choosing a fluid, it is important to consider the start-up and operating temperatures of the hydrostatic system . Generally, the fluid is thick when the hydraulic system is started. With movement, the fluid warms to a point where the cooling system begins to operate. From then on, the fluid is maintained at the temperature for which the hydrostatic system was designed. In actual applications this sequence varies; hydrostatic systems are used in many environments from very cold to very hot. Cooling systems also vary from very elaborate to very simple, so ambient temperature may affect operating temperature. Equipment manufacturers who use Eaton hydrostatic components in their products should anticipate temperature in their designs and make the appropriate fluid recommendations to their customers.

In general, an ISO viscosity grade 68 fluid is recommended for operation in cold to moderate climates. An ISO viscosity grade 100 fluid is recommended for operation in moderate to hot climates.

Cleanliness

Cleanliness of the fluid in a hydrostatic system is extremely important. Eaton recommends that the fluid used in its hydrostatic components be maintained at ISO Cleanliness Code 18/13 per SAE J1165. This code allows a maximum of 2500 particles per milliliter greater than 5 mm and a maximum of 80 particles per milliliter greater than 15 mm. When components with different cleanliness requirements are used in the same system, the cleanest standard should be applied. OEM's and distributors who use Eaton hydrostatic components in their products should provide for these requirements in their designs. A reputable filter supplier can supply filter information.

Fluid Maintenance

Maintaining correct fluid viscosity and cleanliness level is essential for all hydrostatic systems. Since Eaton hydrostatic components are used in a wide variety of applications it is impossible for Eaton to publish a fluid maintenance schedule that would cover every situation. Field testing and monitoring are the only ways to get accurate measurements of system cleanliness. OEM's and distributors who use Eaton hydrostatic components should test and establish fluid maintenance schedules for their products. These maintenance schedules should be designed to meet the viscosity and cleanliness requirements laid out in this document.

Fluid Selection

Premium grade petroleum based hydraulic fluids will provide the best performance in Eaton hydrostatic components. These fluids typically contain additives that are beneficial to hydrostatic systems. Eaton recommends fluids that contain anti-wear agents, rust inhibitors, antifoaming agents, and oxidation inhibitors. Premium grade petroleum based hydraulic fluids carry an ISO VG rating.

Hydraulic Fluid Recommendations

Viscosity and Cleanliness Guidelines

Product Line	Minimum	Optimum Range	Maximum	ISO Cleanliness Requirements	Comments
Heavy Duty Piston Pumps and Motors	10cSt (60 SUS)	16 - 39 cSt (80 - 180 SUS)	2158 cSt (10,000 SUS)	18/13	

Additional Notes:

- Fluids too thick to flow in cold weather start-ups will cause pump cavitation and possible damage. Motor cavitation is not a problem during cold start-ups. Thick oil can cause high case pressures which in turn cause shaft seal problems.
- If the natural color of the fluid has become black it is possible that an overheating problem exists.
- If the fluid becomes milky, water contamination may be a problem.
- Take fluid level reading when the system is cold.
- Contact your Eaton representative if you have specific questions about the fluid requirements of Eaton hydrostatic components.

Biodegradable Oil (Vegetable) Guidelines

Product Line	Rating With Biodegradable Oil	Comments
Heavy Duty Piston Pumps and Motors	80% of normal pressure rating listed for mineral oils.	82° C (180° F) max fluid temp (unit) 71° C (160° F) max fluid temp (reservoir)

Additional Notes:

- Viscosity and ISO cleanliness requirements must be maintained as outlined on previous page.
- Based on limited product testing to date, no reduction in unit life is expected when operating at the pressure ratings indicated above.
- Vegetable oil is miscible with mineral oil. However, only the vegetable oil content is biodegradable. Systems being converted from mineral oil to vegetable oil should be repeatedly flushed with vegetable oil to ensure 100% biodegradability.
- Specific vegetable oil products may provide normal unit life when operating at pressure ratings higher than those indicated above.
- Vegetable oils oxidize more quickly than petroleum based hydraulic fluid. Care must be taken to maintain fluid temperature within specified limits and to establish more frequent fluid change intervals.

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Powering Business Worldwide

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Supercedes E-PUPI-MC004-E1
December 2012

Heavy Duty Hydrostatic Transmissions

Series 1 Variable Displacement
Piston Pumps (ACA) and Motors (ACE)
Fixed Displacement Motors (HHD)

Peak pressure 480 bar (7000 psi)
Displacement 64-125 cm^3/r (3.9-7.6 in^3/r)



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Heavy Duty Hydrostatic Transmissions

Features and Benefits

Typical Applications

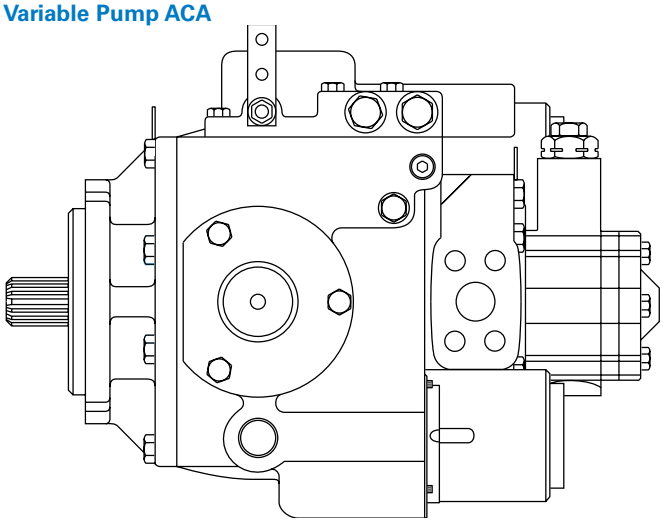
Construction
- Transit Mixer
- Road Roller
- Paver
- Motor Grader
- Loader
- Dozer

Agriculture
- Tractor
- Harvester
- Windrower
- Sprayer
- Planter

Material Handling & Utility
- Crane
- Sweeper
- Lift Truck

Industrial Applications
- Oil & Gas
- Marine

Variable Pump ACA



Drive shafts – a wide variety of options are available to suit every need.

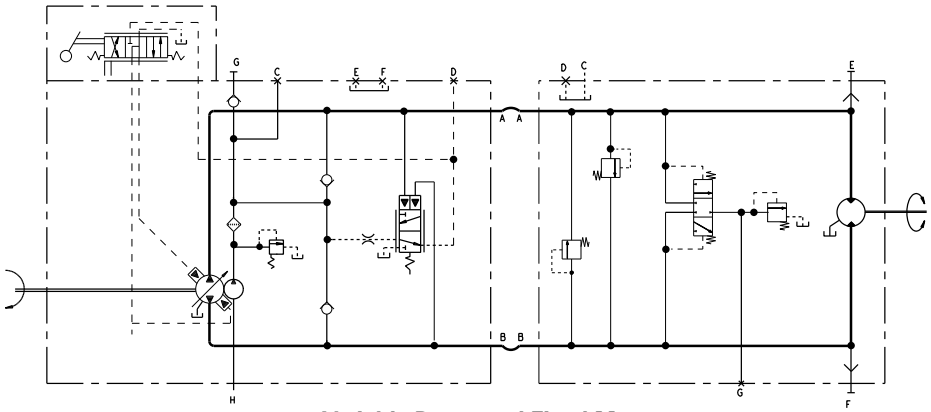
High strength swashplates on variable pumps and motors – resist deflection under high load.

High strength cast iron housings – provide greater noise damping and wall strength.

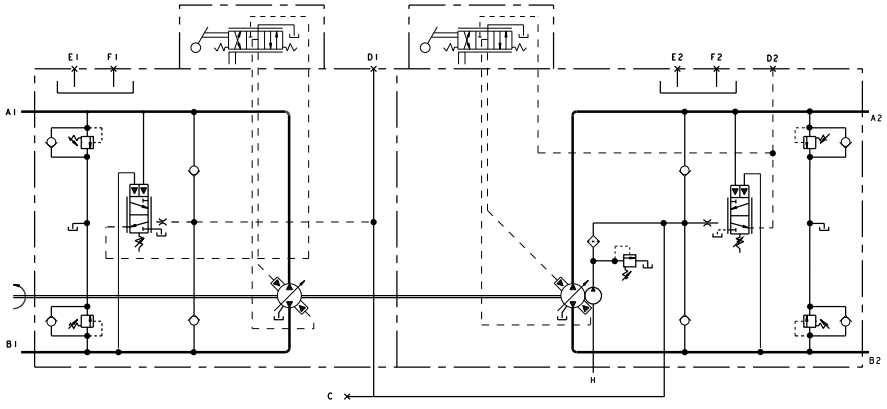
High flow check valves in pumps – keep the system primed with minimal pressure drop.

Charge pumps on pumps – gerotor type, several displacement options are available to suit the needs of every application. All cast iron construction.

Cartridge shaft seal – lends itself to easy serviceability. Mechanical face seal design tolerates high speed and high case pressures.



Variable Pump and Fixed Motor

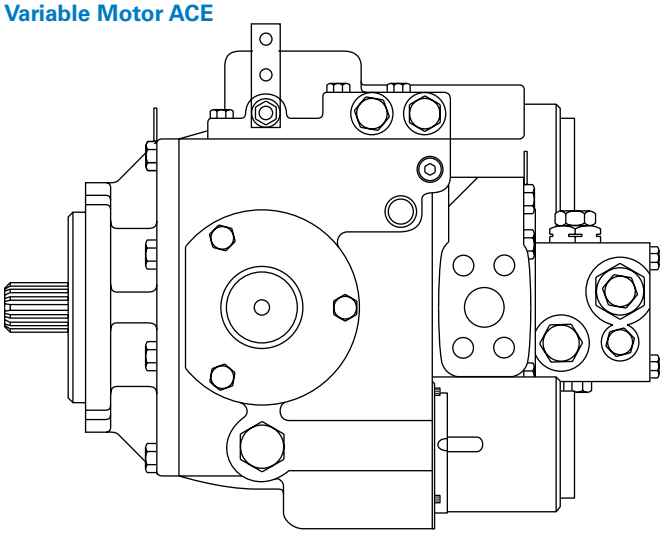


Tandem Variable Pump

Heavy Duty Hydrostatic Transmissions

Features and Benefits

Variable Motor ACE



Bi-metal bearing plate – has steel for high speed and pressure. Bronze provides greater bearing properties.

Valve plate – hardened steel for long life.

End cover – large passages minimizes losses. Both side and rear ports are available on Models 39 through 64 fixed motors.

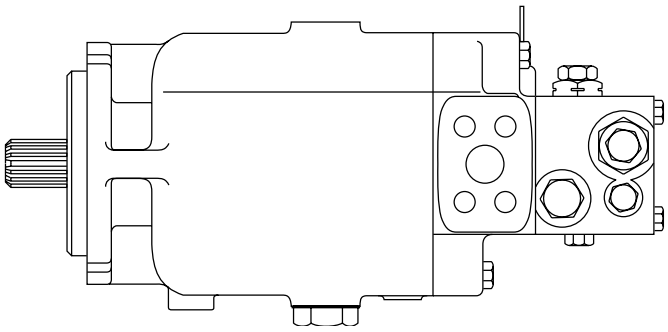
C-Pad rear mount – available on Models 39 through 64 variable pumps for tandem units or for a through shaft.

Relief valves – pilot operated cartridge and fast acting direct types available.

Controls – a wide variety of control options are available for pumps and motors to meet application needs.

Ports – SAE code 61 and code 62 as well as o-ring boss ports are available.

Fixed Motor HDD



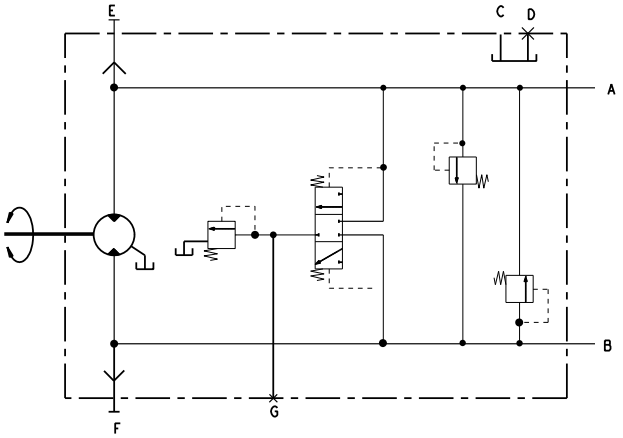
Advanced cylinder barrel design – permits high speed and pressure.

Fixed clearance slipper hold down – on Models 39 through 64 allows operation at high speed and reduces friction. Model 76 is a ball guide unit.

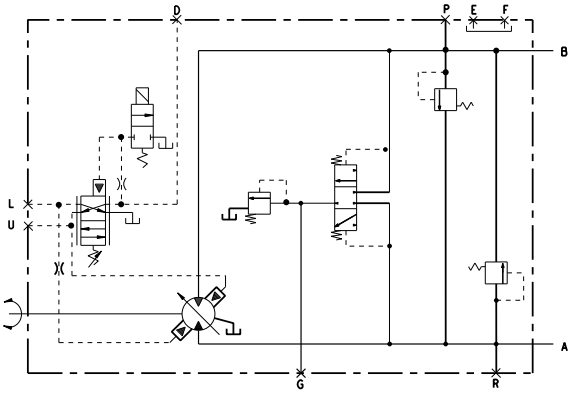
Pistons – have long engagement with cylinder bore resulting in low leakage.

Hydraulic servo control – provides low effort operation with low control pressure. Large servo pistons hold swashplate position and provide damping.

Large case drain ports – minimize case back pressure.



Fixed Motor



Variable Motor

Model Code

ACA Series 1 Variable Pump

The following 33 digit coding system has been developed to identify standard configuration options for the Series 1 Hydrostatic Variable Displacement Pump. Use this model code to specify a pump with the desired features. All 33 digits of the code must be present to release a new product number for ordering.

ACA	39	2	03	02	L	1	A	C	C	EA	A	A	A	2	C	N	A	A	1	0	D	A	15	0	0	B
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	31	32	33

Note: Options in bold fonts are commonly used.

1, 2, 3 Pump Series

ACA – Hydrostatic - Heavy Duty Variable Pump

4,5 Displacement

39 – 63.66 cm^3/r (3.885 in^3/r)
46 – 75.28 cm^3/r (4.594 in^3/r)
54 – 89.13 cm^3/r (5.439 in^3/r)
64 – 105.4 cm^3/r (6.431 in^3/r)
76 – 124;8 cm^3/r (7.616 in^3/r)

6 Type

2 – Variable Displacement Pump

7 Design Type

0 – Ball-Guide (Model 76)
3 – Series 1 (Models 39-64)

8, 9 Input Shaft

01 – (1.500) Diameter straight with (.3750) x (2.5) square key (Models 39-64)
02 – (1.750) Diameter straight with (.4375) x (3.0) square key (Model 76)
13 – 13 Tooth 8/16 pitch spline (Model 76)
14 – 14 Tooth 12/24 pitch spline (Models 33-64)
21 – 21 Tooth 16/32 pitch spline (Models 39-64)
22 – 21 Tooth 16/32 pitch spline with (3.22) extension (Models 46-64)
23 – 23 Tooth 16/32 pitch spline (Models 39-64)
24 – 23 Tooth 16/32 pitch Sspline with 3/8-24 UNF hole (Models 39-64)
25 – 21 Tooth 16/32 pitch spline with 3/8-24 UNF hole (Models 39-64)
27 – 27 Tooth 16/32 pitch spline (Model 76)
30 – 13 Tooth 8/16 pitch spline with (2.93) extension and for 76 seal (Models 54-64)
33 – 13 Tooth 8/16 pitch spline with (2.19) extension and for 76 seal (Model 54)
36 – 21 Tooth 16/32 pitch spline with M10 x 1.5 threaded hole (Models 39-46)
37 – 23 Tooth 16/32 pitch spline with M10 x 1.5 threaded hole (Models 39-54)
38 – 27 Tooth 16/32 pitch spline with (2.93) extension and for 76 seal (Models 54-64)
39 – 34.9 (1.375) Diameter tapered with 9.5 (.3750) x 25.4 (1.00) square key (Models 39-64)
40 – 38 (1.50) Diameter tapered with 9.5 (.3750) x 25.4 (1.00) square key (Models 54-64)
41 – 44 (1.75) Diameter tapered with 11 (.4375) x 25.4 (1.00) square key (Model 76)
44 – 14 Tooth 12/24 pitch spline with M10 x 1.5 threaded hole (Models 39-46)

10 Input Rotation

L – Counterclockwise (Lefthand)
R – Clockwise (Righthand)

11 Valve Plate

0 – Standard (V-groove)
1 – Propel

12 Main Ports

A – 25.4 (1.00) - Code 61 per SAE J518
B – 25.4 (1.00) - Code 62 per SAE J518
D – (1.00) - Code 61 per SAE J518 with port A and B gage ports
E – (1.00) - Code 62 per SAE J518 with port A and B gage ports

13,14 Power Limiter Valve Setting Port A (position 13 and Port B (position 14)

0 – None
C – 103 bar (1500 lbf/in^2)
D – 138 bar (2000 lbf/in^2)
E – 172 bar (2500 lbf/in^2)
F – 207 bar (3000 psi)
G – 241 bar (3500 psi)
H – 276 bar (4000 psi)
J – 310 bar (4500 psi)
K – 345 bar (5000 psi)
L – 379 bar (5500 psi)
M – 414 bar (6000 psi)
N – 448 bar (6500 psi)

15,16 Control Option

0B – Shipping cover, with control feedback link

Electro-proportional

EJ – Electronic proportional control 12 volt DC
EK – Electronic proportional control 24 volt DC
FD – Electronic proportional control, 12VDC, swash plate electronic sensor feedback, de-stroking valve
FE – Electronic proportional control, 24VDC, swash plate electronic sensor feedback, de-stroking valve
SC – Electric control 12 volt with swashplate feedback sensor, with electrical connectors DIN 43650
SD – Electric control 24 volt with swashplate feedback sensor, with electrical connectors DIN 43650

Forward-Neutral-Reverse

FR – Forward-neutral-reverse control 12 volt DC with 2-pin weatherpack connector
FS – Forward-neutral-reverse control 24 volt DC with 2-pin weatherpack connector

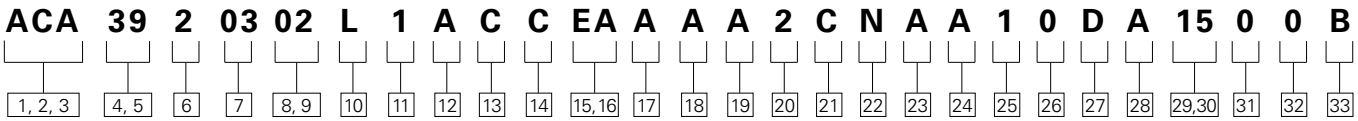
Hydraulic Remote

HA – Hydraulic remote 1.4-14.1 bar (20-205 psi)
HB – Hydraulic remote 1.4-14.1 bar (20-205 psi) with wide band neutral
HC – Hydraulic remote 3.1-14.5 bar (45-210 psi)
HD – Hydraulic remote 4.5-20.0 bar (65-290 psi)
HF – Hydrualic remote 4.5-20.0 bar (65-290 psi) with wide band neutral
HG – Hydraulic remote 4,5-20,0 bar (65-290 lbf/in^2) with 12vdc (NC) destroke valve (non-manifold) with electrical connector (male only) per din 43650
HH – Hydraulic remote 11,0-32,4 bar (160-470 lbf/in^2)
HJ – Hydraulic remote 3.1-14.5 bar (45-210 psi) with wide band neutral
HK – Hydraulic remote 4,5-20,0 bar (65-290 lbf/in^2) with 12vdc (NC) destroke valve (non-manifold) with electrical connectors (male & female) per din 43650 for 6,0-10,0 (.24-.39) diameter cable

Model Code

ACA Series 1 Variable Pump

The following 33 digit coding system has been developed to identify standard configuration options for the Series 1 Hydrostatic Variable Displacement Pump. Use this model code to specify a pump with the desired features. All 33 digits of the code must be present to release a new product number for ordering.



Note: Options in bold fonts are commonly used.

Mechanical Manual

MA – Manual

MB – Manual with wide band neutral and 3/4-16UN plug in neutral lockout port

MC – Manual with wide band neutral

MD – Manual With (NC) neutral lockout switch (wide band neutral)

ME – Manual with neutral detent (wide band neutral)

MJ – Manual with destroke valve (manifold) 12vdc (NO) 3 pin weatherpack connector

MK – Manual With Neutral Detent (Wide Band Neutral) And 24Vdc (Nc) Destroke Valve (Non-Manifold) With Electrical Connectors (Male & Female) Per Din 43650 For 4,5-8,0(.18-.31) Diameter cable

ML – Manual with (NC) neutral lockout switch (wide band neutral) and 12vdc (NC) destroke valve (non-manifold) with electrical connectors (male & female) per DIN 43650 for 4,5-8,0(.18-.31) diameter cable

MM – Manual with (NO) neutral lockout switch (wide band neutral) and destroke valve (manifold) 12vdc with 2 pin weather pack connector

MN – Manual with (NC) neutral lockout switch (wide band neutral) and destroke valve 12vdc (NO), (non-manifold), no manual override, 2 pin weatherpack connector mounted connector down

MP – Manual with destroke valve (non-manifold) 12vdc (NO), 3 pin packard connector mounted right angle up

MS – Manual with wide band neutral and 24vdc (NC) destroke valve (non-manifold) with electrical connectors (male & female) per din 43650 for 4,5-8,0(.18-.31) diameter cable

MT – With wide band neutral and inching valve with seal

MU – Manual with wide band neutral, inching valve with seal and neutral detent

MV – With wide band neutral, inching valve with seal and neutral lockout switch (NC)

MW – Manual with destroke valve (manifold) 12vdc (NO) with 2 pin weatherpack connector

MZ – Manual with (NC) neutral lockout switch (wide band neutral) with packard 2 pin connector

NA – Manual with destroke valve (manifold) 12vdc (NO) 3 pin weatherpack connector and (NC) neutral lockout switch (wide band neutral) with packard 2 pin connector

NB – Manual with destroke valve (manifold) 24vdc (NO) 2 pin weatherpack connector

NC – Manual with wide band neutral, inching valve with seal and neutral lockout switch (NC) with packard 2 pin connector

ND – Manual with destroke valve (manifold) 12vdc (NO) with 2 pin weatherpack connector with (NC) neutral lockout switch (wide band neutral) with packard 2 pin connector

NG – Manual with (NC) neutral lockout switch (wide band neutral) and destroke valve (manifold) 12vdc (NC) with 2 pin weatherpack connector

NH – Manual with neutral detent (wide band neutral) and 12vdc (NO) destroke valve (manifold) with manual override and electrical connectors (male & female) per DIN 43650 for 4.5-8.0(.18-.31) diameter cable

NK – Manual with wide band neutral, inching valve with seal and neutral lockout switch (NO)

NR – Manual with destroke valve (manifold) 12vdc (NO) with 2 pin weatherpack connector. no manual override. (NC) neutral lockout switch (wide band neutral) with packard 2 pin connector

NS – Manual with (NC) neutral lockout switch (wide band neutral) and destroke valve (manifold) 24vdc (NC) with 2 pin weatherpack connector

NT – Manual with (NC) neutral lockout switch (wide band neutral) and destroke valve (manifold) 12vdc (NO) with 2 pin metri-pack connector

NV – Manual with (NC) neutral lockout switch (wide band neutral) and destroke valve (manifold) 24vdc (NO) with 2 pin weatherpack connector

NW – Manual with (NC) neutral lockout switch (wide band neutral) with weatherpack (2) pin connector and destroke valve (manifold) 12vdc (NO) with 2 pin metri-pack connector

PA – Port plate, no control feedback link

Remote Electric

RD – Remote electric with (NC) destroke valve, (3) 12vdc with (1) 2 pin and (1) 4 pin weatherpak connectors, no displacement control, with 0,33 (.013) control supply orifice

RE – Remote electric with (NC) destroke valve, (3) 12vdc with (3) 2 pin weatherpak connectors, no displacement limiter, with 0,33 (.013) control supply orifice

RF – Remote electric with (nc) destroke valve including 3,58 (.141) orifice, (3) 12vdc with (3) 2 pin weatherpak connectors, no displacement limiter, with 0,33 (.013) control supply orifice

RG – Remote electric with (NC) destroke valve, (3) 24vdc with (3) 2 pin weatherpak connectors, no displacement limiter, with 0,33 (.013) control supply orifice

Model Code

ACA Series 1 Variable Pump

The following 33 digit coding system has been developed to identify standard configuration options for the Series 1 Hydrostatic Variable Displacement Pump. Use this model code to specify a pump with the desired features. All 33 digits of the code must be present to release a new product number for ordering.

ACA	39	2	03	02	L	1	A	C	C	EA	A	A	A	2	C	N	A	A	1	0	D	A	15	0	0	B
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	31	32	33

Note: Options in bold fonts are commonly used.

RH – Remote electric with (NC) destroke valve including 3,18 (.125) orifice, (3) 12vdc with (1) 2 pin and (1) 4 pin weatherpak connectors, no displacement limiter, with 0,33 (.013) control supply orifice

RJ – Remote electric with (NO) destroke valve including 3,58(.141) orifice, (3) 12vdc with (3) 2 pin weatherpak connectors, no displacement limiter, with 0,33 (.013) control supply orifice

RK – Remote electric with (NC) destroke valve, (3) 12vdc with wireleads, no displacement limiter, with 0,33 (.013) control supply orifice

17,18,19 Control Supply Orifice

P (pos. 17)
Upper Servo (S1 pos. 18)
Lower Servo (S2 pos. 19)

0 – None
A – 0.71 (.028) Diameter
B – 0.91 (.036) Diameter
C – 1.12 (.044) Diameter
D – 1.32 (.052) Diameter
E – 1.45 (.057) Diameter
F – 1.65 (.065) Diameter
G – 1.85 (.073) Diameter
H – 2.39 (.094) Diameter
J – 2.59 (.102) Diameter

20 Pressure Override

0 – None
2 – Internal Pressure Override
5 – Internal Pressure Override Externally Adjustable

21 Pressure Setting for Pressure Override

0 – None
1 – 196 bar (2850 lbf/in²)
D – 138 bar (2000 psi)
E – 172 bar (2500 psi)
F – 207 bar (3000 psi)
G – 241 bar (3500 psi)
H – 276 bar (4000 psi)
J – 310 bar (4500 psi)
K – 345 bar (5000 psi)
L – 379 bar (5500 psi)
M – 414 bar (6000 psi)
P – 362 bar (5250 lbf/in²)

22 Control Special Features

0 – No control special features
3 – Manual control lever with attachment holes located 66;7 (2.625) and 82;6 (3.25) and 98;4 (3.875) from control shaft mounting hole
6 – Control special features severe duty coils with boots for electronic proportional control with weather-pack connector
7 – Severe duty coils with boots for electronic proportional control
8 – Manual control lever with attachment hole located 98;4 (3.875) from control shaft mounting hole
A – No manual control lever
B – Hardened Standard Manual Control lever mounted parallel to the pump drive shaft towards the mounting flange
D – Hardened standard manual control lever
E – Manual control lever with attachment hole 71;9 (2.83) from control shaft mounting hole. lever mounted parallel to pump drive shaft towards the mounting flange
H – Manual control lever with ball stud mounted 50;8 (2.00) from control shaft mounting hole. lever mounted parallel to pump drive shaft towards mounting flange
K – Manual control lever with 10;4 (0.41) diameter attachment hole 50;8 (2.00) from control shaft mounting hole
M – Manual control lever with ball stud mounted 76;2 (3.00) from control shaft mounting hole. Lever mounted parallel to pump drive shaft towards mounting flange.
N – Manual control lever with external torsion spring mechanism for neutral return
S – Manual control lever with two 1/4-28 UNF attachment holes located at 85;7 (3.375) and 98;4 (3.875) from control shaft mounting hole. Lever mounted parallel to pump drive shaft towards mounting flange.
W – Manual control lever mounted 1 to 2 spline teeth from vertical with external torsion spring mechanism for neutral return
Y – Manual control lever with two 1/4-28 UNF attachment holes located at 85;7 (3.375) and 98;4 (3.875) from control shaft mounting hole

23 Charge Pump

0 – Charge pump included
2 – Charge pump with integral pressure filter mounted on the -A- port side
3 – Charge pump with short element integral pressure filter mounted on the -A- port side and external discharge port for 7/8-14 UNF-2B SAE O-ring fitting with steel hex plug
A – Charge pump with remote pressure filter ports on the -A- port side
B – Charge pump with integral pressure filter mounted on the -B- port side
C – Charge pump with J.Deere integral pressure filter mounted on the -B- port side. diagnostic fitting included
D – Charge pump with external discharge port for 7/8-14 UNF SAE O-ring fitting. With steel hex plug
E – No charge pump

Model Code

ACA Series 1 Variable Pump

The following 33 digit coding system has been developed to identify standard configuration options for the Series 1 Hydrostatic Variable Displacement Pump. Use this model code to specify a pump with the desired features. All 33 digits of the code must be present to release a new product number for ordering.

ACA	39	2	03	02	L	1	A	C	C	EA	A	A	A	2	C	N	A	A	1	0	D	A	15	0	0	B
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	31	32	33

Note: Options in bold fonts are commonly used.

F – Charge pump with external discharge port with 90 degree. 7/8-14 UNF. 37 degree flare tube fitting

G – Charge pump with integral pressure filter and diagnostic fitting mounted on the -B- port side plus inlet gage port with hex plug

H – Charge pump with remote pressure filter ports on -A- port side and inlet gage port on -B- port side

J – Charge pump with integral pressure filter and diagnostic fitting; mounted on the -B- port side and external discharge port with 90 degree; 7/8-14 UNF; 37 degree flare; tube fitting

K – Charge pump with remote pressure filter ports on the -B- port side and external discharge port with 90 degree; 7/8-14 UNF; 37 degree flare; tube fitting

L – Charge pump with integral pressure filter and diagnostic fitting; mounted on the -B- port side and external discharge port with straight; 7/8-14 UNF; 37 degree flare; tube fitting

M – Charge pump with remote pressure filter ports on the -B- port side and external discharge port with straight 7/8-14 UNF SAE O-ring to 3/4-16 UNF; 37 degree flare; tube fitting

P – Charge pump with remote pressure filter ports on the -B- port side and external discharge port with straight 7/8-14 UNF; 37 degree flare; tube fitting

R – No charge pump; with remote pressure filter ports on the -B- port side and external discharge port with 90 degree; 7/8-14 UNF; 37 degree flare; tube fitting

S – Charge pump with integral pressure filter and diagnostic fitting; mounted on the -B- port side and external discharge port for 7/8-14 UNF-2B SAE O-ring fitting; with steel hex plug

T – Charge pump with external discharge port with straight 7/8-14 UNF; 37 degree flare; tube fitting

U – Charge pump with integral pressure filter; mounted on the -B- port side and external discharge port for 7/8-14 UNF-2B SAE O-ring fitting; with steel hex plug

W – Charge pump with integral pressure filter mounted on the -A- port side and external discharge port for 7/8-14 UNF-2B SAE O-ring fitting with steel hex plug

Y – Charge pump with remote pressure filter ports on the -B- port side and external discharge port for 7/8-14 UNF-2B SAE O-ring fitting with steel hex plug

Z – Charge pump with remote pressure filter ports on the -B- port side

24 Auxiliary Mounting

0 – No auxiliary mounting

1 – SAE B-pad, no shaft seal and M12x 1.75-6H Thd

A – SAE A-pad. With shaft seal (dry)

B – SAE B-pad. With shaft seal (dry)

C – SAE A-pad. No shaft seal (wet)

E – SAE C-pad. (Typically front pump of tandem) no shaft seal. Includes 14 tooth 12/24 pitch spline coupling. Charge pressure inlet port with 7/8-14 UNF. 37 degree flare. Tube fitting (45 degree for models 33-46 and straight for models 54-64)

F – SAE B-pad; no shaft seal

G – SAE C-pad; (typically front pump of tandem) no shaft seal; Includes 21 tooth 16/32 pitch spline coupling; Charge pressure inlet port with 7/8-14 UNF; 37 degree flare; Tube fitting (45 degree for models 33-46 and straight for models 54-64)

H – SAE C-pad; (typically front pump of tandem) no shaft seal; Includes 23 tooth 16/32 pitch spline coupling; Charge pressure inlet port with 7/8-14 UNF; 37 degree flare; Tube fitting (45 degree for models 33-46 and straight for models 54-64)

L – SAE C-pad; (typically front pump of tandem) no shaft seal; Includes 14 tooth 12/24 pitch spline coupling; With 7/8-14 SAE O-ring port for charge pressure inlet (no fitting provided)(models 54-64)

N – SAE C-pad; (Typically front pump of tandem) no shaft seal; Includes 14 tooth 12/24 pitch spline coupling; Charge pressure inlet port with 45 deg 7/8-14 UNF; 37 Degree flare; Tube fitting (For models 54-64 Only)

P – SAE C-pad; (Front of tandem) No shaft seal; includes 14 tooth 12/24 Pitch spline coupling; Chg press inlet port with 7/8-14 UNF; 37 deg flare; Tube fitting (45 deg for models 33-64);Chg press gage port 7/8-14 UNF-2A capped

R – SAE A-pad With 11 tooth 16/32 pitch internal spline; No shaft seal (wet)

S – SAE C-pad; (Typically front pump of tandem) no shaft seal; Includes 14 tooth 12/24 pitch spline coupling; Charge pressure inlet port with 7/8-14 UNF; 37 Degree flare; Tube fitting (Straight for models 33-46)

U – SAE C-pad; (Typically front pump of tandem) no shaft seal; Includes 14 tooth 12/24 pitch spline coupling; Charge pressure inlet port on pump centerline with 7/8-14 UNF; 37 Deg flare; Tube fitting (45 degree for models 33-46 and straight for models 54-64)

25 Charge Pump Displacement

0 – No Charge Pump

1 – 13.9 cm^3/r (0.85 in^3/r)

2 – 17.4 cm^3/r (1.06 in^3/r)

3 – 21.0 cm^3/r (1.28 in^3/r)

4 – 27.9 cm^3/r (1.70 in^3/r)

5 – 34.7 cm^3/r (2.12 in^3/r)

Model Code

ACA Series 1 Variable Pump

The following 33 digit coding system has been developed to identify standard configuration options for the Series 1 Hydrostatic Variable Displacement Pump. Use this model code to specify a pump with the desired features. All 33 digits of the code must be present to release a new product number for ordering.

ACA	39	2	03	02	L	1	A	C	C	EA	A	A	A	2	C	N	A	A	1	0	D	A	15	0	0	B
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	31	32	33

Note: Options in bold fonts are commonly used.

26 2nd Displacement of Dual Element

0 – No Dual Element

27 Charge Pressure Rel Valve Setting

0 – None
D – 15 bar (220 psi) - Standard
E – 16 bar (240 lbf/in²)
F – 18 bar (260 lbf/in²)
G – 19 bar (280 psi)
H – 21 bar (300 lbf/in²)
J – 22 bar (320 lbf/in²)
K – 23 bar (340 psi)
L – 24 bar (350 lbf/in²)
M – 26 bar (380 lbf/in²)
N – 28 bar (410 lbf/in²)

28 Charge Pump Special Features

0 – No charge pump special features
A – Steel core charge pump gasket
B – Steel core charge pump gasket and 90 degree inlet fitting; 1 5/8-12 UN threaded end for 37 degree flare tubing ((1.25) OD tubing; (1.25) ID hose)
J – Steel core charge pump gasket; needle bearing
M – Charge inlet manifold with charge relief valve
N – Steel core charge pump gasket and charge inlet mainifold with charge relief valve
P – Charge inlet manifold with external discharge port for 7/8-14 unf sae o-ring port and steel hex plug in inlet port

29,30 Special Pump Assembly Features

00 – No special features
05 – Bottom servo piston with 0.0 degree stop
11 – Both servo sleeves have 1/2-20 UNF-2B thread and steel hex bolts
12 – Bottom servo sleeve has 7/8-14 UNF SAE O-ring port with hex steel plug
13 – Model 76 shaft seal and grade 8 bolts in mounting flange to pump housing (models 54-64)
14 – Special thick section end cover gasket
15 – Rear pump unit for tandem pump assembly (no shaft seal)
18 – Hi-Speed rotating group (model 76)
32 – Both servo sleeves have 7/8-14 UNF SAE O-Ring ports and steel hex plugs
39 – Bottom servo piston with externally adjustable stop
40 – Both servo pistons with externally adjustable stops
53 – Model 76 shaft seal
58 – 1350 Series end yoke assembled to drive shaft (Pos 8,9 must be Code 40)
59 – 1310 Series end yoke assembled to drive shaft (Pos 8,9 must be Code 40)
67 – Metal case drain plug in both ports
79 – Rear pump unit for tandem pump assembly (no shaft seal), both servo pistons with externally adjustable stops
82 – Rear pump unit for tandem assembly (no shaft seal), top servo piston with externally adjustable stop
83 – Externally adjustable displacement stops set at 3.32 in³/rev (54.4cc/rev)

31 Paint and Packaging

0 – Painted primer blue (standard)
A – Painted finish black

32 Identification on Unit

0 – Standard

33 Design Code

A – A
B – B

Model Code

HHD Fixed Motor

The following 23 digit coding system has been developed to identify standard configuration options for the Series 1 Hydrostatic Fixed Displacement Motor. Use this model code to specify a motor with the desired features. All 23-digits of the code must be present to release a new product number for ordering.

HHD	39	3	0	01	A	A	0	0	0	0	0	0	0	00	0	0	B
1, 2, 3	4, 5	6	7	8, 9	10	11	12	13	14	15	16	17	18	19,20	21	22	23

Note: Options in bold fonts are commonly used.

1, 2, 3 Pump Series

HHD – Heavy Duty Hydrostatic Fixed Displacement Motor

4,5 Displacement

33 – 54 cm^3/r (3.3 in^3/r) at 15.5 deg. swashplate angle
39 – 64 cm^3/r (3.9 in^3/r) at 18 deg. swashplate angle
46 – 75 cm^3/r (4.6 in^3/r) at 18 deg. swashplate angle
54 – 89 cm^3/r (5.4 in^3/r) at 18 deg. swashplate angle
64 – 105 cm^3/r (6.4 in^3/r) at 18 deg. swashplate angle
76 – 125 cm^3/r (7.6 in^3/r) at 18 deg. swashplate angle

6 Type

3 – Fixed displacement motor

7 Design Type

0 – Ball-guide - (model 76)
3 – Bixed clearance - (models 39-64)

8, 9 Input Shaft

01 – (1.50) Diameter straight with (.38) x (2.5) square key (models 39-64)
02 – (1.75) Diameter straight with (.44) x (3.0) square key (model 76)
06 – (1.50) Diameter straight with (.38 x (2.5) square key with 3/8-24 UNF x (.75) DP hole in end of shaft (models 39-64)
07 – (1.75) Diameter straight with (.44) x (3.0) square key with 3/8-24 UNF x (.75) dp hole in end of shaft (model 76)
13 – 13 Tooth 8/16 pitch spline (model 76)
14 – 14 Tooth 12/24 pitch spline (models 39-64)
21 – 21 Tooth 16/32 pitch spline (models 39-64)
23 – 23 Tooth 16/32 pitch spline (models 39-64)
24 – 23 Tooth 16/32 pitch spline with (1.92) extension (models 39-64)
25 – 23 Tooth 16/32 pitch spline with 3/8-24 UNF x (.75) DP hole in end of shaft (models 39-64)
27 – 27 Tooth 16/32 pitch spline (model 76)
29 – 14 Tooth 12/24 pitch spline with 3/8-24 UNF x (.75) DP hole in end of shaft (models 39-64)
30 – 21 Tooth 16/32 pitch spline with 3/8-24 UNF x (.75) DP hole in end of shaft (models 39-64)
31 – 17 Tooth 12/24 pitch spline with (2.54) extension (model 76)
32 – (1.50) Diameter tapered with (.38) x (1.00) square key (models 39-64)
33 – 21 Tooth 16/32 pitch spline with M10 x 1.5 threaded hole (models 39-64)
34 – (1.38) Diameter tapered with (.38) x (1.00) square key (models 39-64)
35 – 14 Tooth 12/24 pitch spline (models 39-64) shot peened shaft
37 – 13 Tooth 8/16 pitch spline with (2.93) extension and for 76 seal (models 54-64)
38 – (1.75) Diameter tapered with (.44) x (1.00) square key (model 76)
39 – (1.75) diameter straight with (.38) x (2.00) square key with (2.22) extension (model 39-64 with 76 seal)
41 – 27 tooth 16/32 pitch spline with 2.19 extension and for 76 seal (models 39-64)

10 Main Ports

A – (1.00) SAE 4-bolt split flange port, standard pressure series (code 61)
B – (1.00) SAE 4-bolt split flange port, high pressure series (code 62)
C – 1 5/16-12 UN-2B SAE O-ring port
F – (1.00) SAE 4-bolt split flange port, standard pressure series (code 61) with (2) gauge/pilot pressure ports for .4375-20 UNF-2B SAE O-ring fittings
G – (1.00) SAE 4-bolt split flange port, high pressure series (code 62) with (2) gauge/pilot pressure ports for .4375-20 UNF-2b SAE O-ring fittings
J – Rear ports - (1.00) SAE 4-bolt split flange port, standard pressure series (code 61)
K – Rear ports - (1.00) SAE 4-bolt split flange port, high pressure series (code 62) with diagnostic fittings per SAE J1502 (U.S. units)

11 End Cover and Composite Valve Block Assy

A – Standard end cover, composite valve block with high-rate shuttle valve springs
B – Standard end cover, composite valve block with low-rate shuttle valve springs
C – No composite valve block - with cover plate
D – No composite valve block
G – Integral shuttle valve with low-rate shuttle valve springs and charge pressure relief valve
H – Integral shuttle valve with high-rate shuttle valve springs and charge pressure relief valve
J – Composite valve block without charge pressure relief valve or shuttle valve, but with high pressure relief valves
K – Integral shuttle valve and low pressure relief valve not included - rear ports
N – Integral shuttle valve with low-rate shuttle valve springs and charge pressure relief valve, valve block with high pressure relief valve on side -A- only
P – Standard end cover, shuttle valve block with high-rate shuttle valve springs
R – Integral shuttle valve and low press relief valve not included, removable orifice (.073), rear ports
S – Integral shuttle valve with high-rate shuttle valve springs and charge pressure relief valve, valve block with high pressure relief valves with threaded retainer
T – Composite valve block without charge pressure relief valve or shuttle valve, but with high pressure relief valve with threaded retainer on side -A- only
U – standard end cover, shuttle valve block with low-rate shuttle valve springs

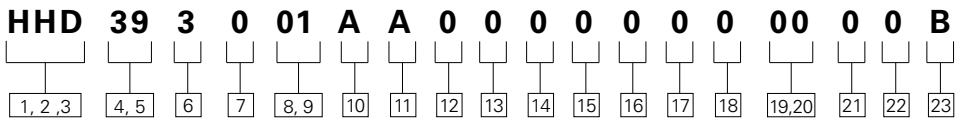
12 Charge Pressure Relief Valve

0 – No relief valve
1 – Standard
2 – Orificed charge pressure relief valve (for composite valve blocks only)
3 – Plugged, no relief valve function

Model Code

HHD Fixed Motor

The following 23 digit coding system has been developed to identify standard configuration options for the Series 1 Hydrostatic Fixed Displacement Motor. Use this model code to specify a motor with the desired features. All 23-digits of the code must be present to release a new product number for ordering.



Note: Options in bold fonts are commonly used.

13 Charge Pressure Relief Valve Setting

0 – none
B – 11,0 bar (160 lbf/in²)
C – 12,4 bar (180 lbf/in²)
D – 13,8 bar (200 lbf/in²)
E – 15,2 bar (220 lbf/in²)
F – 16,6 bar (240 lbf/in²)
G – 17,9 bar (260 lbf/in²)
H – 19,3 bar (280 lbf/in²)
J – 20,7 bar (300 lbf/in²)
K – 24,0 bar (350 lbf/in²)
L – 22,5 bar (326.6 lbf/in²)

14,16 High Pressure Relief Valve – Port A (Pos. 14) Port B (Pos. 16)

0 – None
1 – Standard
2 – Remote pilot operated relief valve
3 – Standard with threaded retainer
4 – Remote pilot operated relief valve with threaded retainer
7 – Remote pilot operated relief valve with o-ring face seal fitting
8 – Remote pilot operated relief valve with threaded retainer, special orifice and spring, with o-ring face seal fitting
9 – Anti-cavitation check valve

15,17 High Pressure Relief Valve Setting – Port A (Pos. 15) Port B (Pos. 17)

0 – None
1 – 11 bar (160 lbf/in²)
2 – 12,4 bar (180 lbf/in²)
3 – 13,8 bar (200 lbf/in²)
4 – 15,2 bar (220 lbf/in²)
5 – 16,6 bar (240 lbf/in²)
6 – 17,9 bar (260 lbf/in²)
7 – 19,3 bar (280 lbf/in²)
8 – 28,3 bar (410 lbf/in²)
C – 103 bar (1500 lbf/in²)
D – 138 bar (2000 lbf/in²)
E – 172 bar (2500 lbf/in²)
F – 207 bar (3000 lbf/in²)
G – 241 bar (3500 lbf/in²)
H – 276 bar (4000 lbf/in²)
J – 310 bar (4500 lbf/in²)
K – 345 bar (5000 lbf/in²)
L – 379 bar (5500 lbf/in²)
M – 414 bar (6000 lbf/in²)
N – 448 bar (6500 lbf/in²)
P – 483 bar (7000 lbf/in²)
Q – 155 bar (2250 lbf/in²)
R – 362 bar (5250 lbf/in²)
S – 466 bar (6750 lbf/in²)
T – 359 bar (5200 lbf/in²)
U – 366 bar (5300 lbf/in²)
V – 400 bar (5800 lbf/in²)
W – 431 bar (6250 lbf/in²)

18 Speed Sensor

0 – No speed sensor
A – Magnetic sensor with 2 wire weather pack connector
B – Digital sensor with 3 wire weather pack connector
C – Speed sensor hole (5/8-18 UNF thread) plugged (for digital or magnetic sensor)
D – Quadrature speed sensor with 4 wire weather pack connector (one 24 pulse per rev speed signal and one directional signal)
E – Quadrature speed sensor with 4 wire weather pack connector (two 12 pulse per rev speed signal in quadrature)
F – Speed sensor hole (9/16-32 UN thread) plugged (for quadrature sensor)

19,20 Special Features

00 – No special features
03 – Bypass valve-spool stem is on the opposite side from the low pressure relief valve in the composite valve block
04 – Int hex case drain plug in motor housing
05 – Case drain plug located opposite the swashplate dowel plug
22 – Nametag opposite dowel
23 – High speed rotating group
26 – Lightweight pistons and nametag opposite dowel
31 – Lightweight pistons
32 – Metal case drain plug in both ports
33 – Nametag opposite dowel and bar code label
34 – Shot peened barrel splines
35 – Metal case drain plug in both ports, shot peened barrel splines, SAE mounting flange tapped with 5/8-18 UNF-2B threads
36 – Bar code label on unit and one on packaging
37 – Lightweight pistons and nametag opposite dowel and bar code label
39 – Lightweight pistons - nametag and case drain plug located opposite the swashplate dowel plug

21 Paint and Packaging

0 – Painted primer blue (standard)
J – Rust preventative spray

22 Identification on Unit

0 – Standard

23 Design Code

A – A
B – B

Model Code

ACE Variable Motor

The following 23 digit coding system has been developed to identify standard configuration options for the Series 1 Hydrostatic Variable Displacement Motor. Use this model code to specify a motor with the desired features. All 29-digits of the code must be present to release a new product number for ordering.

ACE	39	4	0	01	A	A	A	0	0	0	0	0	0	EA	0	0	0	0	00	B	0	A
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

Note: Options in bold fonts are commonly used.

1, 2, 3 Pump series

ACE – Heavy Duty HydroStatic Variable Displacement Motor

4,5 Displacement

39 – 64 cm^3/r (3.9 in^3/r)
46 – 75 cm^3/r (4.6 in^3/r)
54 – 89 cm^3/r (5.4 in^3/r)
64 – 105 cm^3/r (6.4 in^3/r)
76 – 125 cm^3/r (7.6 in^3/r)

6 Type

4 – Variable displacement motor

7 Design Type

0 – Ball-guide (model 76)
1 – Series 1 (models 39-64)
3 – Series 1 (models 39-64)

8, 9 Output Shaft

01 – (1.500) Diameter straight with (.3750) x (2.5) square key (models 33-64)
02 – (1.750) Diameter straight with (.4375) x (3.0) square key (model 76)
13 – 13 Tooth 8/16 pitch spline (model 76)
14 – 14 Tooth 12/24 pitch spline (models 39-64)
19 – 19 Tooth 16/32 pitch spline (models 39-64)
21 – 21 Tooth 16/32 pitch spline (models 39-64)
23 – 23 Tooth 16/32 pitch spline (models 39-64)
27 – 27 Tooth 16/32 pitch spline (model 76)
28 – 27 Tooth 16/32 pitch spline for 76 seal with (2.19) extension (model 54)
30 – 13 Tooth 8/16 pitch spline for 76 seal with (2.93) extension (model 64)
31 – (1.750) Diameter tapered with (.4375) x (1.00) square key (model 76)

10 Minimum Swashplate Angle

A – 18 degrees
B – 17 degrees
C – 16 degrees
D – 15 degrees
E – 14 degrees
F – 13 degrees
G – 12 degrees
H – 11 degrees
J – 10 degrees
K – 9 degrees
L – 8 degrees
M – 7 degrees
N – 6 degrees
P – 5 degrees
Q – 4 degrees
R – 3 degrees
S – 2 degrees
T – 1 degrees
U – 0 degrees

11 Main Ports

A – (1.00) SAE 4-bolt split flange port, standard pressure series (code 61)
B – (1.00) SAE 4-bolt split flange port, high pressure series (code 62)
D – (1.00) SAE 4-bolt split flange port, standard pressure series (code 61) with A and B gauge ports
E – (1.00) SAE 4-bolt split flange port, high pressure series (code 62) with a and B gauge ports

12 End Cover and Composite Valve Block Assy

A – Standard end cover, composite valve block with high-rate shuttle valve springs
B – Standard end cover, composite valve block with low-rate shuttle valve springs
C – No composite valve block - with cover plate
D – No composite valve block
J – High pressure relief valves only - no shuttle or charge pressure relief valves
L – Standard end cover, composite valve block with high-rate shuttle valve springs, remote pilot operated relief valves with O-ring face seal fittings, and O-ring face seal fittings opposite remote pilot operated relief valves
M – Standard end cover, shuttle valve block with high-rate shuttle valve springs
N – Standard end cover, shuttle valve block with low-rate shuttle valve springs

13 Charge Press Relief Valve – Composite Valve Block

0 – No relief valve
1 – Standard
2 – Orificed charge pressure relief valve

14 Charge Pressure Relief

0 – None
B – 11 bar (160 lbf/in^2) - standard
C – 12,4 bar (180 lbf/in^2)
D – 13,8 bar (200 lbf/in^2)
E – 15,2 bar (220 lbf/in^2)
F – 16,6 bar (240 lbf/in^2)
G – 17,9 bar (260 lbf/in^2)
H – 19,3 bar (280 lbf/in^2)
J – 20,7 bar (300 lbf/in^2)

15,17 Composite Valve Block High Pressure Relief Valve –

Port A (Pos. 15)
Port B (Pos. 17)
0 – None
1 – Standard
2 – Remote pilot operated relief valve
3 – Standard with threaded retainer
4 – Remote pilot operated relief valve with threaded retainer
7 – Remote pilot operated relief valve with O-ring face seal fitting
8 – Remote pilot operated relief valve with threaded retainer, special orifice and spring, with O-ring face seal fitting

Model Code

ACE Variable Motor

The following 23 digit coding system has been developed to identify standard configuration options for the Series 1 Hydrostatic Variable Displacement Motor. Use this model code to specify a motor with the desired features. All 29-digits of the code must be present to release a new product number for ordering.

ACE	39	4	0	01	A	A	A	0	0	0	0	0	0	EA	0	0	0	0	00	B	0	A
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

Note: Options in bold fonts are commonly used.

16,18 High Pressure Relief Valve Setting – Port A (Pos. 16) Port B (Pos. 18)

0 – None
1 – 11,0 bar (160 lbf/in²)
2 – 12,4 bar (180 lbf/in²)
3 – 13,8 bar (200 lbf/in²)
4 – 15,2 bar (220 lbf/in²)
5 – 16,6 bar (240 lbf/in²)
6 – 17,9 bar (260 lbf/in²)
7 – 19,3 bar (280 lbf/in²)
C – 103 bar (1500 lbf/in²)
D – 138 bar (2000 lbf/in²)
E – 172 bar (2500 lbf/in²)
F – 207 bar (3000 lbf/in²)
G – 241 bar (3500 lbf/in²)
H – 276 bar (4000 lbf/in²)
J – 310 bar (4500 lbf/in²)
K – 345 bar (5000 lbf/in²)
L – 379 bar (5500 lbf/in²)
M – 414 bar (6000 lbf/in²)
N – 448 bar (6500 lbf/in²)
P – 483 bar (7000 lbf/in²)
Q – 155 bar (2250 lbf/in²)
R – 362 bar (5250 lbf/in²)
S – 465 bar (6750 lbf/in²)
T – 359 bar (5200 lbf/in²)
U – 365 bar (5300 lbf/in²)
V – 400 bar (5800 lbf/in²)

19,20 Control

0A – Shipping plate without control link
HA – Hydraulic remote with pump linkage 4,5-20,0 bar (65-290 lbf/in²)
HB – Hydraulic remote 4,5-20,0 bar (65-290 lbf/in²)
HC – Hydraulic remote 11,0-32,4 bar (160-470 lbf/in²)
HD – Hydraulic remote 1,4-14,1 bar (20-205 lbf/in²)
MA – Manual
PA – Port plate
RA – Pressure response with stroking valve 12 vdc (NC) with 2 pin amp connector
RB – Pressure response
RC – Pressure response with stroking valve 24 vdc (NC) with wire leads
RD – Pressure response with stroking valve 12 vdc (NC) with 2 pin amp connector - special 90 deg diagnostic fitting assembly
RE – Pressure response with stroking valve 12 vdc (NC) - solenoid coil with diode, 2 pin metripak connector - special 90 deg diagnostic fitting assembly
RG – Pressure response with stroking valve 24 vdc (NC) with wire leads and 9/16-18 fittings and hoses
SA – Stroking valve 12 vdc (NC) with 2 pin cannon sure-seal connector
SB – Stroking valve 24 vdc (NC) with wire leads
SC – stroking valve 12 vdc (NC) with 2 pin weathersd stroking valve 12 vdc (NC) with 2 pin weatherpack connector (shroud)
SE – Stroking valve 12 vdc (no) with 2 pin dt04-2p connector

21 Control Orifice

0 – None
A – 0,71 (.028) diameter
B – 0,91 (.036) diameter
C – 1,12 (.044) diameter
D – 1,32 (.052) diameter
E – 1,45 (.057) diameter
F – 1,65 (.065) diameter
G – 1,85 (.073) diameter
H – 2,39 (.094) diameter
J – 2,59 (.102) diameter

22 Press Setting for Pressure Response

0 – None
B – 69 bar (1000 lbf/in²)
C – 103 bar (1500 lbf/in²)
D – 138 bar (2000 lbf/in²)
E – 172 bar (2500 lbf/in²)
F – 207 bar (3000 lbf/in²)
G – 241 bar (3500 lbf/in²)
H – 276 bar (4000 lbf/in²)
J – 310 bar (4500 lbf/in²)
K – 345 bar (5000 lbf/in²)
M – 414 bar (6000 lbf/in²)
V – 250 bar (3625 lbf/in²)
W – 228 bar (3300 lbf/in²)

23 Control Special Features

0 – No special features

24 Speed Sensor

0 – No speed sensor
A – Magnetic speed sensor with 2-wire weather pack connector
B – Digital speed sensor with 3-wire weather pack connector
C – Quadrature speed sensor with 4 wire weather pack connector (one 24 pulse per rev speed signal and one directional signal)

25,26 Displacement

00 – No special features
03 – Externally adjustable servo piston stop - top servo sleeve
06 – Bypass valve - spool stem is on the opposite side from the low pressure relief valve in the composite valve block
08 – Model 76 seal in model 54 with grade 8 mounting flange assembly bolts
22 – High speed rotating group
23 – High speed rotating group and externally adjustable servo piston stop - top servo sleeve
24 – High speed rotating group and plug in top case drain port
25 – Model 76 seal in model 64
27 – Externally adjustable servo piston stops - top and bottom servo sleeves
30 – Bypass valve - spool stem is on the opposite side from the low pressure relief valve in the composite valve block, and charge pressure gauge port with internal hex plug

27 Paint and Packaging

B – Painted primer blue (standard)
J – Rust preventative spray

28 Identification

0 – Standard

29 Identification

A – A
B – B

Performance – Pump

Pump Performance

Model		39	46	54	64	76
Displacement	in^3/rev	3.89	4.60	5.44	6.44	7.62
	cm^3/rev	63,7	75,3	89,1	105,5	124,8
Maximum Shaft	rpm	4160	4160	3720	3720	2775
Speed†	@ 18°					
Nominal Pressure*	psi	6000	6000	6000	6000	6000
	(bar)	(420)	(420)	(420)	(420)	(420)
Peak Pressure**	psi	7000	7000	7000	7000	7000
	(bar)	(480)	(480)	(480)	(480)	(480)
Output Flow	gpm @	67.3	79.2	84.1	99.1	87.9
	3500 psi					
	lpm @	255	300	318	375	333
	241 bar					
Input Torque	lb-in @	2346	2786	3285	3900	4552
	3500 psi					
	Nm @	265	315	371	441	514
	241 bar					

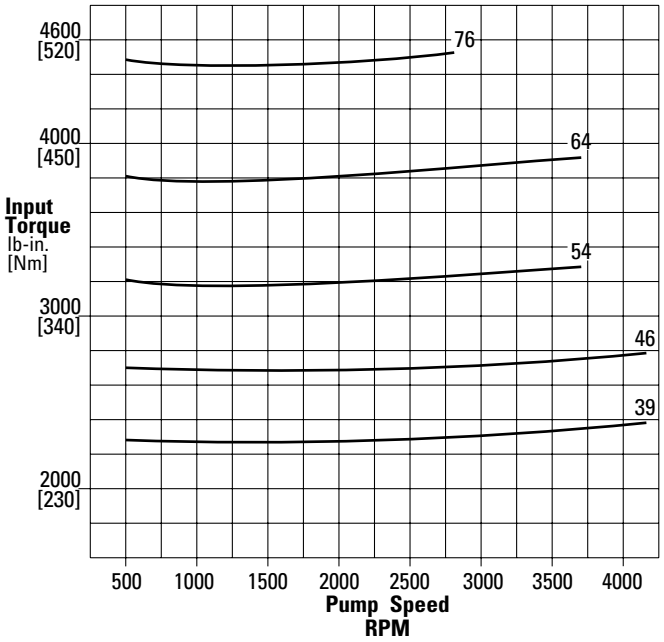
Pump performance calculated at 96% efficiency.

† The maximum pump shaft speed may be limited by the charge pump speed rating.

* Nominal Pressure: Max delta system pressure at which component fatigue does not occur (pump life estimated by bearing life).

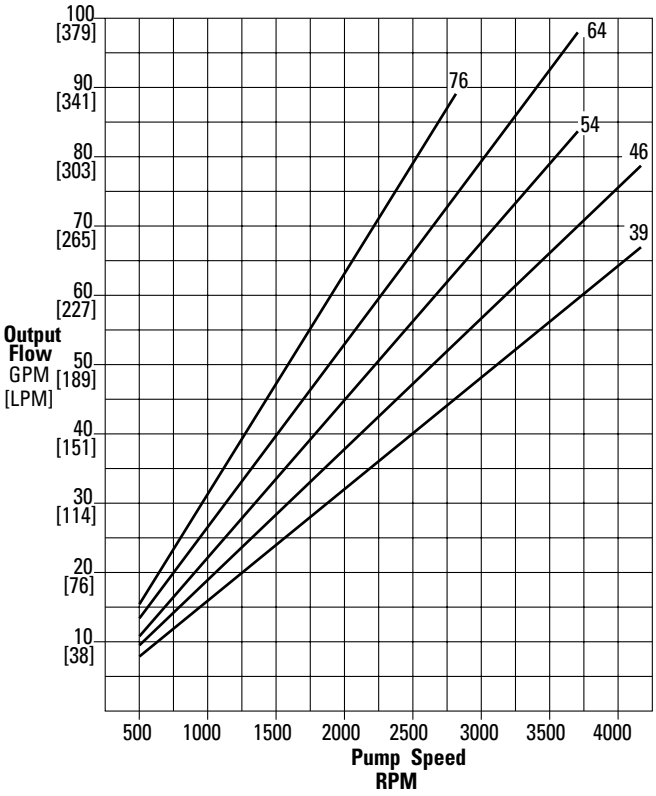
** Peak Pressure: Max operation pressure which is permissible for a short duration of time (t < 1 sec).

Input Torque vs Speed



System Pressure..... 3500 psi (240 bar)
Charge Pressure ..... 220 psi (15 bar)
Oil Viscosity ..... 60 SUS
Temperature..... 180°F (82°C)

Output Flow vs Speed



Performance – Motor

Motor Performance

Model		39	46	54	64	76
Displacement	in^3/rev	3.89	4.60	5.44	6.44	7.62
	cm^3/rev	63,7	75,3	89,1	105,5	124,8
Nominal Pressure*	psi	6000	6000	6000	6000	6000
	(bar)	(420)	(420)	(420)	(420)	(420)
Peak Pressure**	psi	7000	7000	7000	7000	7000
	(bar)	(480)	(480)	(480)	(480)	(480)
Maximum	rpm @ 18°	4160	4160	3720	3720	2775
Shaft Speed	rpm @ 10°	5380¯	5380¯	4810¯	4810¯	3425¯
Maximum	lb-in	3511	4149	4916	5807	6911
Output Torque†	Nm	397	469	556	656	781

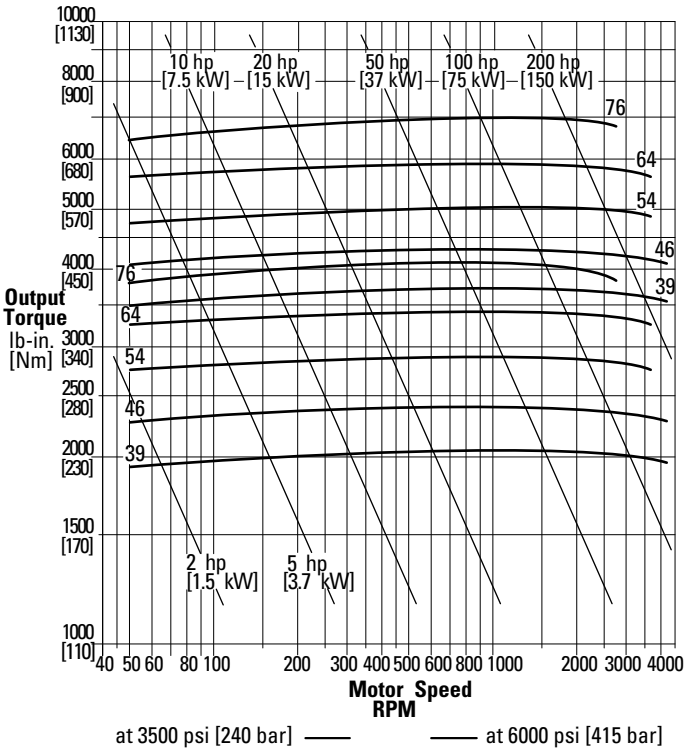
¯ These shaft speeds require maximum charge pressure relief: 340 psi (23 bar) pump and 280 psi (19 bar) motor.

† Maximum output torque is measured at 6000 psi (415 bar).

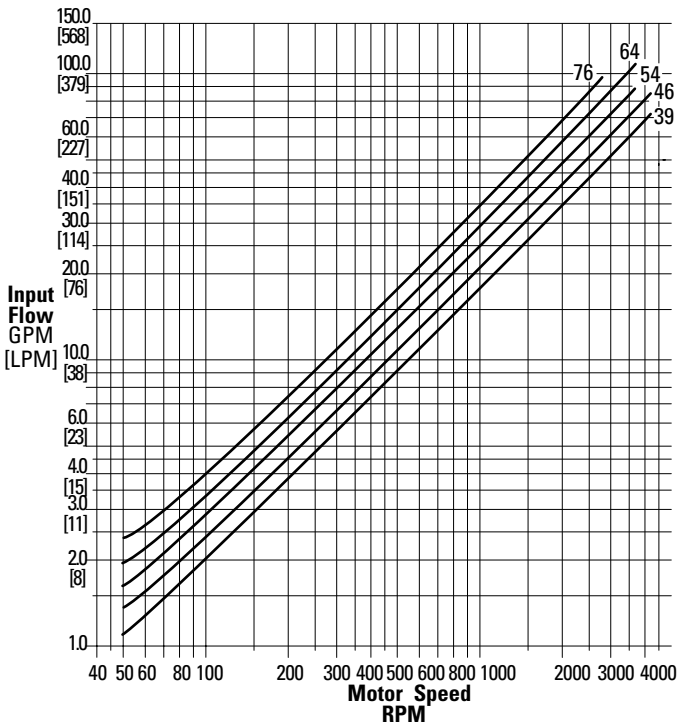
* Nominal Pressure: Max delta system pressure at which component fatigue does not occur (pump life estimated by bearing life).

** Peak Pressure: Max operation pressure which is permissible for a short duration of time (t < 1 sec).

Output Torque vs Speed



Input Flow vs Speed



System Pressure..... 3500 psi (240 bar)
Charge Pressure ..... 220 psi (15 bar)
Oil Viscosity ..... 60 SUS
Temperature..... 180° F (82° C)

Note: Operating the motor below 50 rpm is not recommended for best performance.

Performance – Charge Pump

Charge Pump Performance

Eaton offers a choice of four charge pump displacements to go with their heavy duty transmission line: .85, 1.28, 1.70, and 2.12 in³/rev (13,9; 21,0; 27,8; 34,7 cm³/rev).

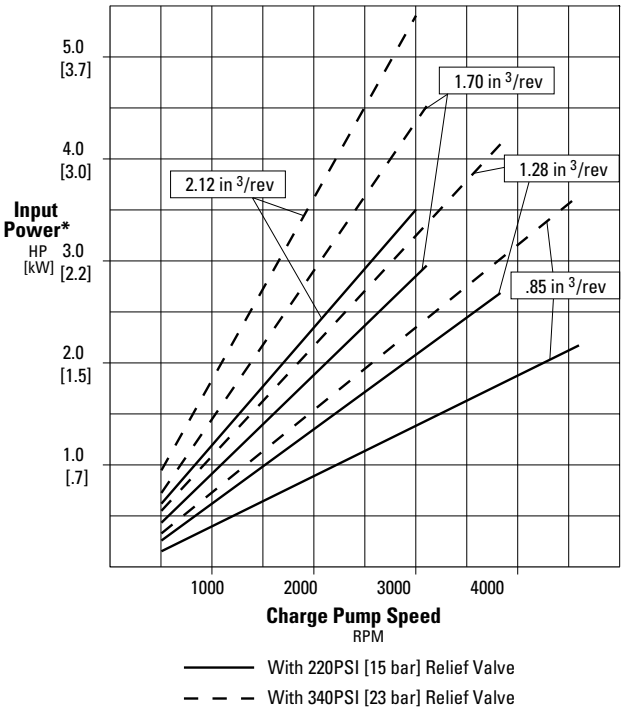
These charge pumps are available with one or more of the following options:

- a pressure sensing port
- remote pressure side filter ports
- a spin-on pressure side filter
- mounting flanges for auxiliary pumps

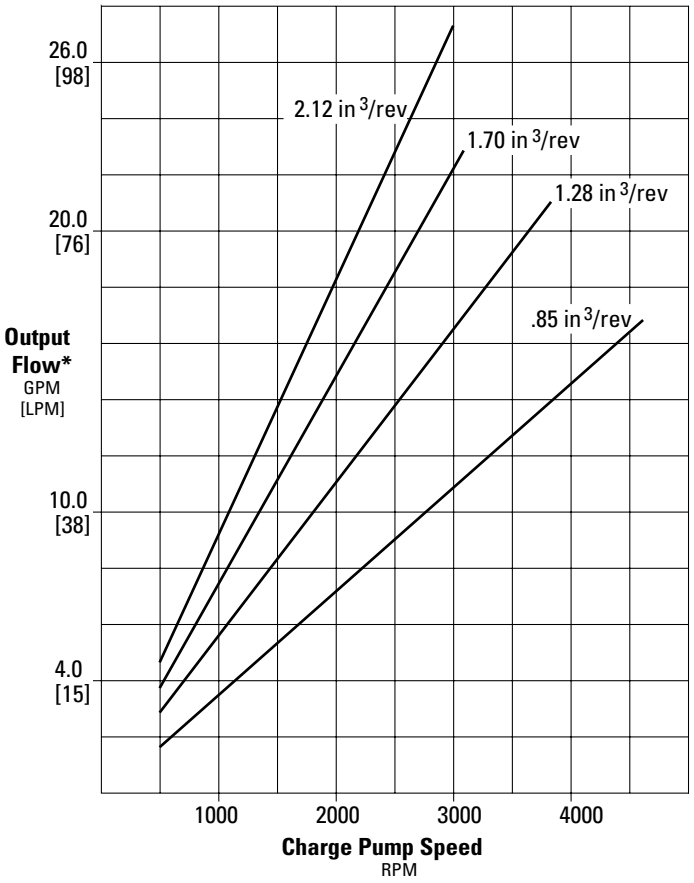
Displacement	in³/rev	.85	1.28	1.70	2.12
	cm³/rev	13,9	21,0	27,9	34,7
Maximum Shaft Speed	rpm	4600	3800	3100	3000
Output Flow @	gpm	16.9	21.0	22.8	27.5
Maximum Speed*	lpm	64,0	79,5	86,3	104,2
Input Power @ 220 psi	hp	2.17	2.70	2.93	3.54
(15 bar) and Maximum Speed*	kW	1,62	2,01	2,18	2,64

*Theoretical Values

Charge Pump Power vs Speed



Charge Pump Flow vs Speed

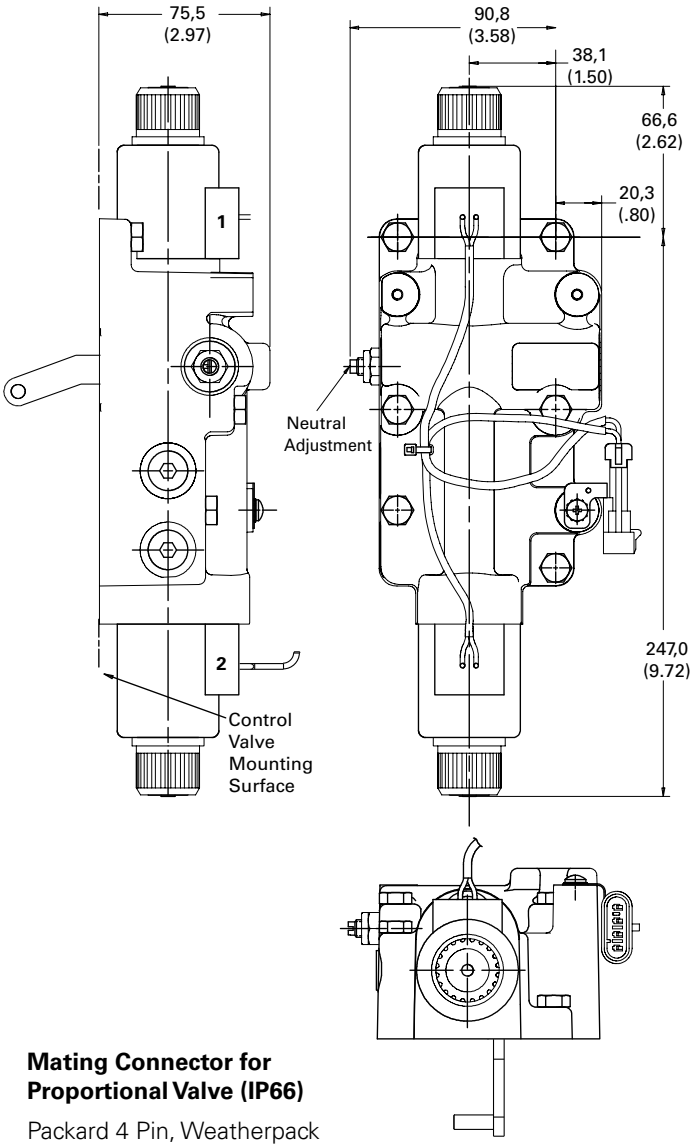


Oil Viscosity . . . . . 60 SUS
Temperature . . . . . 180°F (82°C)
* Theoretical Values

Control Options – Pump
Electronic Proportional Displacement Control with Swashplate Mechanical Feedback

Model Code EJ & EK Position 15,16

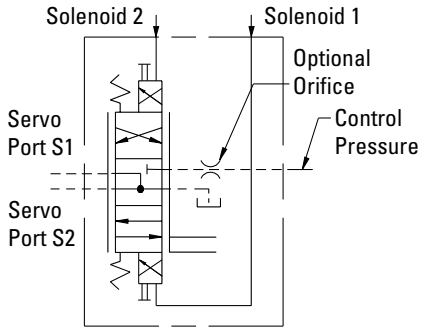
The Electronic Proportional displacement control is ideal for applications requiring electronic pump displacement control. The EP displacement control has been designed to withstand the rigors of off-highway equipment environmental conditions.



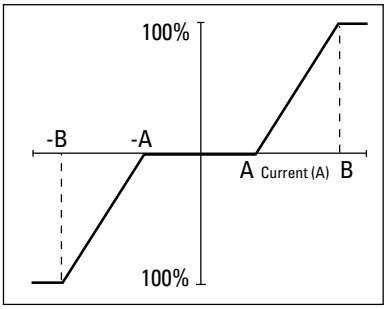
Electronic Proportional Control Features

- Ease of installation
- Automotive style environmentally sealed Metri-Pack connectors
- Return to neutral for loss of power, or loss of command input signal
- Mechanical feedback of swashplate position for closed loop control
- External neutral adjustment
- Manual override capability

Input Shaft Rotation	CCW		CW	
Solenoid Energized	1	2	1	2
Port A Flow	Out	In	In	Out
Port B Flow	In	Out	Out	In



Pump Displacement vs. Coil Current



Voltage	Coil Current (A)	
	A	B
12V	0.5	1.25
24V	0.25	0.625

Note:
Coils have no internal Diodes. A-B Polarity and C-D Polarity Does Not affect operation

Mating Connector for Proportional Valve (IP66)

Packard 4 Pin, Weatherpack P/N 1218 6568 Connector, Qty 1

P/N 1204 8074 PIN Terminal, Qty 4

P/N 1204 8086 Cable Seal, Qty 4

P/N 1204 7948 TPA, Qty 1

Pin	Color	Signal
A	Yellow	Coil 1 PWM
B	White	Coil 1 Return
C	Orange	Coil 2 PWM
D	Black	Coil 2 Return

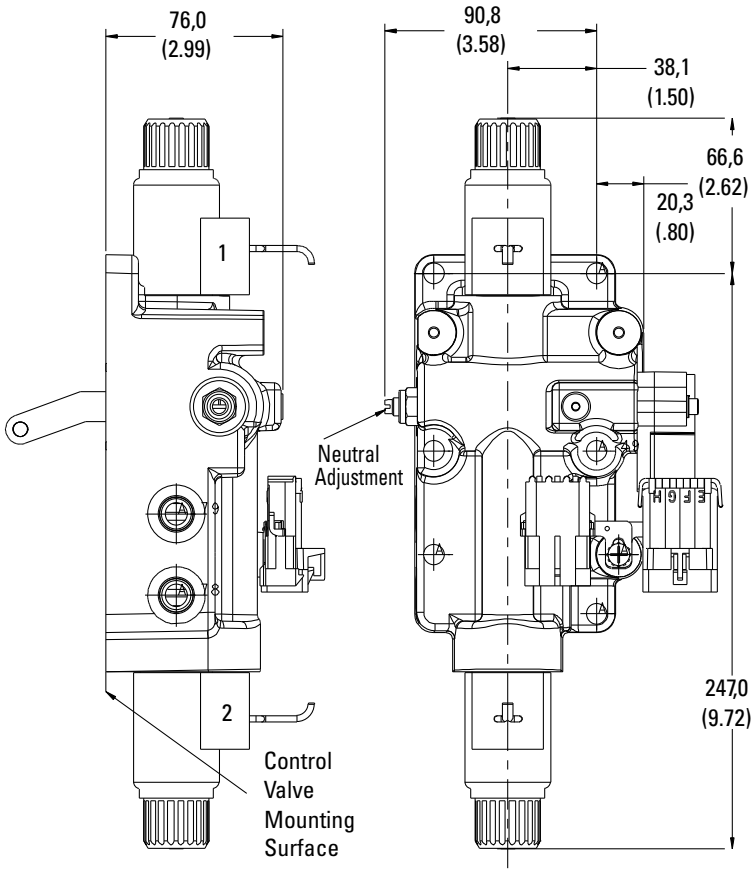
Proportional Valve Specification	EJ	EK	Typical Electronic Controller
Voltage	12 VDC	24 VDC	Contact Eaton for TCA, Maestro, and EFX controller available from Eaton; or customer supplied controller.
Resistance	5.2 Ohms	20.8 Ohms	
Inductance	7.0 mH	27.7 mH	
Current	1500 mA	750 mA	
Threshold Current	200-600 mA	100-300 mA	
PWM Frequency*	70-200 Hz	70-200 Hz	
Dither Frequency	75 Hz	75 Hz	
Dither Amplitude	250 mA	125 mA	
Ambient Temperature	-65°F to 140°F (-54°C to 60°C)		

* 100 Hz recommended when PWM driver does not have built-in dither capabilities

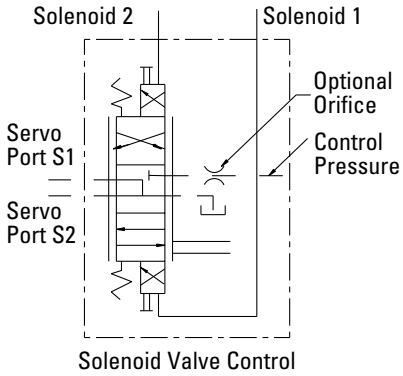
Control Options – Pump
Electronic Proportional Displacement Control with Swashplate Mechanical and Electronic Sensor Feedback

Model Code FD & FE Position 15,16

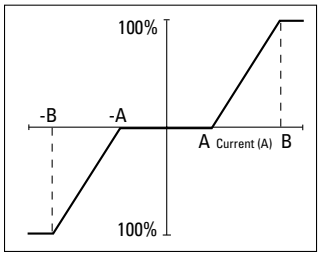
The Electronic Proportional displacement control with both swashplate mechanical and electronic sensor feedback is ideal for applications requiring both precise electronic pump displacement control and inherently safe operation. The dual feedback enables safety integrity level (SIL) compliance.



Input Shaft Rotation	CCW		CW	
Solenoid Energized	1	2	1	2
Port A Flow	In	Out	Out	In
Port B Flow	Out	In	In	Out



Pump Displacement vs Coil Current



Voltage	Coil Current (A)	
	A	B
12V	0.5	1.25
24V	0.25	0.625

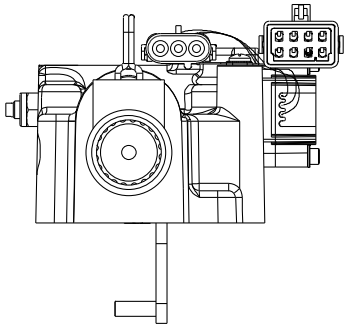
Note:
Coils have no internal Diodes.
A-B Polarity and C-D Polarity
Does Not affect operation

Mating Connector for Sensor (IP66)

Packard 3 Pin, Weatherpack, P/N 12015793 Connector

P/N 12089188, PIN Terminal, Qty 3

P/N 12015323, Cable Seal, Qty 3

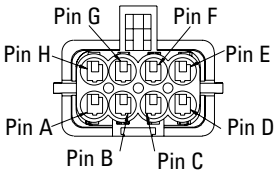


Swatchplate Sensor Electrical Data

Supply Voltage	5±0.50 VDC
Supply Current	10mA
Sensor Gain	10°/V, CW Shaft rotation increases output
Angle Sweep	-20° at 0.5V; +20° at 4.5V; 0° (pump neutral) at 2.5V
Max Output Error*	±3%

*Error includes thermal linearity, and sensitivity drift

Mating Connector for Proportional Valve (IP66)



Pin	Color	Signal
A	Black	Return
B	Blue	V Out (Signal)
C	Red	+5 VDC

Connector	Description	Connector	Description
Pin A	S1 Solenoid Return	Pin E	S2 Solenoid PWM
Pin B	Not Used	Pin F	Not Used
Pin C	Not Used	Pin G	Not Used
Pin D	S2 Solenoid Return	Pin H	S1 Solenoid PWM

Proportional Valve Specification	FD	FE	Typical Electronic Controller
Voltage	12 VDC	24 VDC	Contact Eaton for TCA, Maestro, and EFX controller available from Eaton; or customer supplied controller.
Resistance	5.2 Ohms	20.8 Ohms	
Inductance	7.0 mH	27.7 mH	
Current	1500 mA	750 mA	
Threshold Current	200-600 mA	100-300 mA	
PWM Frequency*	70-200 Hz	70-200 Hz	
Dither Frequency	75 Hz	75 Hz	
Dither Amplitude	250 mA	125 mA	
Ambient Temperature	-65°F to 140°F (-54°C to 60°C)		

*100 Hz recommended when PWM driver doesn't have built-in dither capabilities

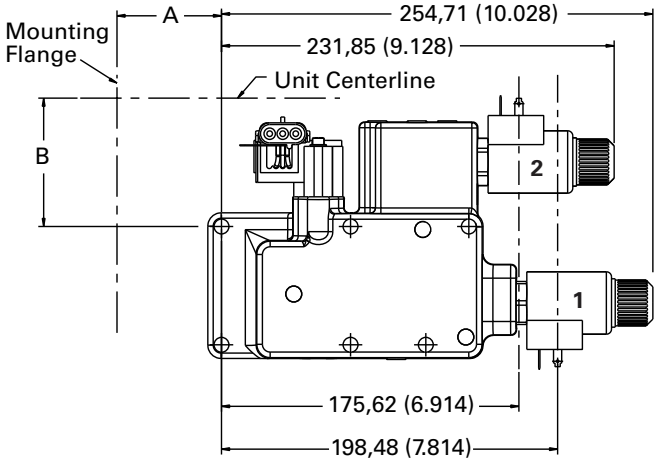
Control Options – Pump
Electric Displacement Control with Swashplate Electronic Sensor Feedback

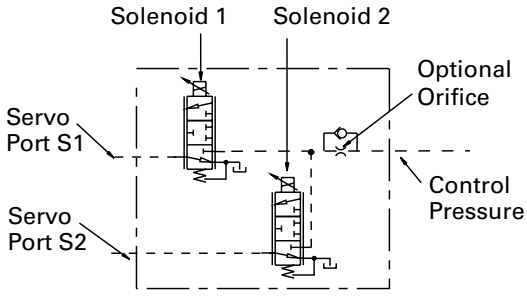
Model Code SC & SD Position 15,16

Controller Dimensions

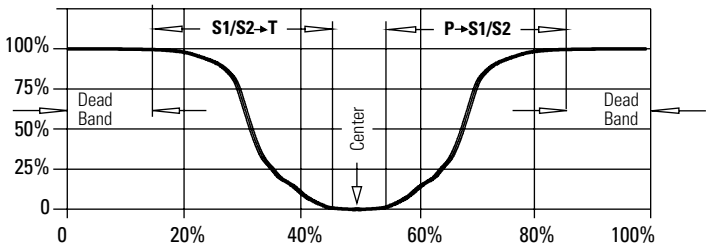
Displacement in³/r	A	B
39, 46	74,9 (2.95)	36,6 (1.44)
54, 64	93,7 (3.69)	45,0 (1.77)
76	110,2 (4.34)	45,2 (1.78)

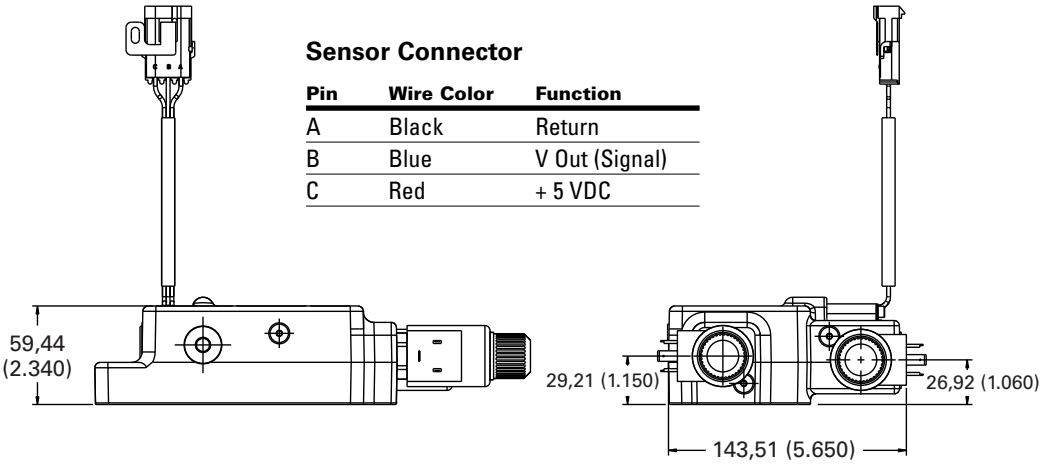
Input Shaft Rotation	CCW		CW	
Solenoid Energized	1	2	1	2
Port A Flow	Out	In	In	Out
Port B Flow	In	Out	Out	In





% Servo Piston Flow vs Valve Coil Current





Sensor Connector

Pin	Wire Color	Function
A	Black	Return
B	Blue	V Out (Signal)
C	Red	+ 5 VDC

Mating Connector for Valve

DIN 43650, Form A (IP65)

(Deutsch connector available upon request)

Mating Connector for Sensor (IP66)

Packard 3 Pin Weatherpack P/N 12015793, Connector Qty 1

P/N 12089188, PIN Terminal, Qty 3

P/N 12015323, Cable Seal, Qty 3

Swashplate Sensor Electrical Data	
Supply Voltage	5±0.50 VDC
Supply Current	10mA
Sensor Gain	10°/V, CW Shaft rotation increases output
Angle Sweep	-20° at 0.5V; +20° at 4.5V; 0° (pump neutral) at 2.5V
Max Output Error*	±3%

*Error includes thermal linearity, and sensitivity drift

Valve Specifications	SC	SD	Typical Electronic Controller
Voltage	12 VDC	24 VDC	Contact Eaton for TCA, Maestro, and EFX controller available from Eaton; or customer supplied controller.
Resistance	4.0 Ohms	16.0 Ohms	
Inductance	12.3 mH	49.4 mH	
Current	1750 mA	875 mA	
Ambient Temp	-65°F to 140°F (-54°C to 60°C)		

Control Options – Pump

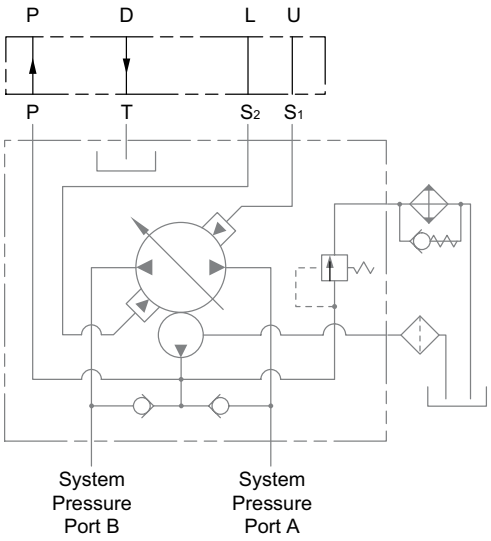
Pump Control Options

Port Plate

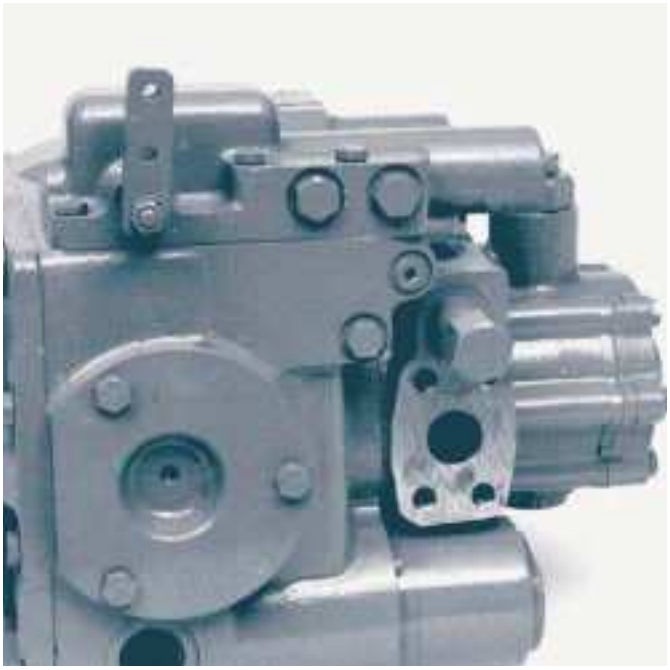


The port plate is the simplest control option available. It fits all Eaton heavy duty pumps and motors.

The port plate is commonly used as a slave control that receives commands from other controls in the same system.

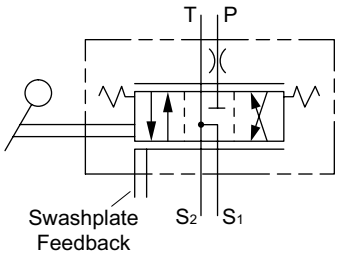


Standard Variable Manual Pump Control



The standard variable pump control is the most common type of control used on heavy duty hydrostatic variable displacement pumps. It is normally actuated by direct mechanical linkages or cables.

A wide band neutral zone controller is available. It expands the center lever position where the pump output is zero flow.

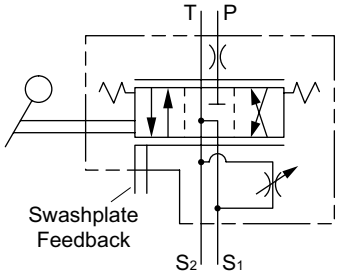


Control Options – Pump

Standard Control with Inching Valve



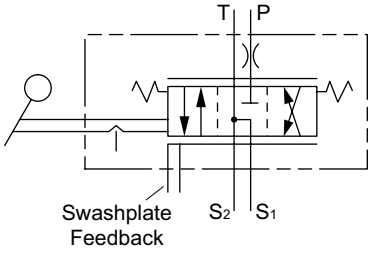
The inching valve is an option that is used in conjunction with the standard variable pump control. This control option would typically be used on a vehicle propel transmission. When the inching valve is operated with a foot pedal it functions like a clutch. A metering orifice in the inching valve's rotary spool cross ports the servo pressure lines providing the operator with smooth acceleration and deceleration.



Standard Control with Neutral Detent



The neutral detent feature on the standard control valve provides a more positive feel when finding neutral. This control is a good choice for transmissions that have long control linkages or cables with varying amounts of free play.



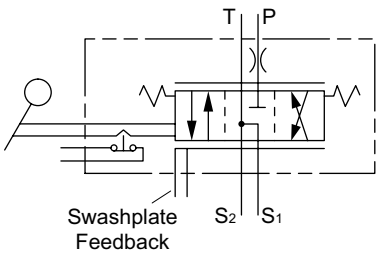
Control Options – Pump

Standard Control with Neutral Lock-out



The neutral lock-out feature is an electrical switch that is closed when the transmission is in neutral. This switch can be used to prevent the activation of certain functions that require the pump to be in neutral.

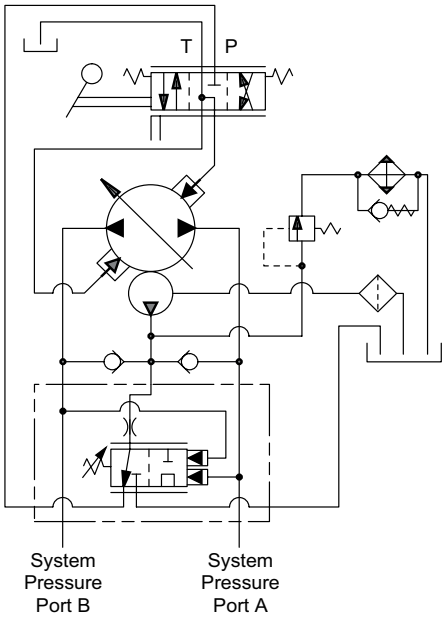
The lock-out feature is commonly used to prevent starting the prime mover or activating auxiliary functions. The electrical switch is available as normally open or normally closed.



Internal Pressure Override Control (IPOR)



The internal pressure override (IPOR) protects the transmission from running at overload conditions for extended periods. It senses system pressure and allows the pump to destroke if pressures exceed a preset limit. The override pressure setting is shim adjustable. Since the IPOR is built into the pump end cover it is not a field conversion option.

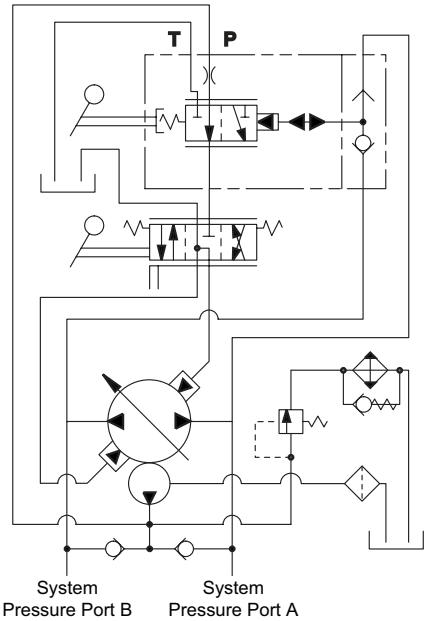


Control Options – Pump

Remote Pressure Override



The remote pressure override control provides a means to remotely adjust the pressure setting of the pressure override valve. This control may be used in applications requiring variable system pressure protection to prevent overloads and excessive heat generation. This valve operates similarly to the IPOR control.

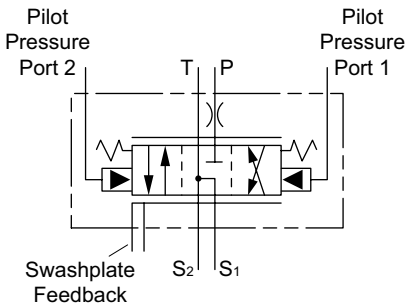


Control Option – Pump

Hydraulic Remote Control
Pump Control



The hydraulic remote control uses a remote pilot pressure signal to move the control spool. This control can be used where cables or mechanical linkages are not feasible.

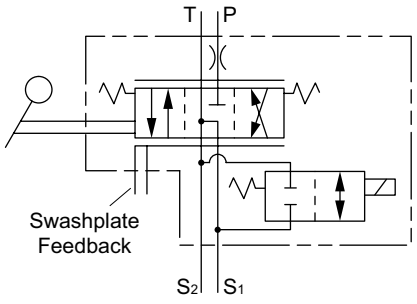


Control Options – Pump

Destroke Control



The heavy duty Destroke Control is a solenoid valve mounted on the standard variable pump control. When energized, the valve cross-ports control pressure allowing centering springs to bring the pump out of stroke. It can be energized with a single switch, push-button, or dead man's switch. The solenoid coil is available in 12 volt or 24 volt DC and normally open and normally closed configurations.



Destroke Solenoid



The heavy duty Destroke Solenoid is available to field convert the standard variable pump control into a destroke control.

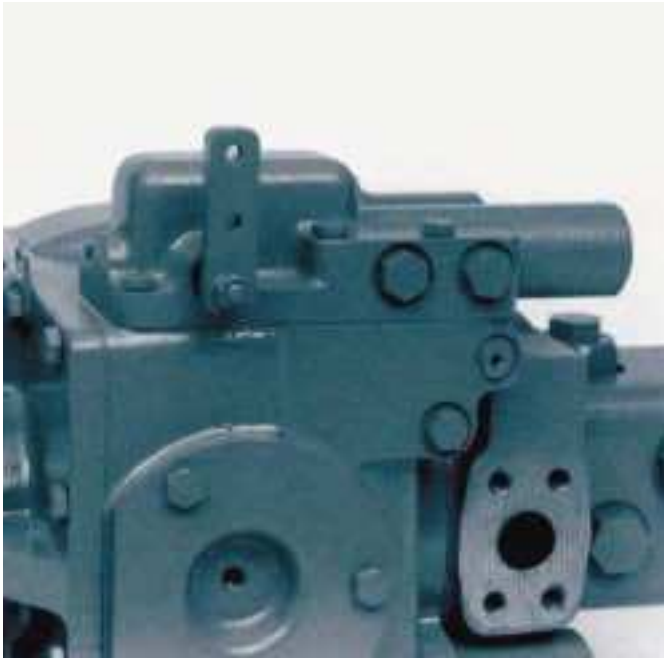
An Anti-Stall Electronics Module is available to drive a normally closed destroke valve. The electronic circuit monitors engine speed. When engine speed drops the anti-stall electronic reduce the pump's displacement.

Anti-Stall Electronics Module

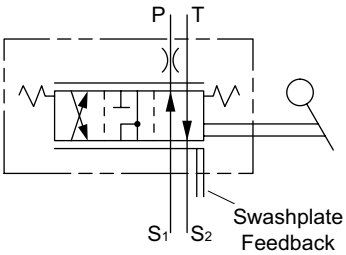


Control Options – Variable Motor

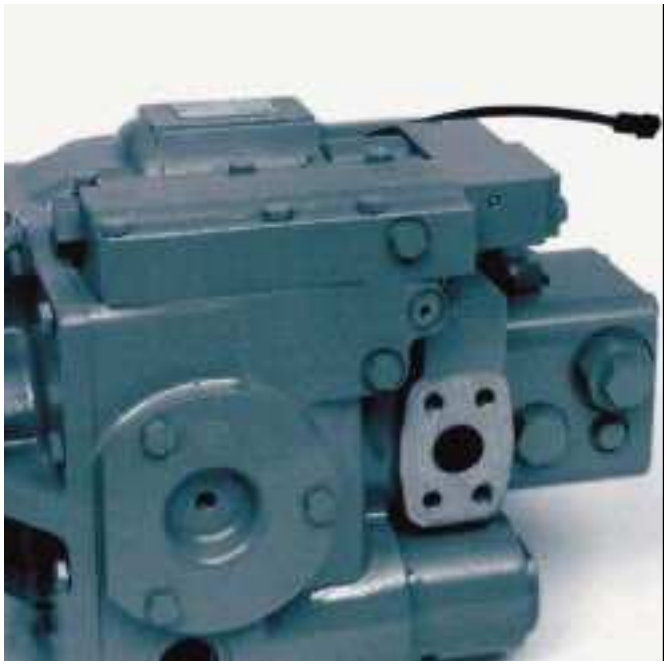
Manual Control



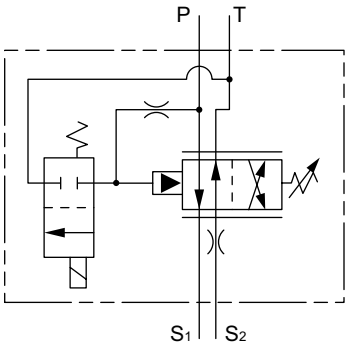
The manual displacement control for variable motors permits remote control of motor displacement using mechanical links or cables. The control operates similarly to the pump manual control, except the motor is biased to maximum displacement when the control handle is in a "neutral" position. Motor displacement may be controlled between maximum and minimum by moving the control lever.



Stroking Valve Control

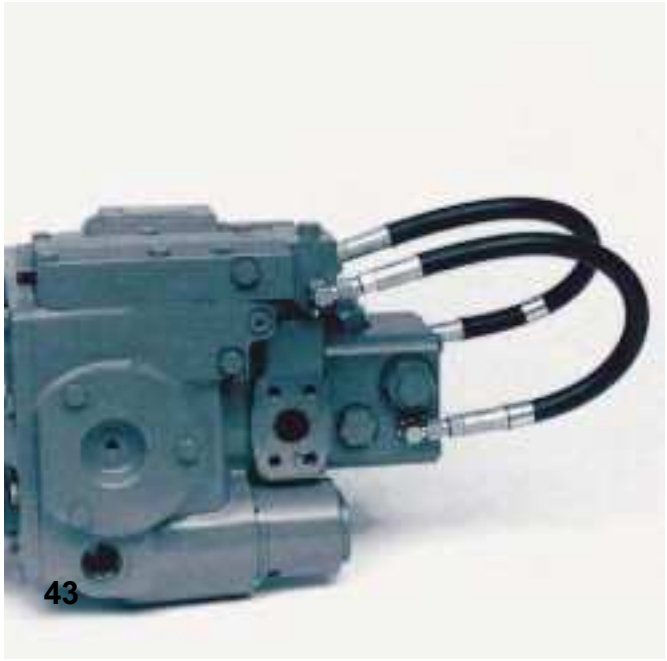


The variable motor stroking control provides a means of controlling motor displacement remotely via an electrical signal. When no electrical signal is supplied to the solenoid valve, the motor will be commanded to maximum displacement to provide maximum torque. Conversely, providing an electrical signal to the solenoid valve will command minimum displacement for maximum output speed. The control is available in 12 volt and 24 volt DC configurations.



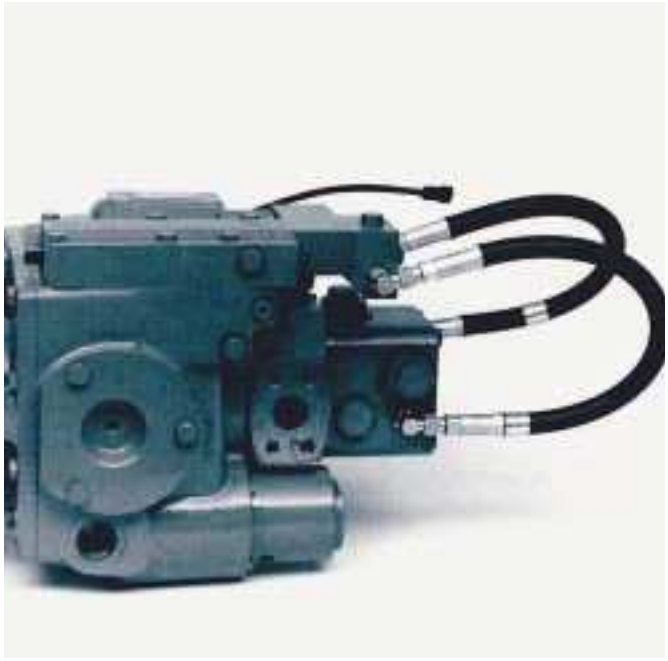
Control Options – Variable Motor

Pressure Response Control

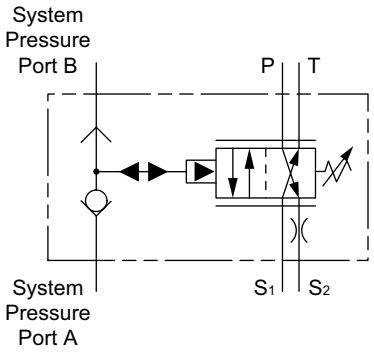


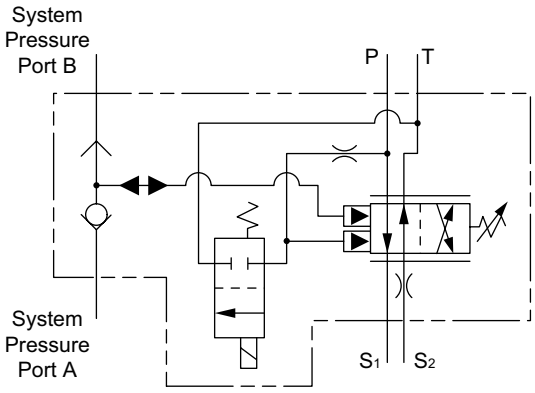
The variable motor pressure response control automatically adjusts motor displacement to meet torque requirements by sensing system pressure. The motor is biased to minimum displacement until system pressure reaches the pressure response setting. The control will then increase motor displacement to maintain the control pressure setting until maximum motor displacement is reached or the load on the system is reduced.

Pressure Response Control with Stroking Valve



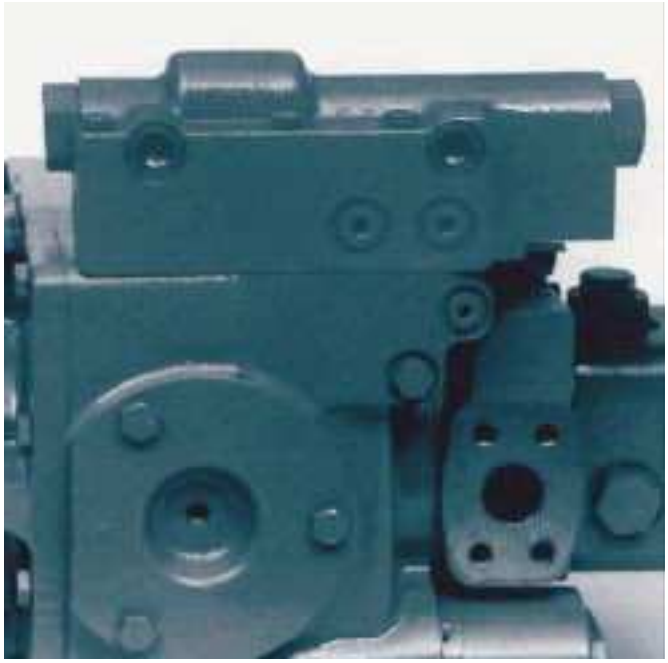
This control valve is a combination of the pressure response control and the stroking valve. With the stroking valve solenoid energized it works like the variable motor pressure response control. De-energize the stroking valve solenoid and the motor goes to full stroke. The control is available in 12 volt and 24 volt configurations.



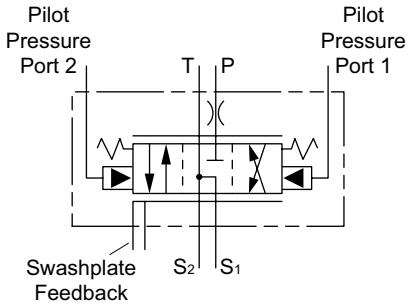


Control Options – Variable Motor

Hydraulic Remote Control
Variable Motor Control

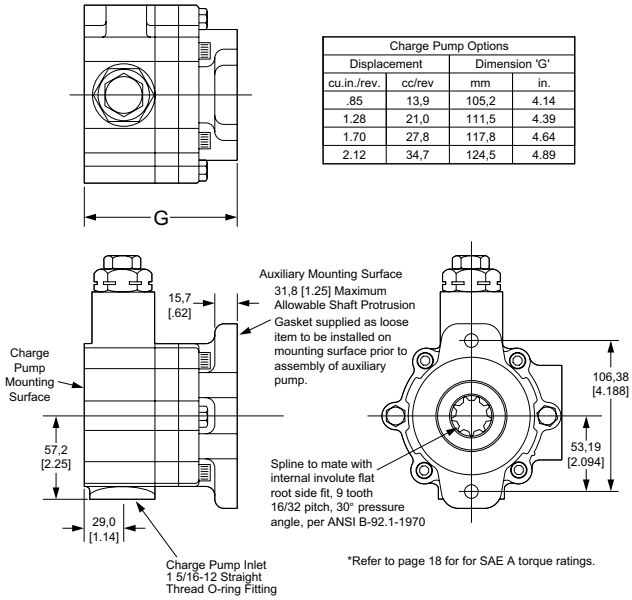


The hydraulic remote control uses a remote pilot pressure to move the control spool. There are two versions of the control available for variable motors. The first version contains a feedback linkage that biases the motor to minimum angle when the pilot pressure is below the control range. The second version contains a feedback linkage that biases the motor to full displacement when the pilot pressure is below the control range. This version permits the use of a single pilot signal to control the displacement of both the pump and motor. The operating pressure ranges of the hydraulic remote controls on pump and motor are selected such that the pump reaches full displacement before the pilot signal begins to reduce the displacement of the variable motor. This system provides infinitely variable speed control range and maximum motor output torque at lower speeds.



Dimensions – Charge Pump

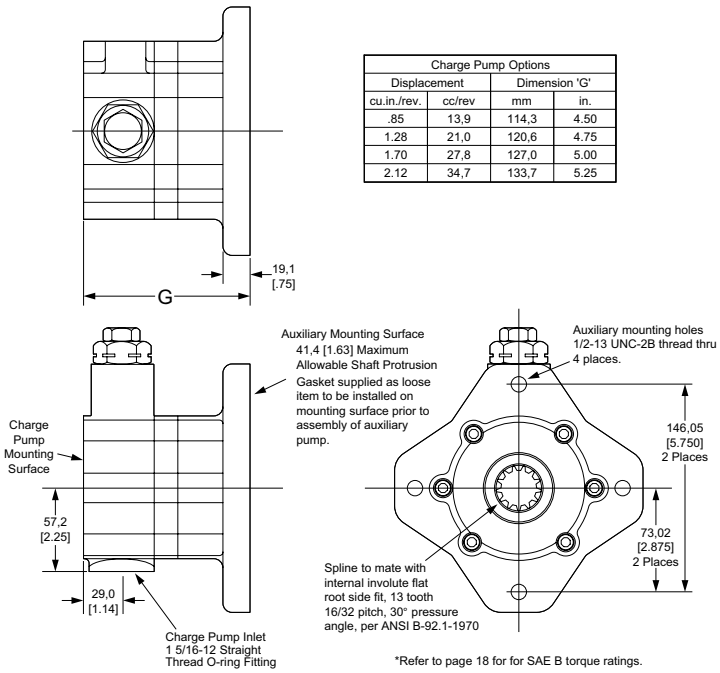
Charge Pump with SAE A Auxiliary Mount



Charge Pump Options			
Displacement		Dimension 'G'	
cu.in./rev.	cc/rev	mm	in.
.85	13,9	105,2	4.14
1.28	21,0	111,5	4.39
1.70	27,8	117,8	4.64
2.12	34,7	124,5	4.89

*Refer to page 18 for for SAE A torque ratings.

Charge Pump with SAE B Auxiliary Mount



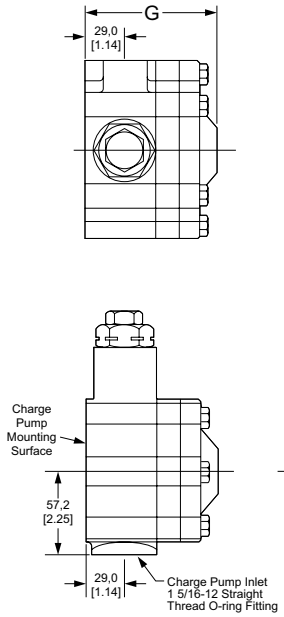
Charge Pump Options			
Displacement		Dimension 'G'	
cu.in./rev.	cc/rev	mm	in.
.85	13,9	114,3	4.50
1.28	21,0	120,6	4.75
1.70	27,8	127,0	5.00
2.12	34,7	133,7	5.25

*Refer to page 18 for for SAE B torque ratings.

Dimensions in mm (in)

Dimensions – Charge Pump

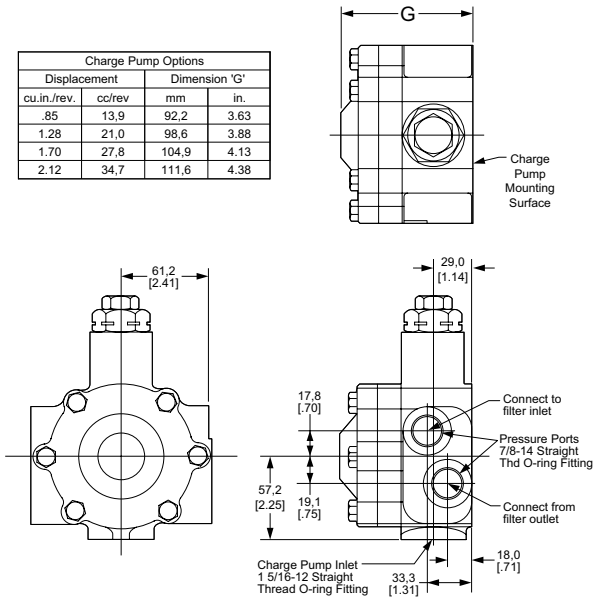
Charge Pump with Auxiliary Pressure Port



Charge Pump Options			
Displacement		Dimension 'G'	
cu.in./rev.	cc/rev	mm	in.
.85	13,9	92,2	3.63
1.28	21,0	98,6	3.88
1.70	27,8	104,9	4.13
2.12	34,7	111,6	4.38

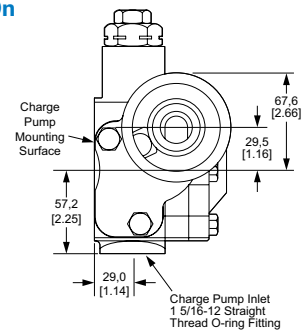
Charge Pump with Remote Filter Ports

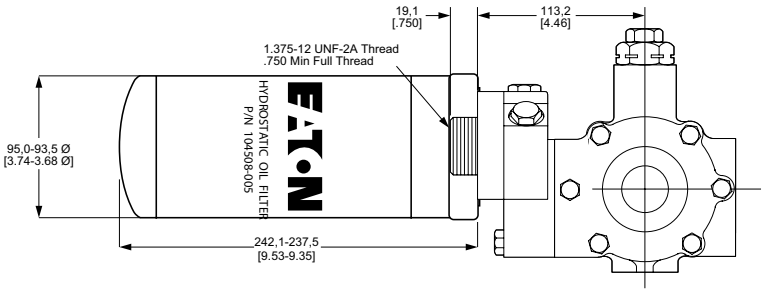
Charge Pump Options			
Displacement		Dimension 'G'	
cu.in./rev.	cc/rev	mm	in.
.85	13,9	92,2	3.63
1.28	21,0	98,6	3.88
1.70	27,8	104,9	4.13
2.12	34,7	111,6	4.38



Charge Pump with Spin-On Pressure Side Filter Pad

*Note: This option supplied with filter.





Dimensions in mm (in)

Dimensions
Models 39 and 46

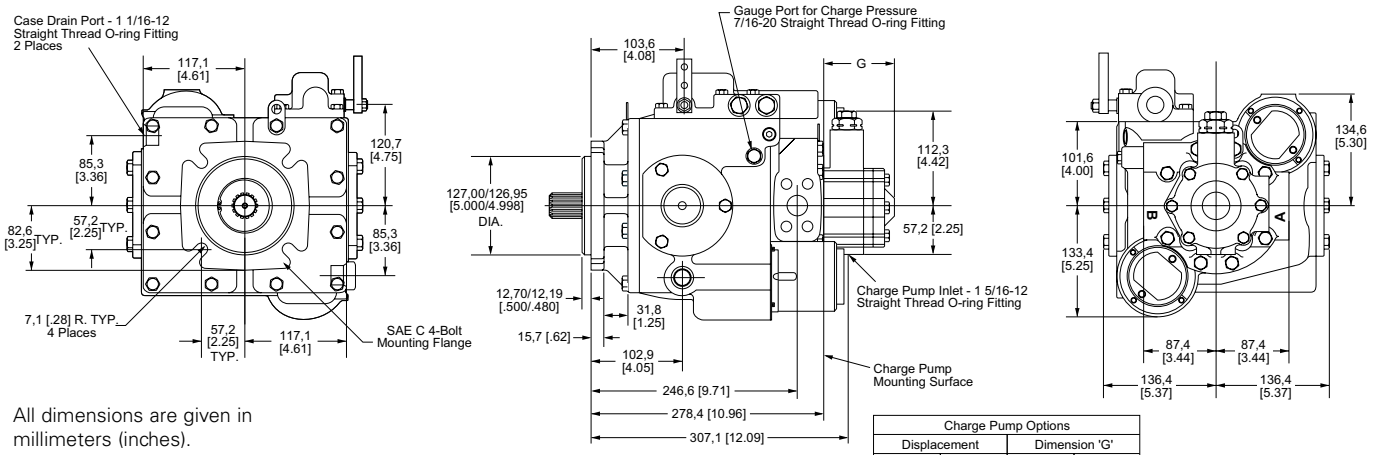
The variable pumps and motors are shown with standard controls. Installation drawings of other controls are available from your Eaton representative. Optional controls are shown on page 23.

The variable pumps are shown with standard charge pumps. Installation drawings of other charge pumps are available from your Eaton representative.

The lever on the standard control has linkage connection holes at 1 and 2 inch radii from the control shaft center.

Detailed drawings of available shafts and ports are shown on page 21.

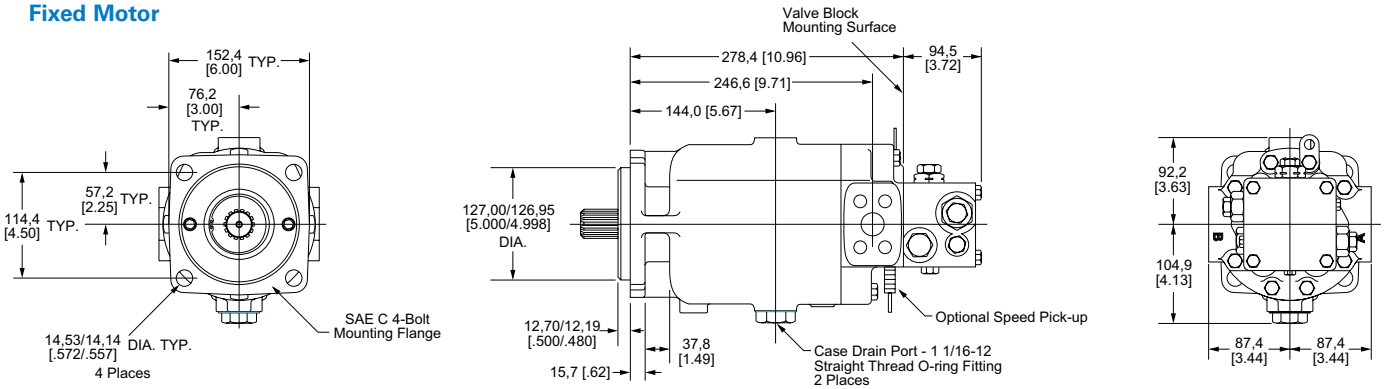
Variable Pump



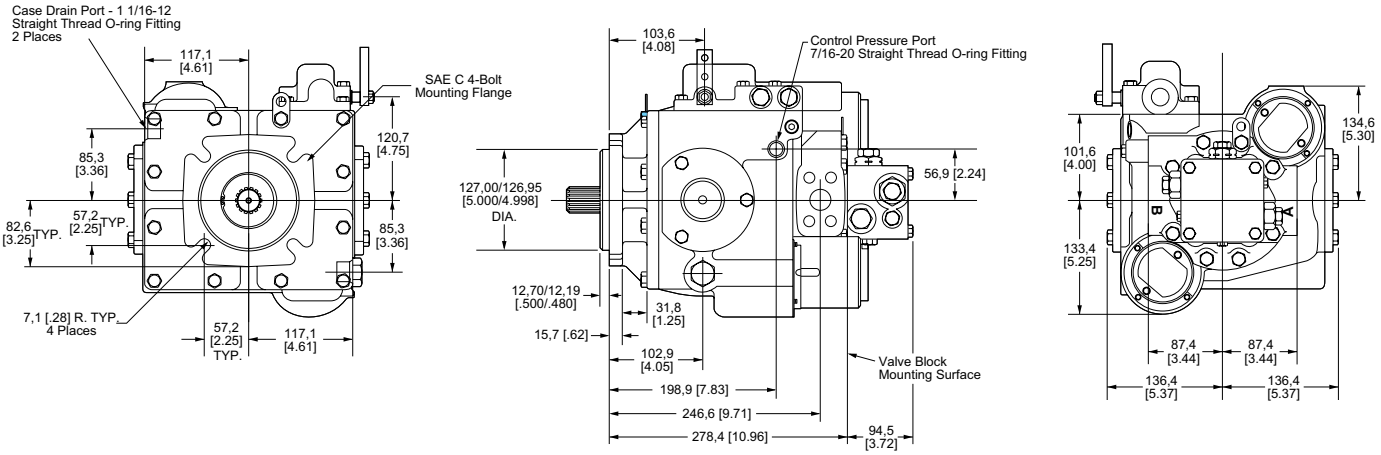
All dimensions are given in millimeters (inches).

Charge Pump Options			
Displacement		Dimension 'G'	
cu.in./rev.	cc/rev	mm	in.
.85	13,9	92,2	3.63
1.28	21,0	98,6	3.88
1.70	27,8	104,9	4.13
2.12	34,7	111,6	4.38

Fixed Motor

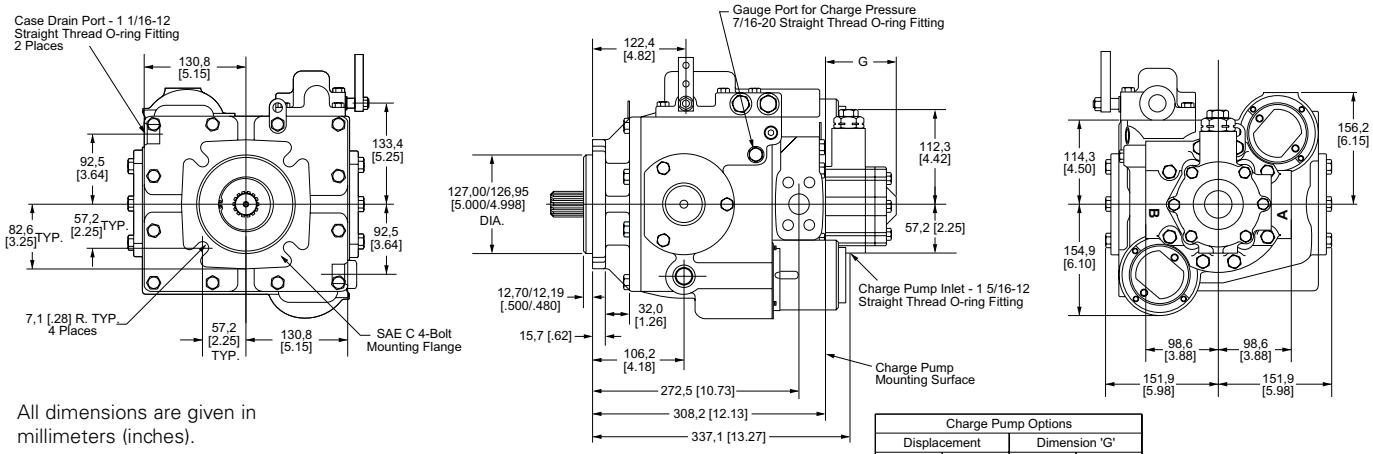


Variable Motor



Dimensions
Models 54 and 64

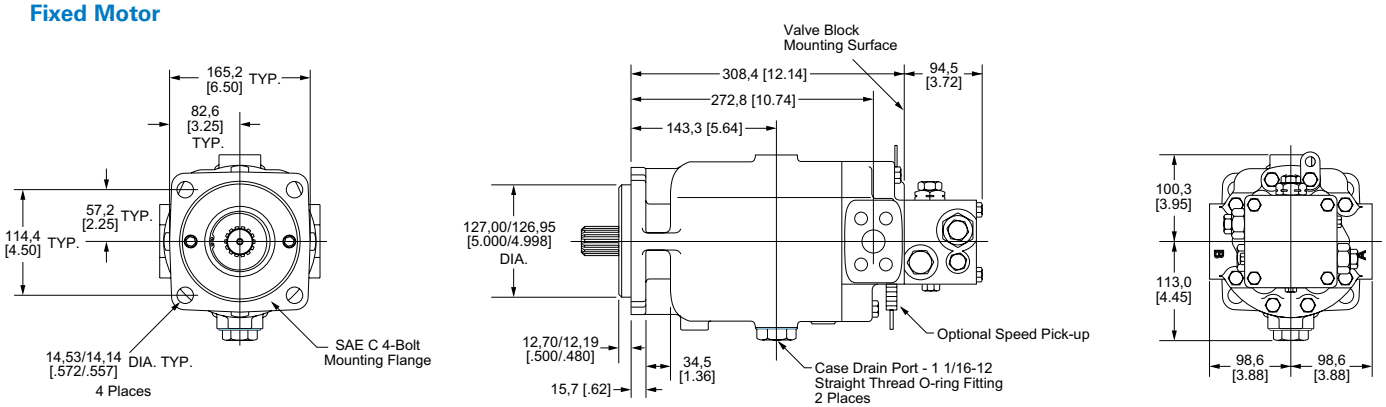
Variable Pump



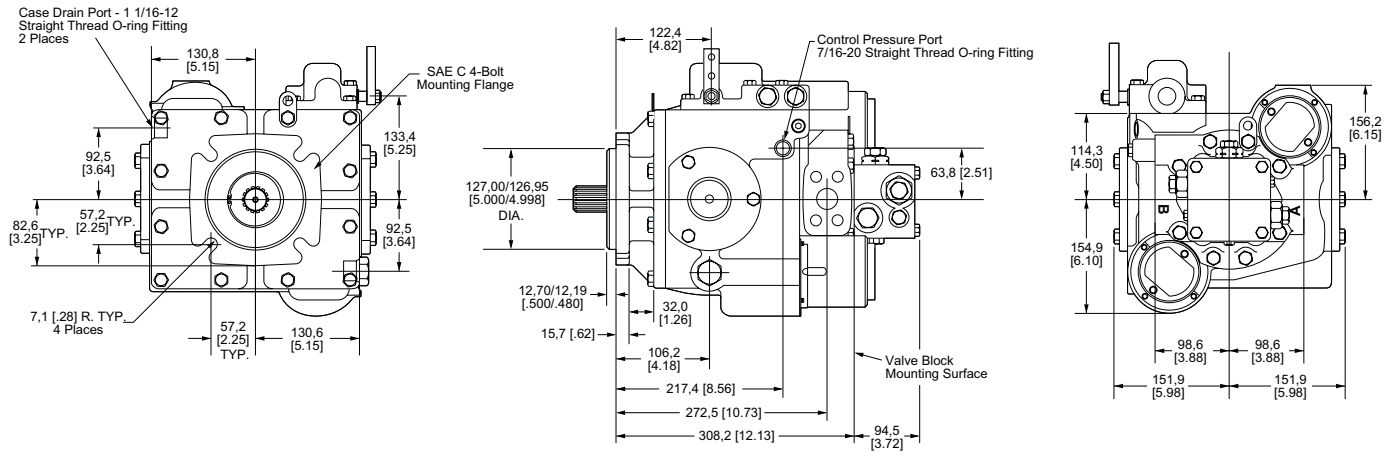
All dimensions are given in millimeters (inches).

Charge Pump Options			
Displacement		Dimension 'G'	
cu.in./rev.	cc/rev	mm	in.
.85	13,9	92,2	3.63
1.28	21,0	98,6	3.88
1.70	27,8	104,9	4.13
2.12	34,7	111,6	4.38

Fixed Motor



Variable Motor



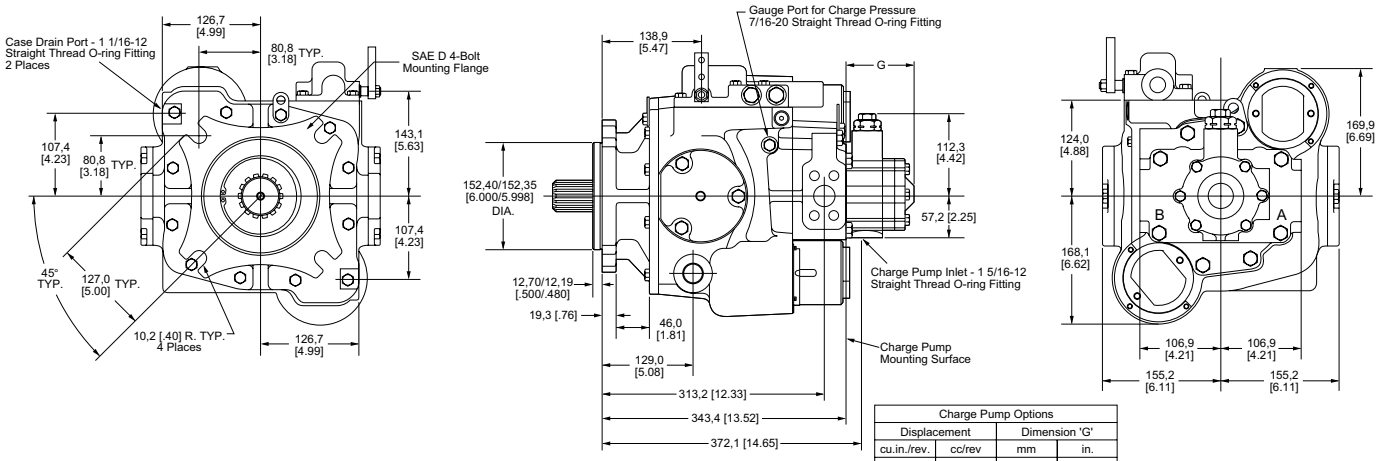
Dimensions

Models 54 and 64

Weight Kg (lb)

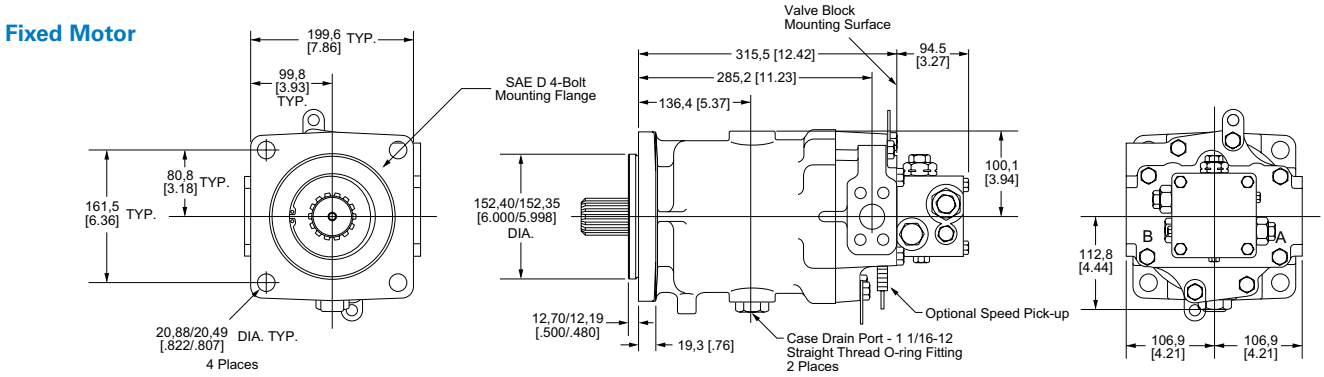
Model	Variable Pump	Fixed Motor	Variable Motor
33	138 (62,6)	83 (37,6)	140 (63,5)
39	138 (62,6)	83 (37,6)	140 (63,5)
46	138 (62,6)	83 (37,6)	140 (63,5)
54	188 (85,3)	106 (48,1)	190 (86,2)
64	188 (85,3)	106 (48,1)	190 (86,2)
76	226 (101,7)	121 (54,5)	228 (102,6)

Variable Pump

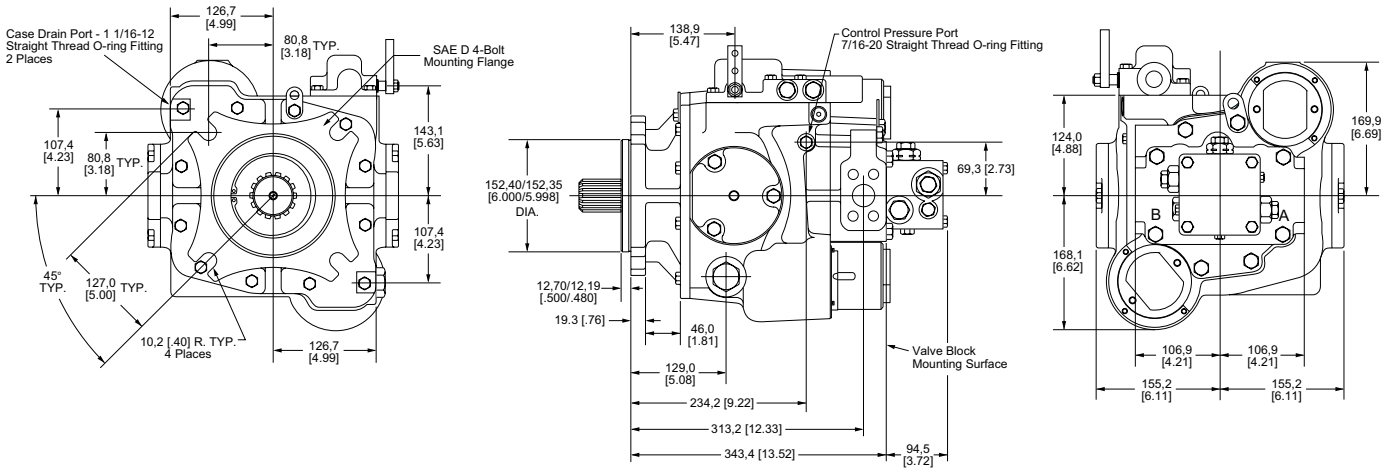


Charge Pump Options			
Displacement		Dimension 'G'	
cu.in./rev.	cc/rev	mm	in.
1.28	21,0	98,6	3.88
1.70	27,8	104,9	4.13
2.12	34,7	111,6	4.38

Fixed Motor



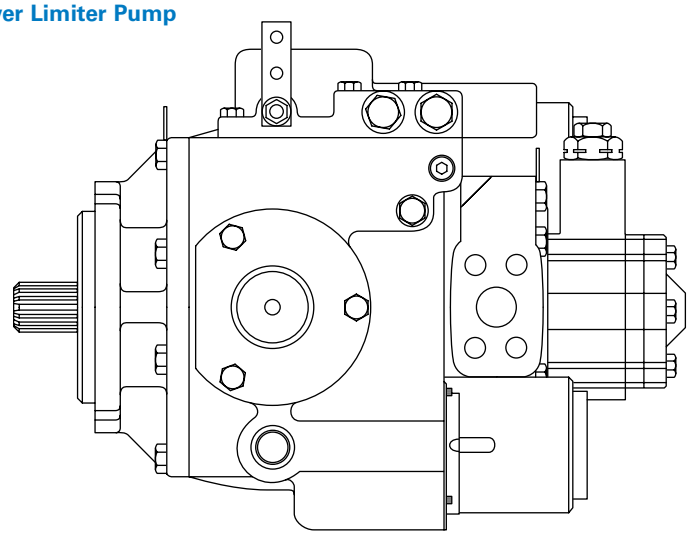
Variable Motor

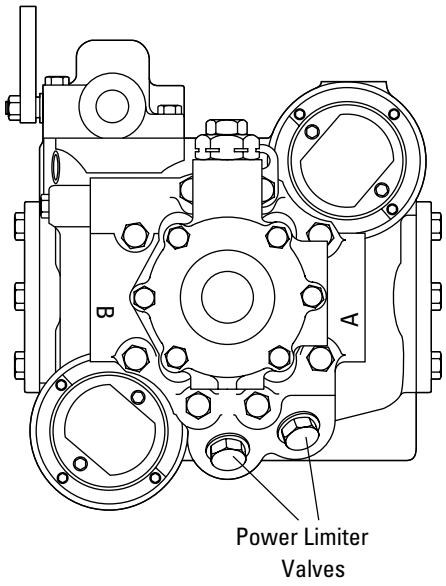


Power Limiter Pumps and Integral Shuttle Valve Motors

Models 39 through 64

Power Limiter Pump





Power Limiter Valve Operation*

Power limiter valves (PLV) are high pressure relief valves built into the pump's end cover. When pressure in the high pressure loop gets too high, the PLV opens to the pump case. Besides an immediate drop in the loop high pressure, the open PLV also causes control pressure to drop. This in turn allows the centering springs on the servo pistons to bring the pump out of stroke until the pressure drops to the relief valve setting and the PLV closes.

The PLV will also act as a check valve to prevent

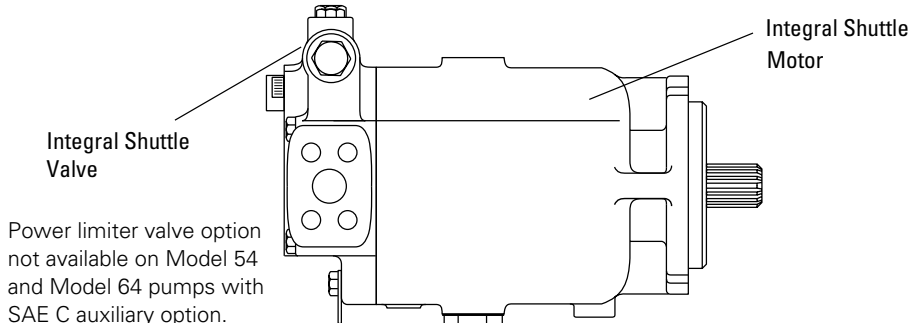
cavitation in the event of a rapid pressure rise and hose expansion.

A motor with integral shuttle valve is used in conjunction with the power limiter valve pump.

Note: Power limiter valves are not recommended for applications with large overrunning loads.

Feature/Benefits

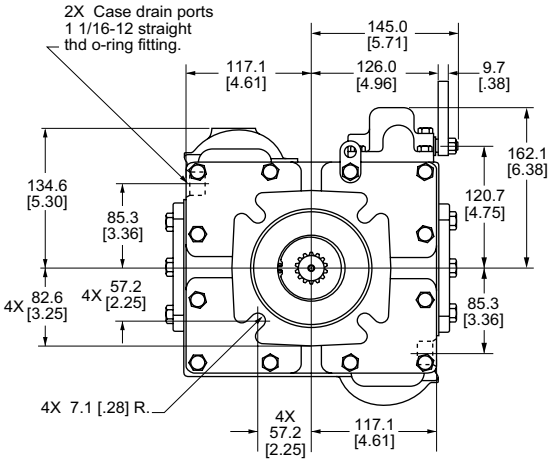
- The motor is shorter and lighter allowing it to fit in tighter spaces.
- The motor's integral shuttle valve and low pressure relief assure good loop flushing.
- The motor is available with side ports, end ports, or both allowing maximum mounting flexibility.
- The power limiter valves (PLV) are quick, direct acting relief valves that prevent high pressure spikes.
- The power limiter pump is ideally suited for use with motors that do not have valve blocks because it eliminates the need for a remote valve block.

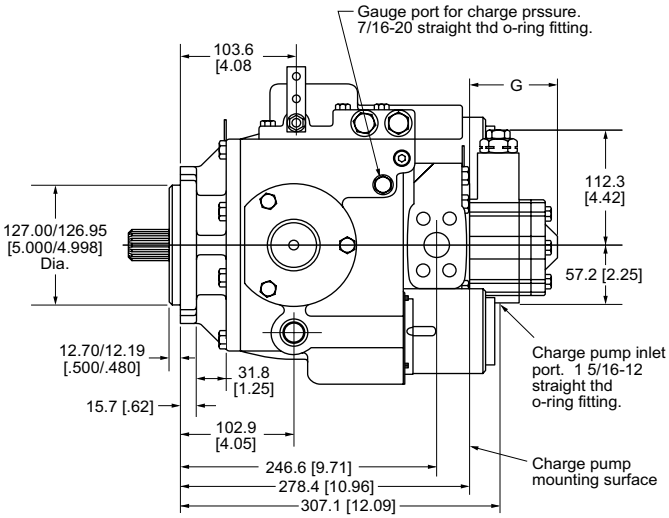


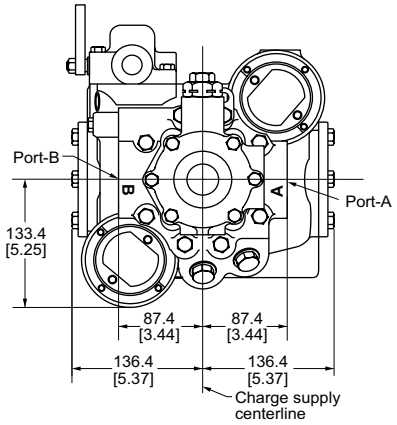
Power limiter valve option not available on Model 54 and Model 64 pumps with SAE C auxiliary option.

Dimensions – Power Limiter Pump

Models 39 and 46



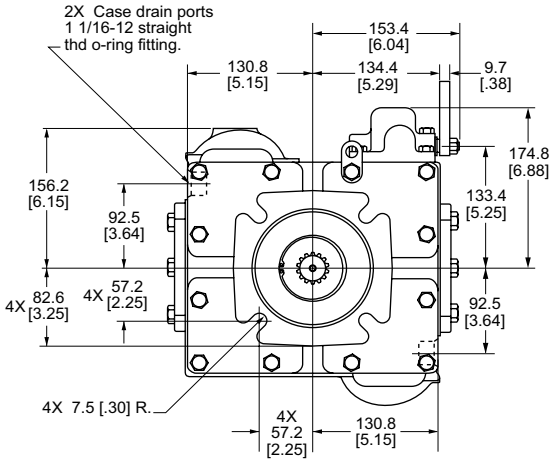


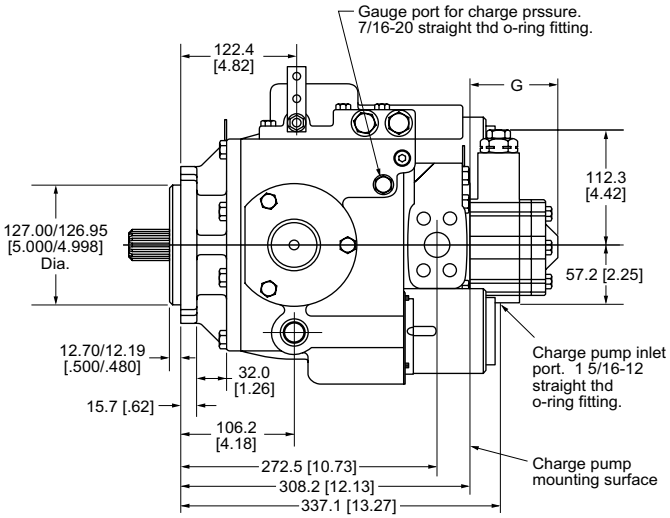


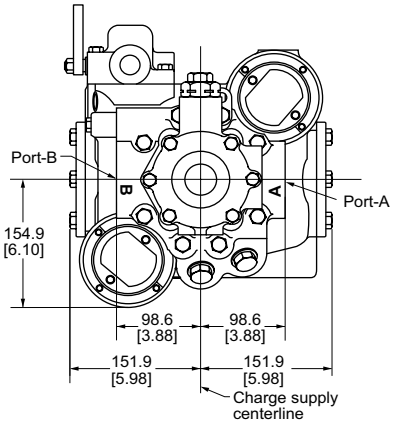
Charge Pump Options			
Displacement		Dimension 'G'	
cu.in./rev.	cc/rev	mm	in.
.85	13,9	92.2	3.63
1.28	21,0	98.6	3.88
1.70	27,8	104.9	4.13
2.12	34,7	111.6	4.38

Dimensions – Power Limiter Pump

Models 54 and 64

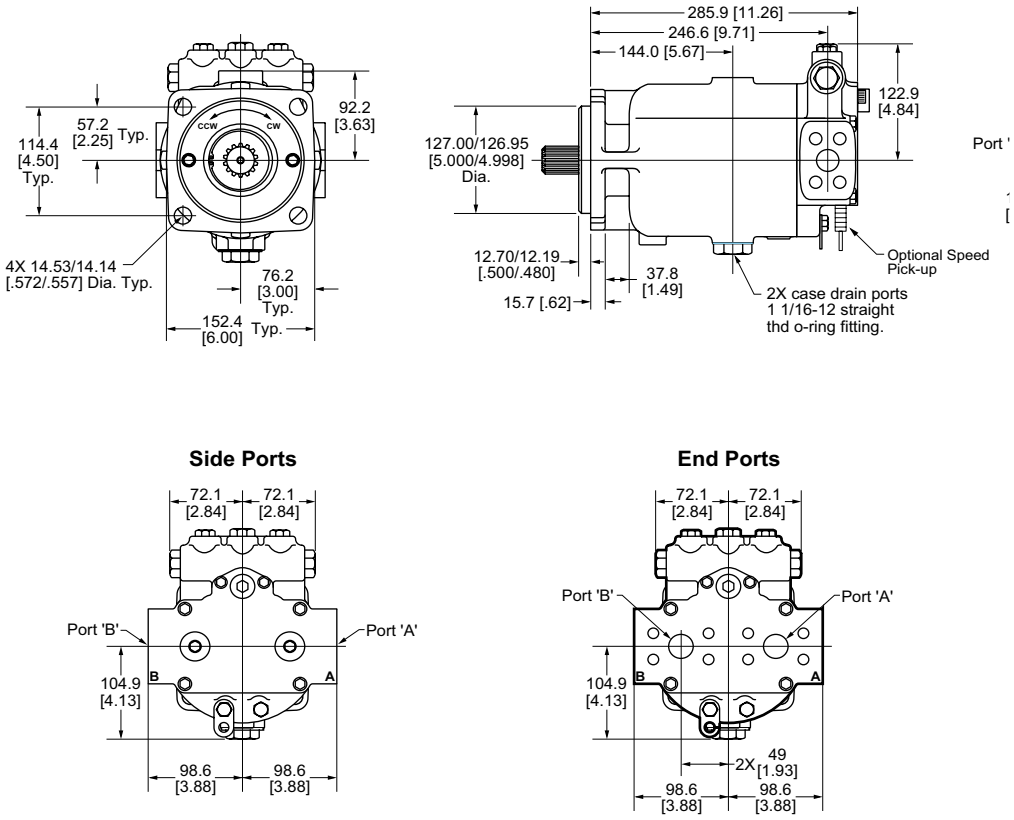






Dimensions – Integral Shuttle Motor

Models 39, and 46



PL Pump and IS Motor Approximate Weights lb (Kg)

Model	PL Pump	IS Motor
39	138 (62,6)	70 (31,8)
46	138 (62,6)	70 (31,8)
54	188 (85,3)	93 (42,2)
64	188 (85,3)	93 (42,2)

Notes: All dimensions are given in millimeters (inches).

The variable pumps are shown with standard controls. Installation drawings of other controls are available from your Eaton representative. Optional controls are shown on page 23.

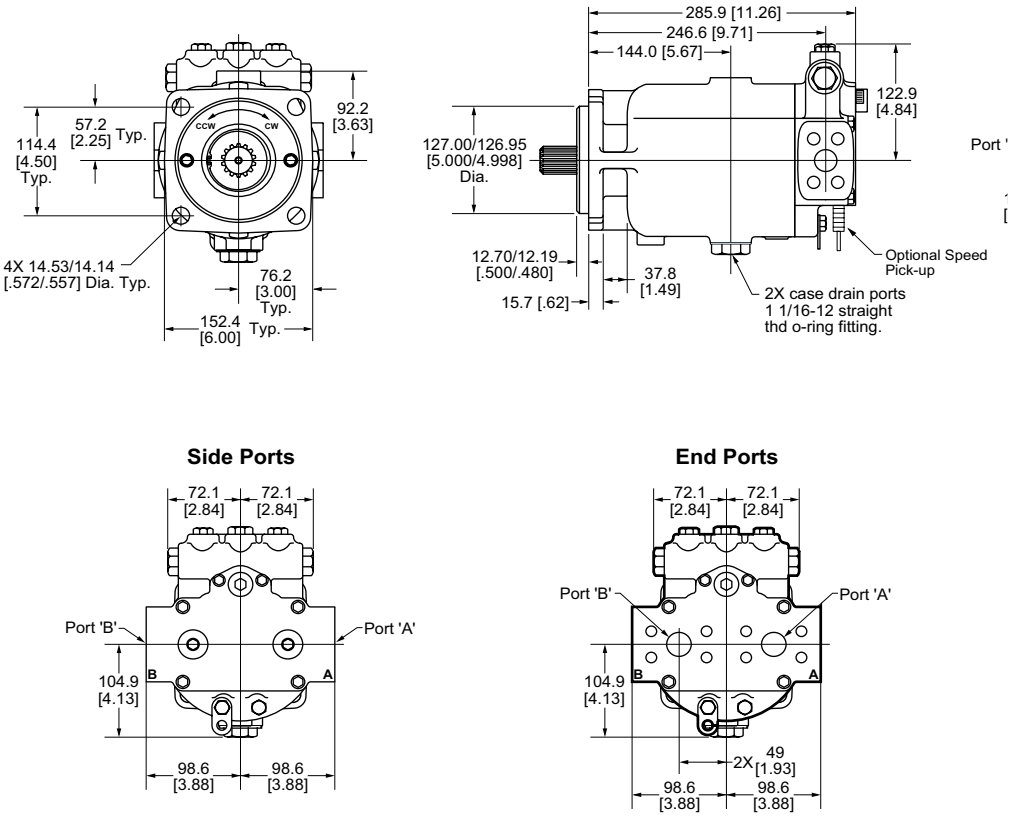
The variable pumps are shown with standard charge pumps. Installation drawings of other charge pumps are available from your Eaton representative.

The lever on the standard pump control has linkage connection holes at 1 and 2 inch radii from the control shaft center.

Detailed drawings of available shafts and ports are shown on page 21.

Dimensions – Integral Shuttle Motor

Models 54 and 64



PL Pump and IS Motor Approximate Weights lb (Kg)

Model	PL Pump	IS Motor
39	138 (62,6)	70 (31,8)
46	138 (62,6)	70 (31,8)
54	188 (85,3)	93 (42,2)
64	188 (85,3)	93 (42,2)

Notes: All dimensions are given in millimeters (inches).

The variable pumps are shown with standard controls. Installation drawings of other controls are available from your Eaton representative. Optional controls are shown on page 23.

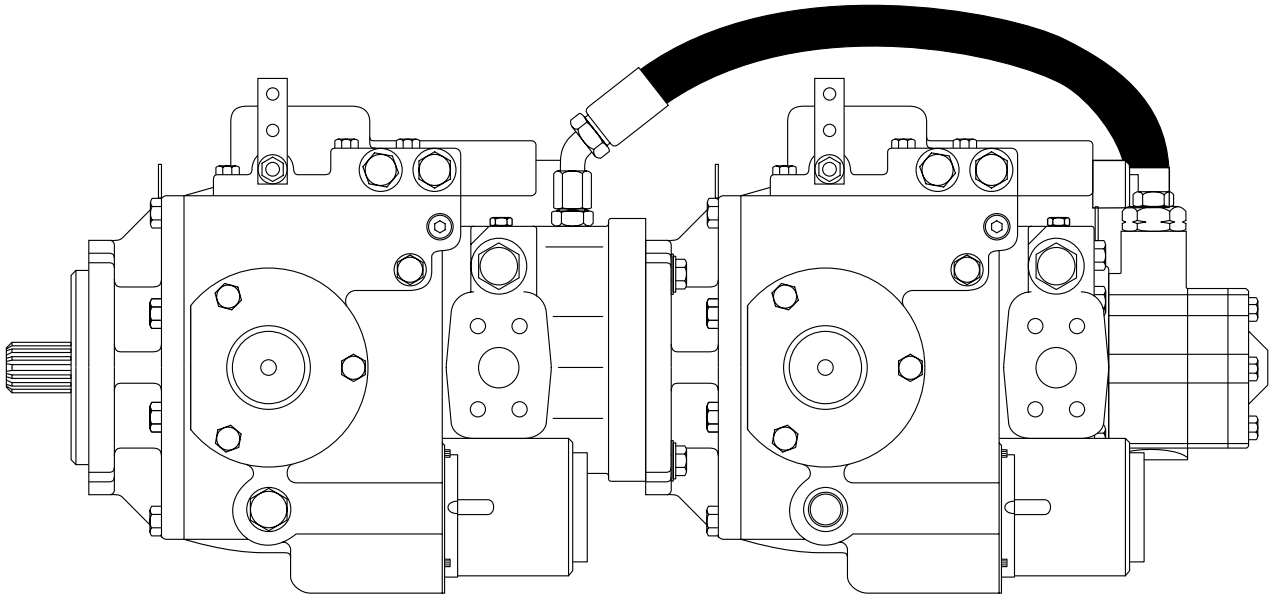
The variable pumps are shown with standard charge pumps. Installation drawings of other charge pumps are available from your Eaton representative.

The lever on the standard pump control has linkage connection holes at 1 and 2 inch radii from the control shaft center.

Detailed drawings of available shafts and ports are shown on page 21.

Heavy Duty Tandem Pumps

Models 39 through 64



Tandem Pump Applications

Tandem pumps are most typically used in applications where two independent sources of hydraulic power are required while taking advantage of using only one power source to drive the two pumps. This saves on the expense of driving two pumps by eliminating the split drive gear box or eliminating another power source such as a second engine or motor. Tandem pumps can be used on machines such as track drive equipment where independent power is required at each track. Speed and power can be controlled to each side of the vehicle for steering and vehicle speed control both in forward and reverse directions.

Tandem pumps can also be used to create the equivalent flow of one larger displacement pump by combining the flows of the two pumps. This is an economic advantage over using a single large displacement pump.

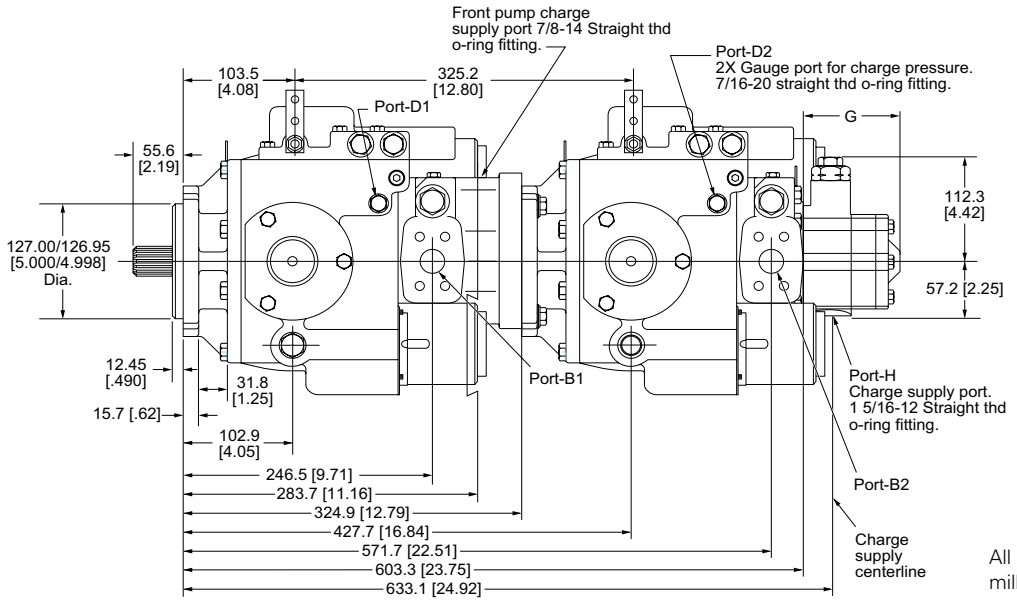
Tandem pumps may also be used in industrial, construction or mining applications where several sources of hydraulic power are required while taking advantage of using only one power source to drive the two pumps.

Features/Benefits

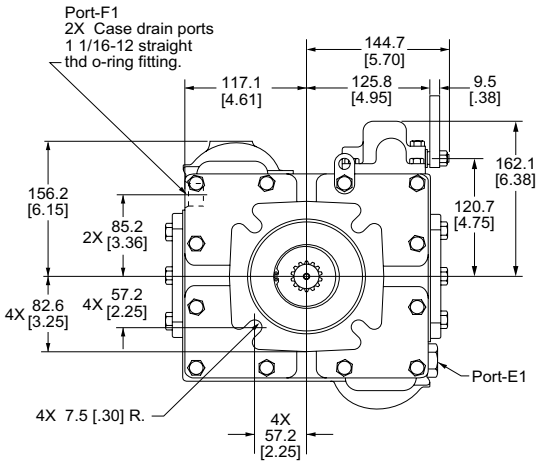
- Pumps mounted in tandem save the expense of a pump drive.
- Tandem pumps, in some applications, are required because of space limitations.
- The rear pump may be the same displacement or smaller than the front pump.
- A tandem pump may be used as an economical alternative for a larger displacement pump by combining the flow of both pumps. For example, combining the flows of two 6.4 in^3/rev pumps connected in tandem provides the flow equivalent to a 12.8 in^3/rev pump.
- Charge pumps with SAE A or SAE B auxiliary mounts are available.
- Pump has standard SAE C flange mount.
- Rear pump can be the same displacement or smaller than front pump.

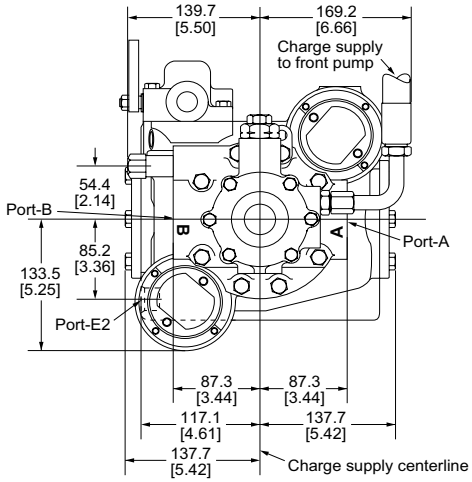
Dimensions – Tandem Pumps

Models 39 and 46 Tandem Pumps



All dimensions are given in millimeters (inches).





Charge Pump Options

Displacement		Dimension 'G'	
cu.in./rev.	cc/rev	mm	in.
.85	13,9	92.2	3.63
1.28	21,0	98.6	3.88
1.70	27,8	104.9	4.13
2.12	34,7	111.6	4.38

Notes: The variable pumps are shown with standard controls. Installation drawings of other controls are available from your Eaton representative. Optional controls are shown on page 23.

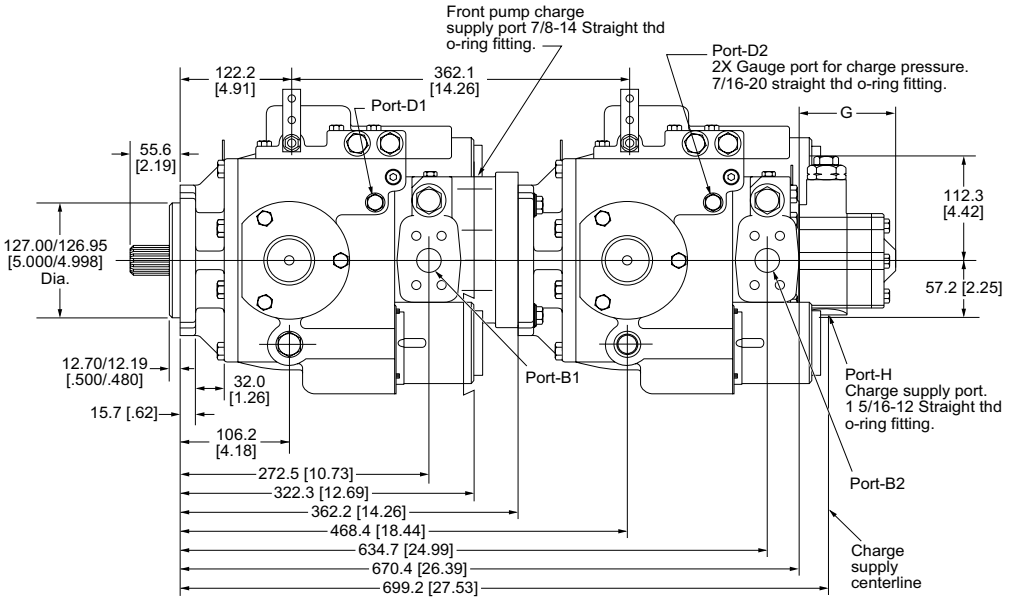
The variable pumps are shown with standard charge pumps. Installation drawings of other charge pumps are available from your Eaton representative.

The lever on the standard pump control has linkage connection holes at 1 and 2 inch radii from the control shaft center.

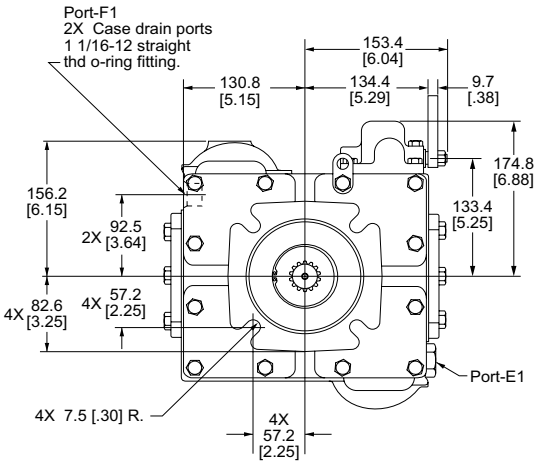
Detailed drawings of available shafts and ports are shown on page 21.

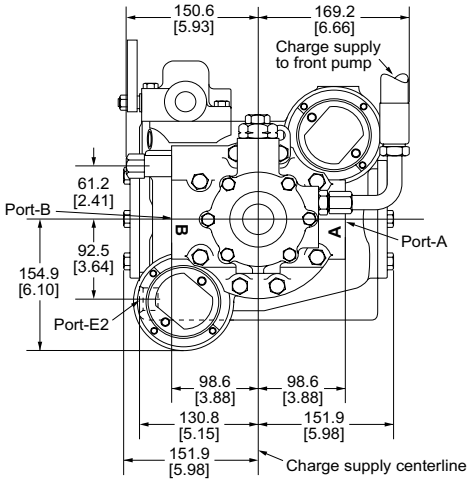
Dimensions – Tandem Pumps

Models 54 and 64 Tandem Pumps



All dimensions are given in millimeters (inches).





Charge Pump Options

Displacement		Dimension 'G'	
cu.in./rev.	cc/rev	mm	in.
.85	13,9	92.2	3.63
1.28	21,0	98.6	3.88
1.70	27,8	104.9	4.13
2.12	34,7	111.6	4.38

Tandem Pump Application Information

Some tandem applications require larger displacement charge pumps.

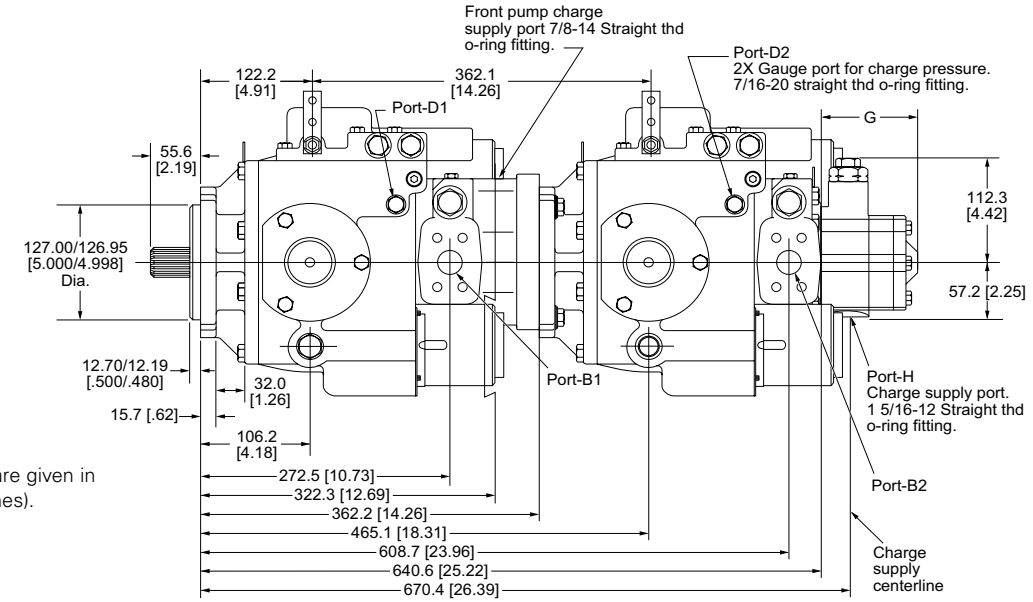
Refer to the Heavy Duty Application manual (no. 5-401) for more information on heavy duty pump and motor applications.

Tandem Pump Approximate Weights

Front Pump	Rear Pump	Weight lb (kg)
Model 39 - 46	Model 33 - 46	276 (125.2)
Model 54 - 64	Model 54 - 64	376 (170.6)
Model 54 - 64	Model 33 - 46	326 (147.9)

Application Information – Tandem Pump

Tandems, Model 54 or 64 Front Pump with Model 39, or 46 Rear Pump



All dimensions are given in millimeters (inches).

Charge Pump Options

Displacement cu.in./rev.	Displacement cc/rev	Dimension 'G' mm	Dimension 'G' in.
.85	13,9	92.2	3.63
1.28	21,0	98.6	3.88
1.70	27,8	104.9	4.13
2.12	34,7	111.6	4.38

Shaft Coupling Point	lb-in.	Nm
Input Shaft Models 54 – 64	11150	1260
Input Shaft Models 33 – 46	8550	966
Front/Rear Pump Coupler	6600	746
Charge Pump	2050	232
B-Pad Auxiliary Pump	1852	209
A-Pad Auxiliary Pump	517	58

Maximum Shaft Torque Limitations

The total input torque, as well as, the torque at each of the drive shaft coupling points must be considered in a tandem pump system.

Torque calculation formulas and the maximum allowable shaft torque limits, for each shaft coupling point in the tandem pump, are given below.

For longest shaft life, use the largest shaft possible.

Shaft Torque Formulas

$$\text{Max. Aux Pump Torque} = \frac{(\text{Max Displ}_{\text{aux pmp}})(\text{Max Pressure}_{\text{aux pmp}})}{(6.28)(.9)}$$

$$\text{Max. Chg Pump Torque} = \frac{(\text{Max Displ}_{\text{chg pmp}})(\text{Max Pressure}_{\text{chg pmp}})}{(6.28)(.9)} + \text{Max. Aux Pump Torque}$$

$$\text{Max. Front/Rear Pump Coupler Torque} = \frac{(\text{Max Displ}_{\text{pmp 2}})(\text{Max Pressure}_{\text{pmp 2}})}{(6.28)(.9)} + \text{Max. Chg Pump Torque}$$

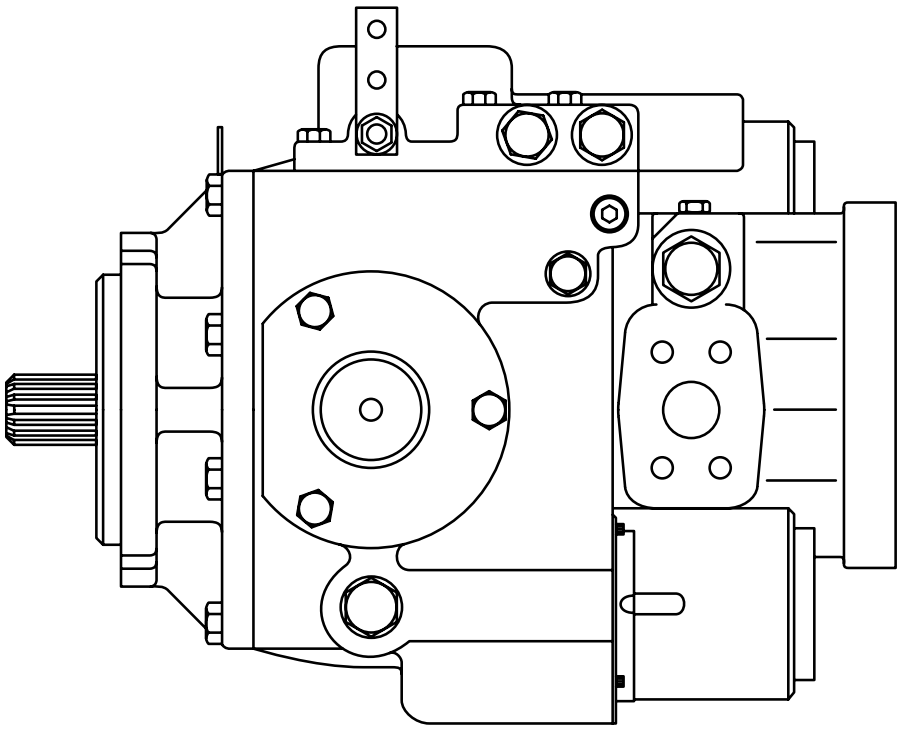
$$\text{Max. Input Shaft Torque} = \frac{(\text{Max Displ}_{\text{pmp 1}})(\text{Max Pressure}_{\text{pmp 1}})}{(6.28)(.9)} + \text{Max. Front/Rear Pump Coupler Torque}$$

Heavy Duty Pumps with C-Pad Rear Mount

Models 39 through 64

Features/Benefits

- The heavy duty pump with a C-Pad rear mount is the front half of the tandem unit.
- Pump has standard SAE C flange mount.
- Rear pump can be the same displacement or smaller than front pump
- The rear mount accepts a standard SAE C flange.
- This pump is ideal for applications that require two different pumps. Road rollers and some construction equipment are applications that employ two different pumps.



Application Information

Maximum Shaft Torque Limitations

The total input torque, as well as, the torque at the drive shaft coupling point must be considered when the pump with the SAE C rear mount is used. Maximum torque values and formulas are given on page 18.

Pumps with SAE C Rear Mount

A 14 tooth, 12/24 pitch, internal spline coupling (Part No. 105853) is required between front and rear pump. A coupling is provided with each SAE C Pump. Optional couplings with 21 tooth, 16/32 pitch; and 23 tooth, 16/32 pitch, are also available.

Pump requires remote charge pump and charge pressure relief. (Charge pressure relief may be built into pump.)

Refer to the Heavy Duty Application manual (no. 5-401) for more information on heavy duty pump and motor applications.

Rear Pump Mounting Information

When an Eaton heavy duty pump is used as the rear

pump, remove its shaft seal so part of the case flow will flow past the bearing into the front pump. It is also necessary to connect the rear pump's upper case drain port to the front pump's lower case drain port, otherwise high case pressures may result.

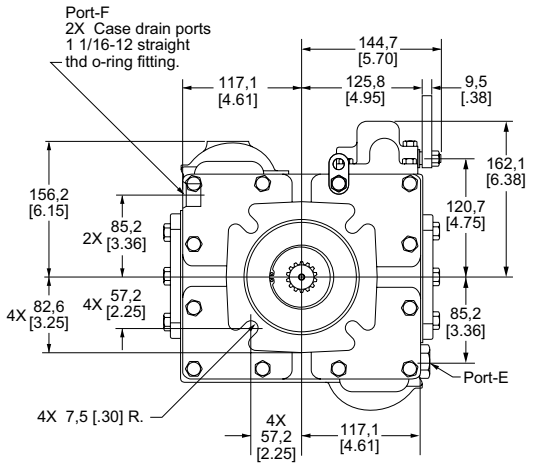
In all cases, check case pressures and ensure that they do not exceed 40 PSI (3 bar).

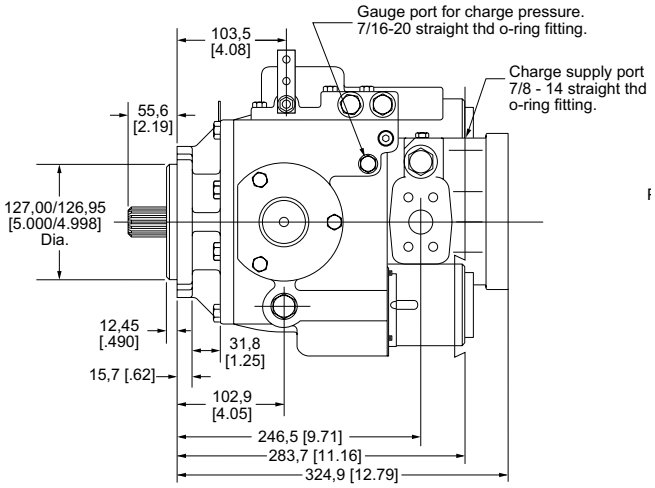
Heavy Duty Application manual (no. 5-401) gives more information on proper case flow routing.

See previous page for shaft torque ratings.

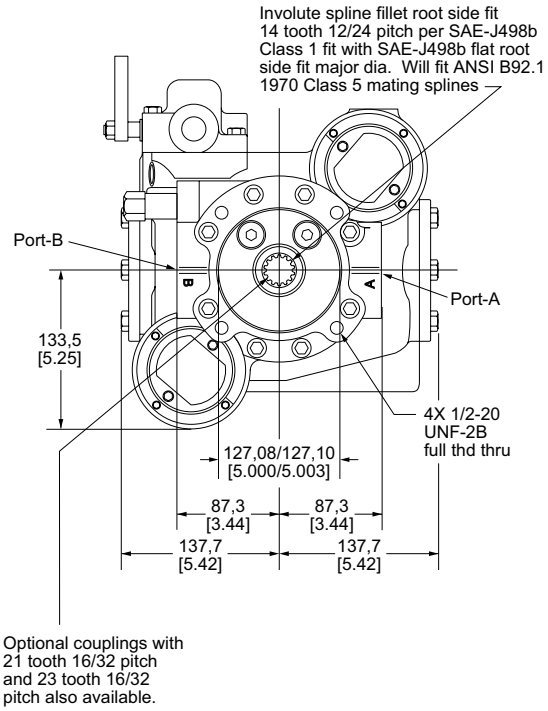
Dimensions – Pumps with C-Pad Rear Mount

Models 39 and 46





All dimensions are given in millimeters (inches).



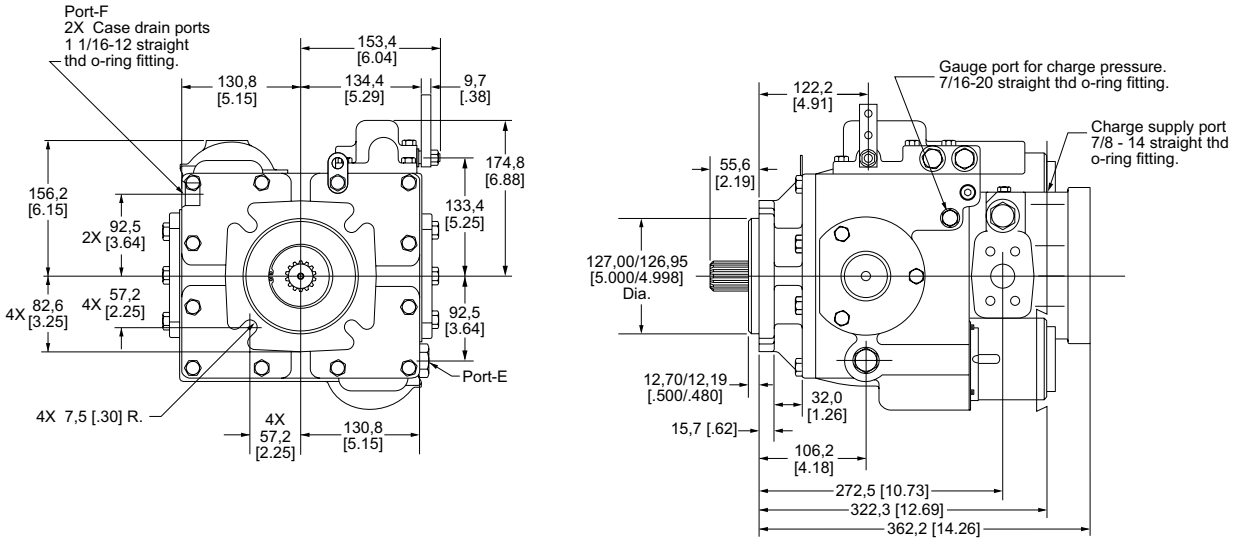
Notes: The variable pumps are shown with standard controls. Installation drawings of other controls are available from your Eaton representative. Optional controls are shown on page 23.

The lever on the standard pump control has linkage connection holes at 1 and 2 inch radii from the control shaft center.

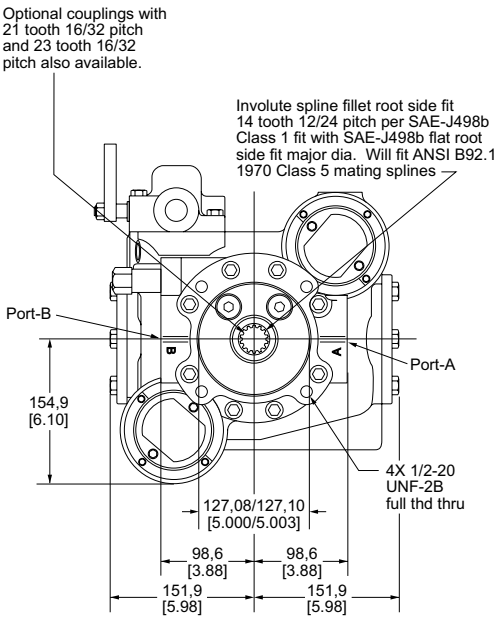
Detailed drawings of available shafts and ports are shown on page 21.

Dimensions – Pumps with C-Pad Rear Mount

Models 54 and 64 Pumps



All dimensions are given in millimeters (inches).



Notes: The variable pumps are shown with standard controls. Installation drawings of other controls are available from your Eaton representative. Optional controls are shown on page 23.

The lever on the standard pump control has linkage connection holes at 1 and 2 inch radii from the control shaft center.

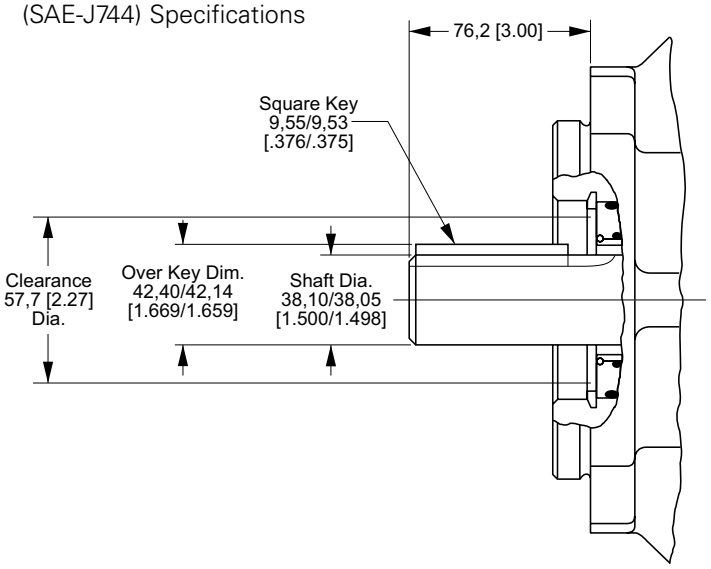
Detailed drawings of available shafts and ports are shown on page 21.

Dimensions – Shaft and Port

Models 39 through 64

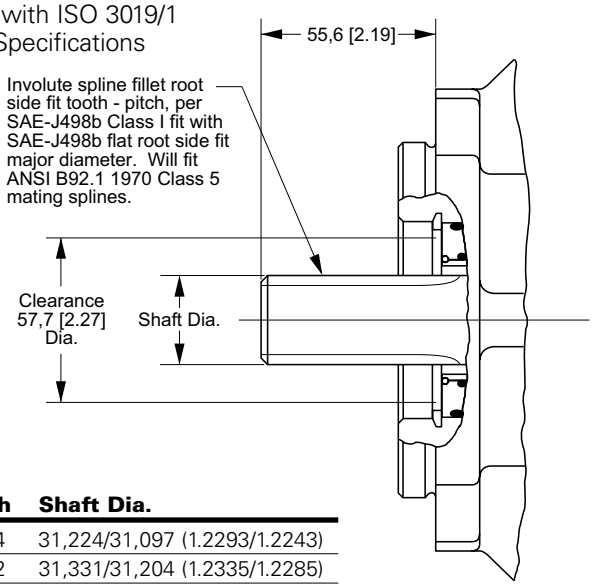
Keyed Shaft Option

Compatible with ISO 3019/1
(SAE-J744) Specifications



Splined Shaft Options

Compatible with ISO 3019/1
(SAE-J744) Specifications

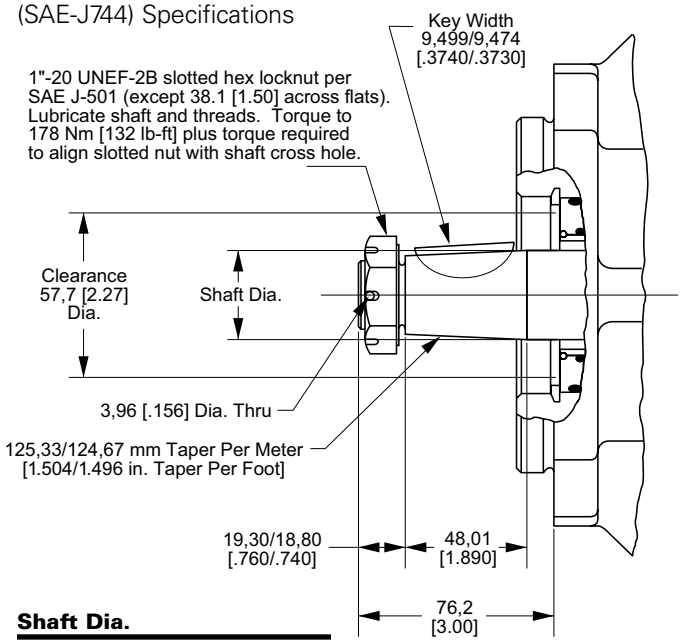


Tooth	Pitch	Shaft Dia.
14*	12/24	31,224/31,097 (1.2293/1.2243)
19	16/32	31,331/31,204 (1.2335/1.2285)
20	16/32	32,918/32,791 (1.2960/1.2910)
21	16/32	34,506/34,379 (1.3585/1.3535)
23	16/32	37,681/37,554 (1.4835/1.4785)

* Not recommended for Model 64 or tandem pumps.

Tapered Shaft Options

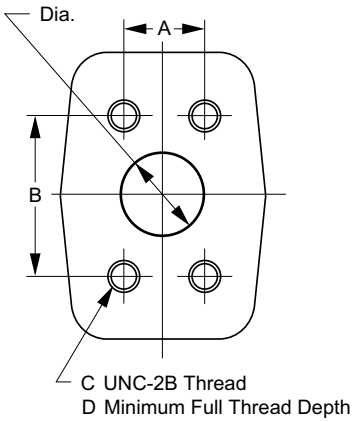
Compatible with ISO 3019/1
(SAE-J744) Specifications



Shaft Dia.
35,05/34,90 (1.380/1.374)
38,23/38,08 (1.505/1.499)

Split Flange Port Options

Per SAE-J518 Specifications



Code	Dia.	A	B	C	D
61	25,4 (1.00)	26,19 (1.031)	52,37 (2.062)	3/8-16	22,4 (.88)
62	25,4 (1.00)	27,76 (1.093)	57,15 (2.250)	7/16-14	27,0 (1.06)

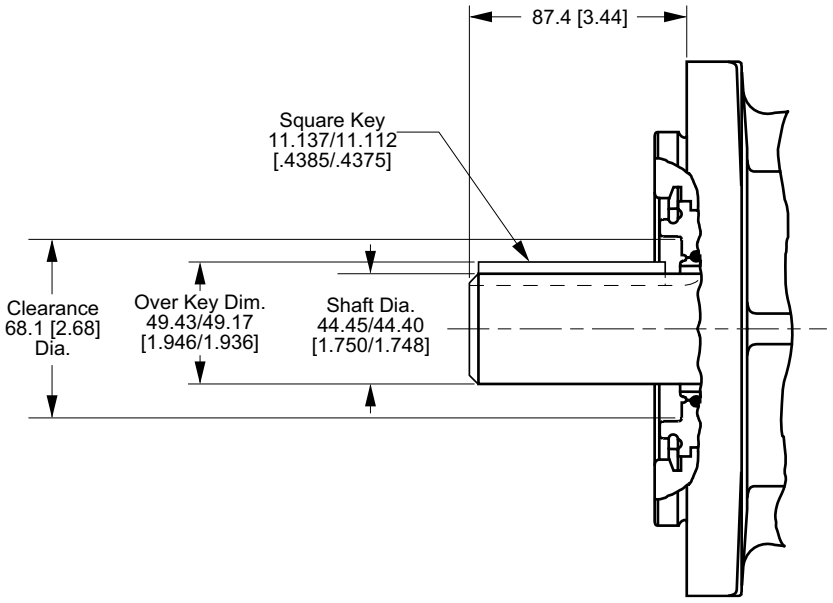
Dimensions in mm (in)

Dimensions – Shaft and Port

Model 76

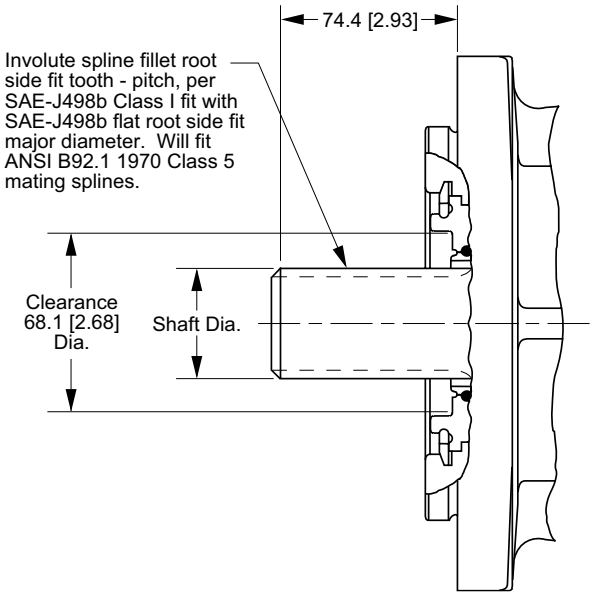
Keyed Shaft Option

Compatible with ISO 3019/1
(SAE-J744) Specifications



Splined Shaft Options

Compatible with ISO 3019/1
(SAE-J744) Specifications



Tooth	Pitch	Shaft Dia.
13	8/16	43.713/43.586 (1.7210/1.7160)
27	16/32	44.031/43.904 (1.7335/1.7285)

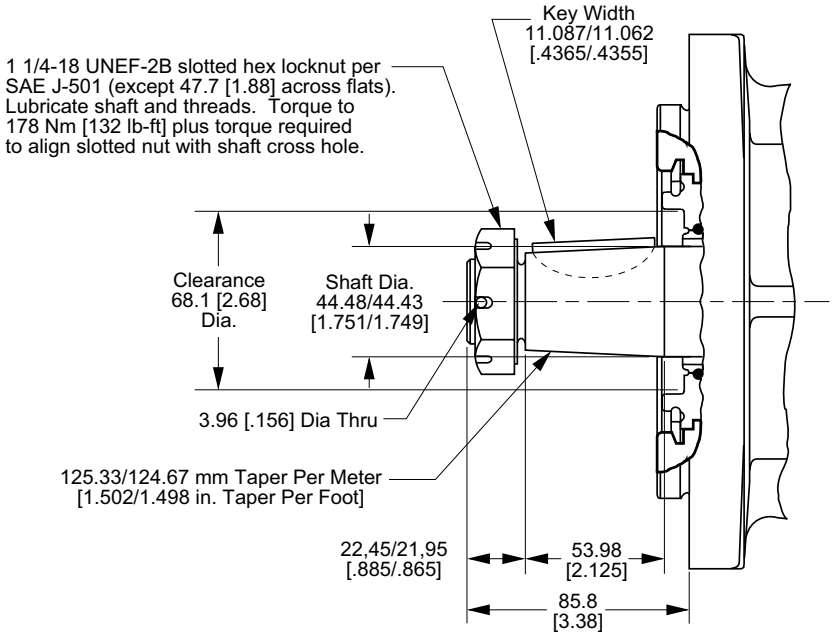
Dimensions in mm (in)

Dimensions – Shaft and Port

Model 76

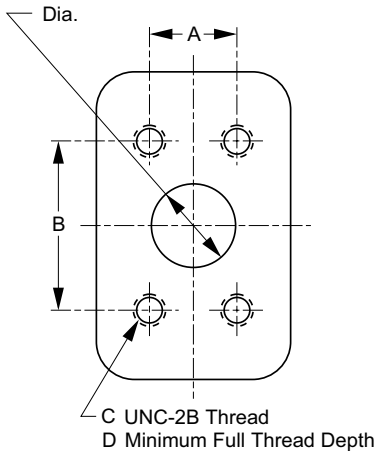
Tapered Shaft Option

Compatible with ISO 3019/1 (SAE-J744) Specifications



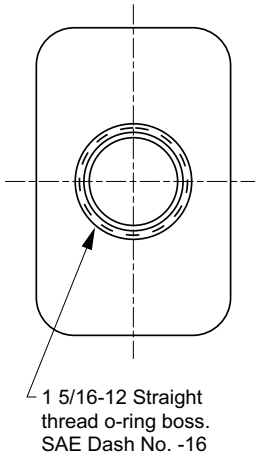
Split Flange Port Options

Per SAE-J518 Specifications



O-ring Port Option

Per SAE-J514 Specifications



Code	Dia.	A	B	C	D
61	25,4 (1.00)	26,19 (1.031)	52,37 (2.062)	3/8-16	22,4 (.88)
62	25,4 (1.00)	27,76 (1.093)	57,15 (2.250)	7/16-14	27,0 (1.06)

Dimensions in mm (in)

Component Descriptions

The Operational Diagram on page 46 shows a typical heavy duty hydrostatic transmission. The axial piston pump and axial piston motor are the main components. The filter, reservoir, heat exchanger, and oil lines make up the rest of the system. The function of each of these components is described below:

A separate energy source, such as an electric motor or internal combustion engine, turns the input shaft of the pump.

Variable Displacement Axial Piston Pump

The variable displacement pump provides a flow of high pressure oil. Pump output flow can be varied to obtain the desired motor output speed. For example, when the pump's displacement is zero, no oil is pumped and the transmission's motor output shaft is stopped. Conversely, maximum pump displacement produces maximum motor shaft speed. The direction of high pressure flow can also be reversed; doing so reverses the direction the motor output shaft rotates.

A charge pump is integrated into the piston pump and driven by the shaft of the piston pump. The drawing illustrates a suction filtration circuit. Eaton recommends a suction filter without a bypass valve. The charge pump has a Low Pressure Relief Valve that regulates the output pressure. Power limiter valves and high pressure relief valves are available as options.

Fixed Displacement Axial Piston Motor

The motor uses the high pressure oil flow from the pump to produce transmission output. The high pressure oil comes to the motor through one of the high pressure lines. It enters the motor, turns the output shaft, then returns to the pump. Eaton piston motors integrate a hot oil shuttle and low pressure relief valve into the end cover. The shuttle valve and low pressure relief valve direct excess charge pump flow into the motor case. The shuttle valve is activated by high pressure and directs excess charge pump flow over the low pressure relief valve. This flushing action allows the charge pump to provide clean, cool oil to the closed loop circuit.

Reservoir

The reservoir is an important part of the hydrostatic transmission system. It should provide adequate oil storage and allow easy oil maintenance.

The reservoir must hold enough oil to provide a continuous oil supply to the charge pump inlet. It must also have enough room for the hydraulic oil to expand as the system warms up. Consider charge pump flow when sizing the reservoir: One half (.5) minute times (X) the maximum charge pump flow should be the minimum oil volume in the reservoir. Maintaining this oil volume will give the oil a minimum of thirty (30) seconds in the reservoir. This will allow any entrained air to escape and contamination to settle out of the oil.

To allow for oil expansion, the reservoir's total volume should be at least six tenths (.6) minute times (X) the maximum charge pump flow.

The reservoir's internal structure should cut down turbulence and prevent oil aeration.

The line returning flow to the reservoir should be fitted with a diffuser to slow the incoming oil to 1 to 1.2 meters (3-4 feet) per second to help reduce turbulence. The return flow line should also be positioned so that returning oil enters the reservoir below the liquid surface. This will help reduce aeration and foaming of the oil.

The reservoir should have baffles between the return line and suction line. Baffles prevent return flow from immediately reentering the pump.

A sixty mesh screen placed across the suction chamber of the reservoir will act as a bubble separator. The screen should be placed at a thirty degree angle to the horizon.

The entrance to the suction line should be located well below the fluid surface so there is no chance of air being sucked into the charge pump inlet. However, the suction line entrance should not be located on the bottom of the reservoir where there may be a buildup of sediment. The suction line entrance should be flared and covered with a screen.

The reservoir should be easily accessible. The fill port should be designed to minimize the possibility of contamination during filling and to help prevent over filling. There should be a drain plug at the lowest point of the reservoir and it should also have a clean-out and inspection cover so the reservoir can be thoroughly cleaned after prolonged use. A vented reservoir should have a breather cap with a micronic filter.

Sealed reservoirs must be used at altitudes above 2500 feet. These reservoirs should be fitted with a two way micronic filter pressure cap to allow for fluid expansion and contraction.

In both cases the caps must be designed to prevent water from entering the reservoir during bad weather or machine washing.

A hydrostatic transmission with a well designed reservoir will run quieter, stay cleaner and last longer.

Application Information

Filter

A filter must be used to keep the hydraulic fluid clean. Either a suction filter or a pressure side filter may be used. The filter must be a no-bypass type. A suction filter is shown in the operational diagram on page 46 System oil particulate levels should not exceed ISO 18/13. Refer to Eaton Hydraulic Fluid Recommendations on page 54.

Recommended beta ratios for each filter type are listed below:

Suction Filter $ß_{10}$ = 1.5 to 2.0

Pressure Side Filter $ß_{10}$ = 10 to 20

When a suction filter is used, its flow capacity must be large enough to prevent an excessive pressure drop between the reservoir and charge pump inlet. The pressure at the charge pump inlet port must not be less than 0.8 bar (11.6 psi) absolute at normal continuous operating temperatures.

Charge Pump Inlet Line

The inlet line to the charge pump should be large enough to keep the pressure drop between the reservoir and charge pump inlet within the limits described in the filter section. Fittings will increase the pressure drop, so their number should be kept to a minimum. It is best to keep fluid velocities below 1,25 meters (4 feet) per second.

Fluid and temperature compatibility must be considered when selecting the inlet line.

Pump and Motor Case Drain Lines

The case drain lines should be large enough to limit the pump and motor case pressures to 2,8 bar (40 psi) at normal operating temperatures. Fluid and temperature compatibility must also be considered when selecting the case drain lines.

High Pressure Lines

The high pressure lines that connect the pump and motor must be able to withstand the pressures generated in the high pressure loop.

Heat Exchanger

Use of a heat exchanger is dependent on the transmission's duty cycle and on machine layout. The normal continuous operating fluid temperature measured in the pump and motor cases should not exceed 80°C (180°F) for most hydraulic fluids. The maximum fluid temperature should not exceed 105°C (220°F).

The heat exchanger should be sized to dissipate 25% of the maximum input power available to the transmission. It must also be sized to prevent the case pressures in the pump and motor from getting too high. Case pressure up to 2.8 bar (40 psi), at normal operating temperatures, are acceptable.

Heat Exchanger Bypass Valve

The heat exchanger bypass valve is a pressure and/or temperature valve in parallel with the heat exchanger. Its purpose is to prevent case pressures from getting too high. The heat exchanger bypass valve opens when the oil is thick, especially during cold starts.

Reservoir Return Line

The same general requirements that apply to case drain lines apply to the reservoir return line.

Application Information

Shaft Couplings and Mounting Brackets

Shaft couplings must be able to with stand the torque that will be transmitted to the pump or motor. If the pump or motor is to be directly coupled to the drive, the misalignment should not exceed .050 mm (.002 in.) total indicator run-out for the combination of perpendicularity and concentricity measurements.

The hardness of the couplings connected to Eaton pump or motor shafts should be 35 Rc for tapered or straight keyed shafts and 50-55 Rc for splined shafts.

Open Loop Circuits

Eaton heavy duty pumps and heavy duty motors may be used in open loop circuits under certain operating conditions. Consult your Eaton representative for details.

Orientation

The mounting orientation of Eaton heavy duty pumps and motors is unrestricted. The case drain line that carries the flow leaving the pump or motor should be connected to the highest drain port on each of the units. This assures that the pump and motor cases remain full.

Multiple Pump or Motor Circuits

Multiple pumps or motors can be combined in the same circuit. When two pumps are used in a parallel circuit, their swashplate controls can be operated in phase or in sequence. The following precautions should be observed whenever multiple pumps and/or motors are connected in the same circuit:

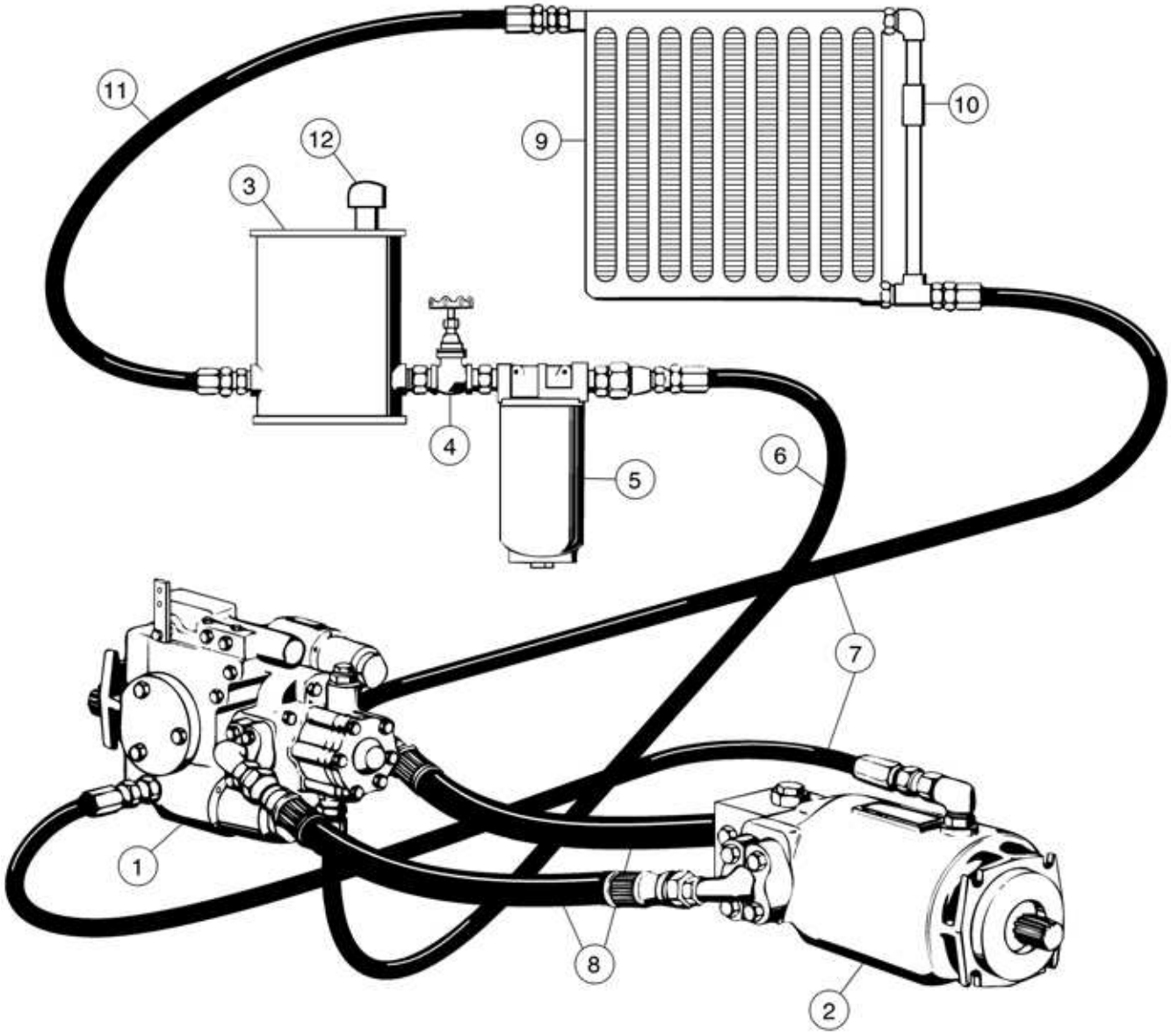
1. Charge pump flow must be greater than the sum of the charge pump flow requirements of the individual units.

2. The possibility of motor overspeeding increases in multiple motor circuits. The parallel motor circuit will act as a frictionless differential. Should one of the motors stall the other could overspeed. The motors used in parallel circuits should, therefore, be sized to prevent overspeeding. Valves that will limit the flow to each of the motors may be used to prevent overspeeding. This will allow the use of smaller motors, however the flow limiting valves will create heat.

3. When using one pump with multiple motors, the case drain lines should be connected in series. The case flow should be routed from the most distant motor, through the remaining motors, to the pump, and finally back to the reservoir. The most distant motor should have the valve block or integral shuttle valve while the additional motors do not need a valve block or integral shuttle valve. A remote valve block is also available for multiple motor circuits. A series-parallel drain line circuit may be needed for the high case flow created in multiple pump circuits. In either case, each pump and motor should be checked for proper cooling when testing the prototype circuit.

4. Series circuits present a unique problem for axial piston motors. Pressure applied to the input port and discharge port are additive as regards to the load and life of the drive shaft and the drive shaft bearings. Please consult with your Eaton representative regarding series circuits.

Description of Operation



← Direction of case flow and charge pump inlet flow.

1 – Variable Displacement Pump
2 – Fixed or Variable Displacement Motor
3 – Reservoir
4 – Shut-off Valve (Optional)
5 – Filter
6 – Charge Pump Inlet Line
7 – Pump and Motor Case Drain LInes
8 – High Pressure Lines
9 – Heat Exchanger
10 – Heat Exchanger By-pass Valve
11 – Reservoir Return Line
12 – Reservoir Fill Cap and Breather

Description of Operation – Neutral

Hydrostatic Transmission

A hydrostatic transmission is a dynamic system that operates through a wide range of conditions. Nevertheless, this wide operating range can conveniently be divided into three basic modes: neutral, forward and reverse.

The following color schematics and their accompanying explanations will help you visualize what's going on inside the transmission during each of the operating modes.

Important: As you study the following flow descriptions remember that in all modes of operation the input shaft of the pump is being turned by an external power source.

Neutral

The hydrostatic transmission is in neutral when the variable pump's displacement is zero. With zero displacement no high pressure oil is pumped to the motor and its output shaft is stopped. Refer to the "Neutral" color schematic as you read this explanation.

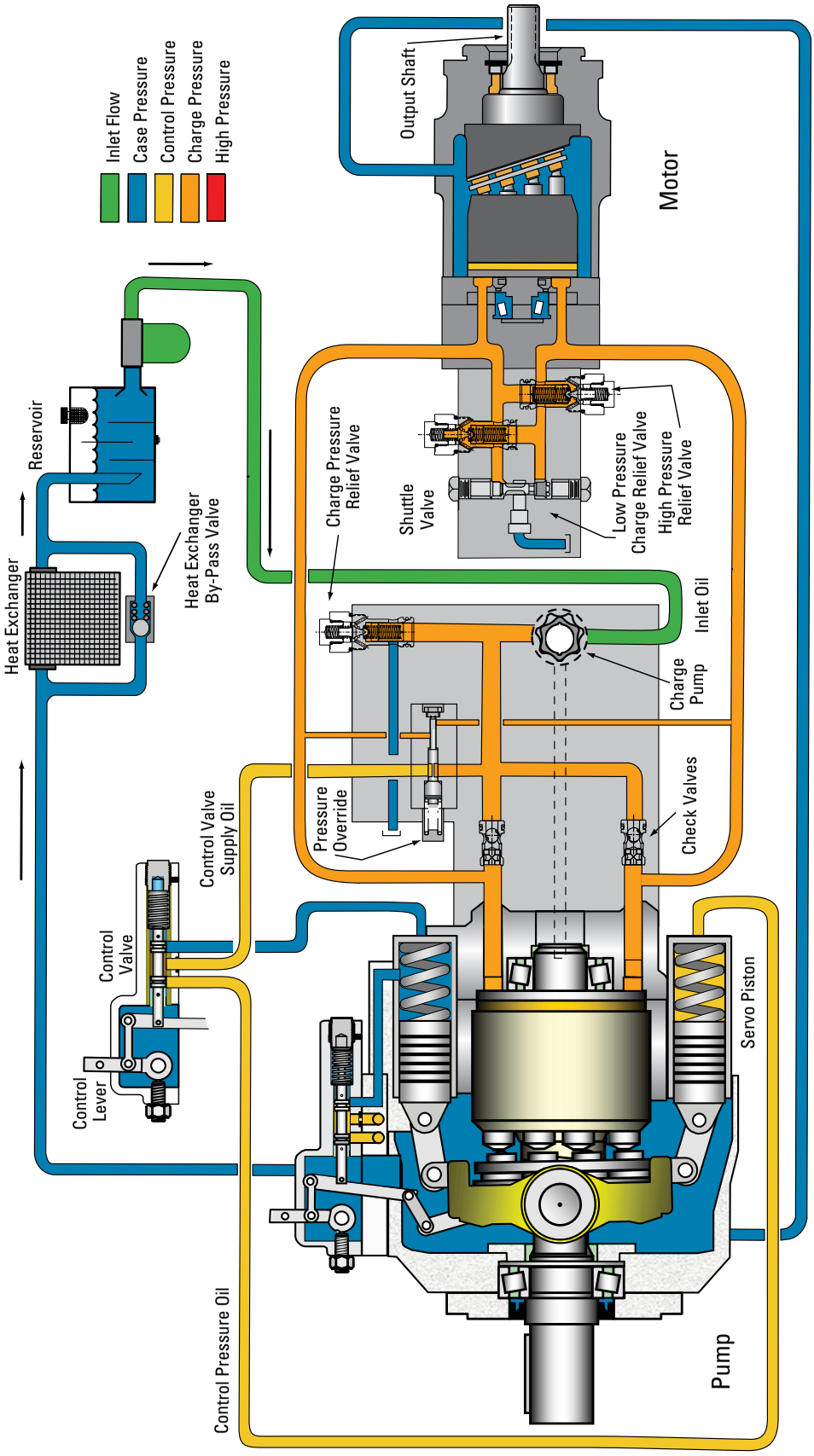
Putting the control lever in the neutral position centers the control spool. Centering the control spool connects both lines to the serve pistons to case and blocks the control pressure line. Connecting the servo piston lines to case allows the oil to drain from the servo pistons and the servo springs center the variable swashplate. With the swashplate centered the pistons don't reciprocate as the cylinder barrel is rotated, and no high pressure oil is pumped.

The charge pump, which is connected to the input shaft, pumps oil in all modes of transmission operation. In neutral it takes cooled, filtered oil from the reservoir and fills the system. Charge pump flow passes through the check valves in the pump's end cover and fills the pump's pistons, the high pressure lines, and the motor's pistons. This oil flow is intended to make up for internal leakage and keep the circuit primed.

After the high pressure circuit has been primed the charge pump pressure opens the charge pressure relief valve located in the charge pump. This directs the charge pump flow through the pump case and back to the reservoir. This oil flow flushes and cools the pump.

Flow Description – Neutral

Axial Piston Variable Displacement Pump & Fixed Displacement Motor Schematic



Description of Operation – Forward/Reverse

Hydrostatic Transmission

The forward mode and the reverse mode are similar, so hence forth they will be grouped and called the forward/reverse mode.

Forward/Reverse

The hydrostatic transmission is in forward/reverse mode when flow in the high pressure circuit causes the motor shaft to rotate. Refer to the forward/reverse color schematic as you can read this explanation.

Flow in the high pressure circuit is created by tilting the pump's variable swashplate from its center, or neutral, position. With the swashplate tilted the pistons reciprocate as the cylinder barrel rotates and flow is generated.

The swashplate may be tilted to either side of center. Tilting it one way generates flow that makes the transmission go forward. And tilting it the other way reverses flow and the motor shaft rotates in the opposite direction.

Besides controlling direction, the swashplate angle also controls output speed. Swashplate angle affects speed by changing the pump's displacement. The largest swashplate angle produces the largest displacement and the fastest motor speed.

The standard control circuit has a single lever that sets both speed and direction. Center the lever for neutral. Move it to one side of center for forward, the other side for reverse. Motor speed is controlled by how far the lever is moved.

The control circuit varies the swashplate angle by directing control pressure to either of the servo pistons. Control pressure, at the charge pressure relief valve setting, is supplied to the control valve by the charge pump. In the forward/reverse schematic control pressure is directed to the lower servo piston which causes the swashplate to tilt. Oil in the upper servo sleeve drains to case, through the control valve, as the swashplate tilts.

The follow-up link, between the swashplate and control valve, holds the swashplate at the angle set by the control lever. As the swashplate moves to the desired angle the follow-up link moves the control spool so that it opens/closes the lines to the servo pistons. The swashplate will hold that position until the control lever is moved.

Charge pump flow that is not used by the control circuit passes through the end cover check valve into the low pressure side of the loop. There it provides back pressure to the motor pistons.

The spring centered shuttle valve, located in the motor's valve block, moves to connect the low pressure side of the loop to the charge pressure relief valve. When back pressure gets high enough the charge pressure relief valve, in the valve block, opens and charge pump flow enters the motor case.

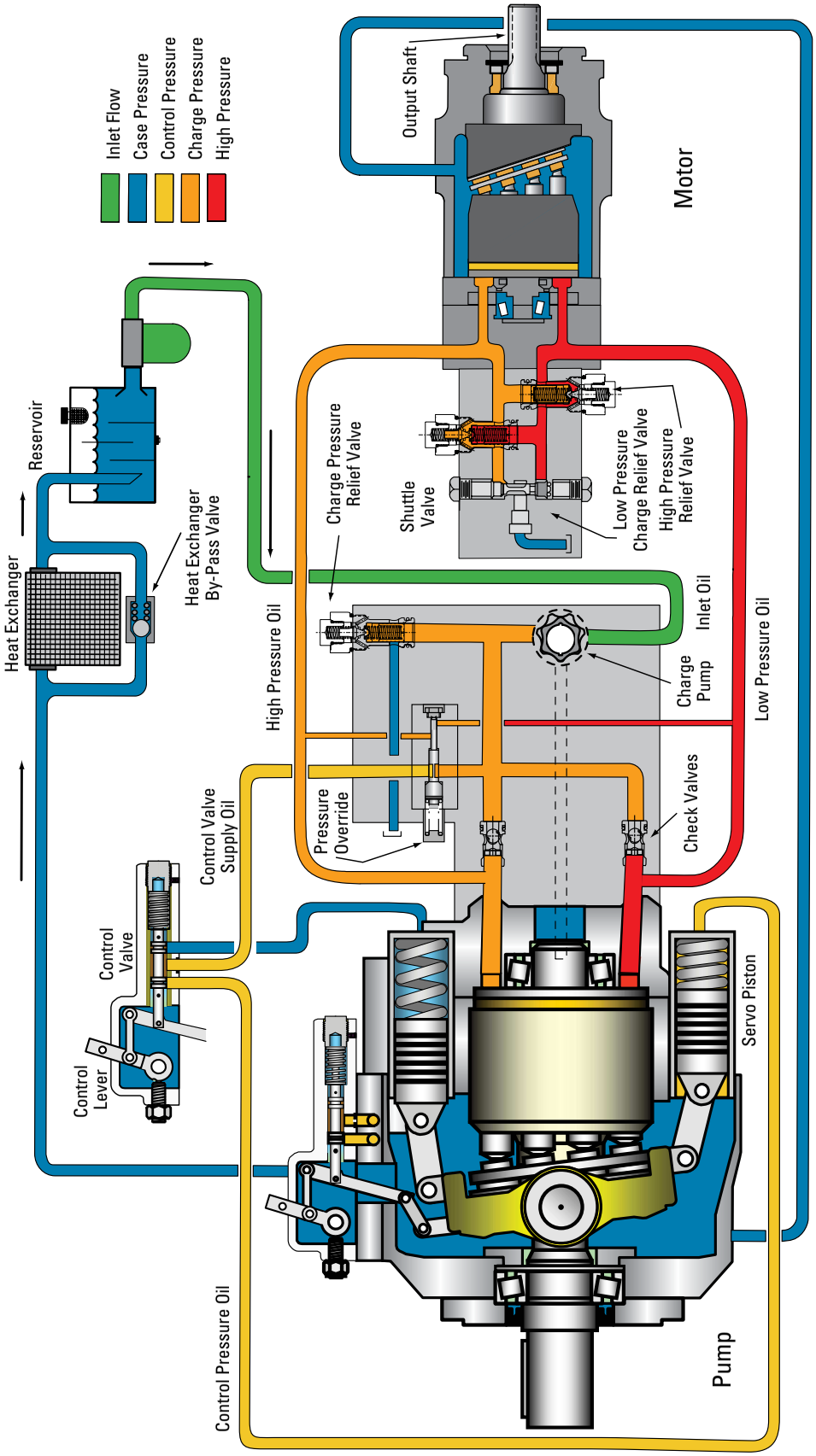
Case flow flushes the pump and motor cases and helps keep the transmission cool. The charge pressure relief valve in the motor's valve block typically has a lower setting than the charge pressure relief valve in the charge pump. This is so case flow will begin at the motor, go to the pump, and return to the reservoir. The arrows on the drawing a A Typical Heavy Duty Hydrostatic Transmission, page 4, show case flow's path.

The charge pressure relief valve in the charge pump opens when the transmission is in neutral and the shuttle valve is centered. Compare the shuttle valve in each of the color schematics to better understand its operation.

The high pressure relief valves in the motor's valve block open to connect the high pressure side of the loop to the low pressure side if the motor stalls and the pressure gets too high. There are two high pressure relief valves; one works in forward the other in reverse.

Flow Description – Forward/Reverse

Axial Piston Variable Displacement Pump & Fixed Displacement Motor Schematic



Hydraulic Fluid Recommendations

Objective

The ability of Eaton hydrostatic components to provide the desired performance and life expectancy depends largely on the fluid used. The purpose of this document is to provide readers with the knowledge required to select the appropriate fluids for use in systems that employ Eaton hydrostatic components.

Selecting a Hydraulic Fluid

The hydraulic fluids in hydraulic systems are bound to perform in different dimensions. They serve as the power transmission medium, lubricate the moving components and carry away the heat produced within the system. Therefore the fluids must have adequate properties to give the assurance of adequate wear protection, effective power transmission and excellent chemical stability under the most adverse operating conditions. The multi dimensional performance establishes that the hydraulic fluid is a vital factor in a hydraulic system; proper selection of oil assures satisfactory life and operation of the system components / lubricants.

Viscosity

The most important characteristics to consider when choosing a fluid to be used in a hydraulic system are viscosity. The fluid must be thin enough to flow easily but thick enough to seal and maintain a lubricating film between bearing and sealing surfaces. Viscosity requirements for Eaton's Heavy Duty Hydrostatic product line are specified later in this document

Viscosity and Temperature

Temperature and viscosity are related inversely. As the fluid warms it gets thinner and its viscosity decreases. When fluid cools the fluid viscosity increases. It is important to consider the entire operating temperature window for selecting the right viscosity for a hydraulic system. Calculate the viscosity of the fluid temperatures at start up, normal operating conditions and maximum possible point, and compare the same with the recommendation of the hydraulic system.

Generally, the fluid is thick when the hydraulic system is started. With movement, the fluid warms to a point where the cooling system begins to operate. From then on, the fluid is maintained at the temperature for which the hydrostatic system was designed. In actual applications this sequence varies; hydrostatic systems are used in many environments from very cold to very hot. Cooling systems also vary from very elaborate to very simple, so ambient temperature may affect operating temperature. Equipment manufacturers who use Eaton hydrostatic components in their products should anticipate temperature in their designs and make the appropriate fluid recommendations to their customers.

In general, a lower ISO viscosity grade fluid is recommended for operation in cold to moderate climates. Higher ISO viscosity grade fluid is recommended for operation in moderate to hot climates.

Cleanliness

Cleanliness of the fluid in a hydrostatic system is extremely important. Eaton recommends that the fluid used in its hydrostatic components be maintained at ISO Cleanliness Code 18/13 per SAE J1165. This code allows a maximum of 2500 particles per milliliter greater than 5 µm and a maximum of 80 particles per milliliter greater than 15 µm. When components with different cleanliness requirements are used in the same system, the cleanest standard should be applied. OEM's and distributors who use Eaton hydrostatic components in their products should provide for these requirements in their designs. A reputable filter supplier can supply filter information.

Hydraulic Fluid Recommendations

Viscosity and Cleanliness Guidelines

Product Line	Minimum	Optimum Range	Maximum	ISO Cleanliness Requirements
Heavy Duty Piston	10cSt	16 - 39 cSt	2158 cSt	18/13
Pumps and Motors	(60 SUS)	(80 - 180 SUS)	(10,000 SUS)	

Notes:

- Fluids too thick to flow in cold weather start-ups will cause pump cavitation and possible damage. Motor cavitation is not a problem during cold start-ups. Thick oil can cause high case pressures which in turn cause shaft seal problems.
- If the natural color of the fluid has become black it is possible that an over-heating problem exists.
- If the fluid becomes milky, water contamination may be a problem.
- Take fluid level reading when the system is cold.
- Viscosity modified fluid may lose viscosity due to shearing of viscosity improvers.
- Contact your Eaton representative if you have specific questions about the fluid requirements of Eaton hydrostatic components.

Hydraulic Fluid Recommendations

Fluid Maintenance

Maintaining correct fluid viscosity and cleanliness level is essential for all hydrostatic systems. Since Eaton hydrostatic components are used in a wide variety of applications it is impossible for Eaton to publish a fluid maintenance schedule that would cover every situation. Field testing and monitoring are the only ways to get accurate measurements of system cleanliness. OEM's and distributors who use Eaton hydrostatic components should test and establish fluid maintenance schedules for their products. These maintenance schedules should be designed to meet the viscosity and cleanliness requirements laid out in this document.

Fluid Selection

AW Hydraulic Oil

Premium grade petroleum based AW hydraulic fluids will provide the best performance in Eaton hydrostatic components. These fluids typically contain additives that are beneficial to hydrostatic systems. Eaton recommends fluids that contain anti-wear agents, rust inhibitors, anti-foaming agents, and oxidation inhibitors. Premium grade petroleum based hydraulic fluids carry an ISO VG rating.

Pump performance and reliability are directly affected by the anti-wear additive formulation contained in the oil. Oils providing a high level of anti-wear protection are recommended for optimum performance and long life.

Eaton has its own method to estimate Mineral / Petroleum based AW hydraulic oils for their anti-wear property. The fluid must pass Eaton Vickers® 35VQ25 pump test or meet the performance specification Eaton Vickers M 2950 S.

Engine Oils / Motor Oils

Engine oils using for hydraulic applications, must meet API SF / SG / SH or higher performance specifications. Appropriate SAE Grade to be selected based on the operating temperatures.

Additional Notes:

- Fluids too thick to flow in cold weather start-ups will cause pump cavitation and possible damage. Motor cavitation is not a problem during cold start-ups. Thick oil can cause high case pressures which in turn cause shaft seal problems.
- If the natural color of the fluid has become black it is possible that an overheating problem exists.
- If the fluid becomes milky, water contamination may be a problem.
- Take fluid level reading when the system is cold.
- Viscosity Modified fluid may loose viscosity due to shearing of viscosity improvers.
- Contact your Eaton representative if you have specific questions about the fluid requirements of Eaton hydrostatic components.

Hydraulic Fluid Recommendations

Biodegradable Oil (Vegetable) Guidelines

Product Line	Rating With Biodegradable Oil	Comments
Heavy Duty Piston Pumps and Motors	80% of normal pressure rating listed for mineral oils	82° C (180° F) max fluid temp (unit) 71° C (160° F) max fluid temp (reservoir)

Additional Notes:

- Viscosity and ISO cleanliness requirements must be maintained as outlined on previous page.
- For any system where the fluid is non-petroleum oil, set the target one Range Code cleaner for each particle size, than that of petroleum fluids.

  If the cleanest code required was 19/17/15 and HETG is the system fluid, the target becomes 18/16/14.
- Based on limited product testing to date, no reduction in unit life is expected when operating at the pressure ratings indicated above.
- Vegetable oil is miscible with mineral oil. However, only the vegetable oil content is biodegradable. Systems being converted from mineral oil to vegetable oil should be repeatedly flushed with vegetable oil to ensure 100% biodegradability.
- Specific vegetable oil products may provide normal unit life when operating at pressure ratings higher than those indicated above.
- Vegetable oils oxidize more quickly than petroleum based hydraulic fluid. Care must be taken to maintain fluid temperature within specified limits and to establish more frequent fluid change intervals
- All seals must be Fluorocarbon (FKM) / Viton / HNBR.
- Specific gravity of the fluid is 0.92. Design circuit with reservoir oil level sufficiently above the pump inlet to assure a minimum of 1.0 bar absolute pressure at pump.
- Water contamination may degrade the fluid - 0.07% wt Maximum. Precaution to be taken to avoid water contamination.
- Foaming and aeration can be greater with this fluid than petroleum base oils. Reservoir may be designed to give maximum retention time for effective air release.
- TAN - 2.0 mg KOH/gm Max increase in total acid number from the start up value.

Notes

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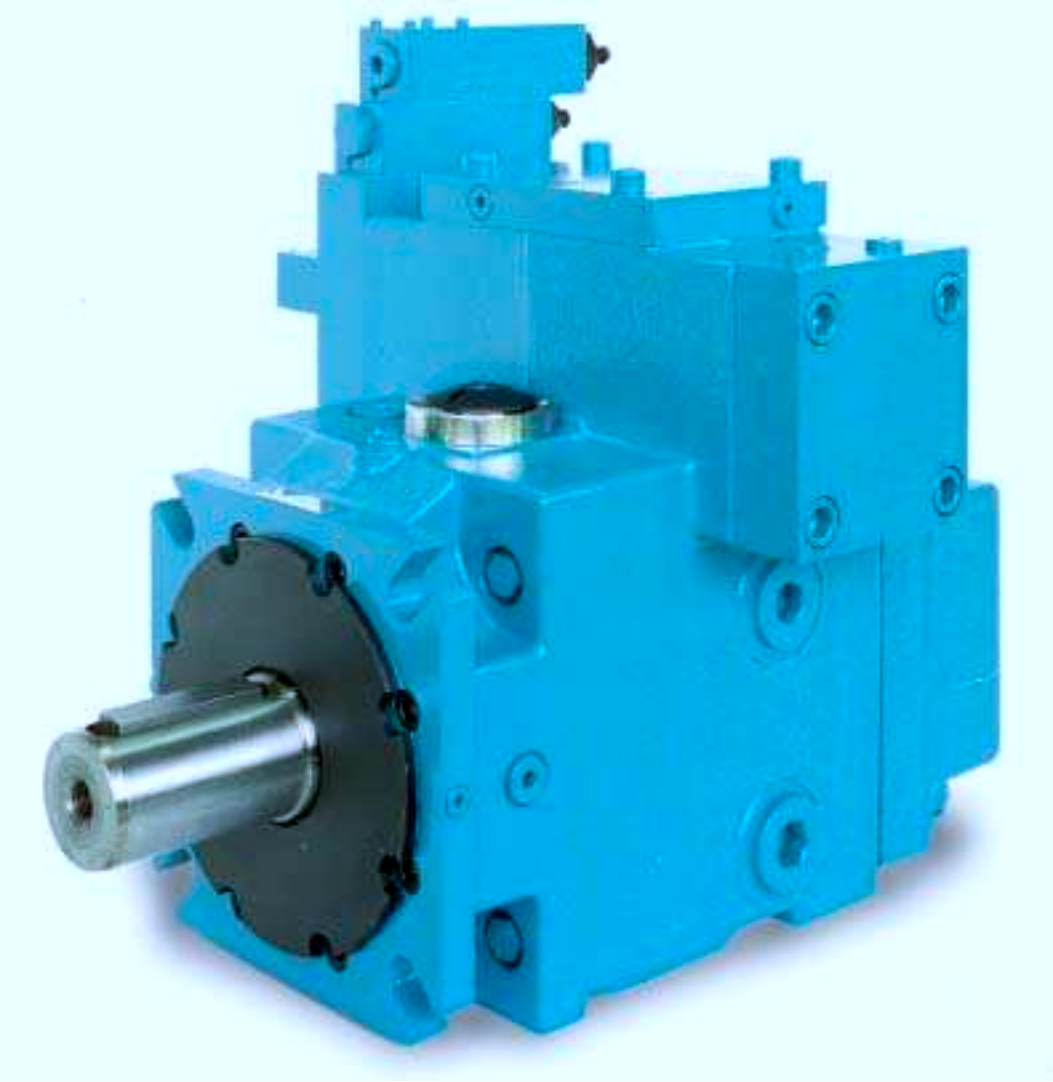
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July 2011

EATON | Vickers

Hydrokraft Open Loop Piston Pumps

Technical Catalog

PVW



VICKERS®

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- Axial piston pumps with swash plate design for reliable operation and long life.
- Pressure up to 420 bar. Rated speed up to 1800 min^{-1}. Higher speeds possible.
- Oversize shafts and bearings.
- Rotating and pressure loaded parts are pressure balanced.
- Through drive enable multiple pump installations from a single shaft. Multiple pump combinations are also available.
- Integrated pilot pump, filter and pressure relief valves available.
- " Building block" design gives these pumps a wide range of application.
- Fast response times.

AVAILABLE DISPLACEMENT SIZES
250 ccm
360 ccm
500 ccm
750 ccm

Displacement Controls:

ES - Electric motor displacement control

DF - Pressure compensator controlled

LR - Power control with pressure limiter

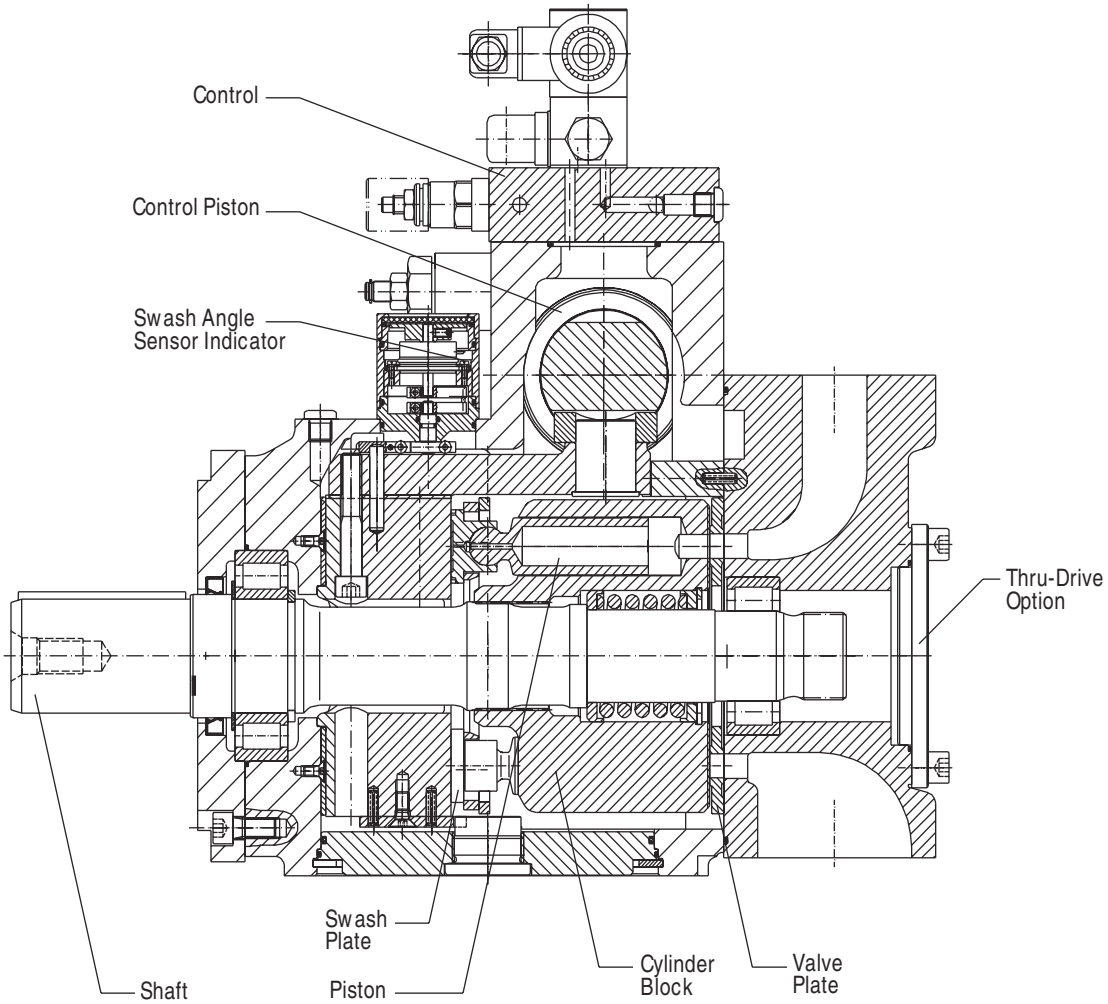
SP, SM - Displacement proportional to electric signal

DP - Displacement proportional to pressure signal

Extra functions available for SP, SM & DP:

Pressure Limitation and/or power control overriding function.

Typical Section of Open Loop PVW - Pump



Dimensional information listed in this catalog is subject to change without notice.

Model Code

Open Loop Pumps

"W" Series

Form Page

The following 48-digit coding system has been developed to identify all of the configuration options for the "W" series (Open Loop) fixed and variable displacement pumps. Use this model code to specify a unit with the desired features. All 48-digits must be present when ordering. You may want to photocopy the matrix below to ensure, that each number is entered in the correct box. If adjustments other than the standard setting (character 40 ... 43) or special features (character 44 ... 46) are needed, please provide the information when ordering.
At the end of this section you may need to provide an additional model code if a combination unit is needed. In case of a combination unit, each single pump section must be specified separately using this or other Eaton catalog information.

Some characters are already filled out and shown on the following pages. For such characters, there is no option available.

Explanation for each character is as follows:

	CHARACTER	PAGE
Basic Pump Model Code	1...23	6
Control Options	24...39	7...13
Customer Adjustment Specification	40...43	7...13
Special Features	44...46	14
Design Number	47, 48	14
Combination Model Code	1...39	15

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
P		**W**		**-**				**M**							**1**				**S**	**V**		**A**

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
																							1	**0**

SPECIFY NON STANDARD ADJUSTMENT BELOW

SPECIFY SPECIAL FEATURE BELOW

Model Code

Open Loop Pumps

"W" Series - Basic Pumps

P	*	W	*	—	*	*	*	M	*	*	*	*	*	*	1	R	*	*	S	V	*	A	#
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

1 Pump

P – Open Loop Pump

2 Displacement

F – Fixed
V – Variable

3 Pump Series

W – "W" Series (was 30 design)

4 Configuration

S – Single Unit
F – Front Unit
M – Middle Unit
R – Rear Unit

5 Separator

6 7 8 Displacement cm³/r

250 – 250 cm³/r [15.3 in3/rev]
360 – 360 cm³/r [22.0 in3/rev]
500 – 500 cm³/r [30.5 in3/rev]
750 – 750 cm³/r [45.8 in3/rev]
??? – Non-Standard Displacement (PFW Only)

9 Basic Standard

M – Metric

10 11 Mounting Flange

07 – ISO 3019/2-200B4HW
08 – ISO 3019/2-250B4HW
* See Chart Below

12 Rotation Direction

R - Right Hand [CW]
L - Left Hand [CCW]

13 Adjustment Stops

0 – No Stop
4 – Mechanical Adjustment Stop Side A (PVW only)
5 – Mechanical Adjustment Stop Side B (PVW only)
6 – Mechanical Adjustment Stops Side A and B (PVW only)

NOTE:
4 is used as max. Adjustment on Side A.
5 is used as min. Adjustment stop side A.

14 15 Thru-Drive Options

00 – None
0A – SAE A
0B – SAE B
0C – SAE C
0D – ISO125A2HW
0E – ISO160A2HW
0F – ISO125B4HW
0G – ISO160B4HW
0H – ISO200B4HW
0J – ISO250B4HW
0P – Pilot Pump (8cm3/r.) (PVW only)
PP – Double Pilot Pump (8 + 8 cm³/r.) (PVW only)
** See Chart Below

16 Main Ports

1 – SAE Ports - Metric Bolts

17 Main Port Orientation

R – Radial (Side Ports)

18 19 Main Drive Shaft End

01 – ISO Straight Key
02 – ISO Spline

20 Drive Shaft Seal Configuration

S – Single Shaft Seal

21 Seal Material

V – Viton*
*Viton is a trademark of E.I. Dupont (other materials available, contact your Eaton representative.)

22 Yoke Position Indicator

0 – No Position Indicator
V – Visual Position Indicator
P – Position Sensor
M – Sensor with Visual Indicator

23 Surface Finish

A – Blue Painted
*Other options on special request available. Contact Eaton Sales.

24 Add Control Model Code

Code (characters 24...43) on the following pages

*MOUNTING FLANGE OPTIONS AVAILABLE	250	360	500	750
ISO 3019/2-200B4HW	•	•		
ISO 3019/2-250B4HW			•	•

**THRU-DRIVE OPTIONS AVAILABLE	250	360	500	750
00	•	•	•	•
0A	•	•	•	•
0B	•	•	•	•
0C	•	•	•	•
0D	•	•	•	•
0E	•	•	•	•
0F	•	•	•	•
0G	•	•	•	•
0H	•	•	•	•
0J			•	•

Model Code

Open Loop Pumps

"W" Series - No Control

0	0	0	0	0	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	#
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

24 25 **Control Type**
00 – No Control (for PFW only)

26 **Displacement Adjustment Options**
0 – Not Applicable

27 28 **Electronic Controls**
00 – Not Required

29 **Yoke Displacement Zone**
A – Single Side of Center "A"

30 **Extra Functions**
0 – Not Required

31 **Pressure Control Options**
0 – Not Applicable

32 33 34 **Power Control**
000 – Not Applicable

35 **Pilot Oil Filter**
0 – Not Applicable

36 **Bypass/ Venting Valve**
0 – Not Applicable

37 **Position Monitoring**
0 – No Position Monitoring

38 **Electric Motor Type**
0 – No Electric Motor

39 **Control Voltage**
0 – Not Applicable

40 41 42 43 **Customer Adjustment Specification**
0000 – None

44 **Special Features**
Add special feature description (characters 44...46) on page 14 if required.

Model Code

Open Loop Pumps

"W" Series - DF Control

D	F	0	0	0	A	*	*	0	0	0	0	*	0	0	*	*	*	*	*	#
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

24 25 Control Type

DF – Pressure Compensator

26 Displacement Adjustment Options

0 – Not Applicable

27 28 Electronic Controls

00 – Not Required

29 Yoke Displacement Zone

A – Single Side of Center "A"

30 Extra Functions

0 – Not Required
1 – Load Sensing Extra Function

31 Pressure Control Options

0 – Not Applicable
F – Remote Port Only
K – Electro Proportional Relief Valve - Incl. Electronic Card

32 33 34 Power Control

000 – Not Applicable

35 Pilot Oil Filter

0 – Not Applicable

36 Venting Valve

0 – Not Applicable
1 – With Solenoid Valve

37 Position Monitoring

0 – No Position Monitoring

38 Electric Motor Type

0 – No Electric Motor

39 Control Voltage

0 – Not Applicable
B – 110 AC 50 HZ/ 120 AC 60 HZ
D – 220 AC 50 HZ/ 240 AC 60 HZ
G – 12 VDC
H – 24 VDC

40 41 42 43 Customer Adjustment Specification

0000 – None
???? – Yes (final number will be assigned by Eaton. Specify on table below)

44 Special Features

Add special feature description (characters 44...46) on page 14 if required.

CUSTOMER ADJUSTMENT SPECIFICATIONS

	Unit	Standard Adjustment	Customer Specified Adjustment	Remarks
All Revolution Adjustments below set at ..	rpm	1500		
Mech. Stop Side A (used as max Adjustment Stop Side A)	L/min	Q_{max}		
Mech. Stop Side B (used as min Adjustment Stop Side B)	L/min	Q_{min}		
Pressure Control Main Stage	bar	20		
Pressure Control Pilot Valve	bar	90		
Load Sense p	bar	15		<15% bar not possible

Model Code

Open Loop Pumps

"W" Series - LR Control

L	R	0	0	0	A	*	*	*	*	*	0	*	0	0	*	*	*	*	*	#
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

24 25 Control Type
LR – Power Control

26 Displacement Adjustment Options
0 – Not Applicable

27 28 Electronic Controls
00 – Not Required

29 Yoke Displacement Zone
A – Single Side of Center "A"

30 Extra Functions
1 – Load Sensing & Pressure Limiter Extra Function
2 – Pressure Limiter Extra Function

31 Pressure Control Options
0 – Not Applicable
F – Remote Port Only
K – Electro Proportional Relief Valve - Incl. Electronic Card

32 33 34 Power Control Define
000 - Not Applicable
??? - KW at 1500 rpm

35 Pilot Oil Filter
0 – Not Applicable

36 Venting Valve
0 – Not Applicable
1 – With Solenoid Valve

37 Position Monitoring
0 – No Position Monitoring

38 Electric Motor Type
0 – No Electric Motor

39 Control Voltage
0 – Not Applicable
B – 110 AC 50 HZ/ 120 AC 60 HZ
D – 220 AC 50 HZ/ 240 AC 60 HZ
G – 12 VDC
H – 24 VDC

40 41 42 43 Customer Adjustment Specification
0000 – None
???? – Yes (final number will be assigned by Eaton. Specify on table below)

44 Special Features
Add special feature description (characters 44...46) on page 14 if required.

CUSTOMER ADJUSTMENT SPECIFICATIONS

	Unit	Standard Adjustment	Customer Specified Adjustment	Remarks
All Revolution Adjustments below set at ..	rpm	1500	-	
Mech. Stop Side A (used as max Adjustment Stop Side A)	L/min	Q_{max}		
Mech. Stop Side B (used as min Adjustment Stop Side B)	L/min	Q_{min}		
Pressure Control Main Stage	bar	20	-	
Pressure Control Pilot Valve	bar	90		
Load Sense p	bar	15		<15% bar not possible

Model Code

Open Loop Pumps

"W" Series - ES Control

E	S	*	0	0	A	0	0	0	0	0	0	0	*	*	0	*	*	*	*	#
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

24 25 Control Type

ES – Electric Motor Displacement Control

26 Displacement Adjustment Options

M – Electric Motor - Fast Response*

N – Electric Motor - Medium Response*

P – Electric Motor - Slow Response*

27 28 Electronic Controls

00 – Not Required

29 Yoke Displacement Zone

A – Single Side of Center "A"

30 Extra Functions

0 – Not Required

31 Pressure Control Options

0 – Not Applicable

32 33 34 Power Control

000 – Not Applicable

35 Pilot Oil Filter

0 – Not Applicable

36 Venting Valve

0 – Not Applicable

37 Position Monitoring

A – 4 Limit Switches

B – 8 Limit Switches

P – 4 Limit Switches w/Sensor

T – 8 Limit Switches w/Sensor

38 Electric Motor Type

2 – Motor With Brake (IP-54)

3 – Motor Without Brake (Explosion Proof)

39 Control Voltage of Venting Valve

0 – Not Applicable

40 41 42 43 Customer Adjustment Specification

0000 – None

???? – Yes (final number will be assigned by Eaton. Specify on table below)

44 Special Features

Add special feature description (characters 44...46) on page 14 if required.

***Response Time (sec) for Zero to Maximum Displacement**

SIZE	250		360		500		750	
Frequency	**50 Hz**	**60 Hz**	**50 Hz**	**60 Hz**	**50 Hz**	**60 Hz**	**50 Hz**	**60 Hz**
Fast	8	7	11	9	10	8	14	12
Medium	20	17	27	23	24	20	35	29
Slow	40	33	55	46	48	40	70	58

CUSTOMER ADJUSTMENT SPECIFICATIONS

		Unit	Standard Adjustment	Customer Specified Adjustment	Remarks
All Revolution Adjustments below set at ..		rpm	1500	-	
Mech. Stop Side A (used as max Adjustment Stop Side A)		L/min	Q_{max}		
Mech. Stop Side B (used as min Adjustment Stop Side B)		L/min	Q_{min}		
Displacement Adjusted to...		cm^3/rev.	~50% Q_{max}		
Position Monitoring Switch	1	L/min	0		
	2	L/min	95% of Q_{max}		<95% not possible
	3	L/min			
	4	L/min			
	5	L/min			
	6	L/min			
	7	L/min			
	8	L/min			

Model Code

Open Loop Pumps

"W" Series - DP Control

D	P	*	0	0	A	*	*	*	*	*	*	0	0	0	0	*	*	*	*	#
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

24 25 Control Type

DP – Pressure Signal Displacement Control

26 Displacement Adjustment Options

G – Mounting Interface CETOP 3 Only
H – Remote Port G 1/4
J – Proportional Relief Inc. Electronics

27 28 Electronic Controls

00 – Not Required

29 Yoke Displacement Zone

A – Single Side of Center "A"

30 Extra Functions

0 – Not Required
4 – Pressure Limiter Overriding Function
5 – Pressure Limiter & Power Control Overriding Function

31 Pressure Control Options

0 – Not Applicable
F – Remote Port Only
K – Electro Prop. Relief Valve - Incl. Electronic Card

32 33 34 Power Control

000 – Not Applicable
??? – KW at 1500 rpm

35 Pilot Oil Filter

0 – Not Applicable
V – Filter with Visual Indicator
E – Filter with Electrical Indicator

36 Venting Valve

0 – Not Applicable

37 Position Monitoring

0 – No Position Monitoring

38 Electric Motor Type

0 – No Electric Motor

39 Control Voltage of Venting Valve

0 – Not Applicable

41 42 43 Customer Adjustment Specification

0000 – None
???? – Yes (final number will be assigned by Eaton. Specify on table below)

44 Special Features

Add special feature description (characters 44...46) on page 14 if required.

***CUSTOMER ADJUSTMENT SPECIFICATIONS**

	Unit	Standard Adjustment	Customer Specified Adjustment	Remarks
All Revolution Adjustments below set at ..	rpm	1500	-	
Pilot Pressure Size 250 & 360	bar	60	-	
Pilot Pressure Size 500 & 750	bar	80	-	
Mech. Stop Side A (used as max Adjustment Stop Side A)	L/min	Q_{max}		
Mech. Stop Side B (used as min Adjustment Stop Side A)	L/min	Q_{min}		
Pressure Override Side A	bar	90		

Model Code

Open Loop Pumps

"W" Series - SM Control

S	M	0	0	0	A	*	*	*	*	*	*	0	0	0	0	*	*	*	*	#
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

24 25 Control Type

SM – Servo Adjustment Displacement Control - Mech. Feedback

26 Displacement Adjustment Options

0 – Not Applicable

27 28 Electronic Controls

00 – Not Required

29 Yoke Displacement Zone

A – Single Side of Center "A"

30 Extra Functions

0 – Not Required
4 – Pressure Limiter Override Function
5 – Pressure Limiter & Power Control Override Function

31 Pressure Control Options

0 – Not Applicable
F – Remote Port Only
K – Electro Proportional Relief Valve - Incl. Electronic Card

32 33 34 Power Control

000 – Not Applicable
??? – KW at 1500 rpm

35 Pilot Oil Filter

0 – Not Applicable
V – Filter with Visual Indicator
E – Filter with Electrical Indicator

36 Venting Valve

0 – Not Applicable

37 Position Monitoring

0 – No Position Monitoring

38 Electric Motor Type

0 – No Electric Motor

39 Control Voltage of Venting Valve

0 – Not Applicable

40 41 42 43 Customer Adjustment Specification

0000 – None
???? – Yes (final number will be assigned by Eaton. Specify on table below)

44 Special Features

Add special feature description (characters 44...46) on page 14 if required.

***CUSTOMER ADJUSTMENT SPECIFICATIONS**

	Unit	Standard Adjustment	Customer Specified Adjustment	Remarks
All Revolution Adjustments below set at ..	rpm	1500	-	
Pilot Pressure for Size 250 & 360 (External)	bar	60	-	
Pilot Pressure for Size 500 & 750 (External)	bar	80	-	
Mech. Stop Side A (used as max Adjustment Stop Side A)	L/min	Q_{max}		
Mech. Stop Side B (used as min Adjustment Stop Side B)	L/min	Q_{miin}		
Pressure Override Side A	bar	90		<95% not possible

Model Code

Open Loop Pumps

"W" Series - SP Control

S	P	*	*	*	A	*	*	*	*	*	*	0	0	0	0	*	*	*	*	#
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

24 25 Control Type

SP – ProportionalValve Adjustment Displacement Control

26 Displacement Adjustment Options

C – With CETOP 3 Prop Valve KDG4V 3

F – With CETOP 5 Prop Valve

27 28 Electronic Controls

03 – ER 9.3 - 10 (CETOP 3)

04 – ER 9.4 - 10 (CETOP 5)

29 Yoke Displacement Zone

A – Single Side of Center "A"

30 Extra Functions

0 – Not Required

4 – Pressure Limiter Overriding Function

5 – Pressure Limiter and Power Control Overriding Function

31 Pressure Control Options

0 – Not Applicable

F – Remote Port Only

K – Electro Proportional Relief Valve - Including Electronic Card

32 33 34 Power Control

000 – Not Applicable

??? – KW at 1500 rpm

35 Pilot Oil Filter

0 – Not Applicable

V – Filter with Visual Indicator

E – Filter with Electrical Indicator

36 Venting Valve

0 – Not Applicable

37 Position Monitoring

0 - No Position Monitoring

38 Elec Motor Type

0 – No Electric Motor

39 Control Voltage of Venting Valve

0 – Not Applicable

40 41 42 43 Customer Adjustment Specification

0000 – None

???? – Yes (final number will be assigned by Eaton. Specify on table below)

44 Special Features

Add special feature description (characters 44...46) on page 14 if required.

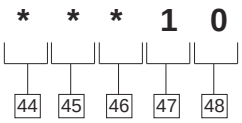
***CUSTOMER ADJUSTMENT SPECIFICATIONS**

	Unit	Standard Adjustment	Customer Specified Adjustment	Remarks
All Revolution Adjustments below set at ..	rpm	1500	-	
Pilot Pressure	bar	60	-	
Mech. Stop Side A (used as max Adjustment Stop Side A)	L/min	Q_{max}		
Mech. Stop Side B (used as min Adjustment Stop Side B)	L/min	Q_{miin}		
Max. Stop by Control Side A	L/min	95% Q_{max}	EI Card Adjustment done by customer	Refer to EI card Manual
Min. Stop by Control Side A	L/min	0+/-2.5%	EI Card Adjustment done by customer	Refer to EI card Manual
Ramp Time 0 → A For 100% Stroke	sec	0	EI Card Adjustment done by customer	Refer to EI card Manual
Ramp Time A → 0 For 100% Stroke	sec	0	EI Card Adjustment done by customer	Refer to EI card Manual
Preset Input Signals S1....S4	L/min	-	EI Card Adjustment done by customer	Refer to EI card Manual

Model Code

Open Circuit Pumps

"W" Series -
Special Features



44 45 46 **Special Features**

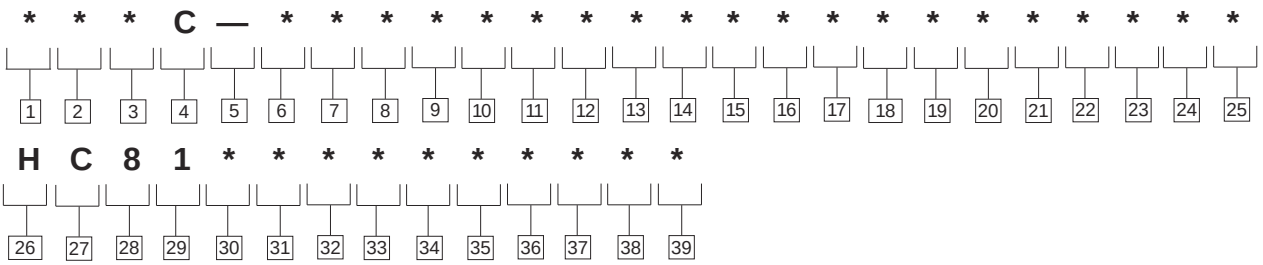
000 – None
******* – Defined by Eaton

47 48 **Design Number**

10 – Design Number

Model Code

Combination Units



1 Combination Unit

P – Pump
T – Transmission Pump
M – Motor

2 Displacement

F – Filled
V – Variable

3 Pump Series

W – "W" Series (was 30 design)
X – "X" Series (was 20 design)

4 Combination Unit

C

5 Separator

6 7 8 First Displacement cm³/r

066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

9 10 First Control Type

00 – No Control (for Fixed Displacement Only)
DF – Pressure Compensator
LR – Power Control
ES – Electric Motor Control
HG – Handwheel Displacement Control
FE – Screw Adjustment Displacement Control
SM – Servo Adjustment Displacement Control - Mech Feedback
DP – Pressure Signal Displacement Control
SP – Proportional Valve Displacement Control

11 12 13 Second Displacement cm³/r

066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

14 15 Second Control Type

00 – No Control (for Fixed Displacement Only)
DF – Pressure Compensator
LR – Power Control
ES – Electric Motor Control
HG – Handwheel Displacement Control
FE – Screw Adjustment Displacement Control
SM – Servo Adjustment Displacement Control - Mech Feedback
DP – Pressure Signal Displacement Control
SP – Proportional Valve Displacement Control

16 17 18 Third Displacement cm³/r

000 – Not Required
066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

19 20 Third Control Type

00 – No Control (for Fixed Displacement Only)
DF – Pressure Compensator
LR – Power Control
ES – Electric Motor Control
HG – Handwheel Displacement Control
FE – Screw Adjustment Displacement Control
SM – Servo Adjustment Displacement Control - Mech Feedback
DP – Pressure Signal Displacement Control
SP – Proportional Valve Displacement Control

21 22 23 Fourth Displacement cm³/r

000 – Not Required
066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

24 25 Fourth Control Type

00 – No Control (for Fixed Displacement Only)
DF – Pressure Compensator
LR – Power Control
ES – Electric Motor Control
HG – Handwheel Displacement Control
FE – Screw Adjustment Displacement Control
SM – Servo Adjustment Displacement Control - Mech Feedback
DP – Pressure Signal Displacement Control
SP – Proportional Valve Displacement Control

26 27 28 29 Assembly Numbers

HC81 – Defined By Eaton

30 31 32 33 34 35 36 37 38 39 Assembly Numbers

Defined By Eaton

- For a combination of two or more units fill out this Combination Model Code.
- Start with the biggest size unit for the first displacement.
- For each unit included in this combination, a separate model code must be chosen. Use the form on page 5.
- Character 26 to 39 will be P/N of the combination. This number will be defined by Eaton and provided in the order acknowledgement.
- Charge and Pilot Pump through drive option must be specified on the rear unit of the combination (as a special feature).
- Front and middle units shall have the through drive option of the following unit in the combination.

Example 1: Combination of two open loop pumps

Model Code Front Unit	PVWF-500M08R0001R02SVMASPC03A0000000000000000010
Model Code Rear Unit	PVWR-250M07R0001R02SVMASPC03A0000000000000000010
Model Code Combination Unit	PVWC-500SP250SP0000000000HC81**********

Example 2: Combination of one closed loop - and two open loop pumps (For other product model codes refer to the according catalog)

Mode Code Front Unit	TVWF-500M08R0000H1R02SVMA20SPC03C00000000E000H000000010
Model Code Middle Unit	PVWM-250M07R0001R02SV0ADF000A0000000000000000010
Model Code Rear Unit	PFXR-130M02R00P1A02SV0A00000A0000000000000000010
Model Code Combination Unit	TVWC-500SP250DF1300000000HC81**********

Pump Specifications - US

MODEL			PFW/PVW 250	PFW/PVW 360	PFW/PVW 500	PFW/PVW 750
Design			Swashplate - Axial piston pump			
Type of mounting			Flange or foot-mounted. Combination units foot mounted only			
Pipe connection SAE Flange	B A	psi	3 1/2" = 500 1 1/2" = 6000	3 1/2" = 500 1 1/2" = 6000	5" = 500 2" = 6000	5" = 500 2" = 6000
Direction of rotation			Clockwise when viewing shaft end of pump Counterclockwise available on request			
Speed range	n_{min} n_{max}	rpm	150 1800	1500	1800	1200
Installation position			Optional, see mounting information			
Ambient temperature range	min max	°F	-4 122			
Weight	m	lb	467	485	750	871
Mass of inertia	J	lb ft^2	3.46	3.61	11.9	13.1

HYDRAULIC CHARACTERISTICS

Nominal pressure (100% duty cycle)	p_N	psi	5075			
Input pressure	p_{1min} p_{1max}	psi psi	14,5 abs 725			
Max. pressure to DIN 24312	p_{2max}	psi	6090			
Hydraulic fluid	Hydraulic oil to DIN 51524 part 2. Refer to section Aplication Data-Fluid Recommendations					
Hydraulic fluid temperature range	min max	°F	–13 194			
Viscosity range for continous operation	min max	cSt cSt	10 75			
Maximum perrmissible start viscosity	max	cSt	1000			
Cleanliness acc.	ISO 4406		18/15/13			
Maximum geometric Displacement n= 1500 rpm n= 1800 rpm	Vg	in^3	15.2	22	30.5	45.7 (at 1200 rpm)
Maximum geometric Pump flow n= 1500 rpm n= 1800 rpm	Qg	Usgpm	99 119	142 –	198 238	238 (at 1200 rpm) –
Case pressure	$p_{v\ max}$	psi	max. 7.2psi over p_1 p_{vmax} = 58psi abs.			
Pilot Pump	V	in^3	0.5			
Pilot pressure	p_{St}	psi	870	870	1160	1160

DRIVE

Maximum Driving torque - (p_{2max}, η= 100%)	$M_{1\ single}$	lb.ft	1232	1774	2463	3688
Maximum Power consumpt. - (p_{2max}, 1800 rpm, η= 100%)	$P_{1\ single}$	hp	422 (at 1800 rpm)	507 (at 1500 rpm)	845 (at 1800 rpm)	845 (at 1200 rpm)

COMBINATION UNITS

Maximum driving torque combination unit splined shaft only	M_1	lb.ft	2x 1232	2x 1774	3688	3688

Pump Specifications - Metric

MODEL			PFW/PVW 250	PFW/PVW 360	PFW/PVW 500	PFW/PVW 750
Design			Swashplate - Axial piston pump			
Type of mounting			Flange or foot-mounted. Combination units foot mounted only			
Pipe connection SAE Flange	B A	psi	3 1/2" = 500 1 1/2" = 6000	3 1/2" = 500 1 1/2" = 6000	5" = 500 2" = 6000	5" = 500 2" = 6000
Direction of rotation			Clockwise when viewing shaft end of pump Counterclockwise available on request			
Speed range	n_{min} n_{max}	min^{-1}	150 1800	1500	1800	1200
Installation position			Optional, see mounting information			
Ambient temperature range	min max	°C	–20 +50			
Weight	m	kg	212	220	340	395
Mass of inertia	J	$kg\ m^2$	0.146	0.152	0.5	0.55

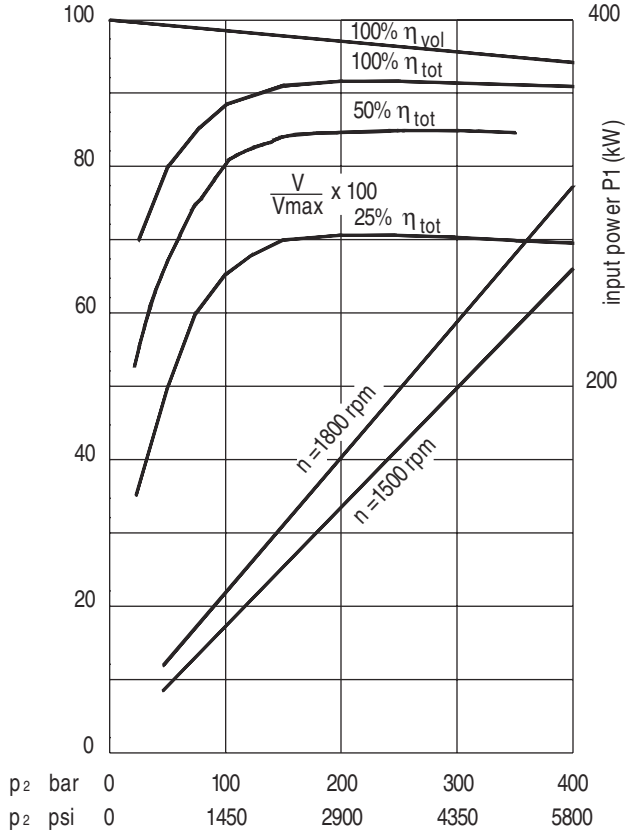
HYDRAULIC CHARACTERISTICS						
Nominal pressure (100% duty cycle)	p_N	bar	350			
Input pressure	p_{1min} p_{1max}	bar bar	1 abs 50			
Maximum pressure to DIN 24312	p_{2max}	bar	420			
Hydraulic fluid	Hydraulic oil to DIN 51524 part 2. Refer to section Aplication Data-Fluid Recommendations					
Hydraulic fluid temperature range	min max	°C	–25 90			
Viscosity range for continous operation	min max	cSt cSt	10 75			
Max.perrmissible start viscosity	max	cSt	1000			
Cleanliness acc.	ISO 4406		18/15/13			
Maximum geometric n= 1500 min^{-1} Displacement n= 1800 min^{-1}	Vg	cm^3	250 250	360 –	500 410	750 (at 1200 min^{-1}) –
Maximum geometric n= 1500 min^{-1} Pump flow n= 1800 min^{-1} Case pressure	Qg p_{vmax}	l/min bar	375 375 max. 0.5 bar over p_1. p_{vmax} = 4 bar abs.	540 –	750 738	900 (at 1200 min^{-1}) –
Pilot Pump	V	cm^3	8			
Pilot pressure	p_{St}	bar	60	60	80	80

DRIVE						
Maximum Driving torque - (p_{2max}, η = 100%)	$M_{1\ single}$	Nm	1670	2405	3340	5000
Max.Power consumpt. - (p_{2max}, η = 100%)	$P_{1\ single}$	kW	315 (at 1800 min^{-1})	378 (at 1500 min^{-1})	630 (at 1800 min^{-1})	630 (at 1200 min^{-1})

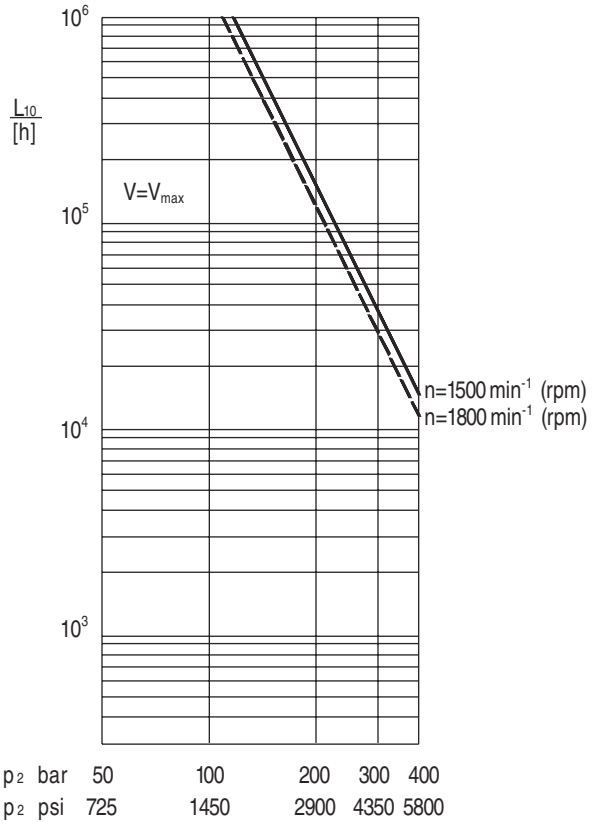
COMBINATION UNITS						
Maximum driving torque combination unit splined shaft only	M_1	Nm	2x1670	2x 2405	5000	5000

Performance Curves - 250 Series

Power efficiency performance curve



Roller bearing life



Combination units

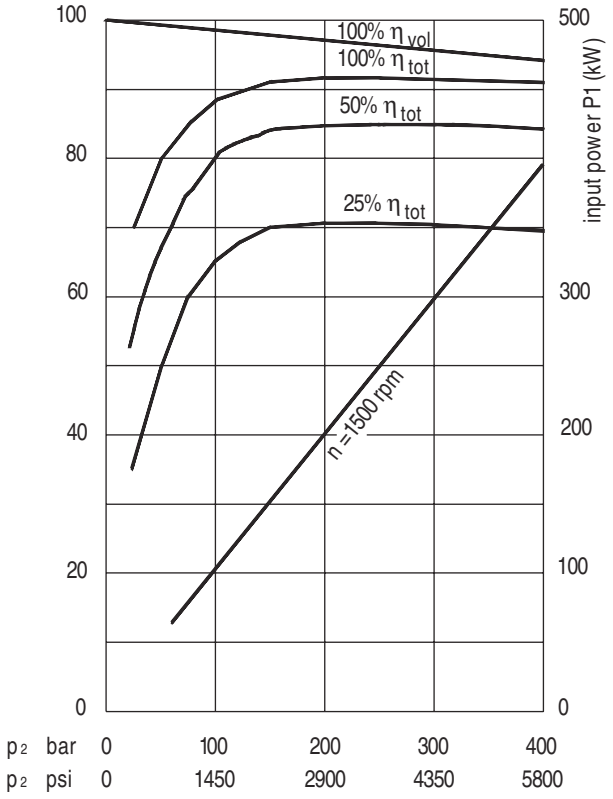
For combination pumps the characteristic values are as for the individual units.

For reduced swash-angle:

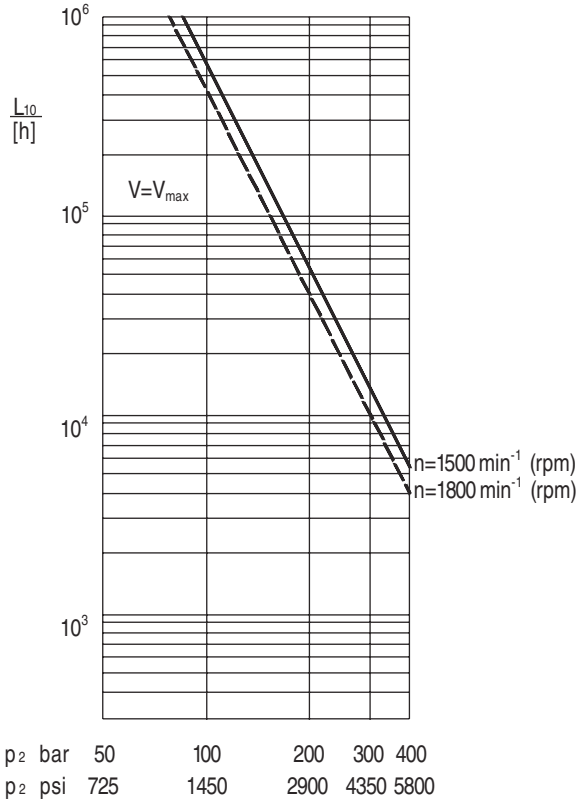
$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

Performance Curves - 360 Series

Power efficiency performance curve



Roller bearing life



Combination units

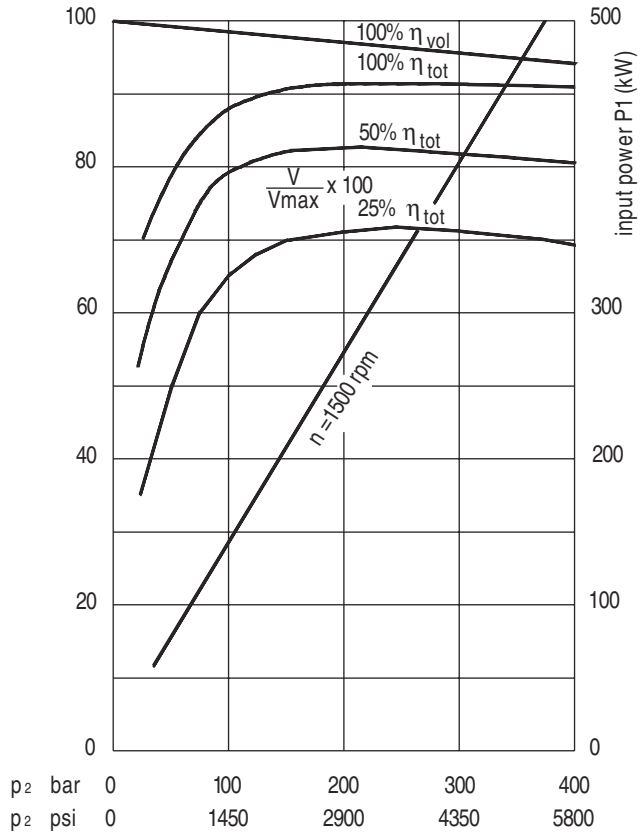
For combination pumps the characteristic values are as for the individual units.

For reduced swash-angle:

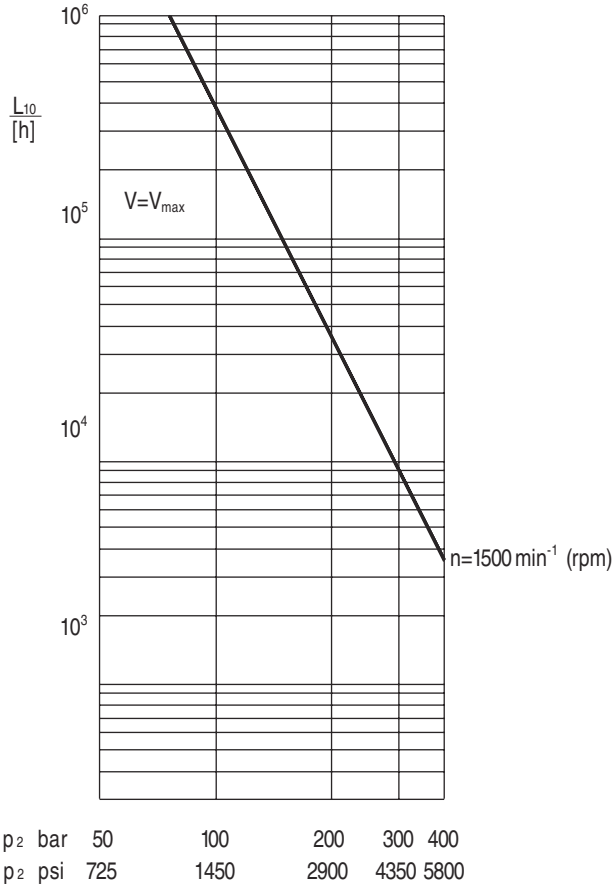
$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

Performance Curves - 500 Series

Power efficiency performance curve



Roller bearing life



Combination units

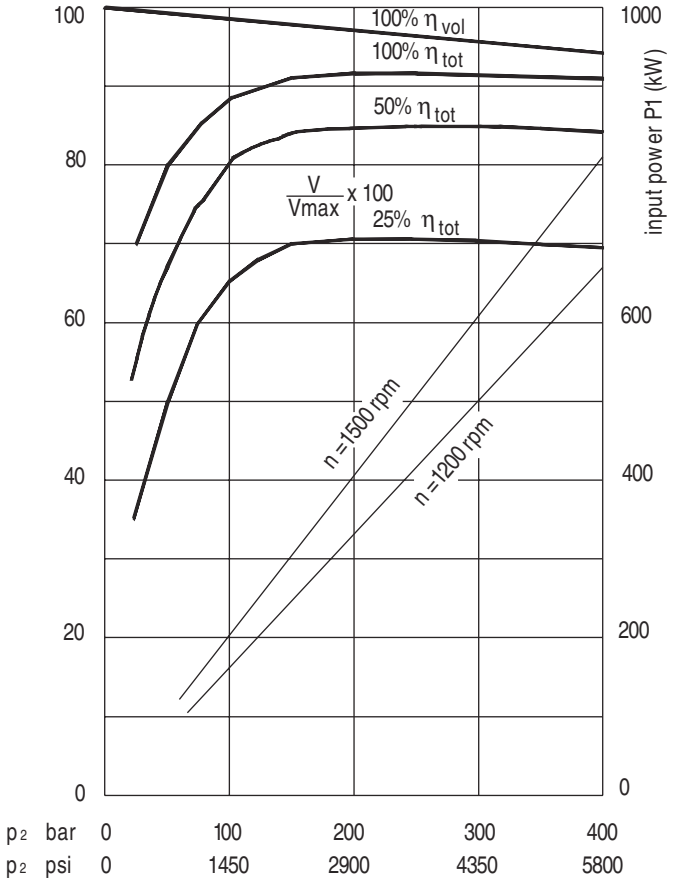
For combination pumps the characteristic values are as for the individual units.

For reduced swash-angle:

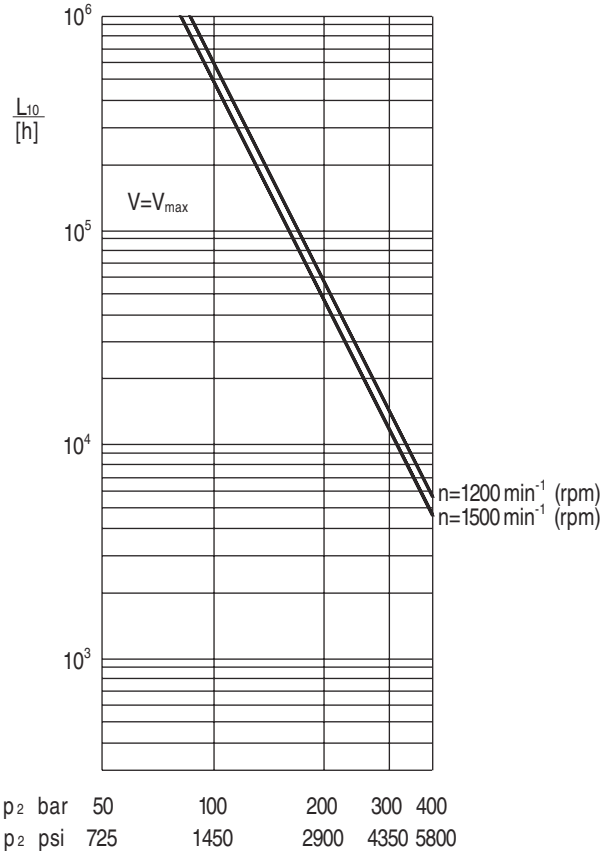
$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

Performance Curves - 750 Series

Power efficiency performance curve



Roller bearing life



Combination units

For combination pumps the characteristic values are as for the individual units.

For reduced swash-angle:

$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

Electric Motor Displacement Control ES

Open Loop Pumps

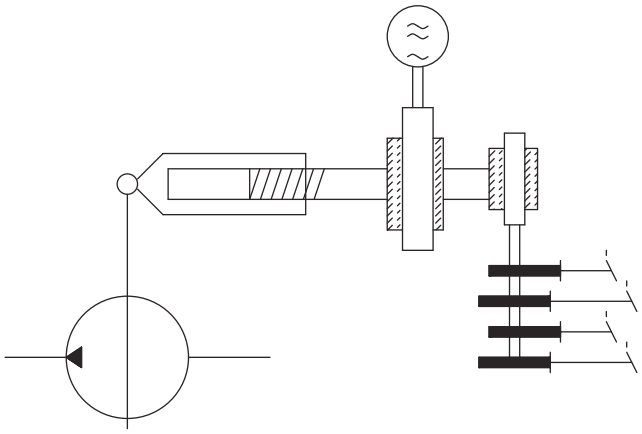
"W" Series

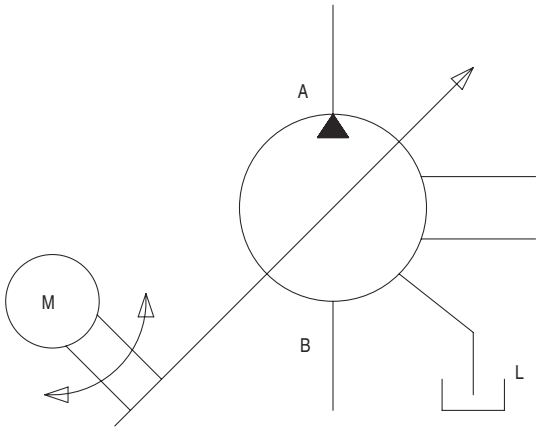
This unit is used for flow adjustment. It has a three phase electric servo motor, worm gearing and a switch box with 4 or (optional) 8 limit switches for different positions. A potentiometer for stepless adjustment and/or position monitoring is also available.

The response times from zero to maximum depends on the chosen ratio and the (fixed) speed of the servo motor (this means that once the control is defined and built the response time are not variable during operation.)

Explosion Protection versions are also available.

No Pressure/Power Limiter possible!

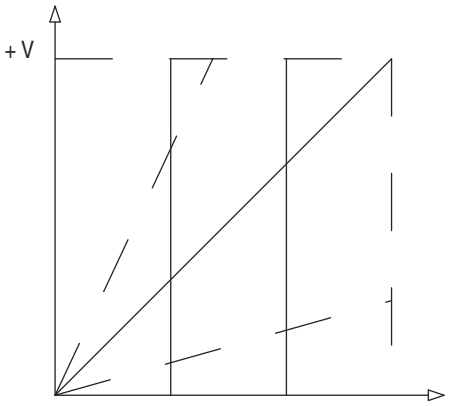




Theoretical Response Time (sec) for Maximum Displacement

SIZE	250		360		500		750	
Frequency	**50 Hz**	**60 Hz**	**50 Hz**	**60 Hz**	**50 Hz**	**60 Hz**	**50 Hz**	**60 Hz**
Fast	8	7	11	9	10	8	14	12
Medium	20	17	27	23	24	20	35	29
Slow	40	33	55	46	48	40	70	58

Response time from 0 to +Qmax



Response time from 0 to +V maximum displacement

DF, LR Displacement Controls

Open Loop Pumps

"W" Series

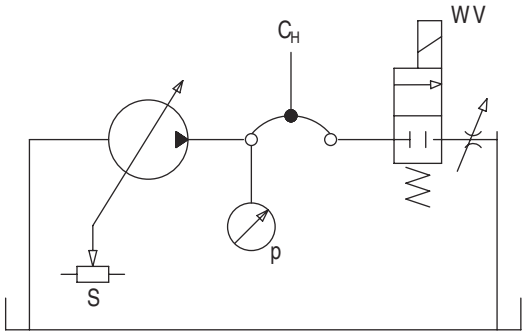
Energy saving hydraulic drives are possible with pressure compensated and/or power controlled pumps, especially in combination with the load-sensing option.

DF The system pressure remains constant for the entire volume flow rate. System pressure can be set either manually, hydraulically or electronically. The standard Hydrokraft pressure compensator is pilot operated, has a remote port and is very stable.

LR The p/Q characteristic curve is a hyperbola. For constant speed, the drive torque, i.e. the power used, is held constant. The power hyperbola can be continuously adjusted between Pmin and Pmax. Pmin is given by the minimum set value of control's main stage (app. 20 bar) and power loss of the pump.

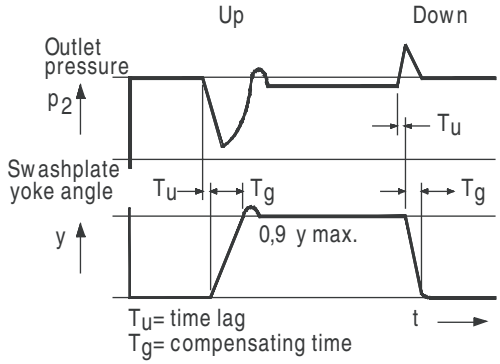
Both controllers can be combined with another or with additional options, for possible variations, see the model coding and circuit diagrams. The maximum flow of the pump can be limited mechanically to between 50% and 100% by screw. As an additional option the maximum (or minimum) flow can also be limited by a spacer inside the control cylinder (position no.13 in model coding, options 4, 5 or 6 in combination with customer adjustment speculation position 40-43 for the set values).

This solution is also recommended for very rough operating conditions and the need of a very exact repeatability over a long time period. The setting must be defined before ordering and cannot be modified during operation.

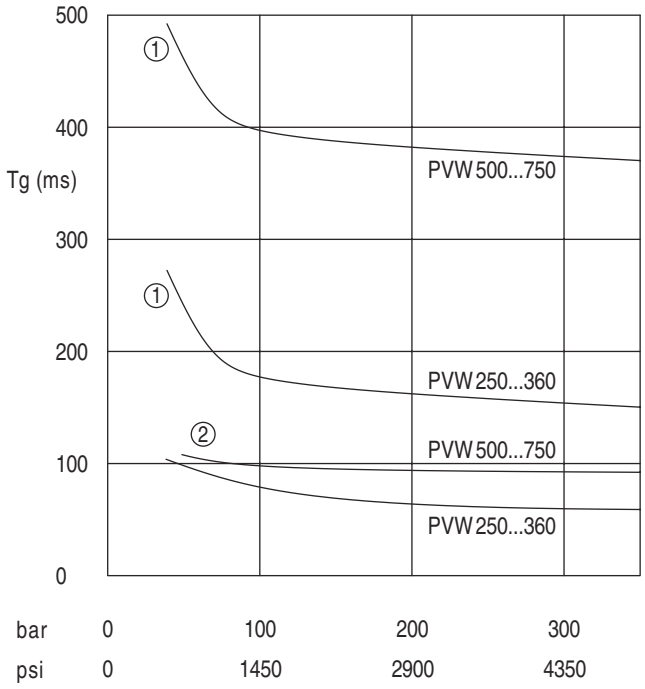


Typical controller action: (Closing/opening the directional control valve WV)

CH - 50mm ID x 2 meters

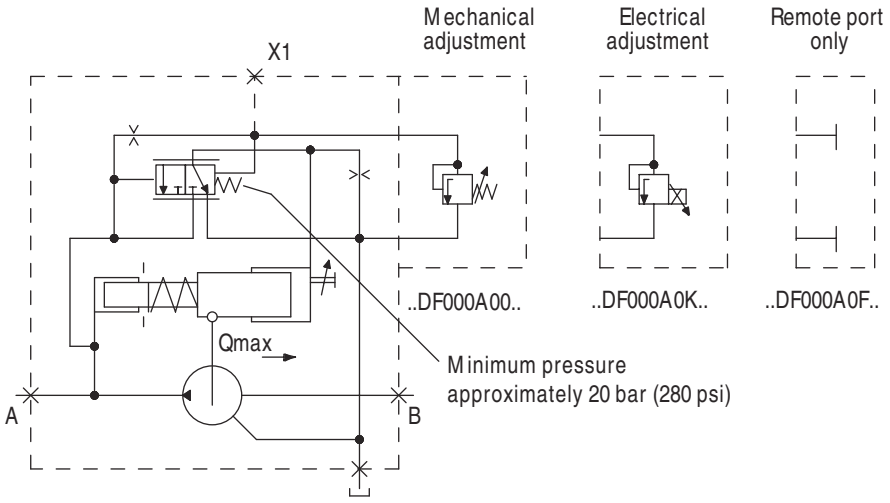


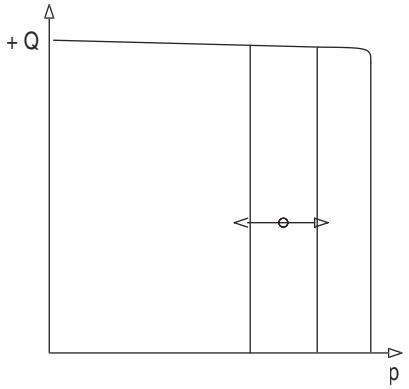
(1) On stroke control time T_g (0 → 0.9 y max.)
(2) Off stroke control time T_g (0.9 y max. → 0)



DF Pressure Compensator
DF000A...
Control valve adjustable mechanically, electrically or remote port only

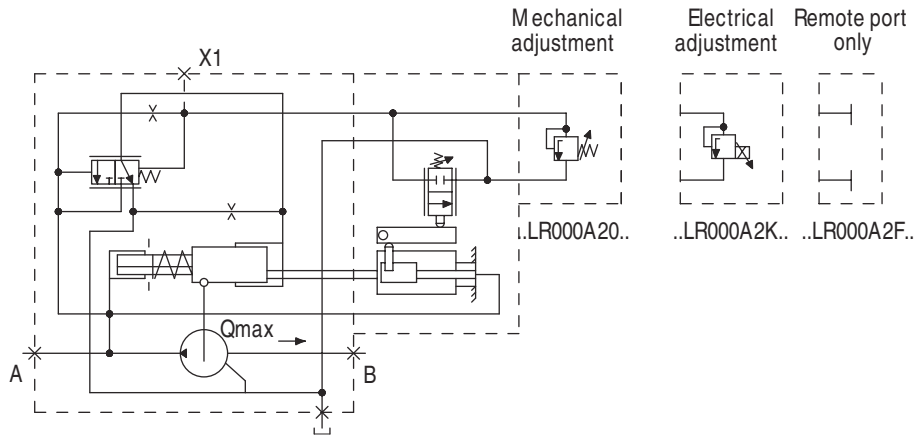
Alternatively

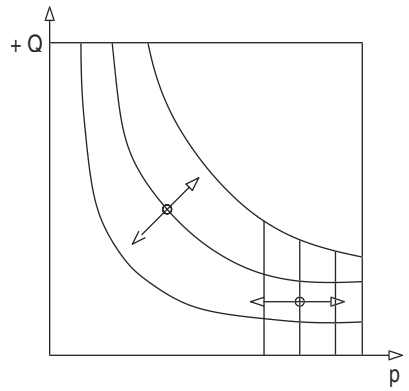




LR Power Control
with overriding pressure limiter
LR000A2...
Pressure control pilot valve adjustable mechanically, electrically or remote port only

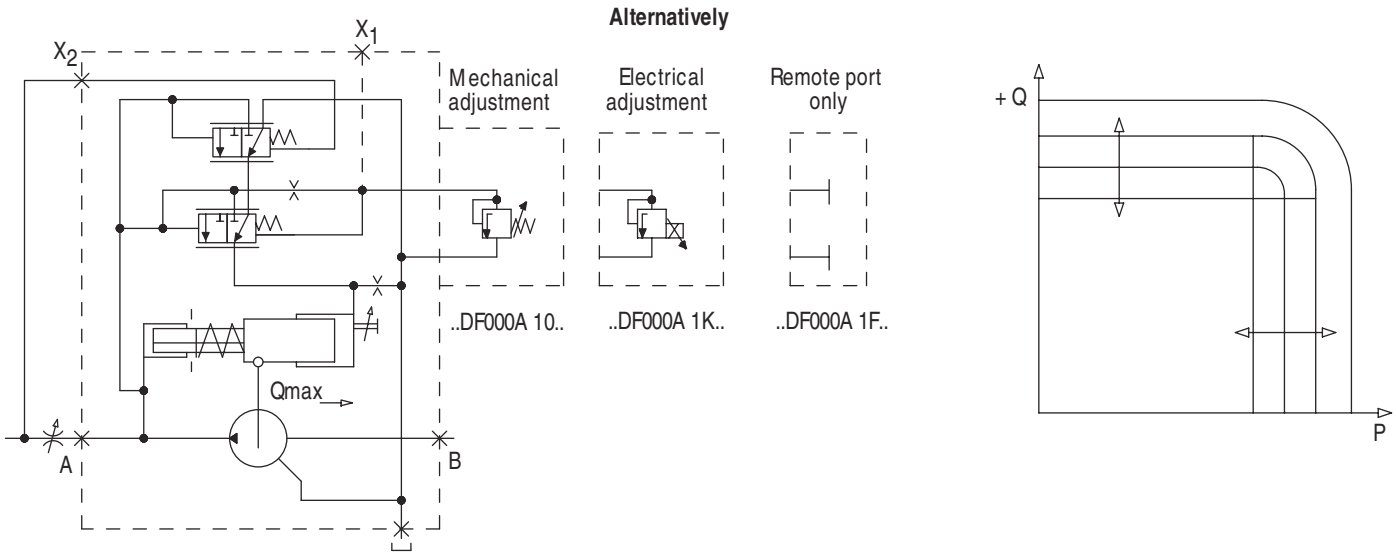
Alternatively





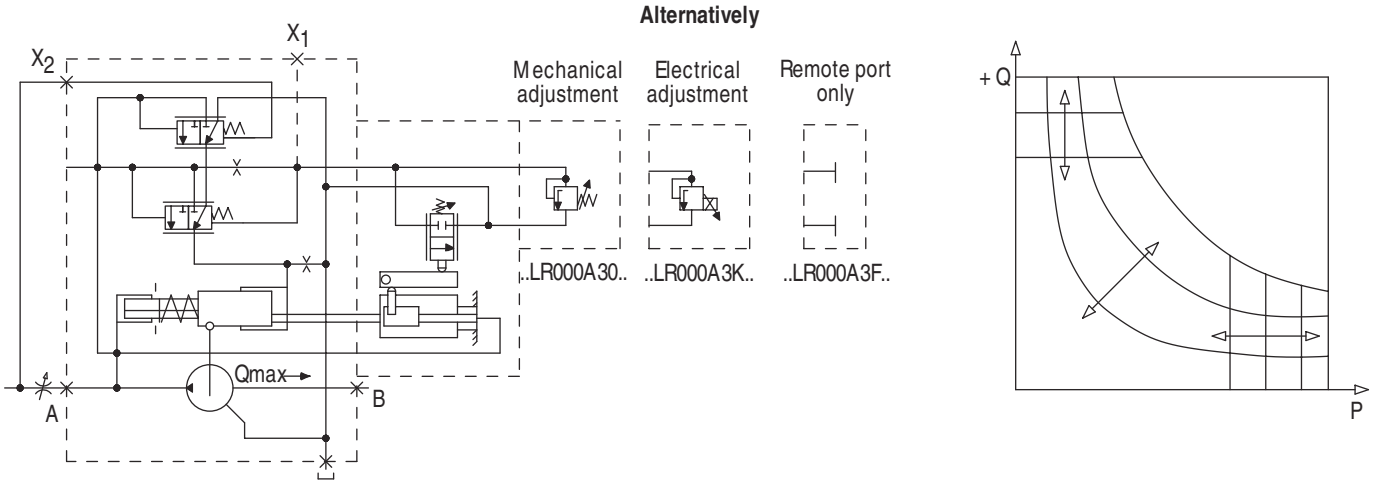
DF Pressure Compensator
with load sensing

DF000A1...
Control valve adjustable mechanically, electrically or remote port only



LR Power Control
with load sensing and pressure limiter

LR000A3...
Pressure control pilot valve adjustable mechanically, electrically or remote port only



Pressure Signal Displacement Control DP

Open Loop Pumps

"W" Series

The output flow of the pump is proportional to the pilot pressure.

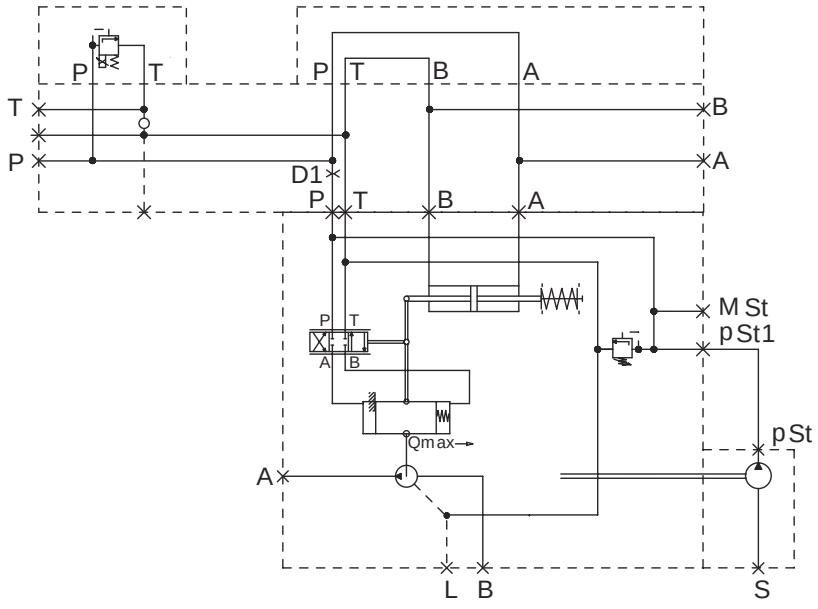
A separate pilot oil circuit is necessary. From this, the control pressure is reduced to the desired set value by means of a suitable pressure control valve (with P-T line) and throttle in P line 0.8 Ø (0.03 in).

The DP control can be used for steepless flow control with standard requirements for dynamic and precision control. No feedback signal is needed, an optical indicator is recommended (position 22 in model coding, option "V").

A pilot oil filter can be mounted in-line between pump and control (pos. 35 in model coding, option "V" or "E").

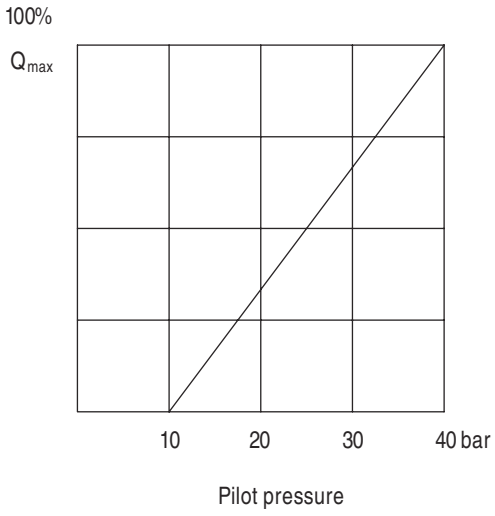
The maximum flow of the pump can be limited mechanically to between 50% and 100% by a screw. As an additional option, the maximum (and/or minimum) flow can be limited by a spacer inside the control cylinder (position no.13 in model coding, options 4, 5 or 6 in combination with cust. adj. spec. pos. 40-43 for the set values).

This solution is also recommended for very rough operating conditions and the need of a very exact repeatability over a long time period. The setting must be defined before ordering and cannot be modified during operation.



The output flow of the pump is proportional to the pilot pressure.

SIZE	RESPONSE TIME (SEC) 12 L/MIN PILOT OIL FLOW	PILOT PRESSURE P_{ST} BAR
250/360	1.0	60
500/750	2.2	80



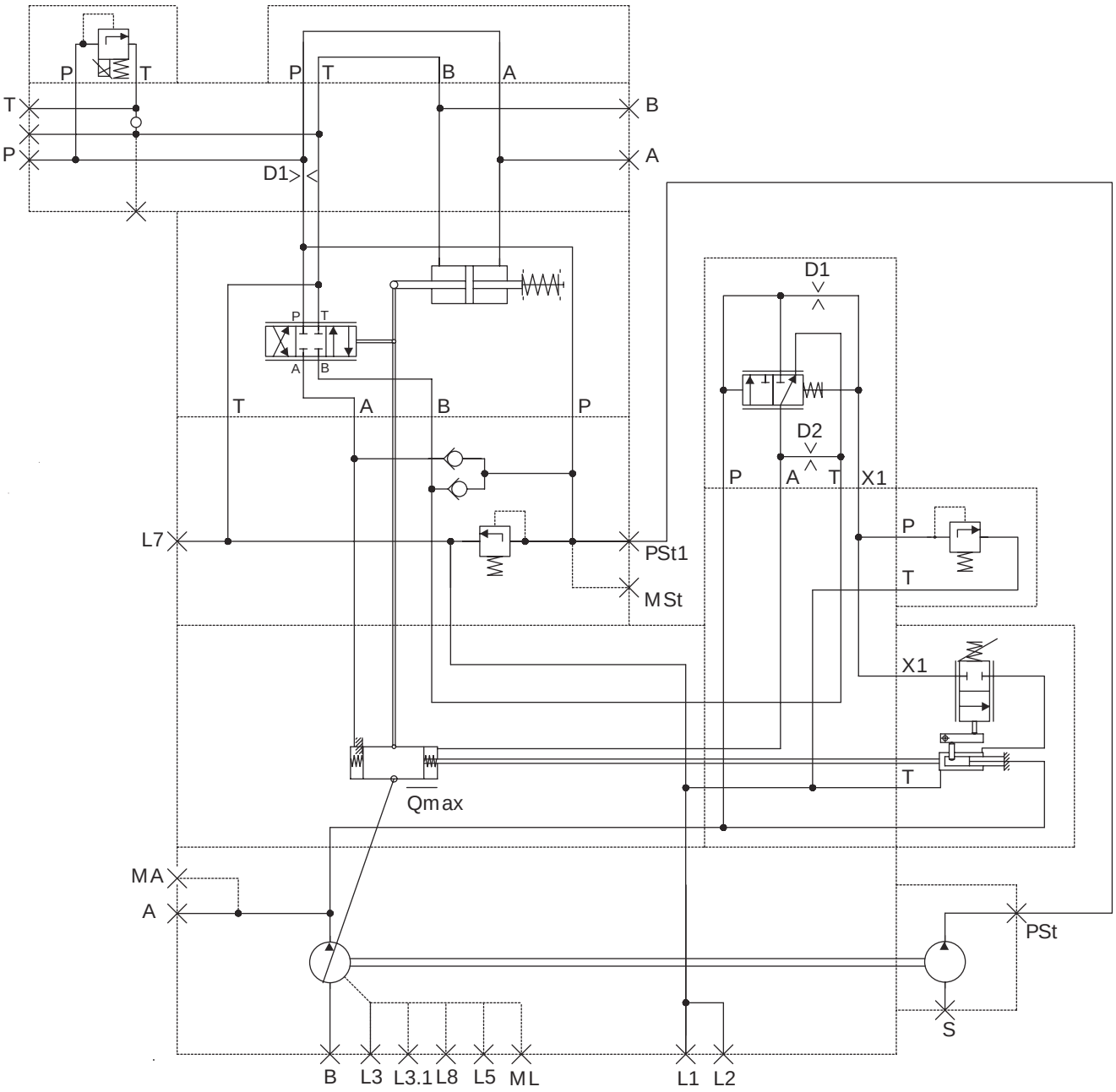
Example for PVW... DP Control with pressure & power limiter

Open Loop Pumps

"W" Series

DP Control with pressure limiter and power control overriding function

example shown:
DPJ00A5...



Note: A setting of the pressure limiter and/or power control lower than the pilot pressure Pst is not possible!

Proportional Valve Displacement Control SP

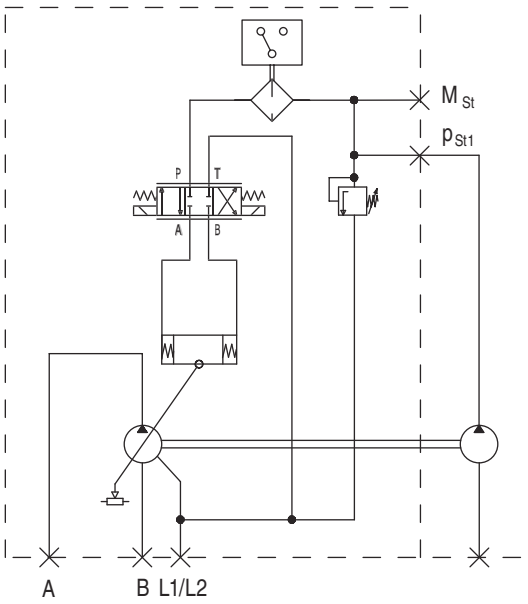
Open Loop Pumps

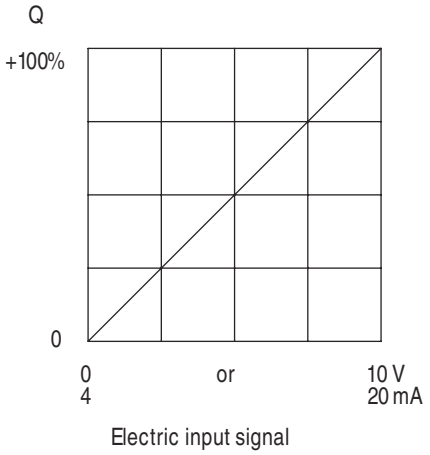
"W" Series

The electrohydraulic displacement control operates a hydrostatic drive and works without throttle losses within electrically adjustable limits. This is done by controlling delivery flow with electrical swash plate angle feedback (electrical closed-loop control). All control values are recorded as an electrical signal and lead back to the control card. The proportional valve and servo piston transform the output signal of the control card to the desired setting. This results in a very precise and dynamic control.

Hysteresis, consistency: approximately 1% of end value. The SP control can also be combined with hydro-mechanical relief valves for pressure and/ or power. Electronical solution for pressure and power override control is in preparation.

The maximum flow of the pump can be limited mechanically to between 50 and 100% by a screw. As an additional option the maximum (and/or minimum) flow can be limited by a spacer inside the control cylinder (position no. 14 in model coding, options 4, 5 or 6 in combination with customer adjustment speculation position 40-43 for the set values). This solution is also recommended for very rough operating conditions and the need of a very exact repeatability over a long time period. The setting must be defined before ordering and cannot be modified during operation.





Response Times - Electronic Control Cards

PROPORTIONAL VALVE	PILOT OIL FLOW	CONTROL PRESSURE PST	CONTROL ELECTRONICS	RESPONSE TIME	UNIT SIZE	SERVO PISTON DIAMETER	STROKE	VOLUME
	L/min (USgpm)	bar (psi)	(Amp.card)[ms]	0 < > Vmax (ms)	cm^3 (in^3)	mm (in)	mm (in)	cm^3 (in^3) per chamber
Medium response	12 (3.17)	60 (857)	ER 9.3-10	500	250 (15.2)	75 (2.95)	18 (.71)	79 (4.82)
KDG4V3*		60 (857)		700	360 (21.9)	75 (2.95)	25 (.98)	110 (6.71)
(CETOP 3)		80 (1142)		650	500 (30.5)	75 (2.95)	22 (.87)	97 (5.92)
		80 (1142)		850	750 (45.8)	75 (2.95)	30 (1.18)	132 (8.06)
High response (CETOP 5)			ON REQUEST					

*KDG4V3-2C20NMUH760

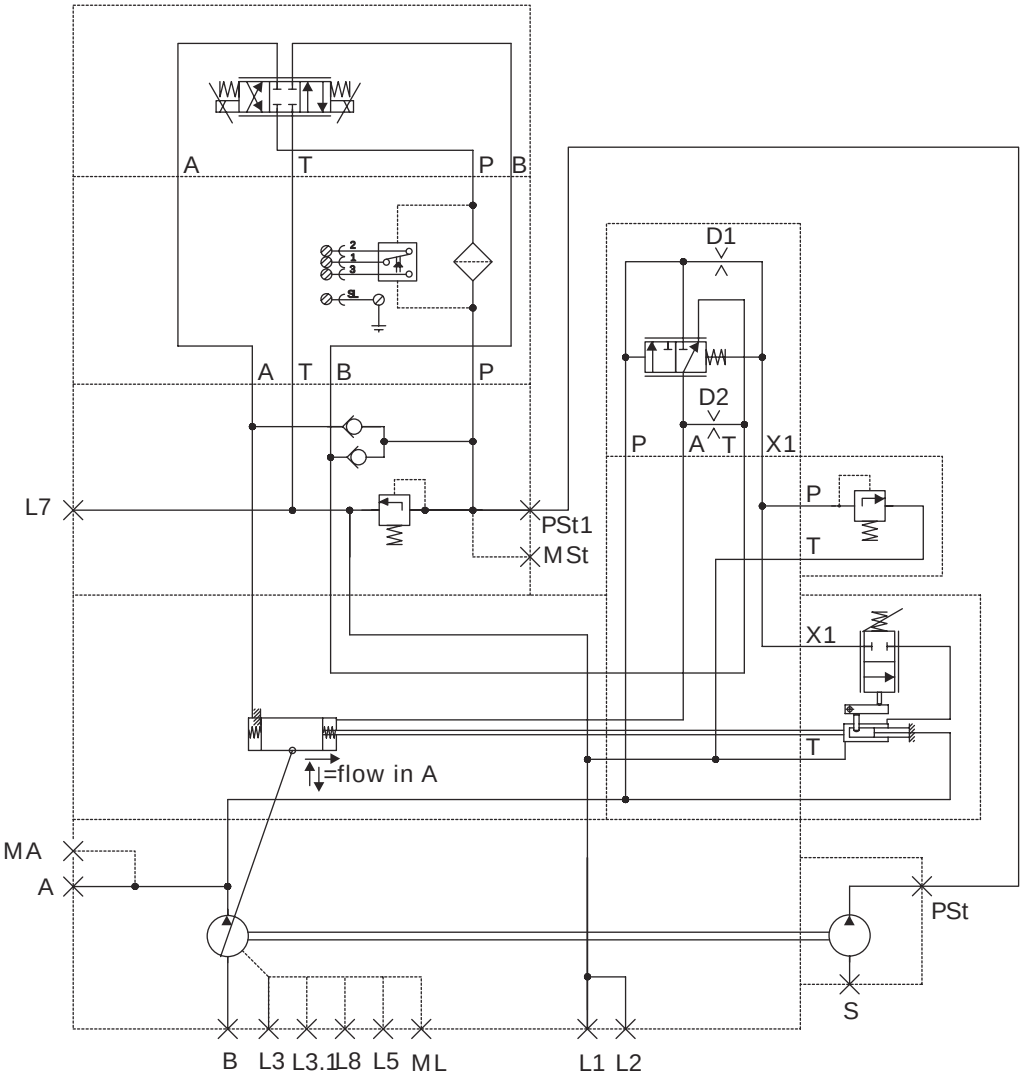
Electrohydraulic Servo Adjustment “ SP”

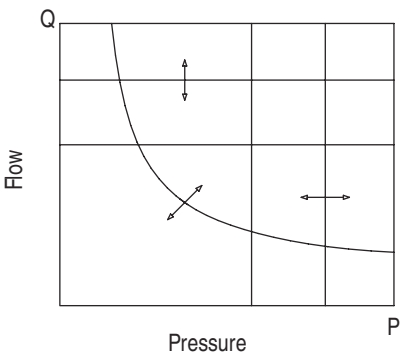
Open Loop Pumps

"W" Series

SP control with pressure limiter and power control overriding function.

example shown:
SPC03A50…E…





Note: A setting of the pressure limiter and/or power control lower than the pilot pressure Pst is not possible!

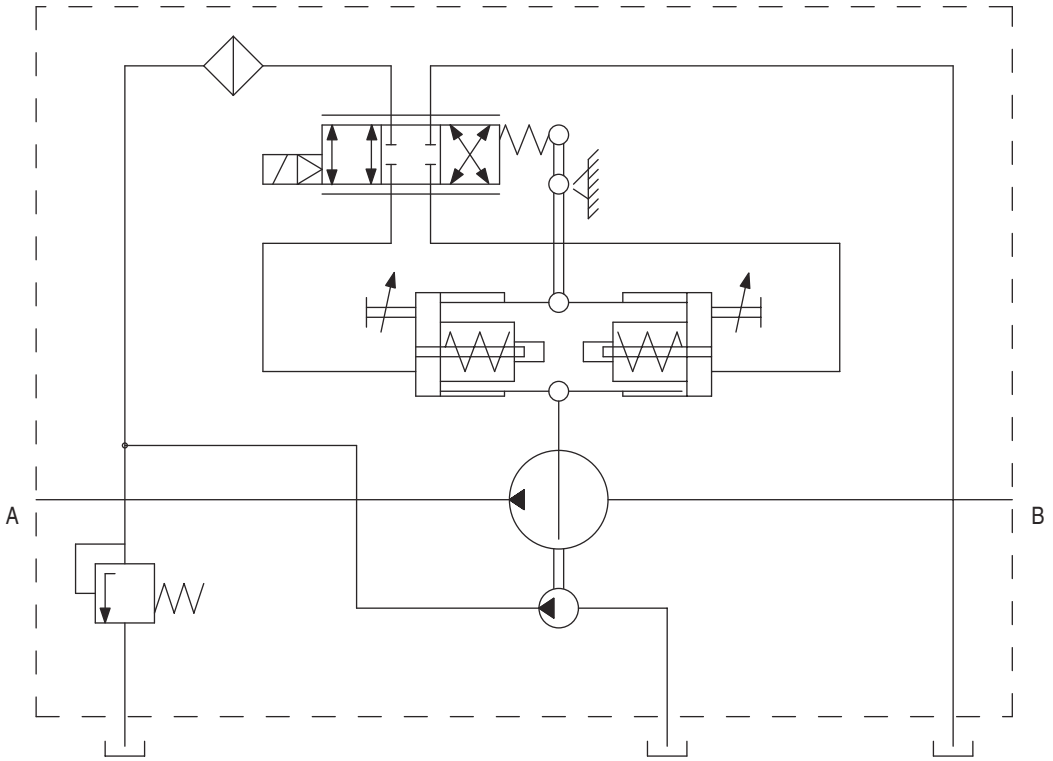
Servo Adjustment Displacement Control with Mechanical Feedback SM

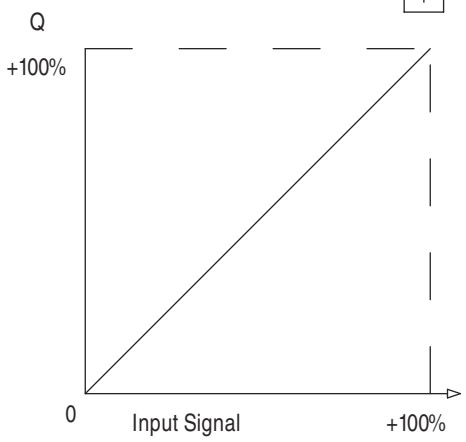
Open Loop Pumps

"W" Series

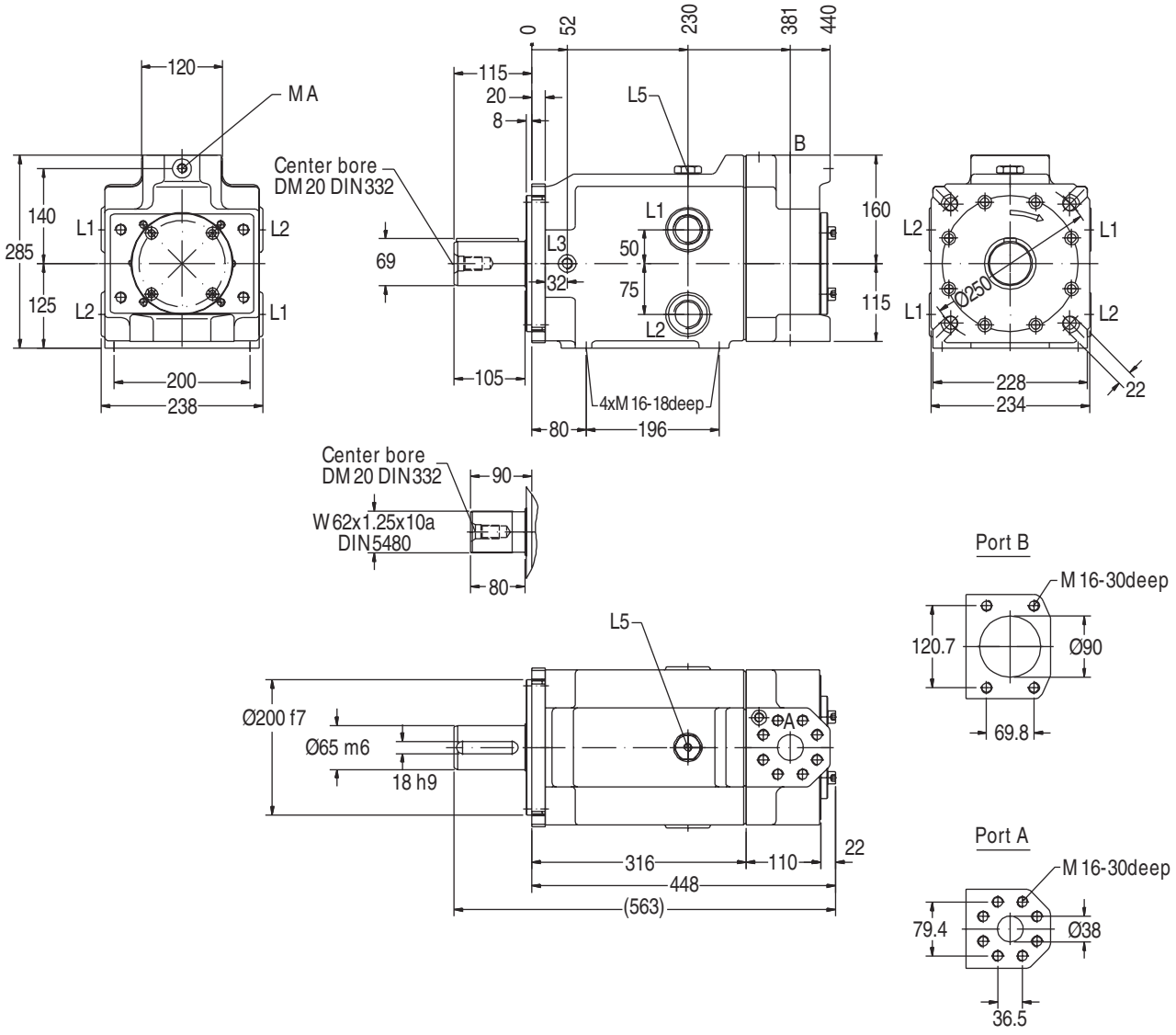
The Servo displacement control SM operates a hydrostatic drive and works without throttle losses within electrically adjustable limits. This is done by controlling delivery flow with mechanical swashplate angle feedback (mechanical closed-loop-control). No electronic control card is necessary. The proportional valve and servo piston transform the input signal to the valve to the desired setting. Input signal for Servo-valve is 0-100 mA. The dynamic is similar to the SP control. Hysteresis, consistency: maximum 8% of end value. The SM control can also be combined with hydro-mechanical relief valves for pressure and/or power.

Also available in explosion proof class version for hazardous duty.





Pump
Dimensions
PFWS - 250



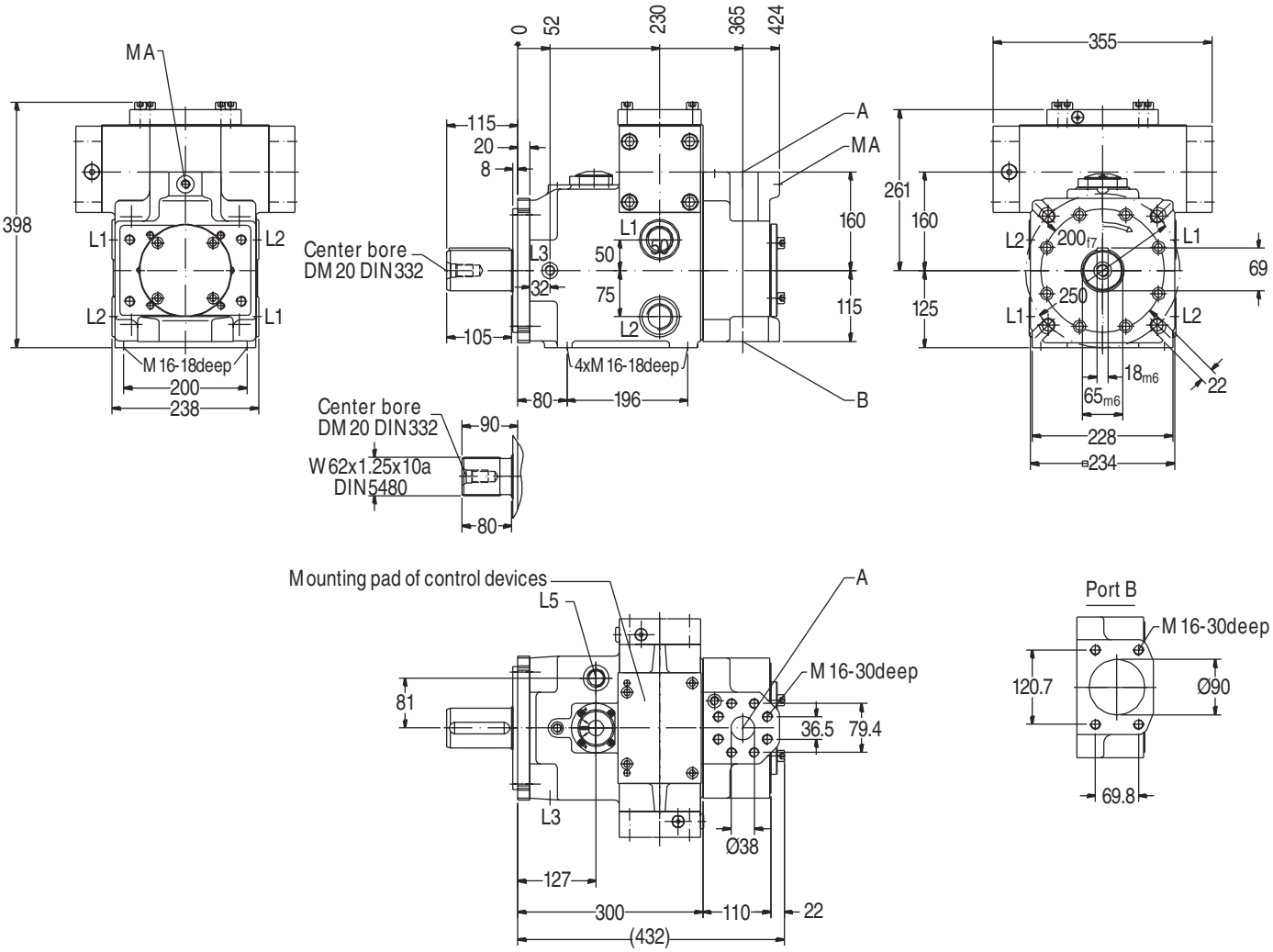
CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

Non-Standard Displacements:

STANDARD DISPLACEMENT	REDUCED DISPLACEMENT
250 ccm/rev	Available 220 or 200 ccm/rev

A	System pressure port SAE 1 1/2", 415 bar (6000psi)	(L1)	Drain port 15/8" - 12 UNF - 2B per mounting position use upper port	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(...)	Normally plugged
B	Inlet connection SAE 3 1/2", 35 bar (500psi)	L2	Drain port G 1 1/4" per mounting position use upper port	(L5)	Oil fill plug		
				(MA)	Gauge port system pressure G 1/4"		

Pump
Dimensions
PVWS - 250
Side Ports



CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

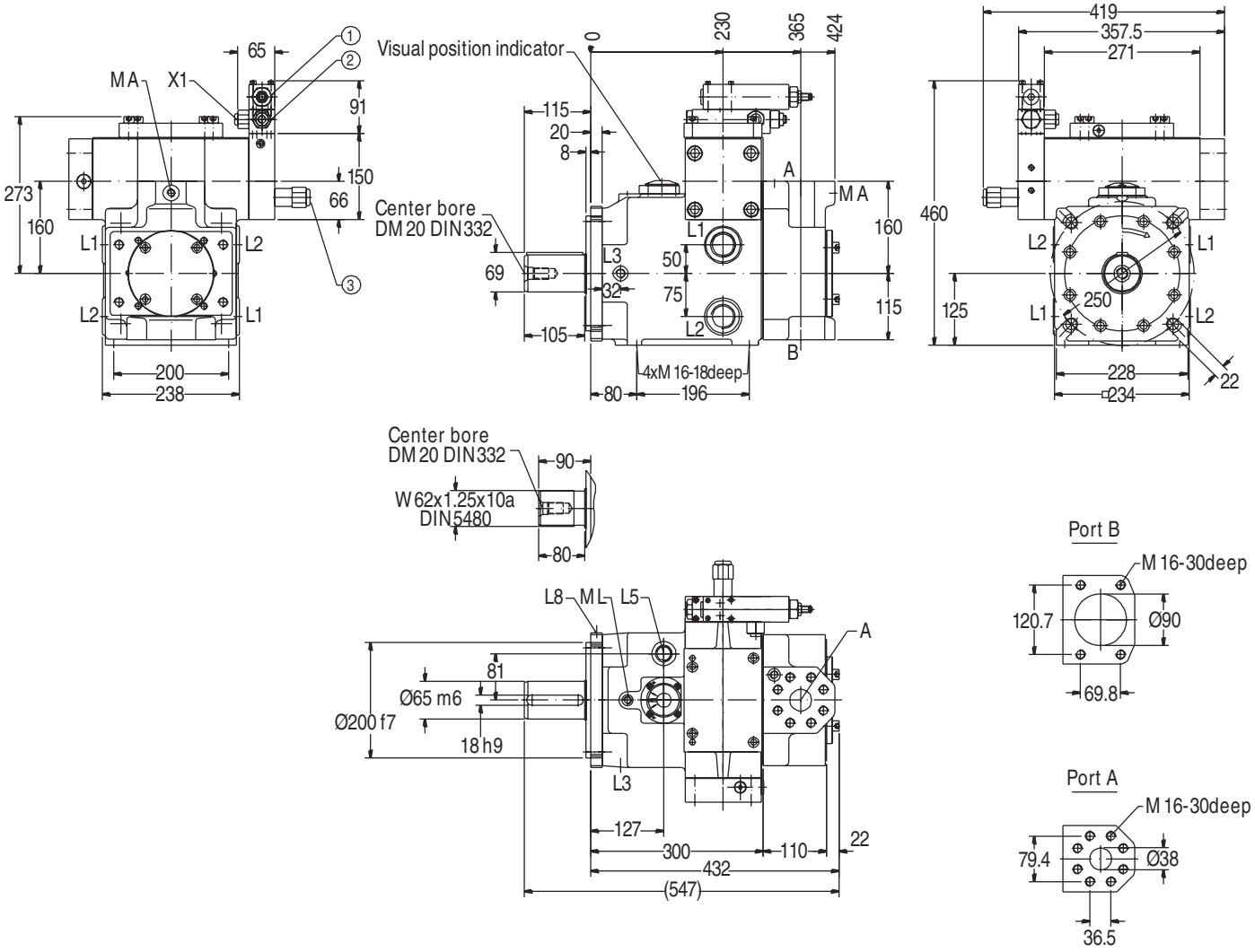
A	System pressure port SAE 1 1/2", 415 bar (6000psi)	(L1)	Drain port 15/8" - 12 UNF - 2B per mounting position use upper port	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(...)	Normally plugged
B	Inlet connection SAE 3 1/2", 35 bar (500psi)	L2	Drain port G 1 1/4" per mounting position use upper port	(L5)	Oil fill plug		
				(MA)	Gauge port system pressure G 1/4"		

Pump Dimensions - PVWS - 250

DF, 2 stage pilot valve

1 Pilot valve (2nd stage)
2 Pressure compensator (1st stage)
3 Max flow adjustment

X1 Remote port pressure limiter
DF000A ...



CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

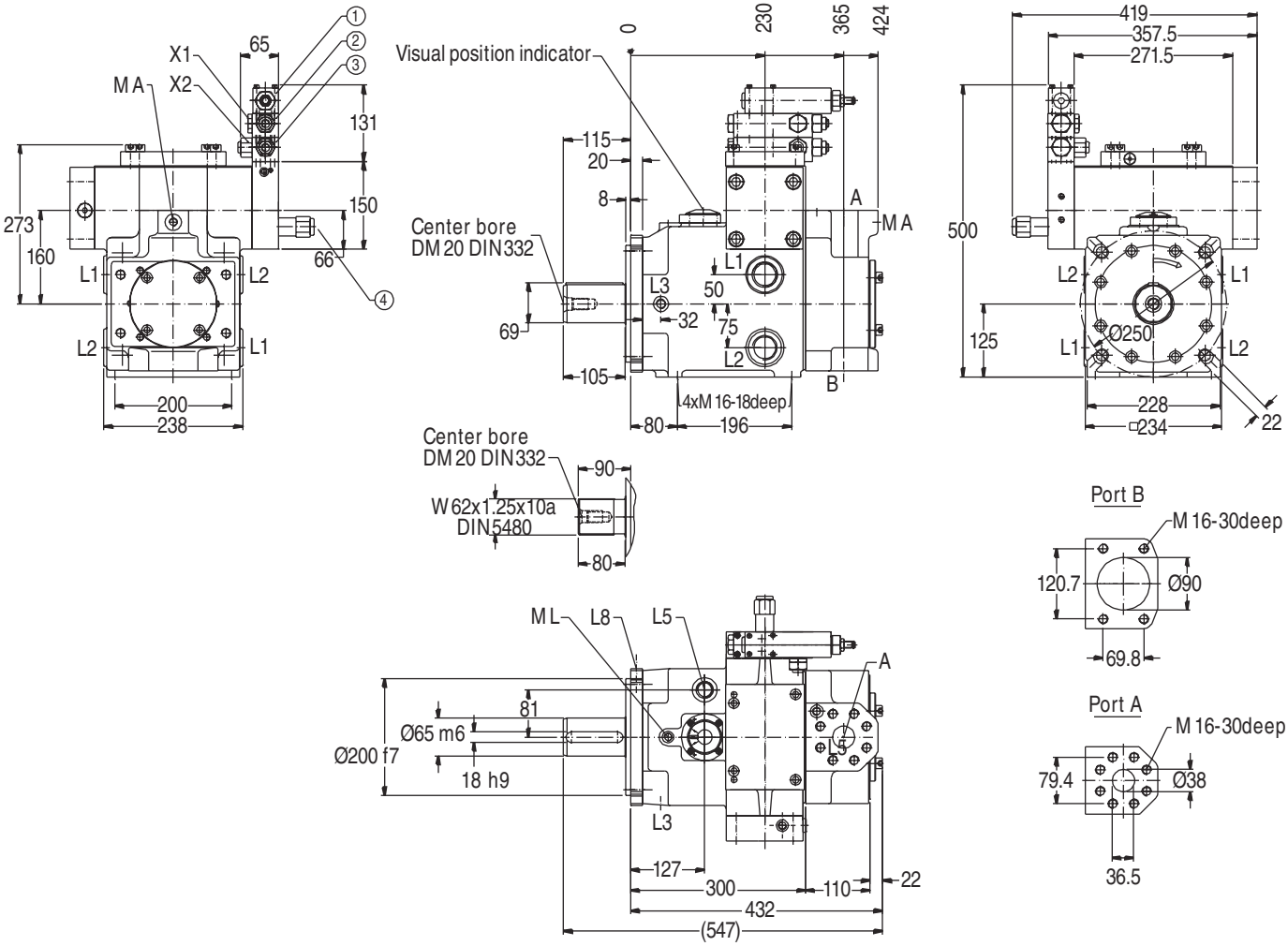
A	System pressure port SAE 1 1/2", 415 bar (6000psi)	L2	Drain port G 1 1/4" per mounting position use upper port	(L8)	Air bleed port G 1/4"	(X1)	Gauge port G 1/4" x 12.5 deep
B	Inlet connection SAE 3 1/2", 35 bar (500psi)	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"	(...)	Normally plugged
(L1)	Drain port 15/8" - 12 UNF - 2B per mounting position use upper port	(L5)	Oil fill plug 1 1/16" - 12 UNF - 2B	(MA)	Gauge port system pressure G 1/4"		
				(ML)	Gauge port of case pressure G 1/4"		

Pump Dimensions - PVWS - 250

DF, with load sensing valve

1 Pilot valve (2nd stage)
2 Pilot compensator (1st stage)
3 Load sensing valve
4 Max flow adjustment

X1 Remote port pressure limiter
X2 Load sense port
DF000A1 ...



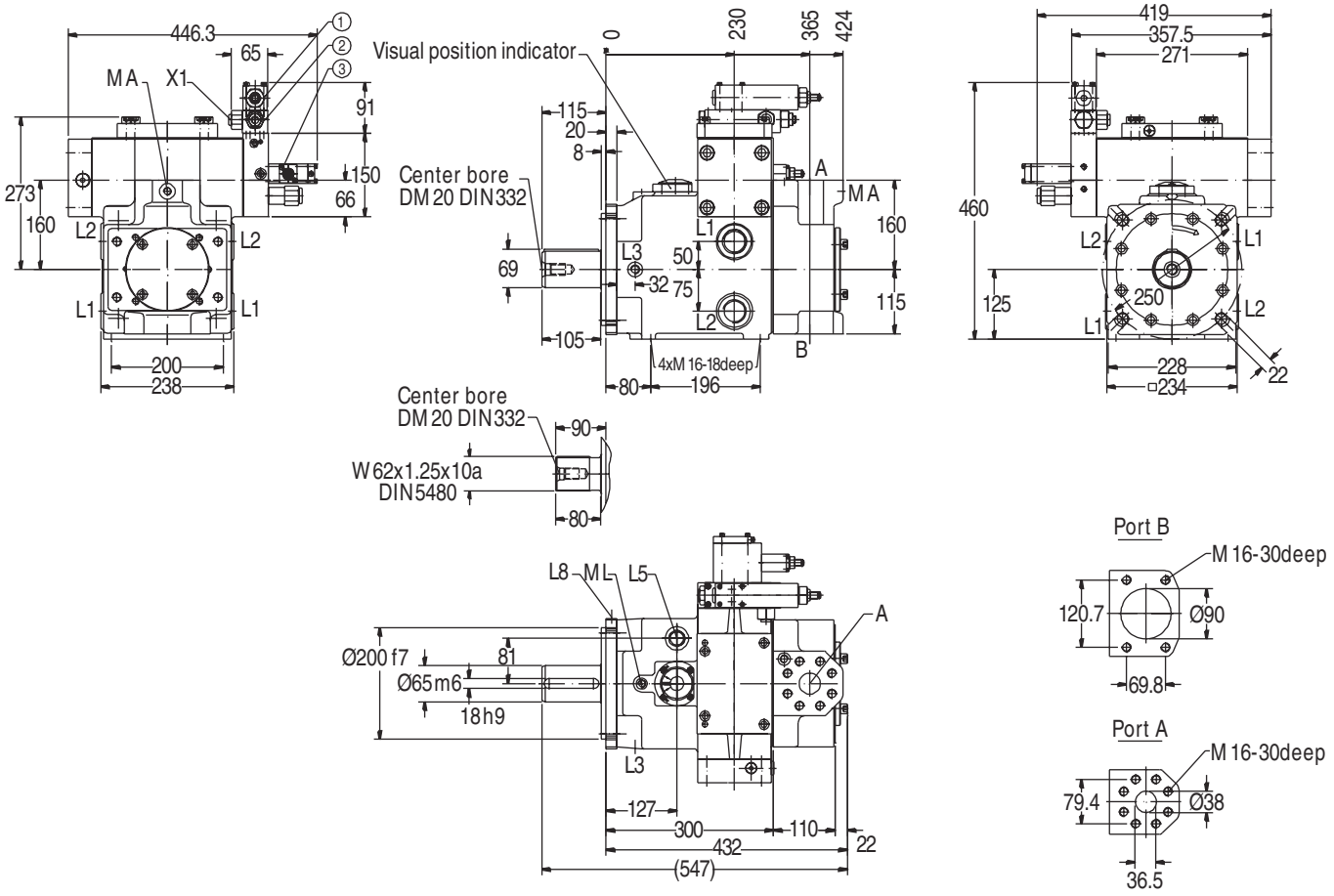
CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

A	System pressure port SAE 1 1/2", 415 bar (6000psi)	L2	Drain port G 1 1/4" per mounting position use upper port	(L8)	Air bleed port G 1/4"	X2	Gauge port G 1/4" x 12.5 deep
B	Inlet connection SAE 3 1/2", 35 bar (500psi)	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"	(...)	Normally plugged
(L1)	Drain port 1 5/8" - 12 UNF - 2B per mounting position use upper port	(L5)	Oil fill plug 1 1/16" - 12 UNF - 2B	(ML)	Gauge port of case pressure G 1/4"		
				(X1)	Gauge port G 1/4" x 12.5 deep		

Pump Dimensions - PVWS - 250

LR, with pressure limiter

1 Pilot valve (2nd stage)
2 Pilot compensator (1st stage)
3 Power limiter valve
4 Max flow adjustment
X1 Remote port pressure limiter
LR000A2 ...



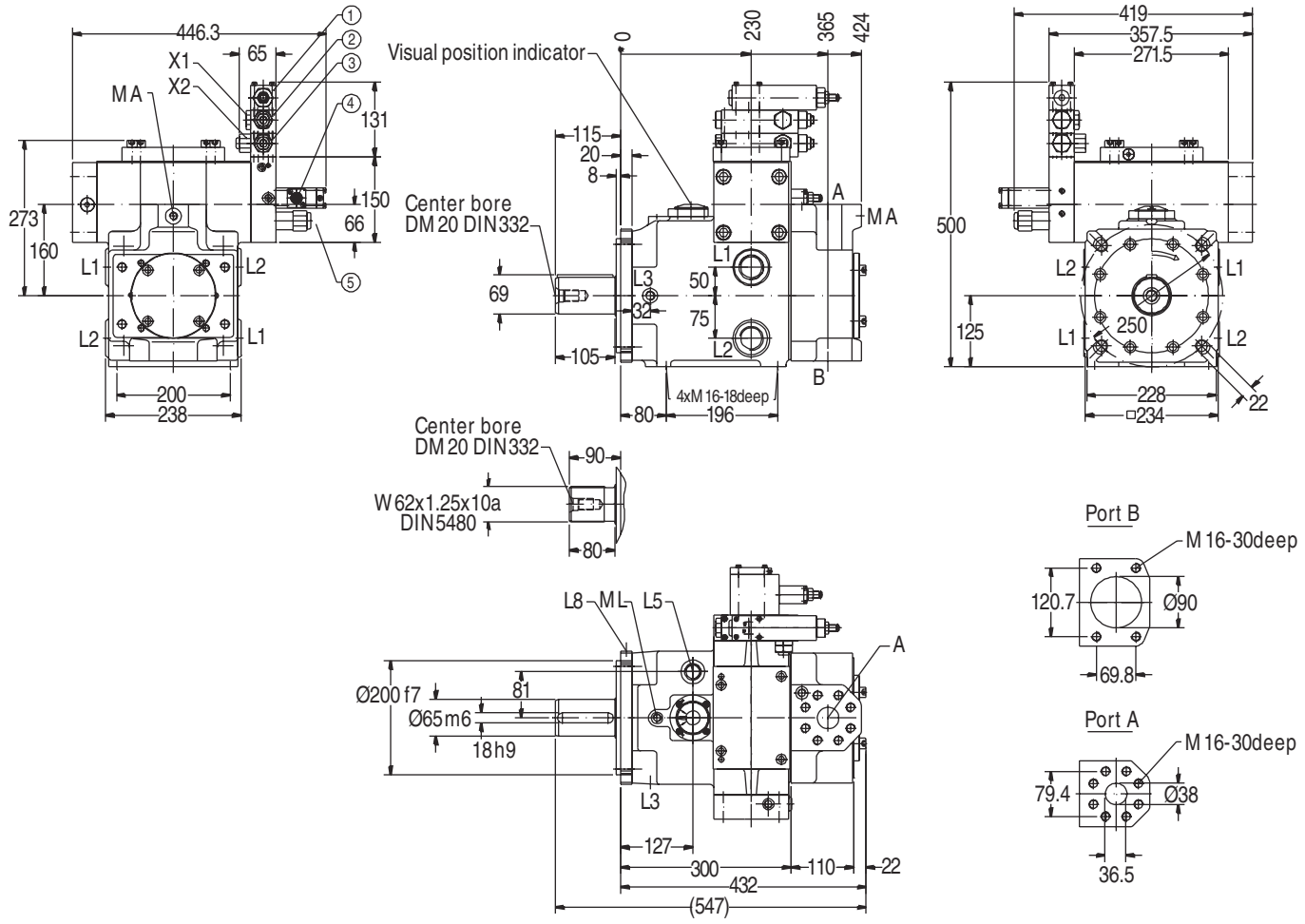
CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

A	System pressure port SAE 1 1/2", 415 bar (6000psi)	L2	Drain port G 1 1/4" per mounting position use upper port	(L8)	Air bleed port G 1/4"	(...)	Normally plugged
B	Inlet connection SAE 3 1/2", 35 bar (500psi)	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"		
(L1)	Drain port 1 5/8" - 12 UNF - 2B per mounting position use upper port	(L5)	Oil fill plug 1 1/16" - 12 UNF - 2B	(ML)	Gauge port of case pressure G 1/4"		
				(X1)	Gauge port G 1/4" x 12.5 deep		

Pump Dimensions - PVWS - 250

LR, with load sensing valve

1 Pilot valve (2nd stage)
2 Pilot compensator (1st stage)
3 Load sensing valve
4 Power limiter valve
5 Max flow adjustment
X1 Remote port pressure limiter
X2 Load sense port
LR000A3 ...



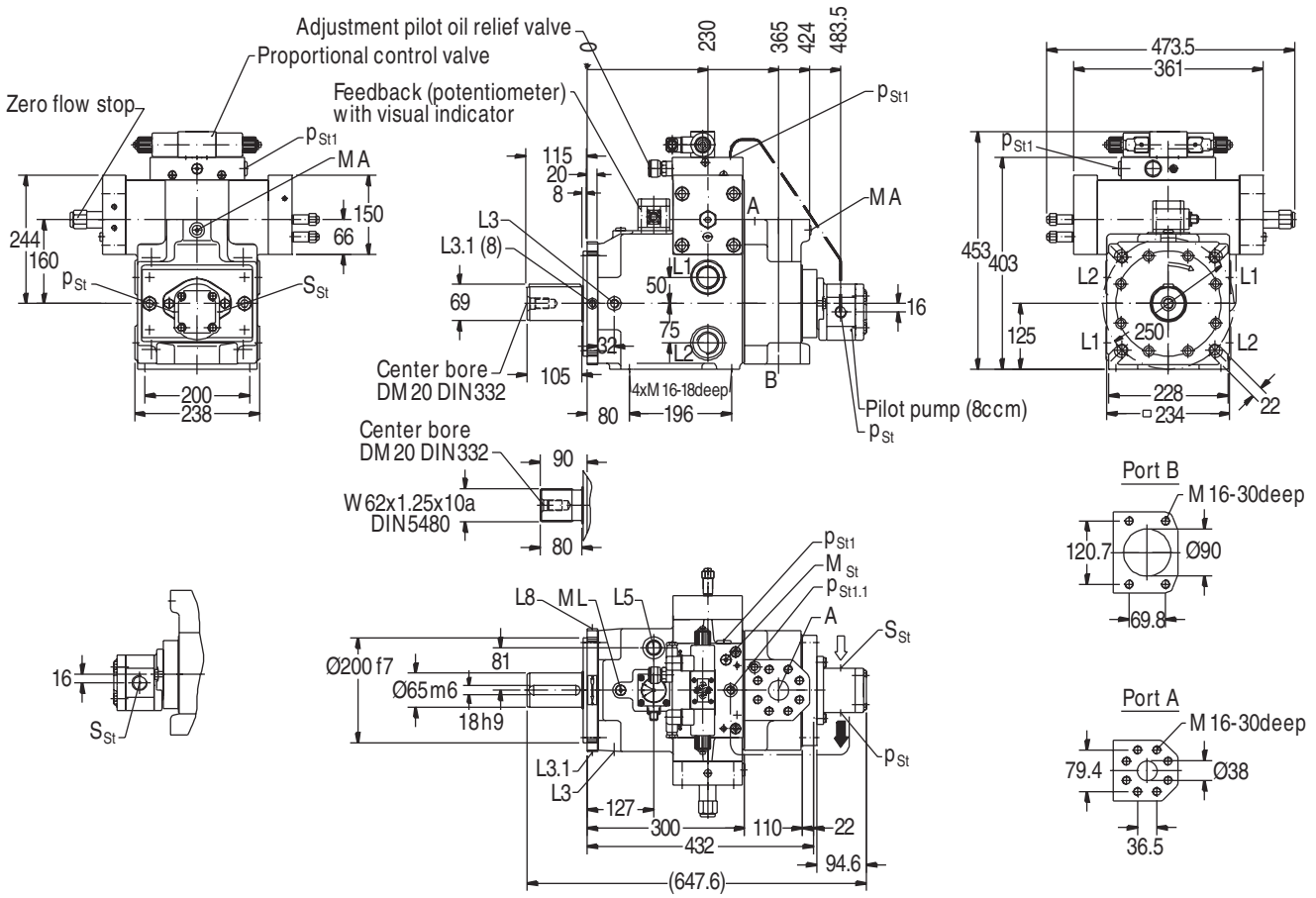
CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

A	System pressure port SAE 1 1/2", 415 bar (6000psi)	L2	Drain port G1 1/4" per mounting position use upper port	(L8)	Air bleed port G 1/4"	X2	Gauge port G 1/4" x 12.5 deep
B	Inlet connection SAE 3 1/2", 35 bar (500psi)	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"	(...)	Normally plugged
(L1)	Drain port 1 5/8" - 12 UNF - 2B per mounting position use upper port	(L5)	Oil fill plug 1 1/16" - 12 UNF - 2B	(ML)	Gauge port of case pressure G 1/4"		
				(X1)	Gauge port G 1/4" x 12.5 deep		

Pump Dimensions - PVWS - 250

SP

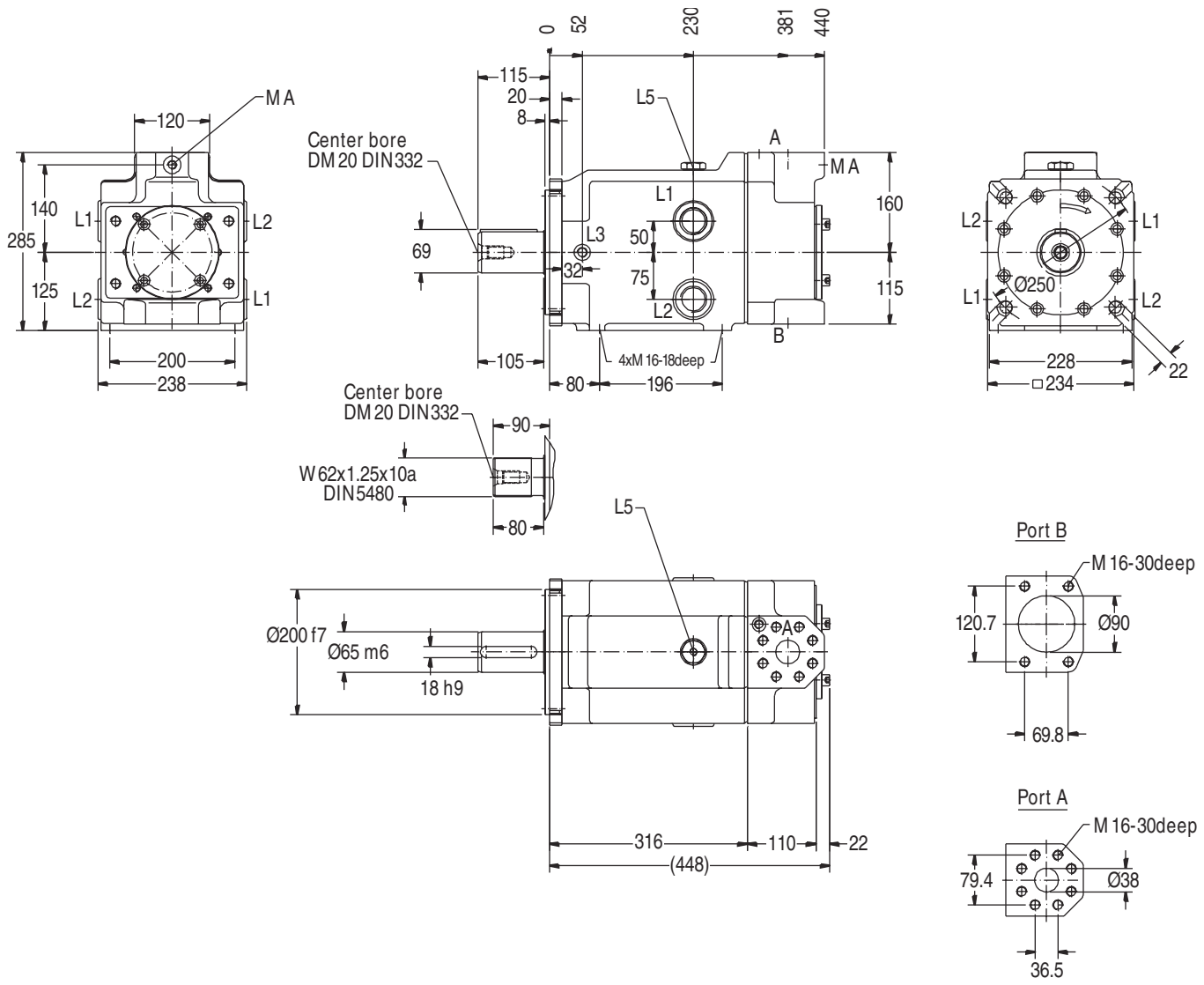
SPC03A ...



CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

A	System pressure port SAE 1 1/2", 415 bar (6000psi)	L2	Drain port G 1 1/4" per mounting position use upper port	(MA)	Gauge port system pressure G 1/4"	(PSt1)	Port of pilot pressure G 1/2" (alternatively PSt1 or PSt1.1)
B	Inlet connection SAE 3 1/2", 35 bar (500psi)	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(ML)	Gauge port of case pressure G 1/4"	(PSt1.1)	Port of pilot pressure G 3/8"
(L1)	Drain port 1 5/8" - 12 UNF - 2B per mounting position use upper port	(L3.1)	Port G 1/4"	(MSt)	Gauge port pilot pressure G 1/4"	XA	Pilot port pressure control G 1/4"
		(L5)	Oil fill plug 1 1/16" - 12 UNF - 2B	SSt	Suction port of pilot pump G 3/4"	(...)	Normally plugged
		(L8)	Air bleed port G 1/4"	PSt	Outlet port of pilot pump G 1/2"		

Pump Dimensions - PFWS - 360



CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

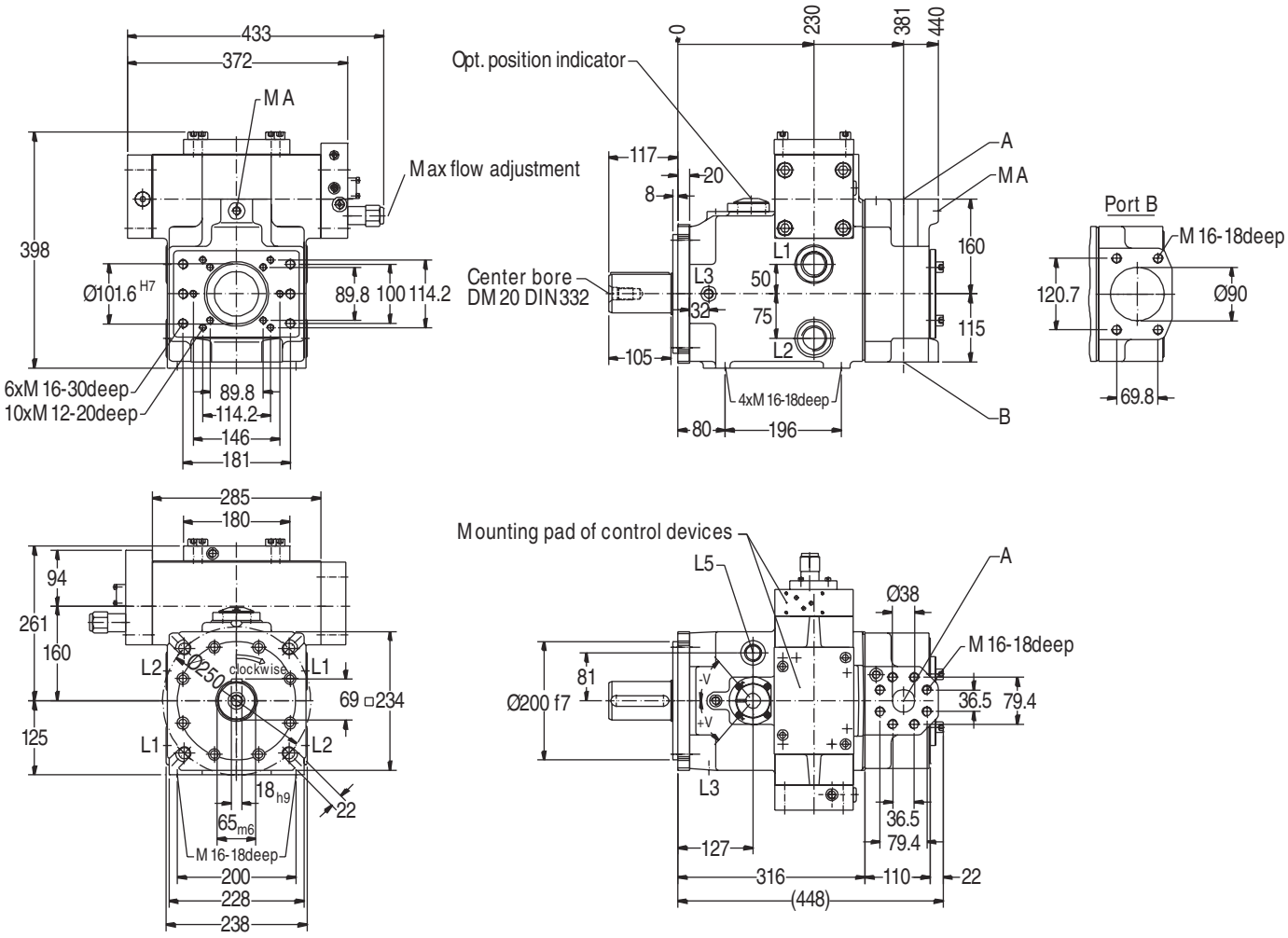
Non-Standard Displacements:

STANDARD DISPLACEMENT	REDUCED DISPLACEMENT
360 ccm/rev	Available 308.5 ccm/rev

A	System pressure port SAE 1 1/2", 415 bar (6000psi)	(L1)	Drain port 15/8" - 12 UNF - 2B per mounting position use upper port	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"
B	Inlet connection SAE 3 1/2", 35 bar (500psi)	L2	Drain port G 1 1/4" per mounting position use upper port	(L5)	Oil fill plug 1 1/16" - 12 UNF - 2B	(...)	Normally plugged

Pump Dimensions - PVWS - 360

Side ports



CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

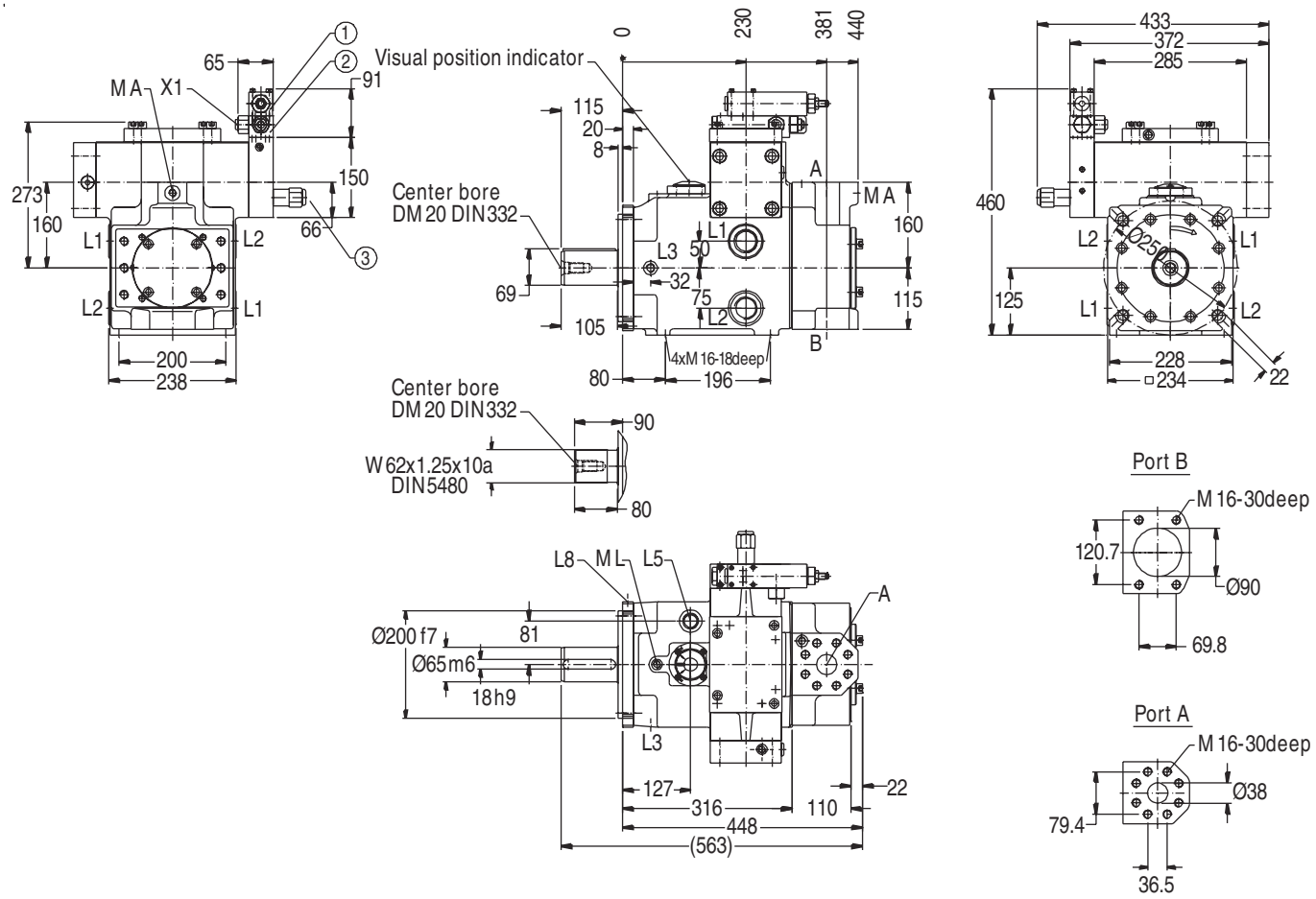
A	System pressure port SAE 1 1/2", 415 bar (6000psi)	(L1)	Drain port 15/8" - 12 UNF - 2B per mounting position use upper port	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"
B	Inlet connection SAE 3 1/2", 35 bar (500psi)	L2	Drain port G 1 1/4" per mounting position use upper port	(L5)	Oil fill plug 1 1/16" - 12 UNF - 2B	(...)	Normally plugged

Pump Dimensions - PVWS - 360

DF, 2 stage pilot valve

1 Pilot valve (2nd stage)
2 Pressure compensator (1st stage)
3 Max flow adjustment

X1 Remote port pressure limiter
DF000A ...



CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

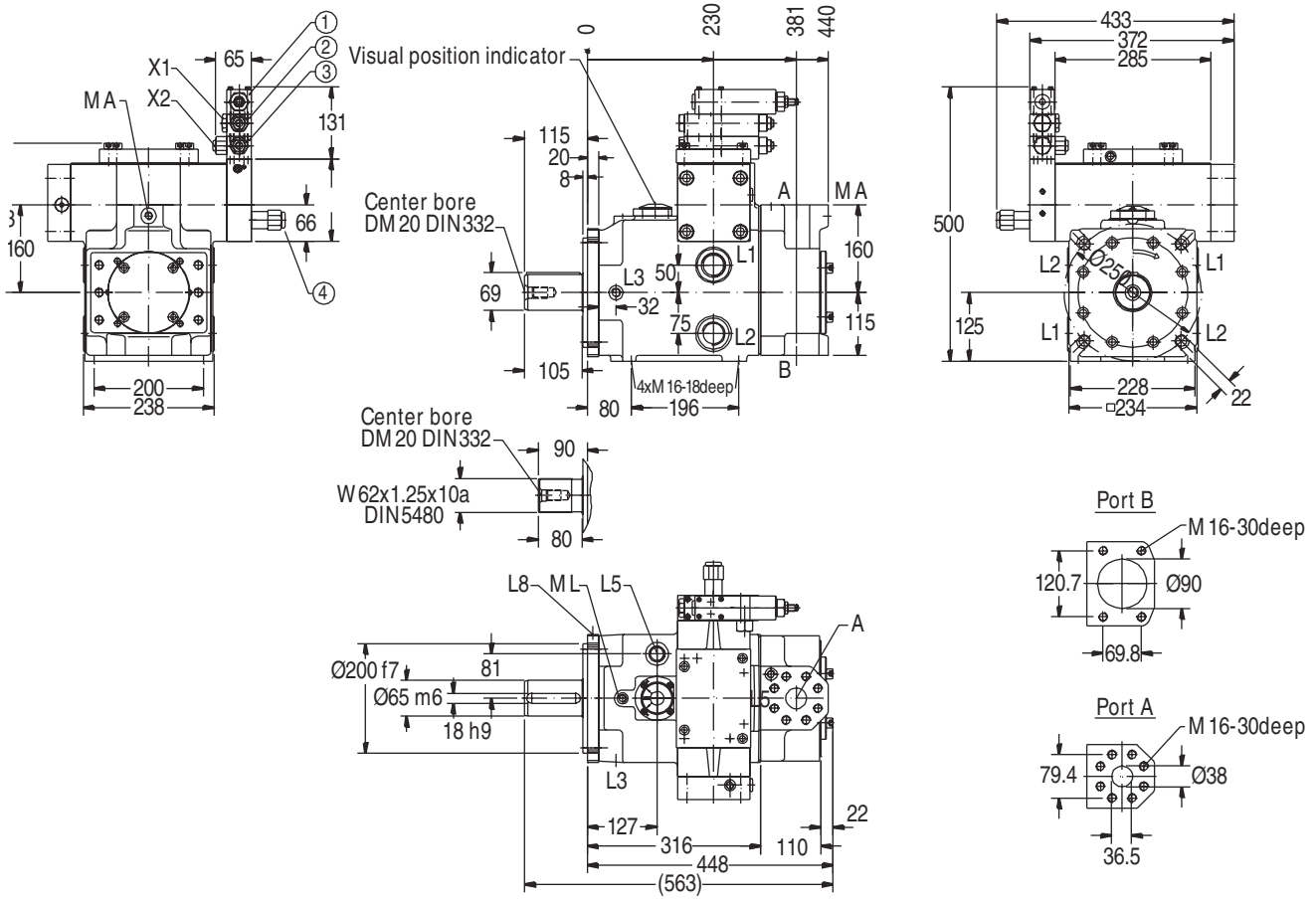
A	System pressure port SAE 1 1/2", 415 bar (6000psi)	L2	Drain port G 1 1/4" per mounting position use upper port	(L8)	Air bleed port G 1/4"	(...)	Normally plugged
B	Inlet connection SAE 3 1/2", 35 bar (500psi)	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"		
(L1)	Drain port 1 5/8" - 12 UNF - 2B per mounting position use upper port	(L5)	Oil fill plug 1 1/16" - 12 UNF - 2B	(ML)	Gauge port of case pressure G 1/4"		
				(X1)	Gauge port G 1/4" x 12.5 deep		

Pump Dimensions - PVWS - 360

DF, with load sensing valve

1 Pilot valve (2nd stage)
2 Pressure compensator (1st stage)
3 Load sensing valve
4 Max flow adjustment

X1 Remote port pressure limiter
X2 Load sense port
DF000A1 ...



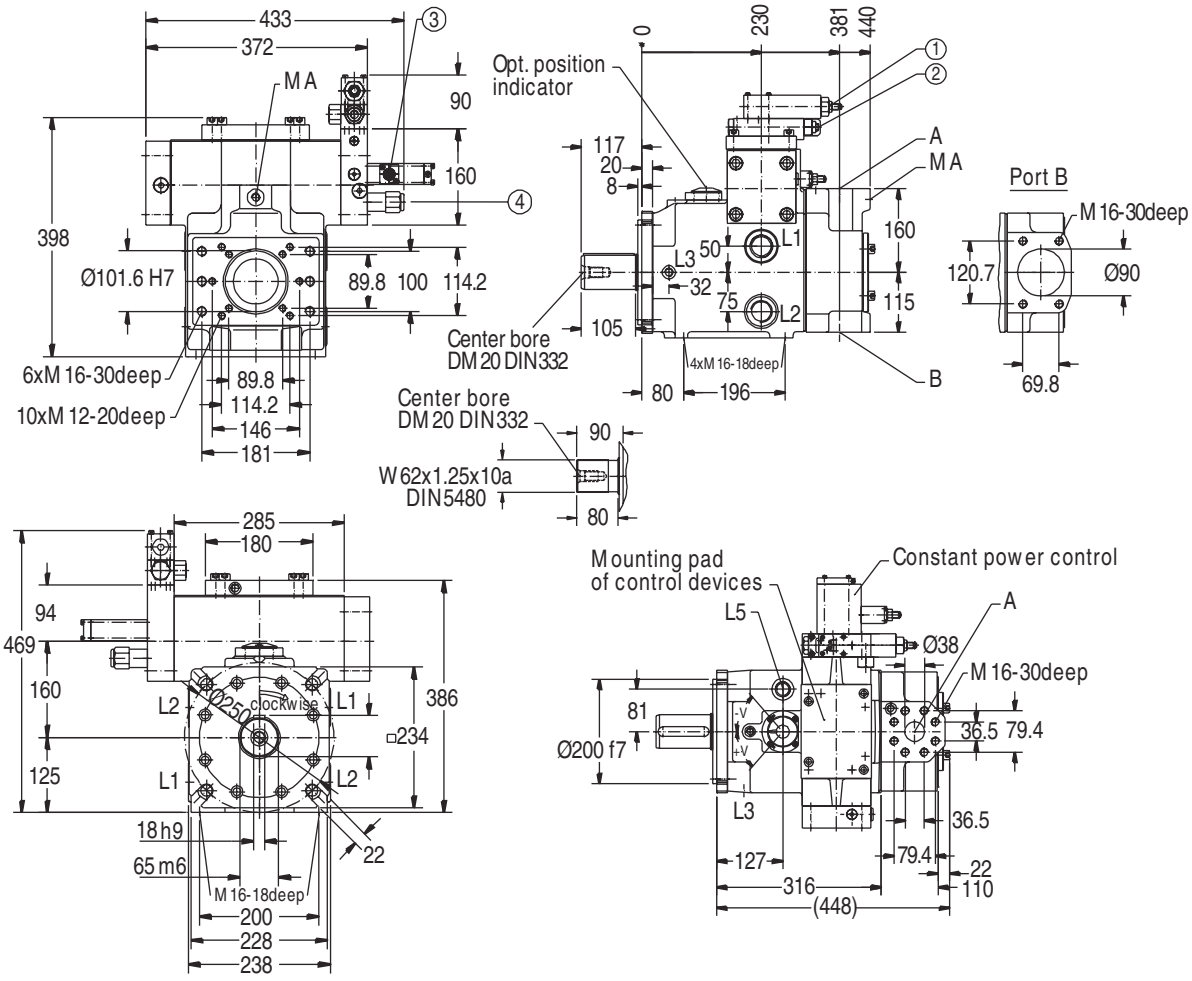
CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

A	System pressure port SAE 1 1/2", 415 bar (6000psi)	L2	Drain port G 1 1/4" per mounting position use upper port	(L8)	Air bleed port G 1/4"	X2	Gauge port G 1/4" x 12.5 deep
B	Inlet connection SAE 3 1/2", 35 bar (500psi)	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"	(...)	Normally plugged
(L1)	Drain port 1 5/8" - 12 UNF - 2B per mounting position use upper port	(L5)	Oil fill plug 1 1/16" - 12 UNF - 2B	(ML)	Gauge port of case pressure G 1/4"		
				(X1)	Gauge port G 1/4" x 12.5 deep		

Pump Dimensions - PVWS - 360

LR, with pressure limiter

1 Pilot valve (2nd stage)
2 Pressure compensator (1st stage)
3 Power limitation valve
4 Max flow adjustment
X1 Remote port pressure limiter
LR000A2 ...



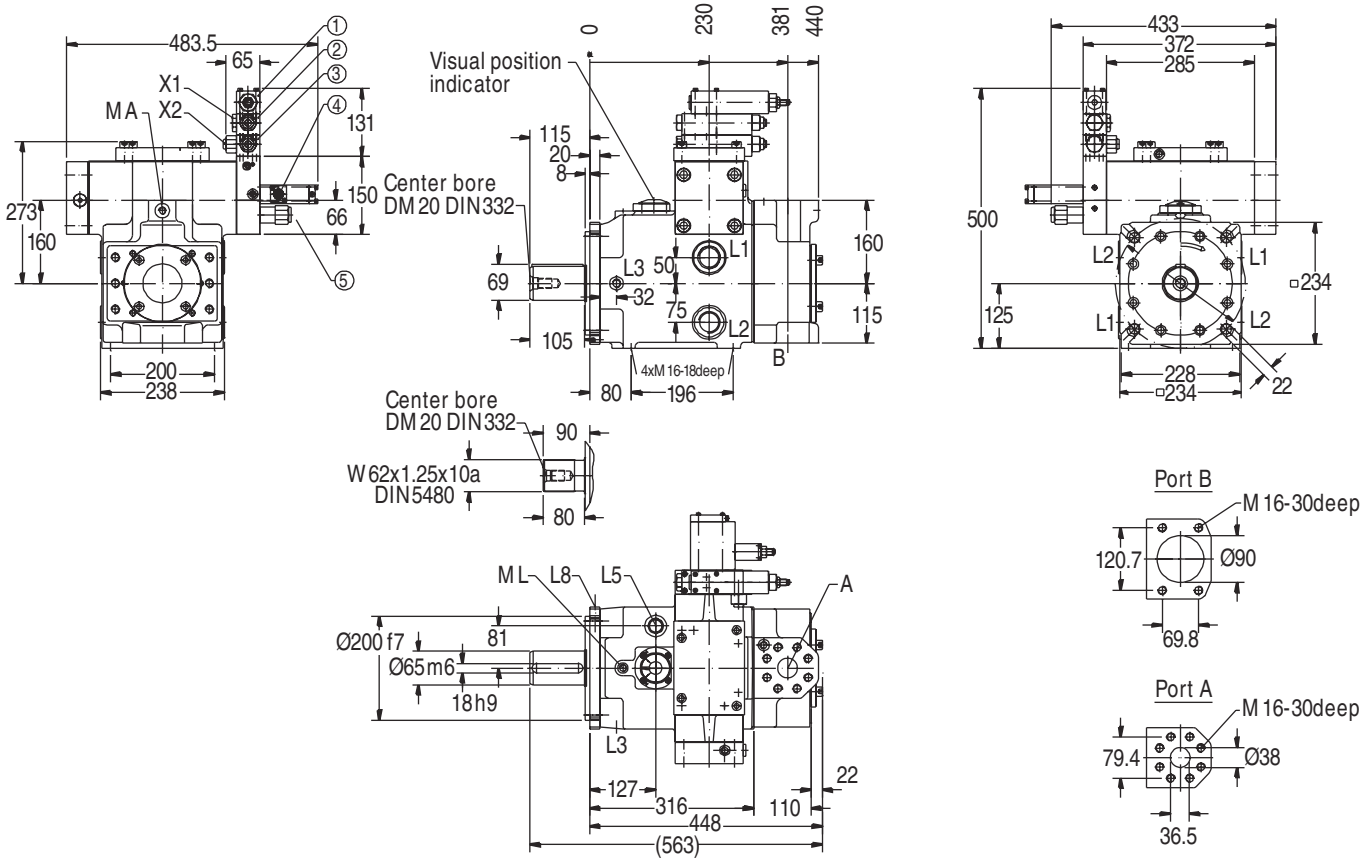
CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

A	System pressure port SAE 1 1/2", 415 bar (6000psi)	L2	Drain port G 1 1/4" per mounting position use upper port	(L8)	Air bleed port G 1/4"	(...)	Normally plugged
B	Inlet connection SAE 3 1/2", 35 bar (500psi)	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"		
(L1)	Drain port 1 5/8" - 12 UNF - 2B per mounting position use upper port	(L5)	Oil fill plug 1 1/16" - 12 UNF - 2B	(ML)	Gauge port of case pressure G 1/4"		
				(X1)	Gauge port G 1/4" x 12.5 deep		

Pump Dimensions - PVWS - 360

LR, with load sensing valve

1 Pilot valve (2nd stage)
2 Pressure compensator (1st stage)
3 Load sensing valve
4 Power limitation valve
5 Max flow adjustment
X1 Remote port pressure limiter
X2 Load sense port
LR000A3 ...



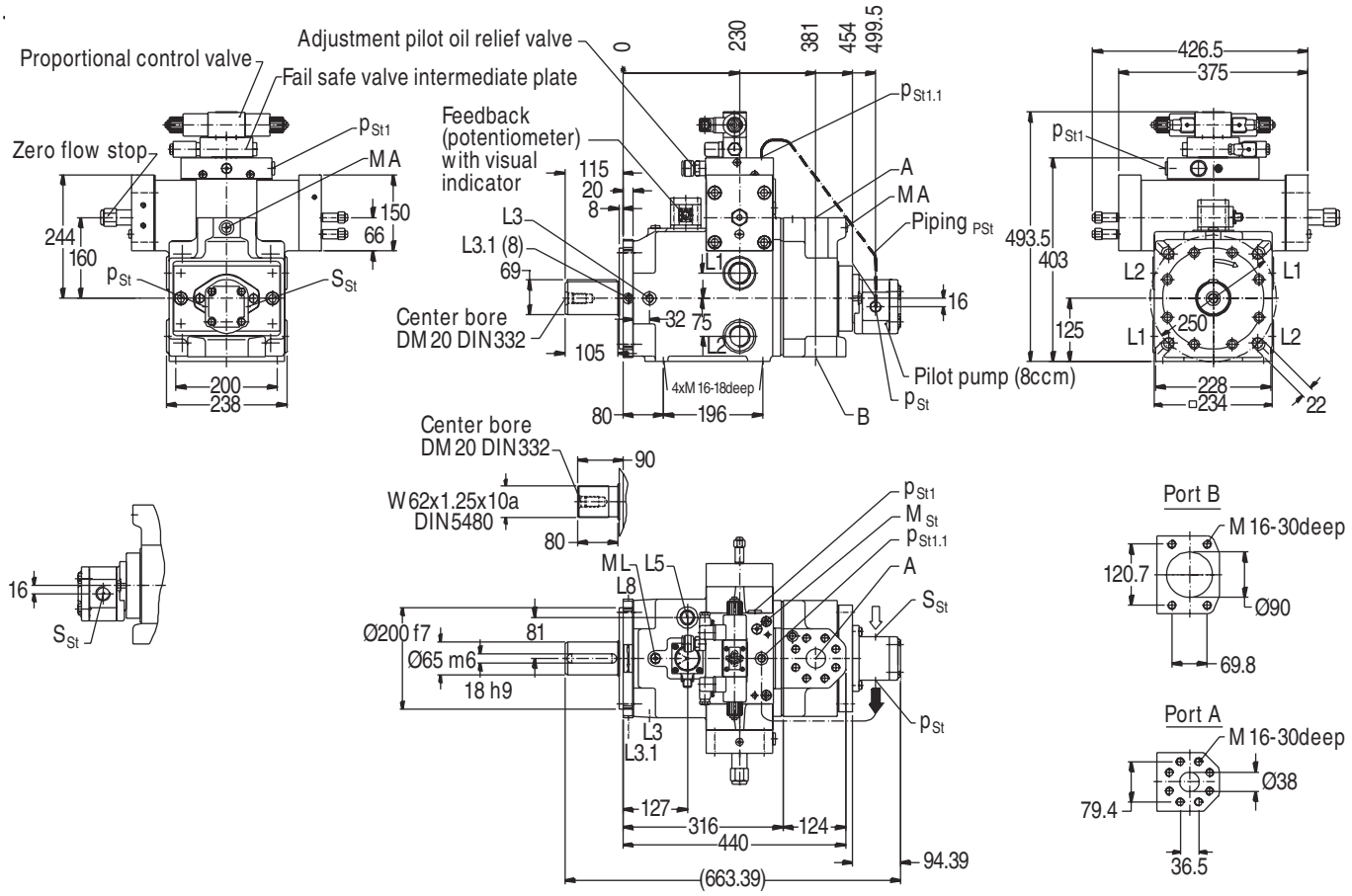
CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

A	System pressure port SAE 1 1/2", 415 bar (6000psi)	L2	Drain port G 1 1/4" per mounting position use upper port	(L8)	Air bleed port G 1/4"	X2	Gauge port G 1/4" x 12.5 deep
B	Inlet connection SAE 3 1/2", 35 bar (500psi)	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"	(...)	Normally plugged
(L1)	Drain port 1 5/8" - 12 UNF - 2B per mounting position use upper port	(L5)	Oil fill plug 1 1/16" - 12 UNF - 2B	(ML)	Gauge port of case pressure G 1/4"		
				(X1)	Gauge port G 1/4" x 12.5 deep		

Pump Dimensions - PVWS - 360

SP

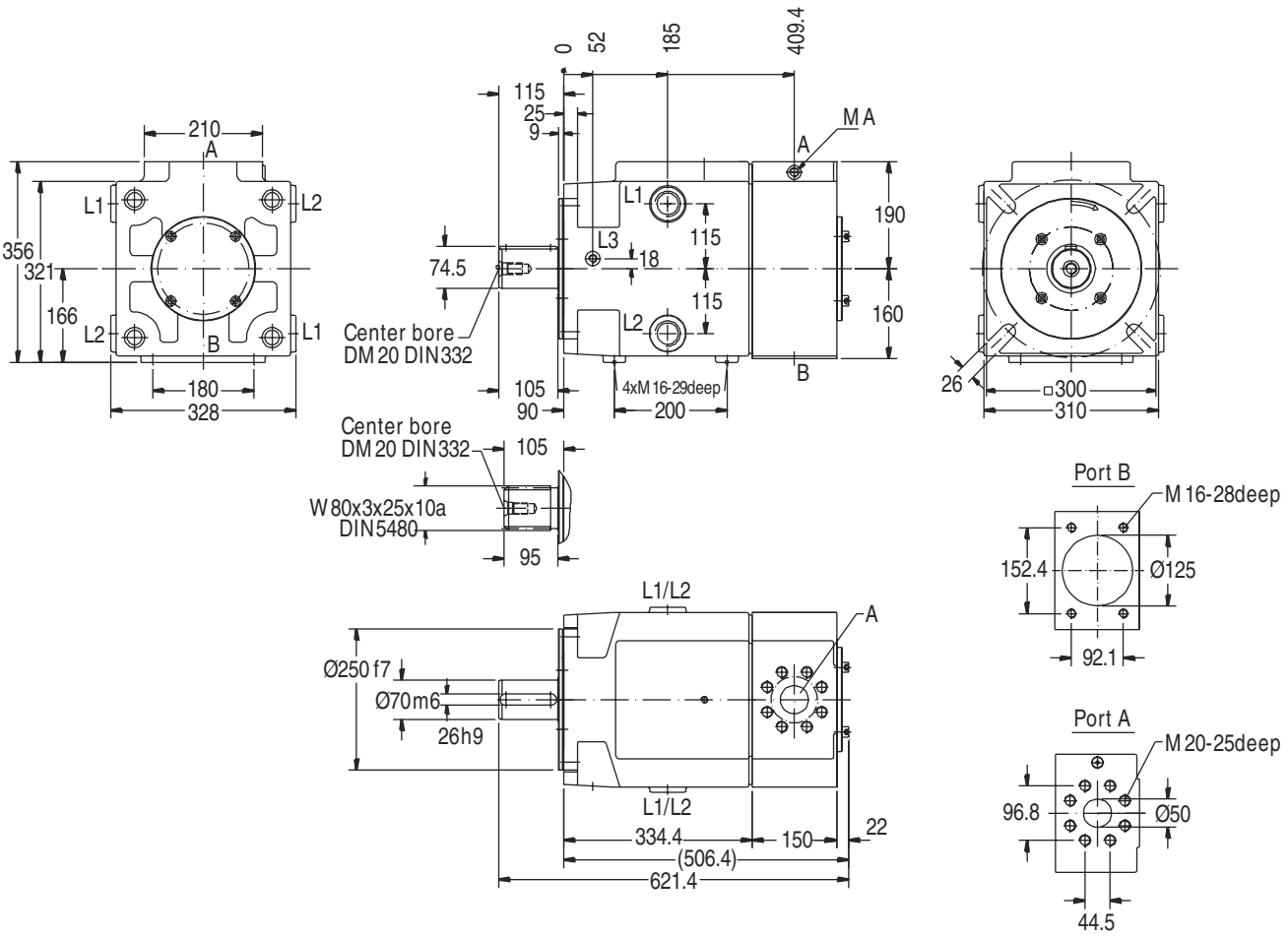
SPC03A ...



CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

A	System pressure port SAE 1 1/2", 415 bar (6000psi)	L2	Drain port G 1 1/4" per mounting position use upper port	(MA)	Gauge port system pressure G 1/4"	(PSt1)	Port of pilot pressure G 1/2" (alternatively PSt1 or PSt11)
B	Inlet connection SAE 3 1/2", 35 bar (500psi)	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(ML)	Gauge port of case pressure G 1/4"	(PSt1.1)	Port of pilot pressure G 3/8"
(L1)	Drain port 1 5/8" - 12 UNF - 2B per mounting position use upper port	(L3.1)	Port G 1/4"	(MSt)	Gauge port pilot pressure G 1/4"	(...)	Normally plugged
		(L5)	Oil fill plug 1 1/16" - 12 UNF - 2B	SSt	Suction port of pilot pump G 3/4"		
		(L8)	Air bleed port G 1/4"	PSt	Outlet port of pilot pump G 1/2"		

Pump Dimensions - PFWS - 500



CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

Non-Standard Displacements:

STANDARD DISPLACEMENT	REDUCED DISPLACEMENT
500 ccm/rev	Available 467 or 364 ccm/rev

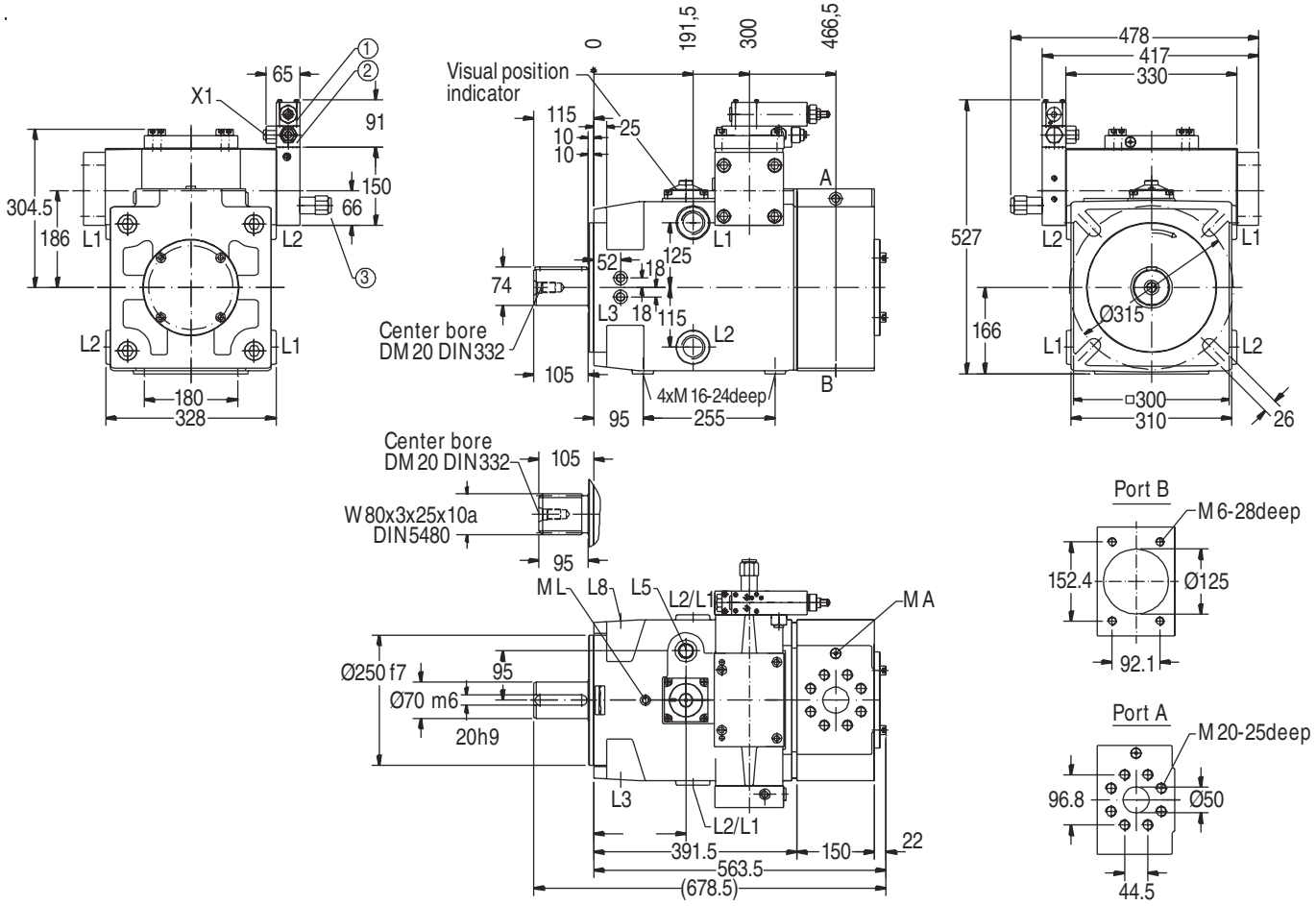
A	System pressure port SAE 2", 415 bar (6000psi)	(L1)	Drain port 15/8" - 12 UNF - 2B per mounting position use upper port	(L3)	Ventilation port for vertical mounting G 1/4" (shaft upwards)	(...)	Normally plugged
B	Inlet connection SAE 5", 35 bar (500psi)	L2	Drain port G 1 1/2" per mounting position use upper port	(MA)	Gauge port system pressure G 1/4"		

Pump Dimensions - PVWS - 500

DF, 2 stage pilot valve

1 Pilot valve (2nd stage)
2 Pressure compensator (1st stage)
3 Max flow adjustment

X1 Remote port pressure limiter
DF000A ...



CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

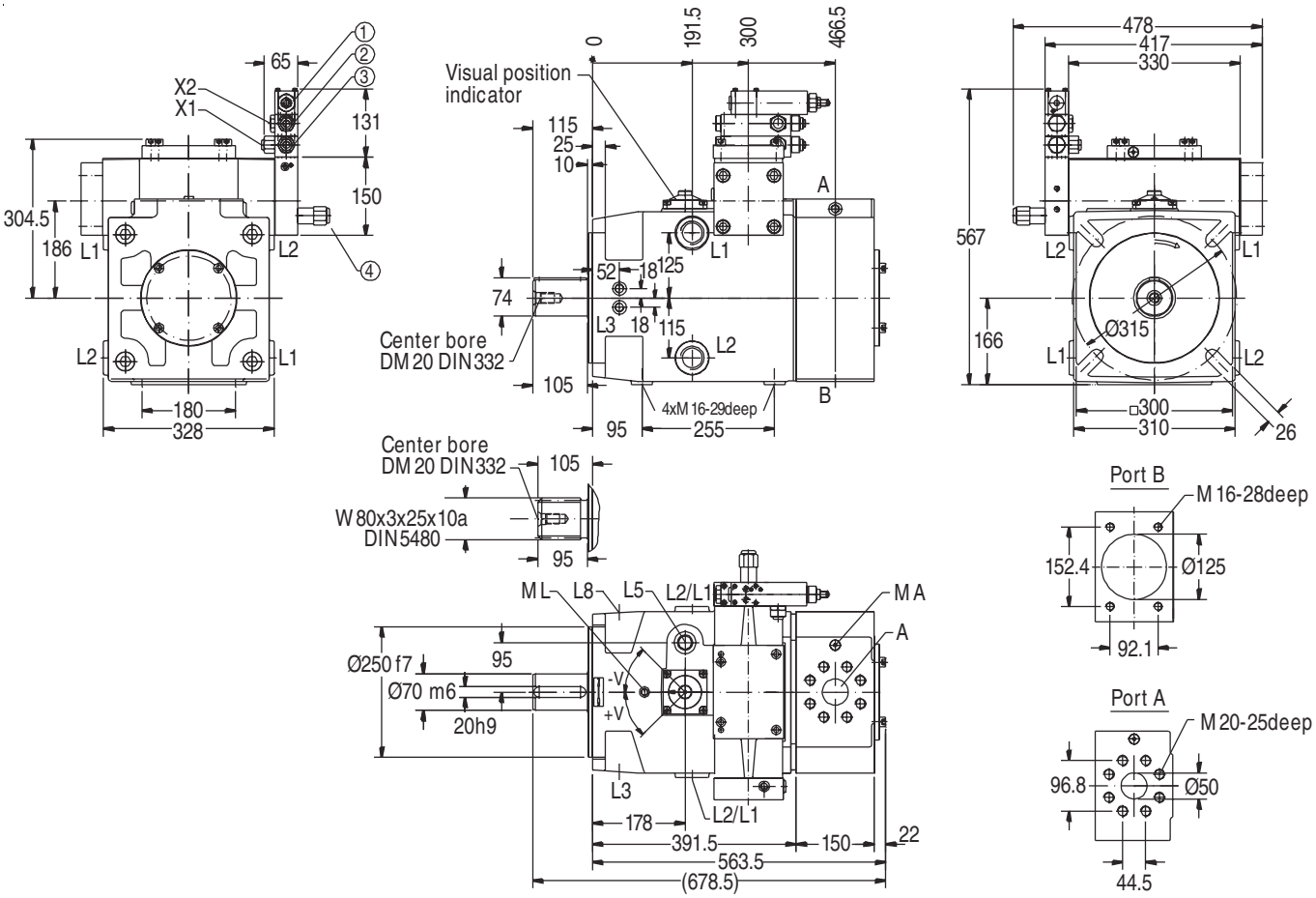
A	System pressure port SAE 2", 415 bar (6000psi)	(L1)	Drain port 1 5/8" - 12 UNF - 2B per mounting position use upper port	(L3)	Ventilation port for vertical mounting G 1/4" (shaft upwards)	(ML)	Gauge port of case pressure G 1/4"
B	Inlet connection SAE 5", 35 bar (500psi)	L2	Drain port G 1 1/2" per mounting position use upper port	(L5)	Oil fill plug G 1 1/2"	(X1)	Gauge port G 1/4" x 12.5 deep
				(L8)	Air bleed port G 1/4"	(...)	Normally plugged
				(MA)	Gauge port system pressure G 1/4"		

Pump Dimensions - PVWS - 500

DF, with load sensing valve

1 Pilot valve (2nd stage)
2 Pressure compensator (1st stage)
3 Load sensing valve
4 Max flow adjustment

X1 Load sense port
X2 Remote port pressure limiter
DF000A1 ...



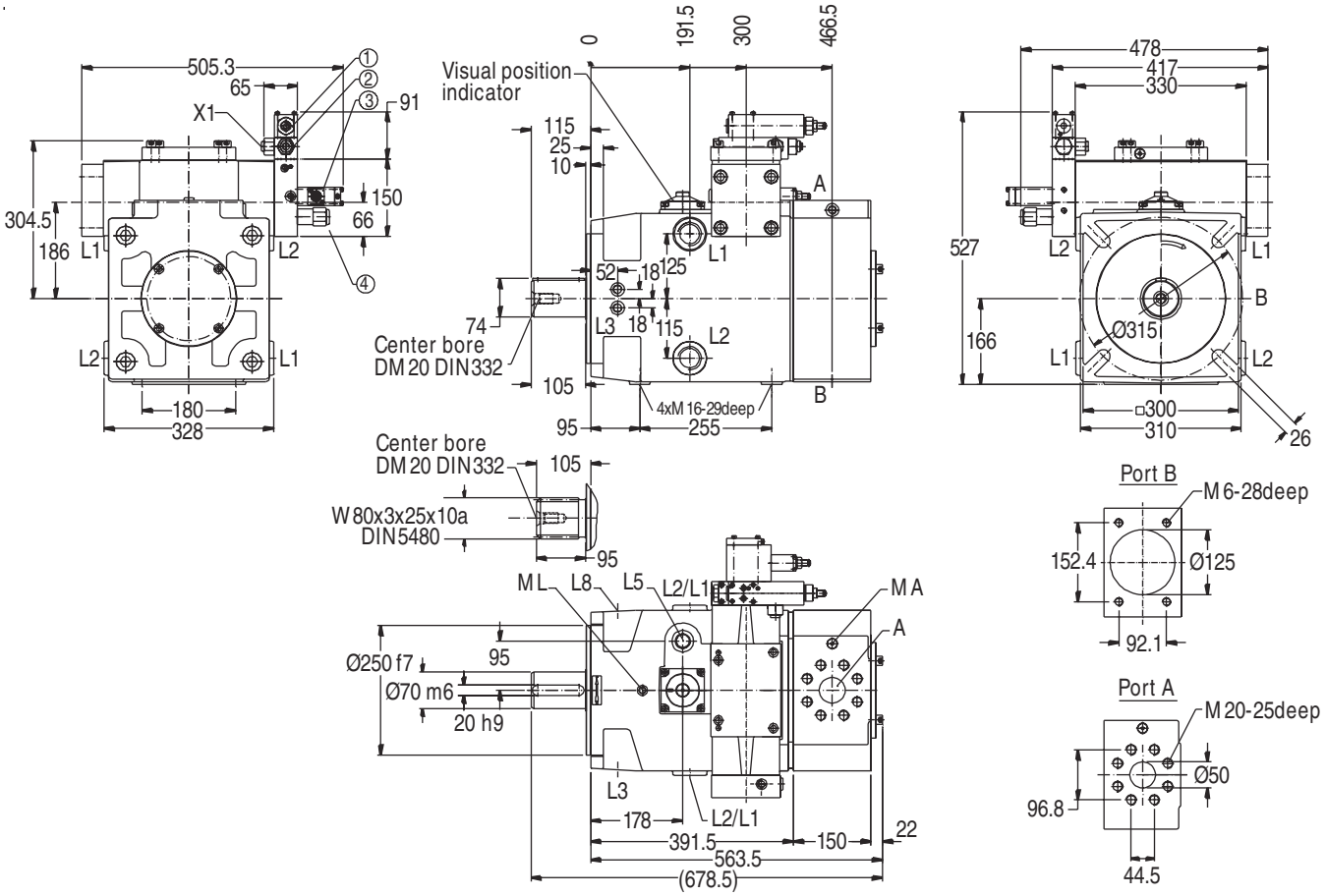
CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

A	System pressure port SAE 2", 415 bar (6000psi)	L2	Drain port G 1 1/2 " per mounting position use upper port	(L8)	Air bleed port G 1/4"	X2	Gauge port G 1/4" x 12.5 deep
B	Inlet connection SAE 5", 35 bar (500psi)	(L3)	Ventilation port for vertical mounting G 1/4" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"	(...)	Normally plugged
(L1)	Drain port 1 5/8" - 12 UNF - 2B per mounting position use upper port	(L5)	Oil fill plug G 1 1/2"	(ML)	Gauge port of case pressure G 1/4"		
				(X1)	Gauge port G 1/4" x 12.5 deep		

Pump Dimensions - PVWS - 500

LR, with pressure limiter

1 Pilot valve (2nd stage)
2 Pressure compensator (1st stage)
3 Power limitation valve
4 Max flow adjustment
X1 Remote port pressure limiter
LR000A2 ...



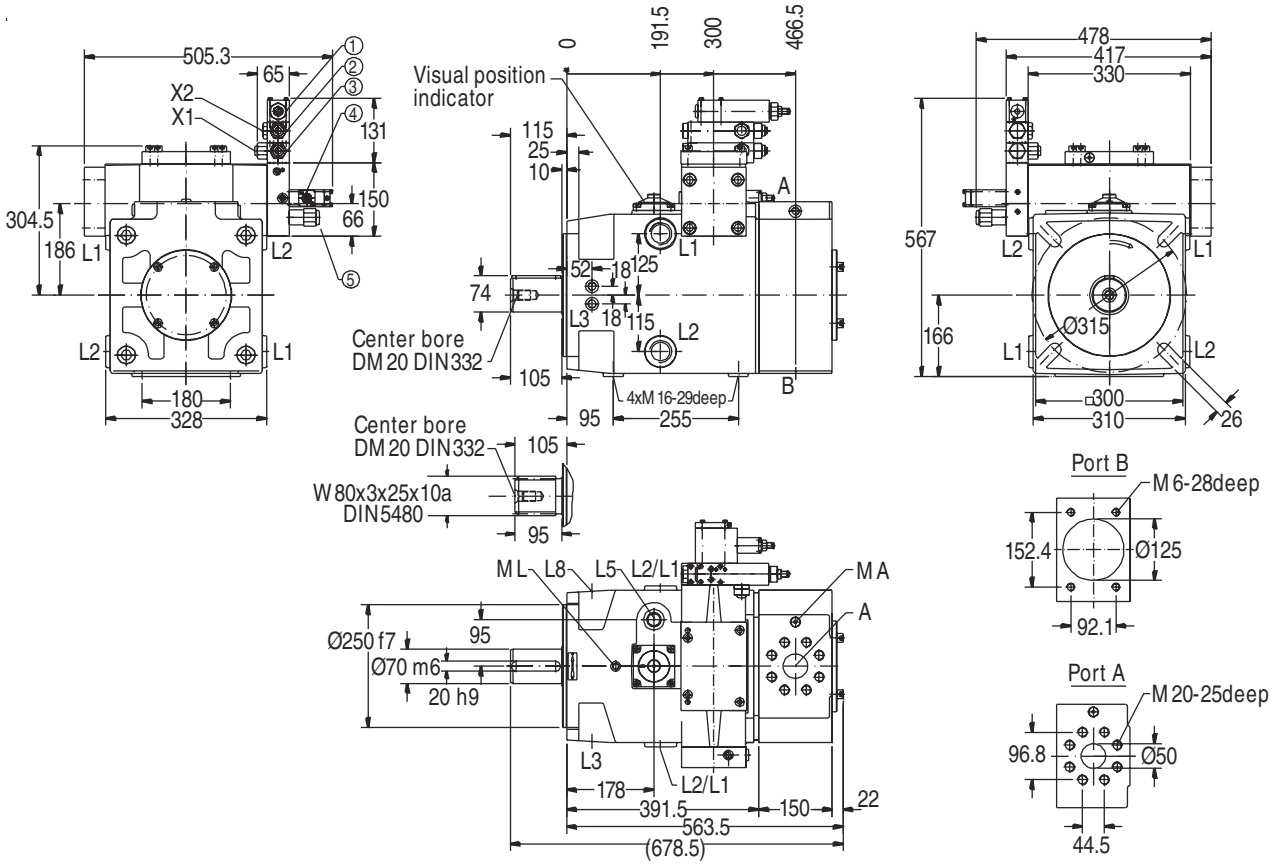
CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

A	System pressure port SAE 2", 415 bar (6000psi)	(L1)	Drain port 1 5/8" - 12 UNF - 2B per mounting position use upper port	(L3)	Ventilation port for vertical mounting G 1/4" (shaft upwards)	(ML)	Gauge port of case pressure G 1/4"
B	Inlet connection SAE 5", 35 bar (500psi)	L2	Drain port G 1 1/2" per mounting position use upper port	(L5)	Oil fill plug G 1 1/2"	(X1)	Gauge port G 1/4" x 12.5 deep
				(L8)	Air bleed port G 1/4"	(...)	Normally plugged
				(MA)	Gauge port system pressure G 1/4"		

Pump Dimensions - PVWS- 500

LR, with load sensing valve

1 Pilot valve (2nd stage)
2 Pressure compensator (1st stage)
3 Load sensing valve
4 Power limitation valve
5 Max flow adjustment
X1 Load sense port
X2 Remote port pressure limiter
LR000A3 ...



CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

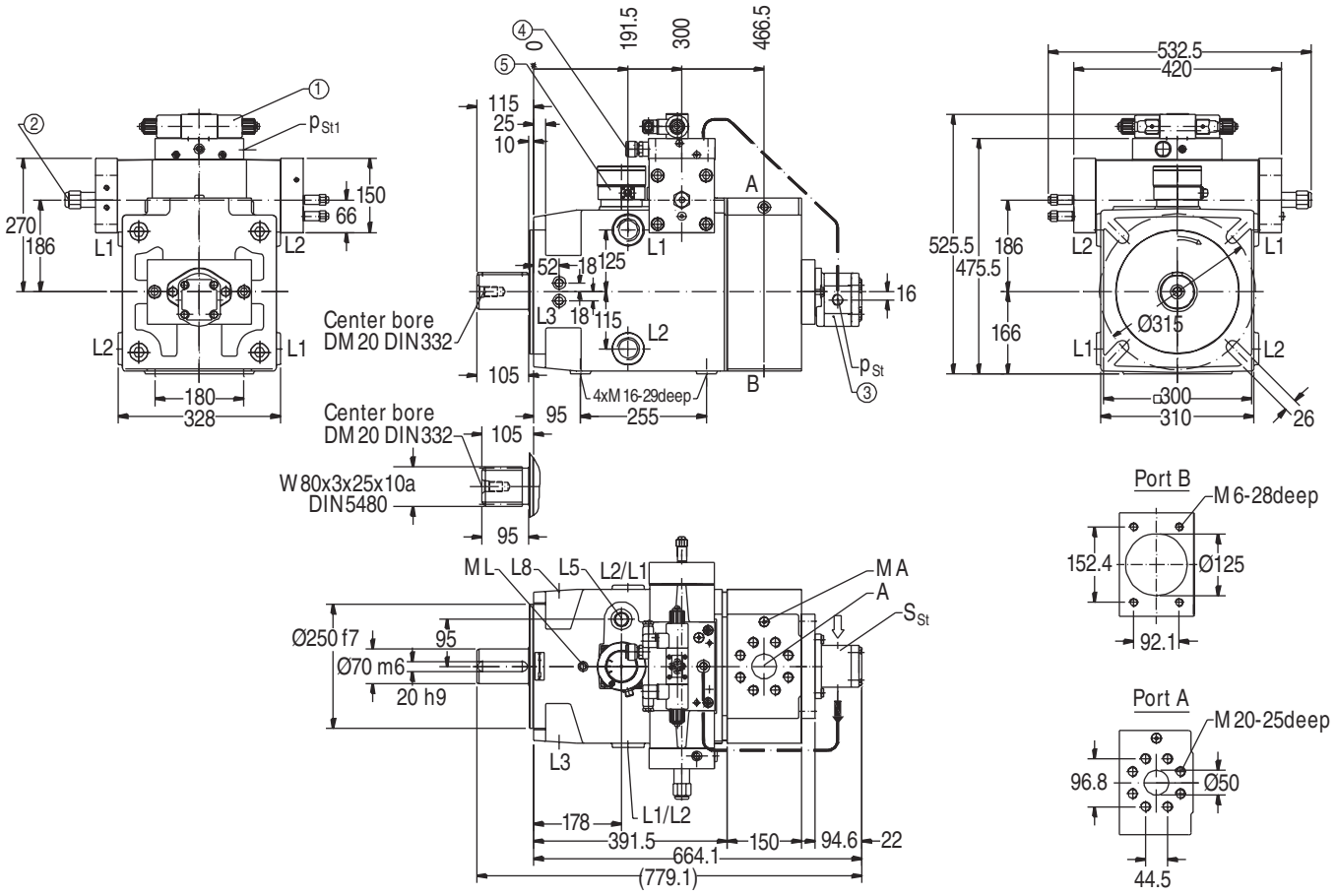
A	System pressure port SAE 2", 415 bar (6000psi)	L2	Drain port G 1 1/2" per mounting position use upper port	(L8)	Air bleed port G 1/4"	X2	Gauge port G 1/4" x 12.5 deep
B	Inlet connection SAE 5", 35 bar (500psi)	(L3)	Ventilation port for vertical mounting G 1/4" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"	(...)	Normally plugged
(L1)	Drain port 1 5/8" - 12 UNF - 2B per mounting position use upper port	(L5)	Oil fill plug G 1 1/2"	(ML)	Gauge port of case pressure G 1/4"		
				(X1)	Gauge port G 1/4" x 12.5 deep		

Pump Dimensions - PVWS- 500

SP

1 Proportional control valve
2 Zero flow stop
3 Pilot pump (8ccm)
4 Adjustment pilot oil relief valve
5 Feedback potentiometer with visual indicator

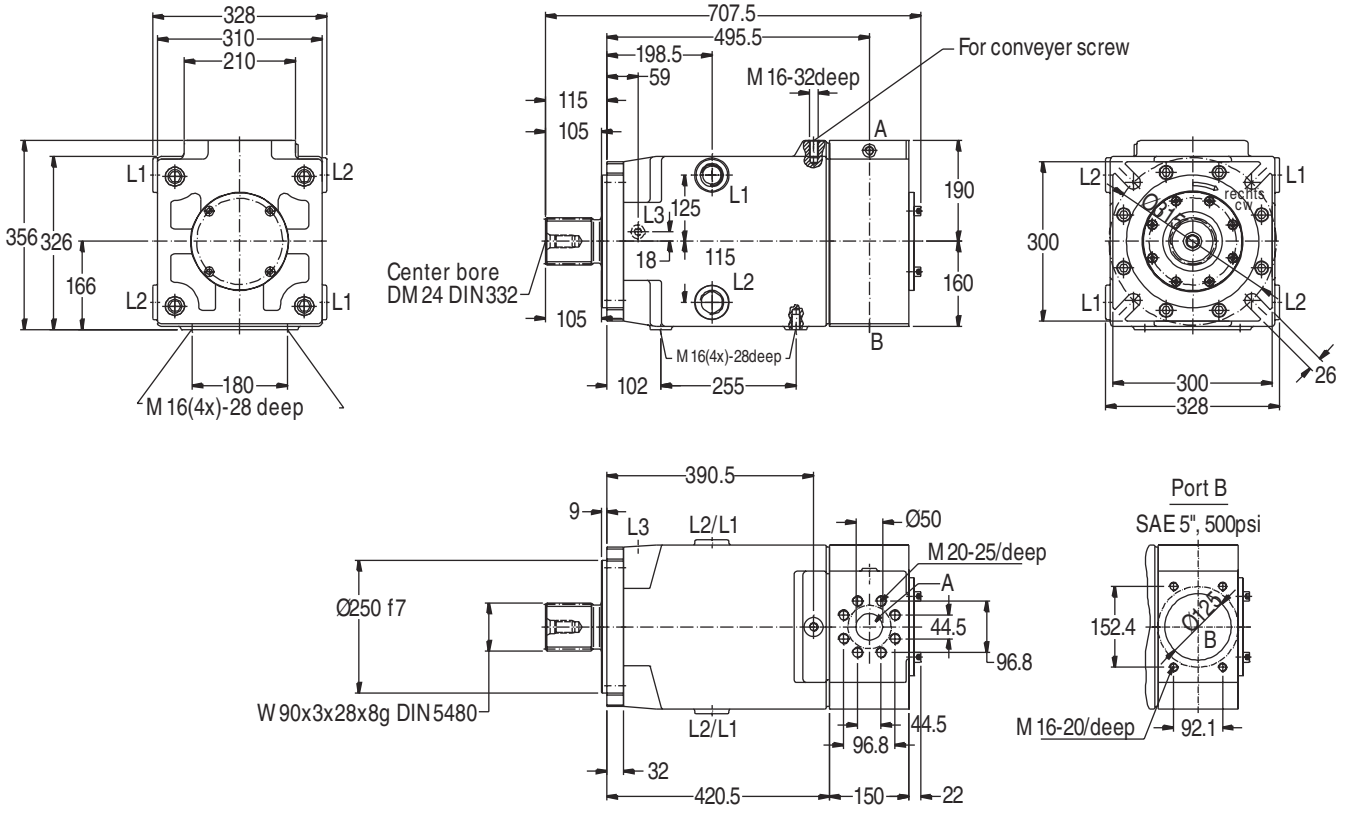
SPC03A ...



CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

A	System pressure port SAE 2", 415 bar (6000psi)	L2	Drain port G 1 1/2" per mounting position use upper port	(L8)	Air bleed port G 1/4"	(PSt)	Port of pilot pressure G 1/2"
B	Inlet connection SAE 5", 35 bar (500psi)	(L3)	Ventilation port for vertical mounting G 1/4" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"	(...)	Normally plugged
(L1)	Drain port 1 5/8" - 12 UNF - 2B per mounting position use upper port	(L5)	Oil fill plug G 1 1/2"	(ML)	Gauge port of case pressure G 1/4"		
				(MSt)	Gauge port pilot pressure G 1/4"		
				(SSt)	Suction port of pilot pump G 3/4"		

Pump Dimensions - PFWS - 750



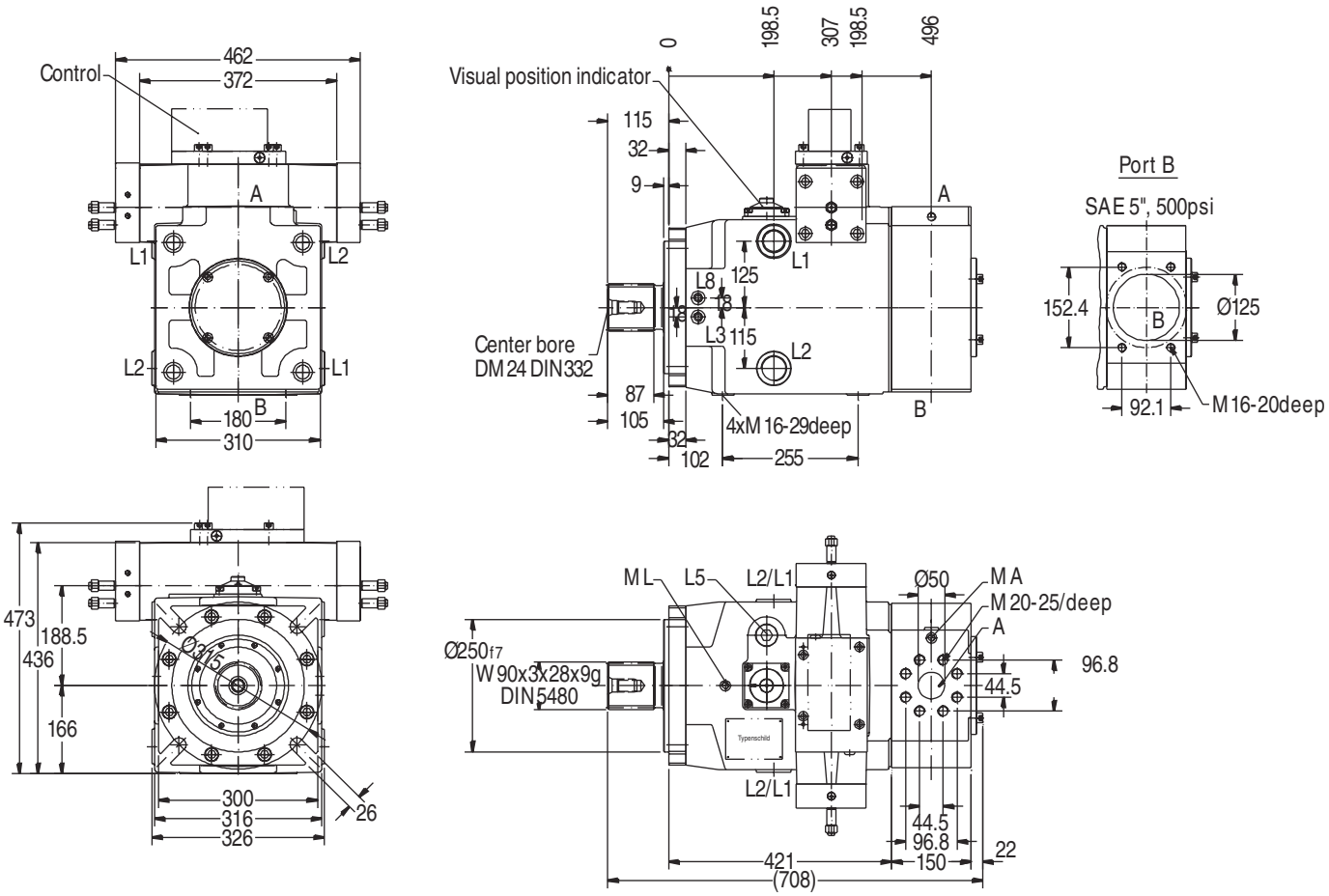
CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

Non-Standard Displacements:

STANDARD DISPLACEMENT	REDUCED DISPLACEMENT
750 ccm/rev	Available 712.5 ccm/rev

A	System pressure port SAE 2", 415 bar (6000psi)	(L1)	Drain port 15/8" - 12 UNF - 2B per mounting position use upper port	(L3)	Ventilation port for vertical mounting G 1/4" (shaft upwards)	(...)	Normally plugged
B	Inlet connection SAE 5", 35 bar (500psi)	L2	Drain port G 1 1/2" per mounting position use upper port	(MA)	Gauge port system pressure G 1/4"		

Pump Dimensions - PVWS - 750

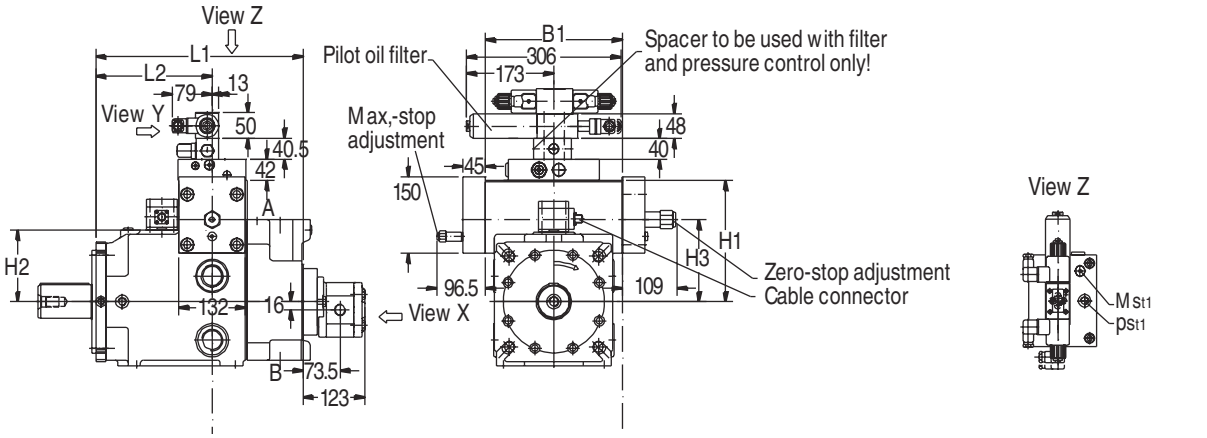


CONTROL	DIRECTION OF ROTATION	INPUT	OUTPUT
to + Vmax	Right hand	B	A

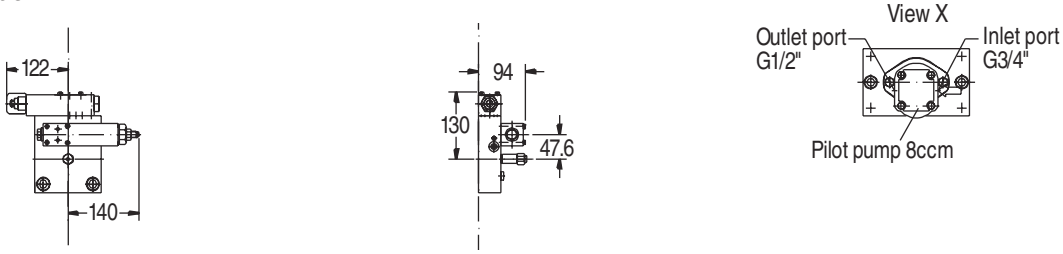
A	System pressure port SAE 2", 415 bar (6000psi)	(L1)	Drain port 15/8" - 12 UNF - 2B per mounting position use upper port	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(ML)	Gauge port case pressure G 1/4"
B	Inlet connection SAE 5", 35 bar (500psi)	L2	Drain port G 1 1/2" per mounting position use upper port	(L5)	Oil fill plug 1 1/16" - 12 UNF - 2B	(...)	Normally plugged
				(MA)	Gauge port system pressure G 1/4"		

Dimensions - PVWS-250/360/500/750 SP Controls

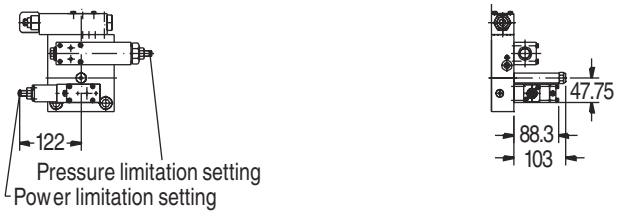
SPC03A ... With CETOP 3
Prop. relief valve



SPC03A4 ... With pressure limiter overriding function



SPC03A5 ... With pressure limiter and power control overriding function

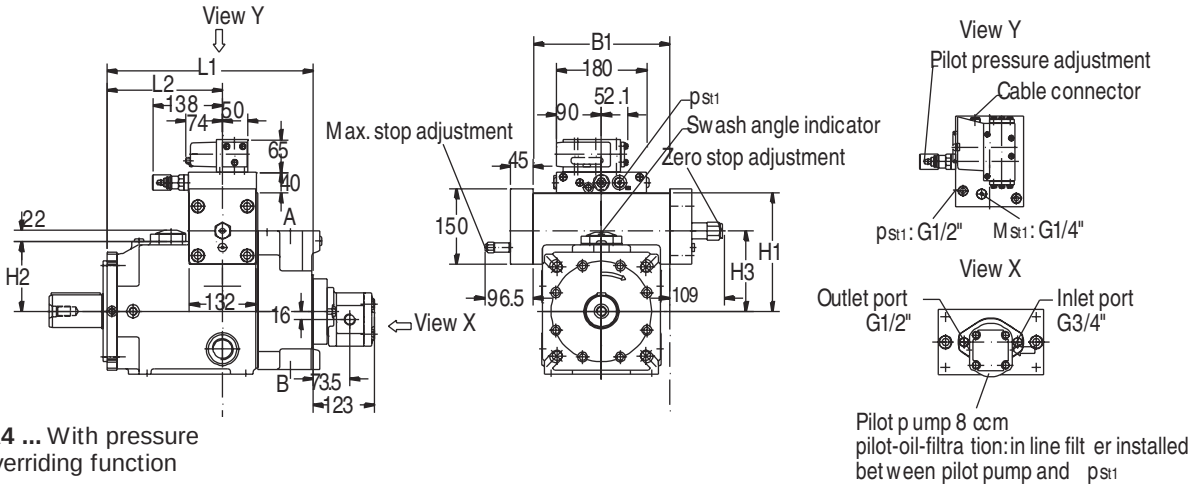


	L1	L2	B1	H1	H2	H3
250	410	230	271	236	135	160
360	426	230	285	236	135	160
500	541,5	300	330	267,5	172	186
750	571	307	372	270	172	188,5

Dimensions - PVWS - 250/360/500/750

SM Controls

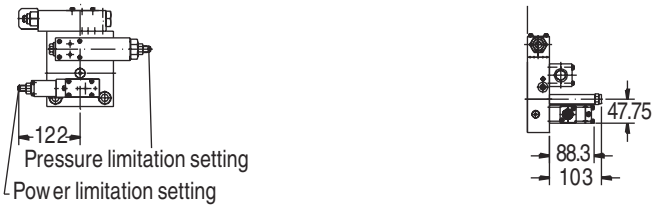
SM000A ...



SM000A4 ... With pressure limiter overriding function



SM000A5 ... With pressure limiter and power control overriding function



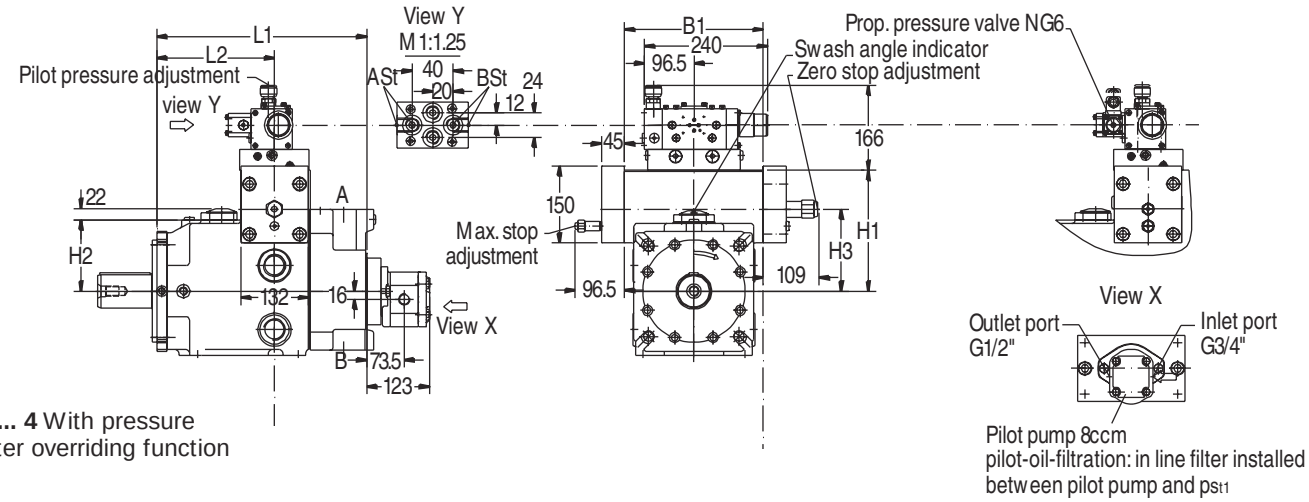
Optional pilot oil filter will be mounted by piping between pilot pump outlet port "pSt" and the "pst1" port.

	L1	L2	B1	H1	H2	H3
250	410	230	271	236	135	160
360	426	230	285	236	135	160
500	541,5	300	330	267,5	172	186
750	571	307	372	270	172	188,5

Dimensions - PVWS - 250/360/500/750

DP Controls

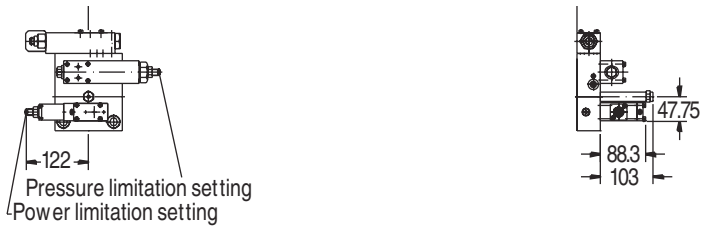
DPH ... DPG ... DPJ...



DP ... 4 With pressure limiter overriding function



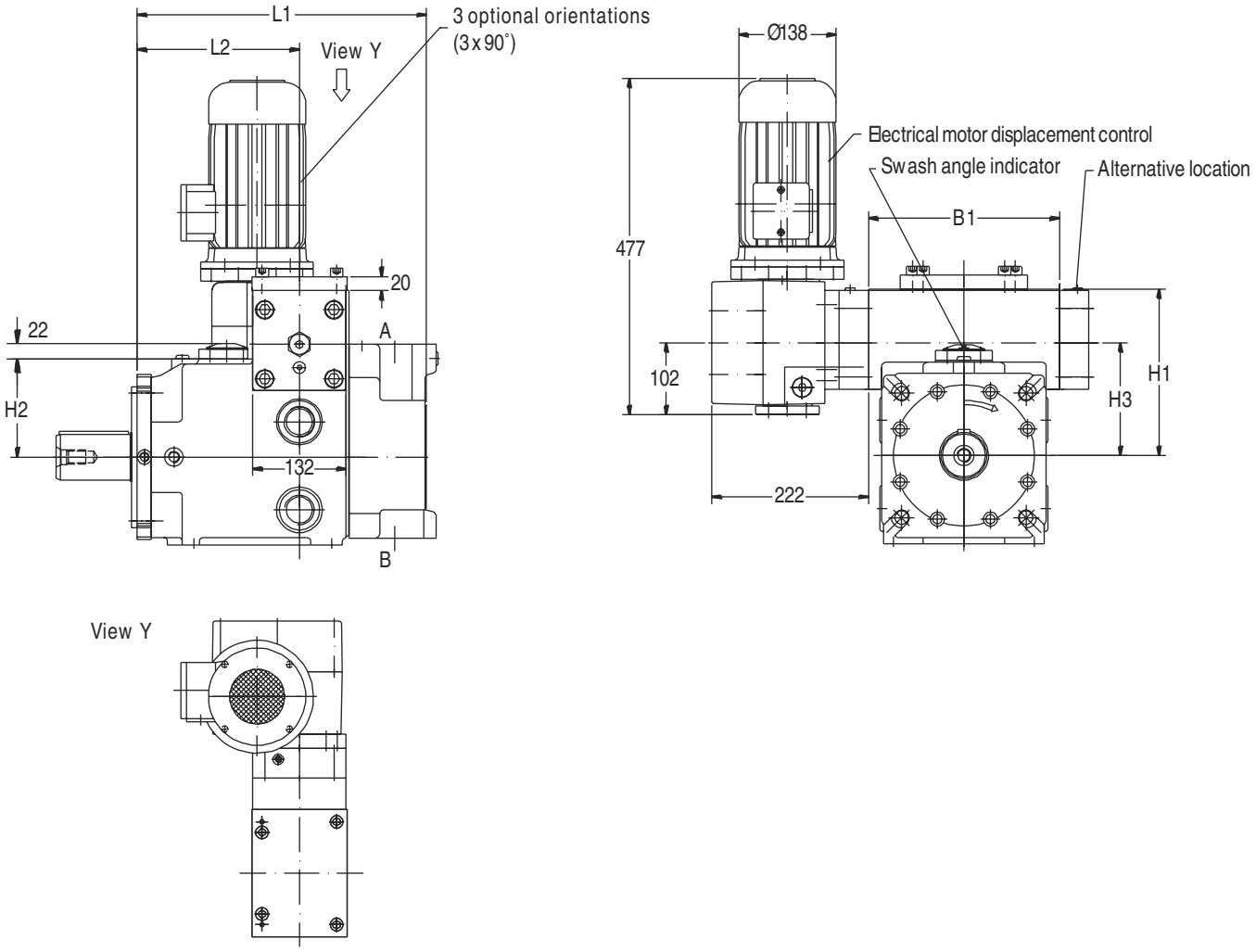
DP ... 5 With pressure limiter and power control overriding function



Optional pilot oil filter will be mounted by piping between pilot pump outlet port "pSt" and the "pst1" port.

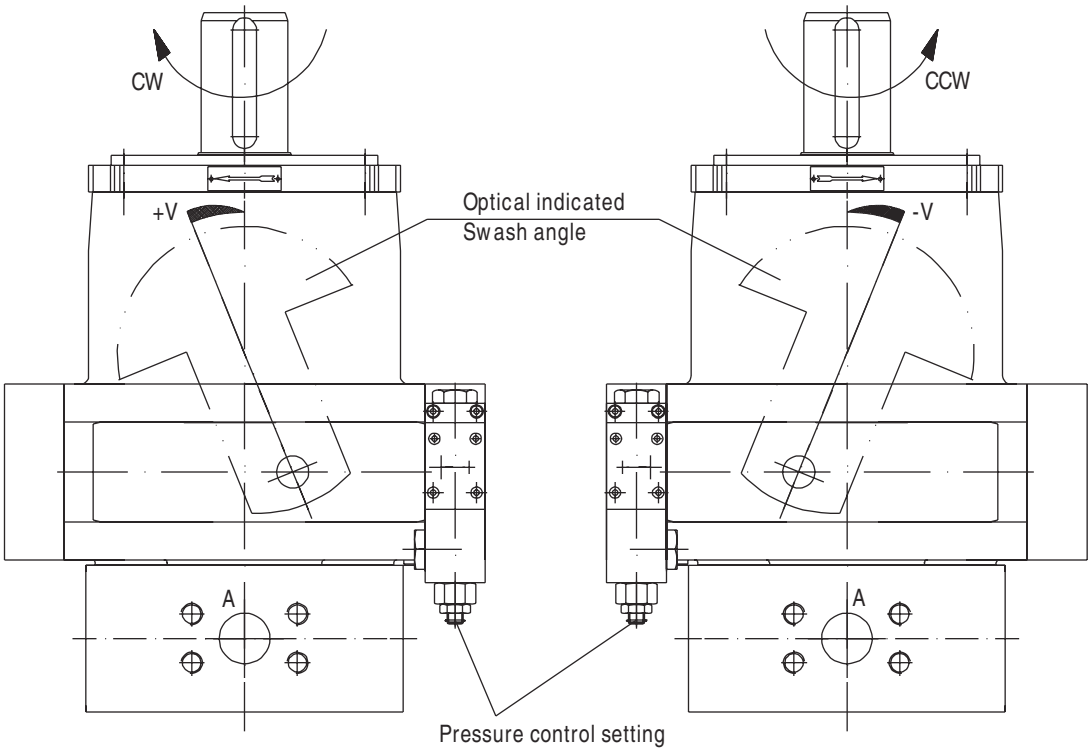
	L1	L2	B1	H1	H2	H3
250	410	230	271	236	135	160
360	426	230	285	236	135	160
500	541,5	300	330	267,5	172	186
750	571	307	372	270	172	188,5

Dimensions - PVW - 250/360/500/750 ES Control

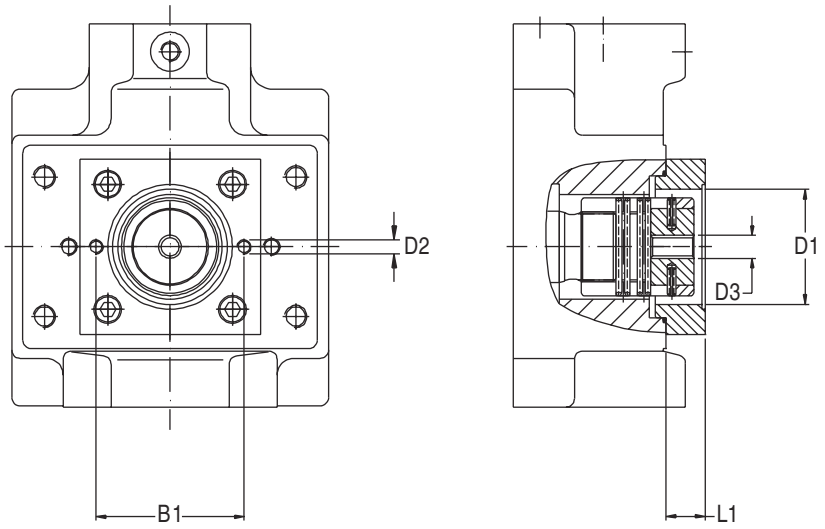


	L1	L2	B1	H1	H2	H3
250	410	230	271	236	135	160
360	426	230	285	236	135	160
500	541,5	300	330	267,5	172	186
750	571	307	372	270	172	188,5

Swash Angle/Flow Direction

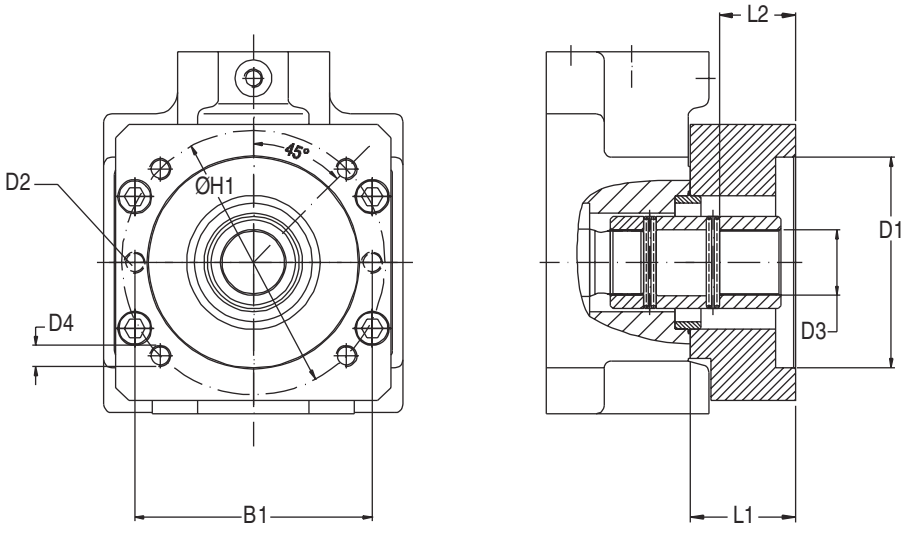


Thru - Drives
PVW 250 to 750
SAE "A, B, C"
Pump



SIZE 250/750	B1	D1	D2	D3	L1
SAE"A"	106	82,6	M 10 x 16 deep	16/32DP-9T	28
SAE"B"	146	102	M 12 x 20 deep	16/32DP-13T	28
SAE"C"	181	127	M 16 x 20 deep	12/24DP-14T	28

ISO Pump

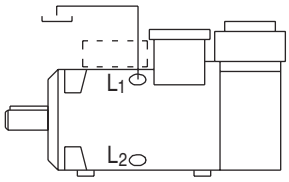
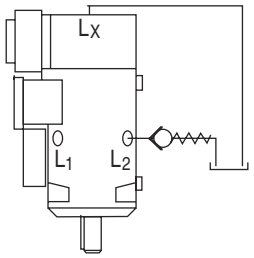


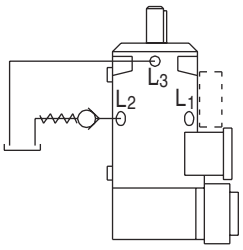
SIZE 250/360	B1	D1	D2	D3 (DIN 5480)	D4	H1	L1
ISO - 125	180	125	M 16 x 20	N40x1.25 x10a	M 12 x 18 deep	160	92
ISO - 160	–	160	–	N50x1.25x10a	M 16 x 20 deep	200	92
ISO - 200	–	200	–	N62x1.25x10a	M 20	250	92

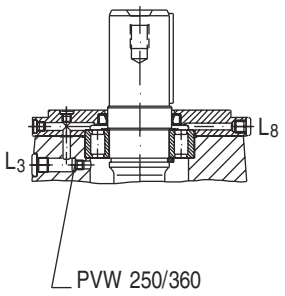
SIZE 500/750	B1	D1	D2	D3 (DIN 5480)	D4	H1	L1
ISO - 125	180	125	M 16 x 20	N40x1.25x10a	M 12 x 18 deep	160	75
ISO - 160	–	160	–	N50x1.25x10a	M 16 x 20 deep	200	75
ISO - 200	–	200	–	N62x1.25x10a	M 20	250	75
ISO - 250	–	250	–	N80x3x28x10a	M 24	315	75

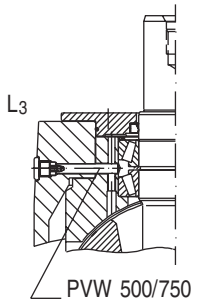
Installation Position

Installation position is optional, however, note bearing lubrication with respect to mounting

INSTALLATION POSITION	DRAIN PIPING	INSTALLATION POSITION	DRAIN PIPING
Shaft horizontal		Shaft pointed downwards	
Pump can be rotated freely about the lateral axis		Use ventilation line L_X (Provided only on request) Pre load drain connection L_2 (L_1) with 0,2 bar (2.9psi)	
Use the highest case drain connection L_1 or L_2			

INSTALLATION POSITION	DRAIN PIPING	INSTALLATION POSITION	DRAIN PIPING
Shaft pointed upwards		Vertically mounted	Internal connection to be closed with pin no. HC406082101401
Use ventilation line L_3		Internal connection close with plug G 1/8”	
Pre load drain port case drain connection L_2 (L_1) with 0.2 bar (2.9psi)		Horizontally mounted	
		Internal connection open L_3 plugged	





Application Data
Fluid Recommendations

Case Flushing Requirements

A check valve must not be used in the drain pipe. The drain pipe must interminate below the oil level in the reservoir.

For all other conditions with low pressure < 20 bar (<300 psi) and low flow (<10% of Qmax), case flushing is required.

For operation with special fluids HFB and HFC, case flushing is recommended.

Flushing Flow

Flushing flow via the pump case should be >1% of maximum pump flow. Maximum flushing flow depends on case pressure.

Notes:

- All listed ratings are based on the use of a good quality fluid.
- Alternative fluids have a reduced tolerance for contamination over petroleum base fluids. good filtration is therefore, critical.
- The pumps will provide exceptional life when used with a good quality clean fluid at the pump ratings specified for that fluid.

Fluids

Pumps in the catalog are primarily designed to operate with conventional petroleum based hydraulic oil. Alternative fluids and restrictions:

- Fluid maintenance is critical to the durability of all hydraulic components, and particularly with hydraulic pumps. This becomes even more of a factor when alternative fluids are used. All types of alternative fluids require extensive maintenance in order to maintain proper levels of water content, acidity, viscosity and contamination.

Fluid Cleanliness

These pumps are rated for anti-wear petroleum fluids with a contamination level of 18/15/13 per ISO 4406. Operation in fluids with levels more contamination than this is not recommended and may reduce the life of the pump's components. Fluids other than petroleum, severe service cycles, or temperature extremes are cause for adjustment of these codes. Please contact your Eaton representative for special duty cycle recommendations.

Eaton pumps, as well as 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 inclusion of air.

Essential information on the correct methods for treating hydraulic fluid is included in Eaton publication 561- "Vickers Guide to Systemic Contamination Control"- available from your local Eaton distributor.

In this publication, filtration and cleanliness levels for extending the life of axial piston pumps and other system components are listed. Included is an excellent discussion of the selection of products needed to control fluid condition.

Ordering Procedure

When ordering, please specify full model designation of items required; see "Model Codes" section of this catalog.

Note the following:

- Designation of variable displacement pumps must include the supplementary designation of the required control.

FLUIDS

TYPE	CLASSIFICATION	MAX. PRESSURE BAR	MAX. SPEED RPM	RECOMMENDED SEAL MATERIAL	MAX OPERATING TEMPERATURE °C	BEARING LIFE
Oil in Water Emulsion	HFAE	Not Rated				0
Water in oil Emulsion	HFB	250	1800	Fluorocarbon	49	50%
Water Glycol	HFC	250	1800	Fluorocarbon	49	25%
Phosphate Ester	HFDR	350/420	1800	Fluorocarbon	66	100%
Polyol Ester	HFDU	350/420	1800	Fluorocarbon	66	100%

*Refer to the general specifications for the displacement speed limitation

Notes

Notes

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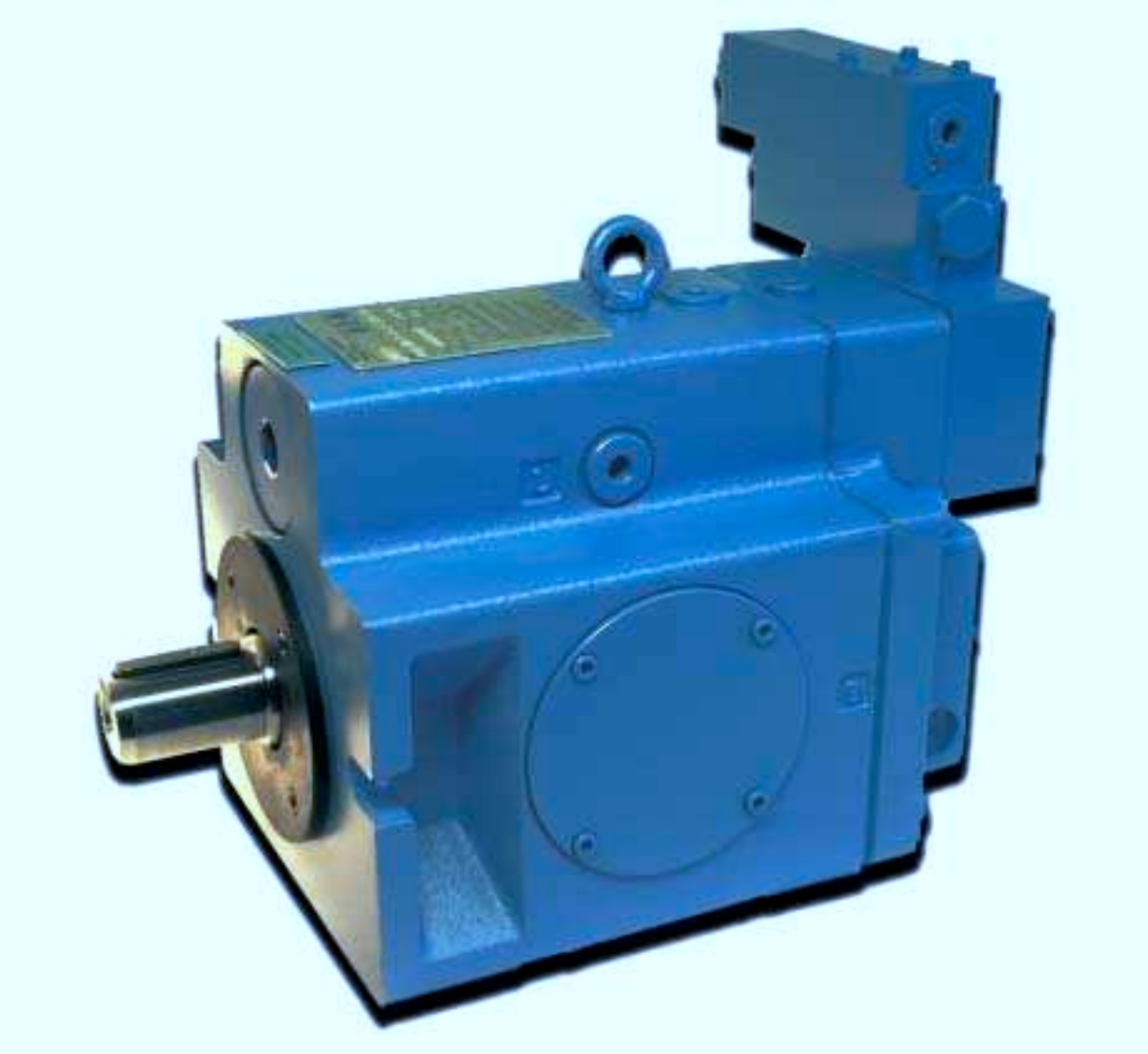
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Hydrokraft Open Loop Piston Pumps

Technical Catalog

PVX



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* Dimensions - PVXS-066 to 250 DQ/HG/FE ask for special drawings.

Introduction

- Axial piston pumps with swashplate design for reliable operation and long life.
- Pressure up to 420 bar. Rated speed up to 1800 min^{-1}. Higher speeds possible.
- Oversize shafts and bearings.
- Rotating and pressure loaded parts are pressure balanced.
- Integrated pilot pump, filter and pressure relief valves available.
- "Building block" design gives these pumps a wide range of application.
- Fast response times.

AVAILABLE DISPLACEMENT SIZES
66 ccm
90 ccm
130 ccm
180 ccm

AVAILABLE REPLACEMENT UNIT DISPLACEMENT SIZES
250 ccm

Displacement controls:

ES - Electric motor displacement control

HG - Handwheel displacement control (Special feature)

FE - Screw adjustment control (Special feature)

DF - Pressure compensator controlled

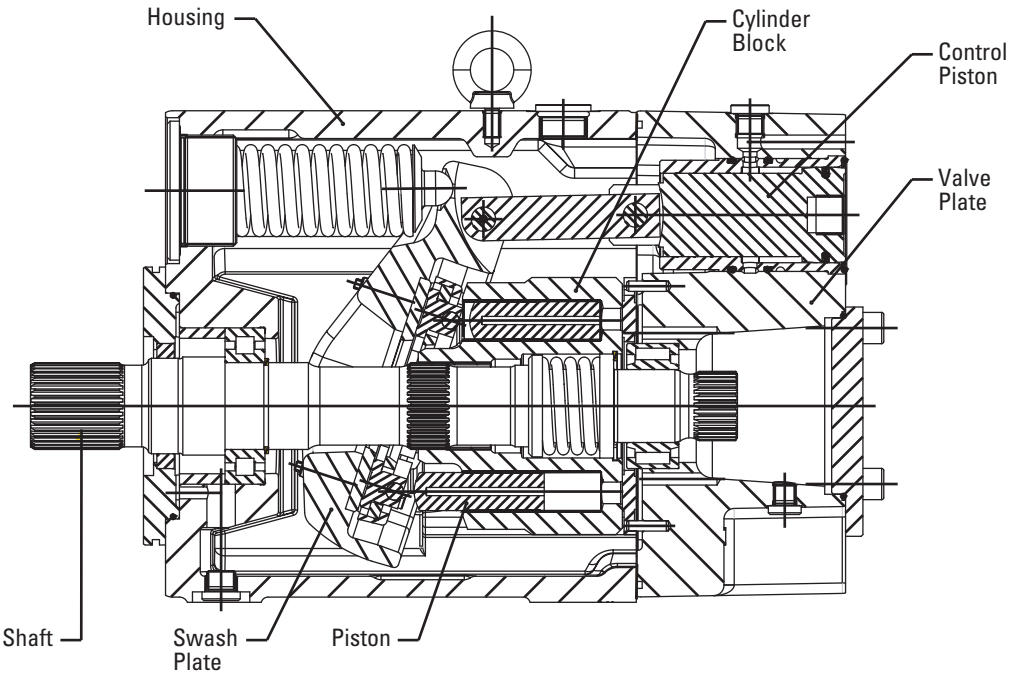
DQ - Mooring control

LR - Power control with pressure limiter

SP, SM - Displacement proportional to electric signal

DP - Displacement proportional to pressure signal

Typical Section of Open Loop PVX Pump



Dimensional information listed in this catalog is subject to change without notice.

Model Code

Fixed & Variable
Displacement Pumps

"X" Series

Form Page

The following 48-digit coding system has been developed to identify all of the configuration options for the "X" series (Open Loop) fixed and variable displacement pumps. Use this model code to specify a unit with the desired features. All 48-digits must be present when ordering. You may want to photocopy the matrix below to ensure that each number is entered in the correct box. If adjustments other than the standard setting (character 40 ... 43) or special features (character 44 ... 48) are needed, please provide the information when ordering.

Some characters are already filled out on the following pages. For such characters there is no option available.

Explanation for each character can be found as follows:

	CHARACTER	PAGE
Basic Pump Model Code	1...23	6
Control Options	24...39	7 - 15
Customer Adjustment Specification	40...43	7 - 15
Special Features	44...46	16
Design Number	47...48	16

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
P		X		–				M							1				S	V		A		
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
																							1	0

SPECIFY NON STANDARD ADJUSTMENT BELOW

SPECIFY SPECIAL FEATURE BELOW

Model Code

Open Loop Pumps

"X" Series - Basic Pump

P	*	X	*	—	*	*	*	M	*	*	*	*	*	*	1	*	*	*	S	V	*	A	#
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

1 Pump
P – Open Loop Pumps

2 Displacement
F – Fixed
V – Variable

3 Pump Series
X – "X" Series (was 20 design)

4 Configuration
S – Single Unit
R – Rear Unit

5 Separator

6 7 8 Displacement cm³/r
066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
??? – Non-Standard Displacement (PFX Only)

9 Basic Standard
M – Metric

10 11 Mounting Flange
02 – ISO 3019/2-125A2HW
04 – ISO 3019/2-160A2HW
06 – ISO 3019/2-200A2HW
* See Chart Below

12 Rotation Direction
R – Right Hand [CW]
L – Left Hand [CCW]
** See Chart Below

13 Adjustment Stops
0 – No Stop
4 – Mechanical Adjustment Stop Side A (PVX only)
5 – Mechanical Adjustment Stop Side B (PVX only)
6 – Mechanical Adjustment Stops Side A and B (PVX only)

NOTE:

4 is used as max. Adjustment on Side A.

5 is used as min. Adjustment stop side A.

6 is the combination of 4 and 5 together

14 15 Thru-Drive Options
00 – None
0A – SAE A
0B – SAE B
0C – SAE C
0P – Pilot pump (8cm³/r) (PVX only)
*** See Chart Below

16 Main Ports
1 – SAE ports - metric bolts

17 Main Port Orientation
A – Axial (in-line rear)
R – Radial (side ports)

18 19 Main Drive Shaft End
01 – ISO straight key
02 – ISO spline

20 Drive Shaft Seal Configuration
S – Single shaft seal

21 Seal Material
V – Viton**

22 Yoke Position Indicator
0 – No position indicator
V – Visual position indicator
P– Position sensor
M – Sensor w/visual indicator

23 Surface Finish
A – Blue painted

24 Add Control Model Code
Code (characters 24...43) on the following pages

*MOUNTING FLANGE OPTIONS AVAILABLE	066	090	130	180	250
ISO 3019/2-125A2HW	•	•			
ISO 3019/2-160A2HW			•	•	
ISO 3019/2-200A2HW					•

**ROTATION DIRECTION	066	090	130	180	250
Right Hand	•	•	•	•	•
Left Hand	•	•	•	•	

***THRU-DRIVE OPTIONS	066	090	130	180	250
SAE A	•	•	•	•	•
SAE B			•	•	•

Model Code

Open Loop Pumps

"X" Series - No Control

0	0	0	0	0	A	0	0	0	0	0	0	0	0	0	0	0	0	0	#
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

24 25 **Control Type**
00 – No Control
(For PFX only)

26 **Displacement Adjustment Options**
0 – Not Applicable

27 28 **Electronic Controls**
00 – Not Required

29 **Yoke Displacement Zone**
A – Single Side of Center "A"

30 **Extra Functions**
0 – Not Required

31 **Pressure Control Options**
0 – Not Applicable

32 33 34 **Power Control**
000 – Not Applicable)

35 **Pilot Oil Filter**
0 – Not Applicable

36 **Venting Valve**
0 – Not Applicable

37 **No Position Monitoring**
0 – No Position Monitoring

38 **Electric Motor Type**
0 – No Electric Motor

39 **Control Voltage**
0 – Not Applicable

40 41 42 43 **Customer Adjustment Specifications**
0000 – None

44 **Special Features**
Add special feature description (characters 44...46) on page 16 if required.

Model Code

Open Loop Pumps

"X" Series - DF Control

D	F	0	0	0	A	*	*	0	0	0	0	*	0	0	*	*	*	*	*	#
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

24 25 Control Type
DF – Pressure Compensator

26 Displacement Adjustment Options
0 – Not Applicable

27 28 Electronic Controls
00 – Not Required

29 Yoke Displacement Zone
A – Single Side of Center "A"

30 Extra Functions
0 – Not Required
1 – Load Sensing Extra Function

31 Pressure Control Options
0 – Not Applicable
F – Remote Port Only
K – Electro Proportional Relief Valve- Incl. Electr. Card

32 33 34 Power Control
000 – Not Applicable

35 Pilot Oil Filter
0 – Not Applicable

36 Venting Valve
0 – Not Applicable
1 – With Solenoid Valve

37 Position Monitoring
0 – No Position Monitoring

38 Electric Motor Type
0 – No Electric Motor

39 Control Voltage of Venting Valve
0 – Not Applicable
B – 110 AC 50 HZ/ 120 AC 60 HZ
D – 220 AC 50 HZ/ 240 AC 60 HZ
G – 12 VDC
J – 24 VDC

40 41 42 43 Customer Adjustment Specification
0000 – None
???? – Yes (final number will be assigned by Eaton. Specify on table below)

44 Special Features
Add special feature description (characters 44...46) on page 16 if required.

***CUSTOMER ADJUSTMENT SPECIFICATIONS**

	Unit	Standard Adjustment	Customer Specified Adjustment	Remarks
All Revolution Adjustments below set at ..	rpm	1500		
Mech. Stop Side A (used as max Adjustment Stop Side A)	L/min	Q_{max}		
Mech. Stop Side B (used as min Adjustment Stop Side B)	L/min	Q_{min}		
Pressure Control Main Stage	bar	20		
Pressure Control Pilot Valve	bar	19		
Load Sense p	bar	15		<15 bar not possible

Model Code

Open Loop Pumps

"X" Series - DQ Control

D	Q	0	0	0	C	0	*	0	0	0	0	*	0	0	*	*	*	*	*	#
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

24 25 Control Type
DQ – Mooring Control

26 Displacement Adjustment Options
0 – Not Applicable

27 28 Electronic Controls
00 – Not Required

29 Yoke Displacement Zone
C – Over Center

30 Extra Functions
0 – Not Required

31 Pressure Control Options
0 – Not Applicable
F – Remote Port Only
K – Electro Proportional Relief Valve– Incl. Electr. Card

32 33 34 Power Control
000 – Not Applicable

35 Pilot Oil Filter
0 – Not Applicable

36 Venting Valve
0 – Not Applicable
1 – With Solenoid Valve

37 Position Monitoring
0 – No Position Monitoring

38 Electric Motor Type
0 – No Electric Motor

39 Control Voltage of Venting Valve
0 – Not Applicable
B – 110 AC 50 HZ/ 120 AC 60 HZ
D – 220 AC 50 HZ/ 240 AC 60 HZ
G – 12 VDC
J – 24 VDC

40 41 42 43 Customer Adjustment Specification
0000 – None
???? – Yes (final number will be assigned by Eaton. Specify on table below)

44 Special Features
Add special feature description (characters 44...46) on page 16 if required.

MOORING CONTROL AVAILABLE ON THE FOLLOWING FRAMES

	Available	Not Available
066	*	
090		*
130	*	
180	*	
250		*

***CUSTOMER ADJUSTMENT SPECIFICATIONS**

	Unit	Standard Adjustment	Customer Specified Adjustment	Remarks
All Revolution Adjustments below set at ..	rpm	1500	-	
Mech. Stop Side A (used as max Adjustment Stop Side A)	L/min	Q_{max}		
Mech. Stop Side B (used as min Adjustment Stop Side B)	L/min	Q_{min}		
Pressure Control Main Stage	bar	20	-	
Pressure Control Pilot Valve	bar	90		

Model Code

Open Loop Pumps

"X" Series - LR Control

L	R	0	0	0	A	*	*	*	*	*	0	*	0	0	*	*	*	*	*	#
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

24 25 Control Type
LR – Power Control

26 Displacement Adjustment Options
0 – Not Applicable

27 28 Electronic Controls
00 – Not Required

29 Yoke Displacement Zone
A – Single Side of Center "A"

30 Extra Functions
2 – Pressure Limiter Extra Function
3 – Load Sense & Pressure Limiter Extra Function

31 Pressure Contro Options
0 – Not Applicable
F – Remote Port Only
K – Electro Proportional Relief Valve– Incl. Electr. Card

32 33 34 Power Control
??? – KW at 1500 rpm

35 Pilot Oil Filter
0 – Not Applicable

36 Venting Valve
0 – Not Applicable
1 – With Solenoid Valve

37 Position Monitoring
0 – No Position Monitoring

38 Electric Motor Type
0 – No Electric Motor

39 Control Voltage of Venting Valve
0 – Not Applicable
B – 110 AC 50 HZ/ 120 AC 60 HZ
D – 220 AC 50 HZ/ 240 AC 60 HZ
G – 12 VDC
H – 24 VDC

41 42 43 Customer Adjustment Specification
0000 – None
???? – Yes (final number will be assigned by Eaton. Specify on table below)

44 Special Features
Add special feature description (characters 44...46) on page 16 if required.

***CUSTOMER ADJUSTMENT SPECIFICATIONS**

	Unit	Standard Adjustment	Customer Specified Adjustment	Remarks
All Revolution Adjustments below set at ..	rpm	1500		
Mech. Stop Side A (used as max Adjustment Stop Side A)	L/min	Q_{max}		
Mech. Stop Side B (used as min Adjustment Stop Side B)	L/min	Q_{min}		
Pressure Control Main Stage	bar	20		
Pressure Control Pilot Valve	bar	90		
Load Sense p	bar	15		<15 bar not possible

Model Code

Open Loop Pumps

"X" Series - ES Control

E	S	*	0	0	A	0	*	0	0	0	0	0	*	*	0	*	*	*	*	#
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

24 25 Control Type

ES – Electric Motor Displacement

26 Displacement Adjustment Options

M – Electric Motor - Fast Response*

N – Electric Motor - Medium Response*

P – Electric Motor - Slow Response*

27 28 Electronic Controls

00 – Not Required

29 Yoke Displacement Zone

A – Single Side of Center "A"

30 Extra Functions

0 – Not Required

31 Pressure Control Options

0 – Not Applicable

32 33 34 Power Control

000 – Not Applicable

35 Pilot Oil Filter

0 – Not Applicable

36 Venting Valve

0 – Not Applicable

37 Position Monitoring

A –4 Limit Switches

B –8 Limit Switches

P –4 Limit Switches w/Sensor

T –8 Limit Switches w/Sensor

38 Electric Motor Type

2 – Motor With Brake (IP-54)

3 – Motor Without Brake (Explosion Proof)

39 Control Voltage of Venting Valve

0 – Not Applicable

40 41 42 43 Customer Adjustment Specification

0000 – None

???? – Yes (final number will be assigned by Eaton. Specify on table below)

44 Special Features

Add special feature description (characters 44...46) on page 16 if required.

Response Time (sec) for Zero to max. Displacement

SIZE	066/090		130/180		250	
Frequency	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
Fast	7	6	18	15	15	13
Medium	24	20	35	29	30	25
Slow	38	32	54	45	48	40

****CUSTOMER ADJUSTMENT SPECIFICATIONS**

		Unit	Standard Adjustment	Customer Specified Adjustment	Remarks
All Revolution Adjustments below set at ..		rpm	1500		
Mech. Stop Side A (used as max Adjustment Stop Side A)		L/min	Q_{max}		
Mech. Stop Side B (used as min Adjustment Stop Side B)		L/min	Q_{min}		
Displacement Adjusted to…		cm^3/rev.	~50% Q_{max}		
Position Monitoring Switch	1	L/min	0		
	2	L/min	95% of Q_{max}		<95% not possible
	3	L/min			
	4	L/min			
	5	L/min			
	6	L/min			
	7	L/min			
	8	L/min			

Model Code

Open Loop Pumps

"X" Series - HG Control

H	G	0	0	0	A	0	0	0	0	0	0	0	0	0	0	*	*	*	*	#
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

24 25 **Control Type**

HG – Handwheel Displacement Control

26 **Displacement Adjustment Options**

0 – Not Applicable

27 28 **Electronic Controls**

00 – Not Required

29 **Yoke Displacement Zone**

A – Single Side of Center "A"

30 **Extra Functions**

0 – Not Required

31 **Pressure Control Options**

0 – Not Applicable

32 33 34 **Power Control**

000 – Not Applicable

35 **Pilot Oil Filter**

0 – Not Applicable

36 **Venting Valve**

0 – Not Applicable

37 **Position Monitoring**

0 – No Position Monitoring

38 **Electric Motor Type**

0 – No Electric Motor

39 **Control Voltage of Venting Valve**

0 – Not Applicable

40 41 42 43 **Customer Adjustment Specification**

0000 – None

???? – Yes (final number will be assigned by Eaton. Specify on table below)

44 **Special Features**

Add special feature description (characters 44...46) on page 16 if required.

***CUSTOMER ADJUSTMENT SPECIFICATIONS**

	Unit	Standard Adjustment	Customer Specified Adjustment	Remarks
All Revolution Adjustments below set at ..	rpm	1500		
Displacement Adjusted to...	L/min	Q_{max}		

Model Code

Open Loop Pumps

"X" Series - FE Control

F	E	0	0	0	A	0	0	0	0	0	0	0	0	0	*	*	*	*	#
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

24 25 Control Type

FE – Screw Adjustment Displacement Control

26 Displacement Adjustment Options

0 – Not Applicable

27 28 Electronic Controls

00 – Not Required

29 Yoke Displacement Zone

A – Single Side of Center "A"

30 Extra Functions

0 – Load Sensing Extra Function

31 Pressure Control Options

0 – Not Applicable

32 33 34 Power Control

000 – Not Applicable

35 Pilot Oil Filter

0 – Not Applicable

36 Venting Valve

0 – Not Applicable

37 Position Monitoring

0 – No Position Monitoring

38 Electric Motor Type

0 – No Electric Motor

39 Control Voltage of Venting Valve

0 – Not Applicable

41 42 43 Customer Adjustment Specification

0000 – None

???? – Yes (final number will be assigned by Eaton. Specify on table below)

44 Special Features

Add special feature description (characters 44...46) on page 16 if required.

***CUSTOMER ADJUSTMENT SPECIFICATIONS**

	Unit	Standard Adjustment	Customer Specified Adjustment	Remarks
All Revolution Adjustments below set at ..	rpm	1500		
Displacement Adjusted to...	L/min	Q_{max}		

Model Code

Open Loop Pumps

"X" Series - DP Control

D	P	*	0	0	A	0	0	0	0	0	*	0	0	0	0	*	*	*	*	#
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

24 25 **Control Type**

DP – Pressure Signal Adjustment Displacement Control

26 **Displacement Adjustment Options**

G – Mounting Interface CETOP 3 Only
H – Remote Port G 1/4
J – Proportional Relief Inc. Electronics

27 28 **Electronic Controls**

00 – Not Required

29 **Yoke Displacement Zone**

A – Single Side of Center "A"

30 **Extra Functions**

0 – Not Required

31 **Pressure Control Options**

0 – Not Applicable

32 33 34 **Power Control**

000 – Not Applicable

35 **Pilot Oil Filter**

0 – Not Applicable
V – Filter with Visual Indicator
E – Filter with Electrical Indicator

36 **Venting Valve**

0 – Not Applicable

37 **Position Monitoring**

0 – No Position Monitoring

38 **Electric Motor Type**

0 – No Electric Motor

39 **Control Voltage of Venting Valve**

0 – Not Applicable

40 41 42 43 **Customer Adjustment Specification**

0000 – None
???? – Yes (final number will be assigned by Eaton. Specify on table below)

44 **Special Features**

Add special feature description (characters 44...46) on page 16 if required.

***CUSTOMER ADJUSTMENT SPECIFICATIONS**

	Unit	Standard Adjustment	Customer Specified Adjustment	Remarks
All Revolution Adjustments below set at ..	rpm	1500	-	
Pilot Pressure	bar	60		
Mech. Stop Side A (used as max Adjustment Stop Side A)	L/min	Q_{max}		
Mech. Stop Side B (used as min Adjustment Stop Side B)	L/min	Q_{min}		

Model Code

Open Loop Pumps

"X" Series - SP Control

S	P	*	*	*	A	0	0	0	0	0	*	0	0	0	0	*	*	*	*	#
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

24 25 Control Type

SP – Proportional Valve Adjustment Displacement Control

26 Displacement Adjustment Options

C – With CETOP 3 Prop Valve KDG4V 3

F – With CETOP 5 Prop Valve

27 28 Electronic Controls

03 – ER 9.3 - 10 (CETOP 3)

04 – ER 9.4 - 10 (CETOP 5)

29 Yoke Displacement Zone

A – Single Side of Center "A"

30 Extra Functions

0 – Not Required

31 Pressure Control Options

0 – Not Applicable

32 33 34 Power Control

000 – Not Applicable

35 Pilot Oil Filter

V –Filter with Visual Indicator

E – Filter with Electrical Indicator

36 Venting Valve

0 – Not Applicable

37 Position Monitoring

0 – No Position Monitoring

38 Electric Motor Type

0 – No Electric Motor

39 Control Voltage of Venting Valve

0 – Not Applicable

40 41 42 43 Customer Adjustment Specification

0000 – None

???? – Yes (final number will be assigned by Eaton. Specify on table below)

44 Special Features

Add special feature description (characters 44...46) on page 16 if required.

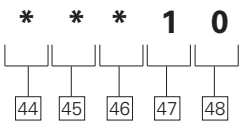
***CUSTOMER ADJUSTMENT SPECIFICATIONS**

	Unit	Standard Adjustment	Customer Specified Adjustment	Remarks
All Revolution Adjustments below set at ..	rpm	1500	-	
Pilot Pressure	bar	60	-	
Mech. Stop Side A (used as max Adjustment Stop Side A)	L/min	Q_{max}		
Mech. Stop Side B (used as min Adjustment Stop Side B)	L/min	Q_{min}		
Max. Stop by Control Side A	L/min	95% Q_{max}	EI Card Adjustment done by customer	Refer to EI card Manual
Min. Stop by Control Side A	L/min	0+/-2.5%	EI Card Adjustment done by customer	Refer to EI card Manual
Ramp Time 0→ A For 100% Stroke	sec	0	EI Card Adjustment done by customer	Refer to EI card Manual
Ramp Time A→ 0 For 100% Stroke	sec	0	EI Card Adjustment done by customer	Refer to EI card Manual
Preset Input Signals S1....S4	L/min	-	EI Card Adjustment done by customer	Refer to EI card Manual

Model Code

Open Loop Pumps

"X" Series - Special Features



44 45 46 **Special Features**

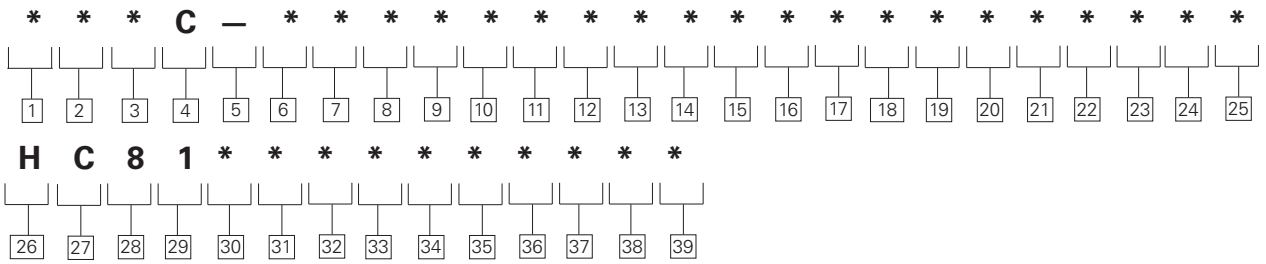
000 – None
******* – Defined by Eaton

47 48 **Design Number**

10 – Design Number

Model Code

Combination Units



1 Combination Unit

P – Pump
T – Transmission Pump
M – Motor

2 Displacement

F – Filled
V – Variable

3 Pump Series

W – "W" Series (was 30 design)
X – "X" Series (was 20 design)

4 Combination Unit

C

5 Separator

6 7 8 First Displacement cm³/r

066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

9 10 First Control Type

00 – No Control (for Fixed Displacement Only)
DF – Pressure Compensator
LR – Power Control
ES – Electric Motor Control
HG – Handwheel Displacement Control
FE – Screw Adjustment Displacement Control
SM – Servo Adjustment Displacement Control - Mech Feedback
DP – Pressure Signal Displacement Control
SP – Proportional Valve Displacement Control

11 12 13 Second Displacement cm³/r

066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

14 15 Second Control Type

00 – No Control (for Fixed Displacement Only)
DF – Pressure Compensator
LR – Power Control
ES – Electric Motor Control
HG – Handwheel Displacement Control
FE – Screw Adjustment Displacement Control
SM – Servo Adjustment Displacement Control - Mech Feedback
DP – Pressure Signal Displacement Control
SP – Proportional Valve Displacement Control

16 17 18 Third Displacement cm³/r

000 – Not Required
066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

19 20 Third Control Type

00 – No Control (for Fixed Displacement Only)
DF – Pressure Compensator
LR – Power Control
ES – Electric Motor Control
HG – Handwheel Displacement Control
FE – Screw Adjustment Displacement Control
SM – Servo Adjustment Displacement Control - Mech Feedback
DP – Pressure Signal Displacement Control
SP – Proportional Valve Displacement Control

21 22 23 Fourth Displacement cm³/r

000 – Not Required
066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

24 25 Fourth Control Type

00 – No Control (for Fixed Displacement Only)
DF – Pressure Compensator
LR – Power Control
ES – Electric Motor Control
HG – Handwheel Displacement Control
FE – Screw Adjustment Displacement Control
SM – Servo Adjustment Displacement Control - Mech Feedback
DP – Pressure Signal Displacement Control
SP – Proportional Valve Displacement Control

26 27 28 29 Assembly Numbers

HC81 – Defined By Eaton

30 31 32 33 34 35 36 37 38 39 Assembly Numbers

Defined By Eaton

- For a combination of two or more units fill out this Combination Model Code.
- Start with the biggest size unit for the first displacement.
- For each unit included in this combination, a separate model code must be chosen. Use the form on page 4.
- Character 26 to 39 will be P/N of the combination. This number will be defined by Eaton and provided in the order acknowledgement.
- Charge and Pilot Pump through drive option must be specified on the rear unit of the combination (as a special feature).
- Front and middle units shall have the through drive option of the following unit in the combination.

Model Code

Examples for
Combination Units

Example 1: Combination of two open loop pumps

Model Code Front Unit	PVWF-500M08R0001R02SVMASPC03A0000000000000000010
Model Code Rear Unit	PVXR-250M07R0001R02SVMASPC03A0000000000000000010
Model Code Combination Unit	PVWC-500SP250SP0000000000HC81**********

Example 2: Combination of one closed loop - and two open loop pumps (For other product model codes refer to the according catalog)

Mode Code Front Unit	TVWF-500M08R0000H1R02SVMA20SPC03C00000000E000H000000010
Model Code Middle Unit	PVWM-250M07R0001R02SV0ADF000A0000000000000000010
Model Code Rear Unit	PFXR-130M02R00P1A02SV0A00000A0000000000000000010
Model Code Combination Unit	TVWC-500SP250DF1300000000HC81**********

Pump Specifications - US

MODEL			66	90	130	180	250
Design			Swashplate - Axial piston pump				
Type of mounting			Flange or foot-mounted. tandem is foot mounted only				
Pipe connection SAE Flange	B A	psi	1 1/2" = 3000 1" = 6000	2" = 3000 1" = 6000	2 1/2" = 3000 1" = 6000	2 1/2" = 3000 1 1/4" = 6000	3 1/2" = 500 1 1/4" = 6000
Direction of rotation			Clockwise when viewing shaft end of pump Counterclockwise available on request				
Speed range	n_{min} n_{max}	rpm	150 1800				
Installation position			Optional, see mounting information				
Ambient temperature range	min max	°F	-4 122				
Weight	m	lb	121	165	234	251	467
Mass of inertia	J	lb ft²	0.38	0.38	1.068	1.068	3.465

HYDRAULIC CHARACTERISTICS							
Nominal pressure (100% duty cycle)	p_N	psi	5000				
Input pressure	p_{1min} p_{1max}	psi psi	12.5 abs 725				
Maximum pressure to DIN 24312	p_{2max}	psi	6090				
Hydraulic fluid			Hydraulic oil to DIN 51524 part 2. Refer to section Application Data-Fluid Recommendations				
Hydraulic fluid temperature range	min max	°F	-13 (on startup) 194				
Viscosity range for continuous operation	min max	cSt cSt	10 75				
Maximum permissible start viscosity	max	cSt	1000				
Filtering	ISO 4406		18/15/13				
Maximum geometric displacement n= 1500 rpm n= 1800 rpm	V_g	in³	4.1	5.5	7.9	11.0	15.2
Maximum geometric pump flow n= 1500 rpm n= 1800 rpm	Q_g	USgpm	26 32	36 43	52 62	71 86	99 119
Case pressure	$p_{v\ max}$	psi	max. 7.2psi over p1. p_{max} = 58 abs.				

DRIVE							
Maximum driving torque - single unit ($p_{2\ max.}$, η= 100%)	$M_{1\ Single}$	lb.ft.	325	444	640	887	1233
Maximum power consumption - single unit ($p_{2\ max.}$, η= 100%; n= 1800 rpm)	$P_{1\ Single}$	hp	93	126	182	254	355
Maximum driving torque limited to splined shaft only - comb. unit	$M_{1\ Comb.}$	lb.ft.	2x325	2x444	2x640	2x887	2x1233

Pump Specifications - Metric

MODEL			66	90	130	180	250
Design			Swashplate - Axial piston pump				
Type of mounting			Flange or foot-mounted. tandem is foot mounted only				
Pipe connection SAE/Flange	B A	psi	1 1/2" = 3000 1" = 6000	2" = 3000 1" = 6000	2 1/2" = 3000 1" = 6000	2 1/2" = 3000 1 1/4" = 6000	3 1/2" = 500 1 1/4" = 6000
Direction of rotation			Clockwise when viewing shaft end of pump Counterclockwise available on request				
Speed range	n_{min} n_{max}	min^{-1}	150 1800				
Installation position			Optional, see mounting information				
Ambient temperature range	min max	°C	-20 50				
Weight	m	kg	55	75	106	114	212
Mass of inertia	J	$kg\ m^2$	0.016	0.016	0.045	0.045	0.146

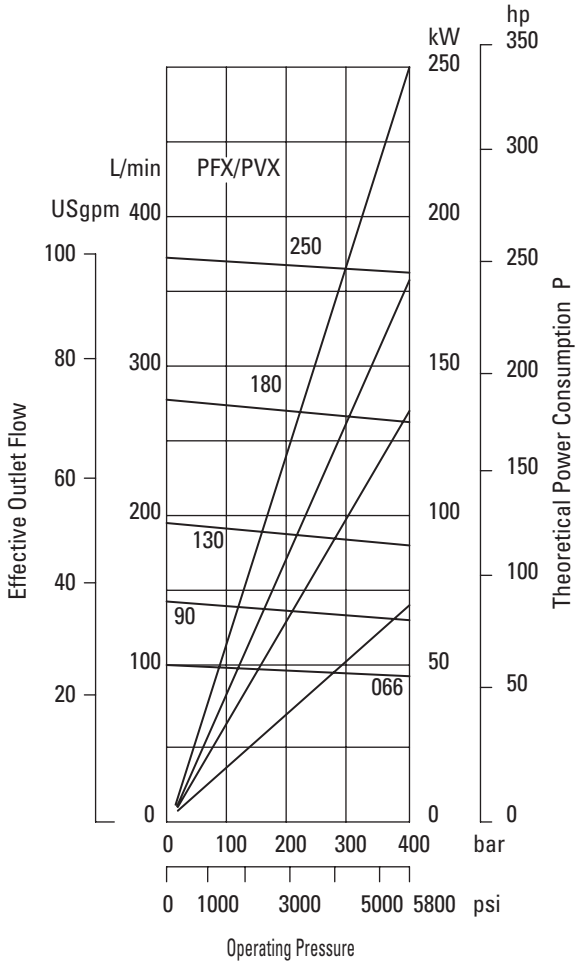
HYDRAULIC CHARACTERISTICS							
Nominal pressure (100% duty cycle)	p_N	bar	350				
Input pressure	p_{1min} p_{1max}	bar bar	0.85 abs 50				
Maximum pressure to DIN 24312	p_{2max}	bar	420				
Hydraulic fluid			Hydraulic oil to DIN 51524 part 2. Refer to section Application Data-Fluid Recommendations				
Hydraulic fluid temperature range	min max	°C	-25 (on start up) 90				
Viscosity range for continuous operation	min max	cSt cSt	10 75				
Maximum permissible start viscosity	max	cSt	1000				
Filtering	ISO 4406		18/15/13				
Maximum geometric displacement n= 1500 min^{-1} n= 1800 min^{-1}	V_g	cm^3	66	90	130	180	250
Maximum geom. pump flow n= 1500 min^{-1} n= 1800 min^{-1}	Q_g	L/min	99 118	135 162	195 234	270 324	375 450
Case pressure	$p_{v\ max}$	bar	max. 0,5 bar over p1. pmax = 4 bar abs.				

DRIVE							
Maximum driving torque - single unit ($p_{2\ max.}$, η= 100%)	$M_{1\ Single}$	Nm	440	600	868	1202	1671
Maximum power consumption - single unit ($p_{2\ max.}$, η= 100%; n= 1800 min^{-1})	$P_{1\ Single}$	kW	69	94	136	189	265
Maximum driving torque limited to splined shaft only - comb. unit	$M_{1\ Comb.}$	Nm	2x440	2x600	2x868	2x1202	2x1671

Performance Curves -

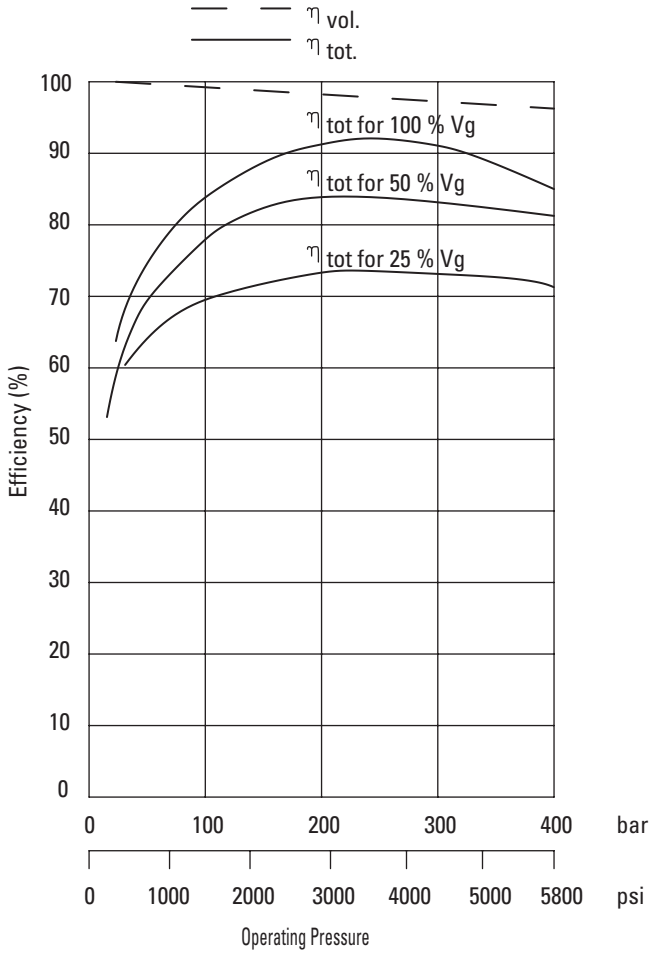
066, 090, 130,
180, 250 Series

Outlet Flow and Theoretical Power Consumption



Typical at 1500 min-1 with anti-wear oil at 40 cSt
Single displacement pumps: PFX,PVX

Volumetric and Overall Efficiencies

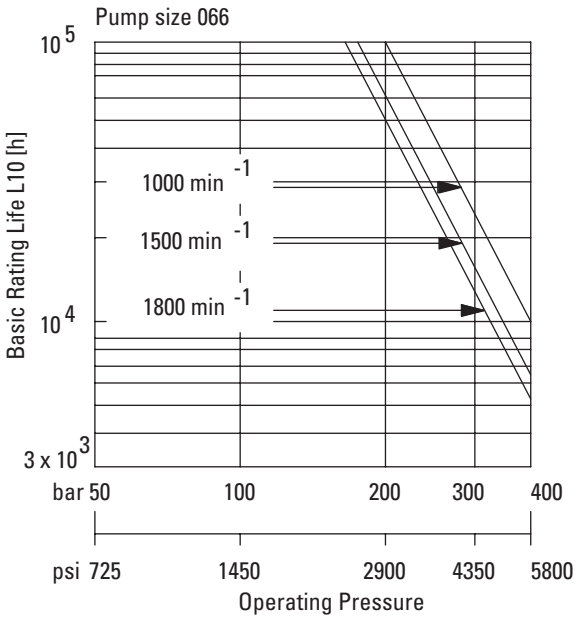


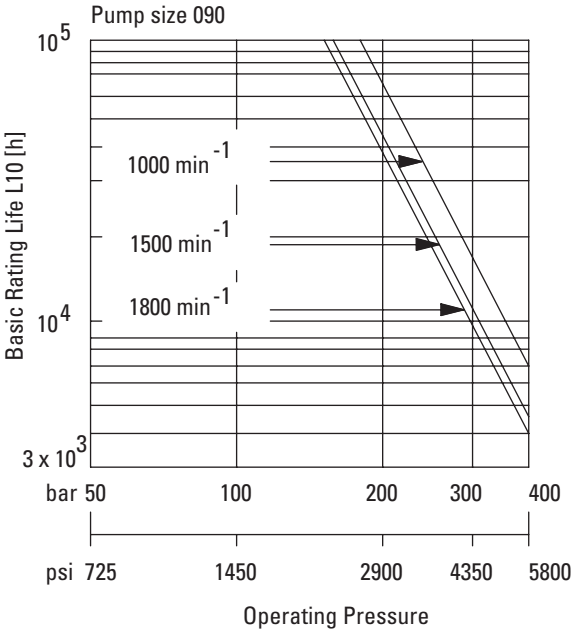
For Calculation: $P_{eff} = P_{th}/\eta_{tot}$

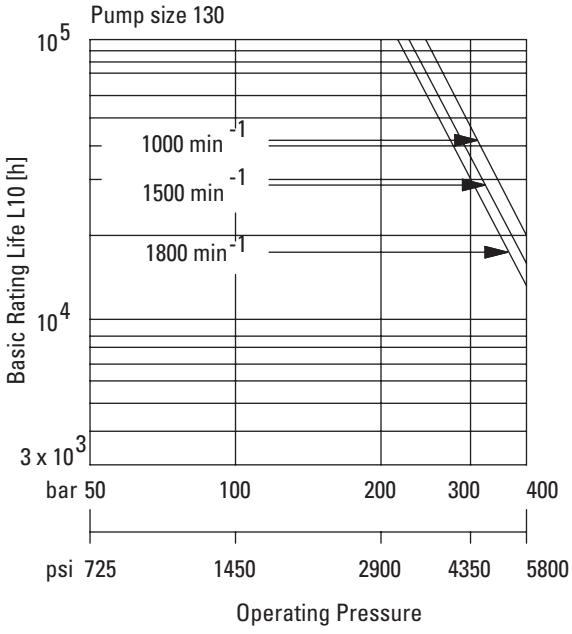
Performance Curves - Operating Data:

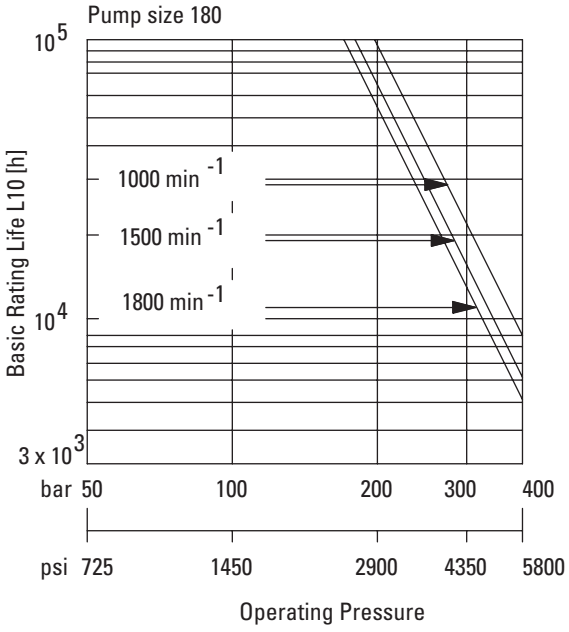
Theoretical Bearing Life Time
066, 090, 130,
180, 250 Series

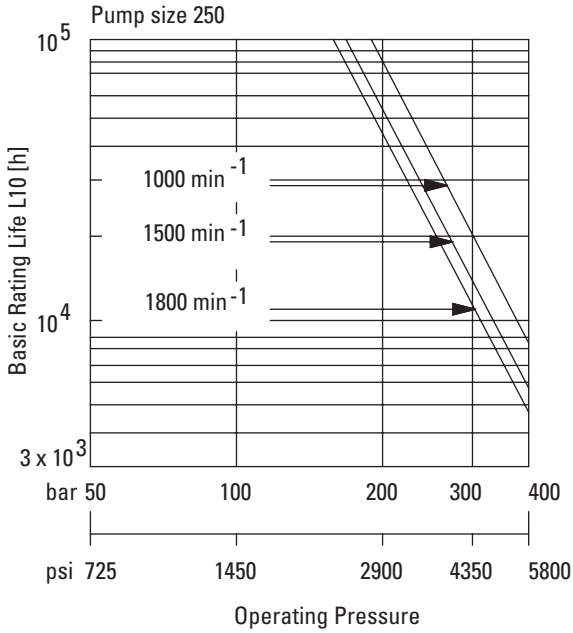
At maximum displacement
and various speeds.





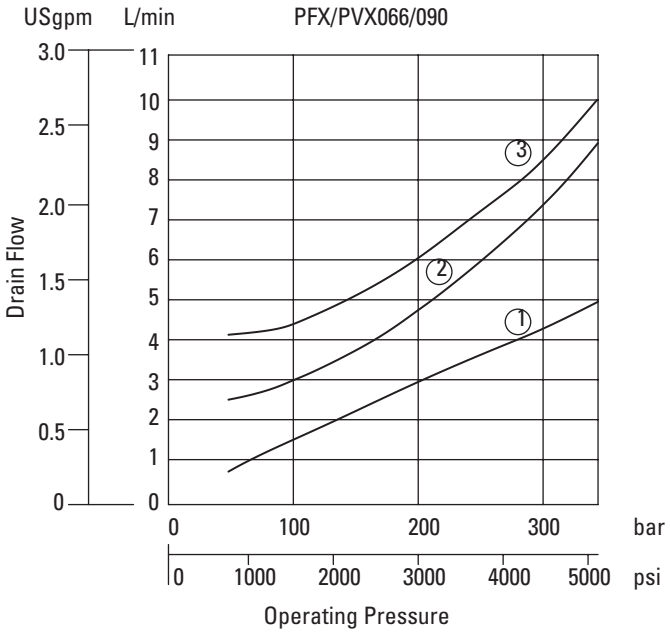


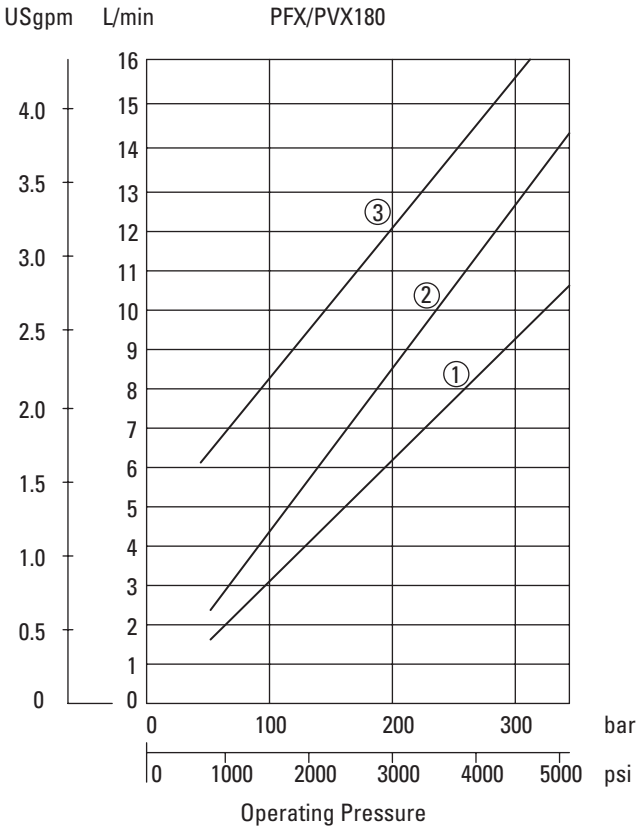


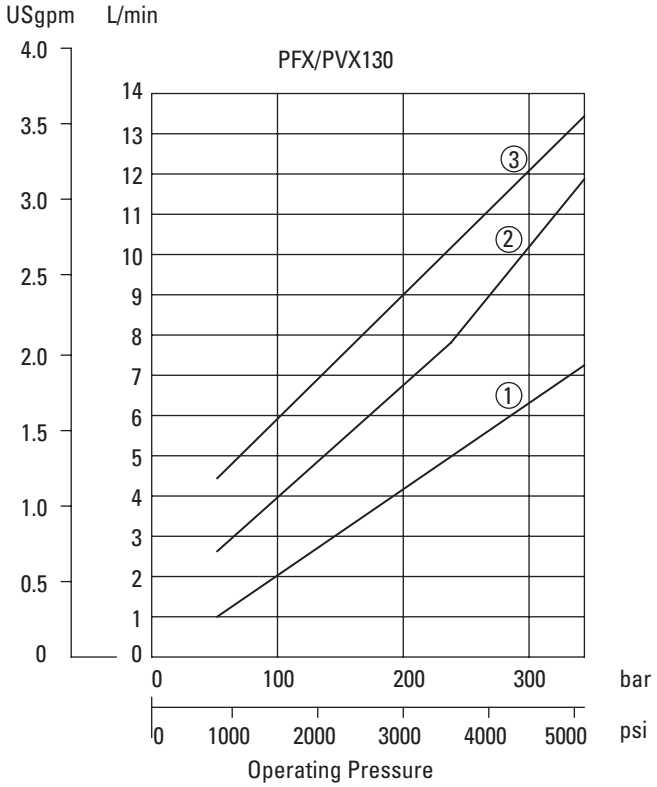


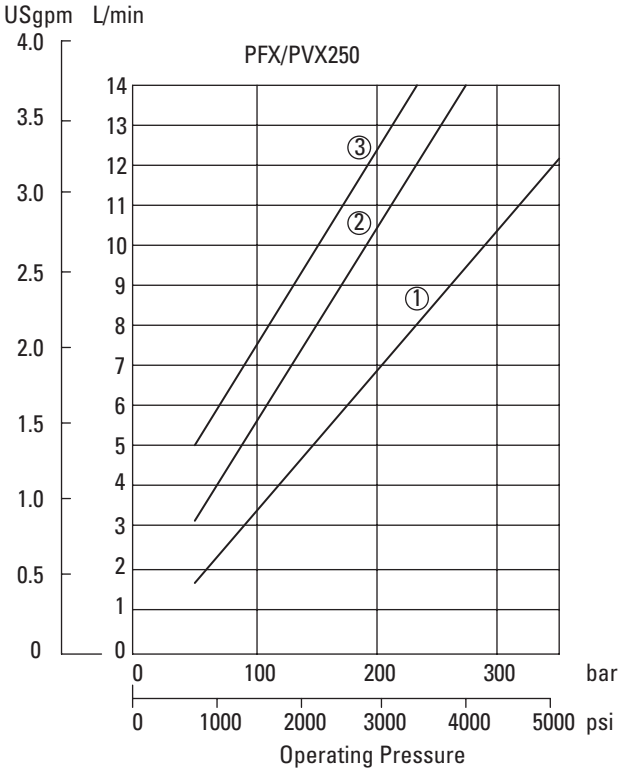
Performance Curves - Operating Data:

Typical Drain Flow from an Open-Loop Pump Based on 1500 r/min and 35cSt









(1) PFX and PVX models at maximum displacement (PVX models with type FE, HG or ES controls i.e. no control oil flow)

(2) PVX in pressure cutoff mode (flow of pilot stage is discharged separately)

(3) PVX in pressure cutoff mode (flow of pilot stage is discharged in case)

Controls - DF, LR Pressure Compensator/ Power Control

"X" Series - Open loop pump

Energy saving hydraulic drives are possible with pressure compensated and/or power controlled pumps, especially in combination with the load-sensing option.

DF The system pressure remains constant for the entire volume flow rate. System pressure can be set either manually, hydraulically or electronically. The standard Hydrokraft pressure compensator is pilot operated and very stable.

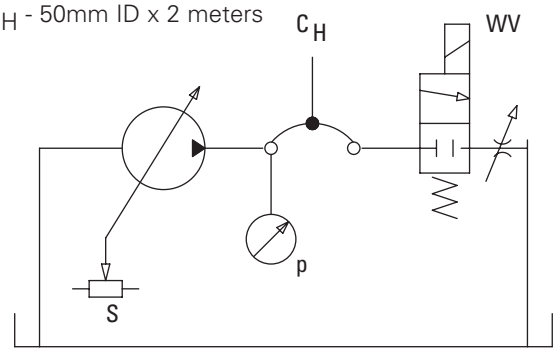
LR The p/Q characteristic curve is a hyperbola. For constant speed the drive torque, i.e. the power used, is held constant. The power hyperbola can be continuously adjusted between Pmin and Pmax. Pmin is given by the minimum set value of control's main stage (app. 20 bar) and power loss of the pump.

Both controllers can be combined with another or with additional options, for possible variations see the model coding and circuit diagrams. The maximum flow of the pump can be limited mechanically to between 50% and 100% by screw.

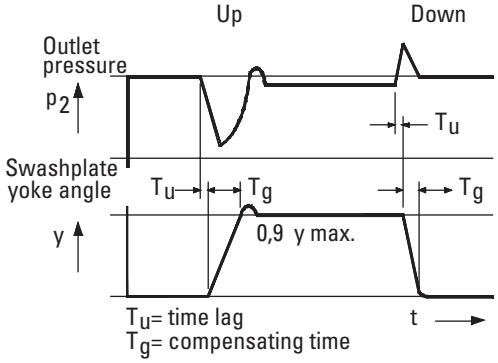
As an additional option the maximum (or minimum) flow can also be limited by a spacer inside the control cylinder (position number 13 in model coding, options 4, 5 or 6 in combination with customer adjustment specifications position 40-43 for the set values). This solution is also recommended for very rough operating conditions and the need of a very exact repeatability over a long time period. The setting must be defined before ordering and cannot be modified during operation.

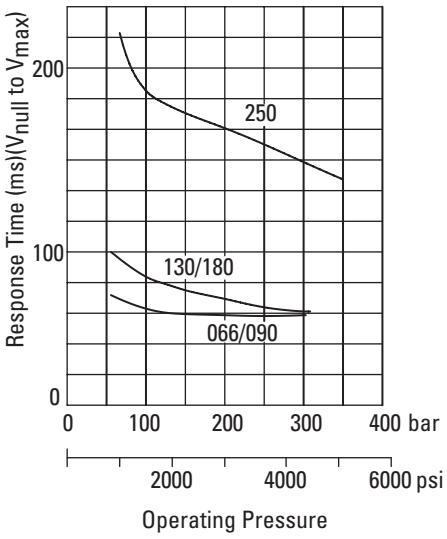
Typical controller action

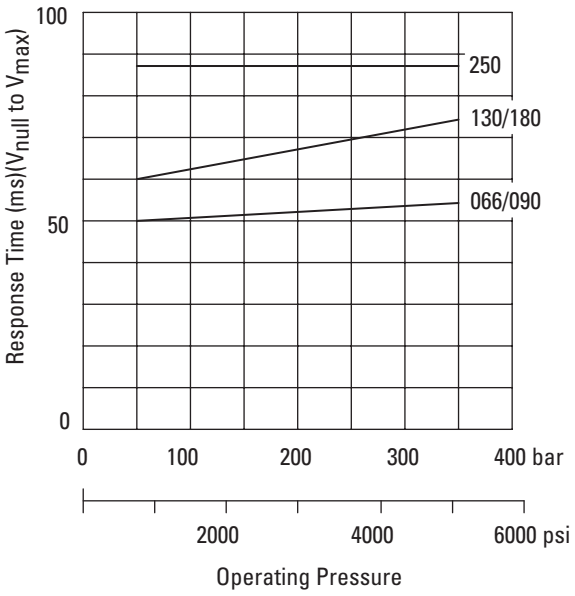
(Closing/opening the directional control valve WV)
Q ➔ Qmax or Qmin ➔ Qmax
C_H - 50mm ID x 2 meters



Pressure compensator response times





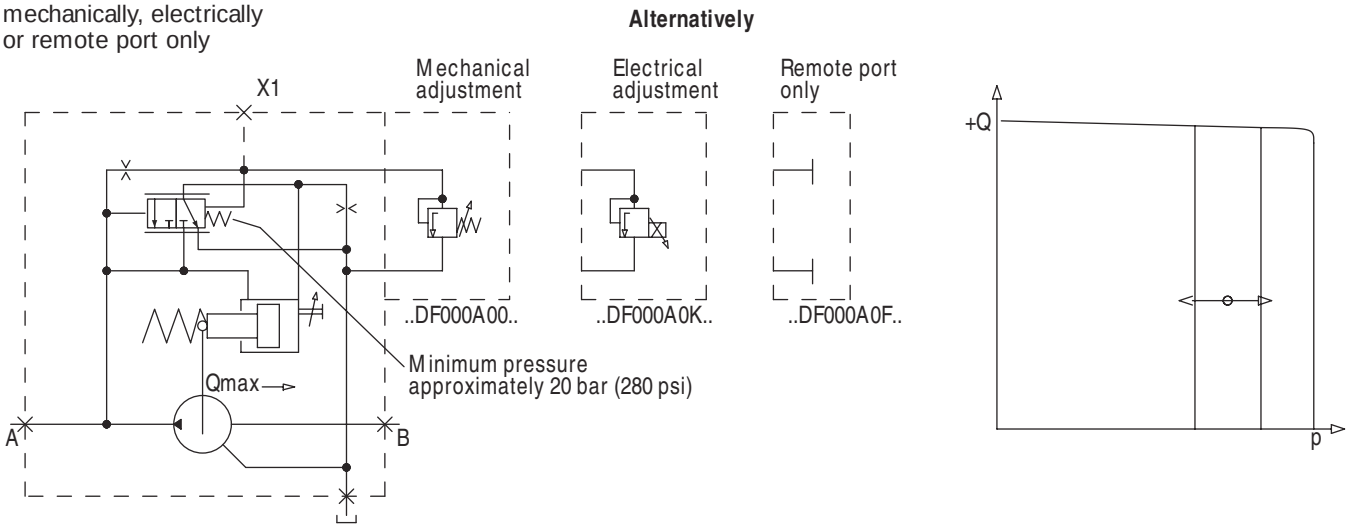


Controls - DF, LR Pressure Compensator/ Power Control

"X" Series - Open loop pump

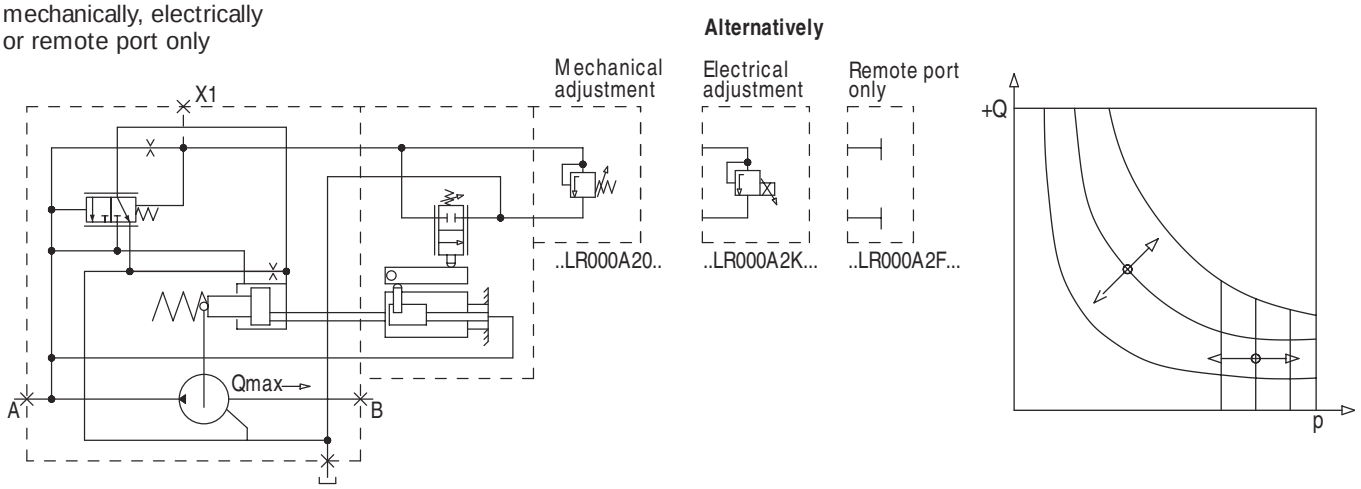
DF Pressure compensator DF000A ...

Control valve adjustable mechanically, electrically or remote port only



LR Power control with overriding pressure limiter LR000A2 ...

Pressure control pilot valve adjustable mechanically, electrically or remote port only

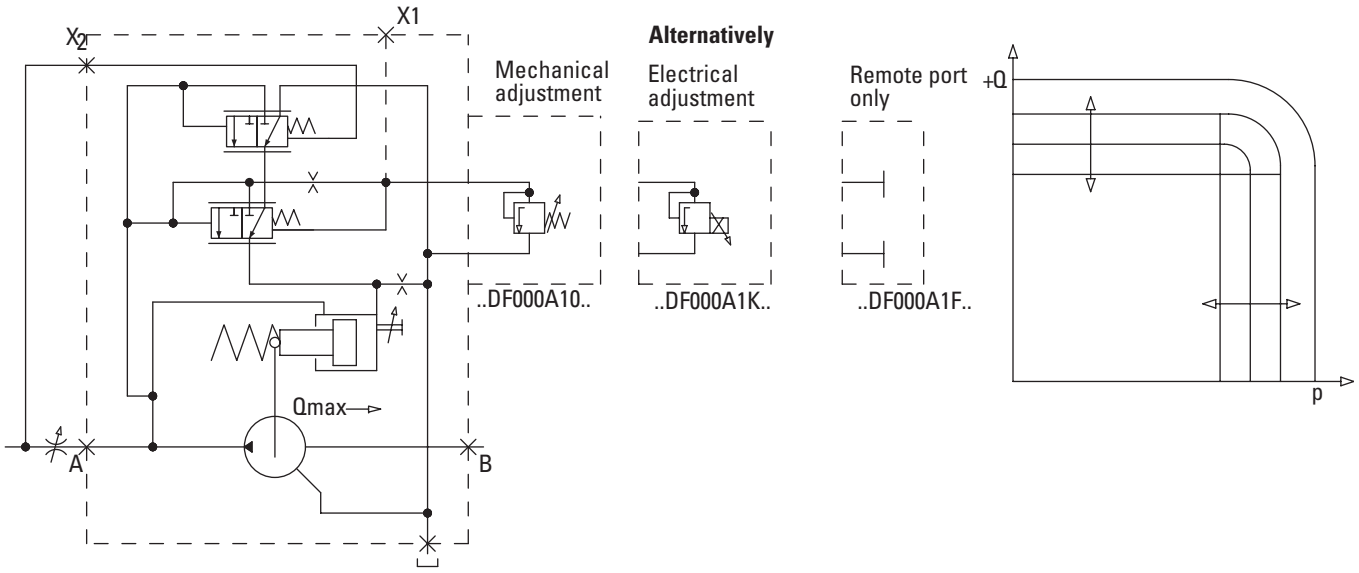


Controls - DF, LR Pressure Compensator/ Power Control

"X" Series - Open loop pump

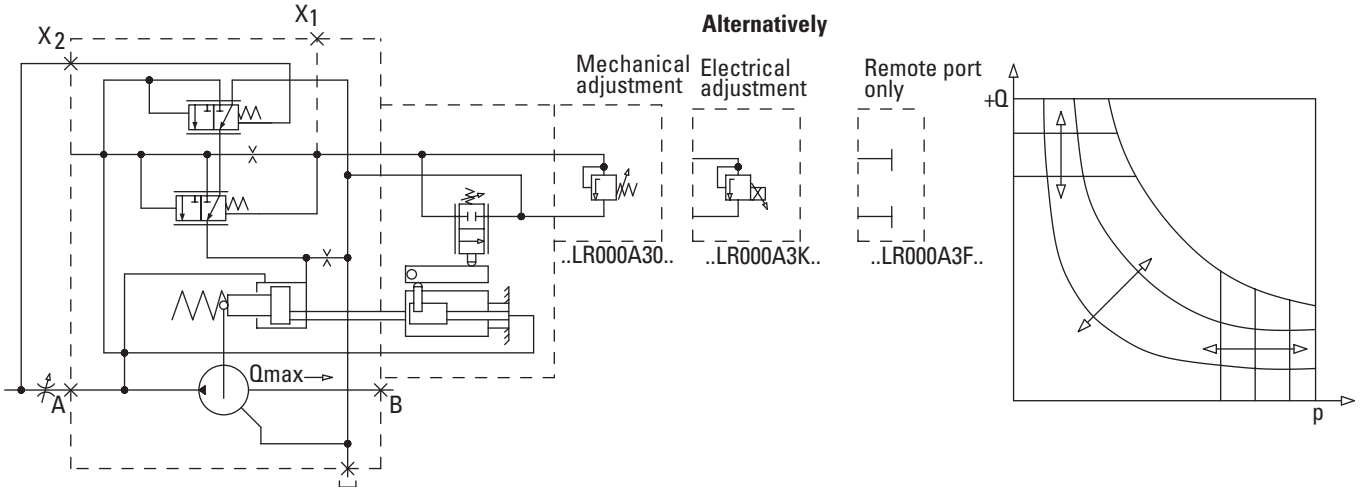
DF Pressure compensator with load sensing DF000A1 ...

Control valve adjustable mechanically, electrically or remote port only



LR Power control with load sensing and pressure limiter LR000A3 ...

Pressure control pilot valve adjustable mechanically, electrically or remote port only



Controls - DQ Mooring Control

"X" Series - Open loop pump

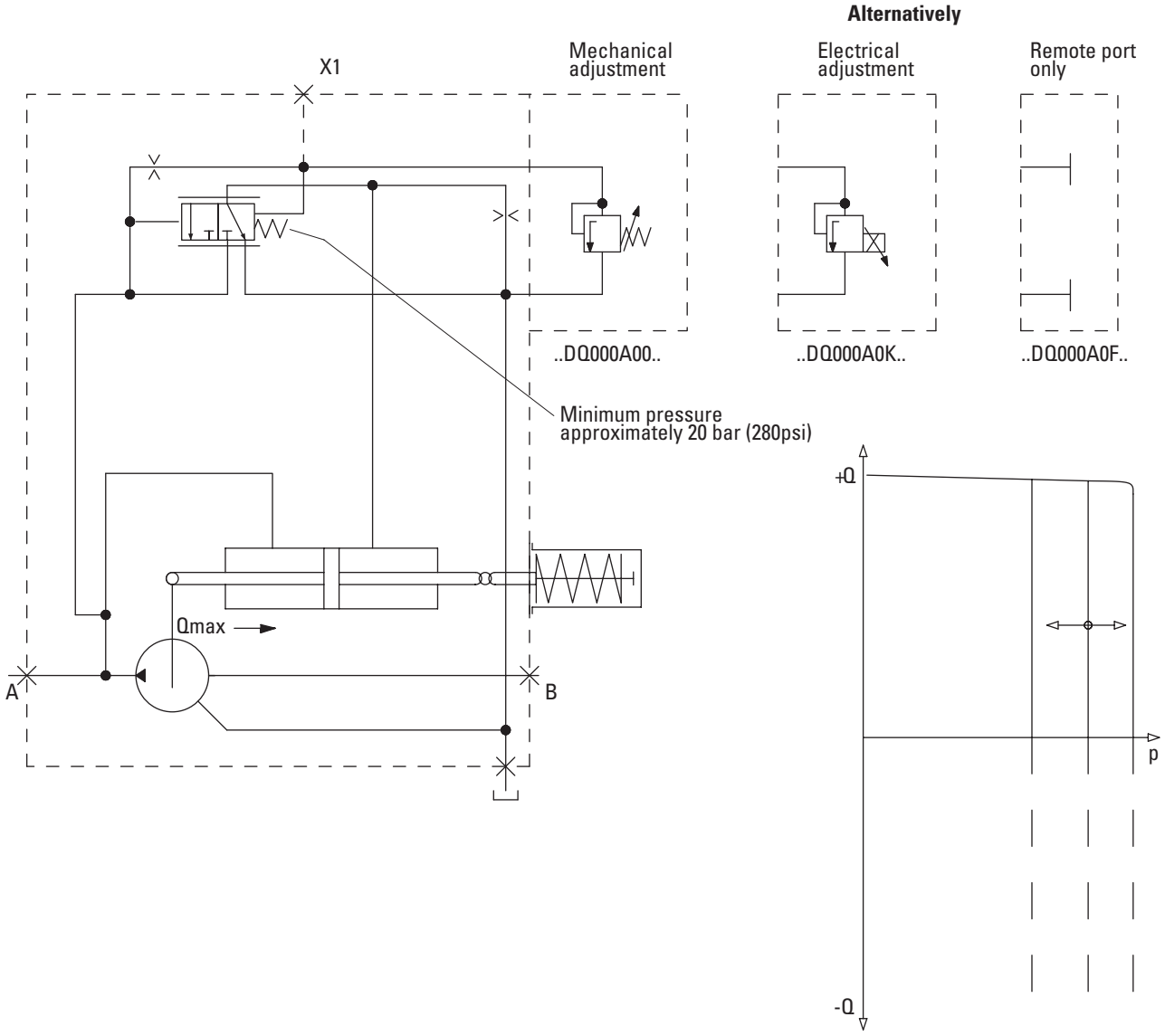
The DQ-control is a pressure control with overcenter operation (2 quadrants). It can be used eg. for counterbalanced systems or applications where reverse flow from the system can drive the pump in reverse (negative pump angle) such as a hydraulic motor.

The DQ-control is only available for sizes 66, (90 on request), 130 and 180 ccm/rev.

Like the standard Hydrokraft pressure compensator this control pilot operated and very stable. For performance data/response time please refer to the DF-control.

As an additional option the maximum (or minimum) flow can be limited by a spacer inside the control cylinder (position number. 13 in model coding, options 4, 5 or 6 in combination with customer adjustment specifications position 40-43 for the set values).

This solution is also recommended for very rough operating conditions and the need of a very exact repeatability over a long time period. The setting must be defined before ordering and cannot be modified during operation.



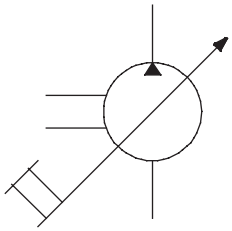
Controls - HG Manual Adjustment Displacement Control FE

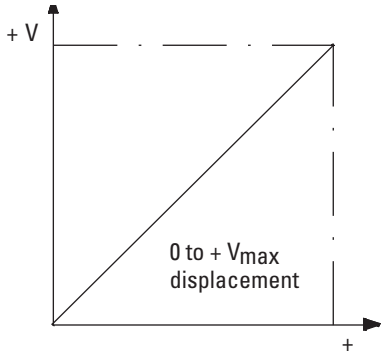
"X" Series - Open loop pump

FE The FE - control is a displacement control where the pump flow is adjusted by a screw.

HG The HG-control is a displacement control where the pump flow can be adjusted by a handwheel.

The maximum (and/or minimum) flow can be limited by a spacer inside the control cylinder (position number 13 in model coding, options 4, 5 or 6 in combination with customer adjustment specifications position 40-43 for the set values). The setting must be defined before ordering and cannot be modified during operation.





Controls - Electric Motor Displacement Control ES

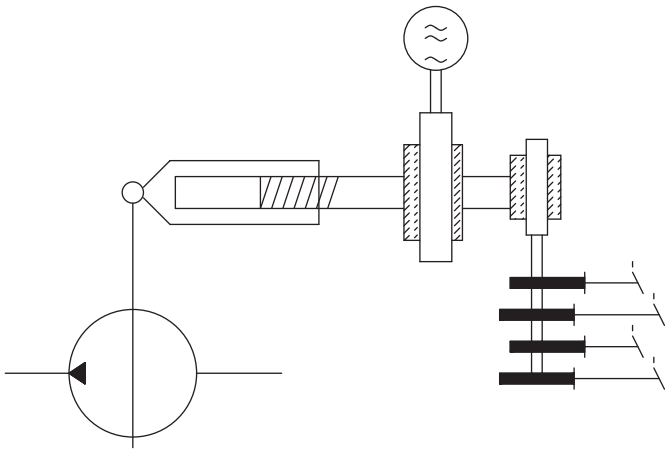
"X" Series - Open loop pump

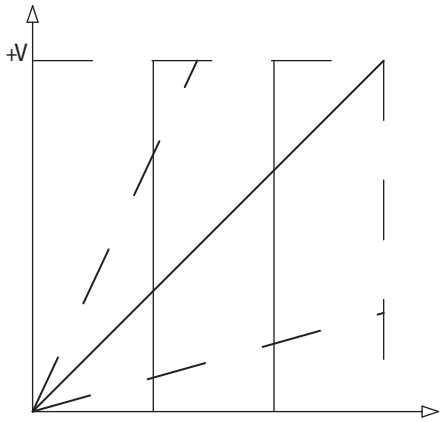
The unit is used for stepless adjustment. It has a three phase electric servo motor, worm gearing and a switch box with 4 and 8 limit switches for different positions. A potentiometer is also available.

The response times from zero to maximum depends on the chosen ration and the speed of the servo motor (this means that during operation the response times are not variable.

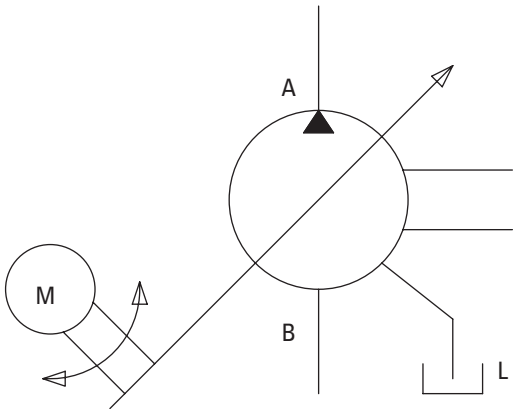
No pressure/power limiter possible.

Explosion protection versions are also available.





Response time from 0 to +V maximum displacement



PVX Response Times ES - Control

	THEORETICAL RESPONSE TIME (SEC) FOR MAX. DISPLACEMENT						CHARACTER IN MODEL CODE POS. 26
Size	**066**	**090**	**130**	**180**	**250**	**250**	
Freq. Hz	50	60	50	60	50	60	
Fast	7	6	18	15	15	13	M
Medium	24	20	35	29	30	25	N
Slow	38	32	54	45	48	40	P

Response time from 0 to $+Q_{max}$

Controls - Pressure Signal Displacement Control DP

"X" Series - Open loop pump

The output flow of the pump is proportional to the pilot pressure

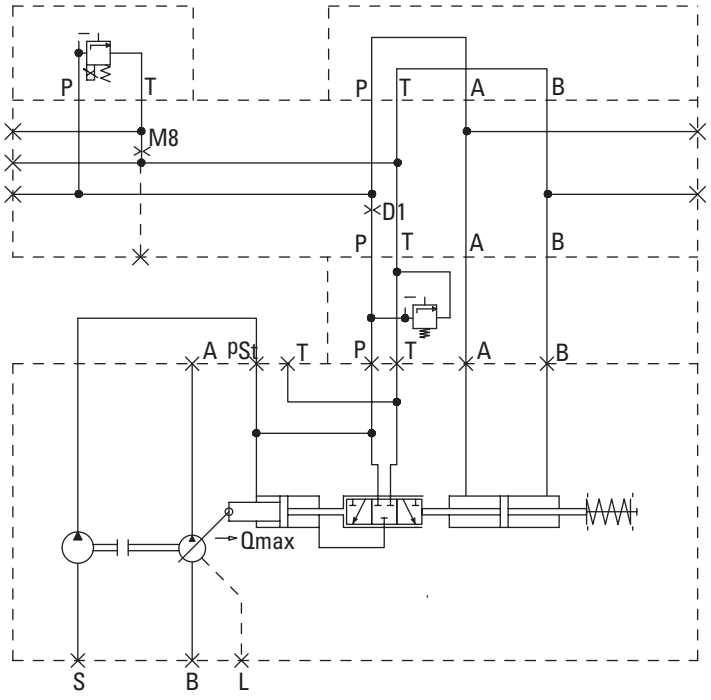
A separate pilot oil circuit is necessary. From this the control pressure is reduced to the desired set value by means of a suitable pressure control valve (with P -T line) and throttle in P - line 0.8 Ø (0.03 in).

The DP-control can be used for steepless flow control with standard requirements for dynamic and precision.

No feedback signal is needed, an optical indicator recommended (position 22 in model coding, option "V"). A pilot oil filter can be mounted in line between pump and control (position 35 in model coding, option "V" or "E").

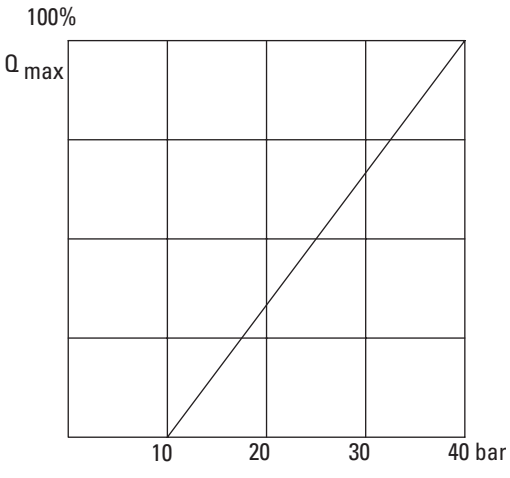
Pressure limiter or power limiter override not available (or such and other options please refer to PVW-Series).

As an additional option the maximum (and/or minimum) flow can be limited by a spacer inside the control cylinder (position number 13 in model coding, options 4, 5 or 6 in combination with customer adjustment specifications position 40-43 for the set values). This solution is also recommended for very rough operating conditions and the need of a very exact repeatability over a long time period. The setting must be defined before ordering and cannot be modified during operation.



PVX Response Times DP - Control

SIZE	RESPONSE TIME (SEC) W/ 12 L/MIN PILOT OIL FLOW (STANDARD)	PILOT PRESSURE P_{ST} BAR
066/090	0.7	60
130/180	0.9	60
250	1.1	60



The output flow of the pump is proportional to the pilot pressure

Controls - Proportional Valve Displacement Control SP

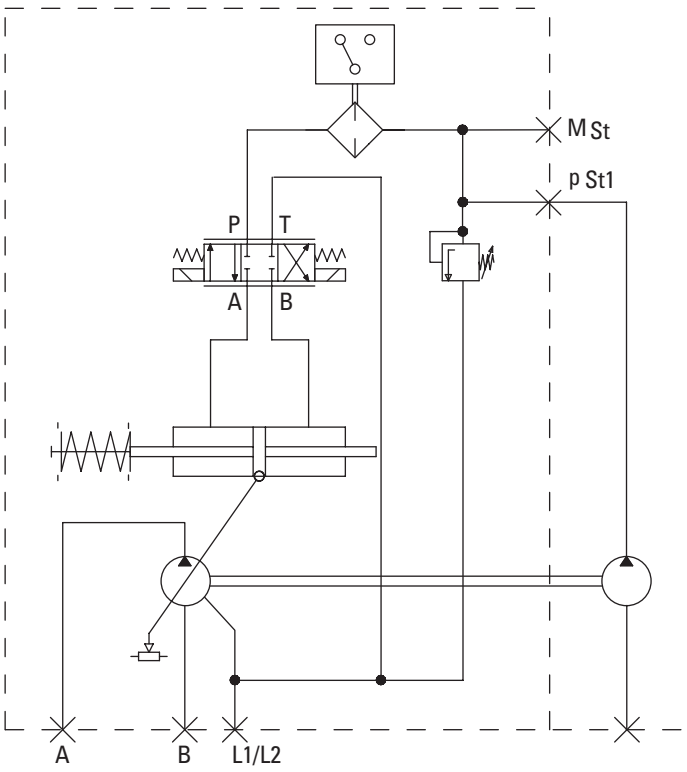
"X" Series - Open loop pump

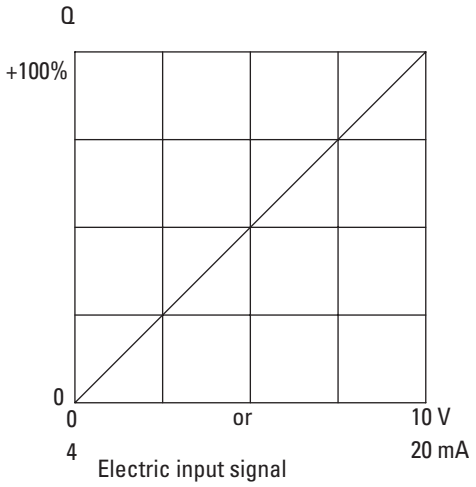
The SP control operates a hydrostatic drive and works without throttle losses within electrically adjustable limits. This is done by controlling delivery flow with electrical swashplate angle feedback (electr-closed-loop control). All control values are recorded as an electrical signal and lead back to the control card.

The proportional valve and servo piston transform the output signal of the control card to the desired setting. This results in a very precise and dynamic control. Pressure limiter override available on request. Power limiter override not available (for such and other options please refer to PVW series).

As an additional option the maximum (and/or minimum) flow can be limited by a spacer inside the control cylinder (position number 13 in model coding, options 4, 5 or 6 in combination with customer adjustment specifications position 40-43 for the set values).

This solution is also recommended for very rough operating conditions and the need of a very exact repeatability over a long time period. The setting must be defined before ordering and cannot be modified during operation.





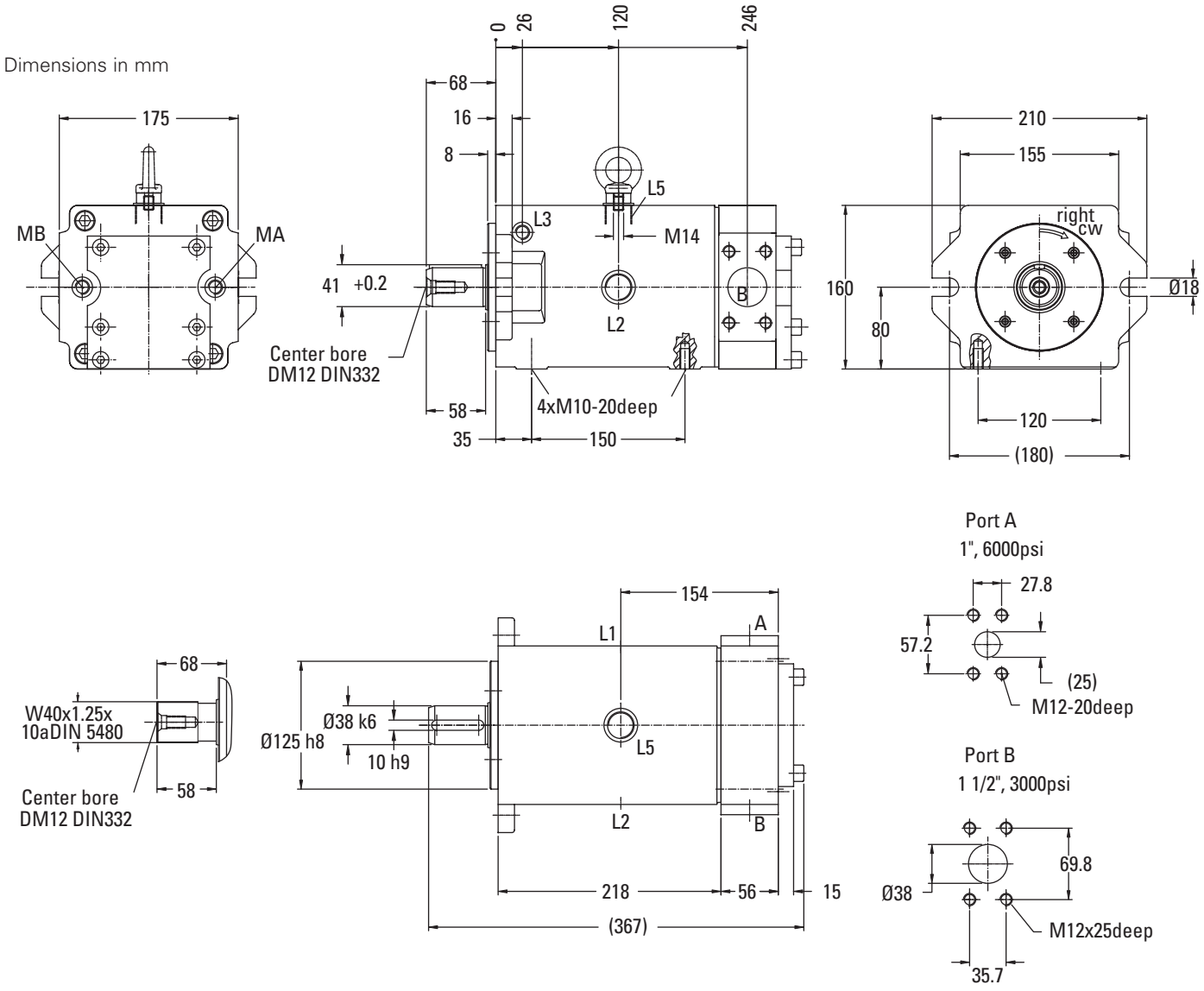
PVX RESPONSE TIMES SP - CONTROL

PROPORTIONAL VALVE	PILOT OIL FLOW	PILOT OIL PRESSURE P_{ST}	CONTROL ELECTRONICS	RESPONSE TIME	UNIT SIZE	SERVO PISTON		
	L/min (Usgpm)	bar (psi)	(Amp. Card)	0 < > V_{max} [ms]	cm^3	Diameter mm (in)	Stroke mm (in)	Volume cm^3 (in^3)
Medium Response		60 (857)		250	066 / 090	40/30 (1.57/1.18)	28 (1.10)	15,4 (0.939)
KDG4V3-2C20NMUH760	12 (3.17)	60 (857)	ER 9.3-10	350	130 / 180	55/38 (2.16/1.49)	35 (1.37)	43,5 (2.654)
(CETOP 3)		60 (857)		550	250	70/50 (2.76/1.97)	43,5 (1.71)	81 (4.942)
High Response					ON REQUEST			
(CETOP 5)								

The ER9.3-10 and ER 9.4-10 (for High Response) digital Amplifier cards are optimized for use with the SP-Control. Please ask for separate Documentation. Software is available for parameter setting and storing (database function). Contact Eaton to request free of charge manual - and software CD.

Pump Dimensions - PFXS 066

Dimensions in mm



A	System pressure port SAE 1", 415 bar (6000 psi)
B	System pressure port SAE 1 1/2", 207 bar (3000 psi)
(L1)	Drain port 7/8" – 14 UNF
(L2)	Ventilation port for vertical mounting M26x1.5
(L3)	Ventilation port for vertical mounting G1/4 " (shaft upwards)
(L5)	Oil filling plug M26x1.5
(MA)	Gauge port system pressure G1/4"
(MB)	Gauge port system pressure G1/4"
(…)	Normally plugged

Non-Standard Displacements:

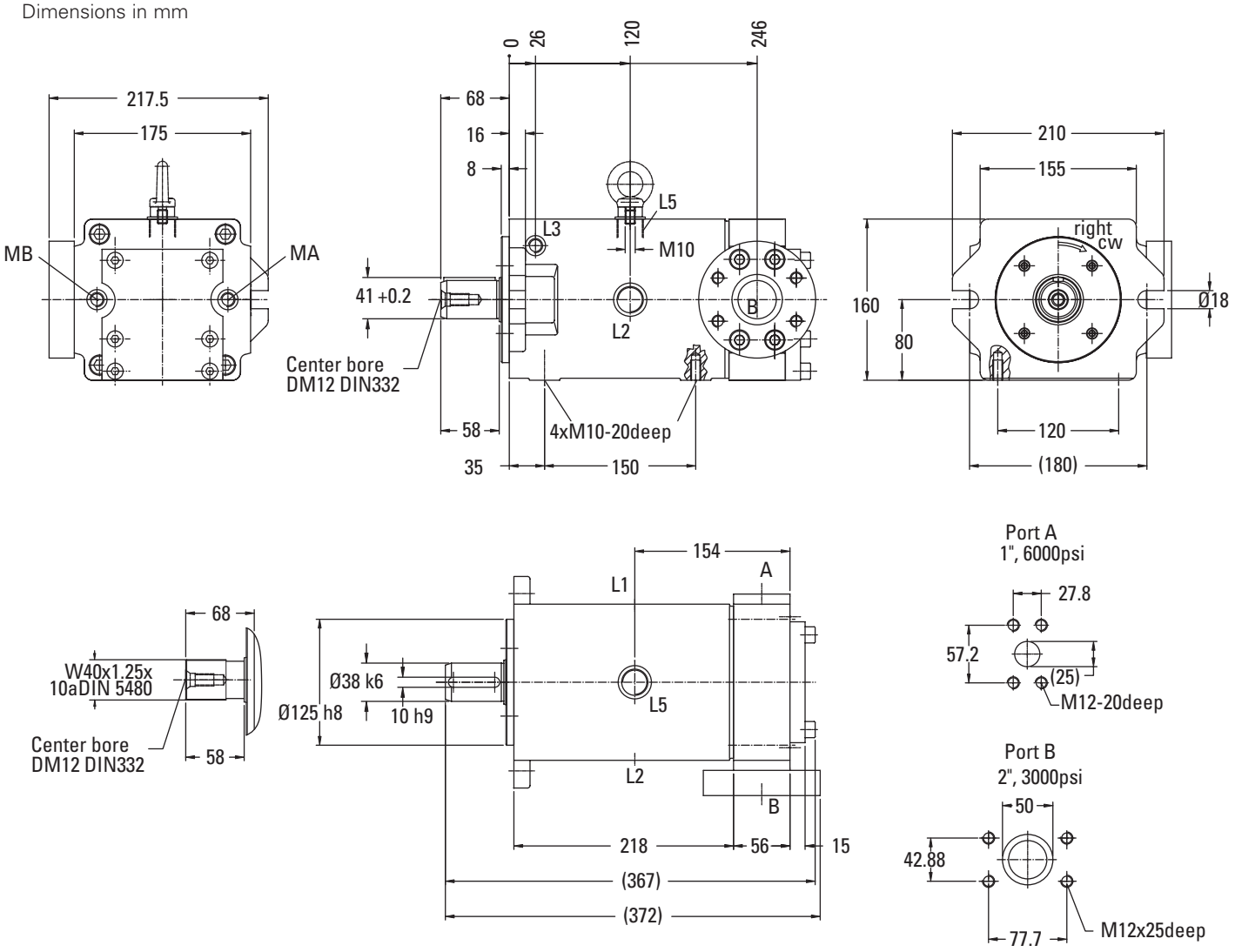
Standard Displacement . . . . . .66 ccm/rev

Reduced Displacement Available . . . . . .55 or 44 ccm/rev

DIRECTION OF ROTATION	INPUT	OUTPUT
Right Hand Rotation	B	A
Left Hand Rotation	A	B

Pump Dimensions - PFXS 090

Dimensions in mm



A	System pressure port SAE 1'', 415 bar (6000 psi)
B	System pressure port SAE 2'', 207 bar (3000 psi)
(L1)	Drain port 7/8" – 14 UNF
(L2)	Ventilation port for vertical mounting M26x1.5
(L3)	Ventilation port for vertical mounting G1/4 " (shaft upwards)
(L5)	Oil filling plug M26x1.5
(MA)	Gauge port system pressure G1/4"
(MB)	Gauge port system pressure G1/4"
(…)	Normally plugged

Non-Standard Displacements:

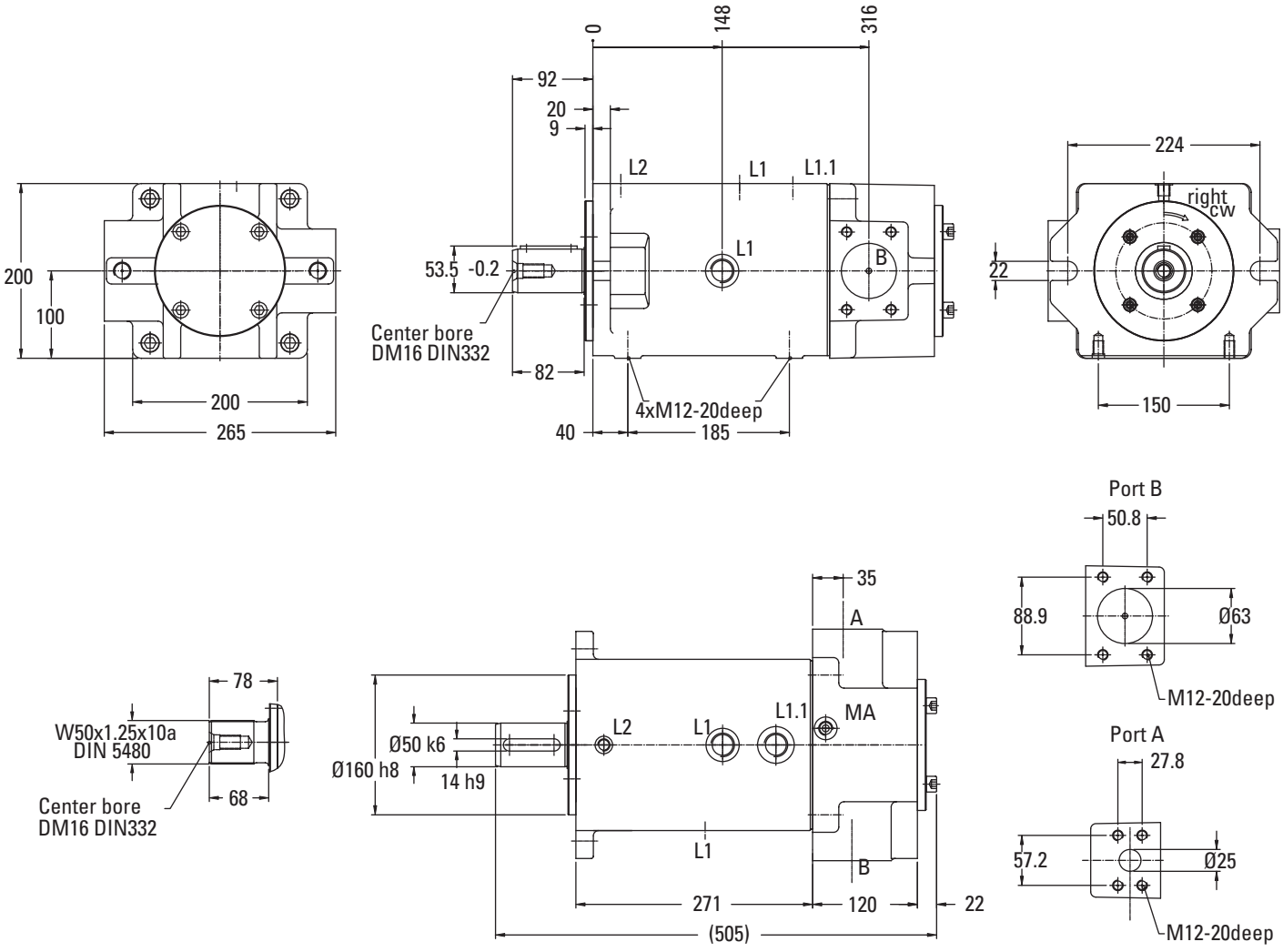
Standard Displacement . . . . . .90 ccm/rev

Reduced Displacement Available . . . . . .75 ccm/rev

DIRECTION OF ROTATION	INPUT	OUTPUT
Right Hand Rotation	B	A
Left Hand Rotation	A	B

Pump Dimensions - PFXS 130

Dimensions in mm



A	System pressure port SAE 1", 415 bar (6000 psi)
B	System pressure port SAE 2 1/2'', 207 bar (3000 psi)
(L1)	Drain port M26x1.5
(L1.1)	Oil filling plug 1 1/16"-12UNF
(L2)	Ventilation port for vertical mounting G1/4"
(MA)	Gauge port system pressure G1/4"
(…)	normally plugged

Non-Standard Displacements:

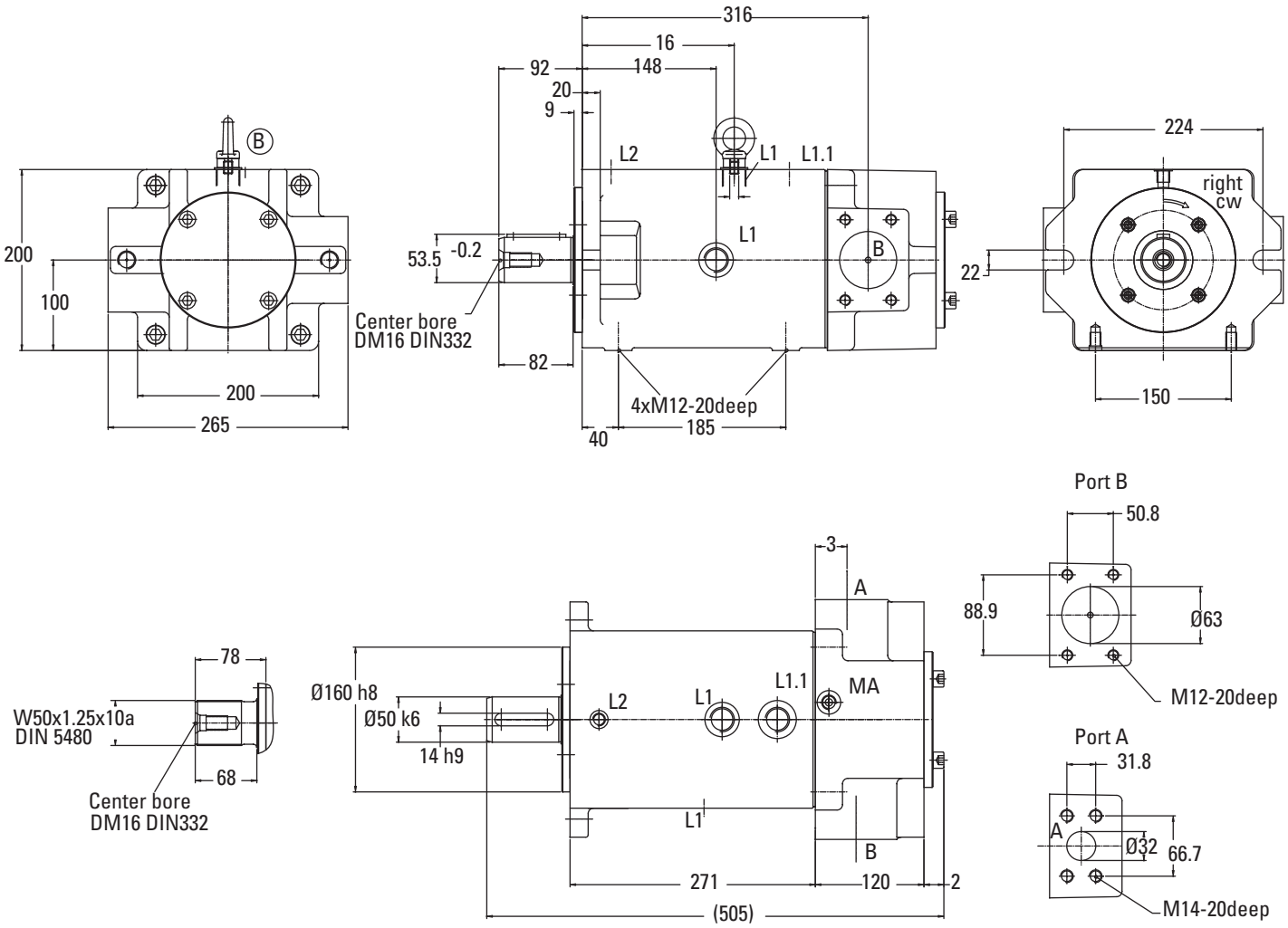
Standard Displacement size 130.....130 ccm/rev

Reduced Displacement Available Size 130...115 or 94 ccm/rev

DIRECTION OF ROTATION	INPUT	OUTPUT
Right Hand Rotation	B	A
Left Hand Rotation	A	B

Pump Dimensions - PFXS 180

Dimensions in mm



A	System pressure port SAE 1 1/4", 415 bar (6000 psi)
B	System pressure port SAE 2 1/2'', 207 bar (3000 psi)
(L1)	Drain port M26x1.5
(L1.1)	Oil filling plug 1 1/16"-12UNF
(L2)	Ventilation port for vertical mounting G1/4"
(MA)	Gauge port system pressure G1/4"
(…)	Normally plugged

Non-Standard Displacements:

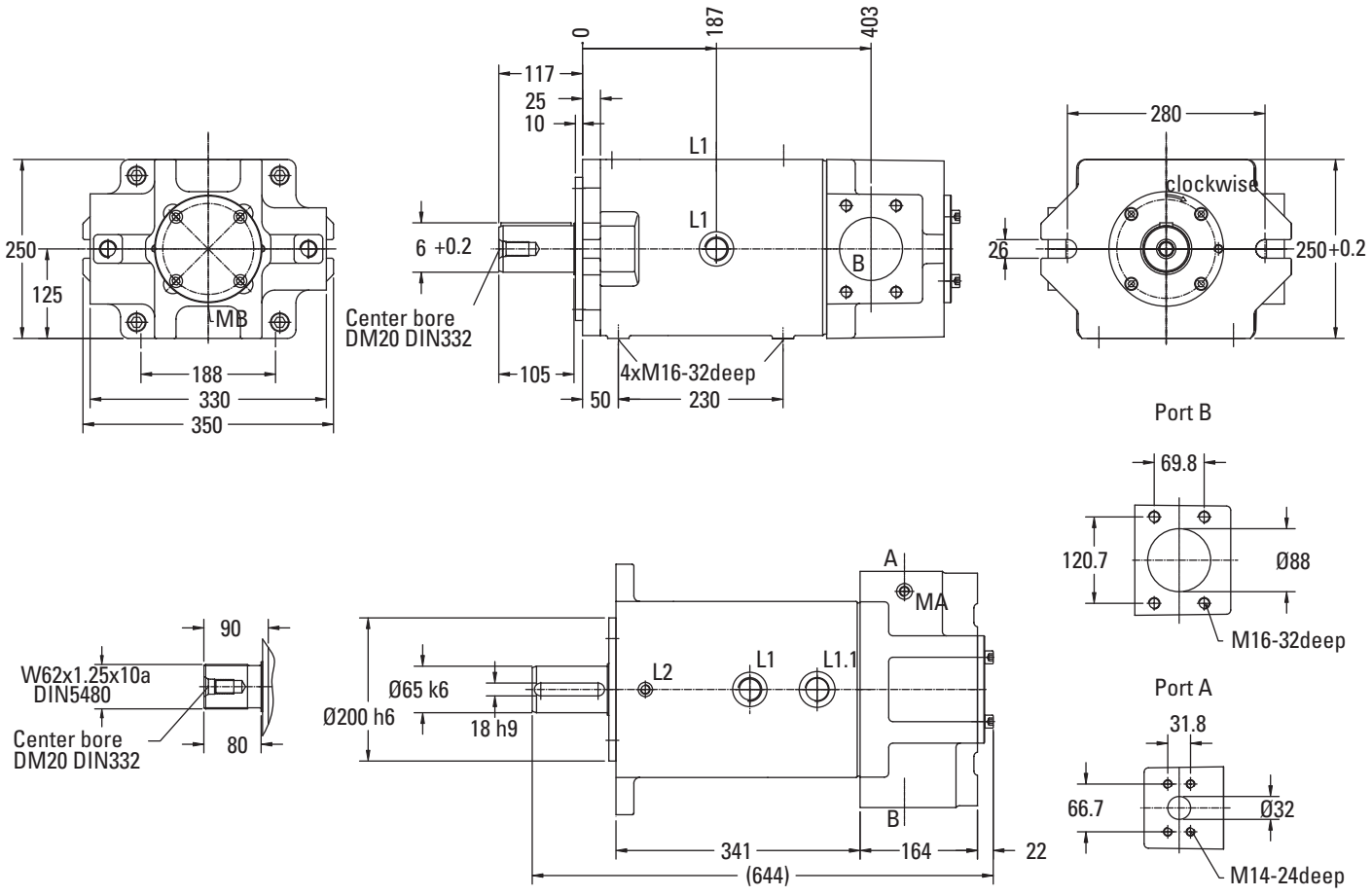
Standard Displacement Size 180 .....180 ccm/rev

Reduced Displacement Available Size 180.....160 ccm/rev

DIRECTION OF ROTATION	INPUT	OUTPUT
Right Hand Rotation	B	A
Left Hand Rotation	A	B

Pump Dimensions - PFXS 250

Dimensions in mm



A	System pressure port SAE 1 1/4", 415 bar (6000 psi)
B	System pressure port SAE 3 1/2'', 35 bar (500 psi)
(L1)	Drain port M26x1.5
(L1.1)	Oil filling plug 1 5/16''-12UN
(L2)	Ventilation port for vertical mounting G1/4"
(MA)	Gauge port system pressure G1/4"
(…)	normally plugged

Non-Standard Displacements:

Standard Displacement .....250 ccm/rev

Reduced Displacement Available.....222, 208 or 194 ccm/rev

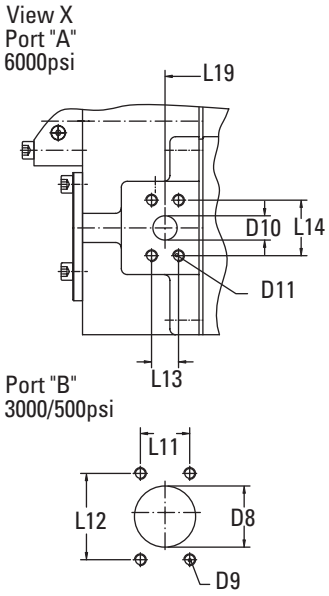
DIRECTION OF ROTATION	INPUT	OUTPUT
Right Hand Rotation	B	A
Left Hand Rotation	A	B

Pump Dimensions - PVXS 066 - 250 DF, Two Stage Pilot Valve

Side ports -
Pressure compensator
DF000A ...

1. Pilot valve (2nd Stage)
2. Pressure compensator (1st stage)

Dimensions in mm



X1 G1/4"x12,5-deep; option for an additional pilot valve and/or discharge valve of the pressure compensator

L1 Two drain ports, one supplied plugged

L2 M18x1, 5x12-deep supplementary drain, or bleed plug. Must be drained in addition to if the pump is installed with the shaft input end pointing upwards.

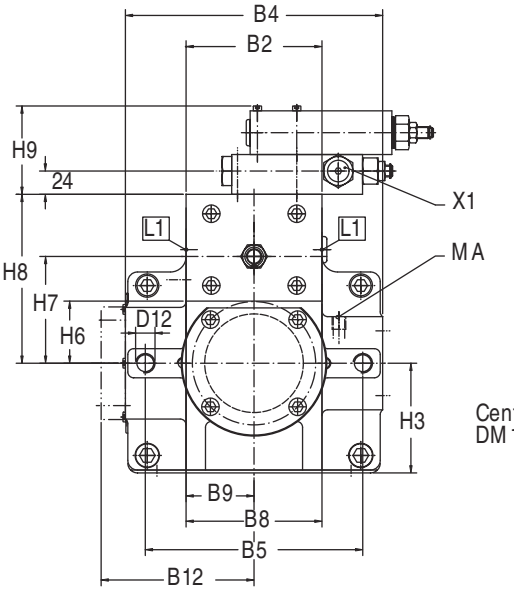
MA G1/4"x12.5-deep gauge port supplied plugged

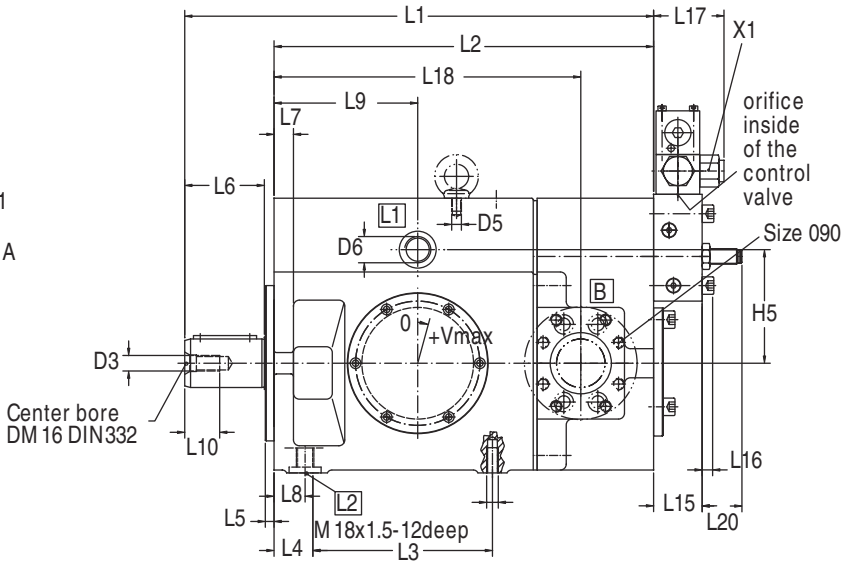
DIRECTION OF ROTATION	CONTROL	INPUT	OUTPUT
Right Hand Rotation	To + Vmax To - Vmax	B A	A B
Left Hand Rotation	To + Vmax To - Vmax	A B	B A

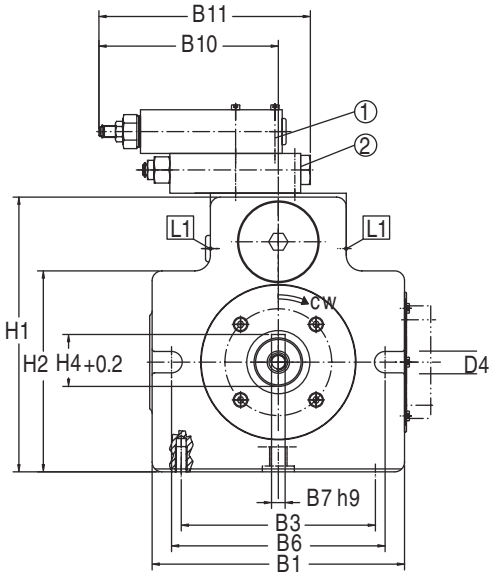
SIZE	SAE-FLANGE "B" 3000(500)PSI, INLET	SAE-FLANGE "A" 6000PSI, OUTLET	WEIGHT KG
066	1 1/2"	1"	55
090	2"	1"	57
130	2 1/2"	1"	111
180	2 1/2"	1 1/4"	113
250	3 1/2"	1 1/4"	226

SIZE	B1	B2	B3	B4	B5	B6	B7 h9	B8	B9	B10	B11	B12
066	210	116	160	235	130	180	10	116	58	185	218	—
090	210	116	160	235	130	180	10	116	58	185	218	157.5
130	260	140	200	265	224	224	14	140	70	185	218	—
180	260	140	200	265	224	224	14	140	70	185	218	—
250	325	175	250	330	280	280	18	175	87.5	185	218	—

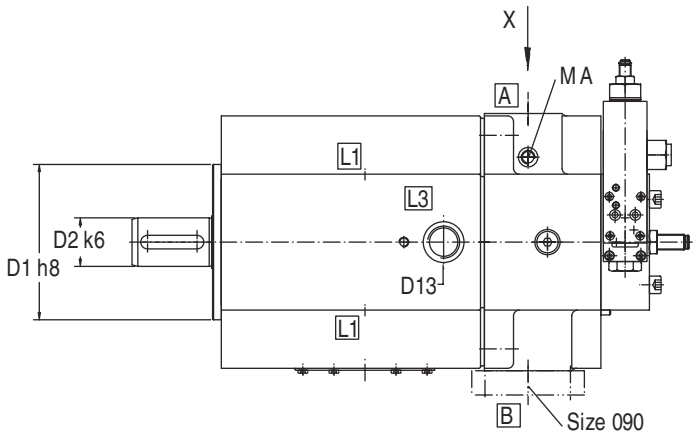
SIZE	D1 h8	D2 k6	D3	D4	D5	D6 Light Execution	D7	DEEP	D8	D9	DEEP	D10	D11	DEEP	D12	D13 SAE 475
066	125	38	M12	18	M8	M22x1.5	M10	24	38	M12	24	25	M12	21	—	7/8-14UNF
090	125	38	M12	18	M8	M22x1.5	M10	20	50	M12	24	25	M12	21	—	7/8-14UNF
130	160	50	M16	22	M10	M26x1.5	M12	20	62	M12	20	25	M12	20	M20	1 1/16-12UNF
180	160	50	M16	22	M10	M26x1.5	M12	20	62	M12	20	32	M14	20	M20	1 1/16-12UNF
250	200	65	M20	26	M12	M33x2	M16	32	90	M16	32	32	M14	24	M24	1 5/16-12UNF







Splined shaft
Dim. See page 51



SIZE	H1	H2	H3	H4 +0.2	H5	H6	H7	H8	H9
066	227	162	90	41	93	53	88	139	91
090	227	162	90	41	93	53	88	139	91
130	283	207	113	53.5	117	64	110	174	91
180	283	207	113	53.5	117	64	110	174	91
250	354	260	140	69	146	77	138	217	91

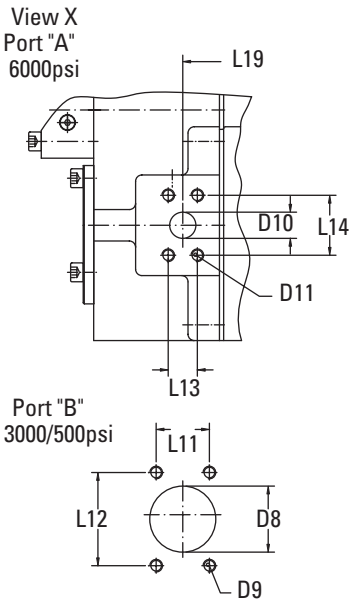
SIZE	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18	L19	L20
066	342	274	150	35	8	58	16	26	120	28	35.7	69.8	27.8	57.2	50	10	72.5	245.6	245.6	31
090	342	274	150	35	8	58	16	26	120	28	42.88	77.77	27.8	57.2	50	10	72.5	245.6	245.6	31
130	483	391	185	40	9	82	20	32	148	36	50.8	89	27.8	57.2	50	12	72.5	316	309	33
180	483	391	185	40	9	82	20	32	148	36	50.8	89	31.8	66.7	50	12	72.5	316	309	33
250	622	505	230	50	10	105	25	41	187	42	69.8	120.7	31.8	66.7	56	—	72.5	403	403	35

Pump Dimensions - PVXS 066 - 250 DF, with Load Sensing Valve

Side ports - Pressure compensator with Load Sensing DF000A1 ...

1. Pilot valve (2nd Stage)
2. Pressure compensator (1st stage)
3. Flow valve

Dimensions in mm



X1 G1/4"x12,5-deep; option for an additional pilot valve and/or discharge valve of the pressure compensator

X2 G1/4"x12,5-deep; load sensing pilot port

L1 Two drain ports, one supplied plugged

L2 M18x1, 5x12-deep supplementary drain, or bleed plug. Must be drained in addition to if the pump is installed with the shaft input end pointing upwards.

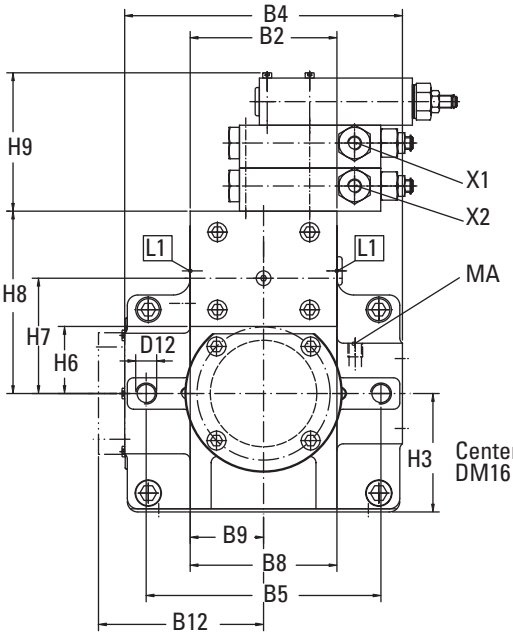
MA G1/4"x12.5-deep gauge port supplied plugged

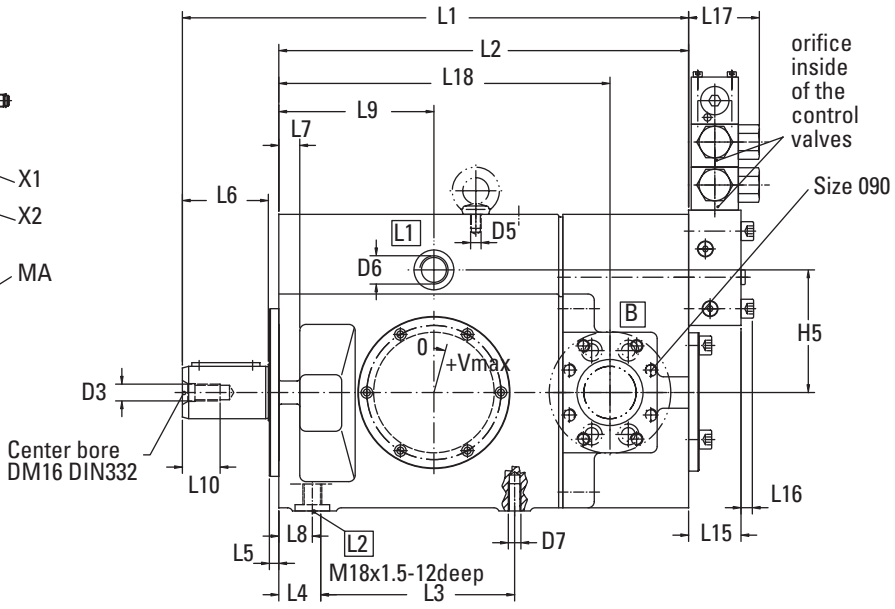
DIRECTION OF ROTATION	CONTROL	INPUT	OUTPUT
Right Hand Rotation	To + Vmax	B	A
	To - Vmax	A	B
Left Hand Rotation	To + Vmax	A	B
	To - Vmax	B	A

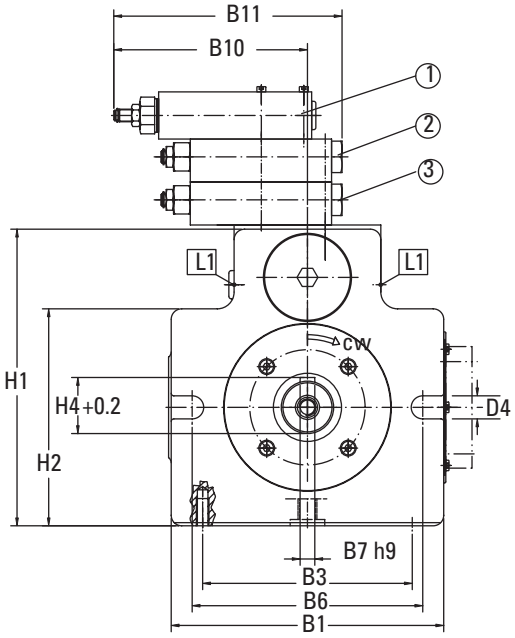
SIZE	SAE-FLANGE "B" 3000(500)PSI, INLET	SAE-FLANGE "A" 6000PSI, OUTLET	WEIGHT KG
066	1 1/2"	1"	55
090	2"	1"	57
130	2 1/2"	1"	111
180	2 1/2"	1 1/4"	113
250	3 1/2"	1 1/4"	226

SIZE	B1	B2	B3	B4	B5	B6	B7 h9	B8	B9	B10	B11	B12
066	210	116	160	235	130	180	10	116	58	185	218	—
090	210	116	160	235	130	180	10	116	58	185	218	157.5
130	260	140	200	265	224	224	14	140	70	185	218	—
180	260	140	200	265	224	224	14	140	70	185	218	—
250	325	175	250	330	280	280	18	175	87.5	185	218	—

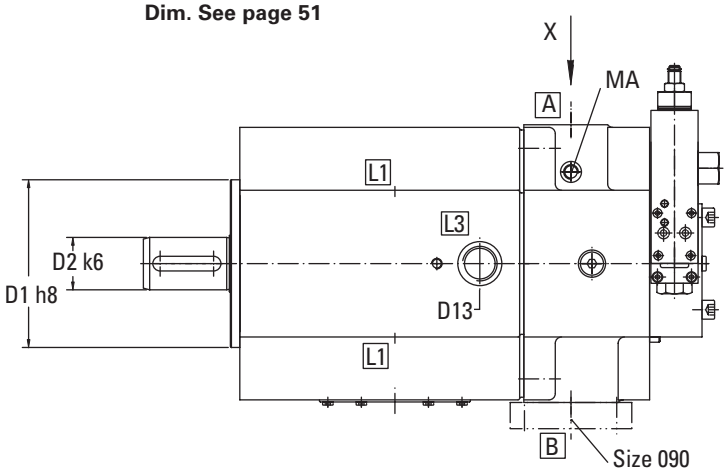
SIZE	D1 h8	D2 k6	D3	D4	D5	D6 Light Execution	D7	DEEP	D8	D9	DEEP	D10	D11	DEEP	D12	D13 SAE 475
066	125	38	M12	18	M8	M22x1.5	M10	24	38	M12	24	25	M12	21	—	7/8-14UNF
090	125	38	M12	18	M8	M22x1.5	M10	20	50	M12	24	25	M12	21	—	7/8-14UNF
130	160	50	M16	22	M10	M26x1.5	M12	20	62	M12	20	25	M12	20	M20	1 1/16-12UNF
180	160	50	M16	22	M10	M26x1.5	M12	20	62	M12	20	32	M14	20	M20	1 1/16-12UNF
250	200	65	M20	26	M12	M33x2	M16	32	90	M16	32	32	M14	24	M24	1 5/16-12UNF







Splined shaft
Dim. See page 51



SIZE	H1	H2	H3	H4 +0.2	H5	H6	H7	H8	H9
066	227	162	90	41	93	53	88	139	132
090	227	162	90	41	93	53	88	139	132
130	283	207	113	53.5	117	64	110	174	132
180	283	207	113	53.5	117	64	110	174	132
250	354	260	140	69	146	77	138	217	132

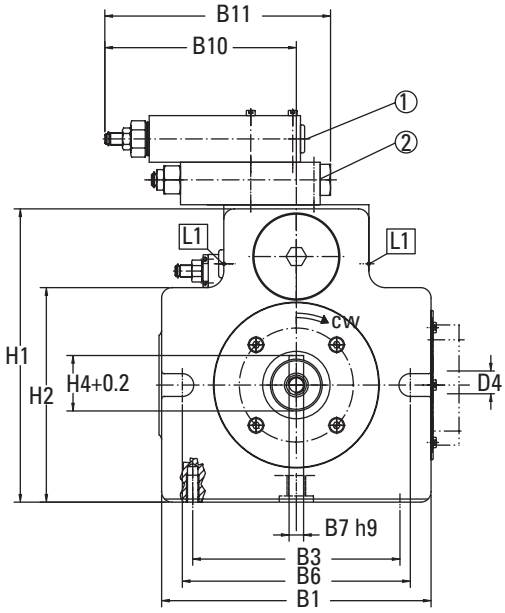
SIZE	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18	L19
066	342	274	150	35	8	58	16	26	120	28	35.7	69.8	27.8	57.2	50	10	67.5	245.6	245.6
090	342	274	150	35	8	58	16	26	120	28	42.88	77.77	27.8	57.2	50	10	67.5	245.6	245.6
130	483	391	185	40	9	82	20	32	148	36	50.8	89	27.8	57.2	50	12	67.5	316	306
180	483	391	185	40	9	82	20	32	148	36	50.8	89	31.8	66.7	50	12	67.5	316	306
250	622	505	230	50	10	105	25	41	187	42	69.8	120.7	31.8	66.7	56	—	70.5	403	403

Pump Dimensions - PVXS 066 - 250 LR, with Pressure Limiter

Side ports -
Power Control LR
(with pressure limiter)
LR000A2 ...

1. Pilot valve (2nd Stage)
2. Pressure compensator (1st stage)
3. Constant power control

Dimensions in mm

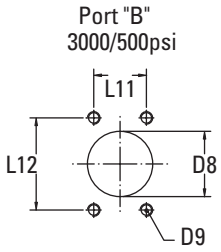


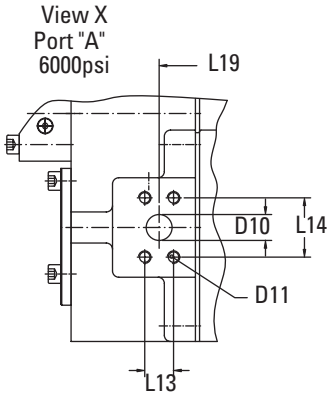
X1 G1/4"x12,5-deep; option for an additional pilot valve and/or discharge valve of the pressure compensator

L1 Two drain ports, one supplied plugged

L2 M18x1, 5x12-deep supplementary drain, or bleed plug. Must be drained in addition to if the pump is installed with the shaft input end pointing upwards.

MA G1/4"x12.5-deep gauge port supplied plugged



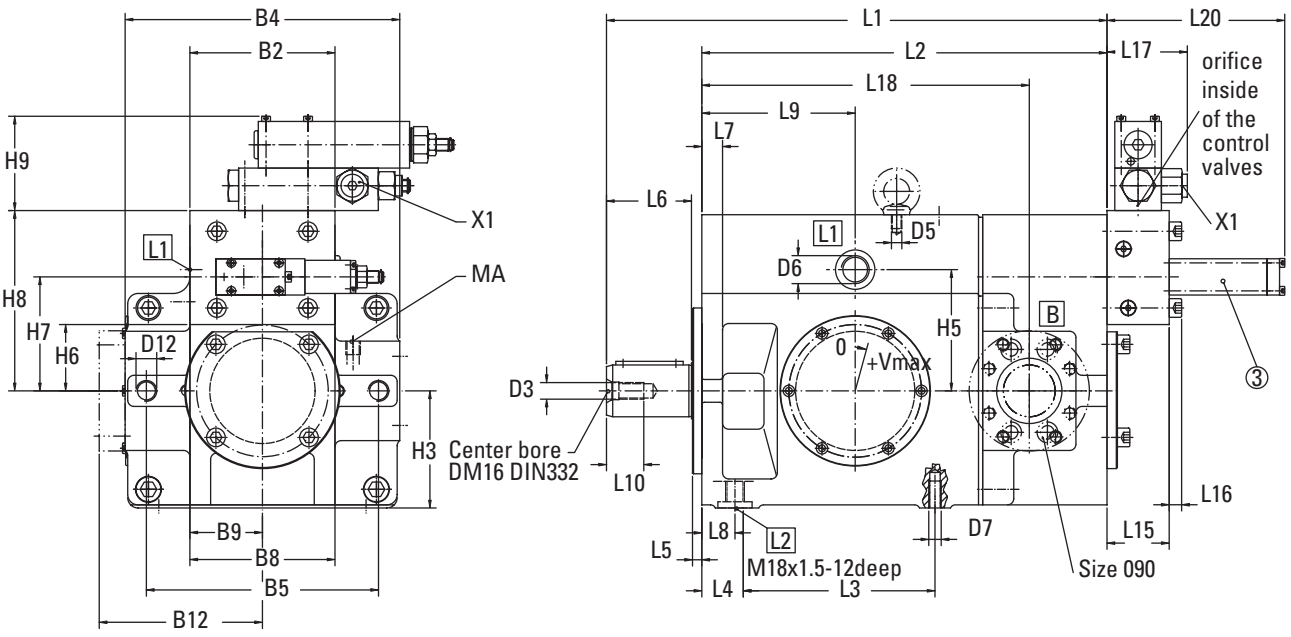


DIRECTION OF ROTATION	CONTROL	INPUT	OUTPUT
Right Hand Rotation	To + Vmax	B	A
	To - Vmax	A	B
Left Hand Rotation	To + Vmax	A	B
	To - Vmax	B	A

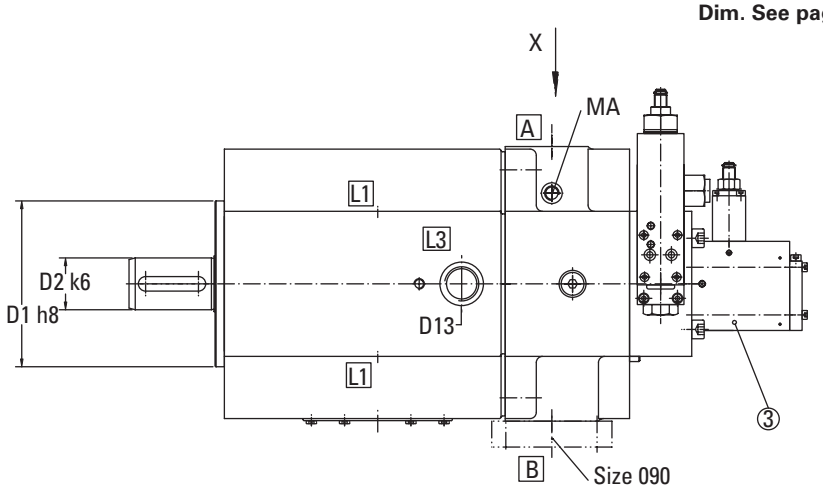
SIZE	SAE-FLANGE "B" 3000(500)PSI, INLET	SAE-FLANGE "A" 6000PSI, OUTLET	WEIGHT KG
066	1 1/2"	1"	55
090	2"	1"	57
130	2 1/2"	1"	111
180	2 1/2"	1 1/4"	113
250	3 1/2"	1 1/4"	226

SIZE	B1	B2	B3	B4	B5	B6	B7 h9	B8	B9	B10	B11	B12
066	210	116	160	235	130	180	10	116	58	185	218	—
090	210	116	160	235	130	180	10	116	58	185	218	157.5
130	260	140	200	265	224	224	14	140	70	185	218	—
180	260	140	200	265	224	224	14	140	70	185	218	—
250	325	175	250	330	280	280	18	175	87.5	185	218	—

SIZE	D1 h8	D2 k6	D3	D4	D5	D6 Light Execution	D7	DEEP	D8	D9	DEEP	D10	D11	DEEP	D12	D13 SAE 475
066	125	38	M12	18	M8	M22x1.5	M10	24	38	M12	24	25	M12	21	—	7/8-14UNF
090	125	38	M12	18	M8	M22x1.5	M10	20	50	M12	24	25	M12	21	—	7/8-14UNF
130	160	50	M16	22	M10	M26x1.5	M12	20	62	M12	20	25	M12	20	M20	1 1/16-12UNF
180	160	50	M16	22	M10	M26x1.5	M12	20	62	M12	20	32	M14	20	M20	1 1/16-12UNF
250	200	65	M20	26	M12	M33x2	M16	32	90	M16	32	32	M14	24	M24	1 5/16-12UNF



Splined shaft
Dim. See page 51



SIZE	H1	H2	H3	H4 +0.2	H5	H6	H7	H8	H9
066	227	162	90	41	93	53	88	139	91
090	227	162	90	41	93	53	88	139	91
130	283	207	113	53.5	117	64	110	174	91
180	283	207	113	53.5	117	64	110	174	91
250	354	260	140	69	146	77	138	217	91

SIZE	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18	L19	L20
066	342	274	150	35	8	58	16	26	120	28	35.7	69.8	27.8	57.2	50	10	72.5	245.6	245.6	161
090	342	274	150	35	8	58	16	26	120	28	42.88	77.77	27.8	57.2	50	10	72.5	245.6	245.6	161
130	483	391	185	40	9	82	20	32	148	36	50.8	89	27.8	57.2	60	12	72.5	316	306	171
180	483	391	185	40	9	82	20	32	148	36	50.8	89	31.8	66.7	60	12	72.5	316	306	171
250	622	505	230	50	10	105	25	41	187	42	69.8	120.7	31.8	66.7	112	—	75.5	403	403	199.5

Pump Dimensions - PVXS 066 - 250 ES

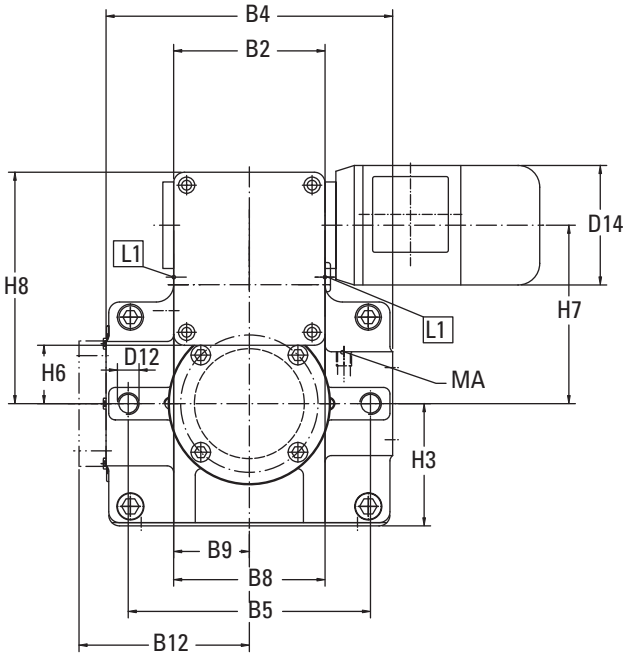
Side ports -
Electric Motor
Displacement Control
ES*00A ...

Dimensions in mm

L1 Two drain ports, one supplied plugged

L2 M18x1, 5x12-deep supplementary drain, or bleed plug. Must be drained in addition to if the pump is installed with the shaft input end pointing upwards.

MA G1/4"x12.5-deep gauge port supplied plugged

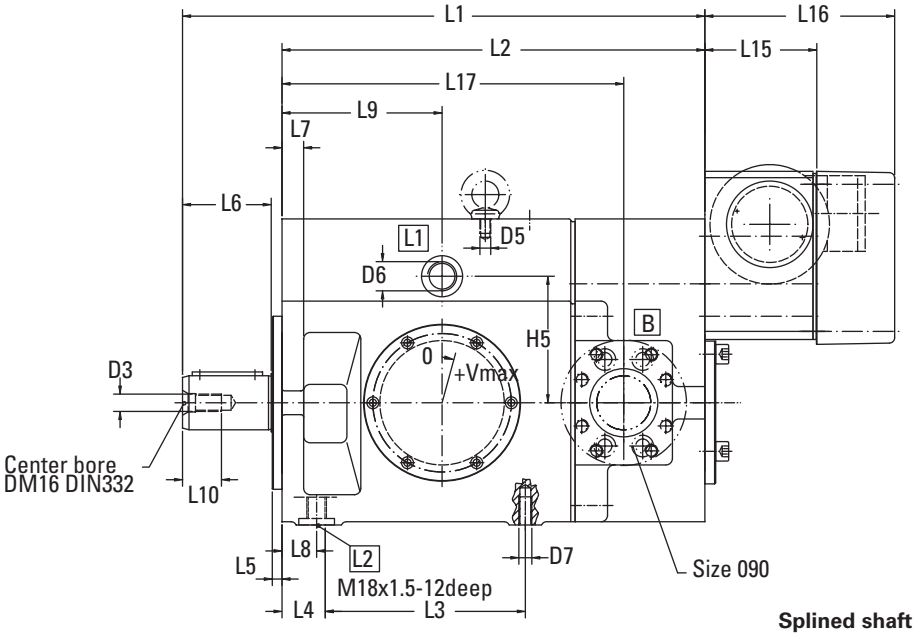


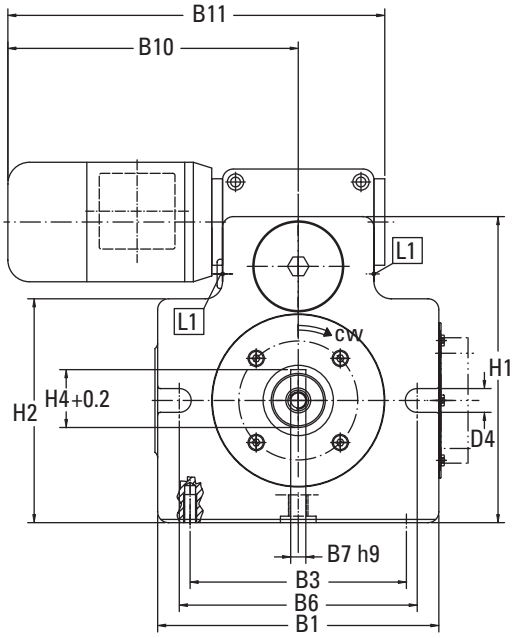
DIRECTION OF ROTATION	CONTROL	INPUT	OUTPUT
Right Hand Rotation	To + Vmax	B	A
	To - Vmax	A	B
Left Hand Rotation	To + Vmax	A	B
	To - Vmax	B	A

SIZE	SAE-FLANGE "B" 3000(500)PSI, INLET	SAE-FLANGE "A" 6000PSI, OUTLET	WEIGHT KG
066	1 1/2"	1"	55
090	2"	1"	57
130	2 1/2"	1"	111
180	2 1/2"	1 1/4"	113
250	3 1/2"	1 1/4"	226

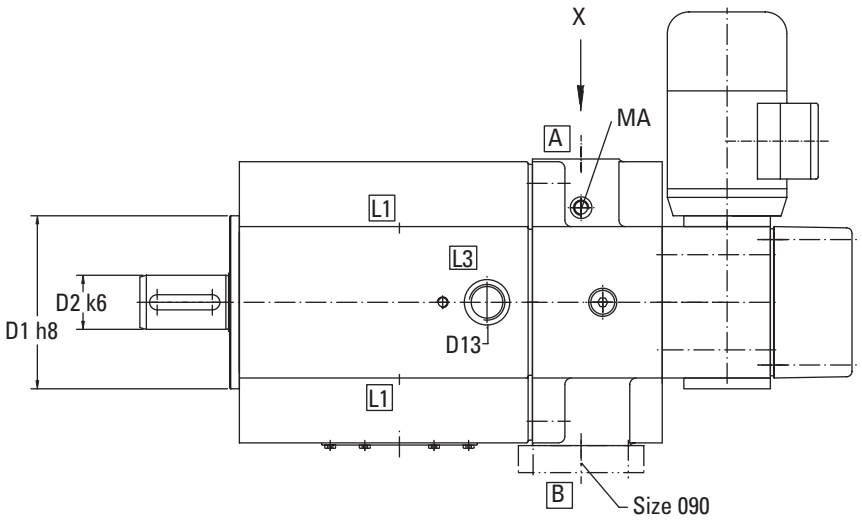
SIZE	B1	B2	B3	B4	B5	B6	B7 h9	B8	B9	B10	B11	B12
066	210	116	160	235	130	180	10	116	58	276.5	334.5	—
090	210	116	160	235	130	180	10	116	58	276.5	334.5	157.5
130	260	140	200	265	224	224	14	140	70	288.5	368.5	—
180	260	140	200	265	224	224	14	140	70	288.5	368.5	—
250	325	180	250	330	280	280	18	175	87.5	332.7	434.7	—

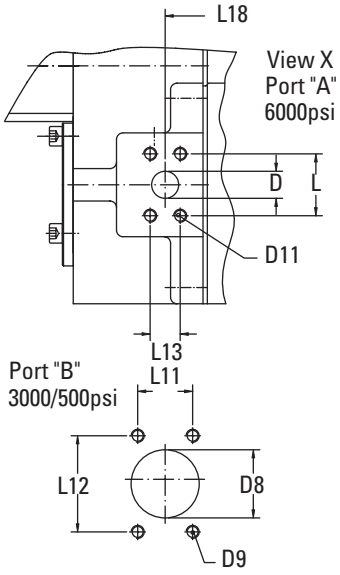
SIZE	D1 h8	D2 k6	D3	D4	D5	D6 Light Execution	D7	DEEP	D8	D9	DEEP	D10	D11	DEEP	D12	D13 SAE 475	D14
066	125	38	M12	18	M8	M22x1.5	M10	24	38	M12	24	25	M12	21	—	7/8-14UNF	110.5
090	125	38	M12	18	M8	M22x1.5	M10	20	50	M12	24	25	M12	21	—	7/8-14UNF	110.5
130	160	50	M16	22	M10	M26x1.5	M12	20	62	M12	20	25	M12	20	M20	1 1/16-12UNF	110.5
180	160	50	M16	22	M10	M26x1.5	M12	20	62	M12	20	32	M14	20	M20	1 1/16-12UNF	110.5
250	200	65	M20	26	M12	M33x2	M16	32	90	M16	32	32	M14	24	M24	1 5/16-12UNF	123





Splined shaft
Dim. See page 51





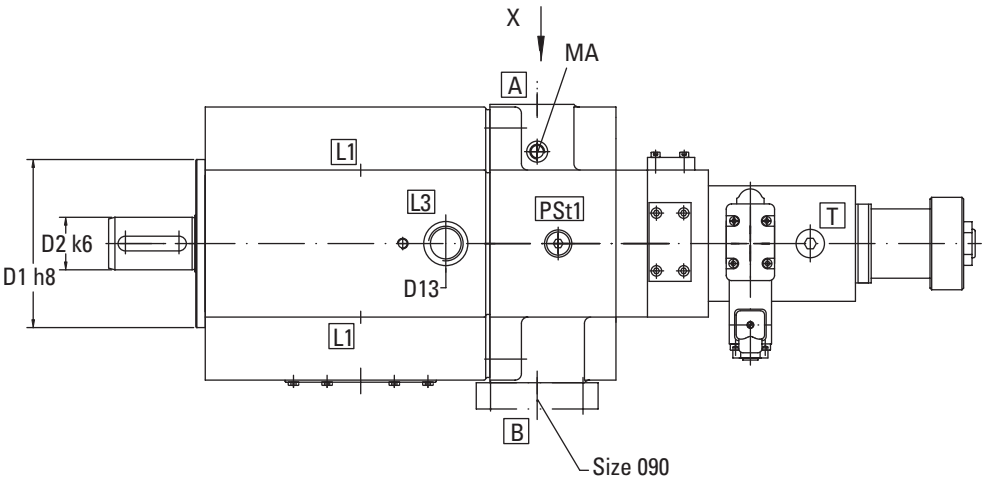
SIZE	H1	H2	H3	H4 +0.2	H5	H6	H7	H8
066	227	162	90	41	93	53	122	168
090	227	162	90	41	93	53	122	168
130	283	207	113	53.5	117	58.5	165	214
180	283	207	113	53.5	117	58.5	165	214
250	354	260	140	69	146	77	198	262

SIZE	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18
066	342	274	150	35	8	58	16	26	120	28	35.7	69.8	27.8	57.2	78	153.5	7245.6	245.6
090	342	274	150	35	8	58	16	26	120	28	42.88	77.77	27.8	57.2	78	153.5	245.6	245.6
130	483	391	185	40	9	82	20	32	148	36	50.8	89	27.8	57.2	100	175.5	316	306
180	483	391	185	40	9	82	20	32	148	36	50.8	89	31.8	66.7	100	175.5	316	306
250	622	505	230	50	10	105	25	41	187	42	69.8	120.7	31.8	66.7	88	163.5	403	403

Pump Dimensions - PVXS 066 - 250

Side ports -
Pressure Signal
Displacement Control
DP*00A ...

1. Pressure proportional valve
2. Pressure limiter



Dimensions in mm

T G1/2" Tank port

SSt G3/4" Suction port of pilot pump

PSt G3/4" Port of pilot pressure

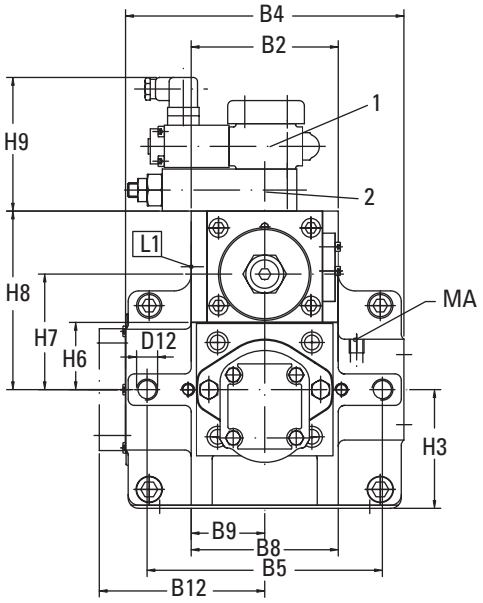
PSt1 Port of pilot pressure Size 006/090=M14x1.5
Size 130/180=M16x1.5
Size 250=G1/2"(M22x1.5)

L1 Two drain ports, one supplied plugged

L2 M18x1, 5x12-deep supplementary drain, or bleed plug. Must be drained in addition to if the pump is installed with the shaft input end pointing upwards.

MA G1/4"x12.5-deep gauge port supplied plugged

Splined shaft
Dim. See page 51

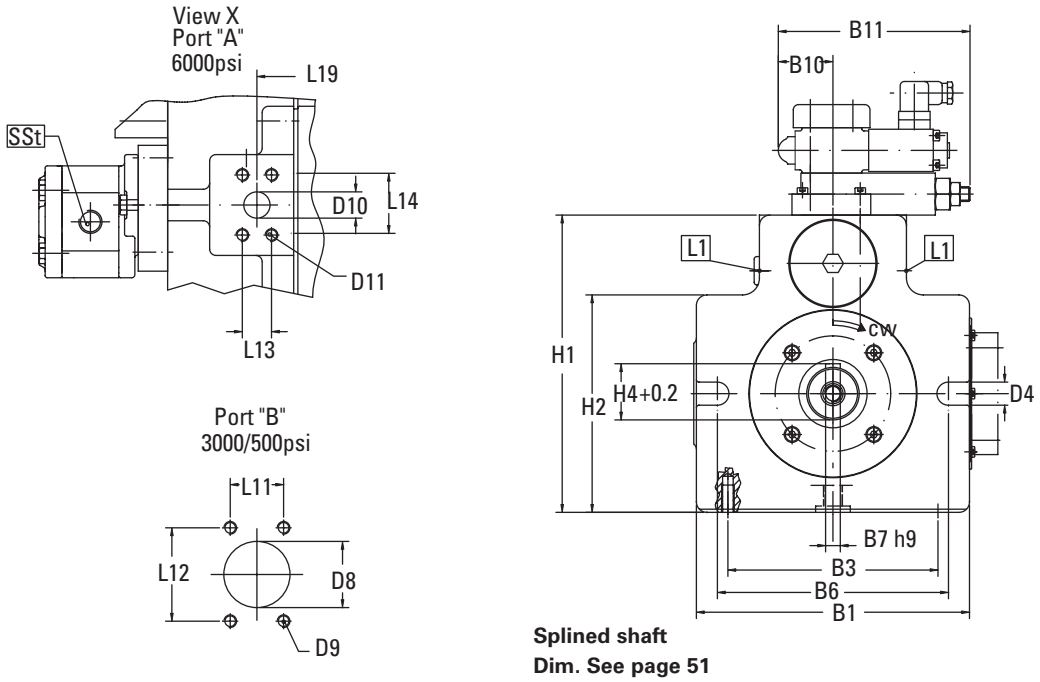


DIRECTION OF ROTATION	CONTROL	INPUT	OUTPUT
Right Hand Rotation	To + Vmax To - Vmax	B A	A B
Left Hand Rotation	To + Vmax To - Vmax	A B	B A

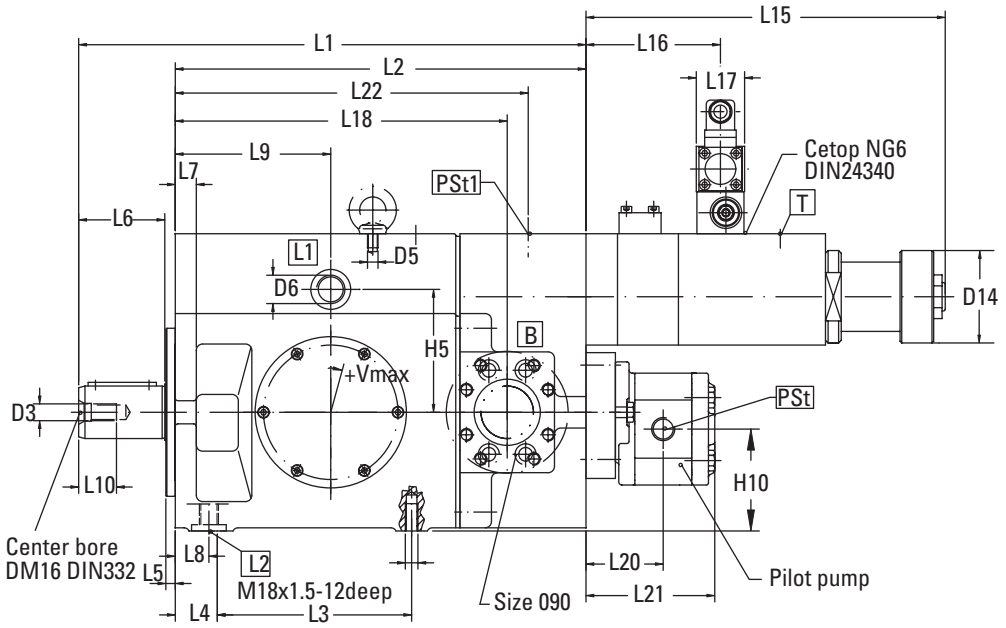
SIZE	SAE-FLANGE "B" 3000(500)PSI, INLET	SAE-FLANGE "A" 6000PSI, OUTLET	WEIGHT KG
066	1 1/2"	1"	55
090	2"	1"	57
130	2 1/2"	1"	111
180	2 1/2"	1 1/4"	113
250	3 1/2"	1 1/4"	226

SIZE	B1	B2	B3	B4	B5	B6	B7 h9	B8	B9	B10	B11	B12
066	210	116	160	235	130	180	10	116	58	52	182.5	—
090	210	116	160	235	130	180	10	116	58	52	182.5	157.5
130	260	140	200	265	224	224	14	140	70	52	182.5	—
180	260	140	200	265	224	224	14	140	70	52	182.5	—
250	325	180	250	330	280	280	18	175	87.5	52	182.5	—

SIZE	D1 h8	D2 k6	D3	D4	D5	D6 Light Execution	D7	DEEP	D8	D9	DEEP	D10	D11	DEEP	D12	D13 SAE 475	D14
066	125	38	M12	18	M8	M22x1.5	M10	24	38	M12	24	25	M12	21	—	7/8-14UNF	64
090	125	38	M12	18	M8	M22x1.5	M10	20	50	M12	24	25	M12	21	—	7/8-14UNF	64
130	160	50	M16	22	M10	M26x1.5	M12	20	62	M12	20	25	M12	20	M20	1 1/16-12UNF	88
180	160	50	M16	22	M10	M26x1.5	M12	20	62	M12	20	32	M14	20	M20	1 1/16-12UNF	88
250	200	65	M20	26	M12	M33x2	M16	32	90	M16	32	32	M14	24	M24	1 5/16-12UNF	88



Splined shaft
Dim. See page 51



SIZE	H1	H2	H3	H4 +0.2	H5	H6	H7	H8	H9	H10	H11
066	227	162	90	41	93	53	88	137	127	97	113
090	227	162	90	41	93	53	88	137	127	97	113
130	283	207	113	53.5	117	64	110	170	127	97	131
180	283	207	113	53.5	117	64	110	170	127	97	131
250	354	260	140	69	146	77	138	214	127	124	167

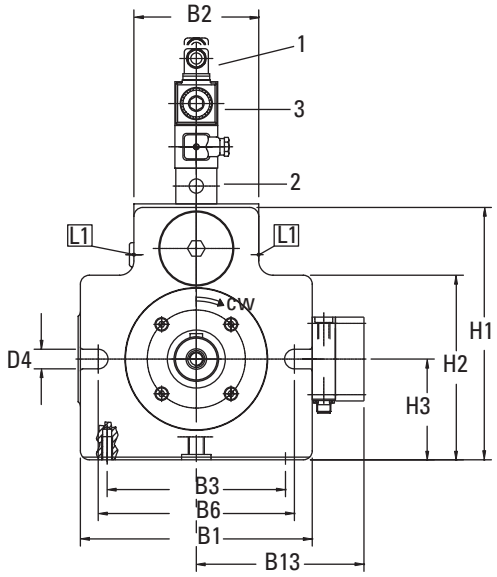
SIZE	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18	L19	L20	L21	L22
066	342	274	150	35	8	58	16	26	120	28	35.7	69.8	27.8	57.2	267	104	46	245.6	245.6	73.5	122.6	230.6
090	342	274	150	35	8	58	16	26	120	28	42.88	77.77	27.8	57.2	267	104	46	245.6	245.6	73.5	122.6	230.6
130	483	391	185	40	9	82	20	32	148	36	50.8	89	27.8	57.2	342	128	46	316	306	73.5	122.6	336
180	483	391	185	40	9	82	20	32	148	36	50.8	89	31.8	66.7	342	128	46	316	306	73.5	122.6	336
250	622	505	230	50	10	105	25	41	187	42	69.8	120.7	31.8	66.7	387	150	46	403	403	73.5	122.6	437

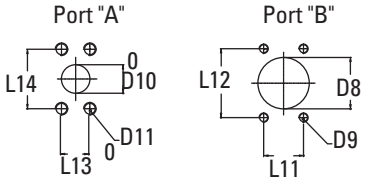
Pump Dimensions - PVXS 066 - 250

Side ports - Proportional Valve Displacement Control SPC03A.....E...

1. Proportional valve
2. Pressure limiter
3. Filter

Dimensions in mm





T G1/2″

Pst G1/2″

Mst G1/4″

L1 Two drain ports, one supplied plugged

L2 M18x1, 5x12-deep supplementary drain, or bleed plug. Must be drained in addition to if the pump is installed with the shaft input end pointing upwards.

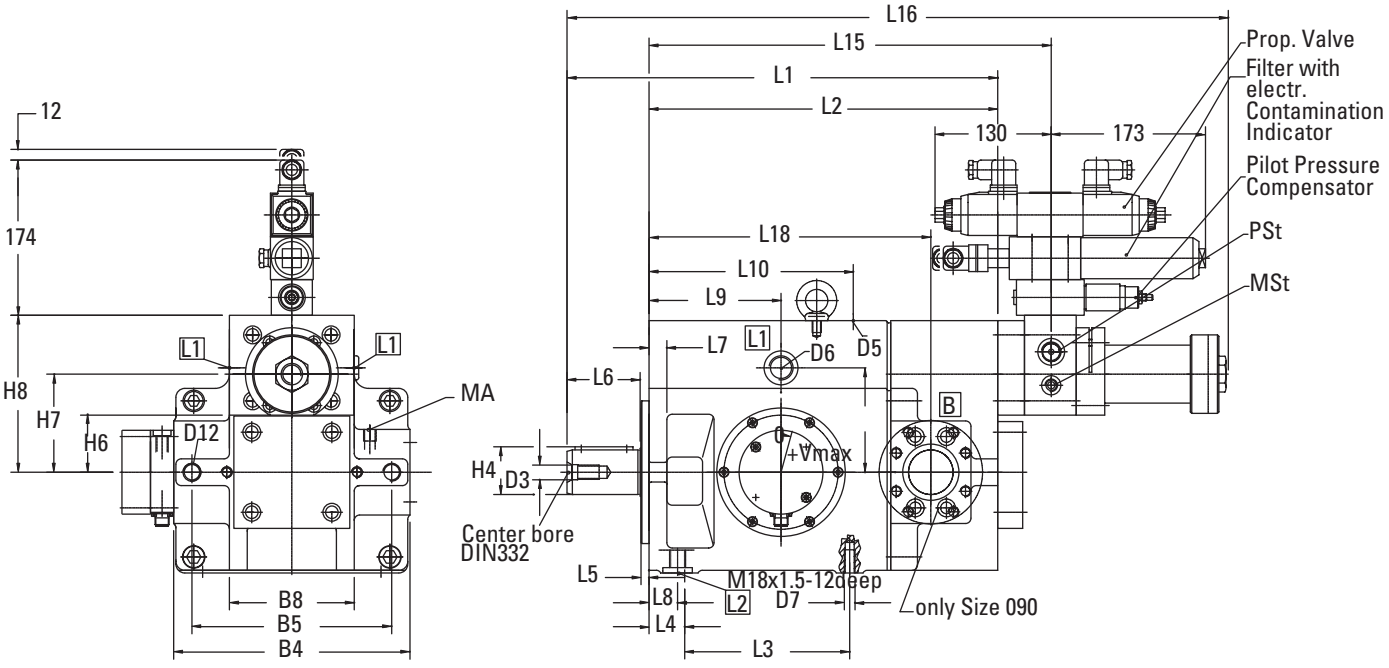
MA G1/4"x12.5-deep gauge port supplied plugged

DIRECTION OF ROTATION	CONTROL	INPUT	OUTPUT
Right Hand Rotation	To + Vmax	B	A
	To - Vmax	A	B
Left Hand Rotation	To + Vmax	A	B
	To - Vmax	B	A

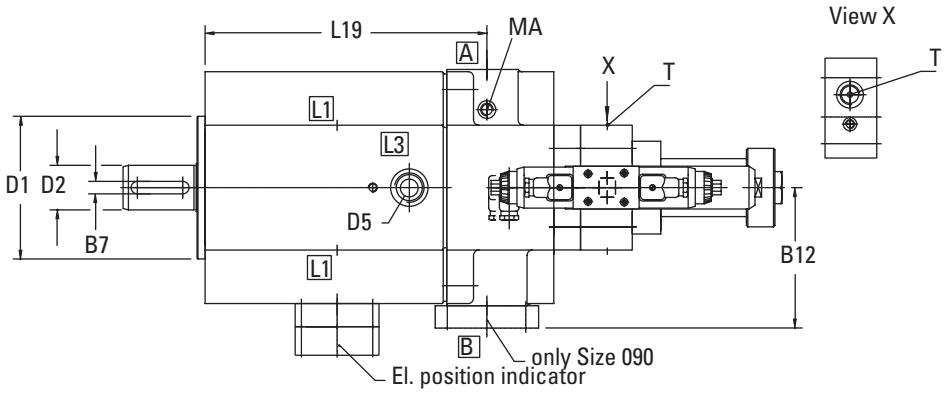
SIZE	SAE-FLANGE "B" 3000(500)PSI, INLET	SAE-FLANGE "A" 6000PSI, OUTLET	WEIGHT KG
066	1 1/2″	1″	55
090	2″	1″	57
130	2 1/2″	1″	111
180	2 1/2″	1 1/4″	113
250	3 1/2″	1 1/4″	226

SIZE	B1	B2	B3	B4	B5	B6	B7 h9	B8	B12	B13
066	210	116	160	235	130	180	10	116	—	165
090	210	116	160	235	130	180	10	116	157.5	165
130	260	140	200	265	224	224	14	140	—	190
180	260	140	200	265	224	224	14	140	—	190
250	325	175	250	330	280	280	18	175	—	221

SIZE	D1 h8	D2 k6	D3	D4	D5	D6 Light Execution	D7	DEEP	D8	D9	DEEP	D10	D11	DEEP	D12
066	125	38	M12	—	7/8-UNF	M22x1.5	M10	20	38	M12	24	25	M12	21	—
090	125	38	M12	18	7/8-UNF	M22x1.5	M10	20	50	M12	24	25	M12	21	—
130	160	50	M16	22	1 1/16-UNF	M26x1.5	M12	20	62	M12	20	25	M12	20	M20
180	160	50	M16	22	1 1/16-UNF	M26x1.5	M12	20	62	M12	20	32	M14	20	M20
250	200	65	M20	26	1 1/16-UNF	M33x2	M16	32	90	M16	32	32	M14	24	M24



Splined shaft
Dim. See page 51



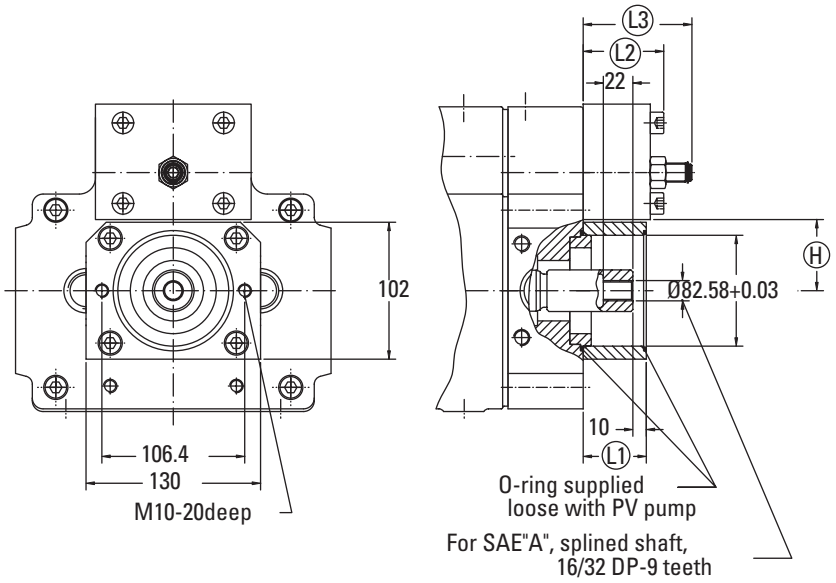
SIZE	H1	H2	H3	H4 +0.2	H5	H6	H7	H8
066	227	162	90	41	93	53	88	139
090	227	162	90	41	93	53	88	139
130	283	207	113	53.5	117	64	110	176
180	283	207	113	53.5	117	64	110	176
250	354	260	140	69	146	77	138	220

SIZE	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L18	L19	L20	L21
066	342	274	150	35	8	58	16	26	120	185	35.7	69.8	27.8	57.2	328	576	245.6	245.6	68	58
090	342	274	150	35	8	58	16	26	120	185	42.88	77.77	27.8	57.2	328	576	245.6	245.6	68	58
130	483	391	185	40	9	82	20	32	148	229	50.8	89	27.8	57.2	451	738	316	306	78	68
180	483	391	185	40	9	82	20	32	148	229	50.8	89	31.8	66.7	451	738	316	306	78	68
250	622	505	230	50	10	105	25	41	187	281	69.8	120.7	31.8	66.7	579	931	403	403	90	80

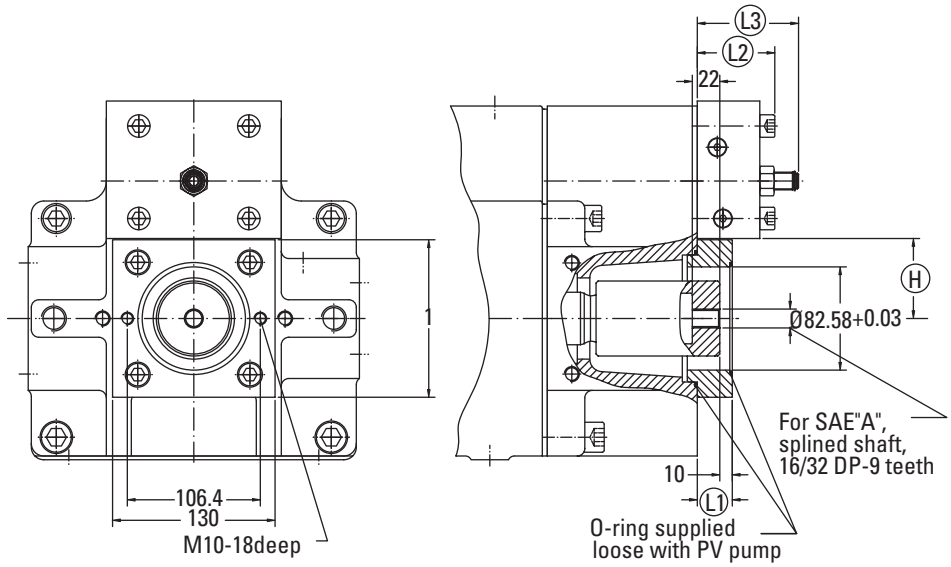
Pump Dimensions - PVXS Thru-Drive

Mounting, Thru-Drive Options
SAE "A" and SAE "B"

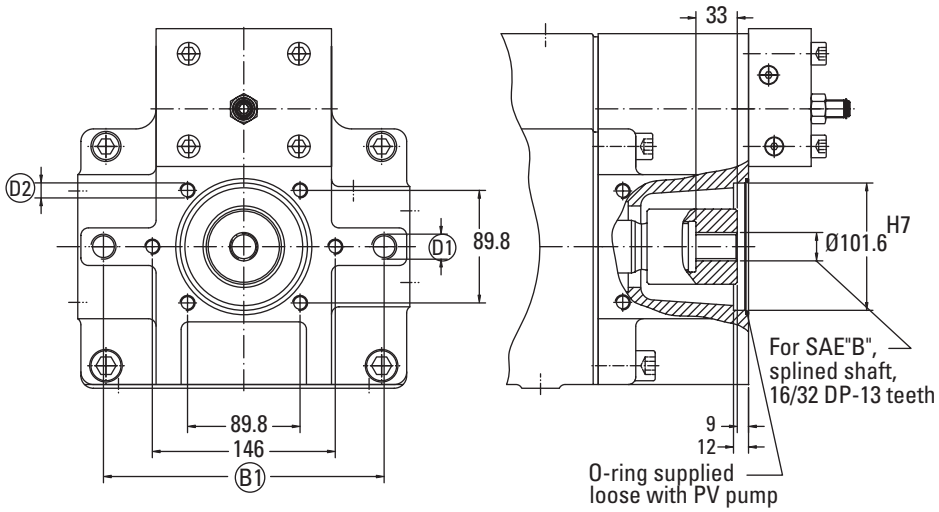
PVX 066 / 090
SAE "A"



PVX 130 / 180 / 250
SAE "A"



PVX 130 / 180 / 250
SAE "B"

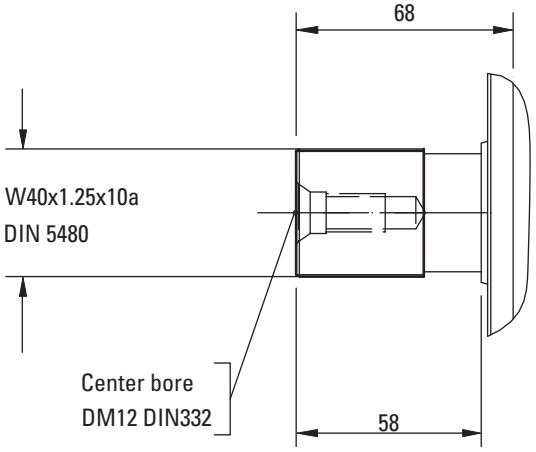


SIZE	THROUGH SHAFT	B1	D1	D2	L1	L2	L3	H
066/090	SAE "A"	—	—	—	47	60	81	53
130/180	SAE "A"	224	M20-30 deep	M12-20 deep	28	62	81	64
	SAE "B"	—	—	—	—	62	81	64
250	SAE "A"	280	M24-38 deep	M12-24 deep	28	56	91	77
	SAE "B"	—	—	—	—	56	91	77

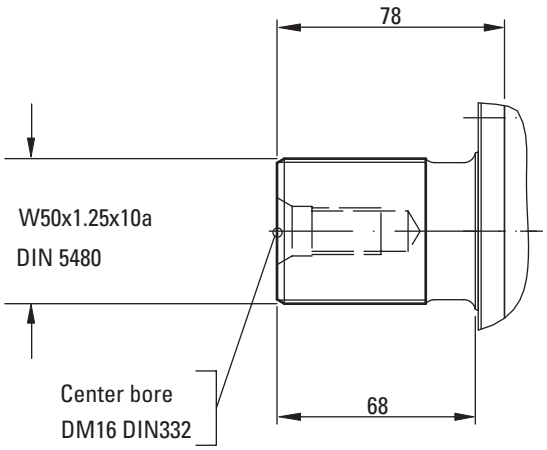
Pump Dimensions - Splined Shafts

For Variable Displacement Pumps (PVXS) Only

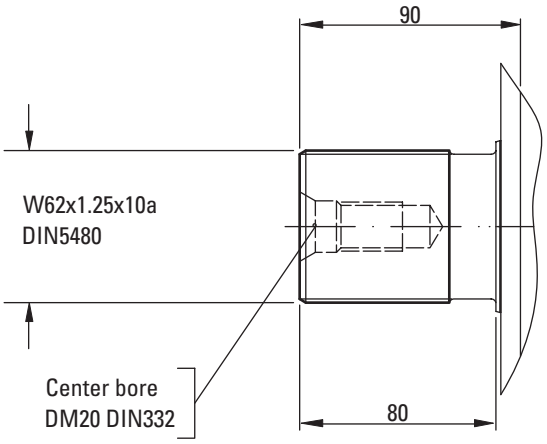
Size 066 / 090



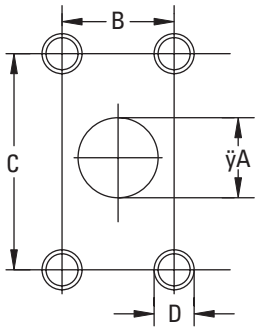
Size 130 / 180



Size 250



Pump Dimensions - PVXS SAE 4-Bolt Mounting Pads



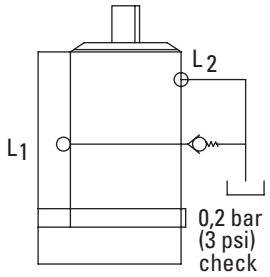
	DIM.	CODE 61 SERIES				CODE 62 SERIES	
		1 1/2"	2"	2 1/2"	3 1/2"	1"	1 1/4"
	A	38	50	62	90	25	32 max
	B	35,7	42,9	50,8	69,8	27,8	31,8
	C	69,8	77,8	89	120,7	57,2	66,7
	D	M12x20	M12x20	M12x20	M16x26	M12x18	M14x24
PFX / PVX 066	Inlet	•					
	Outlet					•	
PFX / PVX 090	Inlet		•				
	Outlet					•	
PFX / PVX 130	Inlet			•			
	Outlet					•	
PFX / PVX 180	Inlet			•			
	Outlet						•
PFX / PVX 250	Inlet				•		
	Outlet						•

Thru-drive Shaft Output Torque

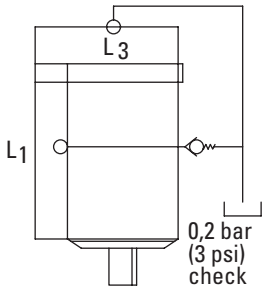
	MAX. OUTPUT TORQUE, NM (LB.FT)		
Pump Size	Keyed Shaft Increasing Load	Keyed Shaft Increasing Load	Splined Shaft
066	520 (383)	260 (190)	660 (485)
090	520 (383)	260 (190)	660 (485)
130	720 (530)	360 (265)	900 (665)
180	720 (530)	360 (265)	900 (665)
250	1400 (1032)	1400 (1032)	2500 (1843)

Installation **Drain piping**

Shaft up



Shaft down



Application Data - Fluid Recommendations

Case Flushing Requirements

A check valve must not be used in the drain pipe. The drain pipe must interminate below the oil level in the reservoir.

For all other conditions with low pressure <20 bar (<300 psi) and low flow (<10% of Q_{max}) case flushing is required.

For operation with special fluids HFB and HFC, case flushing is recommended.

Flushing Flow

Flushing flow via the pump case should be >1% of maximum pump flow. Maximum flushing flow depends on case pressure.

Notes:

- All listed ratings are based on the use of a good quality fluid.
- Alternative fluids have a reduced tolerance for contamination over petroleum base fluids. Good filtration is therefore critical.
- The pumps will provide exceptional life when used with a good quality clean fluid at the pump ratings specified for that fluid.

Fluids

Pumps in the catalog are primarily designed to operate with conventional petroleum based hydraulic oil. Alternative fluids and restrictions:

- Fluid maintenance is critical to the durability of all hydraulic components, and particularly so with hydraulic pumps. This becomes even more of a factor when alternative fluids are used. All types of alternative fluids require extensive maintenance in order to maintain proper levels of water content, acidity, viscosity and contamination.

Fluid Cleanliness

These pumps are rated for anti-wear petroleum fluids with a contamination level of 18/15/13 per ISO 4406. Operation in fluids with levels more contamination than this is not recommended and may reduce the life of the pump components. Fluids other than petroleum, severe service cycles, or temperature extremes are cause for adjustment of these codes. Please contact your Eaton representative for special duty cycle recommendations.

Eaton pumps, as well as 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 inclusion of air.

Essential information on the correct methods for treating hydraulic fluid is included in Eaton publication 561- "Vickers Guide to Systemic Contamination Control"- available from your local Eaton distributor.

In this publication, filtration and cleanliness levels for extending the life of axial piston pumps and other system components are listed. Included is an excellent discussion of the selection of products needed to control fluid condition.

Ordering Procedure

When ordering please specify full model designation of items required; see "Model Codes" section of this catalog.

Note the following:

- Designation of variable displacement pumps must include the supplementary designation of the required control.

FLUIDS

Type	Classification	Max. Pressure Bar	Max. Speed rpm	Recommended Seal Material	Max Operating Temperature °C	Bearing Life
Oil in Water Emulsion	HFAE	Not Rated				0
Water in Oil Emulsion	HFB	250	1800	Fluorocarbon	49	50%
Water Glycol	HFC	250	1800	Fluorocarbon	49	25%
Phosphate Ester	HFDR	350/420	1800	Fluorocarbon	66	100%
Polyol Ester	HFDU	350/420	1800	Fluorocarbon	66	100%

Notes

Notes

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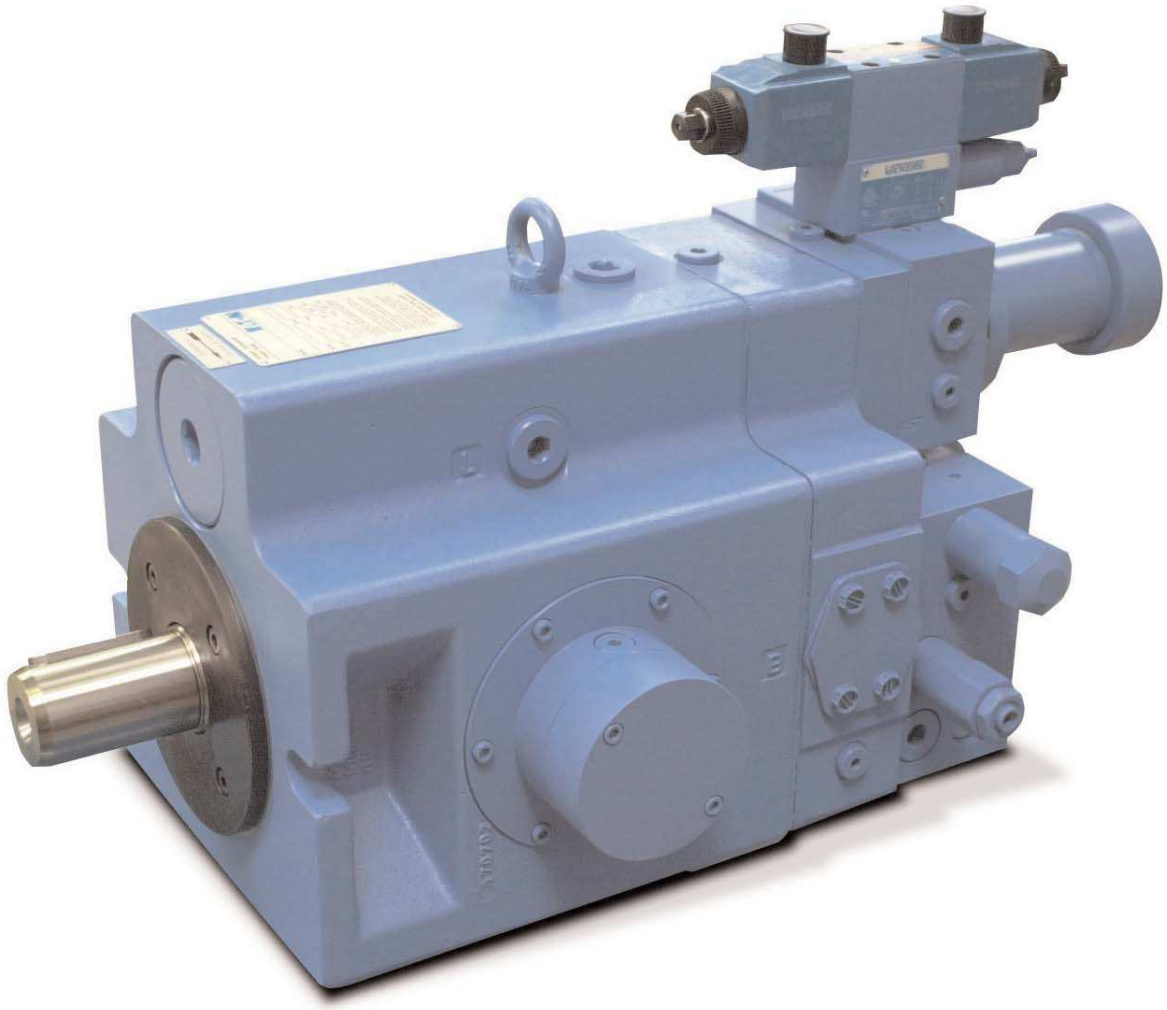
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March 2003

EATON | Vickers

Hydrokraft Transmission
Closed Loop Piston Pumps

Technical Catalog

TVX



VICKERS®

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  For new applications please use TVWS
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Introduction

- Axial piston pumps with swashplate design for reliable operation and long life.
- Special design for closed loop application.
- Pressure up to 420 bar. Rated speed up to 1800 r/min higher speeds possible.
- Rotating and pressure loaded parts are pressure balanced.
- Oversize shaft and shaft bearings.
- Large charge flow rates for low system temperature.
- Wide range of available integrated charge and pilot pressure pump combinations.
- Standard available transmission circuits with integrated valves and filters to build complete closed loop system for charge flow and flushing.
- Fast response times.
- For new product applications use TVW. Use TVX 130-250 for service replacement only.

AVAILABLE DISPLACEMENT SIZES
66 ccm
90 ccm

AVAILABLE REPLACEMENT UNIT DISPLACEMENT SIZES
130 ccm
180 ccm
250 ccm

Displacement controls:

ES - Electric motor displacement control

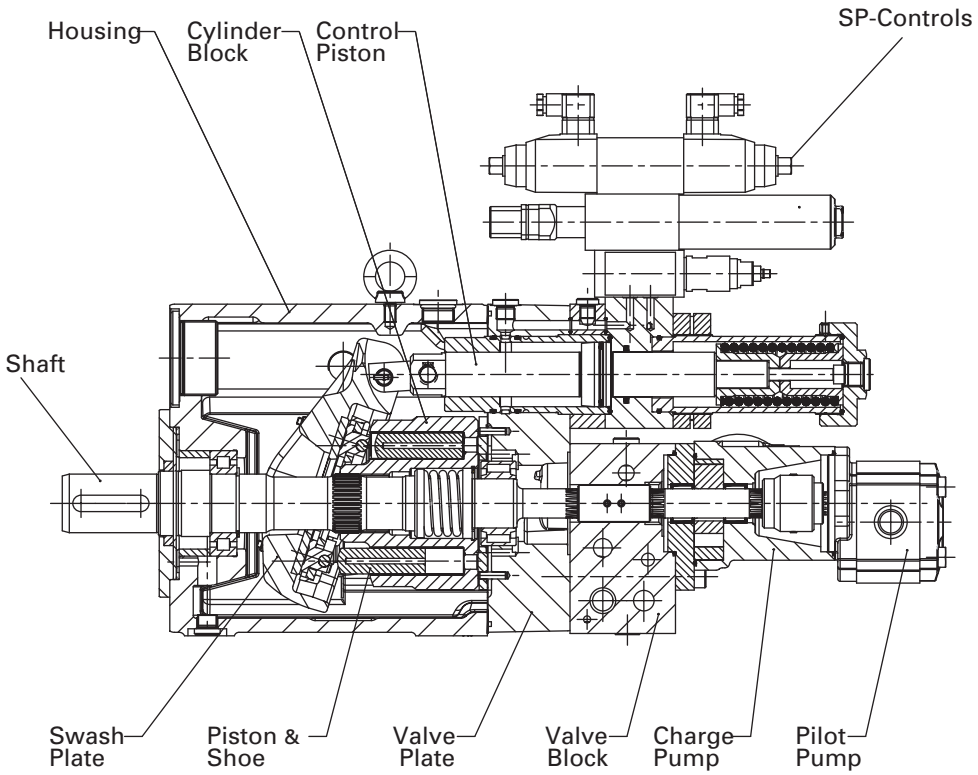
HG - Handwheel displacement control

FE - Screw adjustment control

SP - Displacement proportional to electric signal

DP - Displacement proportional to pressure signal

Typical Section of Transmission Pump



Dimensional information listed in this catalog is subject to change without notice.

Model Code

Transmission Pumps

"X" Series

Form Page

The following 55-digit coding system has been developed to identify all of the configuration options for the "X" Series Transmission pumps. Use this model code to specify a unit with the desired features. All 55-digits must be present when ordering. You may want to photocopy the matrix below to ensure that each number is entered in the correct box. If adjustments other than the standard settings (character 47...50) or special features (character 51...53) are needed, please provide the information when ordering. At the end of this section you may need to provide an additional model code if a combination unit is needed. In case of a combination unit, each single pump section must be specified separately using this or other Eaton catalog information.

In the model code string below some characters are already filled out and shown on this and the following pages. For such characters there is no option available.

Explanation for each character can be found as follows:

	CHARACTER	PAGE
Basic Pump Model Code	1.....27	6
Control Options	28...46	7-11
Customer Adjustment Specification	47...50	7-11
Special Features	51...53	12
Design Number	54...55	12
Combination Model Code	1.....39	13

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
T	V	X		–				M									1	R			S	V		A		

28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
																										1	0

SPECIFY NON STANDARD ADJUSTMENT BELOW

SPECIFY SPECIAL FEATURE BELOW

Model Code

Transmission Pumps

"X" Series - Basic Pump

T	V	X	*	–	*	*	*	M	*	*	*	*	*	*	*	*	1	R	*	*	S	V	*	A	*	*	#
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

1 Pump

T – Transmission Pump

2 Displacement

V – Variable displacement

3 Pump Series

X – "X" Series (was 30 design)

4 Configuration

S – Single Unit
R – Rear Unit

5 Separator

– – Separator

6 7 8 Displacement Size

066 – 66 cm^3/r [4.0 in^3/rev]
090 – 90 cm^3/r [5.5.0 in^3/rev]
130 – 130 cm^3/r [7.9 in^3/rev]
180 – 180 cm^3/r [11.0 in^3/rev]
250 – 250 cm^3/r [15.3 in^3/rev]
750 – 750 cm^3/r [45.8 in^3/rev]

9 Basic standard

M – Metric

10 11 Mounting flange

02 – ISO 3019/2 - 125A2HW (66 and 90 cm^3/r)
04 – ISO 3019/2 - 160A2HW (130 and 180 cm^3/r)
06 – ISO 3019/2 - 200A2HW (250 cm^3/r)

12 Rotation Direction

R – Right hand [CW]
L – Left hand [CCW]

13 Adjustment stop

0 – No adjustment stop
4 – Fixed mechanical Adjustment stop side A
5 – Fixed mechanical Adjustment stop side B
6 – Fixed mechanical Adjustment stop side A and B

14 15 16 17 Thru-Drive Options

0000 – None
000A – SAE A
000B – SAE B
000C – SAE C
000P – Pilot pump (8 cm^3/r)
000T – Charge pump (~25% of unit displacement size)
00TP – Charge pump (~25% of unit displacement size) and Pilot pump (8 cm^3/r)

18 Main Ports

1 – SAE Port - Metric bolts

19 Main Port Orientation

R – Radial (side ports)

20 21 Main Drive Shaft End

01 – ISO straight key
02 – ISO spline

22 Drive Shaft Seal Configuration

S – Single shaft seal

23 Seal Material

V – Viton*
* Viton is a trademark of E.I. Dupont (other materials available, contact your Eaton Representative)

24 Yoke Position Indicator

0 – No position indicator
V – Visual position indicator
P – Position sensor
M – Position sensor and visual indicator

25 Housing surface finish

A – Blue painted

26 Transmission Circuit

0 – No transmission circuit
1 – Block filter, optical dirt indicator
2 – Block, filter, electrical dirt indicator
3 – Block without filter

27 Zero Position Valve

0 – No Zero Position Valve
A – With Zero Position Valve

28 Add Control Model Code

Code (characters 28...50) on the following pages

Model Code

Transmission Pumps

"X" Series - ES Control

E	S	*	0	0	*	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	#
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51

28 29 Control type

ES – Electric motor displacement control

30 Displacement Adjustment Options

M – Electric Motor - fast response

N – Electric Motor - mdeium response

P – Electric Motor - slow response

31 32 Electronic Controls

00 – Not required

33 Yoke Displacement Zone

A – Single side of center "A"

C – Over center

34 Extra Functions

0 – Not available

35 Pressure Control Options

0 – Not applicable

36 37 38 39 40 41 Power Control Options

000000 – Not applicable

42 Pilot Oil Filter

0 – Not required

43 Fail Safe Valve

0 – Not required

44 Position Monitoring

A – 4 limit switches

B – 8 limit switches

P – 4 limit switches + sensor

T – 8 limit switches + sensor

45 Electric Motor Type

2 – Motor with brake (IP54)

3 – Motor without brake (explosion proof)

46 Control Voltage of Zero Position Valve

0 – Not applicable

B – 110 AC 50 Hz/ 120 AC 60 Hz

D – 220 AC 50 Hz/ 240 AC 60 Hz

G – 12 VDC

H – 24 VDC

47 48 49 50 Customer Adjustment Specification

0000 - None

???? - Yes (Final number will be assigned by Eaton. Specify on table below)

51 Special Features

Add special feature description (characters 51...55) on page 12 if required

Theoretical Response Time (sec) for Zero to Maximum Displacement

SIZE	066/90		130/180		250	
f Hz	50	60	50	60	50	60
Fast	7	6	18	15	15	13
Medium	24	20	35	29	30	25
Slow	38	432	54	45	48	40

CUSTOMER ADJUSTMENT SPECIFICATIONS		UNIT	STD. SETTING	CUSTOMER ADJUSTMENT OPTION	REMARKS
All Revolution Adjustments below set at ...		rpm	1500	–	
Pressure Relief Valve Side A		bar	350		
Pressure Relief Valve Side B		bar	350		
Charge Pressure Relief Valve - Size 066 & 090		bar	10	–	
Charge Pressure Relief Valve - Size 130 & 180		bar	13	–	
Charge Pressure Relief Valve - Size 250		bar	20	–	
Flushing (Low) Pressure Relief Valve - Size 066 & 090		bar	5	–	
Flushing (Low) Pressure Relief Valve - Size 130 & 180		bar	7	–	
Flushing (Low) Pressure Relief Valve - Size 250		bar	10	–	
Pilot Pressure		bar	60	–	
Mechanical Adjustment Stop Side A		L/min	Q_{max}		
Mechanical Adjustment Stop Side B		L/min	Q_{min}		
Displacement Adjusted to ...		L/min	-50% Q_{max} Side A		
Position Monitoring Switch	1	L/min	0 from A		
Position Monitoring Switch	2	L/min	95% Q_{max} Side A		> 95% not possible
Position Monitoring Switch	3	L/min	0 from B		
Position Monitoring Switch	4	L/min	95% Q_{max} Side B		> 95% not possible
Position Monitoring Switch	5	L/min	–		
Position Monitoring Switch	6	L/min	–		
Position Monitoring Switch	7	L/min	–		
Position Monitoring Switch	8	L/min	–		

Pressure Override Side A & B deleted

Model Code

Transmission Pumps

"X" Series - HG Control

H	G	0	0	0	*	0	0	0	0	0	0	0	0	0	0	0	*	*	*	*	#
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51

28 29 **Control type**

HG – Hand wheel displacement control

30 **Displacement Adjustment Options**

0 – Not applicable

31 32 **Electronic Controls**

00 – Not required

33 **Yoke Displacement Zone**

A – Single side of center "A"

C – Over center

34 **Extra Functions**

0 – Not available

35 **Pressure Control Options**

0 – Not applicable

36 37 38 39 40 41 **Power Control Options**

000000 – Not applicable

42 **Pilot Oil Filter**

0 – Not required

43 **Fail Safe Valve**

0 – Not required

44 **Position Monitoring**

0 – Not position monitoring

45 **Electric Motor Type**

0 – No electric motor

46 **Control Voltage of Zero Position Valve**

0 – Not applicable

47 48 49 50 **Customer Adjustment Specification**

0000 - None

???? - Yes (Final number will be assigned by Eaton. Specify on table below)

51 **Special Features**

Add special feature description (characters 51...55) on page 12 if required

CUSTOMER ADJUSTMENT SPECIFICATIONS	UNIT	STANDARD SETTING	CUSTOMER ADJUSTMENT OPTION	REMARKS
All Revolution Adjustments below set at ...	rpm	1500	–	–
Pressure Relief Valve Side A	bar	350		
Pressure Relief Valve Side B	bar	350		
Charge Pressure Relief Valve - Size 066 & 090	bar	10	–	
Charge Pressure Relief Valve - Size 130 & 180	bar	13	–	
Charge Pressure Relief Valve - Size 250	bar	20	–	
Flushing (Low) Pressure Relief Valve - Size 066 & 090	bar	5	–	
Flushing (Low) Pressure Relief Valve - Size 130 & 180	bar	7	–	
Flushing (Low) Pressure Relief Valve - Size 250	bar	10	–	
Displacement Adjusted to...	L/min	Q_{max} Side A		

Model Code

Transmission Pumps

"X" Series - FE Control

F	E	0	0	0	*	0	0	0	0	0	0	0	0	0	0	0	*	*	*	*	#
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51

28 29 **Control type**

FE – Screw adjusted displacement control

30 **Displacement Adjustment Options**

0 – Not applicable

31 32 **Electronic Controls**

00– Not required

33 **Yoke Displacement Zone**

A – Single side of center "A"
C – Over center

34 **Extra Functions**

0 – Not available

35 **Pressure Control Options**

0 – Not applicable

36 37 38 39 40 41 **Power Control Options**

000000 – Not applicable

42 **Pilot Oil Filter**

0 – Not required

43 **Fail Safe Valve**

0 – Not required

44 **Position Monitoring**

0 – No position monitoring

45 **Electric Motor Type**

0 – No electric motor

46 **Control Voltage of Zero Position Valve**

0 – Not applicable

47 48 49 50 **Customer Adjustment Specification**

0000 - None

???? - Yes (Final number will be assigned by Eaton. Specify on table below)

51 **Special Features**

Add special feature description (characters 51...55) on page 12 if required

CUSTOMER ADJUSTMENT SPECIFICATIONS	UNIT	STANDARD SETTING	CUSTOMER ADJUSTMENT OPTION	REMARKS
All Revolution Adjustments below set at ...	rpm	1500	–	–
Pressure Relief Valve Side A	bar	350		
Pressure Relief Valve Side B	bar	350		
Charge Pressure Relief Valve - Size 066 & 090	bar	10	–	
Charge Pressure Relief Valve - Size 130 & 180	bar	13	–	
Charge Pressure Relief Valve - Size 250	bar	20	–	
Flushing (Low) Pressure Relief Valve - Size 066 & 090	bar	5	–	
Flushing (Low) Pressure Relief Valve - Size 130 & 180	bar	7	–	
Flushing (Low) Pressure Relief Valve - Size 250	bar	10	–	
Displacement Adjusted to...	L/min	Q_{max} Side A		

Model Code

Transmission Pumps

"X" Series - DP Control

D	P	*	0	0	*	0	0	0	0	0	0	0	*	0	0	0	*	*	*	*	*	#
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51

28 29 Control type

DP – Pressure signal displacement control

30 Displacement Adjustment Options

G – Mounting interface Cetop 3 only
H – Remote port G 1/4
J – Proportional relief inc. electronics
K – Proportional relief inc. electronics & displacement control

31 32 Electronic Controls

00 – Not required

33 Yoke Displacement Zone

A – Single side of center "A"
C – Over center

34 Extra Functions

0 – Not available

35 Pressure Control Options

0 – Not applicable

36 37 38 39 40 41 Power Control Options

000000 – Not applicable

42 Pilot Oil Filter

0 – Not required
V – Filter with visual indicator
E – Filter with electronic indicator

43 Fail Safe Valve

0 – Not required

44 Position Monitoring

0 – No position monitoring

45 Electric Motor Type

0 – No electric motor

46 Control Voltage of Zero Position Valve

0 – Not applicable
B – 110 AC 50 Hz/ 120 AC 60 Hz
D – 220 AC 50 Hz/ 240 AC 60 Hz
G – 12 VDC
H – 24 VDC

47 48 49 50 Customer Adjustment Specification

0000 - None

???? - Yes (Final number will be assigned by Eaton. Specify on table below)

51 Special Features

Add special feature description (characters 51...55) on page 12 if required

CUSTOMER ADJUSTMENT SPECIFICATIONS	UNIT	STANDARD SETTING	CUSTOMER ADJUSTMENT OPTION	REMARKS
All Revolution Adjustments below set at ...	rpm	1500	–	–
Pressure Relief Valve Side A	bar	350		
Pressure Relief Valve Side B	bar	350		
Charge Pressure Relief Valve - Size 066 & 090	bar	10	–	
Charge Pressure Relief Valve - Size 130 & 180	bar	13	–	
Charge Pressure Relief Valve - Size 250	bar	20	–	
Flushing (Low) Pressure Relief Valve - Size 066 & 090	bar	5	–	
Flushing (Low) Pressure Relief Valve - Size 130 & 180	bar	7	–	
Flushing (Low) Pressure Relief Valve - Size 250	bar	10	–	
Pilot Pressure	bar	60	–	
Mechanical Adjustment Stop Side A	L/min	Q_{max}		
Mechanical Adjustment Stop Side B	L/min	Q_{min}		

Model Code

Transmission Pumps

"X" Series - SP Control

S	P	*	*	*	*	0	0	0	0	0	0	0	0	*	*	0	0	*	*	*	*	*	#
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51

28 29 Control type

SP – Proportional Valve Displacement Control

30 Displacement Adjustment Options

C – With Cetop 3 Proportional valve KDG4V 3

F – With Cetop 5 Proportional valve

31 32 Electronic Controls

00 – Not required

03 – ER 9.3 - 10 (Cetop 3)

04 – ER 9.4 - 10 (Cetop 5)

33 Yoke Displacement Zone

A – Single side of center "A"

C – Over center

34 Extra Functions

0 – Not required

35 Pressure Control Options

0 – Not applicable

36 37 38 39 40 41 Power Control Options

000000 – Not applicable

42 Pilot Oil Filter

0 – Not required

V – Filter with visual indicator

E – Filter with electronic indicator

43 Fail Safe Valve

0 – Not required

1 – With solenoid valve

44 Position Monitoring

0 – No position monitoring

45 Electric Motor Type

0 – No electric motor

46 Control Voltage of Zero Position Valve

0 – Not applicable

B – 110 AC 50 Hz/ 120 AC 60 Hz

D – 220 AC 50 Hz/ 240 AC 60 Hz

G – 12 VDC

H – 24 VDC

47 48 49 50 Customer Adjustment Specification

0000 – None

???? – Yes (Final number will be assigned by Eaton. Specify on table below)

51 Special Features

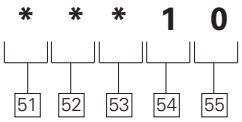
Add special feature description (characters 51...55) on page 12 if required

CUSTOMER ADJUSTMENT SPECIFICATIONS	UNIT	STD. SETTING	CUSTOMER ADJUSTMENT OPTION	REMARKS
All Revolution Adjustments below set at ...	rpm	1500	–	–
Pressure Relief Valve Side A	bar	350		
Pressure Relief Valve Side B	bar	350		
Charge Pressure Relief Valve - Size 066 & 090	bar	10	–	
Charge Pressure Relief Valve - Size 130 & 180	bar	13	–	
Charge Pressure Relief Valve - Size 250	bar	20	–	
Flushing (Low) Pressure Relief Valve - Size 066 & 090	bar	5	–	
Flushing (Low) Pressure Relief Valve - Size 130 & 180	bar	7	–	
Flushing (Low) Pressure Relief Valve - Size 250	bar	10	–	
Pilot Pressure	bar	60	–	
Mechanical Adjustment Stop Side A	L/min	Q_{max}		
Mechanical Adjustment Stop Side B	L/min	Q_{min}		
Max. Stop by Control Side A	L/min	95% Q_{max}	El. Card Adjustment Done by Customer	Refer to El. card manual
Max. Stop by Control Side B	L/min	95% Q_{max}	El. Card Adjustment Done by Customer	Refer to El. card manual
Ramp Time 0 _ A For 100% Stroke	sec	0	El. Card Adjustment Done by Customer	Refer to El. card manual
Ramp Time A _ 0	sec	0	El. Card Adjustment Done by Customer	Refer to El. card manual
Preset Input Signals S1 ... S4	L/min	–	El. Card Adjustment Done by Customer	Refer to El. card manual

Model Code

Transmission Pumps

"X" Series -
Special Features



51 52 53 **Special Features**

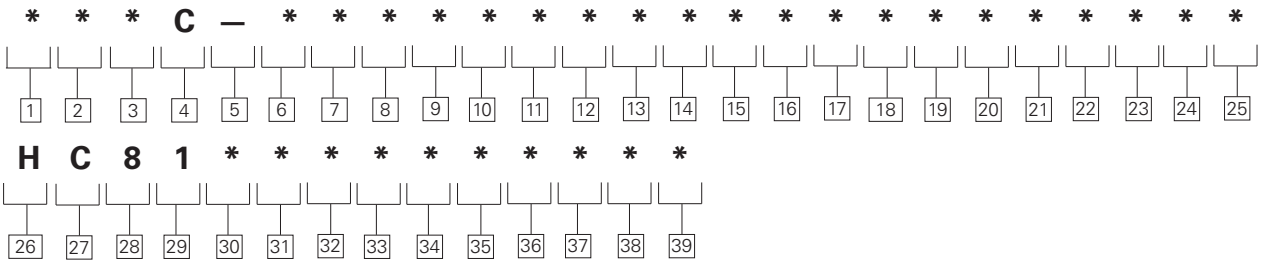
000 – None
******* – Defined by Eaton

54 55 **Design Number**

10 – Design Number

Model Code

Combination Units



1 Combination Unit

P – Pump
T – Transmission Pump
M – Motor

2 Displacement

F – Filled
V – Variable

3 Pump Series

W – "W" Series (was 30 design)
X – "X" Series (was 20 design)

4 Combination Unit

C

5 Separator

6 7 8 First Displacement cm³/r

066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

9 10 First Control Type

00 – No Control (for Fixed Displacement Only)
DF – Pressure Compensator
LR – Power Control
ES – Electric Motor Control
HG – Handwheel Displacement Control
FE – Screw Adjustment Displacement Control
SM – Servo Adjustment Displacement Control - Mech Feedback
DP – Pressure Signal Displacement Control
SP – Proportional Valve Displacement Control

11 12 13 Second Displacement cm³/r

066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

14 15 Second Control Type

00 – No Control (for Fixed Displacement Only)
DF – Pressure Compensator
LR – Power Control
ES – Electric Motor Control
HG – Handwheel Displacement Control
FE – Screw Adjustment Displacement Control
SM – Servo Adjustment Displacement Control - Mech Feedback
DP – Pressure Signal Displacement Control
SP – Proportional Valve Displacement Control

16 17 18 Third Displacement cm³/r

000 – Not Required
066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

19 20 Third Control Type

00 – No Control (for Fixed Displacement Only)
DF – Pressure Compensator
LR – Power Control
ES – Electric Motor Control
HG – Handwheel Displacement Control
FE – Screw Adjustment Displacement Control
SM – Servo Adjustment Displacement Control - Mech Feedback
DP – Pressure Signal Displacement Control
SP – Proportional Valve Displacement Control

21 22 23 Fourth Displacement cm³/r

000 – Not Required
066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

24 25 Fourth Control Type

00 – No Control (for Fixed Displacement Only)
DF – Pressure Compensator
LR – Power Control
ES – Electric Motor Control
HG – Handwheel Displacement Control
FE – Screw Adjustment Displacement Control
SM – Servo Adjustment Displacement Control - Mech Feedback
DP – Pressure Signal Displacement Control
SP – Proportional Valve Displacement Control

26 27 28 29 Assembly Numbers

HC81 – Defined By Eaton

30 31 32 33 34 35 36 37 38 39 Assembly Numbers

Defined By Eaton

- For a combination of two or more units fill out this Combination Model Code.
- Start with the biggest size unit for the first displacement.
- For each unit included in this combination, a separate model code must be chosen. Use the form on page 5.
- Character 26 to 39 will be P/N of the combination. This number will be defined by Eaton and provided in the order acknowledgement.
- Charge and Pilot Pump through drive option must be specified on the rear unit of the combination (as a special feature).
- Front and middle units shall have the through drive option of the following unit in the combination.

Model Code

Examples for
Combination Units

Example 1: Combination of two closed loop pumps

Model Code Front Unit	TVWF-500M08R0000H1R02SVMA20SPC03C00000000E100H000000010
Model Code Rear Unit	TVXR-066M02R000001R02SVMA00SPC03C00000000E000H000000010
Model Code Combination Unit	TVWC-500SP0660SP0000000000HC81**********

Example 2: Combination of one closed loop - and two open loop pumps (For open loop model code refer to the according catalog)

Mode Code Front Unit	TVWF-500M08R0000H1R02SVMA20SPC03C00000000E100H000000010
Model Code Middle Unit	PVWM-250M07R00E1R02SV0ADF000A0000000000000000010
Model Code Rear Unit	PFXR-130M02R00P1A02SV0A00000A0000000000000000010
Model Code Combination Unit	TVWC-500SP250DF1300000000HC81**********

Pump Specifications - US

MODEL			TVX 066	TVX 090	TVX 130	TVX 180	TVX 250
Design			Swashplate - Axial piston pump				
Type of mounting			Flange or foot-mounted. Combination units foot mounted only				
Pipe connection SAE/Flange	B A	psi	1" = 6000 1" = 6000	1" = 6000 1" = 6000	1" = 6000 1" = 6000	1" = 6000 1" = 6000	1" = 6000 1" = 6000
Direction of rotation			Clockwise when viewing shaft end of pump Counterclockwise available on request				
Speed range	n_{min} n_{max}	rpm	150 1800				
Installation position			Optional, see mounting information				
Ambient temperature range	min max	°F	-4 122				
Weight	m	lb	168	168	348	379	540
Mass of inertia	J	lb ft^2	0.38	0.38	1.068	1.068	3.456

HYDRAULIC CHARACTERISTICS

Nominal pressure (100% duty cycle)	p_N	psi	5000				
Input pressure	p_{1min} p_{1max}	psi psi	12.5 abs Pressure can be applied to the pump inlet but the sum of p_1 and p_2 must not exceed the maximum value of 6090psi)				
Maximum pressure to DIN 24312	p_{2max}	psi	6090				
Hydraulic fluid			Hydraulic oil to DIN 51524 part 2. Refer to section Application Data-Fluid Recommendations				
Hydraulic fluid temperature range	min max	°F	-13 on startup 194				
Viscosity range for continuous operation	min max	cSt cSt	10 75				
Maximum permissible start viscosity	max	cSt	1000				
Filtering	ISO 4406		18/15/13				
Maximum geometric displacement	V_g	in^3	66	90	130	180	250
Maximum geometric pump flow n= 1500 rpm n= 1800 rpm	Q_g	USgpm	28 32	36 43	52 62	71 86	99 119
Case pressure	$p_{v\ max}$	psi	max 7.2psi over p_A, p_B				

HYDRAULIC CHARACTERISTIC OF CHARGE AND PILOT PUMP

Displacement charge pump	$V_{g\ Sp}$	in^3	0.97	1.4	2.01	2.44	3.91
Charge pressure	$p_{N\ Sp}$	psi	73/145	73/145	102/189	102/189	145/290
Input pressure charge & pilot pump	$p_{min\ Sp/St}$	psi	11.6 absolute				
Displacement pilot pump	$V_{g\ St}$	in^3	0.5				
Pilot pressure	p_{St}	psi	870	870	870	870	870

DRIVE

Maximum driving torque - single unit ($p_{2\ max}$, η= 100%)	$M_{1\ Single}$	lb.ft.	325	443	640	887	1243
Maximum power consumption - single unit ($p_{2\ max}$, η= 100%; n= 1800 rpm)	$P_{1\ Single}$	hp	93	126	182	254	355
Max. driving torque - comb. unit	$M_{1\ Comb.}$	lb.ft.	2x325	2x443	2x643	2x890	2x1248

1) TVW - 750 at 1800 rpm reduced to 38.1 in^3

2) When pressure below 1450psi and flow below 25% of maximum flow

Pump Specifications - Metric

MODEL			TVX 066	TVX 090	TVX 130	TVX 180	TVX 250
Design			Swashplate - Axial piston pump				
Type of mounting			Flange or foot-mounted. Combination units foot mounted only				
Pipe connection SAE/Flange	B A	psi	1" = 6000 1" = 6000	1" = 6000 1" = 6000	1" = 6000 1" = 6000	1" = 6000 1" = 6000	1" = 6000 1" = 6000
Direction of rotation			Clockwise when viewing shaft end of pump Counterclockwise available on request				
Speed range	n_{min} n_{max}	min^{-1}	150 1800				
Installation position			Optional, see mounting information				
Ambient temperature range	min max	°C	-20 50				
Weight	m	kg	76	76	138	172	245
Mass of inertia	J	$kg\ m^2$	0.016	0.016	0.045	0.045	0.146

HYDRAULIC CHARACTERISTICS							
Nominal pressure (100% duty cycle)	p_N	bar	5000 (350)				
Input pressure	p_{1min} p_{1max}	bar bar	4 abs Pressure can be applied to the pump inlet but the sum of p_1 and p_2 must not exceed the maximum value of 420 bar				
Maximum pressure to DIN 24312	p_{2max}	bar	420				
Hydraulic fluid			Hydraulic oil to DIN 51524 part 2. Refer to section Application Data-Fluid Recommendations				
Hydraulic fluid temperature range	min max	°C	-25 on startup 90				
Viscosity range for continuous operation	min max	cSt cSt	10 75				
Maximum permissible start viscosity	max	cSt	1000				
Filtering	ISO 4406		18/15/13				
Maximum geometric displacement	V_g	cm^3	4.03	5.49	7.93	10.98	15.26
Maximum geometric pump flow n= 1500 min^{-1} n= 1800 min^{-1}	Q_g	L/min L/min	99 118	135 162	195 234	270 324	375 450
Case pressure	$p_{v\ max}$	bar	max 7.2psi (0.5 bar) over air pressure p_A, p_B				

HYDRAULIC CHARACTERISTIC OF CHARGE AND PILOT PUMP							
Displacement charge pump	$V_{g\ Sp}$	cm^3	16	23	33	40	64
Charge pressure	$p_{N\ Sp}$	bar	5/10	5/10	7/13	7/13	10/20
Input pressure charge & pilot pump	$p_{min\ Sp/St}$	bar	0,8 absolute				
Displacement pilot pump	$V_{g\ St}$	cm^3	8				
Pilot pressure	p_{St}	bar	60	60	60	60	60

DRIVE							
Maximum driving torque - single unit ($p_{2\ max}$, η= 100%)	$M_{1\ Single}$	Nm	440	600	868	1202	1685
Maximum power consumption - single unit ($p_{2\ max}$, η= 100%; n= 1800 min^{-1})	$P_{1\ Single}$	kW	69	94	136	189	265
Maximum driving torque - comb. unit	$M_{1\ Comb.}$	Nm	2x440	2x600	2x868	2x1202	2x1685

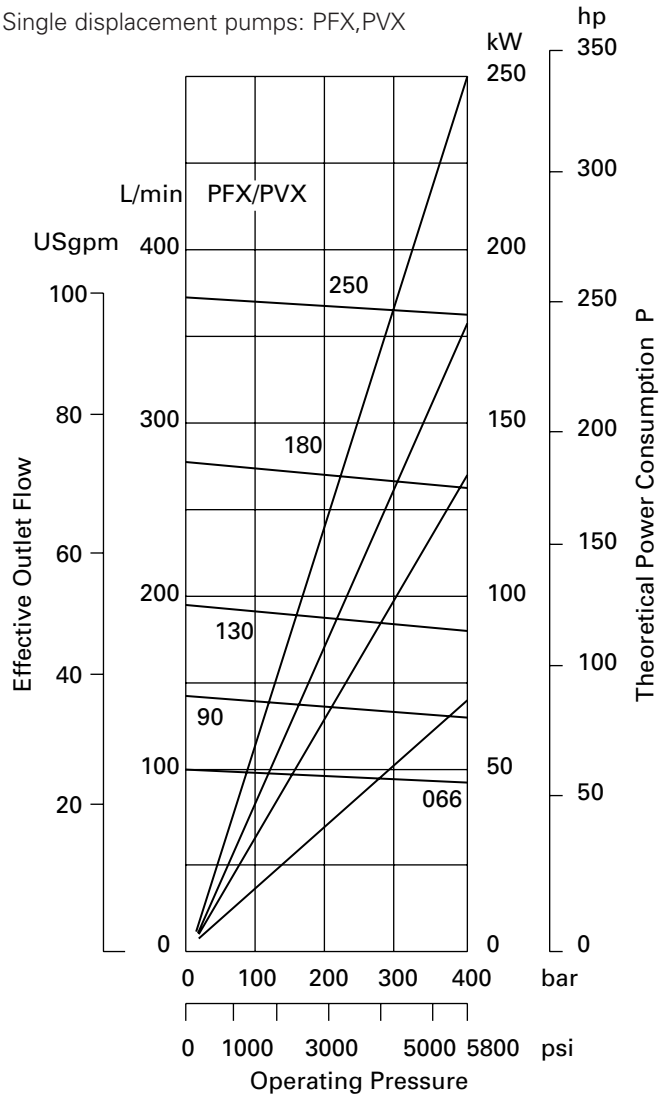
1) TVW - 750 at 1800 min^{-1} reduced to 625cm^3

2) When pressure below 100 bar and flow below 25% of maximum flow

Performance Curves - 066, 090, 130, 180, 250 Series

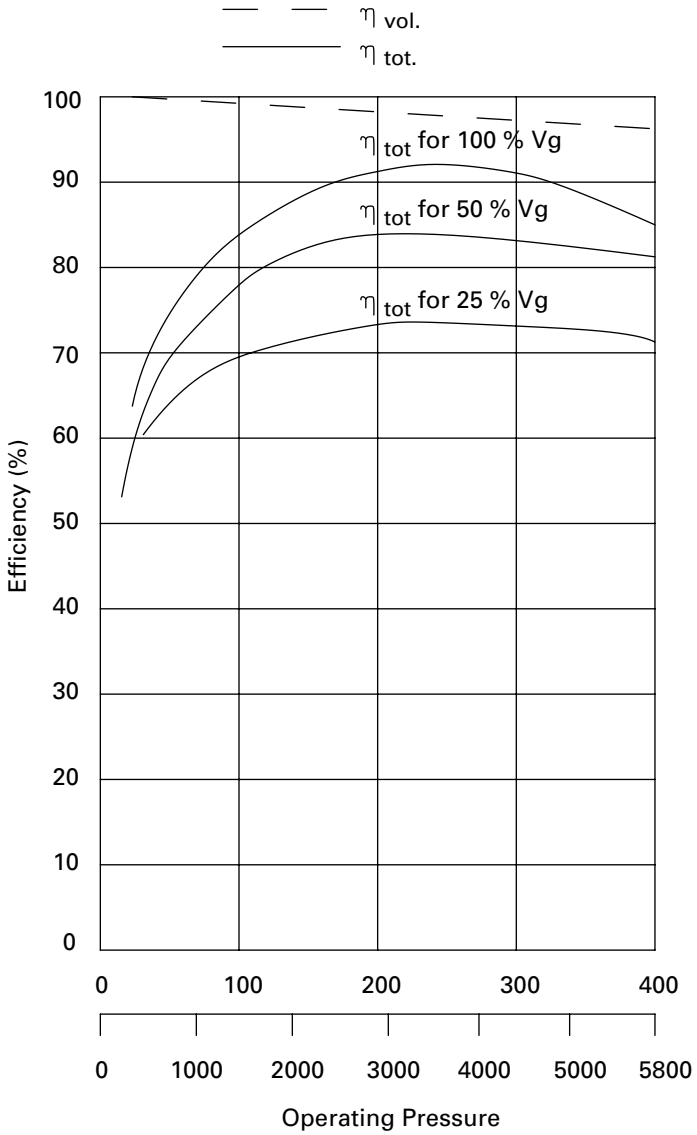
Outlet Flow and Theoretical Power Consumption

Typical at 1500 min^{-1} with anti-wear oil at 40 cSt
Single displacement pumps: PFX,PVX



Volumetric and Overall Efficiencies

For Calculation: Peff = Pth/ηtot



Combination units

For combination pumps the characteristic values are as for the individual units.

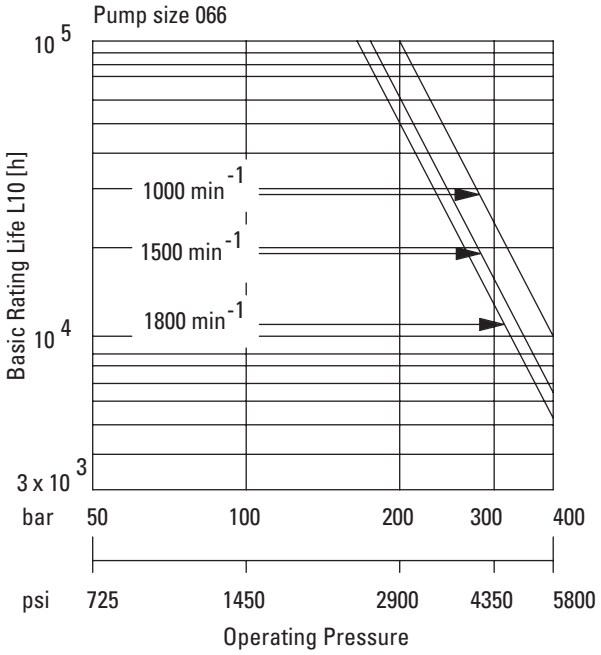
For reduced swash-angle:

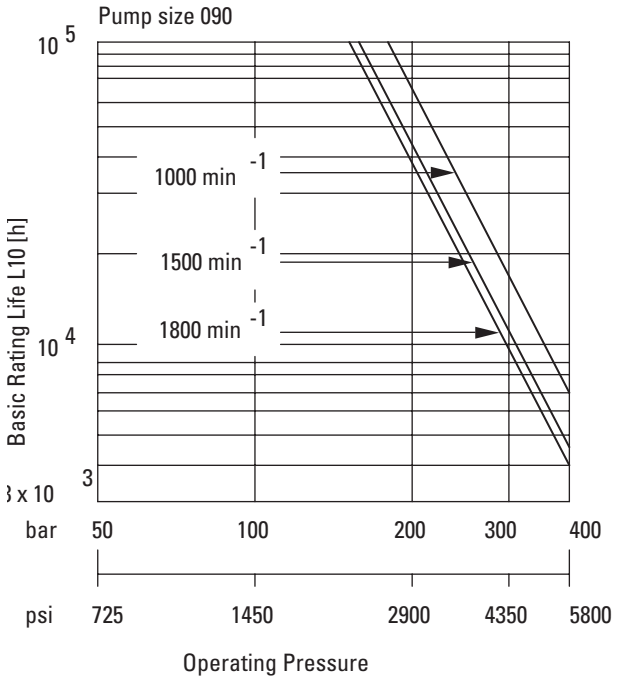
$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

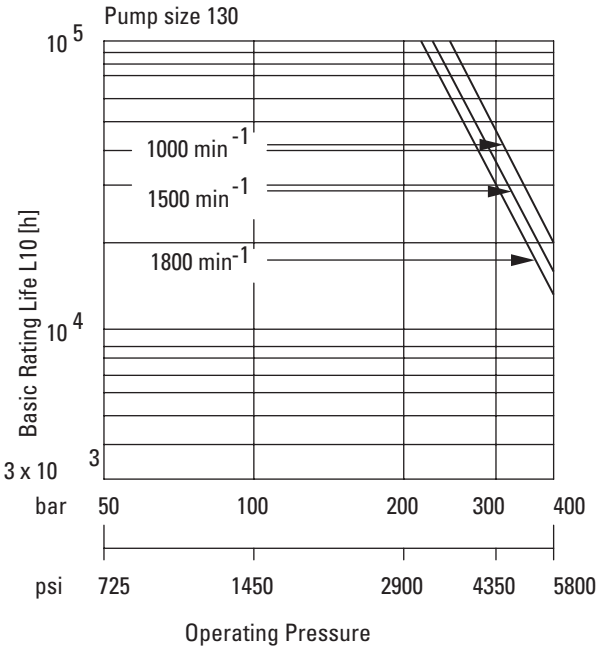
Operating Data
066,090,130,180, 250 Series

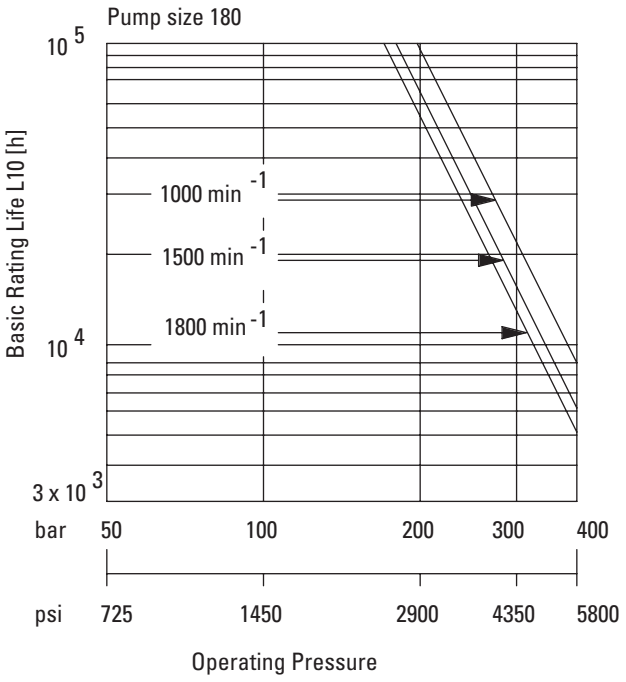
Theoretical Bearing Life Time

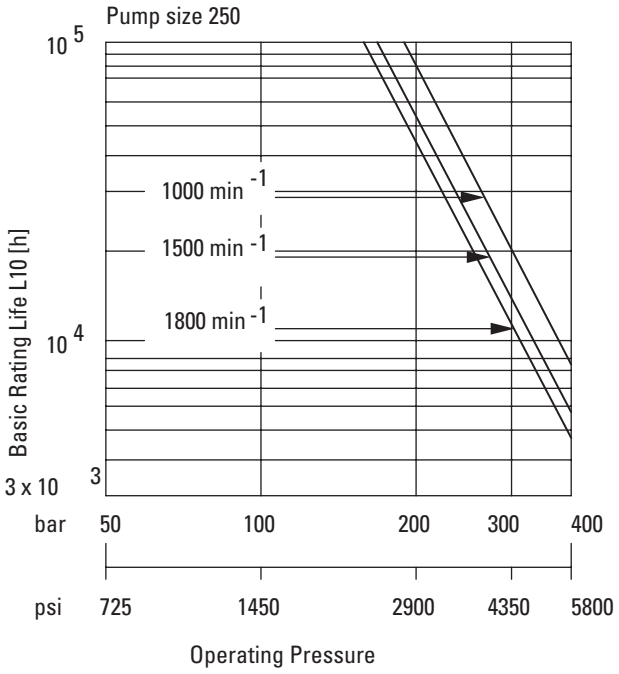
At maximum displacement and various speeds.









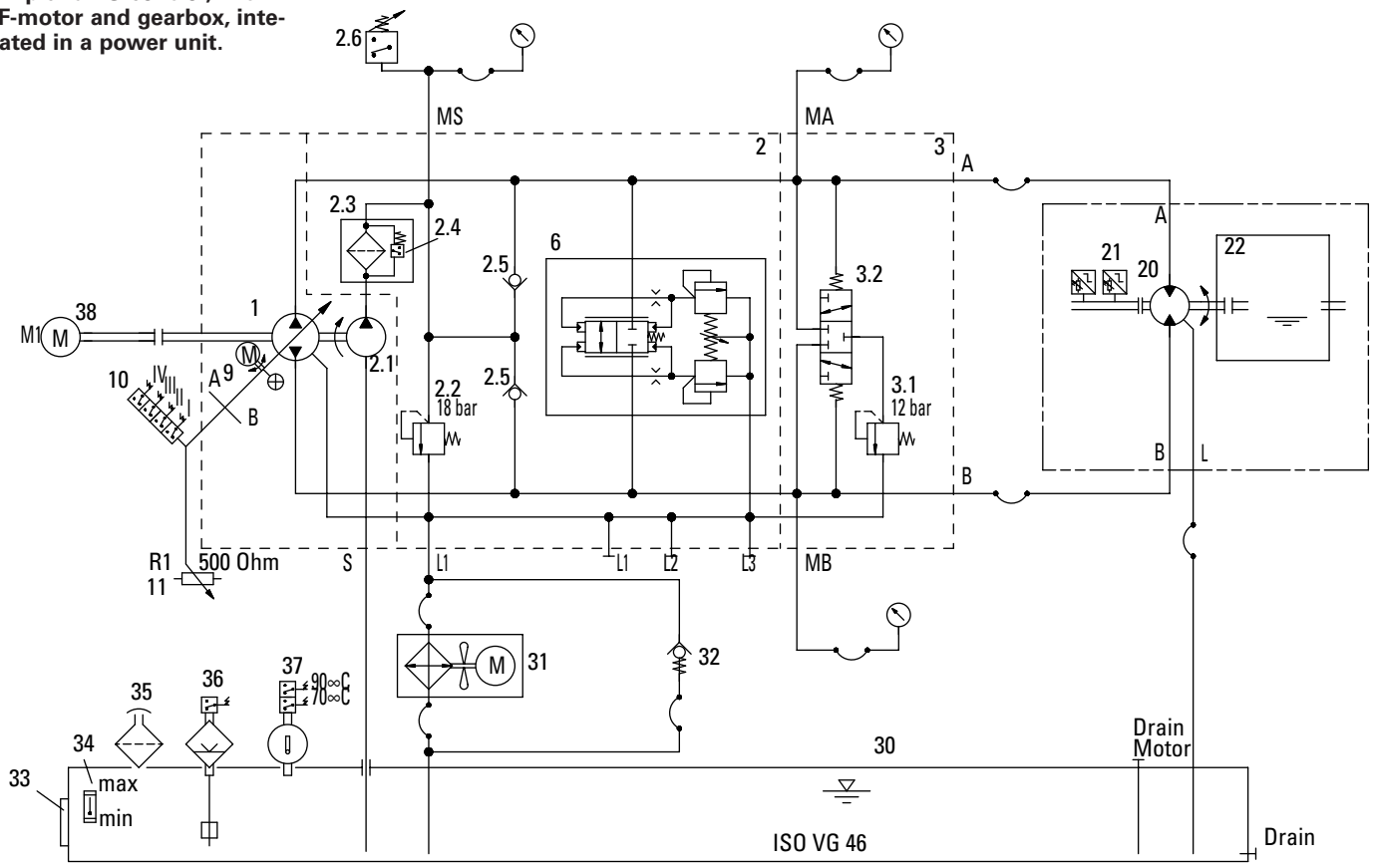


Hydraulic Transmission Circuit

"X" Series – Closed Loop

Example for a completed Hydraulic Transmission

Example shown is a complete drive for a slow speed conveyor belt, with TVX-pump and ES-control, with MF-motor and gearbox, integrated in a power unit.



A, B System port

L1, L2, Drain port

L3 Oil filling plug

MA, MB Gauge port-system pressure

MS Gauge port-charge pressure

S Suction port for charge pump

L Drain port motor

1 Basic pump

2 Charge block

2.1 Charge pump

2.2 Charge pressure relief valve

2.3 Charge flow filter

2.4 Clogging indicator for charge flow filter

2.5 Charge check valves (2 pcs)

2.6 Charge pressure relief switch

3 Flushing block

3.1 Low pressure relief valve (replenishing valve)

3.2 Flushing flow shuttle valve

6 High pressure relief valve

9 Servo motor

10 Control limit switches

11 Control feedback potentiometer

20 Motor MF

21 Limit switches (speed control)

22 Rearbox

30 Reservoir

31 Cooler Oil/Air

32 Bypass - Valve

33 Thermometer

34 Optical Level Indicator

35 Venting Filter

36 Level switch

37 Temperature switch

38 Electric motor

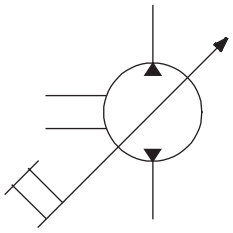
FE, HG Manual Adjustment Displacement Control

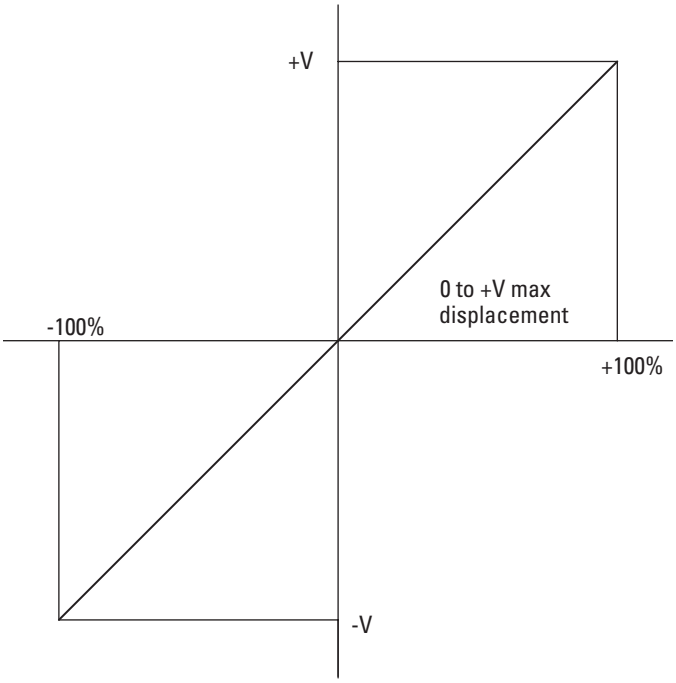
"X" Series – Closed Loop

FE The FE-control is a displacement control where the pump flow is adjusted by a screw.

HG The HG-control is a displacement control where the pump flow can be adjusted by handwheel.

The maximum (and/or minimum) flow can be limited by a spacer inside the control cylinder (position no. 13 in modelcoding, options 4, 5 or 6 in combination with customer adjustment speculation position 47-50 for the set values). The setting must be defined before ordering and cannot be modified during operation.





Electric Motor Displacement Control ES

"X" Series – Closed Loop

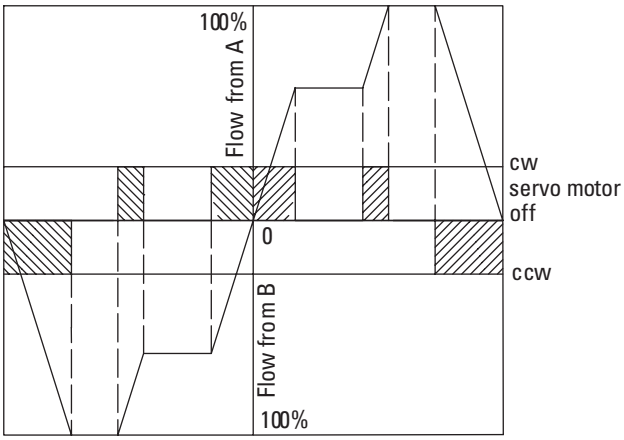
The unit is used for flow adjustment. It has a three phase electric servo motor, worm gearing and a switch box with 4 or (optional) 8 limit switches for different positions. A potentiometer is also available.

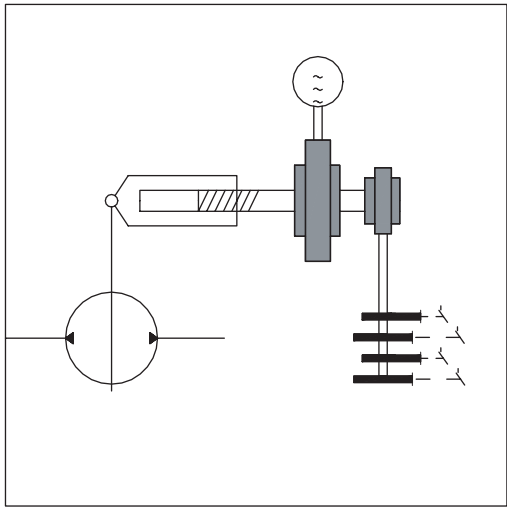
The response times from zero to maximum depends on the chosen ratio and the (fixed) speed of the servo motor (this means that once the control is defined and built the response times are not variable during operation).

No Pressure / Power Limiter possible!

Explosion protection versions are also available.

As an additional option the maximum (and/or minimum) flow can be limited by a spacer inside the control cylinder (position no. 13 in model coding, options 4, 5 or 6 in combination with customer adjustment speculation position 47-50 for the set values). The setting must be defined before ordering and cannot be modified during operation.





Response Time Table

THEORETICAL RESPONSE TIME (SEC) FOR MAXIMUM DISPLACEMENT CHARACTER IN MODELCODE POS. 30

Size	066 / 090		130 / 180		250		
Freq. Hz	50	60	50	60	50	60	
Fast	7	6	18	15	15	13	M
Medium	24	20	35	29	30	25	N
Slow	38	32	54	45	48	40	P

Response time from 0 to +Qmax or 0 to - Qmax

Pressure Signal Displacement Control DP

"X" Series – Closed Loop

The output flow of the pump is proportional to the pilot pressure.

A separate pilot oil circuit is necessary.

From this, the control pressure is reduced to the desired set value by means of a suitable pressure control valve (with P-T line) and throttle in P-line 0.8 Ø (0.03 in).

To work in both directions, a solenoid valve is needed to switch the pilot flow from A to B (pos. 30 in model coding, option "K").

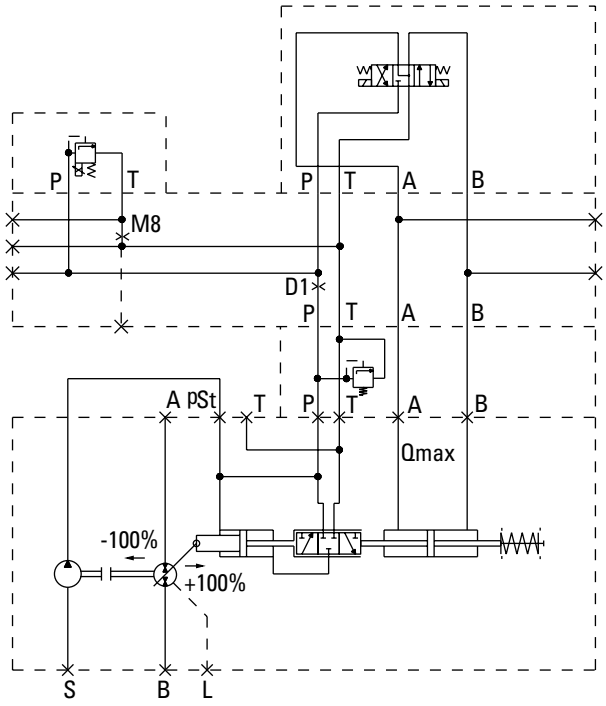
The DP-control can be used for stepless flow control with standard requirements for dynamic and precision.

No feedback signal is needed, an optical indicator recommended (pos. 24 in model coding, option "V").

A pilot oil filter can be mounted in-line between pump and control (pos. 42 in model coding, option "V" or "E").

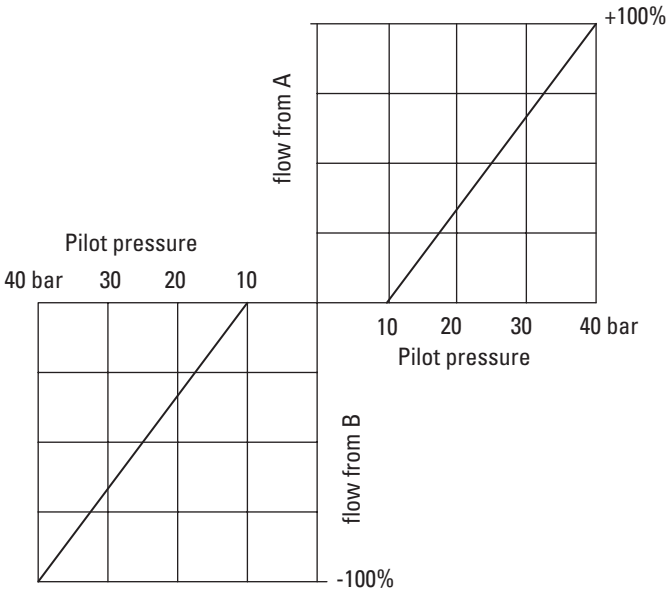
Pressure limiter or power limiter override not available (for such and other options please refer to PVW-Series).

As an additional option the maximum (and/or minimum) flow can be limited by a spacer inside the control cylinder (position no.13 in model coding, options 4, 5 or 6 in combination with customer adjustment speculation position 47-50 for the set values). The setting must be defined before ordering and cannot be modified during operation.



TVX Response Times DP - Control

SIZE	RESPONSE TIME (SEC) WITH 12 L/MIN PILOT OIL FLOW	
	(Standard)	Pilot Pressure pSt [bar]
066/090	0,7	60
130/180	0,9	60
250	1,1	60



The output flow of the pump is proportional to the pilot pressure

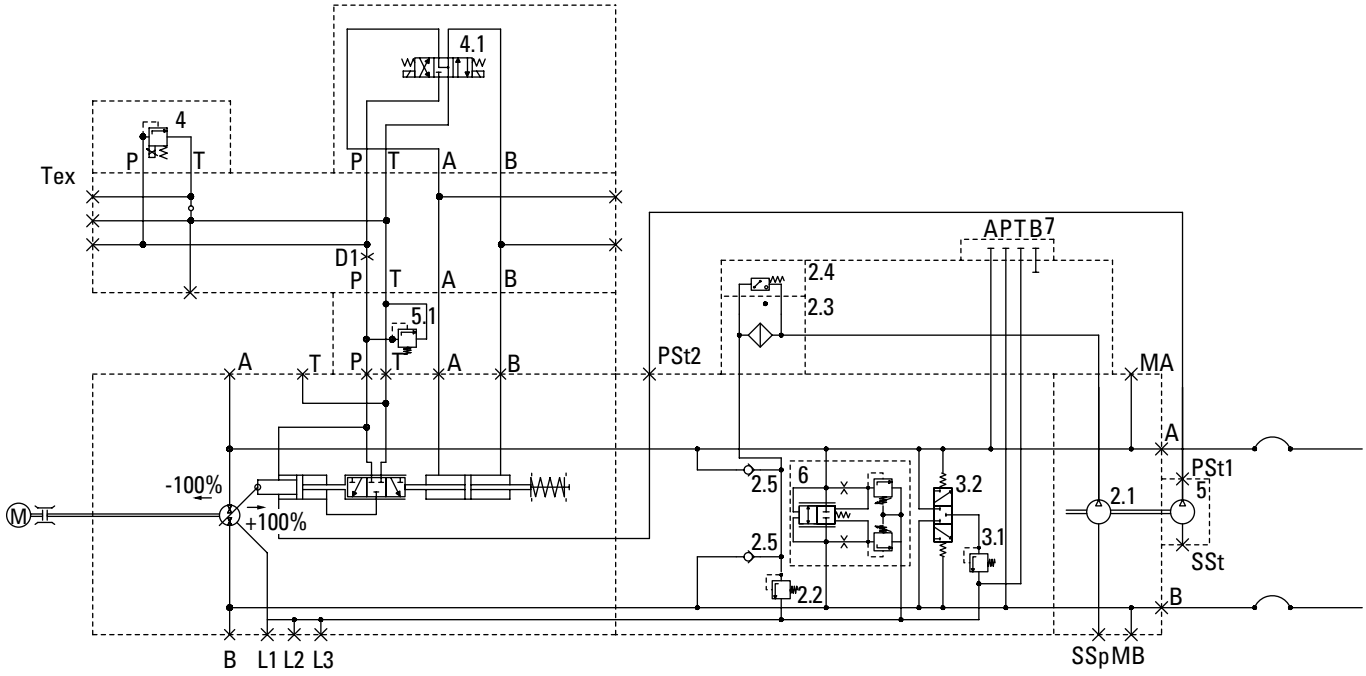
Example for TVXS
DP Control

"X" Series – Closed Loop

The example shows a TVXS-130 pump with DP-control and complete transmission circuit, for over-center operation (with solenoid valve 24V DC) with charge oil filter with electrical indicator, but without pilot oil filter.

Other model coding also possible due to some variations which cannot be seen in the circuit diagram (seal material, main drive shaft end).

Possible model coding for such pump:
TVXS-130M04R000TP1R01SVVA20DPK00C000000000000H000000010.



A, B	System ports
L1, L2, L3	Drain ports
MA, MB	Gauge port-system pressure
SSp	Suction port for charge pump
SSt	Suction port for pilot pump
pSt1	Outlet port pilot pump
pSt2	Pilot pressure port
X1	Remote port control pressure
T	Return line control circuit
1	Basic pump
2.1	Charge pump
2.2	Charge pressure relief valve
2.3	Charge flow filter
2.4	Clogging indicator for charge flow filter
2.5	Check valves (2 pcs)
3.1	Low pressure relief valve
3.2	Flushing flow shuttle valve Tex return line proportional relief valve
4	Proportional pressure relief valve
4.1	Solenoid valve for directional control
5	Pilot pump
5.1	Pilot pressure relief valve
6	High pressure relief valve
7	Interface for short cut valve

Proportional Valve Displacement Control SP

"X" Series – Closed Loop

The SP control operates a hydrostatic drive and works without throttle losses within electrically adjustable limits. This is done by controlling delivery flow with electrical swashplate angle feedback (electrical closed-loop control).

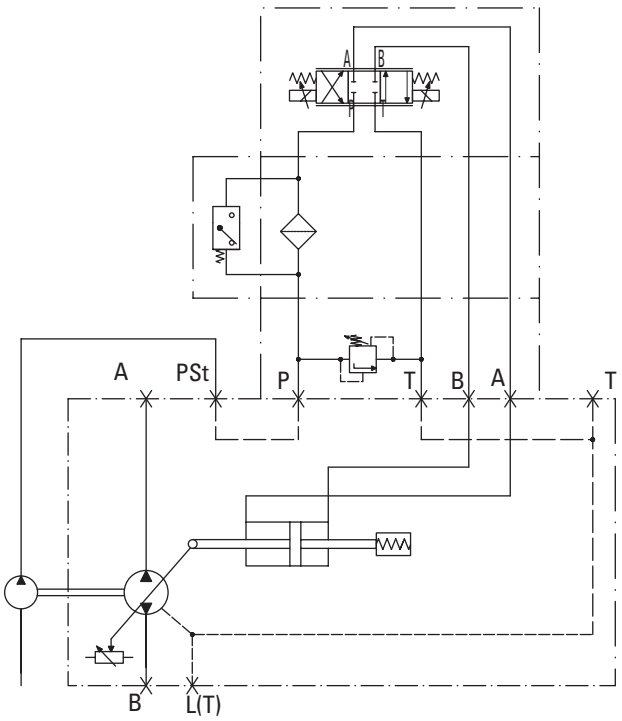
All control values are recorded as an electrical signal and lead back to the control card. The proportional valve and servo piston transform the output signal of the control card to the desired setting.

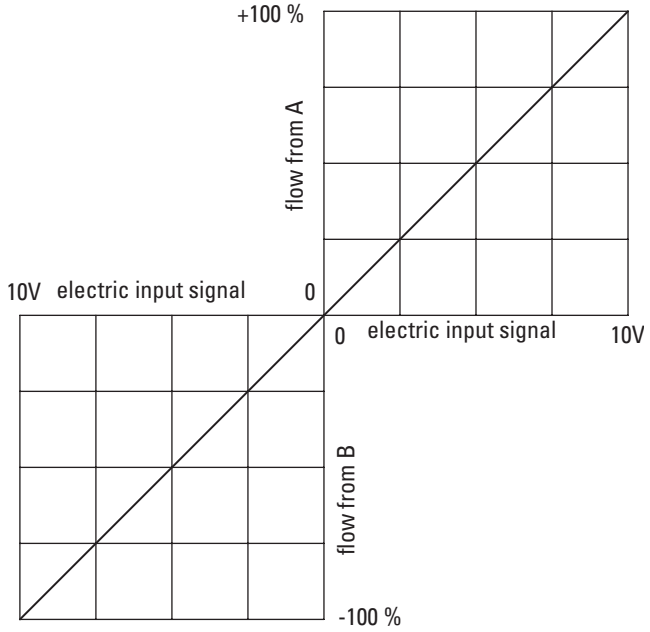
This results in a very precise and dynamic control.

Pressure limiter override available on request.

Power limiter override not available (for such and other options please refer to TVW series).

As an additional option the maximum (and/or minimum) flow can be limited by a spacer inside the control cylinder (position no.13 in model coding, options 4, 5 or 6 in combination with customer adjustment speculation position 47-50 for the set values). The setting must be defined before ordering and cannot be modified during operation.





TVX Response Times SP - Control

PROPORTIONAL VALVE

	Pilot Oil Flow	Pilot Oil Pressure p_{St}	Control Electronics	Response Time	Unit Size	Servo Piston		
	L/min (USgpm)	**bar (psi)**	**(Amp.card) bar (psi)**	**0 < > Vmax [ms]**	**cm³**	**Diameter mm (in)**	**Stroke mm (in) one side**	**Volume cm³ (in³) per chamber**
Medium response	12 (3.17)	60 (857)	ER 9.3-10	250	**066 / 090**	40/30 (1.57/1.18)	28 (1.10)	15,4 (0.939)
KDG4V3-2C20NMUH760	12 (3.17)	60 (857)	ER 9.3-10	350	**130 / 180**	55/38 (2.16/1.49)	35 (1.37)	43,5 (2.654)
(CETOP 3)	12 (3.17)	60 (857)	ER 9.3-10	550	**250**	70/50 (2.76/1.97)	43,5 (1.71)	81 (4.942)
High response (CETOP 5)	ON REQUEST							

The ER9.3-10 and ER 9.4-10 (for high response) digital amplifier cards are optimized for use with the SP-Control. Please ask for separate documentation. Software is available for parameter setting and storing (database function). Contact Eaton to request free of charge manual and software CD.

Example for TVXS
SP Control

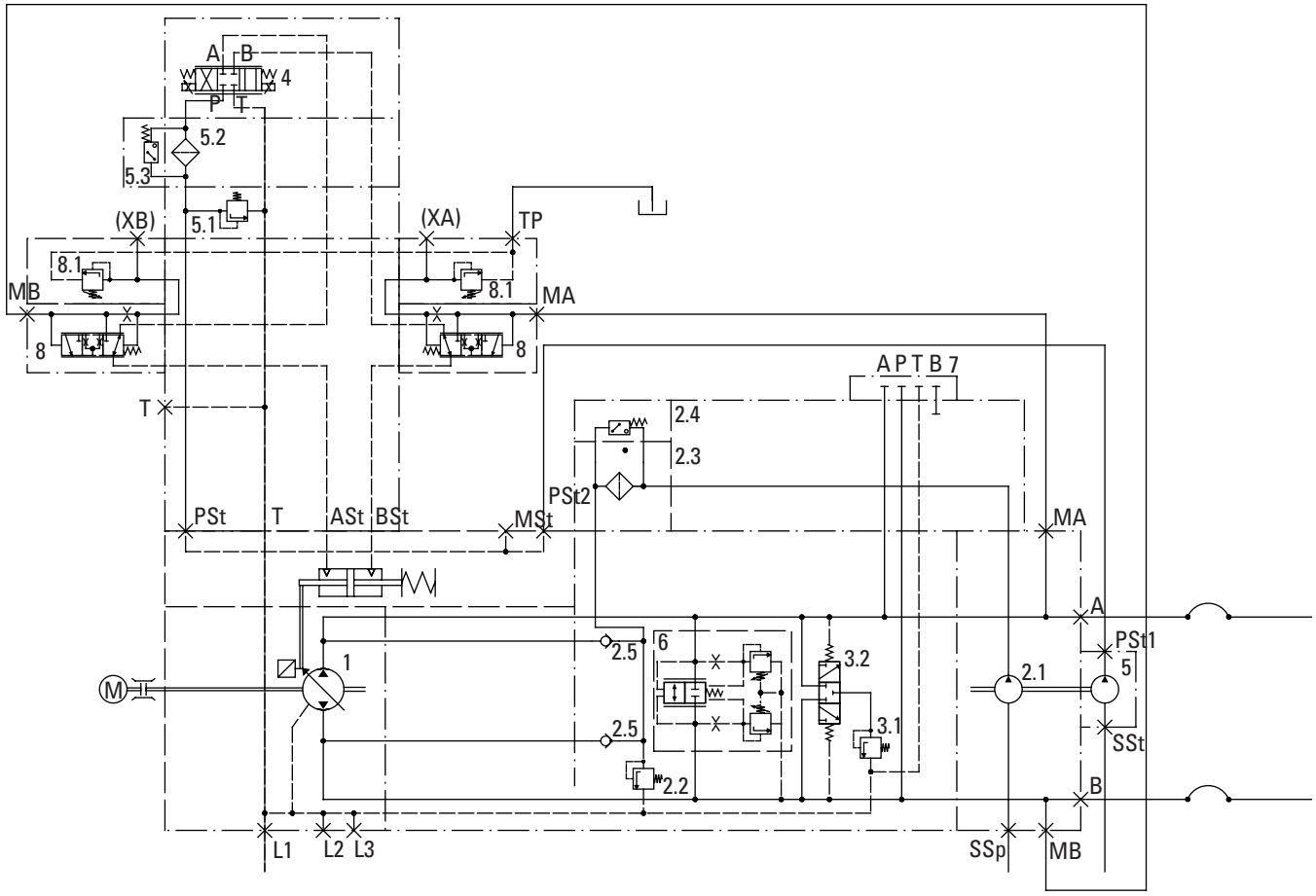
"X" Series – Closed Loop

The example shows a TVXS-130 pump with SP-control, complete transmission circuit and pressure limiter override for both sides, with charge and pilot oil filter with electrical indicator.

Other model coding also possible due to some variations which cannot be seen in the circuit diagram (seal material, main drive shaft end).

Note: the below shown pressure limiter override is not in standard model coding, but will be available on request.

Possible model coding for such pump:
TVXS-130M04R000TP1R01SVPA20SPC03C30000000E0000000000010.



A, B	System ports
L1, L2, L3	Drain ports
MA, MB	Gauge port-system pressure
MSt	Gauge port-charge pressure
SSp	Suction port for charge pump
SSt	Suction port for pilot pump
pSt1	Outlet port pilot pump
pSt2	Pilot pressure port
T	Return line control circuit
TP	Return line pressure limiter override
1	Basic pump
2.1	Charge pump
2.2	Charge pressure relief valve
2.3	Charge flow filter
2.4	Clogging indicator for charge flow filter
2.5	Charge check valves (2 pcs)
3.1	Low pressure relief valve
3.2	Flushing flow shuttle valve
4	Proportional control valve
5	Pilot pump
5.1	Pilot pressure relief valve
5.2	Pilot oil filter
5.3	Clogging indicator for pilot oil filter
6	High pressure relief valve
7	Interface for short cut valve
8	Pressure limiter override (main stage)
8.1	Pressure limiter override (pilot stage)

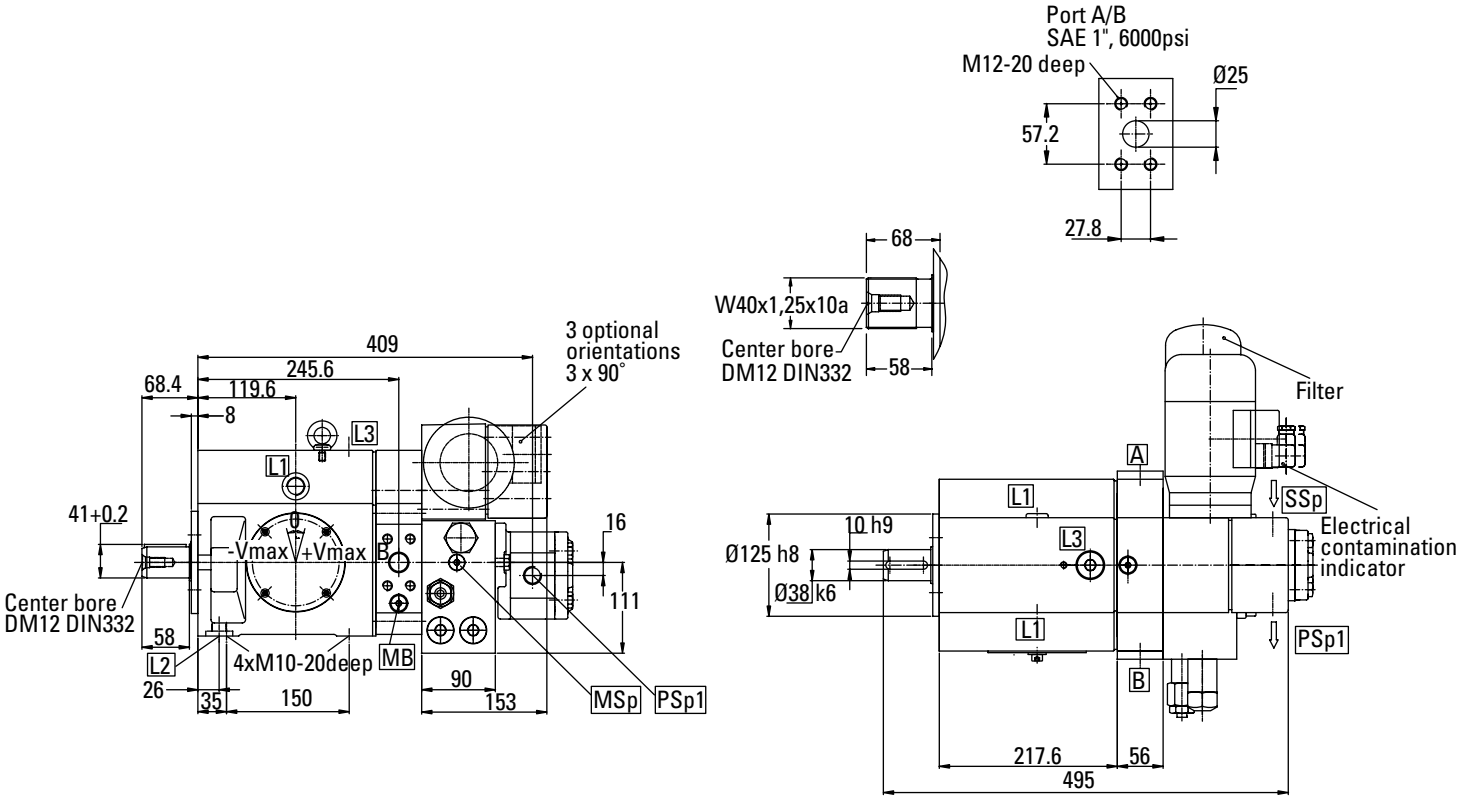
Pump Dimensions - TVXS - 066/090

ES Control

Dimensions in mm

Type ES, Electric Motor Displacement Control

Control displacement from + Vmax to - Vmax through V_0

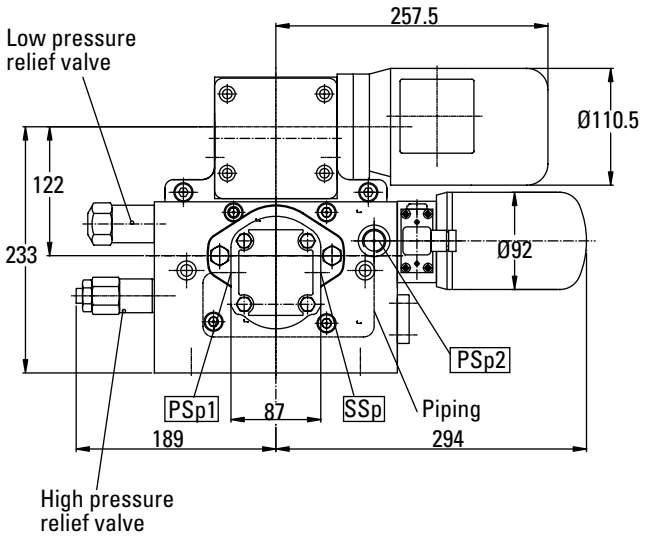


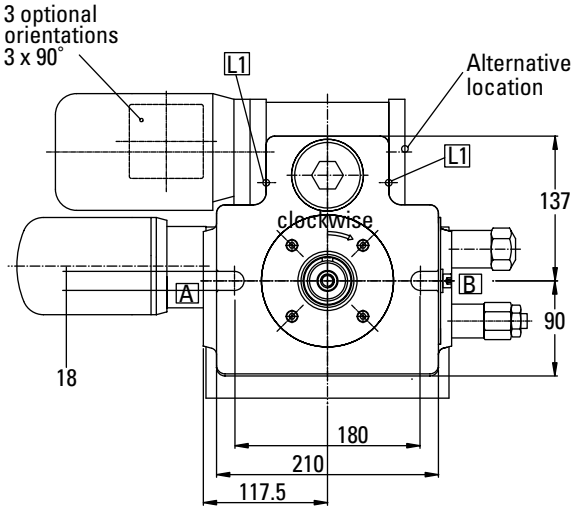
A, B	System pressure port (see detail)	L2	M18x1.5x12-deep supplementary drain, or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing upwards.	(L3)	Oil filling 7/8-14UNF-SAEJ475 or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing downwards.	(MSp)	Gauge port charge pump pressure G 1/4
(L1)	Drain port M22x1.5/two drain ports, one supplied plugged			(MA)	Gauge port system pressure G 1/4	pSp1	Pressure port of charge pump G 1/2
				(MB)	Gauge port system pressure G 1/4	pSp2	Pressure port M22x1.5
						SSp	Suction port of charge pump G 3/4
						(...)	Normally plugged

Pump Dimensions - TVXS - 066/090

ES Control

(cont.)





DIRECTION OF ROTATION	CONTROL	INPUT	OUTPUT
Right Hand Rotation	To + Vmax	B	A
	To - Vmax	A	B
Left Hand Rotation	To + Vmax	A	B
	To - Vmax	B	A

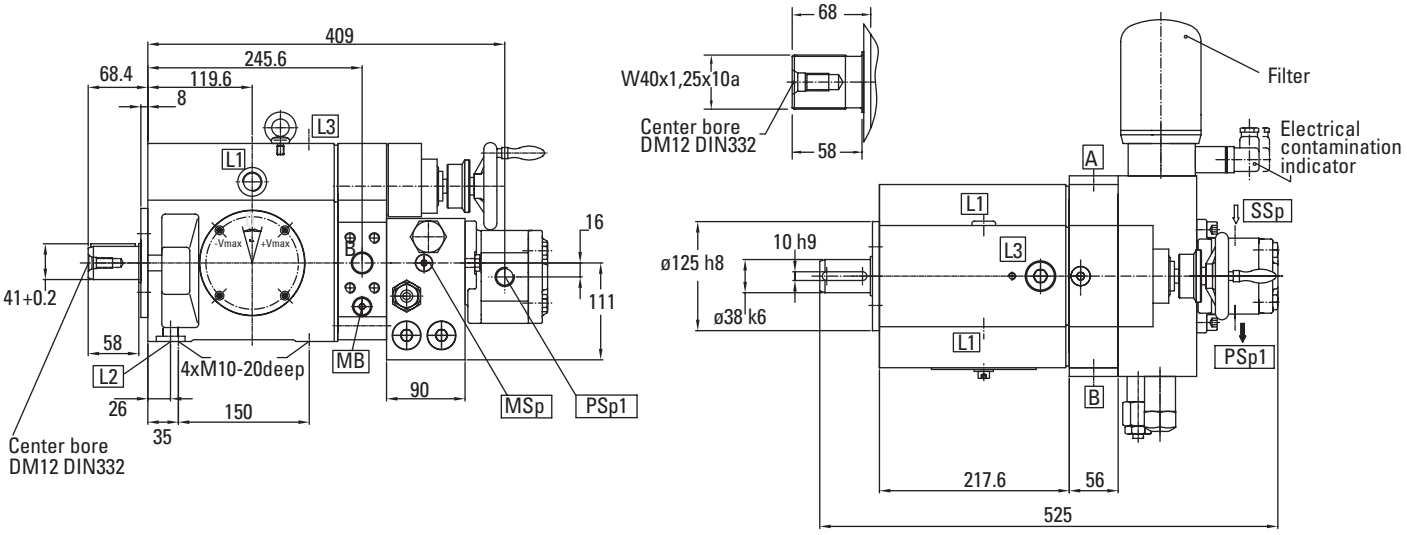
Pump Dimensions - TVXS - 066/090

HG Control

Dimensions in mm

Type HG, Handwheel Displacement Control

Control displacement from
+ Vmax to - Vmax through V0

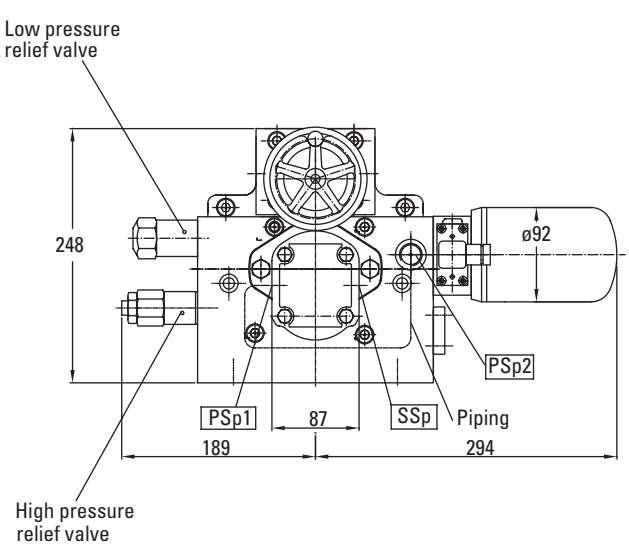


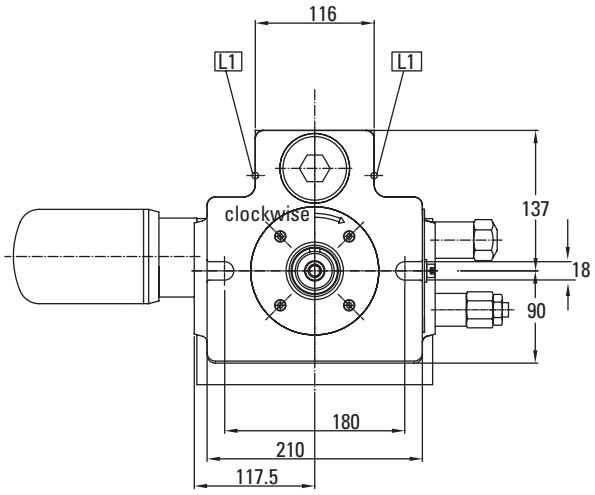
A, B	System pressure port (see detail)	L2	M18x1.5x12-deep supplementary drain, or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing upwards.	(L3)	Oil filling 7/8-14UNF-SAEJ475 or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing downwards.	(MSp)	Gauge port charge pump pressure G 1/4
(L1)	Drain port M22x1.5/two drain ports, one supplied plugged			(MA)	Gauge port system pressure G 1/4	pSp1	Pressure port of charge pump G 1/2
				(MB)	Gauge port system pressure G 1/4	pSp2	Pressure port M22x1.5
						SSp	Suction port of charge pump G 3/4
						(...)	Normally plugged

Pump Dimensions - TVXS - 066/090

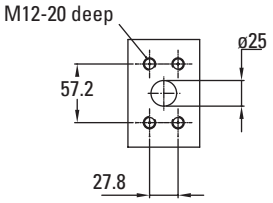
HG Control

(cont.)





Port A/B
SAE 1", 6000psi



DIRECTION OF ROTATION	CONTROL	INPUT	OUTPUT
Right Hand Rotation	To + Vmax	B	A
	To - Vmax	A	B
Left Hand Rotation	To + Vmax	A	B
	To - Vmax	B	A

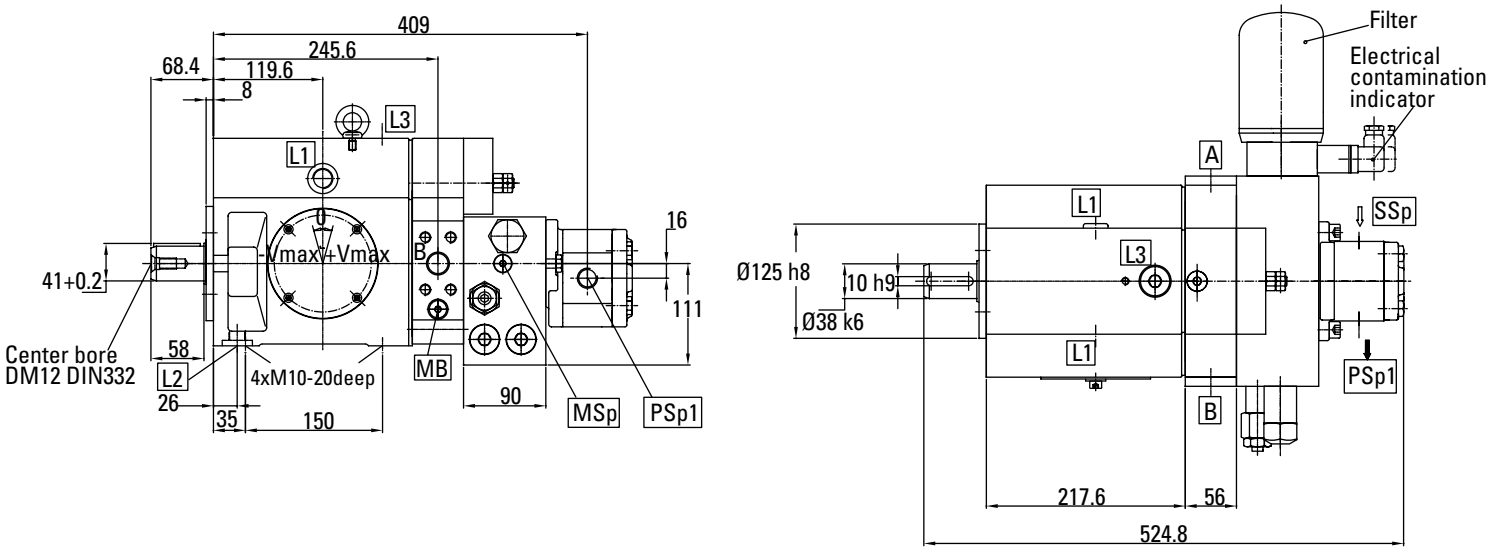
Pump Dimensions - TVXS - 066/090

FE Control

Dimensions in mm

Type FE, Screw Adjustment Displacement Control

Control displacement from + Vmax to - Vmax through V0

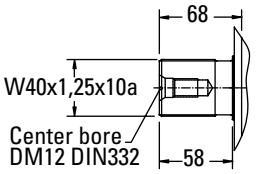


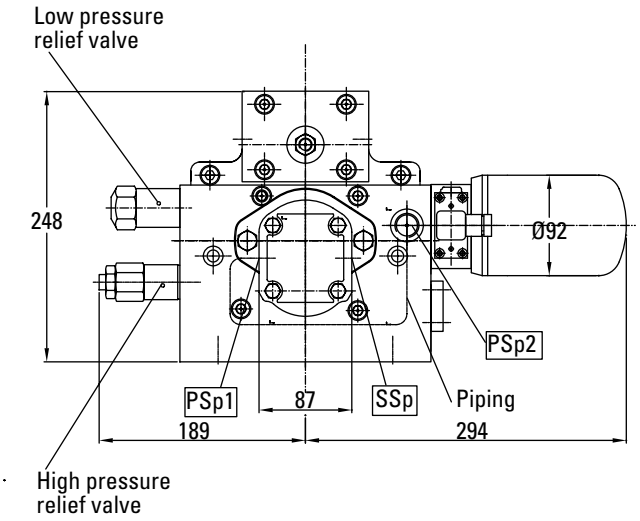
A, B	System pressure port (see detail)	(L3)	Oil filling 7/8-14UNF-SAEJ475 or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing downwards.	(MSp)	Gauge port charge pump pressure G 1/4	(...)	Normally plugged
(L1)	Drain port M22x1.5/two drain ports, one supplied plugged	(MA)	Gauge port system pressure G 1/4	pSp1	Pressure port of charge pump G 1/2		
L2	M18x1.5x12-deep supplementary drain, or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing upwards.	(MB)	Gauge port system pressure G 1/4	pSp2	Pressure port M22x1.5		
				SSp	Suction port of charge pump G 3/4		

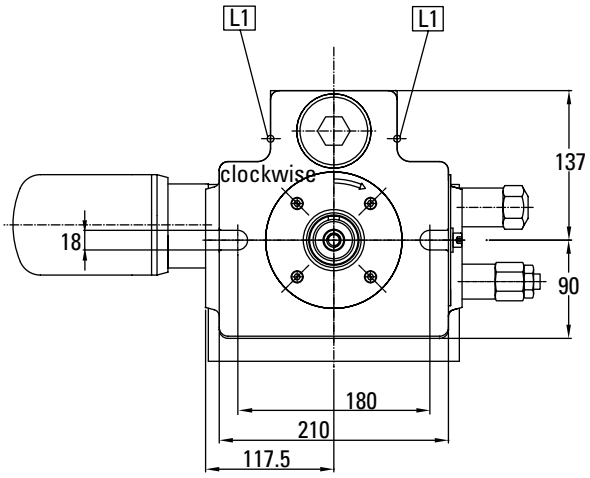
Pump Dimensions - TVXS - 066/090

FE Control

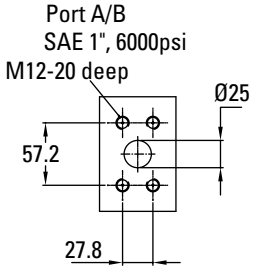
(cont.)







DIRECTION OF ROTATION	CONTROL	INPUT	OUTPUT
Right Hand Rotation	To + Vmax	B	A
	To - Vmax	A	B
Left Hand Rotation	To + Vmax	A	B
	To - Vmax	B	A



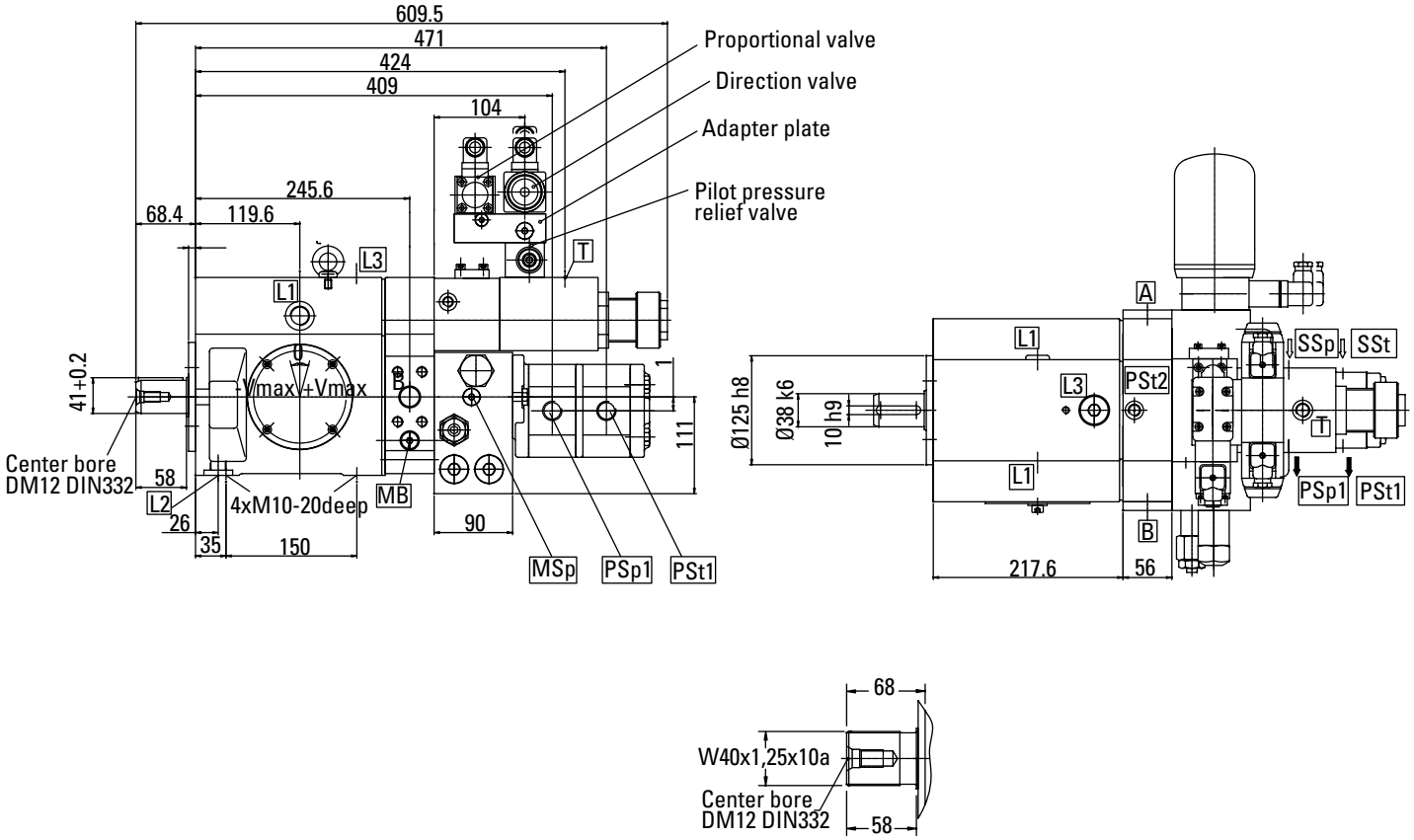
Pump Dimensions - TVXS - 066/090

DP Control

Dimensions in mm

Type DP, Pressure Signal Displacement Control

Control displacement from + Vmax to - Vmax through V0, with internal mechanical feedback

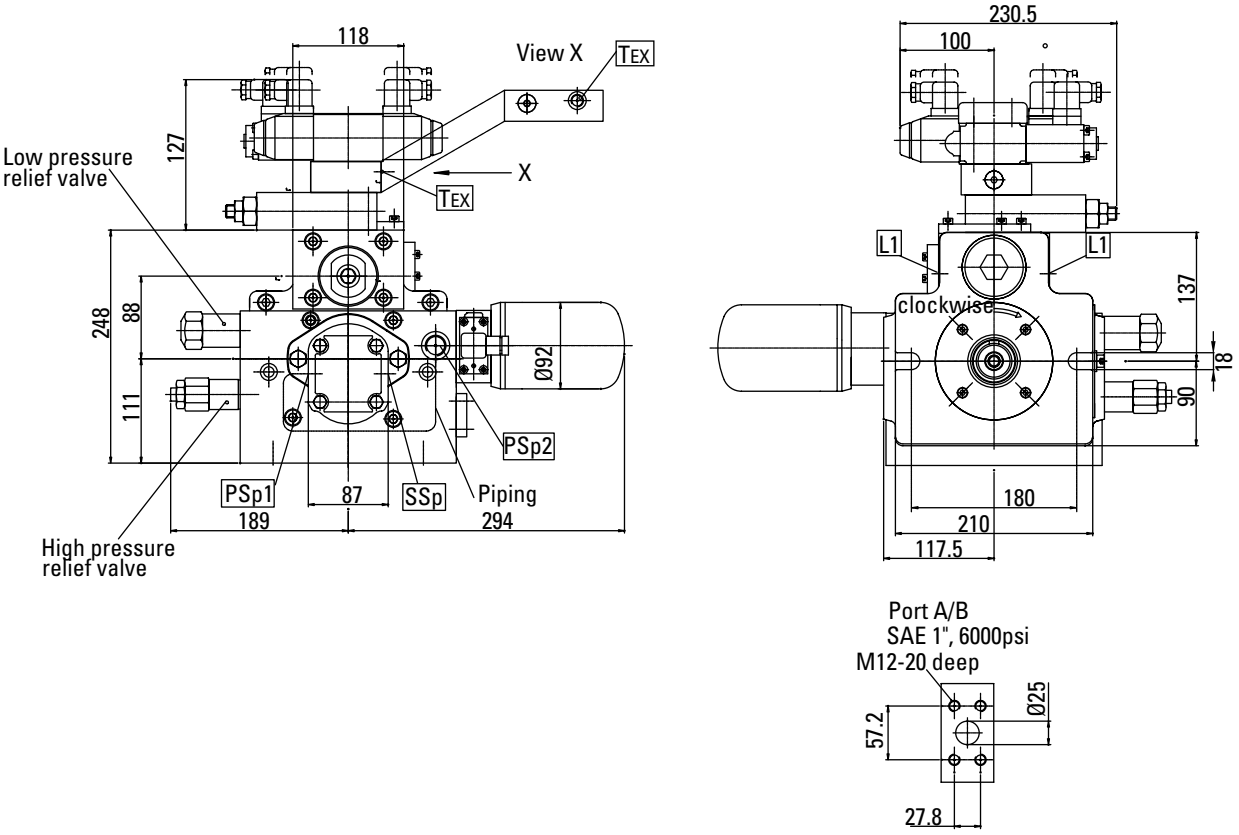


A, B	System pressure port (see detail)	(L3)	Oil filling 7/8-14UNF-SAEJ475 or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing downwards.	(MB)	Gauge port system pressure G 1/4	SSp	Suction port of charge pump G 3/4
(L1)	Drain port M22x1.5/two drain ports, one supplied plugged	(MA)	Gauge port system pressure G 1/4	(MSp)	Gauge port charge pump pressure G 1/4	SSt	Suction port of pilot pump G 3/4
L2	M18x1.5x12-deep supplementary drain, or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing upwards.			pSt1	Pilot pump outlet port G 1/2	T	Return line of control circuit G 1/2
				pSt2	Pilot pressure port M14x1.5	TEX	Return line Prop. valve G 1/2
				pSp1	Pressure port of charge pump G 1/2	(...)	Normally plugged
				pSp2	Pressure port M22x1.5		

Pump Dimensions - TVXS - 066/090

DP Control

(cont.)



DIRECTION OF ROTATION	CONTROL	INPUT	OUTPUT
Right Hand Rotation	To + Vmax	B	A
	To - Vmax	A	B
Left Hand Rotation	To + Vmax	A	B
	To - Vmax	B	A

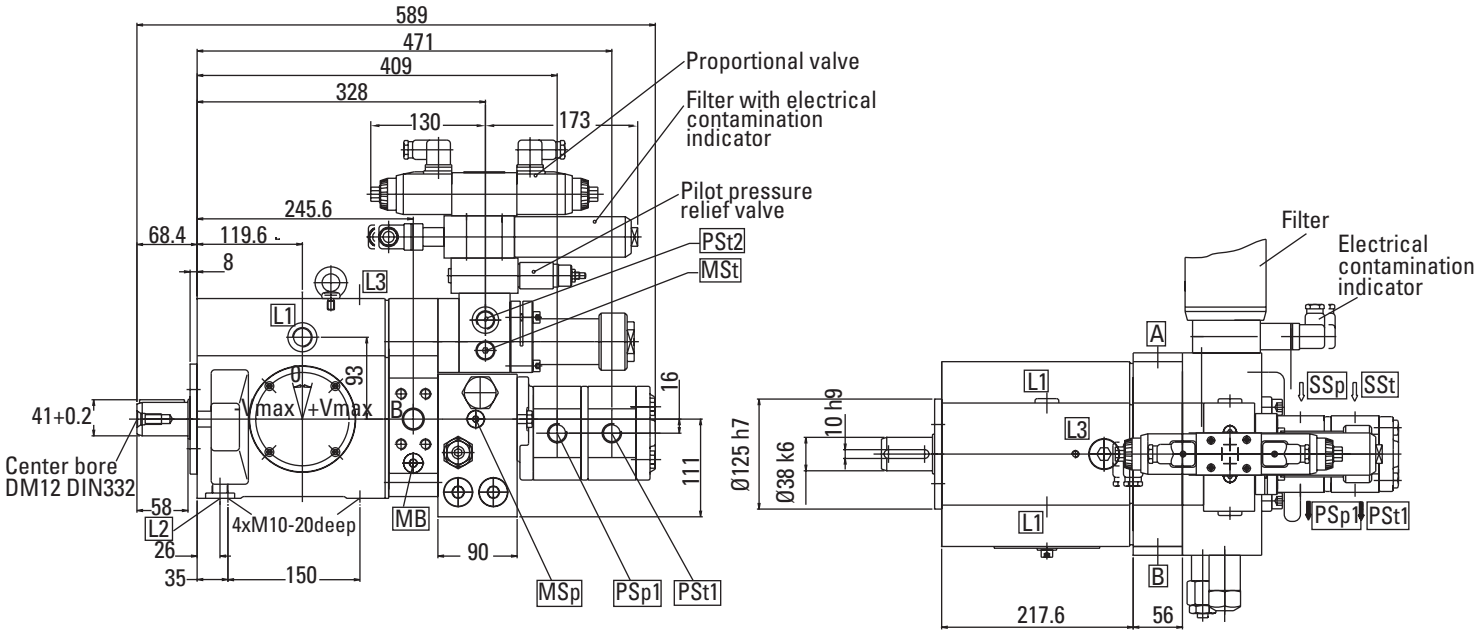
Pump Dimensions - TVXS - 066/090

SP Control

Dimensions in mm

Type SP, Proportional Valve Displacement Control

Control displacement from + Vmax to - Vmax V0, with position feedback (via potentiometer) of swashplate

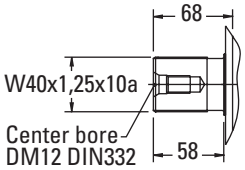


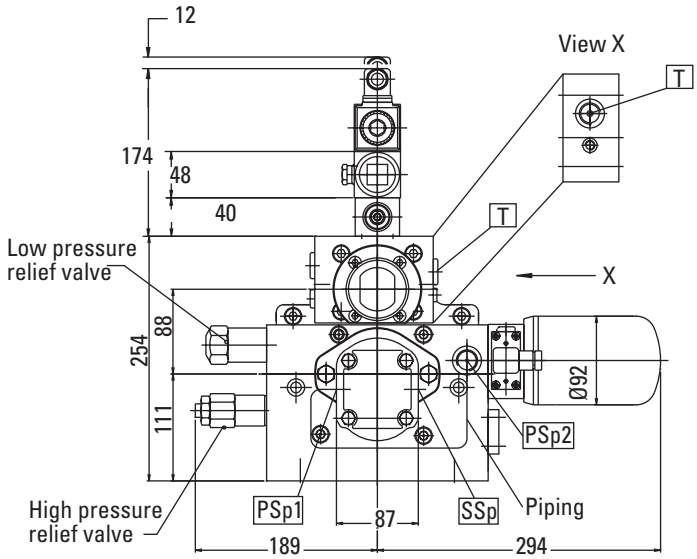
A, B	System pressure port (see detail)	(L3)	Oil filling 7/8-14UNF-SAEJ475 or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing downwards.	(MSp)	Gauge port charge pump pressure G 1/4	SSp	Suction port of charge pump G 3/4
(L1)	Drain port M22x1.5/two drain ports, one supplied plugged	(MA)	Gauge port system pressure G 1/4	pSt1	Pilot pump outlet port G 1/2	SSt	Suction port of pilot pump G 3/4
L2	M18x1.5x12-deep supplementary drain, or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing upwards.	(MB)	Gauge port system pressure G 1/4	pSt2	Pilot pressure port G 1/2	T	Return line of control circuit G 1/2
		(MSt)	Gauge port pilot pressure G 1/4	pSp1	Pressure port of charge pump G 1/2	(...)	Normally plugged
				pSp2	Pressure port M22x1.5		

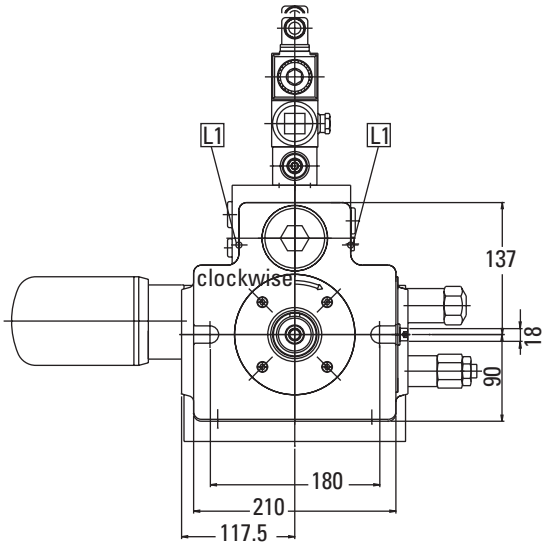
Pump Dimensions - TVXS - 066/090

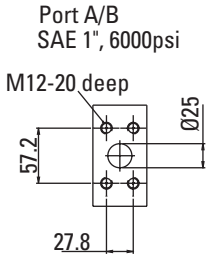
SP Control

(cont.)









DIRECTION OF ROTATION	CONTROL	INPUT	OUTPUT
Right Hand Rotation	To + Vmax	B	A
	To - Vmax	A	B
Left Hand Rotation	To + Vmax	A	B
	To - Vmax	B	A

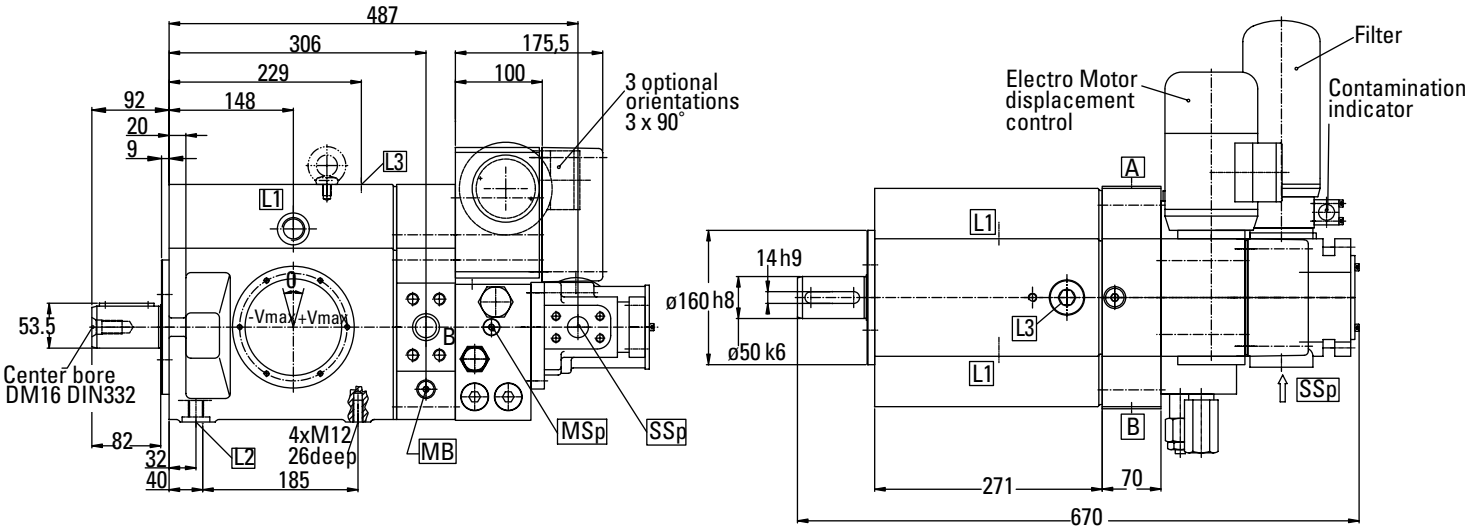
Pump Dimensions - TVXS - 130/180

ES Control

Dimensions in mm

Type ES, Electric Motor Displacement Control

Control displacement from
+ Vmax to - Vmax through V0

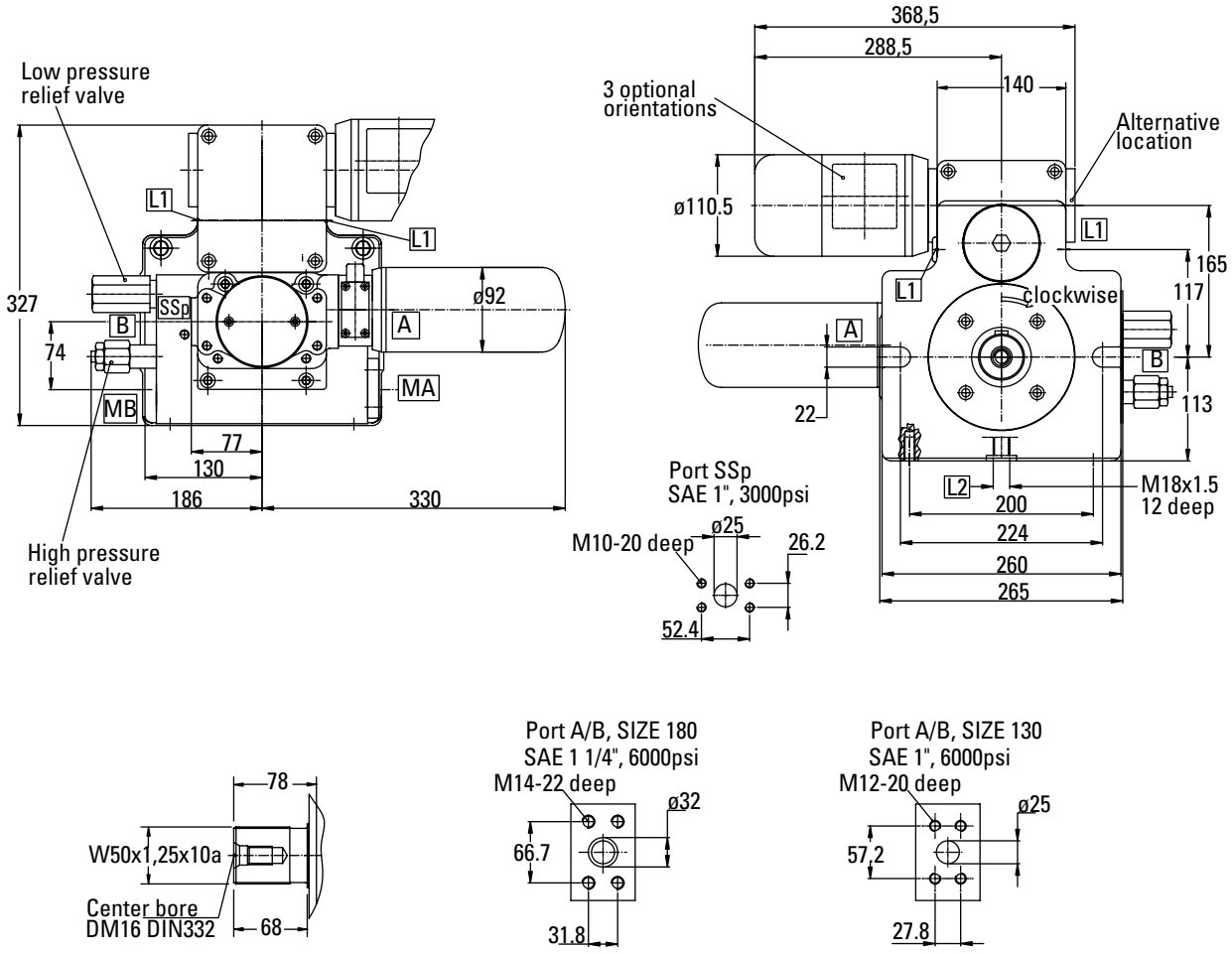


A, B	System pressure port (see detail)	L2	M18x1.5x12-deep supplementary drain, or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing upwards.	(L3)	Oil filling 1-1/16-12UNF SAEJ475 or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing downwards.	(MB)	Gauge port system pressure G 1/4
(L1)	Drain port M26x1.5/two drain ports, one supplied plugged			(MA)	Gauge port system pressure G 1/4	(MSp)	Gauge port charge pump pressure G 1/4
						SSp	Suction port of charge pump SAE 1", 3000psi/500psi
						(...)	Normally plugged

Pump Dimensions - TVXS - 130/180

ES Control

(cont.)



DIRECTION OF ROTATION	CONTROL	INPUT	OUTPUT
Right Hand Rotation	To + Vmax	B	A
	To - Vmax	A	B
Left Hand Rotation	To + Vmax	A	B
	To - Vmax	B	A

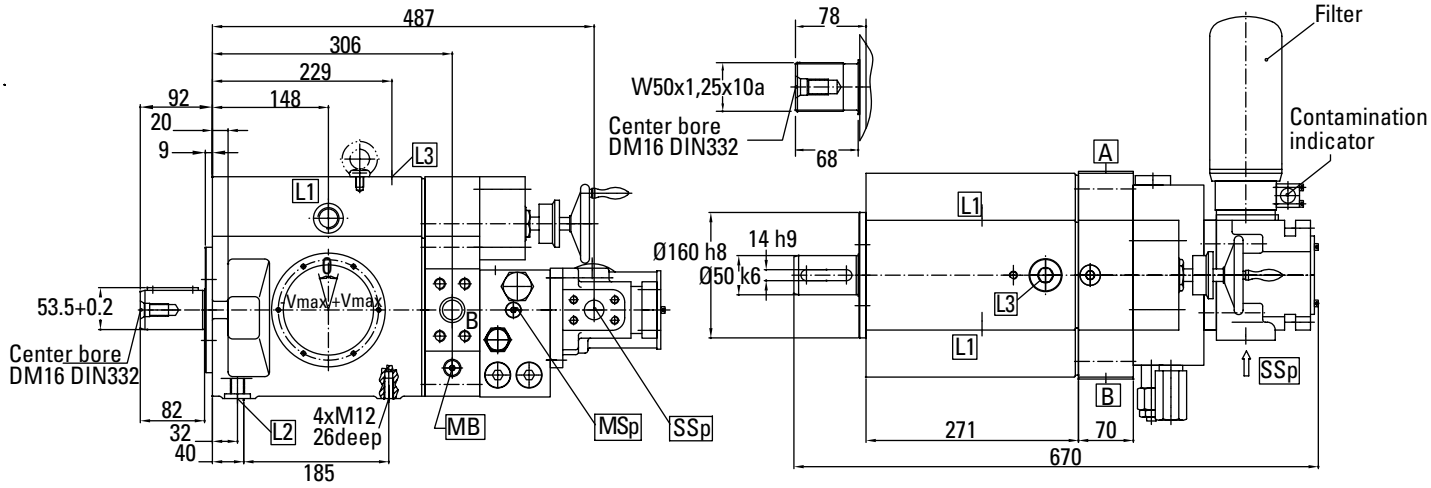
Pump Dimensions - TVXS - 130/180

HG Control

Dimensions in mm

Type HG, Handwheel Displacement Control

Control displacement from
+ Vmax to - Vmax through V0

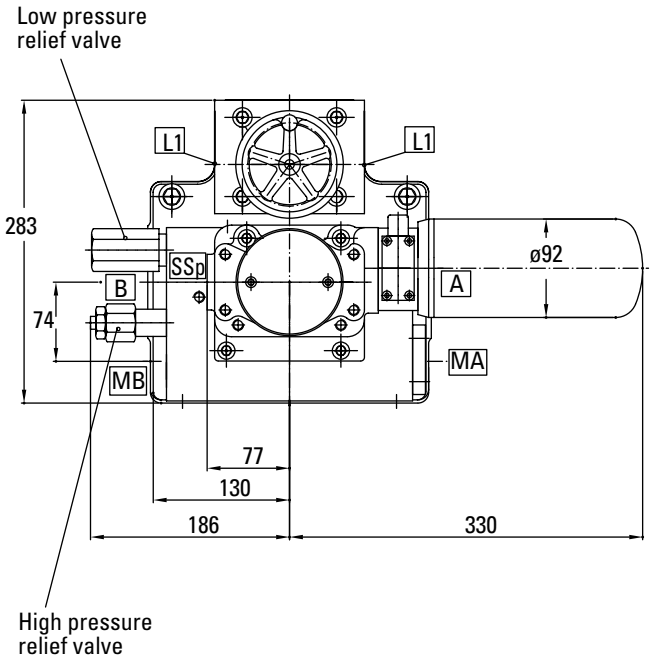


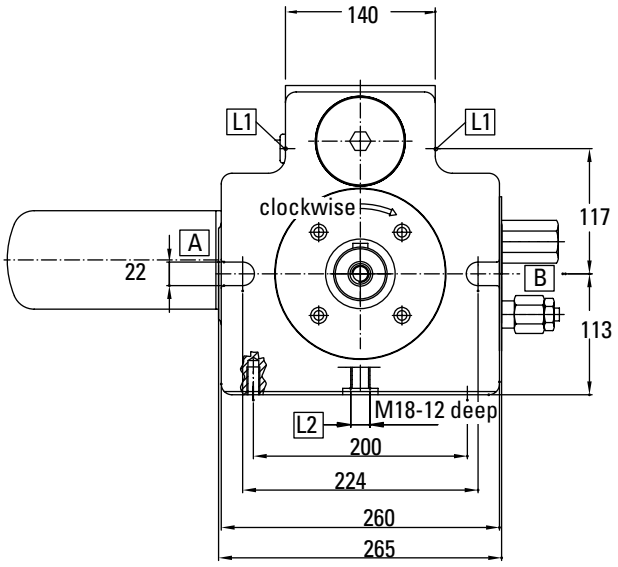
A, B	System pressure port (see detail)	L2	M18x1.5x12-deep supplementary drain, or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing upwards.	(L3)	Oil filling 1-1/16-12UNF SAEJ475 or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing downwards.	(MB)	Gauge port system pressure G 1/4
(L1)	Drain port M26x1.5/two drain ports, one supplied plugged			(MA)	Gauge port system pressure G 1/4	(MSp)	Gauge port charge pump pressure G 1/4
						SSp	Suction port of charge pump SAE 1", 3000psi/500psi
						(...)	Normally plugged

Pump Dimensions - TVXS - 130/180

HG Control

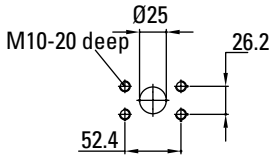
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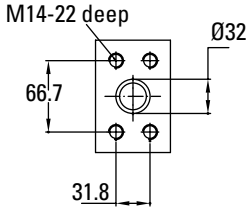


DIRECTION OF ROTATION	CONTROL	INPUT	OUTPUT
Right Hand Rotation	To + Vmax	B	A
	To - Vmax	A	B
Left Hand Rotation	To + Vmax	A	B
	To - Vmax	B	A

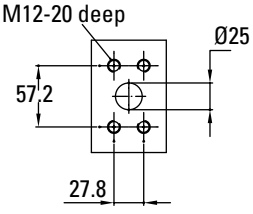
Port SSp
SAE 1", 3000psi/500psi



Port A/B, SIZE 180
SAE 1 1/4", 6000psi



Port A/B, SIZE 130
SAE 1", 6000psi



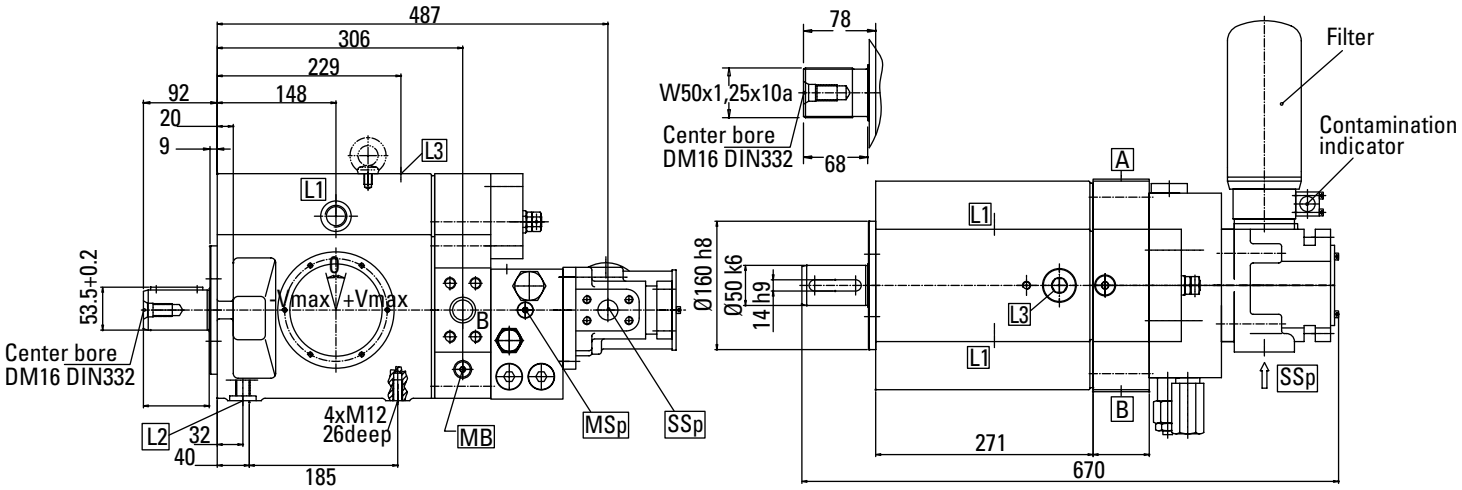
Pump Dimensions - TVXS - 130/180

FE Control

Dimensions in mm

Type FE, Screw Adjustment Displacement Control

Control displacement from
+ Vmax to - Vmax through V0

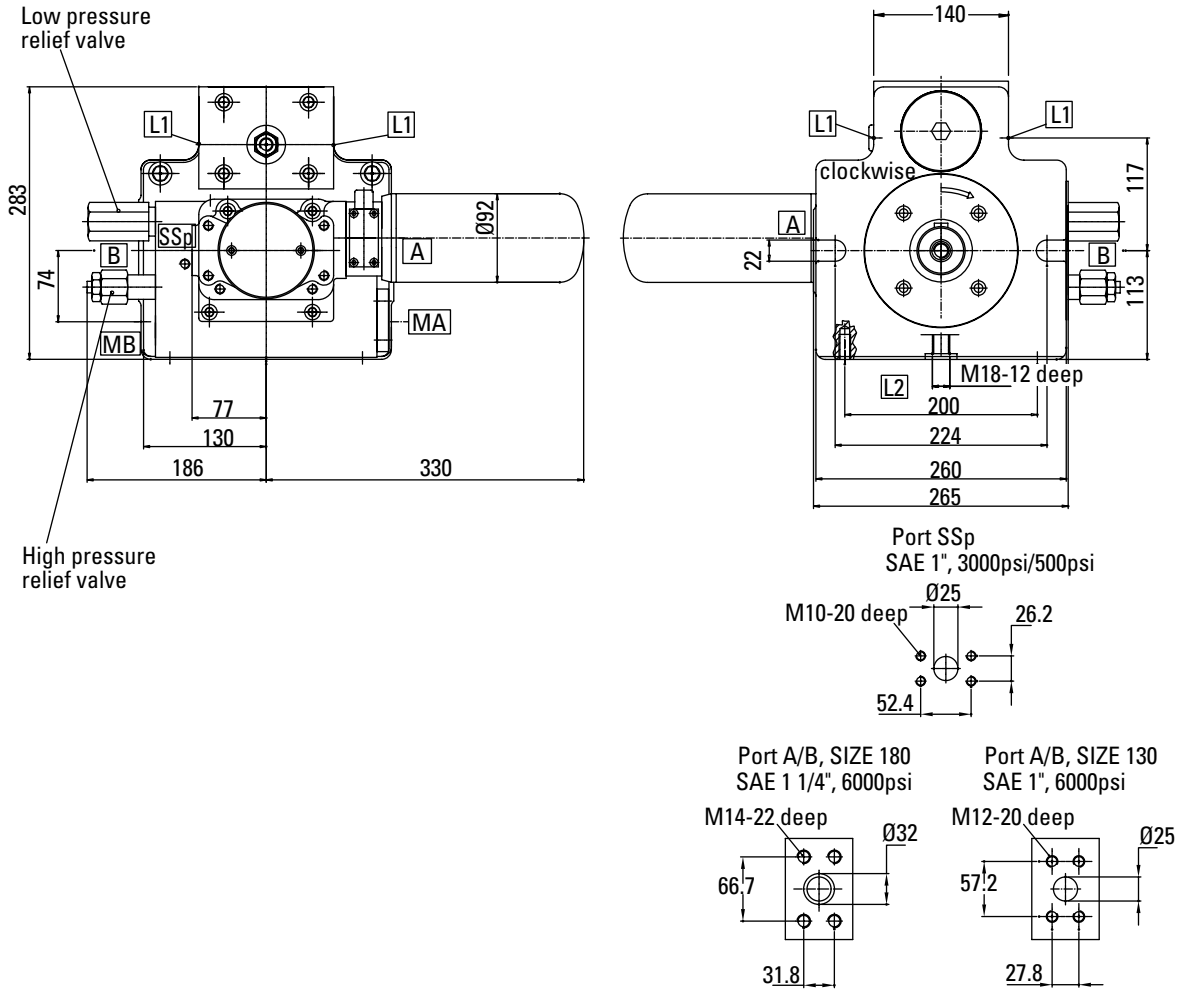


A, B	System pressure port (see detail)	L2	M18x1.5x12-deep supplementary drain, or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing upwards.	(L3)	Oil filling 1-1/16-12UNF SAEJ475 or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing downwards.	(MB)	Gauge port system pressure G 1/4
(L1)	Drain port M26x1.5/two drain ports, one supplied plugged			(MA)	Gauge port system pressure G 1/4	(MSp)	Gauge port charge pump pressure G 1/4
						SSp	Suction port of charge pump SAE 1", 3000psi/500psi
						(...)	Normally plugged

Pump Dimensions - TVXS - 130/180

FE Control

(cont.)



DIRECTION OF ROTATION	CONTROL	INPUT	OUTPUT
Right Hand Rotation	To + Vmax	B	A
	To - Vmax	A	B
Left Hand Rotation	To + Vmax	A	B
	To - Vmax	B	A

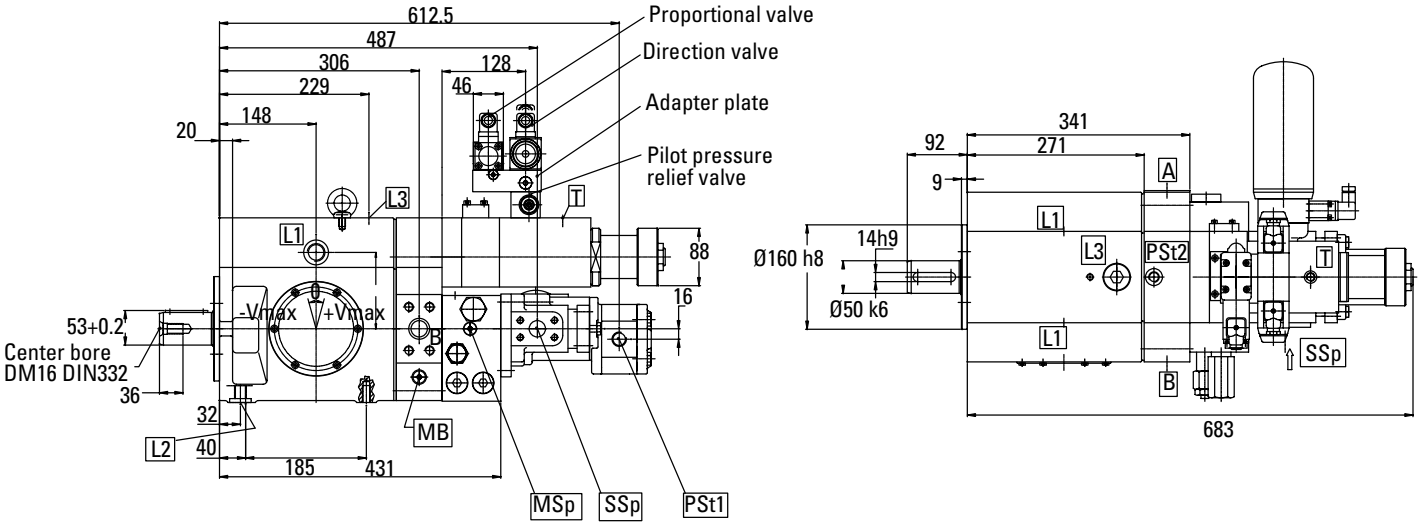
Pump Dimensions - TVXS - 130/180

DP Control

Dimensions in mm

Type DP, Pressure Signal Displacement Control

Control displacement from + Vmax to - Vmax through V0, with internal mechanical feedback

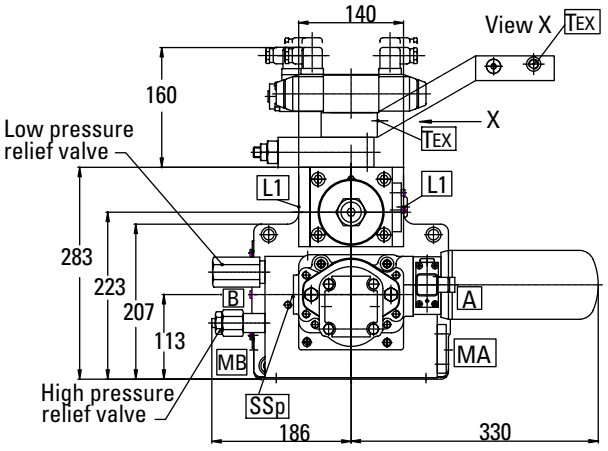


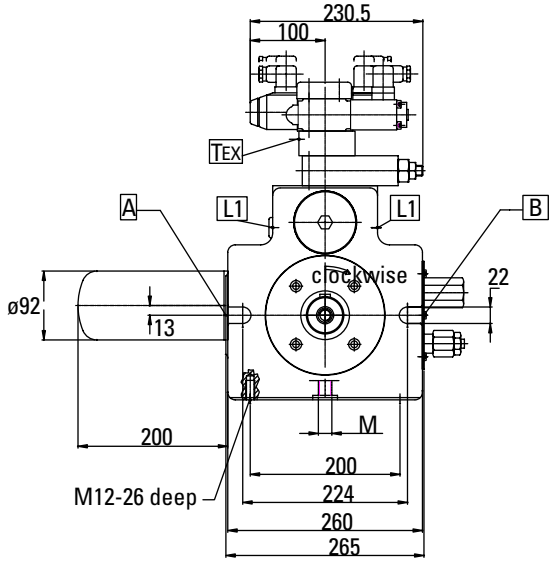
A, B	System pressure port (see detail)	(L3)	Oil filling 1-1/16-12UNF SAEJ475 or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing downwards.	(MB)	Gauge port system pressure G 1/4	SSt	Suction port of pilot pump G 3/4
(L1)	Drain port M26x1.5/two drain ports, one supplied plugged	(MA)	Gauge port system pressure G 1/4	(MSp)	Gauge port charge pump pressure G 1/4	T	Return line of control circuit G 1/2
L2	M18x1.5x12-deep supplementary drain, or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing upwards.			pSt1	Pilot pump outlet port G 1/2	Tex	Return line Prop. valve G 1/4
				pSt2	Pilot pressure port M16x1.5	(...)	Normally plugged
				SSp	Suction port of charge pump SAE 1", 3000psi/500psi		

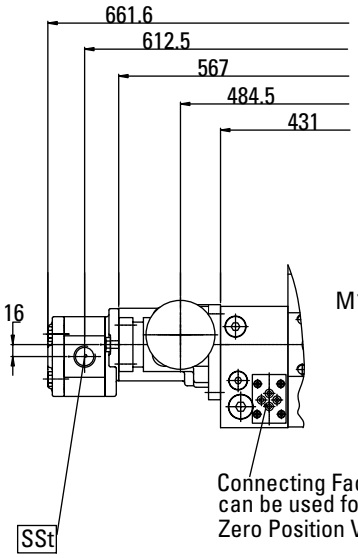
Pump Dimensions - TVXS - 130/180

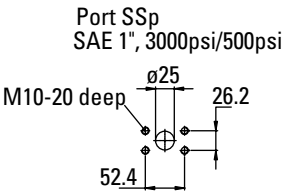
DP Control

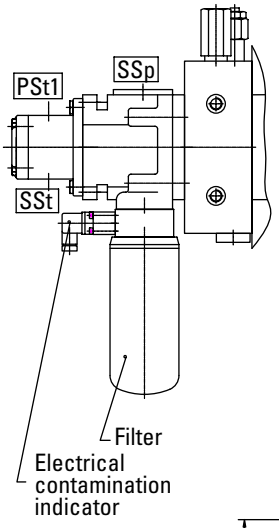
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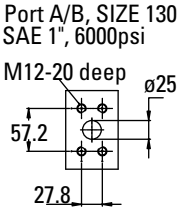


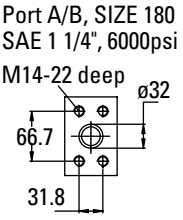


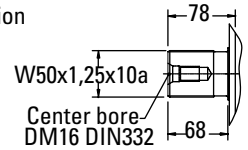












DIRECTION OF ROTATION	CONTROL	INPUT	OUTPUT
Right Hand Rotation	To + Vmax	B	A
	To - Vmax	A	B
Left Hand Rotation	To + Vmax	A	B
	To - Vmax	B	A

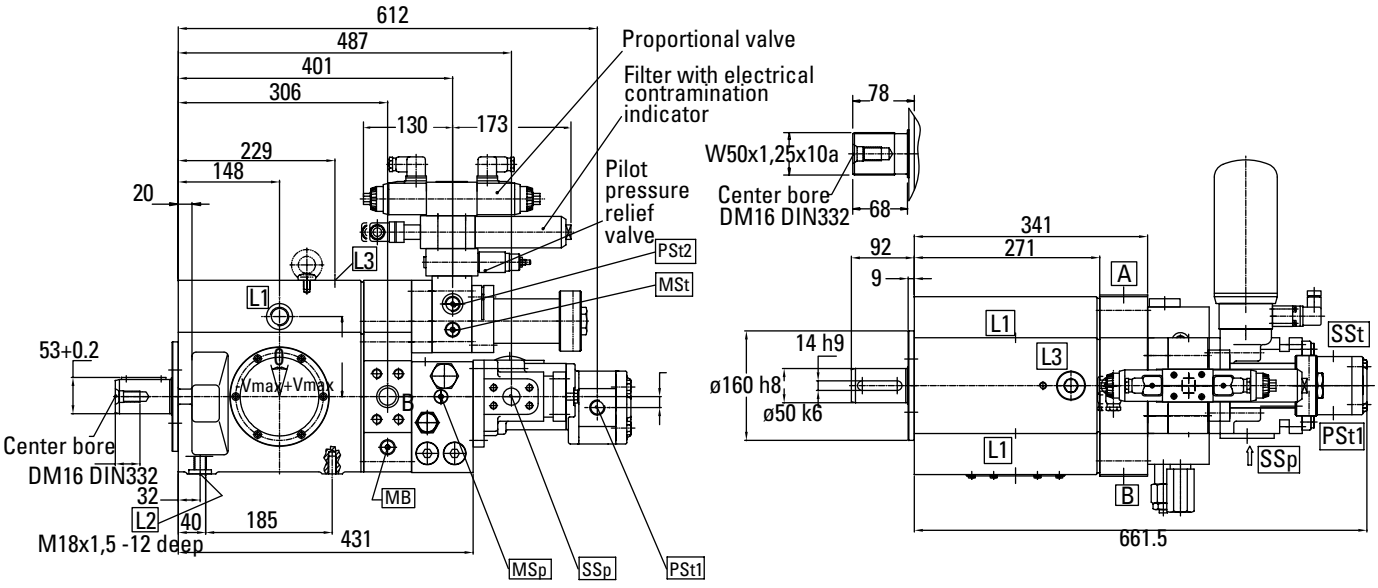
Pump Dimensions - TVXS - 130/180

SP Control

Dimensions in mm

Type SP, Proportional Valve Displacement Control

Control displacement from + Vmax to - Vmax through V0, with position feedback (via potentiometer) of swashplate

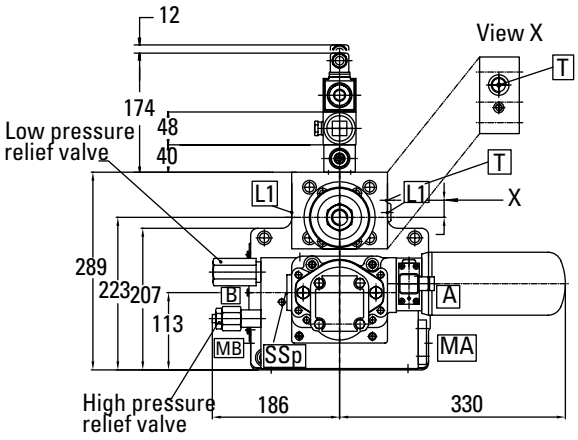


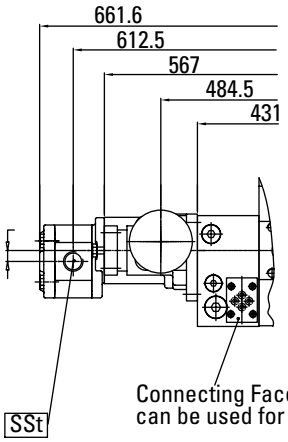
A, B	System pressure port (see detail)	(L3)	Oil filling 1-1/16-12UNF SAEJ475 or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing downwards.	(MB)	Gauge port system pressure G 1/4	SSp	Suction port of charge pump SAE 1", 3000psi/500psi
(L1)	Drain port M26x1.5/two drain ports, one supplied plugged	(MA)	Gauge port system pressure G 1/4	(MSt)	Gauge port pilot pressure G 1/4	SSt	Suction port of pilot pump G 3/4
L2	M18x1.5x12-deep supplementary drain, or bleed plug. Must be drained in addition to L1 if the pump is installed with the shaft input end pointing upwards.			(MSp)	Gauge port charge pump pressure G 1/4	T	Return line of control circuit G 1/2
				pSt1	Pilot pump outlet port G 1/2	(...)	Normally plugged
				pSt2	Pilot pressure port G 1/2		

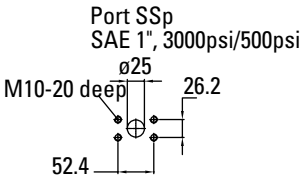
Pump Dimensions - TVXS - 130/180

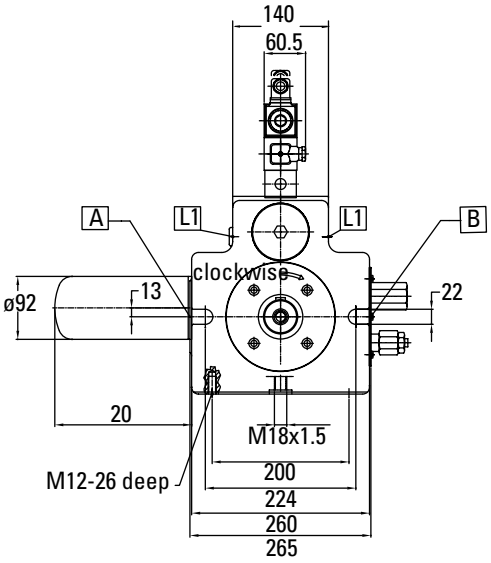
SP Control

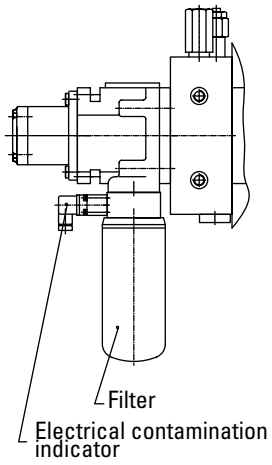
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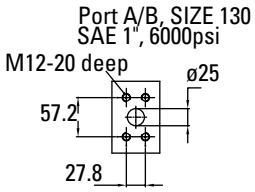


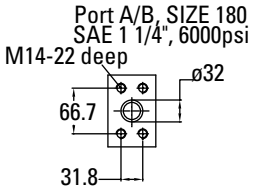






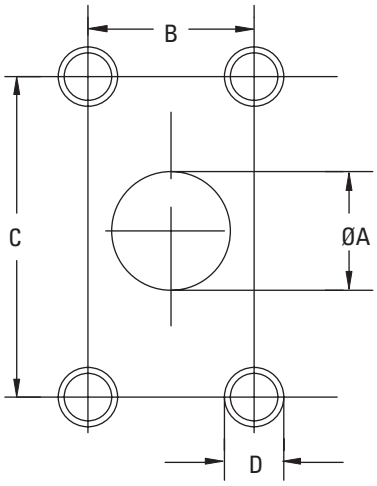






DIRECTION OF ROTATION	CONTROL	INPUT	OUTPUT
Right Hand Rotation	To + Vmax	B	A
	To - Vmax	A	B
Left Hand Rotation	To + Vmax	A	B
	To - Vmax	B	A

SAE 4-Bolt
Mounting Pads

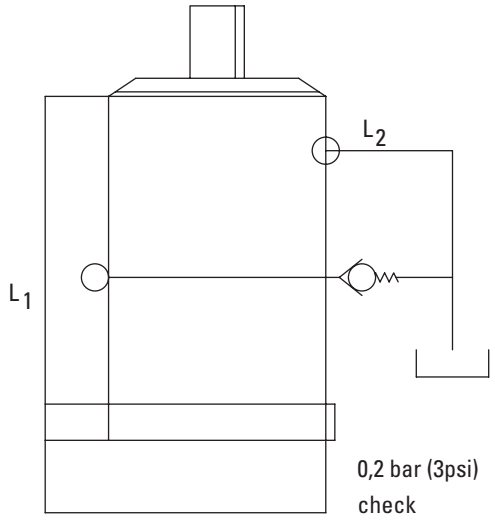


SIZE	DIM.	CODE 62 SERIES	
		1"	1 1/4"
	A	25	32 max
	B	27,8	31,8
	C	57,2	66,7
	D	M12 x 18	M14 x 24
TVX 066	Inlet	•	
	Outlet	•	
TVX 090	Inlet	•	
	Outlet	•	
TVX 130	Inlet	•	
	Outlet	•	
TVX 180	Inlet		•
	Outlet		•

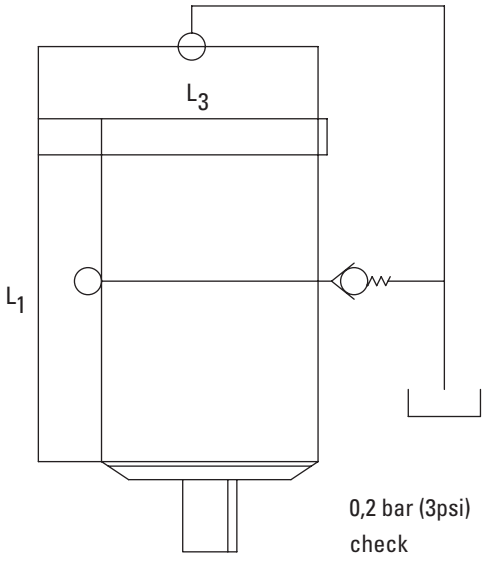
Thru-drive Shaft Output Torque

	MAXIMUM OUTPUT TORQUE, NM (LB.FT)		
Pump Size	**Keyed Shaft Increasing Load**	**Keyed Shaft Increasing Load**	**Splined Shaft**
066	520 (383)	260 (190)	660 (485)
090	520 (383)	260 (190)	660 (485)
130	720 (530)	360 (265)	900 (665)
180	720 (530)	360 (265)	900 (665)

INSTALLATION POSITION	DRAIN PIPING
Shaft pointed upwards	



Shaft pointed downwards



Application Data - Fluid Recommendations

Case Flushing Requirements

A check valve must not be used in the drain pipe. The drain pipe must interminate below the oil level in the reservoir.

For all other conditions with low pressure <20 bar (<300psi) and low flow (<10% of Qmax) case flushing is required.

For operation with special fluids HFB and HFC, case flushing is recommended.

Flushing Flow

Flushing flow via the pump case should be >1% of maximum pump flow. Maximum flushing flow depends on case pressure.

Notes:

- All listed ratings are based on the use of a good quality fluid.
- Alternative fluids have a reduced tolerance for contamination over petroleum-base fluids. Good filtration is therefore critical.
- The pumps will provide exceptional life when used with a good quality clean fluid at the pump ratings specified for that fluid.

Fluids

Pumps in the catalog are primarily designed to operate with conventional petroleum-based hydraulic oil. Alternative fluids and restrictions:

- Fluid maintenance is critical to the durability of all hydraulic components, and particularly so with hydraulic pumps. This becomes even more of a factor when alternative fluids are used. All types of alternative fluids require extensive maintenance in order to maintain proper levels of water content, acidity, viscosity and contamination.

Fluid Cleanliness

These pumps are rated for anti-wear petroleum fluids with a contamination level of 18/15/13 per ISO 4406. Operation in fluids with higher contamination levels than this is not recommended and may reduce the life of the pump components. Fluids other than petroleum, severe service cycles, or temperature extremes are cause for adjustment of these codes. Please contact your Eaton representative for special duty cycle recommendations.

Eaton pumps, as well as 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 inclusion of air.

Essential information on the correct methods for treating hydraulic fluid is included in Eaton publication 561- "Vickers Guide to Systemic Contamination Control"- available from your local Eaton distributor.

In this publication, filtration and cleanliness levels for extending the life of axial piston pumps and other system components are listed. Included is an excellent discussion of the selection of products needed to control fluid condition.

Ordering Procedure

When ordering please specify full model designation of items required; see "Model Codes" section of this catalog.

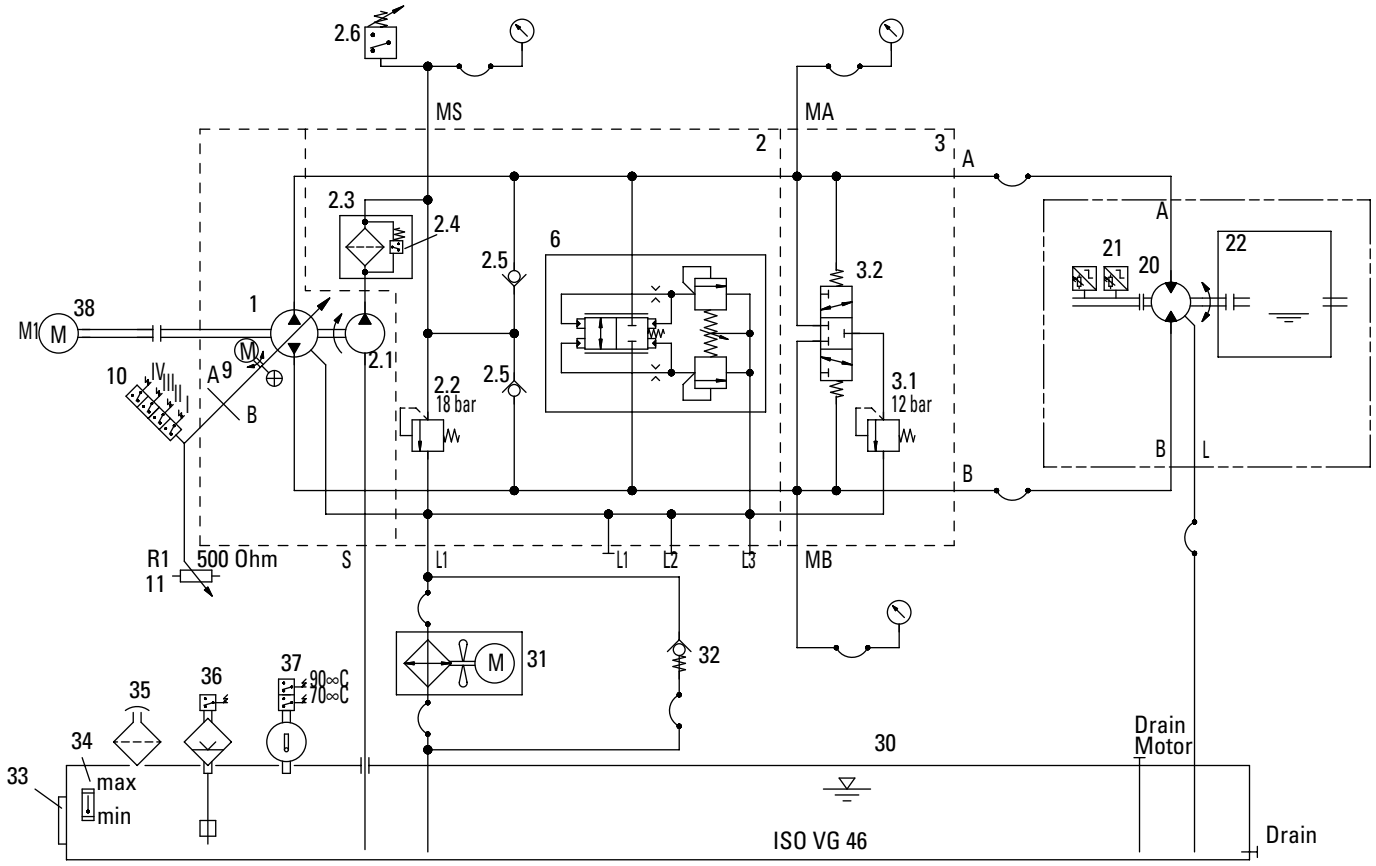
Note the following:

- Designation of variable displacement pumps must include the supplementary designation of the required control.

FLUIDS

TYPE	CLASSIFICATION	MAX PRESSURE BAR	MAX SPEED RPM	RECOMMENDED SEAL MATERIAL	MAX OPERATING TEMPERATURE °C	BEARING LIFE
Oil in Water Emulsion	HFAE	Not Rated				0%
Water in oil Emulsion	HFB	250	1800	Fluorocarbon	49	50%
Water Glycol	HFC	250	1800	Fluorocarbon	49	25%
Phosphate Ester	HFDR	350/420	1800	Fluorocarbon	66	100%
Polyol Ester	HFDU	350/420	1800	Fluorocarbon	66	100%

Description of Closed Loop Transmission with Electric Motor Displacement Control



The schematic enclosed shows a typical heavy duty hydrostatic transmission. The pump and motor are the main components. The filter, reservoir, heat exchanger and oil lines make up the rest of the system.

The function of these components is described below:

The Pump

The pump generates the flow of high pressure oil. The typical transmission employs a variable displacement pump. The variable displacement feature allows the amount of oil pumped to be varied. And the amount of oil pumped controls the motor's output speed. For example, when the pump's displacement is zero, no oil is pumped and the transmission's output shaft is at rest. Conversely, maximum displacement produces maximum speed. The direction of high pressure flow can also be reversed; doing so reverses the direction the output shaft rotates. An external energy source, called the prime mover (usally an electrical motor), turns the input shaft of the pump.

The Motor

The motor uses the high pressure oil flow from the pump to produce transmission output. The high pressure oil comes to the motor through one of the high pressure lines. It enters the motor, turns the output shaft, then returns to the pump. The pump and motor in the drawing are connected in a closed-loop circuit.

Important:

Remember, the pump generates flow, and the load on the motor's output shaft causes resistance to that flow. That resistance to flow is what creates the high pressure. Therefore, the oil flowing in the lines that connect the pump and motor is called "high pressure flow."

The pump and motor in the drawing are contained in separate housings. This configuration provides maximum flexibility in design and transmission installation.

The Charge Pump

The charge pump generates a low pressure oil flow that has three functions. First, it supplies a continuous flow of oil through the pump and motor cases. This "case flow" keeps the transmission cool. In the drawing, the case flow goes from the motor to the pump, then to the heat exchanger and back to the reservoir. Second, the charge pump keeps the high pressure lines filled. This ensures that the transmission remains primed even after extended periods of running in neutral. Finally, charge pump flow provides back pressure in the high pressure lines when the transmission is in forward or reverse. The charge pump contains a relief valve that helps maintain the pressure of the low pressure oil flow.

The charge pump bolts onto the pump and its input shaft connects with the input shaft of the pump. The charge pump inlet receives oil from the reservoir.

The Valve Block

The valve block contains a two-sided high pressure relief valves, a shuttle valve and a charge pressure relief valve.
The high pressure relief valve protects the transmission from pressures that are too high. The shuttle valve and charge pressure relief valve direct excess charge pump flow into the pumps case. This case flow cools the pump. The valve block bolts directly to the pump.

The Heat Exchanger, Reservoir, Filter, and Oil Lines

The heat exchanger, reservoir, filter and oil lines are all necessary for heavy duty transmission operation. The heat exchanger connects between the case flow outlet and the reservoir. It cools the oil before it enters the reservoir. The heat exchanger must be fitted with a by-pass valve that opens when case drain pressure gets too high. The by-pass valve is especially important during cold starts when the oil is thick. The reservoir supplies a steady flow of oil to the charge pump inlet. It also provides room for the oil to expand as it gets hot and for entrapped air to escape. The filter is installed between the charge pump outlet and the valve block. It removes contaminants from the oil.

The oil lines provide passage ways for the oil flowing among the transmission components. They must be strong enough to withstand the pressures generated and may be rigid or flexible.

Description of Operation

A hydrostatic transmission is a dynamic system that operates through a wide range of conditions. Nevertheless, this wide operating range can conveniently be divided into three basic modes: neutral, forward and reverse.

The schematics and their accompanying explanations will help you visualize what's going on inside the transmission during each of the operating modes.

Important: As you study the following flow descriptions, remember that in all modes of operation, the input shaft of the pump is being turned by an external power source.

Neutral

The hydrostatic transmission is in neutral when the variable pump's displacement is zero. With zero displacement, no high pressure oil is pumped to the motor and its output shaft is stopped.

Putting the control signal in the neutral position centers the swashplate. With the swashplate centered the pistons don't reciprocate as the cylinder barrel is rotated and no high pressure oil is pumped.

The charge pump, which is connected to the input shaft, pumps oil in all modes of transmission operation. In neutral, it takes cooled, filtered oil from the reservoir and fills the system. Charge pump flow passes through the check valves in the pump's end cover and fills the pump pistons, the high pressure lines and the motor's pistons. This oil flow is intended to make up for internal leakage and keep the circuit primed.

After the high pressure circuit has been primed, the charge pump pressure opens the charge pressure relief valve located in the charge pump. This directs the charge pump flow through the pump case and back to the reservoir. This oil flow flushes and cools the pump.

The forward mode and the reverse mode are similar, so they will be grouped and called the forward! reverse mode.

Application Information (cont.)

Forward/Reverse

The hydrostatic transmission is in the forward/reverse mode when flow in the high pressure circuit causes the motor shaft to rotate.

Flow in the high pressure circuit is created by tilting the pump's variable swashplate from its center or neutral, position. With the swashplate tilted, the pistons reciprocate as the cylinder barrel rotates and flow is generated.

The swashplate may be tilted to either side of center. Tilting it one way generates flow that makes the transmission go forward. And tilting it the other way reverses flow and the motor shaft rotates in the opposite direction.

Besides controlling direction, the swashplate angle also controls output speed. Swashplate angle affects speed by changing the pump's displacement. The largest swashplate angle produces the largest displacement and the fastest motor speed.

The Electrical Motor Displacement Control circuit varies the swashplate angle by turning a spindle directly fixed to the servo piston. According to the direction of rotation of the control motor, the spindle turns and the swashplate is tilt until the motor is switched off (for more detailed explanations refer to separate description of the Electrical Motor Displacement Control).

Charge pump flow that is not used by the control circuit passes through the end cover check valve into the bw pressure side of the loop. There it provides back pressure to the motor pistons.

The spring centered shuttle valve, located in the pump's valve block, moves to connect the low pressure side of the loop to the charge pressure relief valve. When back pressure gets high enough the charge pressure relief valve, in the valve block, opens and charge pump flow enters the the pump case.

Case flow flushes the pump cases and helps keep the transmission cool. The charge pressure relief valve typically has a lower setting than the charge pressure relief valve in the charge pump. This is so case flow will begin at the motor, go to the pump, and return to the reservoir.

The charge pressure relief valve in the charge pump opens when the transmission is in neutral and the shuttle valve is centered.

The 2-side high pressure relief valve opens to connect the high pressure side of the loop to the low pressure side if the motor stalls and the pressure gets too high. This valve works in forward and in reverse direction.

Last remark

All valves, relief valves and switches, are adjusted at the test bench according customers specification and needs and must not be misplaced without special knowlegde of the hydraulic system!

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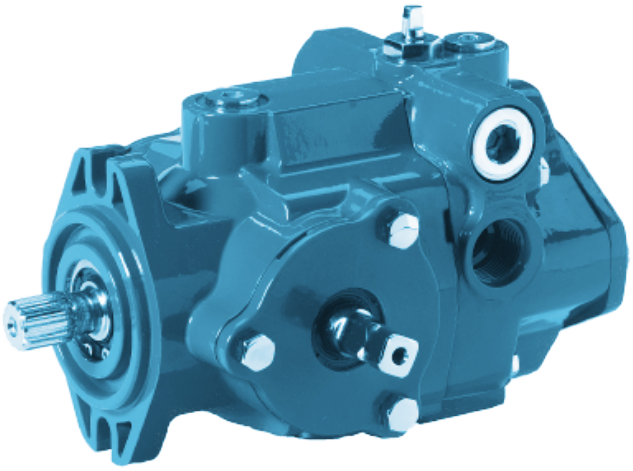
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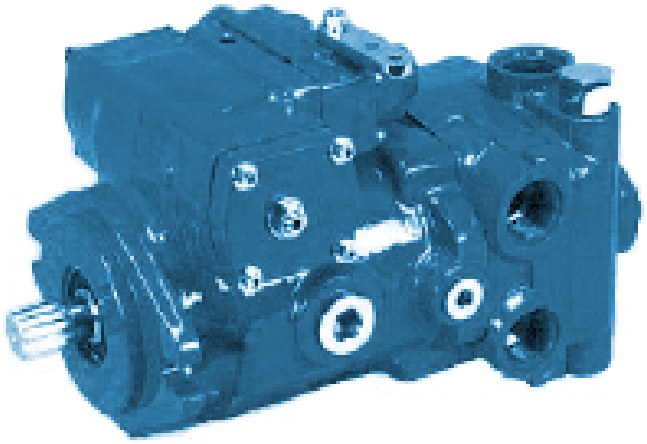
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March 2003

Medium Duty Piston Pump

Variable Displacement Closed Circuit

Model 70160	Model 70360	Model 72400
20.3 cm^3/r [1.24 in^3/r]	40.6 cm^3/r [2.48 in^3/r]	40.6 cm^3/r [2.48 in^3/r]
23.6 cm^3/r [1.44 in^3/r]	49.2 cm^3/r [3.00 in^3/r]	49.2 cm^3/r [3.00 in^3/r]







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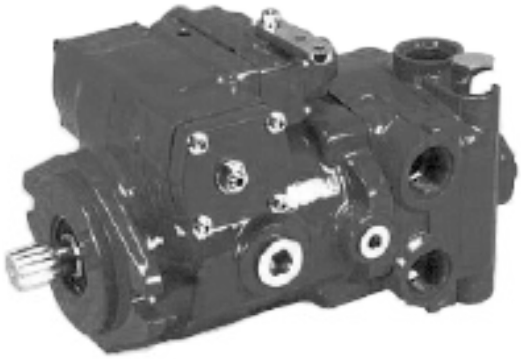
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Introduction

In axial piston pumps, the pistons reciprocate parallel to the axis of rotation of the cylinder block. The simplest type of axial piston pump is the swash plate in-line design.

The cylinder block in this pump is turned by the drive shaft. Pistons fitted to bores in the cylinder block are connected through piston shoes and a shoe plate, so that the shoes bear against an angled swash plate causing the pistons to reciprocate. The ports are arranged in the valve plate so that the pistons pass the inlet as they are pulled out and pass the outlet as they are forced back in.

The displacement of axial piston pumps is determined by the size and number of pistons, as well as the stroke length which is determined by the angle of the swash plate.

Variable Displacement Piston Pumps are used in closed loop systems either as a single or tandem pump. Oil is circulated by the pump to the motor and then returned directly back to the pump. A charge supply is used to supplement the closed loop system with oil. The charge supply may be supplied by an internal charge pump (standard) or an external source.

Typical Applications

Harvester Equipment

Combines
Fruit or Vegetable Pickers
Swathers

Forestry Equipment

Log Skidders
Bark Removers
Limb Removers

Construction Equipment

Trenchers
Skid Steer Loaders
Utility Vehicles
Sweepers

Turf Care Equipment

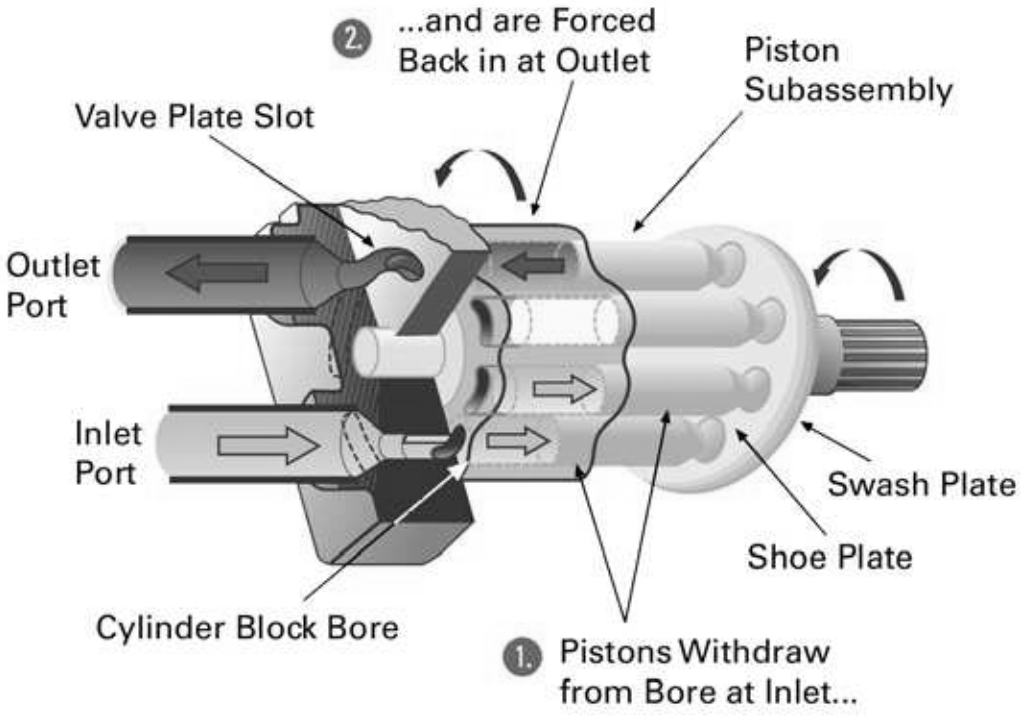
Mowers
Loaders

Paving Equipment

Rollers
Packers

Industrial Equipment

Lift Trucks
Scissor Lifts



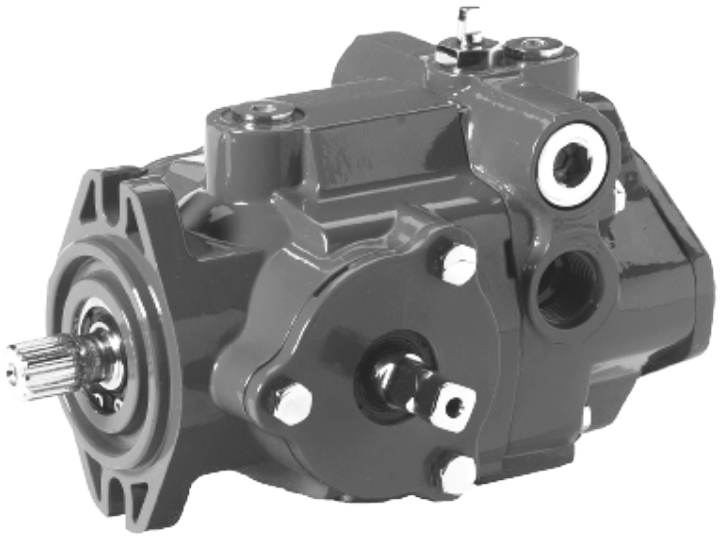
Section 1 - Model 70160

Manual Controlled

20,3 cm^3/r [1.24 in^3/r]

23,6 cm^3/r [1.44 in^3/r]

Displacement



Identification Numbers - Manual Variable Displacement Piston Pump - Closed Circuit

Stamped on each unit.

A – Product Number Description

- 70160 = Single Piston Pump
- 78162 = Single Piston Pump with Gear Pump
- 78161 = Tandem Piston Pumps
- 78163 = Tandem Piston Pumps with Gear Pump

B – Rotation

- R = Right Hand
- L = Left Hand

C – Sequential Letter

D – Design Code Number

Single Pump – Product Number

70160-RAA-03

A B C D

Tandem Pumps – Product Number

78163-RAB-03

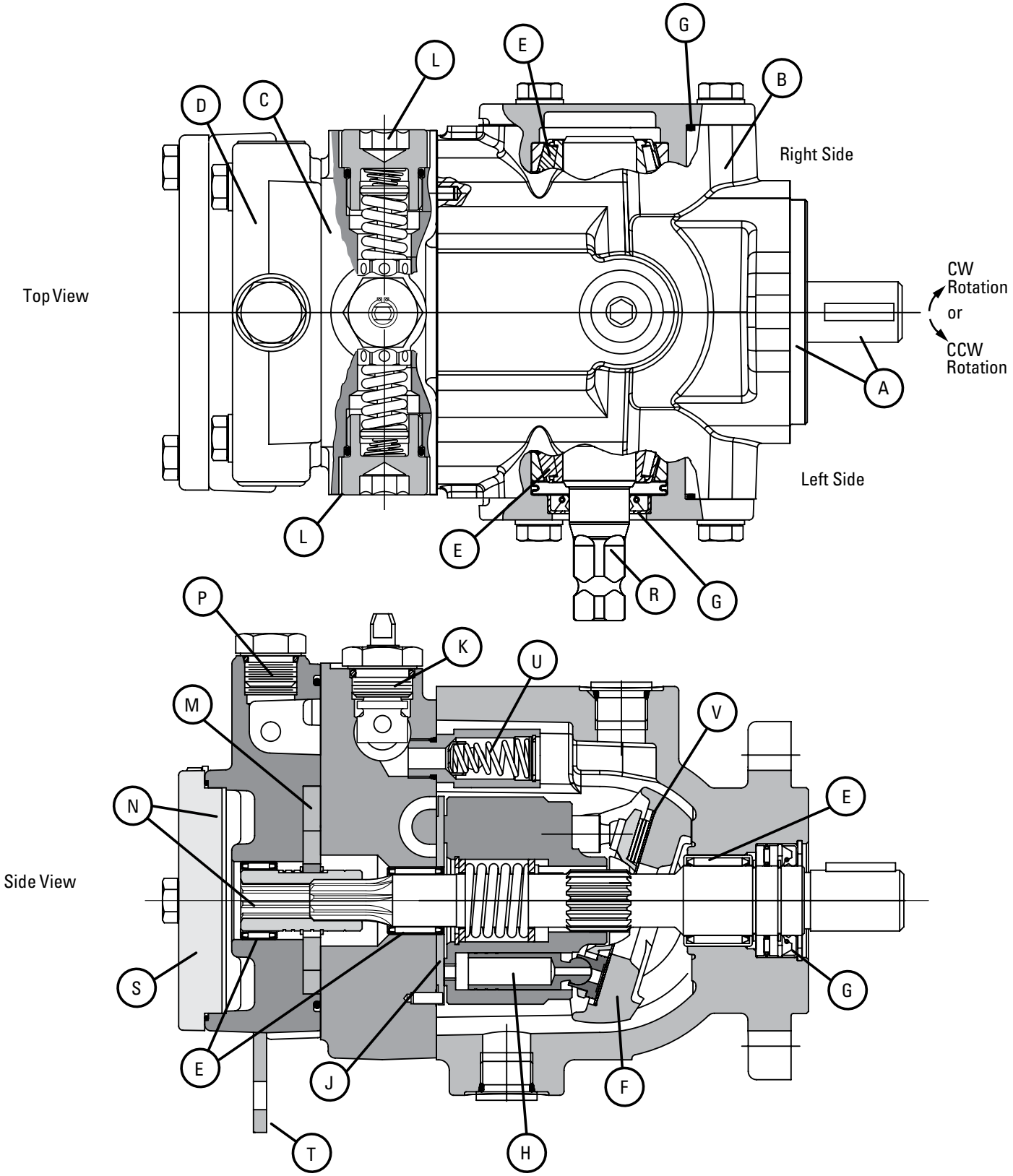
A B C D

Serial Number Code

10 05 06 XXX 1 000

- Last Two Digits of Year Built. (10 for 2010 etc.)
- Month Built (two digits)
- Day Built (two digits)
- Manufacturing Cell
- Shift Number
- Specific Number of the Pump

Model 70160
Features



Model 70160
Features

A Input Shaft and Mounting

- Shaft options
- SAE "A" mounting flange
- Tandem capability

B Housing

- Compact
- Lightweight, die cast aluminum

C Endcover

- Opposite side porting and same side porting available.

D Charge Pump Housing w/ Auxiliary Mount

E Bearings

F Swashplate

G Seals

H Rotating Group

- 20,3 cm^3/r [1.24 in^3/r] displacement
- 23,6 cm^3/r [1.44 in^3/r] displacement

J Valve Plate

K Bypass Valve

- Option for cross porting a closed loop hydraulic circuit — used to move a disabled machine a limited distance.

L Internal High Pressure Relief Valves

- Prevents excessive pressure

M Gerotor Charge Pump

- Two sizes available.
  6,9 cm /r [.42 in /r]
  13,8 cm /r [.84 in /r]

N Auxiliary Pump Drive

P Auxiliary Port

- For pressure check port or remote charge pressure port.

R Control Shaft

- Positioned on left or right side of pump.

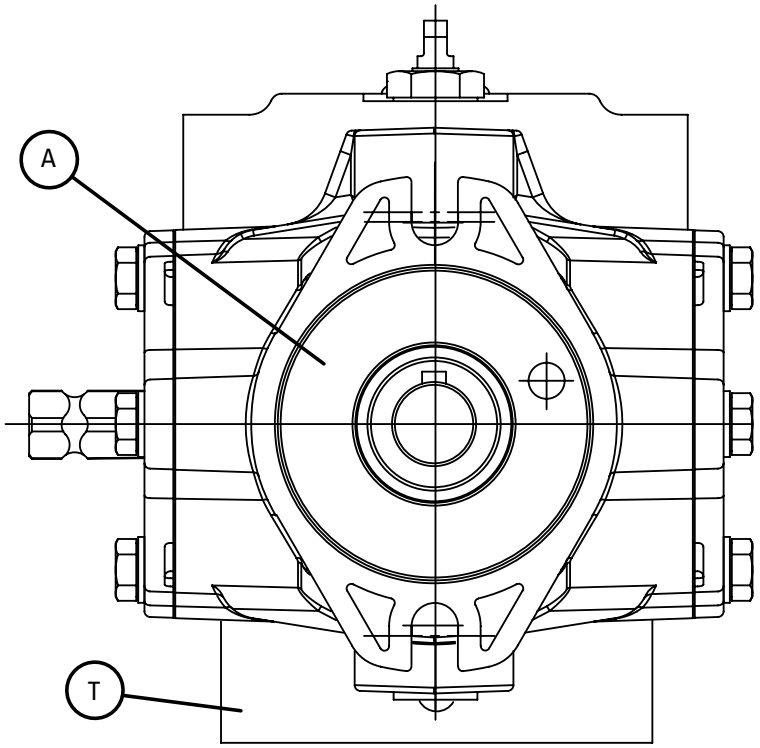
S "A" Pad Rear Cover Plate

T Mounting Bracket

- For support of rear unit of tandem pump. This bracket must be attached to the engine flywheel housing on the bulk-head used to mount the front unit of a tandem pump.

U Low Pressure Relief Valve

V Swashplate Insert



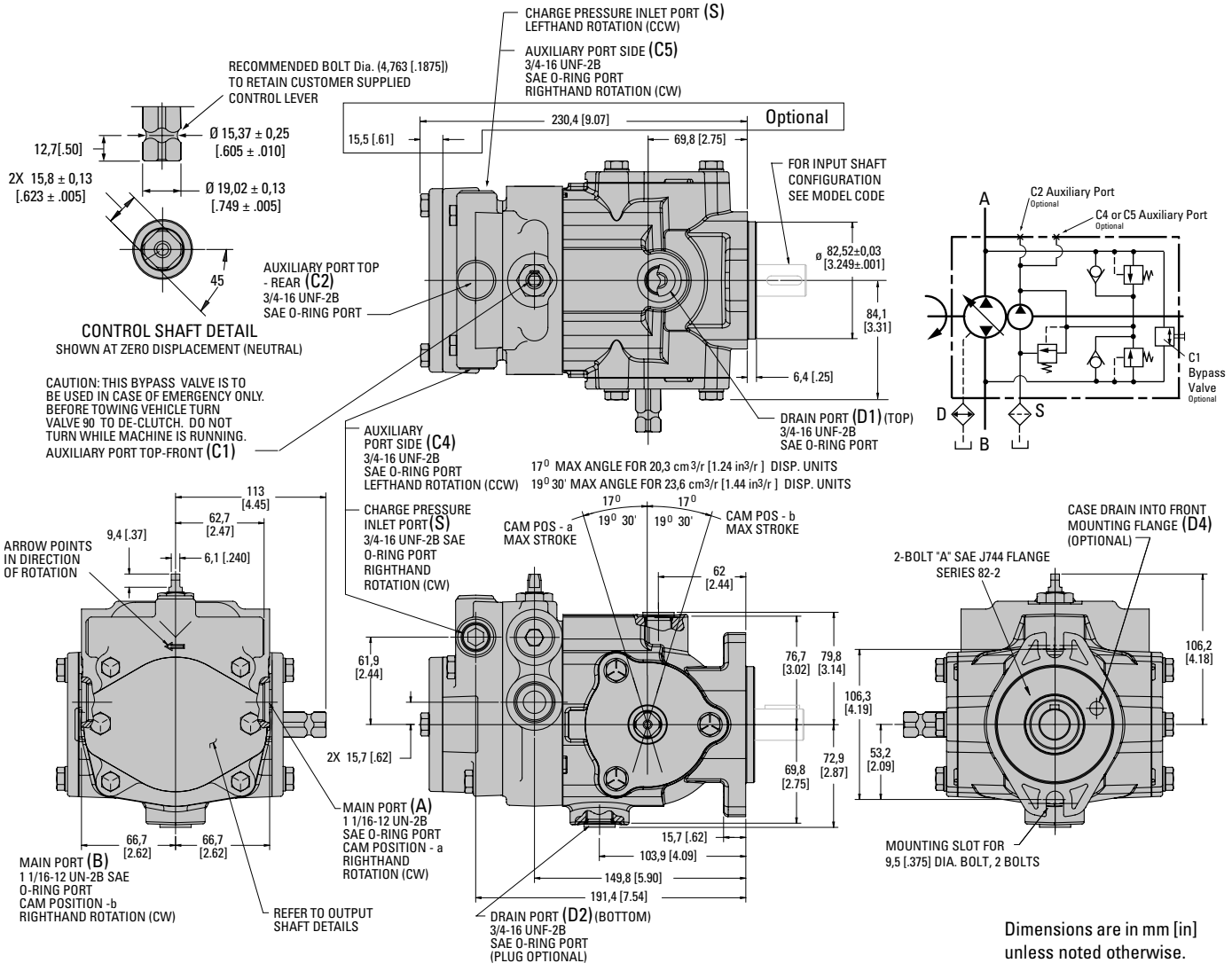
Front View

Model 70160
Assembly Installation Drawings

Opposite Side Porting with Internal Charge



Port ID	Type of Port	Size and Description
A	Main Port	1- 1/16 - 12 UN-2B SAE O-ring
B	Main Port	1- 1/16 - 12 UN-2B SAE O-ring
C1	Auxiliary Port Top - Front or Bypass Valve	3/4 - 16 UNF-2B SAE O-ring
C2	Auxiliary Port Top - Rear	3/4 - 16 UNF-2B SAE O-ring
C4	Auxiliary Port Side - Left Side	3/4 - 16 UNF-2B SAE O-ring
C5	Auxiliary Port Side - Right Side	3/4 - 16 UNF-2B SAE O-ring
D1	Drain Port - Top	3/4 - 16 UNF-2B SAE O-ring
D2	Drain Port - Bottom	3/4 - 16 UNF-2B SAE O-ring
D3	Thru Drain - Rear	9,27 [.365] Dia.
D4	Thru Drain - Front	9,27 [.365] Dia.
S	Charge Suction Port	3/4 - 16 UNF-2B SAE O-ring



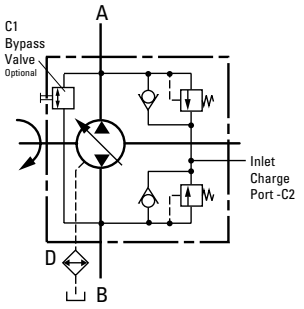
Dimensions are in mm [in]
unless noted otherwise.

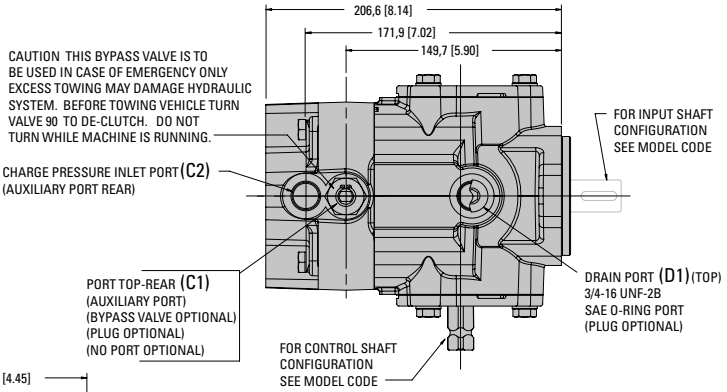
Model 70160
Assembly Installation Drawings

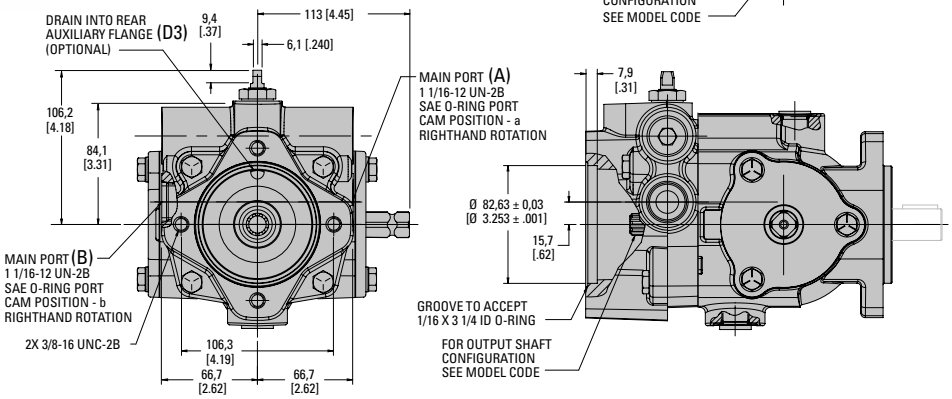
Opposite Side Porting

Note: External charge pump required.





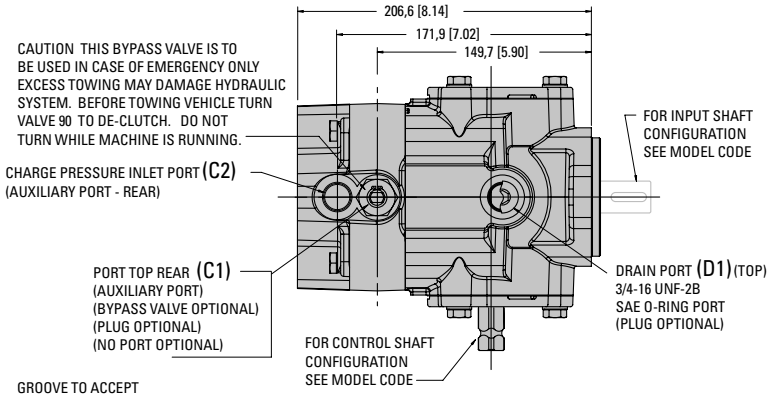


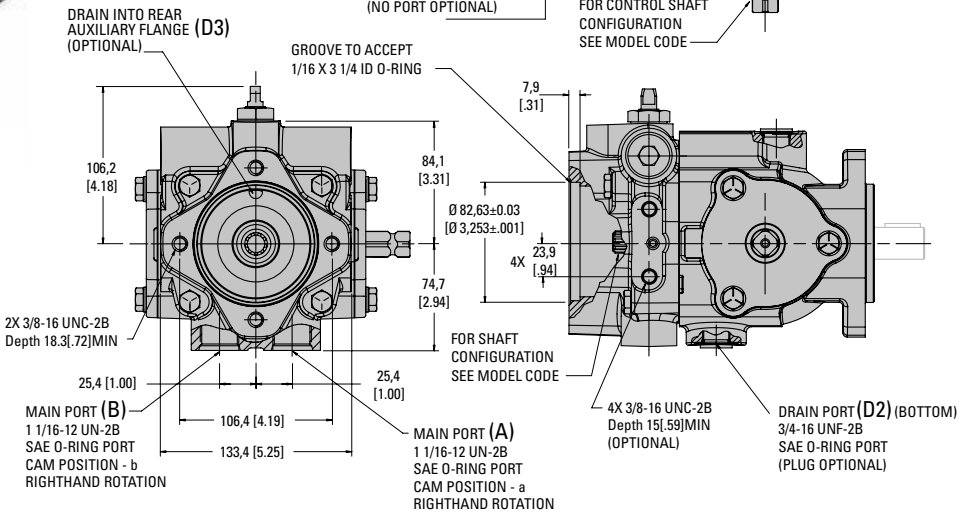


Same Side Porting

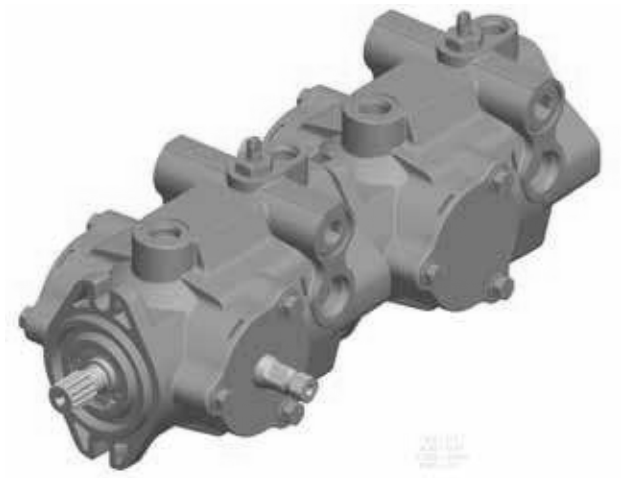
Note: External charge pump required.

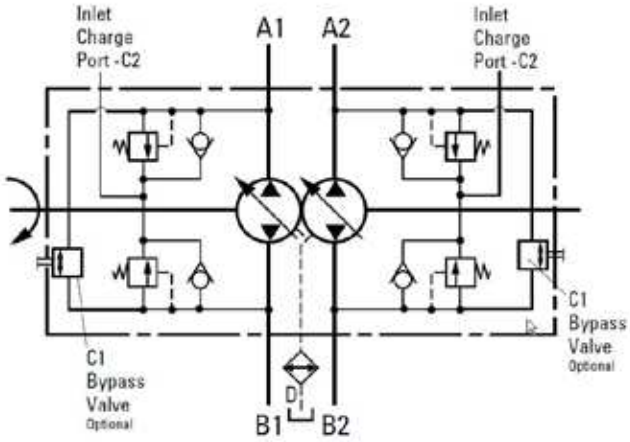


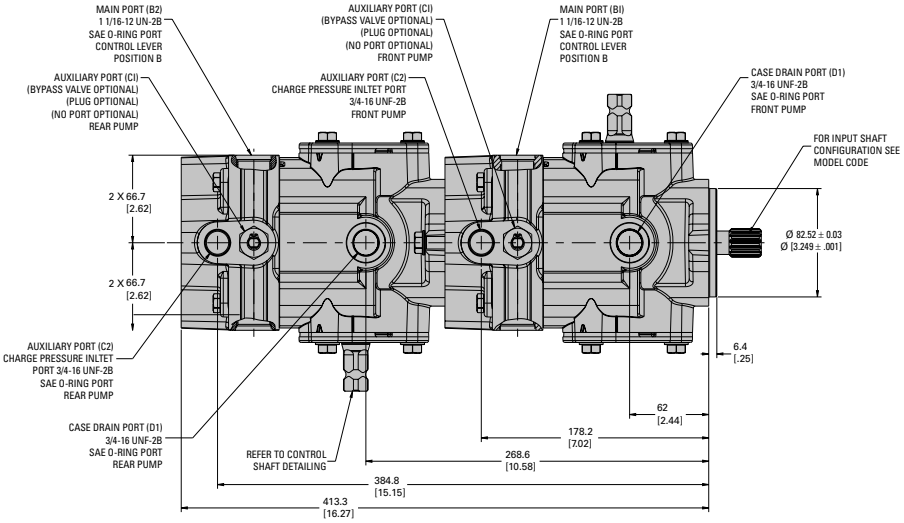


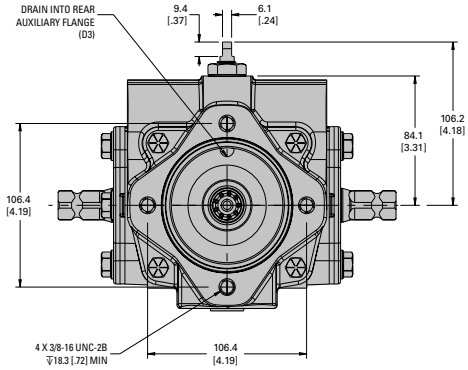


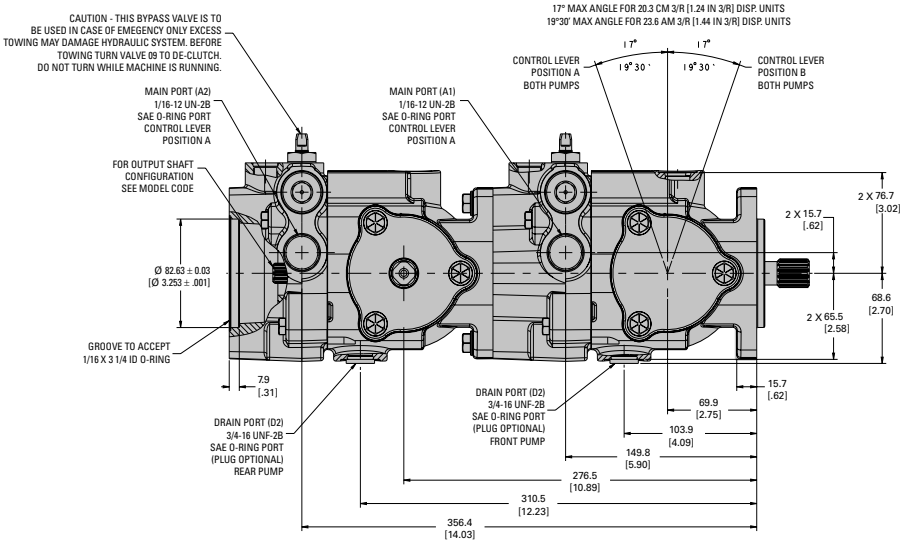
Model 70160
Tandem Assembly Installation Drawing

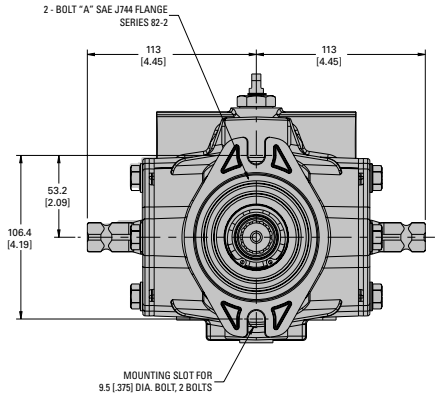




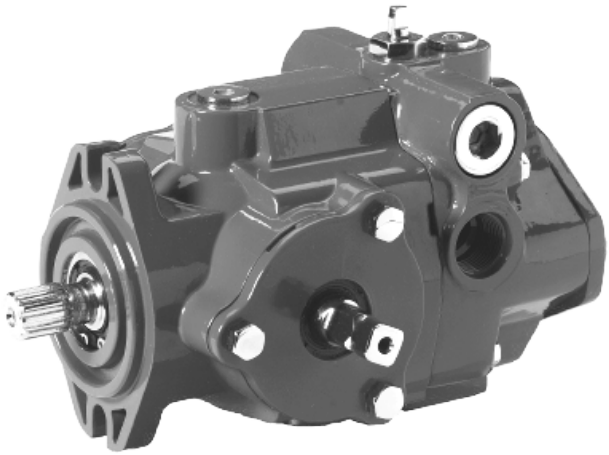








Model 70160
Specifications



Specifications - Piston Pump

Maximum Displacement	20,3 cm^3/r [1.24 in^3/r]	23,6 cm^3/r [1.44 in^3/r]
Input Mounting Flange	SAE "A"	SAE "A"
Flow @ Rated Speed & PSI	64,3 l/min [17 gal/min]	75,7 l/min [20 gal/min]
Maximum Rated Speed	3600 RPM	3600 RPM
Nominal Pressure Rating*	345 bar [5000 PSI]	345 bar [5000 PSI]
Peak Pressure Rating**	380 bar [5500 PSI]	380 bar [5500 PSI]
Max Input Power	42 kw (56 HP)	49 kw (65 HP)
Max Input Torque	119 N-m (1050 lbf-in)	136 N-m (1200 lbf-in)
Continuous Allowable Case Pressure	2 bar [25 PSI]	2 bar [25 PSI]
Maximum Case Drain Temperature	107° C [225° F]	107° C [225° F]
Weight Per Single Pump	9,5 kg [21 lbs]	9,5 kg [21 lbs]

Moment of Inertia

Single 160 Pump (Rotating kit)	1.164e-3 kg*m^2
Two 160 Pumps (Rotating kits)	2.329e-3 kg*m^2
G Load Capacity (Single Pump)***-	10 G

Specifications - Integral Gerotor Charge Pump

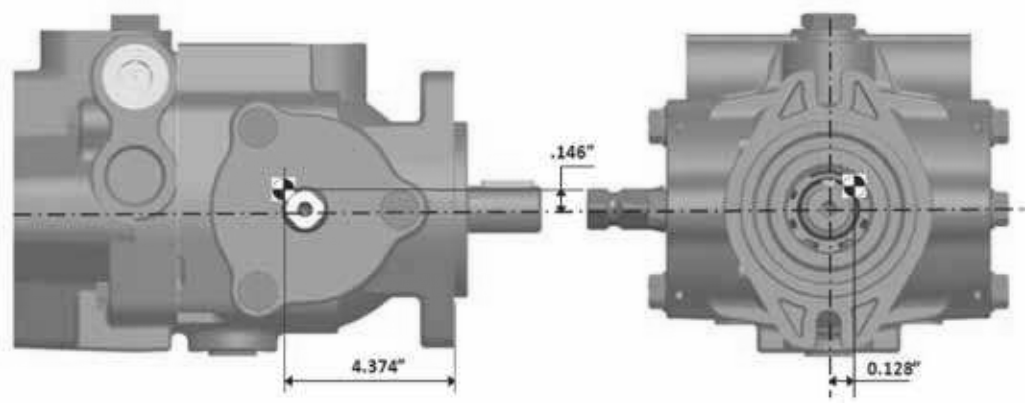
Displacement Options	6,9 cm^3/r [.42 in^3/r] 13,8 cm^3/r [.84 in^3/r]
Operating Pressure Range (std.)	7 to 10 bar [100 to 150 PSI]
Maximum Charge Inlet Vacuum	0,80 bar Abs. [11.6 PSI Abs.]

* Nominal Pressure: Max delta system pressure at which component fatigue does not occur (pump life estimated by bearing life).

** Peak Pressure: Max operation pressure which is permissible for a short duration of time (t < 1 sec).

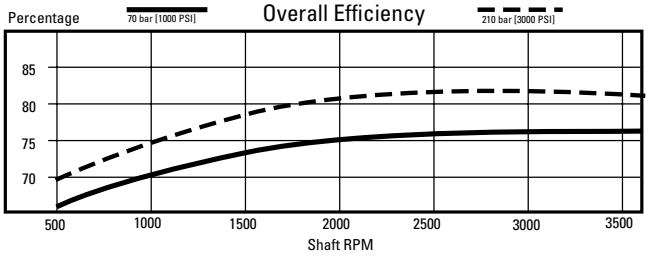
*** Please contact Eaton representative for specific requirements.

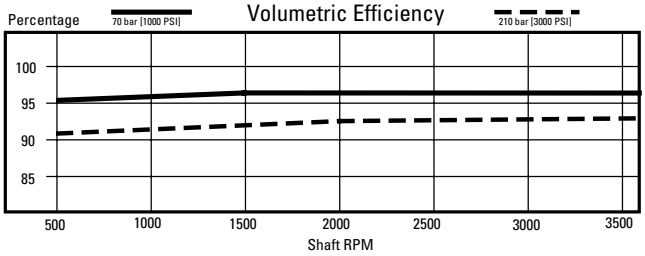
Center of Gravity (C.G.)

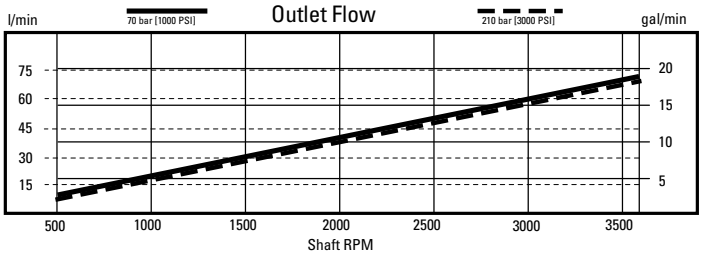


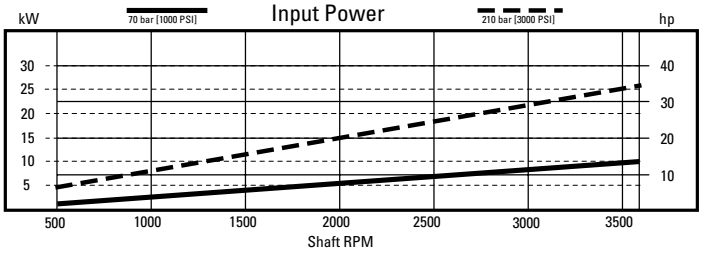
Model 70160
Performance Data

The charts below are representative of a **20,3 cm³/r [1.24 in³/r]** Variable Displacement Piston Pump. The tests were run at an oil temperature of 82°C [180°F] with viscosity 7 - 9 cSt [50 - 54 SUS] and the pump at maximum displacement.

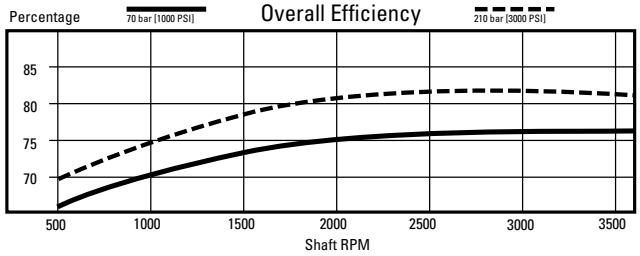


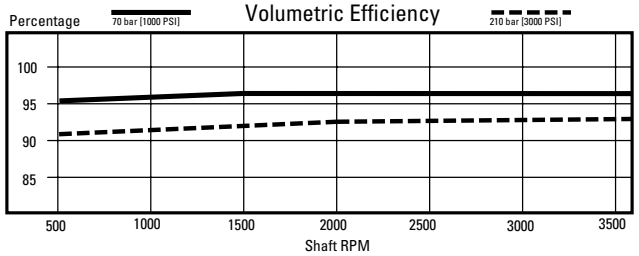


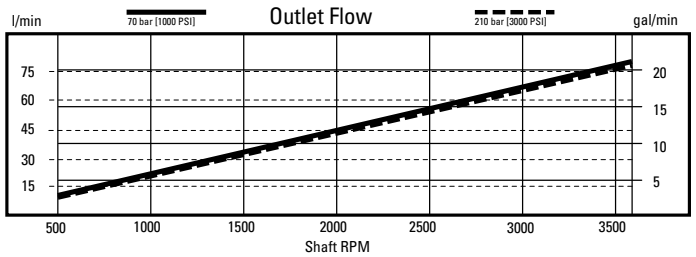


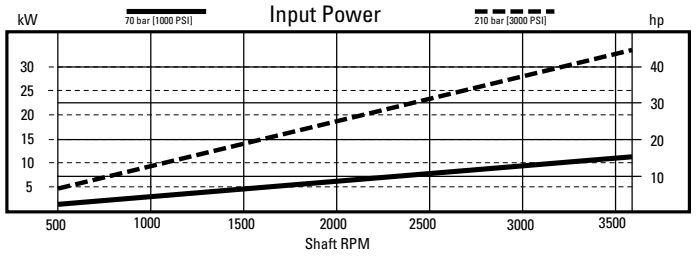


The charts below are representative of a **23,6 cm³/r [1.44 in³/r]** Variable Displacement Piston Pump. The tests were run at an oil temperature of 82°C [180°F] with viscosity 7 - 9 cSt [50 - 54 SUS] and the pump at maximum displacement.



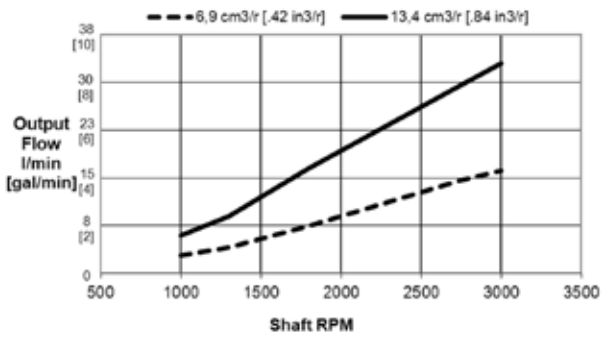






Charge Pump Performance - Flow vs Speed

The chart at right is representative of a 6,9 cm³/r [.42 in³/r] cm³/r and 13,4 [.84 in³/r] displacement charge pumps. The test was run at an oil temperature of 60°C [150°F] with viscosity 13 cSt [65 SUS].



Model 70160 Code

The Model 70160 Variable Displacement Piston Pumps are specified by the following model code. Once a pump is built from the model code, a product number will be assigned to that configuration. Make sure all positions are selected within the 32 digit code for each pump.

Code Example:	**ADB**	**12**	**R**	**1**	**A**	**B**	**D**	**1**	**1**	**T**	**T**	**1**	**A**	**0**	**A**	**AA**	**3**	**1**	**1**	**A**	**0**	**0**	**00**	**0A**	**0**	**C**
Position -	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	31	32
	ADB			**1**			**D**		**1**					**0**												**C**

Position 1, 2, 3
- **Code Title**

ADB = Series 160 Manually Variable Displacement Axial Piston Pump with SAE J744 Flange 82-2 (2 Bolt A)

All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump

	Code	Single Unit	Tandem Unit Front	Tandem Unit Rear
Positions 4, 5 - Displacement				
12 = 20,3 cm^3/r [1.24 in^3/r]	12	Std.	Std.	Std.
14 = 23,6 cm^3/r [1.44 in^3/r]	14	Std.	Std.	Std.
Position 6 - Input Shaft Rotation				
R = Righthand Rotation (CW)	R	Std.	Std.	Std.
L = Lefthand Rotation (CCW)	L	Std.	Std.	Std.
Position 7 - Valve Plate				
1 = Type 1	1	Std.	Std.	Std.
Position 8 - Input Shaft (see page 17 for details)				
A = 13 Tooth 16/32 Pitch Spline, Shaft Extension 41,1 [1.62]	A	Std.	Std.	NA
C = 35 Tooth 48/96 Pitch Spline, Shaft Extension 32,0 [1.26]	C	NA	NA	Std.
F = Straight Shaft Dia. 22,2 [.875], Keyway 6,35 [.25] x 25,9 [1.02], Shaft Extension 41,1 [1.62] (Key Included)	F	Opt.	NA	NA
Position 9 - Control Shaft and Location				
L = Left Side	L	Std.	Std.	Std.
R = Right Side	R	Std.	Std.	Std.
Position 10 - Control Shaft				
D = with 15.7 [.62] square arm, with bolt groove; 113 [4.45] from unit centerline to control shaft end	D	Std.	Std.	Std.
Position 11 - Main Ports (A and B) Location (see page 20 for port location)				
1 = Opposite Sides	1	Std.	Std.	Std.
2 = Same Side (without internal charge pump)	2	Opt.	Opt.	Opt.
Position 12 - Main Ports (A and B) Size				
1 = 1- 1/16 -12 UN-2B Port, SAE Straight Thread O-ring Ports	1	Std.	Std.	Std.
2 = 7/8 -14 UNF-2B Port, SAE Straight Thread O-ring Ports	2	Opt.	Opt.	Opt.
Positions 13, 14 - Relief Valve Setting for Main Ports (Select a setting for port "A" in position 10 and port "B" in position 11.)				
0 = No Relief, Check Valve Assembly Only	0	Opt.	Opt.	Opt.
B = 138 bar [2000 PSI]	B	Opt.	Opt.	Opt.
E = 173 bar [2500 PSI]	E	Opt.	Opt.	Opt.
H = 207 bar [3000 PSI]	H	Opt.	Opt.	Opt.
L = 241 bar [3500 PSI]	L	Opt.	Opt.	Opt.
N = 276 bar [4000 PSI]	N	Opt.	Opt.	Opt.
Q = 310 bar [4500 PSI]	Q	Opt.	Opt.	Opt.
T = 344 bar [5000 PSI]	T	Std.	Std.	Std.
Position 15 - Charge Displacement, Suction Port (S) (see page 20 for port location)				
0 = No Charge	0	Opt.	Std.	Opt.
1 = 6,9 cm^3/r [.42 in^3/r]; 3/4 - 16 UNF-2B SAE o-ring port for suction inlet (right side CCW, Left side CW)	1	Std.	NA	NA
3 = 13,8 cm^3/r [.84 in^3/r]; 3/4 -16 UNF-2B SAE o-ring port for suction inlet (right side CCW, Left side CW)	3	Opt.	NA	Std.
Position 16 - Charge Relief Setting and Routing				
0 = No (requires external relief set between 6,89 bar [100 lbf/in^2] and 20,68 bar [300 lbf/in^2])	0	Opt.	Std.	Opt.
A = 6,89-10,34 bar [100-150 PSI]; Relieved to case	A	Std.	NA	Std.
B = 10,34-13,79 bar [150-200 PSI]; Relieved to case	B	Opt.	NA	Opt.
C = 13,79-17,24 bar [200-250 PSI]; Relieved to case	C	Opt.	NA	Opt.
D = 17,24-20,68 bar [250-300 PSI]; Relieved to case	D	Opt.	NA	Opt.
E = 20,68-24,13 bar [300-350 PSI]; Relieved to case	D	Opt.	NA	Opt.
F = 6,89-10,34 bar [100-150 PSI]; Recirculated	F	Std.	NA	Std.
G = 10,34-13,79 bar [150-200 PSI]; Recirculated	G	Opt.	NA	Opt.
H = 13,79-17,24 bar [200-250 PSI]; Recirculated	H	Opt.	NA	Opt.
J = 17,24-20,68 bar [250-300 PSI]; Recirculated	J	Opt.	NA	Opt.
L = 4.14-7.58 bar [60-110 lbf/in2] Relieved to Case	L	Opt	NA	Opt
P = 11.38-14.82 bar [165-215 lbf/in2] Recirculated	P	Opt	NA	Opt

Dimensions are in mm [in] unless noted otherwise.

Model 70160 Code

Continued

Position 17 - Charge Special Feature				
0 = No Special Feature	0	Std.	Std.	Std.
Position 18 - Auxiliary Rear Mount and Output Shaft (see page 18 for details)				
A = With Integral Charge: Horizontal 2-Bolt "A" SAE J744 Flange 82-2; Accepts 9 tooth internal 16/32 pitch spline with 31,7 [1.25] shaft extention	A	Std.	NA	Std.
B = No Integral Charge: Horizontal or Vertical 2-Bolt "A" SAE J744 Flange 82-2; Accepts 11 tooth external 16/32 pitch spline with 31,7 [1.25] shaft extention (Coupler required)	B	Opt.	NA	Opt.
C = No Integral Charge: Horizontal or Vertical 2-Bolt "A" SAE J744 Flange 82-2; Accepts 9 tooth external 16/32 pitch spline with 31,7 [1.25] shaft extention (Coupler required)	C	Opt.	NA	Opt.
D = No Integral Charge: Horizontal or Vertical 2-Bolt "A" SAE J744 Flange 82-2; Accepts 35 tooth external 48/96 pitch spline with 32 [1.26] shaft extention (Coupler required)	D	Opt.	Std.	Opt.
E = No Integral Charge: Horizontal or Vertical 2-Bolt "A" SAE J744 Flange 82-2; Accepts 9 tooth external 20/40 pitch spline with 31,7 [1.25] shaft extention (Coupler required)	E	Opt.	NA	Opt.
Position 19, 20 - Special Features Auxiliary Mounting				
00 = No Special Features	00	Std.	Std.	Std.
AA = Supply Cover Plate for 2-Bolt "A" SAE J744 Flange 82-2	AA	Opt.	Opt.	Opt.
AB = Supply Shaft Coupler 9 tooth 16/32 pitch	AB	Opt.	Opt.	Opt.
AC = Supply Shaft Coupler 9 tooth 20/40 pitch	AC	Opt.	Opt.	Opt.
AD = Supply Shaft Coupler 11 tooth 16/32 pitch	AD	Opt.	Opt.	Opt.
AE = Supply Shaft Coupler 35 tooth 48/96 pitch	AE	Opt.	Opt.	Opt.
AF = Bottom Mounting Bracket (632), Square Shaped	AF	Opt.	Opt.	Opt.
AG = Bottom Mounting Bracket (709), V Shaped	AG	Opt.	Opt.	Opt.
AH = Auxiliary Mounting Holes, 2 holes .375-16 UNC-2B thread, 15 [.59] min full thread, both sides	AH	Opt.	Opt.	Opt.
AJ = Auxiliary Mounting Holes, 2 holes .375-16 UNC-2B thread, 15 [.59] min full thread, both sides (9T coupler and Mounting Holes)	AJ	Opt.		
Position 21 - Auxiliary Port Top-Front (C1) or Bypass Valve (see page 20 for port location)				
0 = None	0	Std.	Std.	Std.
1 = 3/4 -16 UNF-2B SAE o-ring port	1	Opt.	Opt.	Opt.
2 = 3/4 -16 UNF-2B SAE o-ring port plugged	2	Opt.	Opt.	Opt.
3 = Bypass Valve Installed	3	Opt.	Opt.	Opt.
Position 22 - Auxiliary Port Top-Rear (C2) (see page 20 for port location)				
0 = None	0	Std.	Std.	Std.
1 = 3/4 -16 UNF-2B SAE o-ring port	1	Std.	Std.	Std.
2 = 3/4 -16 UNF-2B SAE o-ring port plugged	2	Opt.	Opt.	Opt.
Position 23 - Auxiliary Port Side (C4 or C5) (Integral Charge Only) (see page 20 for port location)				
0 = None	0	Opt.	NA	Opt.
1 = 3/4 -16 UNF-2B SAE o-ring port (right side CW, left side CCW)	1	Opt.	NA	Opt.
Position 24 - Case Drain (D1 and D2) (see page 20 for port location)				
A = 3/4 -16 UNF-2B SAE o-ring port D1-top (D2-bottom plugged)	A	Std.	Opt.	Std.
B = 3/4 -16 UNF-2B SAE o-ring port D2-bottom (D1-top plugged)	B	Opt.	Opt.	Opt.
C = 3/4 -16 UNF-2B SAE o-ring port (D1-top plugged and D2-bottom plugged)	C	Opt.	Opt.	Opt.
D = 3/4 -16 UNF-2B SAE o-ring port (D1-top and D2-bottom open)	D	Opt.	Opt.	Opt.
Position 25 - Thru Drain (D3 and D4) (see page 20 for port location)				
0 = None	0	Opt.	Opt.	Opt.
A = .365 Dia. D3-rear	A	Opt.	Std.	Opt.
B = .376 Dia. D4-front	B	Opt.	Opt.	Std.
C = .365 Dia. D3-rear and .376 Dia. D4-front	C	Opt.	Opt.	Opt.
Position 26 - Additional Functions				
0 = None	0	Std.	Std.	Std.
A = Bleed-Off Valve in Control Shaft Position "a" set at 13.79-17.24 bar [200-250 lbf/in2]	A	Opt.	Opt.	Opt.
Position 27, 28 - Special Features				
00 = None	00	Std.	Std.	Std.
0A = Flourocarbon rubber drive shaft seal	0A	Opt.	Opt.	Opt.
0D = Polyacrylate Drive Shaft Seal	OD	Opt.	Opt.	Opt.
Position 29, 30 - Paint				
0A = Primer, Red Oxide	0A	Std.	Std.	Std.
0B = Black	0B	Opt.	Opt.	Opt.
CD = Primer, Blue	CD	Opt.	Opt.	Opt.
Position 31 - Identification				
0 = Standard: Nameplate	0	Std.	Std.	Std.
Position 32 - Design Code				
C = C	C	Std.	Std.	Std.

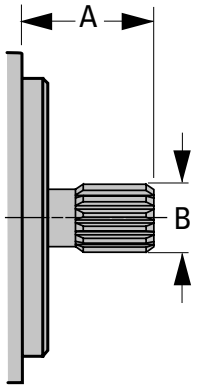
Model 70160
Input Shafts
Code Position 8

Dimensions are in mm [in] unless noted otherwise.

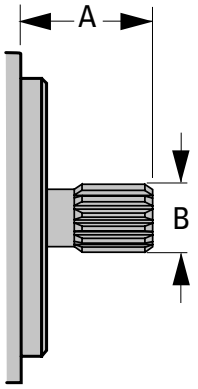
Code	Input Shafts		
	A	**C**	**F**
Type	13 Tooth	35 Tooth	Straight Keyed
A Dimension	41,1 [1.62]	32,0 [1.26]	41,1 [1.62]
B Dimension	21,810 [.8585]	19,0 [.75]	22,23 +0,00/-0,03 [.875 +.000/ -.001] Dia.
Maximum Input Torque	209,3 N•m [1852 lbf•in]	Used for tandem connection only	209,3 N•m [1852 lbf•in]
Shaft Specifications	16/32 Pitch 30 Degree Involute Flat Root, Class 1 Side Fit Spline, SAE J498b	48/96 Pitch 45 Degree Involute Fillet Root, Class 1 Side Fit Spline, SAE J498b	--

Torque Note:

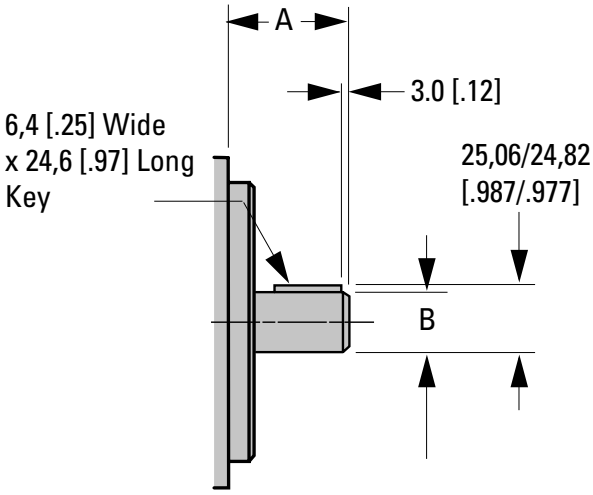
The combined torque required for multiple pumps must not exceed the torque rating of the input drive shaft of the front piston pump. Consult an Eaton representative and/or Eaton engineering on side load recommendations.



Input Shaft A
13 Tooth



Input Shaft C
35 Tooth



Input Shaft F
Straight Keyed

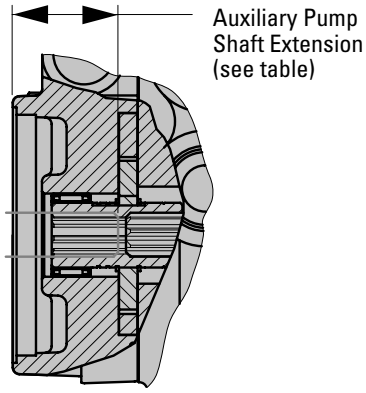
Model 70160
Auxiliary Rear Mounts & Output Shafts

Code Position 18

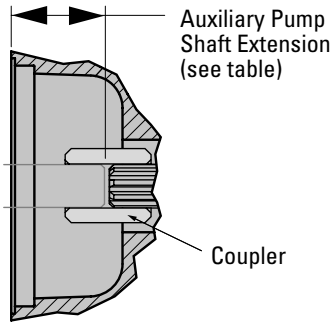
Dimensions are in mm [in] unless noted otherwise.

Code	Input Shafts				
	A	**B**	**C**	**D**	**E**
Type	9 Tooth	11 Tooth	9 Tooth	35 Tooth	9 Tooth
Shaft Outside Diameter	15,88 [.6250]	19,33 [.761]	15,88 [.6250]	19 [.75]	15,88 [.6250]
Shaft Diametrical Pitch	16/32 Pitch Int.	16/32 Pitch Ext.	16/32 Pitch Int.	48/96 Pitch Ext.	20/40 Pitch Ext.
Auxiliary Mount SAE A 2 Bolt	SAE J744	SAE J744	SAE J744	SAE J744	SAE J744
Auxiliary Pump Shaft Extension	31,7 [1.25]	31,7 [1.25]	31,7 [1.25]	32,0 [1.26]	31,7 [1.25]
Charge Pump	Yes	No	No	No	No
Maximum Torque	54 N•m [480 lbf•in]	119 N•m [1050 lbf•in]	76 N•m [672 lbf•in]	Used for tandem connection only	76 N•m [672 lbf•in]
Coupler Required; In code Postion 19, 20 select...	No	Yes, Code "AD"	Yes, Code "AB"	Yes, Code "AE"	Yes, Code "AC"

Auxiliary "A" Mount with Charge Pump



Auxiliary "A" Mount without Charge Pump

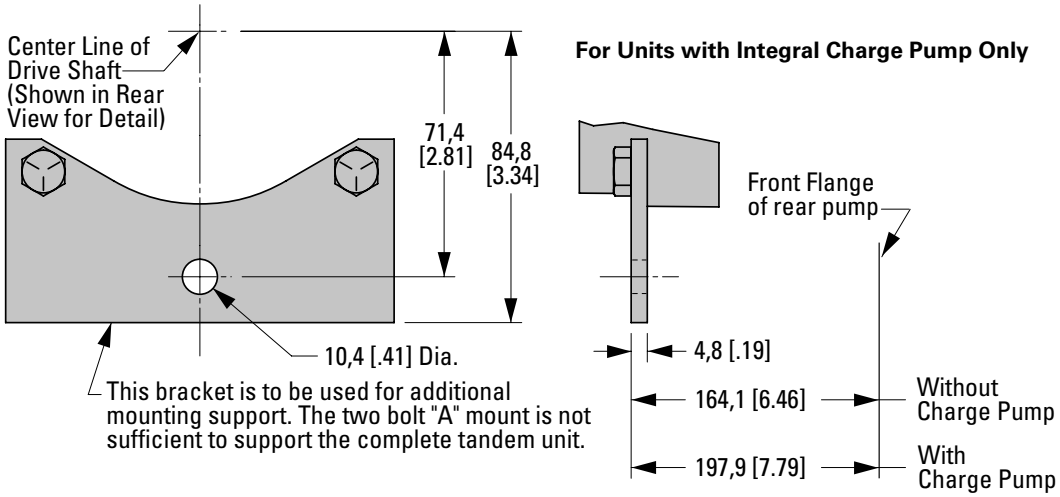


		Type	Diameter	Length
Code Position 12 and 20	**AB**	9T	28,45 [1.12] Dia.	39,12 [1.540]
	AC	9T	28,45 [1.12] Dia.	34,29 [1.35]
	AD	11T	31,8 [1.25] Dia.	38,9 [1.531]
	AE	35T	28,45 [1.12] Dia.	37,9 [1.49]

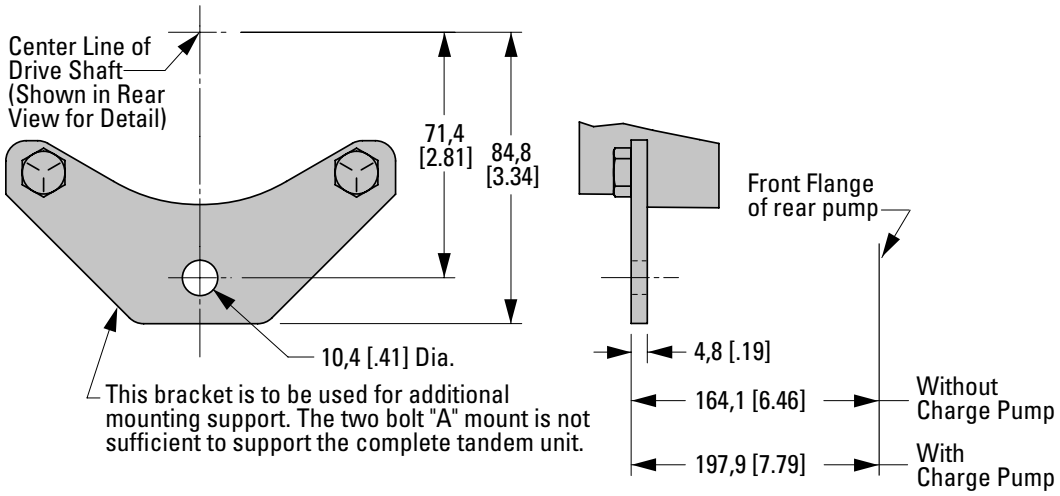
Model 70160
Bracket and Cover Plate

Code Position 19 and 20

Code "AF" Bracket



Code "AG" Bracket



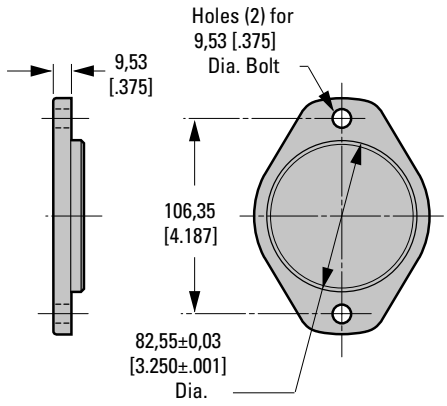
Cover Plate

Code Position 19, 20

Fits SAE "A" auxiliary mounting flange in place of auxiliary pump.

Cover Plate Kit #70142-915 includes cover plate, cap screws (2) and o-ring.

Code "AA"

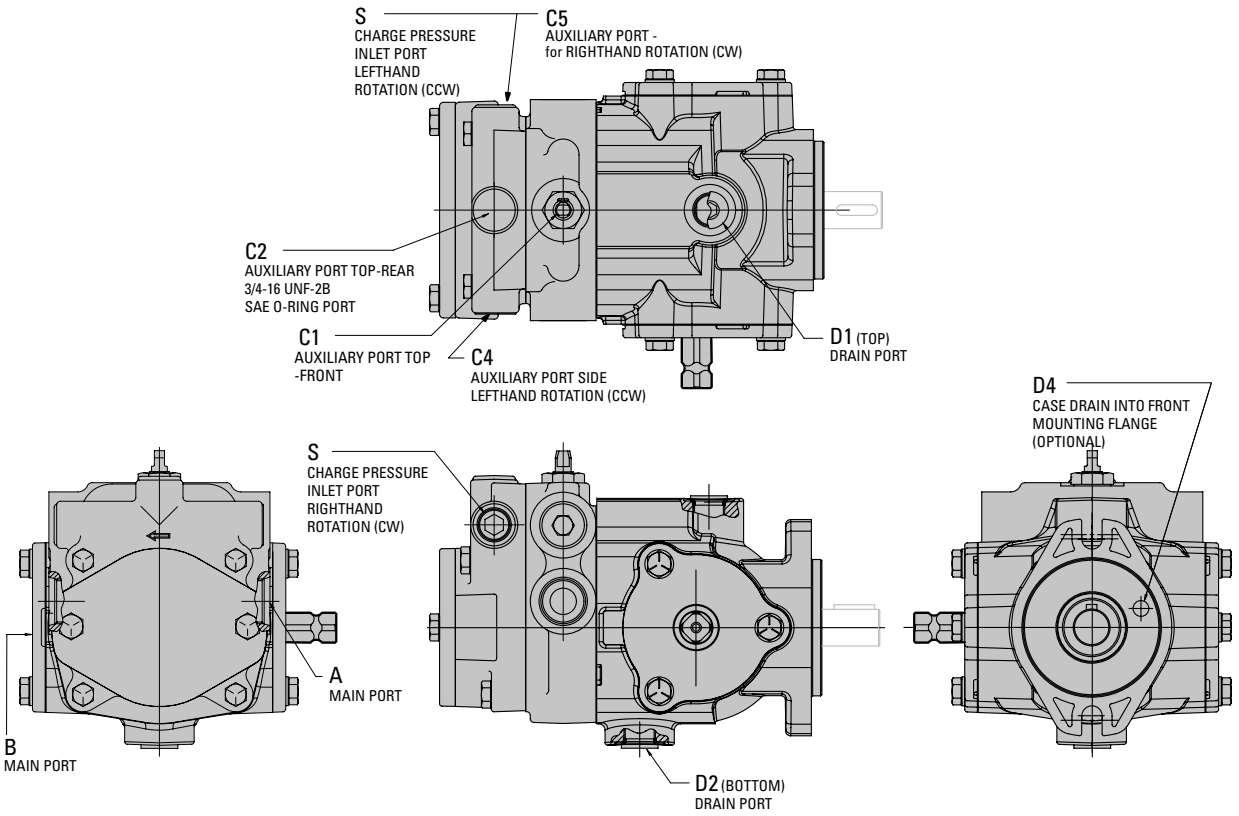


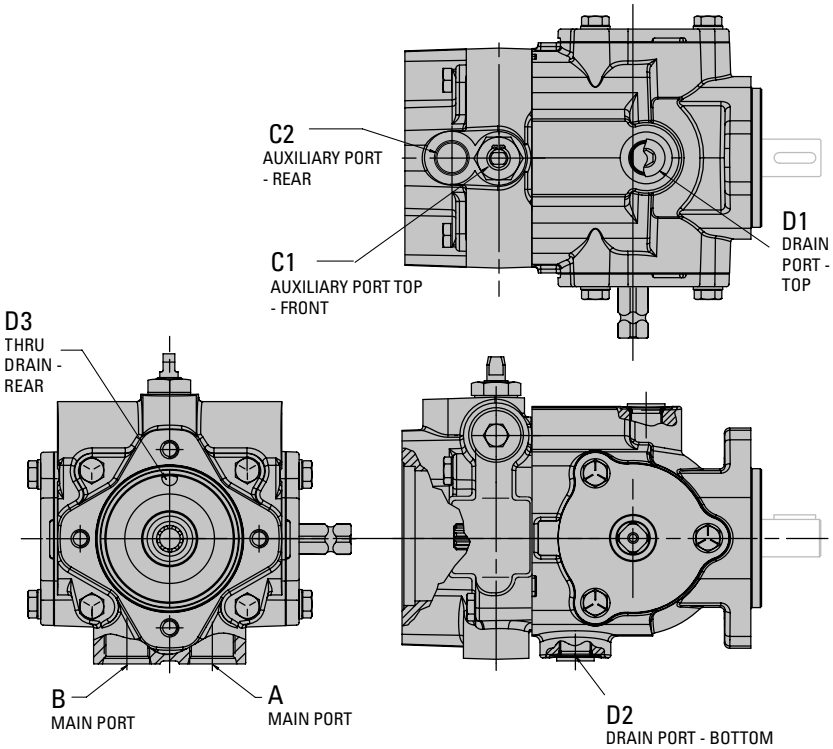
Dimensions are in mm [in] unless noted otherwise.

Model 70160
Port Locations

Code Position 21 through 25

Pump Without Integral Charge





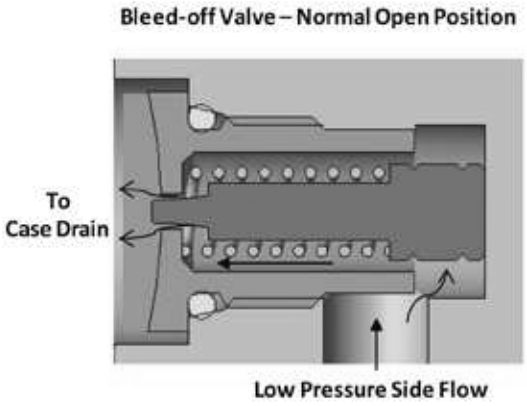
Port ID	Type of Port	Size and Description
A	Main Port	1- 1/16 - 12 UN-2B SAE O-ring, 7/8 -14 UNF-2B SAE O-ring
B	Main Port	1- 1/16 - 12 UN-2B SAE O-ring, 7/8 -14 UNF-2B SAE O-ring
C1	Auxiliary Port TopFront or Bypass Valve	3/4 - 16 UNF-2B SAE O-ring
C2	Auxiliary Port Top-Rear	3/4 - 16 UNF-2B SAE O-ring
C4	Auxiliary Port Side-Left Side	3/4 - 16 UNF-2B SAE O-ring
C5	Auxiliary Port Side - Right Side	3/4 - 16 UNF-2B SAE O-ring
D1	Drain Port - Top	3/4 - 16 UNF-2B SAE O-ring
D2	Drain Port - Bottom	3/4 - 16 UNF-2B SAE O-ring
D3	Thru Drain - Rear	9,27 [.365] Dia.
D4	Thru Drain - Front	9,27 [.365] Dia.
S	Charge Suction Port	3/4 - 16 UNF-2B SAE O-ring

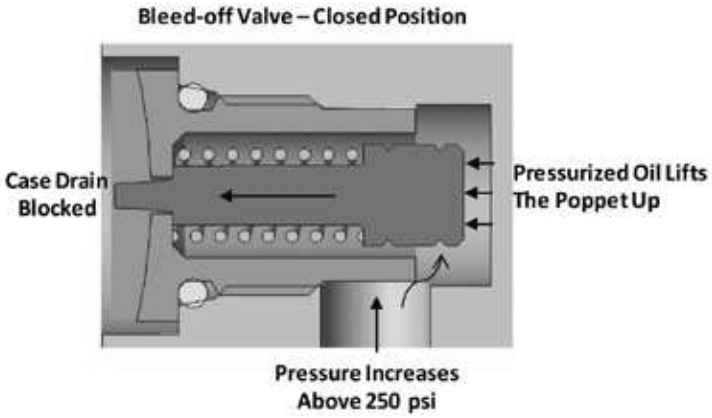
Model 70160
Bleed-Off Valve

Code Position 26, Code "A"

Pump with Integral Charge

Bleed-off valves are used to bleed oil from the low pressure side of the loop. They are "normally open" valves which close when pressurized to 200-250 psi. These valves close and open abruptly, causing vehicles to lurch when operators move across neutral into the opposite direction. As designed, a bleed-off valve can withstand flows of .8 to 1.2 gpm. Increasing the flow capacity of the valve will magnify the lurch that operators experience.

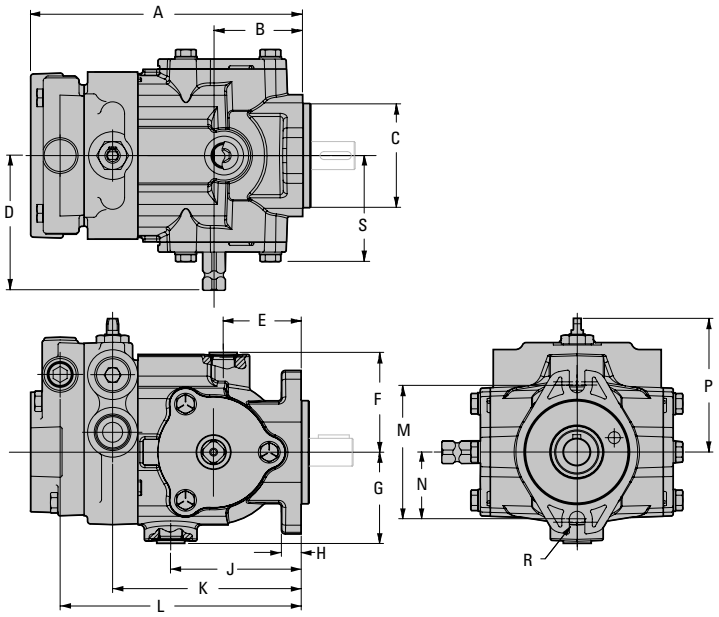




Model 70160 and 70142 Dimension Comparison

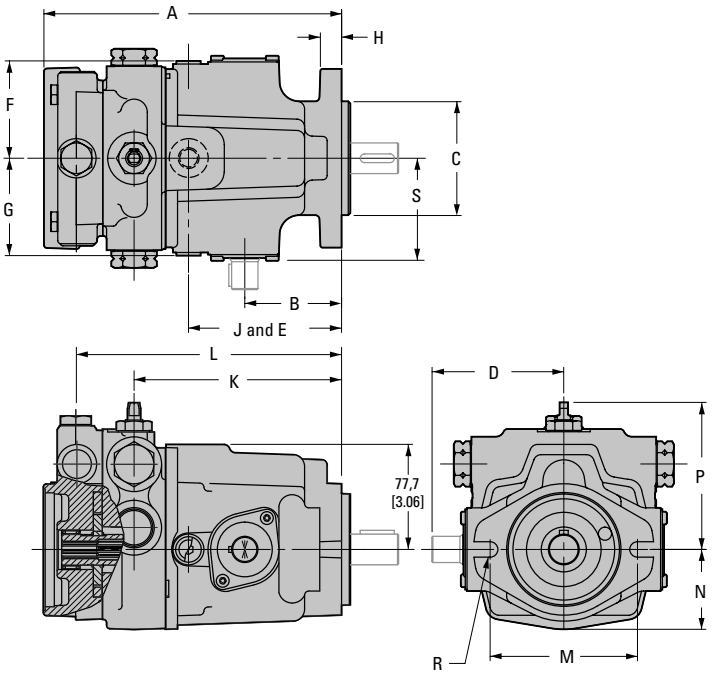
Model 70160

Opposite Side Porting, with Integral Charge



Model 70142

Opposite Side Porting, with Integral Charge



	Model 70160	Model 70142
A	214,8 [8.46]	214,8 [8.46]
B	69,8 [2.75]	69,8 [2.75]
C	82,52 [3.249]	82,52 [3.249]
D	113,0 [4.45]	95,2 [3.75]
E	62,0 [2.44]	110,5 [4.35]
F	79,8 [3.14]	70,6 [2.75]
G	72,9 [2.87]	70,6 [2.75]
H	15,7 [.62]	15,2 [.60]
J	103,9 [4.09]	110,5 [4.35]
K	149,8 [5.90]	149,6 [5.89]
L	191,4 [7.54]	191,4 [7.54]
M	106,6 [4.19]	106,6 [4.19]
N	53,2 [2.09]	53,2 [2.09]
P	106,2 [4.18]	106,6 [4.20]
R	11,2 [.44] Ø Bolt Slot	9,5 [.375] Ø Bolt Slot
S	84,1 [3.31]	74,7 [2.94]

1.24 in³/r Displacement Frame Size Key Improvements

1. Redesigned Trunnion Bearing & Covers
   - Changed from needle to tapered roller bearings
   - Improved thrust load capabilities
   - Minimizes section seal leaks
   - Facilitates assembly and disassembly
2. Swash Plate
   - Incorporates thrust plate to improve serviceability
3. Main Housing & Mounting Flange
   - Mounting flange rotated 90 degrees to facilitate larger trunnion bearings
   - Stiffer mounting flange to minimize requirement for additional mounting brackets
   - Larger case drain for higher flow capacity
   - Top & Bottom case drain locations minimize entrapped air and reduces risks of cavitation
4. Input Control Shaft & Seals
   - Redesigned to ease customer assembly of control linkages
   - Square input shaft to reduce wear between linkage and input shaft
   - Annular groove in input shaft to facilitate retention of linkage to the input shaft
5. Computer Generated Valve Plate Designs
   - Reduces noise and improved sound quality
   - Designs tailored to meet customer control and noise requirements
6. Improved Rotating Group
   - Improved neutral centering characteristics

Section 2 - Model 70360

Manual Controlled

40,6 cm^3/r [2.48 in^3/r]

49,2 cm^3/r [3.00 in^3/r]

Displacement



Identification Numbers - Manual Variable Displacement Piston Pump - Closed Circuit

Identification numbers

Stamped on each unit.

A – Product Number Description

- 70360 = Single Piston Pump
- 78362 = Single Piston Pump with Gear Pump
- 78361 = Tandem Piston Pumps
- 78363 = Tandem Piston Pumps with Gear Pump

B – Rotation

- R / S = Right Hand
- L / M = Left Hand

C – Sequential Letter

D – Design Code Number

Single Pump – Product Number

7 0 3 6 0 - R A A - 0 2

A B C D

Tandem Pumps – Product Number

7 8 3 6 3 - R A B - 0 2

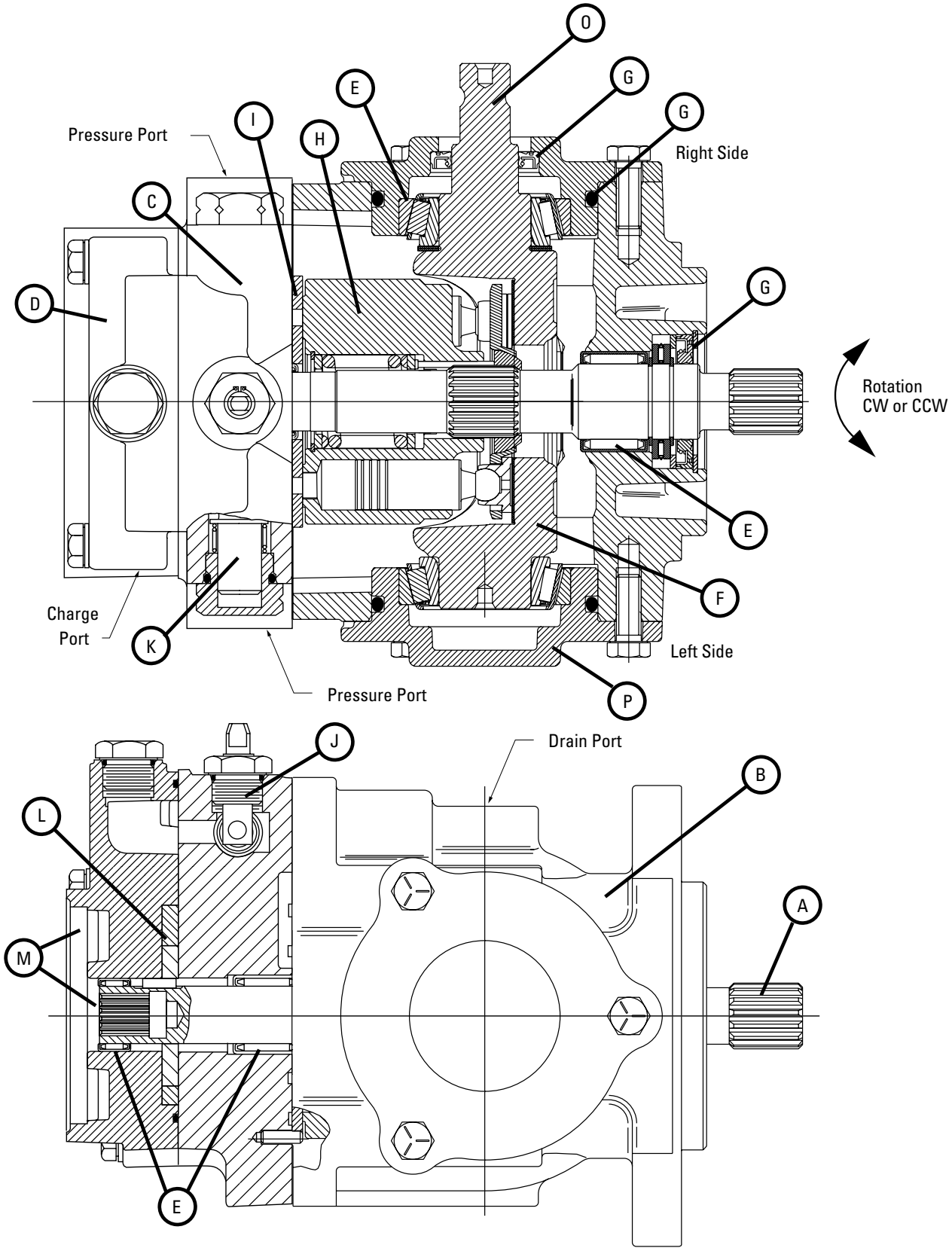
A B C D

Serial Number Code

10 05 06 XXX 1 000

- Last Two Digits of Year Built. (10 for 2010 etc.)
- Month Built (two digits)
- Day Built (two digits)
- Manufacturing Cell
- Shift Number
- Specific Number of the Pump

Model 70360
Features & Benefits



Model 70360
Features & Benefits

A Input Shaft and Mounting
- Auxiliary or tandem mount capability.
- Numerous shaft options.
- SAE "B" or "B-B" Mount (2 Bolt).

B Housing
- Compact and lightweight package size
- Durable, sturdy design.
- Reduces customer requirements for additional support brackets

C End cover
- Opposite side porting and same side porting w/ auxiliary mount

D Charge Pump Housing

E Tapered Trunnion Bearings
- Reduces noise and vibration.
- Improves neutral return thrust load capabilities

F Swash plate
- Reduces noise and vibration

G Seals

H Rotating Group
- 40,6 cm3/r [2.48 in3/r] Displacement
- 49,2 cm3/r [3.00 in3/r] Displacement

I Valve Plate
- Reduces noise and swash plate moments.

J Bypass Valve
- Cross ports the closed loop hydraulic circuit used to move a disabled machine a limited distance.

K Internal High Pressure Relief Valves
- Prevents excessive pressure

L Ge-rotor Charge Pump
- Four sizes available.
  6,9 cm3/r [.42 in3/r]
  13,8 cm3/r [.84 in3/r]
  17.2 cm3/r [1.05 in3/r]
  20.7 cm3/r [1.26 in3/r]

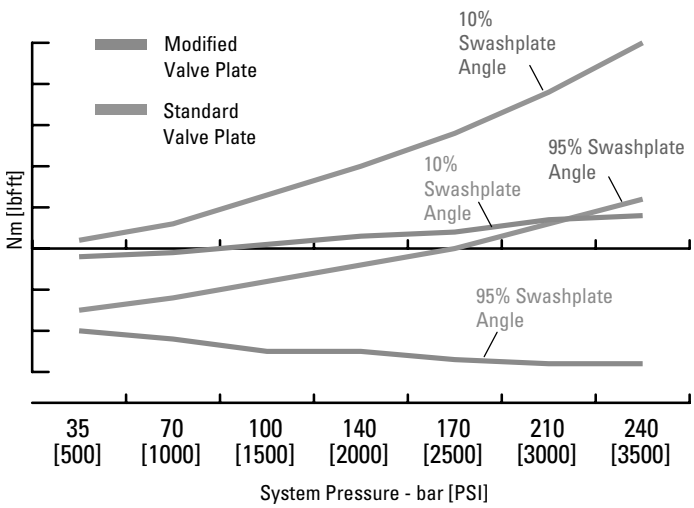
M Auxiliary Pump Mounting Flange (Rear)
- SAE 'A' or 'B'

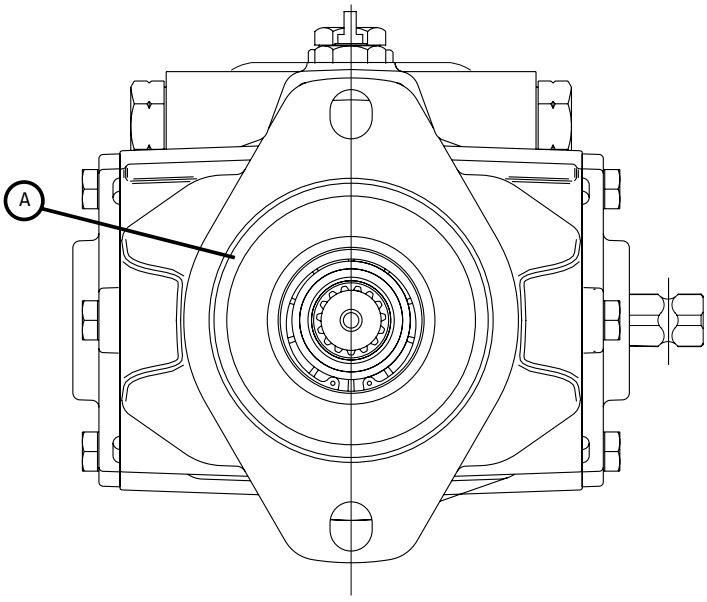
N Auxiliary Port
- For pressure check port or remote charge pressure port.

O Control Shaft (Square Std.)
- Positioned on left or right side of pump.
- Eases the assembly of customer installed control lever
- Reduces wear on control shaft and control lever.

P Cover Plate

Lower Swashplate Moments



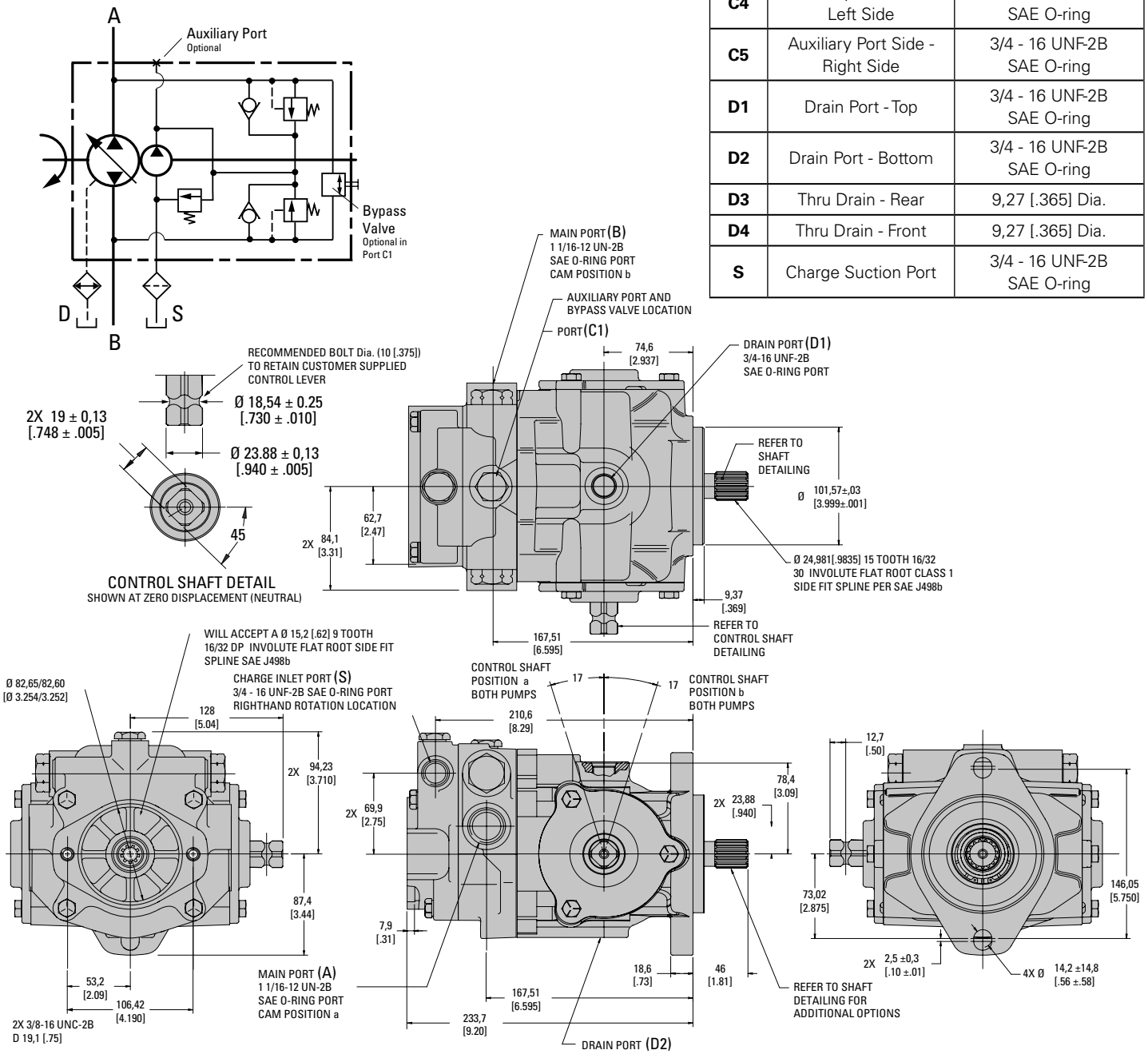


Model 70360
Single Pump Installation Drawing

Port ID	Type of Port	Size and Description
A	Main Port	1- 1/16 - 12 UN-2B SAE O-ring
B	Main Port	1- 1/16 - 12 UN-2B SAE O-ring
C1	Auxiliary Port Top - Front or Bypass Valve	3/4 - 16 UNF-2B SAE O-ring
C2	Auxiliary Port Top - Rear	3/4 - 16 UNF-2B SAE O-ring
C3	Auxiliary Port Rear - Rear	3/4 -16 UNF-2B SAE O-ring
C4	Auxiliary Port Side - Left Side	3/4 - 16 UNF-2B SAE O-ring
C5	Auxiliary Port Side - Right Side	3/4 - 16 UNF-2B SAE O-ring
D1	Drain Port - Top	3/4 - 16 UNF-2B SAE O-ring
D2	Drain Port - Bottom	3/4 - 16 UNF-2B SAE O-ring
D3	Thru Drain - Rear	9,27 [.365] Dia.
D4	Thru Drain - Front	9,27 [.365] Dia.
S	Charge Suction Port	3/4 - 16 UNF-2B SAE O-ring

Opposite Side Porting with internal charge pump. Used as a single pump or on rear of multiple units.

Note: The Charge Pump for a single pump is normally a 6,9 cm^3/r [.42 in^3/r] displacement and for a tandem unit is a 13,8 cm^3/r [.84 in^3/r] displacement.

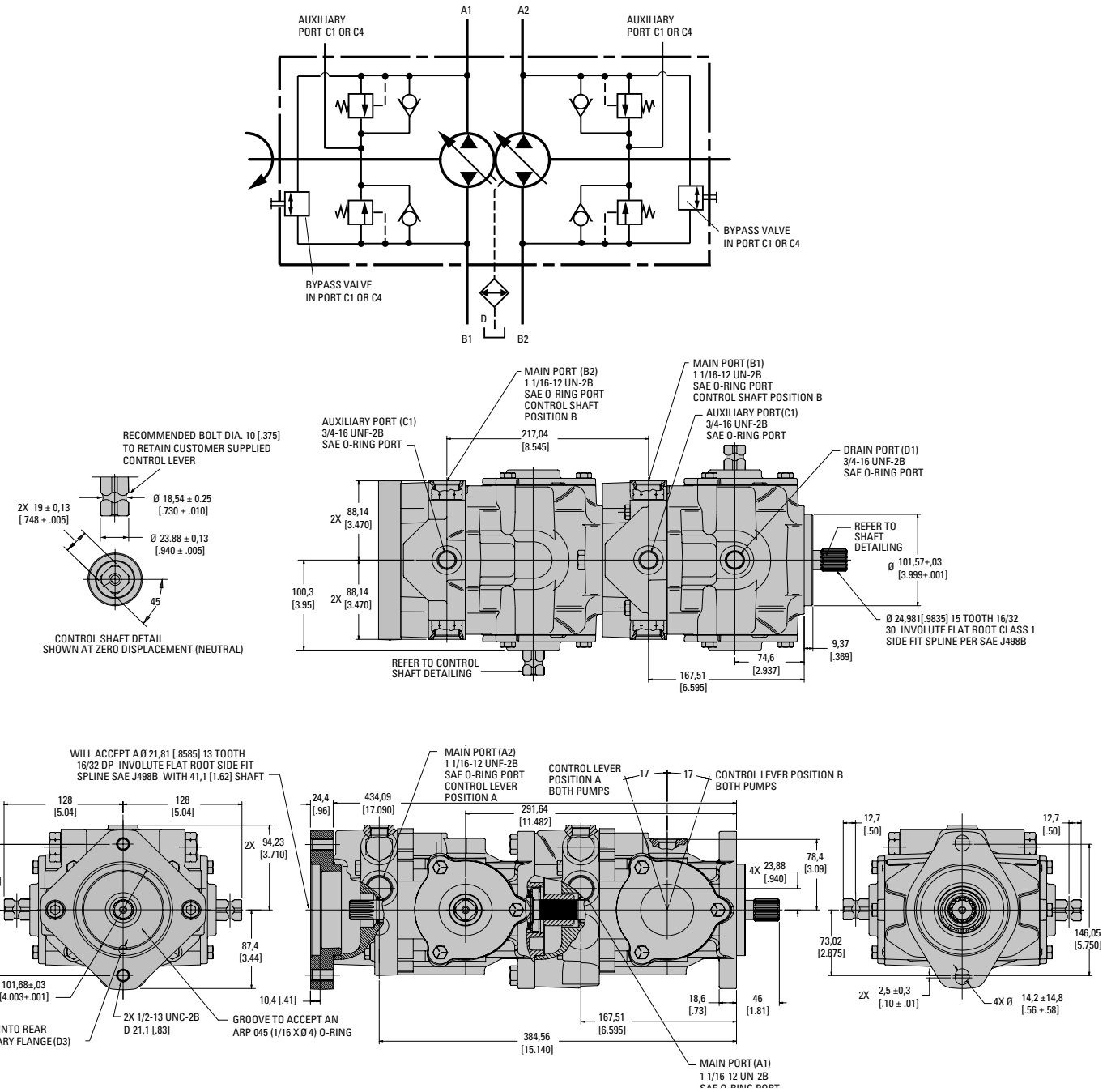


Right-hand (CW) Rotation Shown All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump.

Dimensions are in millimeters [inches], unless otherwise specified.

Model 70360
Tandem Pump Installation Drawing

Opposite Side Porting and Rear SAE "B" Auxiliary Mounting Flange. External Charge Pump Required.



Right-hand (CW) Rotation Shown All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump.

Dimensions are in millimeters [inches], unless otherwise specified.

Model 70360
Specifications



Specifications - Piston Pump

Maximum Displacement	40,6 cm^3/r [2.48 in^3/r]	49,2 cm^3/r [3.00 in^3/r]
Input Mounting Flange	SAE “B” or "BB"	SAE “B” or "BB"
Flow @ Rated Speed & PSI	140 l/min [37.0 gal/min]	169 l/min [44.8 gal/min]
Maximum Rated Speed	3600 RPM	3600 RPM
Nominal Pressure Rating*	345 bar [5000 PSI]	345 bar [5000 PSI]
Peak Pressure Rating**	380 bar [5500 PSI]	380 bar [5500 PSI]
Max Input Power	84 kw (113 HP)	102 kw (137 HP)
Max Input Torque	237 N-m (2099 lbf-in)	286 N-m (2528 lbf-in)
Continuous Allowable Case Pressure	2 bar [25 PSI]	2 bar [25 PSI]
Maximum Case Drain Temperature	107° C [225° F]	107° C [225° F]
Weight Per Single Pump	14,1 to 15,9 kg [31 to 35 lbs]	14,1 to 15,9 kg [31 to 35 lbs]

Moment of Inertia

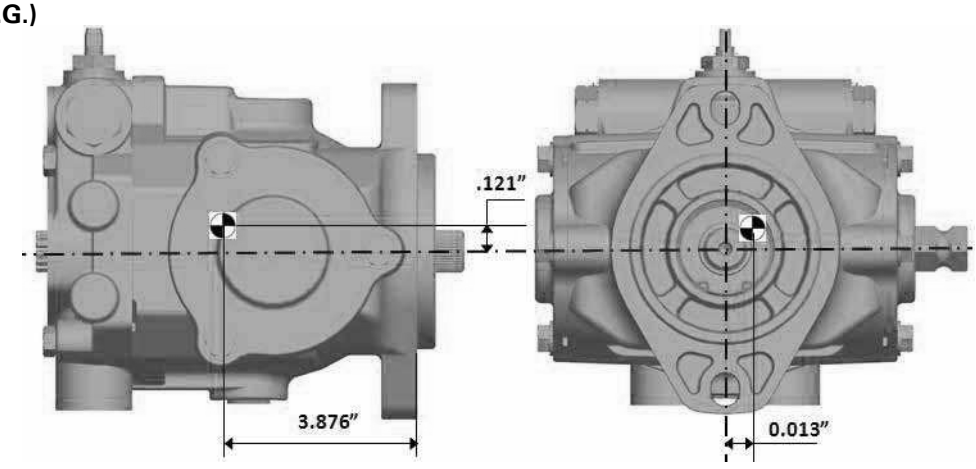
Single 360 Pump (rotating kit and shaft)	2.731e-3 kg*m^2
Two 360 Pumps (two rotating kits and shafts)	5.462e-3 kg*m^2
Two 360 Pumps plus Gear Pump (two rotating kits, shafts and gear pump gears)	5.475e-3 kg*m^2
G Load Capacity (Single Pump)***	10 G

Specifications - Internal Gerotor Charge Pump

Displacement Options	6,9 cm^3/r [.42 in^3/r] 13,8 cm^3/r [.84 in^3/r] 17.2 cm3/r [1.05 in3/r] 20.7 cm3/r [1.26 in3/r]
Operating Pressure Range (std.)	7 to 21 bar [100 to 300 PSI]
Maximum Charge Inlet Vacuum	0,80 bar Abs. [6 inHg]

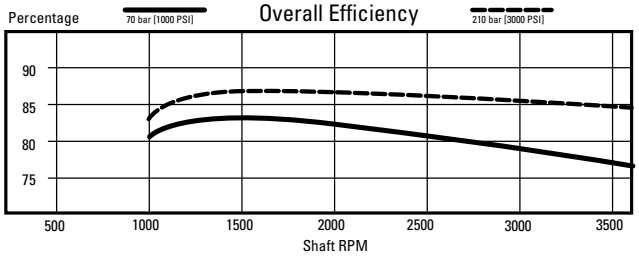
* Nominal Pressure: Max delta system pressure at which component fatigue does not occur (pump life estimated by bearing life).
** Peak Pressure: Max operation pressure which is permissible for a short duration of time (t < 1 sec).
*** Please contact Eaton representative for specific requirements.

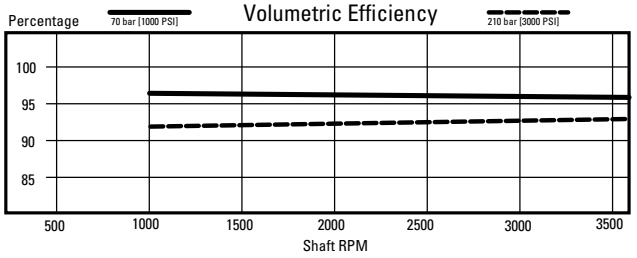
Center of Gravity (C.G.)

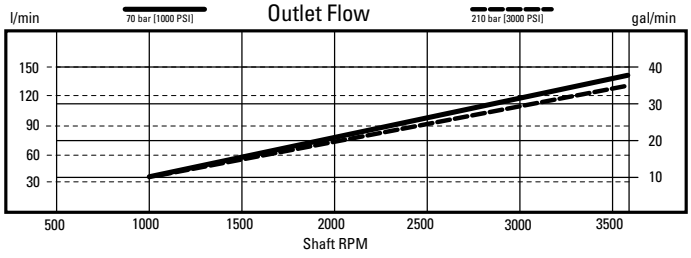


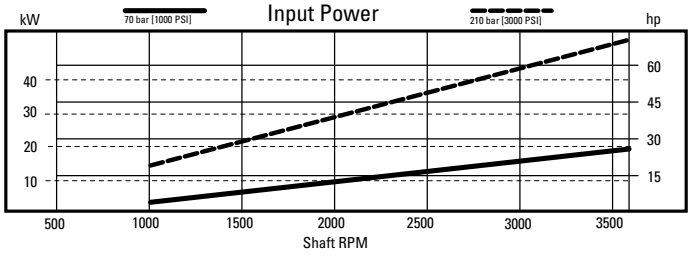
Model 70360
Performance Data

The charts below are representative of a single 40,6 cm^3/r [2.48 in^3/r] Variable Displacement Piston Pump. The tests were run at an oil temperature of 82°C [180°F] with viscosity at 9 - 12 cSt [54-66 SUS] and the pump at maximum displacement.



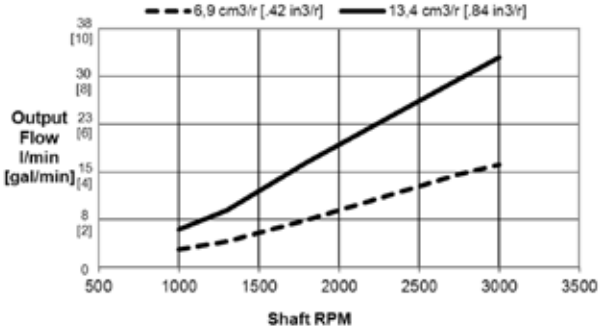






Charge Pump Performance - Flow vs Speed

The chart below is representative of a 6,9 cm^3/r [.42 in^3/r] cm^3/r and 13,4 [.84 in^3/r] displacement charge pumps. The test was run at an oil temperature of 60°C [150°F] with viscosity 13 cSt [65 SUS].



Model 70360 Code

Ordering Instructions: The Model 70360 piston pumps are specified by using the following model code system tailoring the pump configuration to the requirement. Once a pump is built from the model code, a product number will be assigned to that configuration and the pump identified.

Make sure all positions are selected within the 25 digit code for each pump order. Also state if the pumps making up a tandem are required to be mounted together or separately.

Code Example:	**ACV**	**20**	**R**	**A**	**B**	**1**	**T**	**T**	**A1**	**C**	**1**	**11**	**1**	**0**	**0 0**	**CD**	**0**	**A**
Position -	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

Position 1, 2, 3 - **Code Title**

ACV = Series 360 Manually Variable Displacement Axial Piston pump with SAE J744 Flange 101-2 (2 Bolt "B")

All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump

	Code	Single Unit	Tandem Unit Front	Tandem Unit Rear
Positions 4, 5 - Displacement and Valve Plate				
20 = 40,6 cm^3/r [2.48 in^3/r]; Rotating Kit-Standard; Valve Plate - Type 1	20	Std	Std	Std
30 = 49.2 cm^3/r [3.00 in^3/r]; Rotating Kit-Standard; Valve Plate - Type 1	30	Std	Std	Std
Position 6 - Input Shaft Rotation				
L = Lefthand Rotation (CCW)	L	Std.	Std.	Std.
R = Right-hand Rotation (CW)	R	Std.	Std.	Std.
Position 7- Input Shaft				
A = 15 Tooth external spline, 16/32 pitch; 24,981 [.9835] Major Dia.; 46 [1.81] Shaft extension	A	Std	Std	NA
B = 41 Tooth external spline, 48/96 pitch; 22,2 [.875] Major Dia.; 24,4 [.96] Shaft extension	B	NA	NA	Std
C = 13 Tooth external spline, 16/32 pitch; 21,81 [.8585] Major Dia.; 41,1 [1.62] Shaft extension	C	Opt	NA	NA
D = .125 :1 Taper; 25.4 [1.00] Diameter; 6,1 [.25] W x 19,8 [.78] L keyway; 3/8 - 24 UNF -2B Thread; 35,1 [1.38] Shaft extension	D	Opt	Opt	NA
E = Straight 22,2 [.875] Diameter; 6,3 [.25] W x 24,6 [.97] L key; 41,3 [1.62] Shaft extension	E	Opt	NA	NA
G = Straight 25,4 [1.00] Dia.; 6,1 [.25] x 28,4 [1.12] L key, 46,0 [1.81] Shaft extension	G	Opt	NA	NA
Position 8 - Control Shaft and Location				
J = Right; 19 [.748] Square Shaft with bolt groove; 128 [5.04] from centerline to control shaft end	J	Std.	Std.	Std.
K = Left; 19 [.748] Square Shaft with bolt groove; 128 [5.04] from centerline to control shaft end	K	Std.	Std.	Std.
Position 9 - Main Ports (A and B), Size and Location				
1 = 1 - 1/16 - 12 SAE Straight Thread, Opposite Sides	1	Std.	Std.	Std.
2 = 1 - 1/16 - 12 SAE Straight Thread, Same Side (without internal charge pump)	2	Opt.	Opt.	Opt.
Positions 10, 11 - Relief Valve Setting for Main Ports (Select a setting for port "A" in position 10 and port "B" in position 11.)				
0 = Check Valve Only	0	Opt.	Opt.	Opt.
B = 138 bar [2000 PSI]	B	Opt.	Opt.	Opt.
E = 173 bar [2500 PSI]	E	Opt.	Opt.	Opt.
H = 207 bar [3000 PSI]	H	Opt.	Opt.	Opt.
L = 241 bar [3500 PSI]	L	Opt.	Opt.	Opt.
N = 276 bar [4000 PSI]	N	Opt.	Opt.	Opt.
Q = 310 bar [4500 PSI]	Q	Opt.	Opt.	Opt.
T = 344 bar [5000 PSI]	T	Std.	Std.	Std.
U = 379.2 bar [5500 PSI]	Opt.	Opt.	Opt.	
Positions 12, 13 - Auxiliary Mount and Output Shaft (rear)				
A1 = SAE J744 flange 82-2 (2 Bolt A); Accepts 9 Tooth 16/32 DP spline with 31,7 [1.25] shaft extension (No coupler required)	A1	Std	Opt	Std
A2 = SAE J744 flange 82-2 (2 Bolt A) with cover plate; Accepts 9 Tooth 16/32 DP spline with 31,7 [1.25] shaft extension (No coupler required)	A2	Opt	NA	Opt
A3 = SAE J744 flange 82-2 (2 Bolt A); Accepts 11 Tooth 16/32 DP spline with 31,7 [1.25] shaft extension (coupler required)	A3	Opt	NA	Opt
A4 = SAE J744 flange 82-2 (2 Bolt A) with cover plate; Accepts 11 Tooth 16/32 DP spline with 31,7 [1.25] shaft extension (coupler required)	A4	Opt	NA	Opt
B4 = Vertical Accepts a SAE J744 flange 101-2 (2 Bolt B); Accepts 41 Tooth 48/96 DP spline B4 NA Std Opt	B4	NA	Std	Opt
Position 14 - Auxiliary Port and Bypass Valve No Bypass Valve Installed				
0 = No auxiliary port	0	Opt	NA	NA
A = 3/4 - 16 UNF - 2B SAE O-ring port, Top (C1)	A	Opt	Opt	Std
B = 3/4 - 16 UNF - 2B SAE O-ring port, Top w/ hex plug (C1)	B	Opt	NA	Opt
F = 3/4 - 16 UNF - 2B SAE O-ring port, Top w/ hex plug (C1); Rear (C3)	F	Opt	NA	Opt

Model 70360 Code

Continued

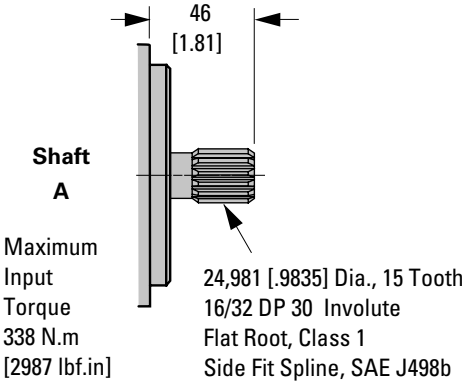
Position 14 - Auxiliary Port and Bypass Valve **No Bypass Valve Installed (Cont...)**				
G = 3/4 - 16 UNF - 2B SAE O-ring port, Top w/ hex plug (C1); Rear-Left 45° (C4)	G	Opt	Std	Opt
H = 3/4 - 16 UNF - 2B SAE O-ring port, Top w/ hex socket plug (C1); Rear (C3)	H	Opt	NA	Opt
J = 3/4 - 16 UNF - 2B SAE O-ring port, Top w/ hex socket plug (C1); Rear- Left 45° (C4)	J	Opt	Opt	Opt
K = 3/4 - 16 UNF - 2B SAE O-ring port, Top (C1); Rear - Left 45° w/ hex plug (C4)	K	Opt	Opt	Opt
L = 3/4 - 16 UNF - 2B SAE O-ring port, Top (C1); Rear w/ hex socket plug (C3)	L	Opt	NA	Opt
M = 3/4 - 16 UNF - 2B SAE O-ring port, Rear (C3)	M	Opt	NA	Opt
N = 3/4 - 16 UNF - 2B SAE O-ring port, Top (C1), Top - Rearward w/ hex socket plug (C2), Left side w/ hex socket plug (C6), Right side w/ hex socket plug (C7)	N	Opt	NA	Opt
P = 3/4 - 16 UNF - 2B SAE O-ring port, Top w/ hex plug (C1), Rear - Right 45° (C5)	P	Opt	Opt	Opt
V = 3/4 - 16 UNF - 2B SAE O-ring port, Top w/ hex plug (C1), Top - Rearward (C2)	V	Opt	NA	Opt
Bypass Valve installed in Top port (C1)				
C = 3/4 - 16 UNF - 2B SAE O-ring port, Top rearward (C2)	C	Opt	Opt	Opt
E = 3/4 - 16 UNF - 2B SAE O-ring port, Top (C1); Rear left 45° (C4)	E	Opt	Opt	Opt
R = 3/4 - 16 UNF - 2B SAE O-ring port, Rear (C3)	R	Opt	NA	Opt
S = 3/4 - 16 UNF - 2B SAE O-ring port, Top w/ hex plug (C2)	S	Opt	NA	Opt
T = 3/4 - 16 UNF - 2B SAE O-ring port, Top - Rearward (C2), Left side w/ hex socket plug (C6), Right side w/ hex socket plug (C7)	T	Opt	NA	Opt
Bypass Valve installed in rear port (C3)				
D = 3/4 - 16 UNF - 2B SAE O-ring port, Top (C1)	D	Opt	NA	Opt
U = 3/4 - 16 UNF - 2B SAE O-ring port, Top (C1)	U	Opt	NA	Opt
Position 15 - Charge Pump				
0 = No charge Pump	0	Opt	Std	Opt
1 = 6,9 cm^3/r [.42 in^3/r]; 3/4-16 UNF - 2B SAE O-ring port for suction inlet (S)	1	Std	NA	NA
2 = 13,8 cm^3/r [.84 in^3/r]; 3/4-16 UNF - 2B SAE O-ring port for suction inlet (S)	2	Opt	NA	Std
5 = 17.2 cm3/r [1.05 in3/r]; 1 5/16-12 UN - 2B SAE O-ring port for suction inlet (S)- B Pad only	5	Std.	NA	Std.
6 = 20.7 cm3/r [1.26 in3/r]; 1 5/16-12 UN - 2B SAE O-ring port for suction inlet (S)- B Pad only	6	Std.	NA	Std.
Position 16, 17 - Charge Pump Relief Setting and Routing				
00 = None	00	Opt	Std	Opt
01 = No charge relief (Requires external relief set between 6,89 bar [100 PSI] 17,24 bar [250 PSI])	01	Opt	Opt	Opt
For Units with Charge Pump				
11 = 6,89-10,34 bar [100-150 PSI]; Recirculated	11	Std	NA	Std
12 = 10,34-13,79 bar [150-200 PSI]; Recirculated	12	Opt	NA	Opt
13 = 13,79-17,24 bar [200-250 PSI]; Recirculated	13	Opt	NA	Opt
14 = 17,24-20,68 bar [250-300 PSI]; Recirculated	14	Opt	NA	Opt
For Units without Charge Pump				
21 = 6,89-10,34 bar [100-150 PSI]; Relieved to case	21	Opt	NA	Opt
22 = 10,34-13,79 bar [150-200 PSI]; Relieved to case	22	Opt	NA	Opt
23 = 13,79-17,24 bar [200-250 PSI]; Relieved to case	23	Opt	NA	Opt
Position 18 - Drain Port Size and Location				
0 = 3/4 - 16 UNF - 2B SAE o-ring port, Top (D1); Bottom plugged (D2); Thru drain in front mounting flange (D4)	0	NA	NA	Std
1 = 3/4-16 UNF-2B SAE o-ring port, Top (D1); Bottom, Plugged (D2)	1	Std	Std	Opt
Position 19 - Additional Functions				
0 = None	0	Std	Std	Std
D= Bleed-off in Control ShaftPosition "a" 13.8-17.2 bar [200-250 lbf/in2]	D	Opt	Opt	Opt
E= Bleed-off in Control ShaftPosition "b" 13.8-17.2 bar [200-250 lbf/in2]	E	Opt	Opt	Opt
F= Bleed-off in Control ShaftPosition "a" & "b" 13.8-17.2 bar [200-250 lbf/in2]	F	Opt	Opt	Opt
Positions 20, 21 - Special Features				
00 = None	00	Std	Std	Std
0A = Fluorocarbon Rubber Drive shaft seal and control shaft seal	0A	Opt	Opt	Opt
0C = Bottom Mounting Bracket with 13,7 [.54] diameter hole	0C	NA	NA	Std
0D = Coupling and o-ring included for rear mount	0D	Opt	Opt	Opt
Positions 22, 23 - Paint				
0A = Primer	0A	Std	Std	Std
0B = Black	0B	Opt	Opt	Opt
Position 24 - Identification				
0 = Standard (Nameplate)	0	Std	Std	Std
Position 25 - Design Code				
B = B	B	Std	Std	Std

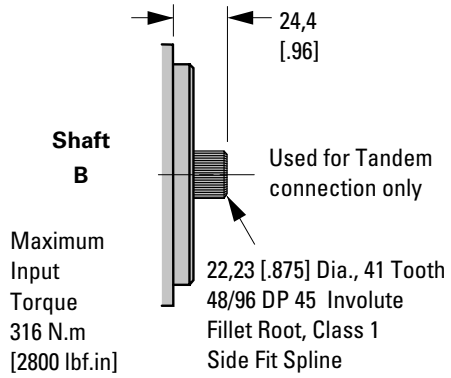
NA = Not Available Opt. = Optional Std. = Standard

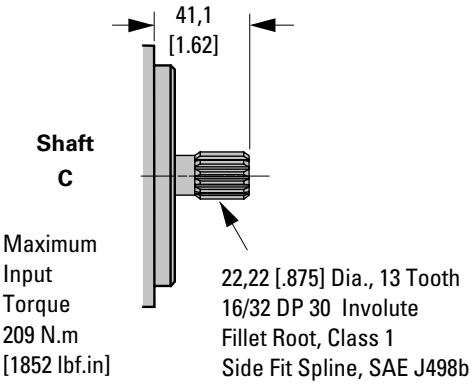
Model 70360
Input Shafts

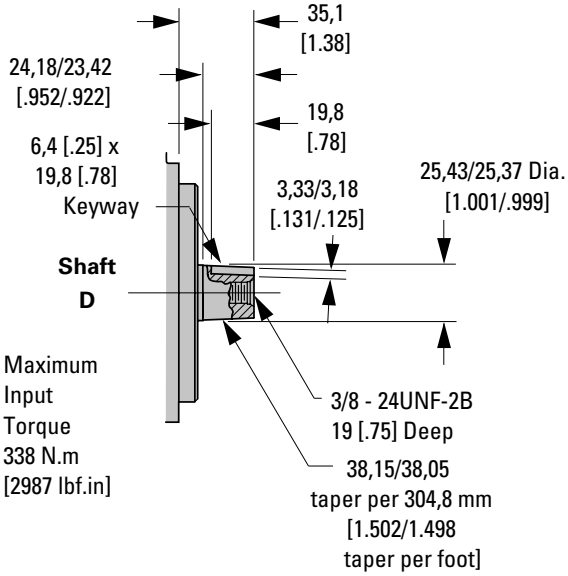
Code Position 7

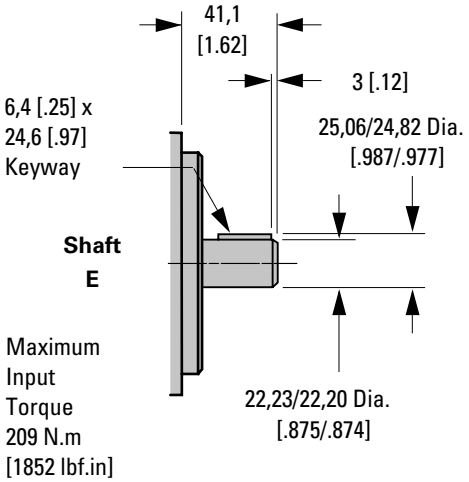
Dimensions are in millimeters [inches], unless otherwise specified.

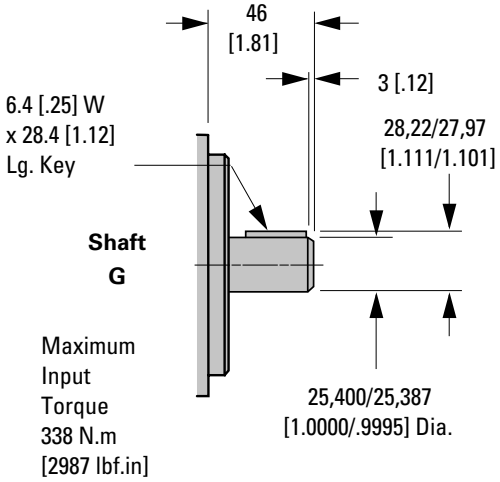












Torque Note:

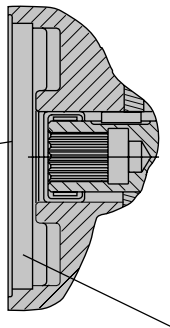
The combined torque required to turn multiple pumps must not exceed the torque rating of the input drive shaft of the front piston pump. Consult an Eaton representative and/or Eaton engineering on side load recommendations.

Model 70360
Auxiliary Mounts & Output Shafts

Code Position 12 and 13

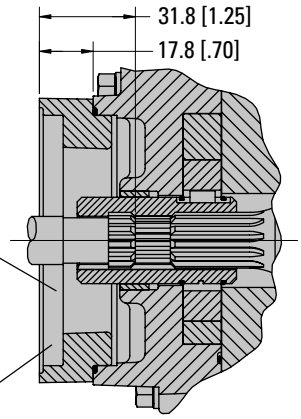
9 Tooth, 16/32 DP Int., 15,88 [.6250] O.D., Accepts 31,8 [1.25] Shaft Ext., SAE "A" Mount J744

Torque limit on internal rear spline of piston pump with internal charge pump must not exceed 54 N• m [480 lbf • in]. Piston pump without internal charge pump must not exceed 76 N • m [672 lbf • in]



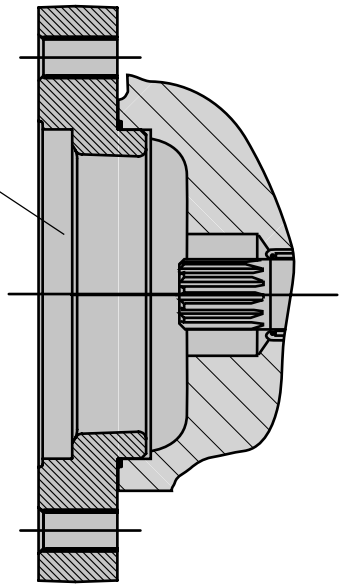
11 Tooth, 16/32 DP Int.; 19,33 [.761] O.D.; Accepts 31,8 [1.25] Shaft Ext., "A" Auxiliary Mount SAE J744
(Used on piston pump with internal charge pump)

Maximum Torque
119 N • m [1050 lbf • in]



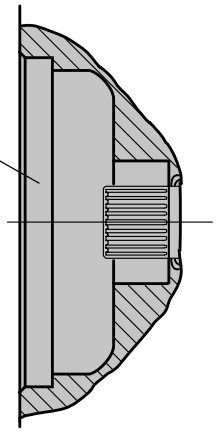
SAE "A" Auxiliary Mount with Charge Pump Shown

13 Tooth , 16/32 DP Ext.; 21,81 [.8585] O.D., Accepts 41,1 [1.62] Shaft Ext.; "B" Auxiliary Mount SAE J744
(Used on piston pump without internal charge pump)



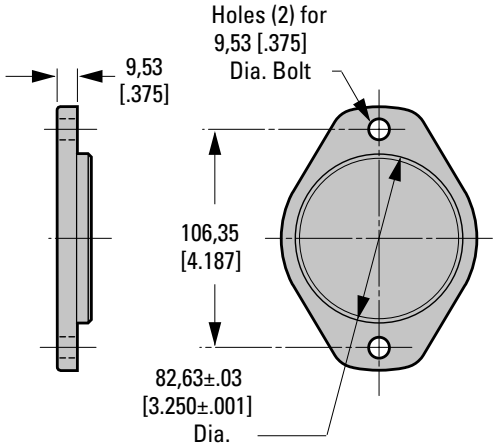
41 Tooth , 48/96 DP Ext., 22,23 [.8750] O.D., Accepts 24,9 [.98] Shaft Ext.; "B" Auxiliary Mount SAE J744
(Used for Tandem Connections)

Maximum Torque
316 N • m [2,800 lbf • in]



Cover Plate

Fits "A" SAE Auxiliary Mounting Flange. Cover Plate Kit #70142-915: Includes plate, cap screws (2), and O-ring



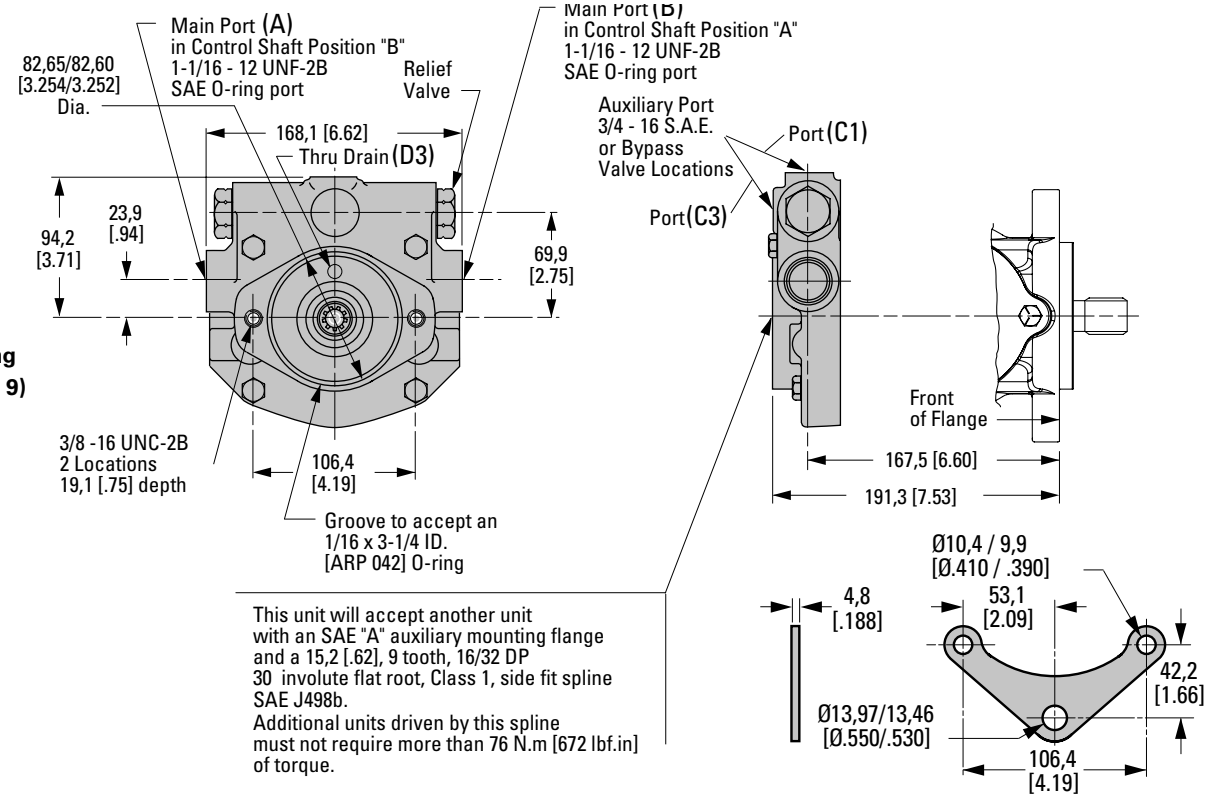
All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump.

Model 70360
Port Locations

Code Position 12 and 13

All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump.

Opposite Side Porting
(Selected in Position 9)

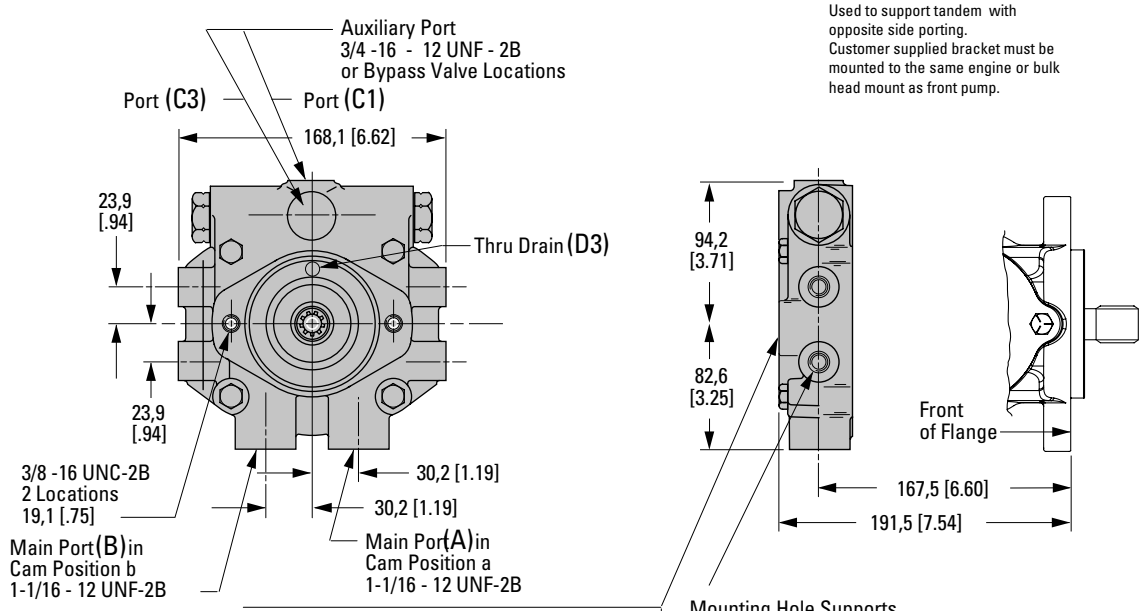


This unit will accept another unit with an SAE "A" auxiliary mounting flange and a 15,2 [.62], 9 tooth, 16/32 DP 30 involute flat root, Class 1, side fit spline SAE J498b.
Additional units driven by this spline must not require more than 76 N.m [672 lbf.in] of torque.

Mounting Bracket

Used to support tandem with opposite side porting.
Customer supplied bracket must be mounted to the same engine or bulk head mount as front pump.

Same Side Porting
(Selected in Position 9)



This unit will accept another unit with an SAE "A" auxiliary mounting flange and a 15,2 [.62], 9 tooth, 16/32 DP 30 involute flat root, class 1, side fit spline SAE J498b.
Additional units driven by this spline must not require more than 76 N.m [672 lbf.in] of torque.

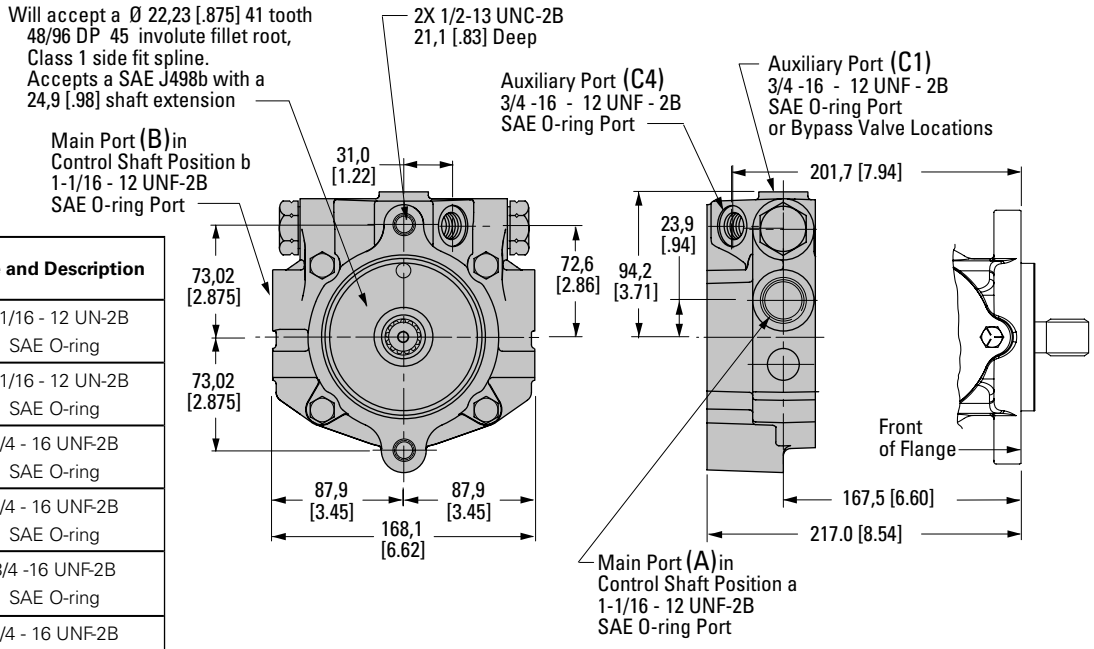
Mounting Hole Supports
4 x 7/16 -14 UNC-2B
18,8 [.74] deep
Customer supplied bracket must be mounted to the same engine or bulk head mount as front pump.

Model 70360
Port Locations

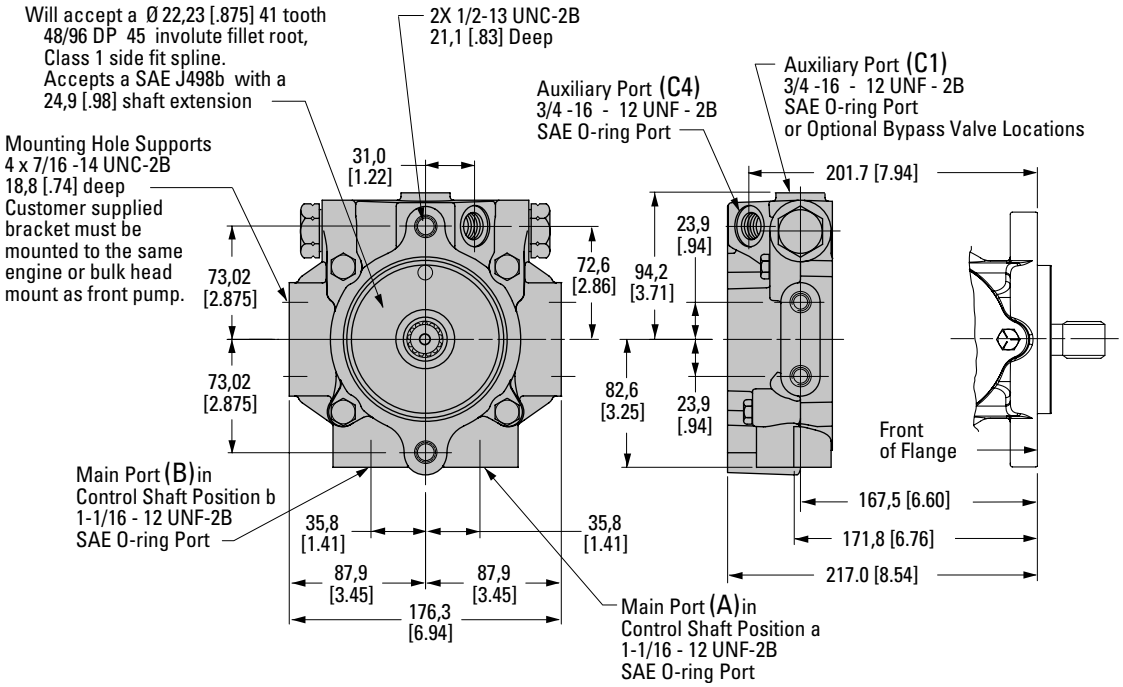
Code Position 12 and 13

Opposite Side Porting
(Selected in Position 9)

Port ID	Type of Port	Size and Description
A	Main Port	1- 1/16 - 12 UN-2B SAE O-ring
B	Main Port	1- 1/16 - 12 UN-2B SAE O-ring
C1	Auxiliary Port Top - Front or Bypass Valve	3/4 - 16 UNF-2B SAE O-ring
C2	Auxiliary Port Top - Rear	3/4 - 16 UNF-2B SAE O-ring
C3	Auxiliary Port Rear - Rear	3/4 -16 UNF-2B SAE O-ring
C4	Auxiliary Port Side - Left Side	3/4 - 16 UNF-2B SAE O-ring
C5	Auxiliary Port Side - Right Side	3/4 - 16 UNF-2B SAE O-ring
D1	Drain Port - Top	3/4 - 16 UNF-2B SAE O-ring
D2	Drain Port - Bottom	3/4 - 16 UNF-2B SAE O-ring
D3	Thru Drain - Rear	9,27 [.365] Dia.
D4	Thru Drain - Front	9,55 [.376] Dia.
S	Charge Suction Port	3/4 - 16 UNF-2B SAE O-ring



Same Side Porting
(Selected in Position 9)



Servo Controlled

40,6 cm^3/r [2.48 in^3/r]

49,2 cm^3/r [3.00 in^3/r]

Displacement



Identification Numbers - Manual Variable Displacement Piston Pump - Closed Circuit

Identification numbers

Stamped on each unit.

A – Product Number Description

- 72400 = Single Piston Pump
- 78461 = Tandem Piston Pump
- 78462 = Single or Tandem Piston Pump with Gear Pump

B – Rotation

- R / S = Right Hand
- L = Left Hand

C – Sequential Letter

D – Design Code Number

Single Pump – Product Number

7 2 4 0 0 - R A K - 0 4

A B C D

Tandem Pumps – Product Number

7 8 4 6 1 - L A A - 0 4

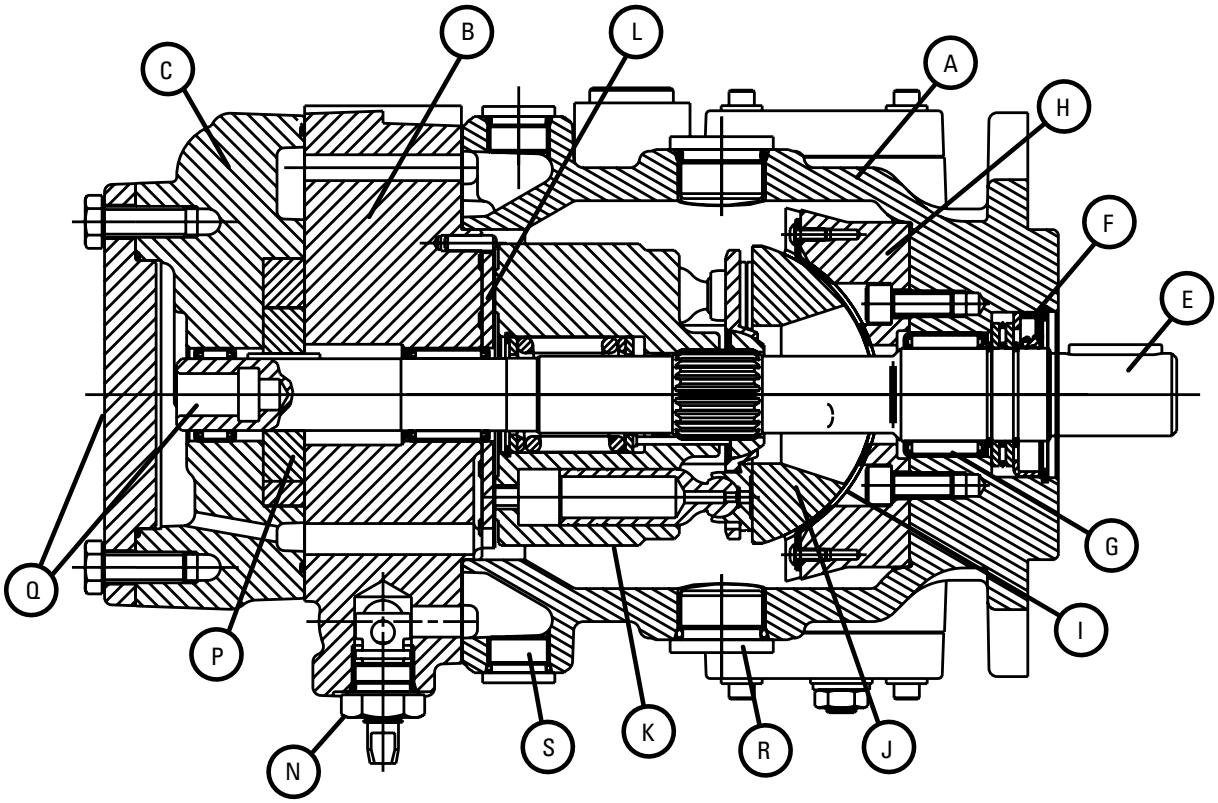
A B C D

Serial Number Code

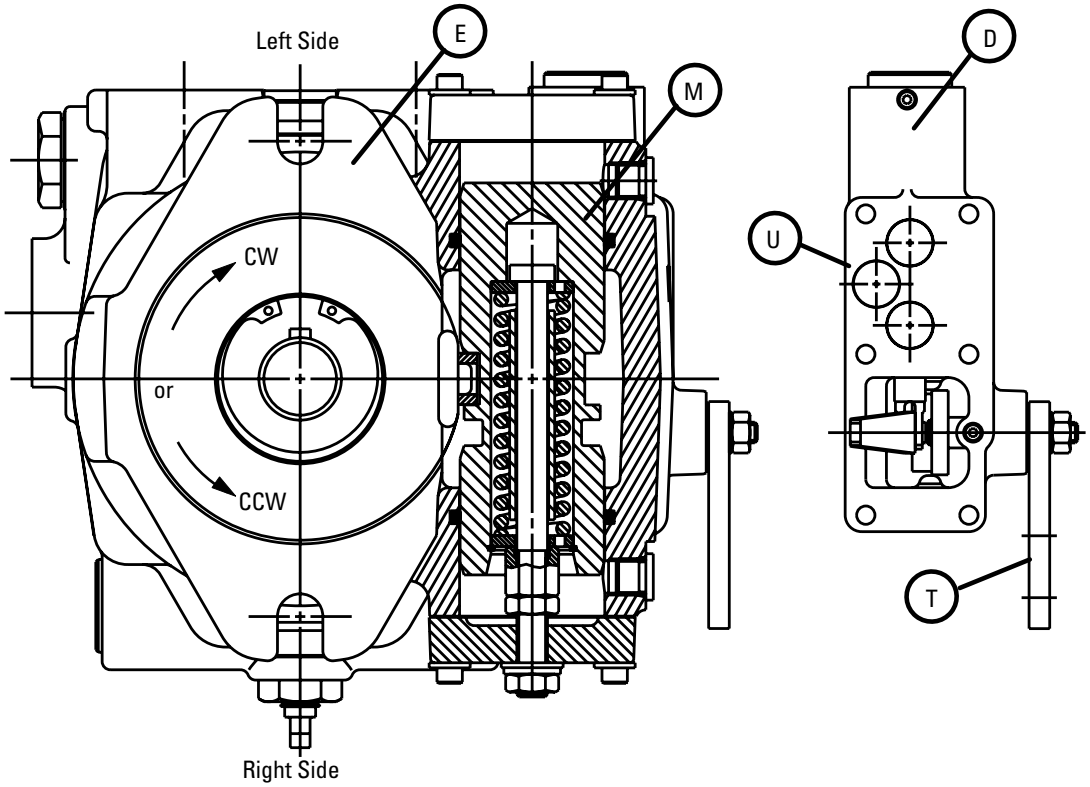
10 05 06 XXX 1 000

- Last Two Digits of Year Built. (10 for 2010 etc.)
- Month Built (two digits)
- Day Built (two digits)
- Manufacturing Cell
- Shift Number
- Specific Number of the Pump

Model 72400 Servo Controlled Features



View "A - A"



Model 72400 Servo Controlled Features and Benefits

A Housing

- Modular design
- Compact package size.
- Durable cast iron design.
- Multiple drain options.
- Quiet operation.
- Improved serviceability

B Endcover

C Charge Pump Adapter

D Manual Displacement Servo Control Valve

- Low operator effort.
- Modular design.

E Input Shaft and Mounting

- SAE "B" or "B-B" Mount (2 Bolt)
- Numerous shaft options.

F Seals

G Bearings

H Swashplate Cradle

I Swashplate Bushing

J Swashplate

K Rotating Group

- 40,6 cm3/r [2.48 in3/r] Displacement
- 49,2 cm3/r [3.00 in3/r] Displacement

L Valve plate

- Improved serviceability.

M Servo Piston Assembly

N Bypass Valve

- Cross ports the closed loop hydraulic circuit - used to move a disabled machine a limited distance.

O Internal High Pressure Relief Valves

- Prevents excessive pressure..

P Gerotor Charge Pump

- Four sizes available.
  6,9 cm3/r [.42 in3/r]
  13,8 cm3/r [.84 in3/r]
  17.2 cm3/r [1.05 in3/r]
  20.7 cm3/r [1.26 in3/r]]

Q Auxiliary Pump Mounting Flange (Rear)

- SAE " A" or "B"
- Auxiliary or tandem mount capability

R Case Drain Port

- Multiple drain options

S Auxillary Port

- For pressure check port or remote charge pressure port.

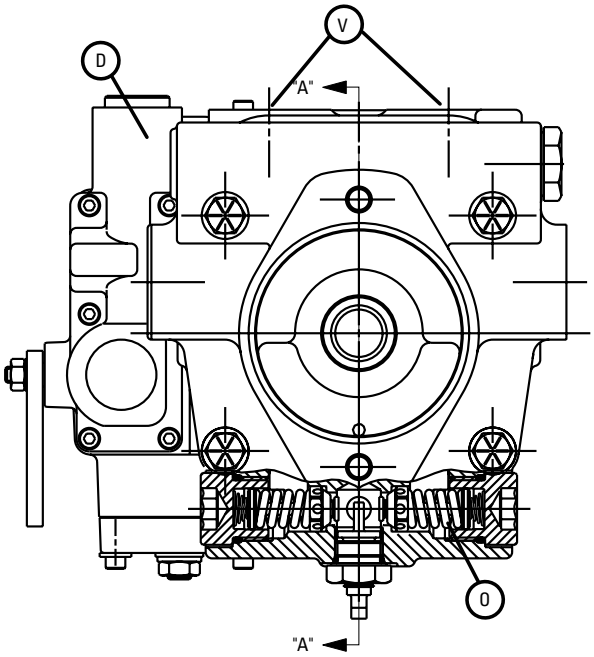
T Control Lever

- Low operator effort

U Control Orifices

- Controls rate of change of displacement.

V Main System Ports

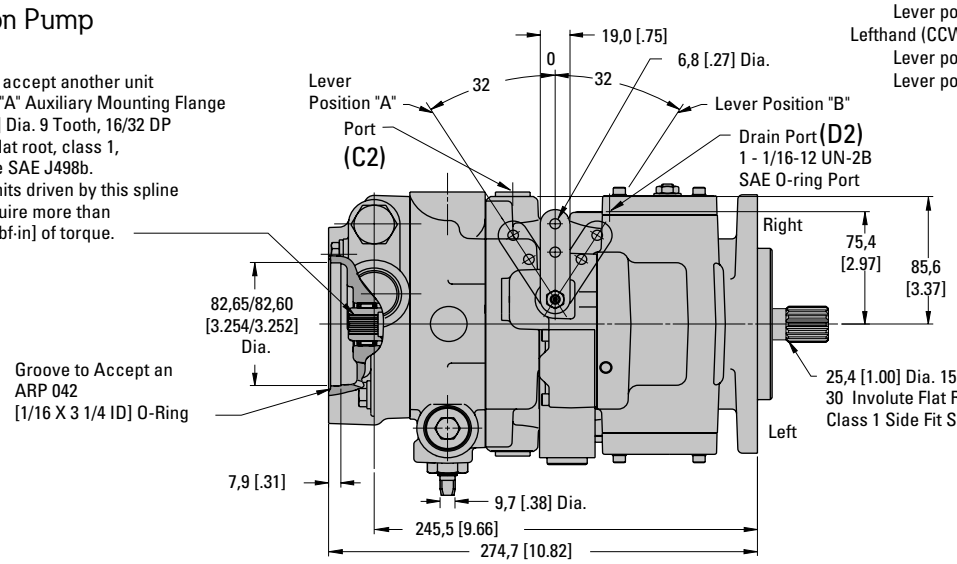


Model 72400 Servo Controlled Installation Drawing

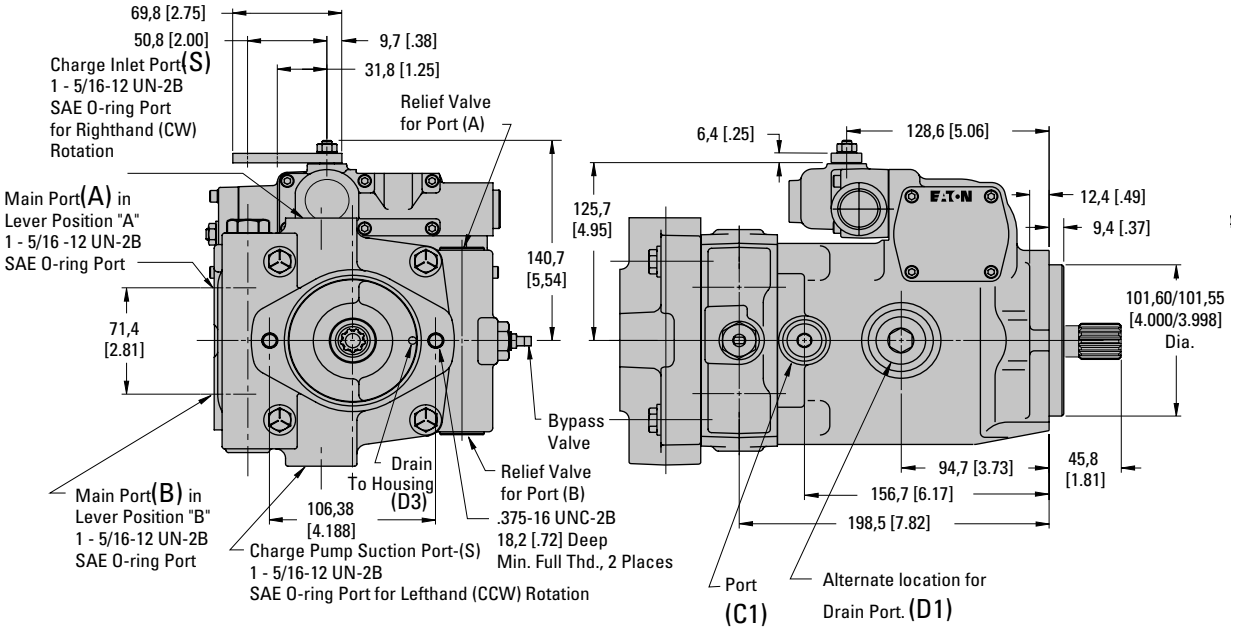
Single Piston Pump

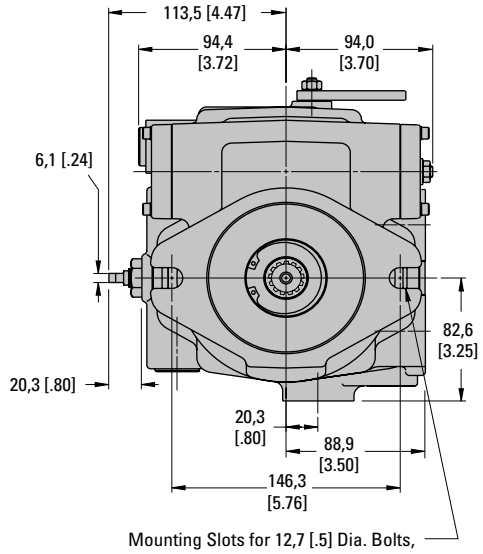
Lever Position vs. Pressurized Port
Righthand (CW) Rotation
Lever position "A"--- Port (A) is Pressurized
Lever position "B"--- Port (B) is Pressurized
Lefthand (CCW) Rotation
Lever position "A"--- Port (B) is Pressurized
Lever position "B"--- Port (A) is Pressurized

This unit will accept another unit with an SAE "A" Auxiliary Mounting Flange and 15,7 [.62] Dia. 9 Tooth, 16/32 DP 30 involute flat root, class 1, side fit spline SAE J498b. Additional units driven by this spline must not require more than 54 N·m [480 lbf·in] of torque.



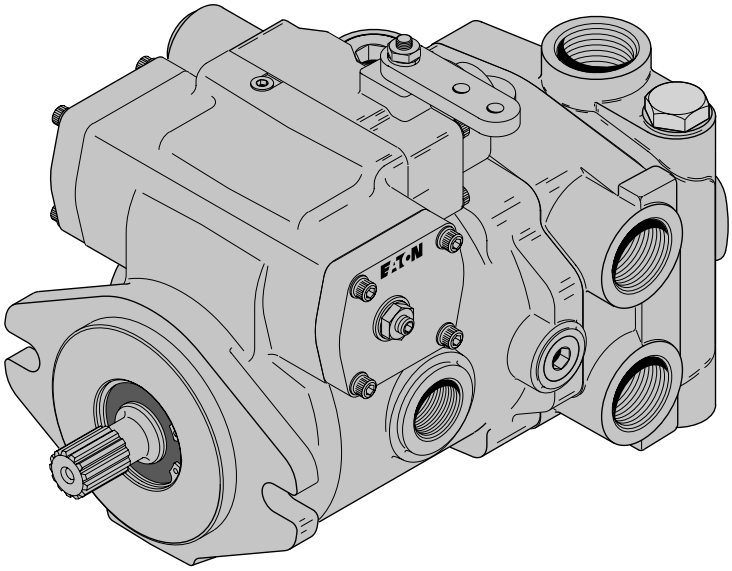
Righthand (CW) Rotation Shown
Dimensions are in mm [in] unless noted otherwise.

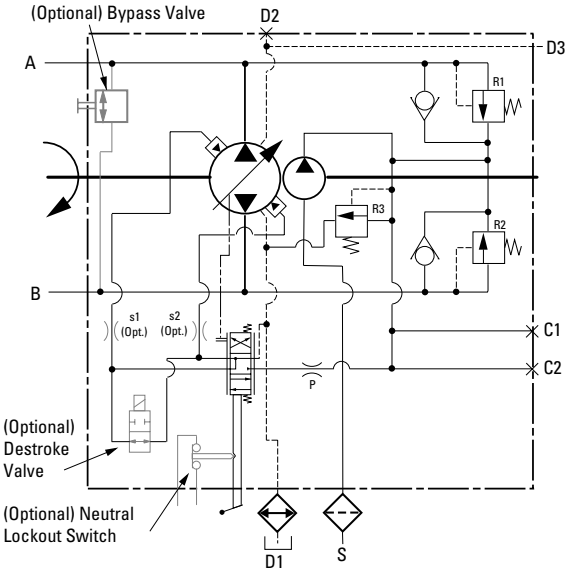




Model 72400 Servo Controlled

Single Piston Pump





Description of Unit on Opposite Page:

Righthand (CW) Rotation

Input Shaft: 15 tooth

Output Shaft: 9 tooth

Auxiliary Rear Mounting: SAE "A" Series 82-2

Charge Pump: 6,9 cm3/r [.42 in3/r] disp. with Inlet Port 1 - 5/16-12 UN-2B, SAE O-ring Port

Charge Pump Relief Setting: 17 to 21 bar [250 to 300 PSI], relieved to case.

Auxiliary Port: 3/4-16 UNF-2B, SAE O-ring Port, plugged on both sides.

Drain Port: 1 - 1/16-12 UN-2B, SAE O-ring Port, on right side and rear flange drained into housing

Main Ports:1 - 5/16-12 UN-2B, SAE O-ring Port, same side on right

Relief Valves: Available in a range of settings to 379 bar [5500 PSI]

Additional Functions: Bypass Valve

Control Assembly: Manual with no additional features

Supply Orifice: ,71 mm [.028 in]

Paint: Black

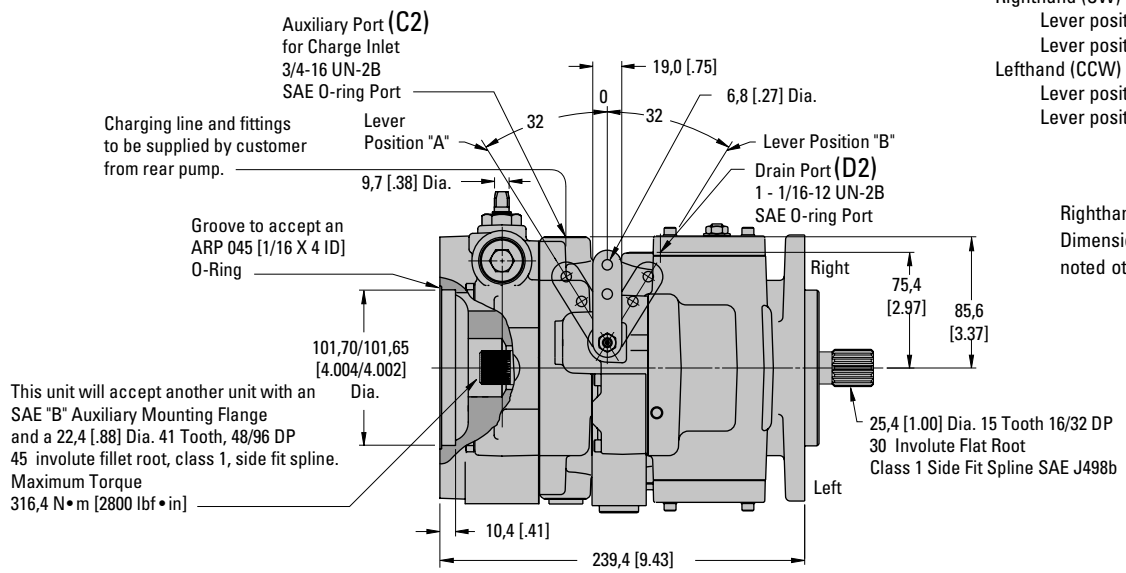
Additional options are available by using the Model Code and Details.

All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump.

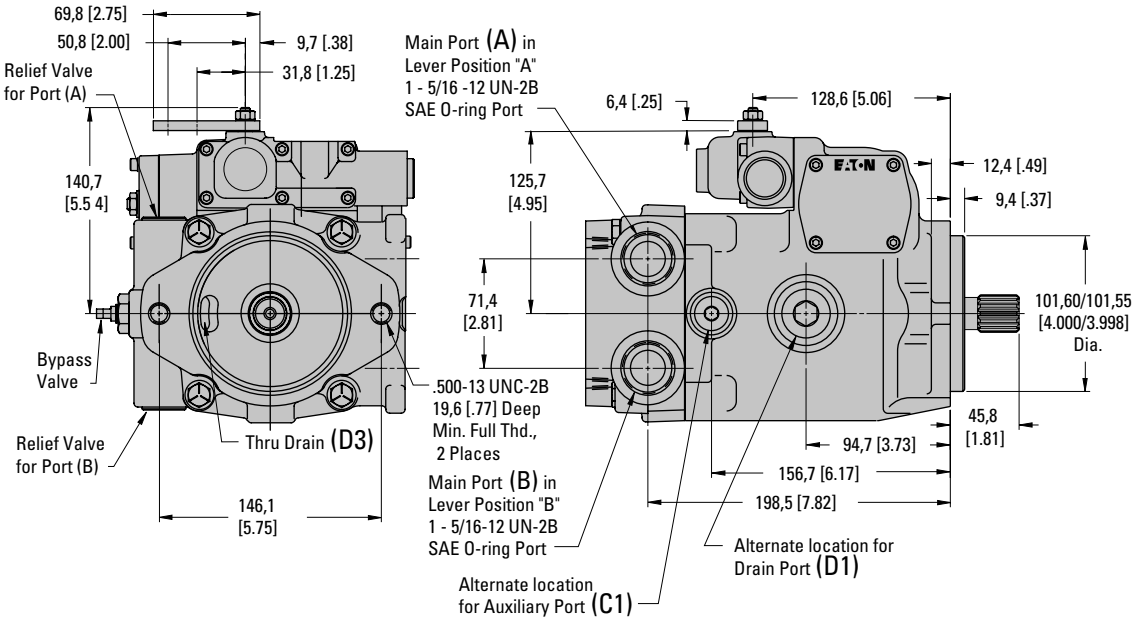
Model 72400 Servo Controlled Installation Drawing

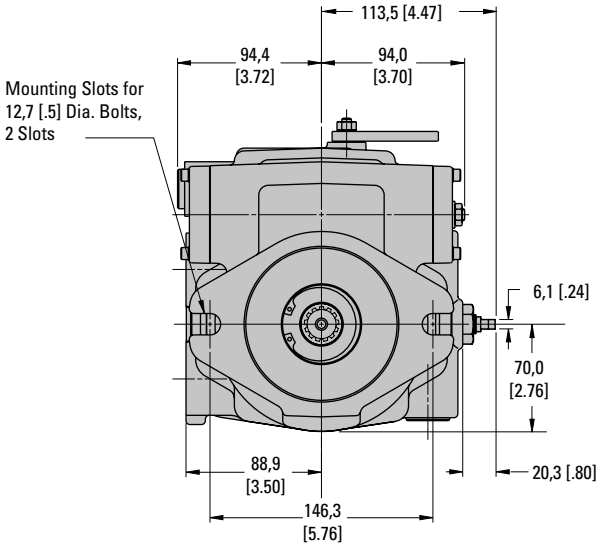
Front Piston Pump of Tandem Pumps

Lever Position vs. Pressurized Port
Righthand (CW) Rotation
Lever position "A"--- Port (A) is Pressurized
Lever position "B"--- Port (B) is Pressurized
Lefthand (CCW) Rotation
Lever position "A"--- Port (B) is Pressurized
Lever position "B"--- Port (A) is Pressurized



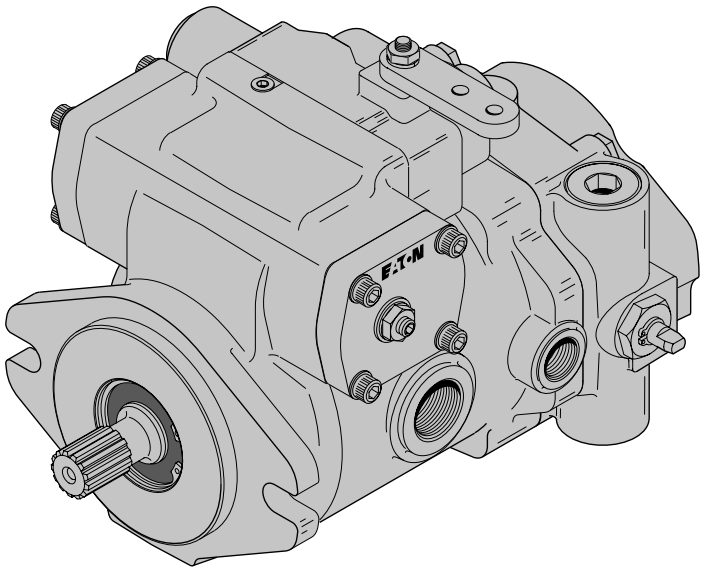
Righthand (CW) Rotation Shown
Dimensions are in mm [in] unless noted otherwise.

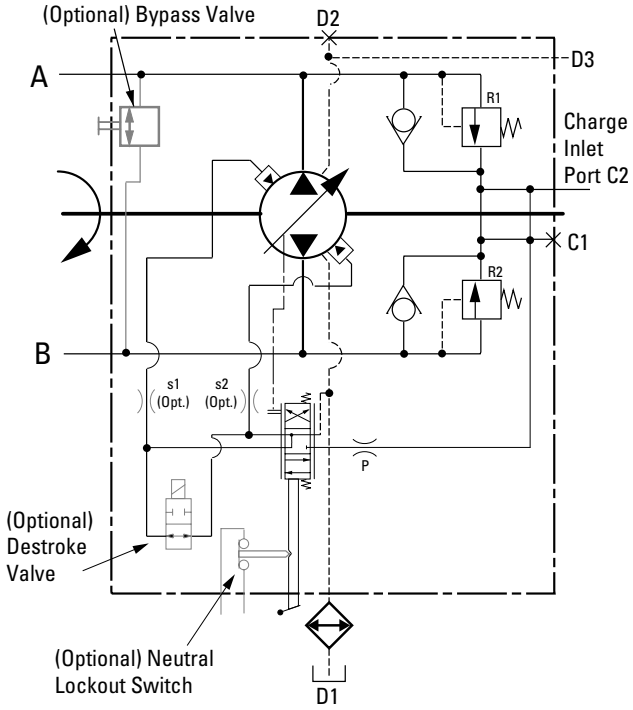




Model 72400 Servo Controlled

Front Piston Pump of Tandem Pumps





Description of Unit on Opposite Page:

Righthand (CW) Rotation

Input Shaft: 15 tooth

Output Shaft: 41 tooth

Auxiliary Rear Mounting: SAE 2 bolt "B" Series 101-2

Charge Pump: Not included

Auxiliary Port: 3/4-16 UNF-2B SAE O-ring Port on right side

Drain Port: 1 - 1/16-12 UN-2B SAE O-ring Port on right side and rear flange drained into housing

Main Ports: 1 - 5/16-12 UN-2B SAE O-ring Port on same side (left side of pump)

Relief Valves: Available in a range of settings to 379 bar [5500 PSI]

Additional Functions: Bypass Valve

Control Assembly: Manual with no additional features

Supply Orifice: ,71 mm [.028 in]

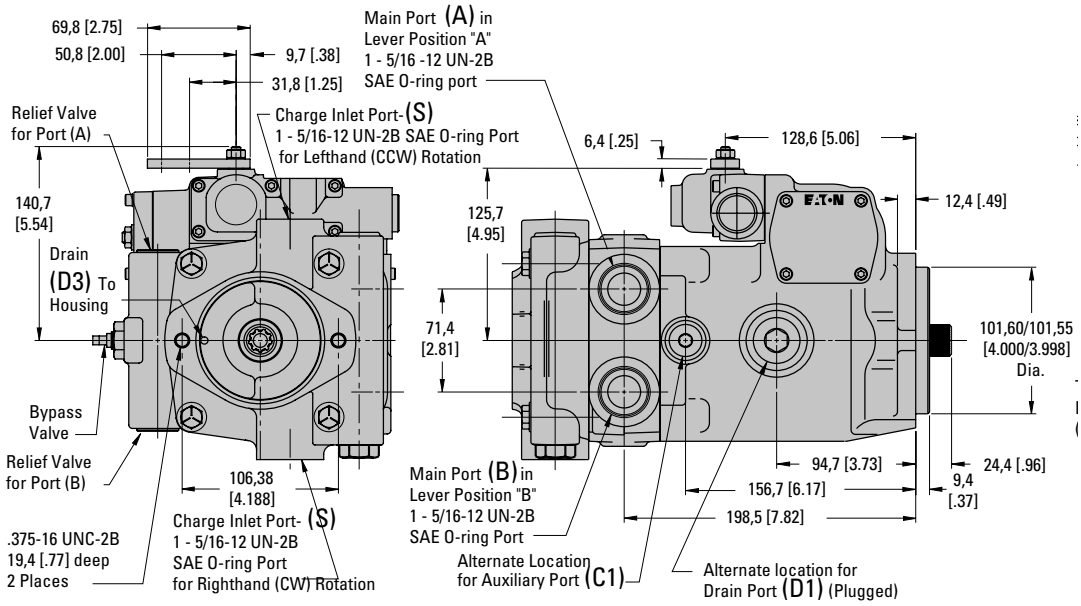
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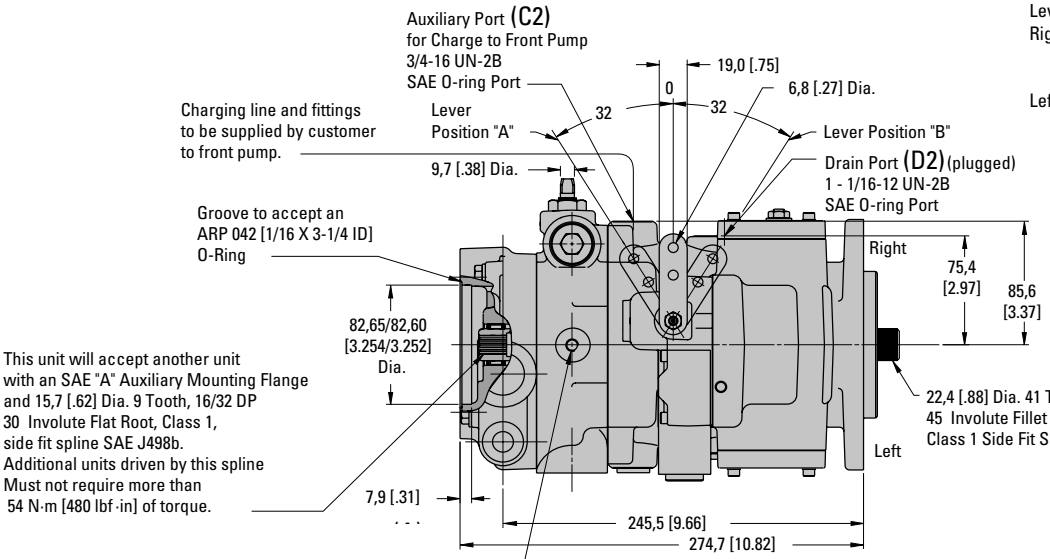
Additional options are available by using the Model Code and Details.

All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump.

Model 72400 Servo Controlled Installation Drawing

Rear Piston Pump of Tandem Pumps





Lever Position vs. Pressurized Port

Righthand (CW) Rotation

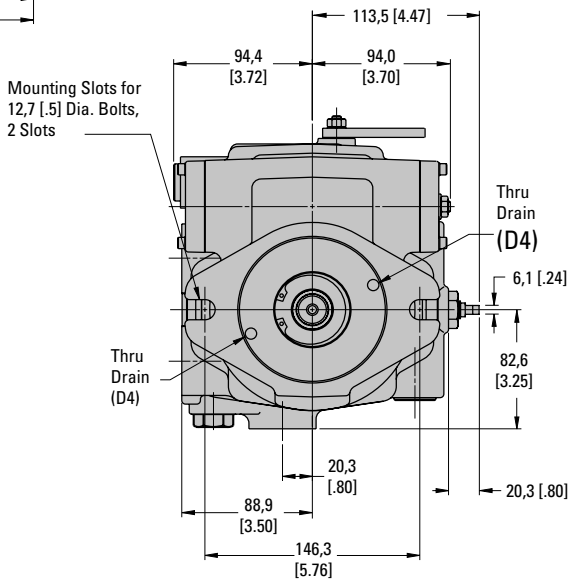
Lever position "A"---	Port (A) is Pressurized
Lever position "B"---	Port (B) is Pressurized

Lefthand (CCW) Rotation

Lever position "A"---	Port (B) is Pressurized
Lever position "B"---	Port (A) is Pressurized

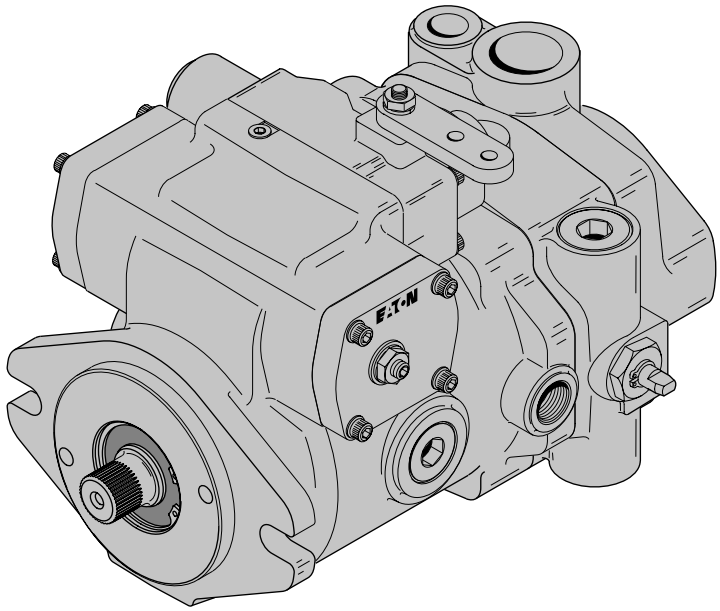
Righthand (CW) Rotation Shown

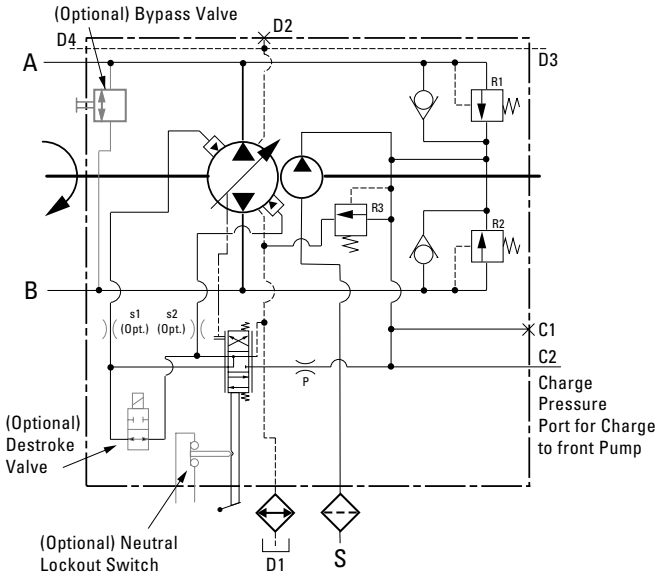
Dimensions are in mm [in] unless noted otherwise.



Model 72400 Servo Controlled

Rear Piston Pump of Tandem Pumps





Description of Unit on Opposite Page:

Righthand (CW) Rotation

Input Shaft: 41 tooth

Output Shaft: 9 tooth

Auxiliary Rear Mounting: SAE "A" Series 82-2 w/mounting support hole

Charge Pump: 13,8 cm3/r [.84 in3/r] disp. with Inlet Port, 1 - 5/16-12 UN-2B SAE O-ring Port

Charge Pump Relief Setting: 17 to 21 bar [250 to 300 PSI], Relieved to Case.

Auxiliary Port: 3/4-16 UNF-2B SAE O-ring Port on right side

Drain Port: 1 - 1/16-12 UN-2B SAE O-ring Port on both sides, plugged, and drain hole thru housing to front pump.

Main Ports: 1 - 5/16-12 UN-2B SAE O-ring Port same side on left

Relief Valves: Available in a range of settings to 379 bar [5500 PSI]

Additional Functions: Bypass Valve

Control Assembly: Manual with no additional features

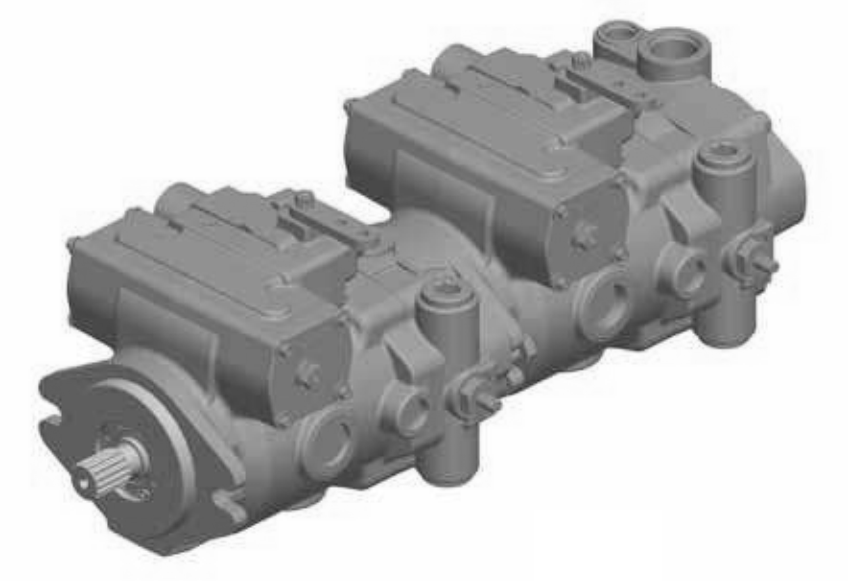
Supply Orifice: ,71 mm [.028 in]

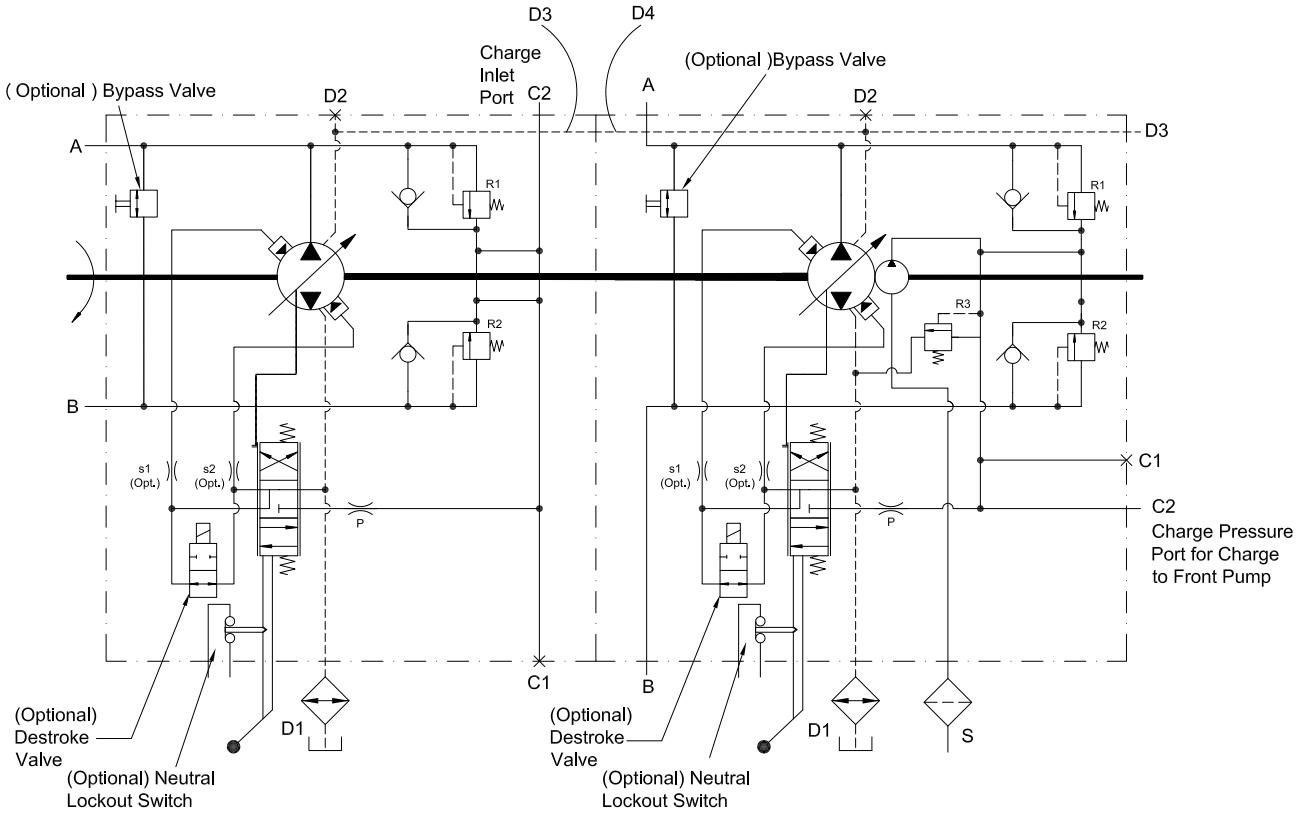
Paint: Black

Additional options are available by using the Model Code and Details.

All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump.

Model 72400 Servo Controlled
Tandem Pump





Model 72400 Servo Controlled
Features, Benefits & Specifications



Specifications - Piston Pump

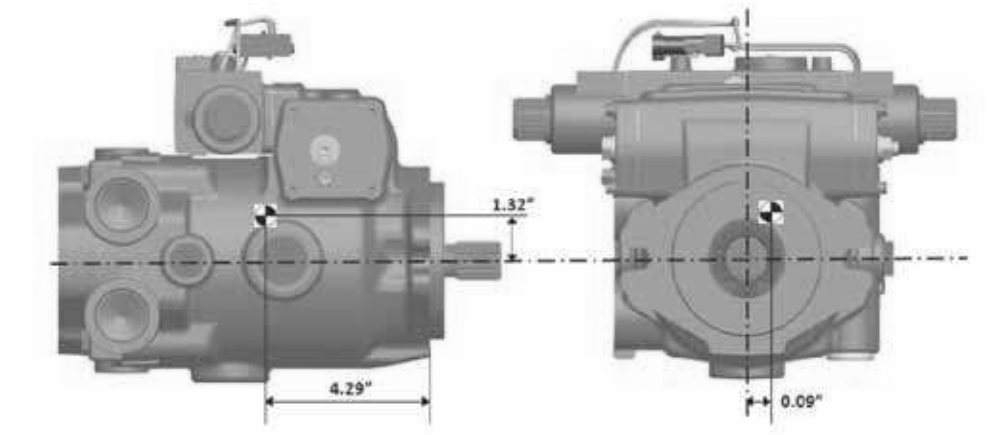
Maximum Displacement	40,6 cm^3/r [2.48 in^3/r]	49,2 cm^3/r [3.00 in^3/r]
Input Mounting Flange	SAE "B" or "BB"	SAE "B" or "BB"
Flow @ Rated Speed & PSI	140 l/min [37.0 gal/min]	169 l/min [44.8 gal/min]
Maximum Rated Speed	3600 RPM	3600 RPM
Nominal Pressure Rating*	345 bar [5000 PSI]	345 bar [5000 PSI]
Peak Pressure Rating**	380 bar [5500 PSI]	380 bar [5500 PSI]
Max Input Power	84 kw (113 HP)	102 kw (137 HP)
Max Input Torque	237 N-m (2099 lbf-in)	286 N-m (2528 lbf-in)
Continuous Allowable Case Pressure	2 bar [25 PSI]	2 bar [25 PSI]
Maximum Case Drain Temperature	107° C [225° F]	107° C [225° F]
Weight Per Single Pump	27 to 28 kg [59 to 62 lbs]	27 to 29 kg [59 to 62 lbs]

Specifications - Internal Gerotor Charge Pump

Displacement Options	
	6,9 cm^3/r [.42 in^3/r] 13,8 cm^3/r [.84 in^3/r] 17.2 cm3/r [1.05 in3/r] 20.7 cm3/r [1.26 in3/r]
Operating Pressure Range (std.)	14 to 21 bar [200 to 300 PSI]
Maximum Charge Inlet Vacuum	0,80 bar Abs. [6 inHg]

* Nominal Pressure: Max delta system pressure at which component fatigue does not occur (pump life estimated by bearing life).
** Peak Pressure: Max operation pressure which is permissible for a short duration of time (t < 1 sec).

Centre of Gravity of EP Controlled Pump***

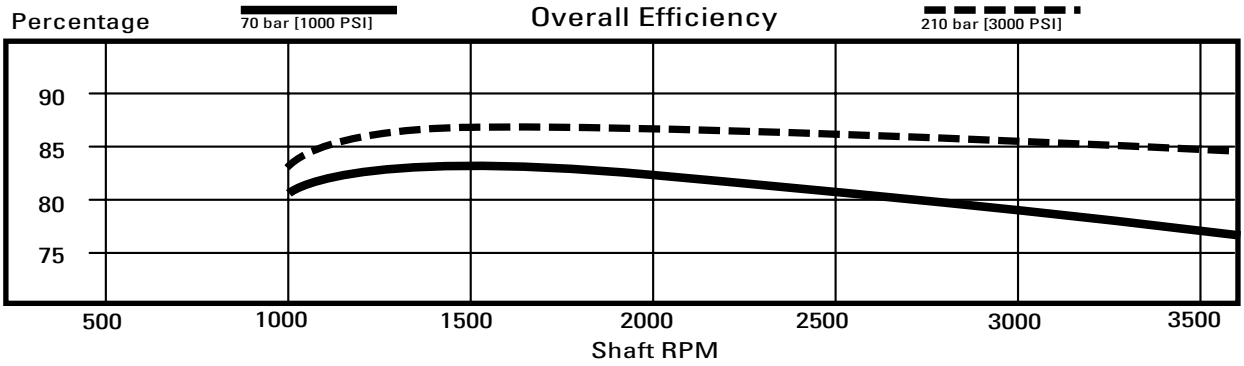


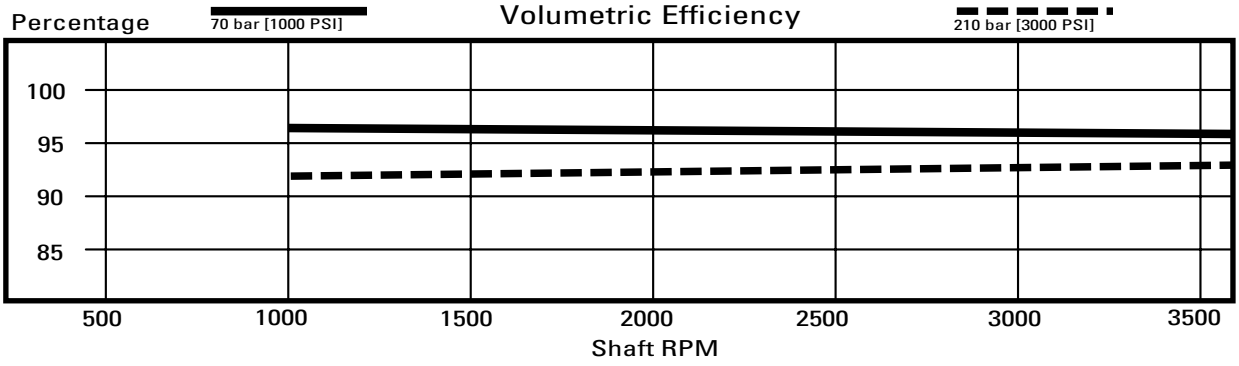
***Contact Eaton representative for specific requirements.

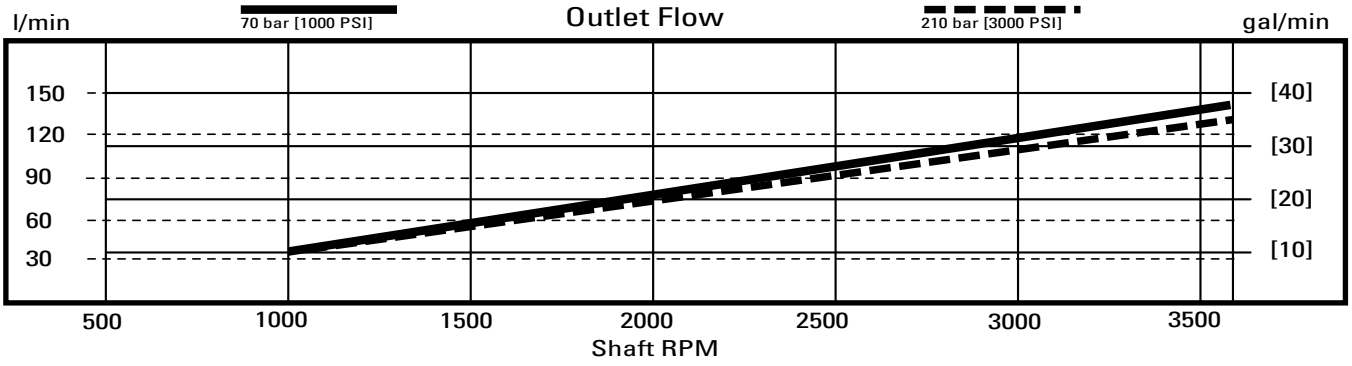
Model 72400 Servo Controlled Performance Data

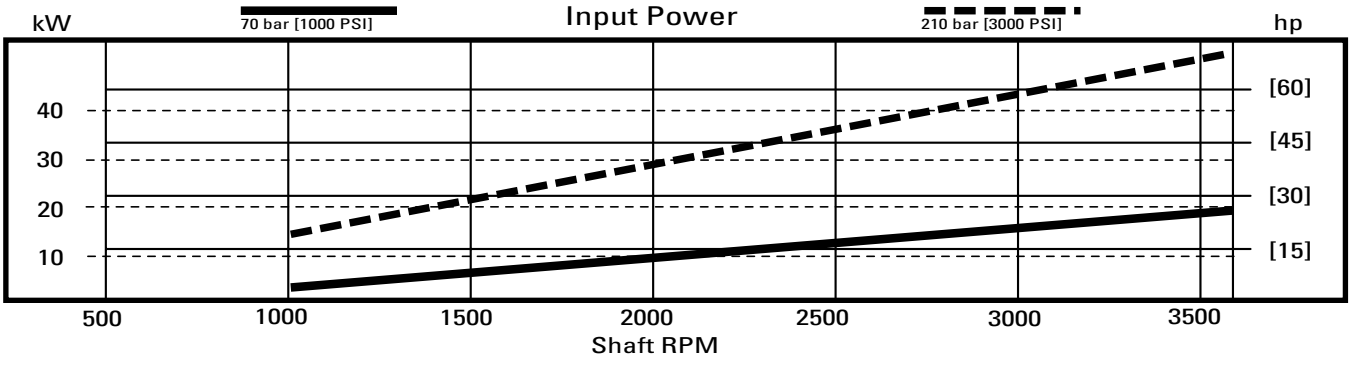
40,6 cm³/r [2.48 in³/r]

The charts below are representative of a single 40,6 cm³/r [2.48 in³/r] Variable Displacement Piston Pump. The tests were run at an oil temperature of 82°C [180°F] with viscosity at 9 - 12 cSt [54 - 66 SUS] and the pump at maximum displacement.





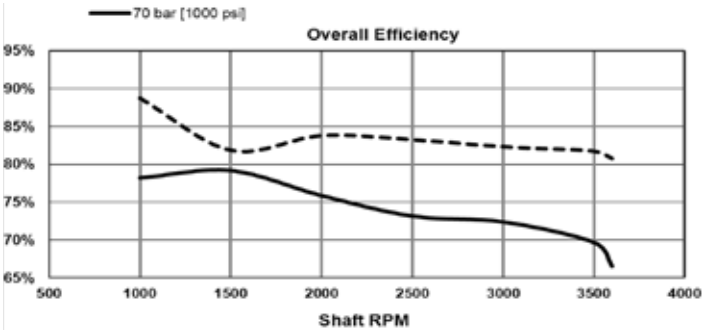


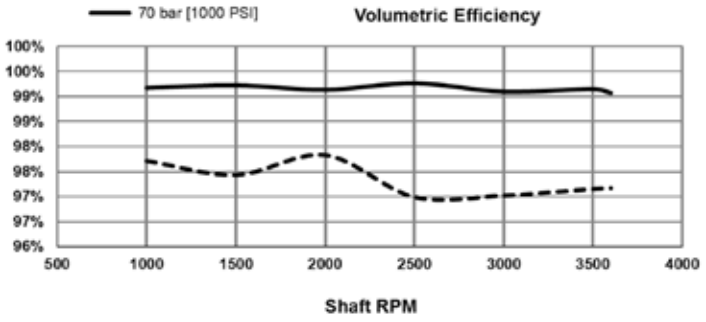


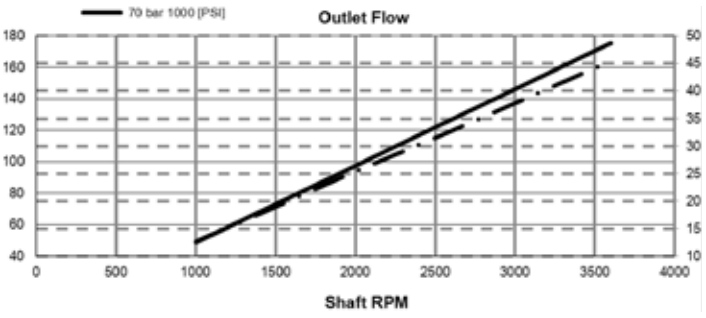
Model 72400 Servo Controlled Performance Data

49.2 cm3/r [3.00 in3/r]

The charts below are representative of a single 49.2 cm3/r [3.00 in3/r] Variable Displacement Piston Pump. The tests were run at an oil temperature of 82°C [180°F] with viscosity at 9 - 12 cSt [54 - 66 SUS] and the pump at maximum displacement.

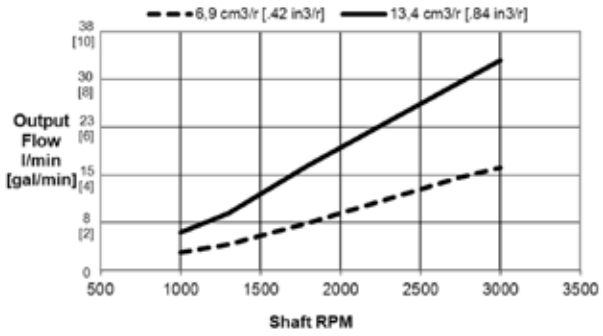






Charge Pump Performance - Flow vs Speed

The chart at right is representative of a 6,9 cm^3/r [.42 in^3/r] cm^3/r and 13,4 [.84 in^3/r] displacement charge pumps. The test was run at an oil temperature of 60°C [150°F] with viscosity 13 cSt [65 SUS].



Model 72400 Servo Controlled Code

Ordering Instructions: The Model 72400 Servo Controlled piston pumps are selected by using the following Model Code System tailoring the pump configuration to the requirement. Once a pump is built from the model code, a product number will be assigned to that configuration and the pump identified.

Make sure all positions are selected within the 27-digit code for each pump ordered.

Code Example:	**AAD**	**R**	**A**	**A**	**A**	**1**	**3**	**E**	**E**	**1**	**TT**	**A**	**M 0**	**0**	**A**	**0**	**0**	**0A**	**0 0**	**0**	**0**
Position -	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
																	0	**0A**		**0**	**D**

Position 1, 2, 3 - **Code Title**

AAD = 40,6 cm³/r [2.48 in³/r] Servo Controlled Variable Displacement Pump

AAE = 40,6 cm³/r [2.48 in³/r] Servo Controlled Variable Displacement Pump (Tandem Front Pump)

AAF = 40,6 cm³/r [2.48 in³/r] Servo Controlled Variable Displacement Pump (Tandem Rear Pump)

ACG = 49,2 cm³/r [3.00 in³/r] Servo Controlled Variable Displacement Pump

ACH = 49,2 cm³/r [3.00 in³/r] Servo Controlled Variable Displacement Pump (Tandem Front Pump)

ACJ = 49,2 cm³/r [3.00 in³/r] Servo Controlled Variable Displacement Pump (Tandem Rear Pump)

	Code	Single Unit	Tandem Unit Front	Tandem Unit Rear
Position 4 - Input Shaft Rotation				
R = Lefthand Rotation (CCW)	L	Std.	Std.	Std.
L = Right-hand Rotation (CW)	R	Std.	Std.	Std.
Position 5- Input Shaft				
A = 15 Tooth, 16/32 External Spline, 46 [1.81] Shaft Extension	A	Std	Std	NA
B = 41 Tooth, 48/96 External Spline, 24,4 [.96] Shaft Extension	B	NA	NA	Std
C = 13 Tooth, 16/32 External Spline, 41,1 [1.62] Shaft Extension	C	Opt	NA	NA
D = Taper 1.502:12, 6,4 [.25] x 19,8 [.78] keyway, 3/8 - 24 UNF Int. Thread, 35,1[1.38] Shaft Extension	D	Opt.	Opt.	NA
G = 25.4 [1.00] Dia. Str., 6,4 [.25] x 28,4 [1.12] keyway, 46 [1.81] Shaft Extension (Key Included)	G	Opt.	NA	NA
Position 6 - Output Shaft				
0 = No Output Shaft				
A = 9 Tooth, 16/32 Internal Spline, Accepts 31,8 [1.25] Shaft Extension (for SAE "A" mount only)	A	Std.	NA	Std.
B = 41 Tooth, 48/96 External Spline, Accepts 24,4 [.96] Shaft Extension (for SAE "B" mount only)	B	NA	Std.	NA
F = 11 Tooth, 16/32 Internal Spline, Accepts 31,8 [1.25] Shaft Extension (for SAE "A" mount only)	F	Opt.	NA	Opt.
J = 11 Tooth, 16/32 External Spline, Accepts 31,8 [1.25] Shaft Extension (for SAE "B" mount only) (To be used with 36,8 [1.45] spacer)	J	Opt.	NA	Opt.
Position 7 - Auxiliary Rear Mounting				
A = "A" SAE Flange Series 82-2	A	Std.	NA	Opt.
B = 2 Bolt "B" SAE Flange Series 101-2	B	Opt.	Std.	Opt.
C = "A" SAE Flange Series 82-2 w/ Cover Plate	C	Opt.	NA	Opt.
D = "A" SAE Flange Series 82-2 w/ Cover Plate and Mounting Support Holes	D	Opt.	NA	Opt.
E = "A" SAE Flange Series 82-2 w/ Mounting Support Holes	E	Opt.	NA	Std.
F = 2 Bolt "B" SAE Flange Series 101-2 w/ Mounting Support Holes	F	Opt.	Opt.	Opt.
Position 8 - Charge Pump				
0 = No charge pump	0	Opt.	Std.	Opt.
1 = 6,9 cm³/r [.42 in³/r] disp. w/1-5/16 - 12 UN-2B SAE O-ring straight thread inlet port (S)	1	Std.	NA	NA
2 = 13,8 cm³/r [.84 in³/r] disp. w/1-5/16 - 12 UN-2B SAE O-ring straight thread inlet port (S)	2	Opt.	NA	Std.
8 = 17.2 cm3/r [1.05 in3/r]; with 1 5/16-12 UN - 2B SAE O-ring port for suction inlet (S)	8	Std.	NA	Std.
9 = 20.7 cm3/r [1.26 in3/r]; with 1 5/16-12 UN - 2B SAE O-ring port for suction inlet (S)	9	Std.	NA	Std.
Position 9 - Charge Pump Relief Setting and Routing				
0 = No charge pump				
0 = No Auxiliary Port	0	Opt.	Std.	Opt.
3 = 17- 21 bar [250-300 PSI] (Relieved to Case)	3	Std.	NA	Std.
4 = 17- 21 bar [250-300 PSI], 1- 5/16 - 12 UN-2B SAE O-ring straight thread Outlet port (C3), 3/4 - 16 UNF-2B SAE O-ring straight thread Return Port (C4), (Remote filter and/or heat exchanger, relieved to case)	4	Opt.	NA	Opt.
Position 10 - Auxiliary Port, Size and Location (left C1 and right C2)				
D = On both sides w/left side plugged (housing), 3/4 - 16 UNF-2B SAE O-ring straight thread port	D	Opt.	Std.	Std.
E = On both sides and both plugged (housing), 3/4 - 16 UNF-2B SAE O-ring straight thread port	E	Std.	NA	NA
Position 11 - Drain Port Size and Location (left D1 and right D2)				
D = On both sides w/ right side plugged & rear flange drained into housing, 1-1/16 - 12 UN-2B SAE O-ring straight thread port	D	Opt.	Opt.	NA
E = On both Sides w/ left side plugged & rear flange drained into housing, 1-1/16 - 12 UN-2B SAE O-ring straight thread port	E	Std.	Std.	NA
M = On both sides w/ left side plugged & thru drain into mount (front), 1-1/16 - 12 UN-2B SAE O-ring straight thread port	M	NA	NA	Opt.
S = On both sides w/ both sides plugged & thru drain into mount (front), 1-1/16 - 12 UN-2B SAE O-ring straight thread port	S	NA	NA	Std.

Model 72400 Servo Controlled Code

Continued

Position 12 - Main Ports,Size and Location (port A and B)				
1 = 1- 5/16 - 12 UN-2B O-ring straight thread port, Same Side (Right Side)	1	Std.	Opt.	Opt.
2 = 1- 5/16 - 12 UN-2B O-ring straight thread port, Same Side (Left Side)	2	Opt.	Std.	Std.
Positions 13, 14 - Relief Valve Setting for Main Ports (Select a Setting for port "A" in position 13 and port "B" in Position 14)				
0 = Check Valve Only	0	Opt.	Opt.	Opt.
B = 140 bar [2000 PSI]	B	Opt.	Opt.	Opt.
E = 175 bar [2500 PSI]	E	Opt.	Opt.	Opt.
H = 210 bar [3000 PSI]	H	Opt.	Opt.	Opt.
L = 240 bar [3500 PSI]	L	Opt.	Opt.	Opt.
N = 275 bar [4000 PSI]	N	Opt.	Opt.	Opt.
Q = 310 bar [4500 PSI]	Q	Opt.	Opt.	Opt.
T = 345 bar [5000 PSI]	T	Std.	Std.	Std.
Y = 379 bar [5500 PSI]	Y	Opt.	Opt.	Opt.
Position 15 - Additional Functions				
0 = No Additional Functions	0	Std.	Std.	Std.
A = Bypass Valve	A	Opt.	Opt.	Opt.
C= Bleed-off valve in port B	C	Opt.	Opt.	Opt.
Positions 16, 17 - Pump Controls				
M0 = No Additional Features	M0	Std.	Std.	Std.
MA = Neutral Lockout Switch (Includes Wide Band Neutral)	MA	Opt.	Opt.	Opt.
MB = Neutral Detent (Includes Wide Band Neutral)	MB	Opt.	Opt.	Opt.
MC = Wide Band Neutral	MC	Opt.	Opt.	Opt.
Port Plate				
P0 = No Additional Features	P0	Opt.	Opt.	Opt.
Hydraulic Remote Control				
HA = 5-15 bar [72-217 PSI] Pilot Pressure range, 2X Port .4375-20 UNF-2B SAE O-ring Port	HA	Opt.	Opt.	Opt.
Electrohydraulic Control				
EC = Electronic Proportional Control 12 Vdc without Electronic Driver	EC	Opt.	Opt.	Opt.
ED = Electronic Proportional Control 24 Vdc without Electronic Driver	ED	Opt.	Opt.	Opt.
EE = Electronic Proportional Control 12/24 Vdc and Electronic Driver with 1 to 6 Vdc Potentiometric Command Input	EE	Opt.	Opt.	Opt.
EG = Electronic Proportional Control 12/24 Vdc and Electronic Driver with 4 to 20 mA Command Input	EG	Opt.	Opt.	Opt.
EL = Electronic Proportional Control 12 Vdc and Electronic Driver with ± 100 mA Command Input	EL	Opt.	Opt.	Opt.
Solenoid Operated				
SA = 3 pos (FNR) 12 Vdc solenoids with Weather Pack Connectors (locations at port s1 and s2)	SA	Opt.	Opt.	Opt.
SB = 2 pos 12 Vdc solenoid with Weather Pack Connectors (location at port s1)	SB	Opt.	Opt.	Opt.
SC = 2 pos 12 Vdc solenoid with Weather Pack Connectors (location at port s2)	SC	Opt.	Opt.	Opt.
SK=Proportion Solenoid Control 12V with Non-Contact Swash Feedback Sensor with 4-Pin Metripack Connector	SK	Std.	Std.	Std.
Position 18 - Destroke Valve				
0 = Not required	0	Std.	Std.	Std.
1 = with 12 VDC Coil and Weather Pack Connector	1	Opt.	Opt.	Opt.
2 = with 24 VDC Coil and Weather Pack Connector	2	Opt.	Opt.	Opt.
3 = with 12 VDC Coil and DIN 43650 Connector	3	Opt.	Opt.	Opt.
4 = with 24 VDC Coil and DIN 43650 Connector	4	Opt.	Opt.	Opt.
Position 19 - Supply Orifice (location p)				
0 = No Supply Orifice (NA for pumps w/ destroke)	0	Opt.	Opt.	Opt.
A = 0,71 mm [.028 in]	A	Opt.	Opt.	Opt.
B = 0,81 mm [.032 in]	B	Opt.	Opt.	Opt.
C = 0,91 mm [.036 in]	C	Std.	Std.	Std.
D = 1,02 mm [.040 in]	D	Opt.	Opt.	Opt.
E = 1,12 mm [.044 in]	E	Opt.	Opt.	Opt.
F = 1,32 mm [.052 in] (Maximum orifice size if position 18 selection is 1 thru 4)	F	Opt.	Opt.	Opt.
G = 1,45 mm [.057 in] (NA for pumps w/ destroke)	G	Opt.	Opt.	Opt.
H = 1,65 mm [.065 in] (NA for pumps w/ destroke)	H	Opt.	Opt.	Opt.
J = 1,85 mm [.073 in] (NA for pumps w/ destroke)	J	Opt.	Opt.	Opt.

Model 72400 Servo Controlled
Code

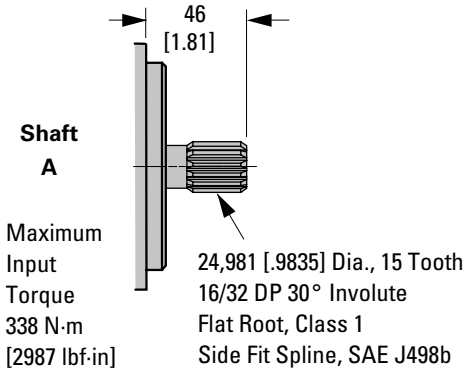
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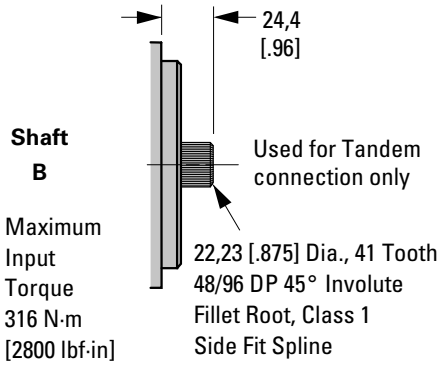
Position 20 - Control Orifice (location s1 & s2)				
0 = No Control Orifice	0	Std.	Std.	Std.
A = 0,71 mm [.028 in]	A	Opt.	Opt.	Opt.
B = 0,81 mm [.032 in]	B	Opt.	Opt.	Opt.
C = 0,91 mm [.036 in]	C	Opt.	Opt.	Opt.
D = 1,02 mm [.040 in]	D	Opt.	Opt.	Opt.
E = 1,12 mm [.044 in]	E	Opt.	Opt.	Opt.
F = 1,32 mm [.052 in]	F	Opt.	Opt.	Opt.
G = 1,45 mm [.057 in]	G	Opt.	Opt.	Opt.
Position 21 - Special Control Option				
Manual Control (only)				
0 = No Special Control Options (Standard Control Lever Position)	0	Std.	Std.	Std.
Positions 22, 23 - Paint				
0A = Primer	0A	Std.	Std.	Std.
0B = Black	0B	Opt.	Opt.	Opt.
Positions 24, 25 - Special Features				
00 = No Special Features	00	Std.	Std.	Std.
BB = Adjustable Displacement Limiter, Both Sides	BB	Opt.	Opt.	Opt.
CK = Speed Sensor				
Position 26 - Identification				
0 = Standard	0	Std.	Std.	Std.
Position 27 - Design Code				
D = Eaton - assigned design code				

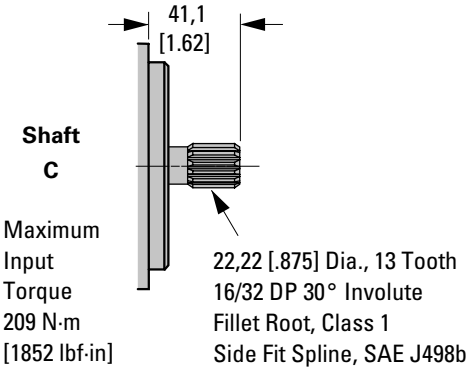
Model 72400 Servo Controlled Input Shafts

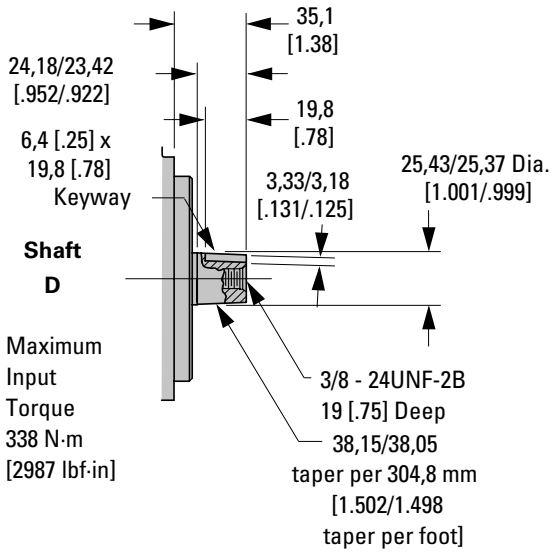
Code Position 5

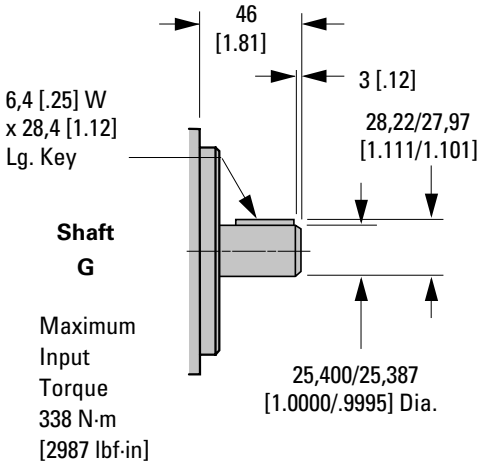
Dimensions are in millimeters [inches], unless otherwise specified.











Torque Note:

The combined torque required to turn multiple pumps must not exceed the torque rating of the input drive shaft of the front piston pump.

Consult an Eaton representative and/or Eaton engineering on side load recommendations.

Ordering Note:

Input and output shafts (code position 5 & 6) must be selected in relationship to pump code (position 1, 2, & 3).

Model 72400 Servo Controlled Output Shafts

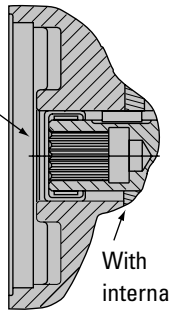
Code Position 6

9 Tooth , 16/32 DP Int., 15,875 [.6250] O.D., Accepts 31,8 [1.25] Shaft Extension, "A" Mount SAE J498b

Position 6

Shaft A

Torque limit on internal rear spline of piston pump with internal charge pump must not exceed 54 N·m [480 lbf· in]. Piston pump without internal charge pump must not exceed 76 N·m [672 lbf·in].



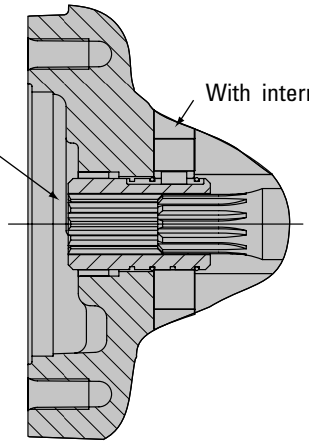
11 Tooth , 16/32 DP Int., 19,33 [.761] O.D., Accepts 31,8 [1.25] Shaft Extension, "A" Mount SAE J498b

Position 6

Shaft F

Maximum Torque

119 N·m [1050 lbf·in]



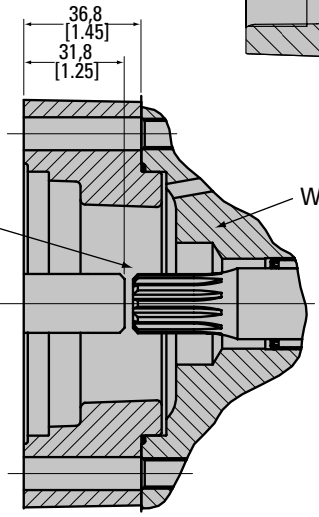
11 Tooth , 16/32 DP Ext., 19,05 [.750] O.D., Accepts 31,8 [1.25] Shaft Extension, "A" Mount SAE J498b (Used with spacer)

Position 6

Shaft J

Maximum Torque

119 N·m [1050 lbf·in]



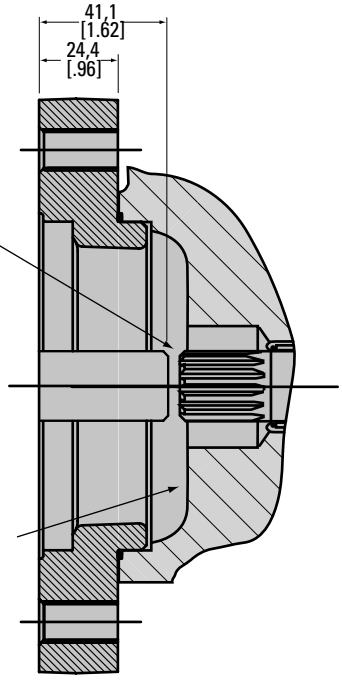
13 Tooth , 16/32 DP External, 21,81 [.8585] O.D., Accepts 41,1 [1.62] Shaft Extension "B" Auxiliary Mount , SAE J744

Position 6

Shaft L

Maximum Torque

209 N·m [1852 lbf·in]



41 Tooth , 48/96 DP Extension, 22,225 [.8750] O.D., Accepts 24,4 [.96] Shaft Extension "B" Auxiliary Mount, SAE J498b

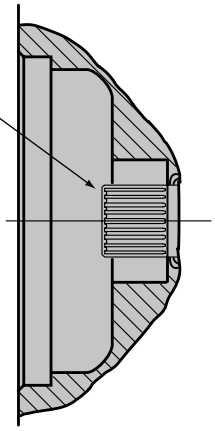
Position 6

Shaft B

Maximum Torque

316 N·m [2,800 lbf·in]

41 Tooth for tandem connections on rear of front pump.



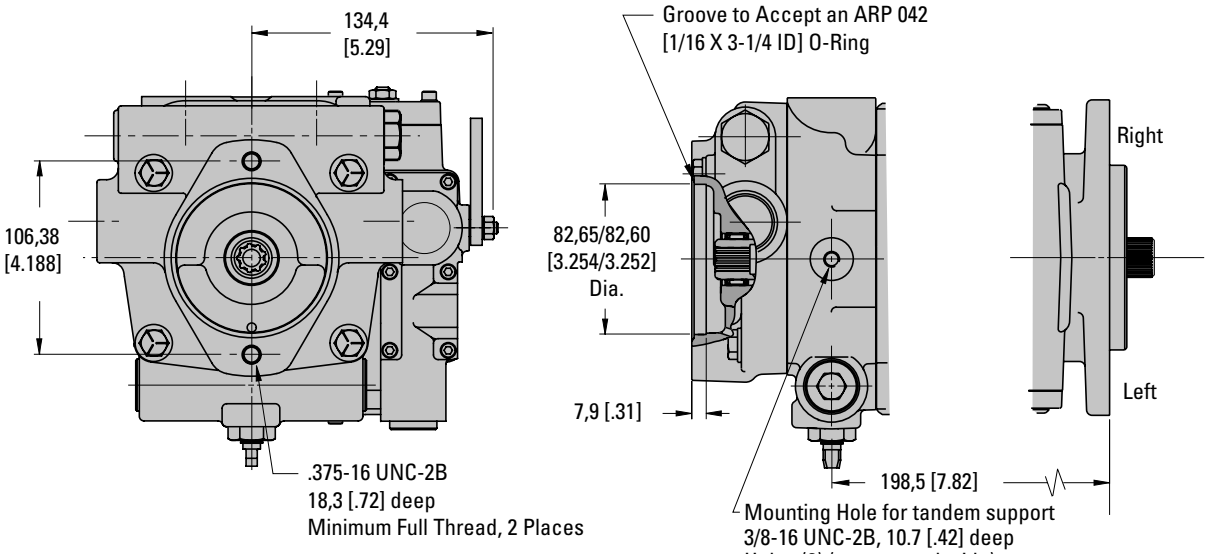
Tandem Servo Piston Pump SAE "B" Mounting Kit #72400-902: Includes 41T coupling, o-ring, cap screws (2), and washer.

Model 72400 Servo Controlled Auxiliary Rear Mounting

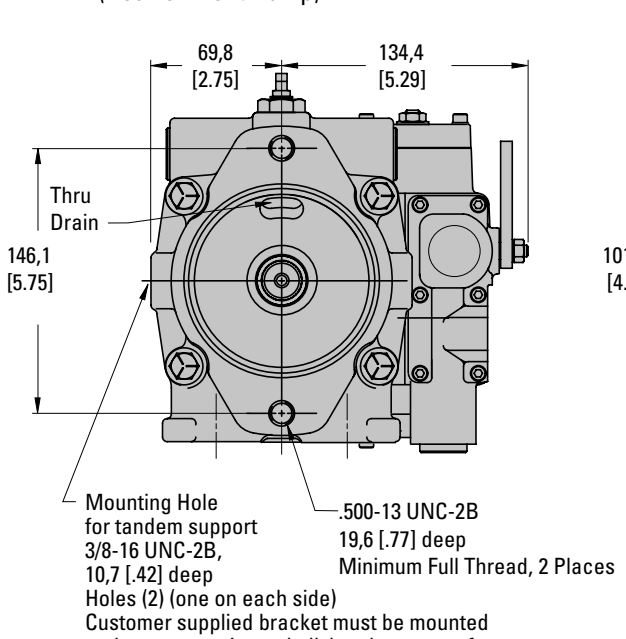
Code Position 7

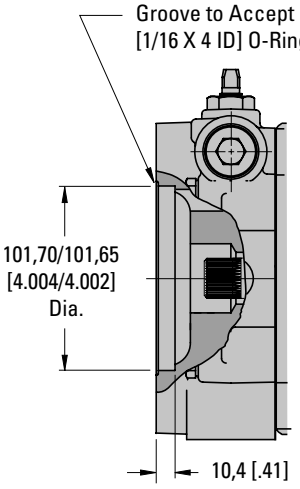
Dimensions are in millimeters [inches], unless otherwise specified.

2 Bolt "A" Auxiliary Mounting Flange (Rear of Single or Tandem Rear Pump)



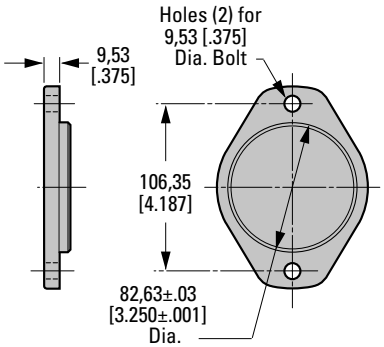
2 Bolt "B" Auxiliary Mounting Flange (Rear of Front Pump)





Cover Plate

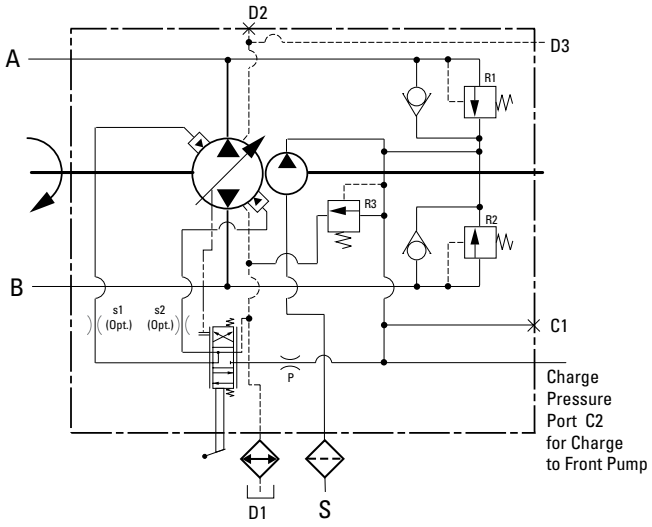
Fits "A" SAE Auxiliary Mounting Flange.
Cover Plate Kit #70142-915: Includes plate, cap screws (2), and o-ring.



Model 72400 Servo Controlled Charge Pump Routing and Location

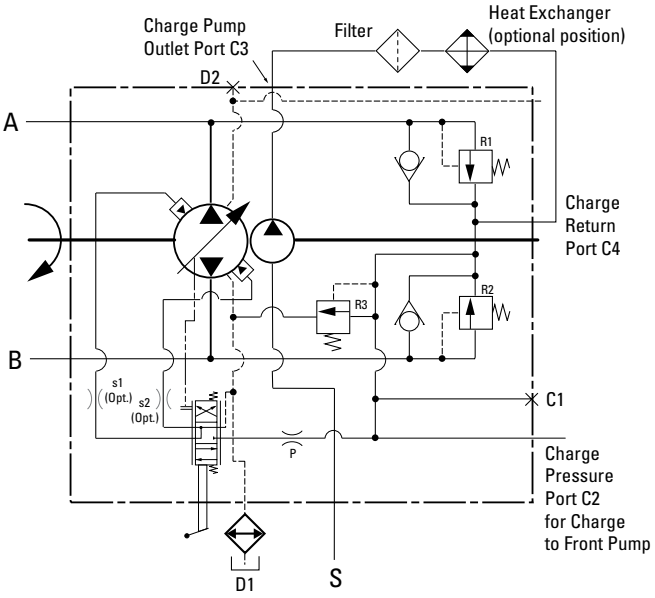
Code Position 9

Standard Pump



Charge Pump with Remote Filter/ Heat Exchanger Ports

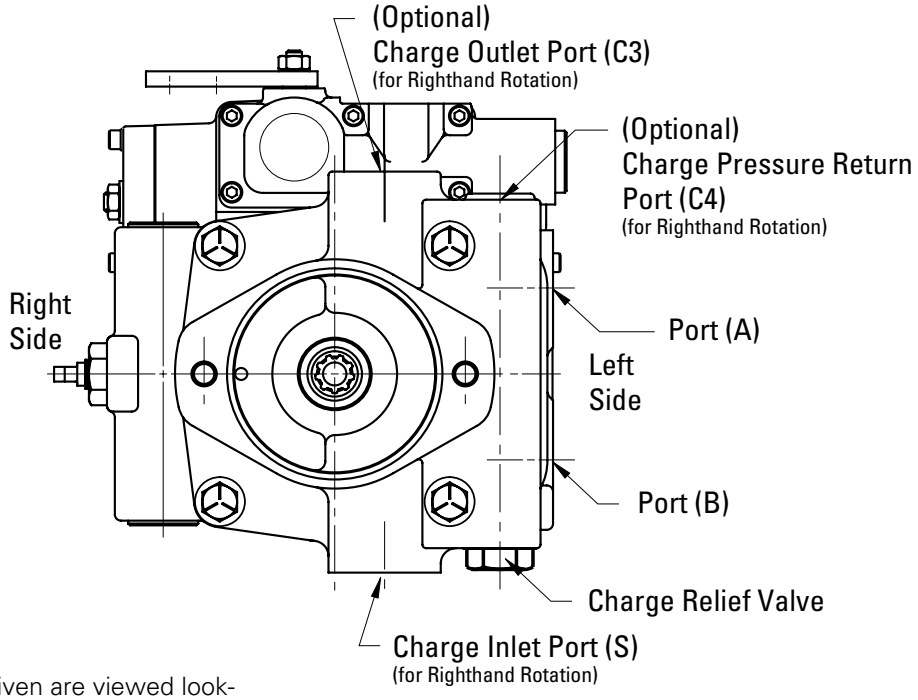
(Filter and heat exchanger supplied by customer.)



Charge Outlet Port Location

The charge outlet and return port is located in the charge pump housing, opposite of the suction port and charge relief valve.

For further detail on port relationship to rotation and position, refer to installation drawings.



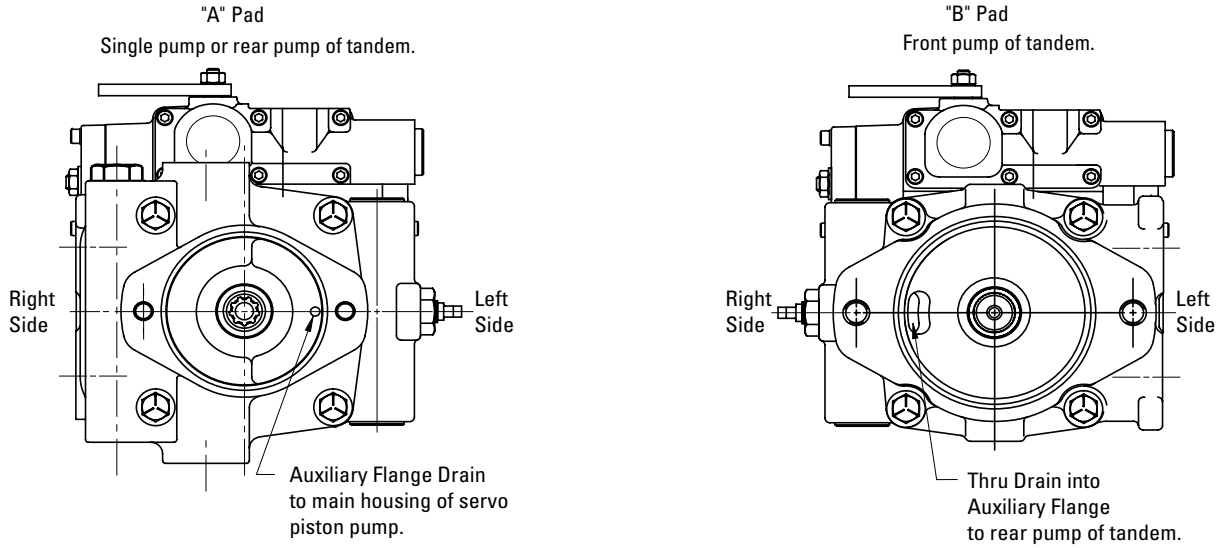
All left (CCW) or right (CW) directions given are viewed looking at the input shaft end of the pump.

Model 72400 Servo Controlled Auxiliary and Drain Port Locations

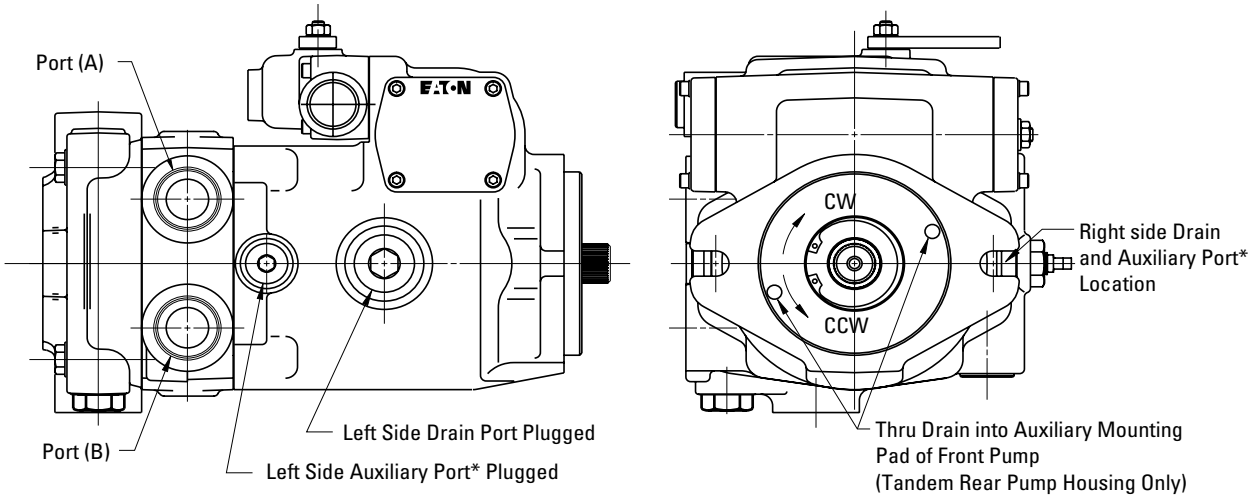
Code Position 10 and 11

(For dimensions, refer to installation drawings.)

Drain Locations in Rear of Pumps



Side and Front of Pump



*Note: Auxiliary port required in rear and front pump of tandem to provide charge flow and pressure to front pump.

All left (CCW) or right (CW) directions given are viewed looking at the input shaft end of the pump.

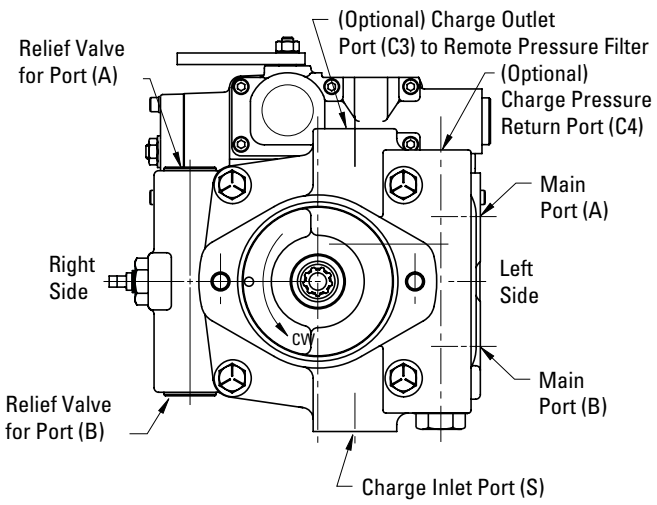
Model 72400 Servo Controlled
Main Ports and Relief Valve Location

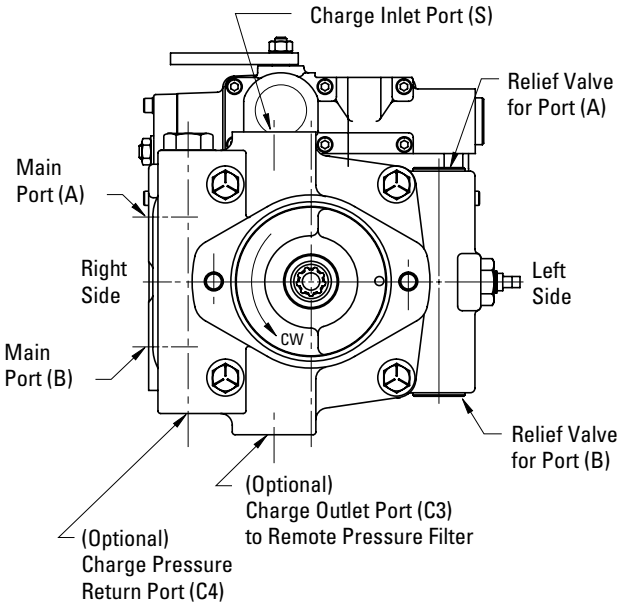
Code Position 12, 13 and 14

(For dimensions, refer to Installation drawings.)

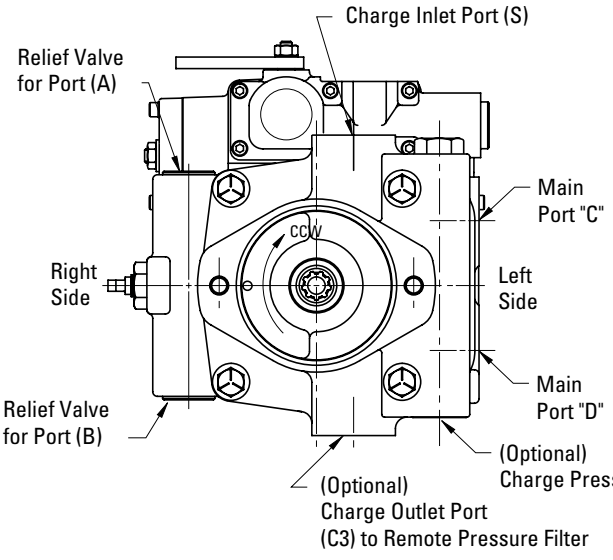
Charge pump position must stay in relationship to backplate as pictured below.

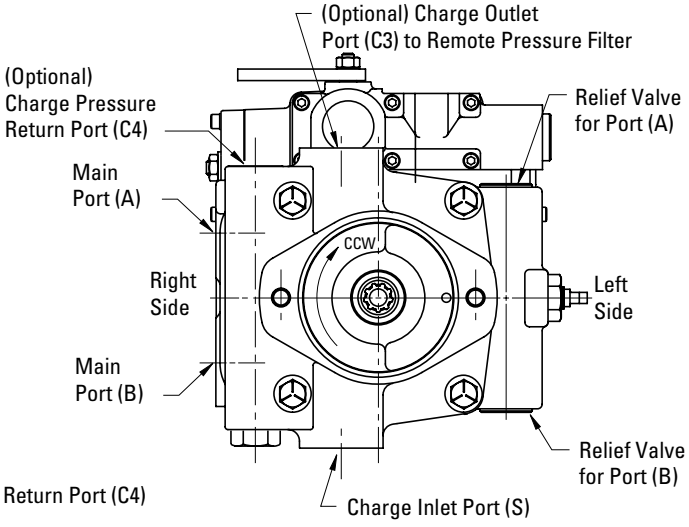
***Righthand Rotation (CW)**





***Lefthand Rotation (CCW)**





*All left (CCW) or right (CW) directions given are viewed looking at the input shaft end of the pump.

Model 72400 Servo Controlled Additional Functions

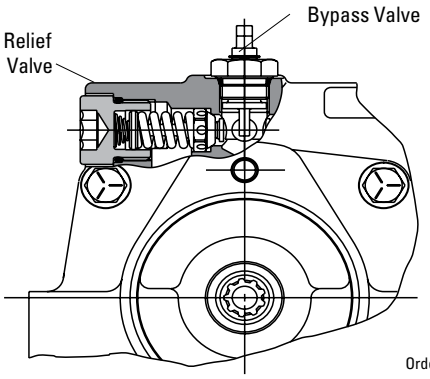
Code Position 15

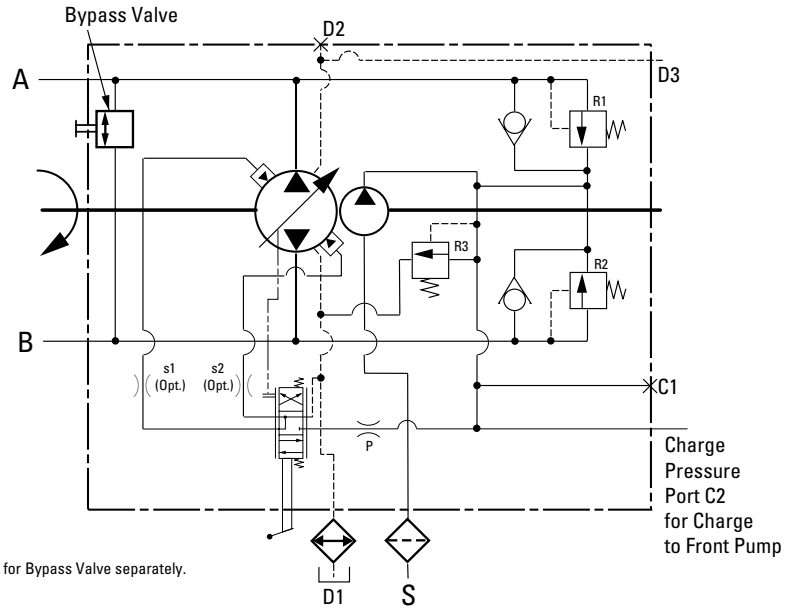
(For dimensions, refer to installation drawings.)

Dimensions are in millimeters [inches], unless otherwise specfied.

Bypass Valve

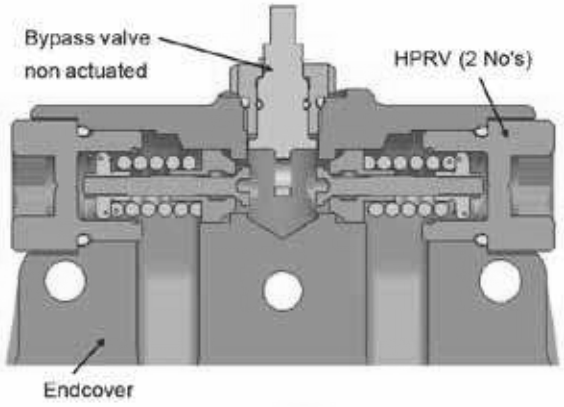
Opens the closed loop hydraulic circuit, allowing limited movement of a machine.





Order #72400-900 kit for Bypass Valve separately.

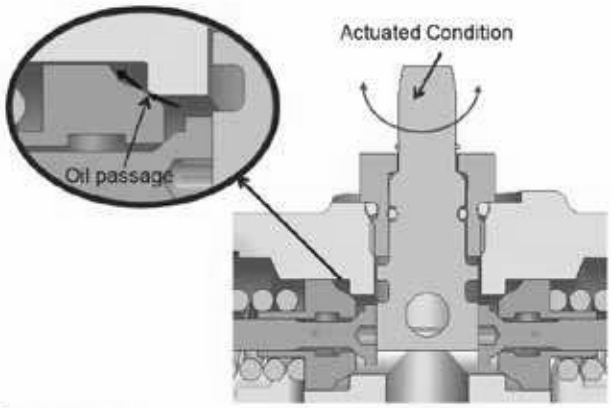
Case 1: Bypass Valve in normal condition (Towing is not permitted)

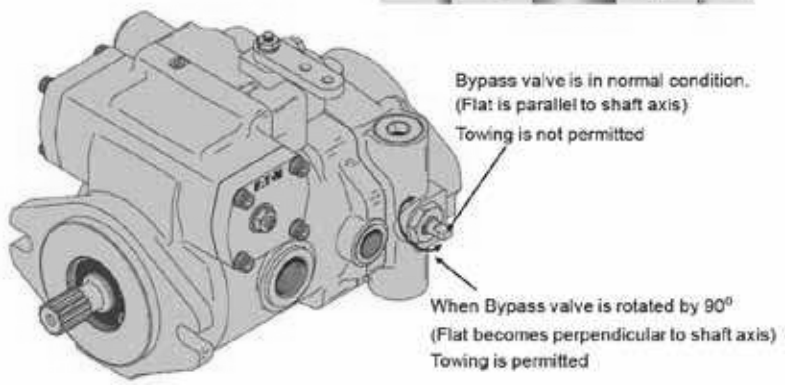




Case 2: Bypass valve in actuated condition.

ie valve is turned to 90° (either side) which allows to open two HPRV spool & hence both the ports are connected to each other and towing to a short distance is permitted in this condition.



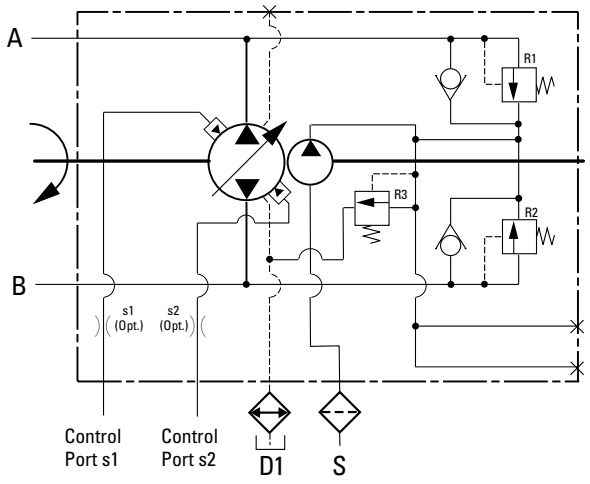


Note: Valve could be rotated by 360°. For towing operation 90° (either side) rotation is required.

Model 72400 Servo Controlled Pump Controls - Control Assembly

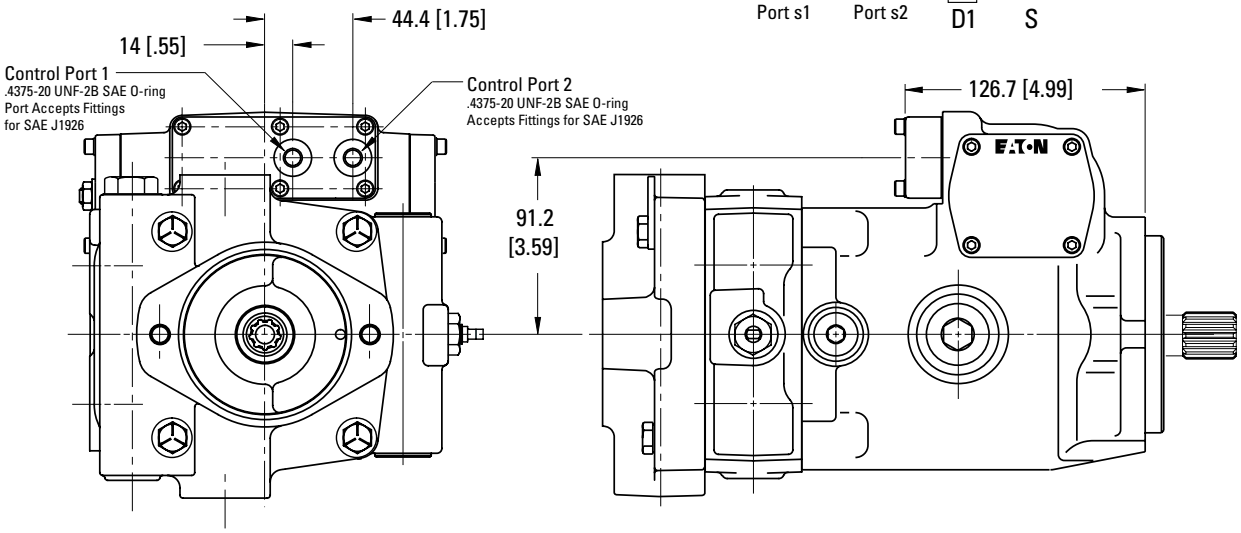
Code Position 16 and 17

The port plate is commonly used as a slave control that receives commands from other controls in the same system.



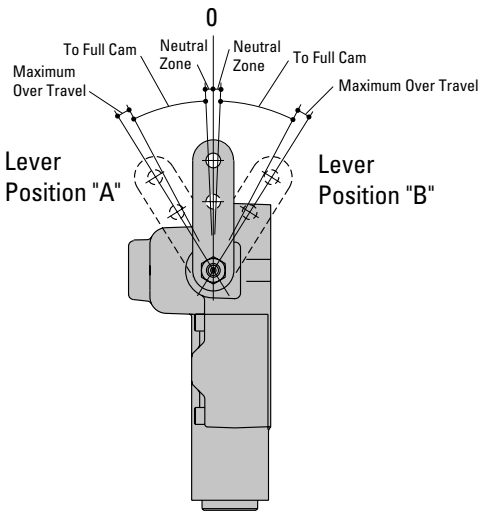
Minimum required control-pressure is 17 bar [250 PSI]

Righthand (CW) Input Rotation	Output Flow
Pressure to Control Port 1	Port (B)
Pressure to Control Port 2	Port (A)
Lefthand (CCW) Input Rotation	Output Flow
Pressure to Control Port 1	Port (A)
Pressure to Control Port 2	Port (B)



Model 72400 Servo Controlled Pump Controls - Manual Control

Code Position 16, 17 and 18



Control Lever Travel	Standard Band	Wide Band	High Gain
Neutral Zone	2.5°	4.0°	3°
Maximum Displacement	25.5°	25.5°	17°
Maximum Over Travel	4.0°	2.5°	10°

***Neutral Detent Feature**

The neutral detent provides a positive, centered feeling to the handle, signaling the operator when the pump is in neutral position.

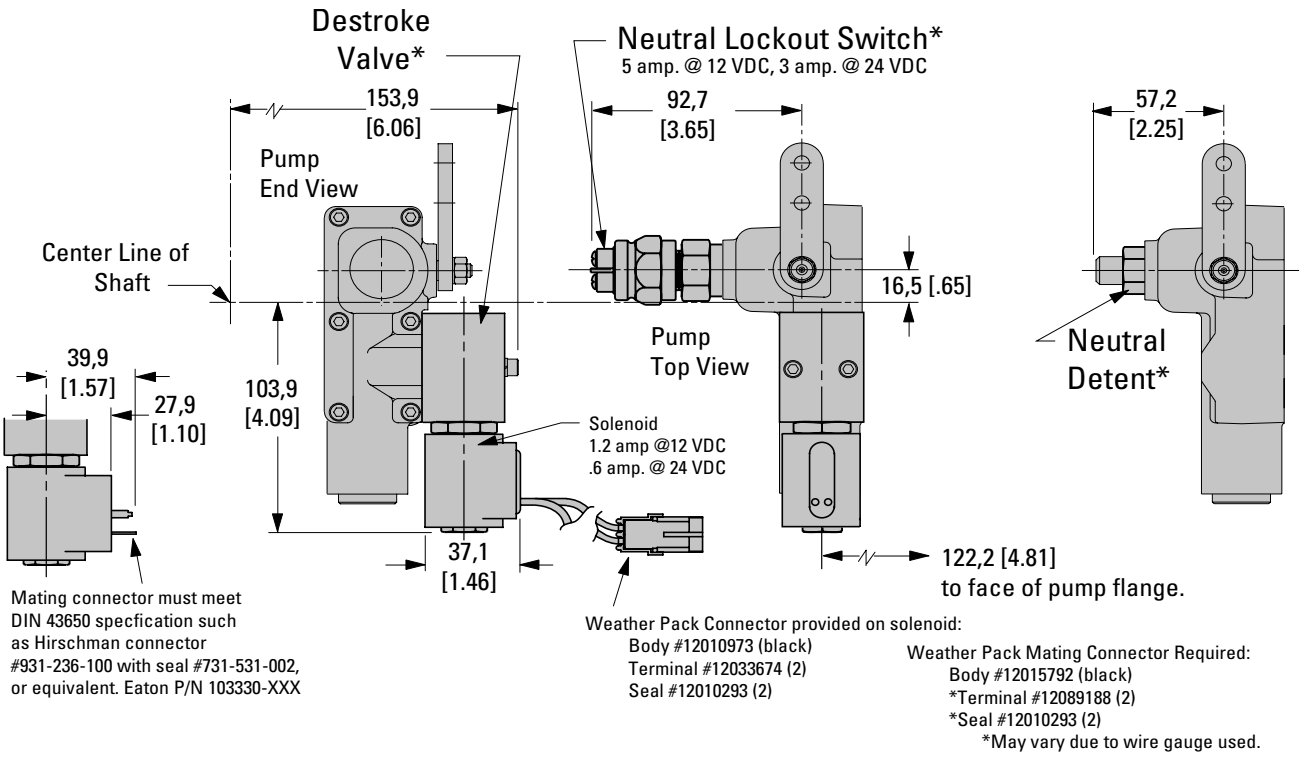
***Neutral Lockout Feature**

The neutral lockout switch consists of an electrical switch installed on the controller. This switch closes at the neutral position of the input lever and opens if lever is rotated either direction. The electronic "lockout" prevents the operator from starting any auxiliary functions unless the pump is in neutral position.

Dimensions are in millimeters [inches], unless otherwise specified.

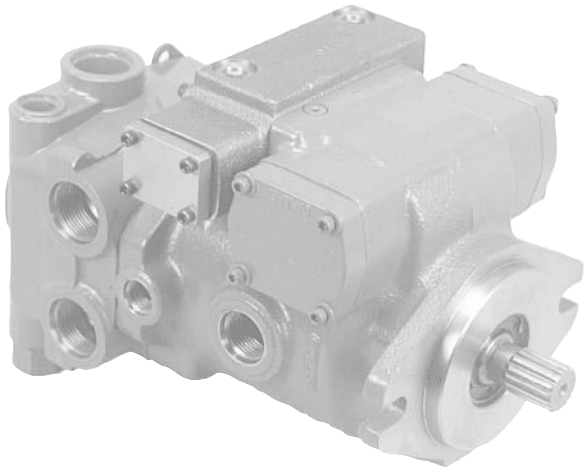
***Destroke Valve Feature**

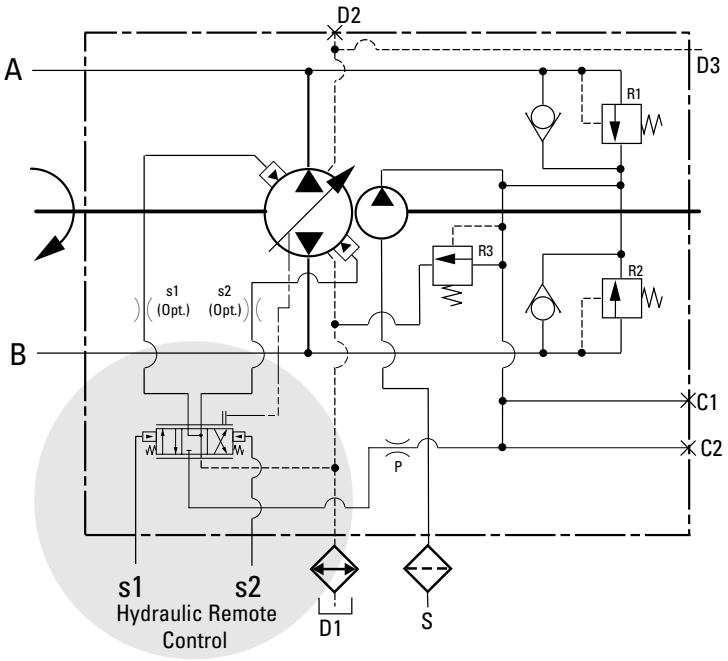
The destroke valve provides an emergency return to neutral and must be energized in order for the pump to stroke. If at any time power is interrupted to the solenoid, the pump will destroke to neutral.

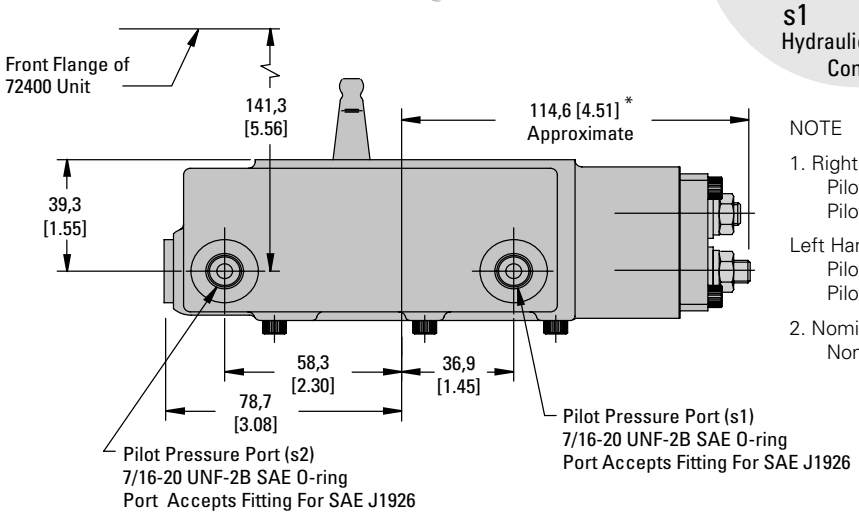


Model 72400 Servo Controlled
Pump Controls - Hydraulic Remote Control

Code Position 16 and 17





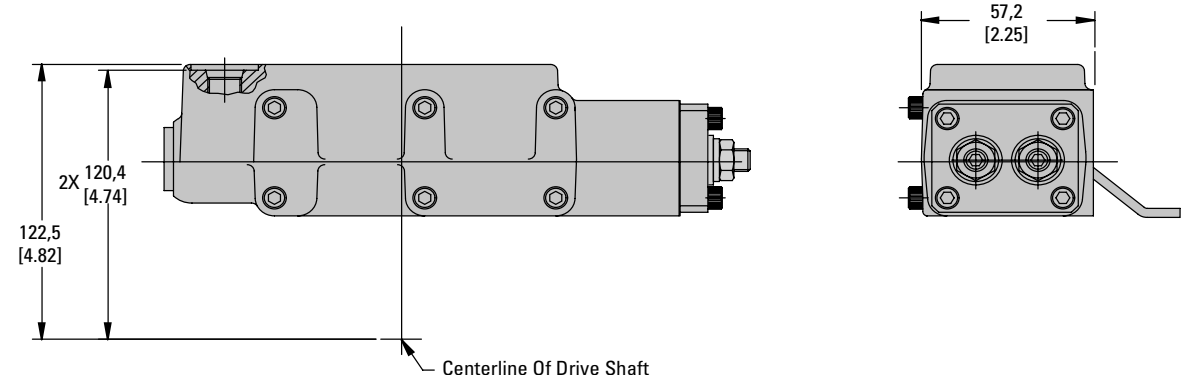


NOTE

1. Right Hand (Clockwise) Rotation
   Pilot Press Port -1 Pressurized...flow From System Press Port -B
   Pilot Press Port -2 Pressurized...flow From System Press Port -A

   Left Hand (Counter Clockwise) Rotation
   Pilot Press Port -1 Pressurized...flow From System Press Port -A
   Pilot Press Port -2 Pressurized...flow From System Press Port -B

2. Nominal Threshold Pressure ..... 5 bar [72.5 PSI]
   Nominal Max Displacement Pressure ..... 15 bar [217.6 PSI]



* Do not touch any of the Control adjustment nuts which are factory set.

Hydraulic Remote Control Conversion Kit

Order Part Number 72400-919

Includes: Control sub-assembly (1pc), Socket head cap screws (6 pc), Control housing gasket (1pc)

Model 72400 Servo Controlled
Pump Controls - Electronic Proportional Displacement Control

Code Position 16 and 17

Model Code	Model Code Description Command Input Signal	Typical Input Devices	Nominal Command Input Impedance of Electronics Module
EE	1 to 6 Vdc Potentiometric	Joysticks or Potentiometers with a resistance between 160 ohms and 50K ohms.	500K Ohms
EG	± 20 mA Current loop (4-20 mA)	Programmable Logic Controllers (PLC)	250 Ohms
EL	± 100 mA differential	Torque motor servo valve current drivers	28 Ohms
EC	12 Volts	Requires customer supplied electronics	
ED	24 Volts		

The Electronic Proportional (EP) displacement control is ideal for applications requiring electronic pump displacement control. The EP displacement control provides the flexibility of three command input choices. Control components include a proportional solenoid actuated valve assembly and an electronic solenoid driver module mounted on the pump.

The control driver module converts a command input signal to a proportional current output to the proportional solenoids resulting in a proportional pump displacement.

The EP displacement control has been designed to withstand the rigors of off-highway equipment environmental conditions.

EP Displacement Control Features

- Ease of installation
- Automotive style environmentally sealed Metri-Pack connectors
- Operates from 12 or 24 Vdc power supply
- External fuse (customer supplied): 3A for 12 Vdc system, 1A for 24 Vdc system
- Three choices for command input signal
- Operating temperature range -40° C to +85° C
- Control driver module encapsulated for environmental protection
- Closed loop current control compensates for resistance change of the proportional solenoids due to temperature variations
- Return to neutral for loss of power, or loss of command input signal
- Mechanical feedback of swashplate position for closed loop control
- External neutral adjustment
- Manual override capability
- Control drive module qualification per SAE J1455, SAE J1113, CISPR 25

Control Driver Module Qualification

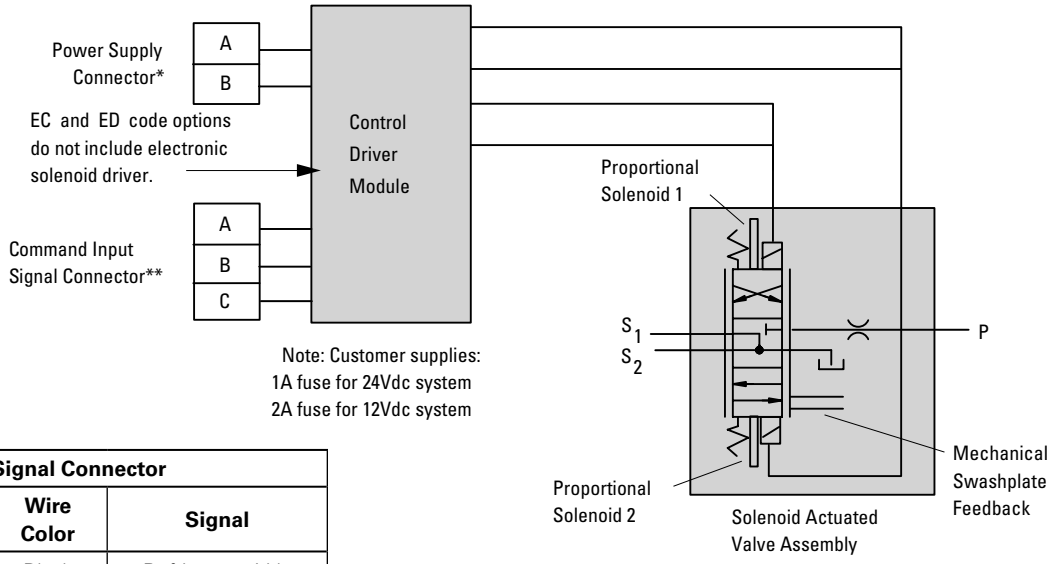
(Contact Eaton for Specific Levels)

- SAE J1455 - Recommended Environmental Practices for Electronic Equipment Design
  - Humidity/Temperature Extreme Cycling
  - Salt Spray
  - Splash & Immersion
  - Steam Cleaning/High Pressure Wash
  - Vibration
  - Mechanical Shock
  - Temperature Cycling
  - Load Dump Transients
  - Inductive Load Switching Transients
- SAE J1113 - Electromagnetic Susceptibility Measurement Procedures for Vehicle Components
  - EMI/EMC - Conducted & Radiated Immunity
- CISPR 25 - International Electrotechnical Commission "Limits and Methods of Measurement of Radio Disturbance Characteristics for the Protection of Receivers used on Board Vehicles".
  - EMI /EMC - Conducted & Radiated Emissions

Model 72400 Servo Controlled
Pump Controls - Electronic Proportional Displacement Control

Code Position 16 and 17 (EE, EG, EL) Cont.

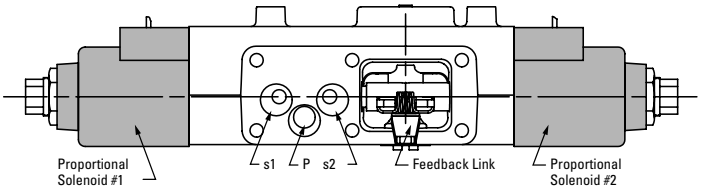
Interface Schematic



** Command Input Signal Connector			
Command Input Signal	**Pins**	**Wire Color**	**Signal**
1 to 6 Vdc Potentiometric	A	Black	Ref Low - 1 Vdc
	B	Green	Command (wiper)
	C	Red	Ref Hi - 6 Vdc
± 20 mA Current Loop (4-20 mA)	A	Orange	Loop Return
	B	White	Loop In
	C	No Connection Required*	
± 100 mA Differential	A	Blue	Loop Return
	B	White	Loop In
	C	No Connection Required*	

* Mating connector kit 990762-000 contains plug to be used to seal mating end connector.

Solenoid Actuated Valve Assembly



Model 72400 Servo Controlled
Pump Controls - Electronic Proportional Displacement Control

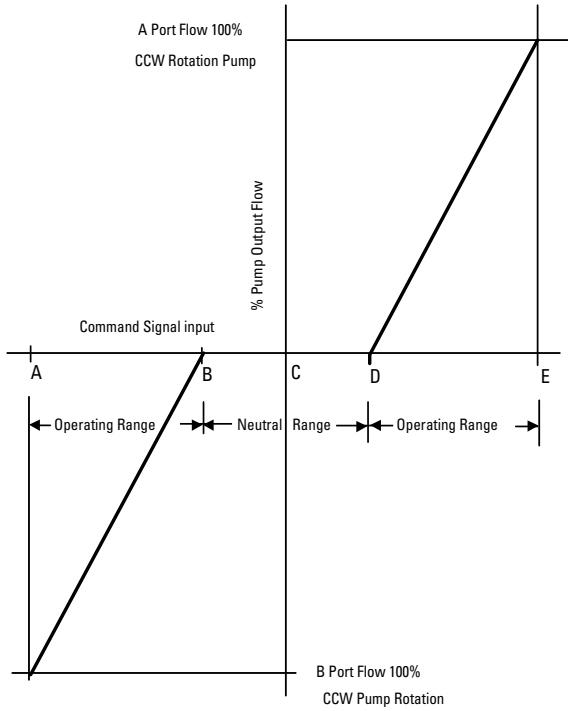
Code Position 16 and 17 (EE, EG, EL) Cont.

Note: In order to assure the most reliable installation and operation of any electronic control, proper installation methods should be followed with respect to interconnection wiring harness, command signal devices, fusing, and input power switching. Proper care should be taken to prevent damage to all electrical and electronic components due to abrasion, moving objects, heat, moisture or other environmental hazards. For safety critical applications, Eaton recommends that a switch be installed in line with (+ Battery) power to the module so that power may quickly be disconnected in case of emergency. A 2 ampere slow blow fuse should always be installed in the + battery line. It is recommended that during initial start-up and checkout, the machine be placed on jack stands to prevent inadvertent movement of the machine.

Command Input Signal	(A max)	B (min)	C	D (min)	E
1 to 6 Vdc	1.5 Vdc	3.3 Vdc	3.5 Vdc	3.7 Vdc	5.5 Vdc
4-20 mA*	-20 mA	-4.5 mA	0 mA	+4.5 mA	+20 mA
±100 mA	-100 mA	-7.5 mA	0 mA	+7.5 mA	+100 mA

*Note: The +20 mA command input signal configuration operates the pumps in one direction. The customer has to change the polarity on the -20 mA signal to operate the pump in the opposite direction.

General Relationship between Command Signal Input and Pump Flow

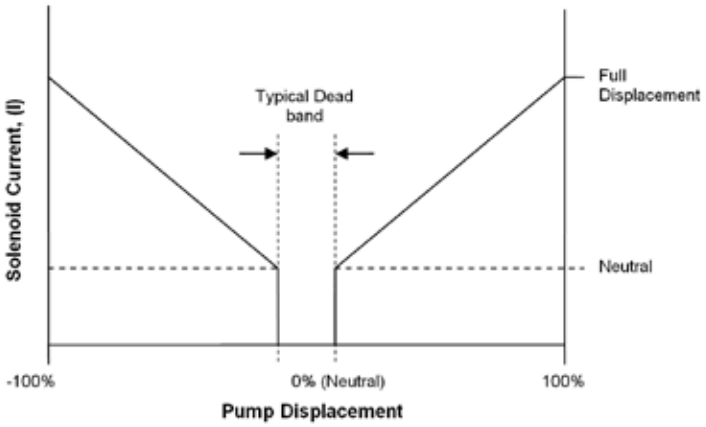


Electronic Proportional Valve Control Guidelines

	Parameter	12 VDC	24 VDC
Signal Input *	Resistance at 25°C - Ohm	5.19 ± 10%	20.80 ± 10%
	Nominal Inductance	17.5 mH	27.7 mH
	Current (I) at Neutral - Amp	< 0.4	<0.2
	Current (I) at Full Displacement – Amp (max continuous)	1.5A	0.75A
Operating Limits	Temperature Ratings	-65°F Min to 140°F Max	
	Power Consumption	28W Max	

*Coils have no internal diodes, polarity does not affect performance.

Signal Profile



PWM Configuration

Closed loop current control of the solenoid current via PWM duty-cycle variation.

Note: Coil currents must be limited to not exceed solenoid coil specifications

Frequency: 70-200Hz

(100Hz recommended when PWM driver does not have built-in dither capabilities)

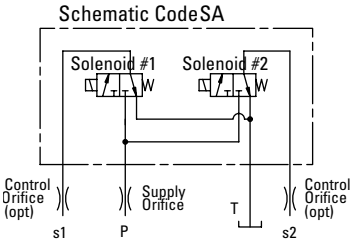
Dither Signal

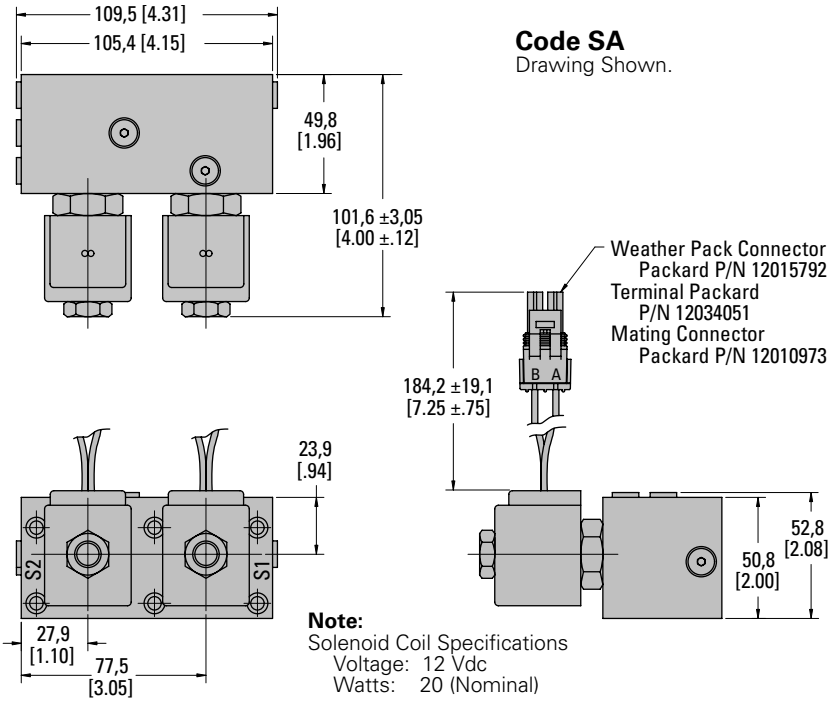
The design must provide for a separate dither signal to be added to the input command.

Waveform: Square
Frequency: 75 (+ 25,-15) Hz
Amplitude: .250 +.100 -.050A pk-pk

Model 72400 Servo Controlled
Pump Controls - Solenoid Operated Control

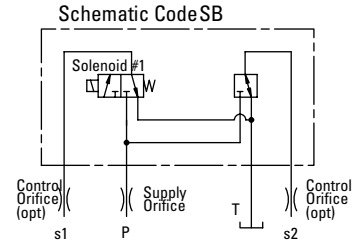
Code Position 16,17

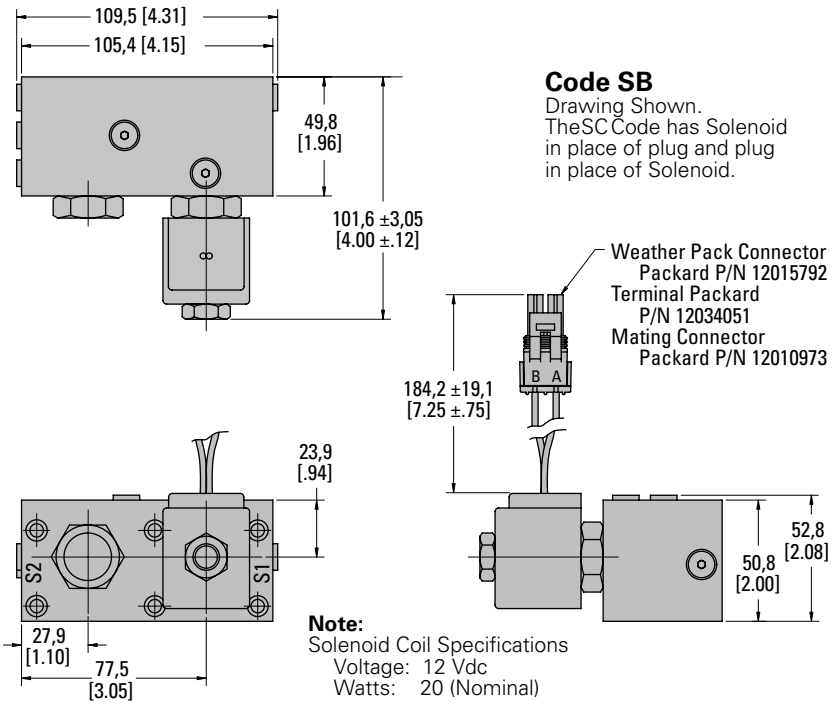




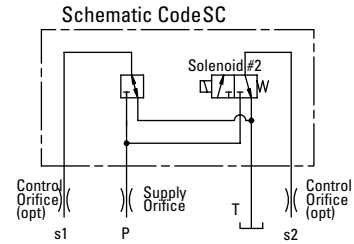
Code SA
Drawing Shown.

Note:
Solenoid Coil Specifications
Voltage: 12 Vdc
Watts: 20 (Nominal)





Code SB
Drawing Shown.
The SC Code has Solenoid in place of plug and plug in place of Solenoid.

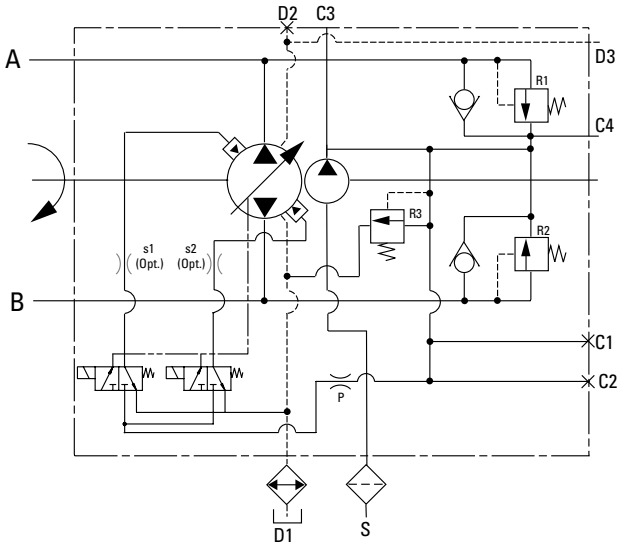


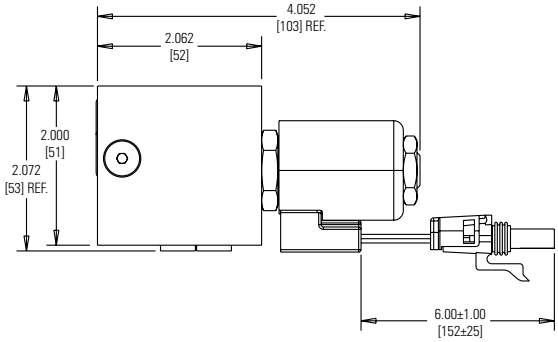
Note:
Solenoid Coil Specifications
Voltage: 12 Vdc
Watts: 20 (Nominal)

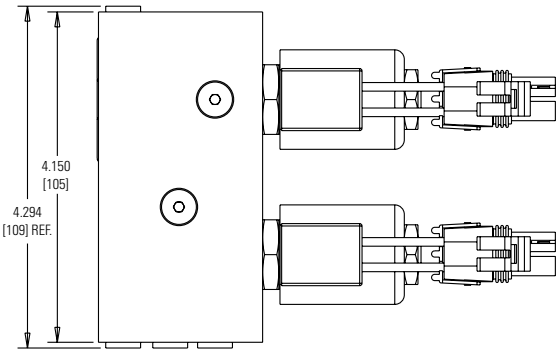
Model 72400 Servo Controlled
Pump Controls - Solenoid Control with Non-contact Swash Feedback Sensor

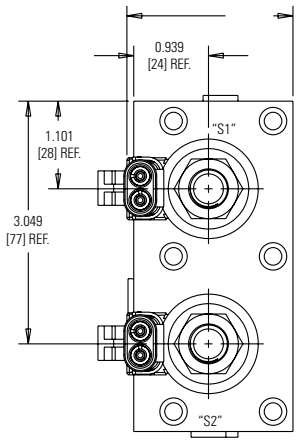
Code Position 16,17

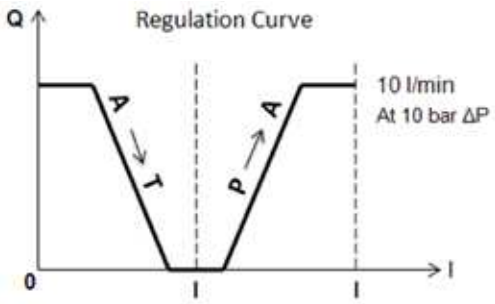










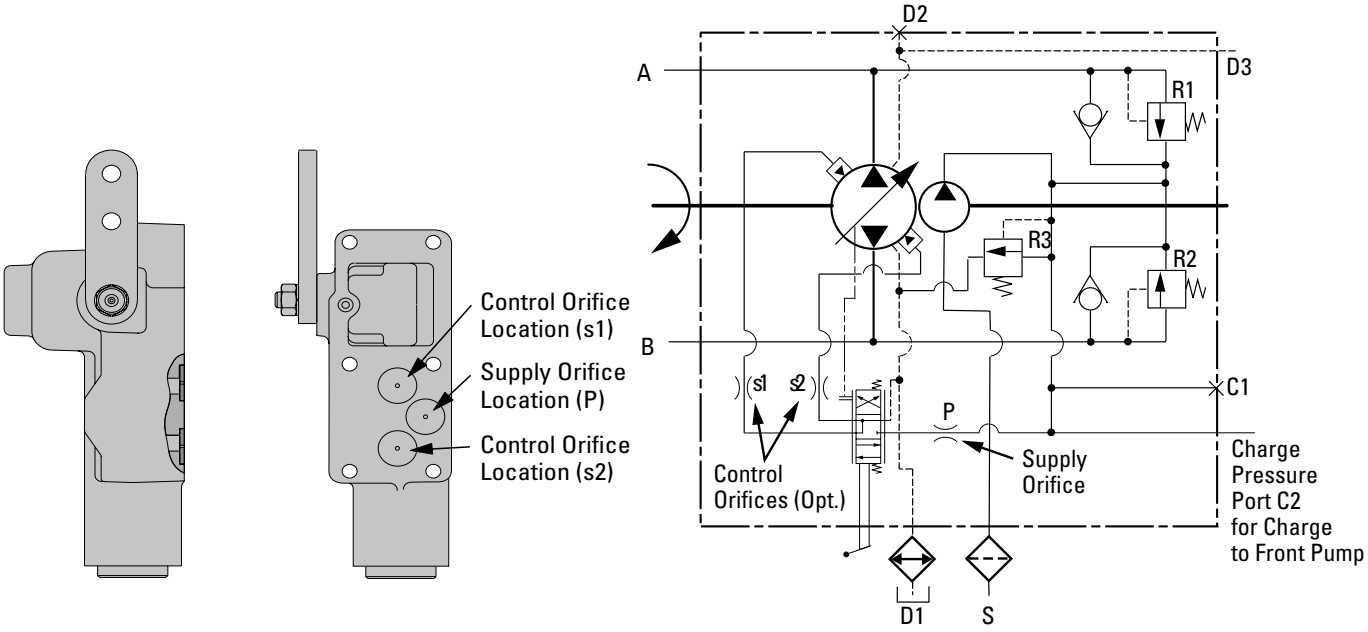


Technical Data

Max inlet pressure		100 bar
Voltage		12 V
Control current		2 A
Coil resistance		2.5 Ω
Temperature range		-30° C to +125° C
Hysteresis		< 8%
Leakage (P, A → T)	without electric supply (P = 60 bar, fluid viscosity 11 cSt)	< 10 cc/min
	With I = I average	< 30 cc/min
Response time		0 - P max < 20 ms P max - 0 < 20 ms

Model 72400 Servo Controlled
Supply and Control Orifice

Code Position 19 and 20



Calculated Time from Neutral to Full Stroke (seconds)

	Control Orifice Size, mm [in]							
Supply Orifice Size mm [in]	0,71 [0.028]	0,81 [0.032]	0,91 [0.036]	1,02 [0.040]	1,12 [0.044]	1,32 [0.052]	1,45 [0.057]	None
0,71 [0.028]	1.245	1.148	1.085	1.043	1.015	0.983	0.972	0.946
0,81 [0.032]	1.199	1.089	1.013	0.961	0.925	0.881	0.866	0.828
0,91 [0.036]	1.173	1.053	0.968	0.907	0.863	0.808	0.788	0.736
1,02 [0.040]	1.157	1.031	0.939	0.871	0.821	0.756	0.731	0.662
1,12 [0.044]	1.147	1.017	0.920	0.847	0.792	0.718	0.688	0.602
1,32 [0.052]	1.136	1.001	0.899	0.820	0.758	0.670	0.633	0.510
1,45 [0.057]	1.133	0.996	0.892	0.810	0.745	0.652	0.611	0.465
1,65 [0.065]	1.129	0.991	0.885	0.801	0.734	0.634	0.589	0.408
1,85 [0.073]	1.128	0.988	0.881	0.796	0.727	0.624	0.576	0.364
None	1.125	0.984	0.875	0.787	0.716	0.606	0.553	0.138

Note: Proper orifice selection must be determined by actual testing.

Model 72400 Servo Controlled Adjustable Displacement Limiter

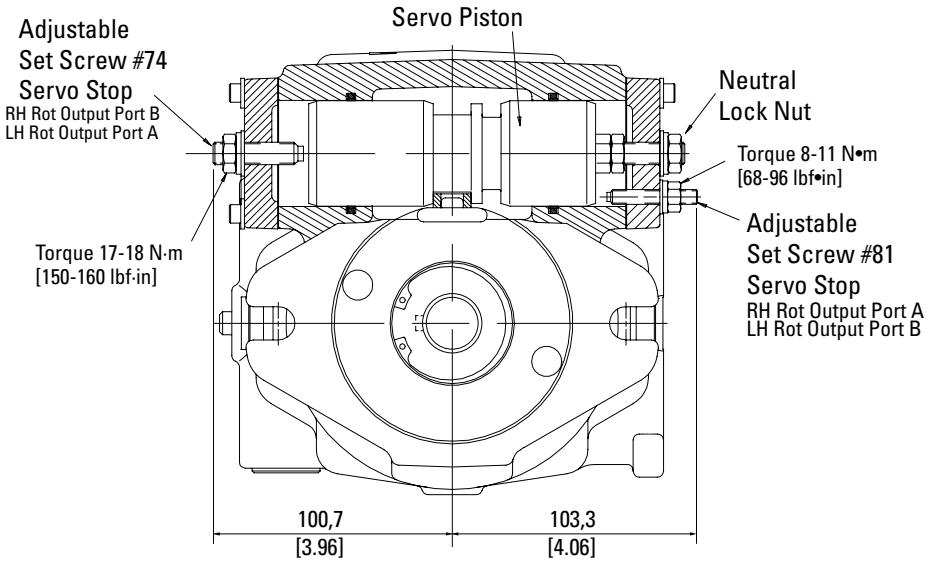
Code Position 24, 25 and Selection BB

- Externally adjustable displacement
- Settings are zero to maximum pump displacement
- Independent adjustment for both main ports
- Field adjustable
- Available in Kit form (see page 62)



All factory units shipped with adjustable stops are set at maximum pump displacement.

See re-adjustment instructions below.



To Calculate Displacement Required

The displacement required divided by displacement of one turn of set screw equals the number of turns of set screw to obtain displacement.

Example for 3.00 in3/r re-adjustment:

2.0 in3/r ÷ .2854 in3/r =

7 turns of set screw

Pump Displacement per Turn		
2.48 in3/r Pump Displacement @ Full Cam		
Turns of Set Screw	**Item # 74 Stop**	**Item # 81 Stop**
0	2.48 in3/r	2.48 in3/r
1	2.22 in3/r	2.26 in3/r
2	1.98 in3/r	2.05 in3/r
3	1.73 in3/r	1.84 in3/r
4	1.49 in3/r	1.63 in3/r
5	1.26 in3/r	1.43 in3/r
6	1.03 in3/r	1.23 in3/r
7	0.80 in3/r	1.03 in3/r
8	0.57 in3/r	0.83 in3/r
9	0.34 in3/r	0.63 in3/r
10	0.12 in3/r	0.44 in3/r
10.5	**0.01 in3/r**	0.34 in3/r
11	N/A	0.25 in3/r
12.0	N/A	0.05 in3/r
12.3	N/A	**0.00 in3/r**

Pump Displacement per Turn		
3.0 in3/r Pump Displacement @ Full Cam		
Turns of Set Screw	**Item # 74 Stop**	**Item # 81 Stop**
0	3.00 in3/r	3.00 in3/r
1	2.71 in3/r	2.75 in3/r
2	2.40 in3/r	2.49 in3/r
3	2.11 in3/r	2.23 in3/r
4	1.82 in3/r	1.98 in3/r
5	1.53 in3/r	1.74 in3/r
6	1.25 in3/r	1.49 in3/r
7	0.97 in3/r	1.25 in3/r
8	0.69 in3/r	1.01 in3/r
9	0.42 in3/r	0.77 in3/r
10	0.14 in3/r	0.54 in3/r
10.5	0.01 in3/r	0.42 in3/r
11	N/A	0.30 in3/r
12.0	N/A	0.07 in3/r
12.3	N/A	**0.00 in3/r**

To Re-Adjust Displacement

- Loosen nut on adjustable see screw #81 servo stop. Screw stop in until it touches the servo piston. Back the screw out (number of turns required) to obtain the flow required.
  Refer to chart for displacements. Lock adjustment with nut. Torque nut 8 to 11 N·m [68 to 96 lbf·in].
- Loosen nut on adjustable set screw #74 servo stop. Screw stop in until it touches the servo piston. Back the screw out (number of turns required) to obtain the flow required.
  Refer to chart for displacements. Lock adjustment in place with nut. Torque nut 17 to 18 N·m [150 to 160 lbf·in].

Metric Conversion: Displacement in3/r X 16.387 = cm^3/r

Model 72400 Servo Controlled Adjustable Displacement Limiter Kits

Field Installed Kits

One side ..... Kit #72400-938
Two sides ..... Kit #72400-940

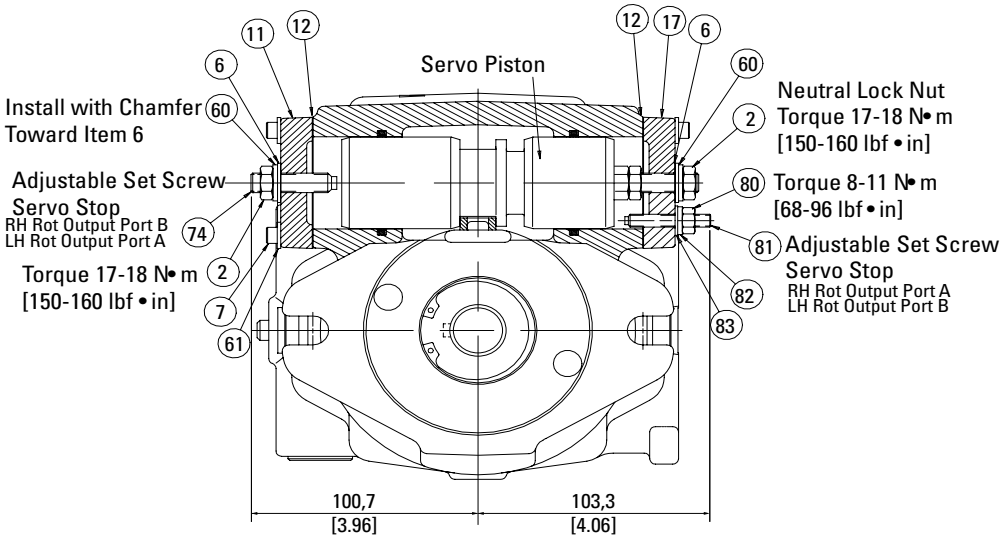
Disassembly

- Remove the four cap screws (Item #7) and washers (Item #61) retaining the existing cover plate (Item #11) opposite neutral set screw.
- After removing existing cover plate (Item #11) and cover gasket, measure the distance from the servo piston to the surface of housing for reference for neutral setting.
- Remove neutral setting nut (Item #2).
- Remove the four cap screws retaining the existing cover plate (Item #17).
- The cover plate (Item #17) is screwed onto the servo piston bolt. When removing the
- cover plate, count the amount of turns it takes to remove cover for reassembly. Also remove existing gasket (Item #12).

Adjustable Servo Stop Kit Parts			Kit #72400-938	Kit #72400-940
Item #	Part Number	Description	Qty.	Qty.
2	16024-6	Jam Nut	1	2
6	16254-6	Seal Washer	1	2
11	72400-651	Cover Plate	1	1
12	72400-621	Cover Gasket	1	2
17	72400-771	Cover Plate		1
60	16254-26	Washer	1	2
74	16139-624	Set Screw	1	1
80	16022-4	Jam Nut		1
81	16139-424	Set Screw		1
82	16254-24	Washer		1
83	16254-4	Seal Washer		1

Installing Servo Stops

- Place new gasket (Item #12) onto the housing on the neutral setting screw side of the servo piston. Hold in position with a small amount of petroleum jelly.
- Screw new cover plate (Item #17) onto servo piston bolt the same number of turns as it took to remove it. Install the four cap screws (Item #7) and washers (Item #61) to retain cover plate. Torque 4,5 to 5,4 N·m [40 to 48 lbf·in].
- Install seal washer (Item #6), washer (Item #60) and jam nut (Item #2). Torque nut 17 to 18 N·m [150 to 160 lbf·in]. At this time, check the distance from the servo piston to housing surface on opposite side. It should be the same as previously measured at disassembly. If not the same, loosen jam nut and with a hex key wrench, adjust and re-torque nut.
- Install new cover plate (Item #11) and retain with four cap screws (Item #7) and washers (Item #61). Torque 4,5 to 5,4 N·m [40 to 48 lbf·in].
- Insert adjustable servo stop set screw (Item #81) in until it touches the servo piston. Back the screw out to obtain the flow required. Refer to chart for displacements.Lock adjustment into place with seal washer (Item #83), washer (Item #82), and jam nut (Item #81). Torque nut 8 to 11 N·m [68 to 96 lbf·in].
- Insert adjustable servo stop set screw (Item #74) in until it touches the servo piston. Back the screw out to obtain the flow required. Refer to chart for displacements. Lock adjustment into place with seal washer (Item #6), washer (Item #60), and jam nut (Item #2). Torque nut 17 to 18 N·m [150 to 160 lbf·in].



Model 72400 Servo Controlled Speed Sensor

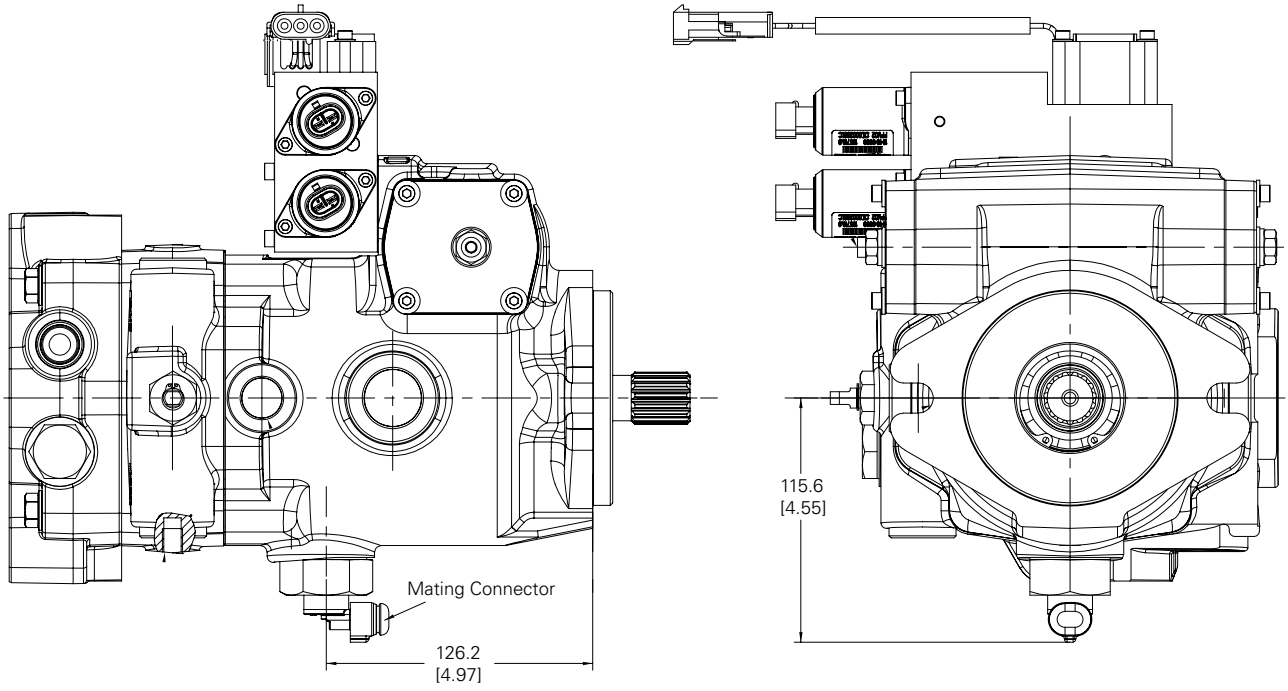
Code Position 24, 25 and Selection CK

Magnetic speed sensor is used to measure the speed of the drive shaft. This is optional feature. Cylinder barrel has cut-outs made on its periphery. Magnetic speed sensor senses the speed of these cutouts and converts it into required RPM signal. This does not sense the direction of rotation of the pump.



Mating Packard Connector
Connector Body – 1216 2192
Connector Seal – 1204 0750
Cable Seal – 1204 0751
Socket – 1212 4075

Optional Mating Connectors
Connector Assembly (Body, Cable Seal, Seal) – 1216 2193
Socket (16 – 18 AWG) – 1212 4075
Socket (20 – 22 AWG) – 1212 4076



Parameter	Condition	Value
Operating Temperature Limit		-40 to 150°C [-40 to 302° F]
Sensor Resistance	25°C (77° F)	1.5 K To 3.5 K Ohms
Sensor Inductance	25°C (77° F)	0.6 to 3.7 H
Output Voltage	25°C (77° F) 9.3 Hz @ 2.29mm [.090 inch] Gap 300 Hz @ 0.25mm [.010 inch] Gap	400 mVpp Min 80 Vpp Max.
Air Gaps		0.26 to 2.28 [.010 to .090] mm [inch]
Vibration Voltage	15G random Vibration	0.4V P-P Max

Component Selection

The long service life of Eaton hydrostatic transmissions is largely dependent on the proper selection and installation of the compo- nents necessary for transmission operation.

The following components are necessary for transmission operation:

- Variable Displacement Pump
- Fixed or Variable Displacement Motor
- Reservoir
- Filter
- Charge Pump Inlet Line
- Pump and Motor Case Drain Lines
- High Pressure Lines
- Heat Exchanger
- Heat Exchanger Bypass Valve
- Reservoir Return Line

Variable Displacement Pump

Eaton hydrostatic variable displacement pumps are an axial piston design. They are equipped with standard SAE mounts, shafts and port connections.

Fixed or Variable Displacement Motor

Eaton hydrostatic motors are an axial piston design. They are equipped with standard SAE mounts, shafts and port connections.

Sizing Equations

For sizing / selecting the right pump for your application please carryout following basic calculations.

Flow Requirements

Pump Flow rate

$$\text{Pump Displacements (DP)} = \frac{\text{Nm X Dm}}{\text{Np X } \eta\text{p (vol.) X}\eta\text{m (Vol.)}}$$

Where,

Nmn = Necessary loaded motor speed (RPM)

Dm = Motor displacement (in3/rev)

Np = Pump input speed (RPM)

ηp (vol.) = Pump volumetric efficiency

ηm (vol.) = Motor volumetric efficiency

$$Q\ (\text{gpm}) = \frac{\text{Pump displacement (in3/rev) X Speed (rpm) X } \eta \text{ (vol. eff.)}}{231}$$

$$\text{Pump Input Power (HP)} = \frac{\text{Flow Rate Out Put (GPM) X Pressure (Psi)}}{1714 \text{ X } \eta \text{ (Overall)}}$$

Torque

$$\text{Torque (lbf.in)} = \frac{\text{Pump displacement (in3/rev) X Pressure (psi)}}{(2\text{x } \pi) \text{ x } \eta \text{ (mech. eff.)}}$$

Charge Pump Displacement

$$D = \frac{0.156\ (n_p \text{ X } D_p + n_m \text{ X } D_m)}{2}$$

Dcp = Charge Pump Displacement
np = Number of Pumps
nm= Number of Motors
Dp = Pump displacement
Dm = Motor displacement

Reservoir

The reservoir is an important part of the hydrostatic transmission system. It should provide adequate oil storage and allow easy oil maintenance.

The reservoir must hold enough oil to provide a continuous oil supply to the charge pump inlet. It must also have enough room for the hydraulic oil to expand as the system warms up. Consider charge pump flow when sizing the reservoir: One half (.5) minute times (X) the maximum charge pump flow should be the minimum oil volume in the reservoir. Maintaining this oil volume will give the oil a minimum of thirty (30) seconds in the reservoir. This will allow any entrained air to escape and contamination to settle out of the oil.

To allow for oil expansion, the reservoir's total volume should be at least six tenths (.6) minute times (X) the maximum charge pump flow.

The reservoir's internal structure should cut down turbulence and prevent oil aeration.

The line returning flow to the reservoir should be fitted with a diffuser to slow the incoming oil to 1 to 1.2 meters [3-4 feet] per second to help reduce turbulence. The return flow line should also be positioned so that returning oil enters the reservoir below the liquid surface. This will help reduce aeration and foaming of the oil.

The reservoir should have baffles between the return line and suction line. Baffles prevent return flow from immediately reenter- ing the pump.

A sixty mesh screen placed across the suction chamber of the reservoir will act as a bubble separator. The screen should be placed at a 30° angle to the horizon.

The entrance to the suction line should be located well below the fluid surface so there is no chance of air being drawn into the charge pump inlet. However, the suction line entrance should not be located on the bottom of the reservoir where there may be a buildup of sediment. The suction line entrance should be flared and covered with a screen.

The reservoir should be easily accessible. The fill port should be designed to minimize the possibility of contamination during filling and to help prevent over filling. There should be a drain plug at the lowest point of the reservoir and it should also have a clean-out

and inspection cover so the reservoir can be thoroughly cleaned after prolonged use. A vented reservoir should have a breather cap with a micronic filter.

Sealed reservoirs must be used at altitudes above 2500 feet.

These reservoirs should be fitted with a two- way micronic filter pressure cap to allow for fluid expansion and contraction.

In both cases the caps must be designed to prevent water from entering the reservoir during bad weather or machine washing.

A hydrostatic transmission with a well designed reservoir will run quieter, stay cleaner and last longer.

Filter

A filter must be used to keep the hydraulic fluid clean. Either a suction filter or a pressure side filter may be used. The filter must be a no-bypass type. System oil particle levels should not exceed ISO 18/15 per ISO 4406. Refer to Eaton Hydraulic Fluid Recommendations.

Recommended filters

Pressure line – 5 micrometer

Suction line = 3 OR 5 micrometer

When a suction filter is used, its flow capacity must be large enough to prevent an excessive pressure drop between the reservoir and charge pump inlet. The pressure at the charge pump inlet port must not be less than 0,80 bar absolute [6 in. Hg.] at normal continuous operating temperatures

Charge Pump Inlet Line

The inlet line to the charge pump should be large enough to keep the pressure drop between the reservoir and charge pump inlet within the limits described in the filter section. Fittings will increase the pressure drop, so their number should be kept to a minimum. It is best to keep fluid velocities below 1,25 meters [4 feet] per second.

Fluid and temperature compatibility must be considered when selecting the inlet line.

Pump and Motor Case Drain

The case drain lines should be large enough to limit the pump and motor case pressures (Medium Duty to 2 bar [25 PSI]) at normal operating temperatures. Fluid and temperature compatibility must also be considered when selecting the case drain lines.

High Pressure Lines

The high pressure lines that connect the pump and motor must be able to withstand the pressures generated in the high pressure loop.

Heat Exchanger

Use of a heat exchanger is dependent on the transmission's duty cycle and on machine layout. The normal continuous operating fluid temperature measured in the pump and motor cases should not exceed 80½C [180½F] for most hydraulic fluids.The maximum fluid temperature should not exceed 107½C [225½F].

The heat exchanger should be sized to dissipate 25% of the maximum input power available to the transmission. It must also be sized to prevent the case pressures in the pump and motor from getting too high. Medium duty case pressure up to 2 bar [25 psi], at normal operating temperatures, are acceptable.

Heat Exchanger Bypass Valve

The heat exchanger bypass valve is a pressure and/or temperature valve in parallel with the heat exchanger. Its purpose is to prevent case pressures from getting too high. The heat exchanger bypass valve opens when the oil is thick, especially during cold starts.

Reservoir Return Line

The same general requirements that apply to case drain lines apply to the reservoir return line.

Bearing Life estimation

Bearing life is defined as the length of time in terms of revolutions or time until a fatigue failure. Bearing load is calculated as a reaction which is derived from the moment created by the piston side load. Magnitude of the side load directly related to the speed and pressure at which a unit can be operated.

Bearing life is a function of the side loads coming on the bearings. Other factors such as fluid type, viscosity of fluid and cleanliness also affects the life of bearing.

If detail bearing life analysis is required, you can contact Eaton representative.

Installation Requirements

The mounting orientation of pumps and motors is unrestricted provided the case drain of the pump and motor remain full. Position the case drain such that it assures an oil level at or above unit center line at start-up. The case drain line that carries the flow leaving the pump or motor should be connected to the highest drain port on each of the units. This assures that the pump and motor cases remain full.

The combined torque required to turn two or more pumps must not exceed the torque rating of the input drive shaft of the front piston pump. Installer to provide centering and a secure neutral for pump swashplate control shaft. An external support is recommended for all tandems.

Open Loop Circuits

Eaton pumps and motors may be used in open loop circuits under certain operating conditions. Consult your Eaton representative for details.

Hydraulic Fluid Recommendations

Introduction

Hydraulic fluids are one of the vital components of hydraulic system. Proper selection of oil assures satisfactory life and operation of system components. The purpose of this section is to provide readers with the knowledge required to select the appropriate fluids for use in systems that employ Eaton hydraulic components

Viscosity and Temperature

Viscosity is the measure of a fluid's resistance to flow. The most important characteristics to consider when choosing a fluid to be used in a hydraulic system is viscosity. The fluid must be thin enough to flow easily but thick enough to maintain adequate lubricating film between components and to maintain proper sealing at the operating temperatures of the hydraulic system.

For viscosity requirements, see table

Viscosity of any fluid is relative to temperature, as the fluid warms the viscosity decreases and vice versa. When choosing a fluid, it is important to consider the start-up and operating temperatures of the hydraulic system. A high VI fluid shows relatively small change of viscosity with temperature.

Lubricants used for hydraulic applications may contain viscosity index improvers (VII). They refer to these fluids as viscosity index improved or multi-viscosity fluids. The viscosity of these fluids may drop down in use due to shearing of VI improvers used in the formulations.

Anti-wear hydraulic oils containing polymeric thickeners, viscosity index improvers (VII) are generally used for wide band operating temperature applications These fluids experience temporary and permanent viscosity loss during use in hydraulic system. Check the extent of viscosity loss (shear stability) to avoid hydraulic service below the recommended minimum viscosity. Oil with good shear stability is recommended for wide band temperature applications.

Multi-grade engine oils, ATFs, UTTOs, etc., also contain VIIs, and viscosity loss will be encountered during use.

Cleanliness

Cleanliness of the fluid in a hydraulic system is extremely important. More than 70% of all failures are caused by contamination Eaton recommends that the fluid used in its hydraulic components be maintained per ISO 4406. Cleanliness level requirements vary with the hydraulic components. The cleanliness of a hydraulic system is dictated by the cleanliness requirements of the most stringent component in the system.

Cleanliness requirements for specific products are given in the table.

OEM's and distributors who use Eaton hydraulic components in their hydraulic systems should provide these requirements in their designs.

Contact Eaton filter representative for filtration information.

Fluid Maintenance

The condition of a fluid has a direct effect on the performance and reliability of the system. Maintaining proper fluid viscosity, cleanliness level, water content, and additive level is essential for excellent hydraulic system performance. Routine fluid condition monitoring is recommended.

Fluid Selection

Premium grade anti-wear (AW) petroleum based hydraulic fluids will provide the best performance with Eaton hydraulic components. Fluids that meet Eaton Hydraulic Fluid Specification E-FDGN-TB002-E are considered good quality anti-wear hydraulic fluids. These fluids pass Eaton Vickers® 35VQ25A high pressure vane pump test (Eaton ATS-373 test procedure, ASTM D 6973).

Automotive crank case oils with American Petroleum Institute (API) letter designation SF, SG, SH, SJ, or higher per SAE J 183 classes of oils are recommended for applications using Eaton DG valves Automotive crankcase oils generally exhibit less shear stability compared to industrial anti-wear hydraulic fluids, which can result in higher loss of viscosity during service life.

Other mineral oil based lubricants commonly used in hydraulic systems are automatic transmission fluids (ATF) and universal tractor transmission oils (UTTO).

Synthetic hydrocarbon base stocks, such as polyalphaolefins (PAO) are also used to formulate hydraulic fluids, engine oils, ATFs and UTTOs Alternate fluids are recommended when specific properties, such as fire resistance biodegradability etc., are necessary for the application. Keep in mind that alternative fluids may differ from AW petroleum fluids in properties.

Additional Notes

When choosing a hydraulic fluid, all the components in the system must be considered. Viscosity limitations have to meet the most stringent component requirements.

For any system where the fluid is non-petroleum oil, set the target one ISO code cleaner for each particle size, than that of petroleum fluids.

Keep adequate fluid level in the reservoir. Take fluid level reading when the system is cold.

Contact your Eaton representative, if you have specific questions about the fluid requirements of Eaton hydraulic components.

Hydraulic Fluid Recommendations

Viscosity & Cleanliness Recommendation

Product	Minimum *	Optimum	Maximum	ISO Cleanliness
Medium Duty Piston Pumps and Motors Charged Systems	6.0 cSt (45 SUS)	10 – 39 cSt (60-180 SUS)	2158 cSt (10000 SUS)	21/18/13

* Minimum viscosity applies at intermittent condition of 10% of every minute.
At viscosities lower than 70 sus, additional antiwear additives must be added to prevent premature wear.
Please refer to Eaton document 03-401 for further details.

Additional Notes:

- Fluids too thick to flow in cold weather start-ups will cause pump cavitation and possible damage. Motor cavitation is not a problem during cold start-ups, except for two speed motors. Thick oil can cause high case pressures which in turn cause shaft seal problems.
- When choosing a hydraulic fluid, all the components in the system must be considered and the optimum viscosity range adjusted accordingly. For example, when a medium duty piston pump is combined with a Disk Valve Motor the optimum viscosity range becomes 100 - 180 SUS [20 - 39 cSt] and viscosity should never fall below 70 SUS [13 cSt].
- If the natural color of the fluid has become black it is possible that an overheating problem exists.
- If the fluid becomes milky, water contamination may be a problem.
- Take fluid level reading when the system is cold.
- Contact your Eaton representative if you have specific questions about the fluid requirements of Eaton hydraulic components.

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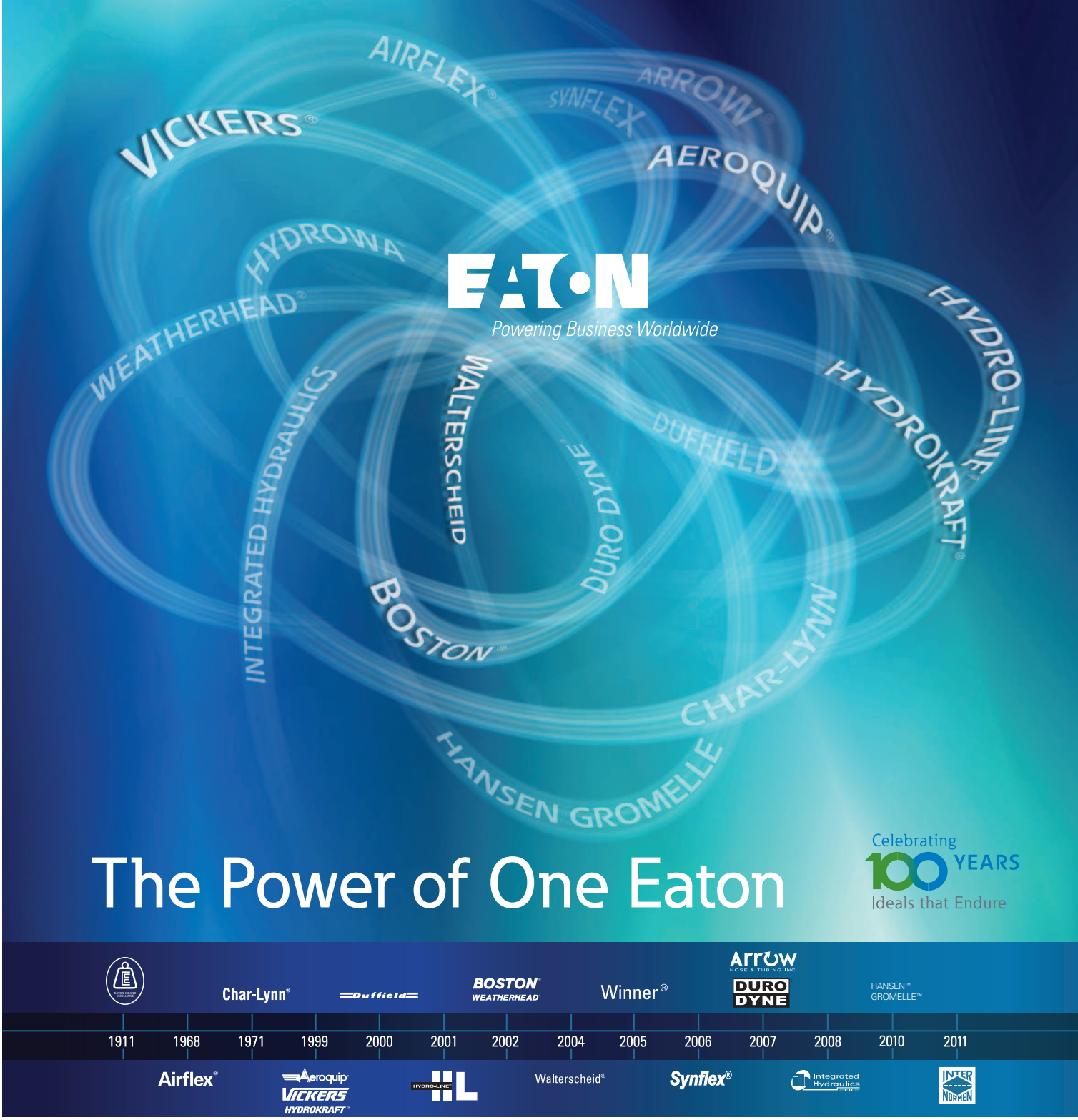
Vickers® Vane Pumps

Single and Double Vane Pumps

Model Series V10, V20, V2010, and V2020
for Industrial Equipment



Powering Business Worldwide



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There's a certain energy at Eaton. It's the power of integrating the competencies of some of the world's most respected names to build a brand you can trust to meet every power management need. The energy created supports our commitment to powering business worldwide.

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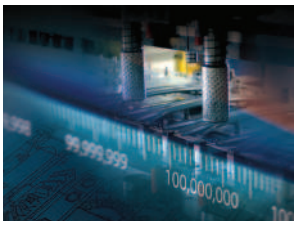
That's the power of One Eaton.

Serving eight key segments - sharing one focus



Alternative Energy

Making energy sources technically practical and economically sound requires the kind of control made possible by high-quality components. When Eaton is on the inside, you will experience the reliable, consistent performance to create and capture energy—making renewable energy an every-day energy.



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Produce at peak efficiency with the superior precision and repeatability of Eaton products. Eaton hydraulic components provide the precise control and consistent operation required for virtually every step in your manufacturing operation. With Eaton, we'll help you redefine the meaning of raw productivity.



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Whatever your industry, no matter which processes you manage, Eaton parts and systems help keep you up and running. Our components make equipment more efficient and easier to use, so you get optimal machine performance and maximum productivity.



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Eaton technologies can make your driving operation more successful. Greater comfort and productivity help increase driver retention, while reduced emissions, leaks, and noise improve environmental performance. Increased efficiencies overall mean lower costs and higher net revenue.



Material Handling

Eaton hydraulic systems provide the precise control and consistent operation required for material handling and utility work. With a broad selection of products and solutions built in, Eaton helps make you a master of your domain.



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When you work on a large scale, even the details are big. You need to trust every part of the equipment that lets you handle construction and mining jobs. For reliable components that deliver consistent performance in extreme conditions, turn to Eaton.

Eaton is a leading diversified power management company

Eaton provides reliable, efficient and safe power management for a growing number of industries.

Understanding and helping our customers succeed

- Listening and understanding to requirements and business drivers
- Delivering solutions with value propositions to solve the critical business needs

Knowing what's important to our customers and integrating that knowledge into the fabric of our business

- ...to deliver innovative, quality products
- ...to respond fast
- ...to provide dedicated customer service and support around the globe

Our strength is global reach with local responsiveness and support

- Customers served in more than 150 countries
- Diverse channels ensure reliable availability and support
- Design and engineering teams provide support for standard products and custom solutions
- Eaton experts offer efficient product and application training

Introduction

Series V10, V20, V2010, and V2020 fixed displacement pumps are of Vickers "balanced vane type" construction. V10 and V20 single pumps have rated flow capacities of 1 to 7 USgpm and 6 to 13 USgpm, respectively.

Double pumps provide a single power source capable of serving two separate hydraulic circuits, or of providing greater volume through the combined delivery of both sections. In either type of application, two pumps in a single housing result in a more compact,simple installation and can be driven through a single shaft coupling.

V2010 double pumps have capacities of 6 to 13 USgpm and 1 to 7 USgpm for their shaft-end and cover-end pumps, respectively. V2020 double pumps have capacities of 6 to 13 USgpm and 6 to 11 USgpm for their shaft-end and cover-end pumps, respectively.

All models are designed for use with oil or synthetic fire-resistant fluids. Shaft rotation is either clockwise or counter-clockwise, but can be changed by changing the assembly of internal parts.

SAE 2-bolt mounting flanges are standard, and foot-mounting brackets are optional. Many electric motor manufacturers can supply drip-proof or totally enclosed, fan cooled motors with end bells on which the pumps can be mounted.

Features and Benefits

Enhanced Bearing Life

Internal inlet and outlet pressure chambers are diametrically opposed. As a result, pressure-induced radial loads are balanced, and bearings have to carry the external load only.

High Performance

Low vane tip/ring loading allows high pressure operation. High speeds are possible because the inlet flow paths are designed to give uniform oil acceleration, and thus better filling characteristics, particularly at low inlet pressures.

Extended Product Life

The superior design of these pumps makes them last longer. They've proven they'll hold up in rugged applications.

Low Cost

Vickers' efficient design produces extra horsepower per dollar of pump investment, providing industry with low pump cost per horsepower capacity.

Versatility

High flow, pressure and speed capabilities enable these pumps to meet the hydraulic circuit needs of many types of modern machinery.

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Basic Performance Data – Single and Double Pumps

Typical operating characteristics at 1200 r/min with petroleum oil

Ring size		Data based on performance at oil temperature of 49° C (120° F), viscosity 32 cSt at 38° C (150 SUS at 100° F)							
		7 bar (100 psi)		69 bar (1000 psi)		138 bar (2000 psi)		155 bar (2250 psi)	
V10 single pump †	V20 single pump ‡	Lpm (USgpm)	Input kW (hp)	Lpm (USgpm)	Input kW (hp)	Lpm (USgpm)	Input kW (hp)	Lpm (USgpm)	Input kW (hp)
1	–	3,8 (1)	0,2 (.3)	2,7 (.7)	0,5 (.8)	2,5 (.65)	1 (1.4)	2,3 (.6)	1,2 (1.6)
2	–	7,6 (2)	0,2 (.3)	6,8 (1.8)	1,3 (1.75)	6,4 (1.7)	2,2 (3)	6 (1.6)	2,8 (3.8)
3	–	11,4 (3)	0,3 (.4)	10,6 (2.8)	1,6 (2.2)	10,2 (2.7)	3,3 (4.4)	9,8 (2.6)	3,7 (5)
4	–	15,1 (4)	0,3 (.4)	14 (3.7)	2,2 (3)	13,6 (3.6)	4,3 (5.8)	13,2 (3.5)	4,8 (6.5)
5	–	18,9 (5)	0,4 (.6)	18,2 (4.8)	2,7 (3.6)	17,4 (4.6)	5,2 (7)	17 (4.5)	5,8 (7.8)
6	–	23,1 (6.1)	0,7 (.9)	21,6 (5.7)	3,7 (5)	20,4 (5.4)	6,7 (9)	20,1 (5.3)	7,5 (10)
7	–	27,2 (7.2)	0,7 (1)	25,7 (6.8)	4,1 (5.5)	24,6 (6.5)	7,8 (10.4)	23,8 (6.3)	8,7 (11.6)
–	6	23,5 (6.2)	0,9 (1.25)	20,1 (5.3)	3,6 (4.9)	19,7 (5.2)	6,3 (8.4)	19,3 (5.1)	7,5 (10)
–	7	26,9 (7.1)	0,9 (1.25)	25 (6.6)	3,7 (5)	23,5 (6.2)	6,9 (9.2)	23,1 (6.1)	8,6 (11.5)
–	8	31 (8.2)	0,9 (1.25)	28,8 (7.6)	4,2 (5.6)	27,2 (7.2)	8,1 (10.9)	26,9 (7.1)	10,4 (14)
–	9	34,8 (9.2)	1 (1.3)	32,6 (8.6)	4,6 (6.2)	31 (8.2)	9 (12.1)	30,7 (8.1)	11,9 (16)
–	11	43,5 (11.5)	1 (1.3)	37,8 (11)	5,7 (7.6)	39,7 (10.5)	10,9 (14.6)	39,4 (10.4)	13 (17.5)
–	12	45,4 (12)	1 (1.3)	43,2 (11.4)	6,1 (8.2)	40,9 (10.8)	11,6 (15.6)	–	–
–	13	51,1(13.5)	1 (1.3)	49,2 (13)	6,6 (8.8)	47,3 (12.5)	12,4 (16.7)	–	–

† Also cover-end ring of V2010 double pump .

‡ Also shaft-end ring of V2010 and V2020 double pumps, and cover-end ring (except sizes 12 & 13) of V2020 double pump.

NOTE: See curves for complete operating characteristics with petroleum oil. See page 8 for single pumps. See page 17 for double pumps

Maximum speeds & pressures using fire-resistant fluids

Ring size	Maximum speed by fluid type – r/min		Maximum pressure by fluid type – bar (psi)		
	Water-glycol and water-in-oil emulsion	Synthetic fluid	Water glycol	Water-in-oil emulsion	Synthetic fluid
1, 2, 3, 4, 5	1800	1800	124 (1800)	103 (1500)	138 (2000)
6, 7, 8, 9	1800	1800	124 (1800)	109 (1575)	138 (2000)
11	1800	1500	109 (1575)	93 (1350)	138 (2000)
12,13	1800	1500	109 (1575)	93 (1350)	124 (1800)

NOTE: 3 inches of Hg is the maximum inlet vacuum for the maximum speeds above. See page 24 for complete application details.

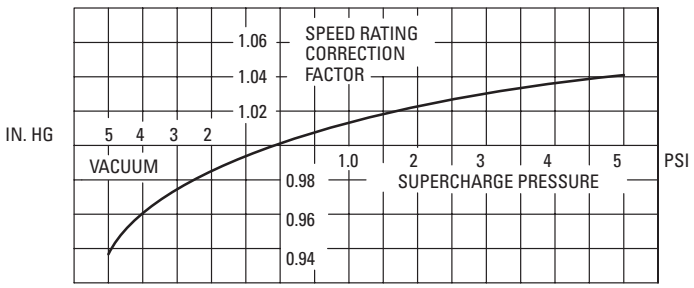
Speed rating per inlet condition

Maximum operating speeds shown on performance curves are for pumps operating at 0 psi inlet condition. To compute maximum operating speeds at other inlet conditions, use appropriate speed rating correction factor shown on the curve on the right.

Example:

Max. speed @ 0 psi inlet	2800 rpm
Correction factor @ 5 in. Hg	x .93
Max. speed @ 5 in. Hg inlet	2604 rpm

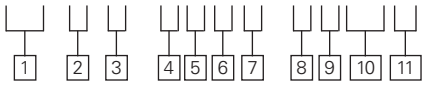
Pump inlet suction should not exceed 5 in. Hg vacuum for petroleum oil or 3 in. Hg vacuum for other fluid types. Positive pressure on inlet should not exceed 10 psi.



Single Pumps

Model Code

F3 - V 10 - 1 P 5 S - 1 C 20 L



1 Special Seals
Omit if not required.
See page 25 for information on seals

2 Vane pump

3 Series
10 or 20

4 Mounting

1 – 2-bolt flange, 3.25" pilot (standard)
6 – 2-bolt flange, 4.00" pilot (optional)

See page 23 for optional foot bracket kits.

5 Inlet port connections

P –1" NPT thread (V10 only)
1 1/4" NPT thread (V20 only)
S –1.3125-12 straight thread (V10 only)
1.625-12 straight thread (V20 only)

6 Ring size
(Delivery at 1200 r/min and 100 psi)

V10 series
1 – 1 USgpm
2 – 2 USgpm
3 – 3 USgpm
4 – 4 USgpm
5 – 5 USgpm
6 – 6 USgpm
7 – 7 USgpm

V20 series
6 – 6 USgpm
7 – 7 USgpm
8 – 8 USgpm
9 – 9 USgpm
11 – 11 USgpm
12 – 12 USgpm
13 – 13 USgpm

7 Outlet port connections

P – 1/2" NPT thd. (V10 only)
R –1.1875–12 St. thd. (V20 only)
S – .750–16 St. thd. (V10 only)
1.0625–12 St. thd. (V20 only)

8 Shafts

1 – Straight keyed
11 – Splined
38 – 11 Tooth – 3/4" OD.
62 – Splined (V20 only)

9 Position of outlet port
(Viewed from cover end of pump)

A – Opposite inlet port
B – 90 CCW from inlet
C – In line with inlet
D – 90 CW from inlet

10 Design

11 – V20 series
20 – V10 series
Subject to change.

11 Shaft rotation
(Viewed from shaft end of pump)

L – Left hand (counterclockwise).
Omit for right hand.

Specifications

Based on using petroleum oil at 49° C (120° F), viscosity 32 cSt at 38° C (150 SUS at 100° F), and 0 psi inlet pressure

Model series	Ring size	Displ.	Max. Speed	Maximum pressure	Typical delivery	Typical input power	Weight
	(Delivery USgpm @ 1200 r/min & 100 psi)	cm^3/r (in^3/r)	r/min	bar (psi)	L/min (USgpm) @ max. speed & pressure	kW (hp) @ max. speed & pressure	kg (lb)
	1	3,3 (.20)	4800	172 (2500)	13,6 (3.6)	5,2 (7)	
	2	6,6 (.40)	4500	172 (2500)	27,6 (7.3)	10,1 (13.6)	
	3	9,8 (.60)	4000	172 (2500)	35,6 (9.4)	13,3 (17.8)	4,5 - 6,8
V10	4	13,1 (.80)	3400	172 (2500)	41,3 (10.9)	15,2 (20.4)	(10 - 15)
	5	16,4 (1.00)	3200	172 (2500)	48,5 (12.8)	17 (22.8)	
	6	19,5 (1.19)	3000	152 (2200)	55,3 (14.6)	18,3 (24.5)	
	7	22,8 (1.39)	2800	138 (2000)	60,6 (16)	17,9 (24)	
	6	19,5 (1.19)	3400	172 (2500)	60,9 (16.1)	21,6 (29)	
	7	22,8 (1.39)	3000	172 (2500)	63,2 (16.7)	22 (29.5)	
	8	26,5 (1.62)	2800	172 (2500)	67 (17.7)	24,2 (32.5)	7,3 - 8,2
V20	9	29,7 (1.81)	2800	172 (2500)	75 (19.8)	26,5 (35.5)	(16 - 18)
	11	36,4 (2.22)	2500	172 (2500)	86,7 (22.9)	28 (37.5)	
	12	39 (2.38)	2400	152 (2200)	87,1 (23)	26,8 (36)	
	13	42,4 (2.59)	2400	152 (2200)	98 (25.9)	29,1 (39)	

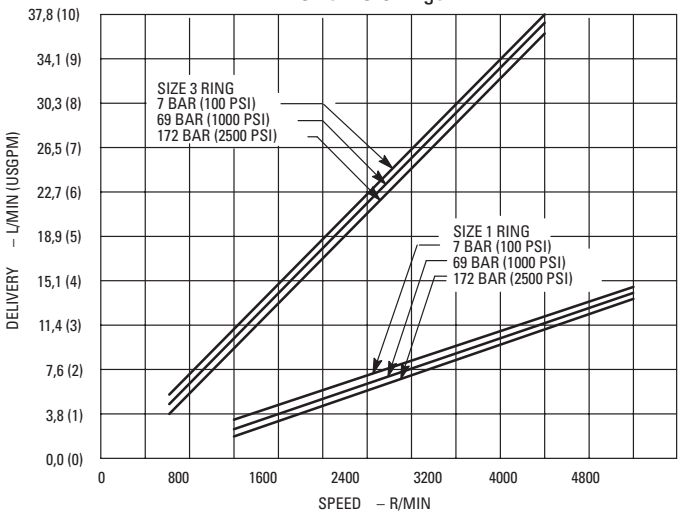
See page 6 for speed correction curve.

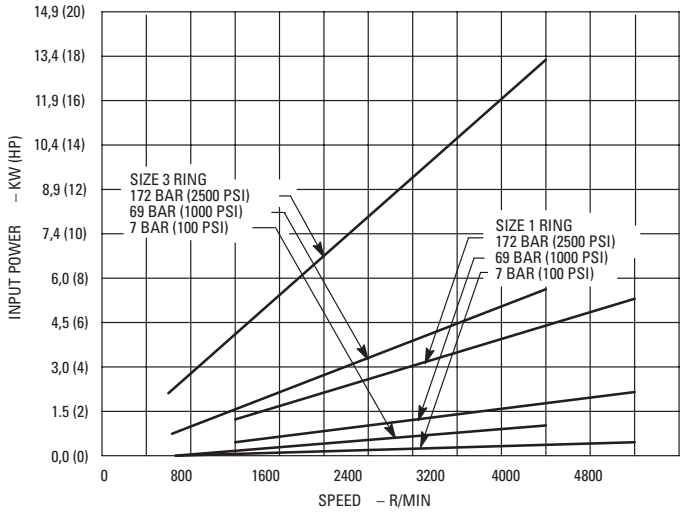
Single Pumps

V10 Performance

Oil temp. 49°C (120°F), viscosity 32 cSt (150 SUS) @ 38°C (100°F), inlet pressure zero

Size 1 & 3 rings



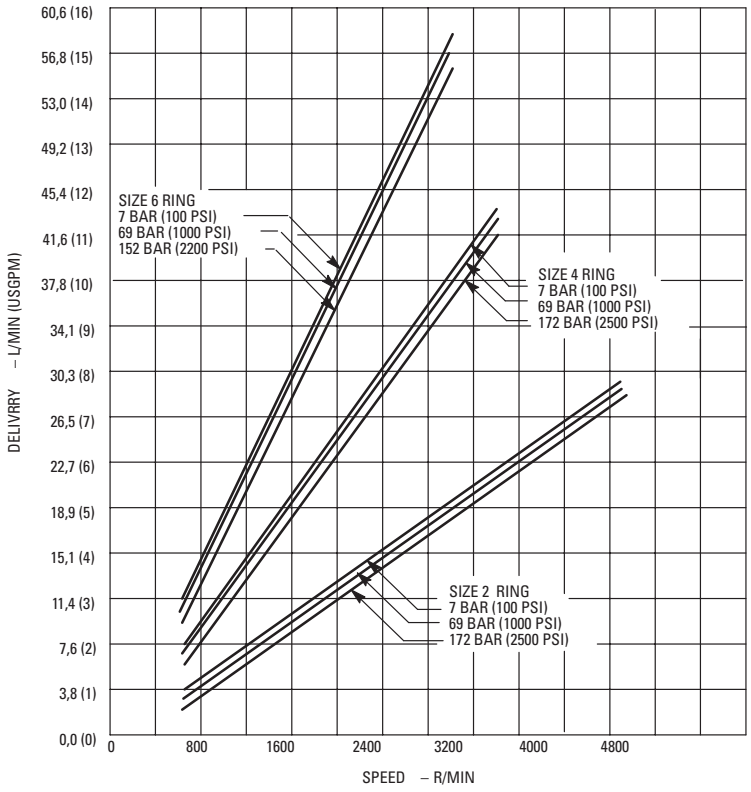


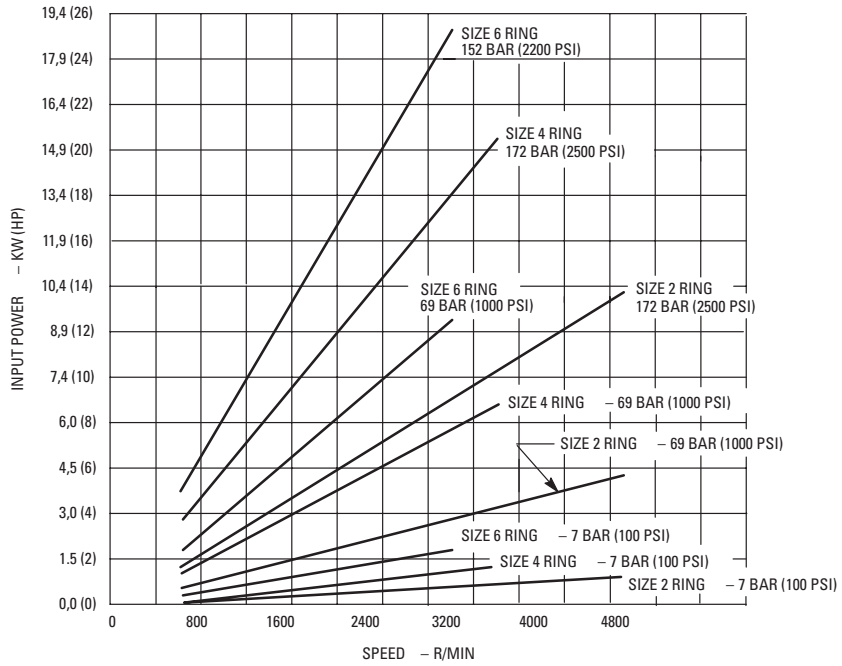
Single Pumps

V10 Performance

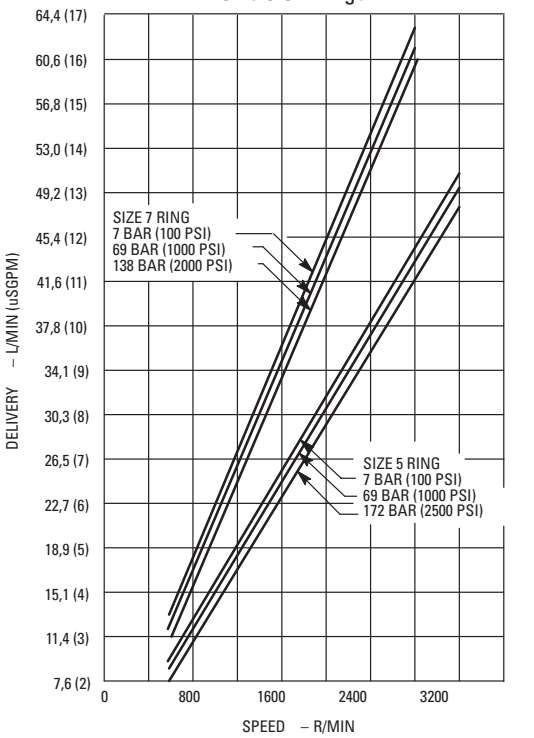
Oil temp. 49°C (120°F), viscosity 32 cSt (150 SUS) @ 38°C (100°F), inlet pressure zero

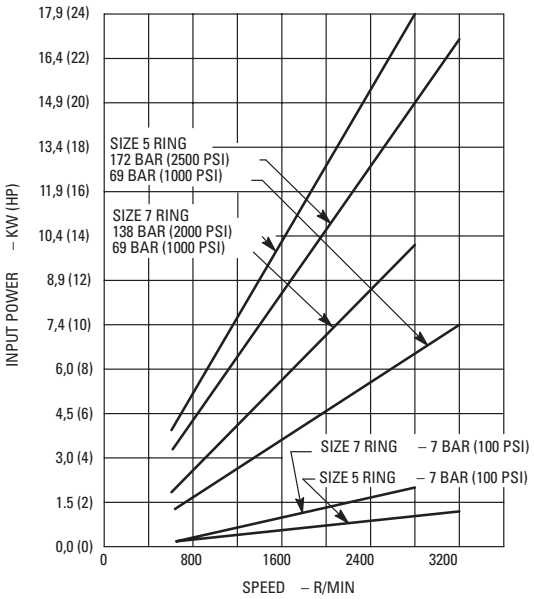
Size 2, 4 & 6 rings





Size 5 & 7 rings

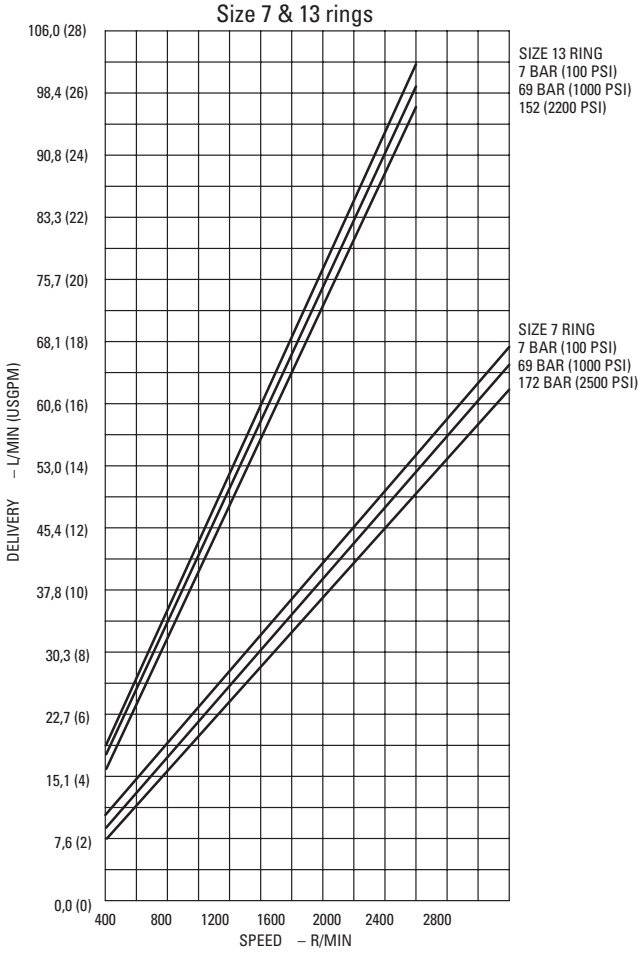


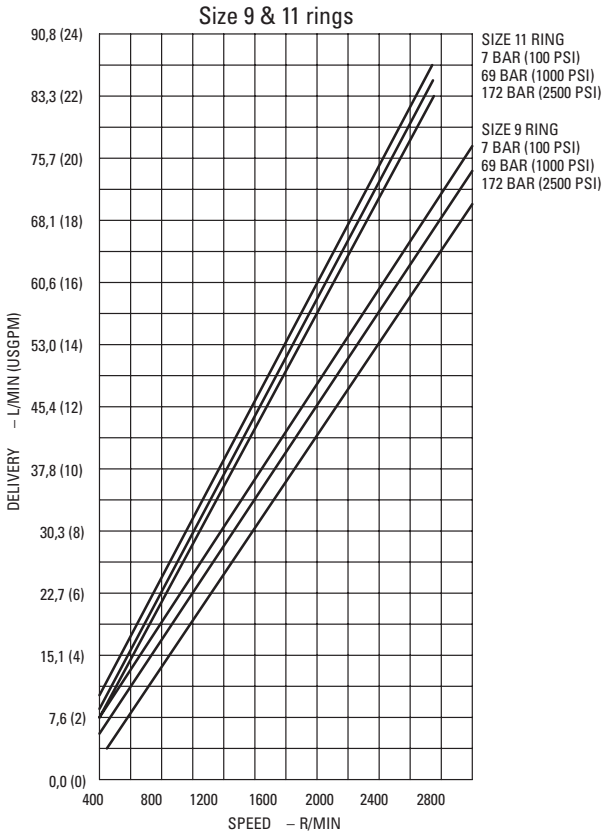


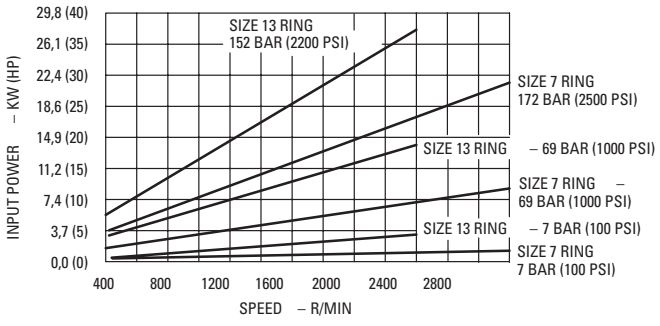
Single Pumps

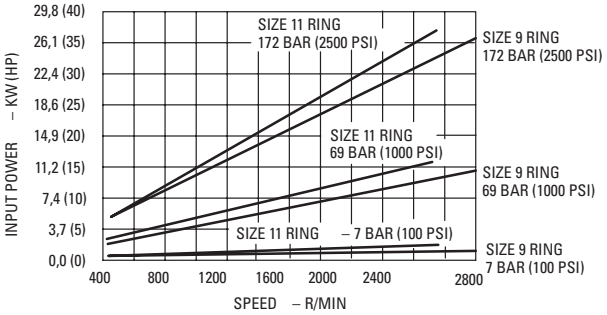
V20 Performance

Oil temp. 49°C (120°F), viscosity 32 cSt (150 SUS) @ 38°C (100°F), inlet pressure zero

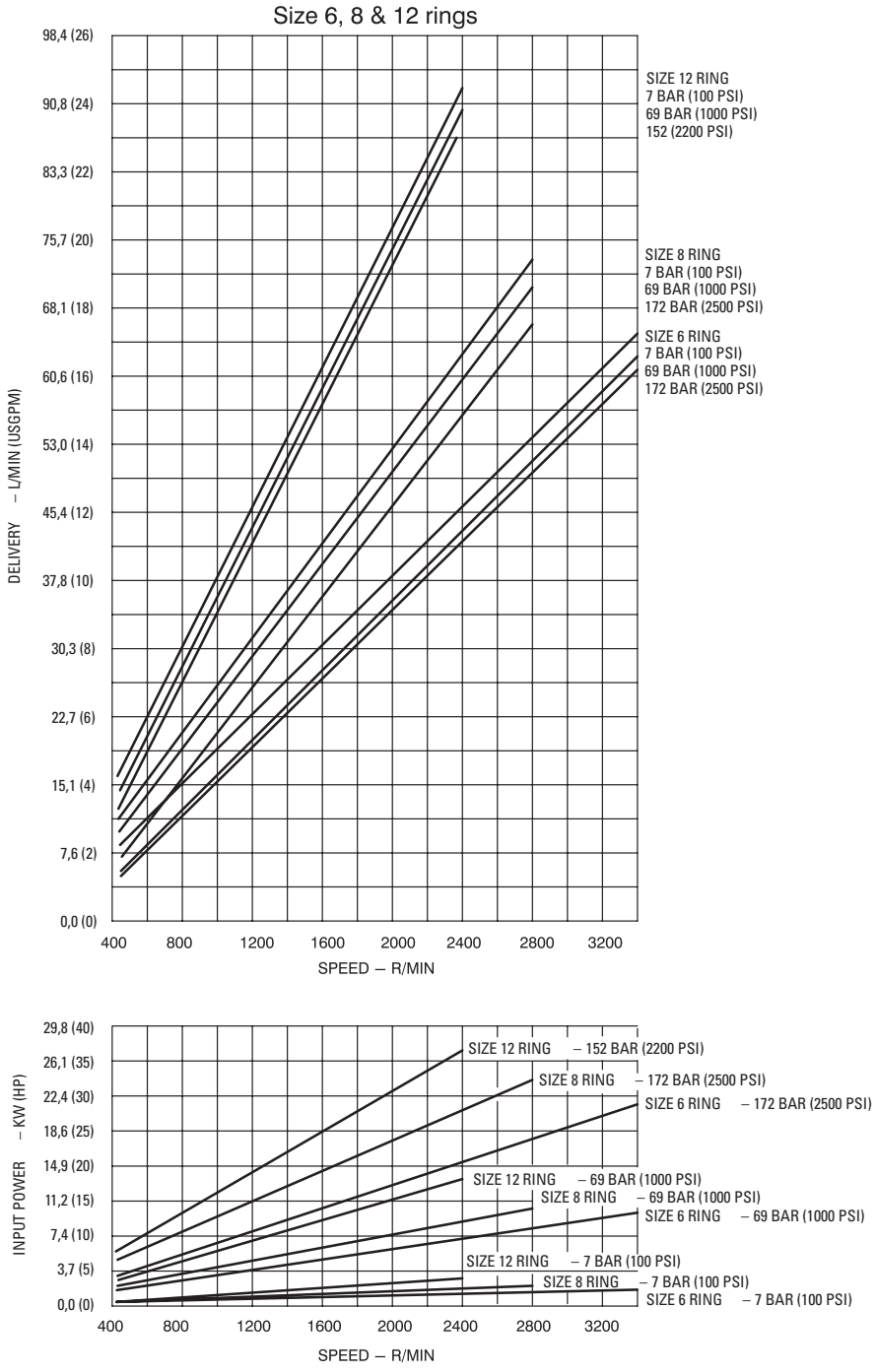








Single Pumps

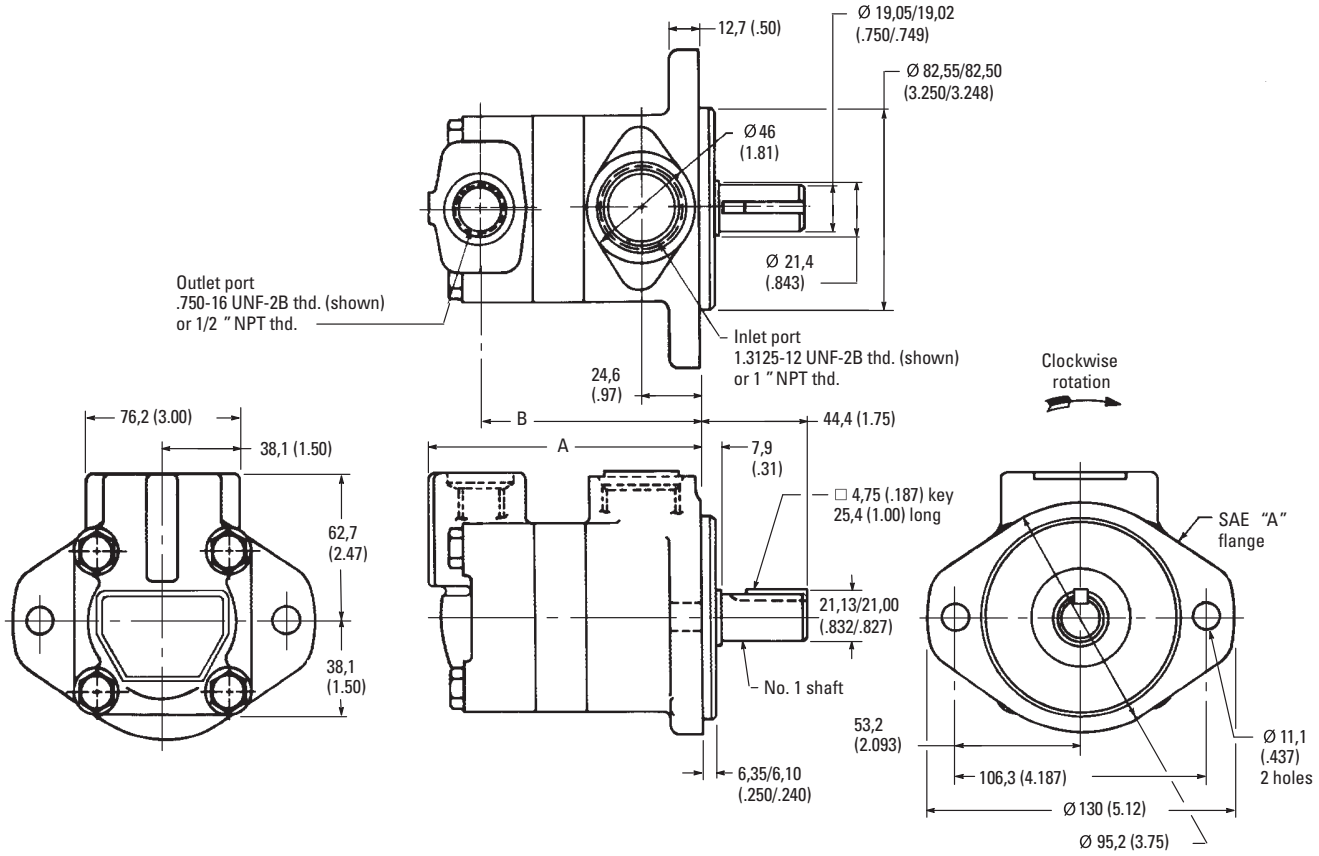


Single Pumps

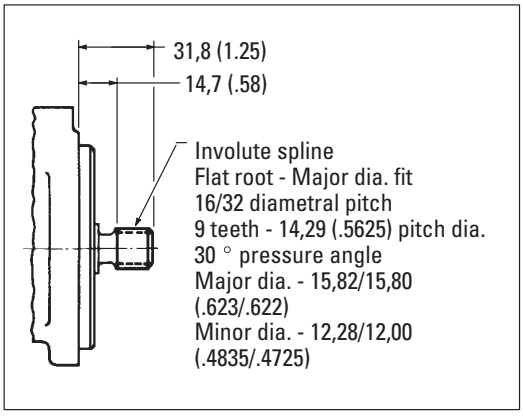
V10 Dimensions

Millimeters (inches)

See page 23 for foot mounting dimensions.



Number 11 shaft



Ring size	Dimension	
	A	B
1	115,6 (4.55)	91,9 (3.62)
2	115,6 (4.55)	91,9 (3.62)
3	115,6 (4.55)	91,9 (3.62)
4	121,9 (4.80)	98,3 (3.87)
5	121,9 (4.80)	98,3 (3.87)
6	127,0 (5.00)	103,4 (4.07)
7	127,0 (5.00)	103,4 (4.07)

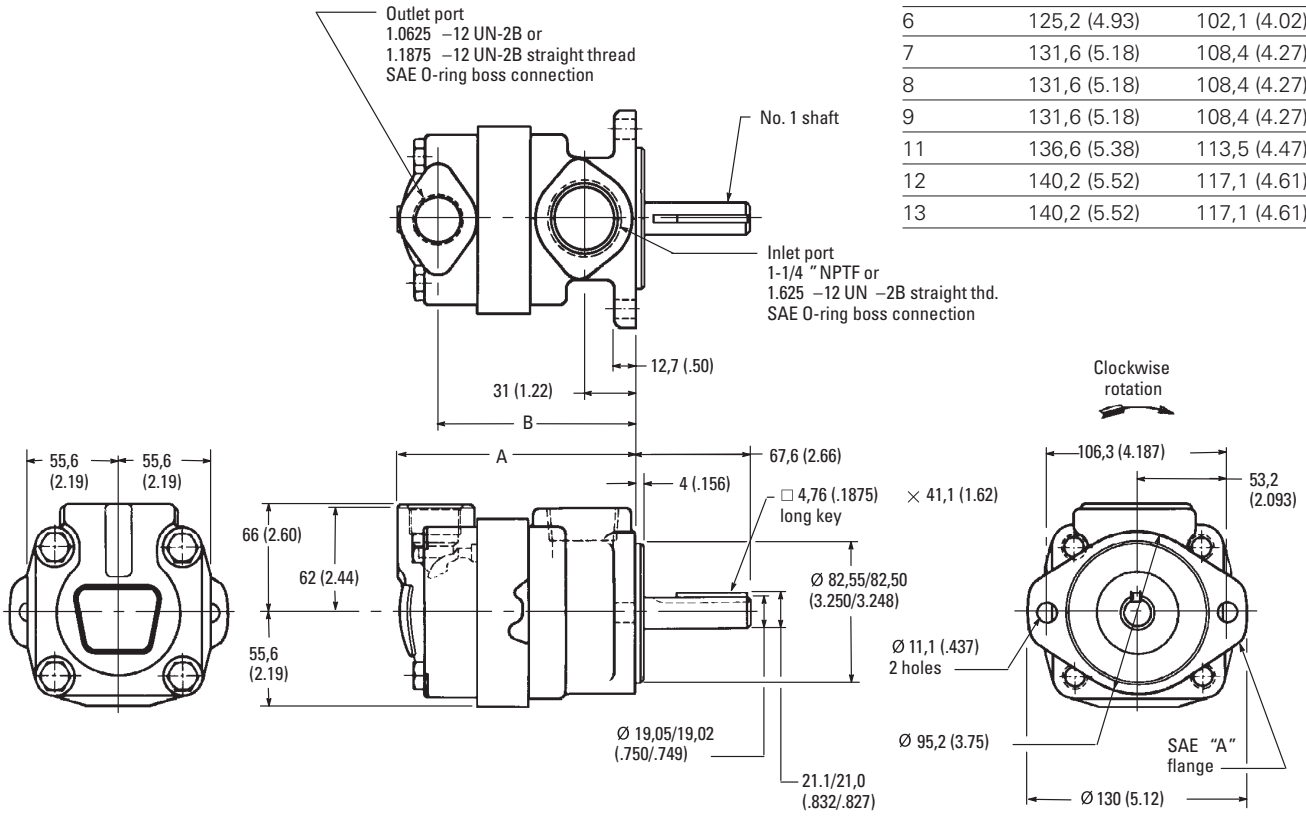
Single Pumps

V20 Dimensions

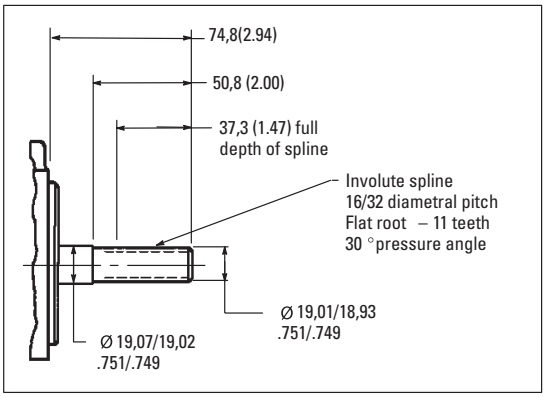
Millimeters (inches)

See page 23 for foot mounting dimensions.

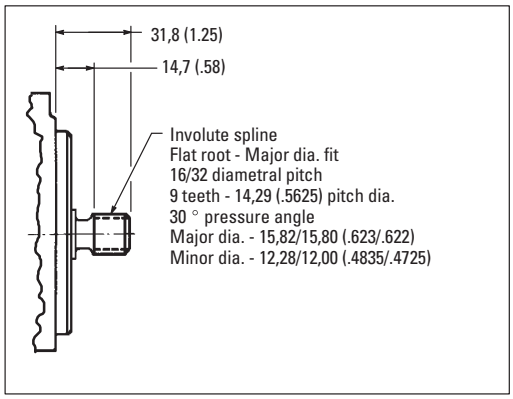
Ring size	Dimension	
	A	B
6	125,2 (4.93)	102,1 (4.02)
7	131,6 (5.18)	108,4 (4.27)
8	131,6 (5.18)	108,4 (4.27)
9	131,6 (5.18)	108,4 (4.27)
11	136,6 (5.38)	113,5 (4.47)
12	140,2 (5.52)	117,1 (4.61)
13	140,2 (5.52)	117,1 (4.61)



Number 11 shaft



Number 62 shaft



Double Pumps

Model Codes

F3 - V 2010 - 1 F 13 S 3 S - 1 CC - 12 - L

1 2 3 4 5 6 7 8 9 10 11 12 13

1 **Special Seals**
Omit if not required.

See page 25 for information on seals.

2 **Vane pump**

3 **Series**
2010 or 2020

4 **Mounting**

1 – 2-bolt flange, 4.00" pilot (standard)
6 – 2-bolt flange, 3.25" pilot (optional)
See page 23 for optional foot bracket kits.

5 **Inlet port connections**

F – 4-bolt flange 1.50 dia. (V2010)
2.00 dia. (V2020)

6 **Shaft-end pump ring size**
(delivery at 1200 rpm & 100 psi)

6 - 6 USgpm
7 - 7 USgpm
8 - 8 USgpm
9 - 9 USgpm
11 - 11 USgpm
12 - 12 USgpm
13 - 13 USgpm

7 **No. 1 outlet port (shaft end)**
S – 1.062-12 UN-2B thd.

8 **Cover-end pump ring size**
(delivery at 1200 r/inm and 100 psi)

1 – 1 USgpm
2 – 2 USgpm
3 – 3 USgpm
4 – 4 USgpm
5 – 5 USgpm
6 – 6 USgpm
7 – 7 USgpm
V2010

6 – 6 USgpm
7 – 7 USgpm
8 – 8 USgpm
9 – 9 USgpm
11 – 11 USgpm
V2020

9 **No. 2 outlet port (cover end)**

S – .750-16 St. Thd. (V2010)
1.062–12 St. Thd. (V2020)

10 **Shafts**

1 – Straight keyed
11 –Splined

11 **Position of outlet**
(Viewed from cover end of pump)

V2010
With no. 1 outlet opposite inlet
AA – No. 2 outlet 135° CCW from inlet
AB – No. 2 outlet 45° CCW from inlet
AC – No. 2 outlet 45° CW from inlet
AD – No. 2 outlet 135° CW from inlet

With no. 1 outlet 90° CCW from inlet
BA – No. 2 outlet 135 CCW from inlet
BB – No. 2 outlet 45 CCW from inlet
BC – No. 2 outlet 45 CW from inlet
BD – No. 2 outlet 135 CW from inlet

With no. 1 outlet in line with inlet
CA – No. 2 outlet 135° CCW from inlet
CB – No. 2 outlet 45° CCW from inlet
CC – No. 2 outlet 45° CW from inlet
CD – No. 2 outlet 135° CW from inlet

With no. 1 outlet 90° CW from inlet
DA – No. 2 outlet 135° CCW from inlet
DB – No. 2 outlet 45° CCW from inlet
DC – No. 2 outlet 45° CW from inlet
DD – No. 2 outlet 135° CW from inlet

V2020
With no. 1 outlet opposite inlet
AA – No. 2 outlet opposite inlet
AB – No. 2 outlet 90° CCW from inlet
AC – No. 2 outlet in line with inlet
AD – No. 2 outlet 90° CW from inlet

With no. 1 outlet 90° CCW from inlet
BA – No. 2 outlet opposite inlet
BB – No. 2 outlet 90° CCW from inlet
BC – No. 2 outlet in line with inlet
BD – No. 2 outlet 90° CW from inlet

With no. 1 outlet inline with inlet
CA – No. 2 outlet opposite inlet
CB – No. 2 outlet 90° CCW from inlet
CC – No. 2 outlet in line with inlet
CD – No. 2 outlet 90° CW from inlet

With no. 1 outlet 90° CW from inlet
DA – No. 2 outlet opposite inlet
DB – No. 2 outlet 90° CCW from inlet
DC – No. 2 outlet in line with inlet
DD – No. 2 outlet 90° CW from inlet

12 **Design**

12 – V2010 series
30 – V2020 series
Subject to change.

13 **Shaft rotation**
(Viewed from shaft end of pump)

L – Left hand for counterclockwise
Omit for right hand

Double Pumps

Specifications

Based on using petroleum oil at 49° C (120° F), viscosity 32 cSt at 38° C (150 SUS at 100° F), and 0 psi inlet pressure

V2010 model series	Ring size (Delivery USgpm @ 1200 r/min & 100 psi)	Displ. cm^3/r (in^3/r)	Max. speed r/min	Maximum pressure bar (psi)	Typical delivery L/min (USgpm) @ max. speed & pressure	Typical input power kW (hp) @ max. speed & pressure	Approx. total weight kg (lb)
Shaft-end pump	6	19,5 (1.19)	3000	172 (2500)	54,9 (14.5)	18,3 (24.5)	13,6 (30)
	7	22,8 (1.39)	3000	172 (2500)	62,5 (16.5)	22,4 (30)	
	8	26,5 (1.62)	2800	172 (2500)	66,2 (17.5)	24,2 (32.5)	
	9	29,7 (1.81)	2800	172 (2500)	75,7 (20)	26,8 (36)	
	11	36,4 (2.22)	2500	172 (2500)	87,1 (23)	28 (37.5)	
	12	39 (2.38)	2400	152 (2200)	87,1 (23)	26,8 (36)	
	13	42,4 (2.59)	2400	152 (2200)	98,4 (26)	29,1 (39)	
Cover-end pump	1	3,3 (.20)	3000	172 (2500)	7,6 (2)	3,4 (4.5)	
	2	6,6 (.40)	3000	172 (2500)	17,8 (4.7)	6,7 (9)	
	3	9,8 (.60)	3000	172 (2500)	26,5 (7)	10 (13.4)	
	4	13,1 (.80)	3000	172 (2500)	36 (9.5)	13,4 (18)	
	5	16,4 (1.00)	3000	172 (2500)	45,4 (12)	16 (21.5)	
	6	19,5 (1.19)	3000	152 (2200)	54,9 (14.5)	18,3 (24.5)	
	7	22,8 (1.39)	2800	138 (2000)	60,6 (16)	17,9 (24)	

See page 6 speed correction curve.

V2010 model series	Ring size (Delivery USgpm @ 1200 r/min & 100 psi)	Displ. cm^3/r (in^3/r)	Max. speed r/min	Maximum pressure bar (psi)	Typical delivery L/min (USgpm) @ max. speed & pressure	Typical input power kW (hp) @ max. speed & pressure	Approx. total weight kg (lb)
Shaft-end pump	12	39 (2.38)	2400	152 (2200)	87,1 (23)	26,8 (36)	15,9 (35)
	13	42,4 (2.59)	2400	152 (2200)	98,4 (26)	29,1 (39)	
Cover- or shaft-end pump	6	19,5 (1.19)	3000	172 (2500)	54,9 (14.5)	19,4 (26)	
	7	22,8 (1.39)	3000	172 (2500)	62,5 (16.5)	22,4 (30)	
	8	26,5 (1.62)	2800	172 (2500)	66,2 (17.5)	24,2 (32.5)	
	9	29,7 (1.81)	2800	172 (2500)	75,7 (20)	26,8 (36)	
	11	36,4 (2.22)	2500	172 (2500)	87,1 (23)	28 (37.5)	

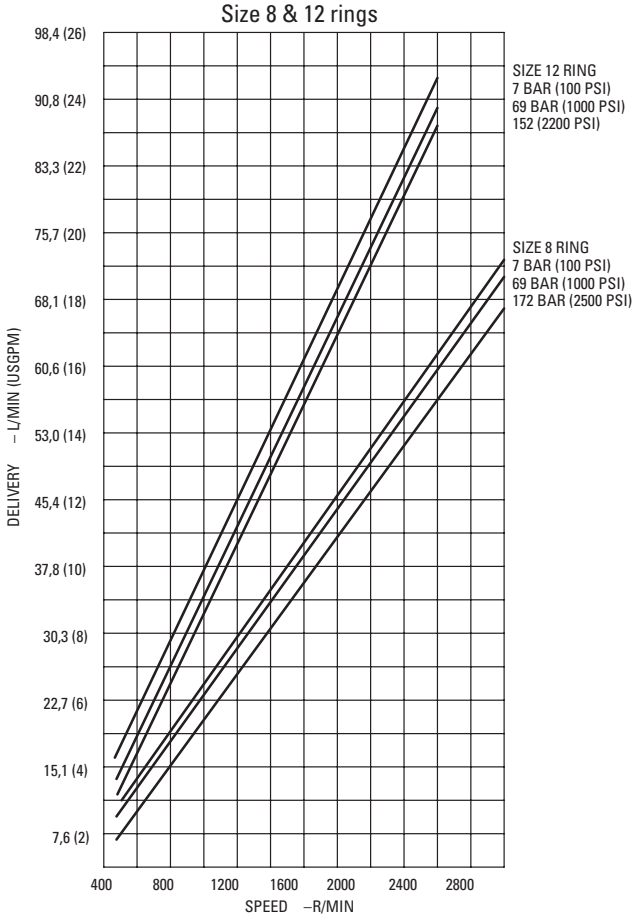
See page 6 speed correction curve.

Double Pumps

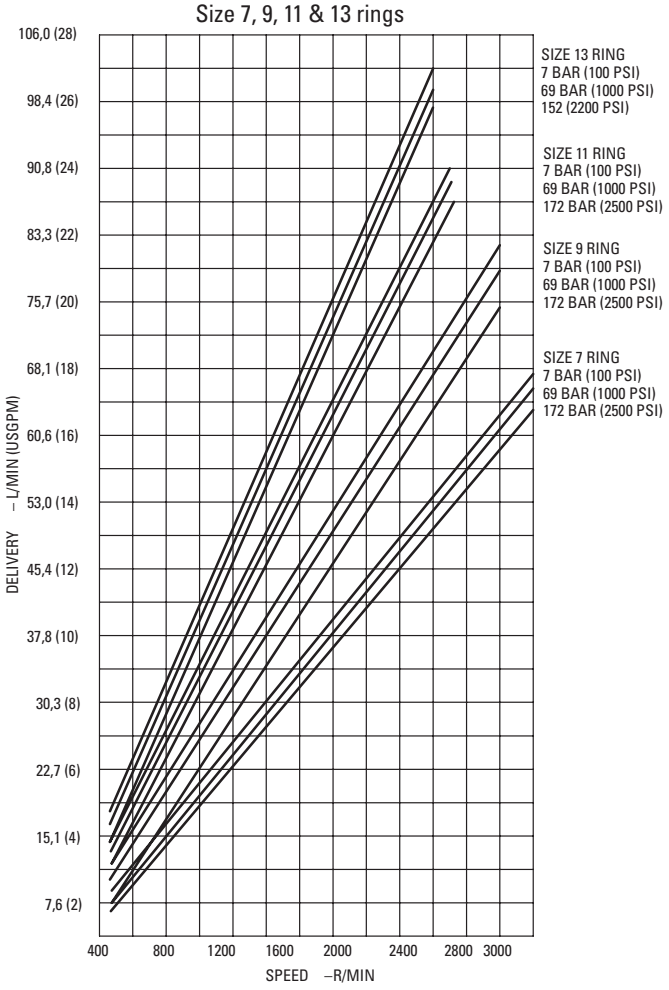
V2010 & V2020 Shaft-end Pump Performance

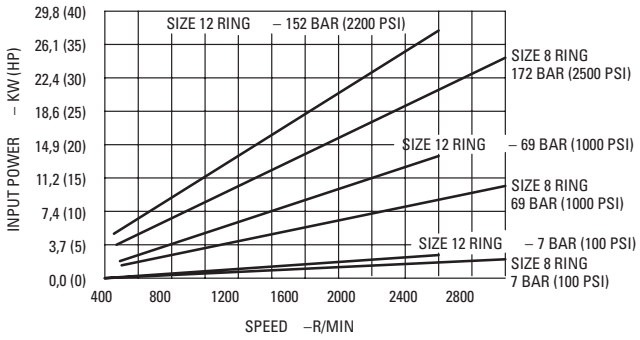
Oil temp. 49°C (120°F), viscosity 32 cSt (150 SUS) @ 38°C (100°F), inlet pressure zero

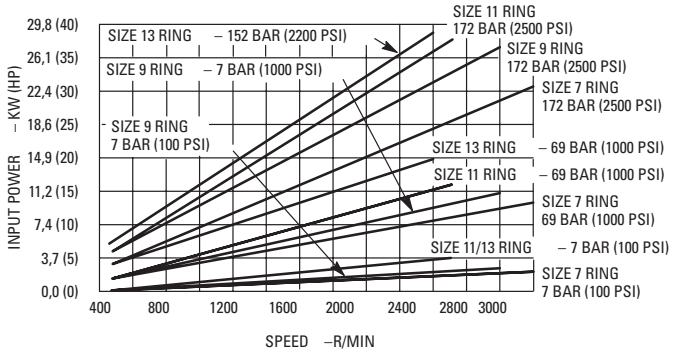
Size 8 & 12 rings



Size 7, 9, 11 & 13 rings





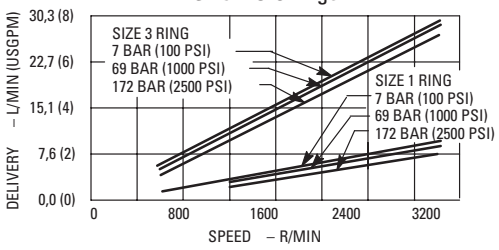


Double Pumps

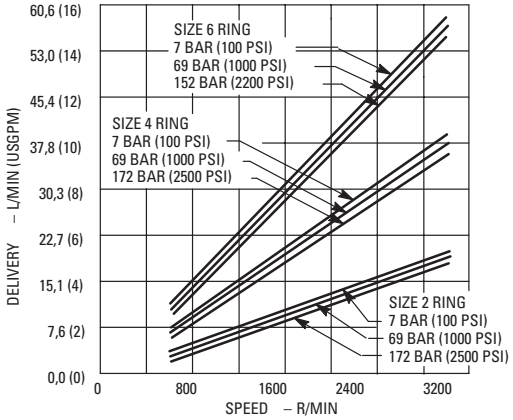
V2010 Cover-end Pump Performance

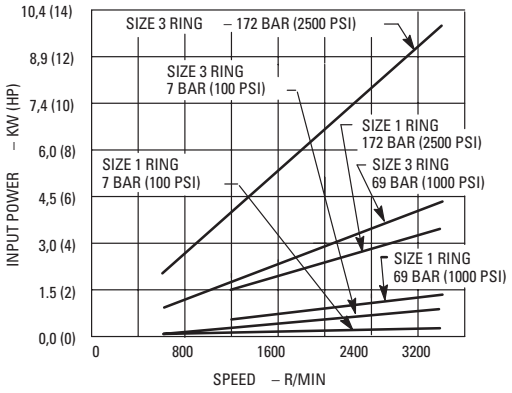
Oil temp. 49°C (120°F), viscosity 32 cSt (150 SUS) @ 38°C (100°F), inlet pressure zero

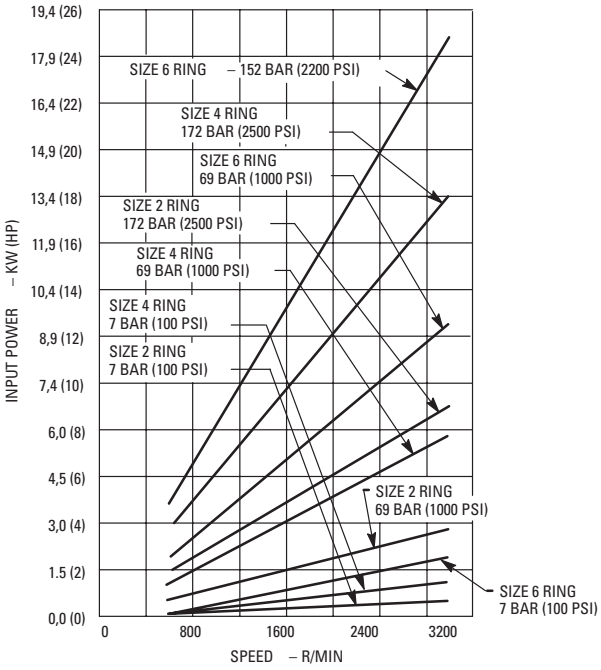
Size 1 & 3 rings



Size 2, 4 & 6 rings





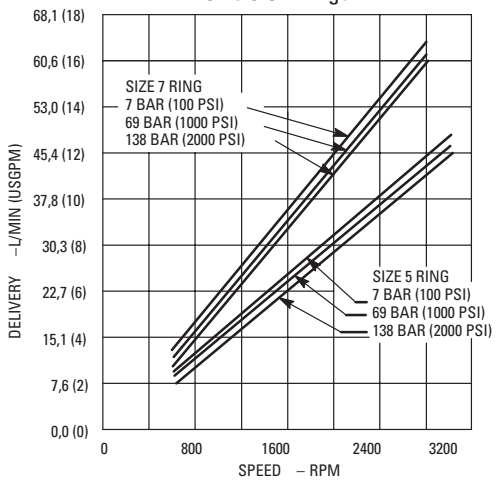


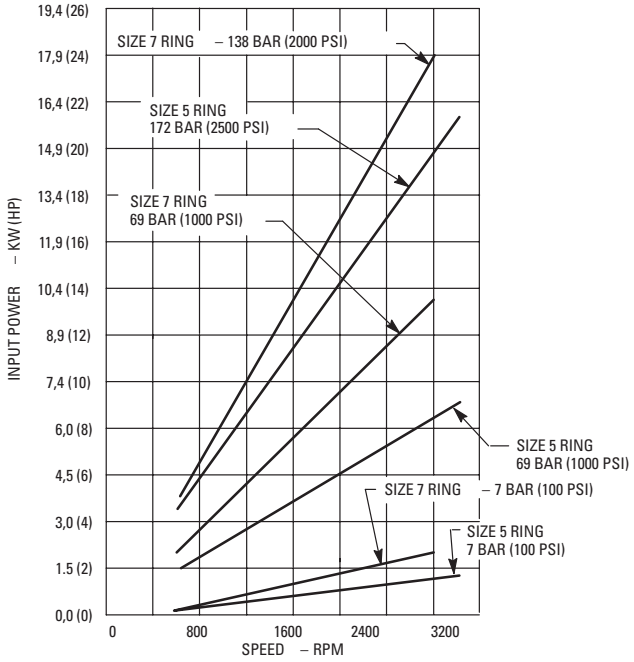
Double Pumps

V2010 Cover-end Pump Performance

Oil temp. 49°C (120°F), viscosity 32 cSt (150 SUS) @ 38°C (100°F), inlet pressure zero

Size 5 & 7 rings



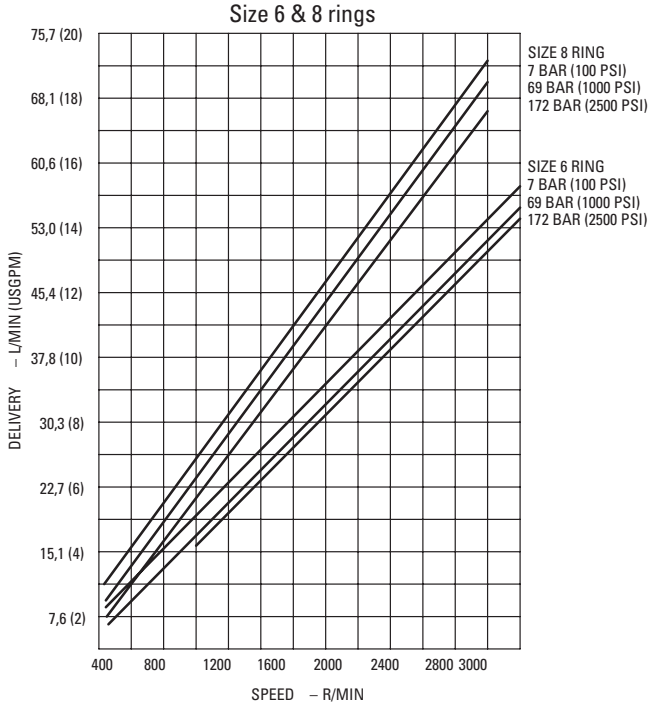


Double Pumps

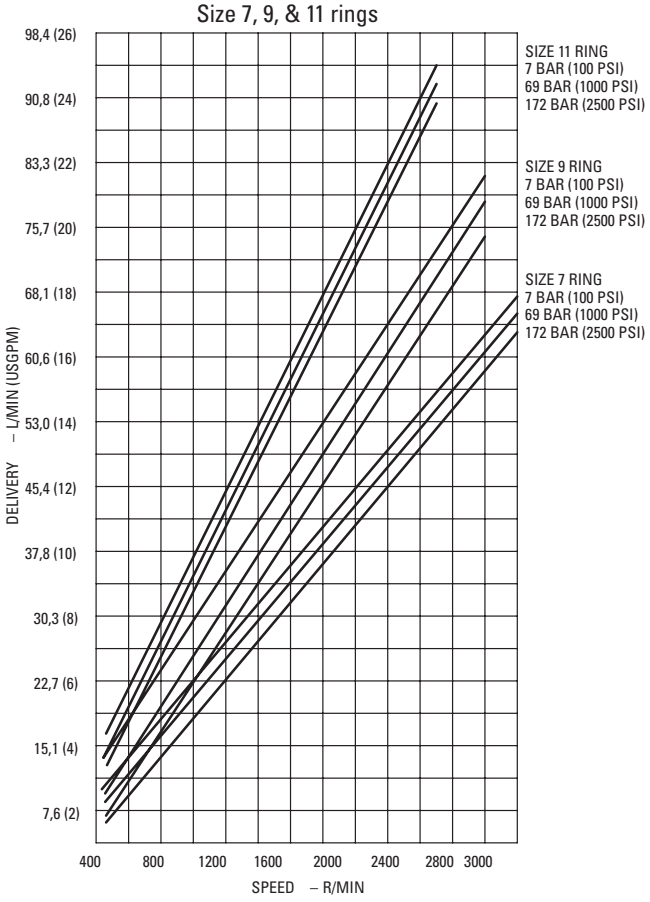
V2020 Cover-end Pump Performance

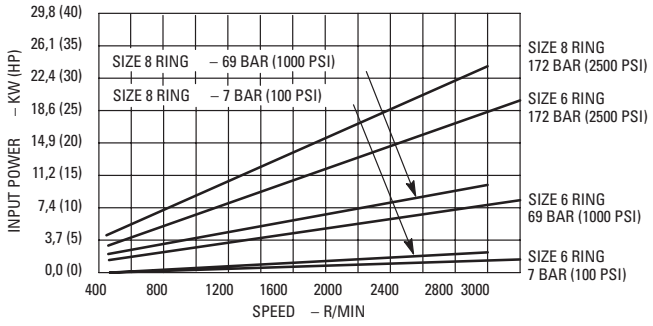
Oil temp. 49°C (120°F), viscosity 32 cSt (150 SUS) @ 38°C (100°F), inlet pressure zero

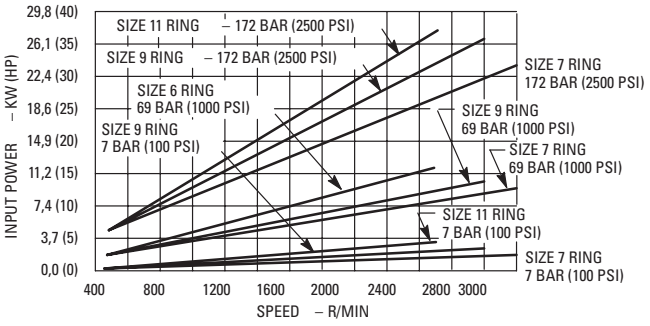
Size 6 & 8 rings



Size 7, 9, & 11 rings







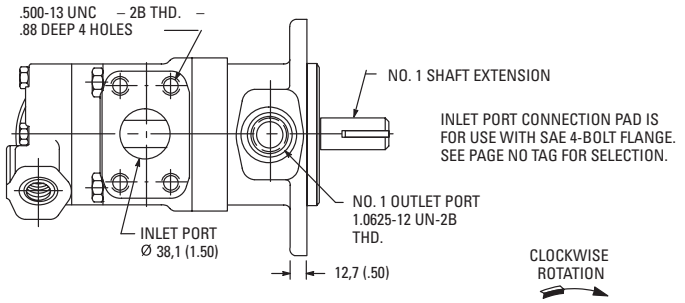
Double Pumps

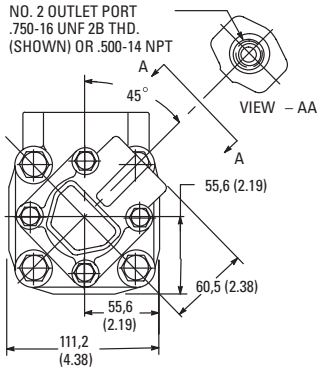
V2010 Dimensions

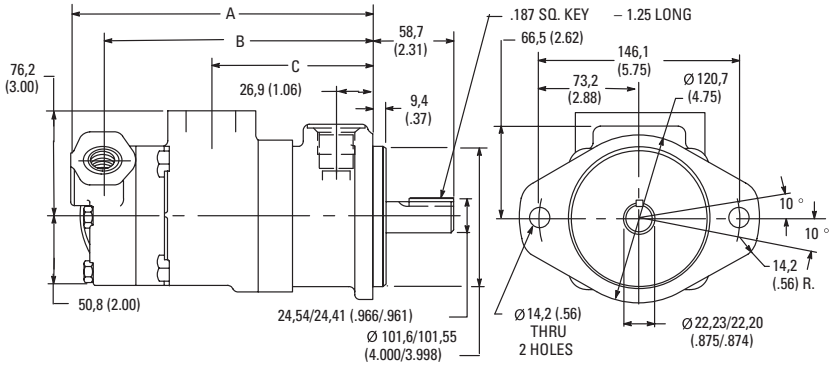
Millimeters (inches)

See page 23 for foot mounting dimensions.

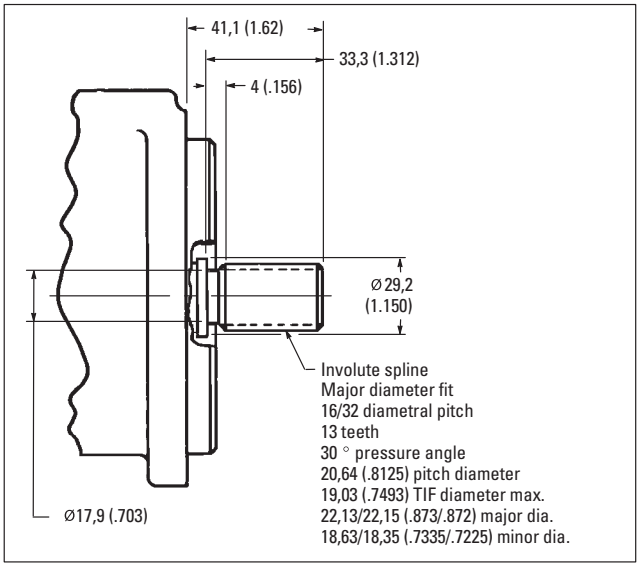
Rated Delivery, gpm @ 1200 rpm & 100 psi		Dimensions		
Shaft end	**Cover end**	**A**	**B**	**C**
7,8 or 9	1, 2 or 3	213,1 (8.39)	189,2 (7.45)	113,3 (4.46)
7,8 or 9	4 or 5	219,5 (8.64)	195,6 (7.70)	113,3 (4.46)
7,8 or 9	6 or 7	224,5 (8.84)	200,7 (7.90)	113,3 (4.46)
11	1, 2 or 3	218,2 (8.59)	194,3 (7.65)	118,1 (4.65)
11	4 or 5	224,5 (8.84)	200,7 (7.90)	118,1 (4.65)
11	6 or 7	229,6 (9.04)	205,7 (8.10)	121,7 (4.79)
12 or 13	1, 2 or 3	221,7 (8.73)	197,9 (7.79)	121,7 (4.79)
12 or 13	4 or 5	227,8 (8.97)	204,0 (8.03)	121,7 (4.79)
12 or 13	6 or 7	232,9 (9.17)	209,0 (8.23)	121,7 (4.79)







Number 11 shaft

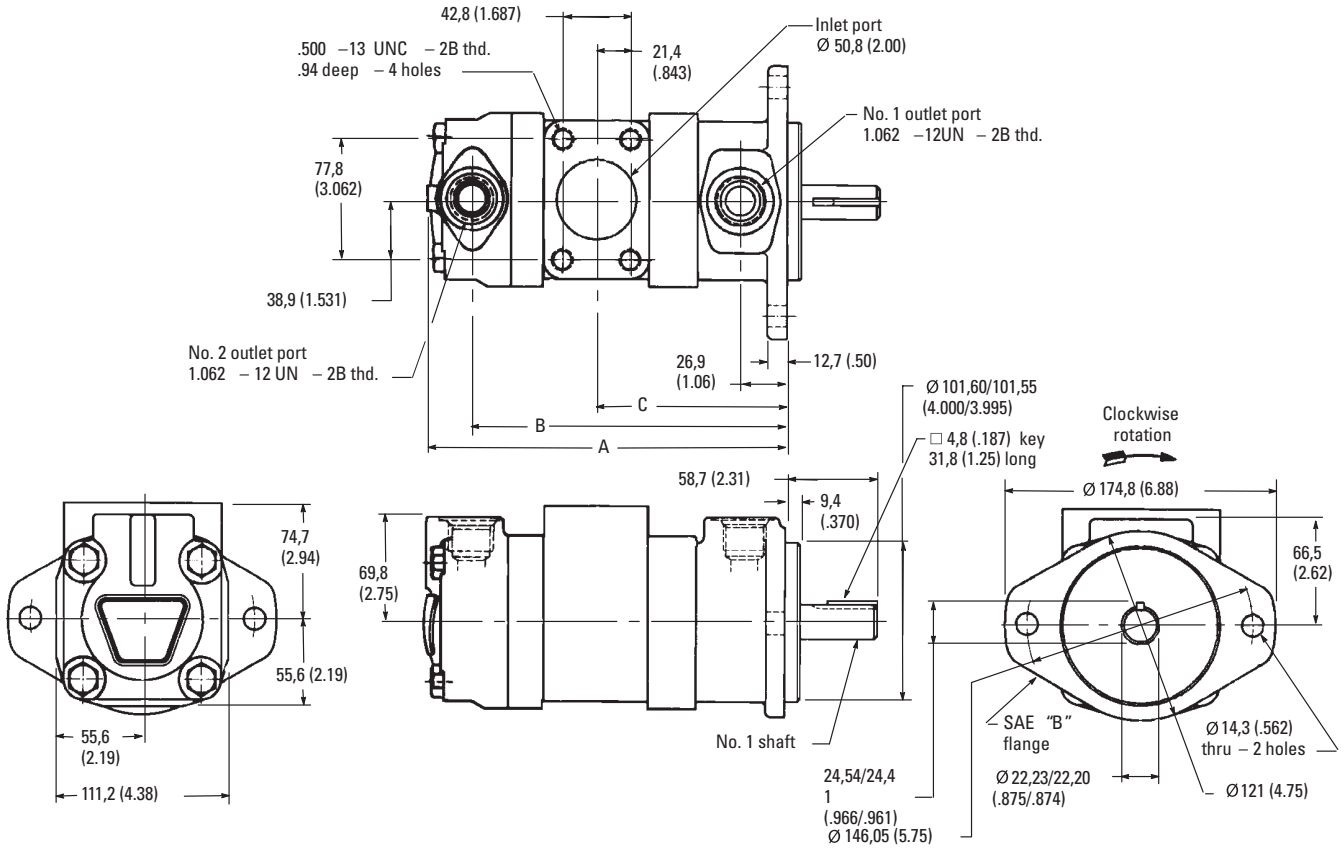


Double Pumps

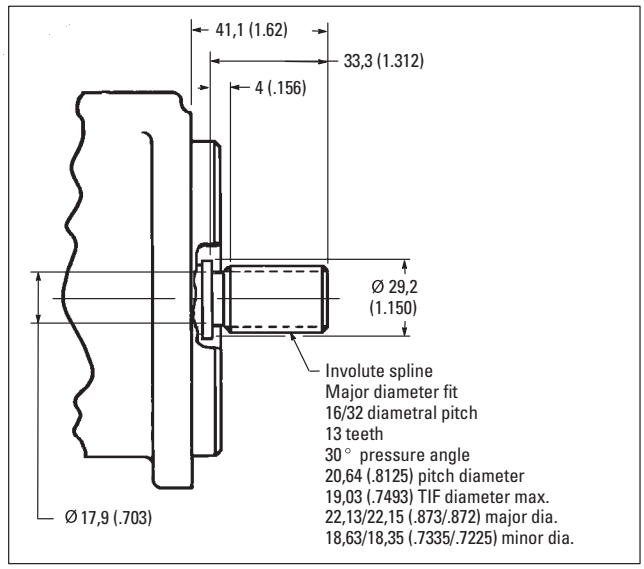
V2020 Dimensions

Millimeters (inches)

See page 23 for foot mounting dimensions.



Number 11 shaft

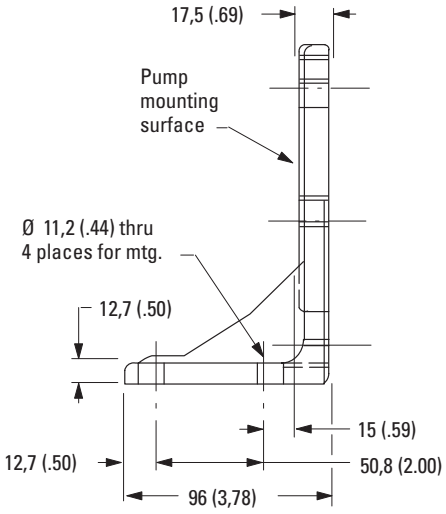


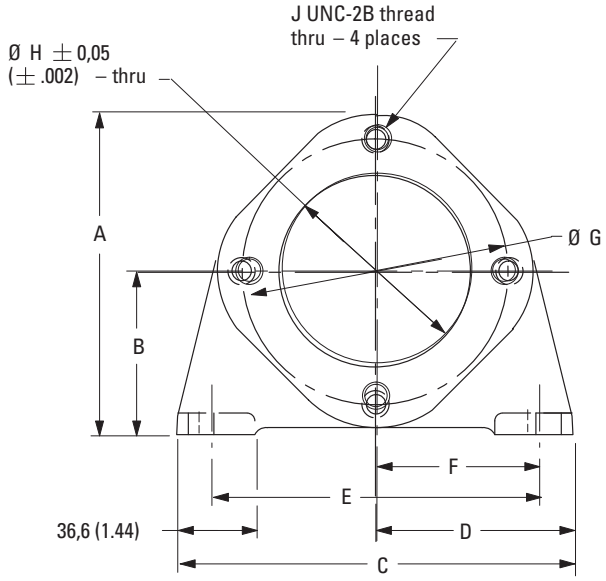
Ring size		Dimensions		
Shaft end	**Cover end**	**A**	**B**	**C**
7, 8 or 9	6	213,6 (8.41)	187,7 (7.39)	114 (4.49)
7, 8 or 9	7, 8 or 9	220 (8.66)	194 (7.64)	114 (4.49)
11	6	218,7 (8.61)	192,8 (7.59)	119,1 (4.69)
11	7, 8 or 9	225 (8.86)	199,1 (7.84)	119,1 (4.69)
11	11	229,9 (9.05)	204 (8.03)	119,1 (4.69)
12 or 13	6	222,2 (8.75)	196,3 (7.73)	122,4 (4.82)
12 or 13	7, 8 or 9	228,3 (8.99)	202,4 (7.97)	122,4 (4.82)
12 or 13	11	233,4 (9.19)	207,5 (8.17)	122,4 (4.82)

Foot Bracket Kit

Dimensions

Millimeters (inches)





Note: Each kit includes screws for mounting pump to bracket.

Model	A	B	C	D	E	F	øG	øH	J
FB-A-10	134,9 (5.31)	69,8 (2.75)	152,4 (6.00)	76,2 (3.00)	127,0 (5.00)	63,5 (2.50)	106,37 (4.188)	82,63 (3.253)	.375-16
FB-B-10	180,8 (7.12)	92,2 (3.63)	171,4 (6.75)	85,7 (3.38)	146,0 (5.75)	73,1 (2.88)	146,0 (5.75)	101,68 (4.003)	.500-13

Minimum Speed

Minimum recommended starting speed is generally 600 r/min. However, the pump size, system characteristics and environmental conditions can raise or lower this speed. A lower speed can often be achieved after the pump has primed.

If low starting or operating speeds are required, consult your Vickers representative.

Inlet Pressure

Recommended inlet pressure is 0 to 0,34 bar (0 to 5 psi) gauge at maximum operating speeds. Inlet pressure should not exceed 0,69 bar (10 psi). Inlet depressions should not exceed 5 inches of Hg with petroleum oil, or 3 inches of Hg with all other fluids.

A pressurized reservoir system does not always assure a positive (supercharge) pressure at the pump inlet. Vacuum at the pump inlet can result during cold start-ups. Avoid high speeds until the circuit has warmed and supercharge pressure actually exists at the pump inlet.

Drives

Vickers pumps are designed for use on direct coaxial drives. If drives imposing radial or axial loads are being considered, consult your Vickers representative for additional information.

Concentricity and angular alignment of shafts are important to pump life. Misalignment can induce heavy loads on bearings, causing premature failure.

Flexible coupling halves must be aligned according to the coupling manufacturer's recommendations.

When using double universal joint couplings, the shafts must be parallel and the yokes must be in line. The offset should be kept as low as possible. Maximum allowable offset will, of course, vary with application conditions. The pump shaft to universal joint diametral fit should be close (major diameter fit) with no looseness.

Mounting Dimensions

Concentricity of the customer's female pilot diameter relative to the effective axis of the female drive must be within 0,10 mm (.004 in.) total indicator reading. The clearance between the male and female pilot diameters must be +0,01 to +0,05 mm (+.0005 to +.0020 in.).

The customer's mounting face to which the pump is affixed must be square to the axis of the female drive within 0,04 mm per mm (.0015 in. per in.).

Dimensions of the customer's keyed shaft receiver must be between +0,003 and +0,025 mm (+.0001 and +.0010 in.) of the maximum shaft diameter shown on the Vickers installation drawing.

Valves and Circuitry

Protect against hydraulic surge pressures (inlet or outlet) applied to or generated by the pump. Relief valves must prevent these surges from exceeding published pressure ratings.

Never assume a relief valve setting is the maximum pressure a pump experiences. Shock conditions may exist which can exceed circuit and pump limitations.

Shaft Loading

Never assume pumps in a double pump assembly can be simultaneously loaded to rated pressure. Shaft loading must be checked for excessive torque and side loads.

Piping

Hydraulic lines should be as short and have as large an inside diameter as possible. Where lines are long, it is desirable to adapt to a larger capacity line than a unit's ports specify. Inlet, outlet and drain lines should not be smaller than the nominal port size shown on installation drawings. A "Y" shaped inlet should not be used to feed two separate pumps because one may be starved and cavitate.

There should be as few bends and fittings in lines as possible. High-pressure lines and fittings are restrictive to flow and may result in excessive pressure drop through the system. They should be used only where necessary in a pressure line.

Hose

When installing a hose, allow enough slack to avoid kinking. A taut hose will not allow movement with pressure surges. Slack in the line compensates for surges, relieving strain. The hose should not be twisted during installation or while in operation. Twisting will weaken the hose and loosen connections.

A neater installation is usually obtainable by using extra fittings to minimize unusually long loops in a line. Hoses should be clamped to prevent rubbing and entanglement with moving parts. Where hoses are subject to chafing, they should be run through protective neoprene hose or shielded metallic guards.

Hydraulic Fluids

Pumps can be used with anti-wear hydraulic oil, or automotive type crankcase oil (designations SC, SD, SE, SF, or SG) per SAE J183 JUN89. Fire-resistant fluids can also be used, but may require the use of special seals as explained in the following "Seals" section.

The viscosity range of petroleum oil, with the pump running, should be 13-54 cSt (70-250 SUS). The oil viscosity at 38° C (100° F) should be 32-48 cSt (150-225 SUS).

Fire-resistant fluids should have a viscosity as close as possible to that of petroleum oil as described above. A maximum specific gravity of 1.3 is suggested for fire-resistant fluids.

An operating temperature of 49° C (120° F) is recommended. The maximum temperature for oil should be 65° C (150° F), and the maximum for water-containing fluids should be 130° F.

For additional fluid and temperature information, refer to 694.

Seals

Nitrile seals are standard and are suitable for use with petroleum, water-glycol, water-in-oil emulsion, polyolester, and high-water-base fluids. Phosphate ester fluids require the use of fluorocarbon seals, which are identified in model codes as an "F3" prefix.

Fluid Cleanliness

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.

Essential information on the correct methods for treating hydraulic fluid is included in Vickers publication 561; "Vickers Guide to Systemic Contamination Control," available from your local Vickers distributor or by contacting Vickers, Incorporated. Recommendations on filtration and the selection of products to control fluid condition are included in 561. Recommended cleanliness levels, using petroleum oil under common conditions, are based on the highest fluid pressure levels in the system and are coded in the chart below. Fluids other than petroleum, severe service cycles, or personnel safety considerations are cause for adjustment of these cleanliness codes. See Vickers publication 561 for exact details.

Vickers products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Other manufacturers will often recommend levels above those specified. Experience has shown, however, that life of any hydraulic components is shortened in fluids with higher cleanliness codes than those listed below. These codes have been proven to provide a long trouble-free service life for the products shown, regardless of the manufacturer.

Product	System Pressure Level – bar (psi)		
	<70 (<1000)	**70-210 (1000-3000)**	**210+ (3000+)**
Vane Pumps – Fixed	**20/18/15**	**19/17/14**	**18/16/13**
Vane Pumps – Variable	18/16/14	17/15/13	
Piston Pumps – Fixed	19/17/15	18/16/14	17/15/13
Piston Pumps – Variable	18/16/14	17/15/13	16/14/12
Directional Valves	20/18/15	20/18/15	19/17/14
Pressure/Flow Control Valves	19/17/14	19/17/14	19/17/14
CMX Valves	18/16/14	18/16/14	17/15/13
Servo Valves	16/14/11	16/14/11	15/13/10
Proportional Valves	17/15/12	17/15/12	15/13/11
Cylinders	20/18/15	20/18/15	20/18/15
Vane Motors	20/18/15	19/17/14	18/16/13
Axial Piston Motors	19/17/14	18/16/13	17/15/12
Radial Piston Motors	20/18/14	19/17/13	18/16/13

Application and Service Information

Aeration

Reservoir and circuit design must prevent aeration of the fluid. Particular care must be used to employ joints, seals and gaskets that will not leak or deteriorate. This is especially important in low pressure and suction lines. Connections should always be tight to prevent air from entering the system.

It is best to use windows and sight glasses in the reservoir and inlet lines during prototype evaluation to determine whether significant amounts of air are present in the fluid. Any opaqueness or milky appearance of the fluid in the lines or reservoir indicates excessive aeration. Bubbles on the surface of the reservoir fluid may indicate that excessive aeration is present.

Reservoir

The oil level of the reservoir should be as high as possible above the pump suction line opening. All return lines should discharge near the tank bottom, always below the oil level, and as far from the pump inlet as possible.

Reservoirs should incorporate a sight gauge, dipstick or other means for easy checking of the oil level. Without these devices, the oil level often goes unchecked and, should a leak occur, the pump can be starved and damaged from loss of lubrication.

Preferably, reservoirs should be located above pumps. This creates a flooded pump inlet which reduces the possibility of pump cavitation.

Pump suction and tank return lines should be attached to the reservoir by flanges or welded heavy-duty coupling. If the suction line is connected to the bottom of the reservoir, the coupling should extend above the bottom inside the tank. This prevents residual dirt from getting into the suction line when the tank is cleaned. The seals used on all suction line connections should be such that they will not deteriorate and leak.

A baffle plate in the reservoir is desirable to separate the suction and return lines. The plate causes return oil to circulate around the outer wall of the reservoir for cooling before it re-enters the pump. It also helps provide time for entrained air to separate from the oil. Baffle plate openings should be designed so that cascade effects and resultant air entrainment are minimized.

Most reservoirs are vented to the atmosphere through an opening that lets air leave or enter the space above the oil as the oil level rises or falls. A filler/breather unit containing an air filtering element is often used as the vent. It must be large enough to handle the air flow required to maintain atmospheric pressure whether the tank is full or empty.

Startup

Before starting, fill the pump with system fluid through the uppermost port. The housing must be kept full at all times to provide internal lubrication.

At initial startup, it may be necessary to bleed air from the pump outlet to permit priming and reduce noise. Bleed by loosening an outlet connection until a solid stream of fluid appears. An air bleed valve for this purpose is available through your Vickers representative.

Application Guidance

To ensure optimum pump performance in conjunction with your specific application, consult your Vickers representative if your:

- Application requires an indirect drive
- Fluid does not meet specifications
- Mounting attitude is other than horizontal
- Oil viscosity at operating temperature is not within 13-54cSt
- (70-250 SUS)
- Oil viscosity at startup is in excess of 220 cSt (1000 SUS)
- Needs require application assistance

Service Information

Refer to the following drawings for service parts information:

Model Series	Drawing
V10	M-2005-S
V20	M-2004-S
V2010	M-2255-S
V2020	M-2256-S

The overhaul manual for V10 and V20 models is I-3143-S.

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Powering Business Worldwide

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Eaton PVH Variable Displacement Piston Pumps

Vickers® Product Line

57-141 cc³ (3.5-8.6 in³)

H-Series Industrial Variable Displacement

H-Series Mobile Variable Displacement



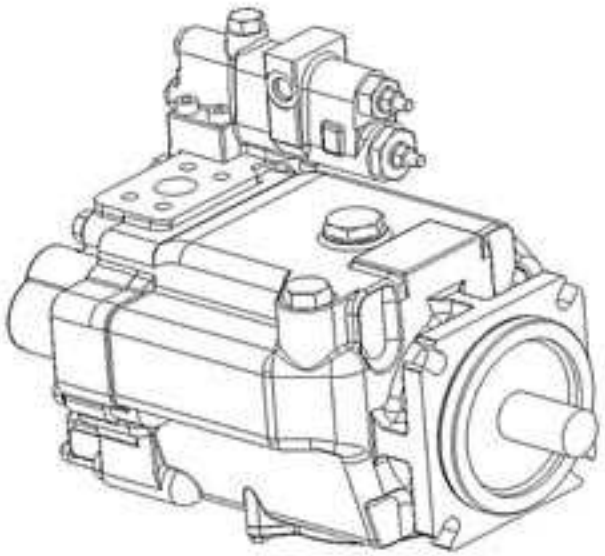
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Introduction



Eaton's Vickers® PVH high flow, high performance pumps are a family of variable displacement, inline piston units that incorporate the proven design, quality manufacturing techniques and operating features of other Vickers piston pumps, but in a smaller, lighter package.

The PVH series has been specially designed to meet the 250 bar (3625 psi) continuous duty performance requirements of new generation equipment designs.

These are efficient, reliable pumps, with a selection of optional controls for maximum operational flexibility. Designed specifically for strenuous application, they provide the productivity gains and controllability improvements desired in earthmoving, construction, machine tool, plastics, and all other energy-conscious markets. As with all Eaton products, these pumps have been fully laboratory tested and field proven.

PVH Series Benefits

- Versatile design includes single pumps, thru-drive arrangements, and a variety of drive shaft and control options that will adapt to any application and provide the most cost effective installation.
- Proven components designed into a heavy duty, compact housing to provide 250 bar (3625 psi) continuous operating performance, and 280 bar (4050 psi) operating performance in a load sensing system. This design assures long life at the higher performance levels required of today's power-dense machinery.
- Compact and lightweight design to reduce the application weight, and provide better access for installation and servicing.
- Service kits developed for the most critical rotating and control components to simplify and assure successful pump servicing.
- Quiet designs available for noise-sensitive industrial applications, reducing sound levels further to provide a more acceptable environment.
- Designed for maximum efficiency in any type of application. A variety of compensators provide the most effective system control, and the 95%-plus volumetric efficiency means more flow, and more input energy, is directed to the work and not into heat and waste.
- Heavy duty bearings and shafts result in minimum internal deflections and wear, providing for longer life and maximum uptime.

Hydraulic System Design Calculations

Basic Formulas

Output Flow (Q)

$$lpm = \frac{cm^3/r \times rpm}{1000} \qquad gpm = \frac{in^3/r \times rpm}{231}$$

Input Power (P)

$$kW = \frac{l/min \times bar}{600} \qquad hp = \frac{gpm \times psi}{1714}$$

Shaft Torque (M)

$$N\text{-}m = \frac{bar \times cm^3/r}{62.8} \qquad lb\text{-}in = \frac{psi \times in^3/r}{6.28}$$

Shaft Speed (n)

$$rpm = \frac{1000 \times 1/min}{cm^3/r} \qquad RPM = \frac{231 \times gpm}{in^3/r}$$

Output Power (P)

$$kW = \frac{N\text{-}m \times RPM}{9549} \qquad hp = \frac{lb\text{-}in \times rpm}{63{,}025}$$

Volumetric Displacement

$$cm^3/r = \frac{lpm \times 1000}{rpm} \qquad in^3/r = \frac{gpm \times 231}{rpm}$$

Basic Formulas

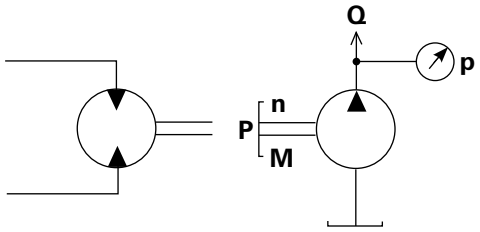
bar = 10 Newtons/cm^2
gpm = gallons per minute
hp = horsepower
lb-in = pound inch
lb-ft = pound feet
kW = kilowatt
kgf = kilograms force
l/min = liters per minute
N-m = Newton meters
psi = pounds per square inch
rpm = revolutions per minute

Efficiencies

$$\text{Volumetric } Nv = \frac{\text{gpm actual}}{\text{gpm theorectical}}$$

$$\text{Mechanical } Nm = \frac{\text{lb-in actual}}{\text{lb-in theorectical}}$$

Total Nt = Nv x Nm

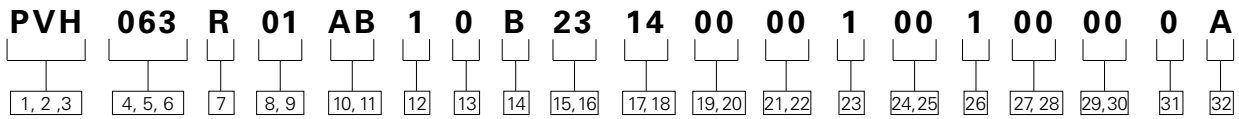


Commonly Used Conversions

To Convert	Into	Multiply by
bar	psi	14.5
cm^3	in^3	0.06102
˚C	˚F	(˚C x 1.8) +32
gallons (US)	liters	3.785
kg	lbs	2.205
kgf/cm^2	psi	14.2
kW	hp	1.341
liters	US Gallons	0.2642
mm	inches	0.03937
N-m	lb-in	8.85
N-m	lb-ft	0.7375
˚F	˚C	(˚F-32)/1.8
hp	kW	0.7457
inch	mm	2.54
in^3	cm^3	16.39
lb-in	N-m	0.113
lb-ft	N-m	1.356
lbs	kg	0.4535
psi	bar	0.06896
psi	kgf/cm^2	.070307

Note: Performance charts can be found on subsequent pages.

Model Codes
PVH Piston Pump



[1, 2, 3] **Pump Series**
PVH – PVH OC Piston Pump

[4, 5, 6] Displacement
057 – 57.4 cm3/r [3.50 in3/r]
063 – 63.1 cm3/r [3.85 in3/r]
074 – 73.7 cm3/r [4.50 in3/r]
081 – 81.0 cm3/r [4.94 in3/r]
098 – 98.3 cm3/r [6.00 in3/r]
106 – 106.5 cm3/r [6.50 in3/r]
131 – 131.1 cm3/r [8.00 in3/r]
141 – 141.0 cm3/r [8.60 in3/r]

[7] **Rotation**
R – Right-Hand Rotation (cw)
L – Left-Hand Rotation (ccw)

[8, 9] **Front Mounting and Input Shaft**
01 – 4 Bolt C, 1-1/4 inch Dia. Keyed
02 – 4 Bolt C, 14T 12/24 DP Splined
03 – 4 Bolt C, 17T 12/24 DP Splined
04 – 4 Bolt C, 1-1/2 inch Tapered Shaft & Woodruff Keyway
05 – 4 Bolt C, 1-1/4 inch Dia. Tapered Keyed & 3/4-16 UNF-2A Ext Thread
08 – 2 Bolt B, 15T 16/32 DP Splined
0N – 4 Bolt M (ISO 125B4HW) with 32.1 (1.26) Dia Straight Keyed
10 – 4 Bolt C, 14T 12/24 DP Splined, 73.2 (2.88) Shaft Ext and 49.0 (1.93) Spline
13 – 4 Bolt C, 1-1/2 inch Dia Straight Keyed
16 – 4 Bolt C, 44.4 (1.75) Dia Straight Keyed
17 – 4 Bolt C, 1-1/4 in Dia Tapered Keyed & M20 x 1-1/2 in. Ext Thread
23 – 2 Bolt C, 17T 12/24 DP Splined Shaft
24 – 2 Bolt B 19T 24/48 DP Splined
30 – 4 Bolt C, 14T 12/24 DP Splined, 78.0 (3.07) Shaft Extension and 54.0 (2.12) Spline Length
51 – 2/4 Bolt C, 1-1/4 inch Dia Straight Keyed
52 – 2/4 Bolt C, 14T 12/24 DP Splined
53 – 2/4 Bolt C, 17T 12/24 DP Splined
58 – 2 Bolt B, 15T 16/32 DP Splined
60 – 2/4 Bolt C, 14T 12/24 DP Splined, 73.2 (2.88) Shaft Extension and 49.0 (1.93) Spline Length
62 – 2 Bolt C, 13T 8/16 DP Splined

[10, 11] **Main Ports Size & Location**
AA – Side Ports; Suction 2 in. (Code 61) Pressure 1 in. (Code 61)
AB – Side Ports; Suction 2 in. (Code 61) - w/ M12 Threads; Pressure 1 in. (Code 61) - w/ M10 Threads
AC – Side Ports; Suction 2 in. (Code 61) - w/ M12 Threads; Pressure 1.25 in. (Code 61) - w/ M12 Threads
AD – Side Ports; Suction 2.5 in. (Code 61) w/ M12 Threads; Pressure 1 in. (Code 61) w/ M10 Threads
AE – Side Ports; Suction 2.5 (Code 61) w/ M12 Threads; Pressure 1.25 (Code 61) w/ M12 Threads
AF – Side Ports; Suction 2.5 in. (Code 61) ; Pressure - 1.25 in. (Code 62)
AG – Side Ports; Suction - 2.5 in. (Code 61) w/ M12 Threads; Pressure - 1.25 in. (Code 62) w/ M14 Threads
AH – Side Ports; Suction - 2.0 in. (Code 61) w/ M12 Threads; Pressure - 1.0 in. (Code 61) w/ M12 Threads
AJ – Side Ports; Suction 2.5 in. (Code 61); Pressure 1.0 in. (Code 61)
AL – Side Ports; Suction - 2.5 in. (Code 61); Pressure - 1.25 in. (Code 61)

[12] **Drain Ports Size & Location**
1 – #8 SAE O-Ring Port - Bottom (Top Plugged)
2 – #8 SAE O-Ring Port - Top (Bottom Plugged)
3 – #10 SAE O-Ring Port - Bottom (Top Plugged)
4 – #10 O-Ring Port - Top (Bottom Plugged)
5 – #8 3/4-16 UNF-2B SAE O-Ring Port - Bottom (Top Plugged)
6 – #8 3/4-16 UNF-2B SAE O-Ring Port - Top (Bottom Plugged)
7 – #10 7/8-14 UNF-2B SAE O-Ring Port - Bottom (Top Plugged)
8 – #10 7/8-14 UNF-2B SAE O-Ring Port - Top (Bottom Plugged)
9 – #12 SAE O-Ring Port - Bottom (Top Plugged)
A – #12 SAE O-Ring Port - Top (Bottom Plugged)
B – M22 x 1.5 Metric O-Ring - Bottom (Top Plugged)
C – M22 X 1.5 Metric O-Ring - Top (Bottom Plugged)
F – Vertical Mount w/ G 1/2 BSPP - Bottom (Top Plugged)
G – Vertical Mount w/ G 1/2 BSPP - Top (Bottom Plugged)

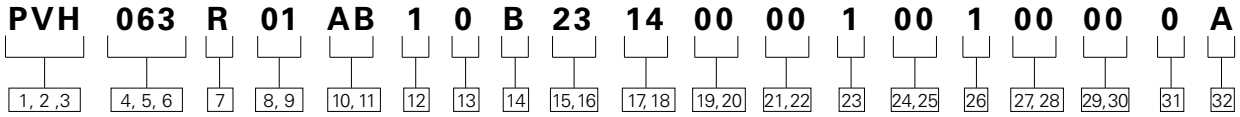
[13] **Diagnostic Pressure Ports**
0 – No Diagnostic Pressure Ports

[14] **Controller Type***
A – Pressure Compensator
B – Pressure And Flow Compensator
D – Pressure Compensator w/ Torque Sensing
E – Pressure And Flow Compensator w/ Torque Sensing
G – IC Pressure Compensator
H – IC Pressure and Flow Compensator
J – IC Pressure and Flow Compensator w/ Torque Sensing
N – Pressure and Flow Compensator w/ Unload Valve

** Torque control is not available with case-to-inlet check value.*

Specify "AA" Pump Special Features

Model Codes
PVH Piston Pump



15,16 **Pressure Comp. Setting**
07 – 66-74 bar [957-1073 psi]
23 – 226-234 bar [3278-3394 psi]
25 – 246-254 bar [3568-3684 psi]
Other Settings Available by Request

17,18 **Flow Compensator Setting**
00 – No Flow Comp. Setting
14 – 13-15 bar [189-218 psi]
24 – 23-25 bar [334-363 psi]
AA – Unload Valve Standby 39-41 bar [334-363 psi]
Other Settings Available by Request

19,20 **Torque Setting/ Other Comp.**
00 – None
04 – 36-44 bar [522-638 psi]
14 – 136-144 bar [1973-2089 psi]
AA – Unload Valve 186.2-193 bar [2700-2800 psi] Reset 157.8-164.6 bar [2288-2387 psi]
AB – Unload Valve 203.4-210.2 bar [2950-3050 psi] Reset 183-190 bar [2650-2748 psi]

21,22 **Control Special Features**
AB –** No Control Special Features
AA – Bleed Down Orifice 0.37 [.015] Ø
AR – Bleed Down Orifice 0.65 [.026] Ø
AV – 1.60 [.063] Ø Orifice (IC Control Only)
AW – 0.76 [.030] Ø Orifice (IC Control Only)

23 **Maximum Displacement Option**
1 – Standard Displacement (As given in code title)
2 – Adjustable Max Displacement (Set at Max)
F – Adjustable Max Displacement (Set at Max) w/ Extended Adjusting Screw
Other Settings Available by Request.

24,25 **Auxiliary (Rear) Mount and Output Shaft**
00 – No Auxiliary Mounting Features
AA – 2/4 Bolt C, 14T 12/24DP
AB – 2/4 Bolt B, 15T 16/32DP
AC – 2 Bolt A, 9T
AY – 2/4 Bolt B, 13T 16/32DP
AZ – 2/4 Bolt C, 17T 12/24DP
BA – 2 Bolt A, 11T 16/32DP

26 **Shaft Seal**
1 – Single, OneWay Shaft Seal, Viton®
3 – Single, OneWay Shaft Seal, Nitrile
5 – Double, TwoWay Shaft Seal, Viton® W/ VHO Filter
6 – Double, TwoWay Shaft Seal, Nitrile W/ VHO Filter

27,28 **Pump Special Features**
00 – No Pump Special Features
AA – No Case To Inlet Check
AE – Q250 Valve Plate, No Case To Inlet Check Valve
AF – Q140 Valve Plate, No Case To Inlet Check Valve
AP – Pressure Lube Swashplate
AR – Pressure Lube Swashplate, No Case To Inlet Check Valve
SC – Q250 Valve Plate, Grooved Saddle Bearings, No Case To Inlet Check Valve
BH – Q250 Valve Plate, Pressure Lube Swashplate
BM – Q250 Valve Plate, Pressure Lube Swashplate, No Case To Inlet Check Valve
BR – Q140 Valve Plate, Grooved Saddle Bearings, No Case To Inlet Check Valve

29,30 **Paint**
00 – No Paint
01 – Blue Primer

31 **Identification**
0 – Standard

32 **Design Code**
A – First Design

Performance Data

Performance data is typical with SAE 10W anti-wear hydraulic oil at 50°C (120°F) and at zero pump inlet pressure, except where otherwise indicated.

Rated Characteristics of PVH Industrial Pumps*

Parameters	PVH057	PVH063	PVH074	PVH081	PVH098	PVH106	PVH131	PVH141
Geometric displacement, max. cm^3/r	57,4	63,1	73,7	81,0	98,3	106,5	131,1	141,1
(in^3/r)	(3.5)	(3.85)	(4.5)	(4.94)	(6.0)	(6.50)	(8.0)	(8.60)
Rated pressure bar (psi)	250 (3625)†	230 (3300)†	250 (3625)†	230 (3300)†	250 (3625)†	230 (3300)†	250 (3625)†	230 (3300)†
Rated speeds in r/min at various inlet pressures								
127 mm Hg (5″ Hg)	1500	1500	1500	1500	1500	1500	1200	1200
Zero inlet pressure	1800	1800	1800	1800	1800	1800	1500	1500
0,48 bar (7 psi)	1800	1800	1800	1800	1800	1800	1800	1800
Typical effective flow in l/min (USgpm) Rated Pressure								
at 1500 r/min 83	102		140		186			
	(22)		(27)		(37)		(49)	
at 1800 r/min	98		125		170		223	
	(26)		(33)		(45)		(59)	

† In load sensing systems the compensator can be set at 280 bar (4060 psi).
* Industrial Valve Plates are specified in Pump Special Feature 'Q250' or 'Q140'

Ratings of PVH Industrial Pumps with Alternate Fluids

Parameters	Petroleum based	Polyol ester	Water glycol	HWBF(90–10) thickened
Max. pressure bar (psi)	250 (3625)	230 (3300)	172 (2500)	155 (2250)
Max. speed in r/min at:				
1,0 bar abs. (0 psi)	1800 ‡	1800	1800	1700
0,85 bar abs. (5″ Hg)	1500 □	1500	1500	1500
Max. inlet temp. deg. C (deg. F)	93 (200)	65 (150)	50 (120)	50 (120)

‡ 1500 rpm for PVH131/141 only. □ 1200 rpm for PVH131/141 only.

Rated Characteristics of PVH Mobile Pumps ◊

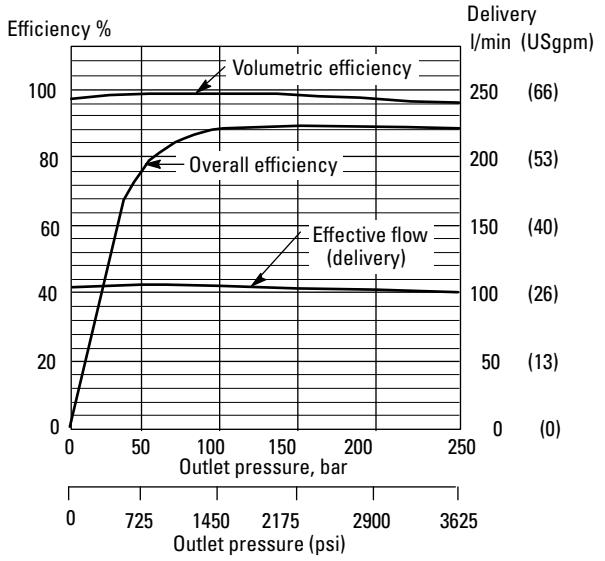
Parameters	PVH057	PVH063	PVH074	PVH081	PVH098	PVH106	PVH131	PVH141
Rated speeds in r/min at various inlet pressures								
127 mm Hg (5″ Hg)	2000	2000	1850	1850	1750	1750	1650	1500
Zero inlet pressure	2400	2400	2200	2200	2100	2100	2000	2000
0,48 bar (7 psi)	3000	3000	2750	2750	2600	2600	2500	2500
Typical effective flow in l/min (USgpm) at 250 bar (3625 psi) and rated speed @ zero inlet pressure	134 (35)	146 (38)	156 (41)	172 (45)	202 (53)	216 (57)	249 (66)	272 (72)

◊ Displacements & rated pressure are same as for PVH*** industrial pumps.

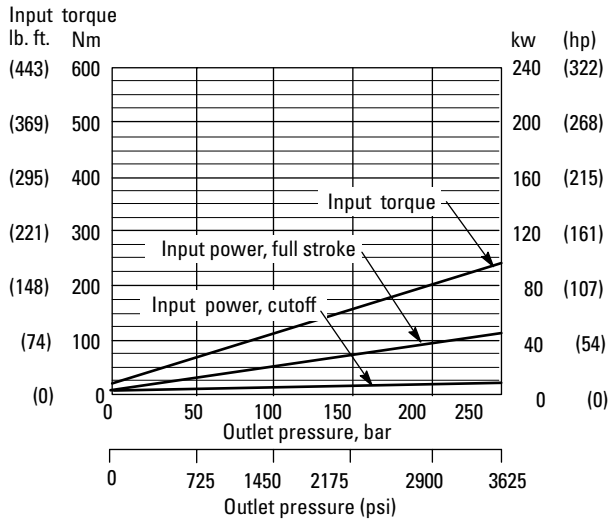
Performance Data

PVH057

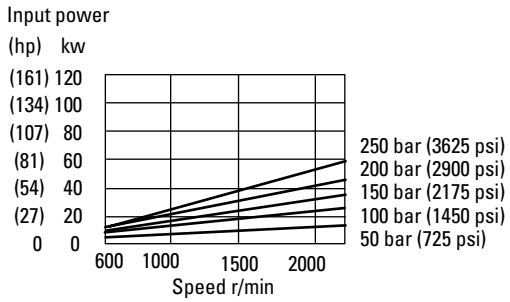
Delivery and efficiency versus outlet pressure at 1800 r/min



Input torque and power versus outlet pressure at 1800 r/min

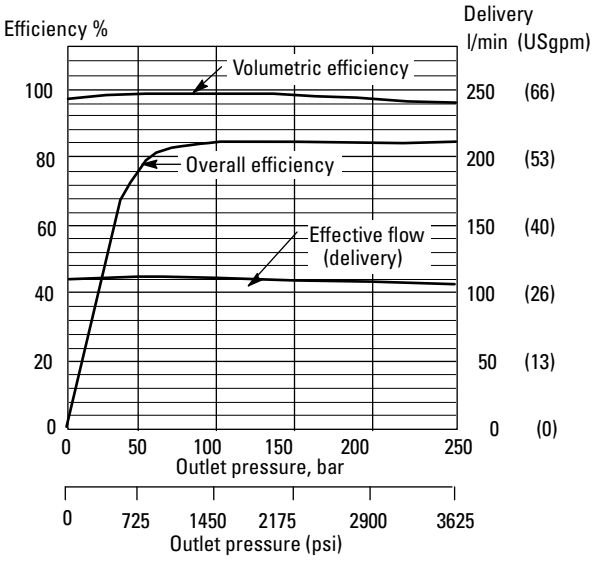


Input power versus speed

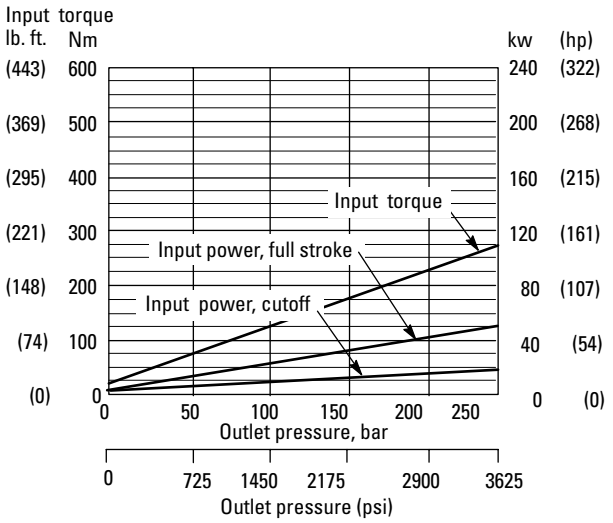


PVH063

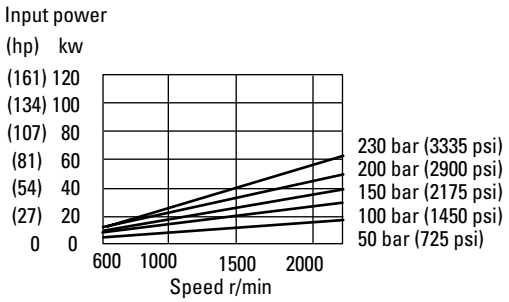
Delivery and efficiency versus outlet pressure at 1800 r/min



Input torque and power versus outlet pressure at 1800 r/min



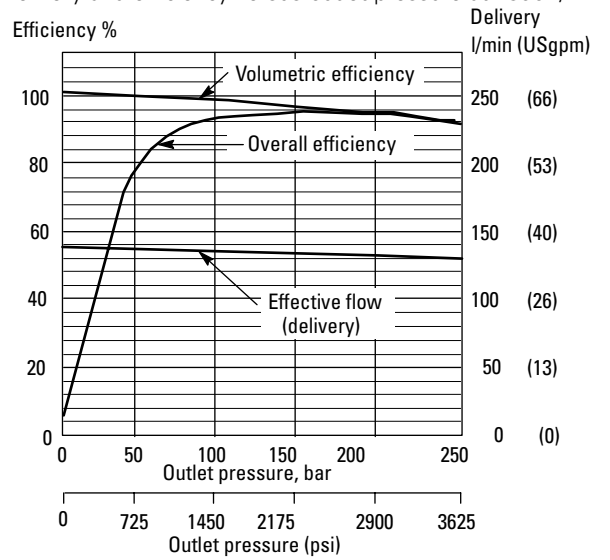
Input power versus speed



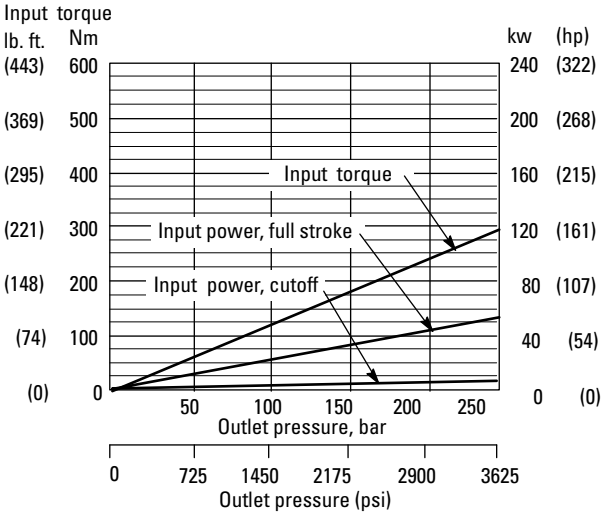
Performance Data

PVH074

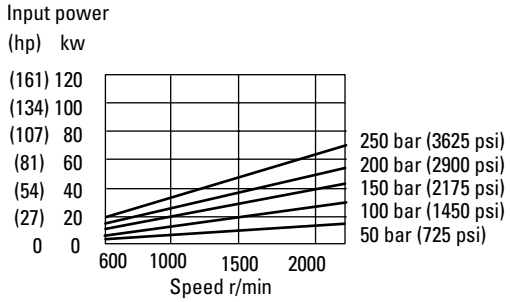
Delivery and efficiency versus outlet pressure at 1800 r/min



Input torque and power versus outlet pressure at 1800 r/min

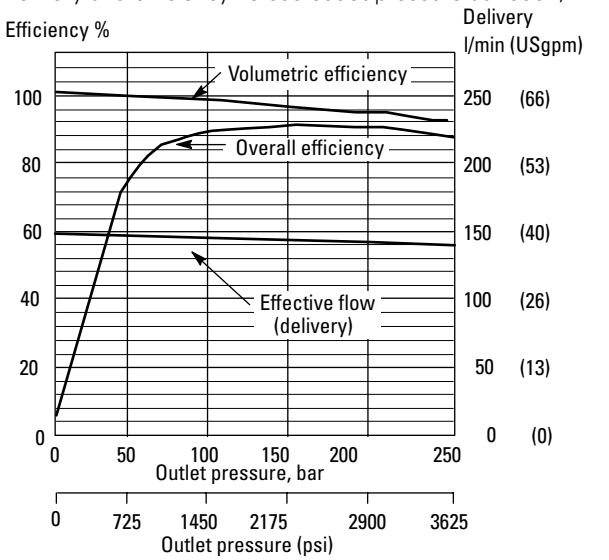


Input power versus speed

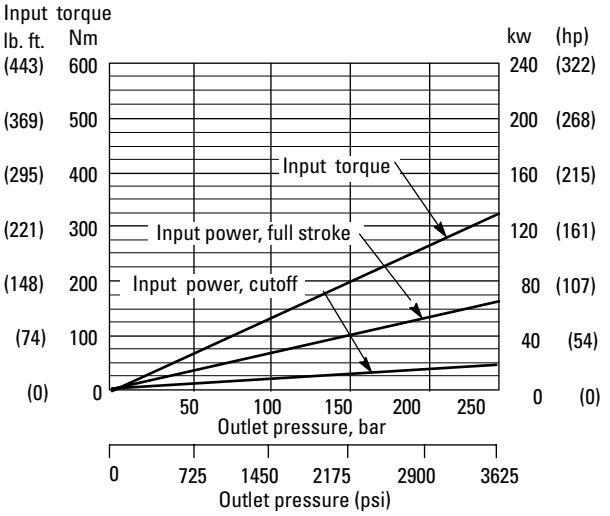


PVH081

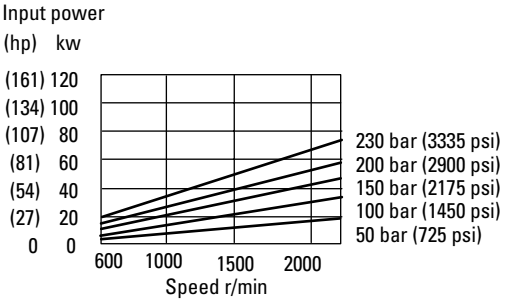
Delivery and efficiency versus outlet pressure at 1800 r/min



Input torque and power versus outlet pressure at 1800 r/min



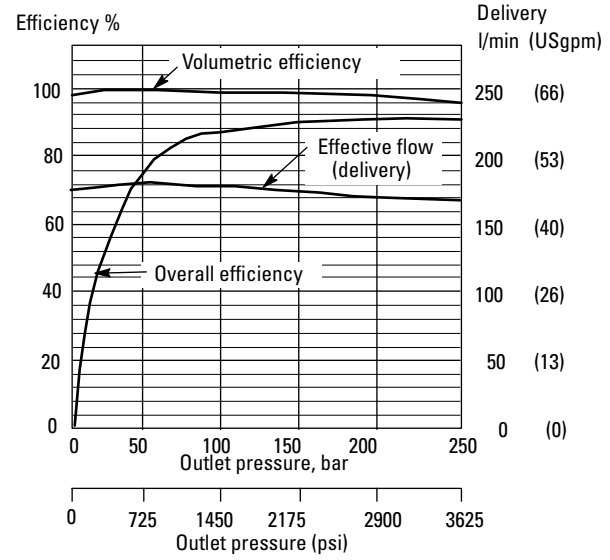
Input power versus speed



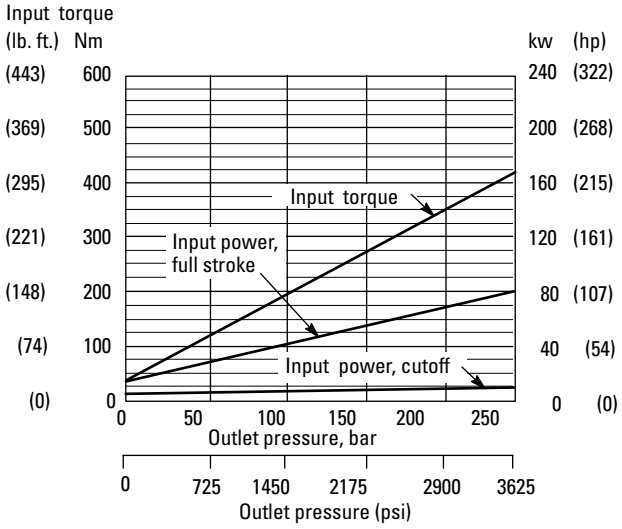
Performance Data

PVH098

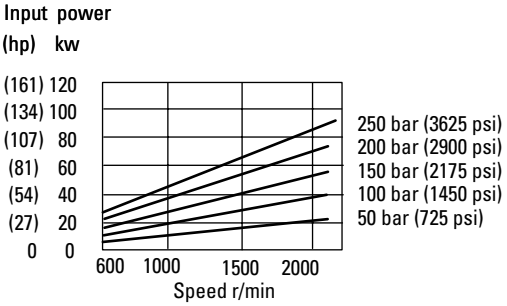
Delivery and efficiency versus outlet pressure at 1800 r/min



Input torque and power versus outlet pressure at 1800 r/min

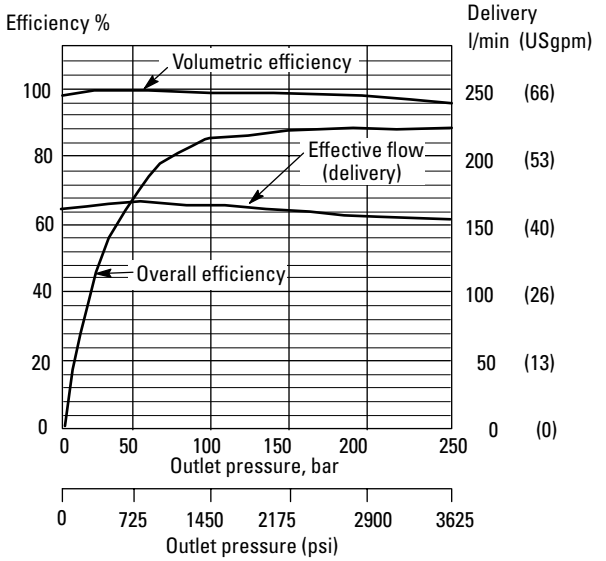


Input power versus speed

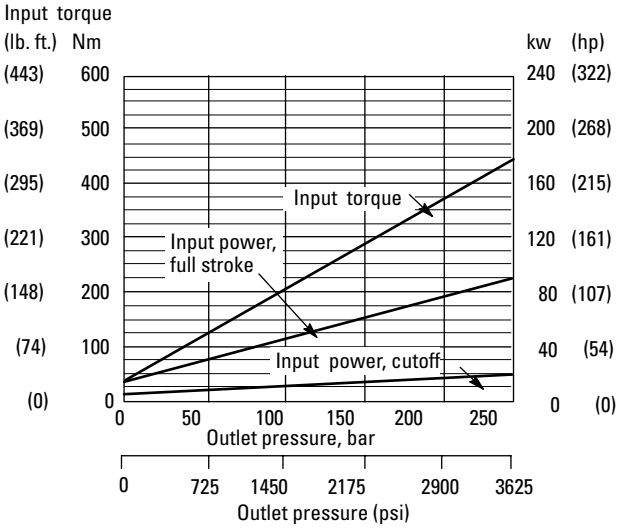


PVH106

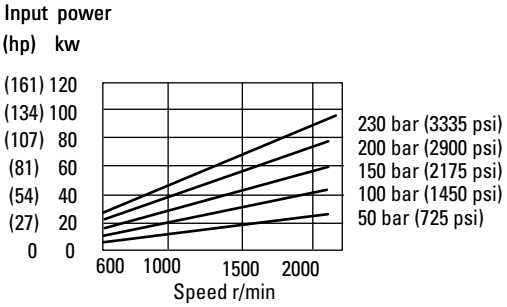
Delivery and efficiency versus outlet pressure at 1800 r/min



Input torque and power versus outlet pressure at 1800 r/min



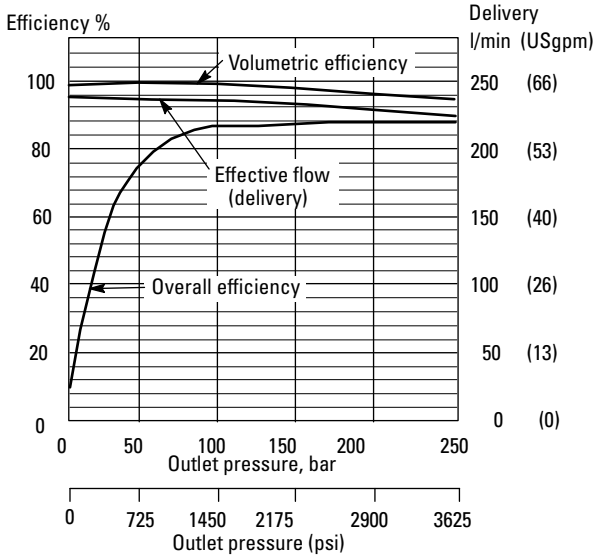
Input power versus speed



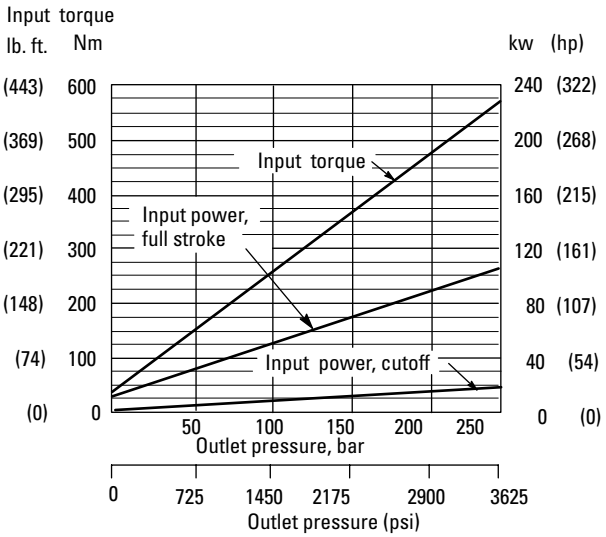
Performance Data

PVH131

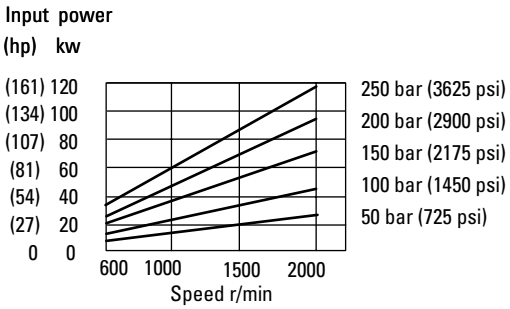
Delivery and efficiency versus outlet pressure at 1800 r/min



Input torque and power versus outlet pressure at 1800 r/min

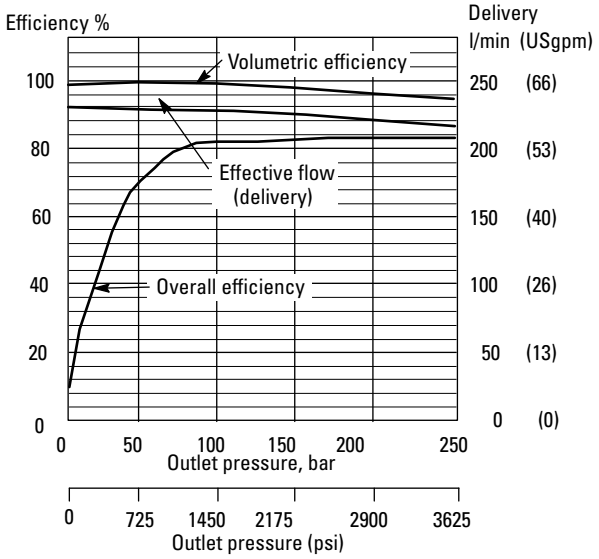


Input power versus speed

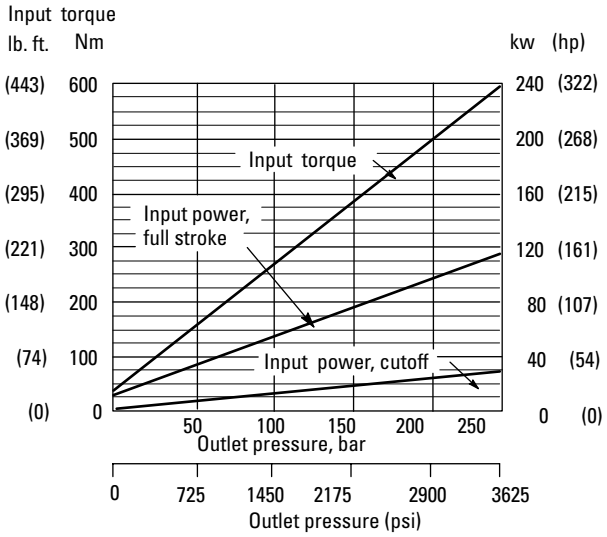


PVH141

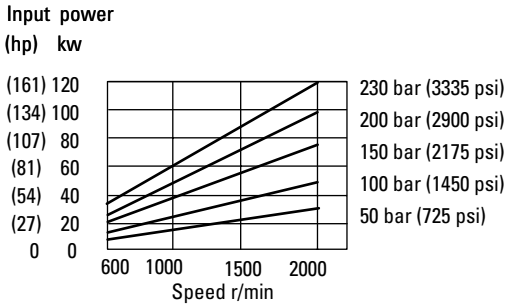
Delivery and efficiency versus outlet pressure at 1800 r/min



Input torque and power versus outlet pressure at 1800 r/min



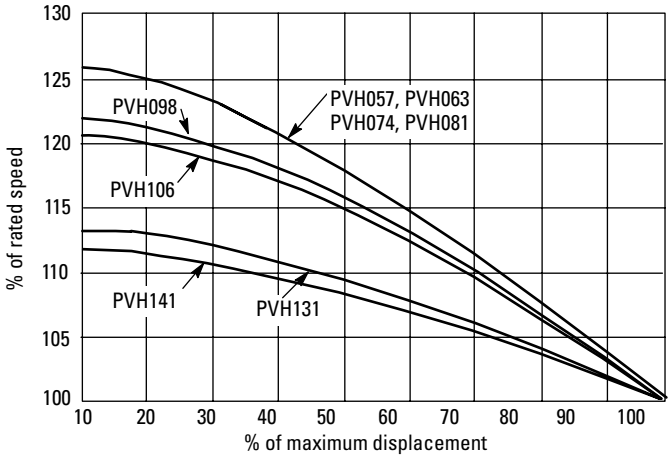
Input power versus speed



Performance Data

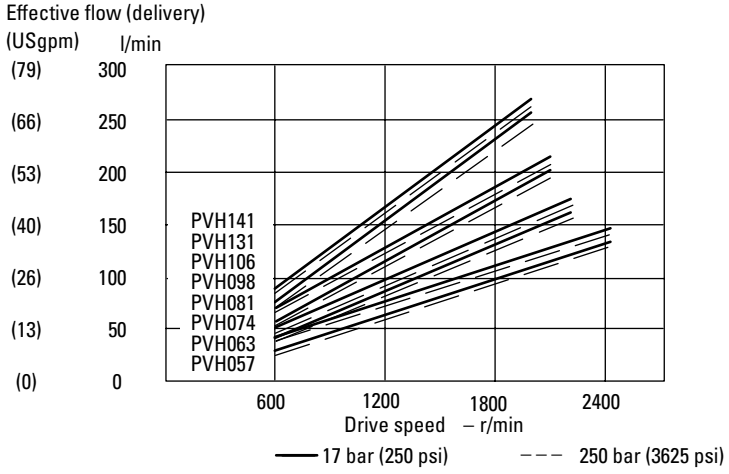
Performance data is typical with SAE 10W anti-wear hydraulic oil at 50°C (120°F) and at zero pump inlet pressure, except where otherwise indicated.

Rated Speed at Reduced Displacement and Zero Inlet Pressure

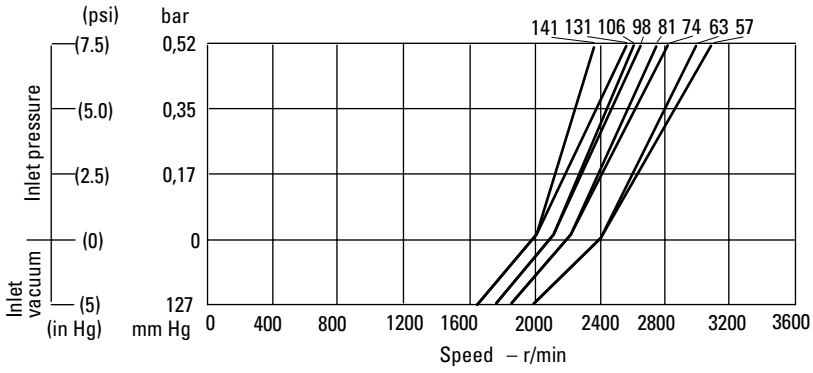


Note: Speeds at 10% displacement represent maximums at load-sense standby condition. These speeds must be reduced to rated speeds at 100% displacement before leaving standby condition, or pump damage may result.

Effective Flow at Maximum Torque



Inlet Pressure/Vacuum versus Speed, Mobile Pumps



Performance Data

Response Data

Model series/ Control type	Typical yoke response † On stroke	Off stroke
PVH057/A**	.101 sec.	.015 sec.
PVH057/B**	.080 sec.	.014 sec
PVH063	.101 sec.	.015 sec.
PVH063	.080 sec.	.014 sec
PVH074/A**	.097 sec.	.015 sec.
PVH074/B**	.088 sec.	.028 sec.
PVH081	.097 sec.	.015 sec.
PVH081	.088 sec.	.028 sec.
PVH098/A**	.134 sec.	.019 sec.
PVH098/B**	.118 sec.	.029 sec.
PVH106	.134 sec.	.019 sec.
PVH106	.118 sec.	.029 sec.
PVH131/A**	.139 sec.	.019 sec.
PVH131/B**	.118 sec.	.029 sec.
PVH141	.139 sec.	.019 sec.
PVH141	.118 sec.	.029 sec.

† Based on 6900 bar/sec (100,000 psi/sec) pressure rise at rated speed and pressure.

Sound Levels

Vickers PVH pumps are designed to provide the highest levels of system performance with noise levels within OSHA requirements. The standard models exhibit low sound levels across a wide range of operating speeds and pressures to accommodate the conditions necessary for high performance mobile vehicles. In addition, the quieter QI models provide even lower sound levels at typical in-plant conditions.

Sound is generated by a variety of factors associated with the system, machine, and environment. For more information concerning the causes and nature of noise in machinery, and methods to reduce sound levels, refer to Eaton's "More Sound Advice" bulletin 390 and "Noise Control in Hydraulic Systems" bulletin 510.

Mobile Version – Sound Level dB(a) DIN (NFPA) ‡

Pressure bar (psi)	PVH057		PVH063		PVH074		PVH081		PVH098		PVH106		PVH131		PVH141	
	1200 r/min	1800 r/min	1800 r/min	2300 r/min	1200 r/min	1800 r/min	1800 r/min	2100 r/min	1200 r/min	1800 r/min	1800 r/min	2000 r/min	1200 r/min	1800 r/min	1800 r/min	1900 r/min
70 (1015)	71	76	77	78	71	76	74	74	71	75	80	80	76	82	81	84
140 (2030)	76	76	77	80	76	78	75	77	74	78	84	82	81	87	86	86
210 (3025)	77	81	79	83	77	81	79	79	77	82	86	84	88	89	88	87
250 (3625)	77	81	80	84	77	81	79	79	78	84	86	85	83	90	89	88

Industrial Version* – Sound Level dB(a) DIN (NFPA) ‡

Pressure bar (psi)	PVH057		PVH063		PVH074		PVH081		PVH098		PVH106		PVH131		PVH141	
	1200 r/min	1800 r/min	1200 r/min	1800 r/min	1200 r/min	1800 r/min	1500 r/min	1800 r/min	1200 r/min	1800 r/min	1500 r/min	1800 r/min	1200 r/min	1800 r/min	1200 r/min	1500 r/min
70 (1015)	64	71	66	73	65	73	73	79	69	75	73	81	75	80	74	74
140 (2030)	68	73	70	72	69	74	72	78	70	76	75	84	77	84	76	78
210 (3025)	70	76	73	76	73	77	75	79	75	80	77	85	80	87	79	81
250 (3625)	71	78	73	77	73	78	76	79	77	82	78	85	82	89	79	82

‡ DIN: Computed semi-anechoic values per DIN 45635. NFPA: Recorded in a semi-anechoic chamber in accordance with NFPA Recommended Standard 13.9.70.12. All values shown are the higher of either maximum displacement or fully compensated conditions.

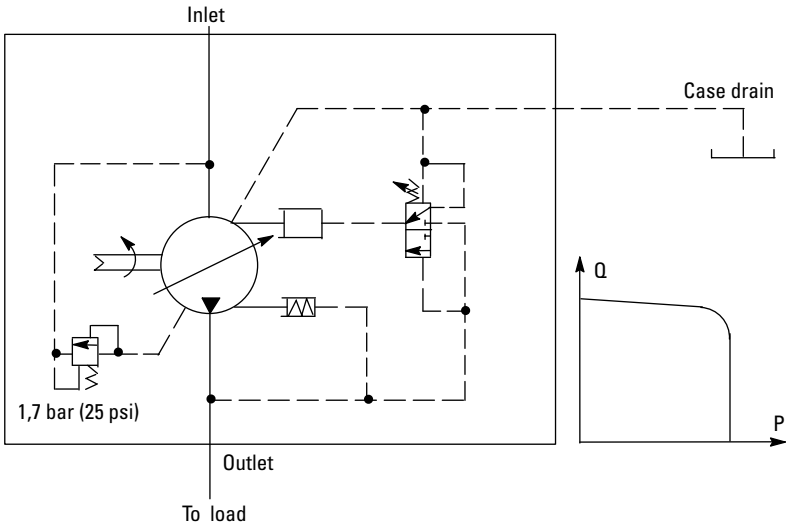
* Q250 Valve Plate

Due to the rounding of numbers during conversion, the difference between DIN and NFPA ratings may be one or two numbers; for example 69 (71) or 69 (72).

Control Options

Pressure Compensator Control (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. The compensator is available in two pressure ranges.



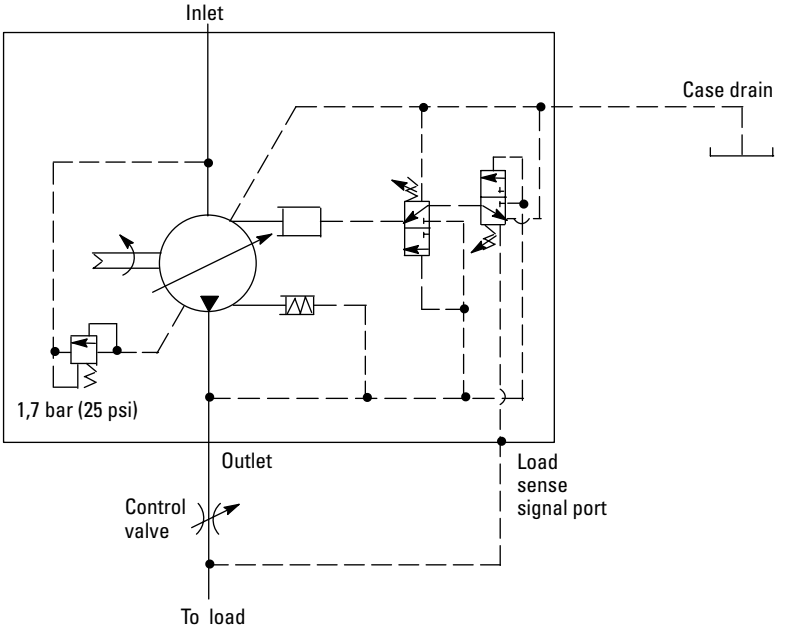
Load Sensing and Pressure Compensator Control (B)

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. The standard differential pressure setting for load sense is 20 bar (290 psi), but can be adjusted to between 17 and 30 bar (247 and 435 psi) on the pump.

If the load pressure exceeds the system pressure setting, the pressure compensator destrokes 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 Vickers representative for the correct configuration of the control.

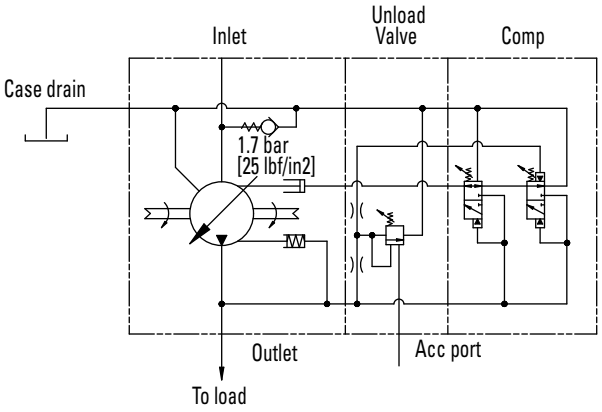


Control Options

Pressure and Flow Compensator with Unloading Valve for Accumulator Circuit

This pump control functions as a load-sensing pressure compensator that unloads the pump at a preset pressure and loads the pump after preset pressure drop.

Unloading Valve Circuit (N)

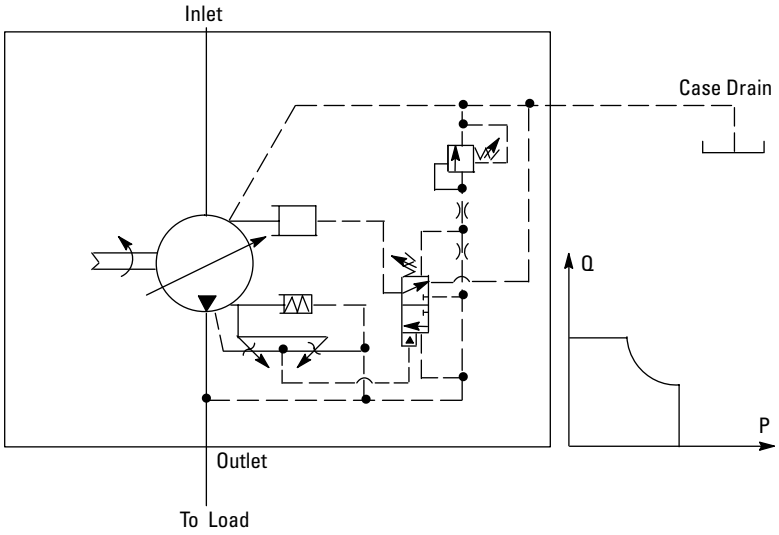


Pressure and Torque Limiter Control (D)

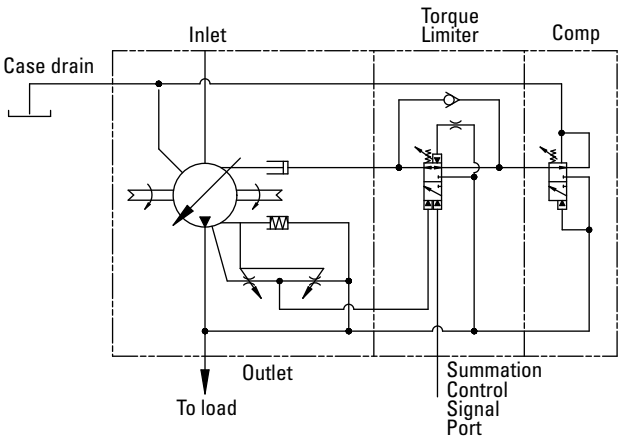
The pump senses pressure and flow and starts destroking at a predetermined input torque level. The rate of flow reduction is normally tailored to follow the maximum power capability curve of the prime mover. Input torque is limited while the pressure compensator limits the system pressure.

When the input speed remains constant (i.e. industrial drives), the torque limiter acts as an input power limiter. This allows a smaller electric motor to be used if maximum pressure and maximum flow are not required at the same time. At low load levels, the control permits high pump displacement and high load speeds. Under heavy loads, speed is reduced, preventing stalling of the prime mover. In the case of variable speed drives (I.C. engines), this function provides, in addition to pressure compensation or limiting, a torque limiting ability that can be adjusted to the torque/speed characteristics of the engine.

The start of torque limiting (pump-destroking) is pressure dependent. This pressure is selectable (see model code) and is factory preset to between 30% and 80% of the maximum pressure control setting. The minimum torque pressure setting is 40 bar (580 psi).



Summation Control (C)

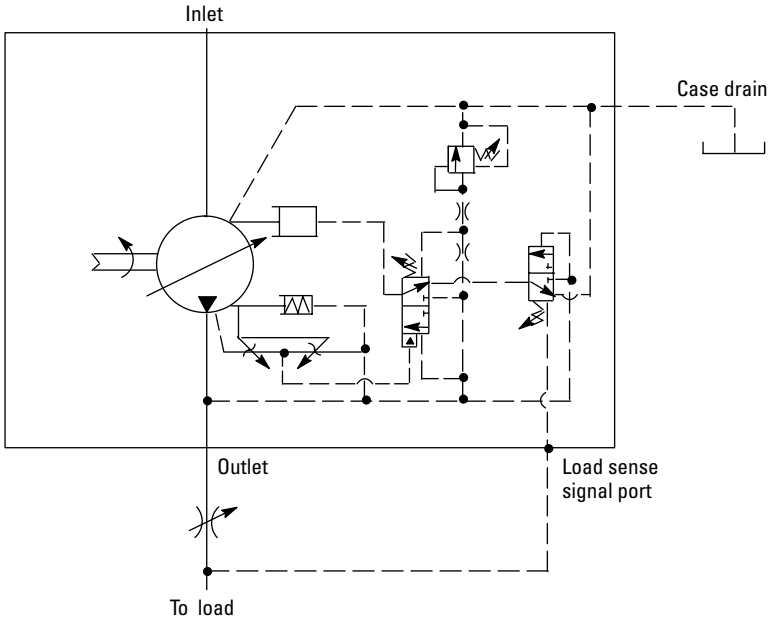


Control Options

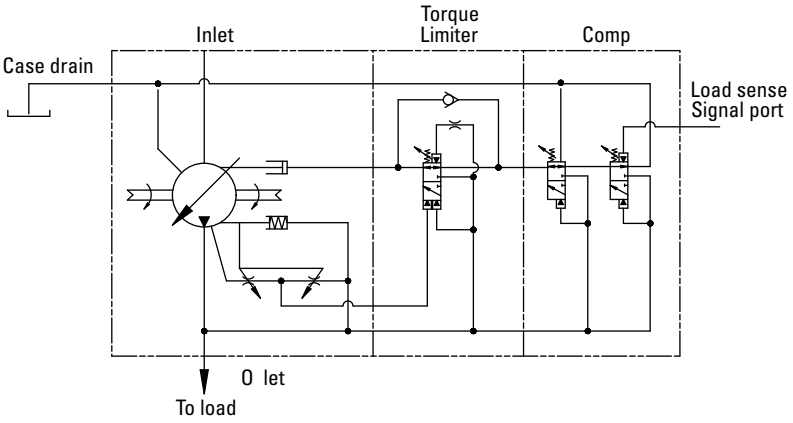
Pressure and Torque Limiting, Plus Load Sensing, Control (E)

The pump's control functions like a load sensing control, but with additional torque limiting tailored to the size of the drive motor selected. The limiting function is the same as for a pressure compensator with torque limiting (see D description, previous page). The combination of the two controls provides the following benefits:

1. The energy savings of a variable displacement load sensing control.
2. The pump pressure follows the load pressure.
3. The torque control allows smaller drive motors to be used.
4. The pressure compensator de-strokes the pump as maximum pressure is reached.
5. The pump pressure can also be remotely controlled using the load sense line. The E control allows complete control of flow and pressure, either mechanically or electrically, if used with proportional valves.



Sumation Control (F)



Industrial Control Compensator

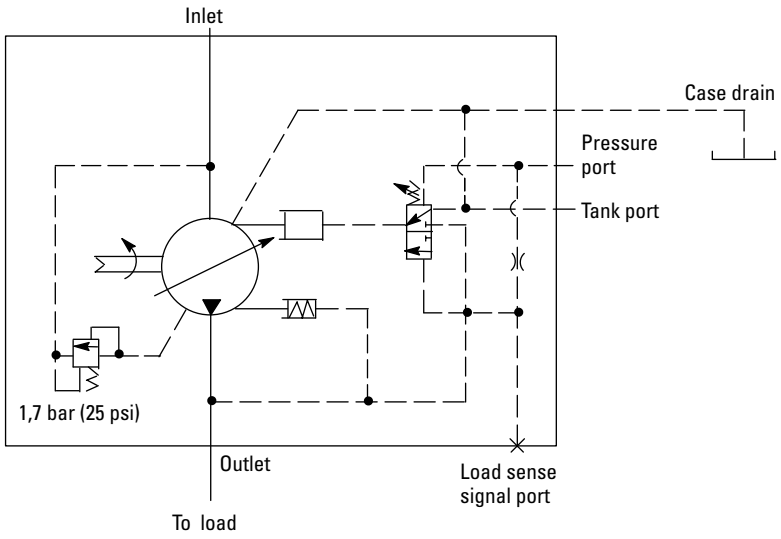
This pump is intended for use when multiple, remote, or electrically controlled compensating settings, with or without load sensing or, with or without torque control are desired.

Pressure compensation is obtained when an internal plug is removed, the load-sense signal port is kept plugged, and internal pilot pressure is applied to the spring chamber of the control spool. For pressure compensation with load sensing, the internal plug stays, the load-sense signal port is unplugged, and pilot pressure is externally applied.

An external relief valve (not supplied) controls spring chamber pressure. The externally adjustable spring determines the differential pressure setting of the control. Outlet pressure is limited to the value of the spring chamber (pressure port) pressure, plus control differential pressure.

(continued on next page)

Pressure Compensating Without Load Sensing (G)



Industrial Control Compensator

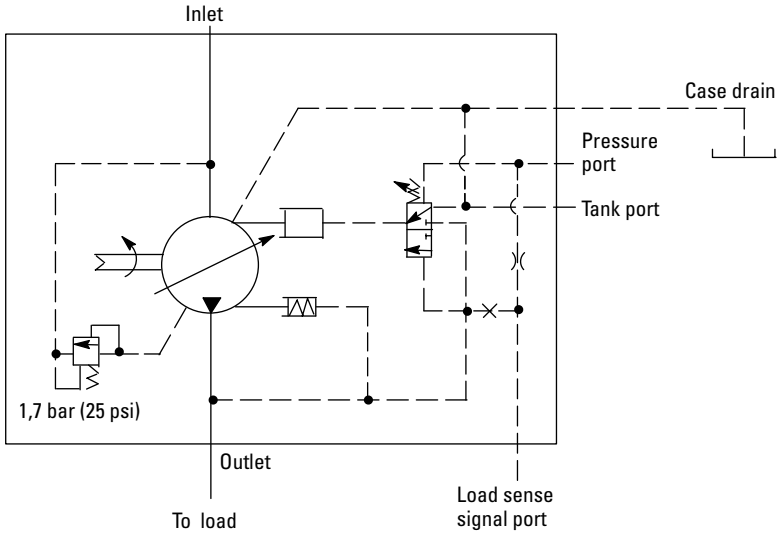
(continued)

Spring chamber (pilot) pressure is separated from outlet pressure by an internal orifice. Outlet pressure shifts the spool when pressure drop across the orifice reaches the differential pressure setting, and the pump de-strokes.

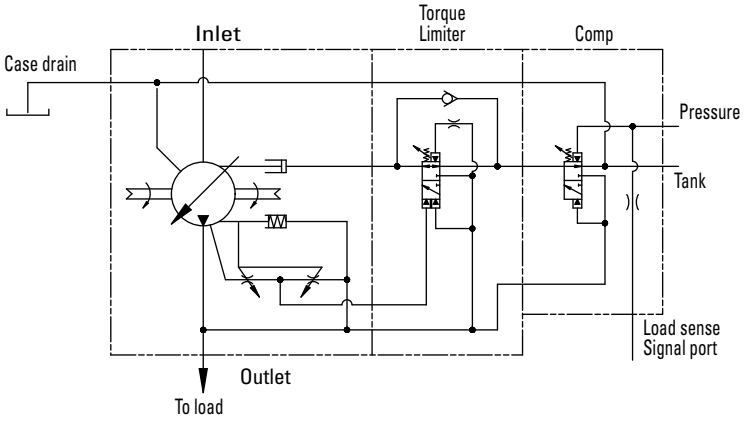
The relief valve can be mounted to an NFPA-D03/ISO 4401-03 pad on the pump control, or remotely located via tapping and blanking plates installed on the pad. See "Ordering Procedure", page 35, for more on valves and plates.

The standard factory-set differential pressure setting of the pump control is 20 bar (290 psi) and is not specified in the pump model number. Any other ordered differential pressure, within the control's adjustable pressure range of 17–35 bar (247–508 psi), will be specified in the model number.

Pressure Compensating with Load Sensing (H)



Pressure Compensating with Load Sensing and Torque Control (J)



Input Shaft Selection Data

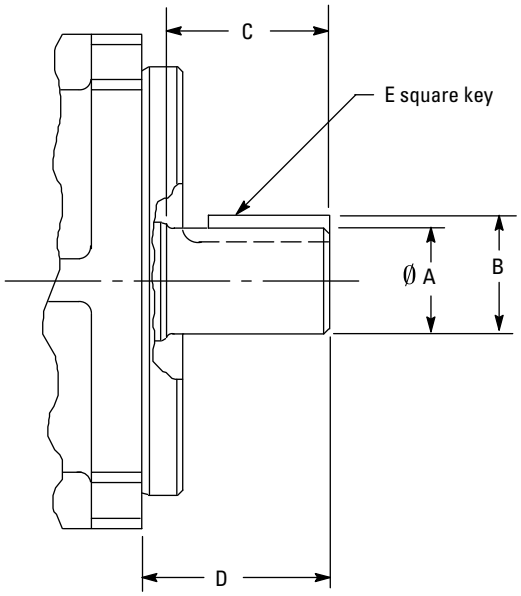
Multiple pump arrangements can be formed by a PVH thru-drive pump and any suitable pump (single or multiple) that can be installed on the SAE "A", "B", or "C" rear-mounting option available for the thru-drive pump.

It is important to check that maximum torque values for individual pump sections, or complete pumps, occurring in a specific application will not exceed the limits tabled below.

Shaft Code	Shaft Designation	Basic Pump Series	Thru-drive Pump Series	Maximum Input Torque Nm (lb. in.)	Maximum Thru-drive Output Torque Nm (lb. in.)
N	ISO 3019/2 – E32N	PVH057/063	–	450 (3,980)	–
	short straight keyed	PVH074/081	–	450 (3,980)	–
1	SAE "C" (J744-32-1)	PVH057/063	PVH057/063	450 (3,980)	335 (2,965)
	straight keyed	PVH074/081	–	450 (3,980)	–
		PVH098/106	–	450 (3,980)	–
2	SAE "C" (J744-32-4)	PVH057/063	PVH057/063	640 (5,660)	335 (2,965)
	14T 12/24 DP FRSF spline	PVH074/081	–	640 (5,660)	–
		PVH098/106	–	640 (5,660)	–
3	SAE "CC" (J744-38-4)	–	PVH074/081	1215 (10,750)	460 (4.070)
	17T 12/24 DP FRSF spline	–	PVH098/106	1215 (10,750)	640 (5,660)
		PVH131/141	PVH131/141	1215 (10,750)	640 (5,660)
12	SAE "D" (J744-44-4)	PVH131/141	PVH131/141	1215 (10,750)	640 (5,660)
	13T 8/16 DP FRSF spline				
13	SAE "CC" (J744-38-1)	–	PVH074/081	765 (6,770)	460 (4.070)
	straight keyed	–	PVH098/106	765 (6,770)	460 (4.070)
		PVH131/141	–	765 (6,770)	–
16	SAE "D" (J744-44-1)	–	PVH131/141	1200 (10,620)	640 (5,660)
	straight keyed				

Note: Any deviation from maximum input torques must be approved by Eaton. To assure developed thru-drive loads are within PVH pump limitations, actual torque values must not exceed values shown.

Input Shaft Dimensions



Straight Keyed Shafts*

Shaft Code	Shaft Designation	A	B	C	D	E
1	SAE "C" (J744-32-1)	31,75	35,32	48,0	56,0	7,93
		(1.25)	(1.38)	(1.89)	(2.20)	(.312)
13	SAE "CC" (J744-38-1)	38,10	42,39	54,0	62,0	9,52
		(1.50)	(1.67)	(2.12)	(2.44)	(.375)
16	SAE "D" (J744-44-1)	44,45	49,46	67,0	75,0	11,11
		(1.75)	(1.95)	(2.64)	(2.95)	(.438)
N	ISO 3019/2–E32N	32,00	35,00	58,0	68,1	10,00
		(1.26)	(1.38)	(2.28)	(2.68)	(.393)

* See torque limits on previous page.

Spline Shafts*

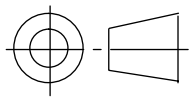
Shaft code	Shaft designation	Number of teeth	C	D
2	SAE "C" (J744-32-4)	14	48,0	56,0
			(1.89)	(2.20)
3	SAE "CC" (J744-38-4)	17	54,0	62,0
			(2.13)	(2.44)
12	SAE "D" (J744-44-4)	13	67,0	75,0
			(2.64)	(2.95)

* See torque limits on previous page.

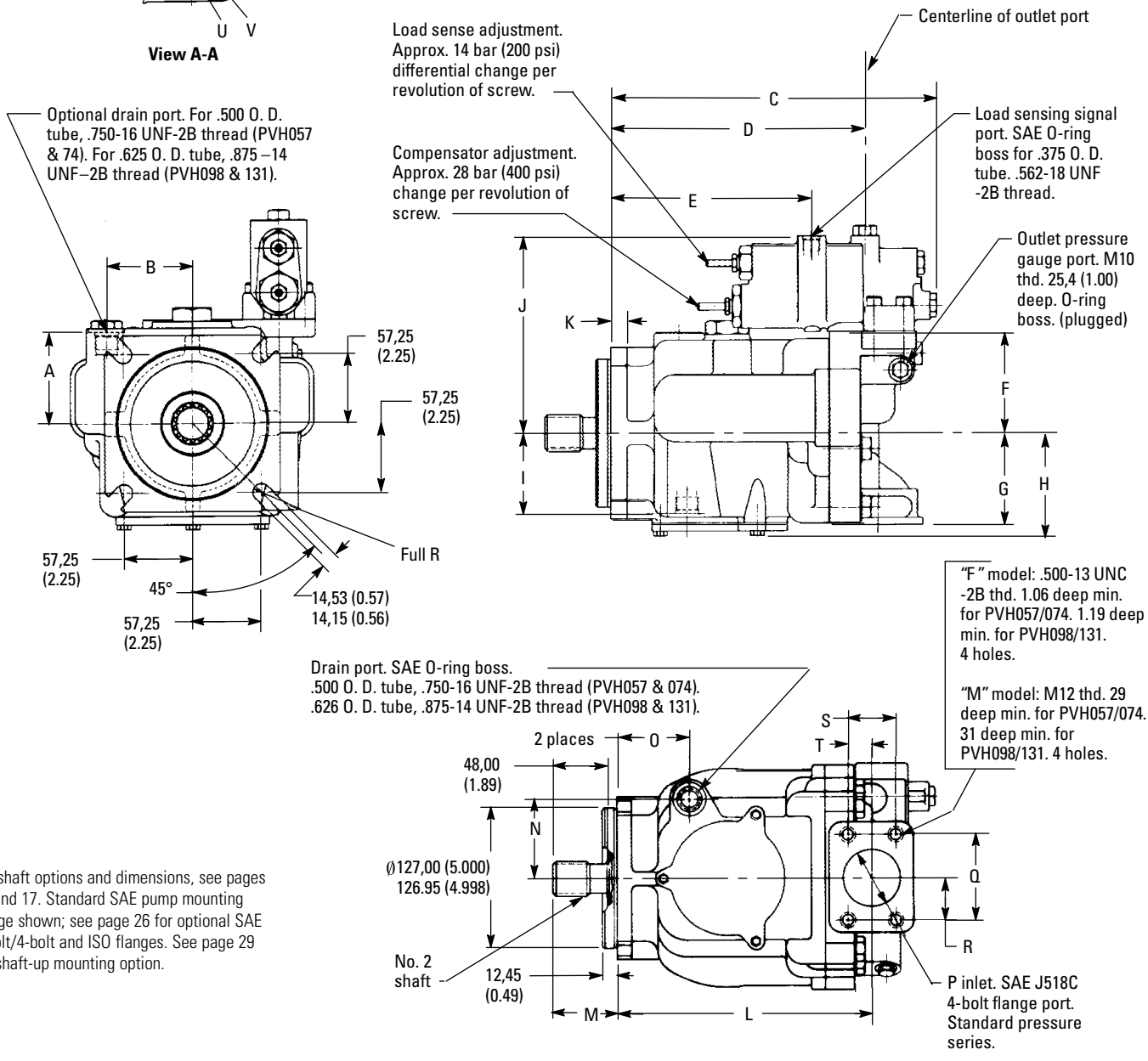
Installation Dimensions

Basic Pump with Pressure Compensator and Load Sense Controls

Dimensions in mm (inches)



3rd angle projection



For shaft options and dimensions, see pages 16 and 17. Standard SAE pump mounting flange shown; see page 26 for optional SAE 2-bolt/4-bolt and ISO flanges. See page 29 for shaft-up mounting option.

Installation Dimensions

Basic Pump with Pressure Compensator and Load Sense Controls

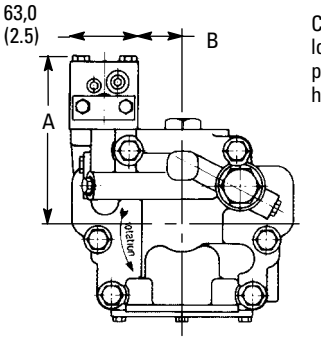
	A	B	C	D	E	F	G	H	I
PVH057	76,0	71,0	293,0	216,5	171,3	86,0	79,0	88,0	69,0
PVH063	(2.99)	(2.79)	(11.54)	(8.52)	(6.74)	(3.39)	(3.11)	(3.46)	(2.71)
PVH074	88,0	70,0	306,6	241,2	194,3	92,0	94,0	95,0	81,0
PVH081	(3.46)	(2.75)	(12.07)	(9.50)	(7.65)	(3.62)	(3.70)	(3.74)	(3.19)
PVH098	93,1	85,0	323,5	251,3	206,1	94,5	87,5	97,1	80,1
PVH106	(3.67)	(3.35)	(12.74)	(9.89)	(8.11)	(3.72)	(3.44)	(3.82)	(3.15)
PVH131	109,4	88,8	377,0	280,4	230,4	120,0	109,0	107,4	84,8
PVH141	(4.31)	(3.50)	(14.84)	(11.04)	(9.07)	(4.72)	(4.29)	(4.23)	(3.34)

	J	K	L	M	N	O	P	Q	R
PVH057	168,0	14,0	227,4	56,1	71,0	64,8	50,8	77,77	38,88
PVH063	(6.6)	(0.55)	(8.95)	(2.21)	(2.80)	(2.55)	(2.0)	(3.06)	(1.53)
PVH074	174.0	15,0	250,1	56,0	70,0	68,0	50,8	77,77	38,88
PVH081	(6.85)	(0.59)	(9.85)	(2.20)	(2.75)	(2.68)	(2.0)	(3.06)	(1.53)
PVH098	176,5	16,0	269,3	55,5	85,0	74,2	63,5	88,9	44,45
PVH106	(6.95)	(0.63)	(10.60)	(2.18)	(3.35)	(2.92)	(2.5)	(3.50)	(1.75)
PVH131	202,0	15,0	298,6	62,0	88,8	70,6	63,5	88,9	44,45
PVH141	(7.95)	(0.59)	(11.75)	(2.44)	(3.50)	(2.78)	(2.5)	(3.50)	(1.75)

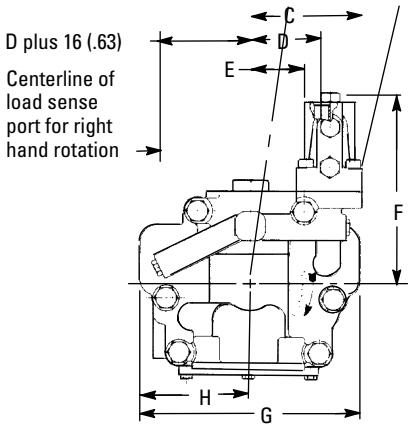
	S	T	U	V	W	X	Y	Z
PVH057	42,88	21,44	25,4	M10x1,5	52,37	26,18	26,19	13,10
PVH063	(1.69)	(0.84)	(1.0)	(.375-16)	(2.06)	(1.03)	(1.03)	(0.52)
PVH074	42,88	21,44	25,4	M10x1,5	52,37	26,18	26,19	13,10
PVH081	(1.69)	(0.84)	(1.0)	(.375-16)	(2.06)	(1.03)	(1.03)	(0.52)
PVH098	50,8	25,4	25,4	M10x15	52,37	26,19	26,19	13,10
PVH106	(2.0)	(1.0)	(1.0)	(.375-16)	(2.06)	(1.03)	(1.03)	(0.52)
PVH131	50,8	25,4	31,75	M14x2,0	66,68	33,34	31,75	15,88
PVH141	(2.0)	(1.0)	(1.25)	(.500-13) (2.63)	(1.31)	(1.25)	(0.63)	

Installation Dimensions

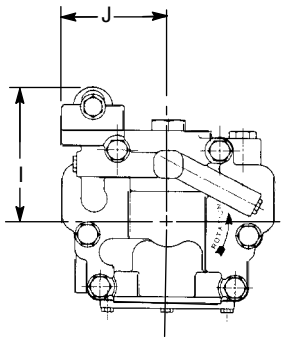
Basic Pump. Rear View with Various Controls



Right hand rotation, pressure compensated and torque limit model



Left hand rotation, pressure compensated and load sensing model

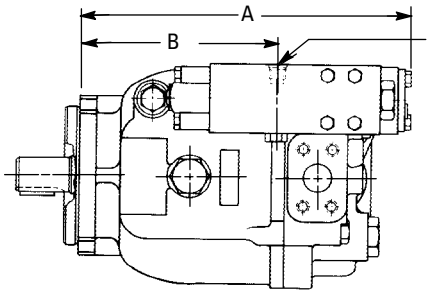


Right hand rotation, pressure compensated model

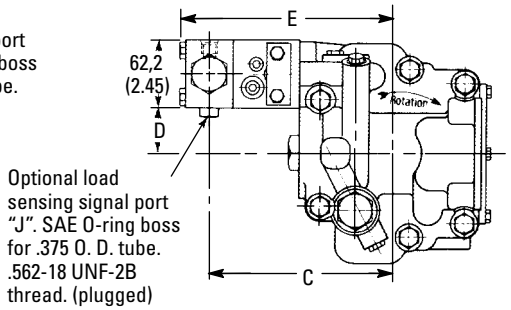
	A	B	C	D	E	F	G	H	I	J
PVH057	176,45	41,0	102,7	64,5	49,0	176,6	203,0	101,5	127,0	102,7
PVH063	(6.95)	(1.61)	(4.04)	(2.54)	(1.93)	(6.95)	(7.99)	(4.00)	(5.00)	(4.04)
PVH074	182,45	47,5	109,2	71,0	55,5	182,6	224,0	112,0	133,0	109,2
PVH081	(7.18)	(1.87)	(4.30)	(2.79)	(2.19)	(7.18)	(8.82)	(4.41)	(5.23)	(4.30)
PVH098	195.45	41,0	102,7	65,5	49,0	185,1	233,0	116,5	135,5	102,7
PVH106	(7.69)	(1.61)	(4.04)	(2.54)	(1.93)	(7.280)	(9.17)	(4.59)	(5.33)	(4.04)
PVH131	210,50	63,6	125,2	87,0	71,5	210,6	254,2	127,1	161,0	125,2
PVH141	(8.29)	(2.50)	(4.92)	(3.42)	(2.81)	(8.29)	(10.00)	(5.00)	(6.37)	(4.92)

*Add 16,0 (.63) to dimension D for right hand rotation model.

Pump with Pressure Compensation, Load Sense and Torque Limit Controls



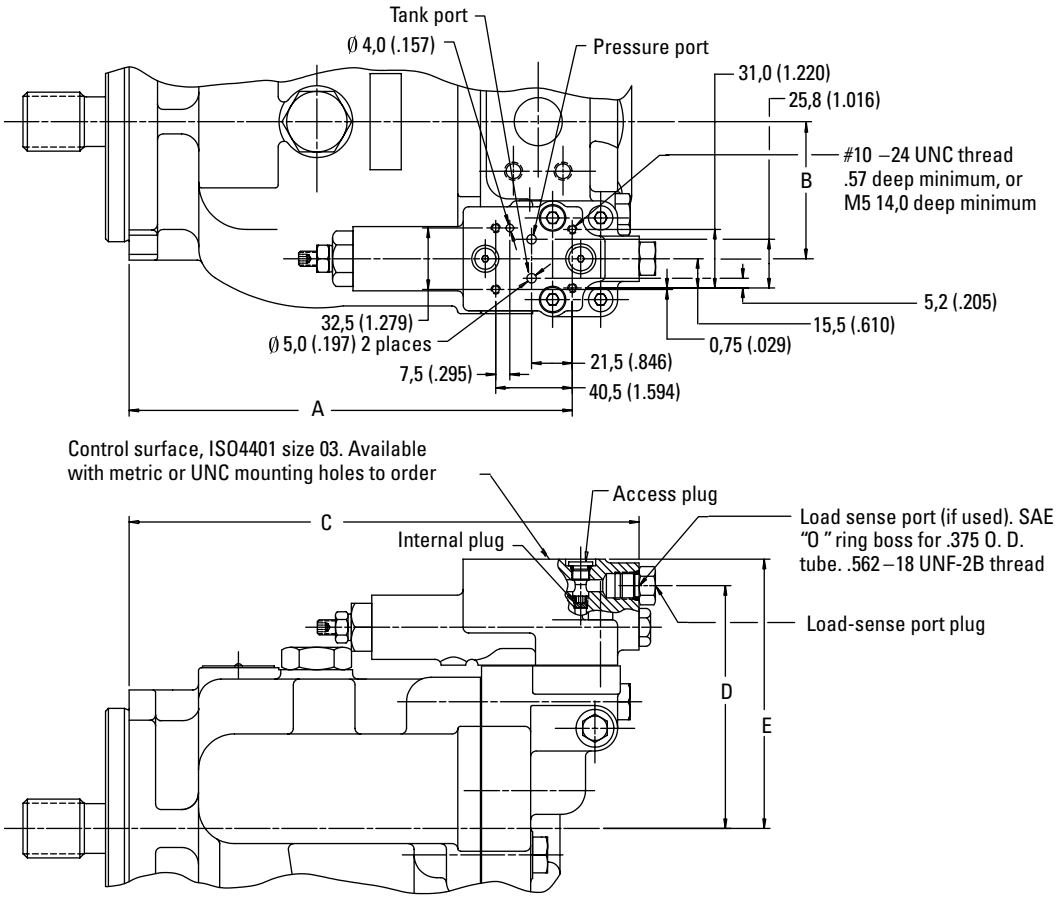
Left hand rotation, pressure compensated with load sense and torque limit model



	A	B	C	D	E
PVH057	316,3	177,4	168,1	41,4	195,4
PVH063	(12.45)	(6.98)	(6.62)	(1.63)	(7.69)
PVH074	335,5	200,1	174,1	47,9	201,4
PVH081	(13.34)	(7.88)	(6.85)	(1.86)	(7.93)
PVH098	351,0	212,3	187,1	41,4	214,4
PVH106	(13.82)	(8.36)	(7.37)	(1.63)	(8.44)
PVH131	375,3	236,6	202,2	63,8	229,5
PVH141	(14.78)	(9.31)	(7.96)	(2.51)	(9.04)

Installation Dimensions

Pump with IC Compensator (Remotely Controllable Pressure Compensator, and Optional Load Sensing)



Pressure compensator:

Remove access plug, using 1/8 inch hex wrench. Remove internal plug, using 5/32 inch hex wrench. Replace access plug and torque to 12,1–12,4 Nm (107–110 lb. in.). Attach relief valve hardware (not supplied) to control surface. See page 15 for more details.

Pressure compensator with load sensing:

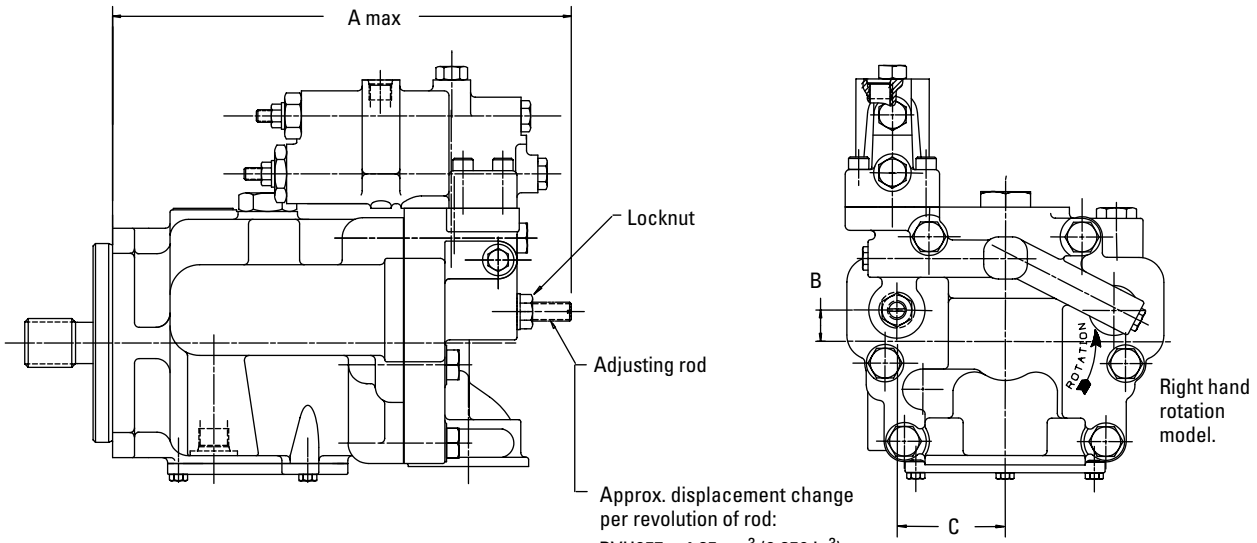
Remove load-sense port plug. (Internal plug must remain in place.) Attach line to load-sense port. Pressure decay rate of this line must not exceed 11 kbar/second (160 kpsi/second). Attach relief valve hardware (not supplied) to control surface. See page 15 for more details.

	A	B	C	D	E
PVH057	234,5	72,5	269,9	128,0	142,0
PVH063	(9.23)	(2.85)	(10.62)	(5.04)	(5.59)
PVH074	257,2	79,0	292,6	134,0	148,0
PVH081	(10.12)	(3.11)	(11.52)	(5.27)	(5.83)
PVH098	269,3	72,5	304,7	136,5	150,5
PVH106	(10.60)	(2.85)	(12.00)	(5.37)	(5.92)
PVH131	293,6	95,0	329,0	162,0	176,0
PVH141	(11.56)	(3.74)	(12.95)	(6.38)	(6.93)

Installation Dimensions

Pump with Adjustable Maximum Volume Stop

This option allows maximum pump delivery to be externally adjusted from 100 percent down to 25 percent. To assist initial priming, adjust stop to allow at least 40 percent of maximum delivery. Adjust by loosening locknut and turning adjusting rod clockwise to decrease maximum delivery, or counter-clockwise to increase maximum delivery. When desired setting is obtained, torque locknut to 25-50 Nm (18-36 lb. ft.).



Right hand rotation model.

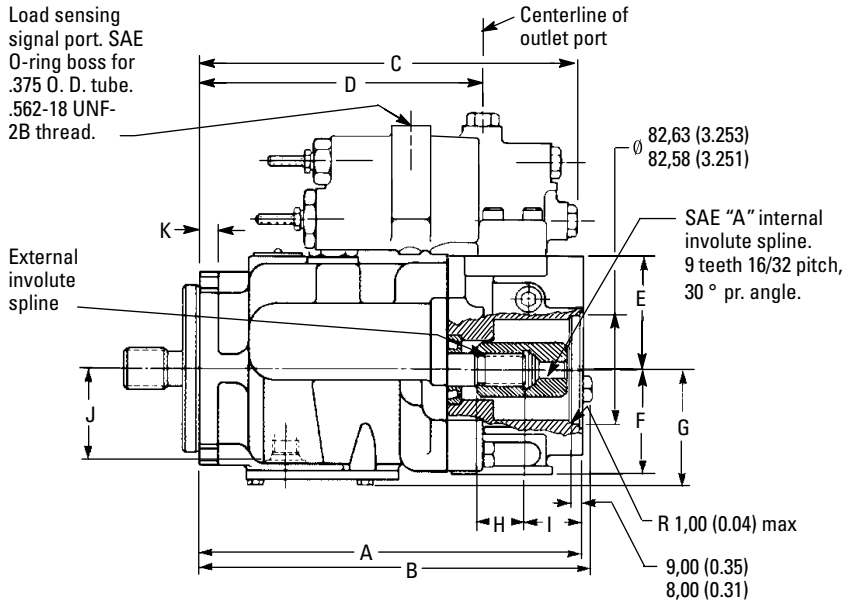
Approx. displacement change per revolution of rod:

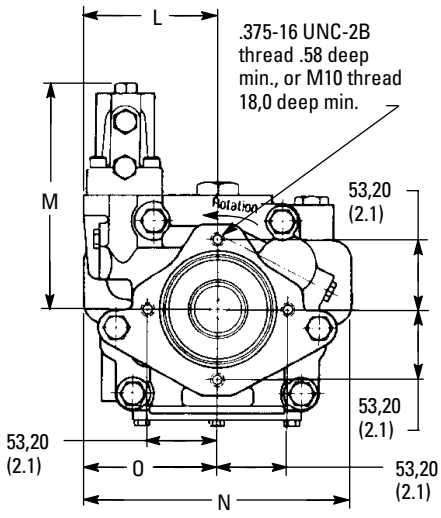
PVH057 – 4,25 cm^3 (0.259 in^3)
PVH063 – 4,70 cm^3 (0.287 in^3)
PVH074 – 5,00 cm^3 (0.305 in^3)
PVH081 – 5,47 cm^3 (0.334 in^3)
PVH098 – 6,25 cm^3 (0.381 in^3)
PVH106 – 6,76 cm^3 (0.413 in^3)
PVH131 – 8,50 cm^3 (0.519 in^3)
PVH141 – 9,15 cm^3 (0.559 in^3)

	A	B	C
PVH057	293,0	20,0	69.5
PVH063	(11.53)	(.79)	(2.74)
PVH074	306,6	22,0	76,0
PVH081	(12.07)	(.87)	(2.99)
PVH098	323,5	27,5	81,0
PVH106	(12.74)	(1.08)	(3.19)
PVH131	377,0	37,5	88,8
PVH141	(14.84)	(1.48)	(3.50)

Installation Dimensions

Thru-drive Pumps with SAE "A" Rear Pad





Right hand rotation, pressure compensated and load sensing model.

For shaft options and dimensions, see page 16 and 17. See page 26 for optional cover for rear pad.

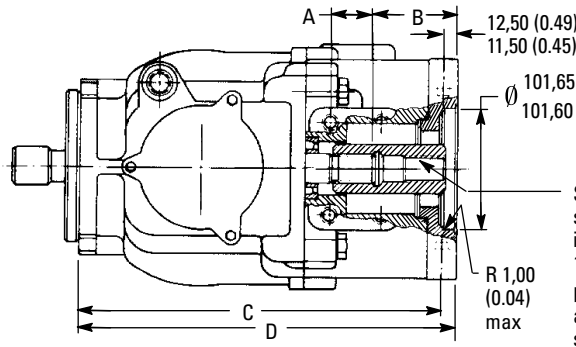
Note: The O-ring for sealing the rear mounting pad is furnished with the pump. The rear drive coupling shown must be ordered separately; see page 23.

	A	B	C	D	E	F	G	H
PVH057	287,9	295,4	275.8	216,4	86,0	79,0	88,0	36,4
PVH063	(11.3)	(11.6)	(10.86)	(8.52)	(3.38)	(3.11)	(3.46)	(1.43)
PVH074	310,6	318,1	300,5	241,2	92,0	94,0	95,0	38,5
PVH081	(12.23)	(12.52)	(11.83)	(9.50)	(3.62)	(3.70)	(3.74)	(1.51)
PVH098	322,8	N/A	312,7	251,3	94,5	87,5	97,1	33,0
PVH106	(12.71)		(12.31)	(9.89)	(3.72)	(3.44)	(3.82)	(1.30)
PVH131	347,1	N/A	337,0	280,4	120,0	109,0	107,4	35,3
PVH141	(13.660)		(13.27)	(11.04)	(4.72)	(4.29)	(4.23)	(1.39)

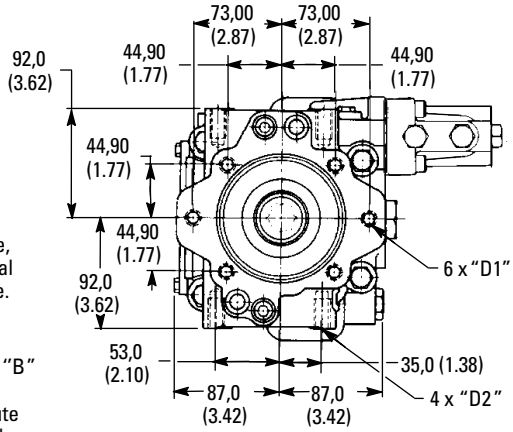
	I	J	K	L	M	N	O
PVH057	43,6	69,0	14,0	102,7	176,6	203,0	101,5
PVH063	(1.72)	(2.71)	(0.55)	(4.04)	(6.95)	(7.99)	(4.00)
PVH074	43,8	81,0	15,0	109,2	182,6	224,0	112,0
PVH081	(1.72)	(3.19)	(0.59)	(4.30)	(7.18)	(8.82)	(4.41)
PVH098	44,6	80,1	16,0	102,7	185,1	233,0	116,5
PVH106	(1.75)	(3.15)	(6.30)	(4.04)	(7.28)	(9.17)	(4.59)
PVH131	44,7	84,8	15,0	125,2	210,6	254,2	127,1
PVH141	(1.76)	(3.34)	(0.59)	(4.93)	(8.29)	(10.0)	(5.00)

Installation Dimensions

Thru-drive Pumps with SAE "B" Rear Pad Adapter

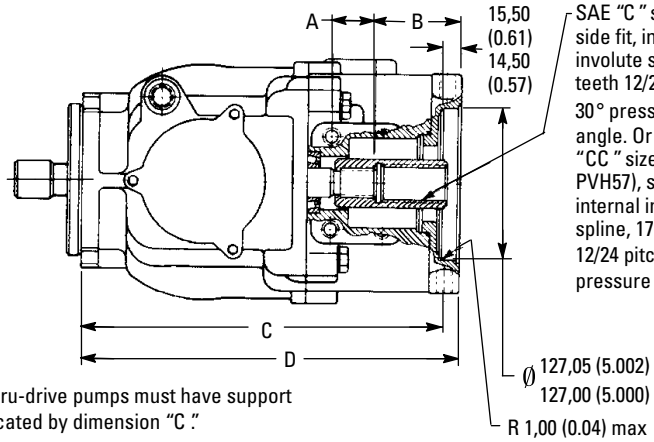


Thru-drive pumps must have support located by dimension "C".

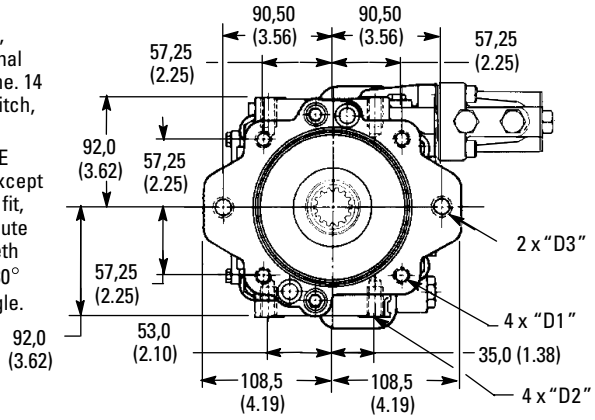


SAE "B" rear mounting. Mounting pad is machined to accept AS568-155 O-ring. Mounting pad is connected to pump case and must be sealed.

Thru-drive Pumps with SAE "C" Rear Pad Adapter



Thru-drive pumps must have support located by dimension "C".



SAE "C" rear mounting. Mounting pad is machined to accept AS568-159 O-ring. Mounting pad is connected to pump case and must be sealed.

Pump Model	A	B	C	D
PVH057	36,4	68,8	300,4	312,9
PVH063	(1.43)	(2.71)	(11.82)	(12.32)
PVH074	33,5	68,3	323,1	335,6
PVH081	(1.32)	(2.69)	(12.72)	(13.21)
PVH098	33,0	69,8	335,3	347,7
PVH106	(1.30)	(2.75)	(13.20)	(13.69)
PVH131	35,3	69,7	359,6	372,1
PVH141	(1.39)	(2.74)	(14.16)	(14.65)

	D1	D2	D3
Metric	M14x2,00	M12x1,75	M16x2,00
	25 deep	25 deep	25 deep
Inch	0,500-13	0.500-13	0.625-11
	UNC-2B	UNC-2B	UNC-2B
	1.0 deep	1.0 deep	1.0 deep

Note: The O-ring for sealing the rear mounting pad is furnished with the pump. The rear drive couplings shown must be ordered separately; see following page.

Installation Dimensions

Thru-drive Flange Kit and Shaft Coupling

Front Pump Model Series	SAE (J744) Mounting Flange for Rear Pump	Mounting Flange Adapter Kit Number*		Coupling Part Number**
		Metric Threads	Inch Threads	
PVH057	A (J744-82-2)	None required	None required	526682
PVH063	B (J744-101-2/4)	876394	876390	526694
	BB (J744-101-2/4)	876394	876390	526695
	C (J744-127-2/4)	876392	876389	526696
PVH074	A (J744-82-2)	None required	None required	864460
PVH081	B (J744-101-2/4)	876394	876390	864457
	BB (J744-101-2/4)	876394	876390	864459
	C (J744-127-2/4)	876392	876389	864458
	CC (J744-127-2/4)	876392	876389	864461
PVH098	A (J744-82-2)	None required	None required	877039
PVH106	B (J744-101-2/4)	876394	876390	877040
PVH131	BB (J744-101-2/4)	876394	876390	877044
PVH141	C (J744-127-2/4)	876392	876389	877045
	CC (J744-127-2/4)	876392	876389	877046

*The basic PVH thru-drive pump has an SAE "A" pad on the rear. An SAE "B" or "C" pad rear mounting requires flange adapters. Required adapters can be provided if specified in the pump model code. The best combination of price, availability and flexibility is achieved by ordering a PVH SAE "A" thru-drive model and the applicable PVH mounting flange adapter separately. For example, a PVH074C-RCF-3S-10-C25-31 may also be ordered as a PVH074C-RAF-3S-10-C25-31 and a 876389 flange adapter.

** Thru-drive shaft couplings must be ordered separately to drive the second pump.

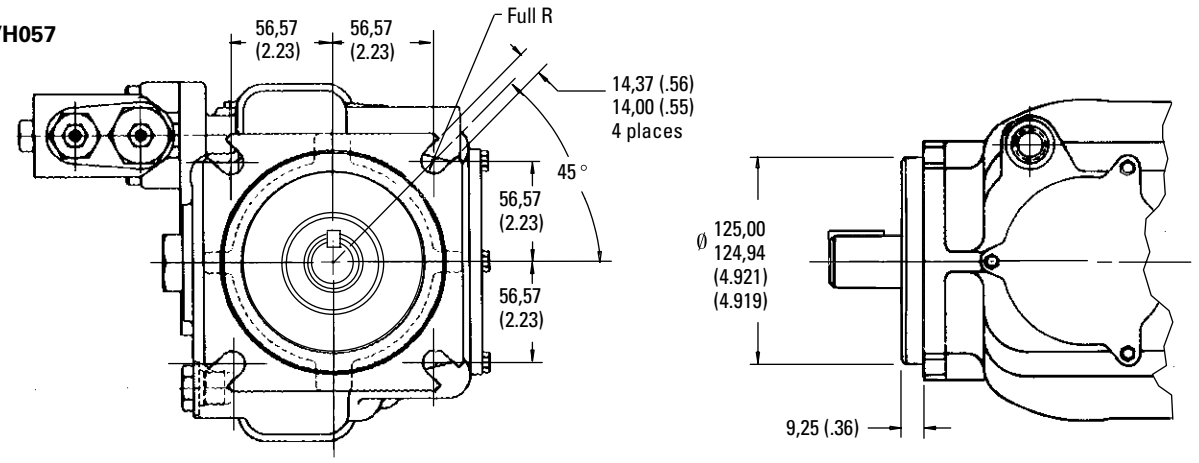
Typical Rear Pumps for Thru-drive Assemblies

Mounting	Piston pump Series	Shaft Code	Vane pump Series	Shaft Code
SAE A	PVQ10/13	3	V10	11
			V20	62
SAE B	PVQ20/32	3	20V	151
	PVQ40/45	3	25V	11
	PVE19/21	9	V2020	11
SAE BB	PVE19/21	2		
	TA19	2		
SAE C	PVH057/063	2	35V	11
	PVH074/081	2	352*V	11
	PVH098/106	2		
SAE CC	PVH131/141	3		

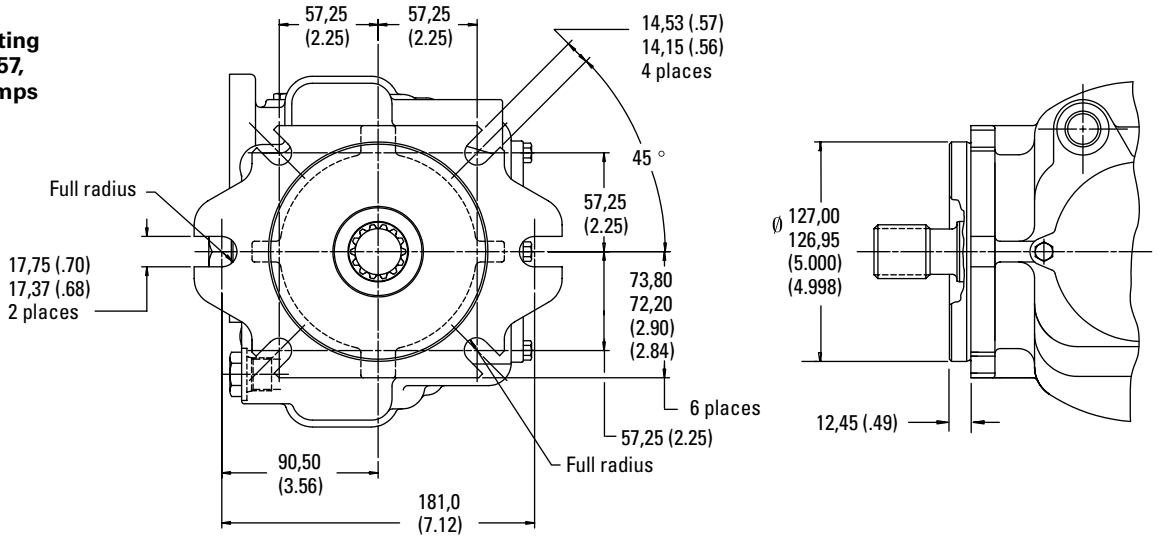
NOTE: The above Vickers pumps are examples of rear pumps for the thru-drive pumps dimensioned on pages 25 and 26. The thru-drive torque limits identified in the chart on page 16 must not be exceeded when applying these multiple pump systems.

Installation Dimensions

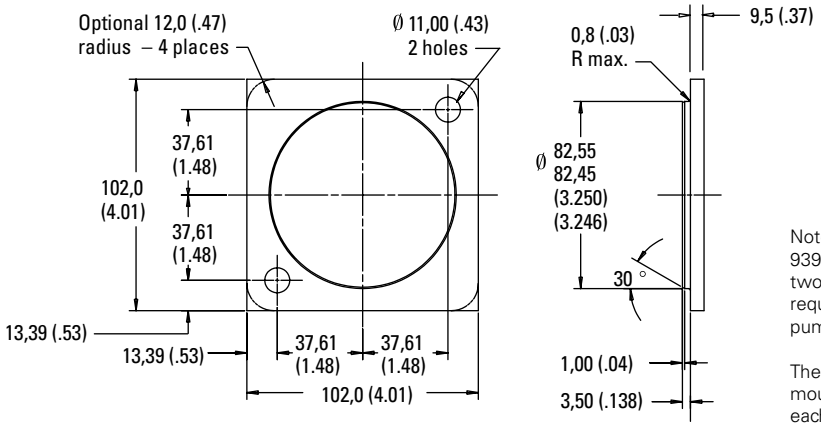
ISO 3019/2-125B4HW Mounting Flange for PVH057 and PVH074 Pumps



SAE 2–bolt/4-bolt Mounting ("027" Option) for PVH057, PVH074 and PVH098 Pumps



Cover ("031" Option) for Thru-drive SAE "A" Rear Mounting Flange



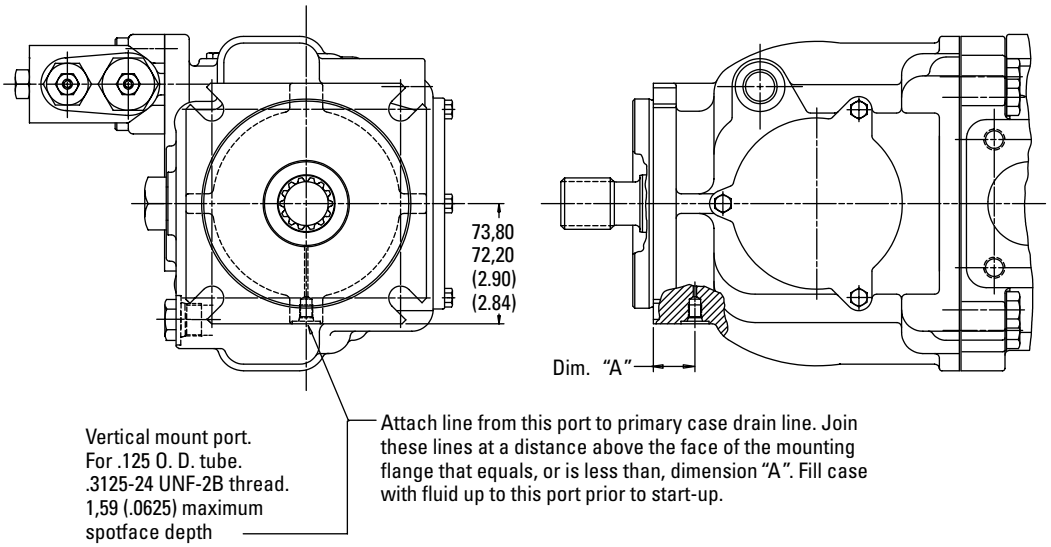
Note: When cover (part number 939790) is ordered as a separate part, two screws (part number 170177) are required to attach the cover to the pump's rear mounting flange.

The O-ring for sealing the rear mounting flange is furnished with each thru-drive pump.

Installation Dimensions

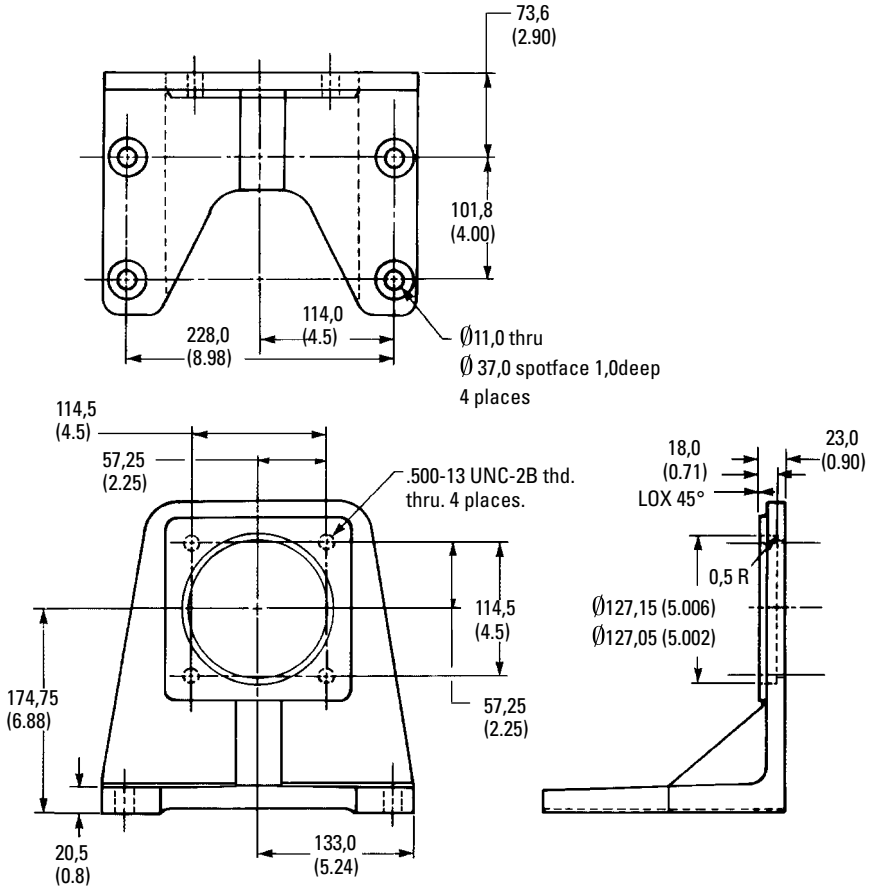
Pumps for Shaft-up Operation (Vertical Mount, "057" Option)

Model	Dim. "A"
PVH057	25,68/24.94
PVH063	(1.01/0.98)
PVH074	26,64/25,90
PVH081	(1.05/1.02)
PVH098	25,82/25,08
PVH106	(1.02/0.99)
PVH131	25,12/24,38
PVH141	(.99/0.96)



Model FB-C4-10 Foot Mounting Kit for All PVH Pumps

Each kit (part no. 02-143419) includes bracket shown and four screws for mounting to the pump. Kits are not included with pumps and must be ordered separately by model number.



Application Data

Hydraulic Fluids and Temperature Ranges

Use anti-wear hydraulic oil, or automotive type crankcase oil (designations SC, SD, SE or SF) per SAE J183 FEB80.

Select a viscosity grade that will allow optimum viscosity, between 40 cSt (180 SUS) and 16cSt (80 SUS), to be achieved.

Cold start capability at 5000 cSt. Max. intermittent temp. 104° C (220° F).

For further information, see 694.

Fluid Cleanliness

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.

Essential information on the correct methods for treating hydraulic fluid is included in Eaton publication 561; "Vickers Guide to Systemic Contamination Control," available from your local Eaton distributor or by contacting Eaton. Recommendations on filtration and the selection of products to control fluid condition are included in 561.

Recommended cleanliness levels, using petroleum oil under common conditions, are based on the highest fluid pressure levels in the system and are coded in the chart below. Fluids other than petroleum, severe service cycles or temperature extremes are cause for adjustment of these cleanliness codes. See Eaton publication 561 for exact details.

Eaton products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Other manufacturers will often recommend levels above those specified. Experience has shown, however, that life of any hydraulic components is shortened in fluids with higher cleanliness codes than those listed below. These codes have been proven to provide a long trouble-free service life for the products shown, regardless of the manufacturer.

Drive Data

Mounting attitude should be horizontal. See preceding page for vertical mount option. Consult your local Vickers representative if a different arrangement is required.

Direction of shaft rotation, viewed at the prime mover end, must be as indicated in the model designation on the pump. See "5" in Model Codes, page 6.

Drive arrangement should be by direct drive through a flexible coupling. Check pump installation drawing for concentricity and squareness tolerances.

Torque capability of shafts in basic (non-thru-drive) pumps is well in excess of that needed for operation at rated pressure and maximum displacement. Limitations for multiple pumps formed by PVH thru-drives as front-end sections are specified in the chart on page 18.

Moment of Inertia (Single Pump Rotating Group)

Model	$Nm.sec^2$	$(lb.in.sec^2)$
PVH057	0,0054	(0.0475)
PVH063	0,0054	(0.0447)
PVH074	0,0078	(0.0692)
PVH081	0,0073	(0.0643)
PVH098	0,0134	(0.1189)
PVH106	0,0123	(0.1086)
PVH131	0,0210	(0.1862)
PVH141	0,0210	(0.1856)

Cleanliness Codes For Petroleum Oil Usage

	System Pressure Level		
Product	**2000 psi**	**2000-3000 psi**	**3000+ psi**
Vane pumps, fixed	20/18/15	19/17/14	18/16/13
Vane pumps, variable	18/16/14	17/15/13	
Piston pumps, fixed	19/17/15	18/16/14	17/15/13
Piston pumps, variable	18/16/14	17/15/13	16/14/12
Directional valves	20/18/15	20/18/15	19/17/14
Proportional valves	17/15/12	17/15/12	15/13/11
Servo valves	16/14/11	16/14/11	15/13/10
Pressure/Flow controls	19/17/14	19/17/14	19/17/14
Cylinders	20/18/15	20/18/15	20/18/15
Vane motors	20/18/15	19/17/14	18/16/13
Axial piston motors	19/17/14	18/16/13	17/15/12
Radial piston motors	20/18/14	19/17/13	18/16/13

Weights, Ordering, Installation/Start-up

Weights in kg (lb)*

Pump Size	Basic Pump	Thru-drive Pump SAE "A"
PVH057	30–36	31-37
PVH063	(66-79)	(68-82)
PVH074	39-45	42-48
PVH081	(86-99)	(93-106)
PVH098	43-49	44-50
PVH106	(95-108)	(97-110)
PVH131	60-66	62-68
PVH141	(132-145)	(137-150)

*Approximate dry weights. Weight for a given model depends upon the type of pump control selected.

Ordering Procedure

Order PVH pumps by the full model designation. Pump displacement, mounting flange type, direction of rotation, pump configuration, shaft end type, shaft seals, pressure adjustment range, specific control functions, and torque limiter settings are all specified in the full model code.

Various Vickers® relief valves from Eaton are suitable for use with the "IC" compensator and must be ordered separately.

Examples include:

- DGMC2-3-AT-BT (plus DG4V-3-8C directional valve) for remotely and electrically controlled dual-pressure compensation, and standby no-flow pump operation in the load sensing mode.
- DGMC-3-PT-FW-30 crossline relief module (with DG4V3-8C directional valve) for electrical selection of dual pressure compensation.
- ECGF-02-9-21 proportional relief valve, with feedback, for remote control of pressure compensation.
- ECG-02-9-30 proportional relief valve for remote control of pressure compensation.
- DGMC-3-AT-BT (plus DG4V-3-0A directional valve) for remotely and electrically selected dual-pressure compensation.
- C175-F-20 (plus blanking plate DGMA-3-B-11 and tapping plate DGMA-T2-20-S) for remote control of pressure compensation.
- CVGC-3-S12 for non-remote control of pressure compensation.
- DGMC-3-PT-FW-30 crossline relief module (with blanking plate DGMA-3-B-11) for non-remote control of pressure compensation.

Contact your Vickers representative for additional information on the application and ordering of relief valves.

Installation and Start-up

The installation of PVH pumps must be in accord with the data on pages 16 and 27.

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 terminate below the oil level.

If the pump has the vertical-mount option, attach a secondary drain line as noted on page 29.

Maximum continuous pressure at the case drain port must not exceed 0,5 bar (7 psi). For multiple pump arrangements that include non-PVH sections, the requirements of the non-PVH units must be considered.

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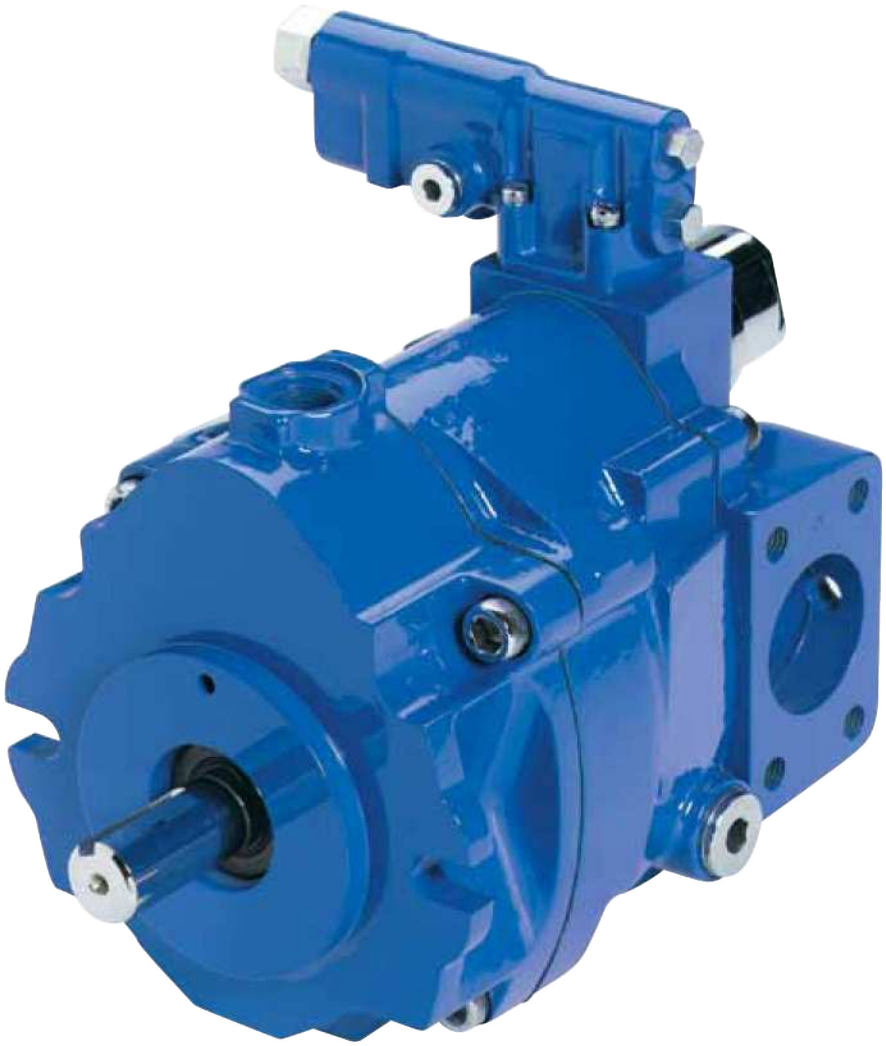
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Powering Business Worldwide

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Eaton PVM Variable Displacement Piston Pumps
Vickers® Product Line

18-141cc³
(1.1-8.6in³)



EATON
Powering Business Worldwide

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Introduction

Eaton 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 to 280 bar (4000 psi) continuous and 320 bar (4600 psi) intermittent – with less maintenance cost. High-load bearings and a stiff drive shaft help provide a pump life of 8000 hours 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 flanges are offered in SAE and ISO configurations, and ports are offered in SAE, ISO, and BSPP in both tube and flange versions. This provides a wide variety of installation opportunities for global machine design.

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

- Long pump life
- Quiet pump operation
- Inlet and outlet gauge ports and adjustable maximum displacement stops – standards
- Astonishingly low 4% pressure ripple
- Low installed and operating costs
- Reduced maintenance
- Flexibility in machine design
- Design promotes leak-free system

Hydraulic System Design Calculations

Basic Formulas

Output Flow (Q)

$$lpm = \frac{cm^3/r \times rpm}{1000} \qquad gpm = \frac{in^3/r \times rpm}{231}$$

Input Power (P)

$$kW = \frac{l/min \times bar}{600} \qquad hp = \frac{gpm \times psi}{1714}$$

Shaft Torque (M)

$$N\text{-}m = \frac{bar \times cm^3/r}{62.8} \qquad lb\text{-}in = \frac{psi \times in^3/r}{6.28}$$

Shaft Speed (n)

$$rpm = \frac{1000 \times 1/min}{cm^3/r} \qquad RPM = \frac{231 \times gpm}{in^3/r}$$

Output Power (P)

$$kW = \frac{N\text{-}m \times RPM}{9549} \qquad hp = \frac{lb\text{-}in \times rpm}{63{,}025}$$

Volumetric Displacement

$$cm^3/r = \frac{lpm \times 1000}{rpm} \qquad in^3/r = \frac{gpm \times 231}{rpm}$$

Basic Formulas

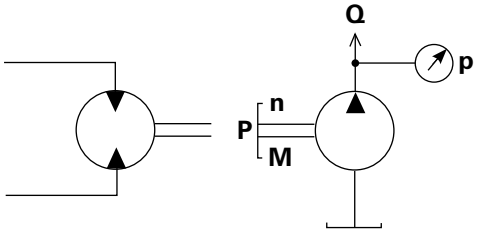
bar = 10 Newtons/cm^2
gpm = gallons per minute
hp = horsepower
lb-in = pound inch
lb-ft = pound feet
kW = kilowatt
kgf = kilograms force
l/min = liters per minute
N-m = Newton meters
psi = pounds per square inch
rpm = revolutions per minute

Efficiencies

$$\text{Volumetric } Nv = \frac{\text{gpm actual}}{\text{gpm theorectical}}$$

$$\text{Mechanical } Nm = \frac{\text{lb-in actual}}{\text{lb-in theorectical}}$$

Total Nt = Nv x Nm



Commonly Used Conversions

To Convert	Into	Multiply by
bar	psi	14.5
cm^3	in^3	0.06102
˚C	˚F	(˚C x 1.8) +32
gallons (US)	liters	3.785
kg	lbs	2.205
kgf/cm^2	psi	14.2
kW	hp	1.341
liters	US Gallons	0.2642
mm	inches	0.03937
N-m	lb-in	8.85
N-m	lb-ft	0.7375
˚F	˚C	(˚F-32)/1.8
hp	kW	0.7457
inch	mm	2.54
in^3	cm^3	16.39
lb-in	N-m	0.113
lb-ft	N-m	1.356
lbs	kg	0.4535
psi	bar	0.06896
psi	kgf/cm^2	.070307

Note: Performance charts can be found on subsequent pages.

Model Code Selection

PVM	045	E	R	01	A	E	01	AA	A	28	00	00	0	0	A	0	A
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

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

4,5,6 Displacement
Twelve displacements available 230 bar and 280 bar continuous ratings

7 Valve Plate
E – Industrial Equipment Speeds

8 Input Rotation
R – Clockwise (Righthand)
L* – Counter-clockwise (Lefthand)

9, 10 Input Shaft
Standard SAE and ISO splined versions (Other configurations optional)

11 Mounting Flange
Thirteen options in SAE and ISO mounts

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

13, 14 Main Port Type
SAE & ISO tube ports and 4-bolt flange (Other configurations optional)

15, 16 Pump Special Features
00 – None
AA – Adjustable Maximum Displacement Stop and single shaft (standard)
AB – Double Shaft Seal, Two Way

17 Control
0 – None
A – Pressure Compensator
B – Pressure and Flow Compensator with Bleed Orifice
C – Pressure and Flow Compensator with Plugged Orifice
E – Industrial Control (57cc through 141 cc only)

18, 19 Pressure Compensator Setting
00 – None
07 – 70 bar (Adjustable between 40 bar and 130 bar)
23 – 230 bar (Adjustable between 130 bar and 320 bar)
28 – 280 bar (Adjustable between 130 bar and 320 bar)

20, 21 Flow Compensator Setting
00 – None
11 – 11 bar setting
20 – 20-20 bar setting
24 – 24-24 bar setting

22, 23 Torque Limiter Setting
00 – None (Not available on M Series)

24 Compensator Special Features
0 – None

25 Auxiliary Mounting Pad
0*** – None

(Auxiliary mounting available on all frame sizes)

26 Paint
0 – No Paint
A – Standard Blue Paint

27 Customer Identification
0 – None (Contact Eaton for Options)

28 Design Code
A – A (Initial Release)

* Not available on 074, 081, 098 and 106 End Port

** Not available on 074, 081, 098 and 106 LH

*** Through drive not available on the LH

**** Not available on 018

Model Code Options

4,5,6 Maximum Geometric Displacement

Displacement Code	018	020	045	050	057	063	074	081	098	106	131	141
cm^3/r	18,0	21,1	45,1	50,0	57,4	63,1	73,7	81,0	98,3	106,5	131,1	141,0
in^3/r	1.1	1.29	2.75	3.05	3.50	3.85	4.50	4.94	6.00	6.50	8.00	8.60

9,10 Shaft-End Type at Electric Motor End

	Shaft Code					
Description	**PVM018/020**	**PVM045/050**	**PVM057/063**	**PVM074/081**	**PVM098/106**	**PVM131/141**
SAE, SAE A, Straight Keyed	01	–	–	–	–	–
SAE, SAE 19-1, Straight Keyed	02	–	–	–	–	–
SAE, SAE A, 9T Spline	03	–	–	–	–	–
SAE, SAE A, 11T Spline	04	–	–	–	–	–
SAE, SAE B, Straight Keyed	05	05	–	–	–	–
SAE, SAE B-B, Straight Keyed	06	06	06	–	–	–
SAE, SAE B, 13T Spline	07	07	07	–	–	–
SAE, SAE B-B, 15T Spline	08	08	08	–	–	–
SAE, SAE C, Straight Keyed	–	–	09	09	09	09
SAE, SAE C-C, Straight Keyed	–	–	–	10	10	10
SAE, SAE C, 14T Spline	–	–	11	11	11	11
SAE, SAE C-C, 17T Spline	–	–	–	12	12	12
SAE, SAE D, Straight Keyed	–	–	–	–	–	13
SAE, SAE D, 13T Spline	–	–	–	–	–	14
ISO E20N, Straight Keyed	15	–	–	–	–	–
ISO E25N, Straight Keyed, Short Spigot	16	–	–	–	–	–
ISO E25N, Straight Keyed	17	17	17	–	–	–
ISO E32N, Straight Keyed, Short Spigot	–	–	18	18	18	18
ISO E40N, Straight Keyed, Short Spigot	–	–	–	19	19	19

11 Mounting Flange Specifications

Code	Description	PVM018/020	PVM045/050	PVM057/063	PVM074/081	PVM098/106	PVM131/141
A	SAE A, 2-bolt	●	○	○	○	○	○
B	ISO 80A2HW	●	○	○	○	○	○
C	SAE B, 2-bolt	●	●	●	○	○	○
D	ISO 100A2HW	●	●	●	○	○	○
E	SAE C, 2-bolt	○	○	●	●	●	●
F	ISO 125-A2HW	○	○	●	●	●	●
G	SAE C, 4-bolt	○	○	●	●	●	●
H	ISO 125B4HW	○	○	●	●	●	●
J	SAE D, 4-bolt	○	○	○	○	○	●
K	ISO 160B4HW	○	○	○	○	○	●

●= Available

○= Not Available

Model Code Options

13,14 Main Port Options

Code	Description	Inlet Outlet	PVM018/020	PVM045/050	PVM057/063	PVM074/081	PVM098/106	PVM131/141
01	SAE J1926 Tube Ports	Inlet	–20	–24	–24 (End ports only)	–	–	–
		Outlet	–12	–16	–16 (End ports only)	–	–	–
02	SAE J518 Flange Ports	Inlet	1.25 inch	2.0 inch	2.0 inch	2.0 inch	2.5 inch	2.5 inch
		Outlet	0.75 inch	1.0 inch	1.0 inch	1.0 inch	1.0 inch	1.25 inch*
03	ISO 6149-1 Tube Ports	Inlet	M42	M48	M48 (End ports only)	–	–	–
		Outlet	M27	M33	M33 (End ports only)	–	–	–
04	ISO 6162 Flange Ports	Inlet	32mm	51mm	51mm	51mm	64mm	64mm
		Outlet	19mm	25mm	25mm	25mm	25mm	32mm*
05	British Standard Parallel Pipe – Tube Ports	Inlet	G 1-1/4	G 1-1/2	–	–	–	–
		Outlet	G 3/4	G 1	–	–	–	–

*SAE Code 62, high pressure series, or ISO 400 bar. Other flange ports are SAE Code 61, standard pressure series, or ISO 25-350 bar.

25 Thru-Drive Options

Code	Description	PVM018/020	PVM045/050	PVM057/063	PVM074/081*	PVM098/106	PVM131/141
O	Single pump, non-thru-drive	●	●	●	●	●	●
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	○	●	●	●	●	●
E	SAE C, 2-/4-bolt, 14T spline	○	○	●	●	●	●
F	SAE C-C, 2-/4-bolt, 17T spline	○	○	○	●	●	●
G	ISO 80-A2HW, 9T SAE spline	●	●	●	●	●	●
H	ISO 80-A2HW, 11T SAE spline	●	●	○	●	●	●
J	ISO 100-A2/B4HW, 13T SAE spline	○	●	●	●	●	●
K	ISO 100-A2/B4HW, 15T SAE spline	○	○	●	●	●	●
L	ISO 125-A2/B4HW, 14T SAE spline	○	○	●	●	●	●
M	ISO 125-A2/B4HW, 17T SAE spline	○	○	○	●	●	●

●= Available

○= Not Available

* Not available on the 074/081 LH

Specifications and Performance

Industrial

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 280 bar (4000 psi)* l/min (USgpm) – Average measured flow rate			
		Continuous	Intermittent*	Peak**	@1800 r/min	@1500 r/min	@1200 r/min	@1000 r/min
PVM018	18 (1.1)	280 (4000)	320 (4600)	350 (5000)	31 (8.2)	26 (7)	21 (5.5)	17 (4.5)
PVM020	21,1 (1.29)	230 (3300)	250 (3600)	280 (4000)	35 (9)	29 (8)	23 (6)	19 (5)
PVM045	45,1 (2.75)	280 (4000)	320 (4600)	350 (5000)	76 (20)	65 (17)	49 (13)	42 (11)
PVM050	50,0 (3.05)	230 (3300)	250 (3600)	280 (4000)	87 (23)	75 (20)	62 (16)	49 (13)
PVM057	57,4 (3.50)	280 (4000)	320 (4600)	350 (5000)	102 (27)	85 (22.4)	66 (17.4)	54 (14.3)
PVM063	63,1 (3.85)	230 (3300)	250 (3600)	280 (4000)	111 (29)	93 (24)	74 (19)	60 (16)
PVM074	73,7 (4.50)	280 (4000)	320 (4600)	350 (5000)	127 (33.5)	106 (28)	86 (22.7)	70 (18.5)
PVM081	81,0 (4.94)	230 (3300)	250 (3600)	280 (4000)	139 (37)	116 (31)	93 (25)	76 (20)
PVM098	98,3 (6.00)	280 (4000)	320 (4600)	350 (5000)	170 (45)	141 (37)	112 (29.6)	92 (24.3)
PVM106	106,5 (6.50)	230 (3300)	250 (3600)	280 (4000)	187 (49)	155 (41)	123 (32)	102 (27)
PVM131	131,1 (8.00)	280 (4000)	320 (4600)	350 (5000)	215 (57)	178 (47)	141 (37)	118 (31)
PVM141	141,0 (8.60)	230 (3300)	250 (3600)	280 (4000)	238 (63)	199 (53)	158 (42)	131 (35)

*Less than 10% of duty cycle.

**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 280 bar (4000 psi) kw (hp)*@88% M.E.				Maximum Torque at 280 bar (4000 psi)* Nm (lb-ft)	Approximate Weight kg (lb)
		@1800 r/min	@1500 r/min	@1200 r/min	@ 1000 r/min		
PVM018	1800	16 (22)	13 (18)	11 (15)	9 (12)	84 (62)	15 (33)
PVM020	1800	14 (18)	11 (15)	9 (12)	8 (10)	73 (54)	15 (33)
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)
PVM057	1800	52 (70)	44 (59)	36 (49)	29 (39)	272 (201)	36 (79)
PVM063	1800	42 (57)	36 (48)	29 (39)	24 (32)	228 (168)	36 (79)
PVM074	1800	63 (84)	52 (70)	42 (56)	35 (47)	334 (246)	45 (99)
PVM081	1800	56 (75)	46 (62)	35 (47)	28 (37)	286 (211)	45 (99)
PVM098	1800	88 (118)	72 (97)	58 (78)	48 (64)	464 (342)	55 (121)
PVM106	1800	72 (97)	60 (80)	48 (64)	40 (54)	383 (282)	55 (121)
PVM131	1800	113 (152)	94 (126)	75 (101)	63 (85)	596 (440)	66 (145)
PVM141	1800	94 (126)	79 (106)	63 (85)	53 (71)	497 (367)	66 (145)

Standard Response Times*

Model Series	On Stroke (msec)	Off Stroke (msec)
PVM018	30	25
PVM020	39	26
PVM045	140	40
PVM050	140	40
PVM057	65	20
PVM063	85	20

* 3300 psi on overbore pumps

Standard Response Times*

Model Series	On Stroke (msec)	Off Stroke (msec)
PVM074	85	30
PVM081	85	30
PVM098	65	25
PVM106	72	29
PVM131	135	30
PVM141	100	30

*Values with pressure compensator control.

Specifications and Performance

Mobile

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 280 bar (4000 psi)	
		Continuous	Intermittent*	Peak**	Flange Ports l/min (USgpm) @ 1 bar inlet	Tube Ports l/min (USgpm) @ 1 bar inlet
PVM018	18,0 (1.10)	280 (4000)	320 (4600)	350 (5000)	46 (12) @ 2800 r/min	46 (12) @ 2800 r/min
PVM020	20,1 (1.22)	230 (3300)	250 (3600)	280 (4000)	53 (14) @ 2800 r/min	53 (14) @ 2800 r/min
PVM045	45,1 (2.75)	280 (4000)	320 (4600)	350 (5000)	115 (30) @ 2600 r/min	106 (28) @ 2400 r/min
PVM050	50,0 (3.05)	230 (3300)	250 (3600)	280 (4000)	125 (33) @ 2600 r/min	116 (31) @ 2400 r/min
PVM057	57,4 (3.50)	280 (4000)	320 (4600)	350 (5000)	140 (37) @ 2500 r/min	128 (34) @ 2300 r/min
PVM063	63,1 (3.85)	230 (3300)	250 (3600)	280 (4000)	150 (40) @ 2500 r/min	140 (37) @ 2400 r/min
PVM074	73,7 (4.50)	280 (4000)	320 (4600)	350 (5000)	163 (43) @ 2400 r/min	–
PVM081	81,0 (4.94)	230 (3300)	250 (3600)	280 (4000)	181 (48) @ 2400 r/min	–
PVM098	98,3 (6.00)	280 (4000)	320 (4600)	350 (5000)	200 (53) @ 2200 r/min	–
PVM106	106,5 (6.50)	230 (3300)	250 (3600)	280 (4000)	222 (59) @ 2200 r/min	–
PVM131	131,1 (8.00)	280 (4000)	320 (4600)	350 (5000)	233 (62) @ 2000 r/min	–
PVM141	141,0 (8.60)	230 (3300)	250 (3600)	280 (4000)	258 (68) @ 2000 r/min	–

*Less than 10% of duty cycle.
**Less than 0.5 second.

Standard Response Times*

Model Series	On Stroke (msec)	Off Stroke (msec)
PVM018	50	20
PVM020	57	22
PVM045	140	40
PVM050	140	23
PVM057	65	20
PVM063	94	20

Standard Response Times*

Model Series	On Stroke (msec)	Off Stroke (msec)
PVM074	95	30
PVM081	135	30
PVM098	85	24
PVM106	90	25
PVM131	100	30
PVM141	128	28

*Values with pressure compensator control.

Specifications and Performance

Mobile

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

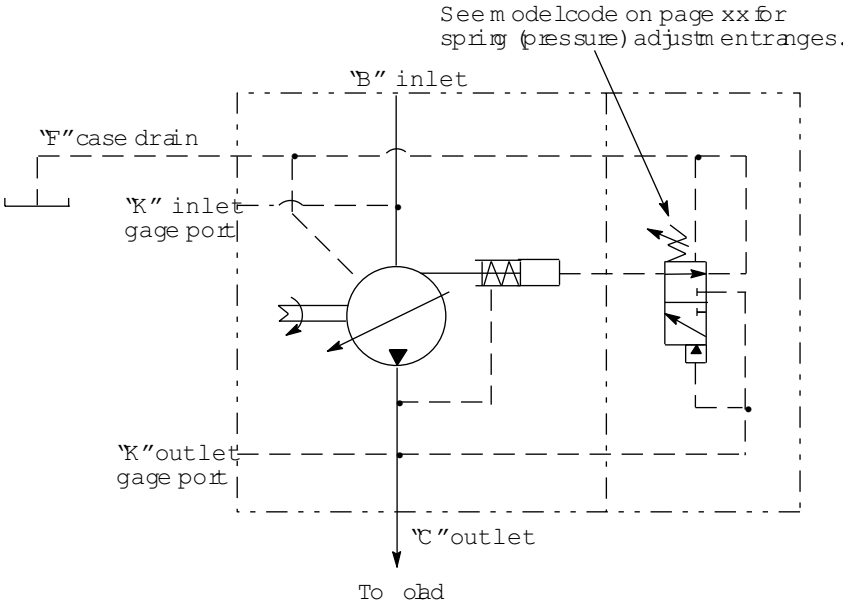
Approximate Model Series	Operating Speed and Pressure r/min			Max. Input Power at Max. Speed and 280 bar (4000 psi) kW (hp)	Max. Torque at 280 bar (4000 psi) Nm (lb-ft)	Weight (dry) kg (lbs)
	1 bar Inlet		0,85 bar Inlet			
	Flange Ports	Tube Ports	Flange Ports			
PVM018	2800 r/min			24 (32)	82 (60)	15 (33)
		2800 r/min		24 (32)		
			2600 r/min	22 (30)		
PVM020	2800 r/min			21 (28)	72 (53)	15 (33)
		2800 r/min		21 (28)		
			2600 r/min	20 (27)		
PVM045	2600 r/min			56 (75)	198 (46)	24 (52)
		2400 r/min		53 (71)		
			2200 r/min	48 (64)		
PVM050	2600 r/min			51 (68)	204 (150)	24 (52)
		2400 r/min		48 (64)		
			2200 r/min	44 (59)		
PVM057	2500 r/min			68 (91)	262 (193)	36 (79)
		2300 r/min		62 (83)		
			2100 r/min	56 (75)		
PVM063	2500 r/min			59 (79)	225 (166)	36 (79)
		2400 r/min		57 (76)		
			2200 r/min	52 (69)		
PVM074	2400 r/min			84 (113)	334 (246)	45 (99)
			1900 r/min	69 (93)		
PVM081	2400 r/min			69 (93)	276 (204)	45 (99)
			1900 r/min	55 (74)		
PVM098	2200 r/min			105 (141)	457 (337)	55 (121)
			1800 r/min	86 (115)		
PVM106	2200 r/min			87 (117)	377 (278)	55 (121)
			1800 r/min	70 (94)		
PVM131	2000 r/min			122 (164)	581 (429)	66 (145)
			1600 r/min	98 (131)		
PVM141	2000 r/min			102 (137)	483 (356)	66 (145)
			1600 r/min	81 (109)		

Control Options

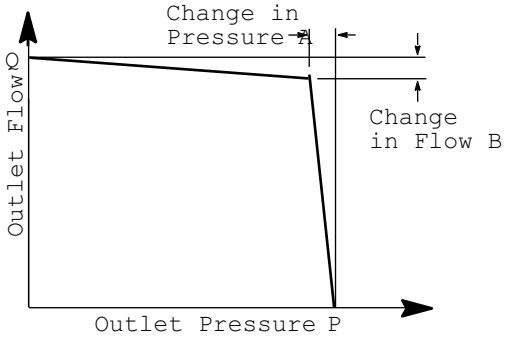
Pressure Compensator Control – Code A

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. See model code on page 4 for compensator pressure ranges.

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 shown on page 7.



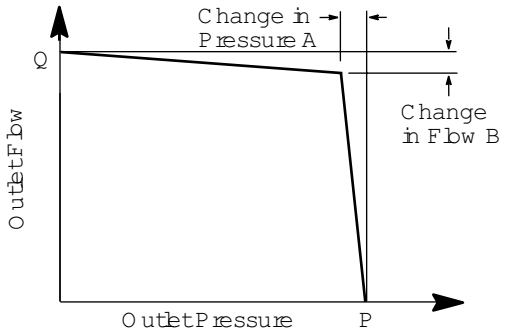
Industrial Pressure Cut-off Characteristics of Code A Pressure Compensator Control at 50°C (120°F), static conditions.



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)
PVM018	1800	32 (8.5)	280 (4000)	2,8 (40)	4,5 (1.2)
PVM020	1800	35 (9.25)	230 (3300)	2,8 (40)	4,5 (1.2)
PVM045	1800	76 (20)	280 (4000)	10 (150)	4,5 (1.2)
PVM050	1800	87 (23)	230 (3300)	10 (150)	4,5 (1.2)
PVM057	1800	102 (27)	280 (4000)	3,5 (51)	14 (3.7)
PVM063	1800	113 (29)	230 (3300)	7,4 (107)	7,6 (2.00)
PVM074	1800	127 (33.5)	280 (4000)	1,5 (22)	37 (9.8)
PVM081	1800	141 (37)	230 (3300)	1,5 (22)	37 (9.8)
PVM098	1800	179 (47)	280 (4000)	1,5 (22)	25 (6.6)
PVM106	1800	195 (51.5)	230 (3300)	1,5 (22)	20 (5.3)
PVM131	1800	229 (60.5)	280 (4000)	3,5 (51)	19 (5.0)
PVM141	1800	238 (63)	230 (3300)	3,5 (51)	14 (3.70)

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)
PVM018	2800	42 (11)	280 (4000)	2,8 (40)	4,5 (1.2)
PVM020	2800	52 (14)	230 (3300)	2,8 (41)	4,5 (1.2)
PVM045	2600	115 (30)	280 (4000)	10 (150)	4,5 (1.2)
PVM050	2600	125 (33)	230 (3300)	10 (150)	4,5 (1.2)
PVM057	2500	140 (37)	280 (4000)	3,5 (50)	14 (3.7)
PVM063	2500	159 (42)	230 (3300)	7,4 (107)	11,4 (3.00)
PVM074	2400	174 (46)	280 (4000)	1,5 (20)	37 (9.8)
PVM081	2400	185 (49)	230 (3300)	1,5 (22)	37 (9.8)
PVM098	2200	217 (57)	280 (4000)	1,5 (20)	32 (8.4)
PVM106	2200	234 (62)	230 (3300)	1,5 (22)	24 (6.33)
PVM131	2000	253 (67)	280 (4000)	1,0 (15)	23 (6.0)
PVM141	2000	258 (68)	230 (3300)	7,0 (100)	14 (3.70)

Control Options

Load Sensing and Pressure Compensator Control – Code B or C

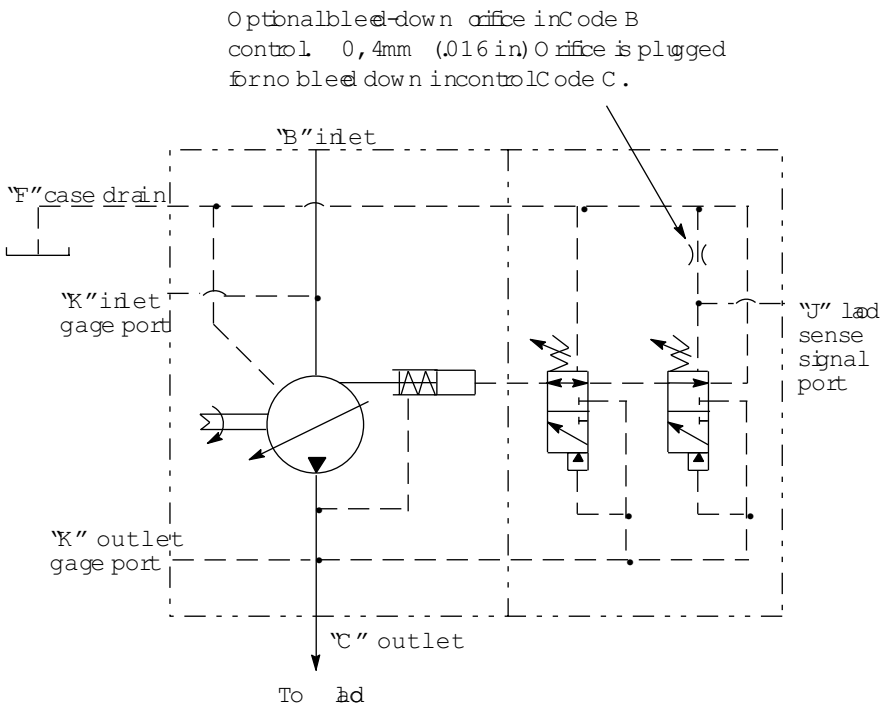
The pump will provide power matching of pump output to system load demand, maximizing efficiency and improving load metering characteristics of any directional control valve installed between the pump and the load.

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. See the model code on page 4 for differential pressure settings for load sensing.

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 Eaton 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 shown on page 7.



Industrial Control Compensator – Code E & F (Model 057-141 only)

This pump is intended for use when multiple, remote, or electronically controlled compensating settings, with or without load sensing, are desired.

Pressure compensation is obtained when an internal plug is removed, the load-sense signal port is kept plugged, and internal pilot pressure is applied to the spring chamber of the control spool. For pressure compensation with load sensing, the internal plug stays, the load-sense signal port is unplugged, and pilot pressure is externally applied.

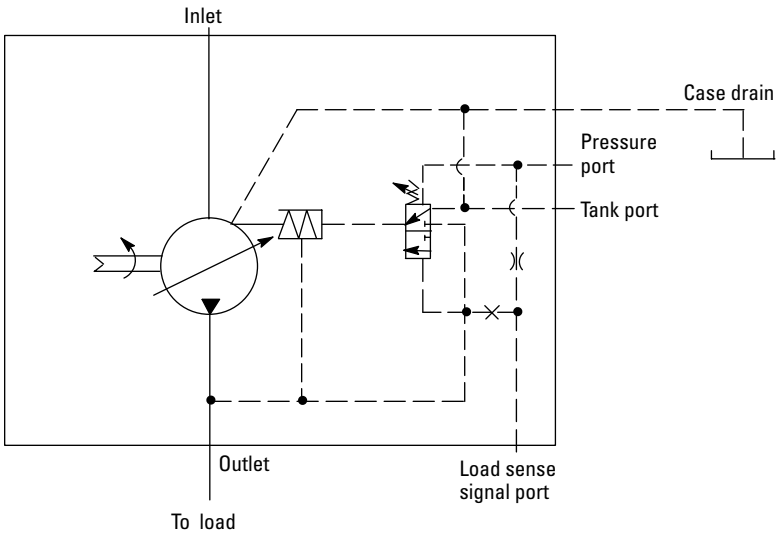
An external relief valve (not supplied) controls spring chamber pressure. The externally adjustable spring determines the differential pressure setting of the control. Outlet pressure is limited to the valve of the spring chamber (pressure port) pressure, plus control differential pressure.

Spring chamber (pilot) pressure is separated from outlet pressure by an internal orifice. Outlet pressure shifts the spool when pressure drop across the orifice reaches the differential pressure setting, and the pump de-strokes.

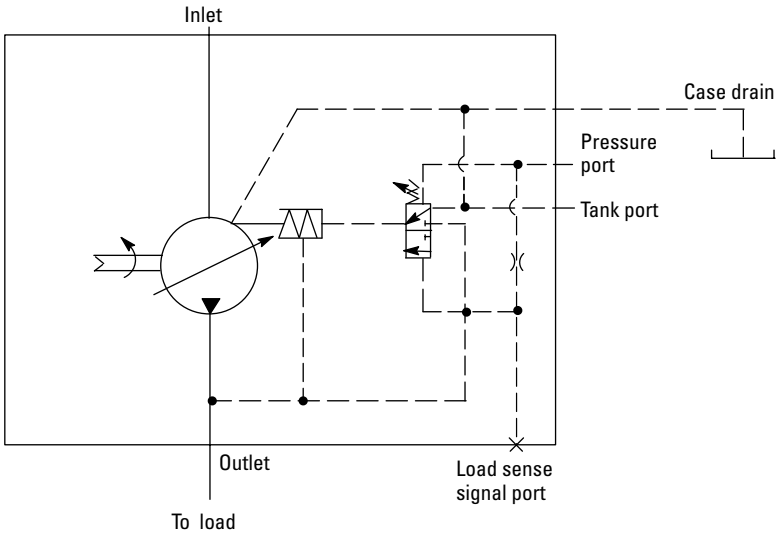
The relief valve can be mounted to an NFPA-D03/ISO 4401-03 pad on the pump control, or remotely located via tapping and blanking plates installed on the pad. See "Ordering Procedure", page 27, for more on valves and plates.

The standard factory-set differential pressure setting of the pump control is 20 bar (290 psi) and is not specified in the pump model number. Any other ordered differential pressure, within the control's adjustable pressure range of 17-35 bar (247-508 psi), will be specified in the model number.

With Pressure & Flow Compensator (E)



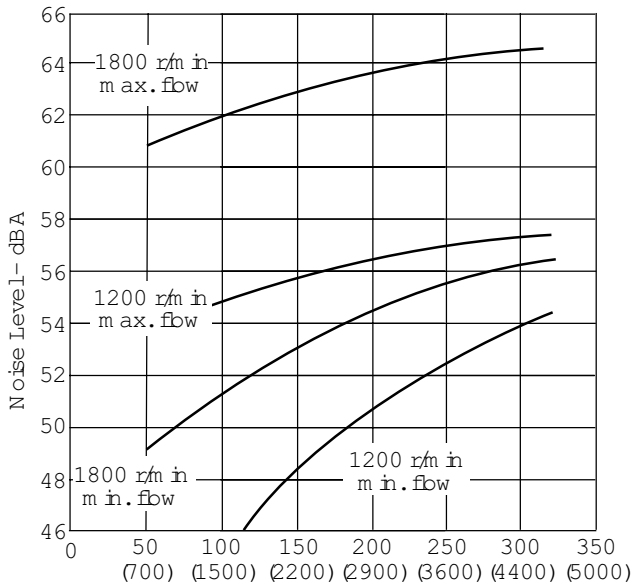
Pressure Compensating Without Load Sensing (F)



Performance

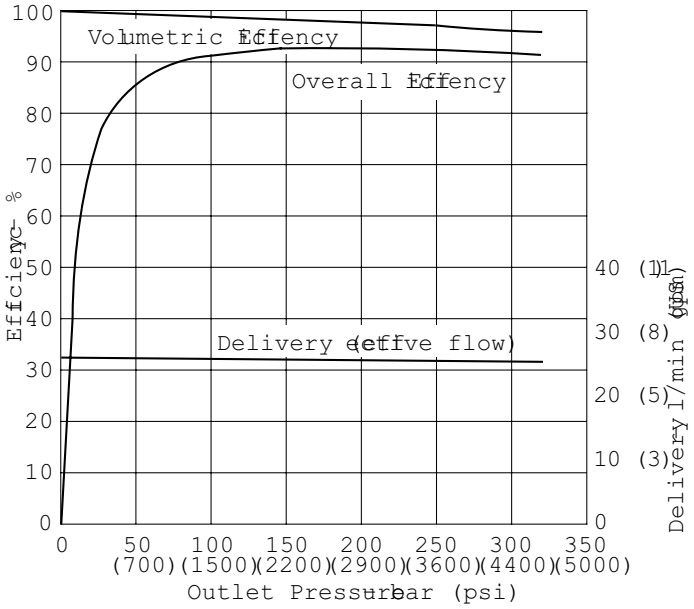
Industrial PVM018

Typical Noise Levels at 1800 and 1200 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet

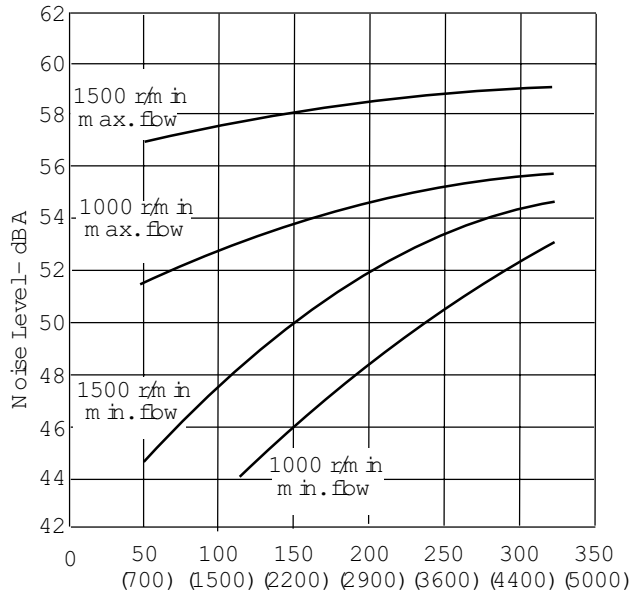


Sound pressure data equivalent to NFPA.

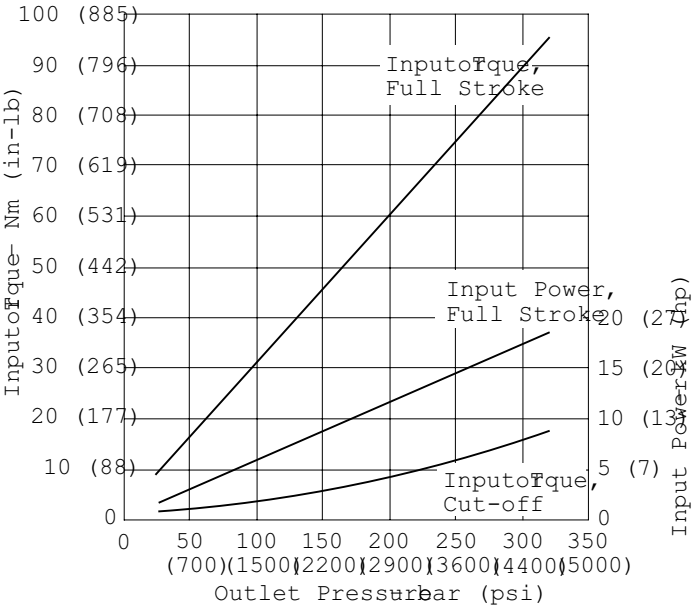
Delivery and Efficiency at 1800 r/min 50°C (120°F) and 1.0 bar absolute (0 psi gauge)



Typical Noise Levels at 1500 and 1000 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet

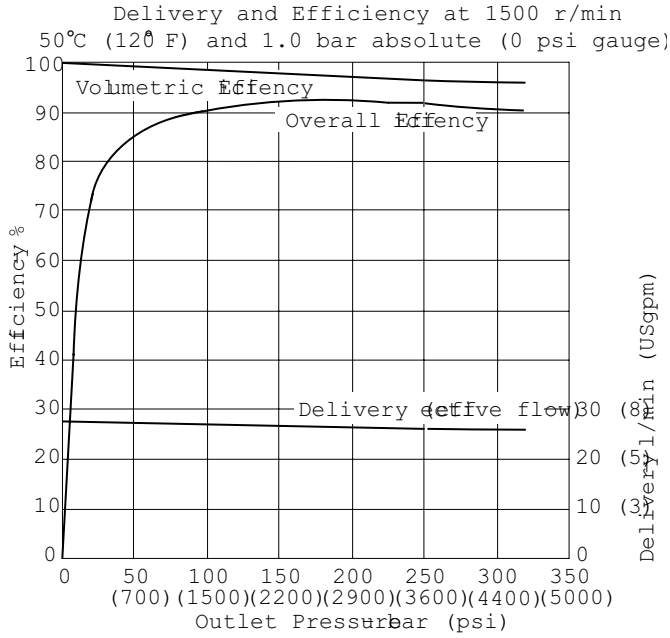


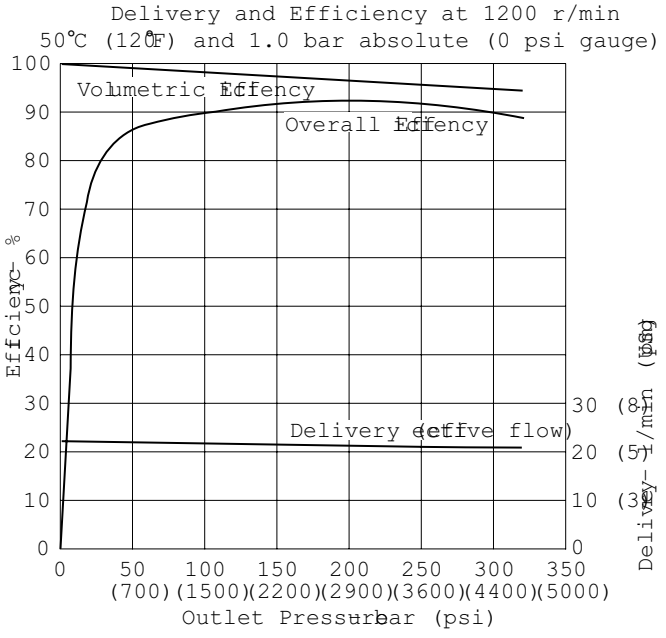
Input Torque and Power at 1800 r/min 50°C (120°F) and 1.0 bar absolute (0 psi gauge)

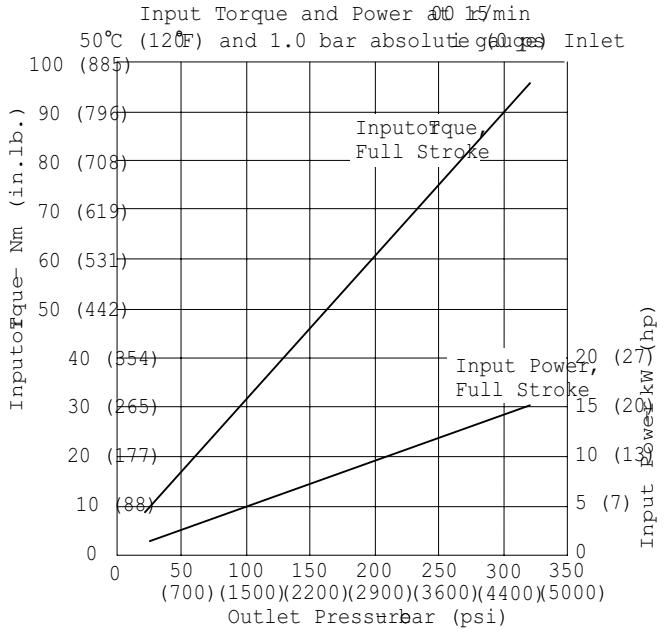


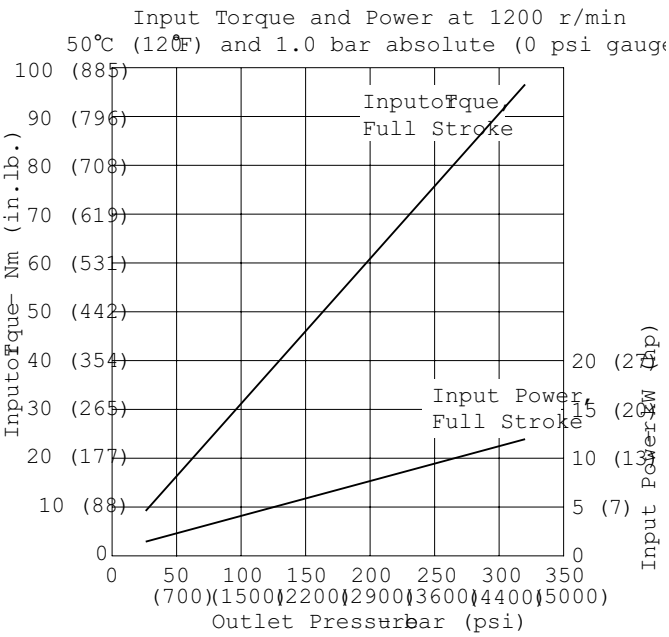
Performance

Industrial PVM018





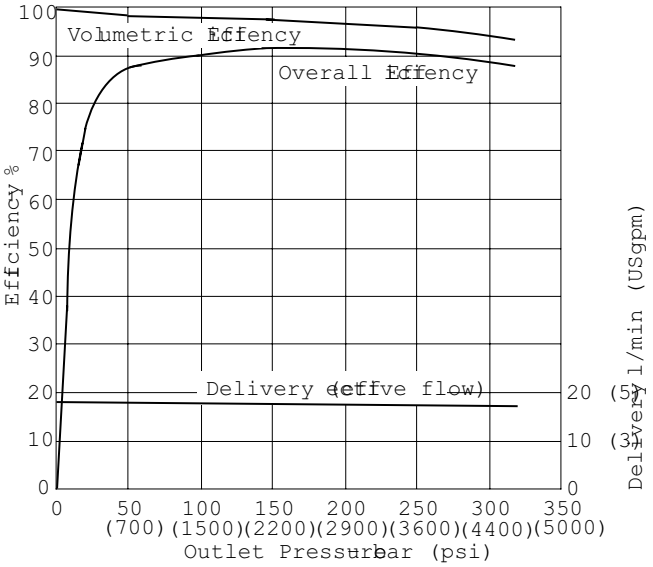




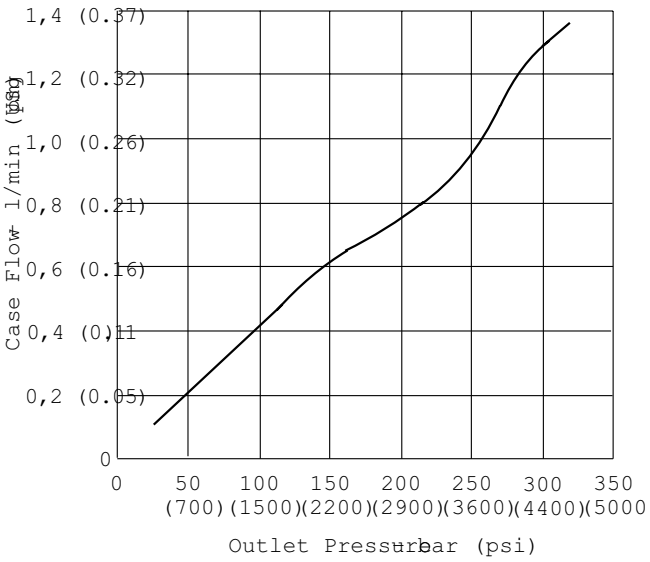
Performance

Industrial PVM018

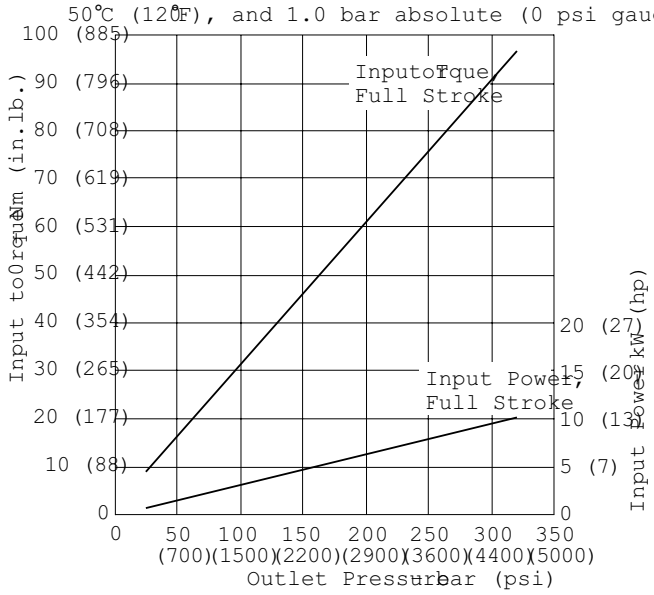
Delivery and Efficiency at 1000 r/min
50°C (120°F) and 1.0 bar absolute (0 psi gauge)



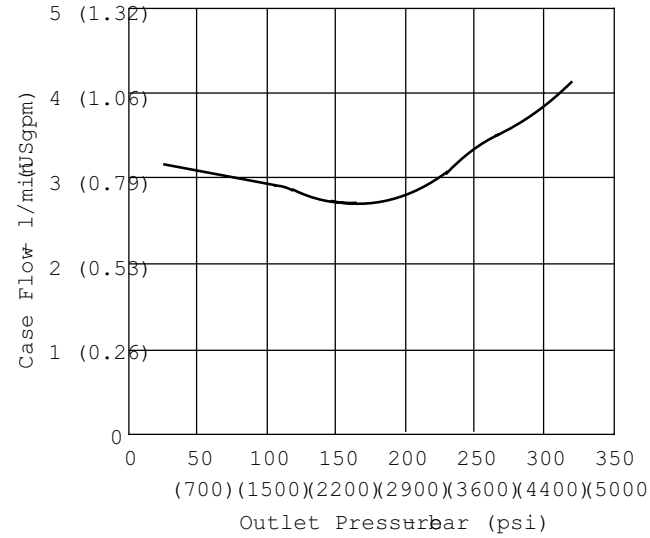
Case Flow Versus Outlet Pressure at 1800 r/min,
50°C (120°F) and 1.0 bar absolute (0 psi gauge



Input Torque and Power at 1000 r/min
50°C (120°F), and 1.0 bar absolute (0 psi gau



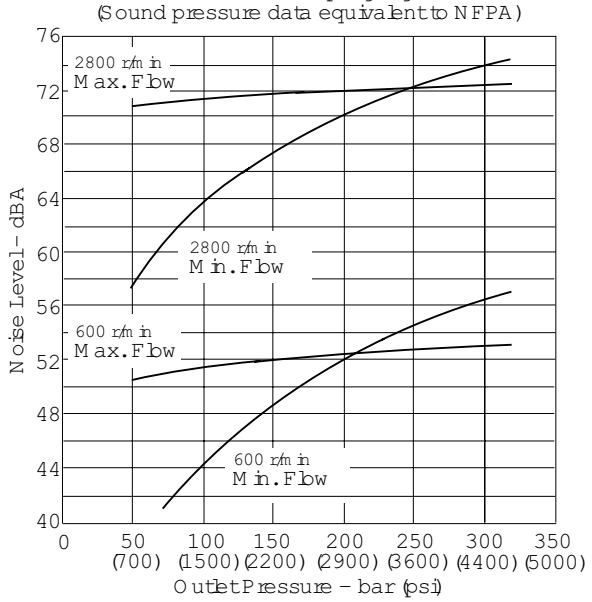
Case Flow Versus Outlet Pressure at Cutoff,
50°C (120°F) and 1.0 bar absolute (0 psi ga



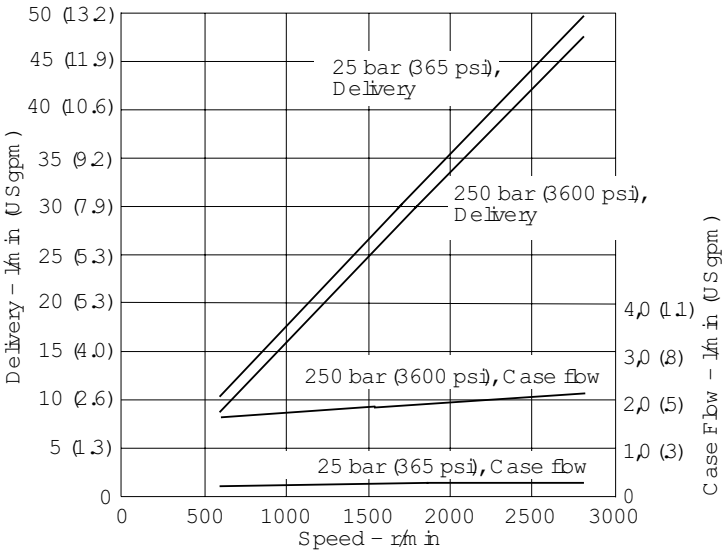
Performance

Mobile PVM018

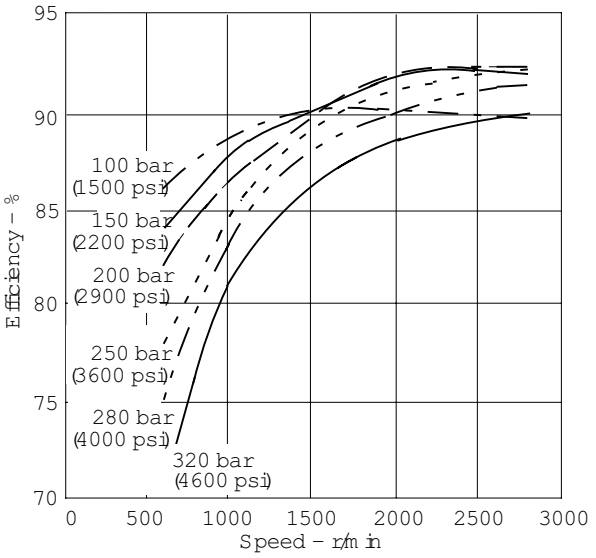
Typical Noise Levels
Petroleum Oil (10W) at 93°C (200°F),
1.0 bar absolute (0 psi gauge) Inlet
(Sound pressure data equivalent to NFPA)



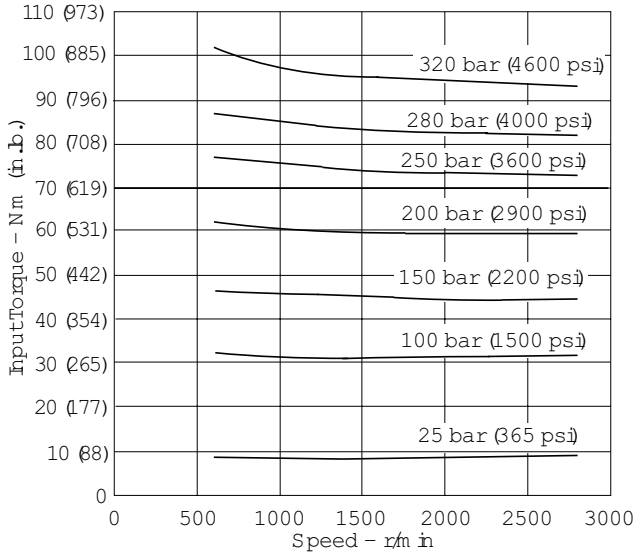
Delivery and Case Flow Versus Speed
@ 93°C (200°F), full flow and 1.0 bar absolute (0 psi) gauge Inlet

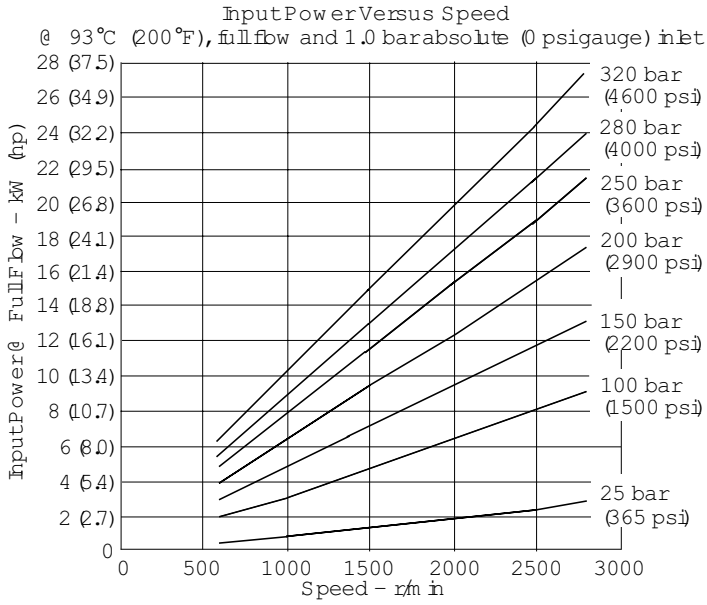


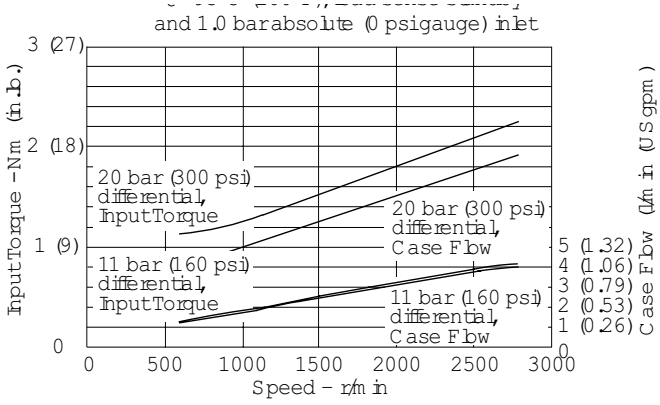
Overall Efficiency Versus Speed
at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) Inlet

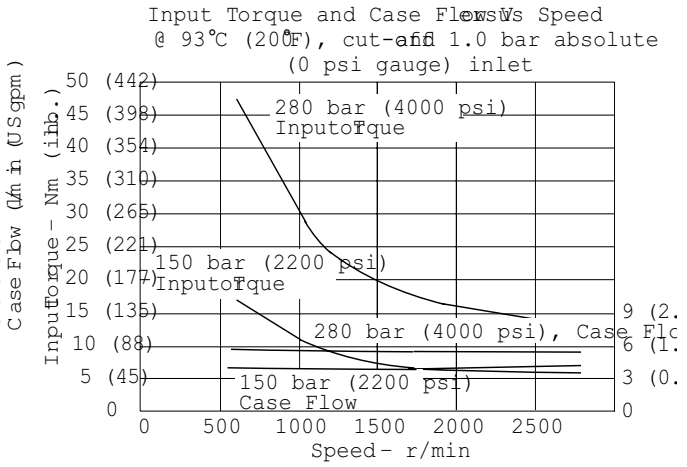


Input Torque Versus Speed
@ 93°C (200°F), full flow and 1.0 bar absolute (0 psi gauge) inlet




Input Power Versus Speed
@ 93°C (200°F), full flow and 1.0 bar absolute (0 psi gauge) inlet
Input Power @ Full Flow – kW (hp)
28 (37.5)
26 (34.9)
24 (32.2)
22 (29.5)
20 (26.8)
18 (24.1)
16 (21.4)
14 (18.8)
12 (16.1)
10 (13.4)
8 (10.7)
6 (8.0)
4 (5.4)
2 (2.7)
0
320 bar (4600 psi)
280 bar (4000 psi)
250 bar (3600 psi)
200 bar (2900 psi)
150 bar (2200 psi)
100 bar (1500 psi)
25 bar (365 psi)
0 500 1000 1500 2000 2500 3000
Speed – r/min

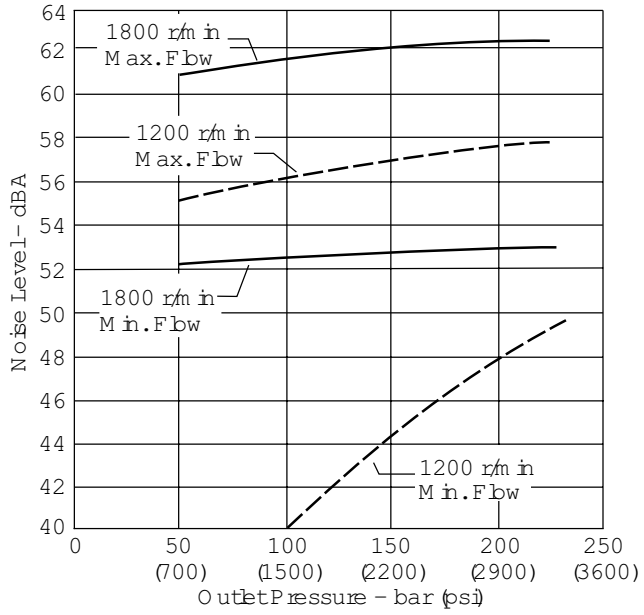

and 1.0 bar absolute (0 psi gauge) inlet
Input Torque – Nm (in.lb.)
3 (27)
2 (18)
1 (9)
0
20 bar (300 psi) differential, Input Torque
11 bar (160 psi) differential, Input Torque
20 bar (300 psi) differential, Case Flow
11 bar (160 psi) differential, Case Flow
Case Flow L/min (US gpm)
5 (1.32)
4 (1.06)
3 (0.79)
2 (0.53)
1 (0.26)
0
0 500 1000 1500 2000 2500 3000
Speed – r/min


Input Torque and Case Flow vs Speed
@ 93°C (200°F), cut-off and 1.0 bar absolute
(0 psi gauge) inlet
Input Torque – Nm (in.lb.)
50 (442)
45 (398)
40 (354)
35 (310)
30 (265)
25 (221)
20 (177)
15 (135)
10 (88)
5 (45)
0
280 bar (4000 psi) Input Torque
150 bar (2200 psi) Input Torque
280 bar (4000 psi), Case Flo
150 bar (2200 psi) Case Flow
9 (2.
6 (1.
3 (0.
0
0 500 1000 1500 2000 2500
Speed – r/min

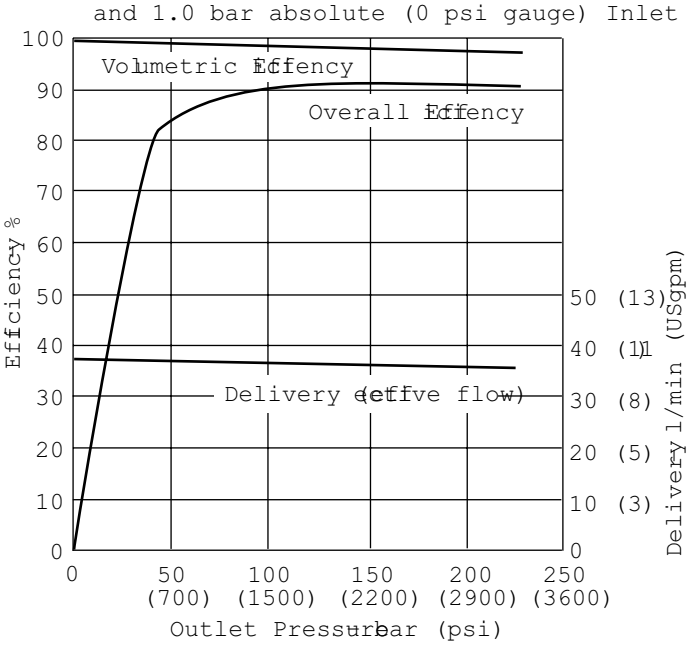
Performance

Industrial PVM020

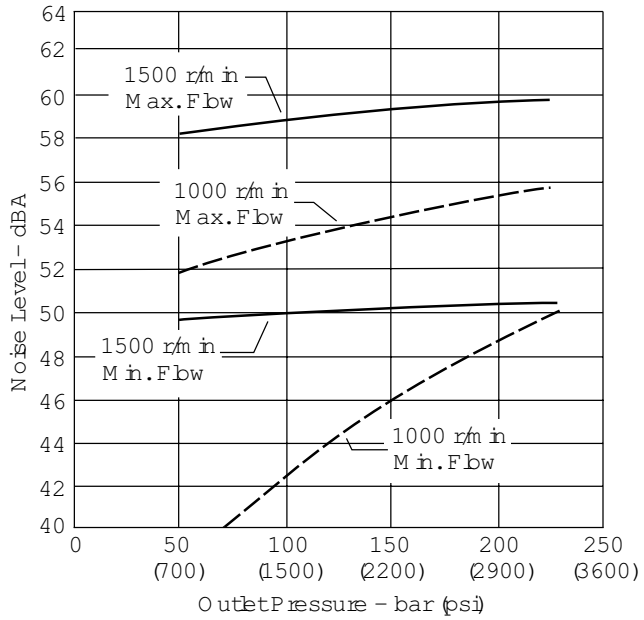
Typical Noise Levels at 1800 and 1200 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Delivery and Efficiency at 1800 r/min (1200°F), and 1.0 bar absolute (0 psi gauge) Inlet

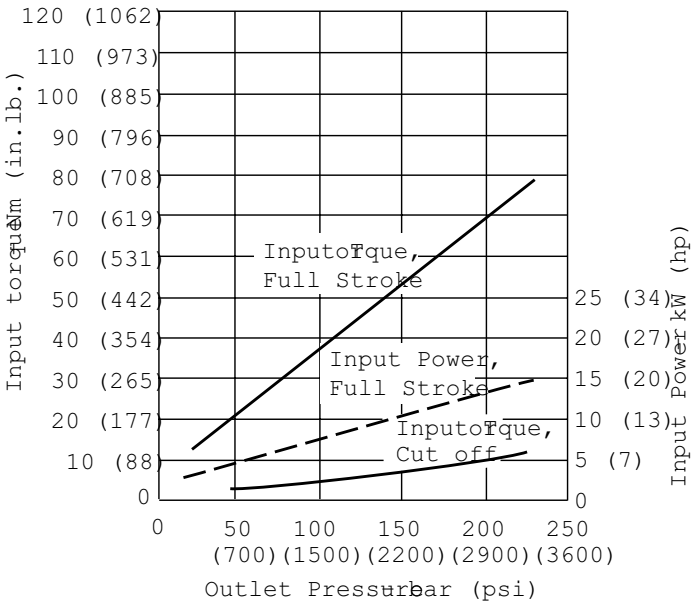


Typical Noise Levels at 1500 and 1000 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



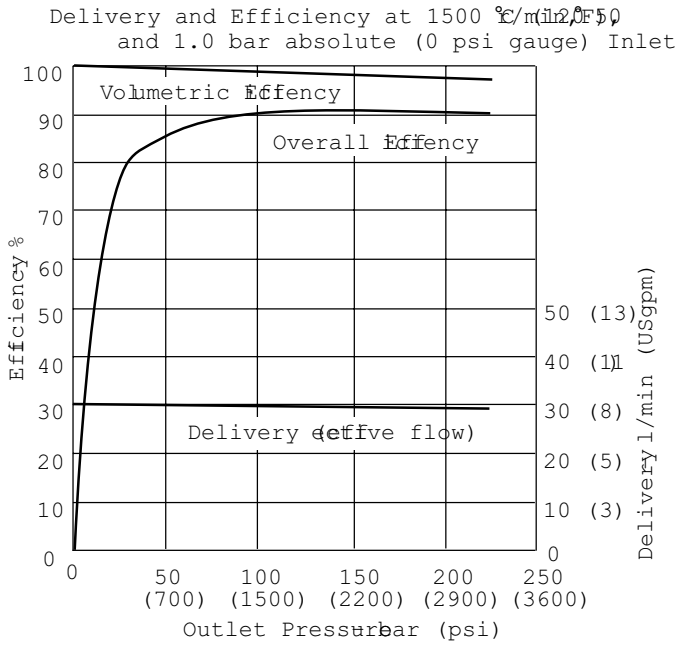
Sound pressure data equivalent to NFPA

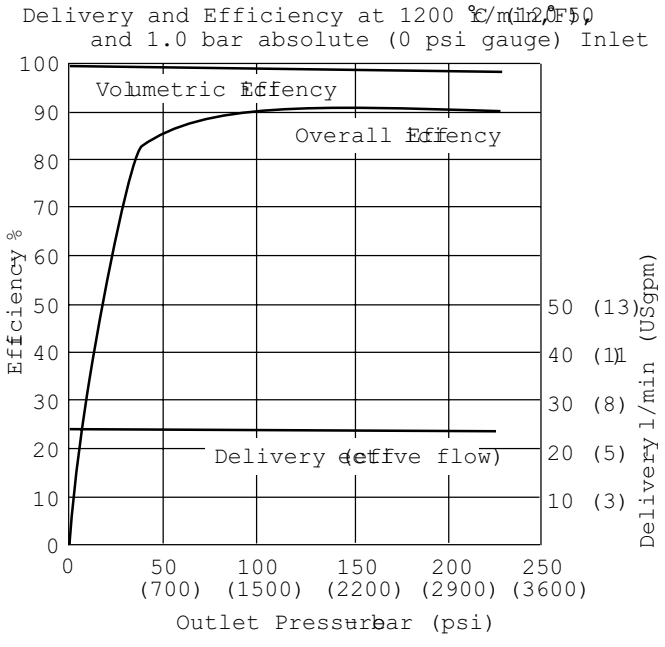
Input Torque and Power at 1800 r/min (1250), and 1.0 bar absolute (0 psi gauge) Inle

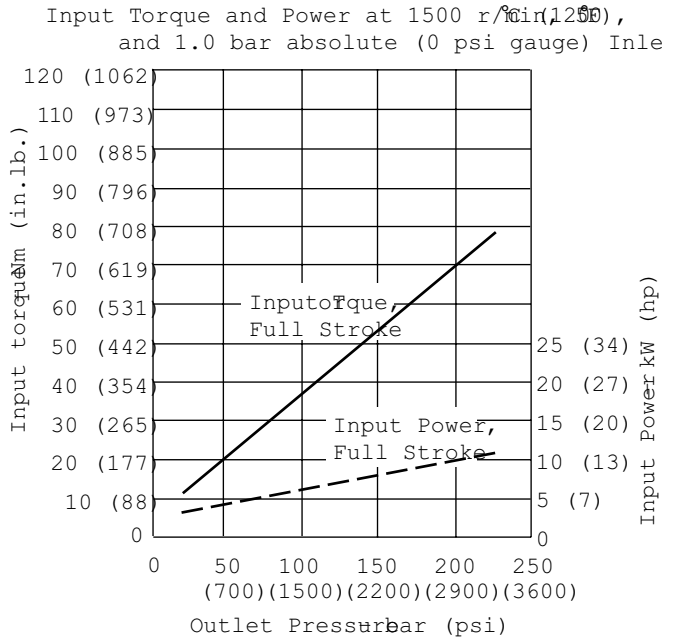


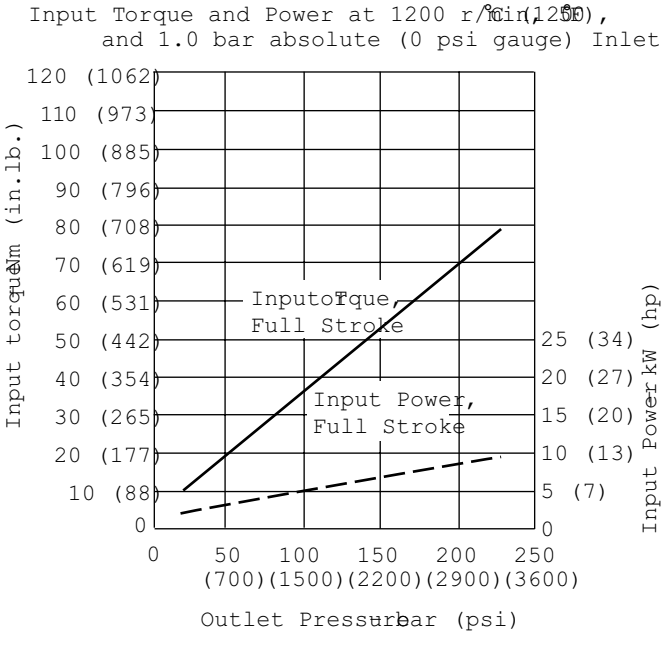
Performance

Industrial PVM020





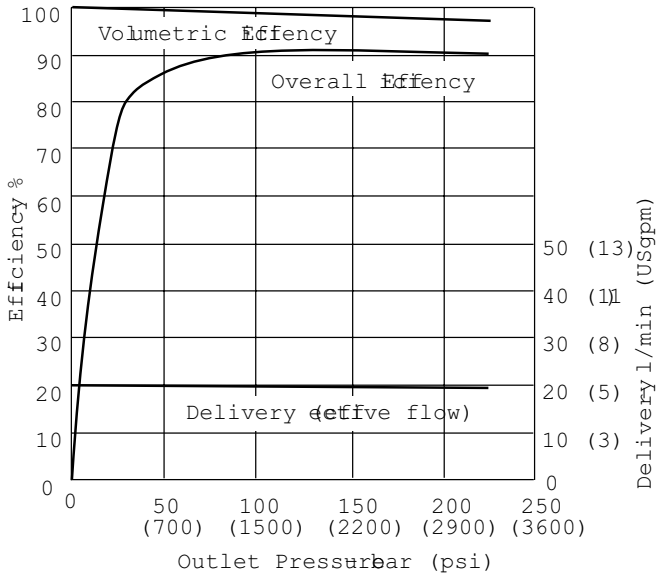




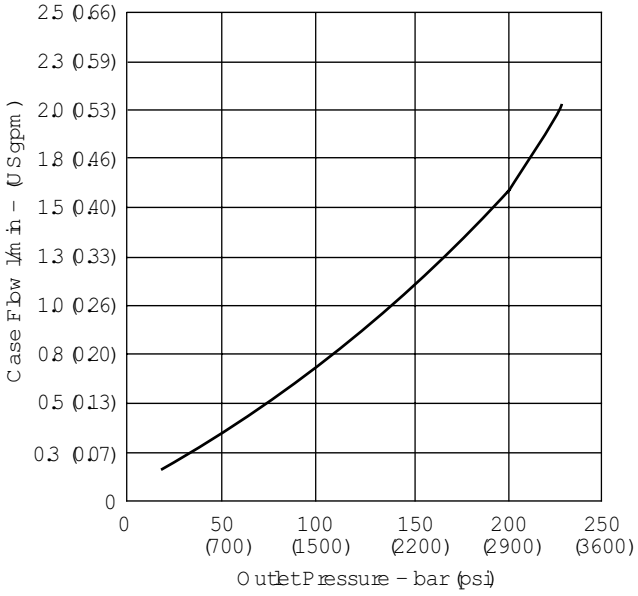
Performance

Industrial PVM020

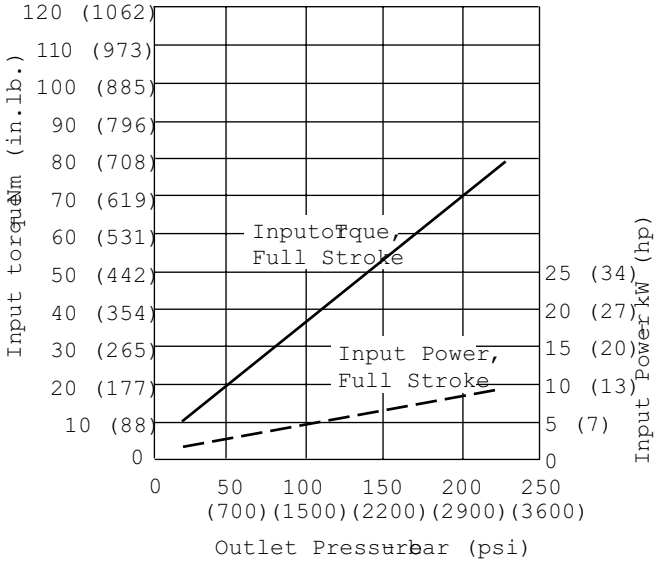
Delivery and Efficiency at 1000 r/min (1200 rpm), 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



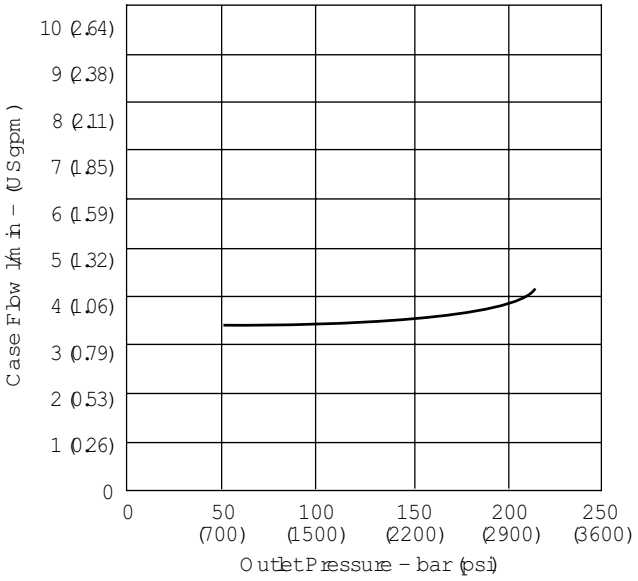
Case Flow versus Outlet Pressure at 1800 r/min, Full Flow, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Power at 1000 r/min (1200 rpm), 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



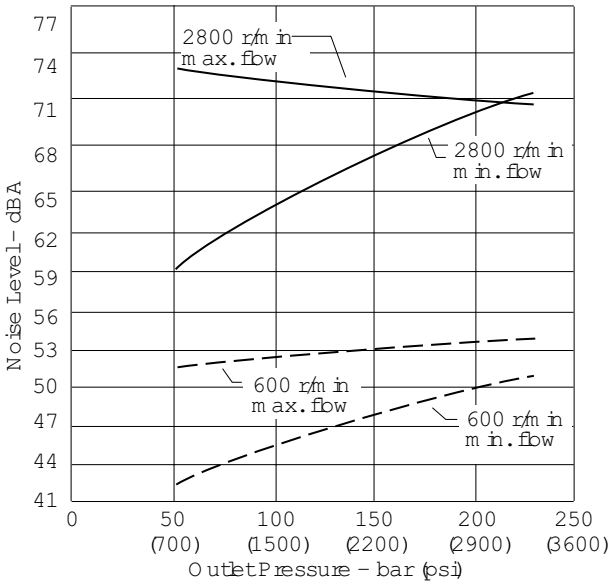
Case Flow versus Outlet Pressure at Cutoff, 1800 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



Performance

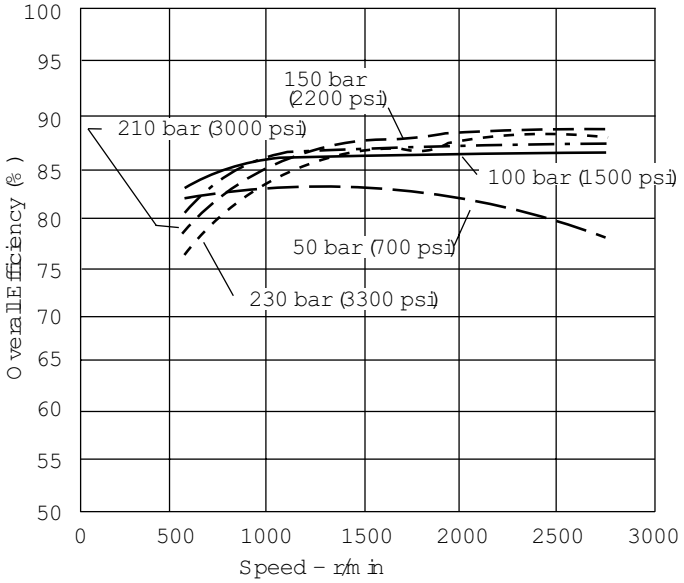
Mobile PVM020

Typical Noise Levels at 2800 & 600 r/min with Petroleum Oil (10W) at 93°C (200°F) and 1.0 bar absolute (0 psig gauge) Inlet

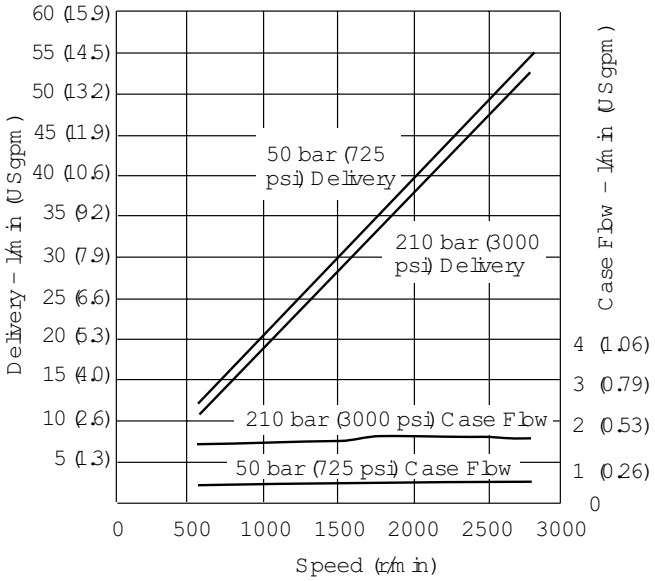


Sound pressure data equivalent to NFPA.

Overall Efficiency versus Speed at 93°C (200°F) and 1.0 bar absolute (0 psig gauge) inlet



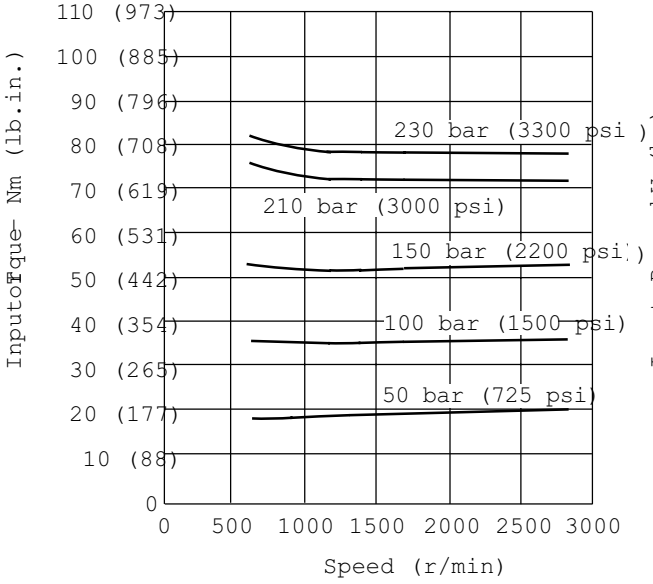
Delivery and Case Flow versus Speed at 93°C (200°F), Full Flow 1.0 bar absolute (0 psig gauge) inlet



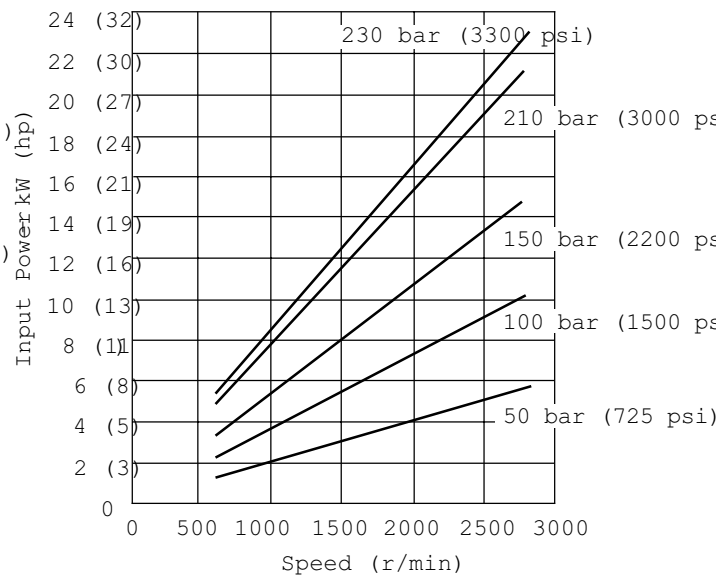
Performance

Mobile PVM020

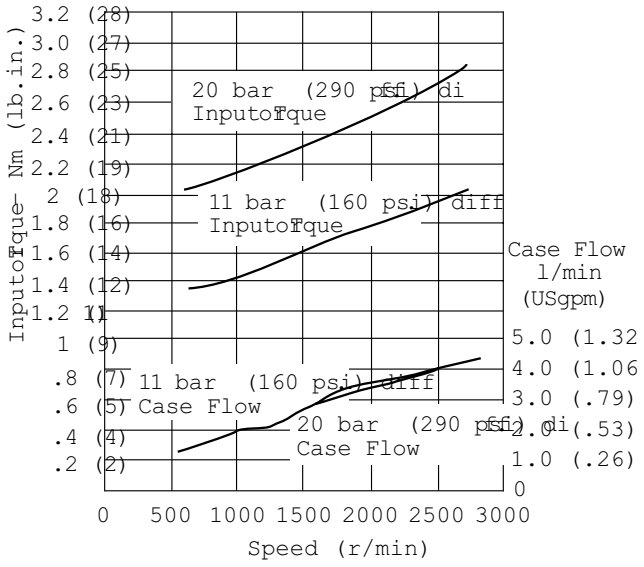
Input Torque versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



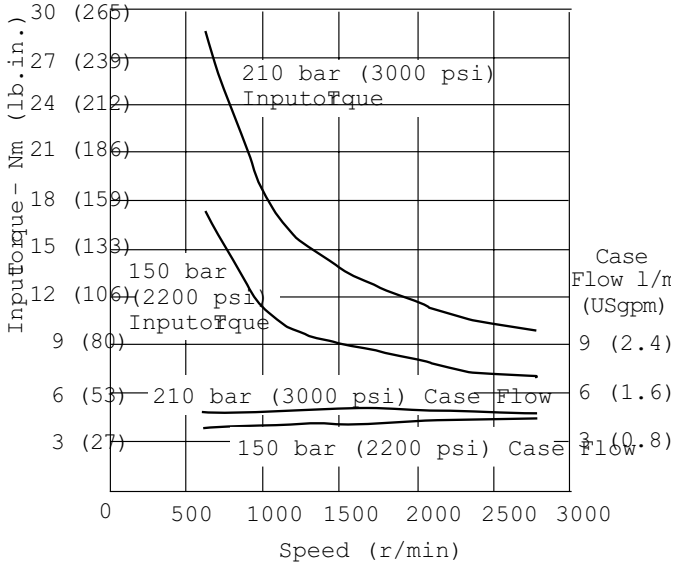
Input Power versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Case Flow versus Speed at 93°C (200°F), Load Sense Standby and 1.0 bar absolute (0 psi gauge) Inlet



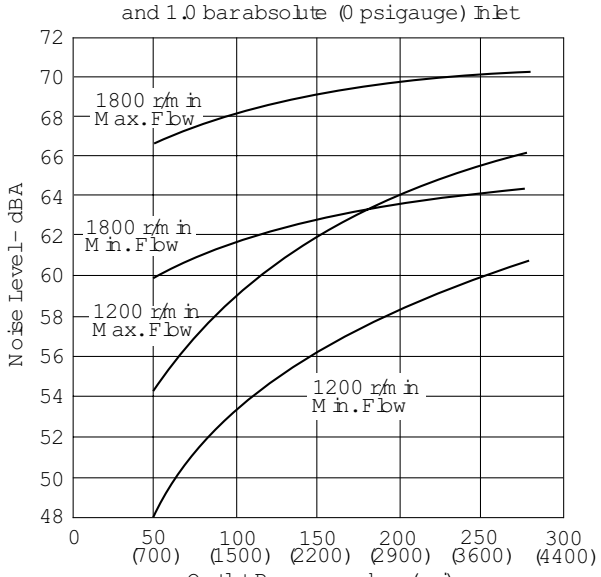
Input Torque and Case Flow versus Speed at 93°C (200°F), Pressure Limit Cut-off and 1.0 bar absolute (0 psi gauge) Inlet



Performance

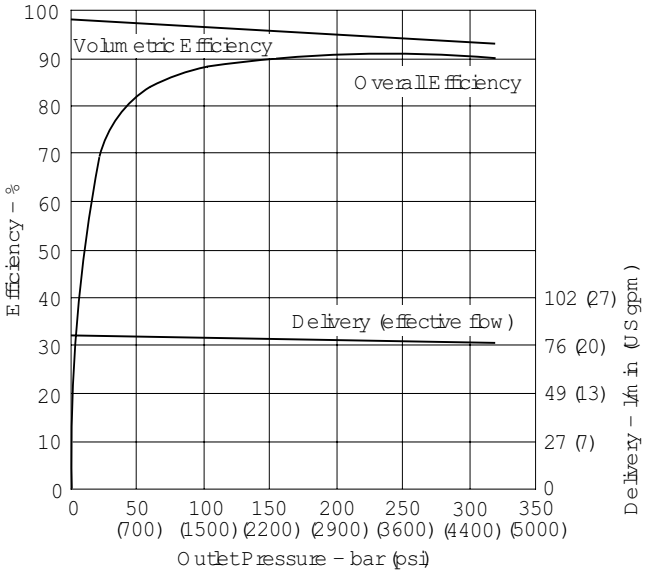
Industrial PVM045

Typical Noise Levels at 1800 and 1200 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psig gauge) Inlet

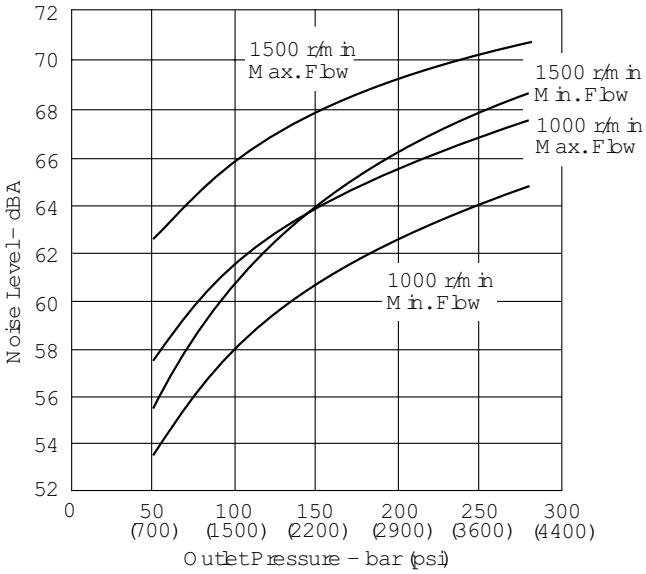


Sound pressure data equivalent to NFPA

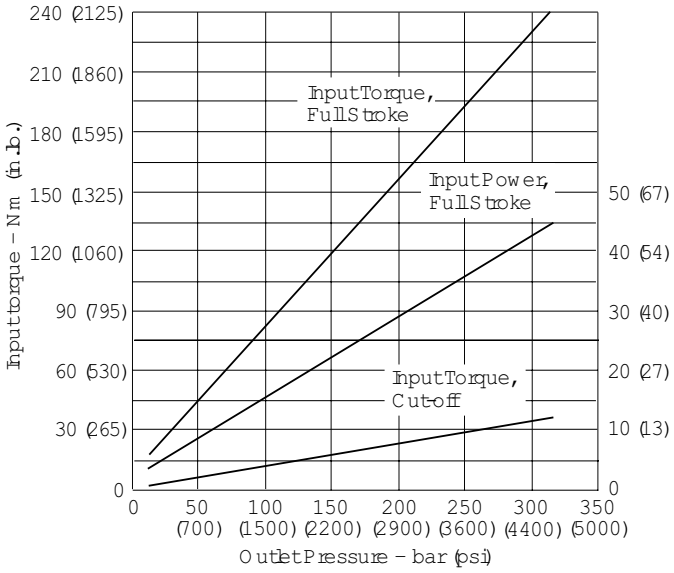
Delivery and Efficiency at 1800 r/min 50°C (120°F) and 1.0 bar absolute (0 psig gauge) Inlet



Typical Noise Levels at 1500 and 1000 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psig gauge) Inlet

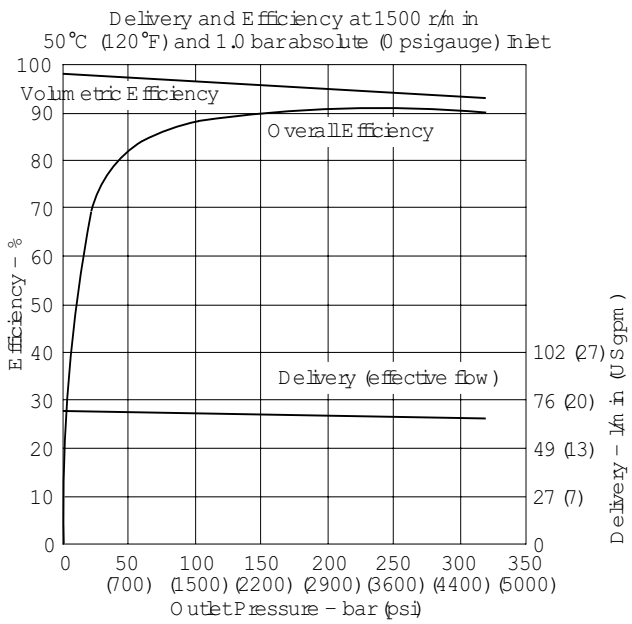


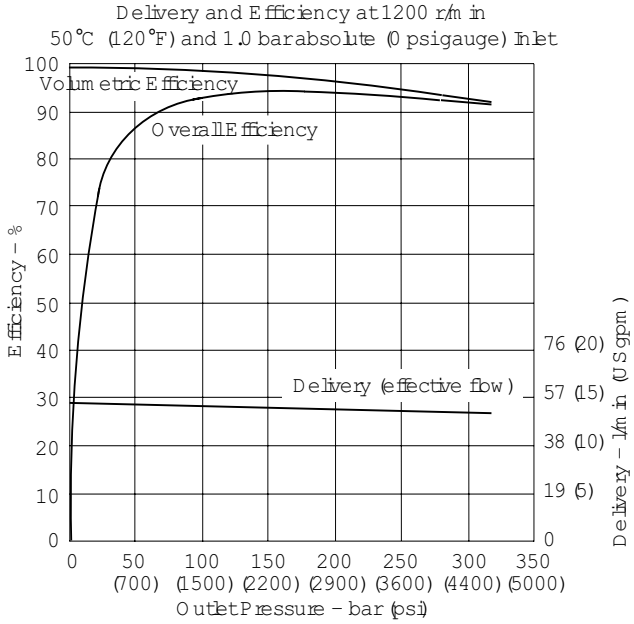
Input Torque and Power at 1800 r/min 50°C (120°F) and 1.0 bar absolute (0 psig gauge) Inlet

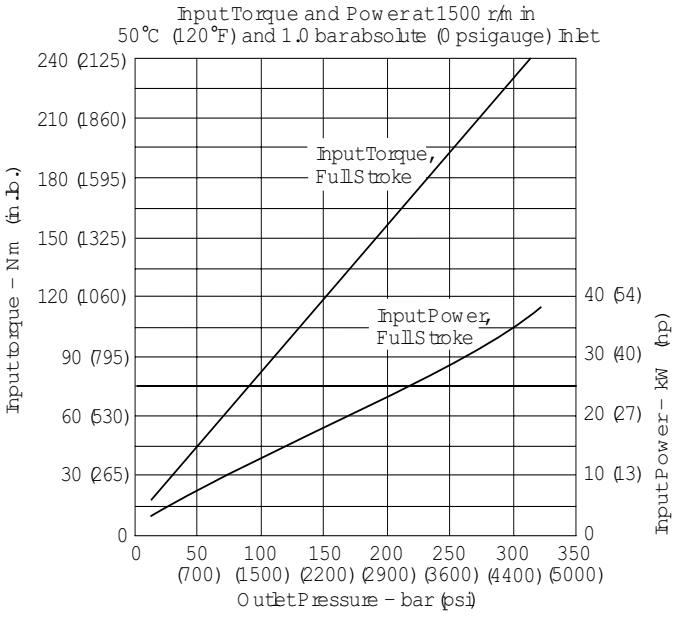


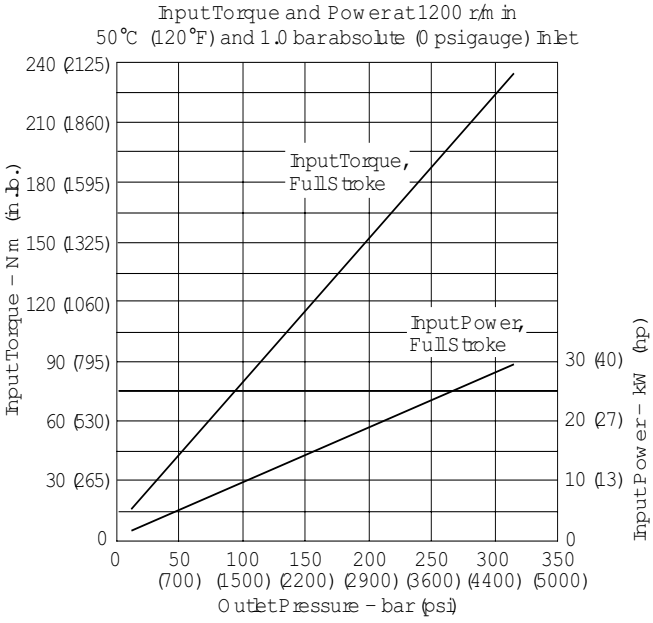
Performance

Industrial PVM045





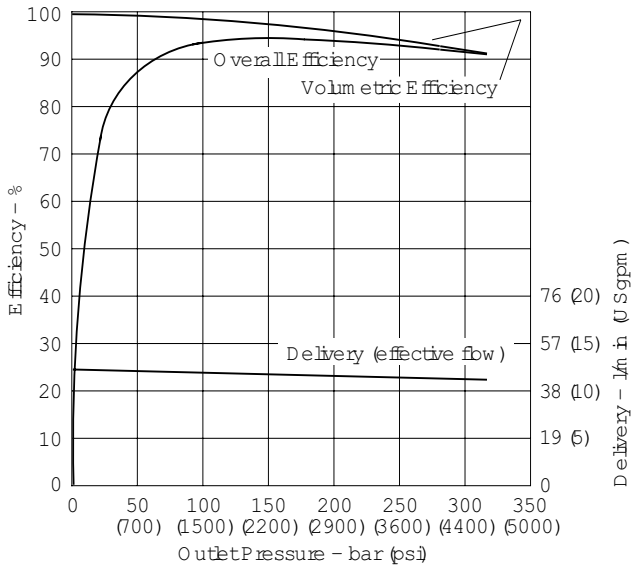




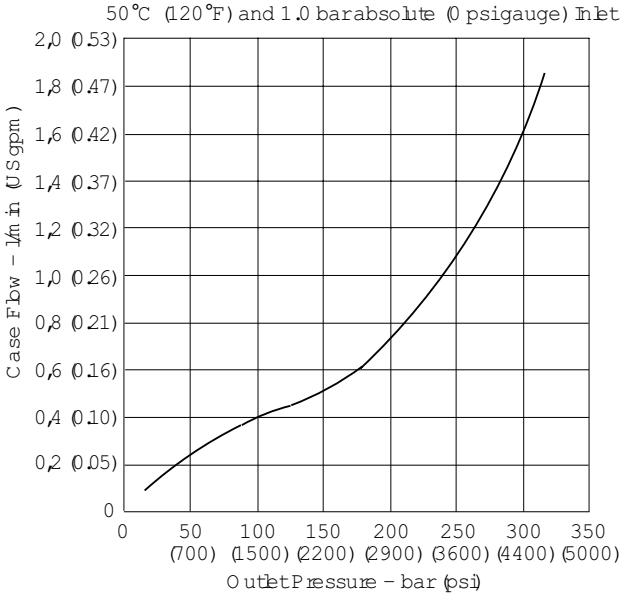
Performance

Industrial PVM045

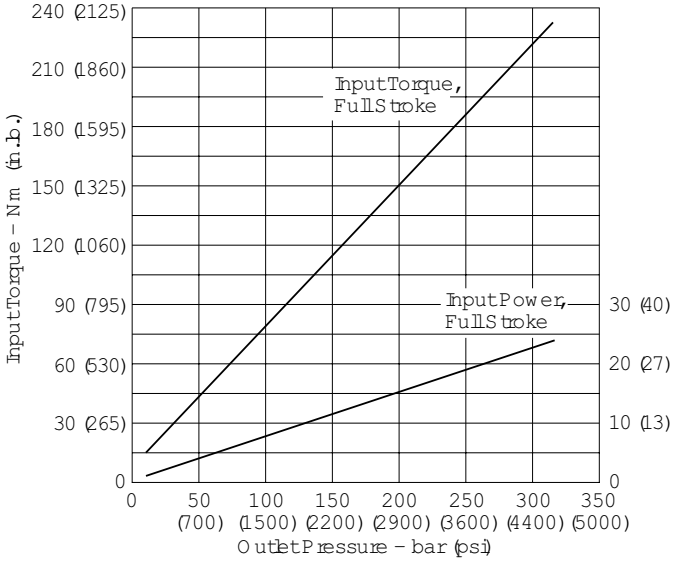
Delivery and Efficiency at 1000 r/min
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



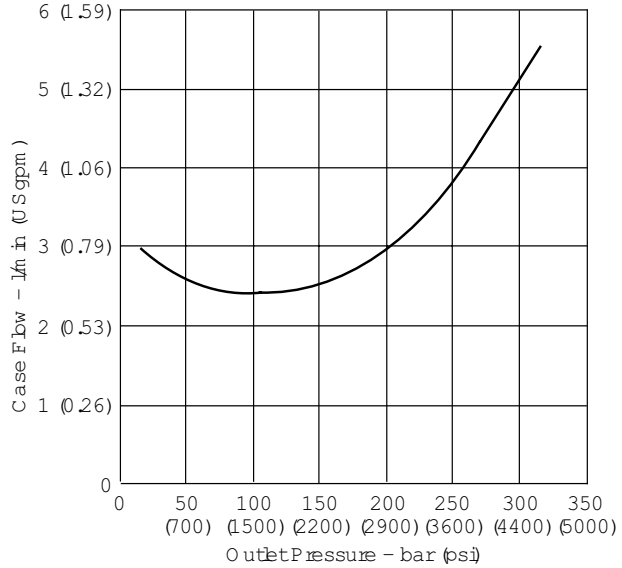
Case Flow Versus Outlet Pressure at 1800 r/min, Full Flow
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Power at 1000 r/min
50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



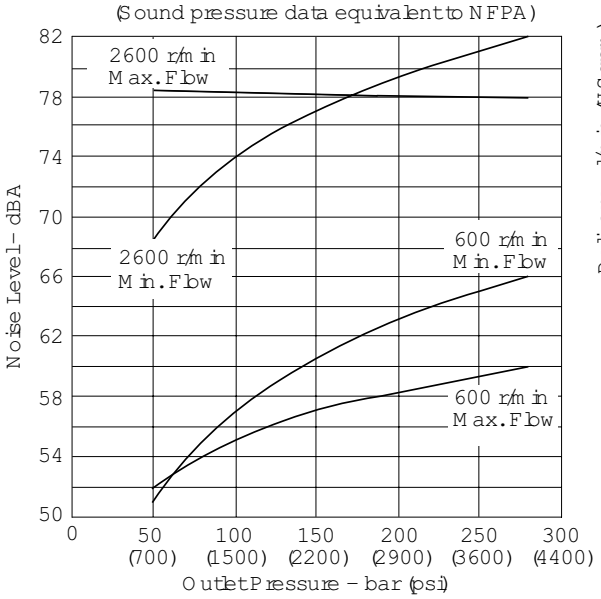
Case Flow Versus Outlet Pressure at Cutoff, 1800 r/min
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



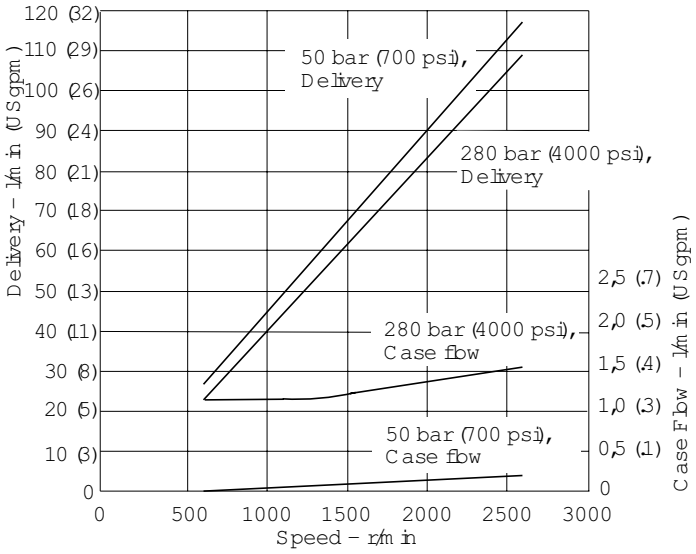
Performance

Mobile PVM045

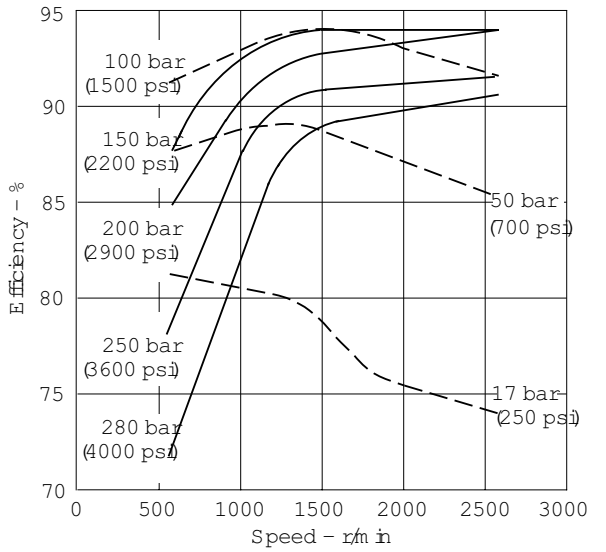
Typical Noise Levels
Petroleum Oil (10W) at 93°C (200°F),
1.0 bar absolute (0 psi gauge) Inlet
(Sound pressure data equivalent to NFPA)



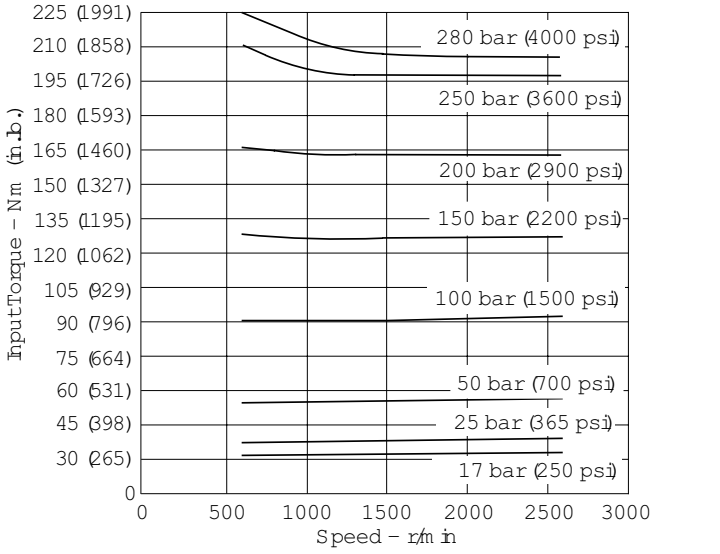
Delivery and Case Flow Versus Speed
@ 93°C (200°F), full flow and 1.0 bar absolute (0 psi) gauge Inlet

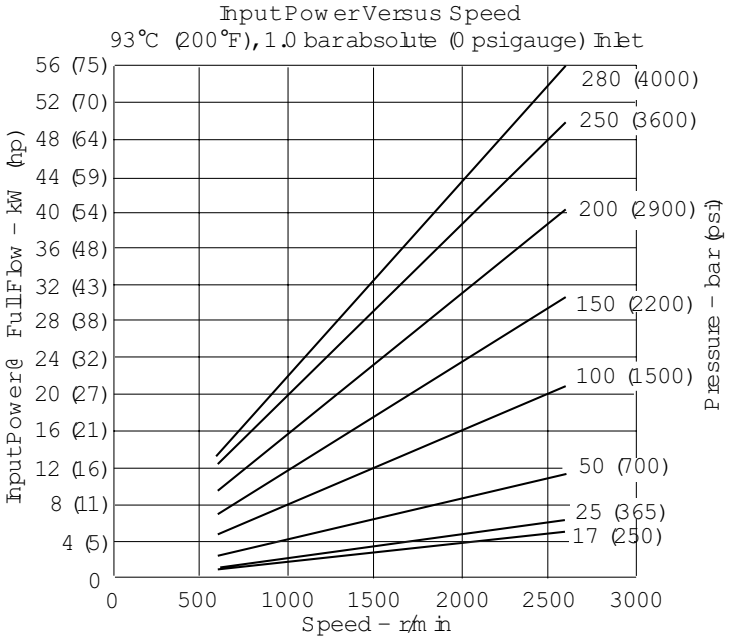


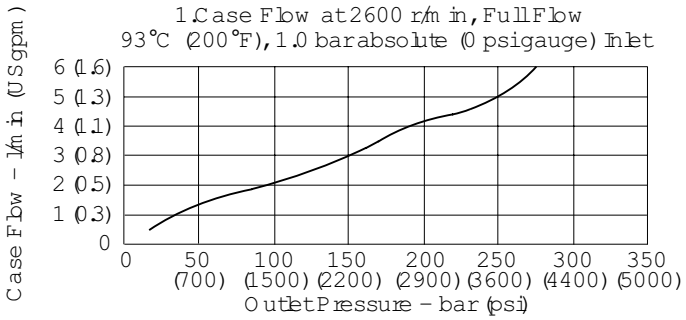
Overall Efficiency Versus Speed
at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) Inlet

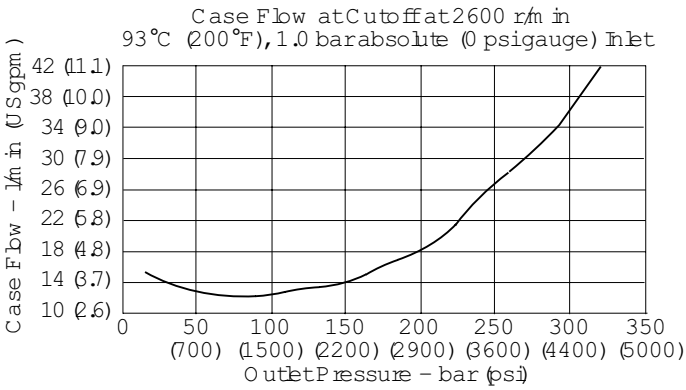


Input Torque Versus Speed
@ 93°C (200°F), full flow and 1.0 bar absolute (0 psi gauge) inlet




Input Power Versus Speed
93°C (200°F), 1.0 bar absolute (0 psi gauge) Inlet
Input Power @ Full Flow – kW (hp)
56 (75)
52 (70)
48 (64)
44 (59)
40 (54)
36 (48)
32 (43)
28 (38)
24 (32)
20 (27)
16 (21)
12 (16)
8 (11)
4 (5)
0
0
500
1000
1500
2000
2500
3000
Speed – r/min
Pressure – bar (psi)
280 (4000)
250 (3600)
200 (2900)
150 (2200)
100 (1500)
50 (700)
25 (365)
17 (250)

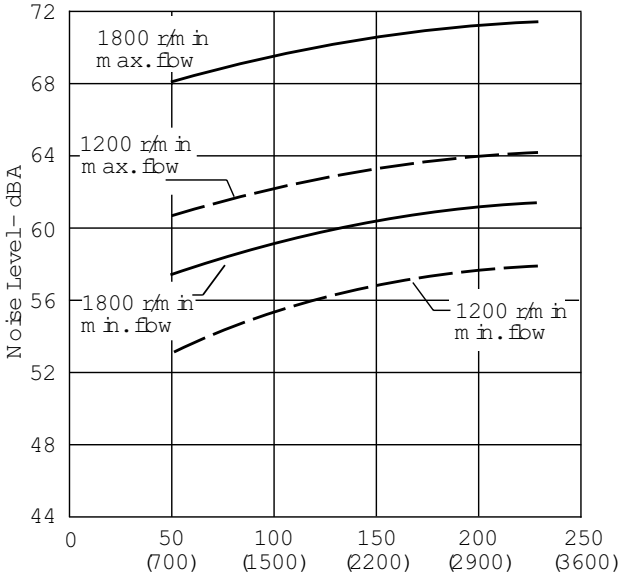

1. Case Flow at 2600 r/min, Full Flow
93°C (200°F), 1.0 bar absolute (0 psi gauge) Inlet
Case Flow – L/min (US gpm)
6 (1.6)
5 (1.3)
4 (1.1)
3 (0.8)
2 (0.5)
1 (0.3)
0
0
50
100
150
200
250
300
350
(700)
(1500)
(2200)
(2900)
(3600)
(4400)
(5000)
Outlet Pressure – bar (psi)


Case Flow at Cutoff at 2600 r/min
93°C (200°F), 1.0 bar absolute (0 psi gauge) Inlet
Case Flow – L/min (US gpm)
42 (11.1)
38 (10.0)
34 (9.0)
30 (7.9)
26 (6.9)
22 (5.8)
18 (4.8)
14 (3.7)
10 (2.6)
0
50
100
150
200
250
300
350
(700)
(1500)
(2200)
(2900)
(3600)
(4400)
(5000)
Outlet Pressure – bar (psi)

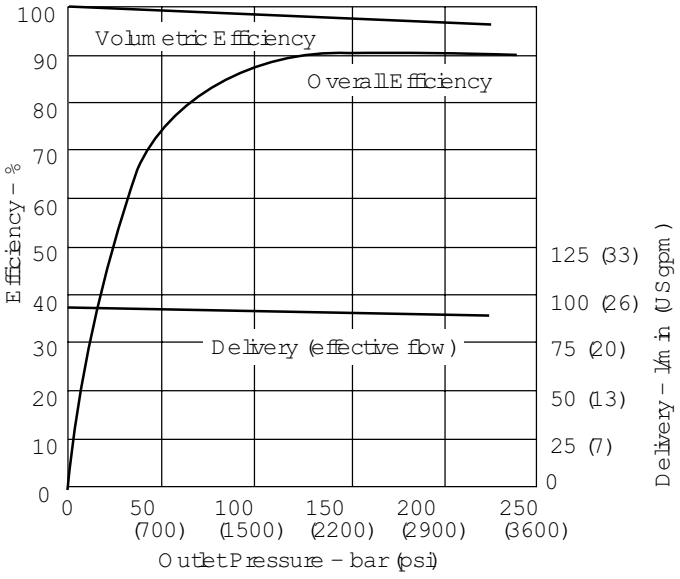
Performance

Industrial PVM050

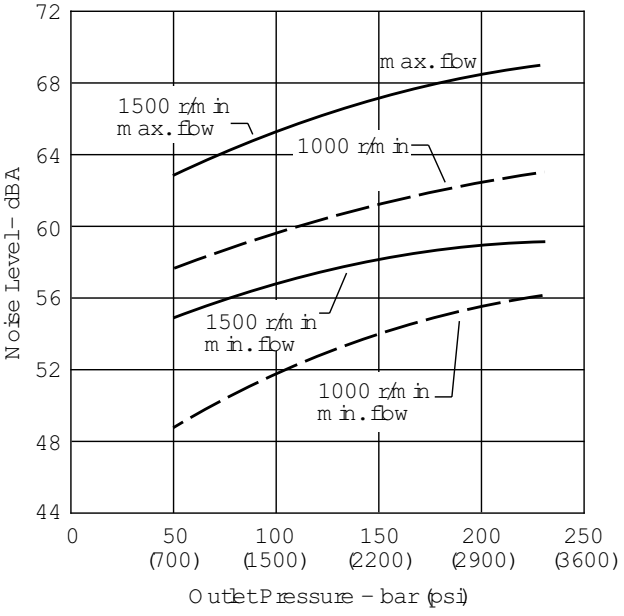
Typical Noise Levels at 1800 and 1200 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



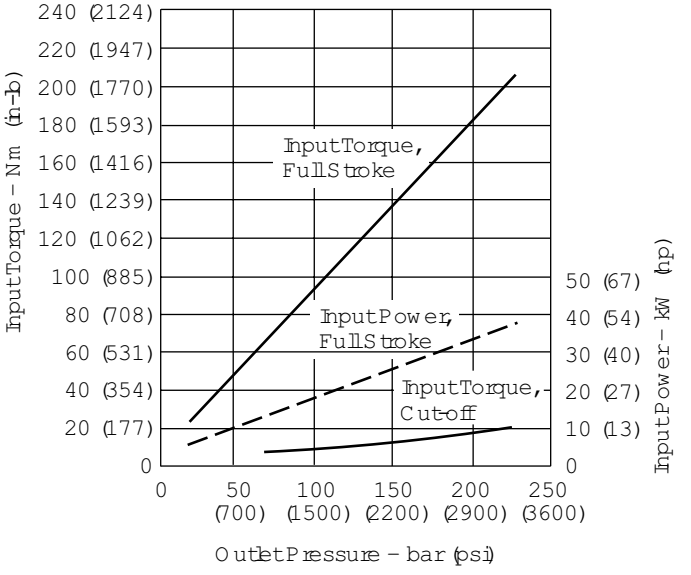
Delivery and Efficiency at 1800 r/min, 50¡C (120¡F), and 1.0 bar absolute (0 psi gauge) Inlet



Typical Noise Levels at 1500 and 1000 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



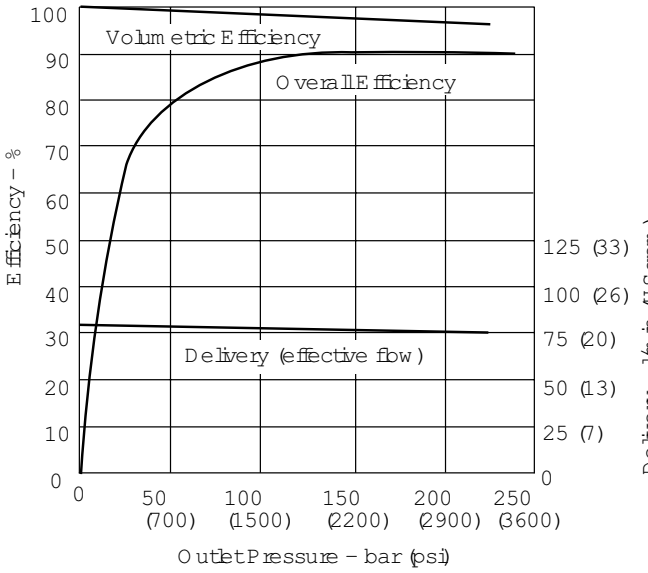
Input Torque and Power at 1800 r/min, 50¡C (120¡F), and 1.0 bar absolute (0 psi gauge) Inlet



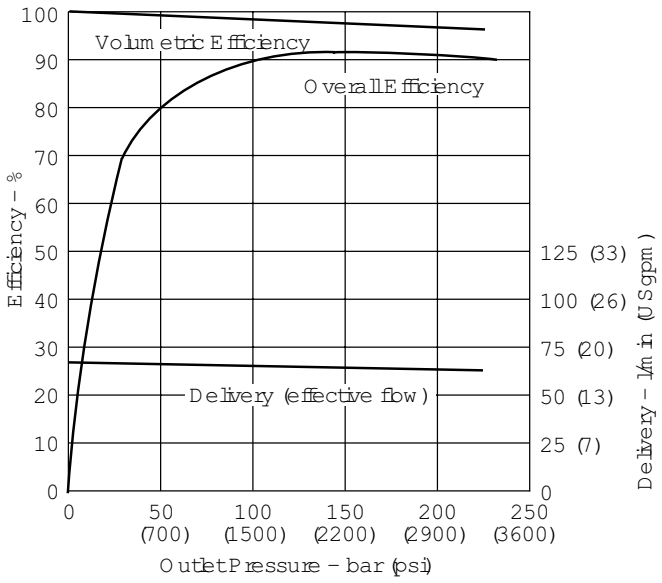
Performance

Industrial PVM050

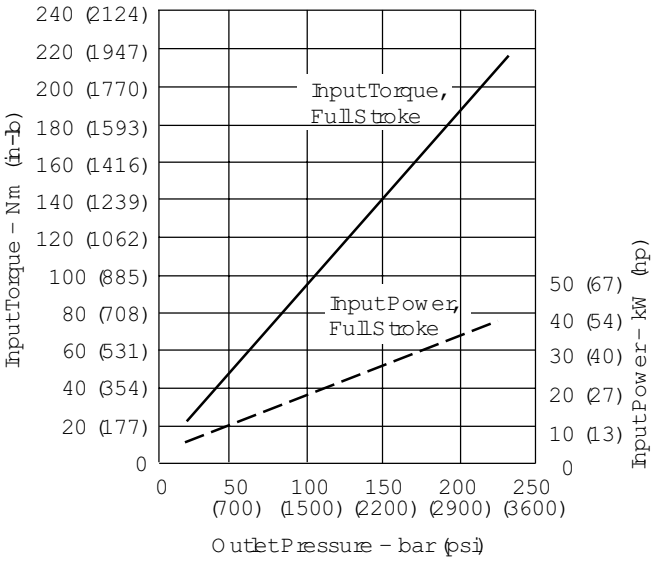
Delivery and Efficiency at 1500 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



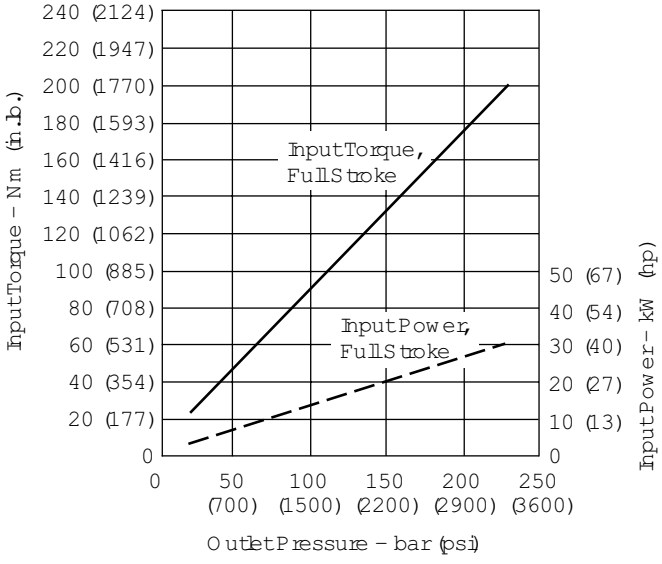
Delivery and Efficiency at 1200 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Power at 1500 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



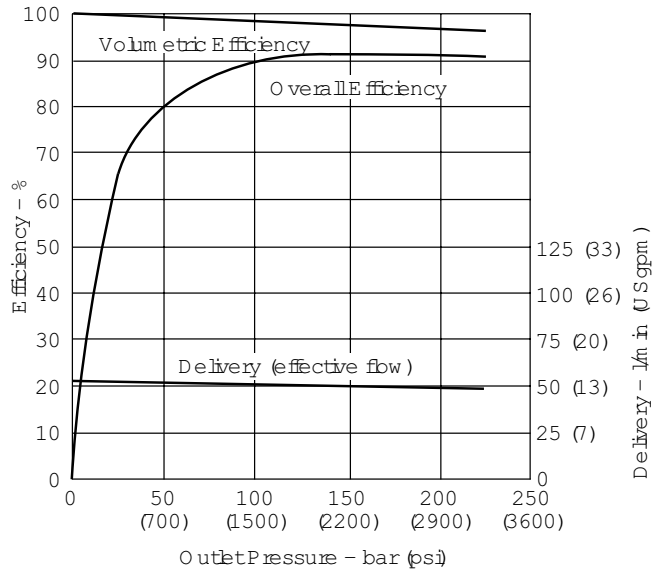
Input Torque and Power at 1200 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



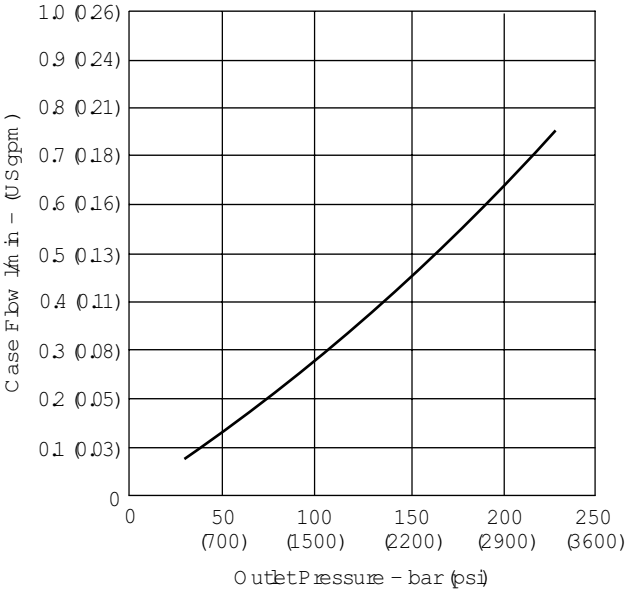
Performance

Industrial PVM050

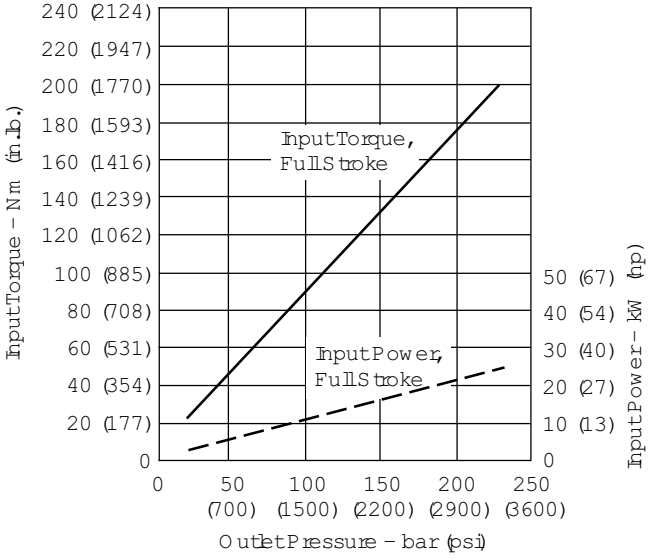
Delivery and Efficiency at 1000 r/min, 50°C (120°F), and 1.0 bar absolute (0 psig gauge) Inlet



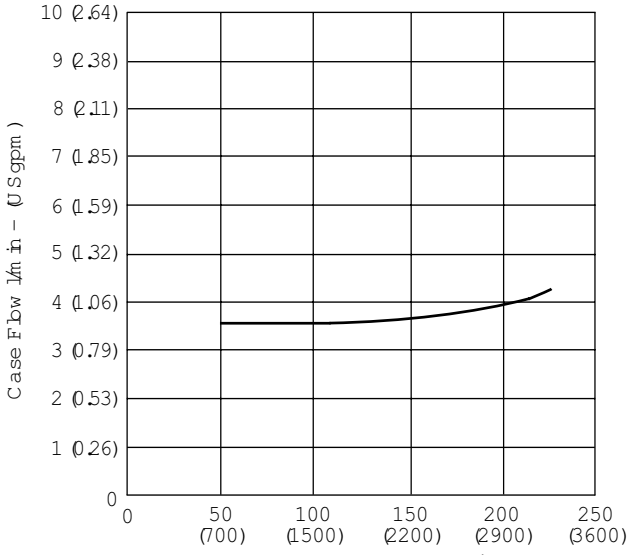
Case Flow versus Outlet Pressure at 1800 r/min, Full Flow, 50°C (120°F), and 1.0 bar absolute (0 psig gauge) Inlet



Input Torque and Power at 1000 r/min, 50°C (120°F), and 1.0 bar absolute (0 psig gauge) Inlet



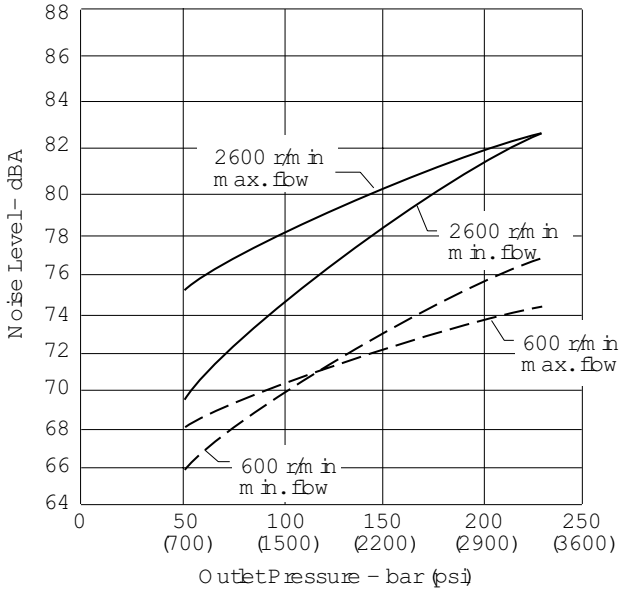
Case Flow versus Outlet Pressure at Cutoff, 1800 r/min, 50°C (120°F), and 1.0 bar absolute (0 psig gauge) Inlet



Performance

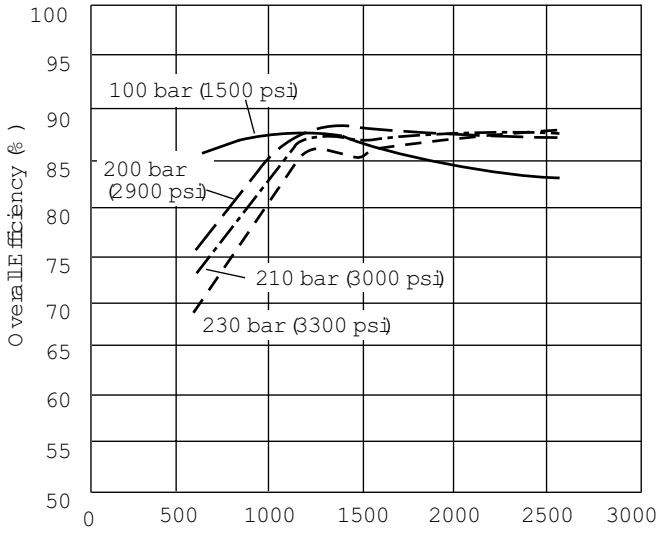
Mobile PVM050

Typical Noise Levels at 2600 & 600 r/min with Petroleum Oil (10W) at 93°C (200°F) and 1.0 bar absolute (0 psig gauge) inlet

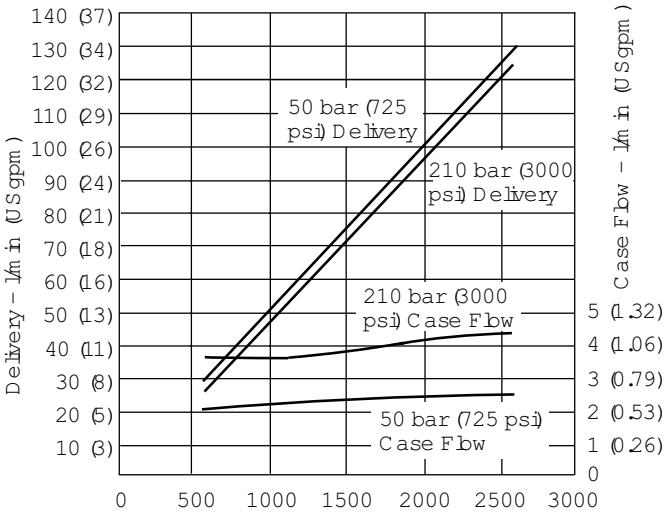


Sound pressure data equivalent to NFPA.

Overall Efficiency versus Speed at 93°C (200°F) and 1.0 bar absolute (0 psig gauge) inlet



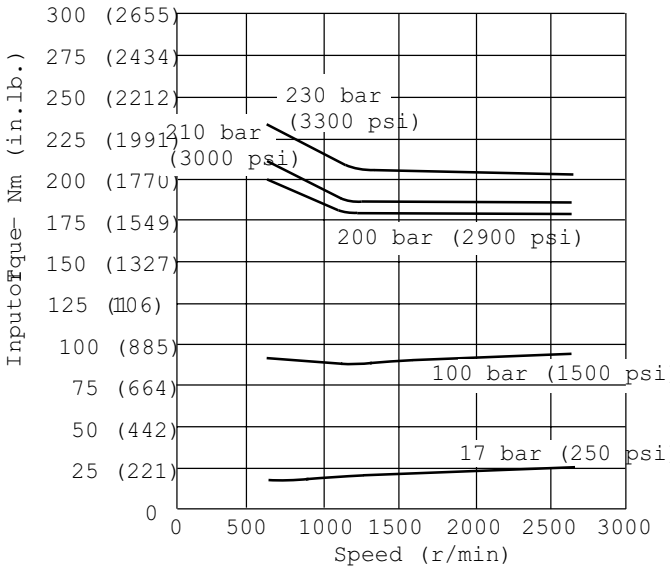
Delivery and Case Flow versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psig gauge) inlet



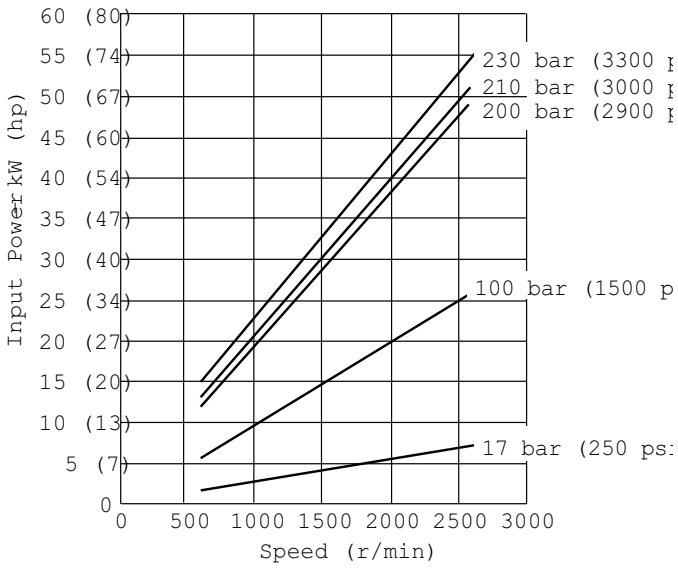
Performance

Mobile PVM050

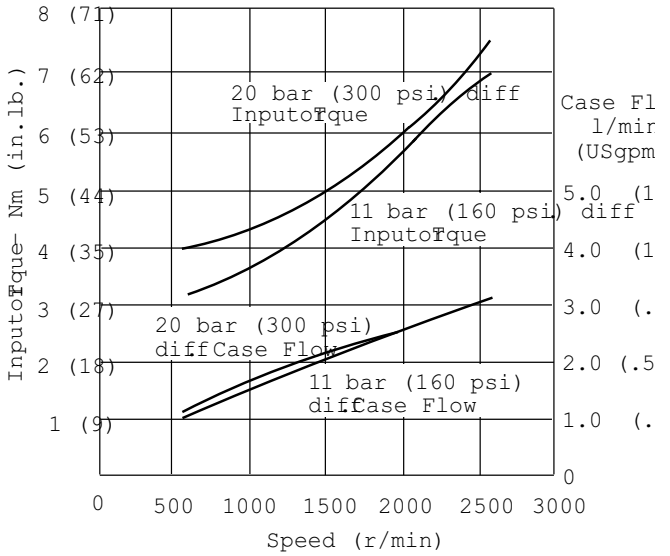
Input Torque versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



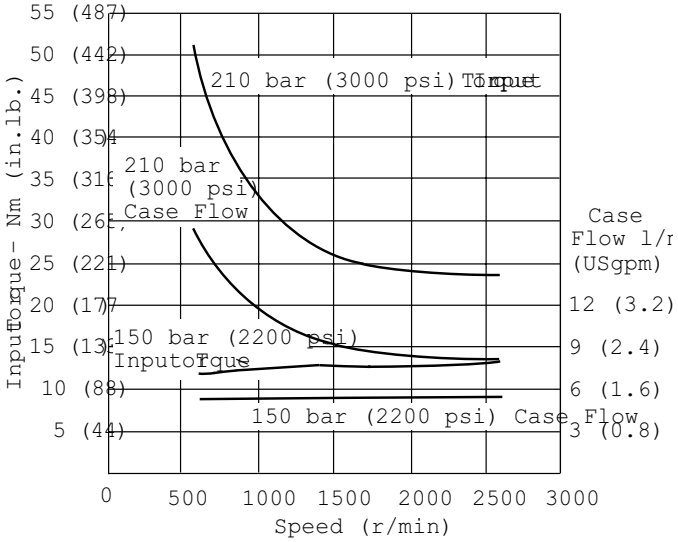
Input Power versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) In



Input Torque and Case Flow versus Speed at 93°C (200°F), Load Sense Standby and 1.0 bar absolute (0 psi gauge) Inlet



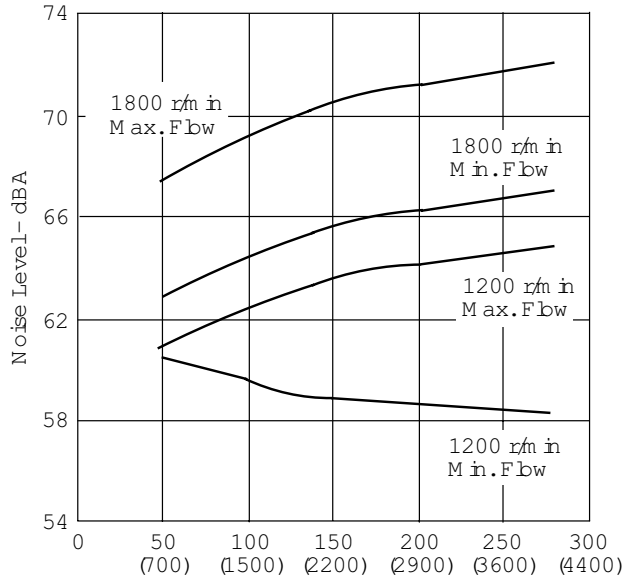
Input Torque and Case Flow versus Speed at 93°C (200°F), Pressure Limit Cut-off and 1.0 bar absolute (0 psi gauge) Inlet



Performance

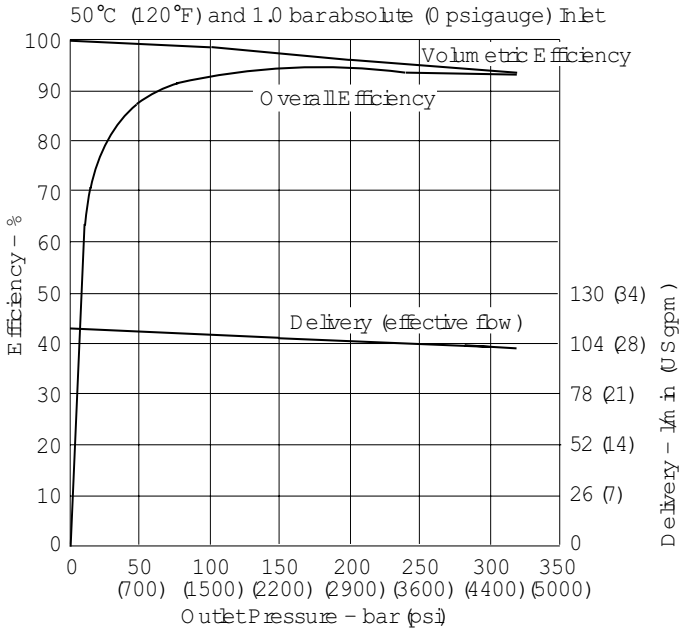
Industrial PVM057

Typical Noise Levels at 1800 and 1200 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psig gauge) Inlet

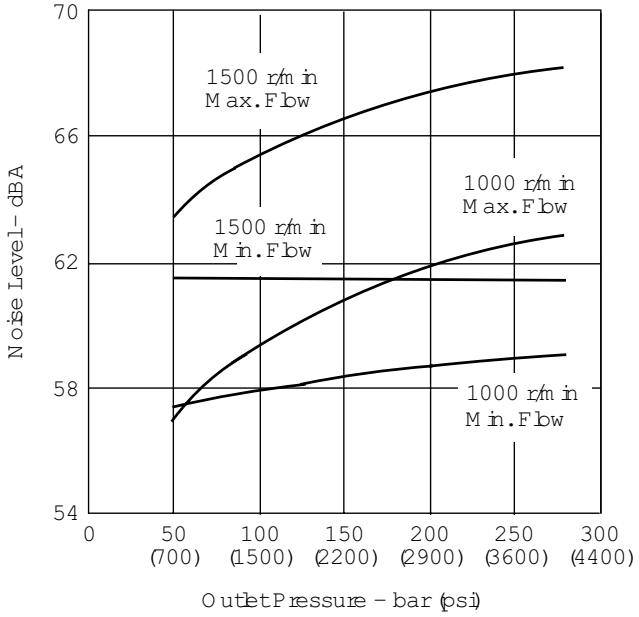


(Sound pressure data equivalent to NFPA)

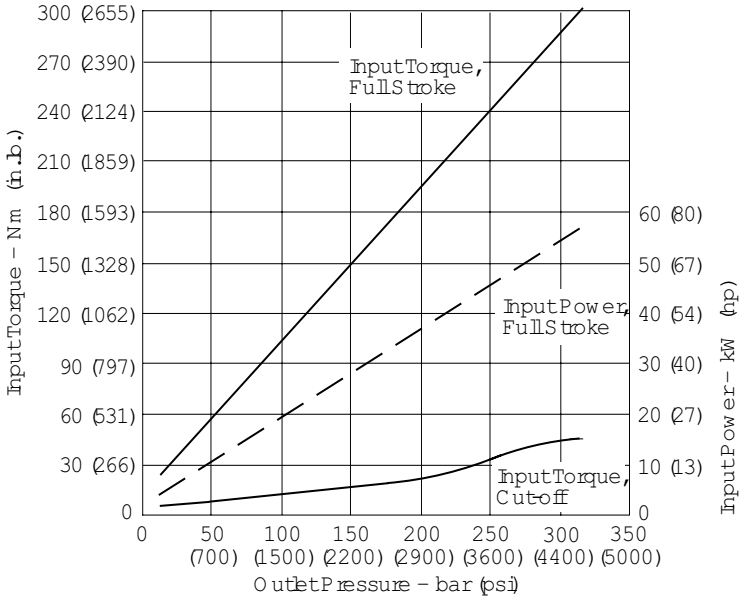
Delivery and Efficiency at 1800 r/min 50°C (120°F) and 1.0 bar absolute (0 psig gauge) Inlet



Typical Noise Levels at 1500 and 1000 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psig gauge) Inlet

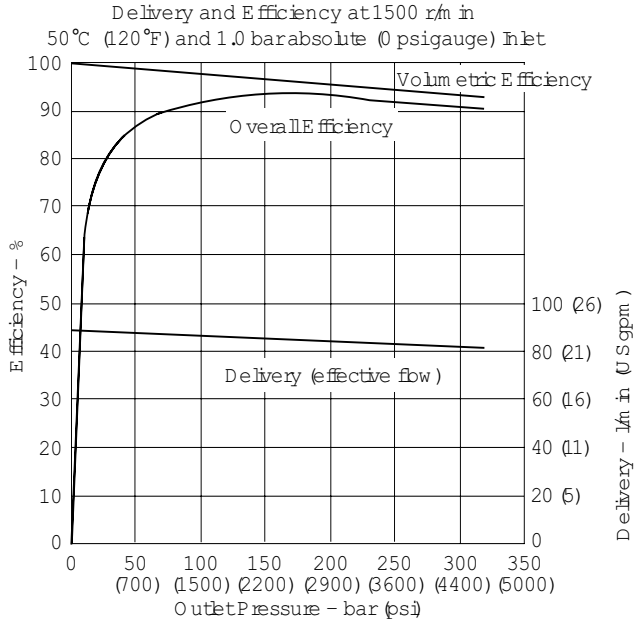


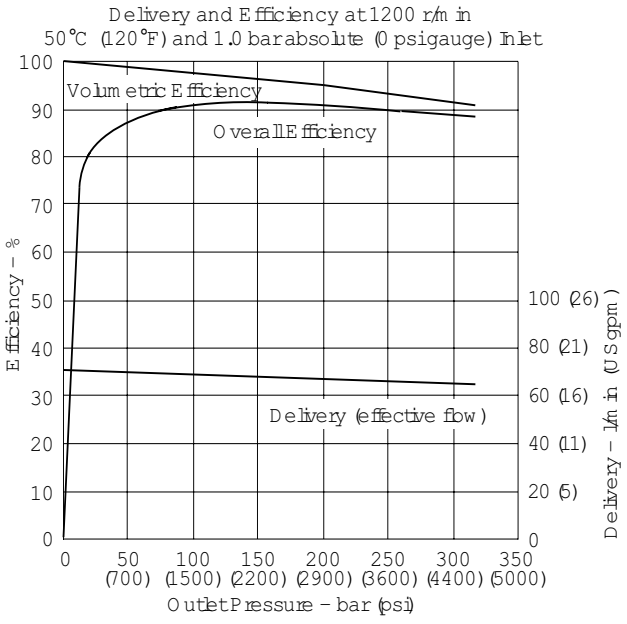
Input Torque and Power at 1800 r/min 50°C (120°F) and 1.0 bar absolute (0 psig gauge) Inlet

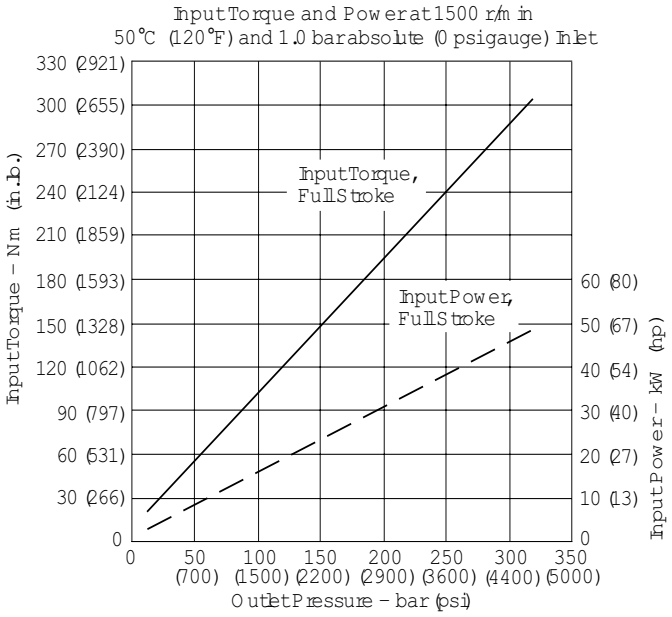


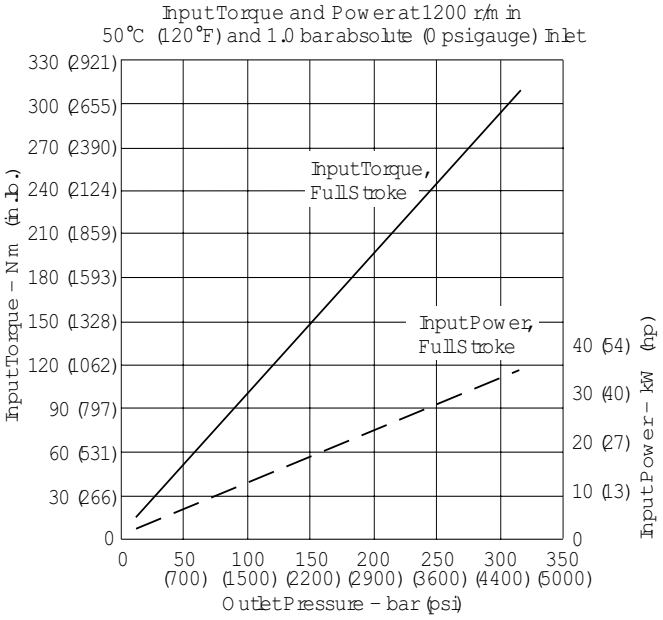
Performance

Industrial PVM057





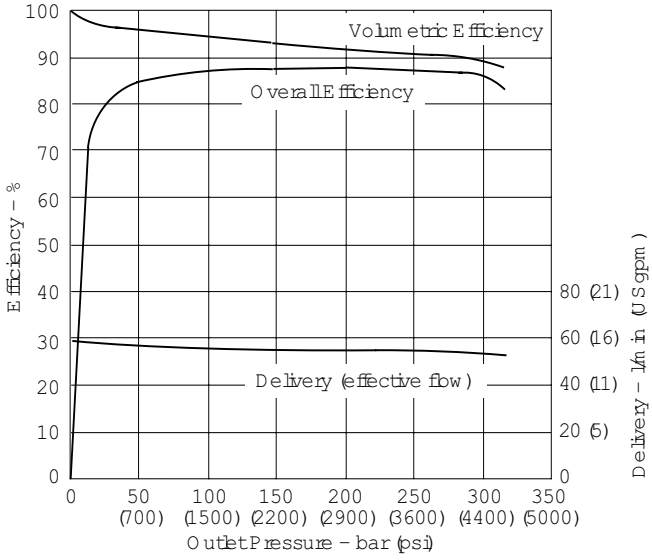




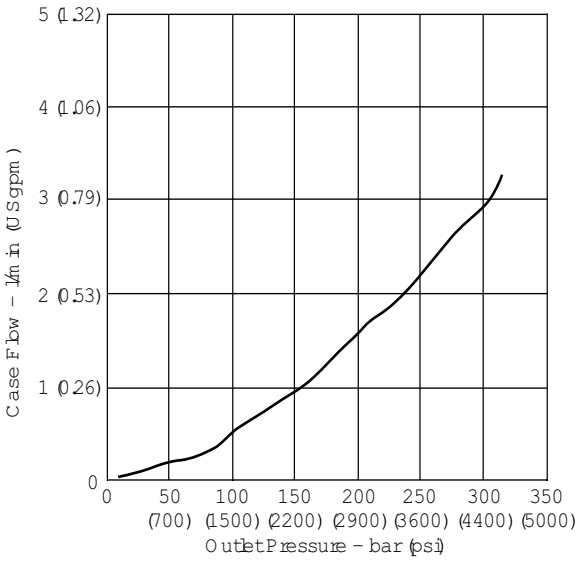
Performance

Industrial PVM057

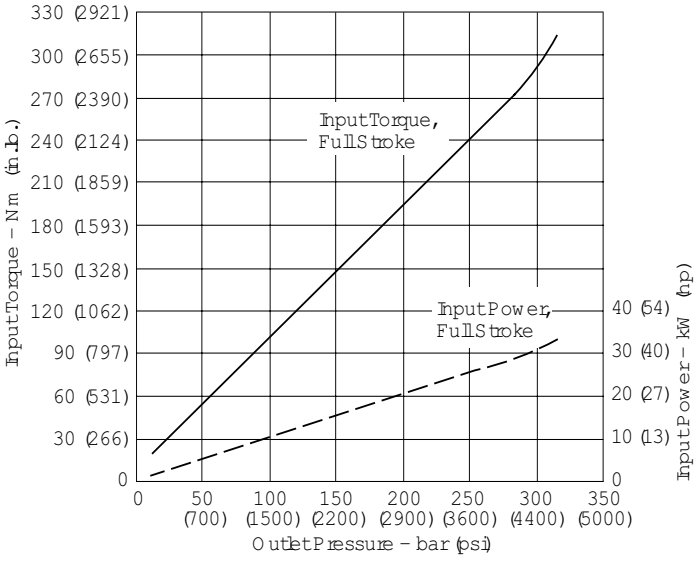
Delivery and Efficiency at 1000 r/m in
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



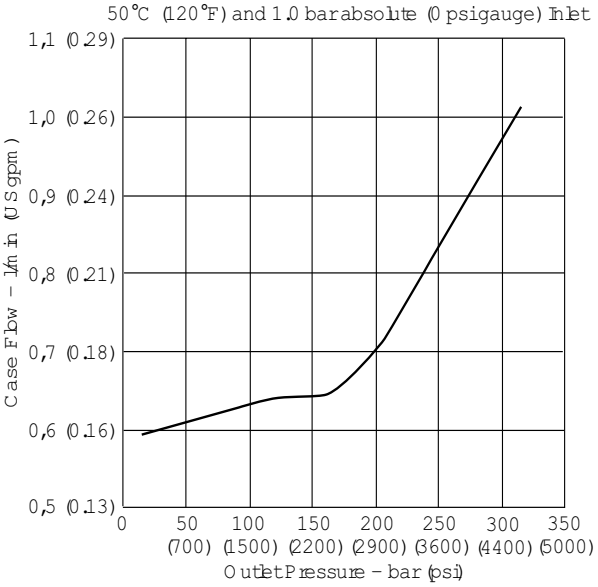
Case Flow Versus Outlet Pressure at Full Flow, 1800 r/m in
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Power at 1000 r/m in
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



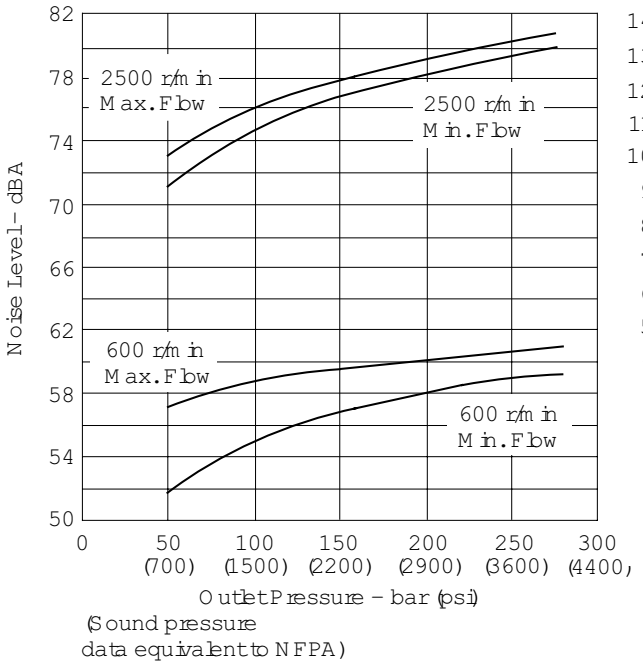
Case Flow Versus Outlet Pressure at Cutoff, 1800 r/m in
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Performance

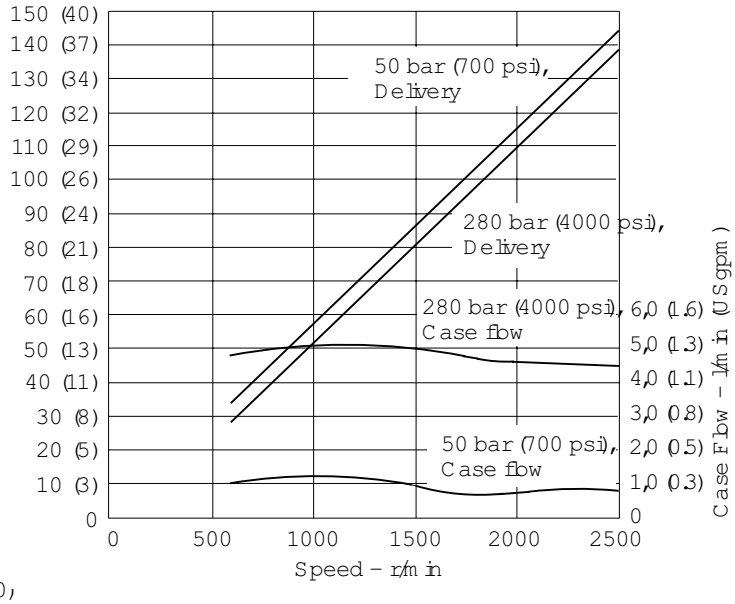
Mobile PVM057

Typical Noise Levels
Petroleum Oil (10W) at 93°C (200°F),
1.0 bar absolute (0 psi gauge) Inlet

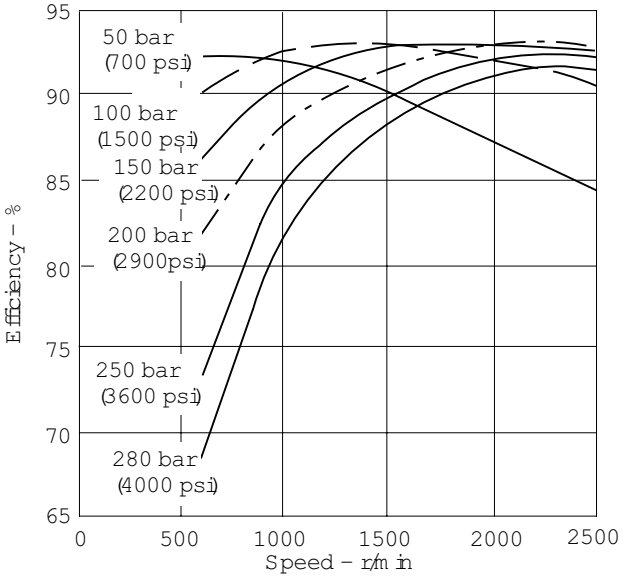


(Sound pressure
data equivalent to NFPA)

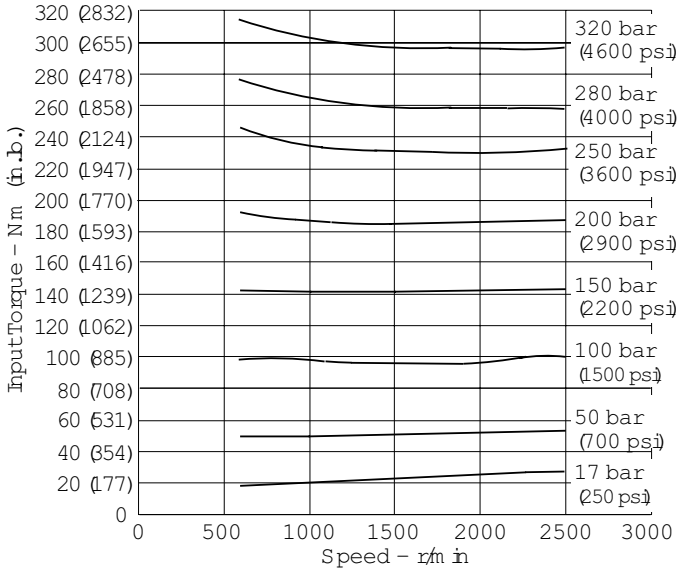
Delivery and Case Flow Versus Speed
@ 93°C (200°F), full flow and 1.0 bar absolute (0 psi) gauge Inlet



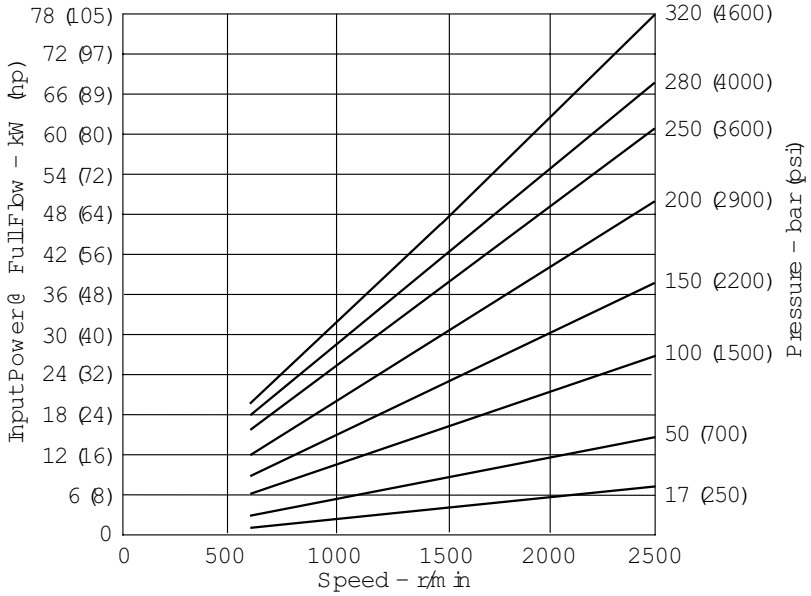
Overall Efficiency Versus Speed
at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) Inlet



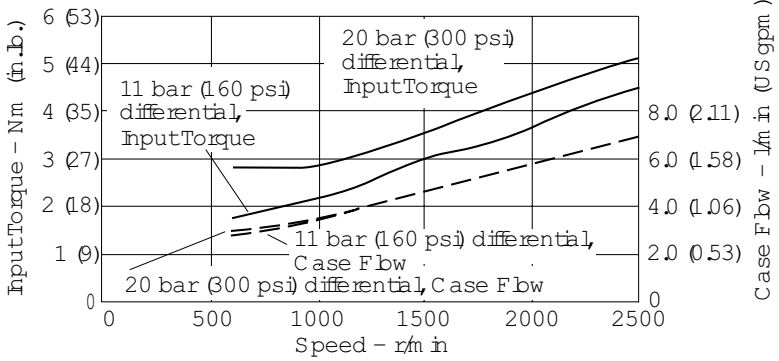
Input Torque Versus Speed
@ 93°C (200°F), full flow and
1.0 bar absolute (0 psi gauge) inlet



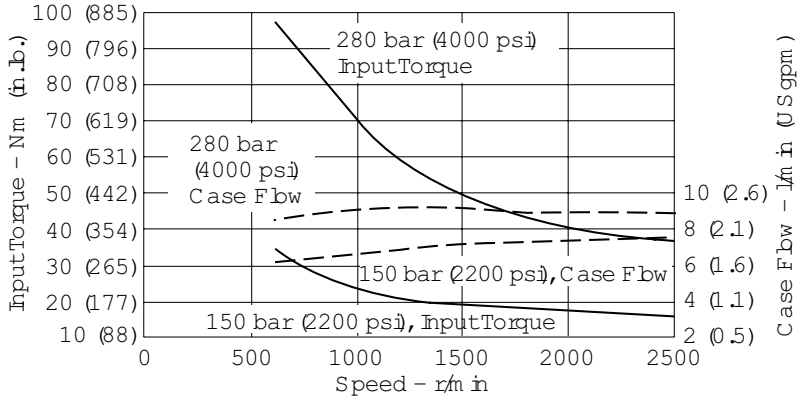
Input Power Versus Speed
93°C (200°F), 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Case Flow Versus Speed
@ 93°C (200°F), load sense standby
and 1.0 bar absolute (0 psi gauge) inlet



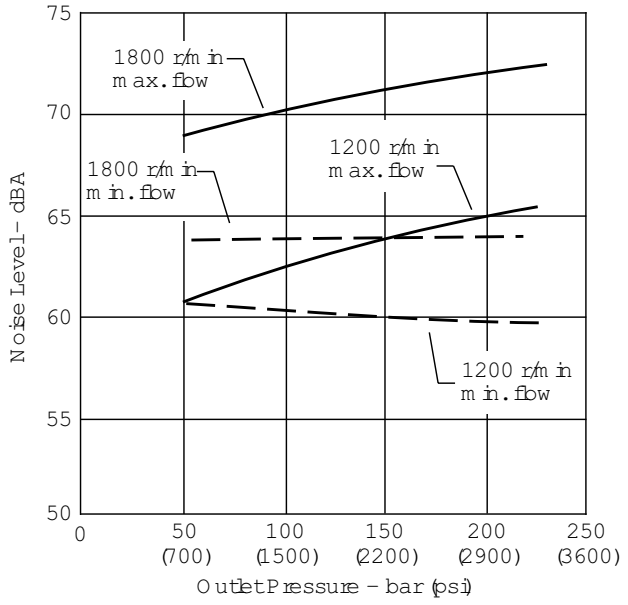
Input Torque and Case Flow Versus Speed
@ 93°C (200°F), cut-off and 1.0 bar absolute (0 psi gauge) inlet



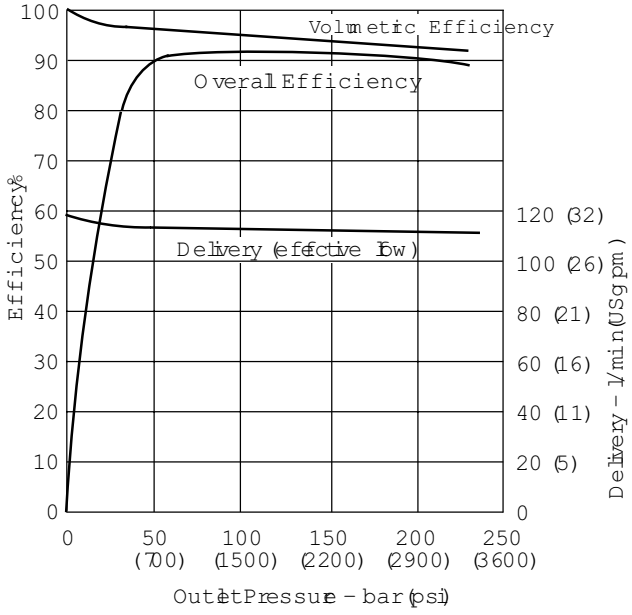
Performance

Industrial PVM063

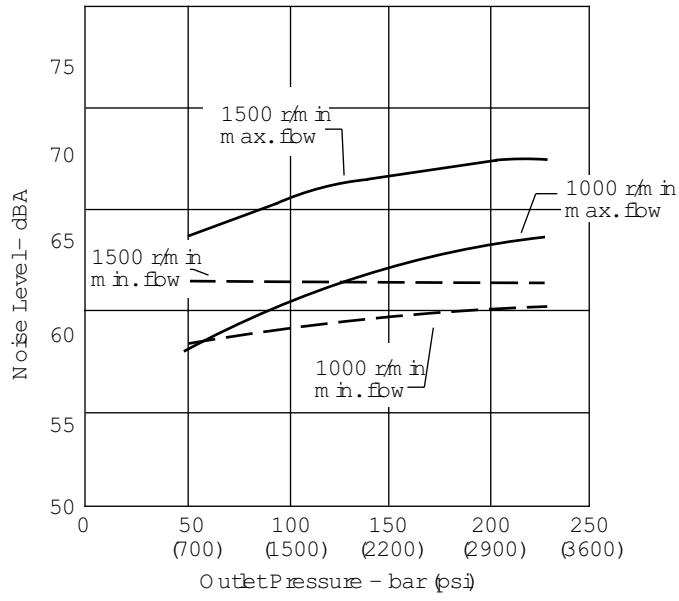
Typical Noise Levels at 1800 and 1200 r/min. with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Delivery and Efficiency at 1800 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet

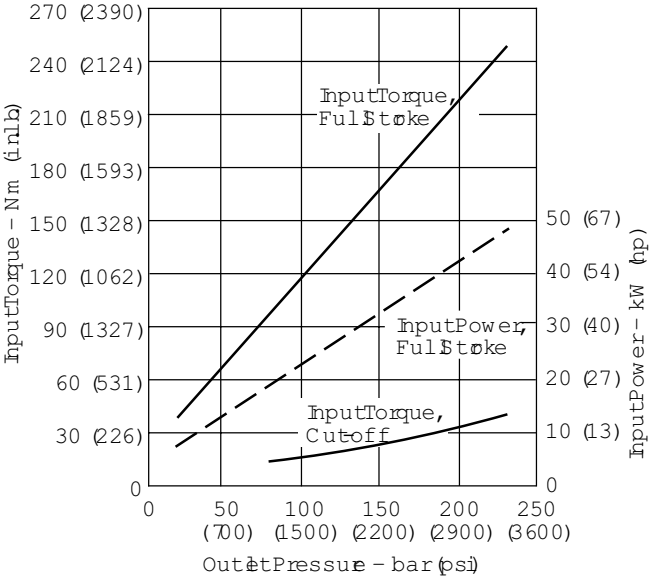


Typical Noise Levels at 1500 and 1000 r/min. with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Sound pressure data equivalent to NFPA.

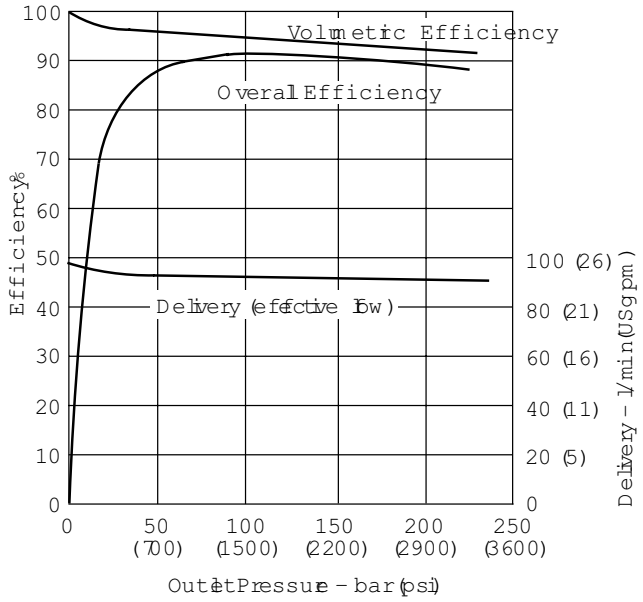
Input Torque and Power at 1800 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



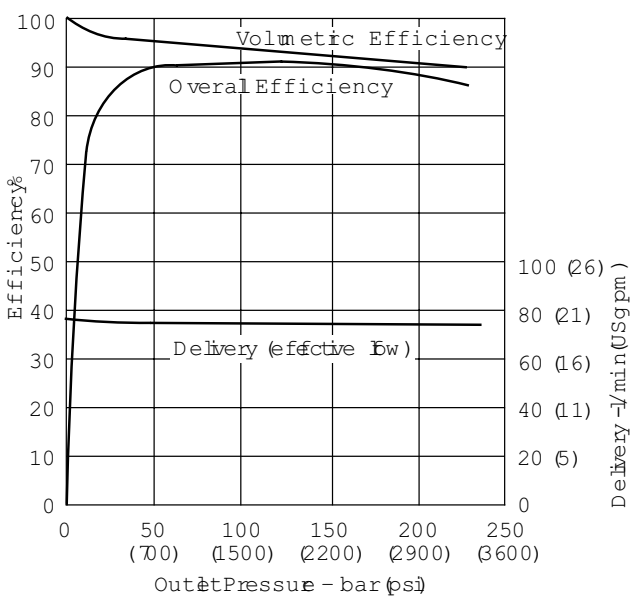
Performance

Industrial PVM063

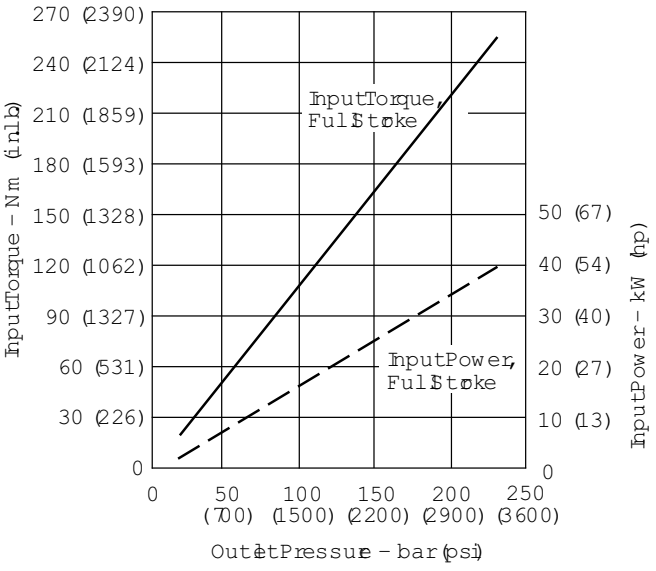
Delivery and Efficiency at 1500 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



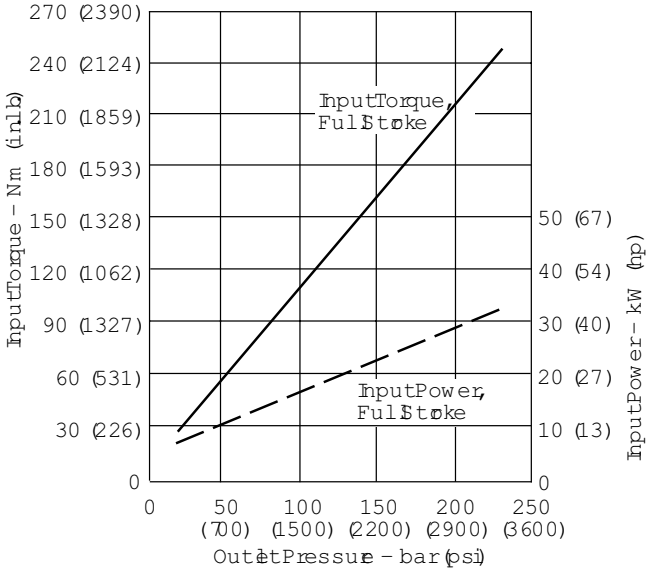
Delivery and Efficiency at 1200 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Power at 1500 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



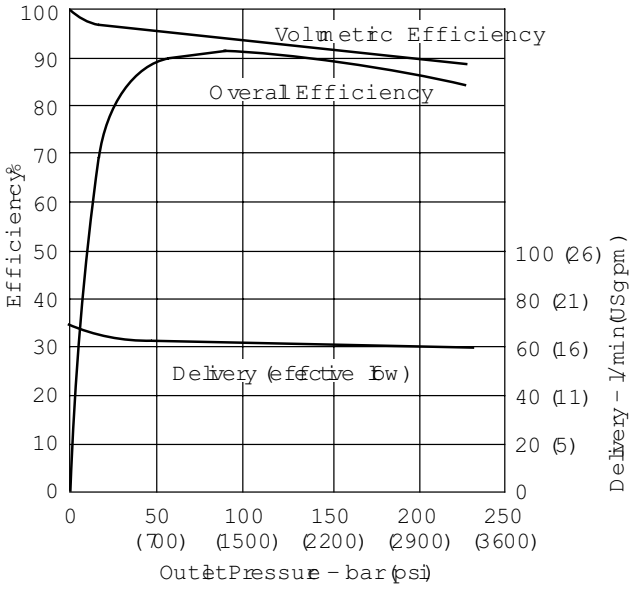
Input Torque and Power at 1200 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



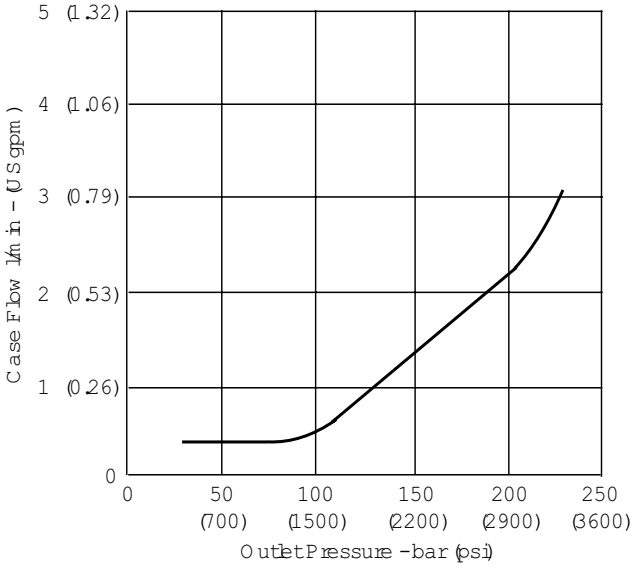
Performance

Industrial PVM063

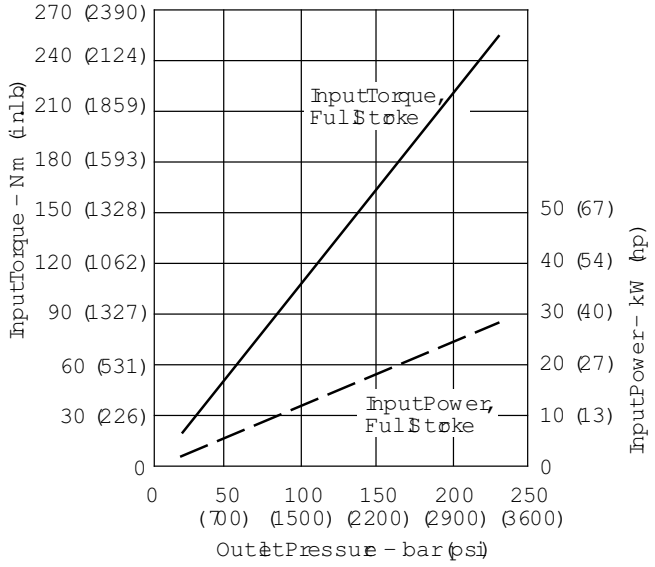
Delivery and Efficiency at 1000 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



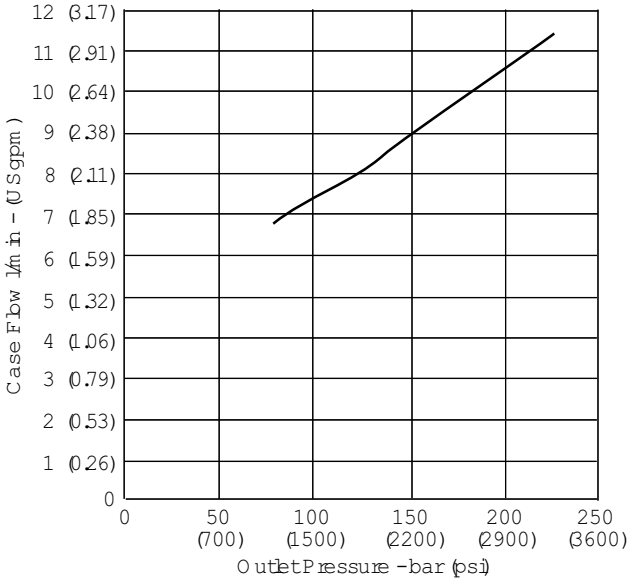
Case Flow versus Outlet Pressure at 1800 r/min, Full Flow, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Power at 1000 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



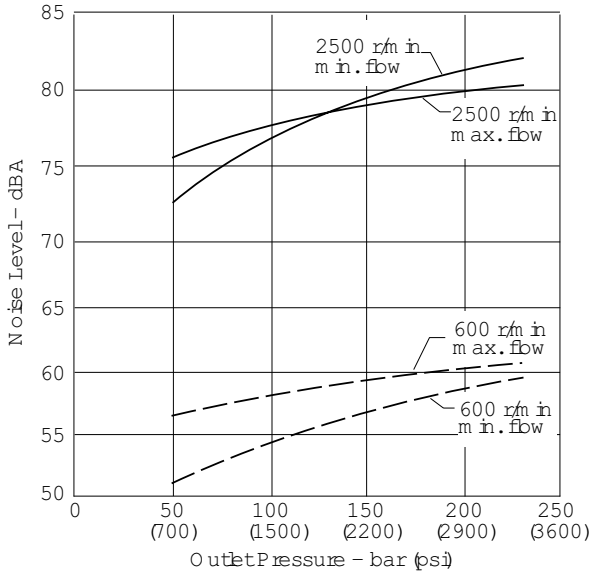
Case Flow versus Outlet Pressure at Cutoff, 1800 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



Performance

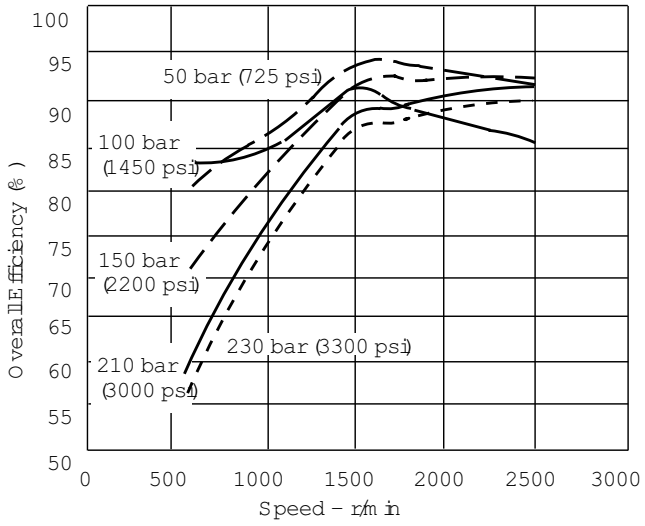
Mobile PVM063

Typical Noise Levels at 2500 & 600 r/min with Petroleum Oil (10W) at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) Inlet

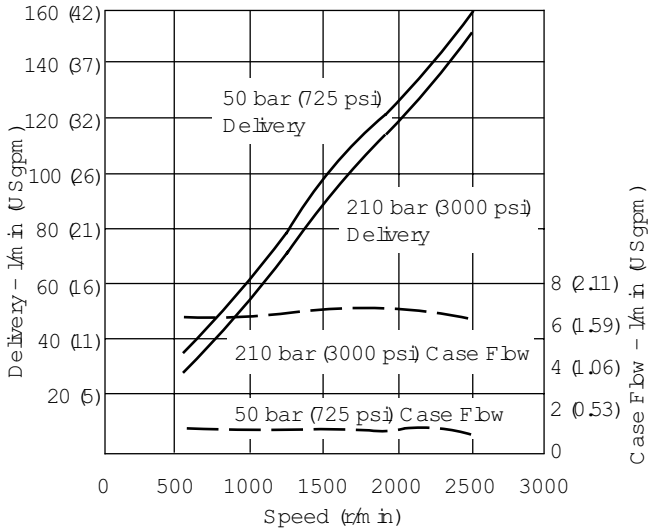


Sound pressure data equivalent to NFPA.

Overall Efficiency versus Speed at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) inlet



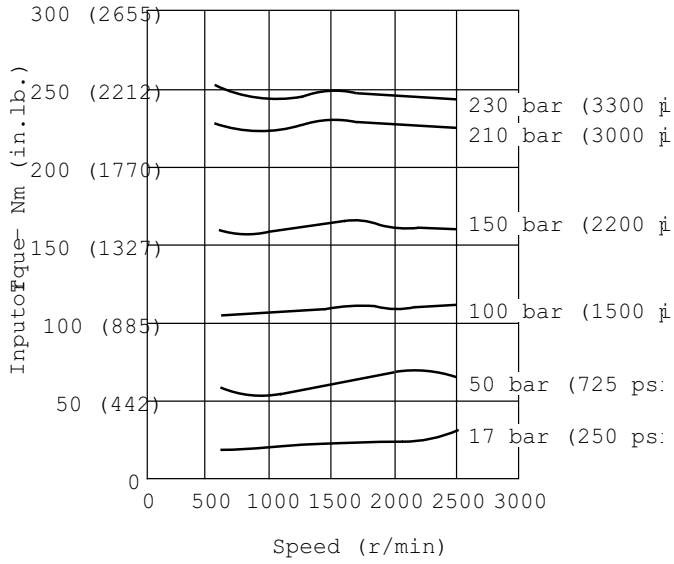
Delivery and Case Flow versus Speed at 93°C (200°F), Full Flow 1.0 bar absolute (0 psi gauge) Inlet



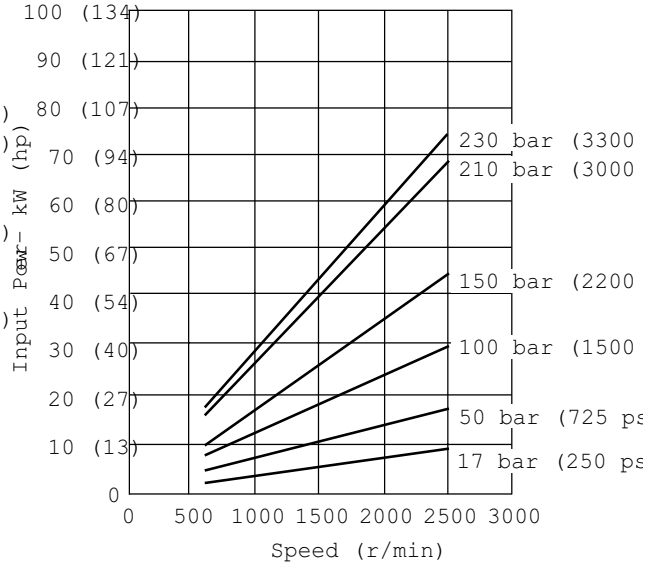
Performance

Mobile PVM063

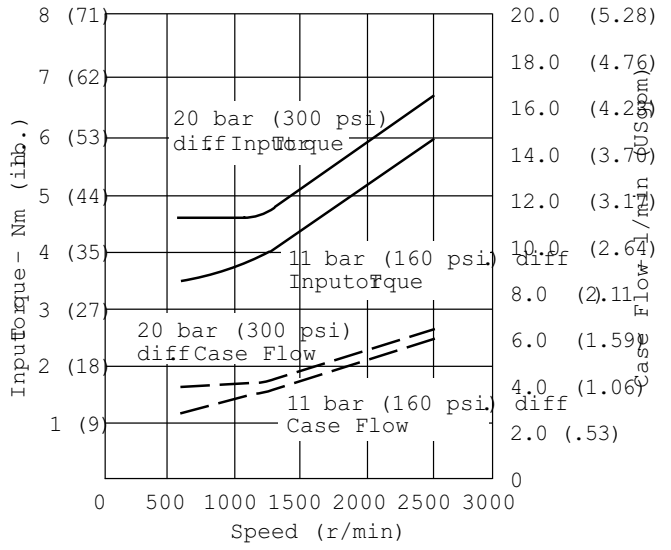
Input Torque versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



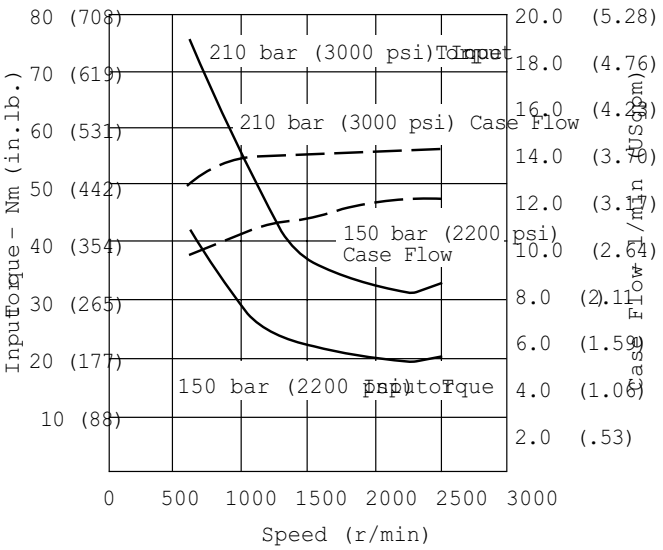
Input Power versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Case Flow versus Speed at 93°C (200°F), Load Sense Standby and 1.0 bar absolute (0 psi gauge) Inlet



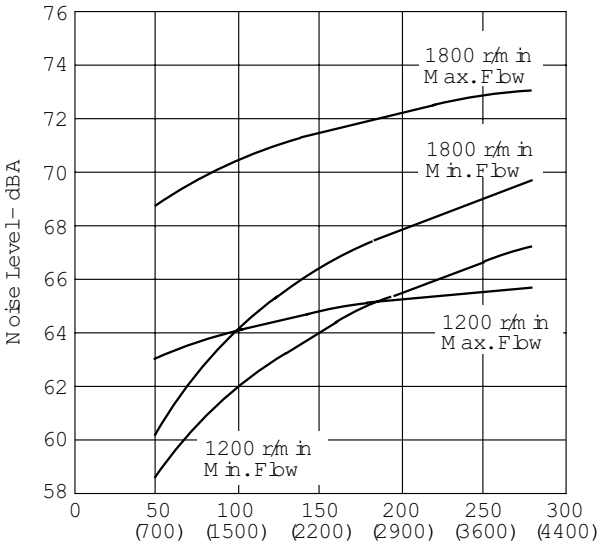
Input Torque and Case Flow versus Speed at 93°C (200°F), Pressure Limit Cut-off and 1.0 bar absolute (0 psi gauge) Inlet



Performance

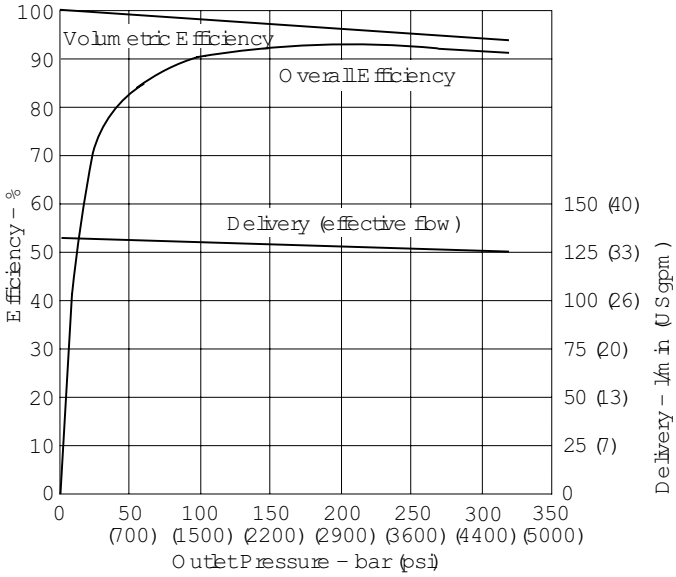
Industrial PVM074

Typical Noise Levels at 1800 and 1200 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet

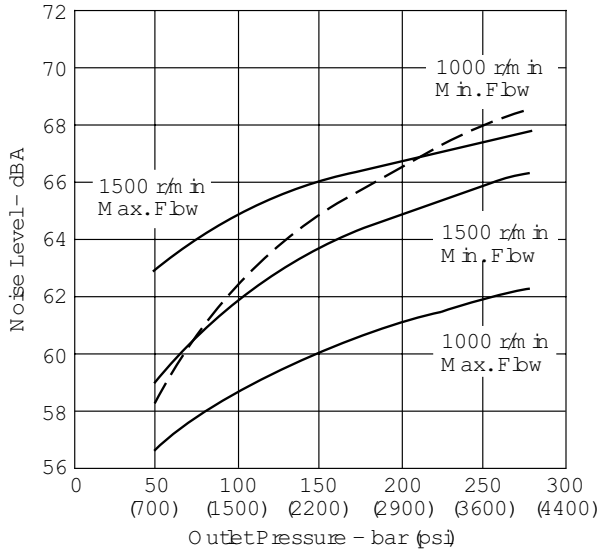


Sound pressure data equivalent to NFPA.

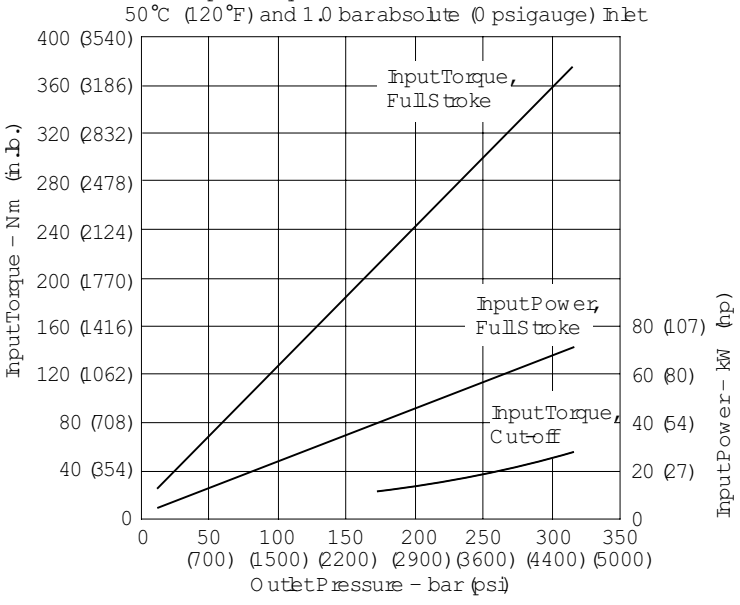
Delivery and Efficiency at 1800 r/min 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Typical Noise Levels at 1500 and 1000 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet

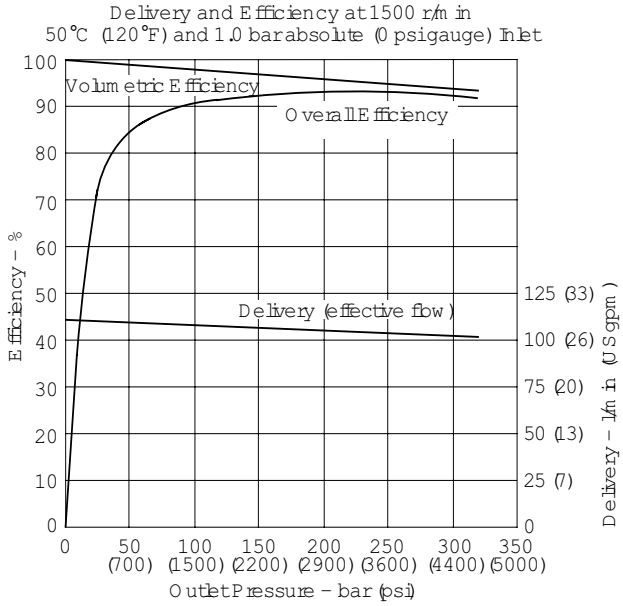


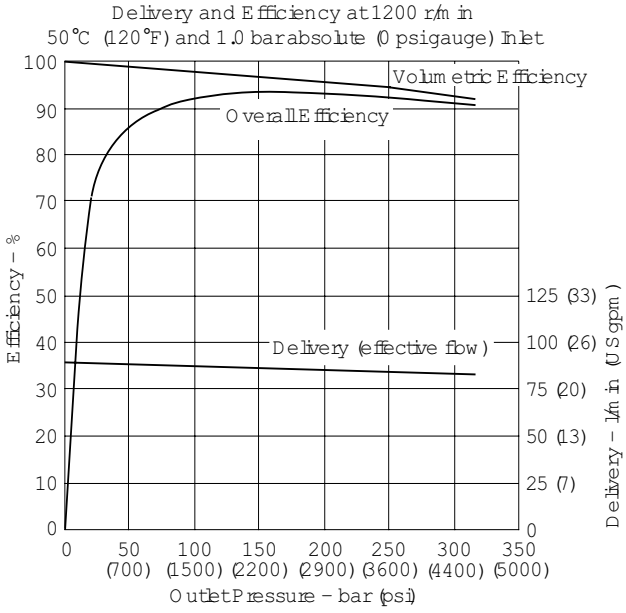
Input Torque and Power at 1800 r/min 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet

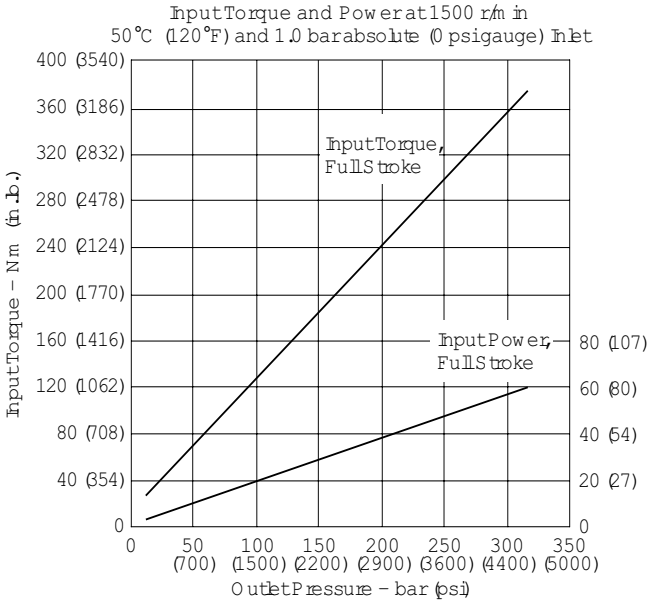


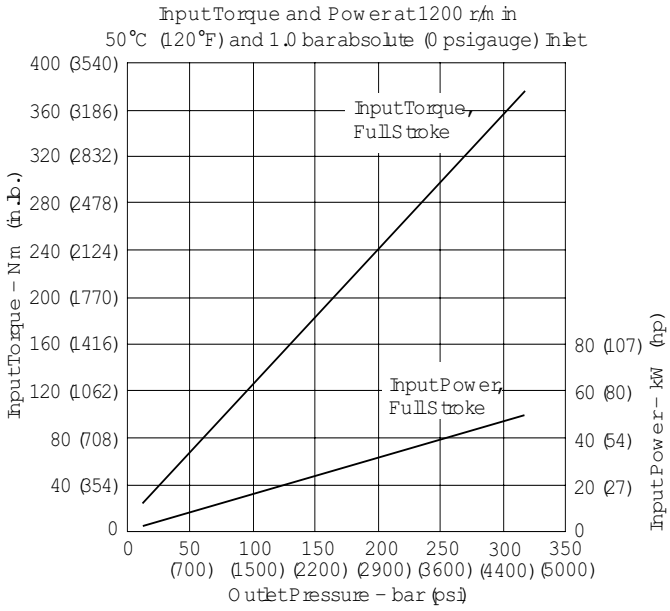
Performance

Industrial PVM074





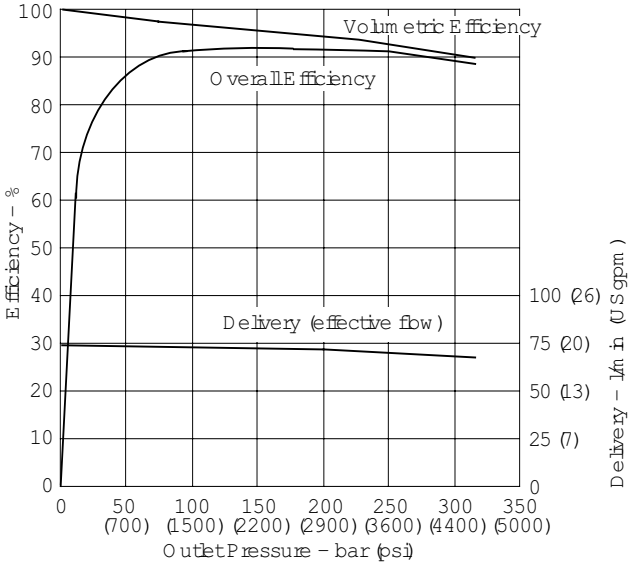




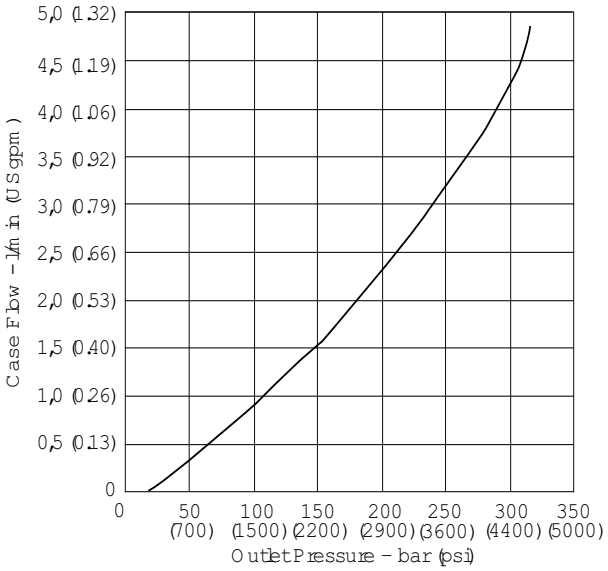
Performance

Industrial PVM074

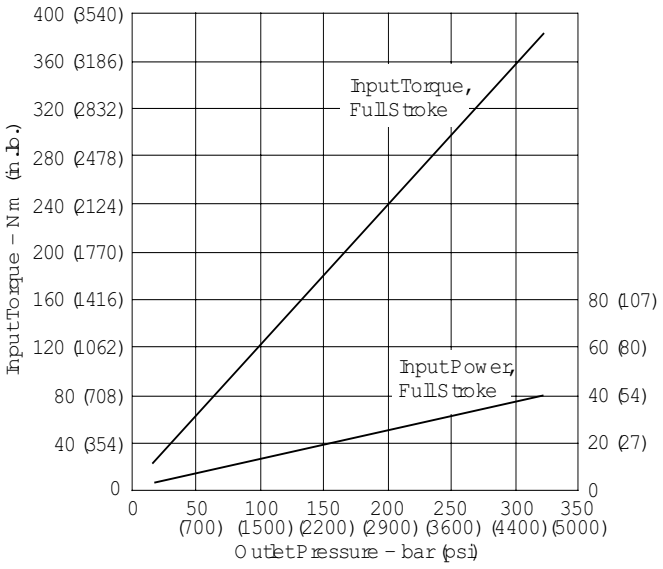
Delivery and Efficiency at 1000 r/m in
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



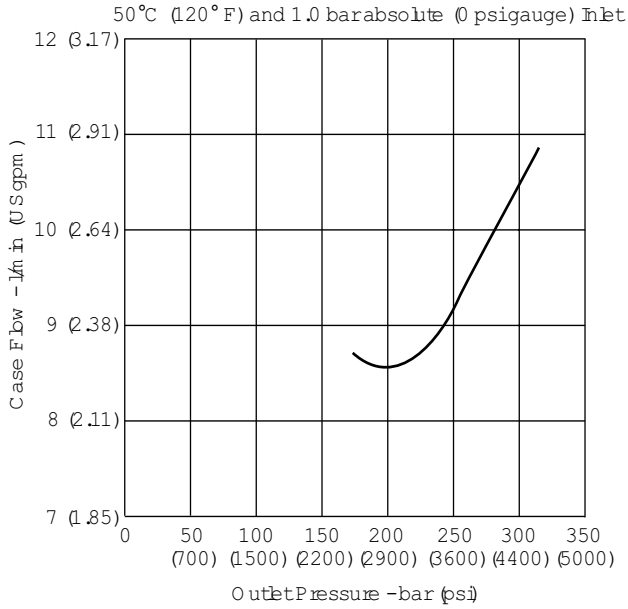
Case Flow Versus Outlet Pressure at Full Flow, 1800 r/m in
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Power at 1000 r/m in
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



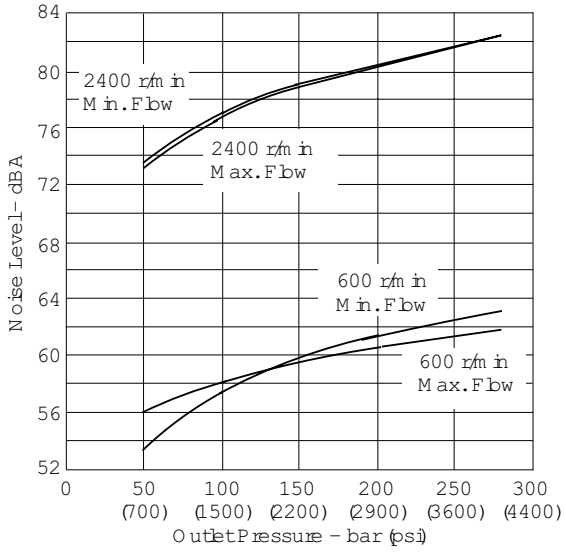
Case Flow Versus Outlet Pressure at Cutoff, 1800 r/m in
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



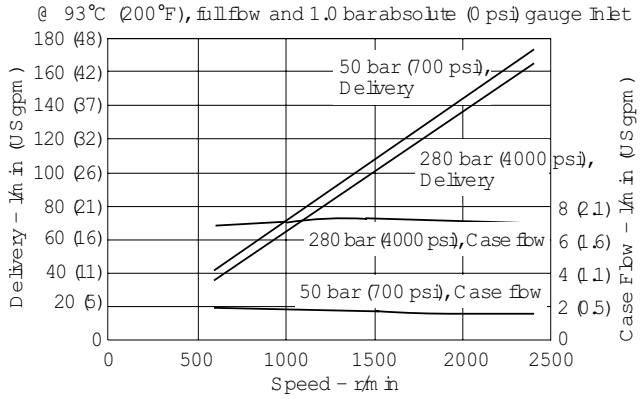
Performance

Mobile PVM074

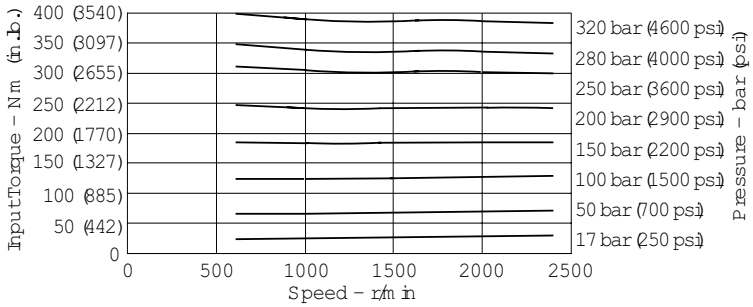
Typical Noise Levels
Petroleum Oil (10W) at 93°C (200°F),
1.0 bar absolute (0 psi gauge) Inlet
(Sound pressure data equivalent to NFPA)



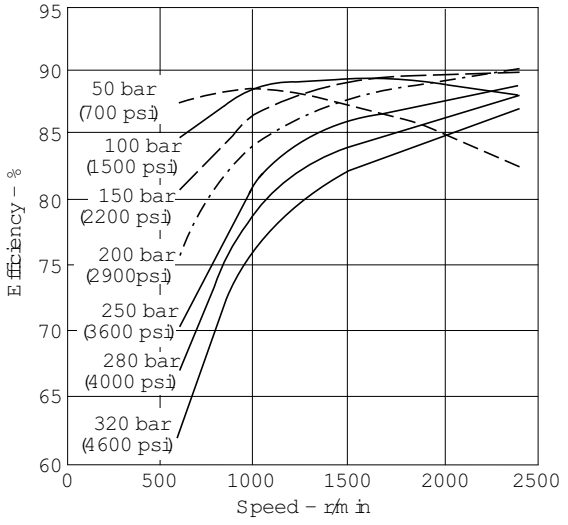
Delivery and Case Flow Versus Speed
@ 93°C (200°F), full flow and 1.0 bar absolute (0 psi) gauge Inlet



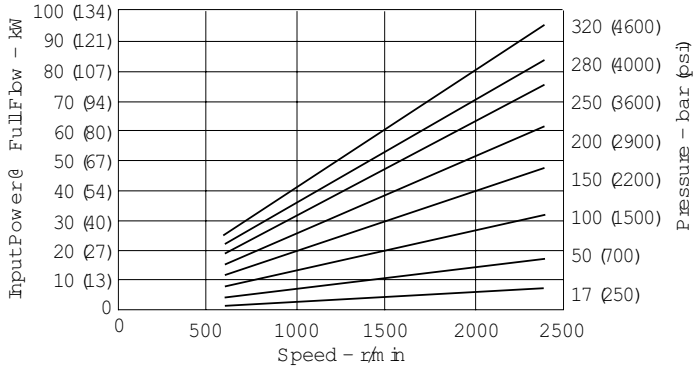
Input Torque Versus Speed
@ 93°C (200°F), full flow and 1.0 bar absolute (0 psi gauge) inlet

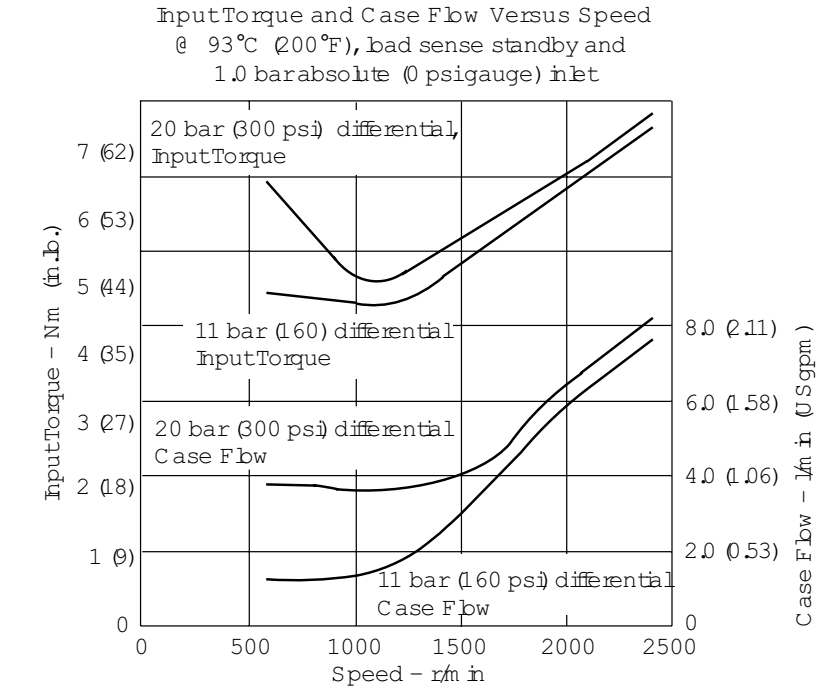


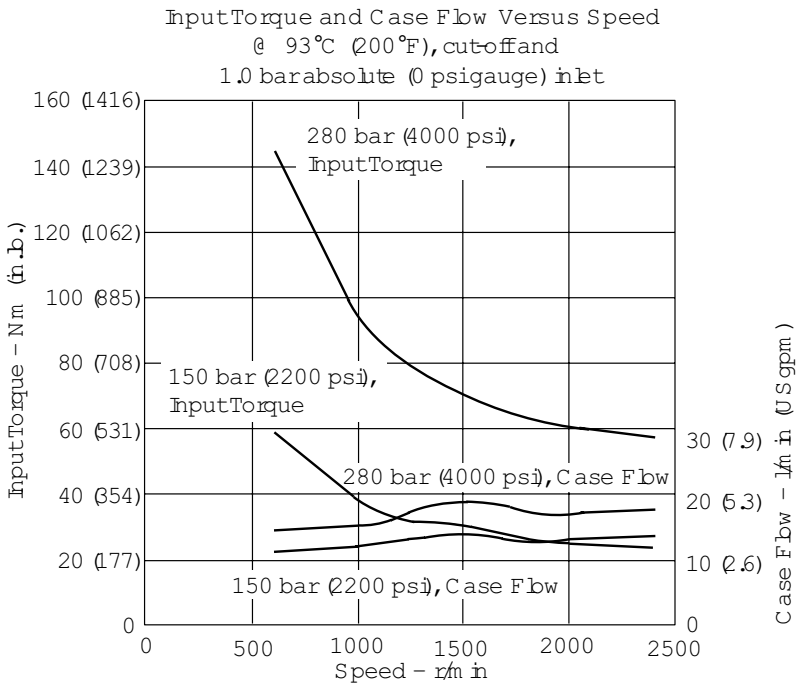
Overall Efficiency Versus Speed
at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) Inlet



Input Power Versus Speed
93°C (200°F), 1.0 bar absolute (0 psi gauge) Inlet



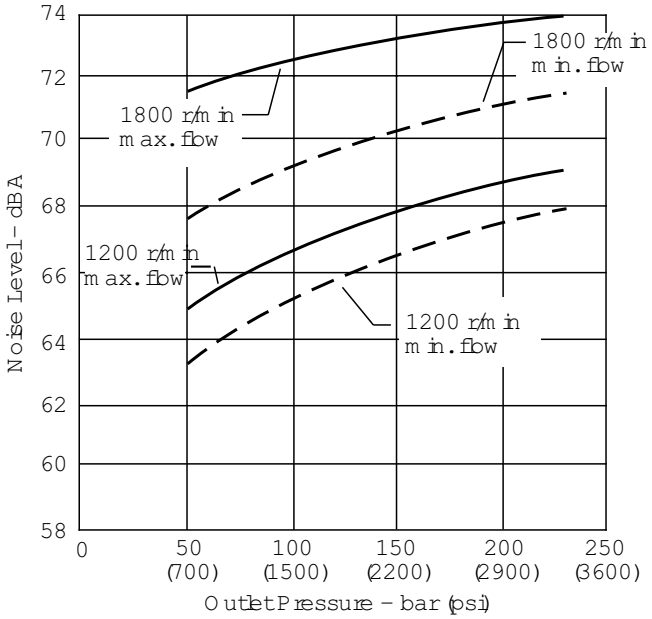

Input Torque and Case Flow Versus Speed
@ 93°C (200°F), bad sense standby and
1.0 bar absolute (0 psi gauge) inlet
20 bar (300 psi) differential,
Input Torque
11 bar (160) differential
Input Torque
20 bar (300 psi) differential
Case Flow
11 bar (160 psi) differential
Case Flow
Input Torque - Nm (in.lb.)
7 (62)
6 (53)
5 (44)
4 (35)
3 (27)
2 (18)
1 (9)
0
Case Flow - l/min (USgpm)
8.0 (2.11)
6.0 (1.58)
4.0 (1.06)
2.0 (0.53)
0
0 500 1000 1500 2000 2500
Speed - r/min


Input Torque and Case Flow Versus Speed
@ 93°C (200°F), cut-off and
1.0 bar absolute (0 psi gauge) inlet
280 bar (4000 psi),
Input Torque
150 bar (2200 psi),
Input Torque
280 bar (4000 psi), Case Flow
150 bar (2200 psi), Case Flow
Input Torque - Nm (in.lb.)
160 (1416)
140 (1239)
120 (1062)
100 (885)
80 (708)
60 (531)
40 (354)
20 (177)
0
Case Flow - l/min (USgpm)
30 (7.9)
20 (5.3)
10 (2.6)
0
0 500 1000 1500 2000 2500
Speed - r/min

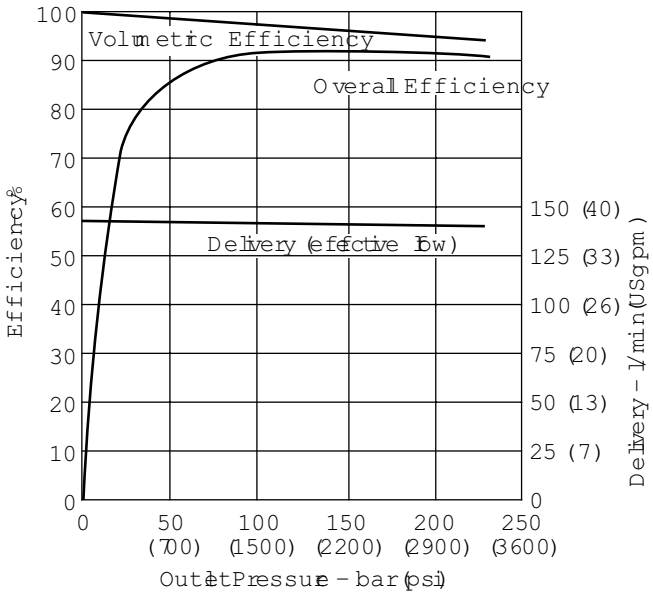
Performance

Industrial PVM081

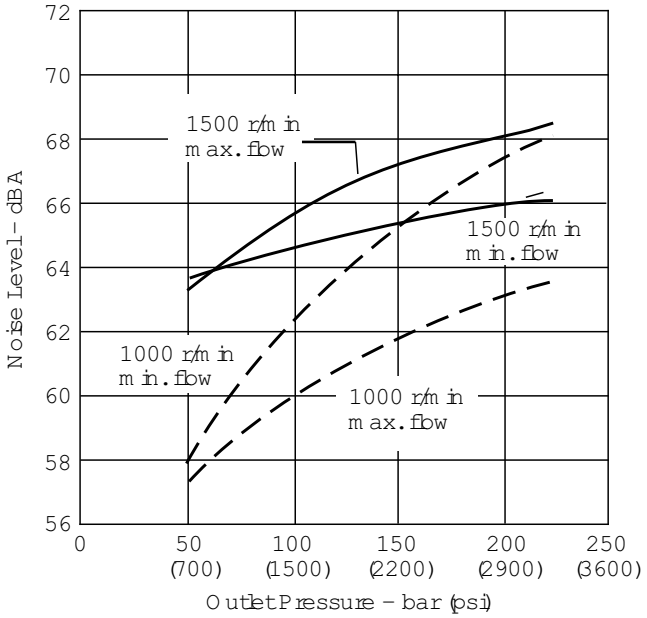
Typical Noise Levels at 1800 and 1200 r/min. with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Delivery and Efficiency at 1800 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet

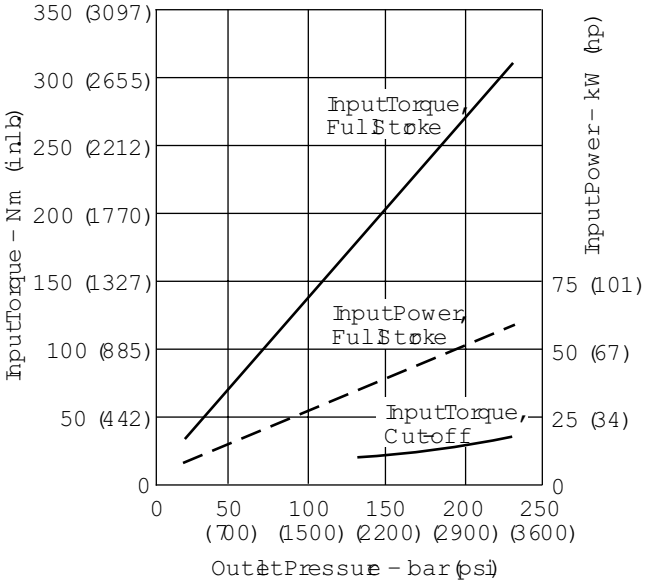


Typical Noise Levels at 1500 and 1000 r/min. with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Sound pressure data equivalent to NFPA.

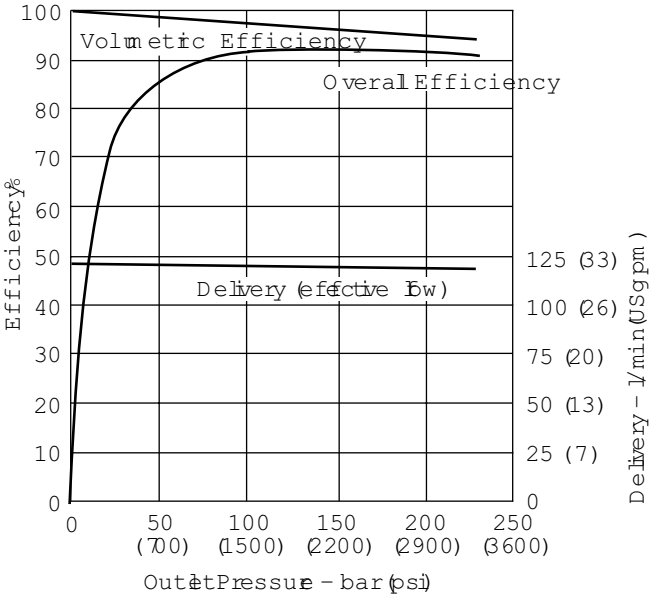
Input Torque and Power at 1800 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



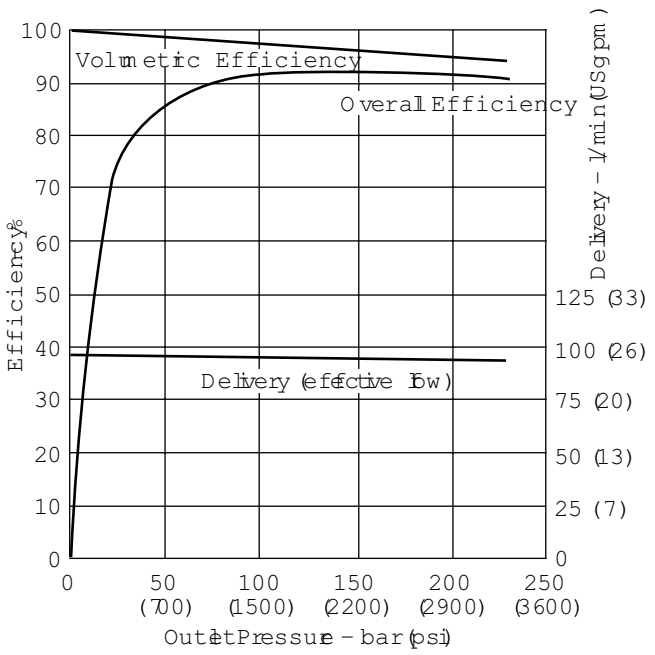
Performance

Industrial PVM081

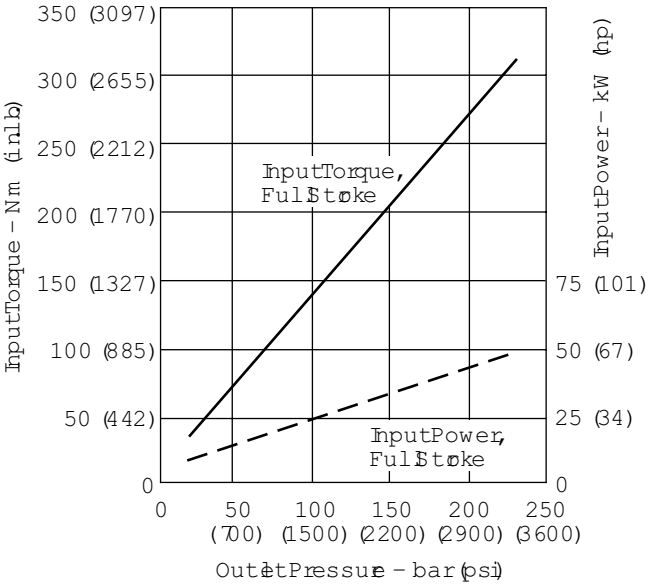
Delivery and Efficiency at 1500 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



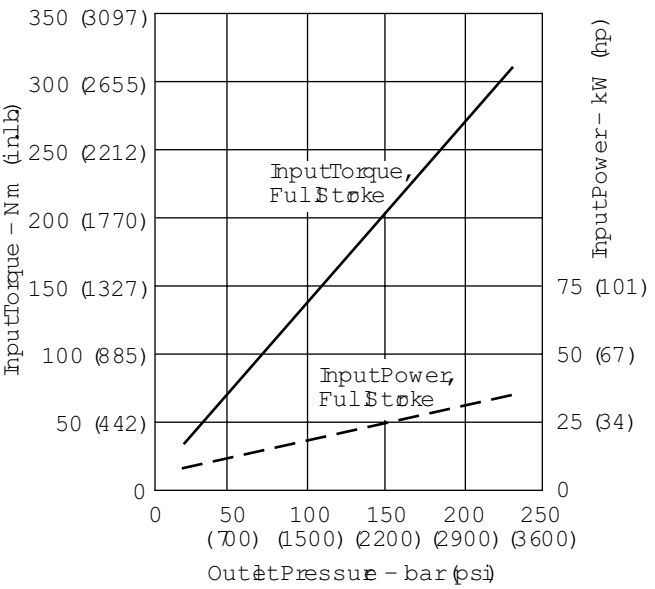
Delivery and Efficiency at 1200 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Power at 1500 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



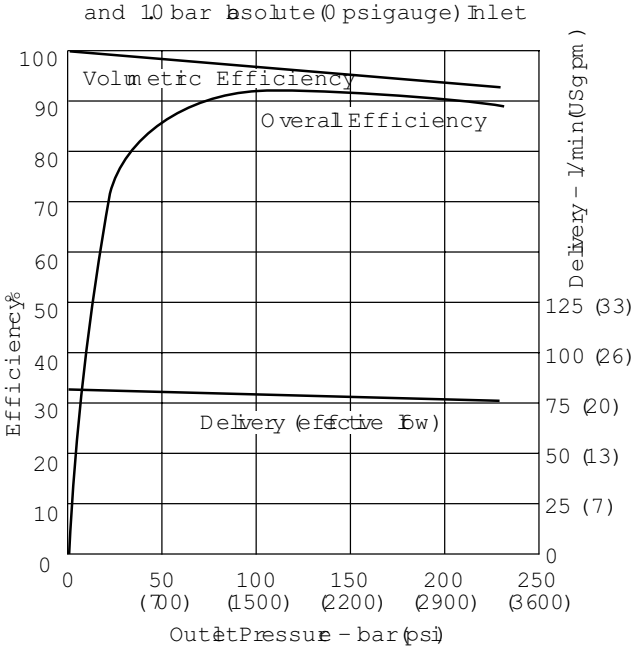
Input Torque and Power at 1200 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



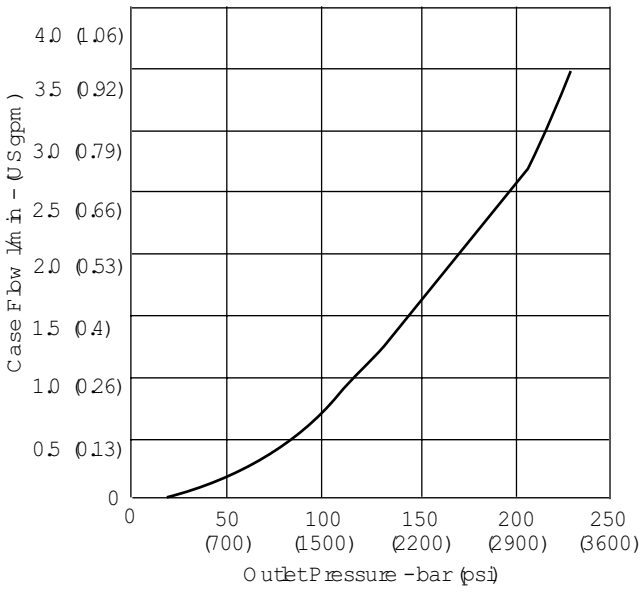
Performance

Industrial PVM081

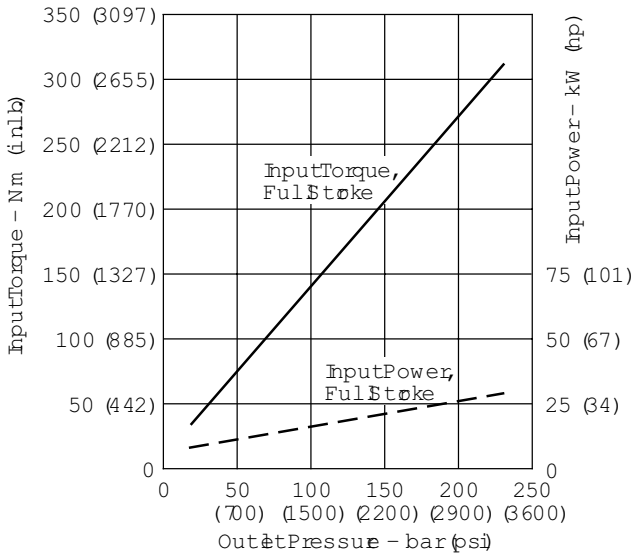
Delivery and Efficiency at 1000 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



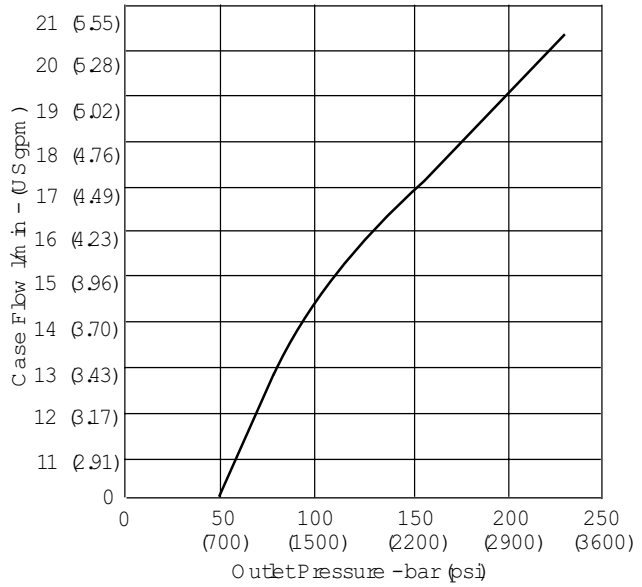
Case Flow versus Outlet Pressure at 1800 r/min, Full Flow, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Power at 1000 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



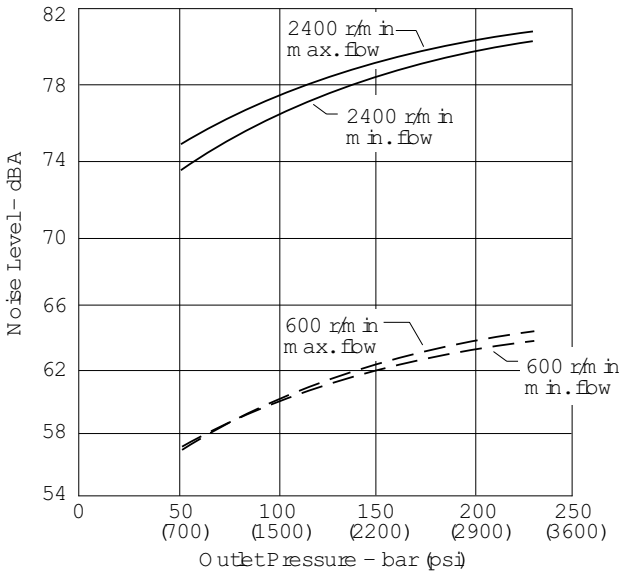
Case Flow versus Outlet Pressure at Cutoff, 1800 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



Performance

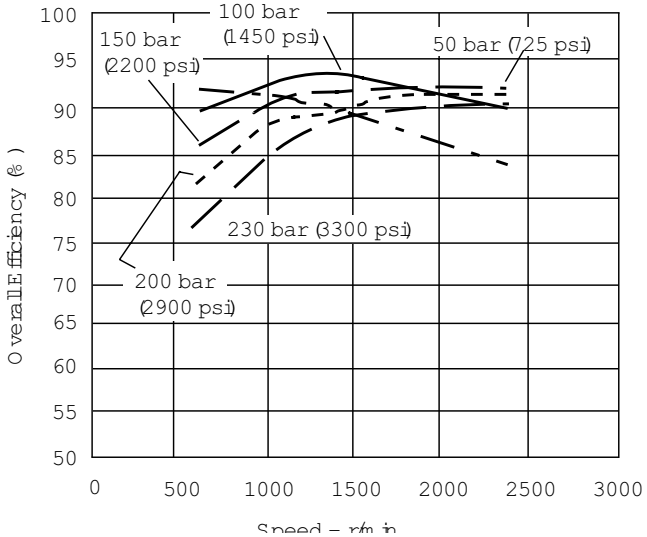
Mobile PVM081

Typical Noise Levels at 2400 & 600 r/min with Petroleum Oil (10W) at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) Inlet

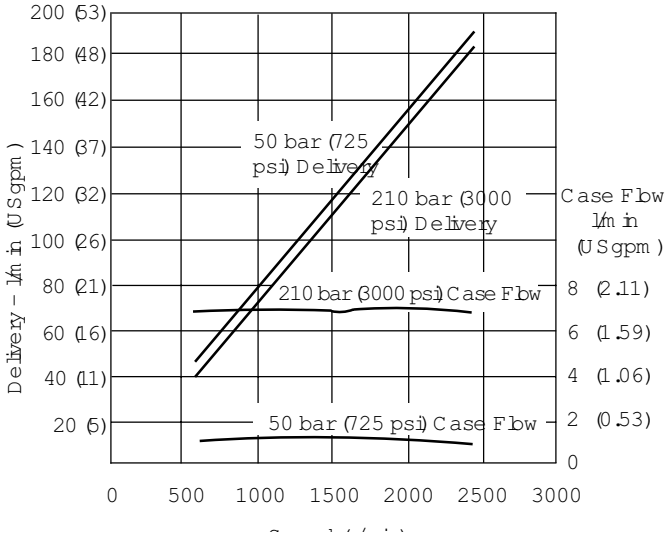


Sound pressure data

Overall Efficiency versus Speed at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) inlet



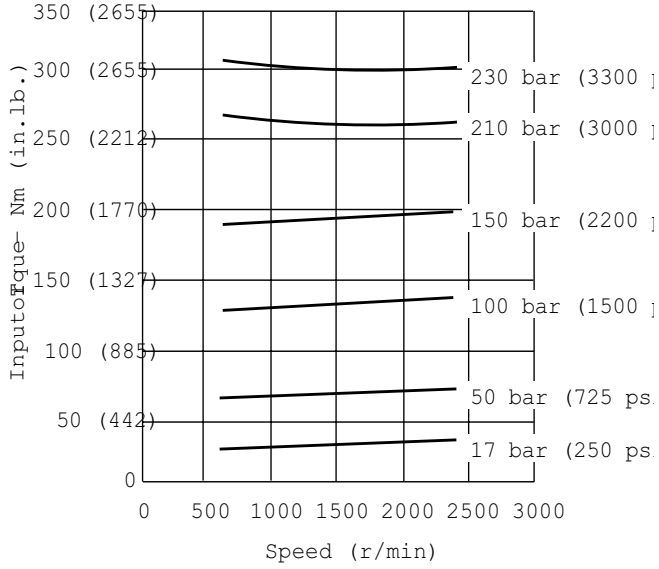
Delivery and Case Flow versus Speed at 93°C (200°F), Full Flow 1.0 bar absolute (0 psi gauge) Inlet



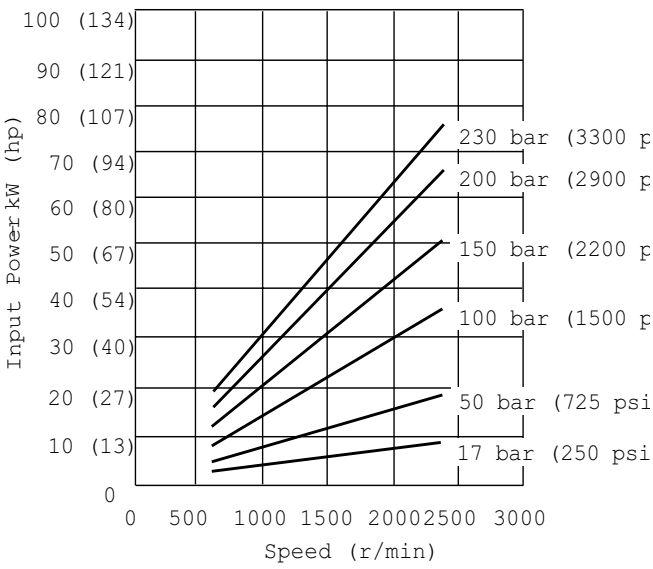
Performance

Mobile PVM081

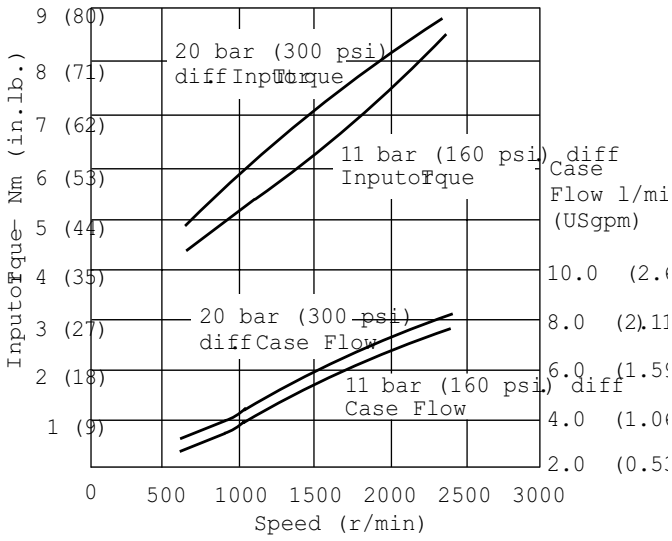
Input Torque versus Speed at (230°F), Full Flow and 1.0 bar absolute (0 psi gauge



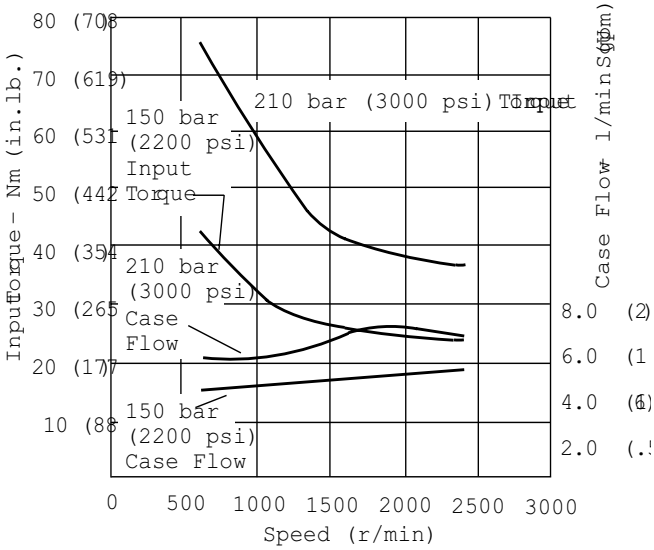
Input Power versus Speed at (200°F), Full Flow and 1.0 bar absolute (0 psi gauge



Input Torque and Case Flow versus Speed at 93 (200°F), Load Sense Standby and 1.0 bar absolu (0 psi gauge) Inlet



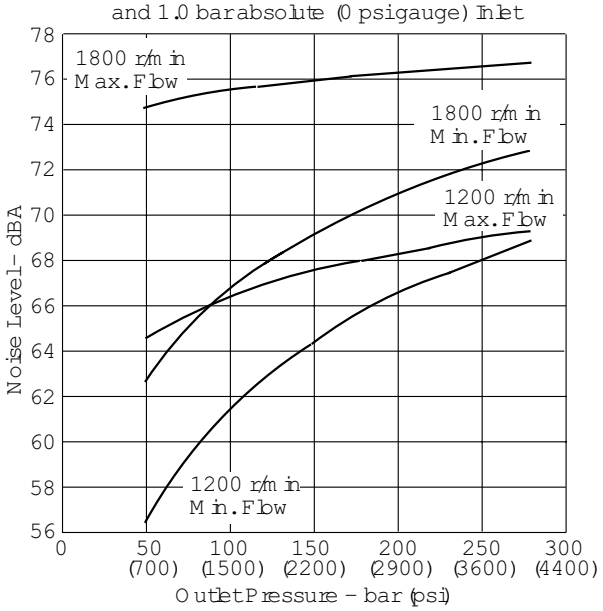
Input Torque and Case Flow versus Speed at 9 (200°F), Pressure Limit Cut-off and 1.0 bar a (0 psi gauge) Inlet



Performance

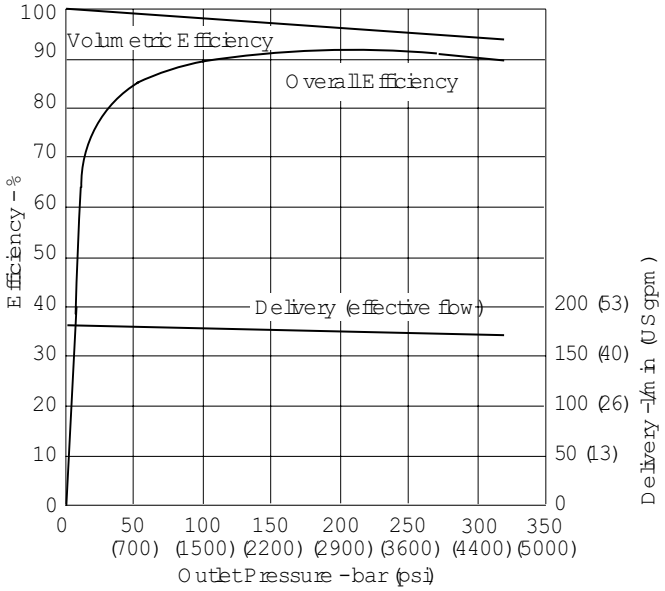
Industrial PVM098

Typical Noise Levels at 1800 and 1200 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet

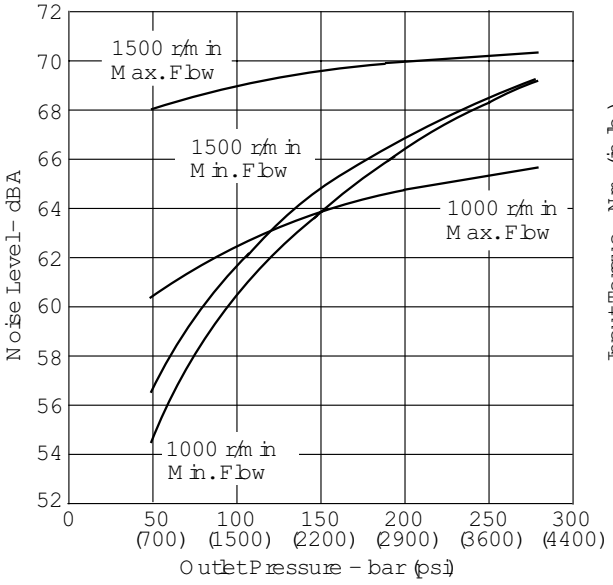


Sound pressure data equivalent to NFPA)

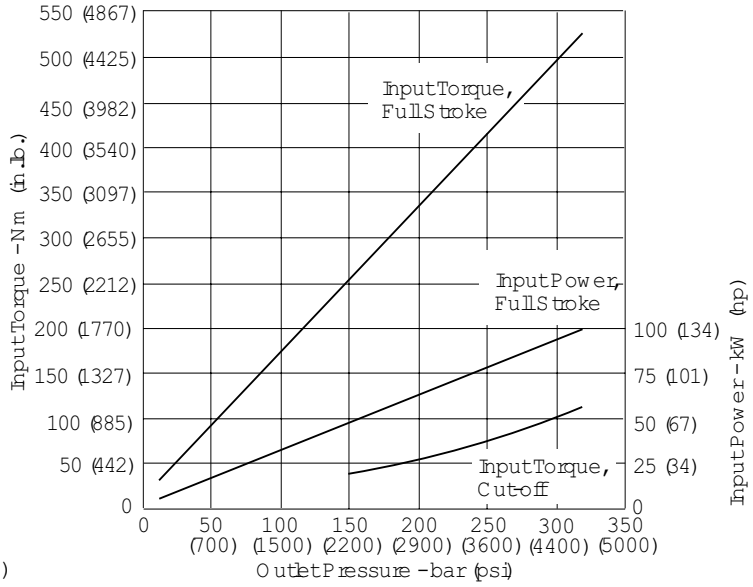
Delivery and Efficiency at 1800 r/min 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Typical Noise Levels at 1500 and 1000 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet

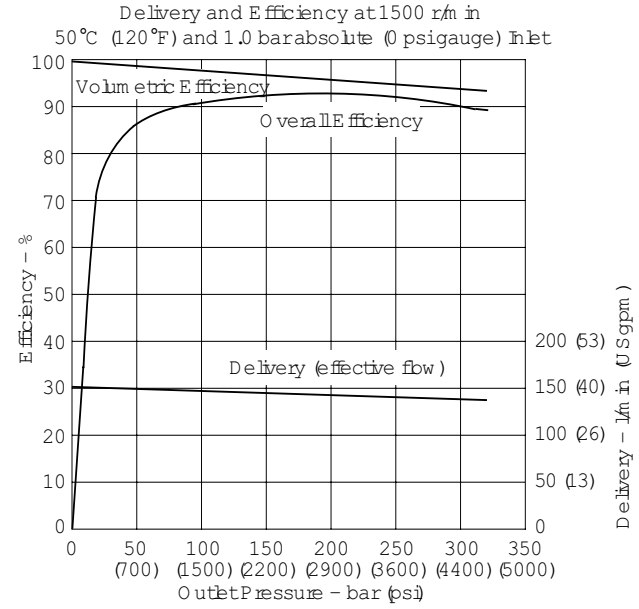


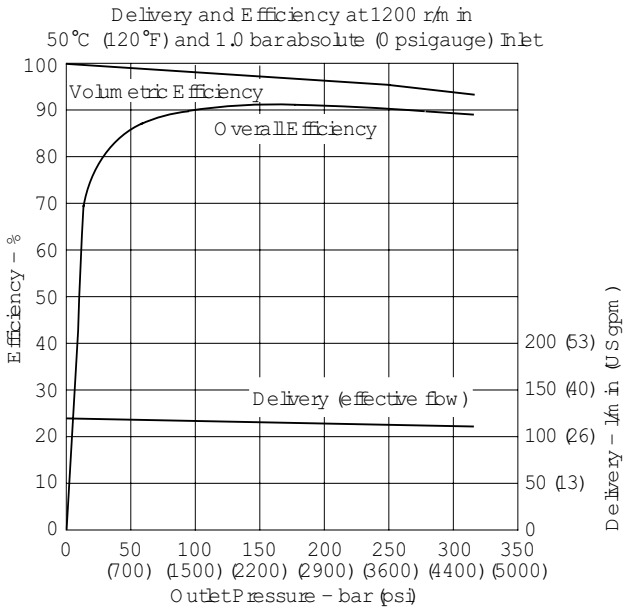
Input Torque and Power at 1800 r/min 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet

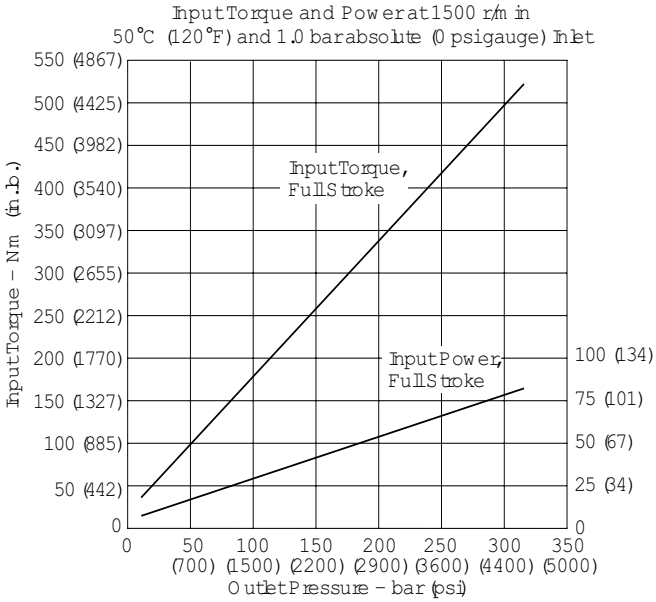


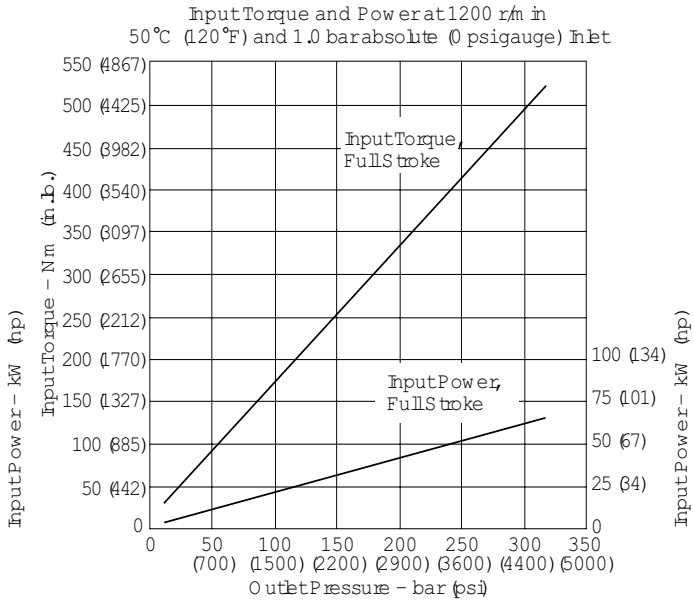
Performance

Industrial PVM098





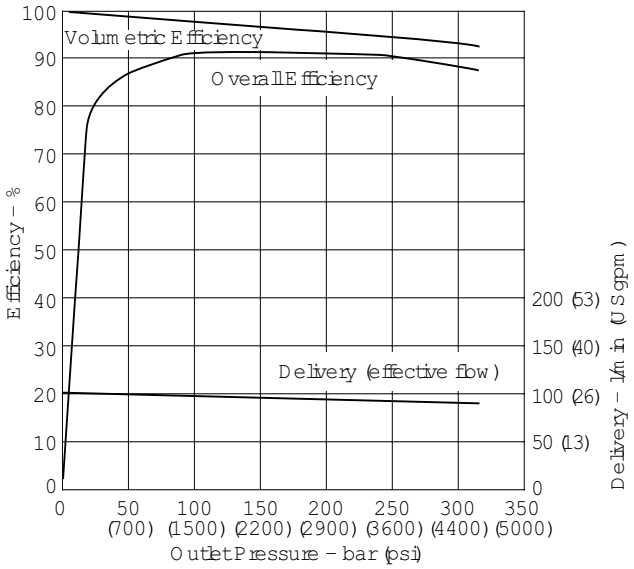




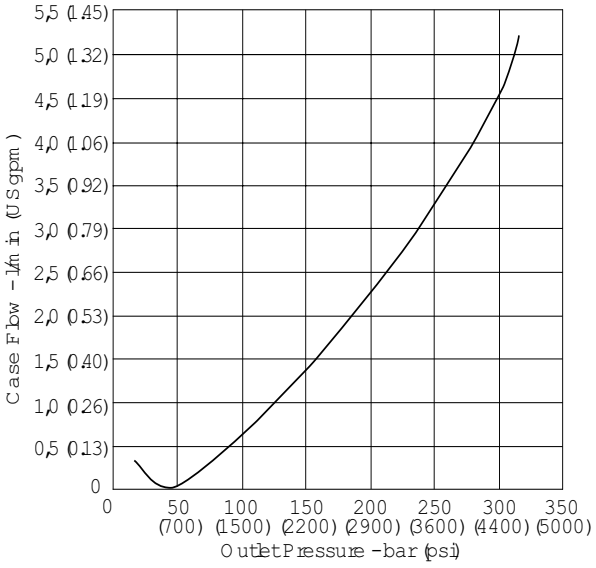
Performance

Industrial PVM098

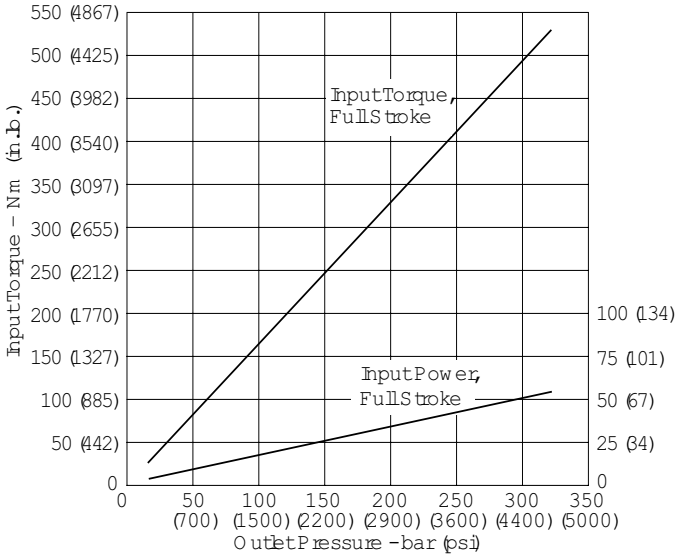
Delivery and Efficiency at 1000 r/m in
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



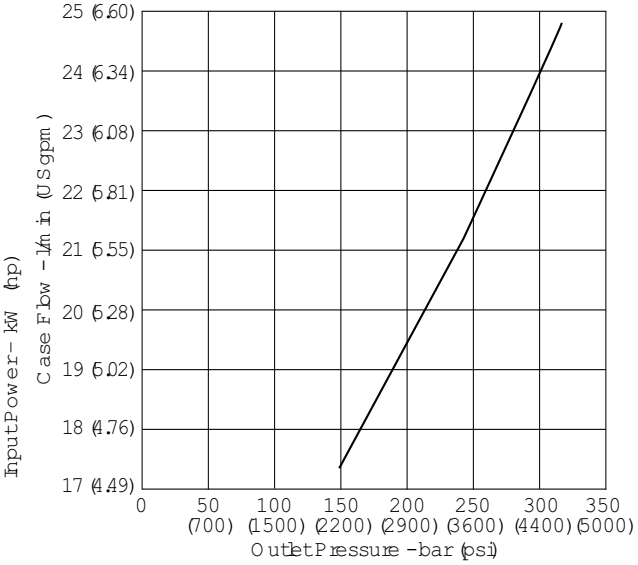
Case Flow Versus Outlet Pressure at Full Flow, 1800 r/m in
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Power at 1000 r/m in
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



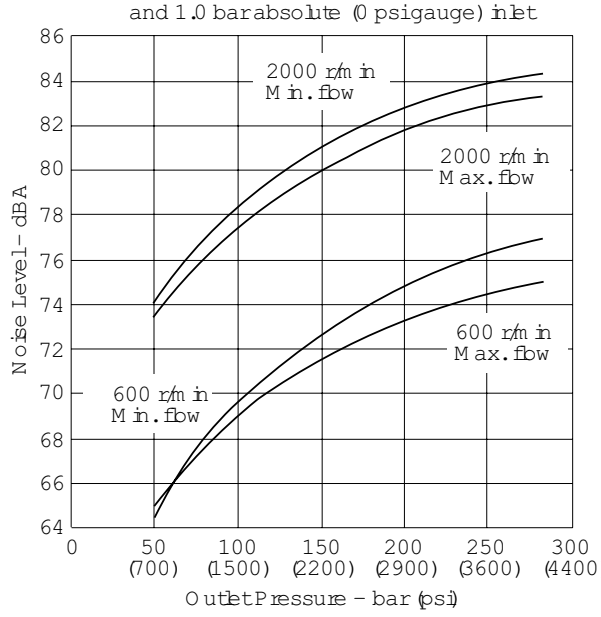
Case Flow Versus Outlet Pressure at Cutoff, 1800 r/m in
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Performance

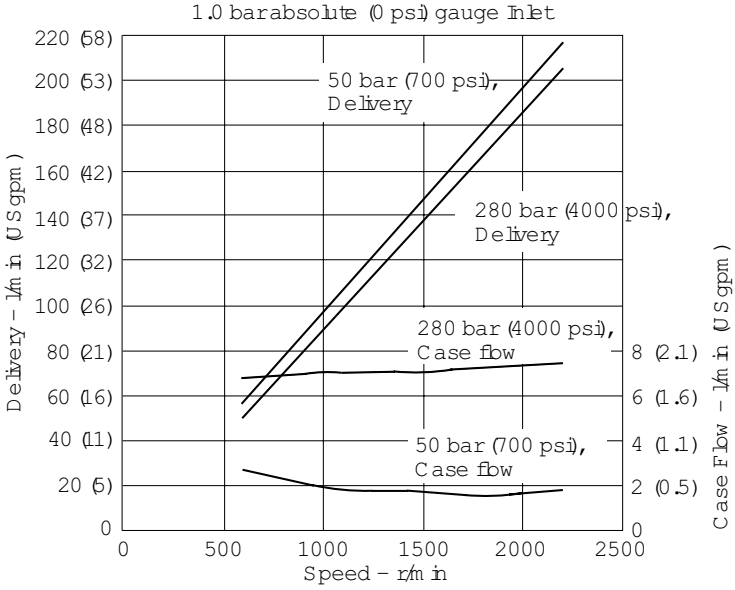
Mobile PVM098

Typical Noise Levels at 2000 and 600 r/min with petroleum oil (10 W) @ 93°C (200°F) and 1.0 bar absolute (0 psi gauge) inlet

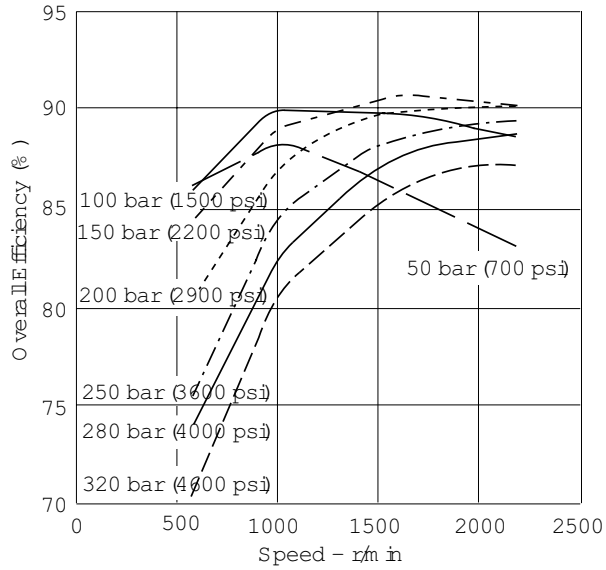


Sound pressure data equivalent to NFP

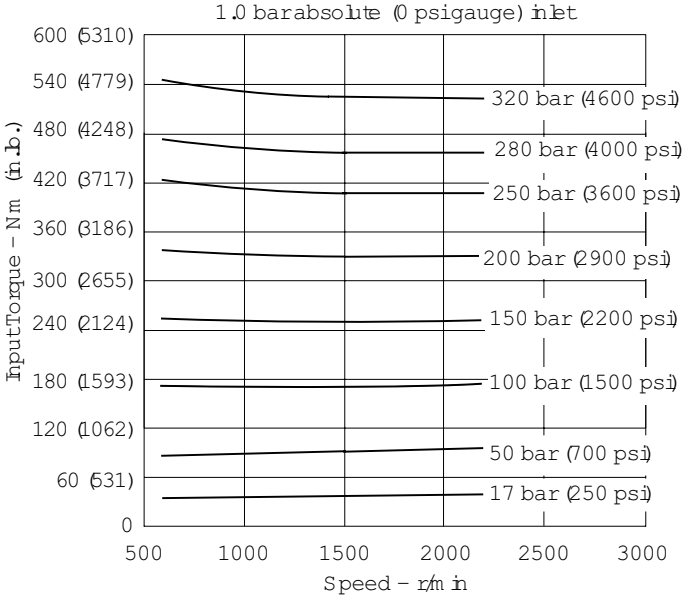
Delivery and Case Flow Versus Speed @ 93°C (200°F), full flow and 1.0 bar absolute (0 psi) gauge Inlet



Overall Efficiency Versus Speed @ 93°C (200°F) and 1.0 bar absolute (0 psi gauge) inlet



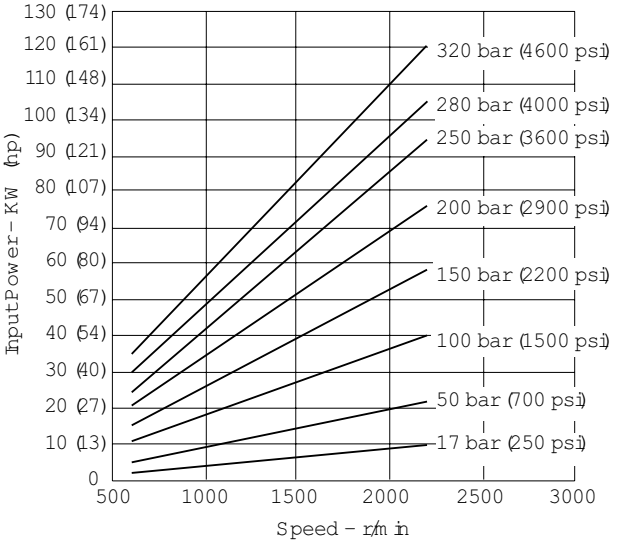
Input Torque Versus Speed @ 93°C (200°F), full flow and 1.0 bar absolute (0 psi gauge) inlet



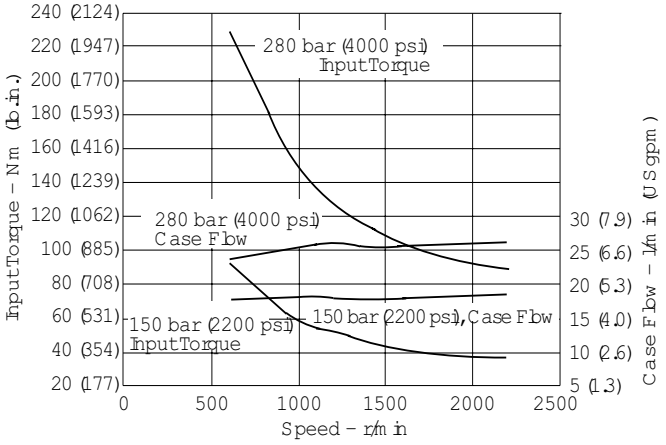
Performance

Mobile PVM098

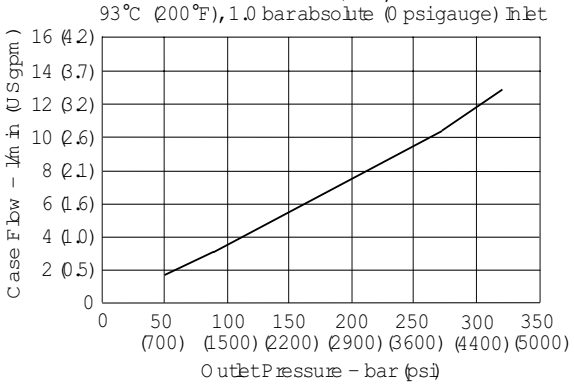
Input Power Versus Speed
@ 93°C (200°F), full flow and
1.0 bar absolute (0 psi gauge) inlet



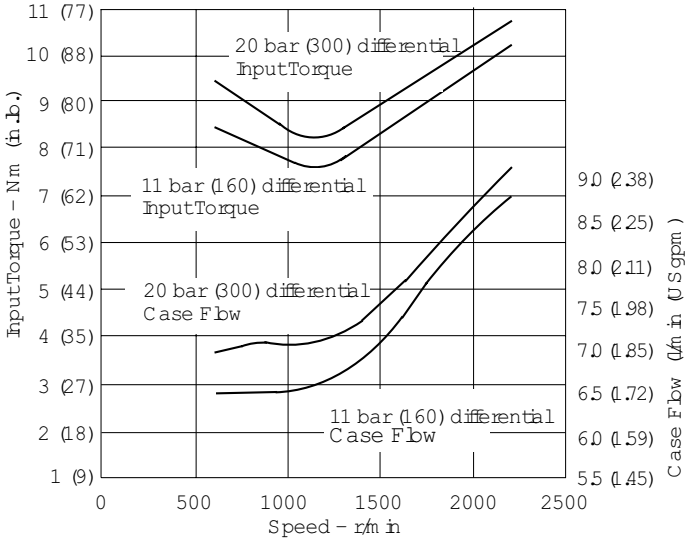
Input Torque and Case Flow Versus Speed
@ 93°C (200°F), cut-off and
1.0 bar absolute (0 psi gauge) inlet



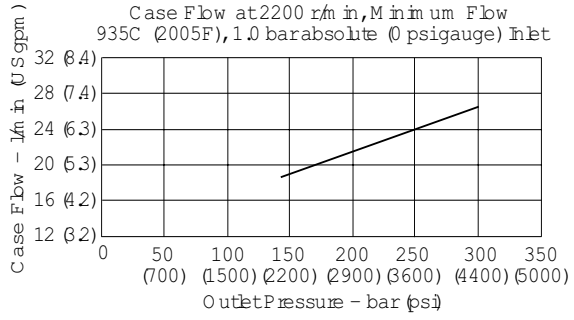
Case Flow at 2200 r/min, Full Flow
93°C (200°F), 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Case Flow Versus Speed
@ 93°C (200°F), bad sense standby
and 1.0 bar absolute (0 psi gauge) inlet



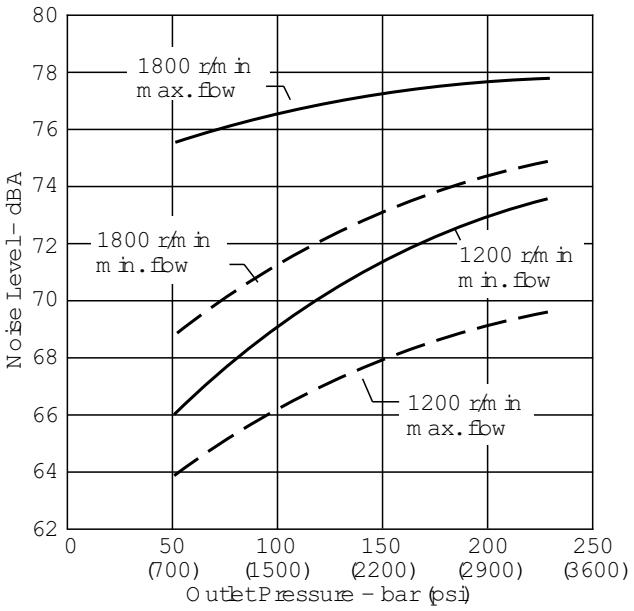
Case Flow at 2200 r/min, Minimum Flow
93°C (200°F), 1.0 bar absolute (0 psi gauge) Inlet



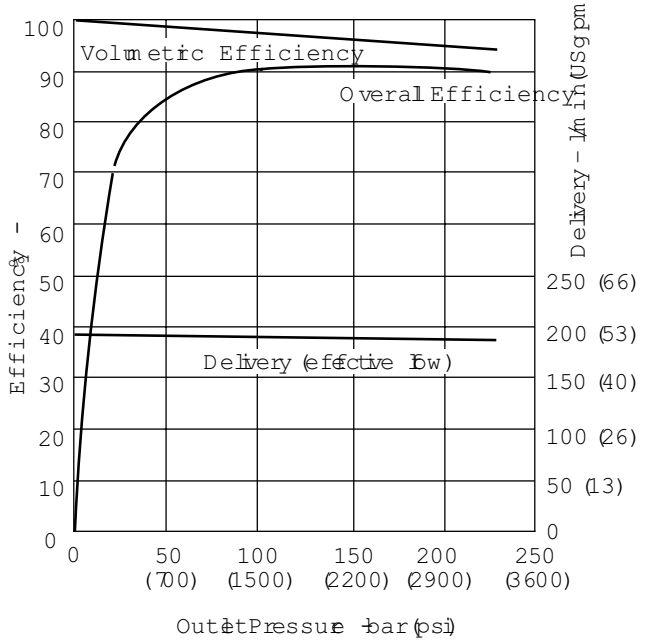
Performance

Industrial PVM106

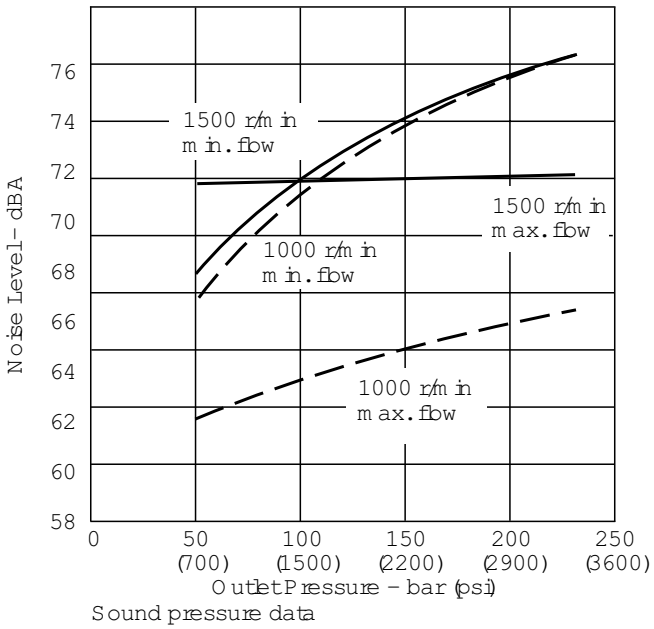
Typical Noise Levels at 1800 and 1200 r/min. with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psig gauge) Inlet



Delivery and Efficiency at 1800 r/min, 50°C (120°F), and 1.0 bar absolute (0 psig gauge) Inlet

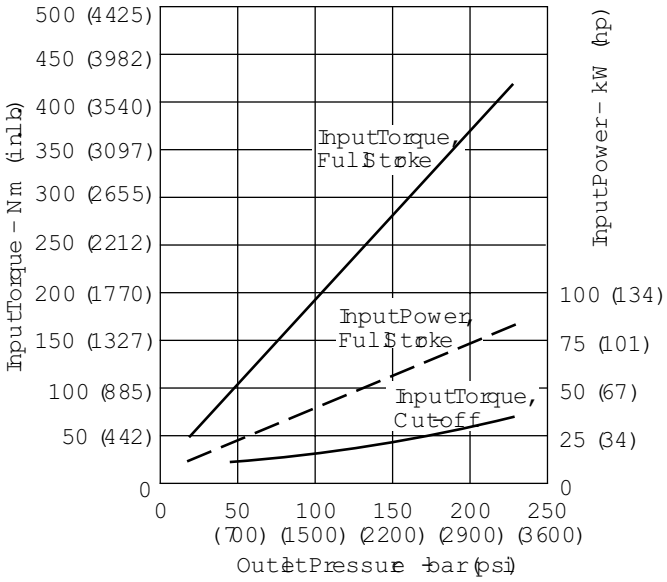


Typical Noise Levels at 1500 and 1000 r/min. with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psig gauge) Inlet



Sound pressure data equivalent to NFPA.

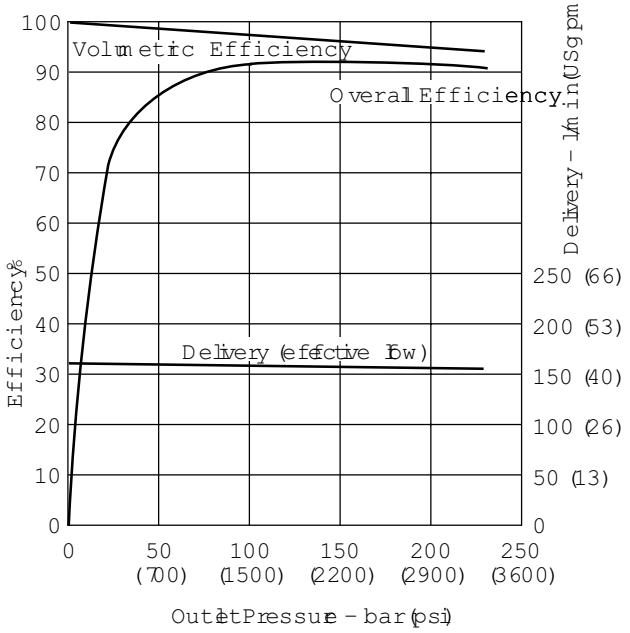
Input Torque and Power at 1800 r/min, 50°C (120°F), and 1.0 bar absolute (0 psig gauge) Inlet



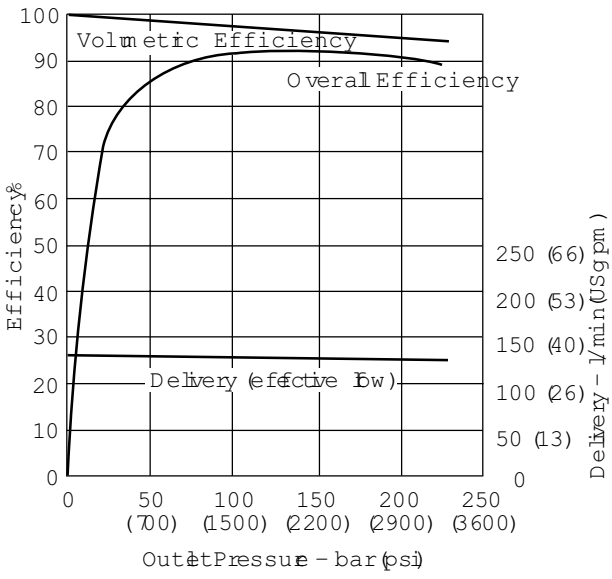
Performance

Industrial PVM106

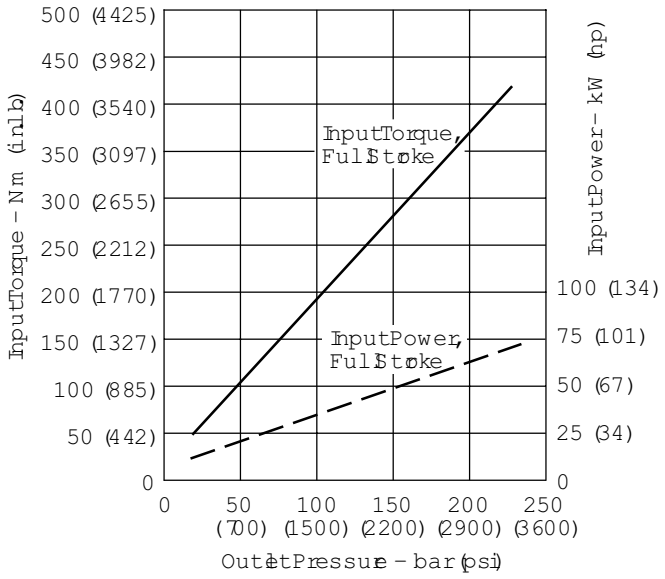
Delivery and Efficiency at 1500 r/min, 50°C (120°F), and 1.0 bar absolute (0 psig gauge) Inlet



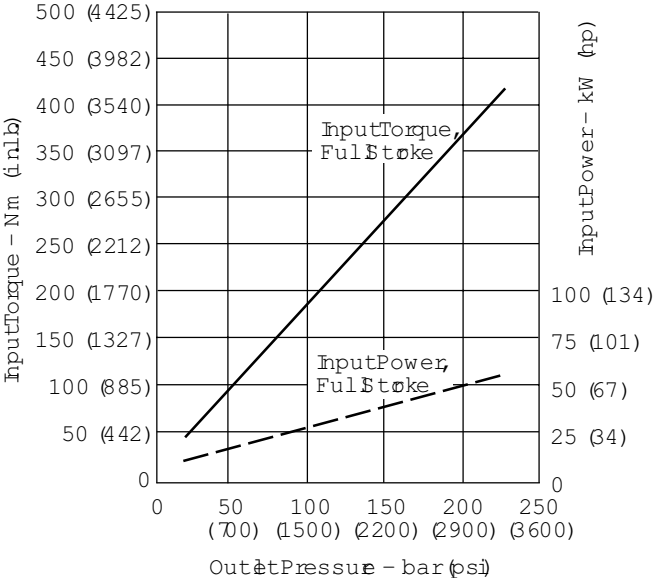
Delivery and Efficiency at 1200 r/min, 50°C (120°F), and 1.0 bar absolute (0 psig gauge) Inlet



Input Torque and Power at 1500 r/min, 50°C (120°F), and 1.0 bar absolute (0 psig gauge) Inlet



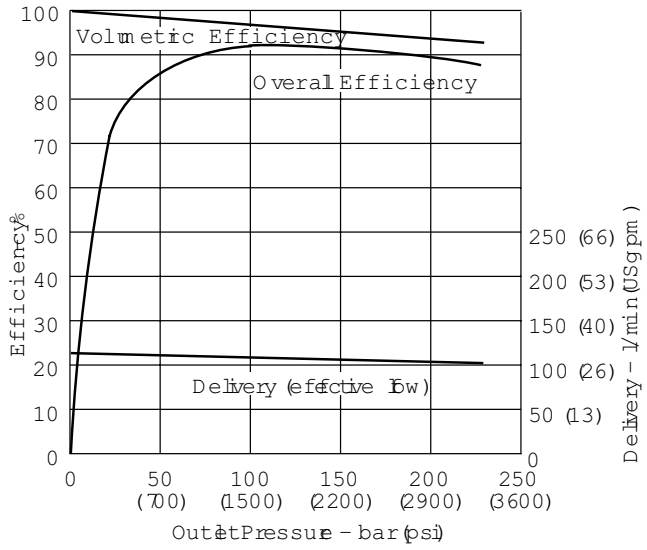
Input Torque and Power at 1200 r/min, 50°C (120°F), and 1.0 bar absolute (0 psig gauge) Inlet



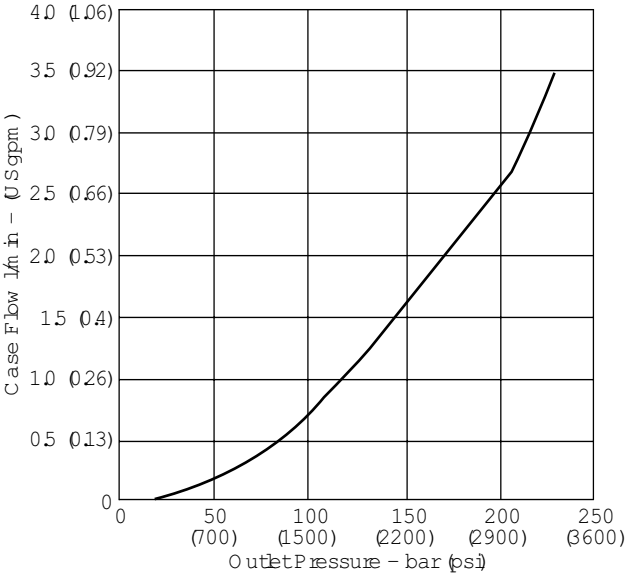
Performance

Industrial PVM106

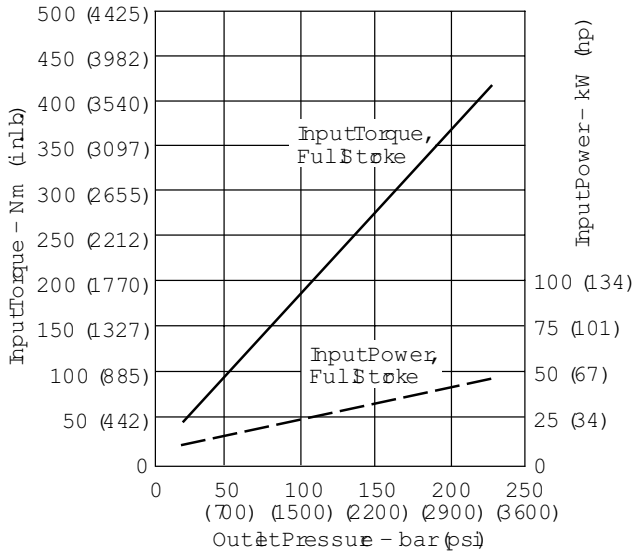
Delivery and Efficiency at 1000 r/min, 50°C (120°F), and 1.0 bar absolute (0 psig gauge) Inlet



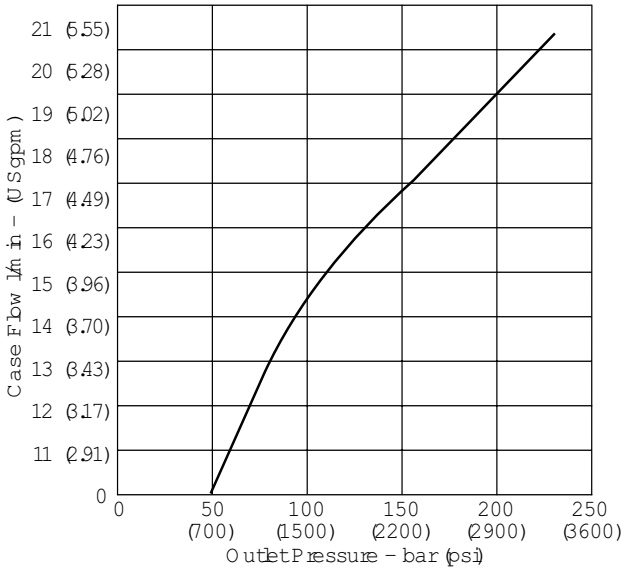
Case Flow versus Outlet Pressure at 1800 r/min, Full Flow, 50°C (120°F), and 1.0 bar absolute (0 psig gauge) Inlet



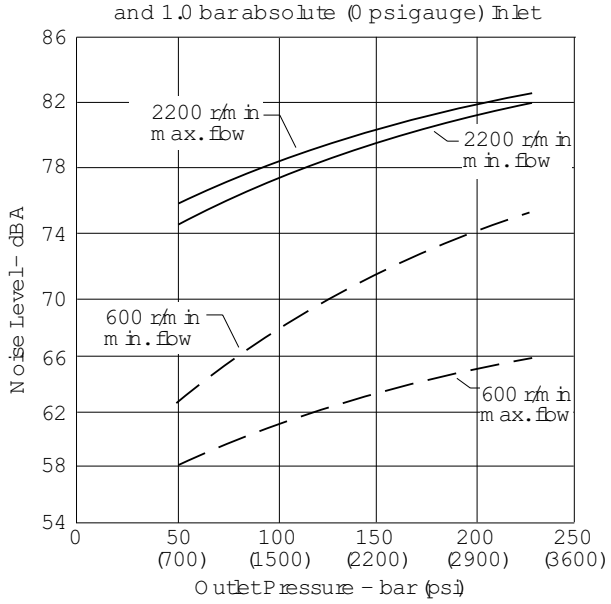
Input Torque and Power at 1000 r/min, 50°C (120°F), and 1.0 bar absolute (0 psig gauge) Inlet



Case Flow versus Outlet Pressure at Cutoff, 1800 r/min, 50°C (120°F), and 1.0 bar absolute (0 psig gauge) Inlet

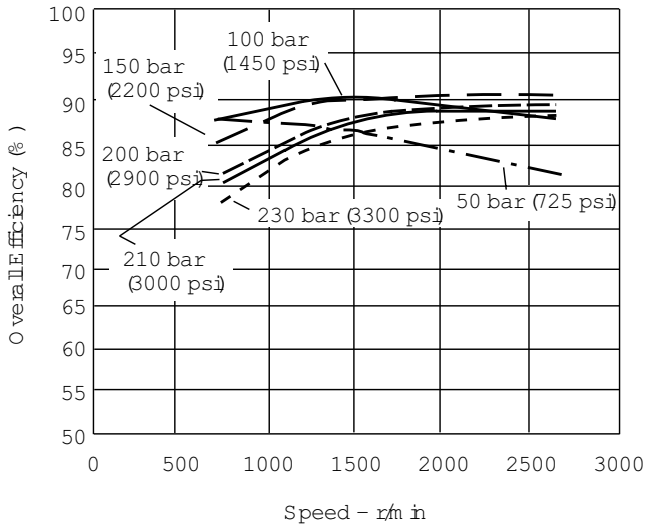


Typical Noise Levels at 2200 & 600 r/min with Petroleum Oil (10W) at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) Inlet

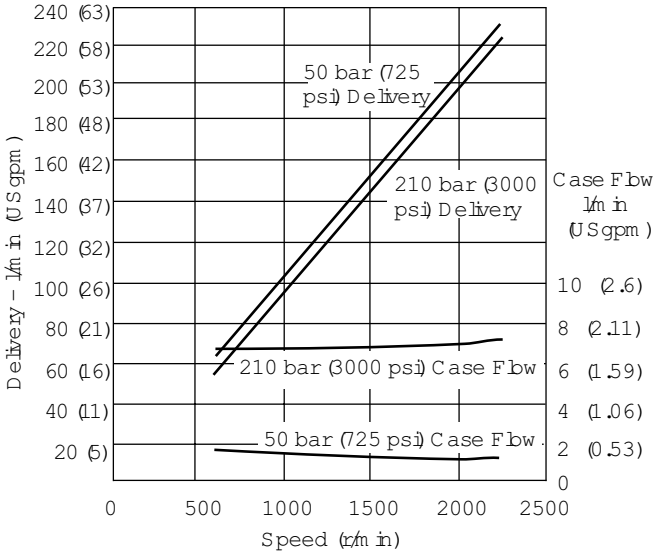


Sound pressure data equivalent to NFPA.

Overall Efficiency versus Speed at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) inlet



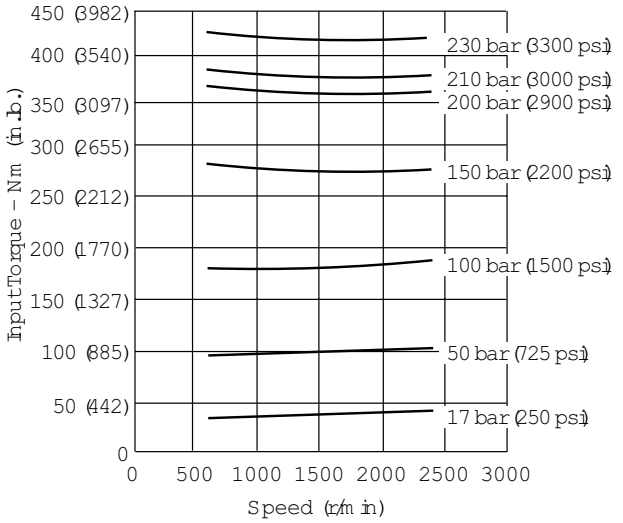
Delivery and Case Flow versus Speed at 93°C (200°F), Full Flow 1.0 bar absolute (0 psi gauge) Inlet



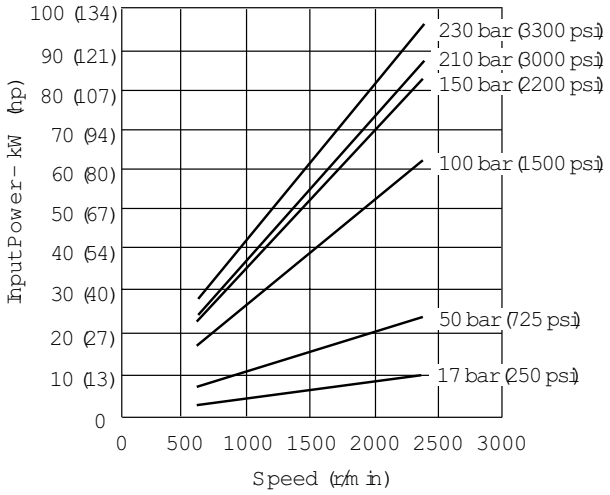
Performance

Mobile PVM106

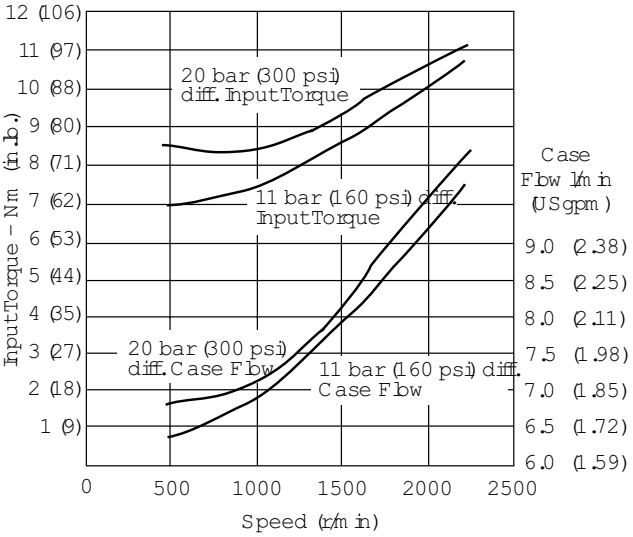
Input Torque versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



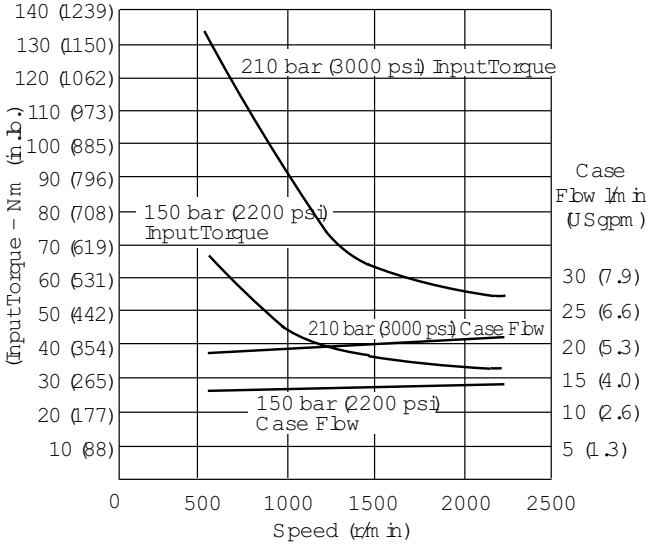
Input Power versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Case Flow versus Speed at 93°C (200°F), Load Sense Standby and 1.0 bar absolute (0 psi gauge) Inlet



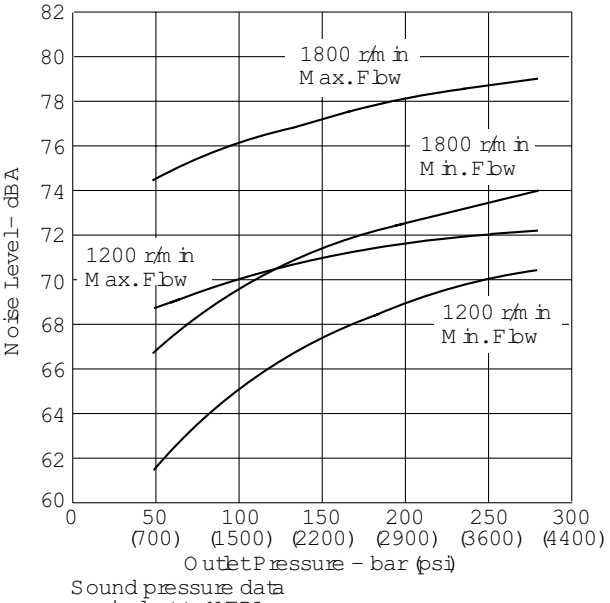
Input Torque and Case Flow versus Speed at 93°C (200°F), Pressure Limit Cut-off and 1.0 bar absolute (0 psi gauge) Inlet



Performance

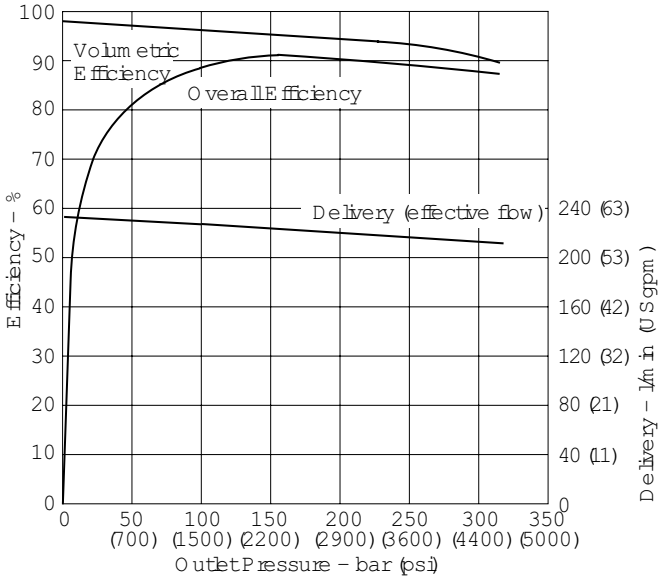
Industrial PVM131

Typical Noise Levels at 1800 and 1200 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet

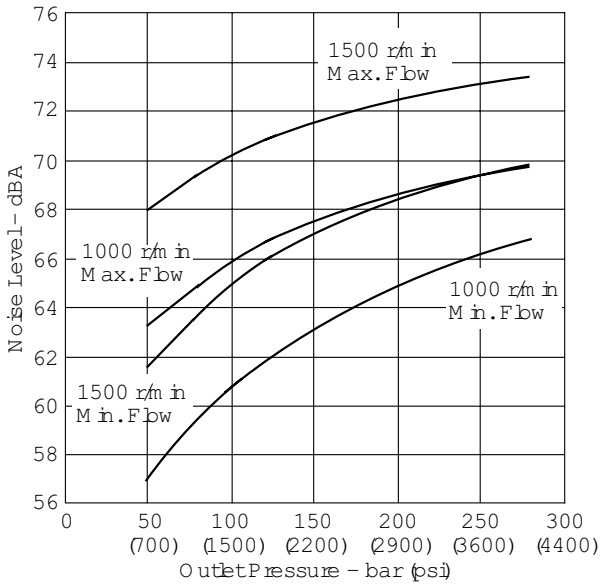


Sound pressure data equivalent to NFPA

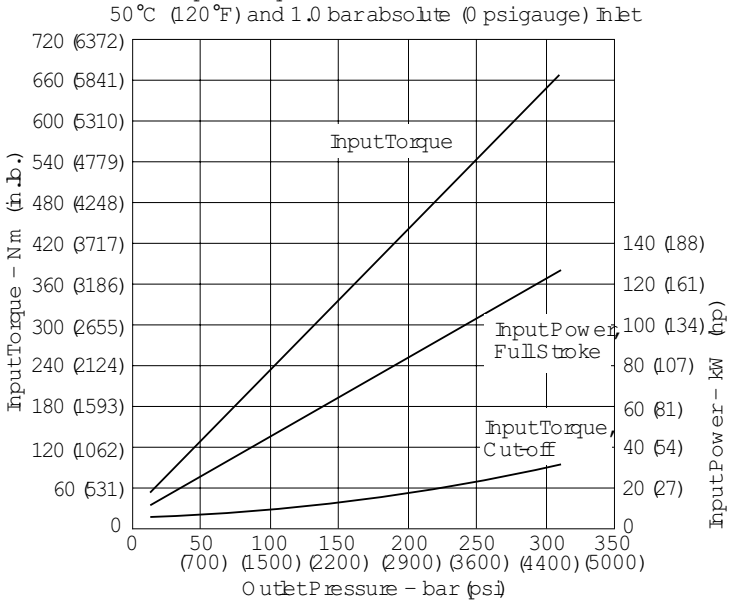
Delivery and Efficiency at 1800 r/min 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Typical Noise Levels at 1500 and 1000 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet

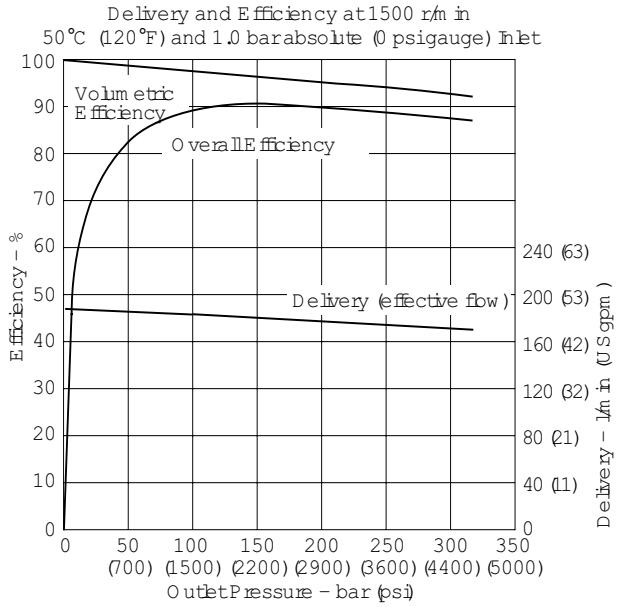


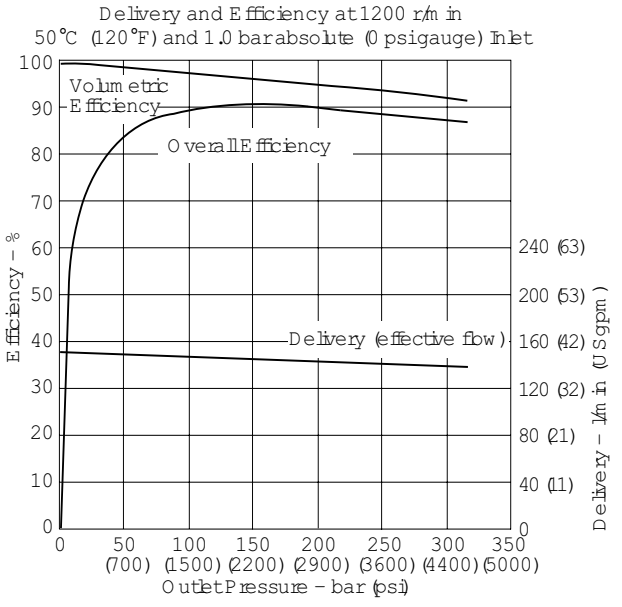
Input Torque and Power at 1800 r/min 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet

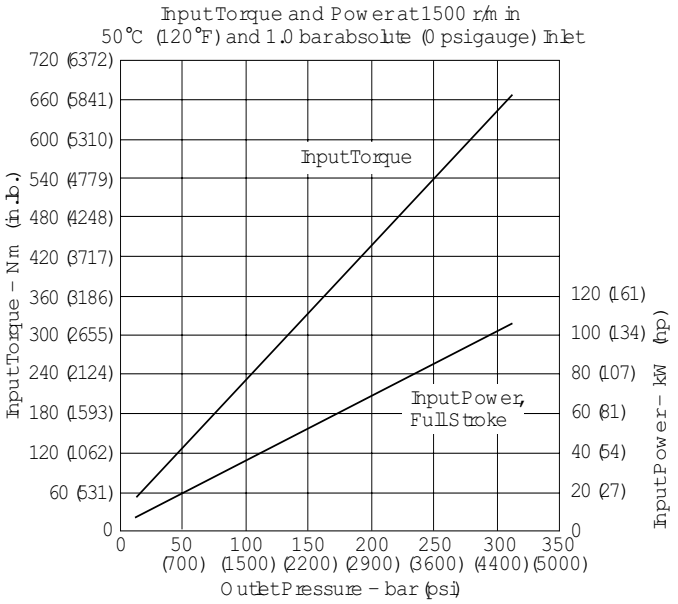


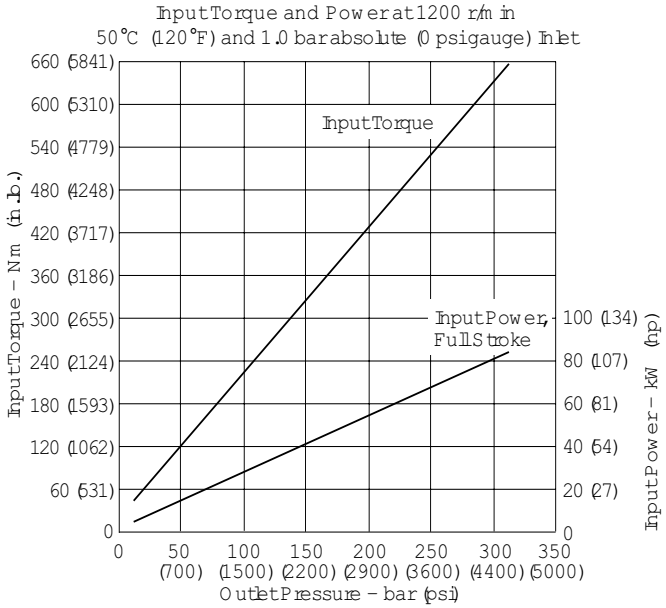
Performance

Industrial PVM131





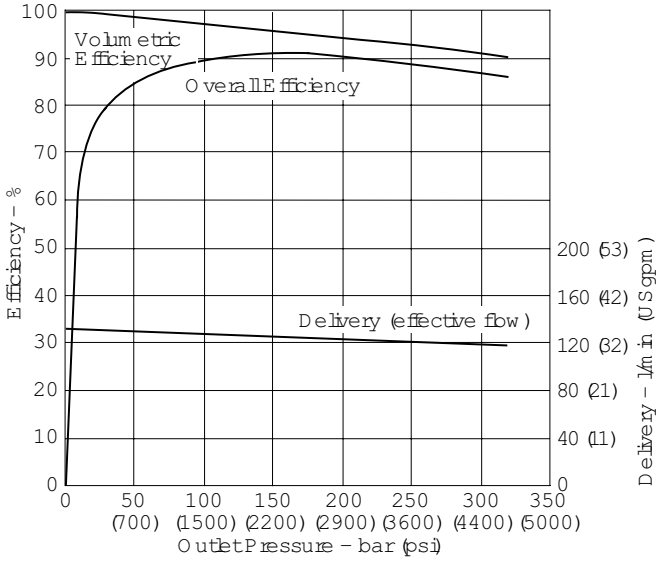




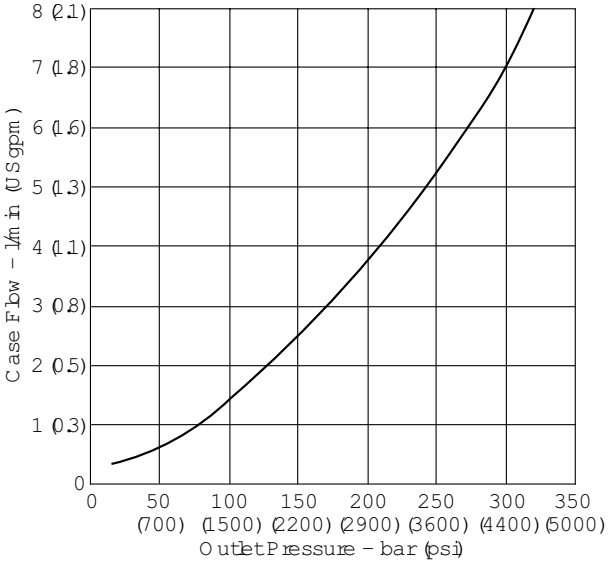
Performance

Industrial PVM131

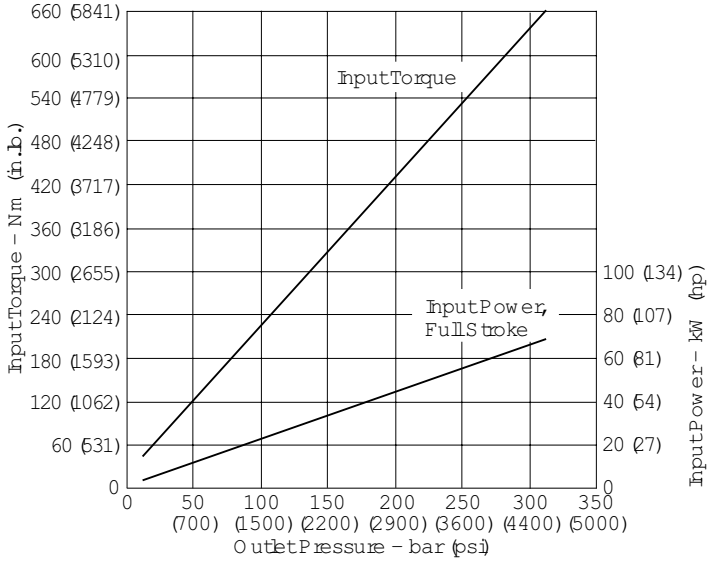
Delivery and Efficiency at 1000 r/m in
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



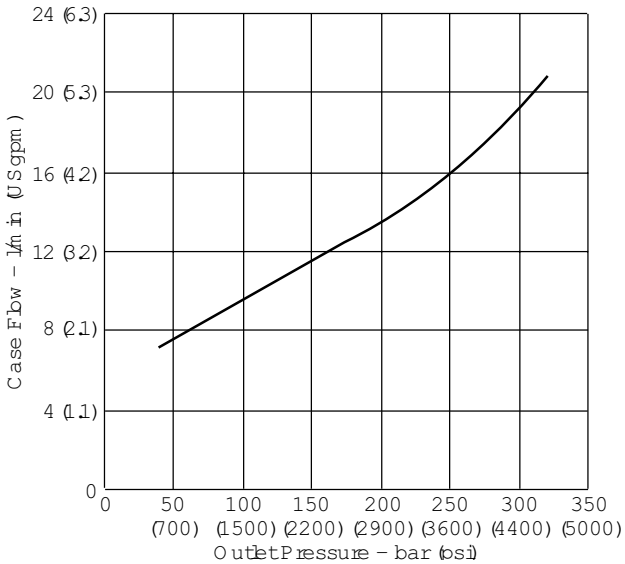
Case Flow Versus Outlet Pressure at Full Flow, 1800 r/m in
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Power at 1000 r/m in
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



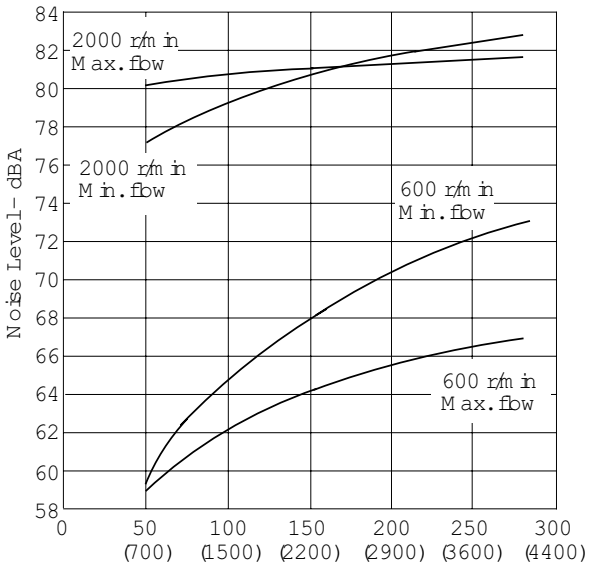
Case Flow Versus Outlet Pressure at Cutoff, 1800 r/m in
50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Performance

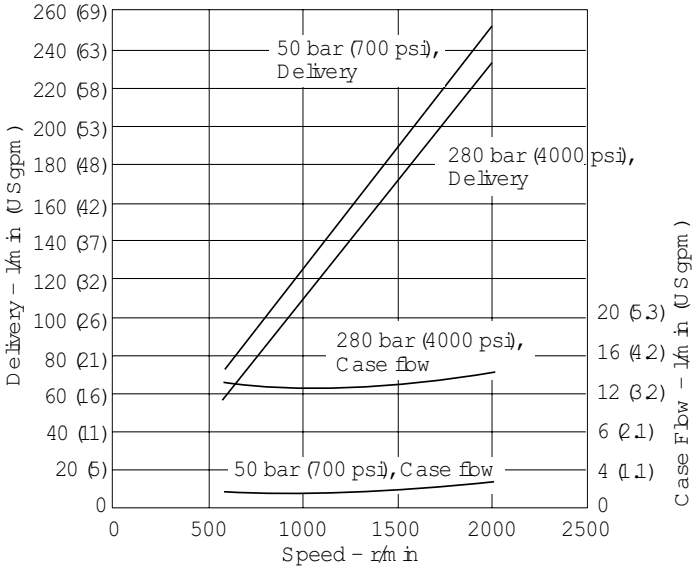
Mobile PVM131

Typical Noise Levels at 2000 and 600 r/min with petroleum oil (10 W) @ 93°C (200°F) and 1.0 bar absolute (0 psi gauge) inlet

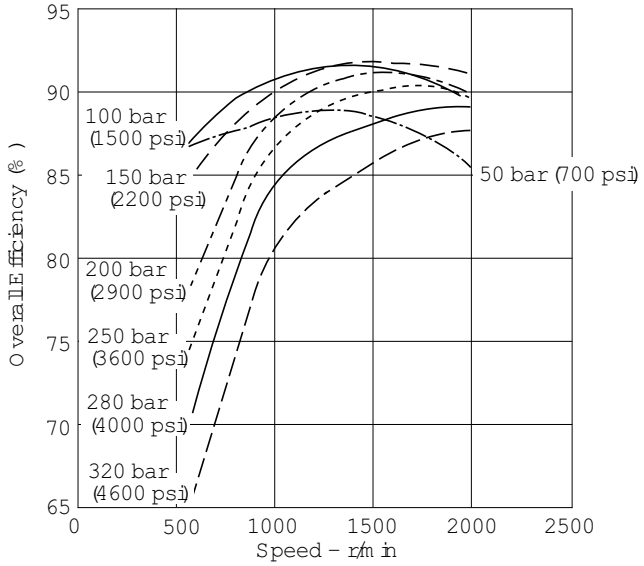


Sound pressure data

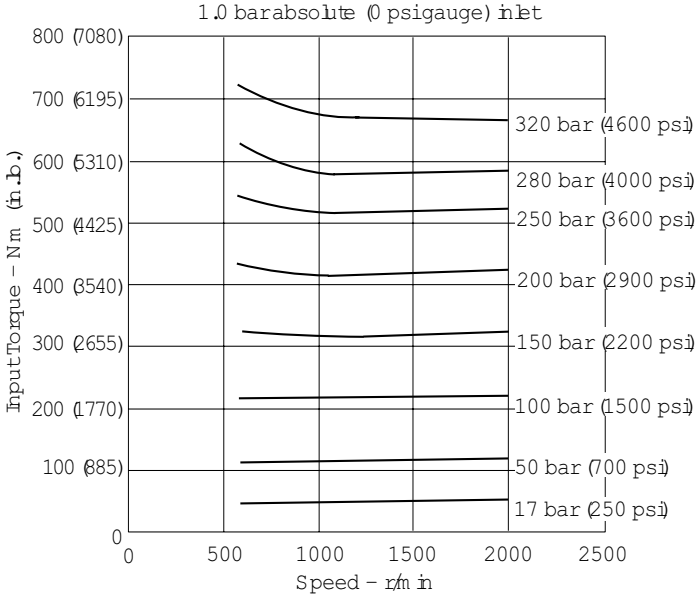
Delivery and Case Flow Versus Speed @ 93°C (200°F), full flow and 1.0 bar absolute (0 psi) gauge Inlet



Overall Efficiency Versus Speed @ 93°C (200°F) and 1.0 bar absolute (0 psi gauge) inlet



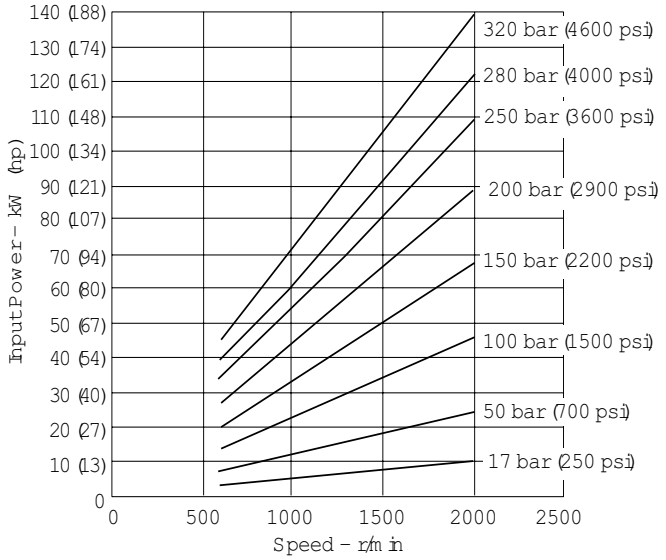
Input Torque Versus Speed @ 93°C (200°F), full flow and 1.0 bar absolute (0 psi gauge) inlet



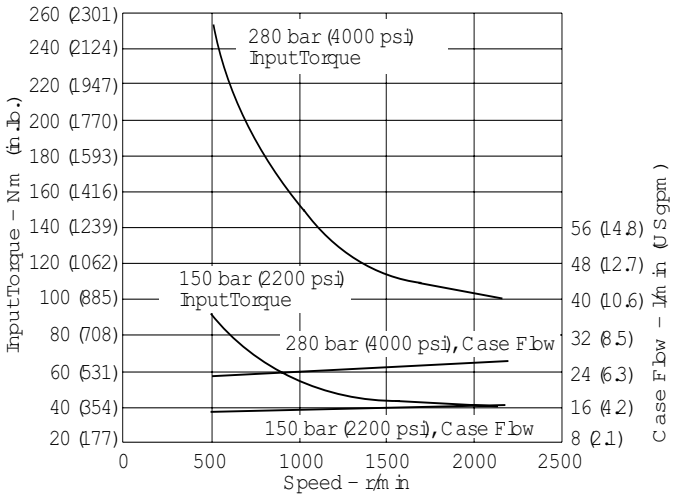
Performance

Mobile PVM131

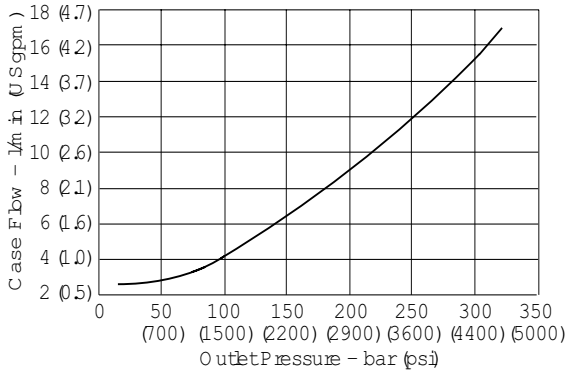
Input Power Versus Speed
@ 93°C (200°F), full flow and
1.0 bar absolute (0 psi gauge) inlet



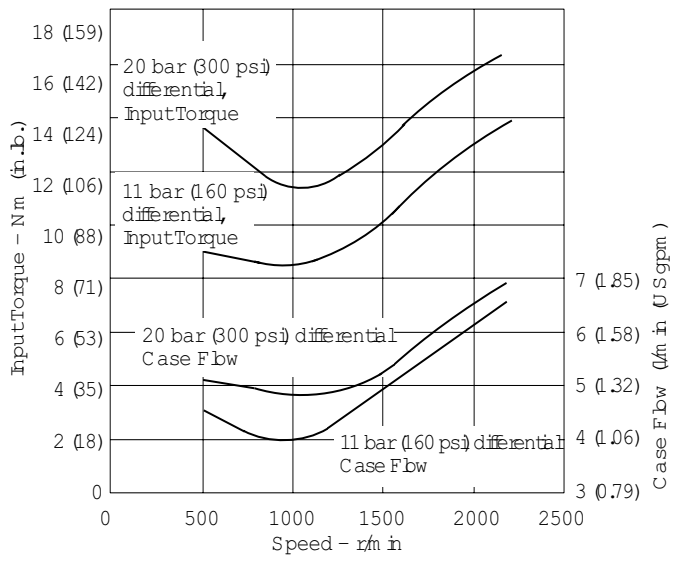
Input Torque and Case Flow Versus Speed
@ 93°C (200°F), cut-off and
1.0 bar absolute (0 psi gauge) inlet



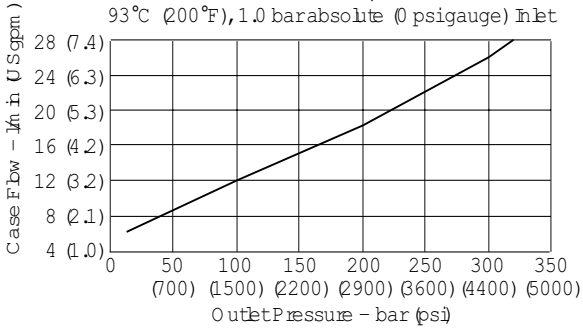
Case Flow at 2000 r/min, Full Flow
93°C (200°F), 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Case Flow Versus Speed
@ 93°C (200°F), bad sense standby
and 1.0 bar absolute (0 psi gauge) inlet



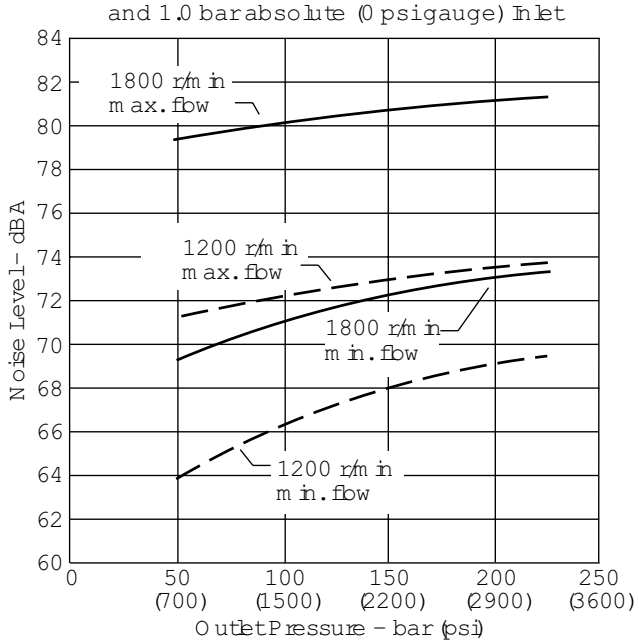
Case Flow at 2000 r/min, Minimum Flow
93°C (200°F), 1.0 bar absolute (0 psi gauge) Inlet



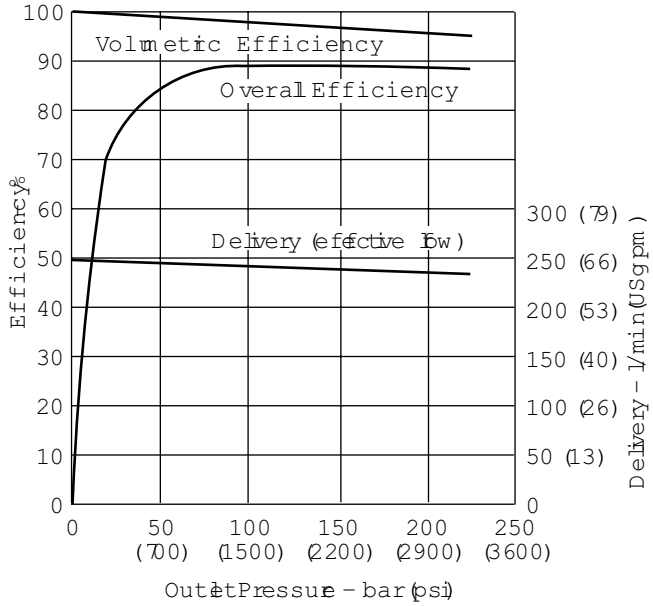
Performance

Industrial PVM141

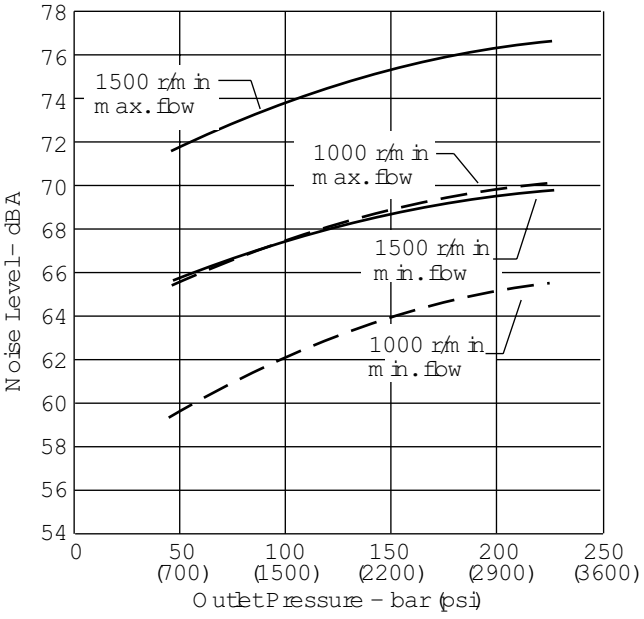
Typical Noise Levels at 1800 and 1200 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Delivery and Efficiency at 1800 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet

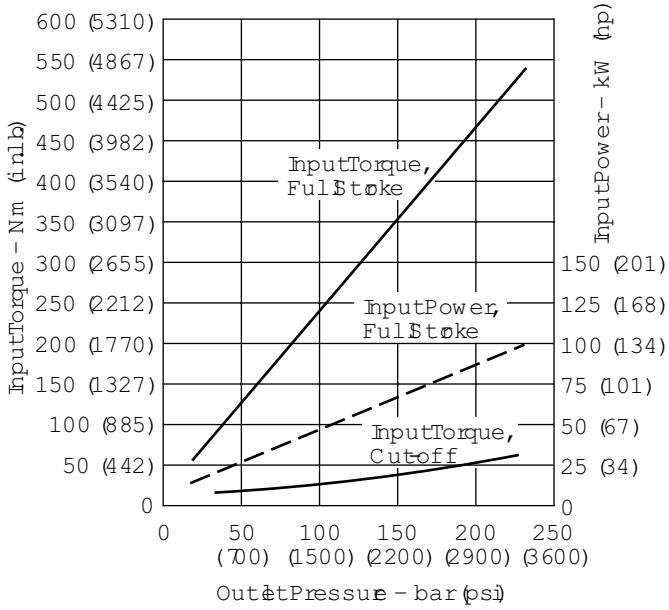


Typical Noise Levels 1500 and 1000 r/min with Petroleum Oil (10W) at 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



Sound pressure data equivalent to NFPA.

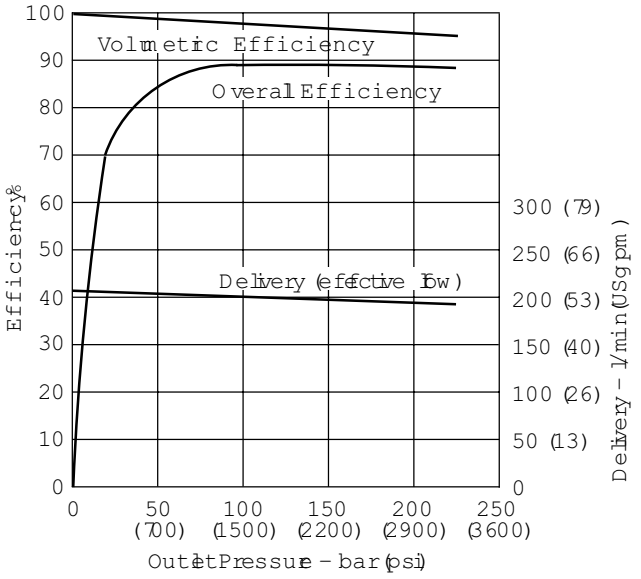
Input Torque and Power at 1800 r/min, 50°C (120°F), and 1.0 bar absolute (0 psi gauge) Inlet



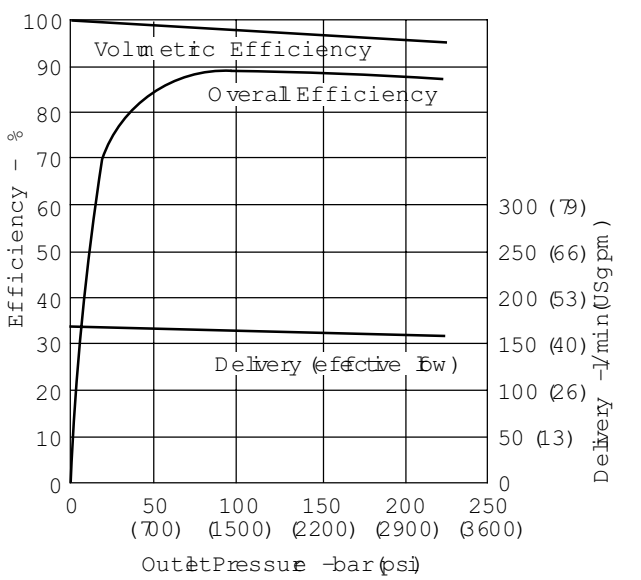
Performance

Industrial PVM141

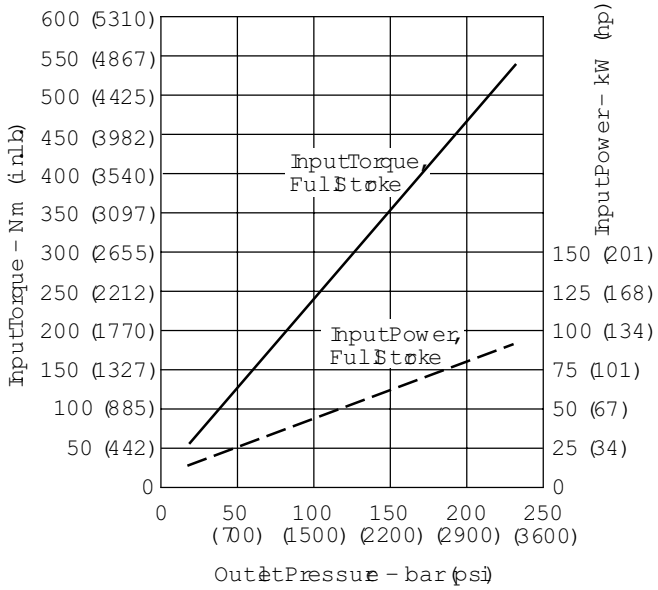
Delivery and Efficiency at 1500 r/min, 50°C (120°F), and 1.0 bar absolute (0 psig gauge) Inlet



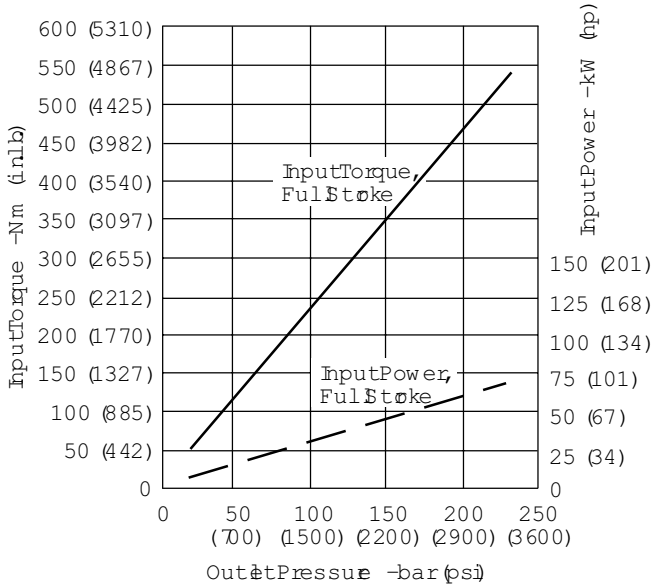
Delivery and Efficiency at 1200 r/min, 50°C (120°F and 1.0 bar absolute (0 psig gauge) Inlet



Input Torque and Power at 1500 r/min, 50°C (120°F), and 1.0 bar absolute (0 psig gauge) Inlet



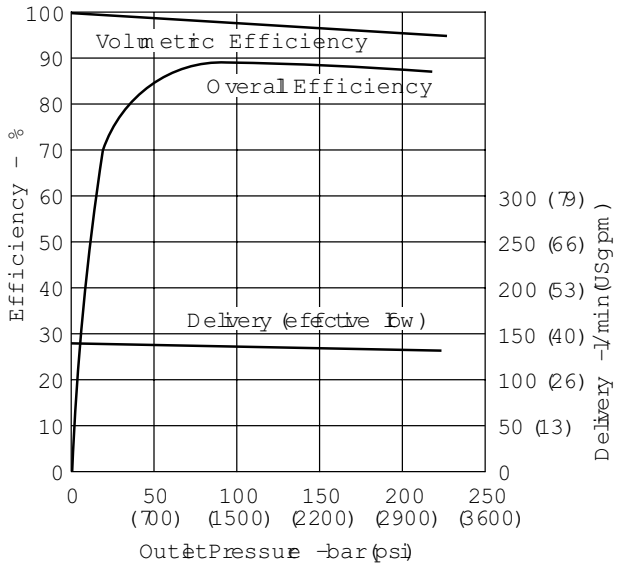
Input Torque and Power at 1200 r/min, 50°C (12 and 1.0 bar absolute (0 psig gauge) Inlet



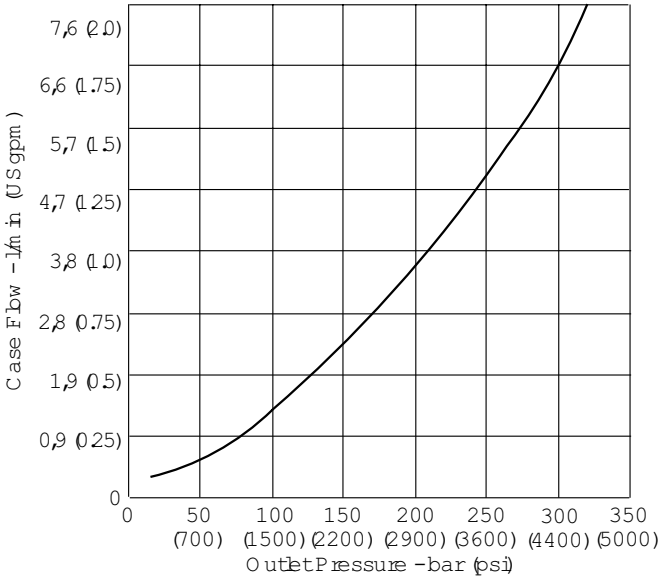
Performance

Industrial PVM141

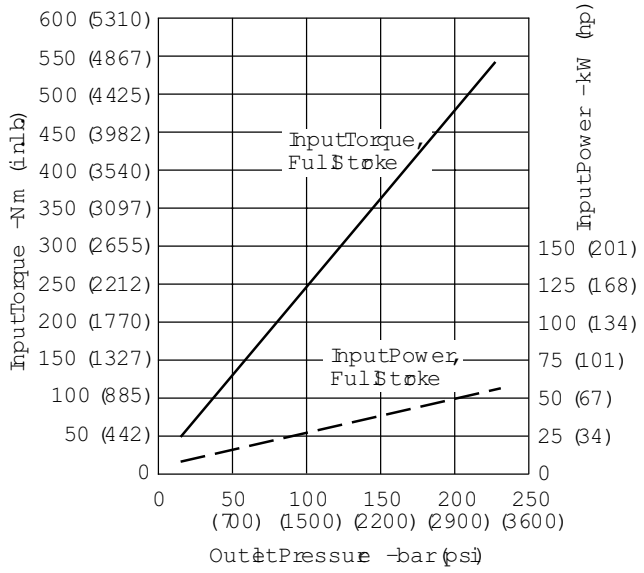
Delivery and Efficiency at 1000 r/min, 50°C (120°F and 1.0 bar absolute (0 psi gauge) Inlet



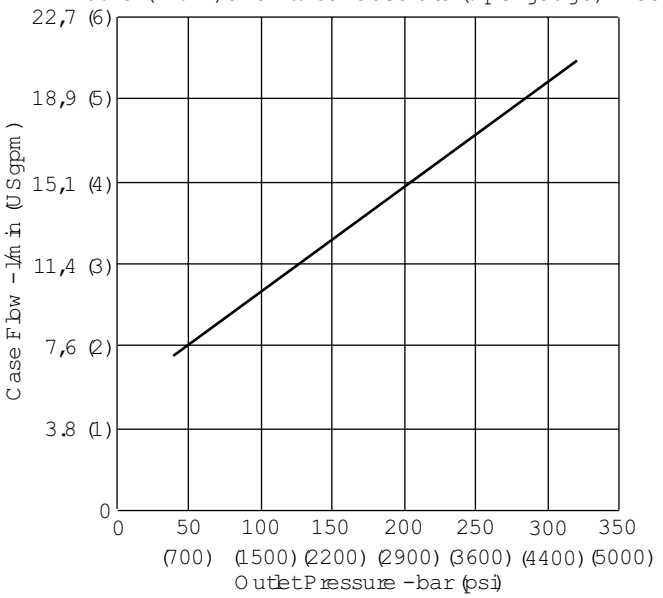
Case Flow Versus Outlet Pressure at Full Flow, 1800 r/min 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet



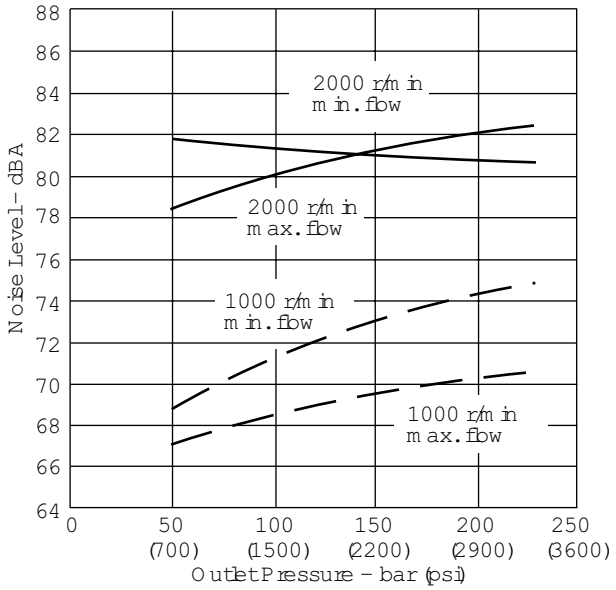
, Input Torque and Power at 1000 r/min, 50°C (120 and 1.0 bar absolute (0 psi gauge) Inlet



Case Flow Versus Outlet Pressure at Cutoff, 1800 r/min 50°C (120°F) and 1.0 bar absolute (0 psi gauge) Inlet

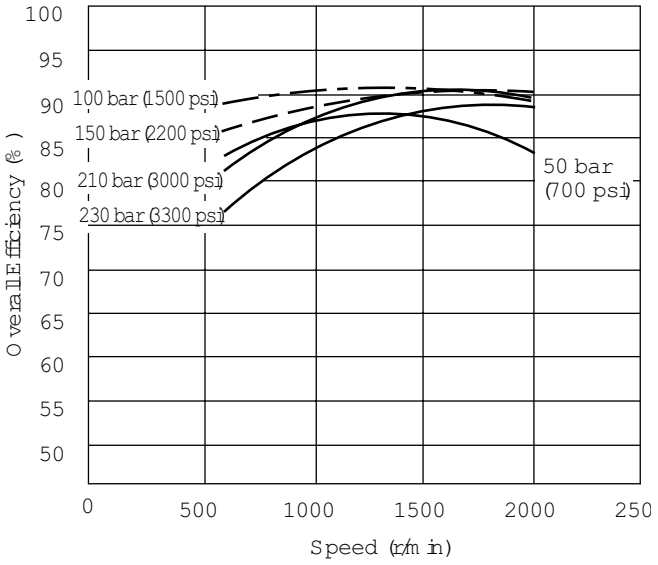


Typical Noise Levels at 2000 and 1000 r/min with Petroleum Oil (10W) at 93°C (200°F), and 1.0 bar absolute (0 psi gauge) Inlet

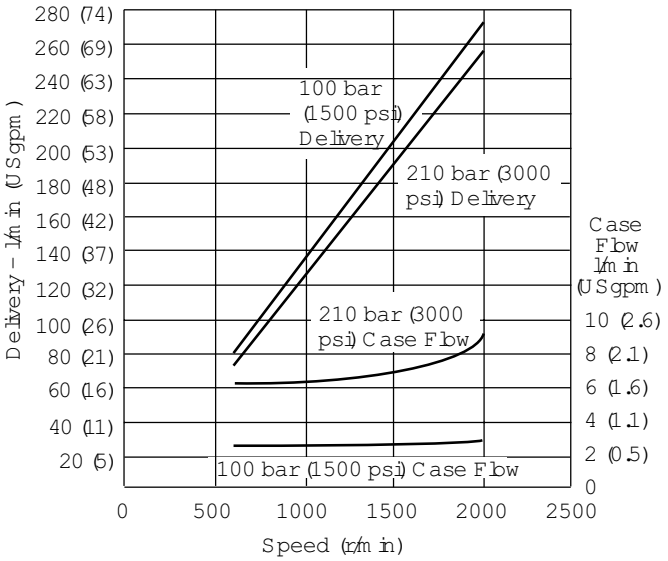


Sound pressure data equivalent to NFPA.

Overall Efficiency versus Speed at 93°C (200°F), and 1.0 bar absolute (0 psi gauge) Inlet



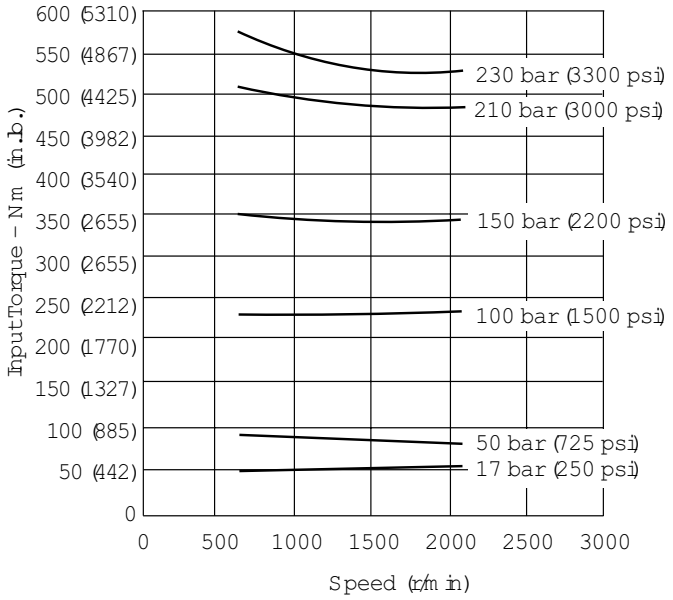
Delivery and Case Flow versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



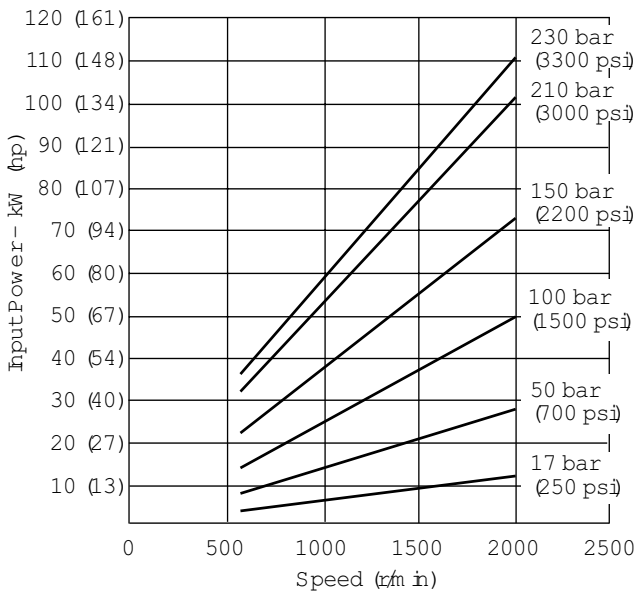
Performance

Mobile PVM141

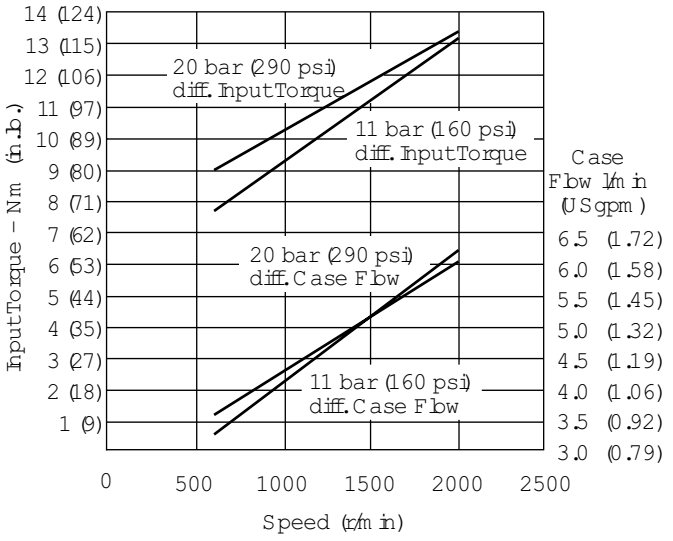
Input Torque versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



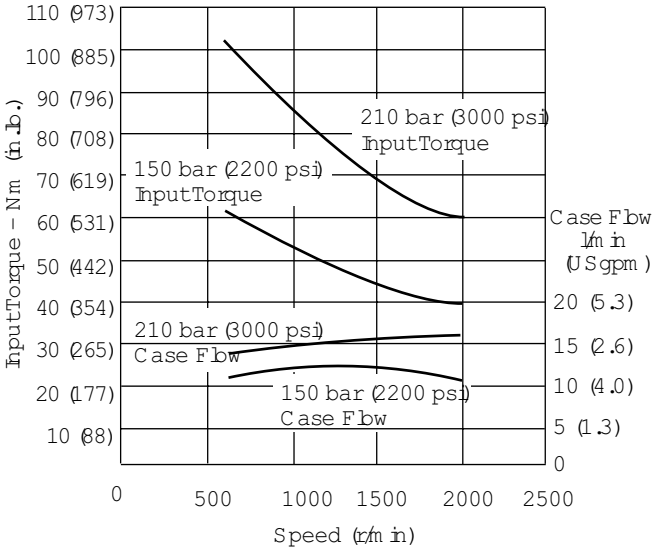
Input Power versus Speed, 93°C (200°F), and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Case Flow versus Speed at 93°C (200°F), Load Sense Standby and 1.0 bar absolute (0 psi gauge) Inlet



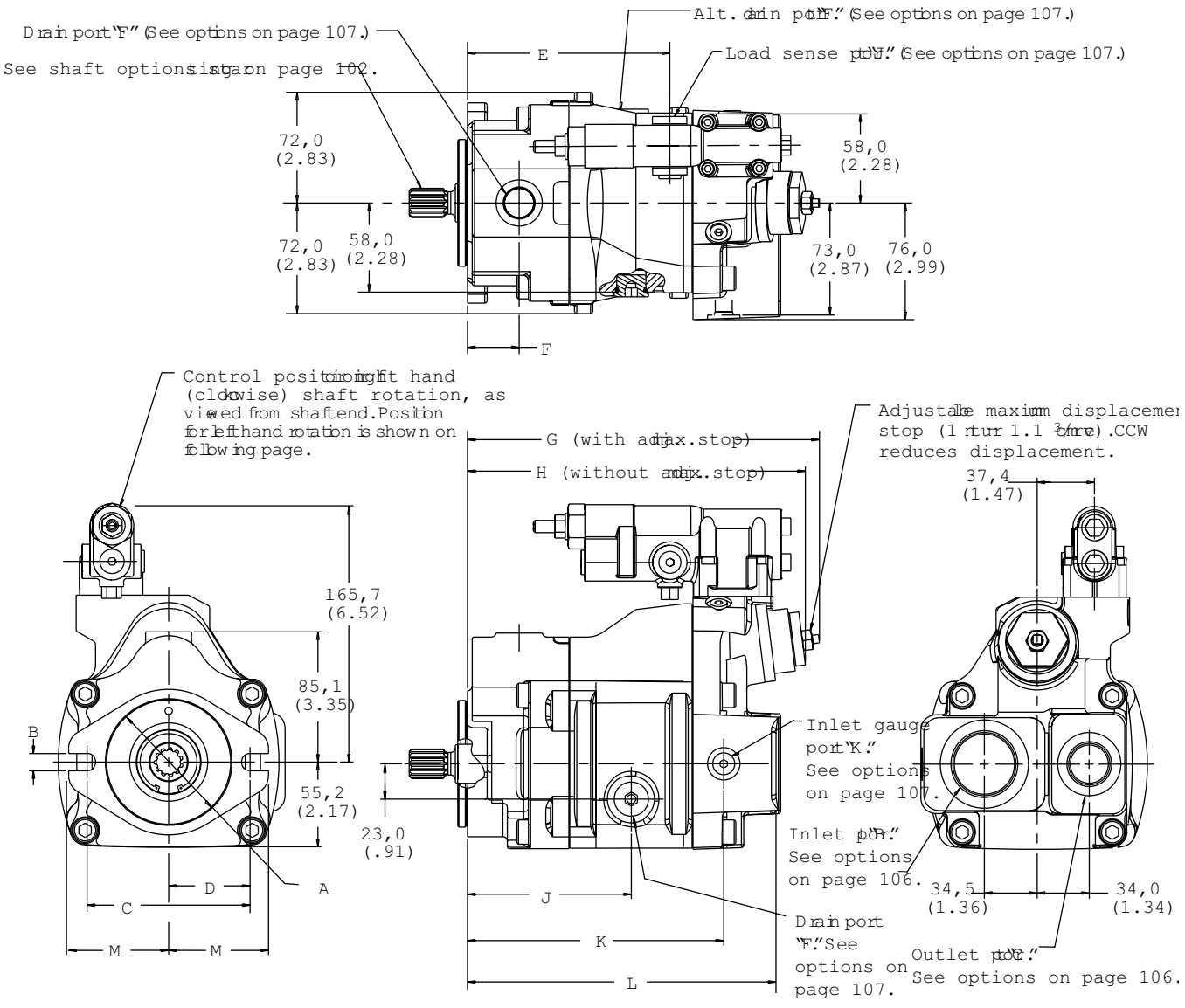
Input Torque and Case Flow versus Speed at 93°C (200°F), Pressure Limit Cut-Off and 1.0 bar absolute (0 psi gauge) Inlet



End-ported Models

PVM018/020

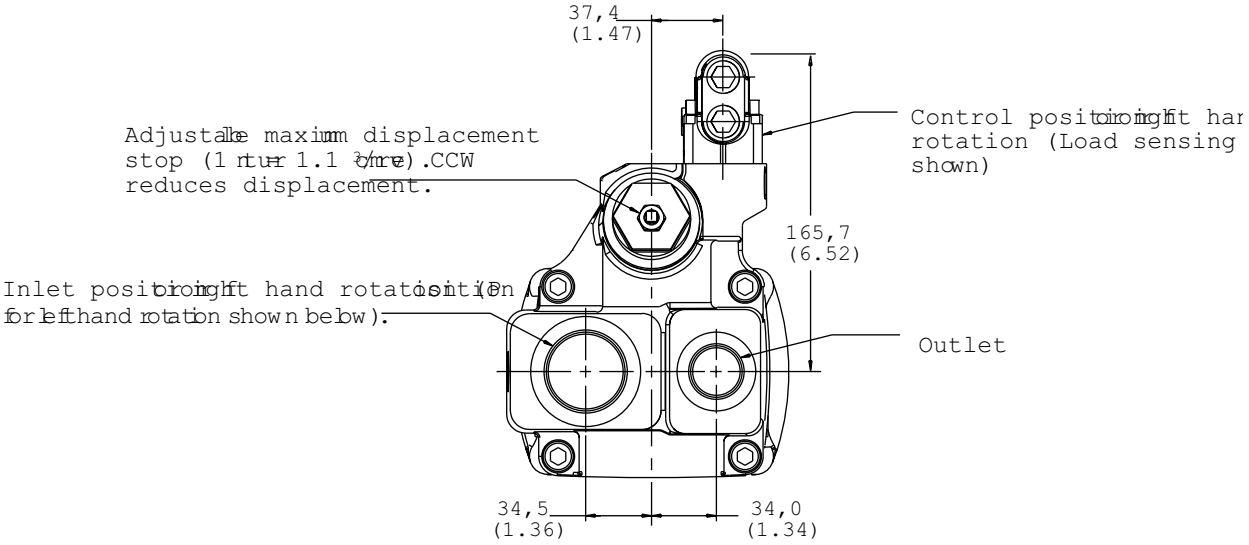
Dimensions in millimeters (inches)



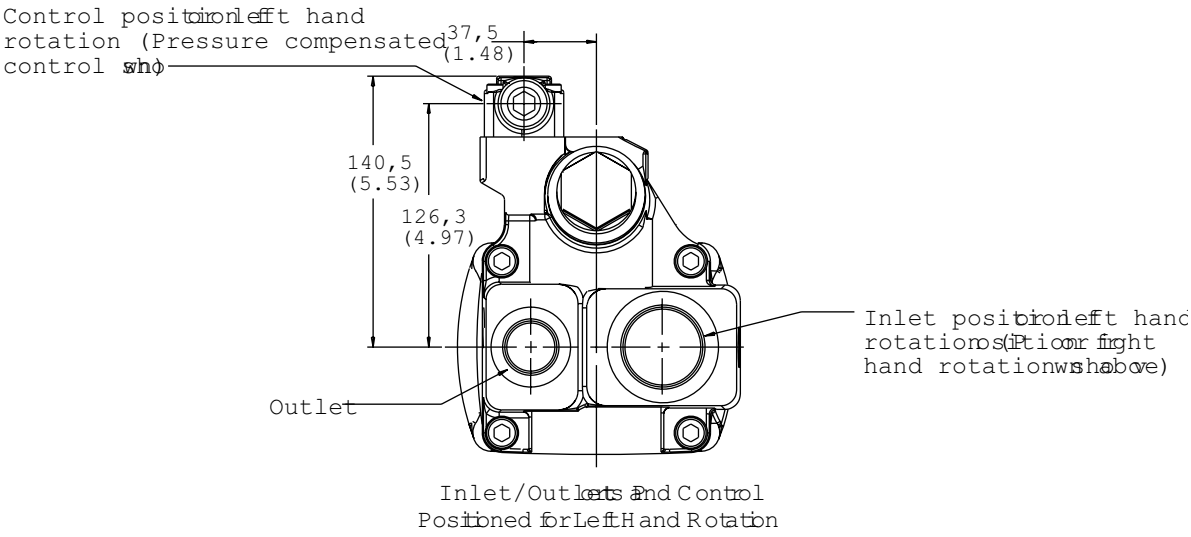
End-ported Models

PVM018/020

Dimensions in millimeters (inches)



Inlet/Outlets and Control Positioned for Right Hand Rotation

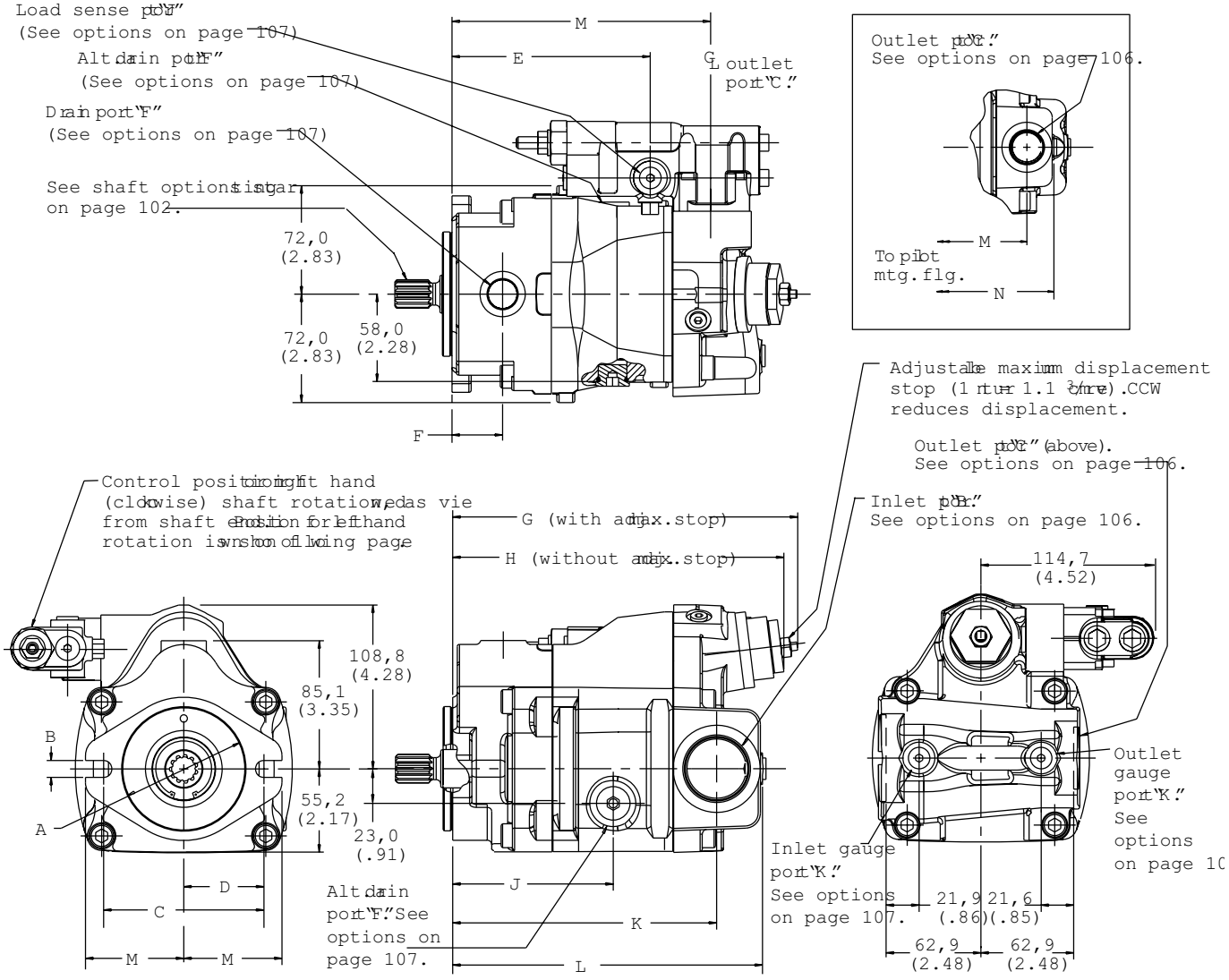


Inlet/Outlets and Control Positioned for Left Hand Rotation

Side-ported Models

PVM018/020

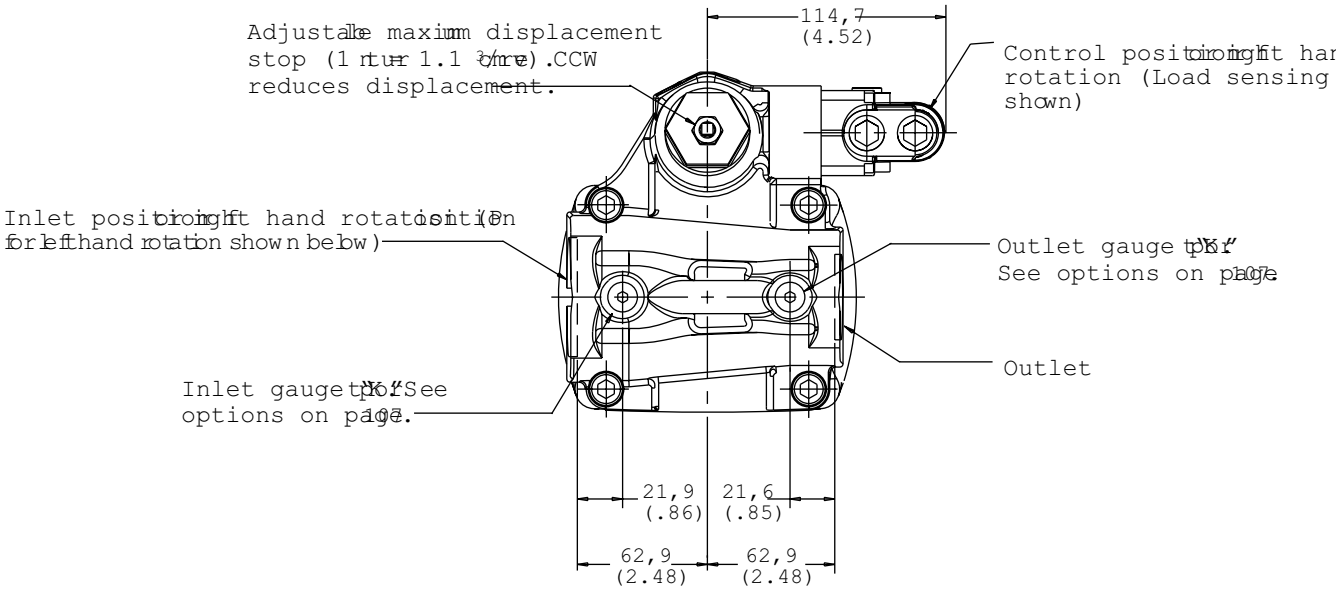
Dimensions in millimeters (inches)



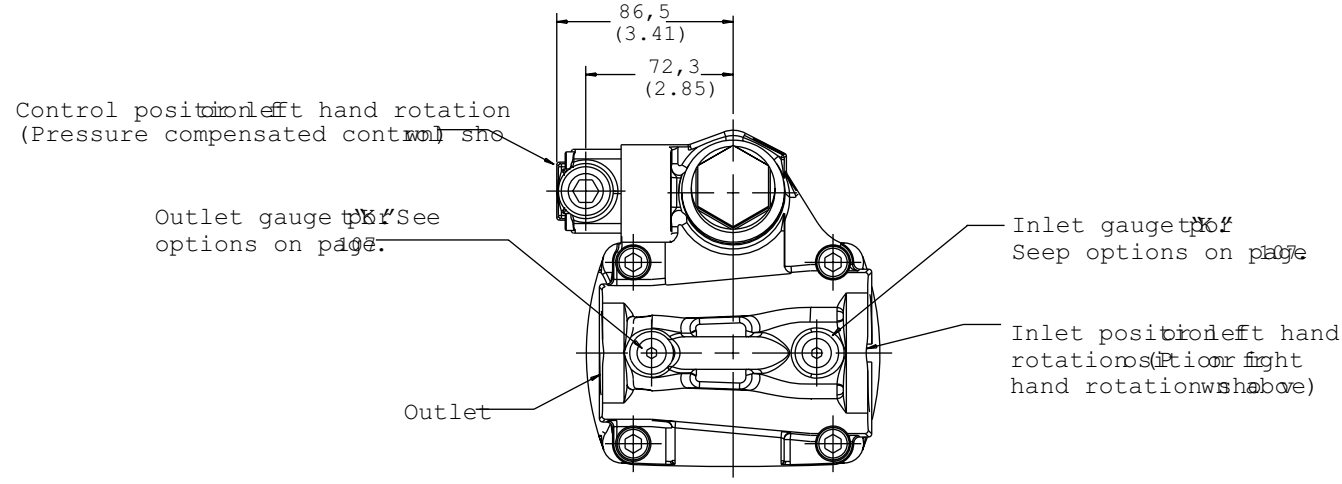
Side-ported Models

PVM018/020

Dimensions in millimeters (inches)



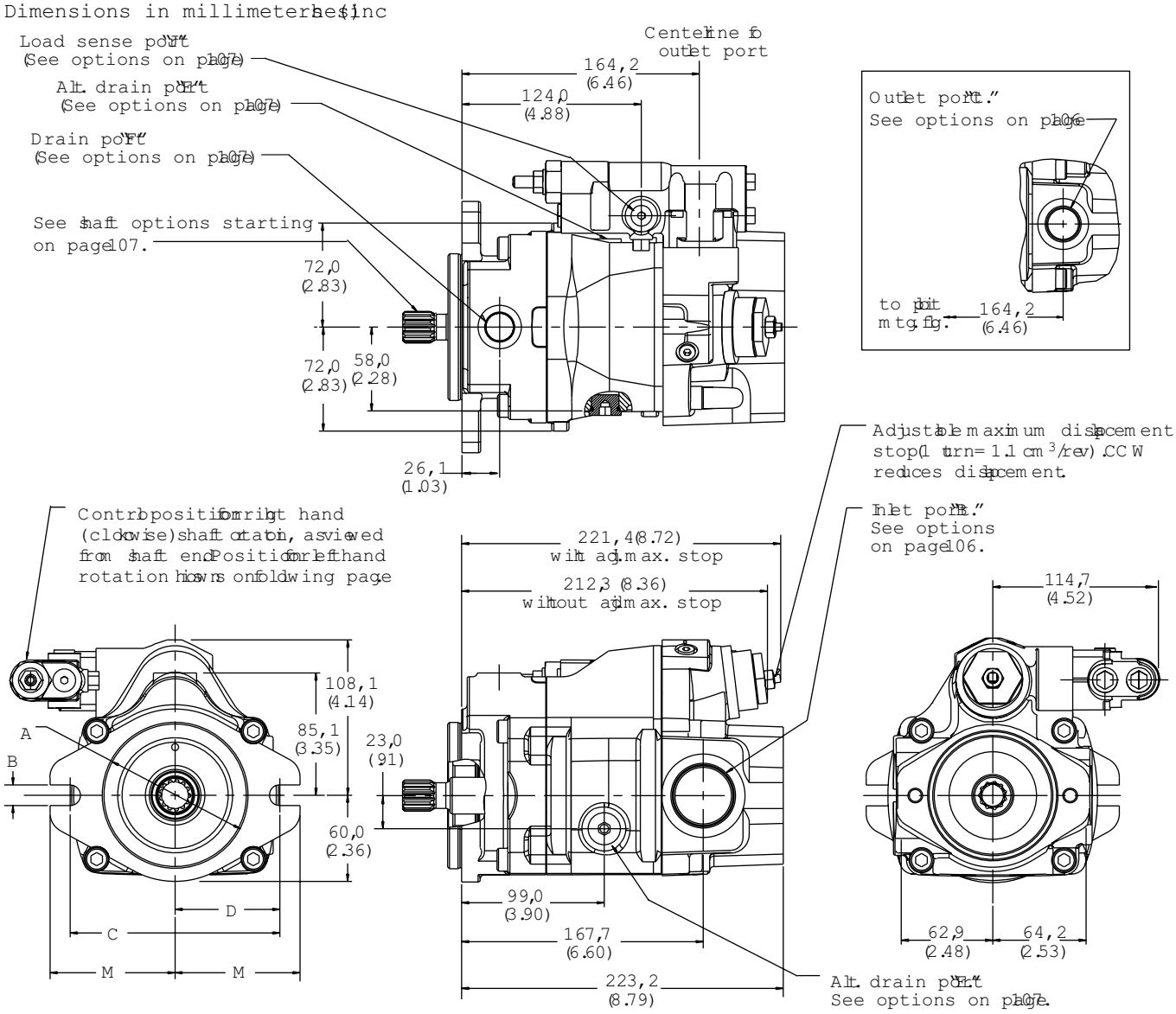
Inlet/Outlets and Control Positioned for Right Hand Rotation



Inlet/Outlets and Control Positioned for Left Hand Rotation

Thru-drive Models

PVM018/020

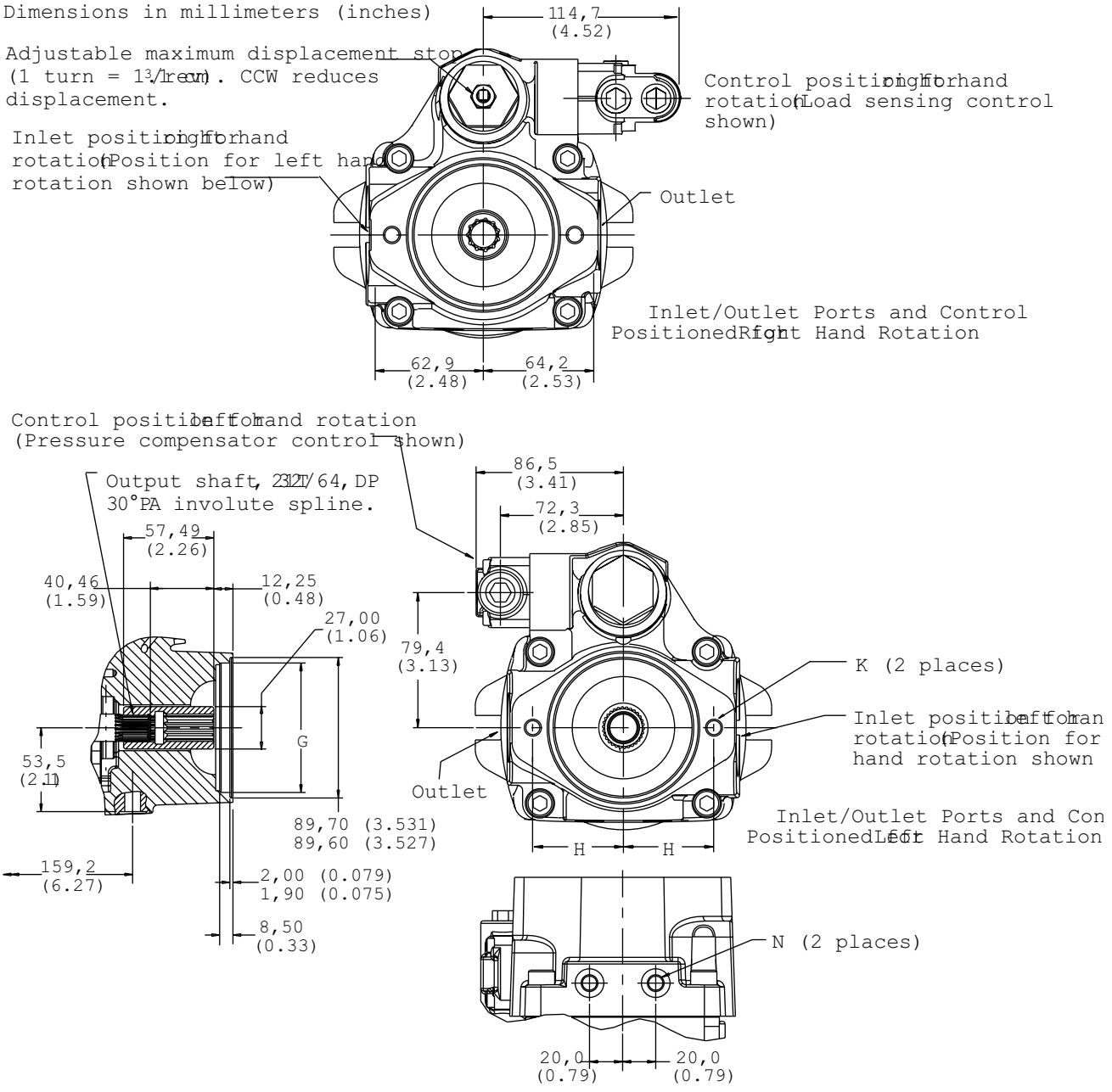


Thru-drive Models

PVM018/020

Model Code Position 25

	Description
A	For SAE "A" pad with a 9T, 16/32 DP, 30° pressure angle, involute spline
B	For SAE "A" pad with a 11T, 16/32 DP, 30° pressure angle, involute spline
G	For ISO 80 A2HW pad with a 9T SAE spline
H	For ISO 80 A2HW pad with a 11T SAE spline



Model Code Position 25	ØG	H	K	N
A,B	82,625 (3.253) 82,575 (3.251)	53,2 (2.09)	375-16 UNC-2B thd. 0.75 deep min	375-16 UNC-2B thd. 0.62 deep min.
G,H	80,046 (3.151) 80,002 (3.150)	54,5 (2.15)	M10 x 1,50 thd. 19,05 deep min	M10 x 1,50 thd. 15,88 deep min.

Flange Designations

PVM018/020

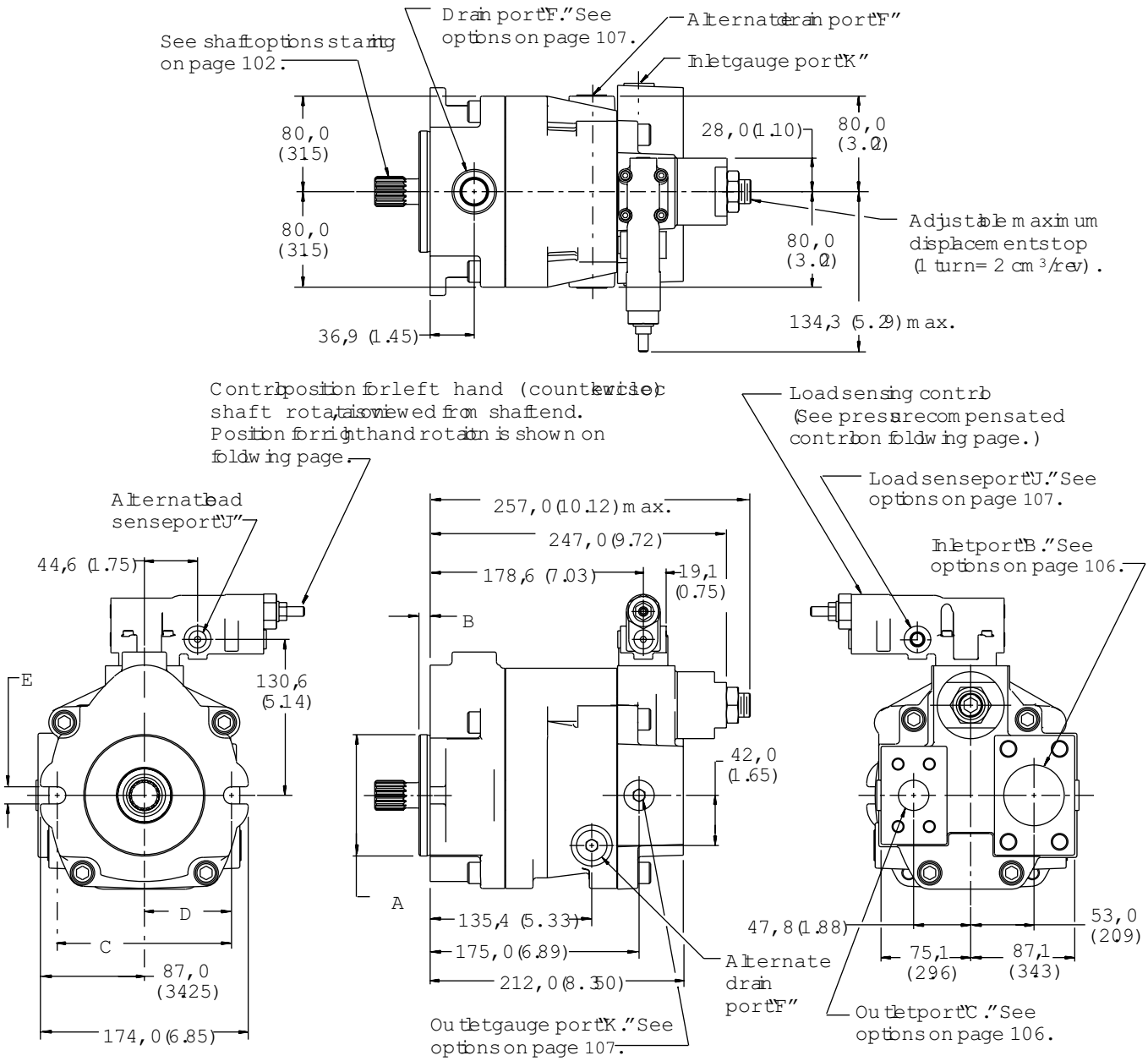
"A" Pilot Flange Designation	ØA	B	C	D	E	F	G	H	J	K	L	M
SAE J744-82-2 Model Code A	82,55 (3.25)	11,35/10,97 (.447/.432)	106,4 (4.19)	53,2 (2.09)	131,5 (5.18)	33,6 (1.32)	228,9 (9.00)	219,8 (8.65)	106,5 (4.19)	166,7 (6.56)	200,7 (7.90)	65,2 (2.57)
ISO 3019/2-80A2HW Model Code B	80,00 (3.15)	11,27/11,00 (.444/.433)	109,0 (4.29)	54,5 (2.15)								
"B" Pilot Flange Designation												
SAE J744-101-2 Model Code C	101,60 (4.00)	14,55/14,17 (.572/.557)	146,0 (5.750)	73,0 (2.875)	124,0 (4.88)	26,1 (1.03)	221,4 (8.72)	212,3 (8.36)	99,0 (3.90)	159,2 (6.27)	193,9 (7.63)	87,0 (3.43)
ISO 3019/2-100A2HW Model Code D	100,00 (3.937)	14,27/14,00 (.562/.551)	140,0 (5.512)	70,0 (2.756)								

Pilot Flange Designation	ØA	B	C	D
SAE J744-127-2 Model Code C	101,60 (4.00)	14,55/14,17 (.572/.558)	146,0 (5.75)	73,0 (2.87)
ISO 3019/2-100 A2HW Model Code D	100,00 (3.94)	14,27/14,00 (.562/.551)	140,0 (5.51)	70,0 (2.76)

End-ported Models

PVM045/050

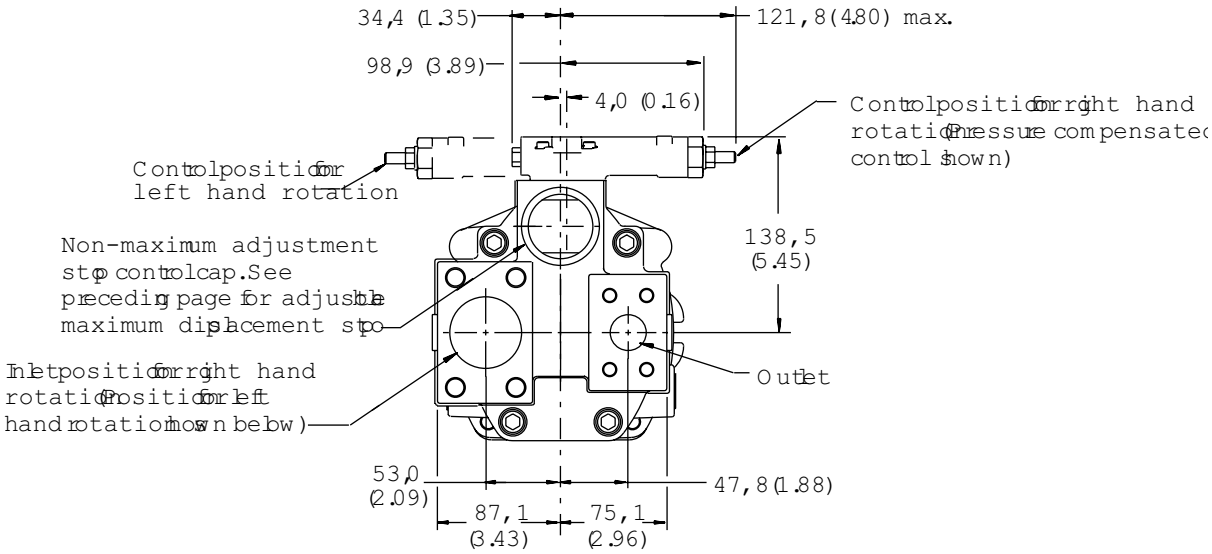
Dimensions in millimeters [inches]



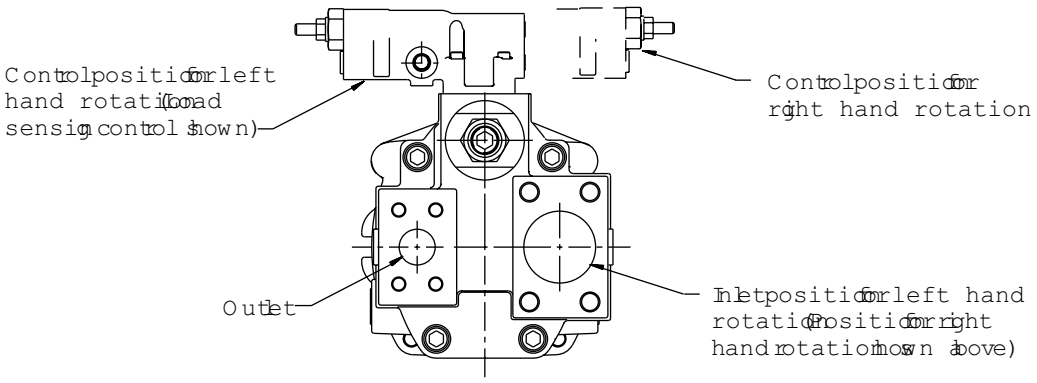
End-ported Models

PVM045/050

Dimensions in millimeters (inches)



Inlet/Outlet Ports and Control Position for Right Hand Rotation

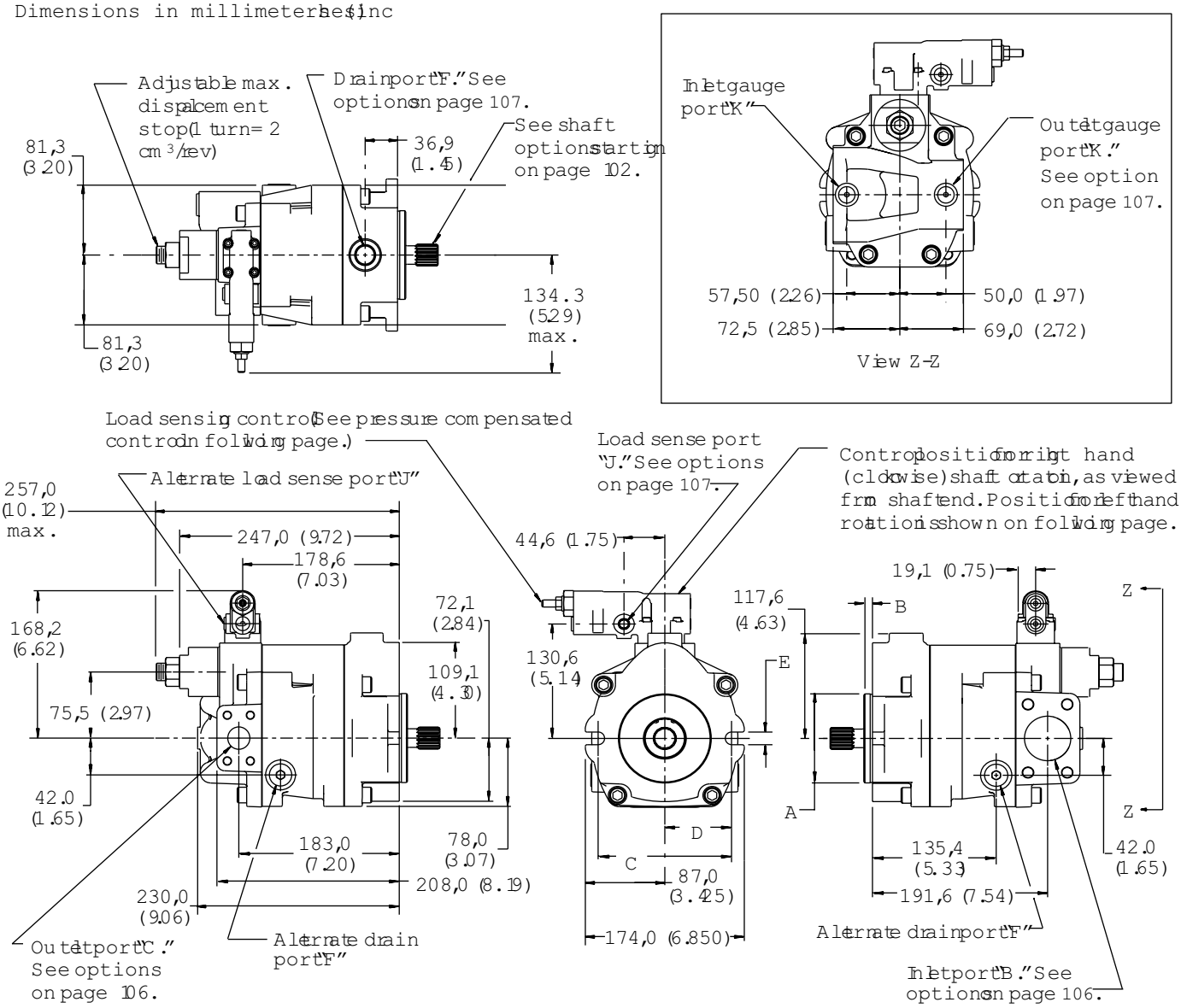


Inlet/Outlet Ports and Control Position for Left Hand Rotation
Dimensions shown on preceding page.

Side-ported Models

PVM045/050

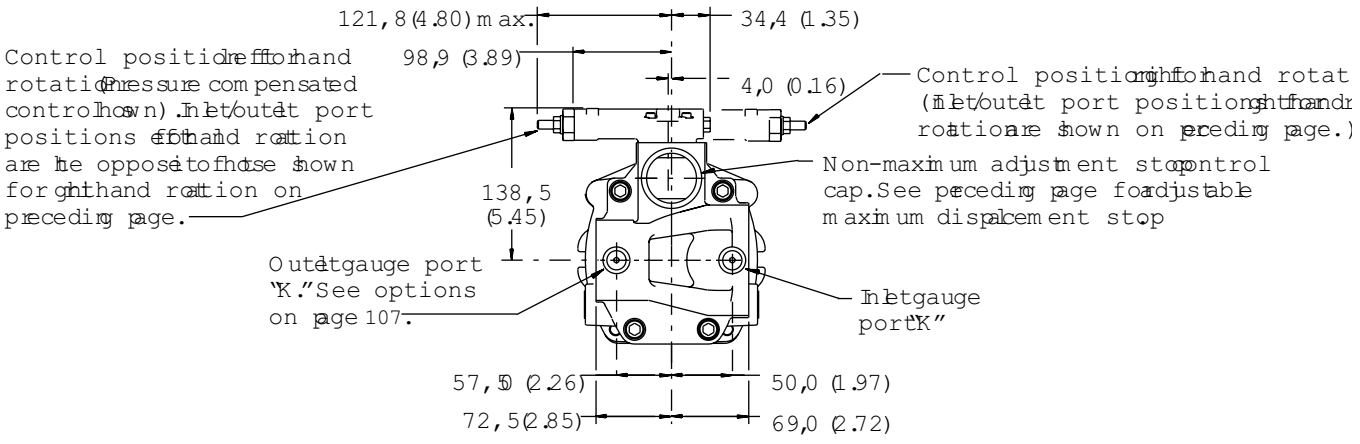
Dimensions in millimeters [inches]



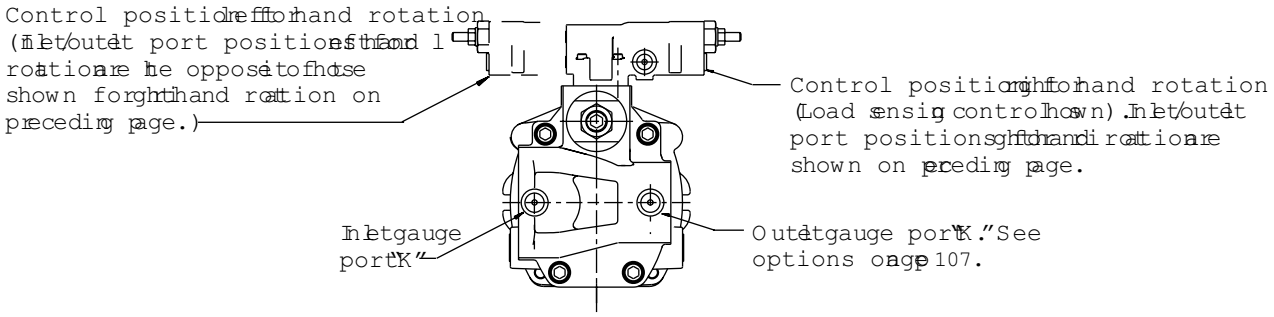
Side-ported Models

PVM045/050

Dimensions in millimeters (inches)



Inlet/Outlet Ports and Control Position for Left Hand Rotation

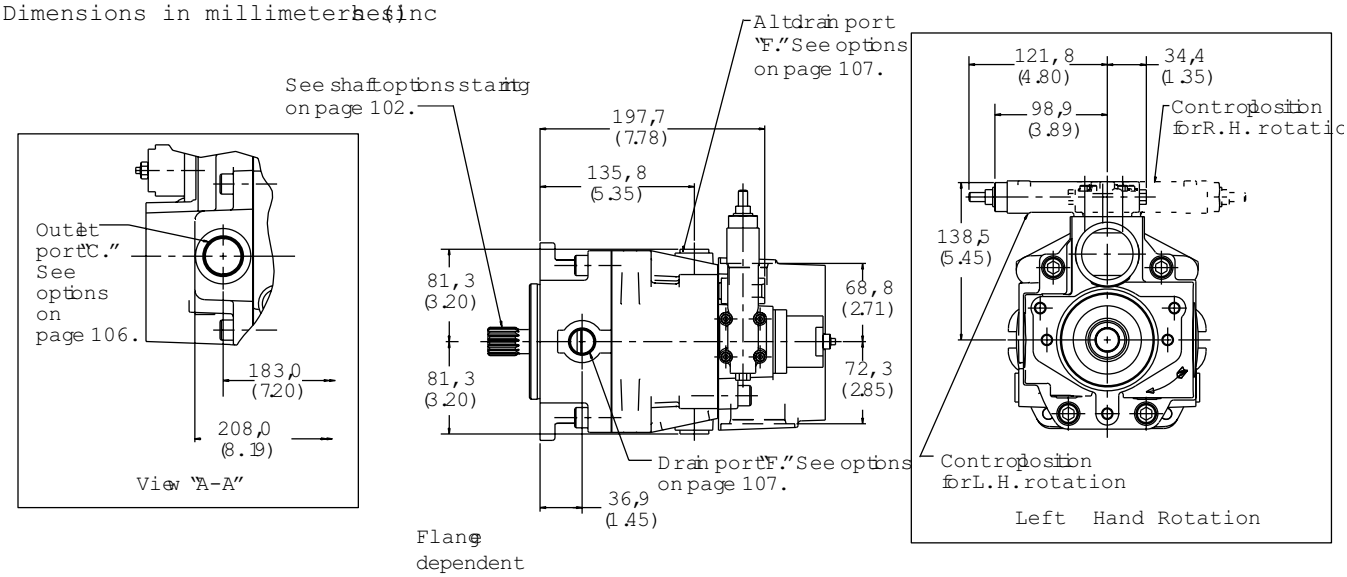


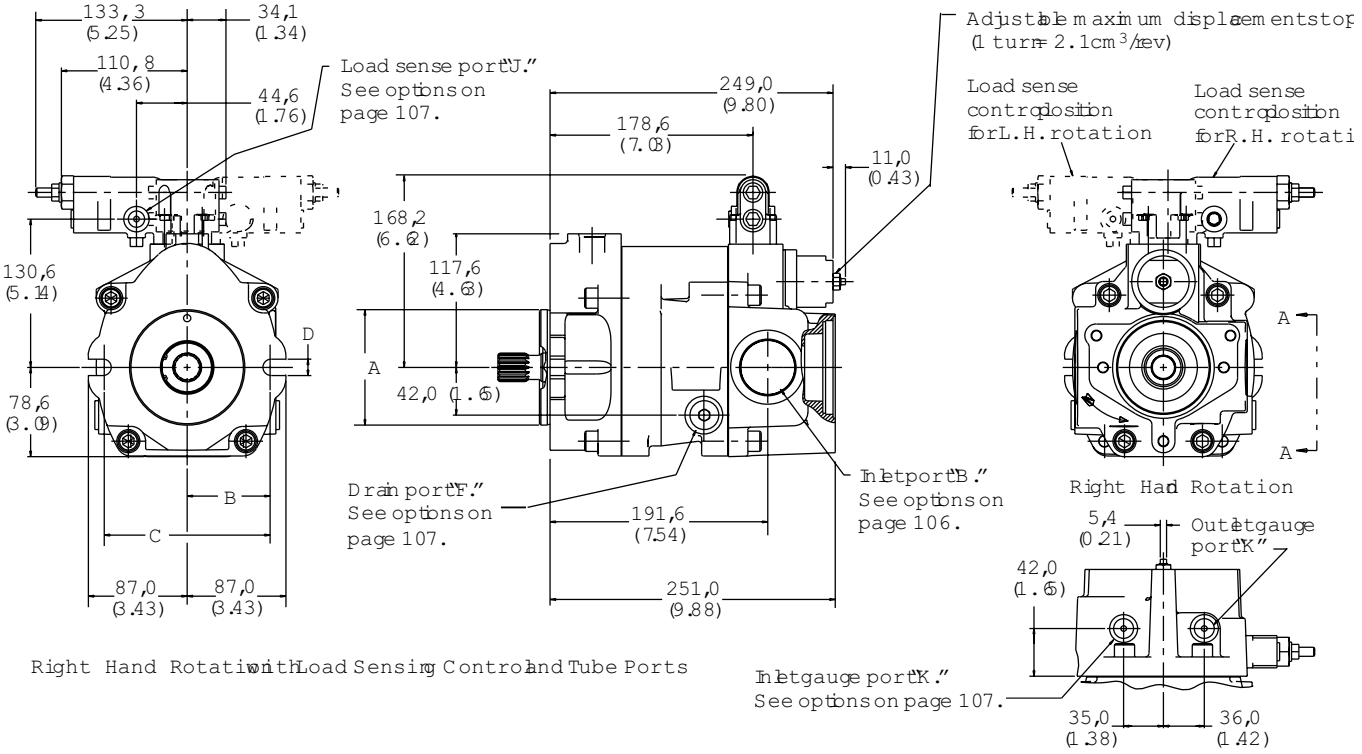
Inlet/Outlet Ports and Control Position for Right Hand Rotation
Dimensions shown on preceding page.

Thru-drive Models

PVM045/050

Dimensions in millimeters [inches]



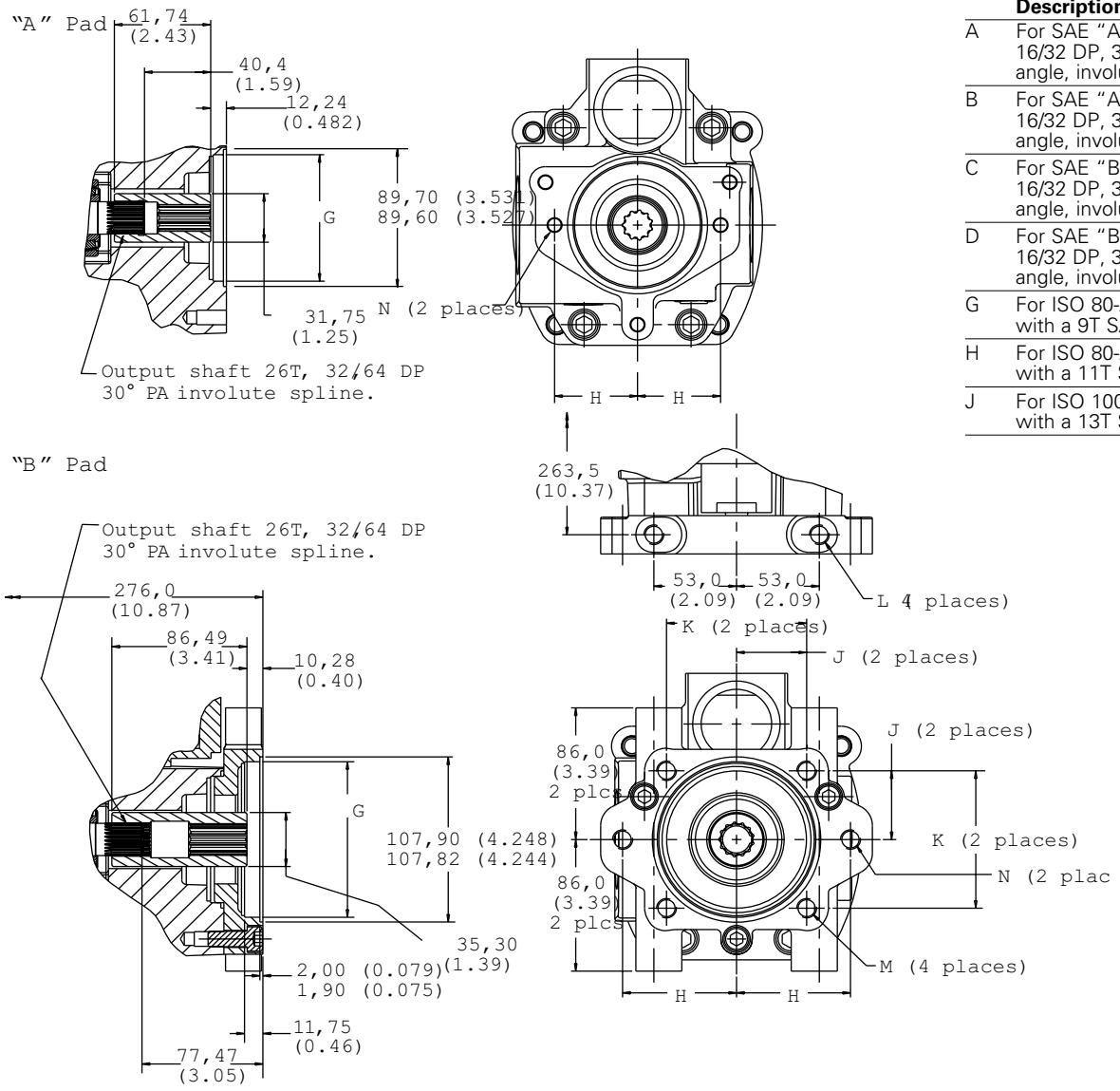


Right Hand Rotation with Load Sensing Control and Tube Ports

Thru-drive Models

PVM045/050

Dimensions in millimeters (inches)



Model Code Position 25

	Description
A	For SAE "A" pad with a 9T, 16/32 DP, 30° pressure angle, involute spline
B	For SAE "A" pad with a 11T, 16/32 DP, 30° pressure angle, involute spline
C	For SAE "B" pad with a 13T, 16/32 DP, 30° pressure angle, involute spline
D	For SAE "B" pad with a 15T, 16/32 DP, 30° pressure angle, involute spline
G	For ISO 80-A2HW pad with a 9T SAE spline
H	For ISO 80-A2HW pad with a 11T SAE spline
J	For ISO 100-A2/B4HW pad with a 13T SAE spline

Model Code Position 25	ØG	H	J	K	L	M	N
A,B	82,58 (3.251) 82,52 (3.249)	53.2 (2.09)	–	–	–	–	.375-16 UNC-2B thd. 0.60 deep min.
G,H	80,046 (3.15) 80,002 (3.149)	54,5 (2.15)	–	–	–	–	M10 thd. x 1,50 15,0 deep min.
C,D	101,65 (4.002) 101,60 (4.00)	73,0 (2.87)	44,9 (1.77)	89,8 (3.54)	.500-13 UNC-2B thd. 24.9 deep min. M12 x 1,50 thd. 24,9 deep min.	.500-13 UNC-2B thd. thru M10 x 1,50 thd. thru	.500-13 UNC-2B thd. thru M12 x 1,50 thd. thru
J,K	100,0 (3.937) 99,946 (3.935)	70,0 (2.76)	44,2 (1.74)	88,38 (3.48)	M12 thd. x 1,50 thd. 24,9 deep min.	M10 x 1,50 thd. thru	M12 x 1,50 thd. thru

Flange Designations

PVM045/050

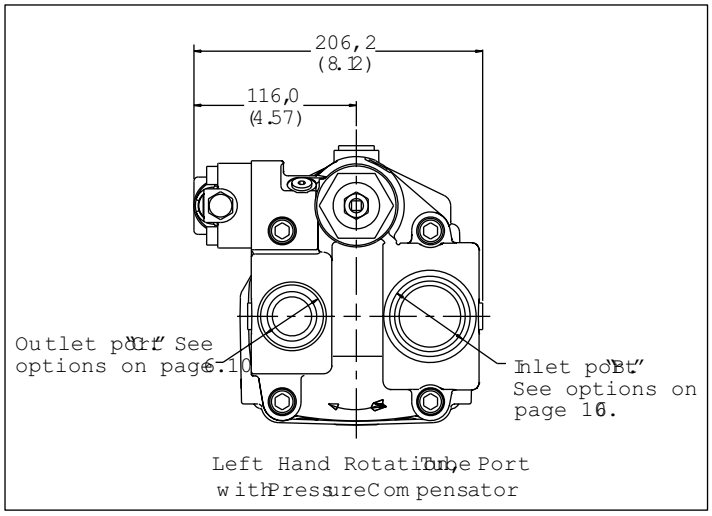
Pilot Flange Designation	ØA	B	C	D	E
SAE J744-101-2	101,60/101,55 (4.000/3.998)	9,70/9,19 (.382/.362)	146,0 (5.750)	73,0 (2.875)	14,55/14,17 (.572/.557)
ISO 3019/2-100A2HW	100,00/99,95 (3.937/3.935)	9,50/9,00 (.374/.354)	140,0 (5.512)	70,0 (2.756)	14,27/14,00 (.562/.551)

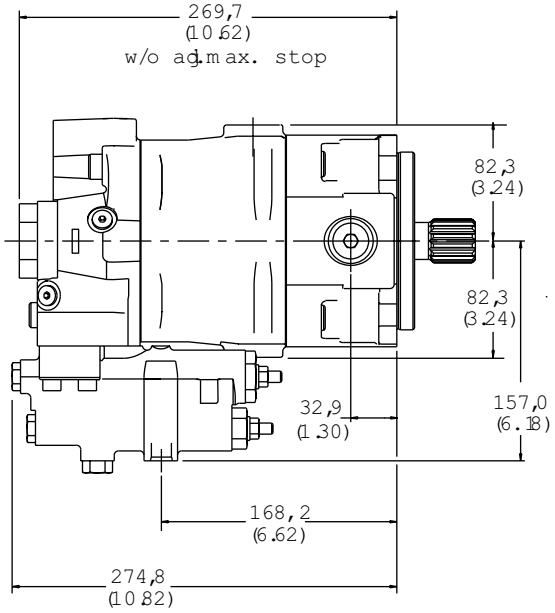
Pilot Flange Designation	ØA	B	C	D
SAE 2-bolt mount	101,60/101,55 (4.000/3.998)	73,0 (2.87)	146,0 (5.750)	14,55/14,17 (.572/.557)
ISO 100 2-bolt mount	100,00/99,95 (3.937/3.935)	70,0 (2.76)	140,0 (5.512)	14,27/14,00 (.562/.551)

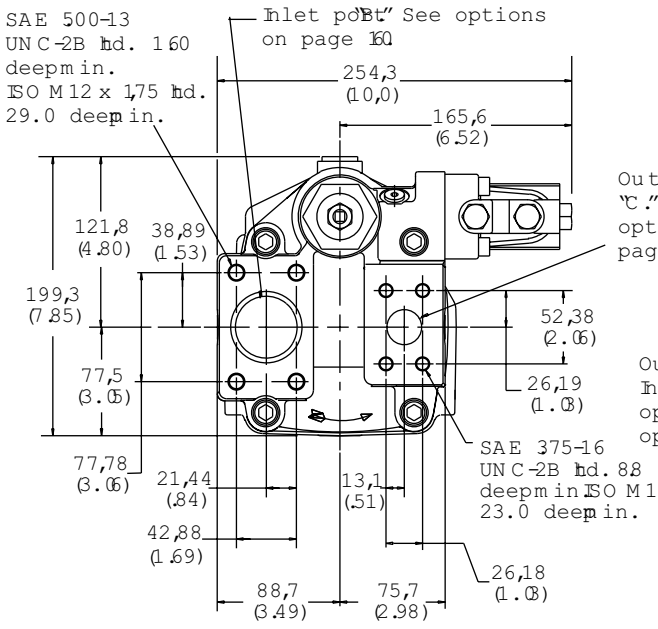
End-ported Models

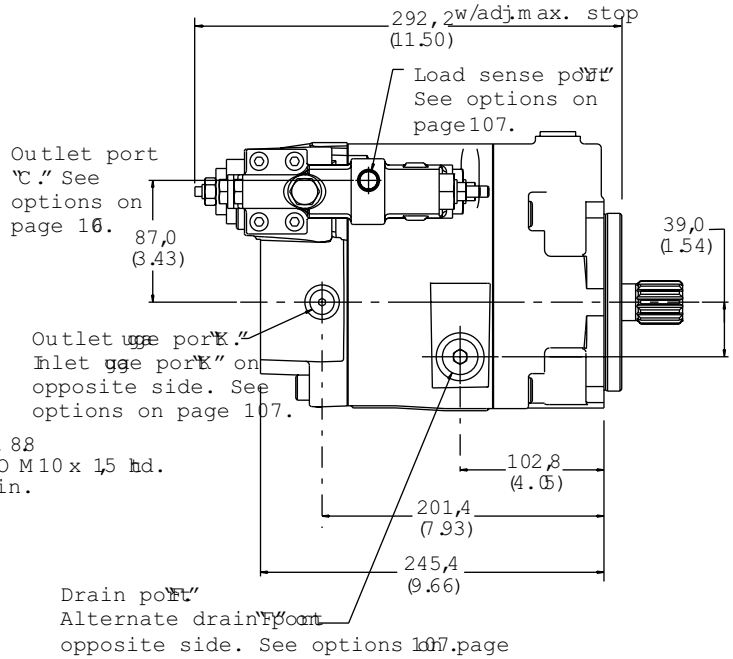
PVM057/063

Dimensions in millimeters [inches]
See mounting flange options on page 101.
See shaft options and ordering on page 102.





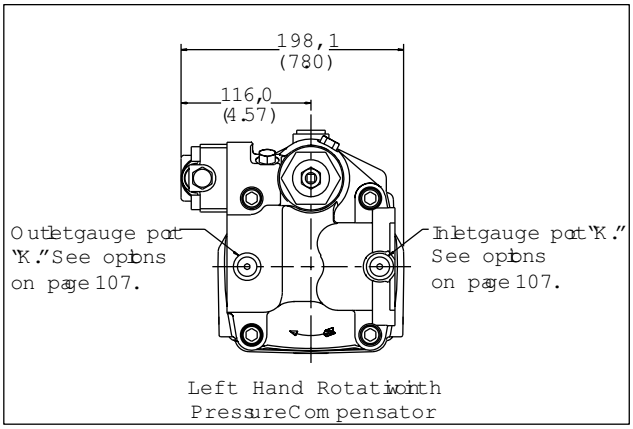


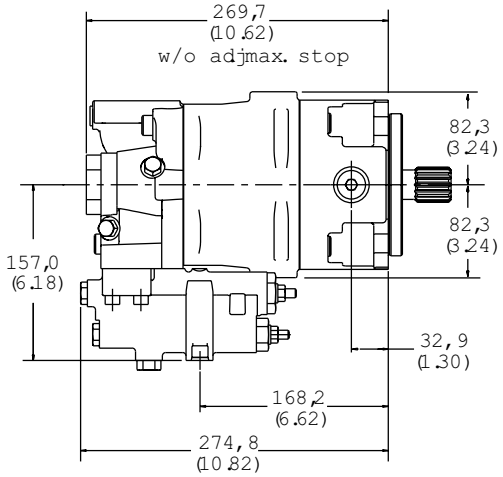


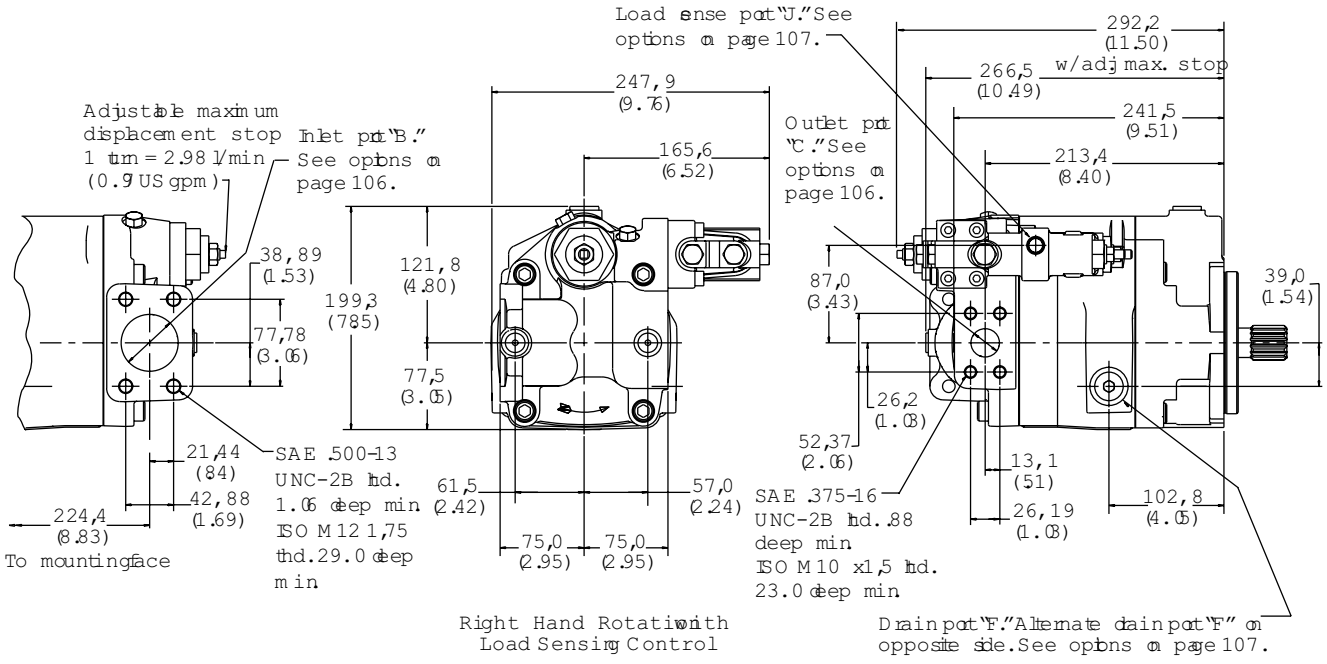
Side-ported Models

PVM057/063

Dimensions in millimeters [inches]
See mounting flange options on page 101.
See shaft options and mating on page 102.



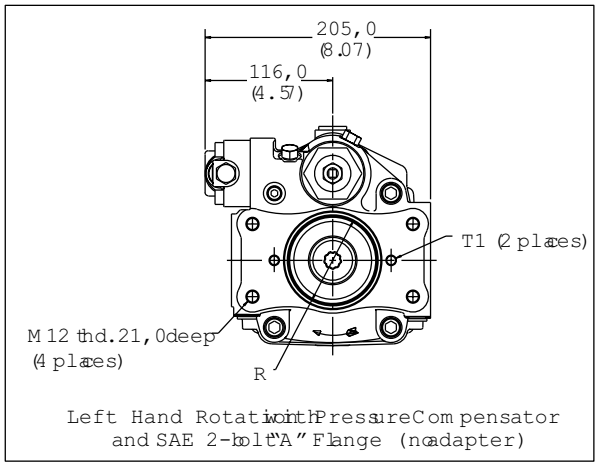




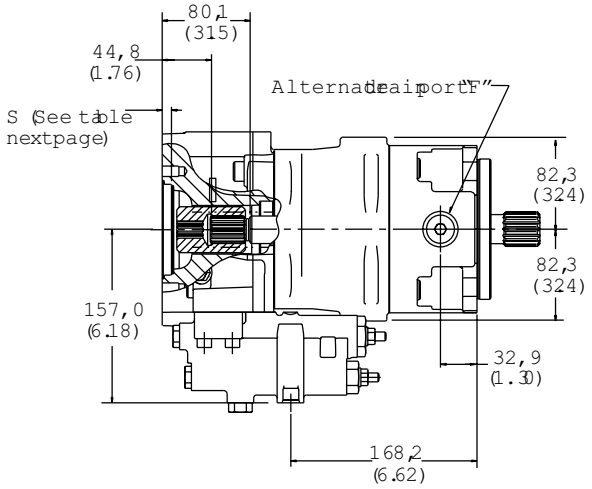
Thru-drive Models

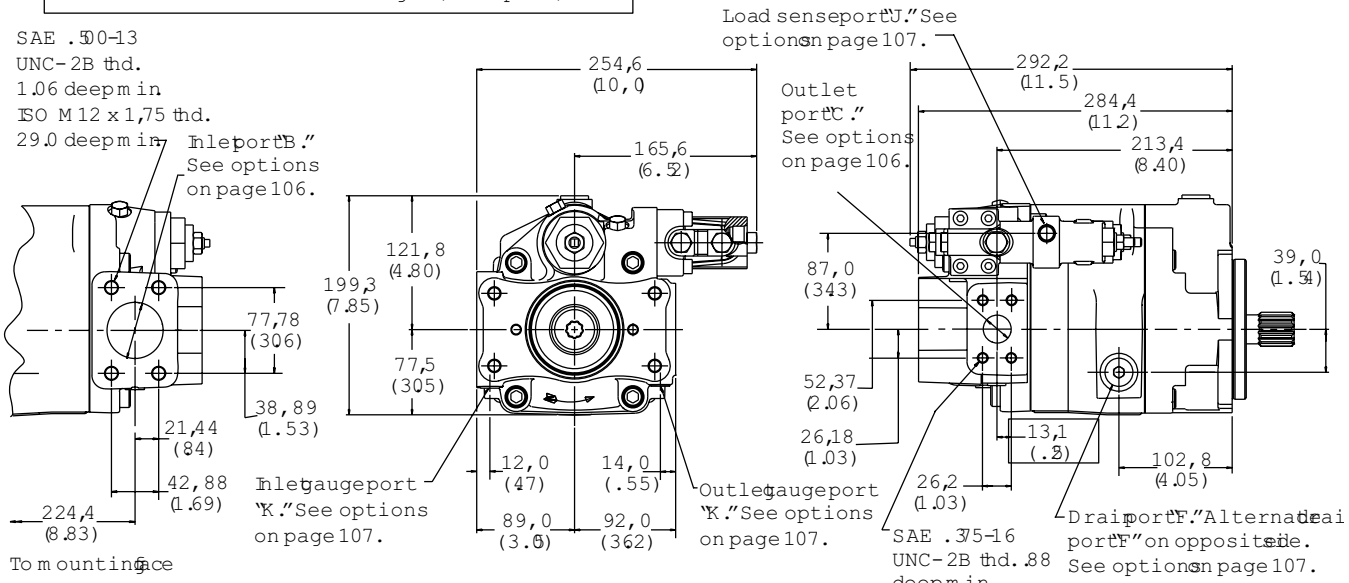
PVM057/063

Dimensions in millimeters [inches]
See pilot flange options on page 101.
See shaft options starting on page 102.



Left Hand Rotation with Pressure Compensator
and SAE 2-bolt "A" Flange (no adapter)



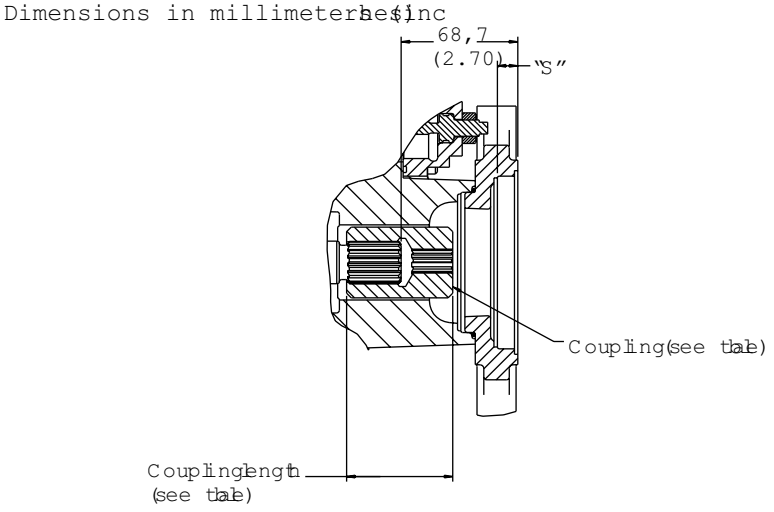


Right Hand Rotation with Load Sensing Control
and SAE 2-bolt "A" Flange (no adapter)

Thru-drive Models

PVM057/063

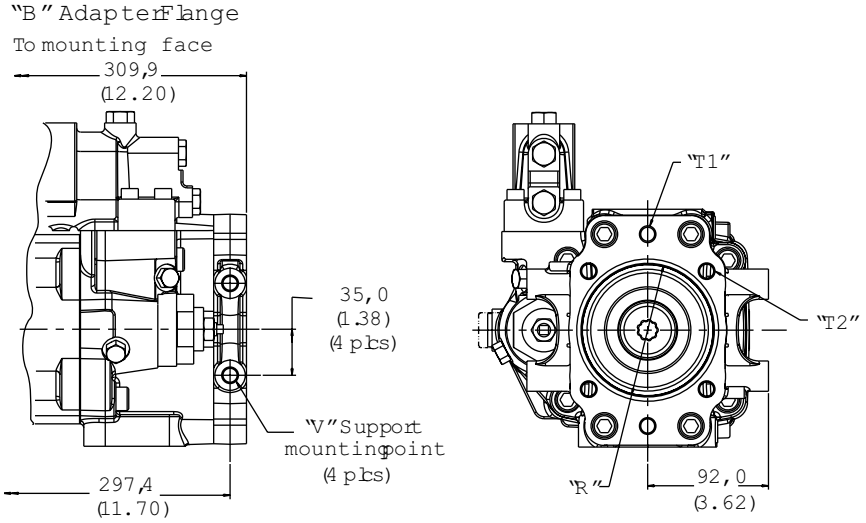
Dimensions in millimeters [inches]



Coupling	Length	Code
SAE "A," 9T	62,5 (2.46)	A,G
SAE "B," 13T	93,0 (3.66)	C,J
SAE "B-B," 15T	93,0 (3.66)	D,K
SAE "C," 14T	93,0 (3.66)	E,L

Model Code Position 25

	Description
A	SAE "A," 9T, 16/32 DP, 30° pressure angle, involute spline
C	SAE "B," 13T, 16/32 DP, 30° pressure angle, involute spline
D	SAE "B-B," 15T, 16/32 DP, 30° pressure angle, involute spline
E	SAE "C," 14T, 12/24 DP, 30° pressure angle, involute spline
G	For ISO 80-A2HW pad with a 9T SAE spline
J	For ISO 100-A2/B4HW pad with a 13T SAE spline
K	For ISO 100-A2/B4HW pad with a 15T SAE spline
L	For ISO 125-A2/B4HW pad with a 14T SAE spline



Right hand rotation with Load Sensing Control and SAE 2-/4-bolt "B" adapter flange

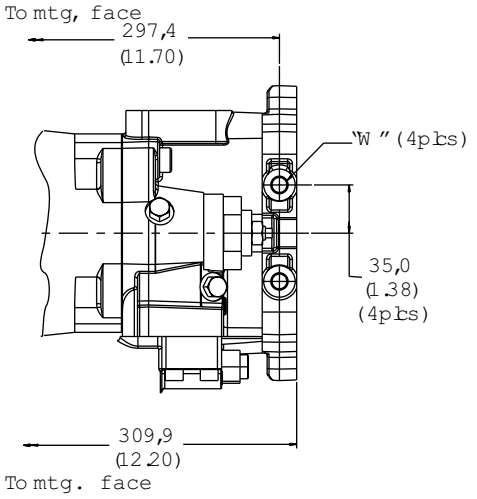
Model Code Position 25			Pilot Dia.	Pilot Depth	2-bolt	4-bolt	Support Mounting Points
	Flange	Bolt	"R"	"S"	"T1"	"T2"	"V"
A,B	SAE "A" 2-bolt	SAE	Ø82,65 (3.25±.001)	8,6/8,1 (.32/.34)	.375-16 UNC-2B thd.	N/A	N/A
G,H	ISO 80	ISO	Ø80,05 (3.15)	9,0/8,0 (.35/.31)	M10 thd.	N/A	N/A
C,D	SAE "B" 2-/4-bolt	SAE	Ø101,65 (4.002±.001)	12,5/11,5 (.49/.45)	.50-13 UNC-2B thd.	.50-13 UNC-2B thd.	.50-13 UNC-2B thd. .98" deep
J,K	ISO 100	ISO	Ø100,05 (3.94)	12,5/11,5 (.49/.45)	M12 thd.	M12 thd.	M12 thd. x 25,0 deep

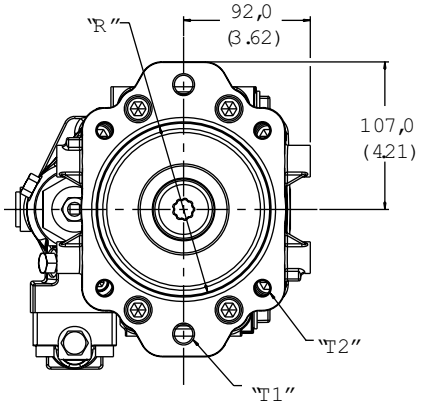
Thru-drive Models

PVM057/063

Dimensions in millimeters [inches]

"C" Adapter Flange





Left hand rotation with Pressure Compensator and SAE 2-/4-bolt "C" Adapter Flange

Model Code Position 25			Pilot Dia.	Pilot Depth	2-bolt	4-bolt	Support Mounting Points
	Flange	**Bolt**	**"R"**	**"S"**	**"T1"**	**"T2"**	**"V"**
E,F	SAE "C" 2-/4-bolt	SAE	Ø127,05 (5.002±.001)	15,5/14,5 (.61/.57)	.625-11 UNC-2B thd.	.50-13 UNC-2B thd.	.50-13 UNC-2B thd. .98" deep
L,M	ISO 125	ISO	Ø125,05 (4.92)	15,5/14,5 (.61/.57)	M16 thd.	M12 thd.	M12 thd. x 25,0 deep

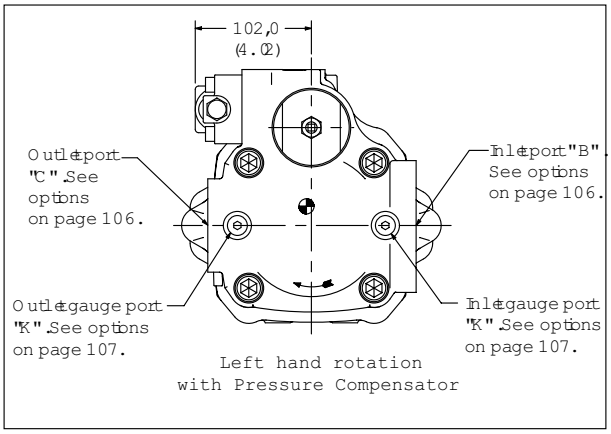
Side-ported Models

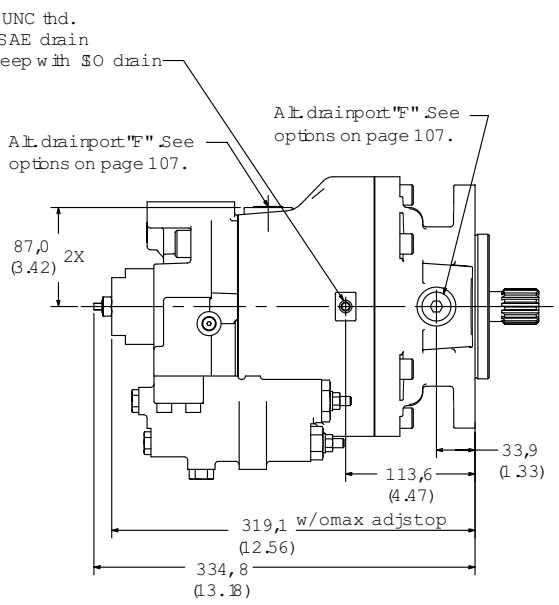
PVM074/081

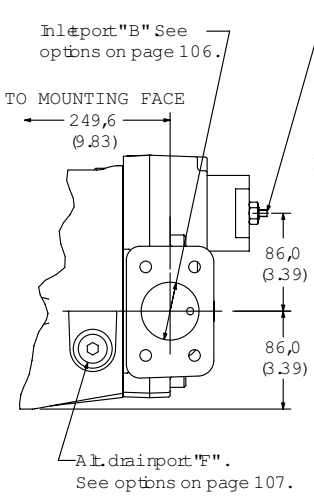
*Right Hand Only

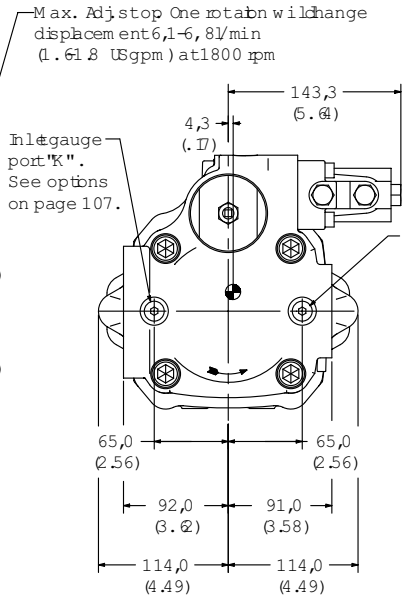
Dimensions in millimeters (inches)

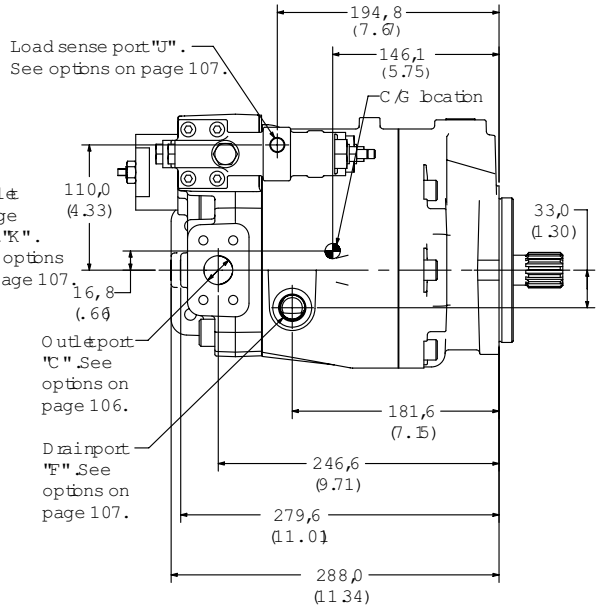
See pilot flange options on page 101.
See shaft options starting on page 102.











PVM074/108 is not available with left hand rotation in any port configuration.

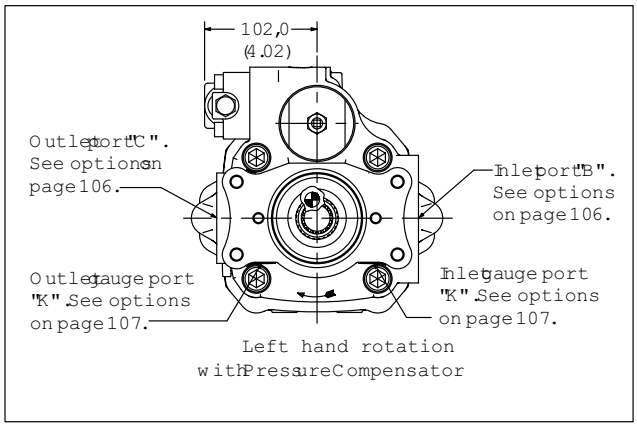
Thru-drive Models

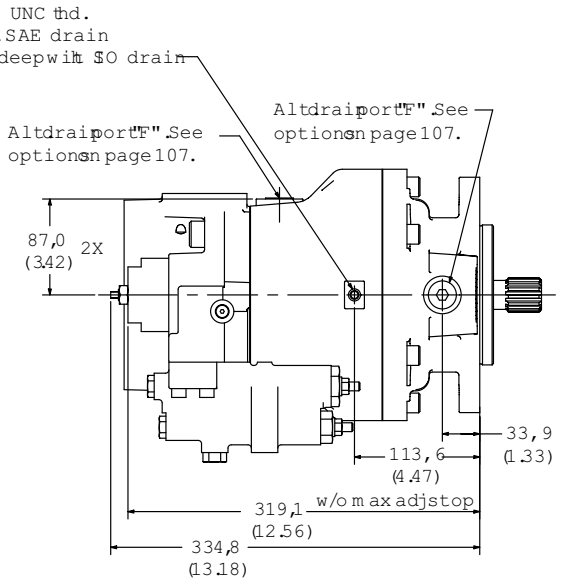
PVM074/081

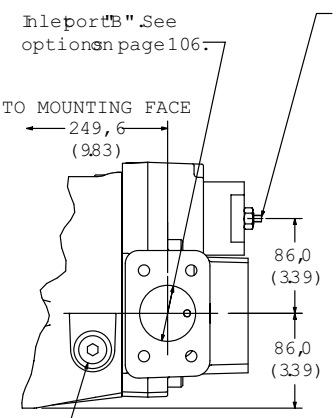
*Right-hand only

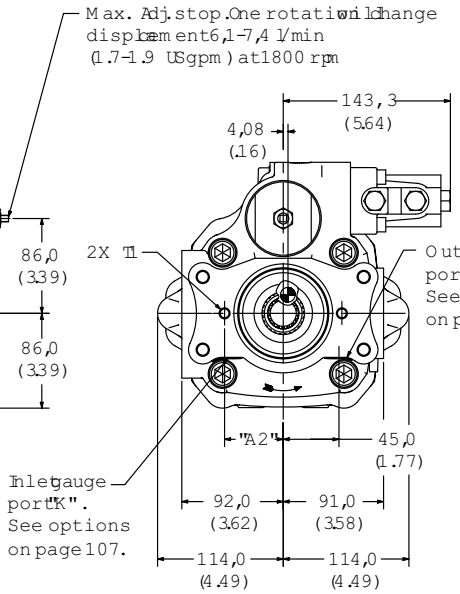
Dimensions in millimeters (inches)

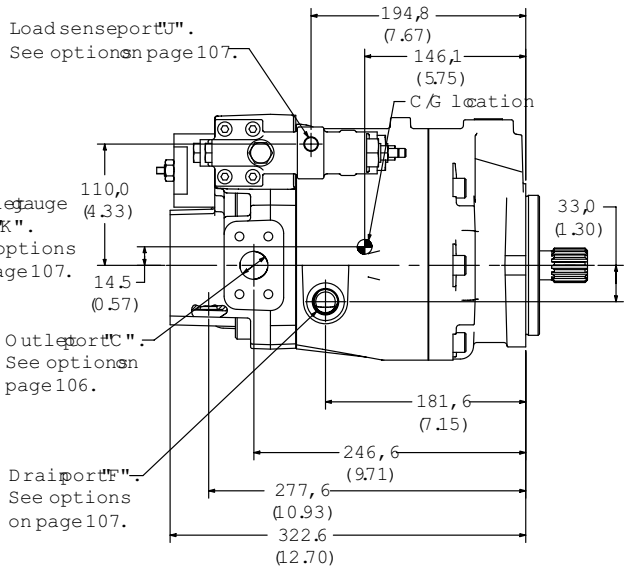
See pilot flange options starting on page 101.
See shaft options starting on page 102.











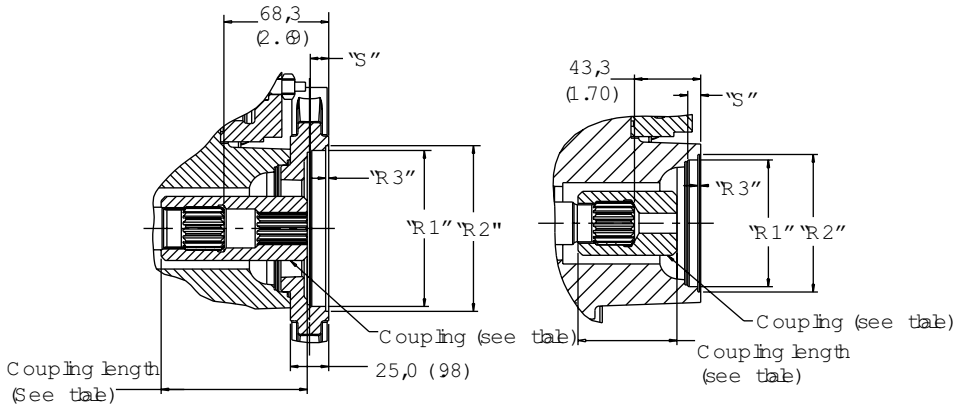
PVM074/108 is not available with left hand rotation in any port configuration.

Thru-drive Models

PVM074/081

*Right-hand only

Dimensions in millimeters [inches]



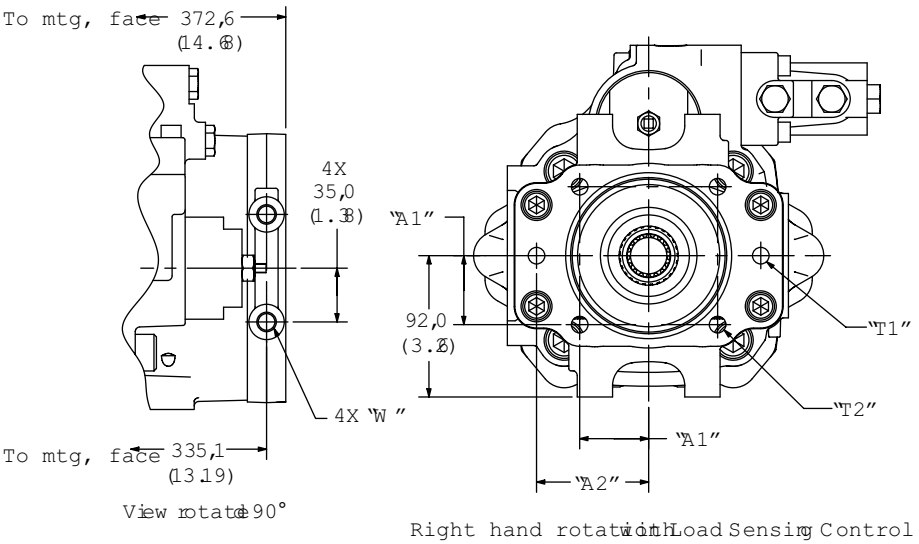
With adapter plate — Without adapter plate

Coupling	Length	Code
SAE "A," 9T	64,5 (2.54)	A,G
SAE "A," 11T	65,3 (2.57)	B,H
SAE "B," 13T	95,3 (3.75)	C,J
SAE "B-B," 15T	95,3 (3.75)	D,K
SAE "C," 14T	95,3 (3.75)	E,L
SAE "C-C," 17T	91,8 (3.61)	F,M

Model code Position 25

	Description
A	SAE "A," 9T, 16/32 DP, 30° pressure angle, involute spline
B	SAE "A," 11T, 16/32 DP, 30° pressure angle, involute spline
C	SAE "B," 13T, 16/32 DP, 30° pressure angle, involute spline
D	SAE "B-B," 15T, 16/32 DP, 30° pressure angle, involute spline
E	SAE "C," 14T, 12/24 DP, 30° pressure angle, involute spline
F	SAE "C-C," 17T, 12/24 DP, 30° pressure angle, involute spline
G	For ISO 80-A2HW pad with a 9T SAE spline
H	For ISO 80-A2HW pad with a 11 T SAE spline
J	For ISO 100-A2/B4HW pad with a 13T SAE spline
K	For ISO 100-A2/B4HW pad with a 15T SAE spline
L	For ISO 125-A2/B4HW pad with a 14T SAE spline
M	For ISO 125-A2/B4HW pad with a 17T SAE spline

"B" Adapter Flange



View rotated 90°

Right hand rotation with Load Sensing Control and ISO or SAE 2-/4-bolt "B" adapter flange

Model Code Position 25			Pilot	O-ring	O-ring	Pilot			Support		
	Flange	Bolt	Dia.	Dia.	Depth	Depth	2-bolt	4-bolt	Mounting Points	4-bolt	2-bolt
			"R1"	"R2"	"R3"	"S"	"T1"	"T2"	"W"	"A1"	"A2"
A,B G,H	SAE "A" 2-bolt	SAE	Ø82,6 (3.25)	Ø89,65 (3.53)	2,00 (.08) 1,90 (.07)	9,0/8,0 (.35/.31)	375-16 UNC-2B thd.	N/A	N/A	N/A	53,2
	ISO 80	ISO	Ø80,05 (3.15)	Ø89,75 (3.53)	2,70 (.11) 2,60 (.10)	9,0/8,0 (.35/.31)	M10 thd.	N/A	N/A	N/A	54,5 (2.15)
C,D J,K	SAE "B" 2-/4-bolt	SAE	Ø101,65 (4.00)	Ø108,05 (4.25)	2,00 (.08) 1,90 (.07)	12,5/11,5 (.49/.45)	.50-13 UNC-2B thd.	.50-13 UNC-2B thd.	.50-13 UNC-2B thd. .98" deep(1.77)	44,9 (2.87)	73,0
	ISO 100	ISO	Ø100,05 (3.94)	Ø108,75 (4.28)	2,70 (.11) 2,60 (.10)	12,5/11,5 (.49/.45)	M12 thd.	M10 thd.	M12 thd. 25,0 deep	44,19 (1.74)	70,0 (2.76)

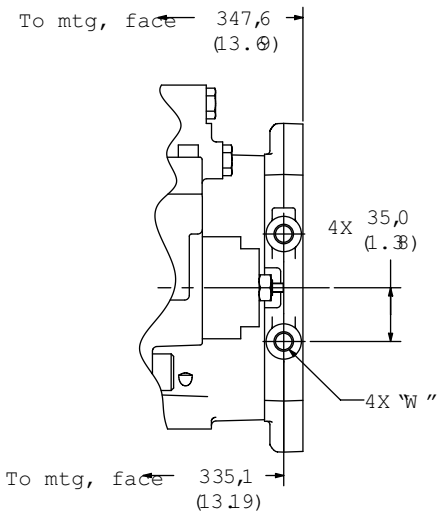
Thru-drive Models

PVM074/081

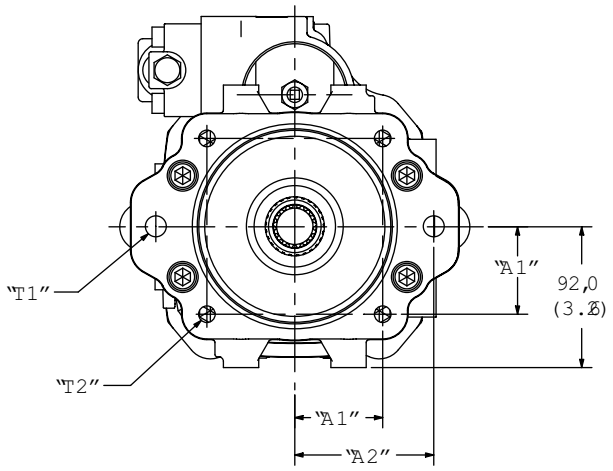
*Right-hand only

Dimensions in millimeters (inches)

"C" Adapter Flange



View rotated 90°



Left hand rotation with Pressure Compensator and ISO or SAE 2-/4-bolt "C" Adapter Flange

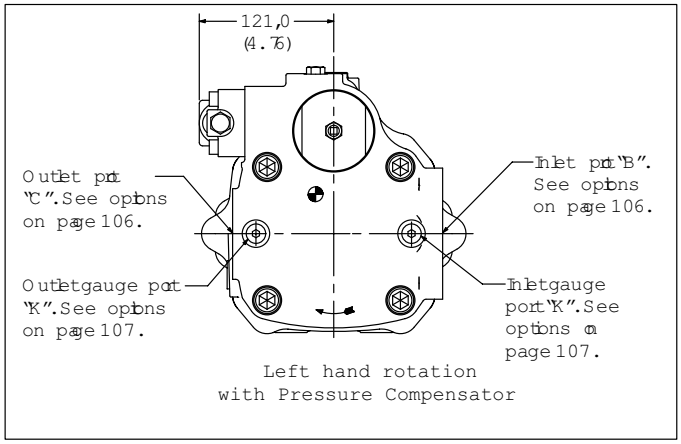
Model Code Position 25	Flange	Bolt	Pilot Dia.	O-ring Dia.	O-ring Depth	Pilot Depth	2-bolt	4-bolt	Support Mounting Points		
			"R1"	"R2"	"R3"	"S"	"T1"	"T2"	"W"	"A1"	"A2"
E,F L,M	SAE "C" 2-/4-bolt	SAE	Ø127,05	Ø133,45	2,00 (.08)	15,5/14,5	.625-11 UNC-2B thd.	.50-13 UNC-2B thd.	.50-13 UNC-2B thd. .98" deep	57,25 (2.25)	90,5 (3.56)
	ISO 125	ISO	Ø125,05 (4.92)	Ø133,75 (3.26)	2,70 (.11) 2,60 (.10)	15,5/14,5 (.61/.57)	M16 thd.	M12 thd.	M12 thd. 25,0 deep	56,57 (2.23)	90,0 (3.54)

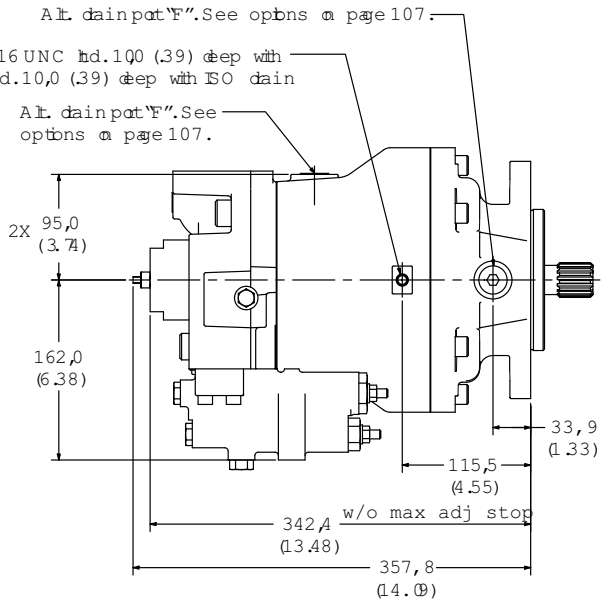
Side-ported Models

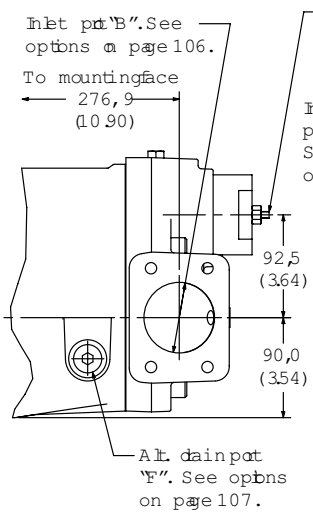
PVM098/106

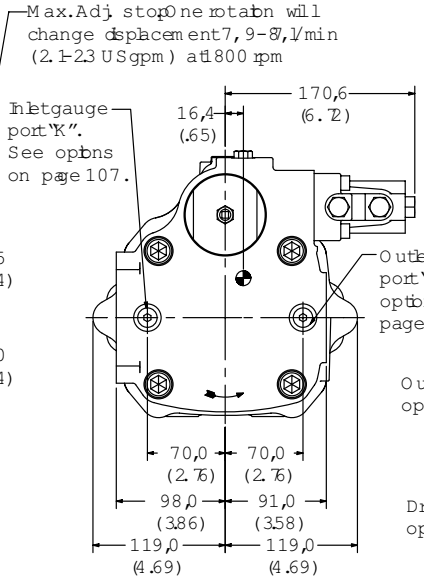
Dimensions in millimeters (inches)

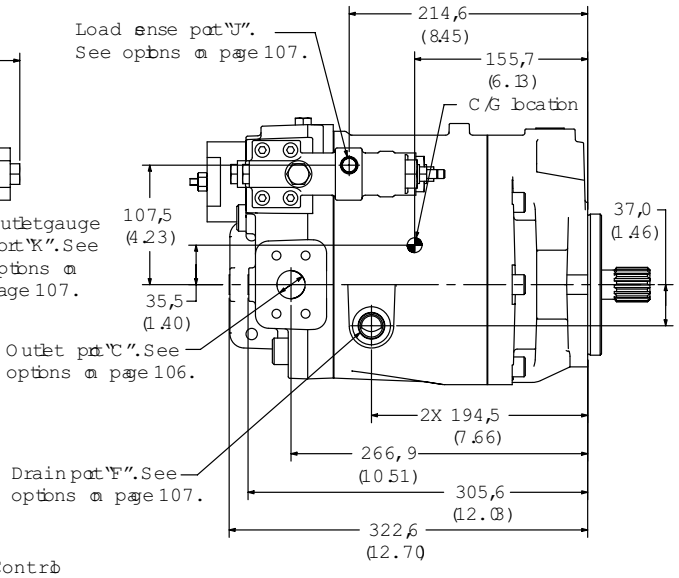
See pilot flange options on page 101.
See shaft options starting on page 102.











Left hand rotation with Load Sensing Control

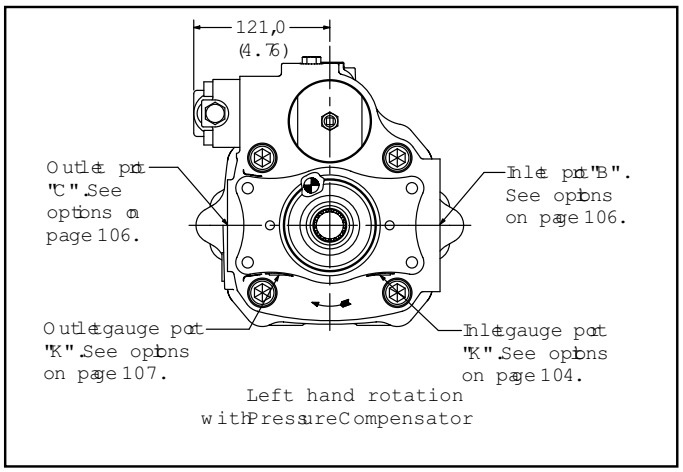
PVM098/106 is not available in left hand rotation with rear ports.

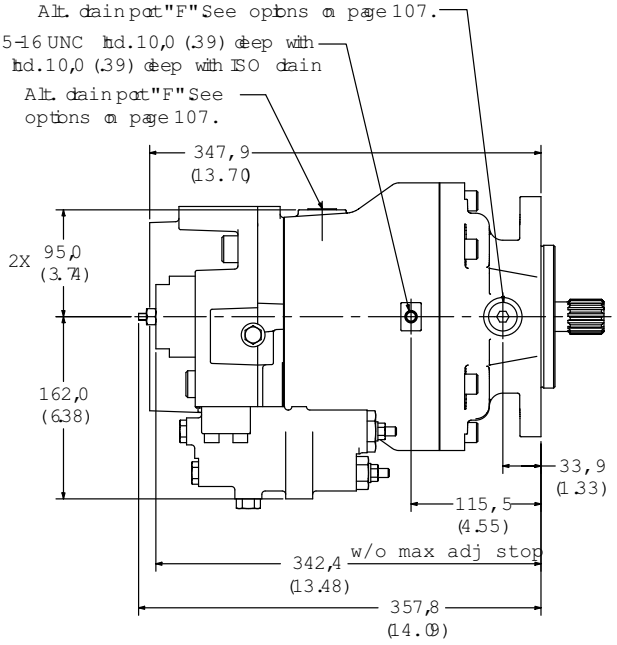
Thru-drive Models

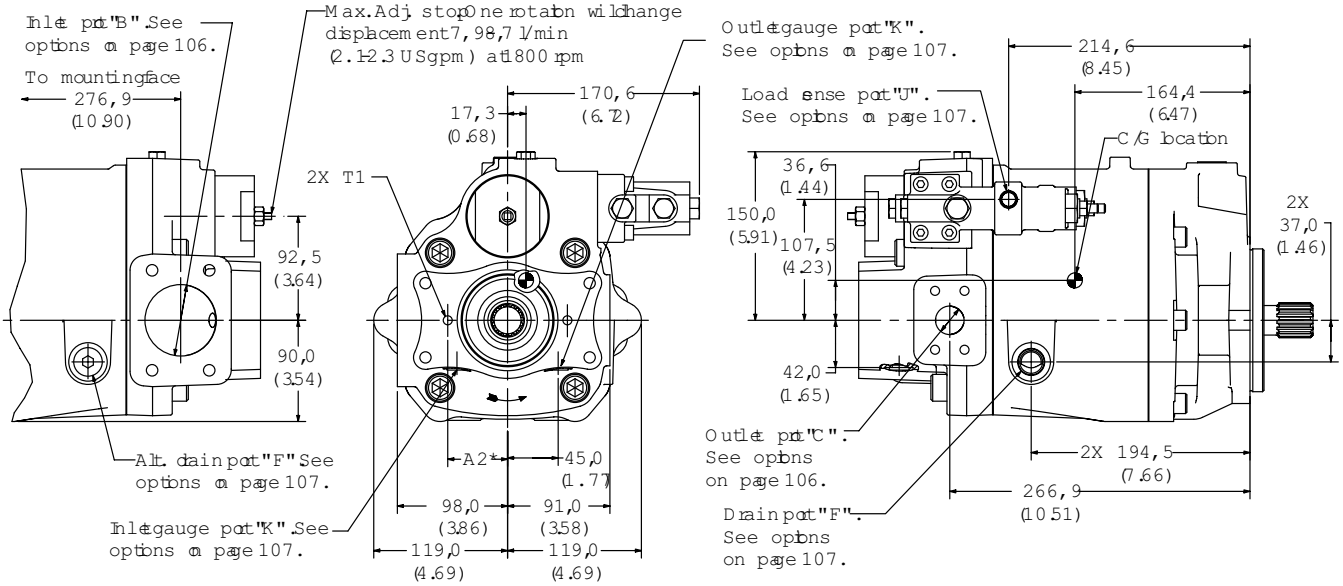
PVM098/106

Dimensions in millimeters [inches]

See pilot flange options starting on page 102.
See shaft options starting on page 102.





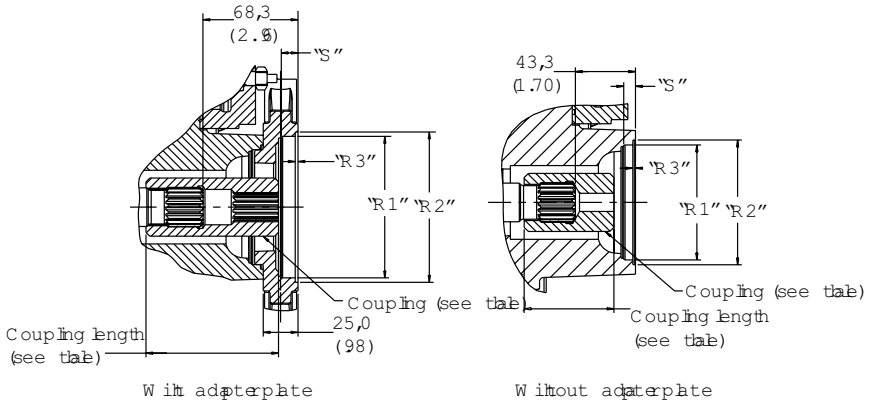


PVM098/106 is not available in left hand rotation with rear ports.

Thru-drive Models

PVM098/106

Dimensions in millimeters (inches)

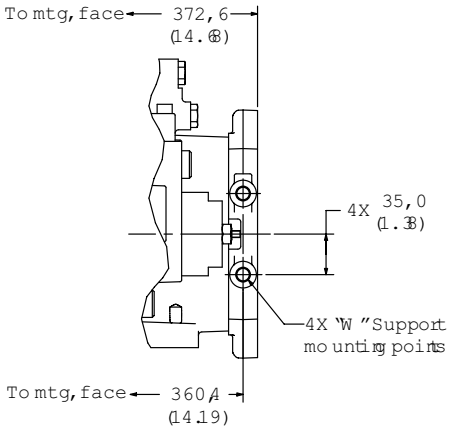


With adapter plate

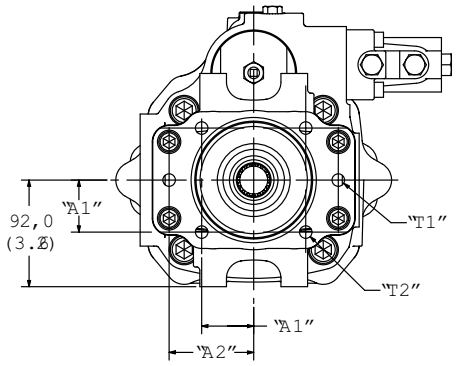
Without adapter plate

Coupling	Length	Code
SAE "A," 9T	64,5 (2.54)	A,G
SAE "A," 11T	65,3 (2.57)	B,H
SAE "B," 13T	95,3 (3.75)	C,J
SAE "B-B," 15T	95,3 (3.75)	D,K
SAE "C," 14T	95,3 (3.75)	E,L
SAE "C-C," 17T	91,8 (3.61)	F,M

"B" Adaptor Flange



View Rotated 90°



Right hand rotation with Load Sensing Cor

Model Code Position 25

	Description
A	SAE "A," 9T, 16/32 DP, 30° pressure angle, involute spline
B	SAE "A," 11T, 16/32 DP, 30° pressure angle, involute spline
C	SAE "B," 13T, 16/32 DP, 30° pressure angle, involute spline
D	SAE "B-B," 15T, 16/32 DP, 30° pressure angle, involute spline
E	SAE "C," 14T, 12/24 DP, 30° pressure angle, involute spline
F	SAE "C-C," 17T, 12/24 DP, 30° pressure angle, involute spline
G	For ISO 80-A2HW pad with a 9T SAE spline
H	For ISO 80-A2HW pad with a 11 T SAE spline
J	For ISO 100-A2/B4HW pad with a 13T SAE spline
K	For ISO 100-A2/B4HW pad with a 15T SAE spline
L	For ISO 125-A2/B4HW pad with a 14T SAE spline
M	For ISO 125-A2/B4HW pad with a 17T SAE spline

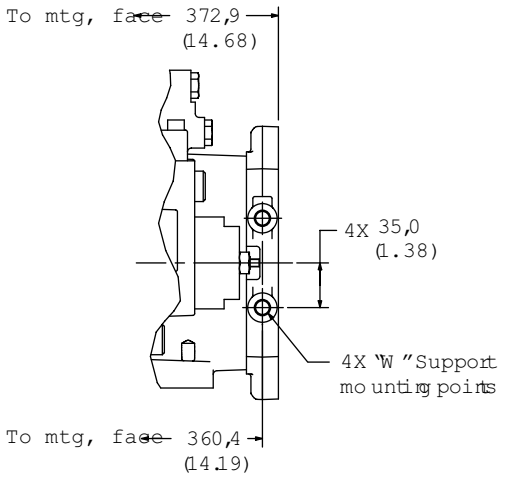
Model Code Position 25			Pilot	O-ring	O-ring	Pilot			Support		
	Flange	Bolt	Dia.	Dia.	Depth	Depth	2-bolt	4-bolt	Mounting Points	4-bolt	2-bolt
			"R1"	"R2"	"R3"	"S"	"T1"	"T2"	"W"	"A1"	"A2"
A,B	SAE "A"	SAE	Ø82,6	Ø89,65	2,00 (.08)	9,0/8,0	375-16 UNC-2B	N/A	N/A	N/A	53,2
G,H	2-bolt		(3.25)	(3.53)	1,90 (.07)	(.35/.31)	thd. 0.59 deep				
	ISO 80	ISO	Ø80,05 (3.15)	Ø89,75 (3.53)	2,70 (.11) 2,60 (.10)	9,0/8,0 (.35/.31)	M10 thd. x 18,0 deep	N/A	N/A	N/A	54,5 (2.15)
C,D J,K	SAE "B" 2-/4-bolt	SAE	Ø101,65 (4.00)	Ø108,05 (4.25)	2,00 (.08) 1,90 (.07)	12,5/11,5 (.49/.45)	.50-13 UNC-2B thd.	.50-13 UNC-2B thd.	.50-13 UNC-2B thd. .98" deep	44,9 (1.77)	73,0 (2.87)
	ISO 100	ISO	Ø100,05 (3.94)	Ø108,75 (4.28)	2,70 (.11) 2,60 (.10)	12,5/11,5 (.49/.45)	M12 thd.	M10 thd.	M12 thd. 25,0 deep	44,19 (1.74)	70,0 (2.76)

Thru-drive Models

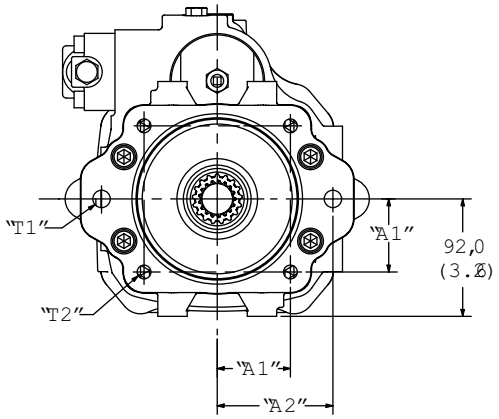
PVM098/106

Dimensions in millimeters [inches]

"C" Adapter Flange



View Rotated 90°



Left hand rotation with Pressure Compensator and ISO or SAE 2-/4-bolt "C" adapter flange

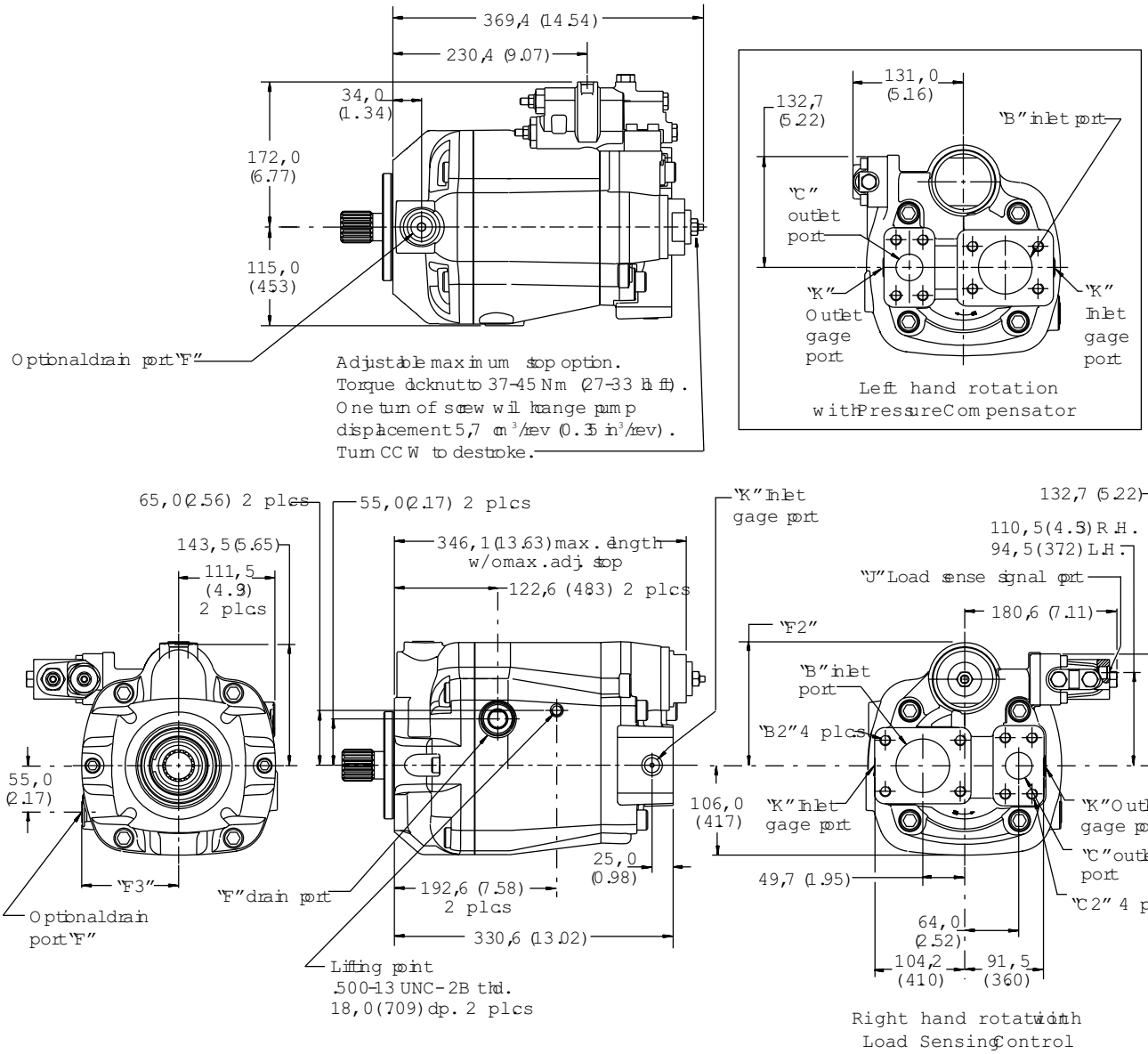
Model Code Position 25	Flange	Bolt	Pilot Dia.	O-ring Dia.	O-ring Depth	Pilot Depth	2-bolt	4-bolt	Support Mounting Points		
			"R1"	"R2"	"R3"	"S"	"T1"	"T2"	"W"	"A1"	"A2"
E,F L,M	SAE "C" 2-/4-bolt	SAE	Ø127,05	Ø133,45	2,00 (.08)	15,5/14,5	.625-11 UNC-2B thd.	.50-13 UNC-2B thd.	.50-13 UNC-2B thd. .98" deep	57,25 (2.25)	90,5 (3.56)
	ISO 125	ISO	Ø125,05 (4.92)	Ø133,75 (3.26)	2,70 (.11) 2,60 (.10)	15,5/14,5 (.61/.57)	M16 thd.	M12 thd.	M12 thd. 25,0 deep	56,57 (2.23)	90,0 (3.54)

End-ported Models

PVM131/141

Dimensions in millimeters (inches)

See pilot flange options starting on page 101
See shaft options starting on page 102

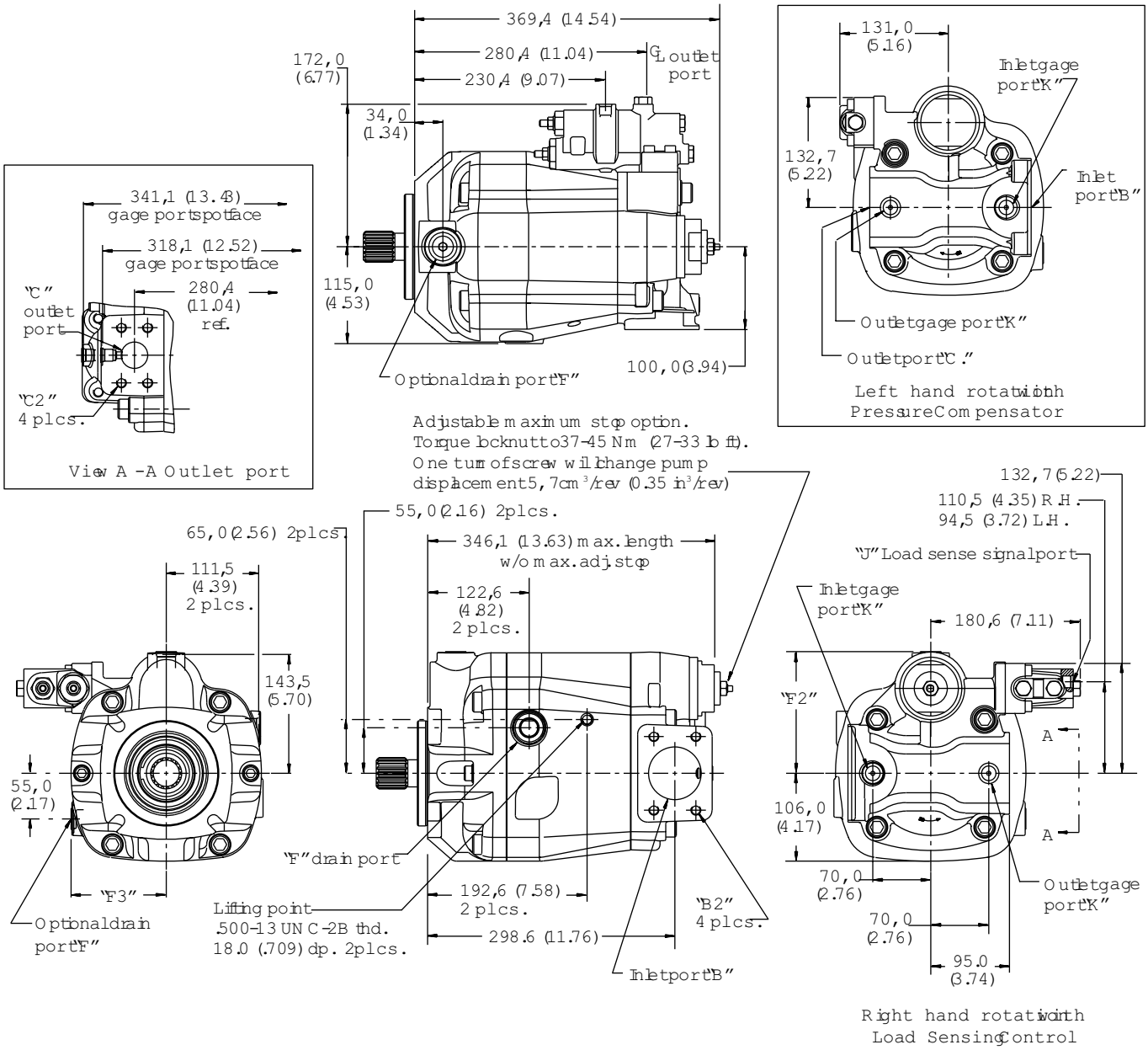


Side-ported Models

PVM131/141

Dimensions in millimeters (inches)

See pilot flange options starting on page 102
See shaft options starting on page 102

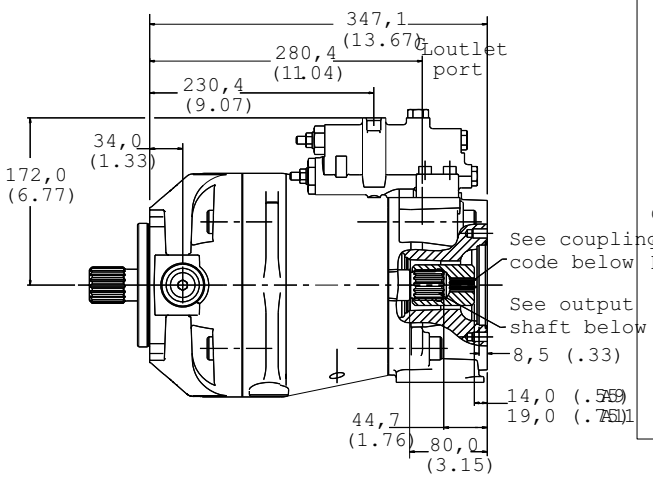


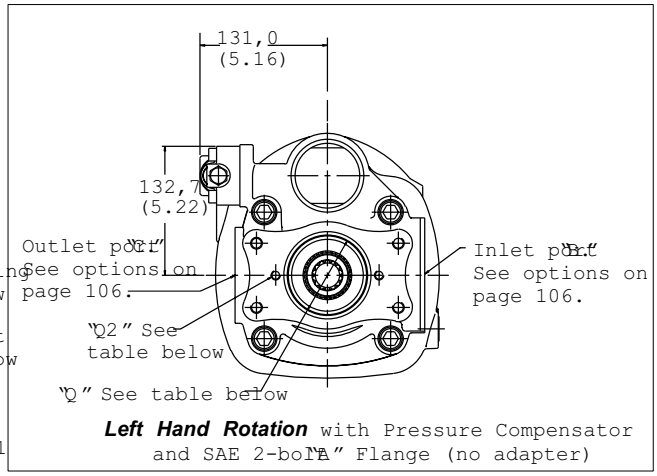
Thru-drive Models

PVM131/141

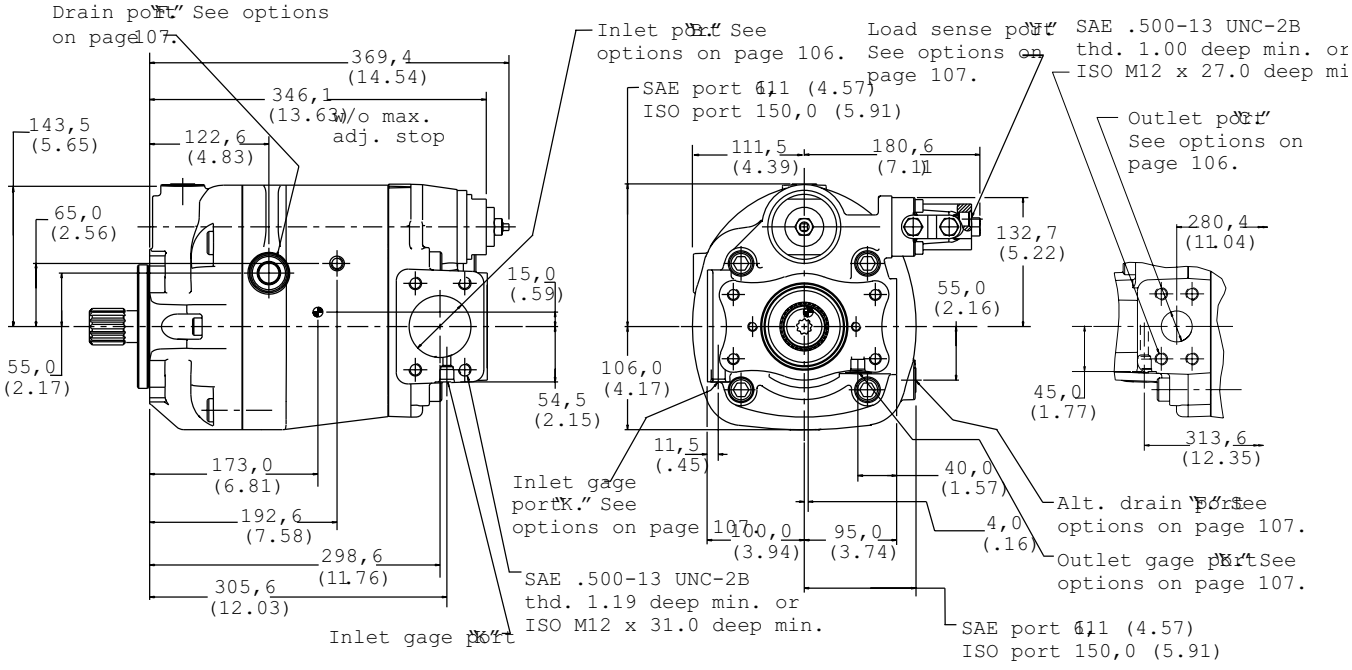
Dimensions in millimeters (inches)

See pilot flange options on page 101.
See shaft options starting on page 102.





Left Hand Rotation with Pressure Compensator and SAE 2-bolt "A" Flange (no adapter)



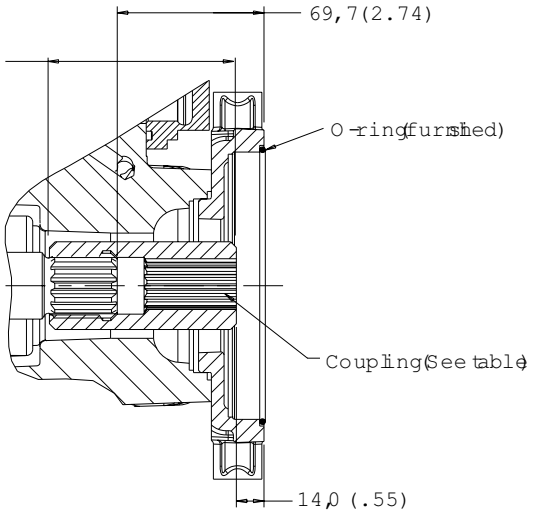
Right Hand Rotation with Load Sensing Control and SAE 2-bolt "A" Flange (no adapter)

Model Code Position 25	"Q1" Thru-drive Flange	"Q2" 2-bolt Thread
A,B	SAE J744-82-2 Ø82.625/82.575 bore	.375-16 UNC-2B thd. 0.80 deep
G,H	ISO 3019/2-80A2 Ø80.075/80.25 bore	M10 thd. x 18,0 deep

Thru-drive Models

PVM131/141

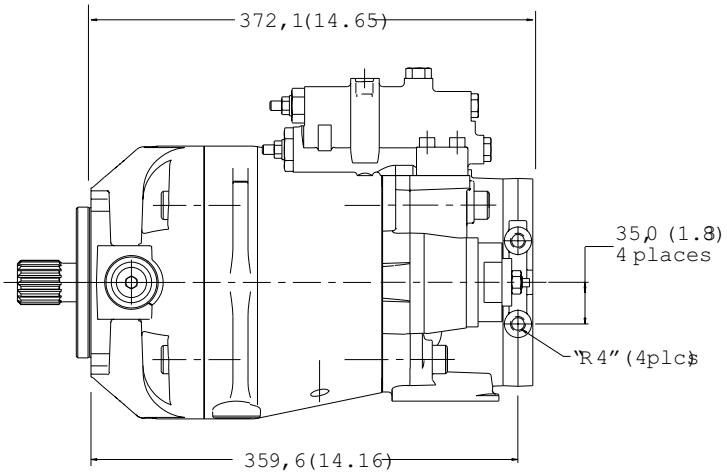
Dimensions in millimeters (inches)

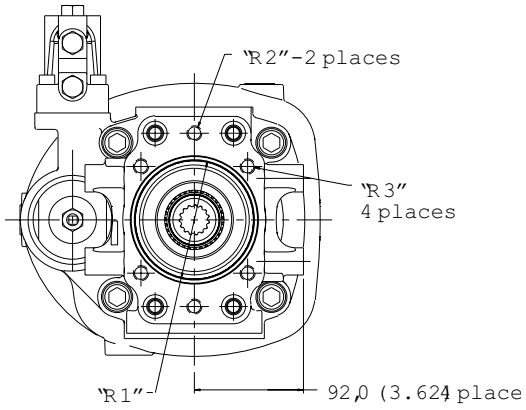


Model Code Position 25

	Description
A	For SAE "A" pad with a 9T, 16/32 DP, 30° pressure angle, involute spline
B Output shaft	For SAE "A" pad with a 11T, 16/32 DP, 30° pressure angle, involute spline 14T 12/24 DP external involute spline
C	SAE "B," 13T, 16/32 DP, 30° pressure angle, involute spline
D	SAE "B-B," 15T, 16/32 DP, 30° pressure angle, involute spline
E	SAE "C," 14T, 12/24 DP, 30° pressure angle, involute spline
F	SAE "C-C," 17T, 12/24 DP, 30° pressure angle, involute spline
G	For ISO 80-A2HW pad with a 9T SAE spline
H	For ISO 80-A2HW pad with a 11T SAE spline
J	For ISO 100-A2/B4HW pad with a 13T SAE spline
K	For ISO 100-A2/B4HW pad with a 15T SAE spline
L	For ISO 125-A2/B4HW pad with a 14T SAE spline
M	For ISO 125-A2/B4HW pad with a 17T SAE spline

"B" Adapter Flange





Right Hand Rotation with SAE 2-/4-Bolt "R1" Flange and ISO 100 Adapter Flange

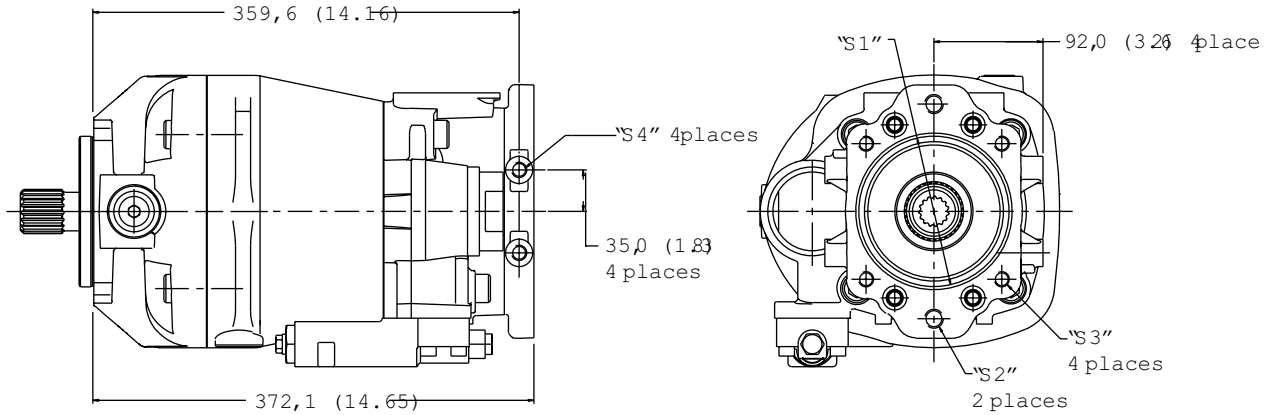
Model Code Position 25	"R1" Thru-drive Flange	"R2" 2-bolt Thread	"R3" 4-bolt Thread	"R4" Support Mounting Points
C,D	SAE J744-101-2 & -4 Ø101,675/101.625 bore 12,50/11,50 deep	.500-13 UNC-2B 0.98 deep	.500-13 UNC-2B 0.98 deep	.500-13 UNC-2B 0.98 deep
J,K	ISO 3019/2-100A2 & B2 Ø100,075/100.025 bore 12,50/11,50 deep	M12 25,0 deep	M12 25,0 deep	M12 25,0 deep

Thru-drive Models

PVM131/141

Dimensions in millimeters (inches)

"C" Adapter Flange



Left Hand Rotation with SAE 2-/4-bolt "C1" and ISO 125 Adapter Flange

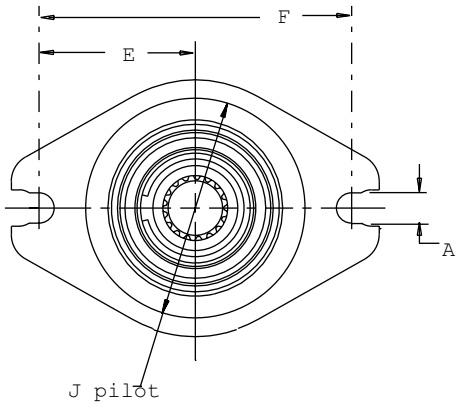
Model Code Position 25	"S1" Thru-drive Flange	"S2" 2-bolt Thread	"S3" 4-bolt Thread	"R4" Support Mounting Points
E,F	SAE J744-127-2 & -4 Ø127,075/127.025 bore 15,50/14,50 deep	.625-11 UNC-2B 0.98 deep	.500-13 UNC-2B 0.98 deep	.500-13 UNC-2B 0.98 deep
L,M	ISO 3019/2-125A2 & B4 Ø125,075/125.025 bore 15,50/14,50 deep	M16 25,0 deep	M12 25,0 deep	M12 25,0 deep

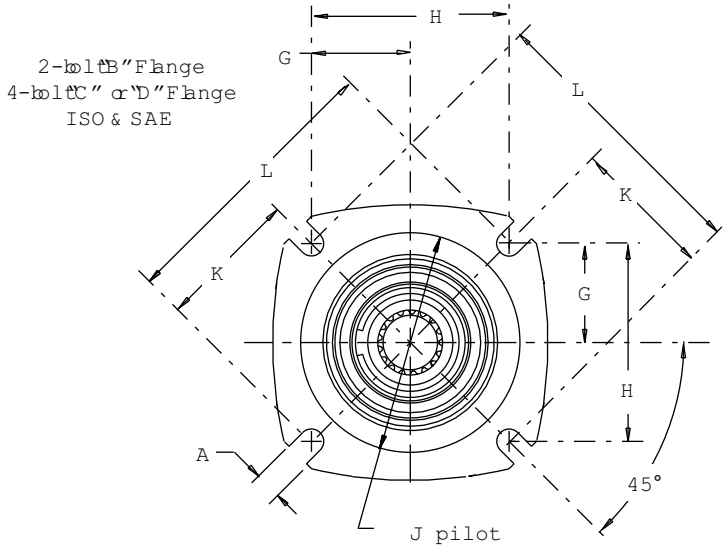
Port	"B"*	"B2"	"C"*	"C2"	"F2"	"F3"
SAE	2.50 inch dia. SAE J518 Code 61, low pressure	.500-13 UNC-2B thd. 1.19 deep minimum	1.25 inch dia. SAE J518 Code 62, high pressure	.500-13 UNC-2B thd. 1.00 deep minimum	146,8 (5.78)	114,9 (4.52)
ISO	64mm diameter. ISO 6162 Type II, 315 bar	M12 thread 31,0 deep minimum	32mm diameter. ISO 6162, 400 bar	M12 thread 27,0 deep minimum	148,5 (5.85)	116,6 (4.59)

*4-bolt flange port. See page 101 for load sensing, drain, and gage port threads.

Mounting Flange Options

Dimensions in millimeters [inches]





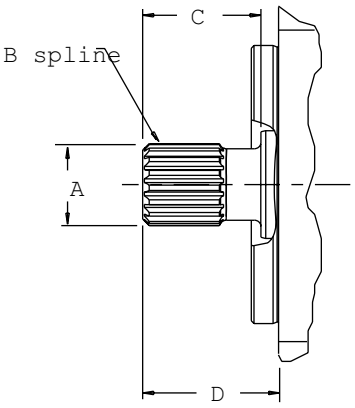
Series	2-bolt or 4-bolt Flange	Code	Flange Description	A	E	F	G	H	J	K	L
PVM018	2-bolt	A	SAE J744-82-2	Ø11,14	53,2	106,4	–	–	Ø82,53 +.02 -.03	–	–
PVM020	"A"			(4.38)	(2.09)	(4.19)	–	–	(Ø3.249) +.000 -.001		
PVM018	2-bolt	B	ISO 3019/2-80A2HW	Ø11,14	54,5	109,0	–	–	Ø79,98 +.02 -.03	–	–
PVM020	"A"			(4.38)	(2.15)	(4.29)	–	–	(Ø3.15) +.000 -.001		
PVM018 PVM020 PVM045 PVM050 PVM057 PVM063	2-bolt "B"	C	SAE J744-101-2	14,36 (.565)	73,0 (2.87)	146,0 (5.75)	– –	– –	Ø101,58+.02 -.03 (Ø3.999) ±.001	–	–
PVM018 PVM020 PVM045 PVM050 PVM057 PVM063	2-bolt "B" (special)	D	ISO 3019/2-100A2HW	14,14 (.557)	70,0 (2.76)	140,0 (5.51)	–	–	Ø100,00/99,95 (Ø3.937/3.935)	–	–
PVM057 PVM063 PVM074 PVM081	2-bolt "C"	E	SAE J744-127-2 ("C")	17,4 (.685)	90,5 (3.562)	181,0 (7.125)	–	–	Ø127,00/126,95 (Ø5.000/4.998)	–	–
		F	ISO 3019/2-125A2HW	18,0 (.709)	90,0 (3.543)	180,0 (7.09)	–	–	Ø125,00/124,95 (Ø4.921/4.919)	–	–
PVM098 PVM106 PVM131 PVM141	4-bolt "C"	G	SAE J744-127-4 ("C")	14,2 (.559)	–	–	57,25 (2.254)	114,50 (4.508)	Ø127,00/126,95 (Ø5.000/4.998)	–	–
		H	ISO 3019/2-125B4HW	14,0 (.551)	–	–	–	–	Ø125,00/124,95 (Ø4.921/4.919)	80,0 (3.150)	160,0 (6.299)
PVM131 PVM141	4-bolt "D"	J	SAE J744-152-4 ("D")	20,6 (.812)	–	–	80,82 (3.182)	161,64 (6.364)	Ø152,40/152,35 (Ø6.000/5.998)	–	–
		K	ISO 3019/2-160B4HW	18,0 (.709)	–	–	–	–	Ø160,00/159,95 (Ø6.299/6.297)	100,0 (3.937)	200,0 (7.874)

*Flanges for PVM020 and PVM050 are shown on pages 73 and 80, respectively.

Shaft Options

Dimensions in millimeters (inches)

SAE Splined Shaft

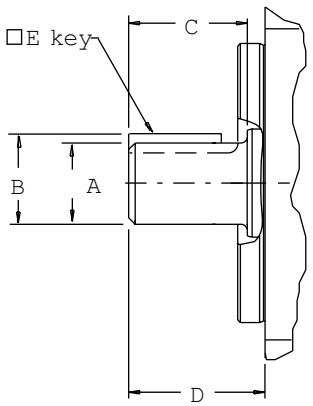


Model Series	SAE Spline Shaft Designation	Shaft Code	A max.	B	C	D	Max. Input Torque Nm (lb. in.)
PVM018/020	SAE J744-16-4 SAE “A” (9T)	03	15,88 (.625)	9T 16/32 DP	37,0 (1.46)	32,0 (1.26)	58 (517)
	SAE J744-19-4 SAE “A” (11T)	04	19,05 (.750)	11T 16/32 DP	30,0 (1.18)	38,0 (1.50)	123 (1100)
	SAE J744-22-4 SAE “B” (13T)	07	21,81 (.859)	13T 16/32 DP	33,0 (1.31)	41,0 (1.61)	208 (1850)
	SAE J744-25-4 SAE “B-B” (15T)	08	24,98 (.983)	15T 16/32 DP	38,0 (1.50)	46,0 (1.81)	337 (2987)
PVM045/050	SAE J744-22-4 SAE “B” (13T)	07	21,81 (.859)	13T 16/32 DP	33,0 (1.31)	41,0 (1.61)	208 (1850)
	SAE J744-25-4 SAE “B-B” (15T)	08	24,98 (.983)	15T 16/32 DP	38,0 (1.50)	46,0 (1.81)	337 (2987)
PVM057/063	SAE J744-22-4 SAE “B” (13T)	07	21,81 (.859)	13T 16/32 DP	33,0 (1.31)	41,0 (1.61)	208 (1850)
	SAE J744-25-4 SAE “B-B” (15T)	08	24,98 (.983)	15T 16/32 DP	38,0 (1.50)	46,0 (1.81)	337 (2987)
	SAE J744-32-4 SAE “C” (14T)	11	31,22 (1.23)	14T 12/24 DP	48,0 (1.89)	56,0 (2.20)	640 (5660)
PVM074/081 PVM098/106	SAE J744-32-4 SAE “C” (14T)	11	31,22 (1.23)	14T 12/24 DP	48,0 (1.89)	56,0 (2.20)	640 (5660)
	SAE J744-38-4 SAE “C-C” (17T)	12	37,57 (1.479)	17T 12/24 DP	54,0 (2.13)	62,0 (2.44)	1215 (10,750)
PVM131/141	SAE J744-32-4 SAE “C” (14T)	11	31,22 (1.23)	14T 12/24 DP	48,0 (1.89)	56,0 (2.20)	640 (5660)
	SAE J744-38-4 SAE “C-C” (17T)	12	37,57 (1.479)	17T 12/24 DP	54,0 (2.13)	62,0 (2.44)	1215 (10,750)
	SAE J744-44-4 SAE “D” (13T)	14	43,71 (1.721)	13T 8/16 DP	67,0 (2.63)	75,0 (2.95)	1215 (10,750)

Shaft Options

Dimensions in millimeters (inches)

SAE Keyed Shaft

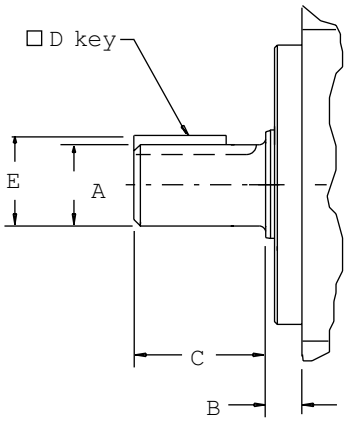


Model Series	SAE Keyed Shaft Designation	Shaft Code	A	B	C	D	E	Max. Input Torque Nm (lb. in.)
PVM018/020	SAE J744-16-1 SAE "A"	01	15,88 (.625)	17,73 (.698)	24,0 (.94)	32,0 (1.26)	4,0 (.157)	58 (517)
	SAE J744-19-1 SAE "19-1"	02	19,05 (.750)	21,23 (.836)	24,0 (.94)	32,0 (1.26)	4,81 (.189)	104 (918)
	SAE J744-22-1 SAE "B"	05	22,22 (.875)	25,12 (.989)	33,0 (1.31)	41,0 (1.61)	6,35 (.250)	135 (1200)
	SAE J744-25-1 SAE "B-B"	06	25,37 (.999)	28,22 (1.111)	38,0 (1.50)	46,0 (1.81)	6,35 (.250)	215 (1900)
PVM045/050	SAE J744-22-1 SAE "B"	05	22,22 (.875)	25,12 (.989)	33,0 (1.31)	41,0 (1.61)	6,35 (.250)	135 (1200)
	SAE J744-25-1 SAE "B-B"	06	25,37 (.999)	28,22 (1.111)	38,0 (1.50)	46,0 (1.81)	6,35 (.250)	215 (1900)
PVM057/063	SAE J744-25-1 SAE "B-B"	06	25,37 (.999)	28,22 (1.111)	38,0 (1.50)	46,0 (1.81)	6,35 (.250)	215 (1900)
	SAE J744-32-1 SAE "C"	09	31,75 (1.25)	35,32 (1.390)	48,0 (1.89)	56,0 (2.20)	7,93 (.312)	450 (3980)
PVM074/081 PVM098/106	SAE J744-32-1 SAE "C"	09	31,75 (1.25)	35,32 (1.390)	48,0 (1.89)	56,0 (2.20)	7,93 (.312)	450 (3980)
	SAE J744-38-1 SAE "C-C"	10	38,10 (1.50)	42,39 (1.67)	54,0 (2.13)	62,0 (2.44)	9,52 (.375)	765 (6770)
PVM131/141	SAE J744-32-1 SAE "C"	09	31,75 (1.25)	35,32 (1.390)	48,0 (1.89)	56,0 (2.20)	7,93 (.312)	450 (3980)
	SAE J744-38-1 SAE "C-C"	10	38,10 (1.50)	42,39 (1.67)	54,0 (2.13)	62,0 (2.44)	9,52 (.375)	765 (6770)
	SAE J744-44-1 SAE "D"	13	44,45 (1.75)	49,46 (1.95)	67,0 (2.63)	75,0 (2.95)	11,11 (.438)	1200 (10,620)

Shaft Options

Dimensions in millimeters (inches)

ISO Keyed Shaft



Model Series	ISO Keyed Shaft Designation	Shaft Code	A	B	C	D	E	Max. Input Torque Nm (lb. in.)
PVM018/020	ISO 3019/2 E20N	15	19,9 (.786)	8,5 (.335)	36 (1.42)	6 (.236)	22,5 (.886)	113 (1000)
	ISO 3019/2 E25N Short Spigot	16	25 (.984)	8,5 (.335)	42 (1.65)	8 (.315)	28,0 (1.102)	215 (1900)
	ISO 3019/2 E25N	17	25 (.984)	10 (.393)	42 (1.65)	8 (.315)	28,0 (1.102)	215 (1900)
PVM045/050	ISO 3019/2 E25N	17	25 (.984)	10 (.393)	42 (1.65)	8 (.315)	28,0 (1.102)	215 (1900)
PVM057/063	ISO 3019/2 E25N	17	25 (.984)	10 (.393)	42 (1.65)	8 (.315)	28,0 (1.102)	215 (1900)
	ISO 3019/2 E32N	18	32 (1.26)	10 (.393)	58 (2.28)	10 (.394)	35,0 (1.378)	450 (3980)
PVM074/081	ISO 3019/2 E32N	18	32 (1.26)	10,5 (.413)	58 (2.28)	10 (.394)	35,0 (1.378)	450 (3980)
PVM098/106	ISO 3019/2 E40N	19	40 (1.57)	10,5 (.413)	82 (3.23)	12 (.472)	43,0 (1.693)	870 (7700)
PVM131/141	ISO 3019/2 E32N	18	32 (1.26)	10 (.393)	58 (2.28)	10 (.394)	35,0 (1.378)	450 (3980)
	ISO 3019/2 E40N	19	40 (1.57)	10 (.393)	82 (3.23)	12 (.472)	43,0 (1.693)	870 (7700)

[1] ISO 80mm pilot only – B

[2] ISO 80mm pilot only – D

*Torque of non-thru-drive PVM pump, or combined torque of PVM thru-drive pump and thru-driven pump.

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

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.)
PVM018/020	SAE J744-16-4 (SAE "A," 9T)	03	58 (513)	Exceeds maximum input torque
	SAE J744-19-4 (SAE "A," 11T)	04	123 (1100)	Exceeds maximum input torque
	SAE J744-22-4 (SAE "B," 13T)	07	208 (1850)	123 (1100)
	SAE J744-25-4 (SAE "B-B," 15T)	08	337 (2987)	123 (1100)
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)
PVM057/063	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 J744-32-4 (SAE "C," 14T)	11	640 (5660)	337 (2987)
PVM074/081 PVM098/106	SAE J744-32-4 (SAE "C," 14T)	11	640 (5660)	515 (4560)
	SAE J744-38-4 (SAE "C-C," 17T)	12	1215 (10,750)	515 (4560)
PVM131/141	SAE J744-32-4 (SAE "C," 14T)	11	640 (5660)	640 (5660)
	SAE J744-38-4 (SAE "C-C," 17T)	12	1215 (10,750)	640 (5660)
	SAE J744-44-4 (SAE "D," 13T)	14	1215 (10,750)	640 (5660)

SAE Keyed Shafts

Model Series	Shaft Designation	Shaft Code	Max. Input Torque† Nm (lb. in.)	Max. Thru-drive Output Torque‡ Nm (lb. in.)
PVM018/020	SAE J744-16-1 (SAE "A")	01	58 (513)	Exceeds maximum input torque
	SAE J744-19-1 (SAE "19-1")	02	104 (920)	Exceeds maximum input torque
	SAE J744-22-1 (SAE "B")	05	135 (1200)	123 (1100)
	SAE J744-25-1 (SAE "B-B")	06	215 (1900)	123 (1100)
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)*
PVM057/063	SAE J744-25-1 (SAE "B-B")	06	215 (1900)	215 (1900)*
	SAE J744-32-1 (SAE "C")	09	450 (3980)	337 (2987)
PVM074/081	SAE J744-32-1 (SAE "C")	09	450 (3980)	450 (3980)*
PVM098/106	SAE J744-38-1 (SAE "C-C")	10	765 (6770)	515 (4560)
PVM131/141	SAE J744-32-1 (SAE "C")	09	450 (3980)	450 (3980)*
	SAE J744-38-1 (SAE "C-C")	10	765 (6770)	640 (5660)
	SAE J744-44-1 (SAE "D")	13	1200 (10,620)	640 (5660)

ISO Keyed Shafts

Model Series	Shaft Designation	Shaft Code	Max. Input Torque† Nm (lb. in.)	Max. Thru-drive Output Torque‡ Nm (lb. in.)
PVM018/020	ISO 3019/2 E20N (B mount only)	15	113 (1000)	Exceeds maximum input torque
	ISO 3019/2 E25N (B mount only)	16	215 (1900)	Exceeds maximum input torque
	ISO 3019/2 E25N (D mount only)	17	215 (1900)	123 (1100)
PVM045/050	ISO 3019/2 E25N	17	215 (1900)	215 (1900)*
PVM057/063	ISO 3019/2 E25N	17	215 (1900)	215 (1900)*
	ISO 3019/2 E32N	18	450 (3980)	337 (2987)
PVM074/081 PVM098/106	ISO 3019/2 E32N	18	450 (3980)	450 (3980)*
	ISO 3019/2 E40N	19	870 (7700)	515 (4560)
PVM131/141	ISO 3019/2 E32N	18	450 (3980)	450 (3980)*
	ISO 3019/2 E40N	19	870 (7700)	640 (5660)

†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.

Port Options

Inlet and Outlet Ports

Model Series	Inlet/Outlet Port Option (per model code, page 5)	Port Code	Inlet Port "B"	Outlet Port "C"
PVM018/020	Inch Flange	02	SAE J518 Code 61, standard pressure. 1.25 inch diameter, .4375-14 x 1.12 bolt holes	SAE J518 Code 61, standard pressure. 0.75 inches diameter, .375-16 x .88 bolt holes
	Metric Flange	04	ISO 6162 Type II, 315 bar. 31,75mm diameter, M10 x 28 bolt holes	ISO 6162 Type II, 315 bar. 19,05mm diameter, M10 x 22 bolt holes
	Inch Tube	01	SAE J514 O-ring –20, for 1-1/4 inch O.D. tube	SAE J514 O-ring -12, for 3/4 inch O.D. tube
	Metric Tube	03	ISO 6149-1, M42 thread	ISO 6149-1, M27 thread
	British Parallel Pipe	05	ISO 228-1:1994 (E), G 1-1/4 thread	ISO 228-1:1994 (E), G 3/4 thread
PVM045/050	Inch Flange	02	SAE J518 Code 61, standard pressure. 2.00 inch diameter, .500-13 x 1.06 bolt holes	SAE J518 Code 61, standard pressure. 1.00 inch diameter, .375-16 x .87 bolt holes
	Metric Flange	04	ISO 6162 Type II, 315 bar. 51mm diameter, M12 x 27 bolt holes	ISO 6162 Type II, 315 bar. 25mm diameter, M10 x 22 bolt holes
	Inch Tube	01	SAE J514 O-ring -24, for 1-1/2 inch O.D. tube	SAE J514 O-ring -16, for 1 inch O.D. tube
	Metric Tube	03	ISO 6149-1, M48 thread	ISO 6149-1, M33 thread
	British Parallel Pipe	05	ISO 228-1:1994 (E), G 1-1/2 thread	ISO 228-1:1994 (E), G1 thread
PVM057/063	Inch Flange	02	SAE J518 Code 61, standard pressure. 2.00 inch diameter, .500-13 x 1.06 bolt holes	SAE J518 Code 61, standard pressure. 1.00 inch diameter, .375-16 x .88 bolt holes
	Metric Flange	04	ISO 6162 Type II, 350 bar. 51mm diameter, M12 x 29 bolt holes	ISO 6162 Type, 350 bar. 25mm diameter, M10 x 23 bolt holes
	Inch Tube (End ported models only)	01	SAE J514 O-ring -24, for 1-1/2 inch O.D. tube	SAE J514 O-ring -16 for 1 inch O.D. tube
	Metric Tube (End ported models only)	03	ISO 6149-1, M48 thread	ISO 6149–1, M33 thread
PVM074/081	Inch Flange	02	SAE J518 Code 61, standard pressure. 2.00 inch diameter, .500-13 x 1.19 bolt holes	SAE J518 Code 61, standard pressure. 1.00 inch diameter, .375 -16 x .88 bolt holes
	Metric Flange	04	ISO 6162 Type II, 315 bar. 51mm diameter, M12 x 20 bolt holes	ISO 6162 Type, 400 bar. 25mm diameter, M10 x 17 bolt holes
PVM098/106	Inch Flange	02	SAE J518 Code 61, standard pressure. 2.50 inch diameter, .500-13 x 1.19 bolt holes	SAE J518 Code 61, standard pressure. 1.00 inch diameter, .375 -16 x .88 bolt holes
	Metric Flange	04	ISO 6162 Type I, 350 bar. 64mm diameter, M12 x 31 bolt holes	ISO 6162 Type I, 350 bar. 25mm diameter, M10 x 23 bolt holes
PVM131/141	Inch Flange	02	SAE J518 Code 61, standard pressure. 2.50 inch diameter, .500-13 x 1.19 bolt holes	SAE J518 Code 62, high pressure. 1.25 inch diameter, .500 -13 x 1.00 bolt holes
	Metric Flange	04	ISO 6162 Type II, 315 bar. 64mm diameter, M12 x 31 bolt holes	ISO 6162 Type, 400 bar. 32mm diameter, M12 x 27 bolt holes

Port Options

Drain, Load Sensing, and Gauge Ports

Model Series	Inlet/Outlet Port Option (per model code, page 5)	Port Code	Drain Port "F"	Load Sensing Port "J"	Gauge Port "K"
PVM018/020	Inch Flange or Tube	01, 03	SAE J514 O-ring, .50" O.D. tube. .750-16 UNF 2B thread	SAE J514 O-ring, .25" O.D. tube. .4375-20 UNF 2B thread	SAE J514 O-ring, .25" tube. .4375-20 UNF 2B thread
	Metric Flange or Tube	03, 04	ISO 6149-1 O-ring M18 x 1,5 thread	ISO 6149-1 O-ring M12 x 1,5 thread	ISO 6149-1 O-ring M12 x 1,5 thread
	British Parallel Pipe	05	ISO 228-1:1994 (E) G 1/2 thread	ISO 228-1:1994 (E) G 1/4 thread	ISO 228-1:1994 (E) G 1/4 thread
PVM045/050	Inch Flange or Tube	01, 03	SAE J514 O-ring, .625" O.D. tube. .875-14 UNF 2B thread	SAE J514 O-ring, .250" O.D. tube. .4375-20 UNF 2B thread	SAE J514 O-ring, .375" O.D. tube. .5625-18 UNF 2B thread
	Metric Flange or Tube	03, 04	ISO 6149-1 O-ring M22 x 1,5 thread	ISO 6149-1 O-ring M12 x 1,5 thread	ISO 6149-1 O-ring M14 x 1,5 thread
	British Parallel Pipe	05	ISO 228-1:1994 (E) G 1/2 thread	ISO 228-1:1994 (E) G 1/4 thread	ISO 228-1:1994 (E) G 1/4 thread
PVM057/063	Inch Flange or Tube	01, 02	SAE J514 O-ring, .625" O.D. tube. .875-14 UNF 2B thread	SAE J514 O-ring, .375" O.D. tube. .5625-18 UNF 2B thread	SAE J514 O-ring, .375" O.D. tube. .5625-18 UNF 2B thread
	Metric Flange or Tube	03, 04	ISO 6149-1 O-ring M22 x 1,5 thread	ISO 6149-1 O-ring M14 x 1,5 thread	ISO 6149-1 O-ring M14 x 1,5 thread
PVM074/83 PVM098/106	Inch Flange	02	SAE J514 O-ring, .625" O.D. tube. .875-14 UNF 2B thread	SAE J514 O-ring, .375" O.D. tube. .562-18 UNF 2B thread	SAE J514 O-ring, .375" O.D. tube. .5625-18 UNF 2B thread
	Metric Flange	04	ISO 6149-1 O-ring M22 x 1,5 thread	ISO 6149-1 O-ring M14 x 1,5 thread	ISO 6149-1 O-ring M14 x 1,5 thread
PVM131/141	Inch Flange	02	SAE J514 O-ring, .625" O.D. tube. .875-14 UNF 2B thread	SAE J514 O-ring, .375" O.D. tube. .562-18 UNF 2B thread	SAE J514 O-ring, .375" O.D. tube. .5625-18 UNF 2B thread
	Metric Flange	04	ISO 6149-1 O-ring M22 x 1,5 thread	ISO 6149-1 O-ring M14 x 1,5 thread	ISO 6149-1 O-ring M14 x 1,5 thread

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 more information, see Eaton publication 579. For operation on other alternative or environmentally friendly fluids, please contact your Eaton Representative.

Fluid Cleanliness

The M Series pumps are rated in anti-wear petroleum fluids with a contamination level of 20/18/13 (Eaton) 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 Eaton Representative for specific duty cycle recommendation.

Eaton 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.

Essential information on the correct methods for treating hydraulic fluid is included in Eaton publication 561 – "Eaton Guide to Systemic Contamination Control" – Available from your local Eaton distributor. In this publication, filtration and cleanliness levels for extending the life of axial piston pumps and other system components are listed. Included is an excellent discussion of the selection of products needed to control fluid condition.

Moment of Inertia (single pump rotating group)

Model	Moment of Inertia	
	N-m (sec^2)	lbf-in (sec^2)
PVM018	0.0012	0.0104
PVM020	0.0012	0.0104
PVM045	0.0036	0.0320
PVM050	0.0034	0.0300
PVM057	0.0052	0.0457
PVM063	0.0051	0.0447
PVM074	0.0078	0.0691
PVM081	0.0073	0.0643
PVM098	0.0132	0.1165
PVM106	0.0123	0.1086
PVM131	0.0213	0.1889
PVM141	0.0210	0.1856

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 Eaton 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 Eaton 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 Eaton 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.

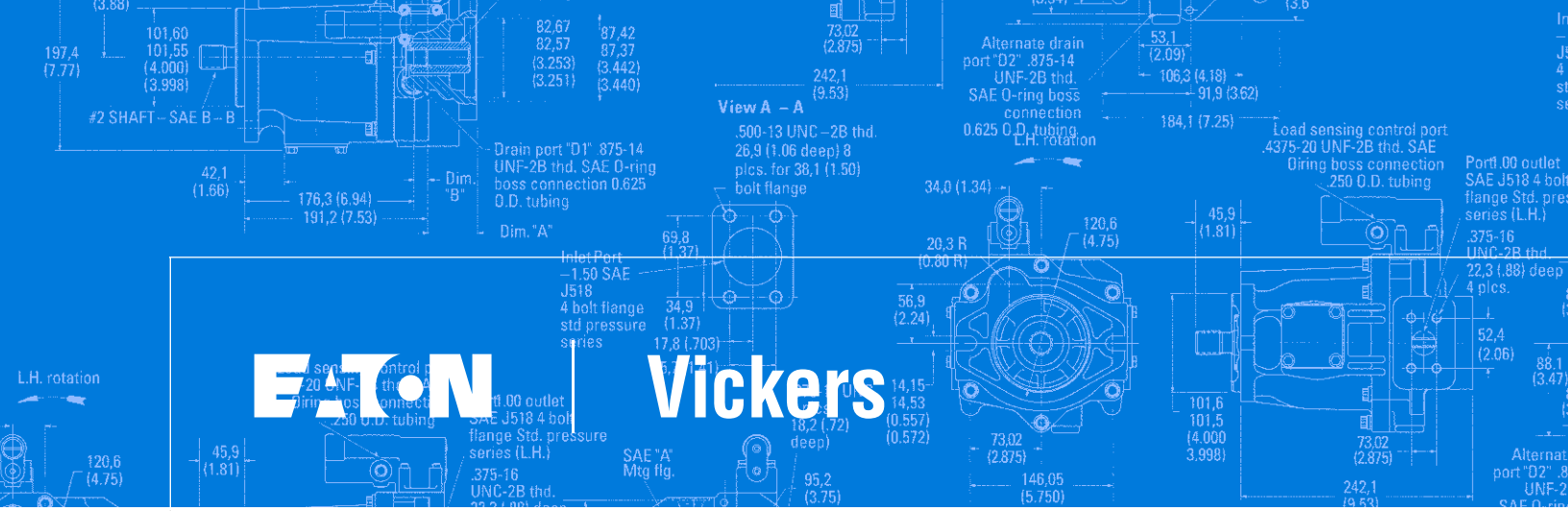
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EATON | Vickers

Q Series Piston Pumps

Variable Displacement, Quiet Series for Industrial Applications

Technical Catalog

PVQ10
PVQ13
PVQ20
PVQ25
PVQ32
PVQ40
PVQ45



VICKERS®

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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^3/r (in^3/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

PVQ10 and PVQ13

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
P	V	Q	1	0	A	2	R	S	E	1	S	2	0	C	*	2	1	V	*	1	1	B	D	1	2	S	*

Nos	Feature	Code	Description
1,2,3	Series PVQ	P	Inline piston pump
		V	Variable volume
		Q	Quiet series
4,5	Displacement in cc/rev and pressure ratings	10	10,5 cc/rev (0.64 cir), 210 bar (3000 psi)
		13	13,8 cc/rev (0.84 cir), 140 bar (2000 psi)
6,7	Mounting flange specifications	A2	Flange SAE J744 82-2 (SAE A)
		MA	Flange ISO 3019/2-80A2HW (available with "N" drive shaft only)
8	Rotation viewed from shaft end	R	Right hand (cw), standard
		L	Left hand (ccw), optional
9,10	Ports, type and location	SE	SAE O-ring rear port, 1.0625" inlet and outlet (standard)
		SS	SAE O-ring side port, 1.3125" inlet and outlet (optional)
11	Shafts, input	1	Straight keyed SAE "A" modified, .75" dia. x 1.75" long
		3	Splined SAE "A" modified, 9T 16/32 DP major dia. fit
		N	Shaft end ISO 3019/2 E20N (available with "MA" mount only)
12	Seals	S	Buna N, standard
		F	Fluorocarbon, optional
13,14	Pump design number	20	Design number subject to change. Installation dimensions remain unchanged for designs 10-19.
15,16	Control type	C**	Pressure compensator. PVQ10: Standard model is C21, indicating setting of 210 bar (3000 psi); range is 02-21 in tens of bar (350-3000 psi). PVQ13: Standard model is C14, indicating factory setting of 138 bar (2000 psi); range is 02-14 in tens of bar (350-2000 psi).
		CM**	Low pressure compensator. Standard model is CM7, indicating factory setting of 69 bar (1000 psi); range is 02-10 in tens of bar (350-1500 psi).

Nos	Feature	Code	Description
15,16	Control type	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 PVQ10 compensator with 210 bar pressure setting and 11 bar load-sense differential.
		C**V**P	Pressure compensator with load-sensing as C**V**B above, but with bleed-down orifice plugged.
		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.
		C**VC**P	Pressure compensator with load-sensing. Same as C**VC**B above, but with bleed-down orifice plugged.
		CG	Pressure compensator modified for hydraulic remote control.
		CD**	Electric dual range compensator. PVQ10: CD21 is standard 210 bar setting of high range (24-210 bar). PVQ13: 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).
		UV	Unloading Valve for accumulator circuits. See installation details.

Model Number System

PVQ10 and PVQ13

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
P	V	Q	1	0	A	2	R	S	E	1	S	2	0	C	*	2	1	V	*	1	1	B	D	1	2	S	*

Nos	Feature	Code	Description
17,18	Pressure setting	21	210 bar (3000 psi) PVQ10
		14	140 bar (2000 psi) PVQ13
19,20	Flow control option	Blank	No flow control
		V	
		VC	
21,22	Load sense differential pressure setting	Blank	No flow control
		11	
		24	
23	Flow control option	Blank	No flow control
		B	
		P	
24	Displacement option	Blank	Without adjustable maximum displacement stop (standard).
		D	Adjustable maximum displacement stop (optional).
25,26	Control design	12	O-ring seal design
27,28	Special pump option suffixes	S2	Shaft up mounting
		S3	British Standard Parallel Threads Counterbore Ports (ISO R288 threads). Contact Eaton for available configurations.
		S9	Special CG compensator for use with electronically modulated relief valves.

RATINGS

Model Number System	Maximum Geometric Displacement cm^3/r (in^3/r)	Rated Speed r/min	Maximum Pressure bar (psi)	Input Power at Max. Pressure and Rated Speed kW (hp)	Approx. Weight kg (lb)
PVQ10	10,5 (0.643)	1800	210 (3000)	7,4 (10)	7,2 (16)
PVQ13	13,8 (0.843)	1800	140 (2000)	6,5 (8.75)	7,2 (16)

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 Compensators

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 3,4 bar (50 psi) 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 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

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 3,4 bar (50 psi) 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 Limiting Compensators

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.

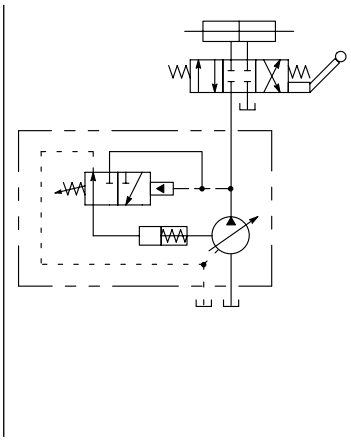
Standard load-sense differential pressure settings, by control type, follow. See model number system for setting range.

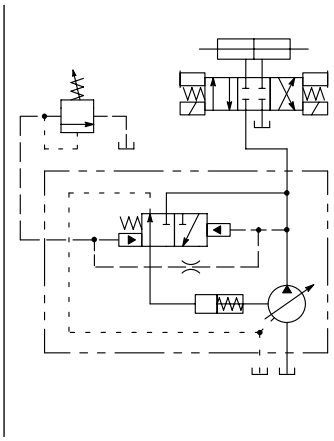
Standard load-sensing and pressure limiting control with 11 bar differential pressure (standard factory setting). Includes bleed-down orifice to exhaust load-sense signal for low-pressure standby condition.

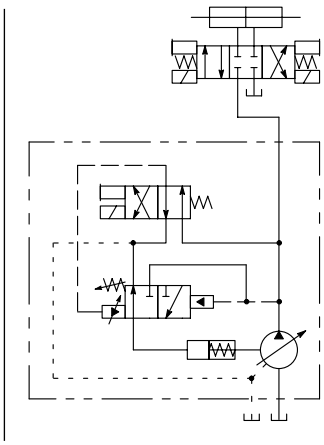
Same as C**V11B above, but with bleed-down orifice plugged.

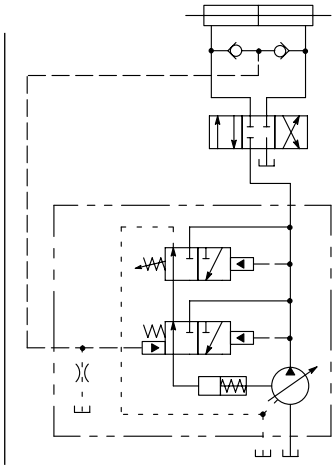
Same as C**V11B, but with factory differential pressure setting of 24 bar.

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







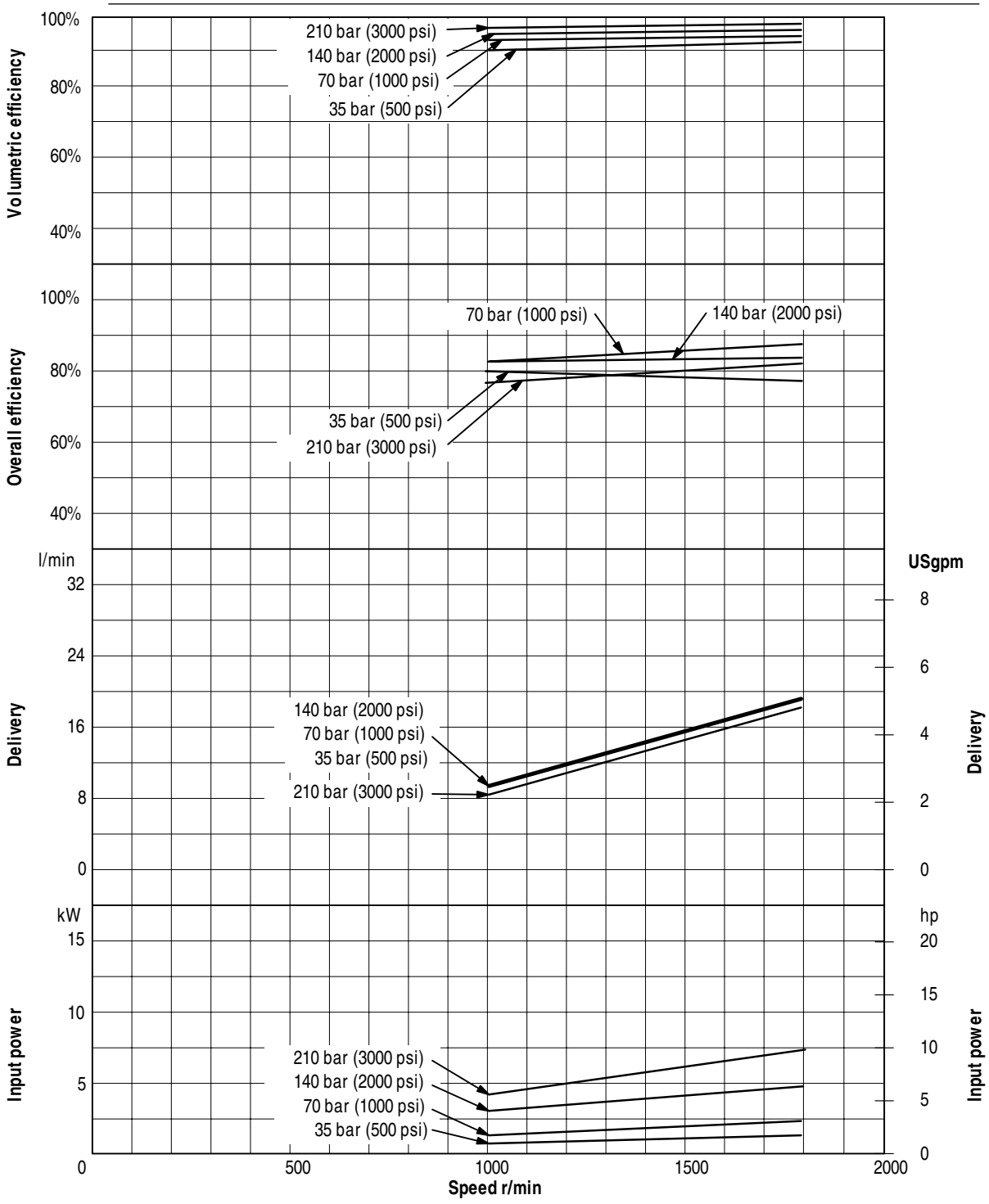


(†orifice open)
(†orifice plugged)

Performance Curves
PVQ10

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

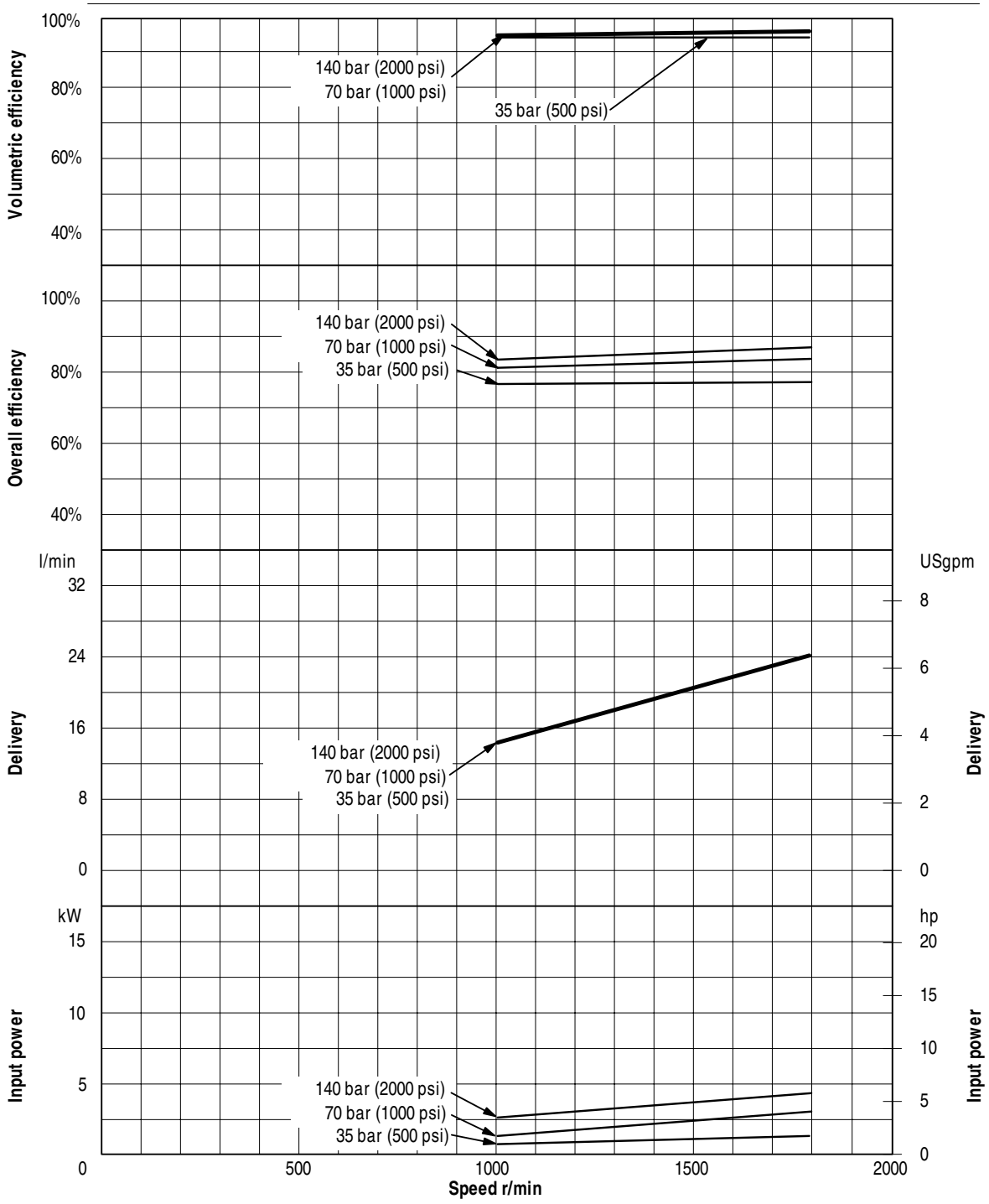
Note: To obtain full flow operation of pump, pressure compensator setting must be 14 bar (200 psi) above desired operating pressure. Full flow curves were obtained with compensator settings 14 bar (200 psi) above 210 bar (3000 psi) max. rated pressure.



Performance Curves
PVQ13

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.



Operating Data

PVQ10 and PVQ13 Sound Data

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

SOUND DATA

		Sound Level dB(A)*			
		Full Stroke		Cutoff	
Speed r/min	Pressure bar (psi)	PVQ10	PVQ13	PVQ10	PVQ13
1000	35 (500)	51	53	43	42
	70 (1000)	55	54	48	50
	100 (1500)	56	55	50	52
	140 (2000)	57	61	51	56
	175 (2500)	59	–	51	–
1200	35 (500)	53	54	46	44
	70 (1000)	55	54	49	52
	100 (1500)	56	58	51	56
	140 (2000)	57	65	53	57
	175 (2500)	60	–	54	–
1500	35 (500)	56	56	47	44
	70 (1000)	59	59	49	51
	100 (1500)	59	60	51	55
	140 (2000)	60	67	53	56
	175 (2500)	62	–	53	–
1800	35 (500)	58	58	52	49
	70 (1000)	60	61	53	56
	100 (1500)	62	63	55	58
	140 (2000)	63	–	57	–
	175 (2500)	65	–	57	–

* Sound pressure data equivalent to NFPA Standard.

Note: To ensure maximum noise reduction at full flow conditions, Engineering recommends limiting pressure of PVQ10 to 175 bar (2500 psi) and PVQ13 to 100 bar (1500 psi) at 1800 rpm.

PVQ10 and PVQ13 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.

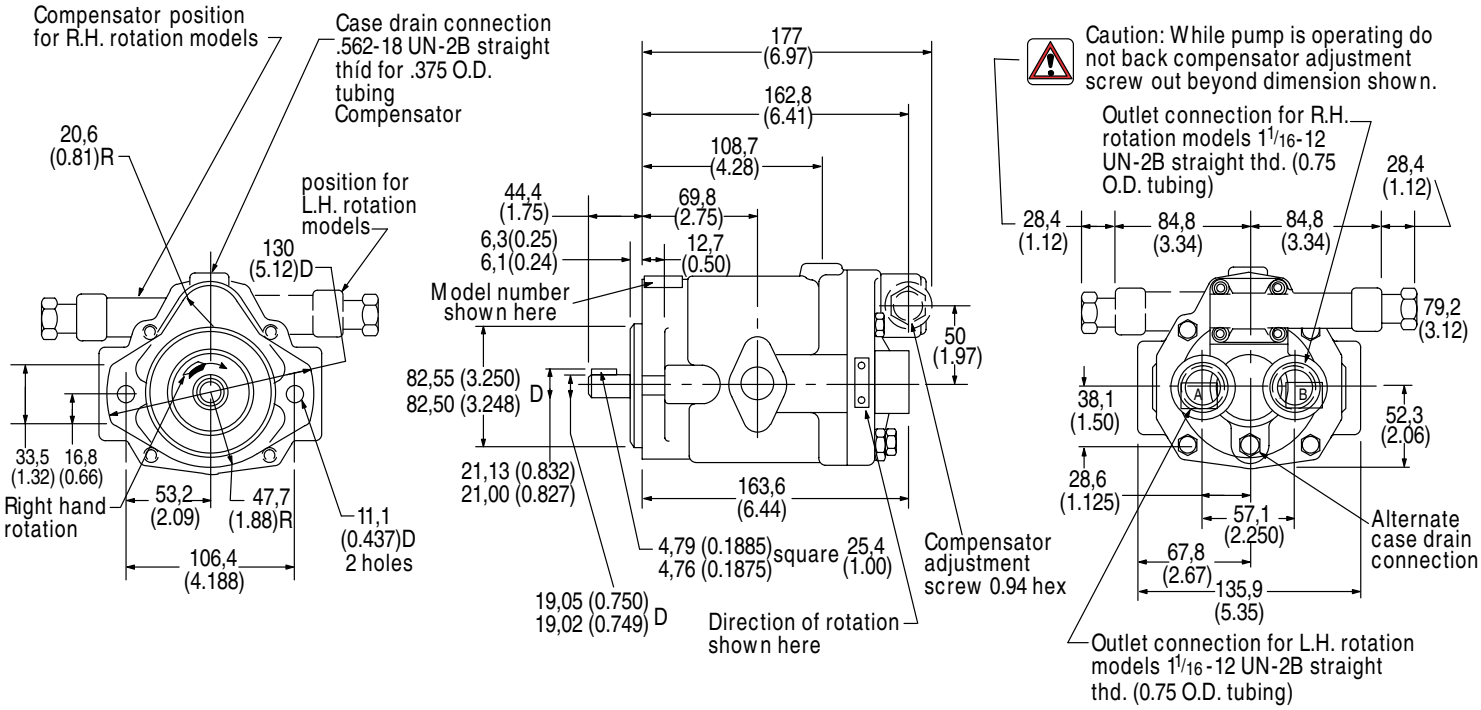
RESPONSE DATA

	PVQ10	PVQ13		
Control Type	On stroke	Off stroke	On stroke	Off stroke
Pressure compensator	0.040 sec.	0.020 sec.	0.048 sec.	0.016 sec.

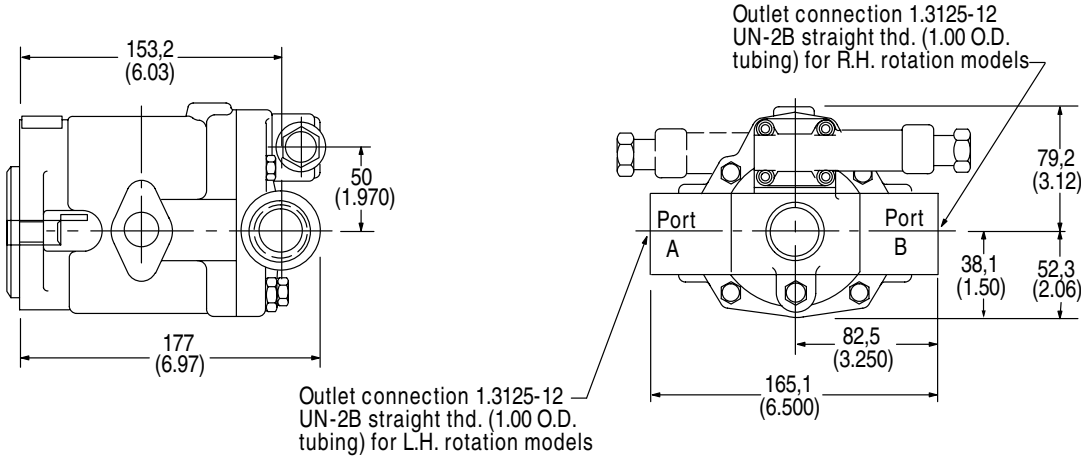
Installation Dimensions

PVQ10 and PVQ13 with Rear Ports

Millimeters (inches)

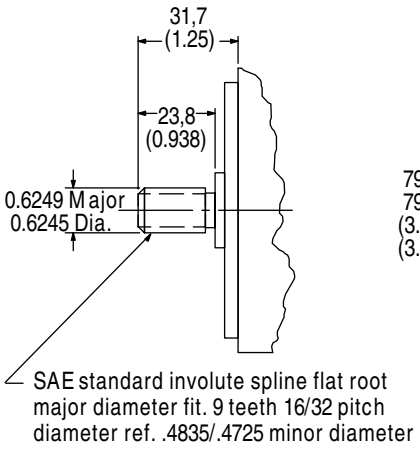


PVQ10 and PVQ13 with Side Ports



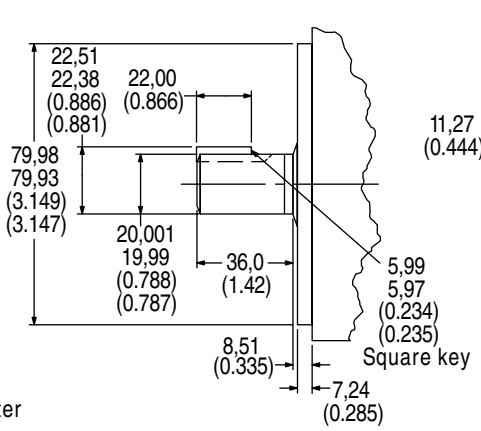
Shaft Options

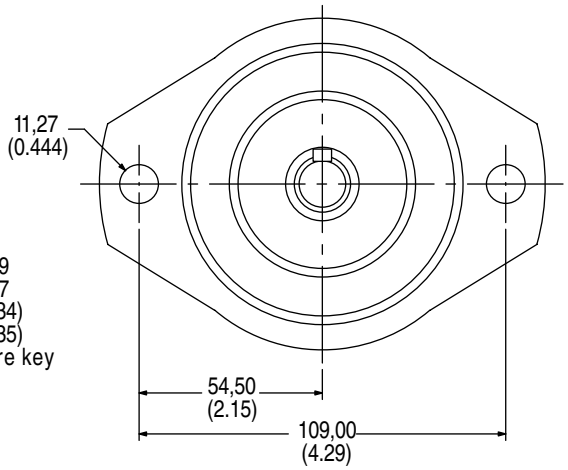
No. 3 Shaft



"N" Shaft with "MA" Flange

(Flange and shaft end ISO 3019/2-80A2HW-E20N)





Controls

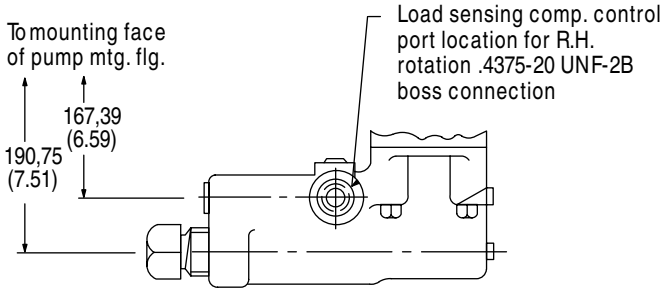
Remote Compensator

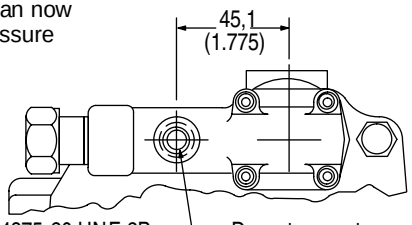
Adjustment

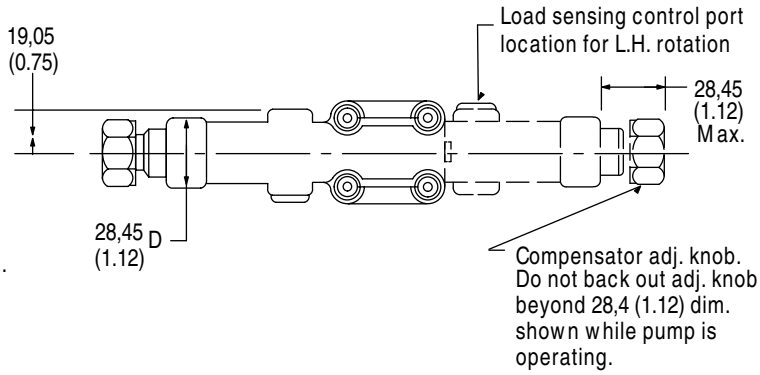
1. Turn pressure control (such as C-175) CCW to minimum setting.
2. Turn compensator adjustment plug to desired minimum pressure (17 bar, 250 psi or higher).
3. Full pressure range can now be obtained with pressure control.

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

Load-sensing with Pressure Limiting Compensator

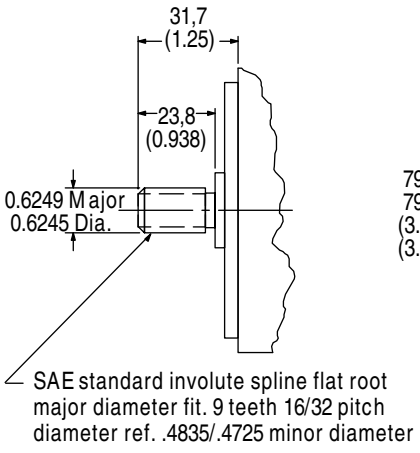






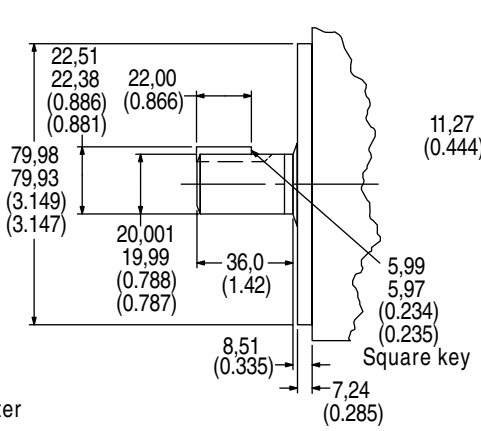
Shaft Options

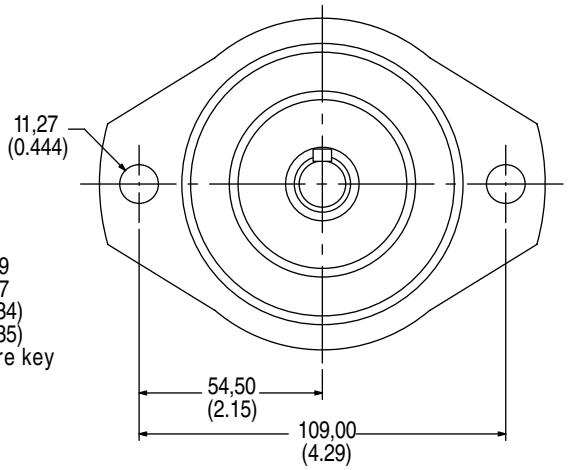
No. 3 Shaft



"N" Shaft with "MA" Flange

(Flange and shaft end ISO 3019/2-80A2HW-E20N)





Controls

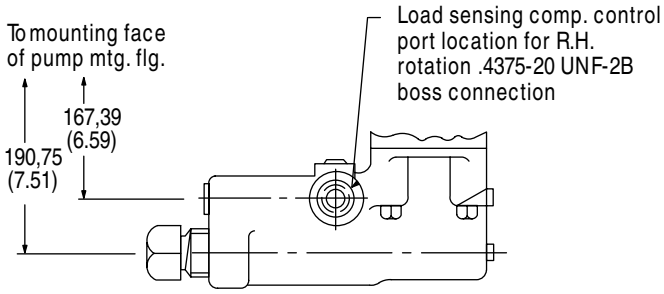
Remote Compensator

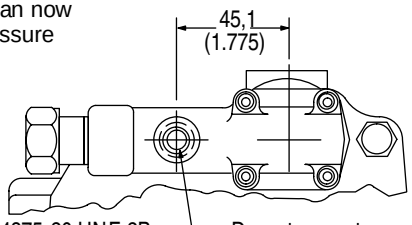
Adjustment

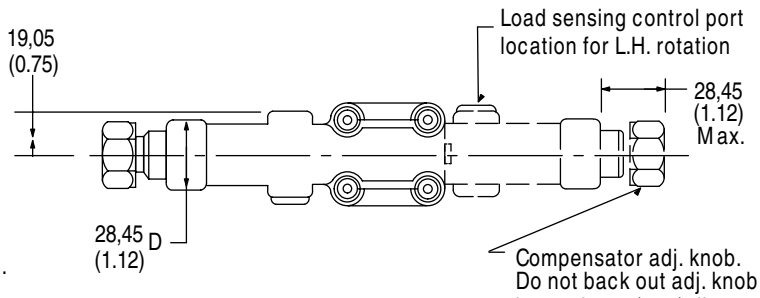
1. Turn pressure control (such as C-175) CCW to minimum setting.
2. Turn compensator adjustment plug to desired minimum pressure (17 bar, 250 psi or higher).
3. Full pressure range can now be obtained with pressure control.

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

Load-sensing with Pressure Limiting Compensator



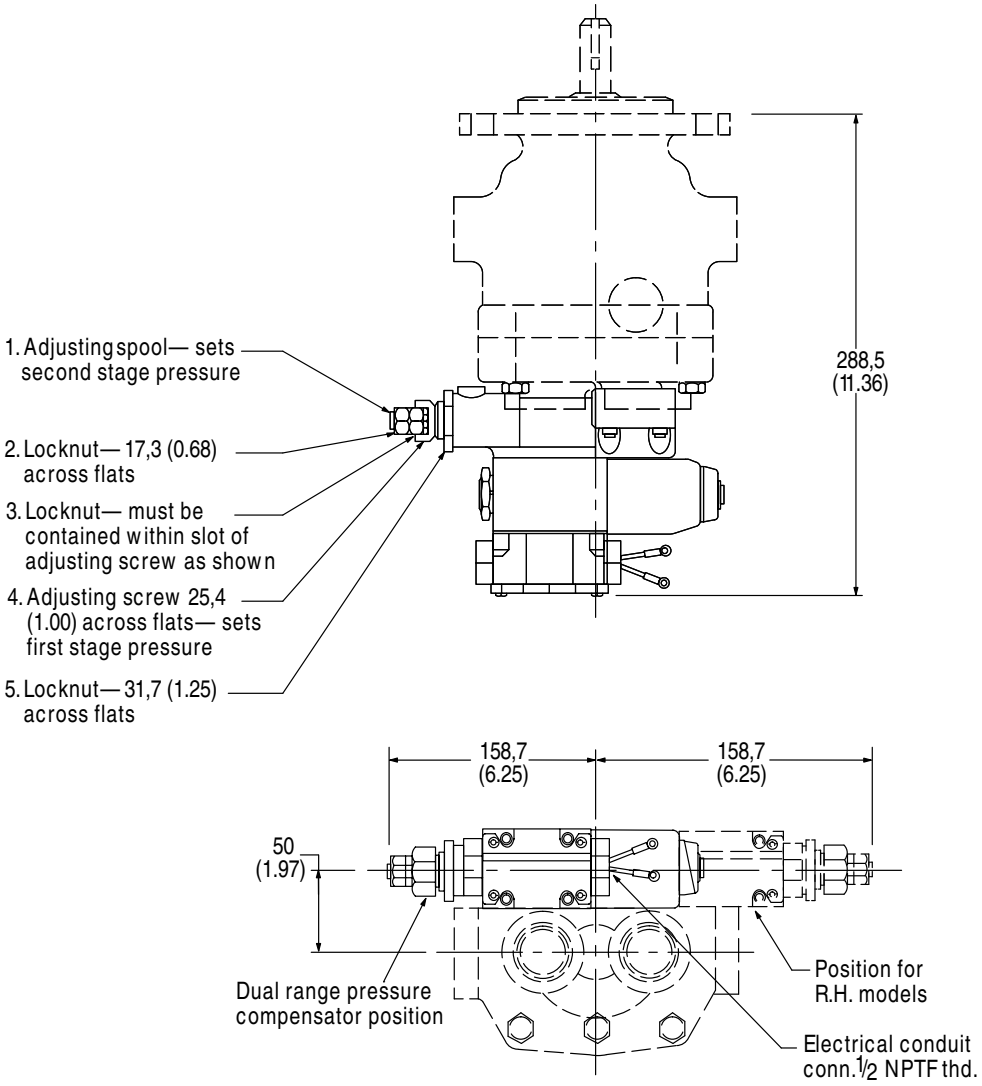




Electric Dual Range Pressure Compensator Control

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.

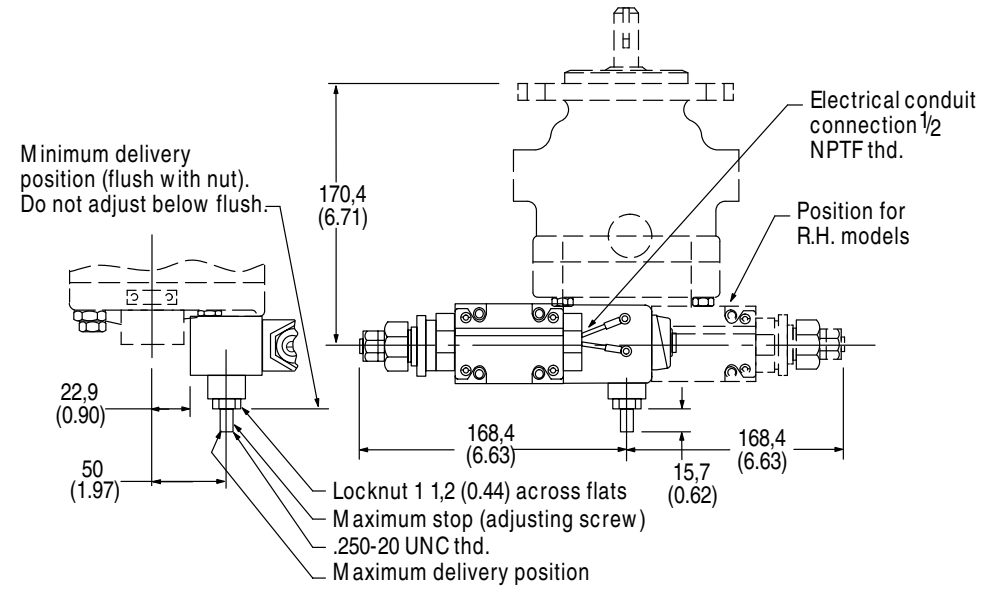
Refer to catalog GB-C-2015B for additional solenoid valve data.

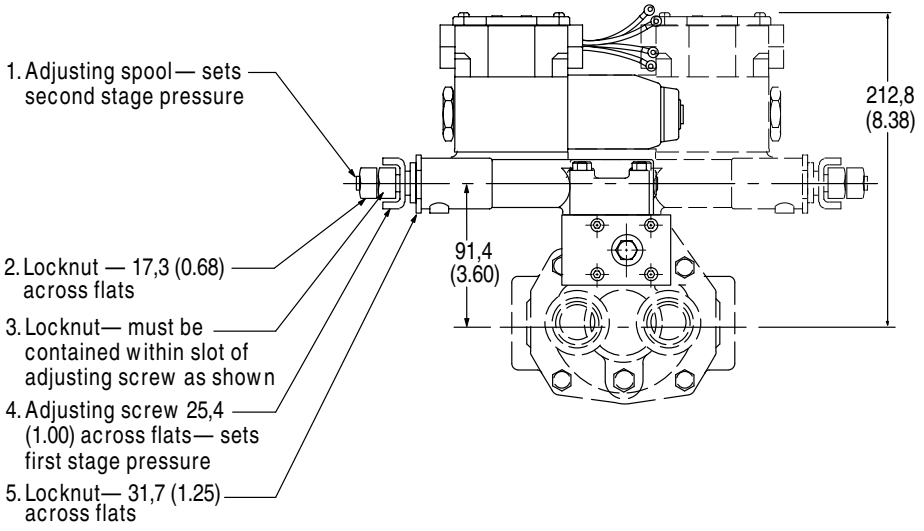
Maximum Flow Adjustment

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.

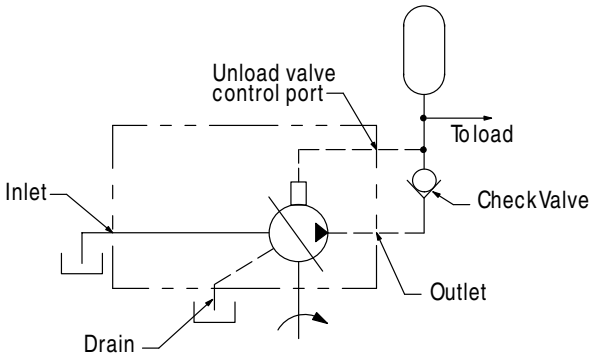
Adjustment range

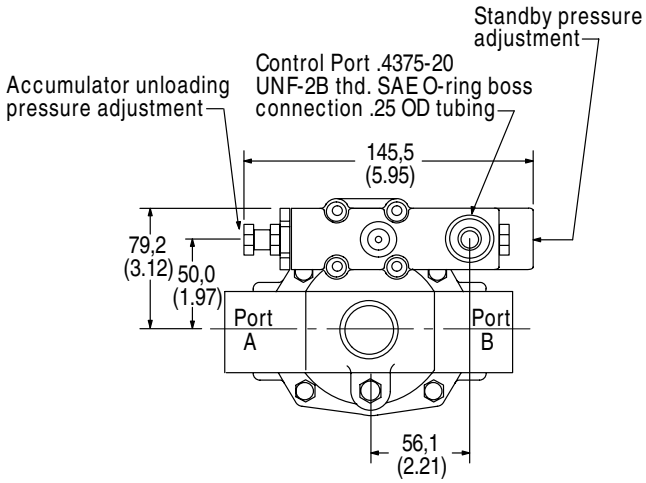
PVQ10	100-210 bar (1500-3000 psi)
PVQ13	100-140 bar (1500-2000 psi)

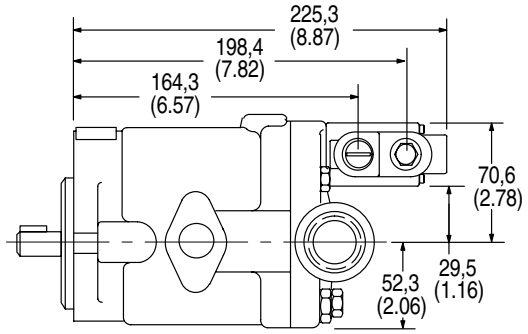
Cut-in pressure is 85% of unloading pressure, minimum.

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.







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
1,2,3	Series PVQ	P	Inline piston pump
		V	Variable volume
		Q	Quiet series
4,5	Displacement in cc/rev and pressure ratings	20	21,1 cc/rev (1.29 cir), 210 bar (3000 psi)
		32	32,9 cc/rev (2.01 cir), 140 bar (2000 psi)
6,7	Mounting flange specifications	B2	Flange SAE J744 101-2 (SAE B)
		MB	Flange ISO 3019/2-100A2HW (available with N" drive shaft only)
8	Rotation viewed from shaft end	R	Right hand (cw), standard
		L	Left hand (ccw), optional
9,10	Thru-drive without coupling (available	Blank	No thru-drive
		A9	SAE J744 82-2 (SAE A) w/9T spline with side ports only)
		A11	SAE J744 82-2 (SAE A) w/11T spline
11,12	Ports, type and location	SE	SAE O-ring rear port, 1.625" inlet and outlet (standard)
		SS	SAE O-ring side port, 1.625" inlet and outlet (optional)
13	Shafts, input	1	Straight keyed SAE "B" modified, 2.31" long
		3	Splined SAE "B" modified, 13T 16/32 DP major dia. fit
		N	Shaft end ISO 3019/2 E25N (available with "MB" mount only)
		28	26-tooth splined shaft (Eaton). Used in PVQ20/32 single to mount on PVQ40/45 "B26" thru-drive.
14	Seals	S	Buna N, standard
		F	Fluorocarbon, optional
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).

Nos	Feature	Code	Description
		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).
		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.
		C**V**P	Pressure compensator with load-sensing as C**V**B above, but with bleed-down orifice plugged.
		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.
		C**VC**P	Pressure compensator with load-sensing. Same as C**VC**B above, but with bleed-down orifice plugged.
		CG	Pressure compensator modified for hydraulic remote control.
		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).
		UV	Unloading Valve for accumultor circuits. See installation details.

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
19,20	Pressure setting	21	210 bar (3000 psi) PVQ20
		14	140 bar (2000 psi) PVQ32
21,22	Flow control option	Blank	No flow control
		V	
		VC	
23,24	Load sense differential pressure setting	Blank	No flow control
25	Flow control optional features	Blank	No flow control
		B	
		P	
26	Control option	Blank	Without adjustable maximum displacement stop (standard)
		D	Adjustable maximum displacement stop (optional)

Nos	Feature	Code	Description
27,28	Control design	12	C** and CM**
		12	C**D and CM**D
		13	C**V(C)**B and C**V(C)**P
		21	UV, CD** CG 30
29,30	Special pump option suffixes	S2	Shaft up mounting
		S3	British Standard Parallel Threads Counterbore Ports (ISO R288 threads). Contact Eaton for available configurations.
		S9	Special CG compensator for use with electronically modulated relief valves

RATINGS

Model Number System	Maximum Geometric Displacement cm^3/r (in^3/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)

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.

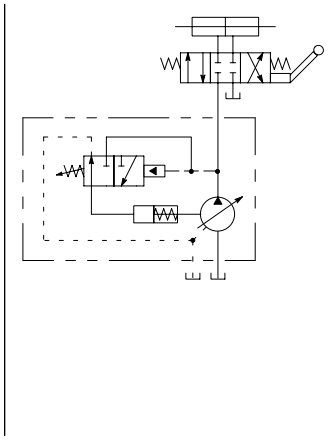
Standard load-sense differential pressure settings, by control type, follow. See model number system for setting range.

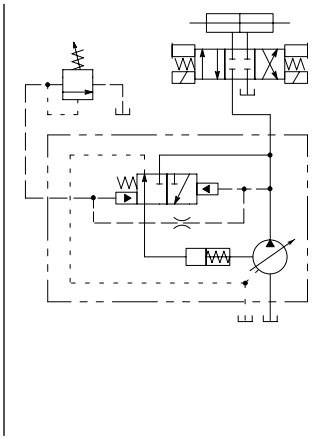
Standard load-sensing and pressure limiting control with 11 bar differential pressure (standard factory setting). Includes bleed-down orifice to exhaust load-sense signal for low-pressure standby condition.

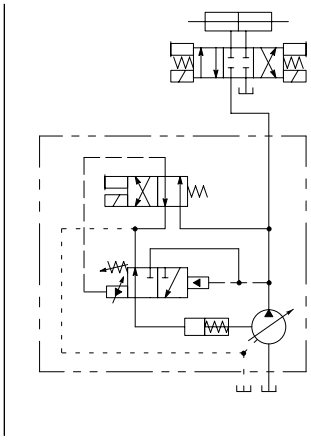
Same as C**V11B above, but with bleed-down orifice plugged.

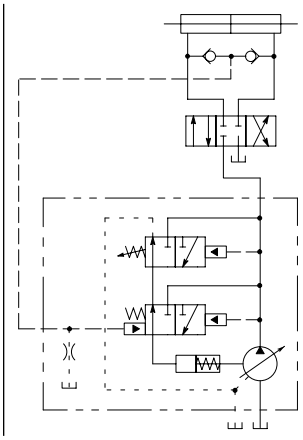
Same as C**V11B, but with factory differential pressure setting of 24 bar.

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









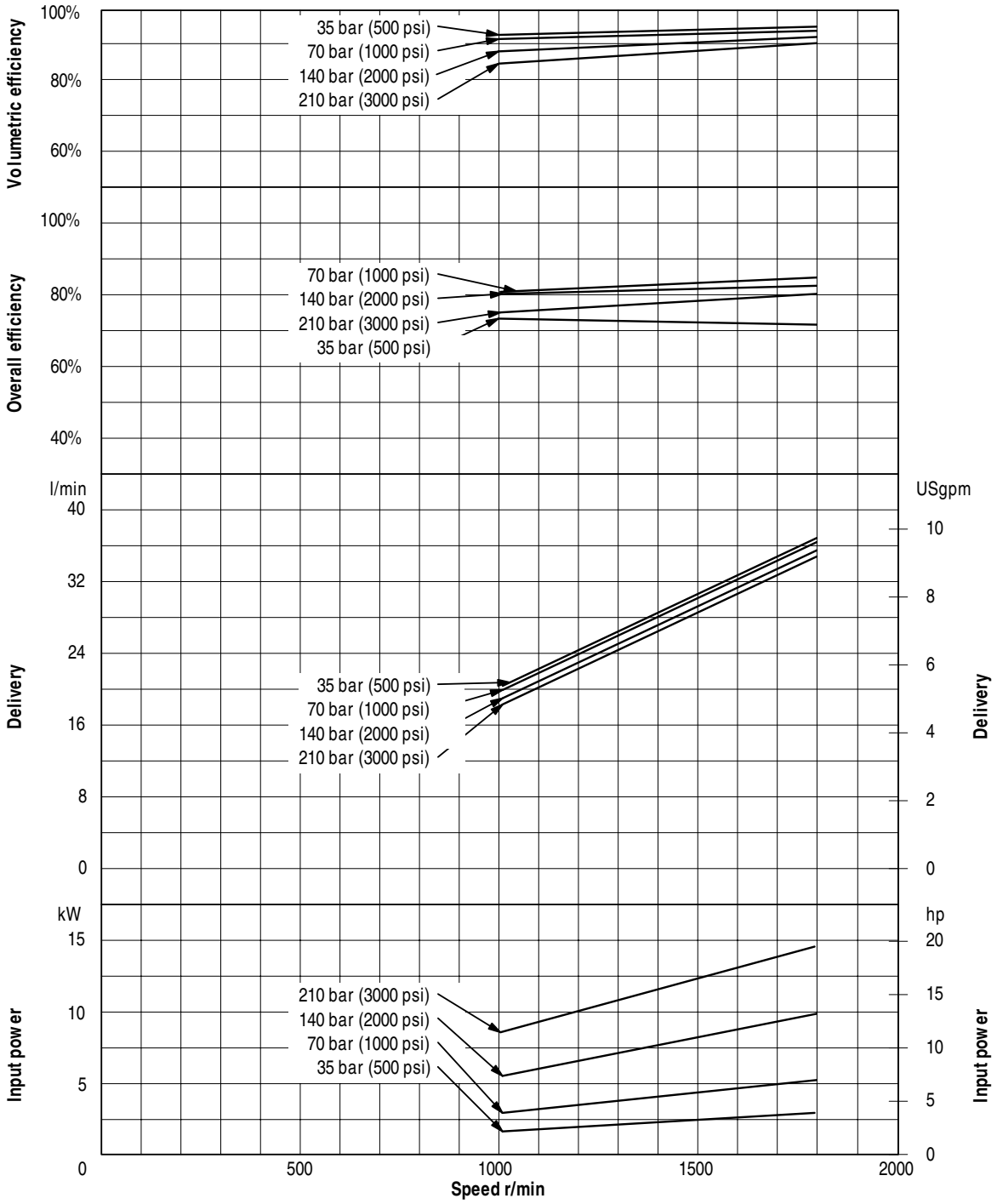
(†orifice open)
(†orifice plugged)

Performance Curves

PVQ20

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

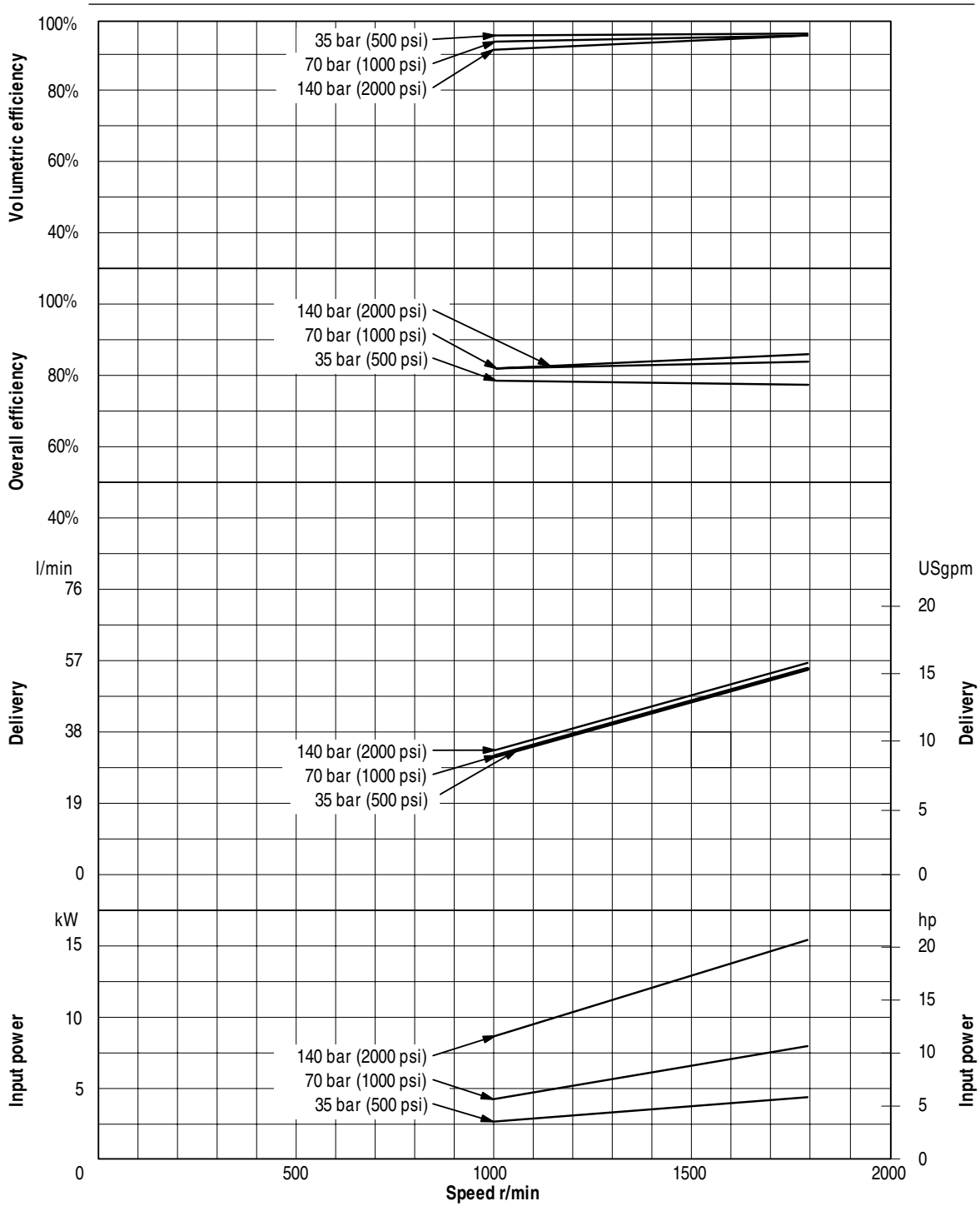
Note: To obtain full flow operation of pump, pressure compensator setting must be 14 bar (200 psi) above desired operating pressure. Full flow curves were obtained with compensator settings 14 bar (200 psi) above 210 bar (3000 psi) max. rated pressure.



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

		Sound Level dB(A)*			
		Full Stroke		Cutoff	
Speed r/min	Pressure bar (psi)	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

	PVQ20		PVQ32	
Control Type	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.

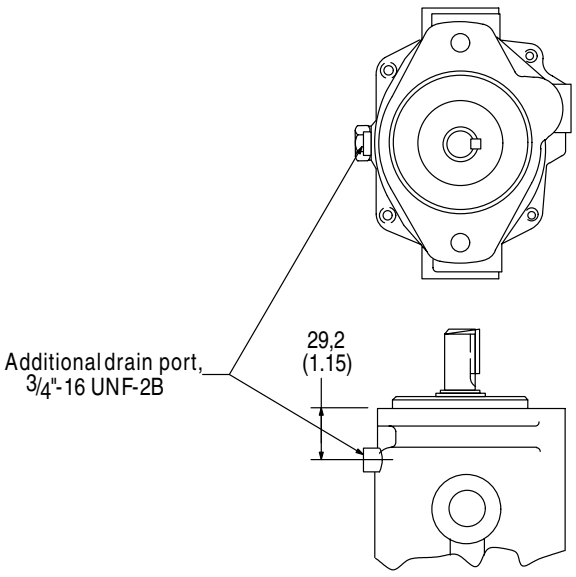
THRU-DRIVE SHAFT TORQUE DATA

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.

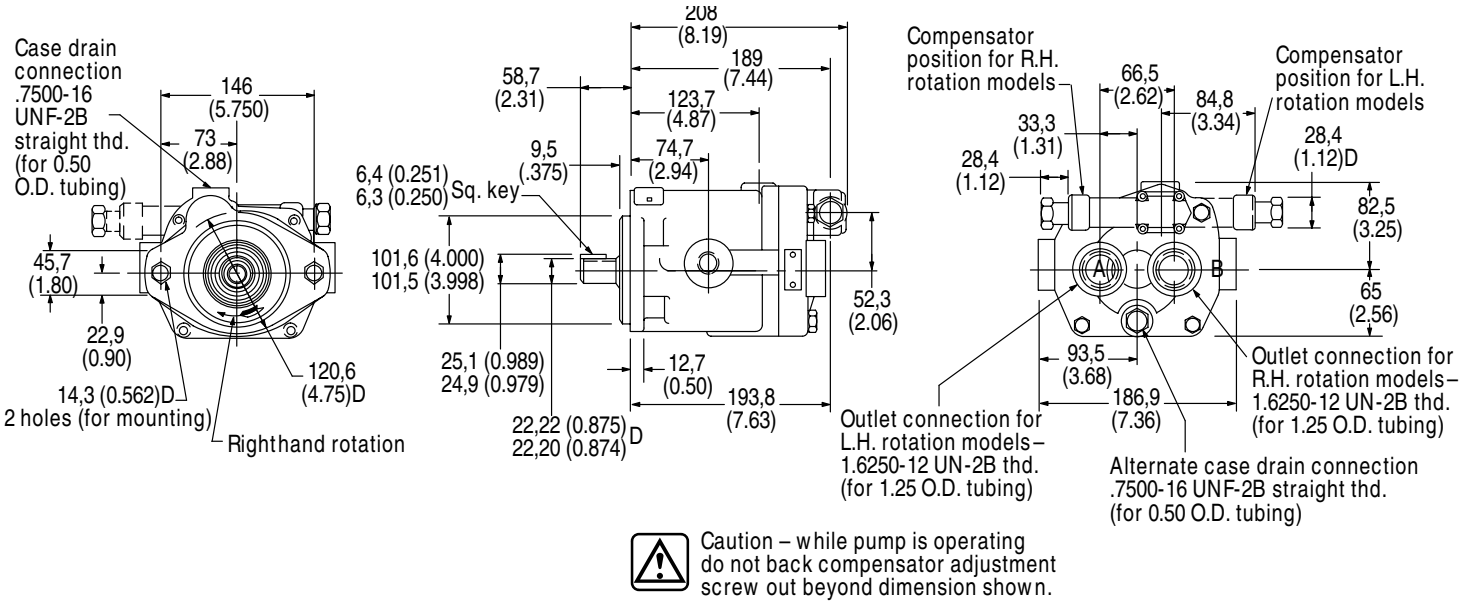
Installation Dimensions

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



Installation Dimensions

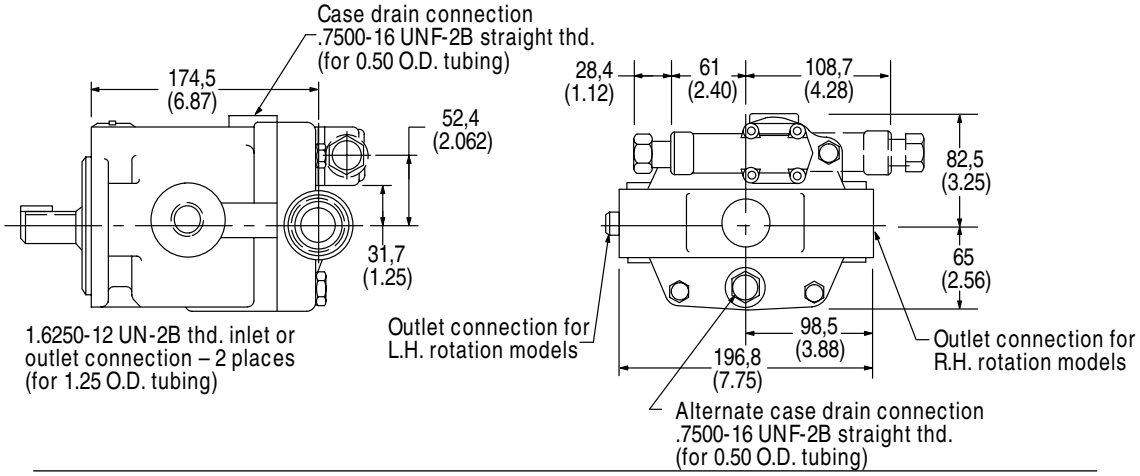
Rear Ports, "C" and "CM" Controls, No. 1 Shaft



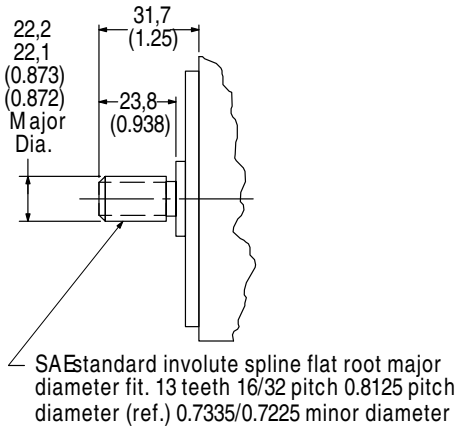
Caution – while pump is operating do not back compensator adjustment screw out beyond dimension shown.

Installation Dimensions

Side Ports

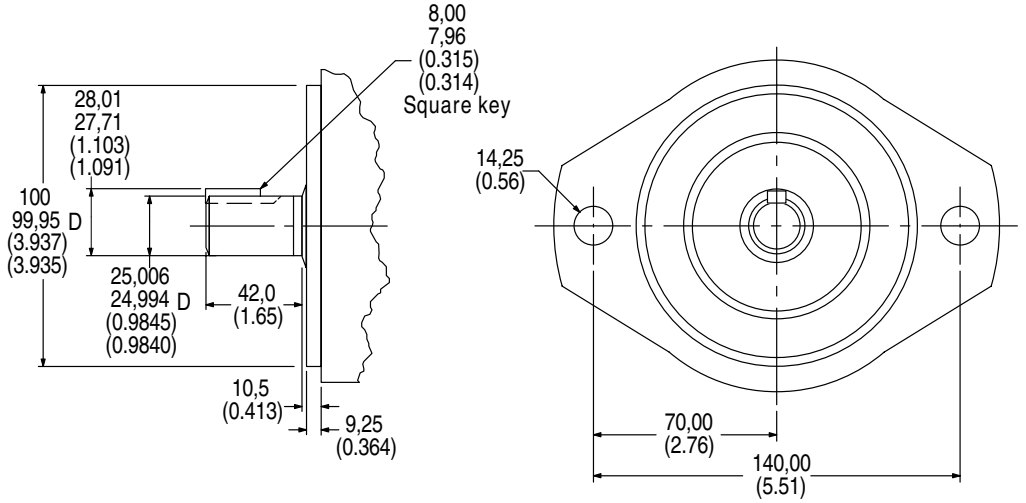


No. 3 Shaft



"N" Shaft with "MB" Flange

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

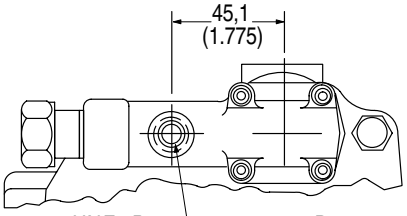


Remote Compensator

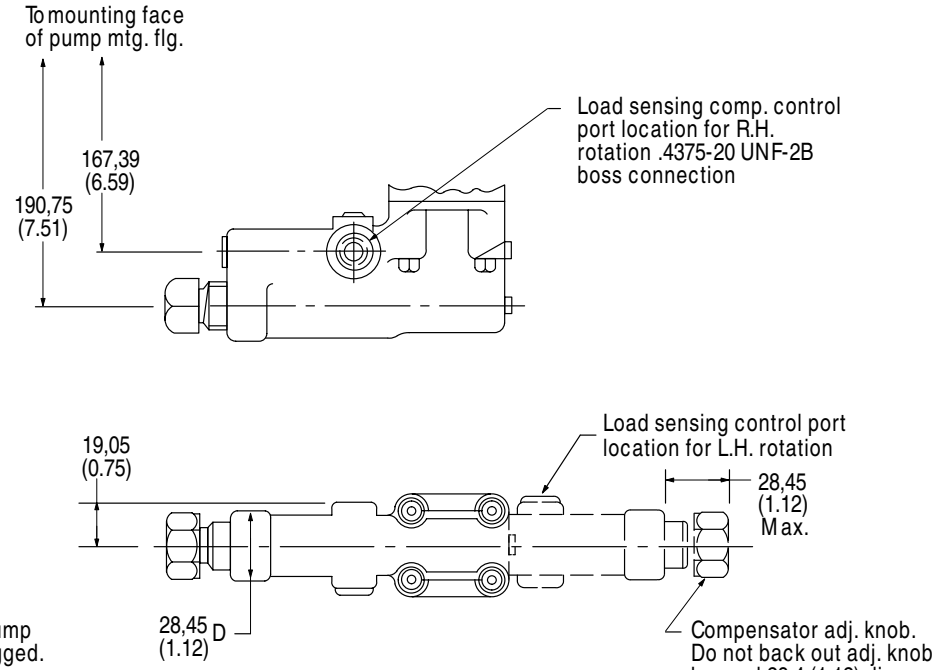
Adjustment

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.



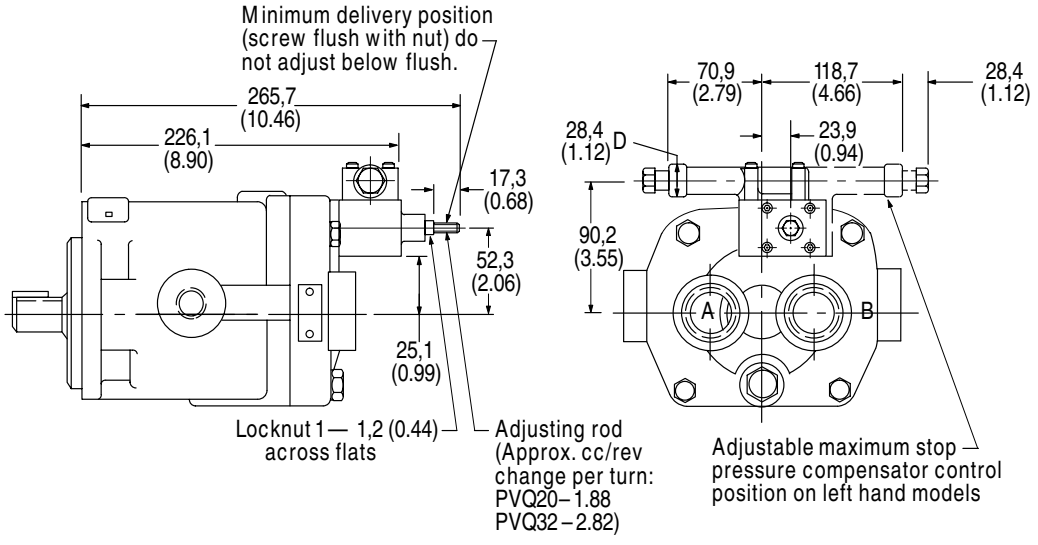
Load-sensing with Pressure Limiter



Pressure Compensator Control with Adjustable Max. Displacement Stop

Adjustment

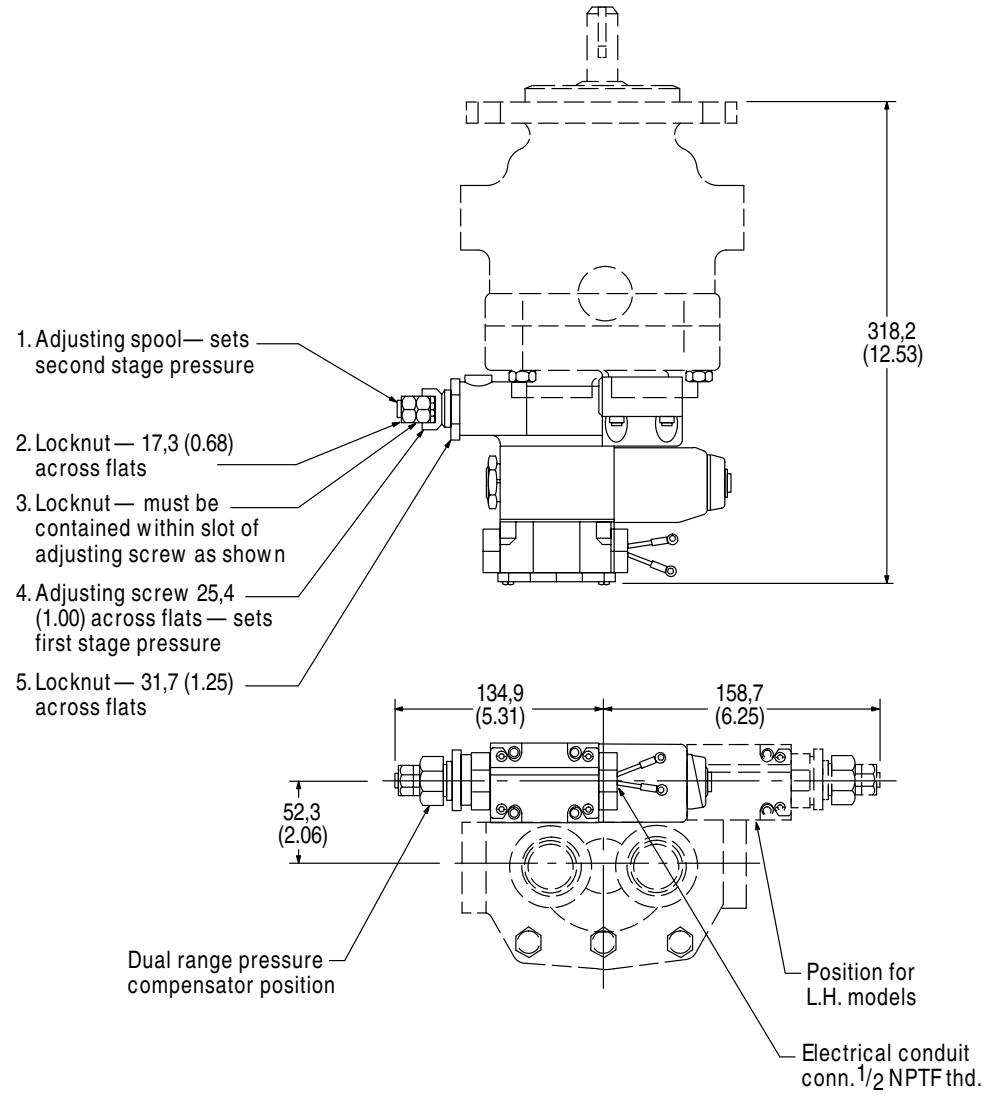
Loosen locknut on adjusting rod. Turn adjusting rod clockwise (CW) to decrease maximum pump delivery or counter-clockwise (CCW) to increase maximum pump delivery until desired setting is obtained. Secure this setting by tightening locknut.



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.

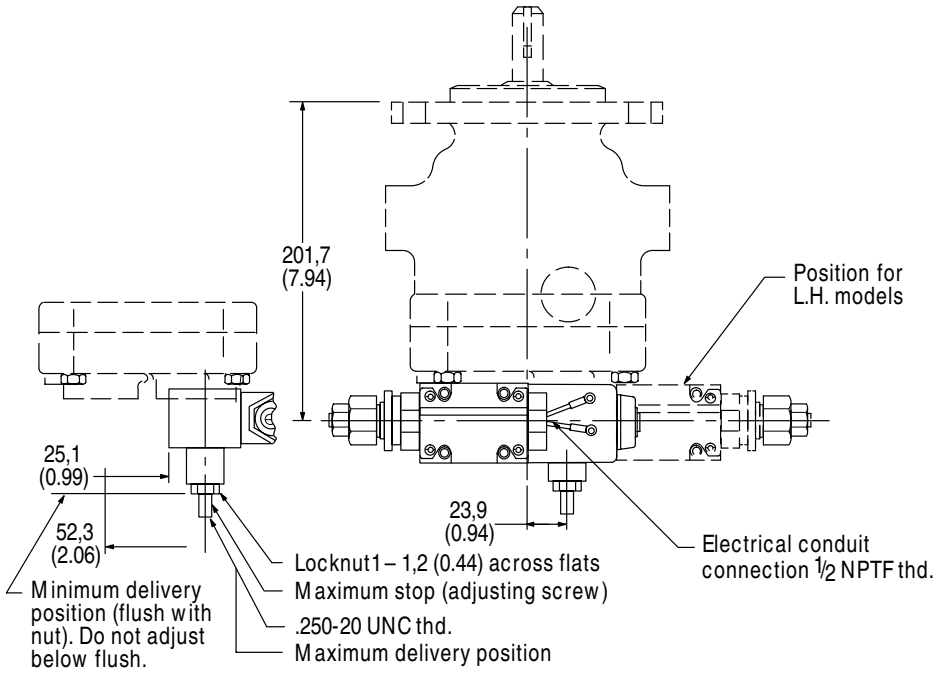
Electric Dual Range Pressure Compensator with Maximum Displacement Stop

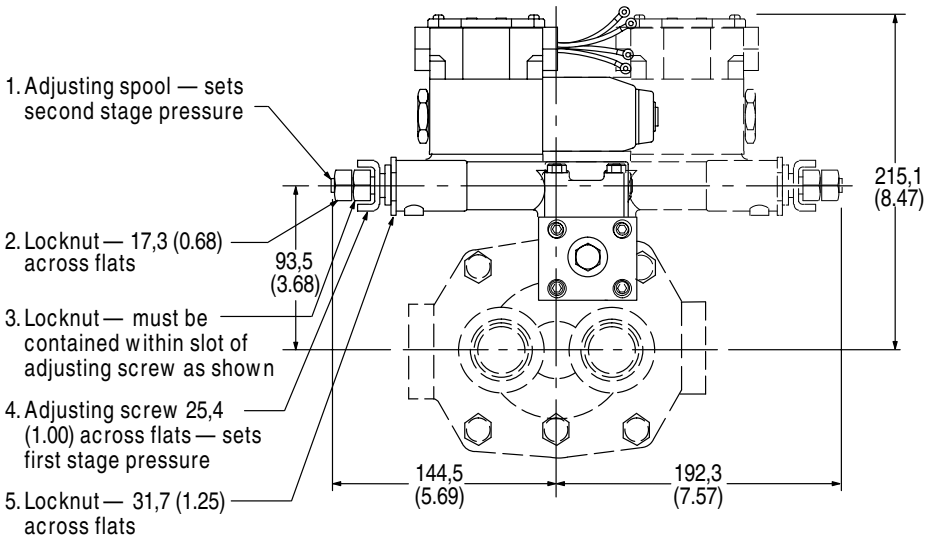
Maximum Flow Adjustment

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".





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.

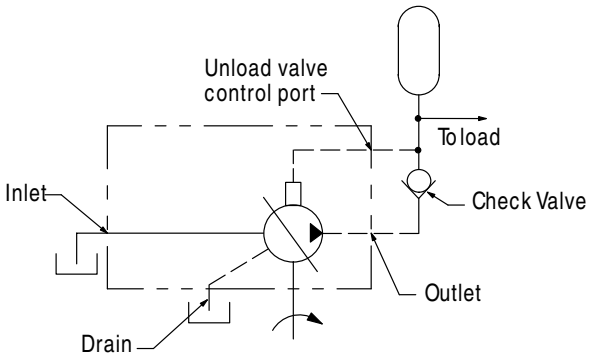
Adjustment range

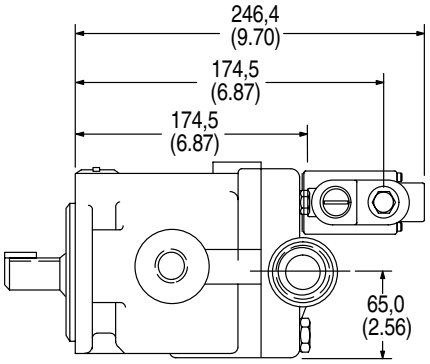
PVQ20	100-210 bar (1500-3000 psi)
PVQ32	100-140 bar (1500-2000 psi)

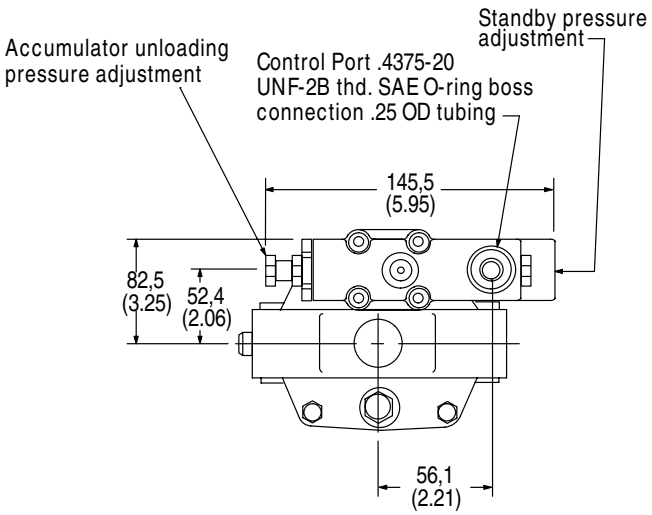
Cut-in pressure is 85% of unloading pressure, minimum.

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.

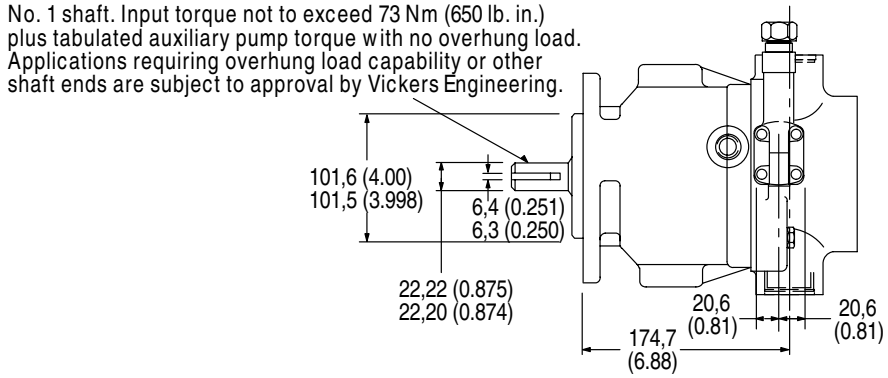




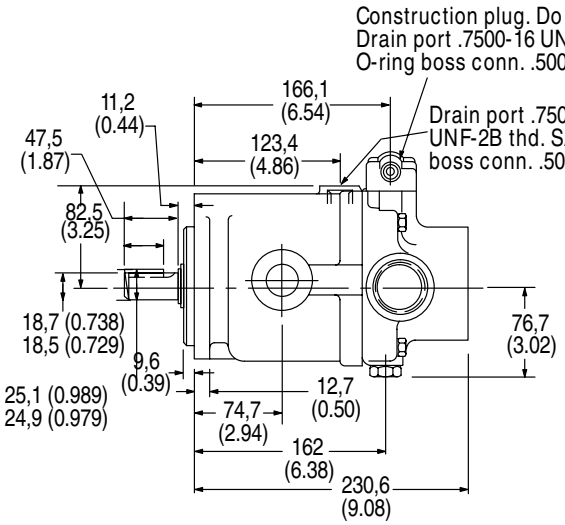


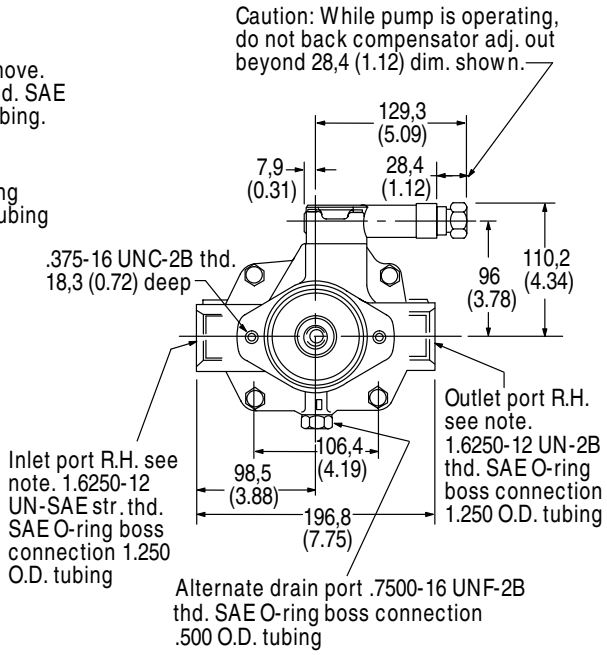
Thru-drives

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



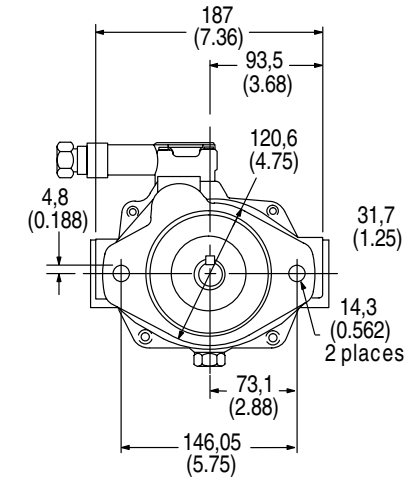
Note: Ports are reversed for L.H. rotation. Control location same for both L.H. and R.H. rotation.

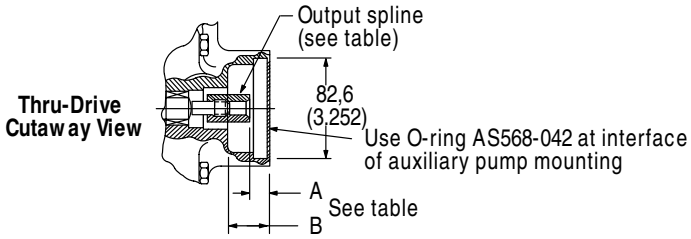




Thru-drives

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.

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

			Installation Dimensions mm (in)		
Model Number System	**Spline Data**	**Max. Torque Nm (in. lb.)**	**A**	**B**	**Coupling Kit**
"A9"	ASA B5.15-1960 9 teeth 16/32 DP Flat root side fit	58 (517)	16,7 (0.66)	33,0 (1.30)	02-136810
"A11"	ANS B92.1-1970 11 teeth 16/32 DP Flat root side fit	123 (1100)	18,5 (0.73)	39,1 (1.54)	02-306041

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

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

Model Series	**Typical Rear Pump**	**Rear Pump Shaft Code**	**Thru-drive Coupling Kit**
"A9"	PVQ10/13	3	02-136810
	PVB5/6	S124 suffix	
	V10	11	
	V20	62	

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

Model Number System

PVQ25

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	31
P	V	Q	2	5	A	R	1	1	A	A	1	0	B	1	1	2	4	0	0	A	2	0	0	1	A	P	C	9	0	1

Nos	Feature	Code	Description
1,2	Code title	PV	Open circuit piston pump
3,4,5,6	Displacement	Q25A	25.2cm^3/r [1.54 in^3/r]
7	Input shaft rotation	L	Left-hand rotation (CCW)
		R	Right-hand rotation (CW)
8,9	Front mounting and input shaft	01	2 Bolt B (SAE J744-101-2) with 22.2 [.88] DIA straight keyed shaft (SAE J744-22-1), key included
		05	2 Bolt B (SAE J744-101-2) with 13T 16/32DP 41.1 [1.62] long splined shaft
		09	2 Bolt B (SAE J744-101-2) with 26T 32/64DP splined shaft
		10	Shaft-2 Bolt VDMA A with 25.0 [.984] DIA straight keyed shaft, key included
10,11	Main ports location and size	AU	End ports; tube ports per SAE J514, suction 1.625-12 UN-2B, pressure – 1.0625-12 UN-2B SAE
		AV	End ports; tube ports per ISO 6149-1, suction M42 x 2, pressure – M27 x 2
12	Drain port size	6	M18 metric O-ring port – top (D1)
		7	M18 metric O-ring port – bottom (D2)
		8	M18 mertic O-ring port – shaft up
		B	.750-16 UNF-2B SAE O-ring port – top (D1)
		C	.750-16 UNF-2B SAE O-ring port – bottom (D2)
		D	.750-16 UNF-2B SAE O-ring port – shaft up
13	Diagnostic pressure point	0	No diagnostic pressure point
14	Controller type	C	Electric dual range pressure Compensator with directional control valve
		E	Unloading valve (accumulator circuits)
		G	Adjustable pressure compensator
		H	Adjustable pressure and flow compensator
		J	Adjustable hydraulic remote control pressure compensator
15,16	Pressure comp./ unloading valve setting	07	65.5-72.4 bar [950-1050 lbf/in2]
		33	206.8-213.7 bar [3000-3100 lbf/in2]
17,18	Flow comp. setting or unload VLV standby	00	No flow compensator setting
		11	9.65-12.41 bar [140-180 lbf/in2]
		24	22.75-25.51 bar [330-370 lbf/in2]
19,20	Secondary compensator setting	00	No secondary compensator setting
		04	186.2-193.1 bar [2700-2800 lbf/in2]
21	Control special features	0	No special features
		A	Bleed down orifice –
		B	External manual stroke adjustment
22	Maximum displacement option	1	Standard displacement
		2	Adjustable maximum displacement (set at maximum)

Note: Consult an Eaton representative for additional settings

Model Number System

PVQ25

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	31
P	V	Q	2	5	A	R	1	1	A	A	1	0	B	1	1	2	4	0	0	A	2	0	0	1	A	P	C	9	0	1

Nos	Feature	Code	Description
23,24	Auxiliary mounting and output shaft	00	No auxiliary mounting or output shaft
25	Shaft seals	0	No shaft seal
		1	Standard shaft seal (nitrile) Vitron option
		3	Flurocarbon
		4	HNBR shaft seal luster glycol fluids
26,27	Special features	AP	Cast iron housing and industrial timing
28,29	Paint	00	No paint
		CD	Blue primer
30	Customer and unit identification	0	STD – mark assembly Number and build data Code on plate
31	Design code	A	First

Note: Consult an Eaton representative for additional settings

RATINGS

Model Number System	Maximum Geometric Displacement cm^3/r (in^3/r)	Rated Speed r/min	Maximum Pressure bar (psi)	Input Power at Max. Pressure and Rated Speed kW (hp)	Approx. Weight kg (lb)
PVQ25	25,2 (1.54)	1800	210 (3000)	16 (24)	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)

"G" Option

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 (PVQ025) 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.

"J" Option

Remote Control Pressure Compensator

Exactly the same as the 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.

"C" Option

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 (PVQ025) 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.

"H" Option

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.

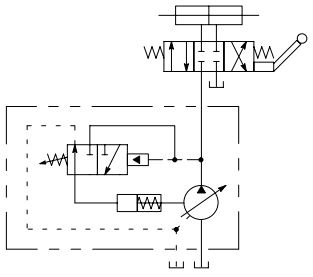
Standard load-sense differential pressure settings, by control type, follow. See model number system for setting range.

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.

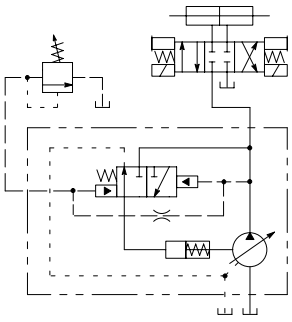
Other Standard Load Sense Options:

1. Bleed-down orifice plugged.
2. Factory differential pressure setting of 24 bar.

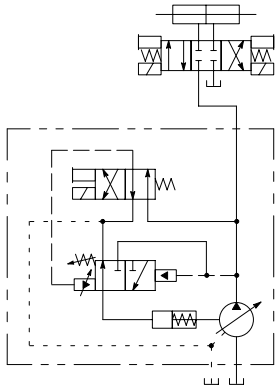
"G" Option



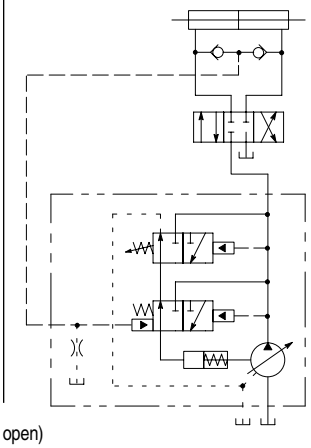
"J" Option



"H" Option



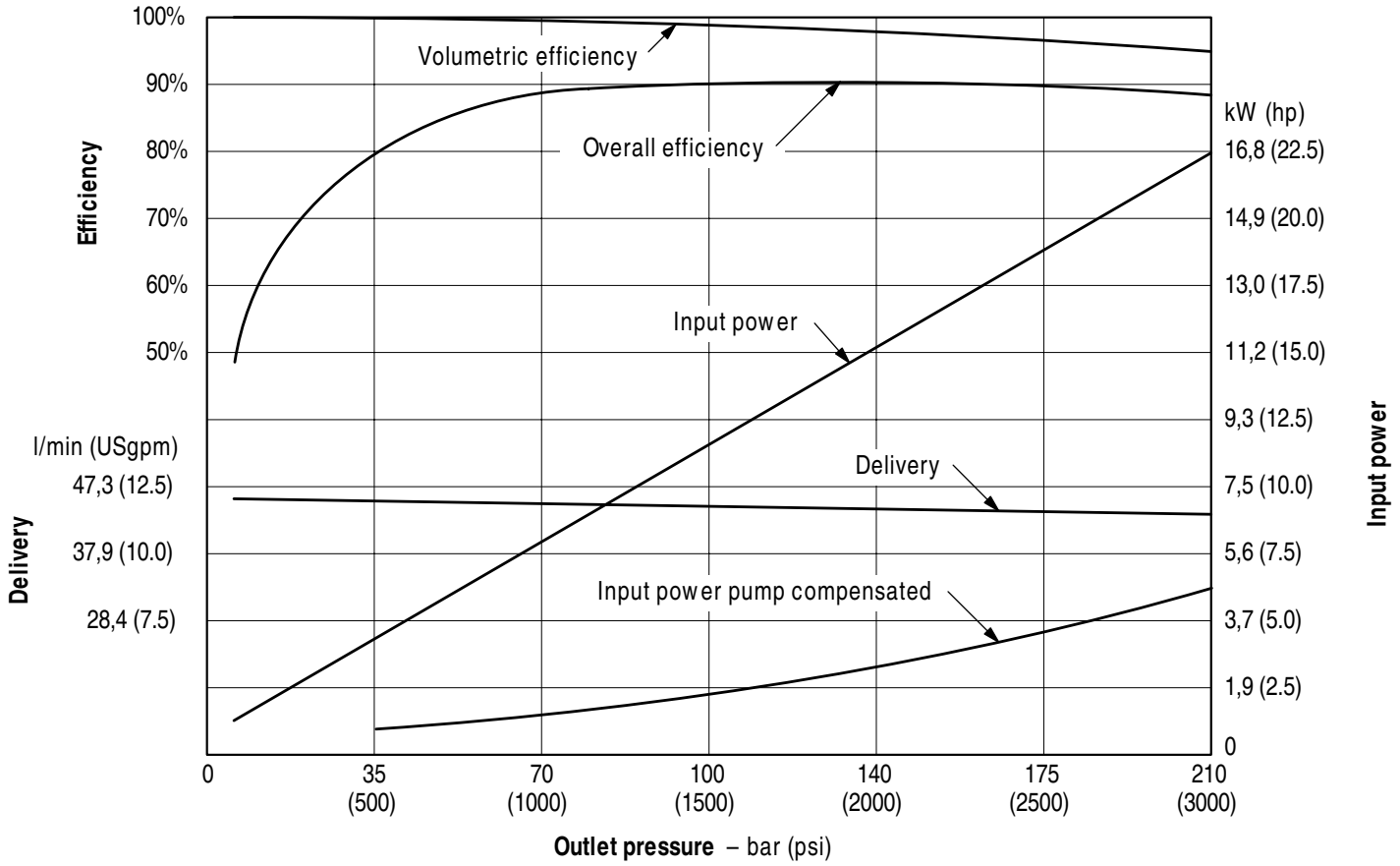
"C" Option



(†orifice open)
(†orifice plugged)

PVQ25 Performance Curves

Performance at 1800 r/min
Oil type: SAE 10W
Oil temp: 50°C (120°F)
Inlet pressure: 0 psi



PVQ25
Operating Data

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
1000	35 (500)	56.5	54.9
	70 (1000)	57.7	58.3
	100 (1500)	58.6	60.0
	140 (2000)	59.5	61.3
	175 (2500)	60.9	62.0
	210 (3000)	66.6	63.1
1200	35 (500)	60.9	56.9
	70 (1000)	62.4	60.1
	100 (1500)	63.1	62.3
	140 (2000)	63.3	63.6
	175 (2500)	63.8	64.5
	210 (3000)	63.8	65.5
1500	35 (500)	61.9	57.7
	70 (1000)	63.5	61.9
	100 (1500)	64.2	62.7
	140 (2000)	65.3	63.3
	175 (2500)	65.1	64.7
	210 (3000)	65.9	65.3
1800	35 (500)	64.0	59.0
	70 (1000)	65.2	62.0
	100 (1500)	66.0	63.4
	140 (2000)	67.1	64.4
	175 (2500)	67.5	65.7
	210 (3000)	67.4	66.6

*Sound pressure data equivalent to NFPA Standard.

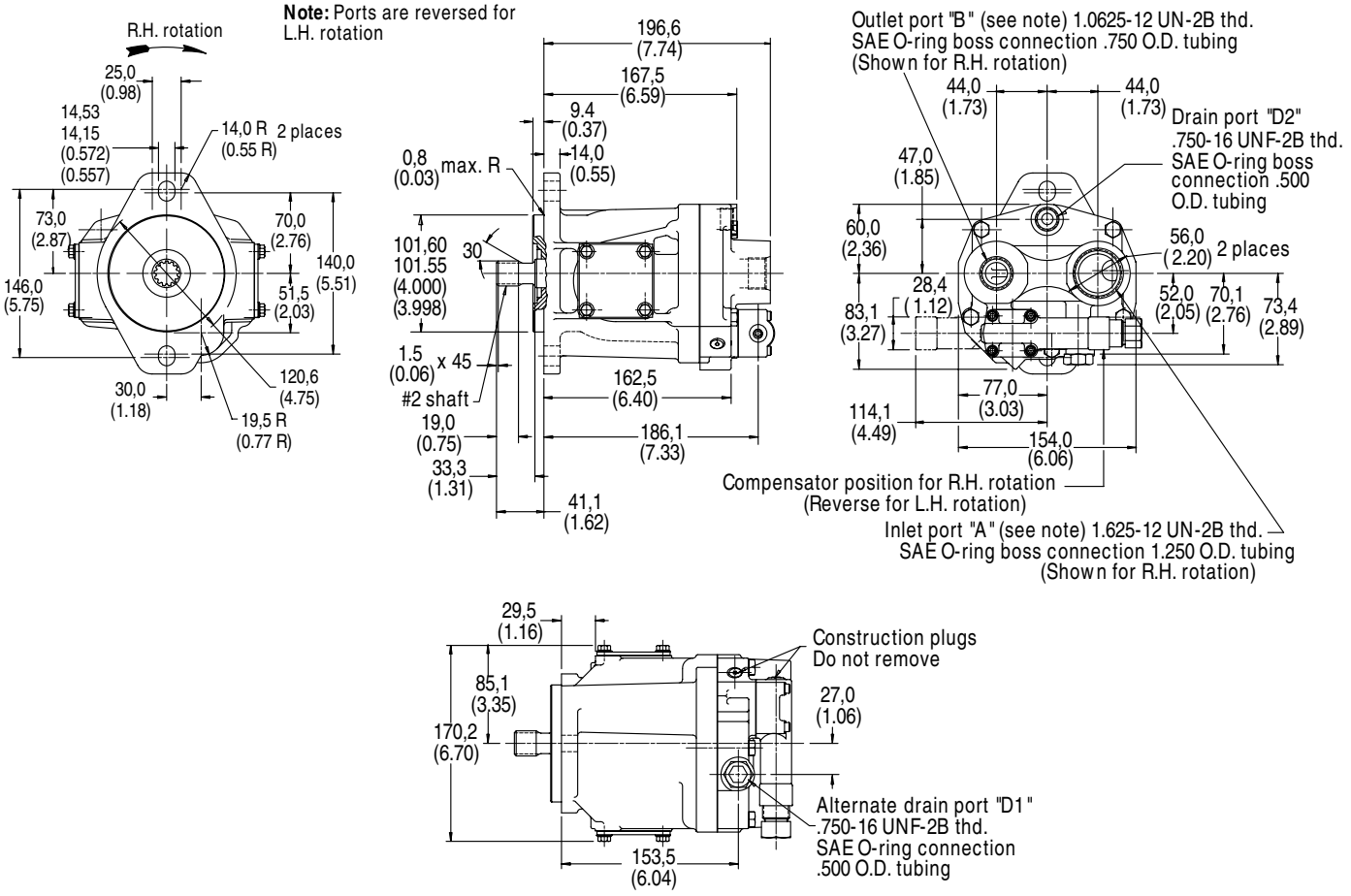
Response Data

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.

Control Type	On stroke	Off stroke
Pressure compensator	0.030 sec.	0.012 sec.
Load sense compensator	0.040 sec.	0.012 sec.

Installation Drawings

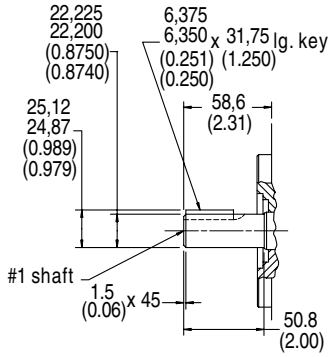
PVQ25 with Pressure Compensator Control



Shaft Options

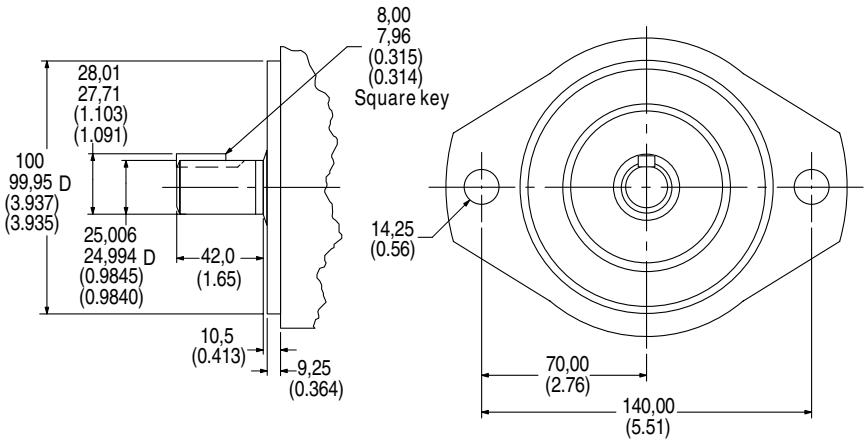
No. 1 Shaft

SAE "B" Straight keyed

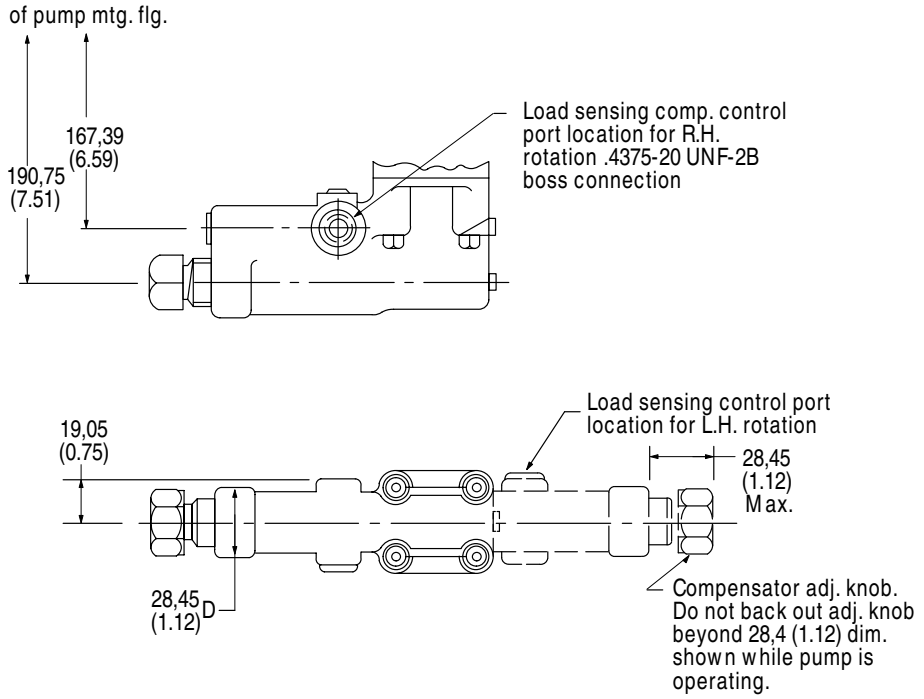


No. 10 Mounting and Input Shaft

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



Load Sensing with Pressure Limiter

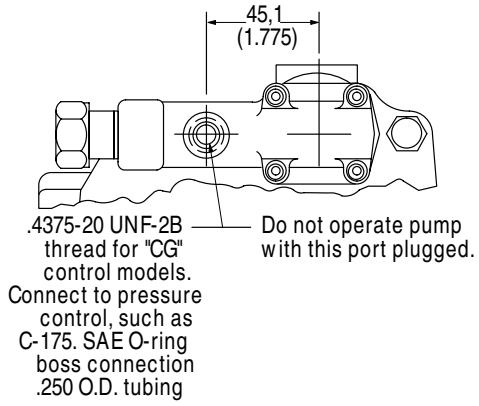


Remote Compensator

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.

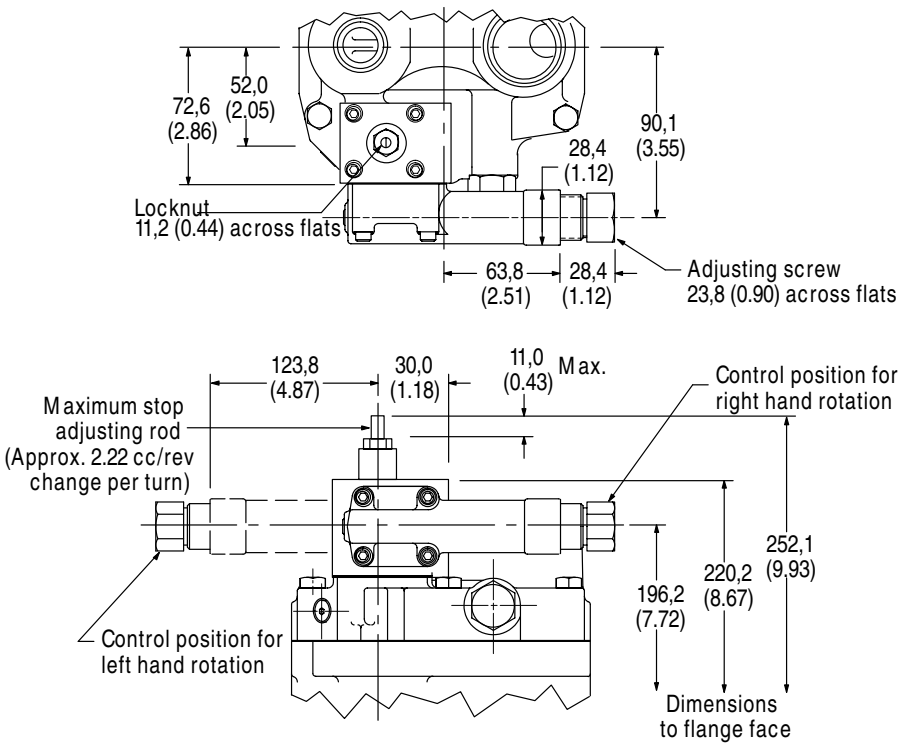
Caution: Effective compensator pressure will be compensator control setting (17-69 bar, 250-1000 psig) plus remote relief valve setting.



Pressure Compensator Control with Adjustable Max. Displacement Stop

Adjustment

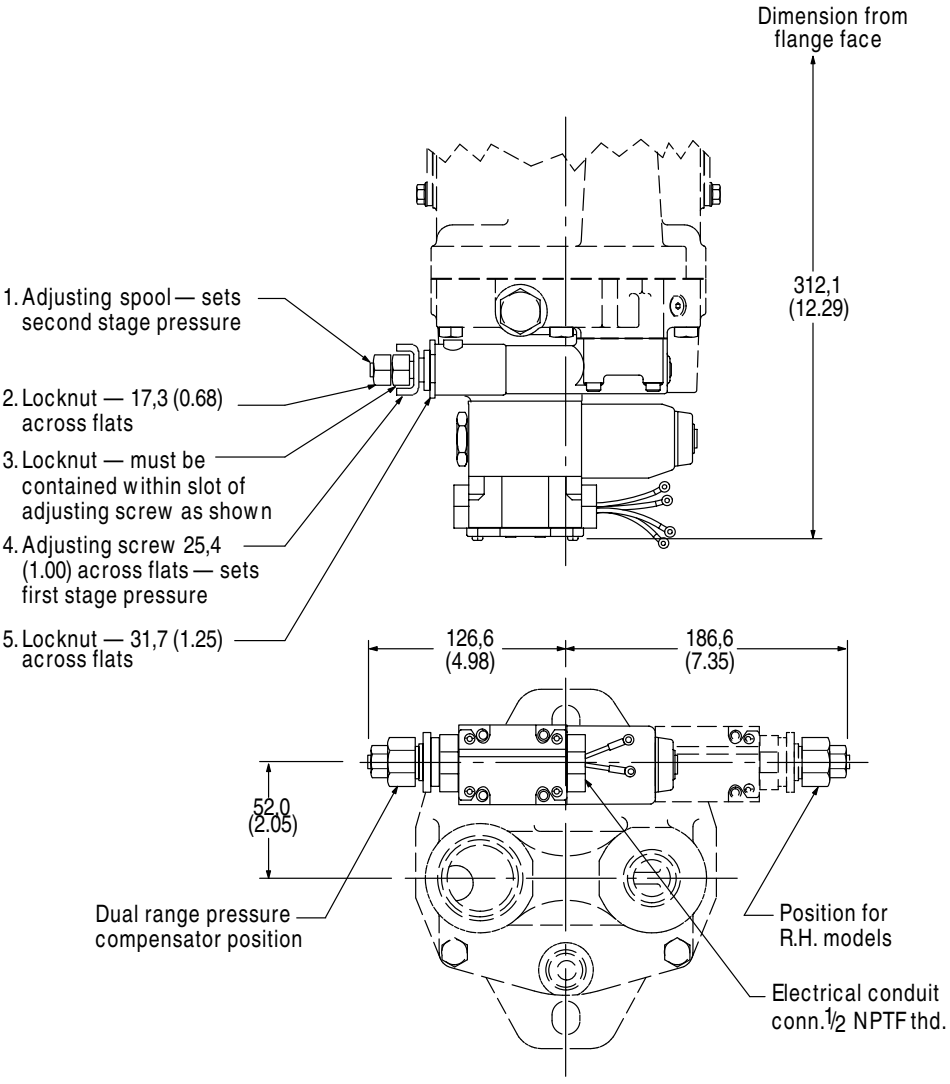
Loosen locknut on adjusting rod. Turn adjusting rod clockwise (CW) to decrease maximum pump delivery or counterclockwise (CCW) to increase maximum pump delivery until desired setting is obtained. Secure this setting by tightening locknut.



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.

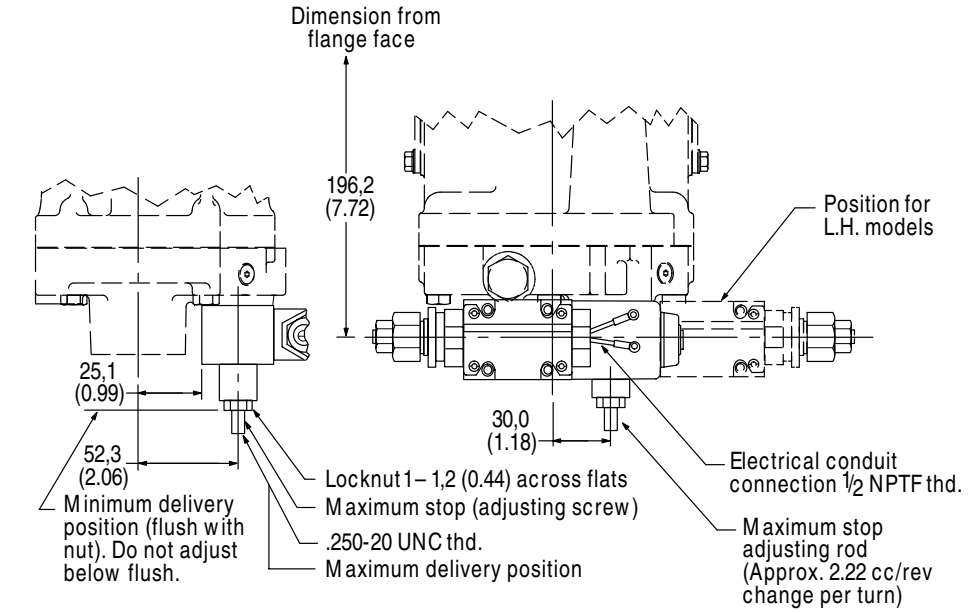
Controls
Electric Dual Range Pressure Compensator with Maximum Displacement Stop

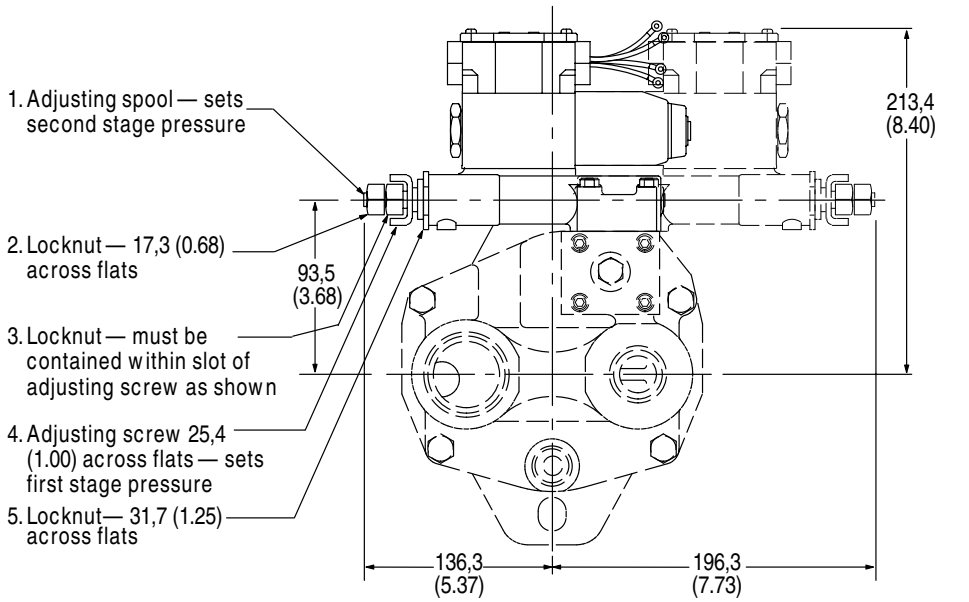
Maximum Flow Adjustment

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 – " E" Option

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.

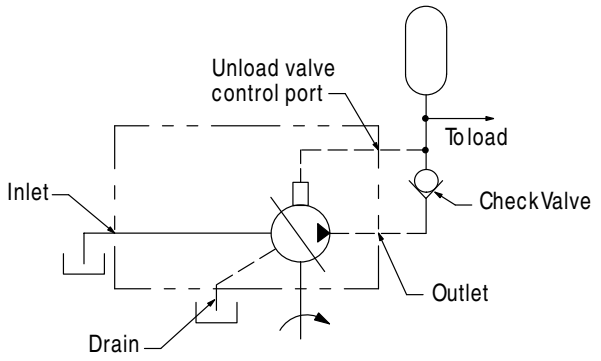
Adjustment range

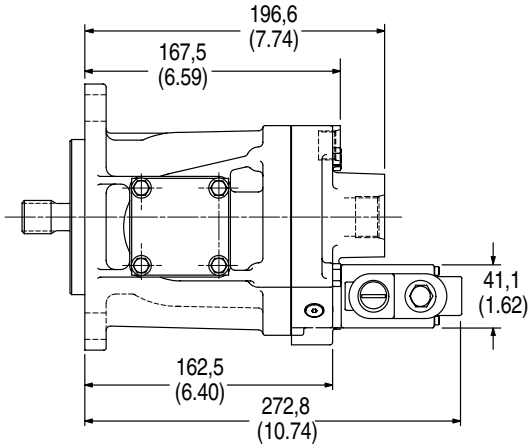
PVQ25 100-210 bar (1500-3000 psi)

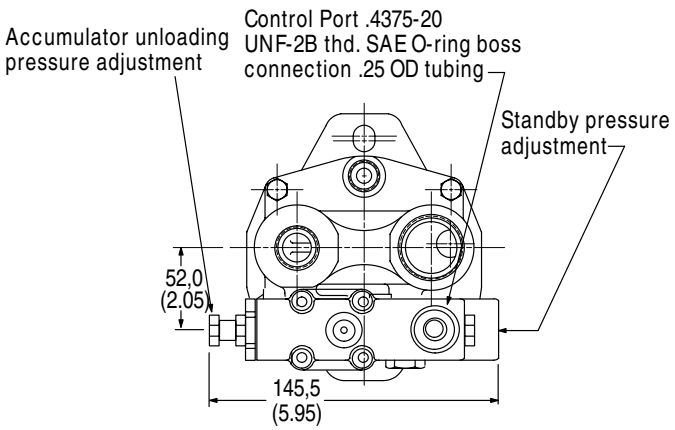
Cut-in pressure is 85% of unloading pressure, minimum.

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.







Model Number System
PVQ40 and PVQ45

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	31
P	V	Q	4	0	A	R	1	1	A	A	1	0	B	1	1	2	4	0	0	A	1	A	A	1	A	F	C	D	0	1

Nos	Feature	Code	Description
1,2	Code title	PV	Open circuit piston pump
3,4,5,6	Displacement	Q40A	41.0cm³/r [2.50 in³/r]
		Q45A	45.1cm³/4 [2.75 in³/r]
7	Input shaft rotation	L	Left-hand rotation (CCW)
		R	Right-hand rotation (CW)
8,9	Front mounting and input shaft	01	2 Bolt B (SAE J744-101-2) with 22.2 [.88] DIA straight key shaft (SAE J744-22-1) (key included)
		02	2 Bolt B-B (SAE J744-101-2) with 25.4 [1.00] DIA straight key shaft (SAE J744-25-1) (key included)
		05	2 Bolt B-B (SAE J744-101-2) with 13T 16/32DP 41.1 [1.62] long splined shaft
		08	2 Bolt B-B (SAE J744-101-2) with 15T 16/32DP splined shaft
		09	2 Bolt B (SAE J744-101-2) with 26T 32/64DP splined shaft
		10	Shaft-2 Bolt VDMA A with25.0 [.984] DIA straight keyed shaft, key included
10,11	Main ports location and size	AA	Side ports; tube ports per SAE J514, suction – 1.875-12 UN-2B, pressure – 1.3125-12 UN-2B
		AB	End ports; tube ports per SAE J514, suction – 1.875-12 UN-2B, pressure – 1.3125-12 UN-2B
		AC	Side ports; SAE J518 flange, suction – 1.500 SAE 4-bolt split flange port (code 61); pressure – 1.000 SAE 4-bolt split flange port (code 61)
		AD	End ports; SAE J518 flange, suction – 1.500 SAE 4-bolt split flange port (code 61); pressure – 1.000 SAE 4-bolt split flange port (code 61)
		AE	Side ports; ISO 6149-1 tube, suction – M48 X 2, pressure – M33 X 2
		AF	End ports; ISO 6149-1 tube, suction – M48 X 2, pressure – M33 X2
		AS	End ports; ISO 6162 flange, suction – 1.500 SAE 4-bolt split flange port with M12 X 1.75 threads; pressure – 1.000 SAE 4-bolt split flange port with M10 X 1.5 threads
12	Drain port size and location	1	.875-14 UNF-2B SAE O-ring port–top (D1)
		2	.875-14 UNF-2B SAE O-ring port – bottom (D2)
		3	.875-14 UNF-2B SAE O-ring port – shaft up
		6	M18 X 1.5 metric O-ring port – top (D1)
		7	M18 X 1.5 metric O-ring port – bottom (D2)
		8	M18 X 1.5 metric O-ring port – shaft up
13	Diagnostic pressure port	0	No diagnostic pressure port
		1	.4375-20 UNF-2B SAE O-ring port – plugged
		2	M14 X 1.5 metric O-ring port – plugged
14	Controller type	C	Electric dual range pressure compensator with directional control valve
		E	Unloading valve (accumulator circuits)
		G	Adjustable pressure compensator
		H	Adjustable pressure and flow compensator
		J	Adjustable hydraulic remote control pressure compensator
15,16	Pressure comp./ unloading valve	07	65.5-72.4 bar [950-1050 lbf/in²]
		18	182.7-189.6 bar [2650-2750 lbf/in²]
		33	206.8-213.7 bar [3000-3100 lbf/in²]
17,18	Flow comp. setting or unload valve standby	00	No flow compensator setting
		11	9.65-12.41 bar [140-180 lbf/in²]
		14	12.41-15.17 bar [180-220 lbf/in²]
		24	22.75-25.51 bar [330-370 lbf/in²]
19,20	Secondary comp. setting	00	No secondary compensator setting
		04	186.2-193.1 bar [2700-2800 lbf/in²]
21	Control special features	0	No special features
		A	Bleed down orifice
		B	External manual stroke adjustment
22	Maximum displacement option	1	Standard displacement
		2	Adjustable maximum displacement (set at maximum)

Note: Consult an Eaton representative for additional settings

Model Number System
PVQ40 and PVQ45

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	31
P	V	Q	4	0	A	R	1	1	A	A	1	0	B	1	1	2	4	0	0	A	1	A	A	1	A	F	C	D	0	1

Nos	Feature	Code	Description
23,24	Auxiliary mounting output shaft	00	No auxiliary mounting or output shaft
		AA	2 Bolt A (SAE J744-82-2) w/ 9T 16/32DP external splined shaft
		AB	2 Bolt A (SAE J744-82-2) w/ 11T 16/32DP external splined shaft
		AC	2 Bolt B (SAE J744-101-2) w/ 13T 16/32 DP internal splined coupling
		AD	2 Bolt B (SAE J744-101-2) w/ 15T 16/32DP internal splined coupling
		AE	2 Bolt B (SAE J744-101-2) w/ 26T 32/64DP external splined shaft
		AH	2 Bolt A (SAE J744-82-2) w/ 9T 16/32DP internal splined coupling
		AJ	2 Bolt A (SAE J744-82-2) w/ 11T 16/32DP internal splined coupling
		AK	2 Bolt B (SAE J744-101-2) w/ 26T 32/64DP internal splined coupling
25	Shaft seals	0	No shaft seal
		1	Standard shaft seal (fluorocarbon)
		8	HNBR shaft seal (water glycol)
26,27	Special features	AP	Cast iron housing and industrial timing
28,29	Paint	00	No paint
		CD	Blue primer
30	Customer and unit	0	STD – mark assembly number, full model code and build date code on plate
31	Design code	A	First design

Note: Consult an Eaton representative for additional settings

RATINGS

Model Number System	Maximum Geometric Displacement cm^3/r (in^3/r)	Rated Speed r/min	Maximum Pressure bar (psi)	Input Power at Max. Pressure and Rated Speed kW (hp)	Approx. Weight kg (lb)
PVQ40	41,5 (2.500)	1800	210 (3000)	27,6 (37)	20,6 (45.4)
PVQ45	45,1 (2.750)	1800	186 (2700)	28,3 (38)	20,6 (45.4)

Pressure Limits:

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

Note: Integral relief valve limits case pressure peaks to 0,7 bar (10 psi) higher than inlet pressure to protect pump. Flow from valve is returned directly to pump inlet. Use of case drain line required to limit steady-state case pressure.

"G" Option

Pressure Compensator Controls

This control automatically varies pump displacement to meet the system flow demand for a constant system pressure. Displacement starts to reduce to zero within 14 bar (200 psi) of the compensator setting. Power draw-off is minimized, therefore, system relief valves should not be required.

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.

"J" Option

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.

"C" Option

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 3,4 bar (50 psi) 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.

"H" Option

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.

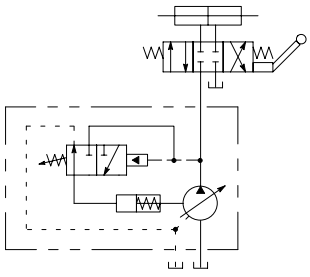
Standard load-sense differential pressure settings, by control type, follow. See model number system for setting range.

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.

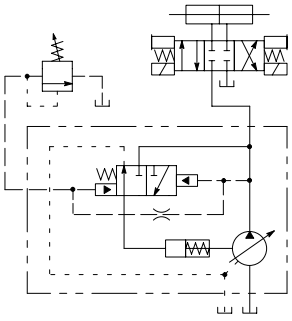
Other Standard Load Sense Options:

1. Bleed-down orifice plugged.
2. Factory differential pressure setting of 24 bar.

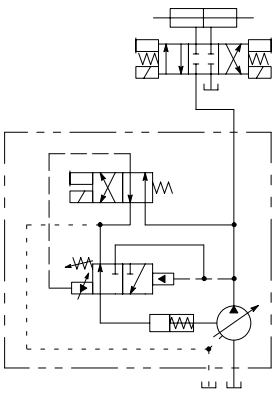
"G" Option



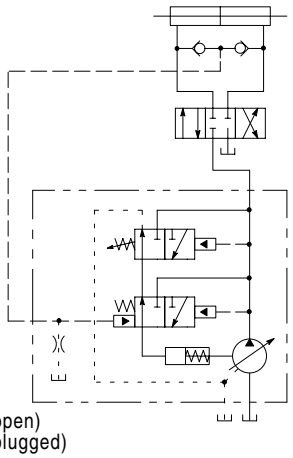
"J" Option



"C" Option



"H" Option



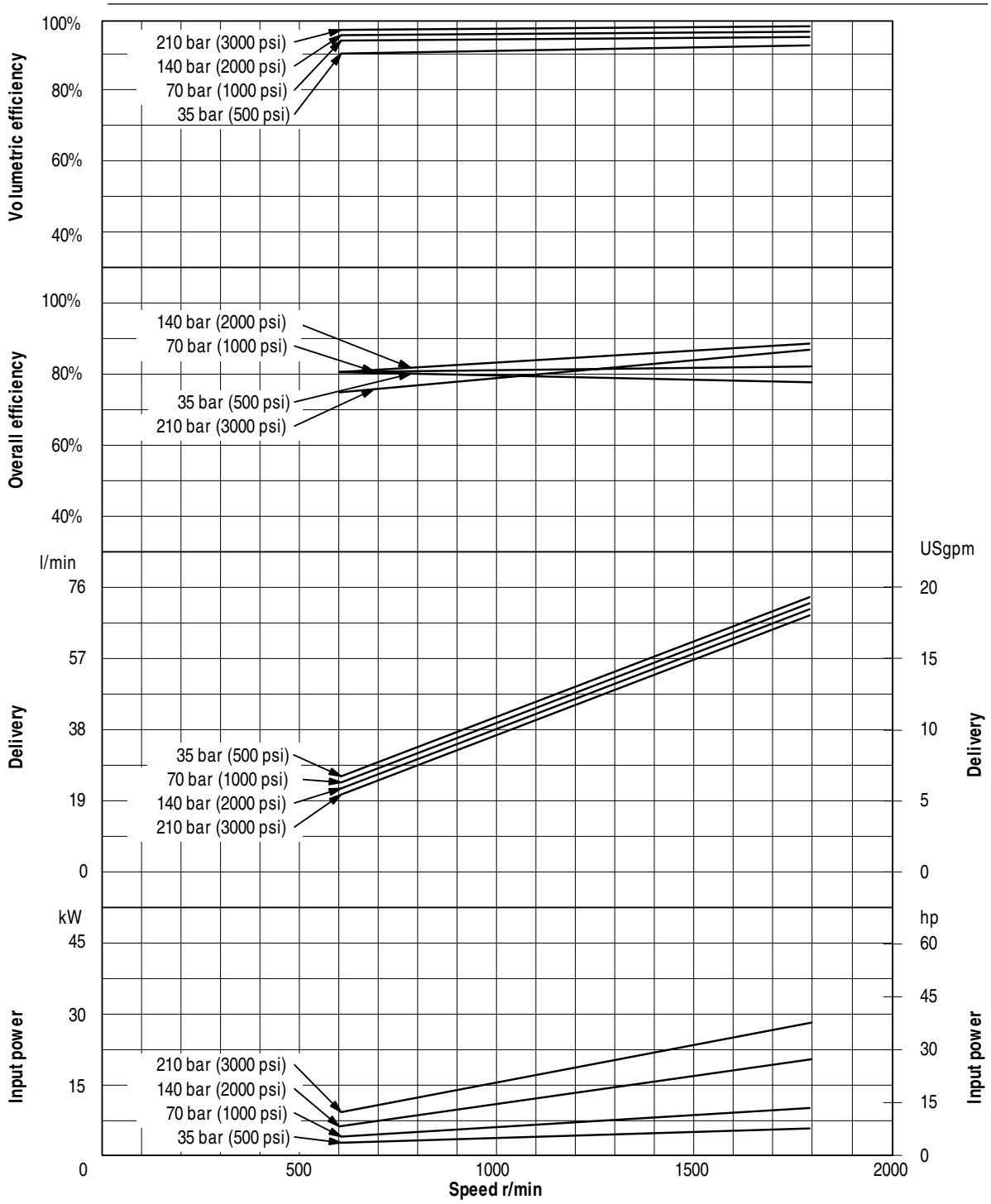
(†orifice open)
(†orifice plugged)

Performance Curves

PVQ40

Oil type: SAE 10W
Oil temperature: 82°C (180°F)
Inlet: 0 psi

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.

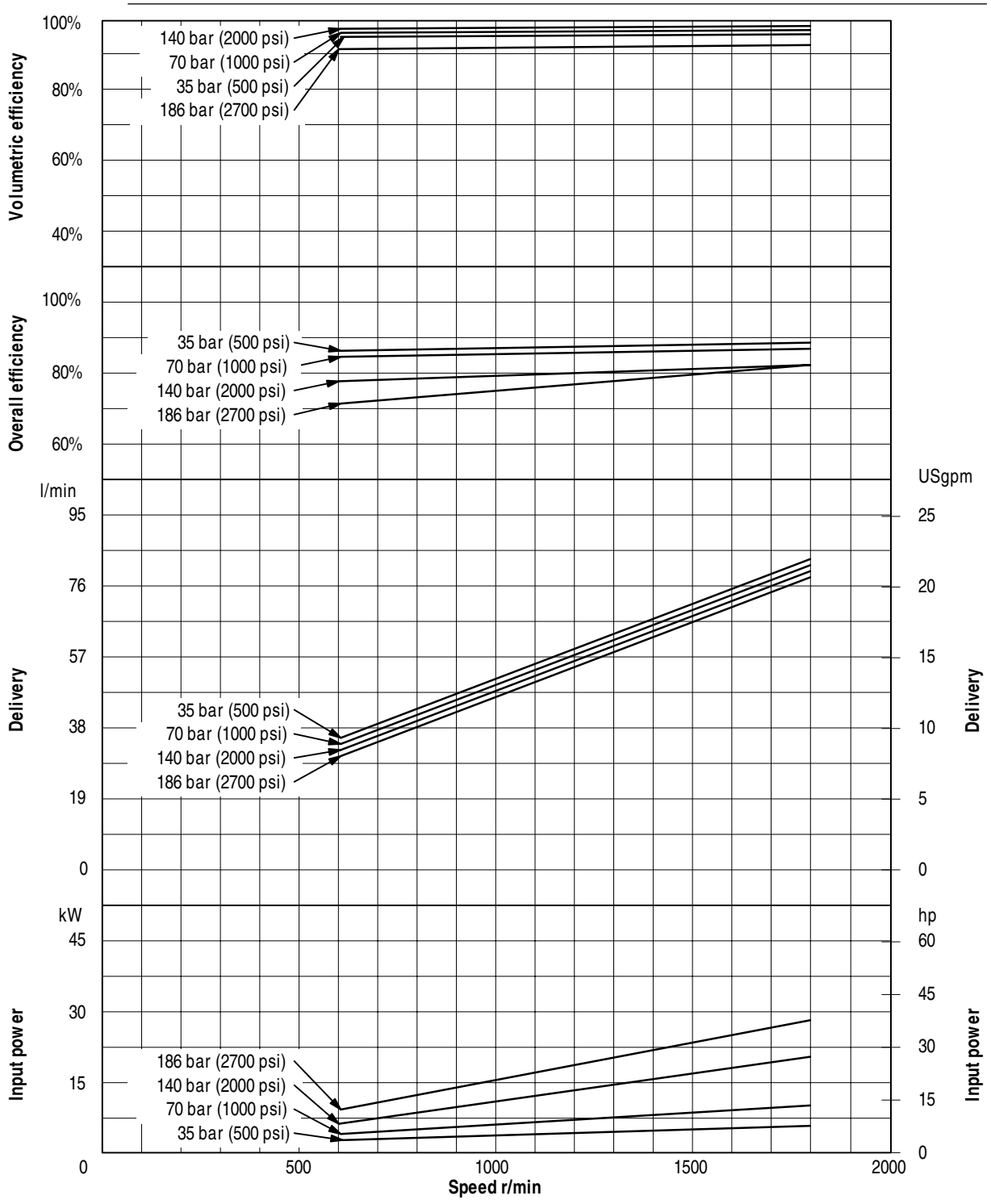


Model Series

PVQ45

Oil type: SAE 10W
Oil temperature: 82°C (180°F)
Inlet: 0 psi

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 186 bar (2700 psi) max. rated pressure.



Operating Data

PVQ40 and PVQ45 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
1000	35 (500)	60	58
	70 (1000)	61	61
	140 (2000)	63	65
	210 (3000)*	65	65
1200	35 (500)	61	60
	70 (1000)	62	62
	140 (2000)	65	65
	210 (3000)*	66	68
1500	35 (500)	65	61
	70 (1000)	67	64
	140 (2000)	68	67
	210 (3000)*	68	69
1800	35 (500)	68	60
	70 (1000)	69	65
	140 (2000)	69	68
	210 (3000)*	71	70

*PVQ40 at 210 bar (3000 psi) and PVQ45 at 186 bar (2700 psi)
**Sound pressure data equivalent to NFPA Standard.

Response Data

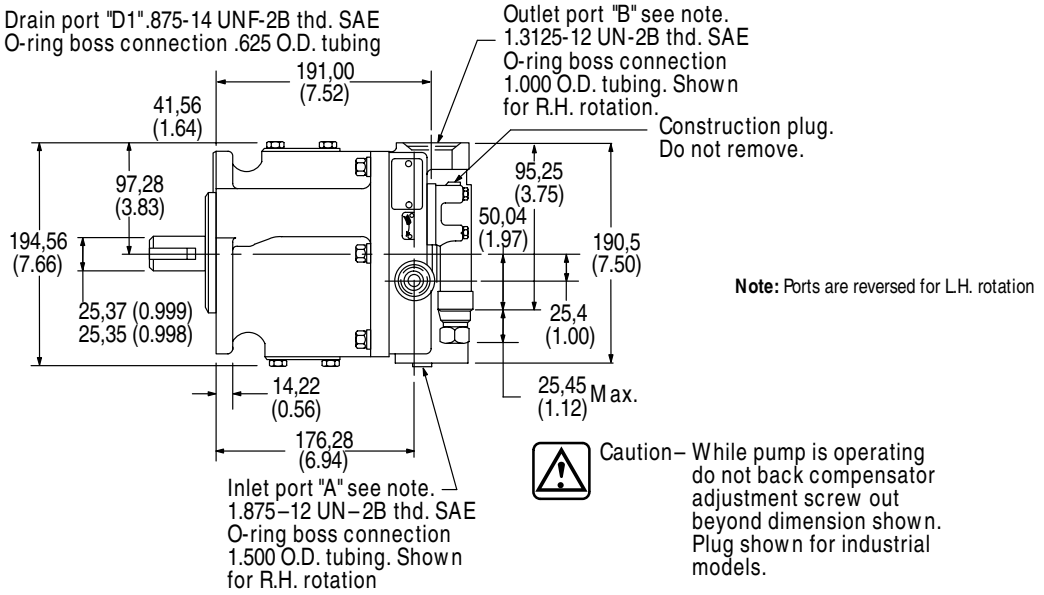
Yoke response recorded at rated speed and pressure, 0 psi inlet, 82°C (180°F), SAE 10W oil. Pressure rise was 6900 bar (100,000 psi) per second.

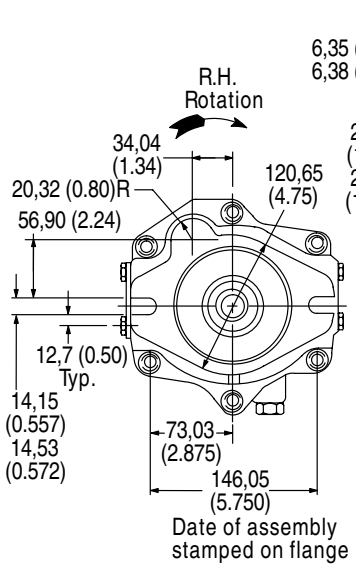
Control Type	On Stroke	Off Stroke
Pressure compensator	0.050 sec.	0.020 sec.
Load sense compensator	0.040 sec.	0.010 sec.

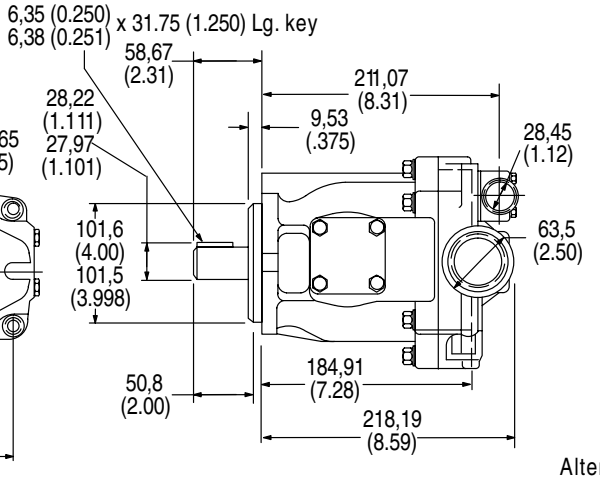
Controls

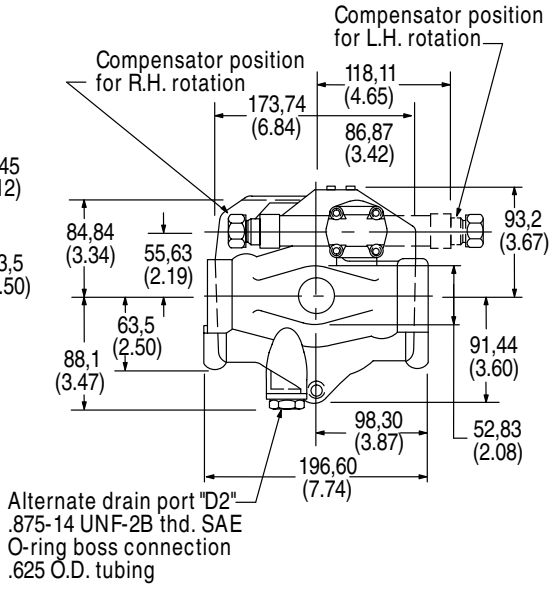
Side Port Controls, No. 2 Mounting and Input Shaft

Millimeters (inches)

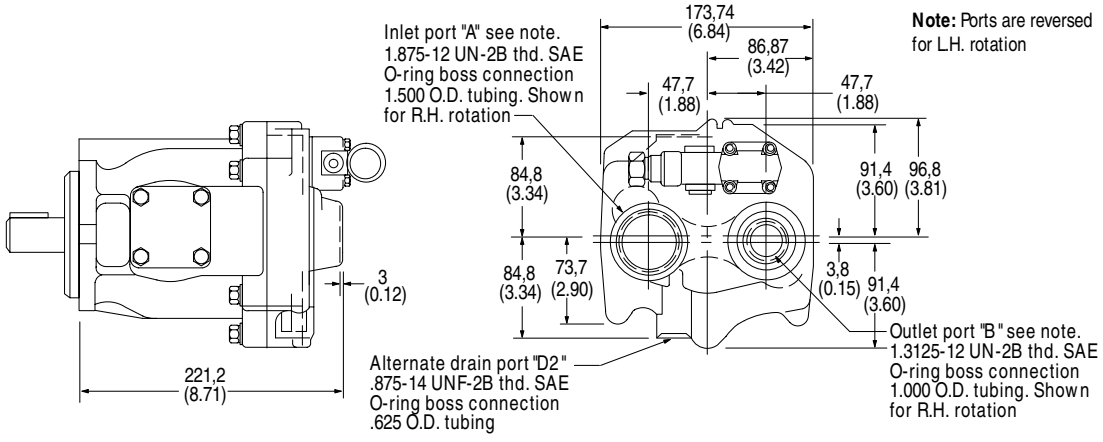




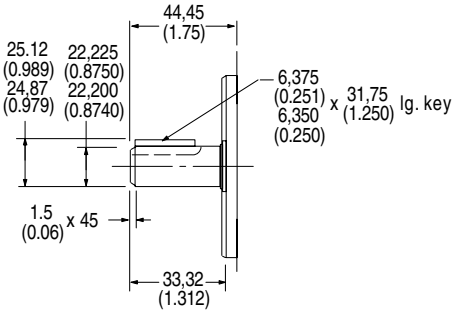




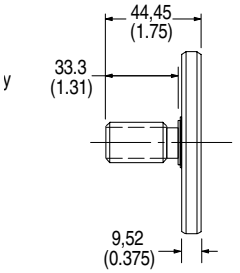
Rear Ports



No. 1 Shaft: SAE "B" Straight Keyed

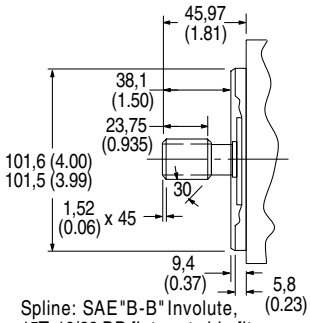


No. 05 Shaft SAE "B" Splined



Spline: SAE "B" Involute, 13T
16/32 DP flat root side fit

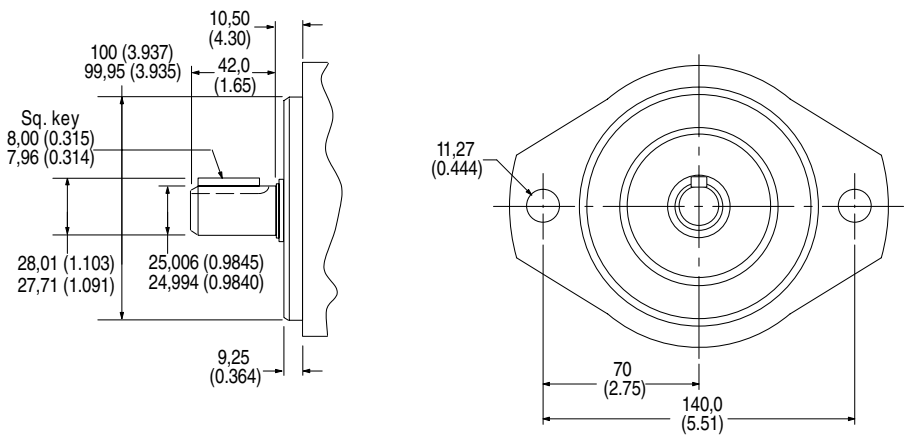
No. 08 Mounting and Input Shaft SAE "B-B" Splined



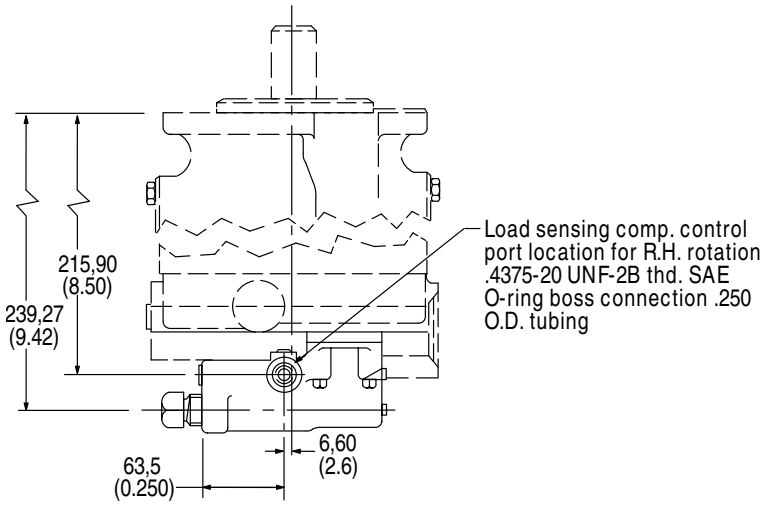
Spline: SAE "B-B" Involute,
15T, 16/32 DP flat root side fit

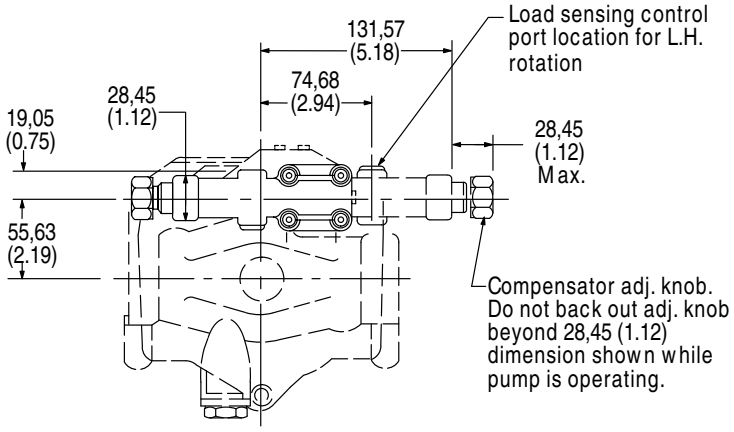
No. 10 Mounting and Input Shaft with VDMA Flange

(Flange and shaft end ISO 3019/2-100A2HW-E25N)

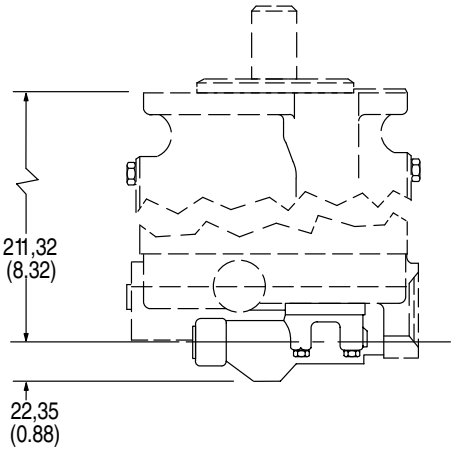


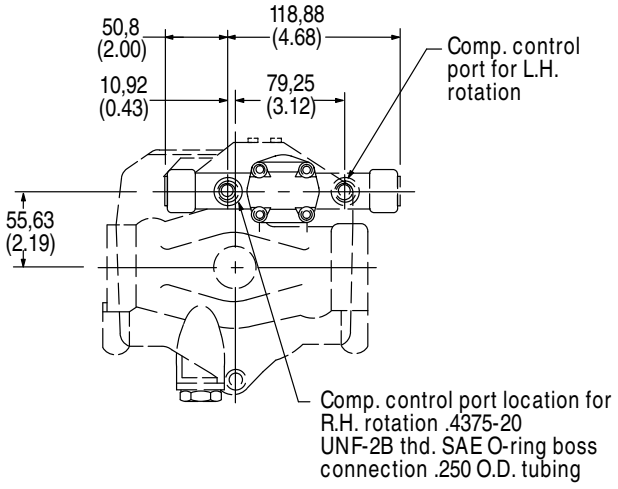
Pressure Compensator with Load Sensing





Remote Control





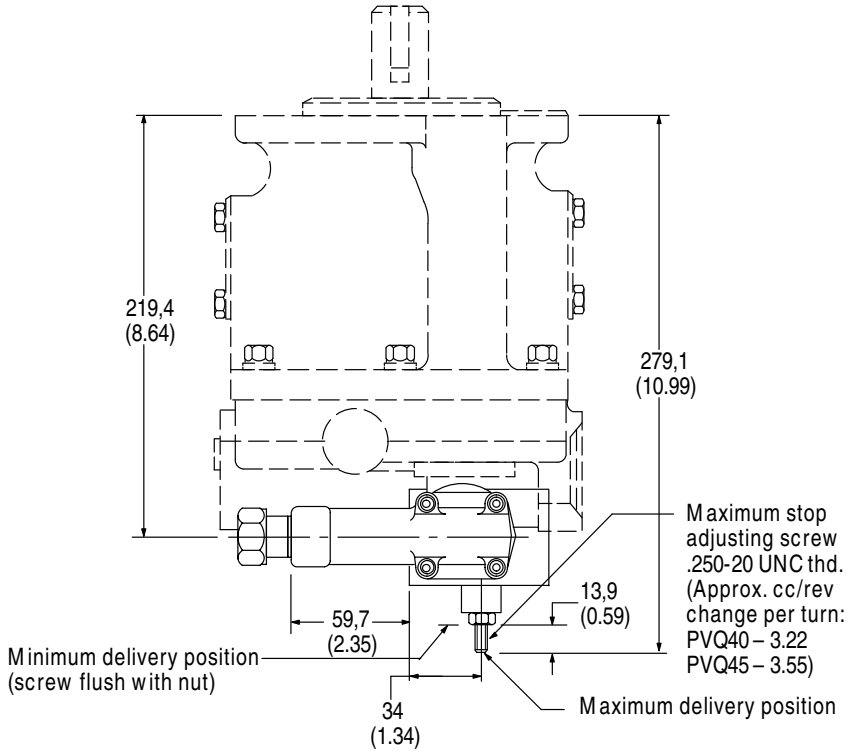
Pressure Compensator Control with Adjustable Maximum Displacement Stop

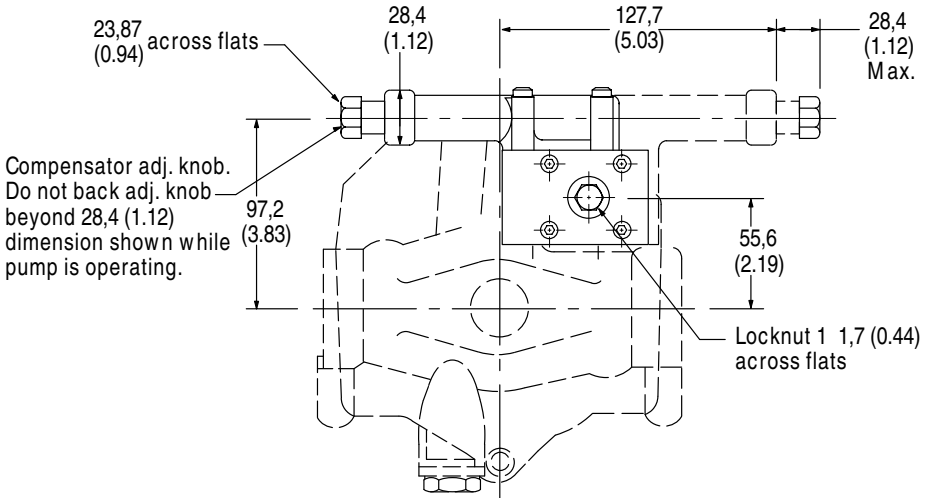
Adjustment

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. To assist initial priming, manual adjustment control setting must be at least 40% of maximum flow position.

This 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.

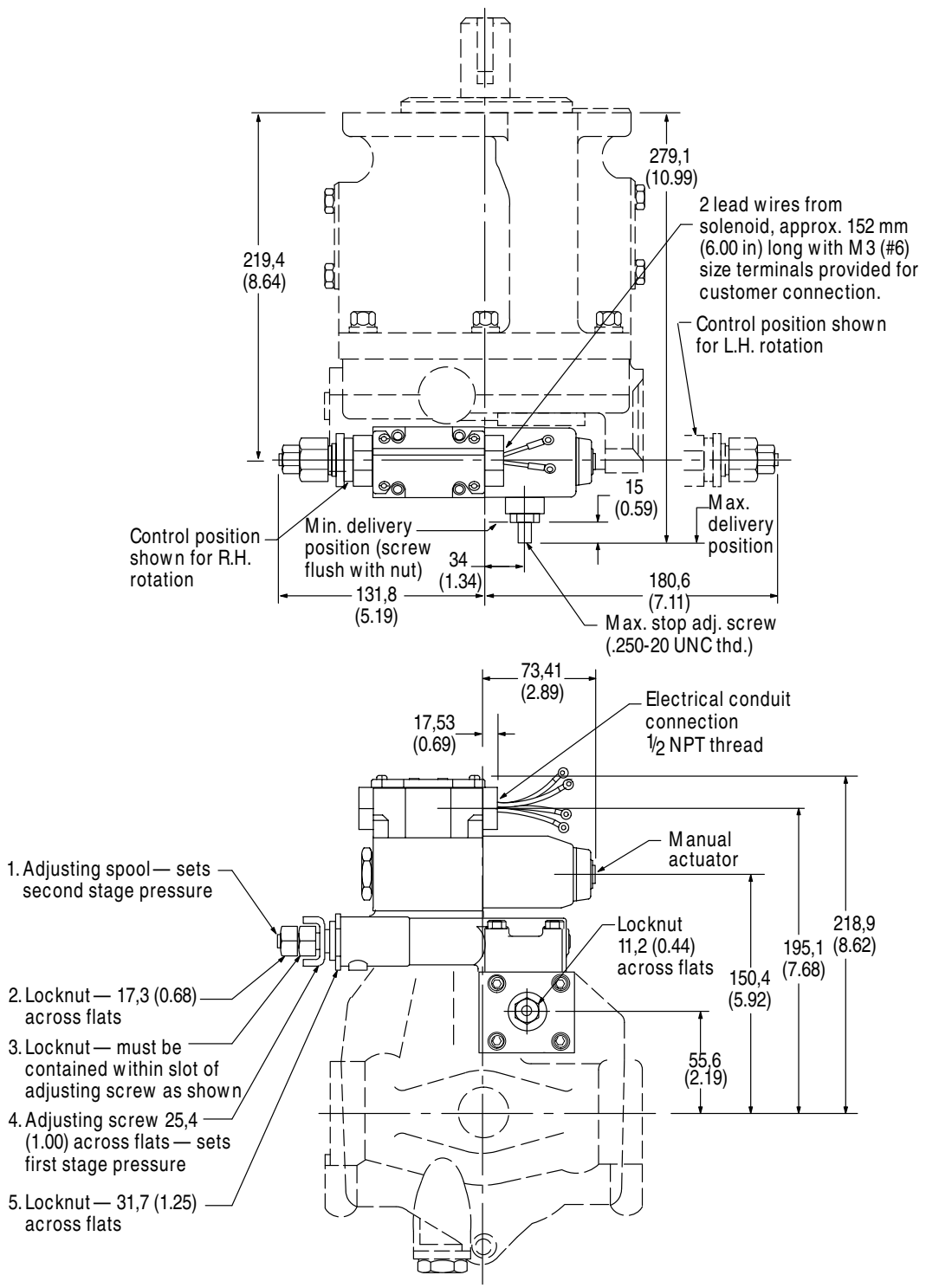
Note: Not available with thru-drive models.





Electric Dual Range Pressure Compensator with Maximum Displacement Stop

See preceding page and following page for adjustment procedures.



Solenoid Data[u] (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.

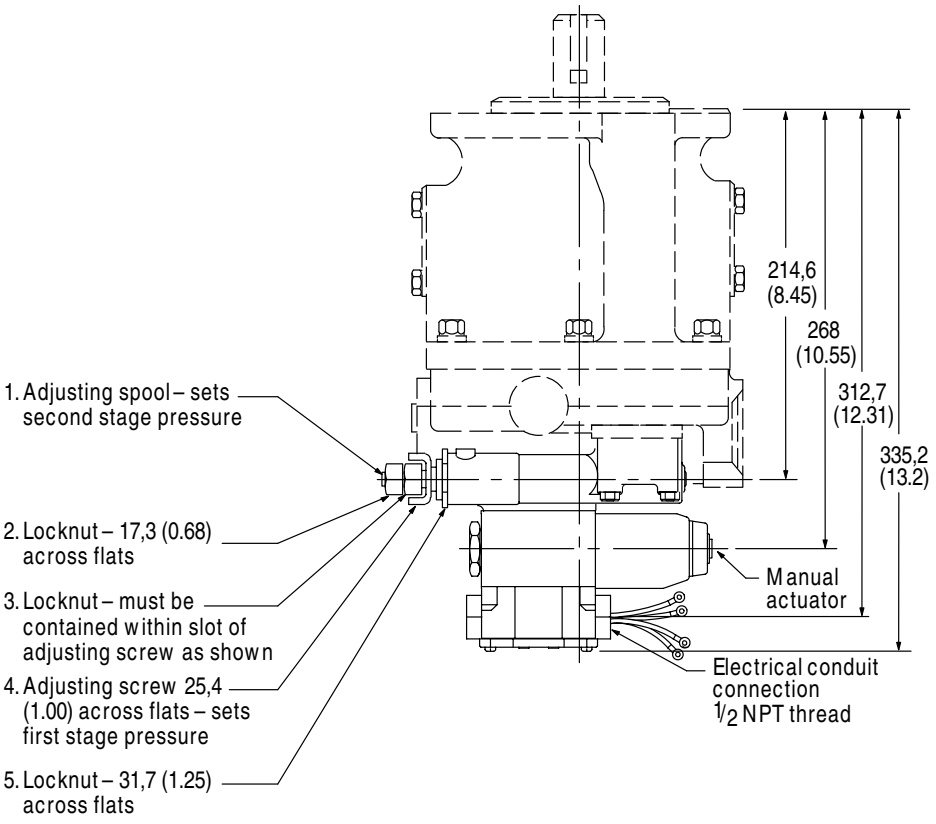
Refer to catalog GB-C-2015B for additional solenoid valve data.

[u]**Note:** Any sliding spool valve, if held shifted under pressure for long periods of time, may stick and not spring return due to fluid residue formation and, therefore, should be cycled periodically to prevent this from happening.

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 readjust if necessary. Secure this setting by tightening locknut " 2".



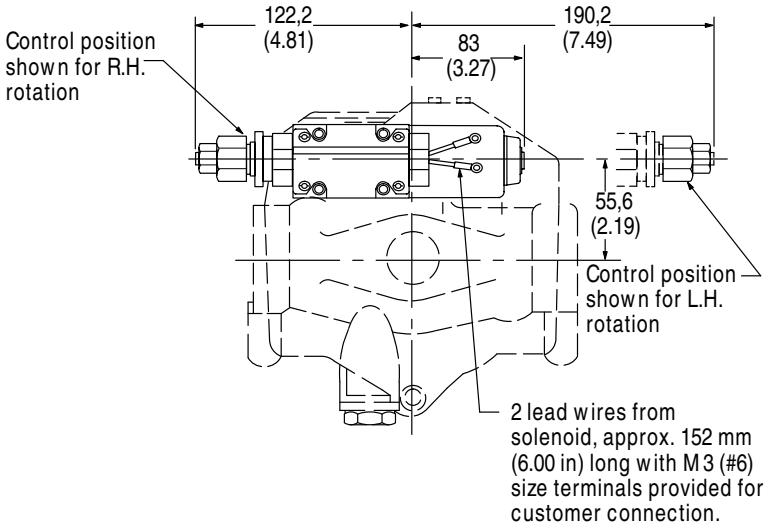
Solenoid Data[u] (110V AC 50 Hz and 115/120V AC 60 Hz)

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.

[u]**Note:** Any sliding spool valve, if held shifted under pressure for long periods of time, may stick and not spring return due to fluid residue formation and, therefore, should be cycled periodically to prevent this from happening.



Controls

Unloading Valve Control – " E" Option

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.

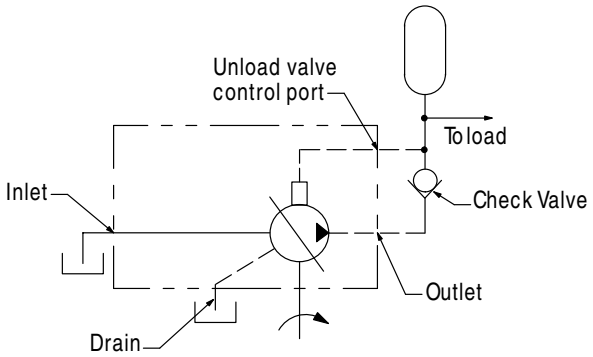
Adjustment range

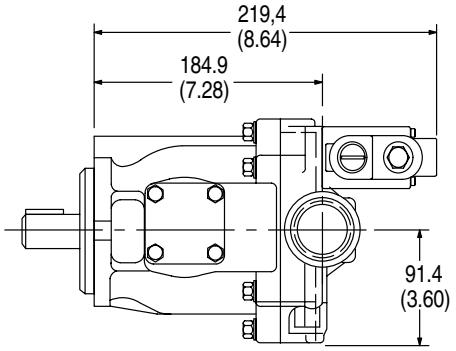
PVQ40	100-210 bar (1500-3000 psi)
PVQ45	100-186 bar (1500-2700 psi)

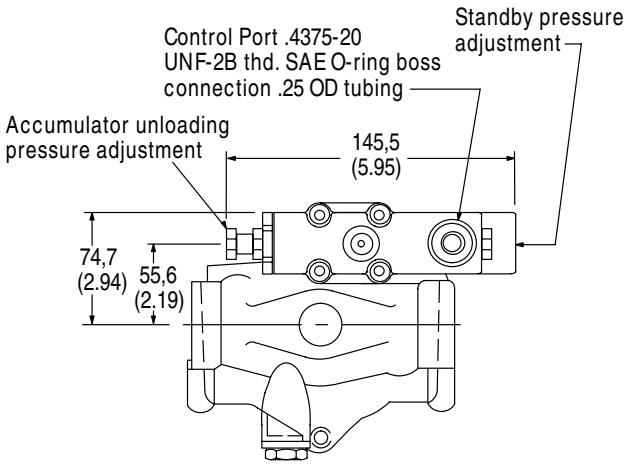
Cut-in pressure is 85% of unloading pressure, minimum.

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.

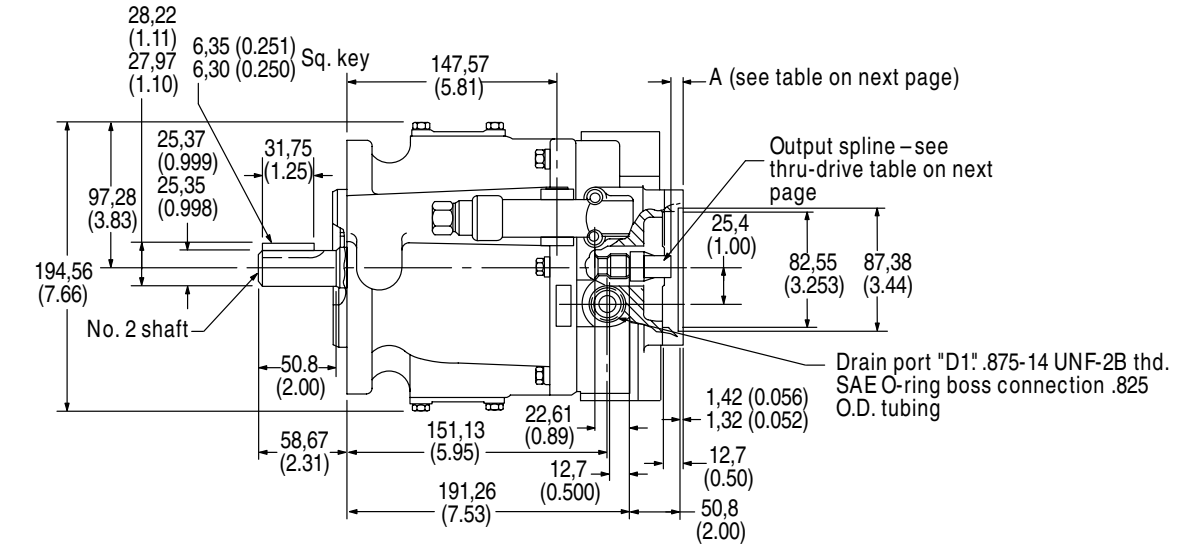


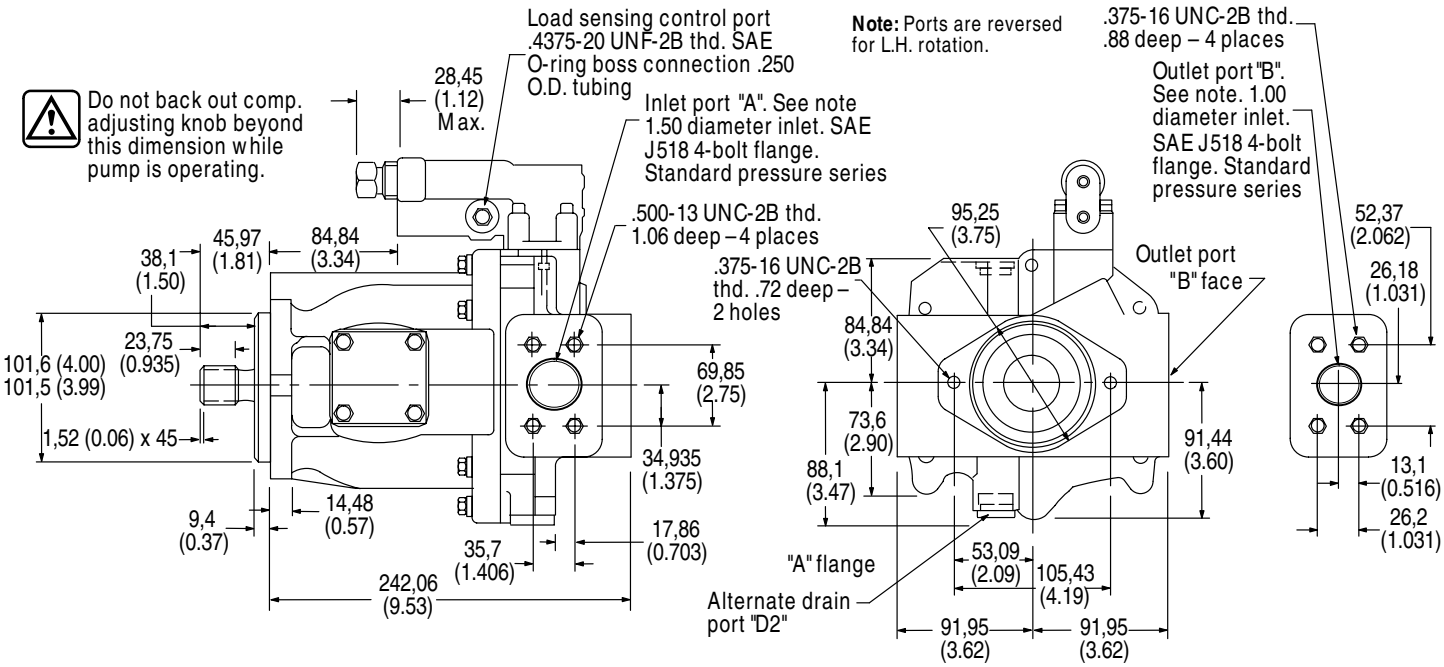




Thru-drives

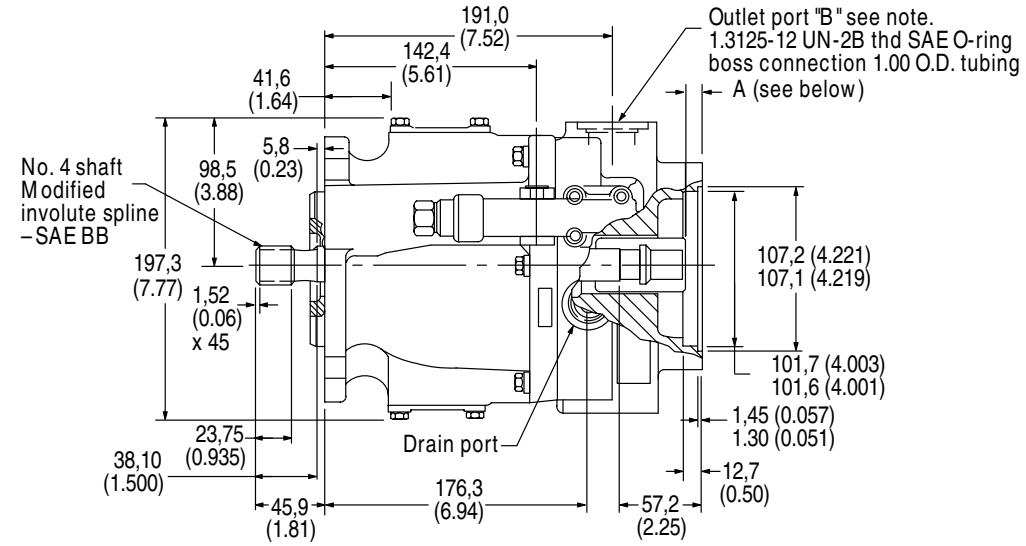
PVQ40 and PVQ45 SAE "A"



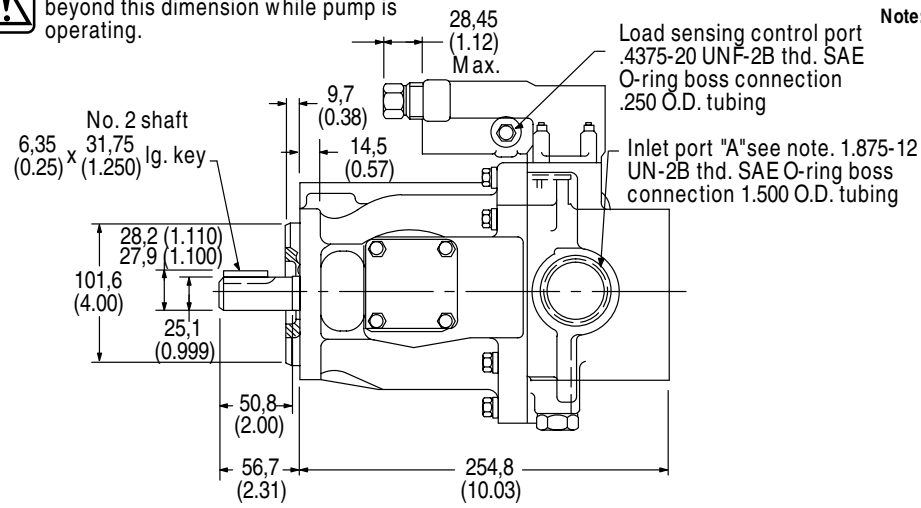


Thru-drives

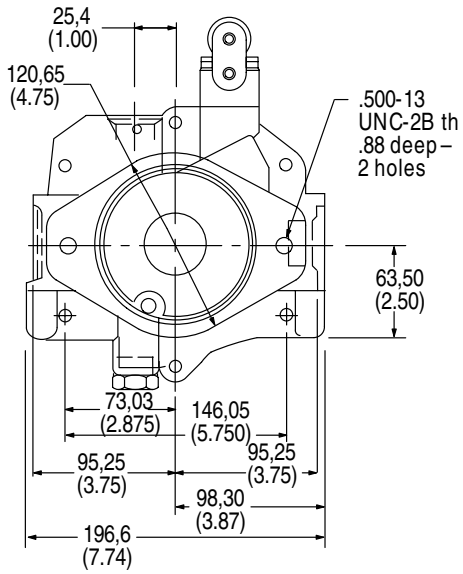
PVQ40 and PVQ45 SAE "B"



Donot back out comp. adjusting knob beyond this dimension while pump is operating.



Note: Ports are reversed for L.H. rotation.



Thru-drive Shaft	Spline Data	Max. Torque Nm (in. lb.)	Dimension A mm (in.)	Coupling Type	Thru-drive Coupling
AA	ASA B5.15-1960 9 teeth 16/32 DP Flat root side fit	58 (517)	10,92 (0.43)	9T/9T	864224
AB	ANS B92.1-1970 11 teeth 16/32 DP Flat root side fit	118 (1050)	12,57 (0.495)	11T/11T	864325
AE	Special Eaton 26 teeth 32/64 DP Flat root side fit	179 (1587)	24,89 (0.98)	26T/26T	627168
			10,92 (0.43)	26T/13T	864307
			20,56 (0.81)	26T/15T	475134

Note: Coupling, screws, and washers must be ordered separately to mount rear pump. "A" O-ring (AS568-042) and "B" O-ring (AS568-155) are included with each thru-drive pump. Couplings for "B26" are step type for 13 and 15 tooth as shown.

Thru-drives

Shaft Torque Data
PVQ40/45

THRU-DRIVE SHAFT TORQUE DATA

Shaft	Input Shaft Code	Maximum Input Torque Total Nm (lb. in.)	Maximum Thru-drive Torque Output Nm (lb. in.)
9T	2	215 (1900)	58 (517)
	5	208 (1850)	
	8	337 (2987)	
11T	2	215 (1900)	123 (1100)
	5	208 (1850)	
	8	337 (2987)	
26T	2	215 (1900)	179 (1587)
	5	208 (1850)	
	8	337 (2987)	

Note: Both input and output limits must be met.

Typical Rear Pumps (with Shaft Codes) for PVQ40/45 Thru-drives

TYPICAL REAR PUMPS (WITH SHAFT CODES) FOR PVQ40/45 THRU-DRIVES

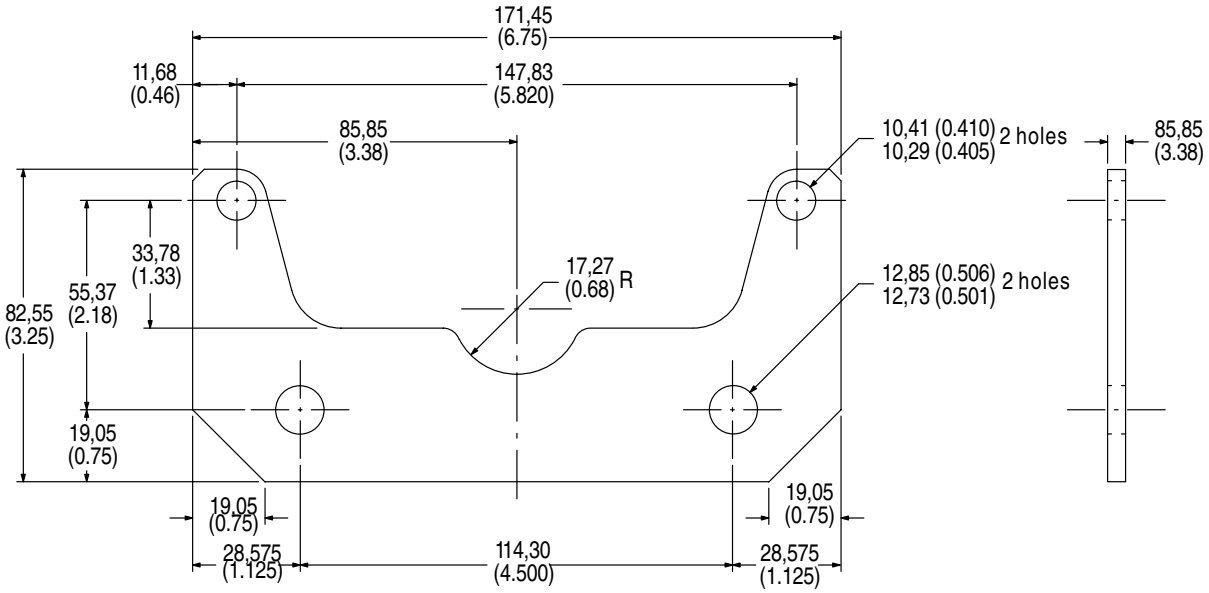
Thru-drive shaft	Typical Rear Pump	Rear Pump Shaft Code	Thru-drive Coupling
9T	PVQ10/13	3	864224
	PVB5/6	S124 suffix	
	V10	11	
	V20	62	
26T	PVE012	2	864307
		28	627168
	PVQ20/32	3	864307
		28	627168
	PVQ40/45	3	864307
		4	475134
		28	627168
	V2010 OR V2020	11	864307
	20V	151	864307
	2520V	166	475134

Note: 11T (not listed above) is intended for special application only.

Thru-drives

PVQ40 and PVQ45 Pump Support Bracket

An optional support bracket should be used when a heavy second pump is mounted to a thru-drive PVQ40 or PVQ45. The support bracket (627179), two screws (199740), and two washers (427700) must be ordered separately.



Application Data

Fluid Cleanliness

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.

Essential information on the correct methods for treating hydraulic fluid is included in Eaton publication 561 " Eaton Guide to Systemic Contamination Control" available from your local Eaton distributor or by contacting Eaton. Recommendations on filtration and the selection of products to control fluid condition are included in 561.

Recommended cleanliness levels, using petroleum oil under common conditions, are based on the highest fluid pressure levels in the system and are coded in the chart below. Fluids other than petroleum, severe service cycles, or temperature extremes are cause for adjustment of these cleanliness codes. See Eaton publication 561 for exact details.

Eaton products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Other manufacturers will often recommend levels above those specified. Experience has shown, however, that life of any hydraulic component is shortened in fluids with higher cleanliness codes than those listed below. These codes have been proven to provide a long, trouble-free service life for the products shown, regardless of the manufacturer.

	System Pressure Level bar (psi)		
Product	**<70 (<1000)**	**70-210 (1000-3000)**	**210+ (3000+)**
Piston Pumps – Variable	**18/16/14**	**17/15/13**	**16/14/12**

Hydraulic Fluids and Temperature Ranges

Use antiwear hydraulic oil, or automotive type crankcase oil designations SC, SD, SE or SF per SAE J183FEB80.

Select a viscosity grade that will allow optimum viscosity, between 40 cSt (180 SUS) and 16 cSt (80 SUS), to be achieved within the optimum performance envelope shown below.

For further information, see Eaton data sheet B-920 or I-286-S.

Fire Resistant Fluids

All pumps can be used with water glycol and polyol ester fluids. All pumps can be operated to 140 bar (2000 psi) with these fluids, except PVQ13 and PVQ32 which are limited to 105 bar (1500 psi). Input speed should not exceed 1800 r/min. System temperature should not exceed 54° C (130° F). Inlet vacuum should not exceed 101,6 millibar (3 in. Hg). For more information, refer to Eaton publication 579.

Installation and Start-up (Commissioning)

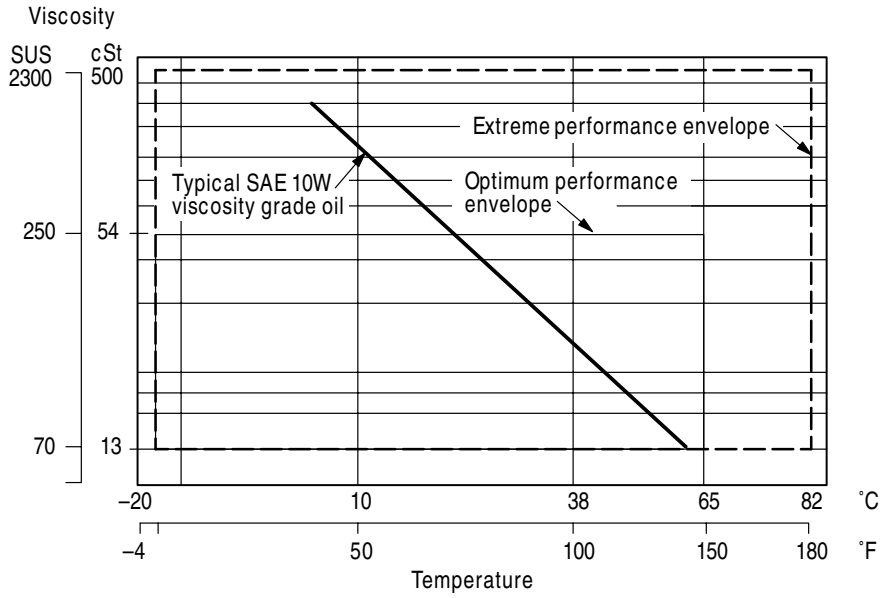
Before a pump is started, fill the case through the uppermost drain port with hydraulic oil of the type to be used. The case drain line must be connected to the reservoir below oil level.

For multiple pump arrangements that include non-PVQ sections, the requirements of the non-PVQ units must be considered.

Ordering Procedure

Order pumps by the full model designation. Pump displacement, mounting flange type, direction of rotation, pump configuration, shaft end type, seals, pressure adjustment range, and specific control functions are all specified in the full model number system.

Couplings, O-rings, capscrews and washers must be ordered separately for all thru-drive pumps.



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Supercedes 11-06-0002-EN-0801
December 2002

Vickers® Vane Pumps

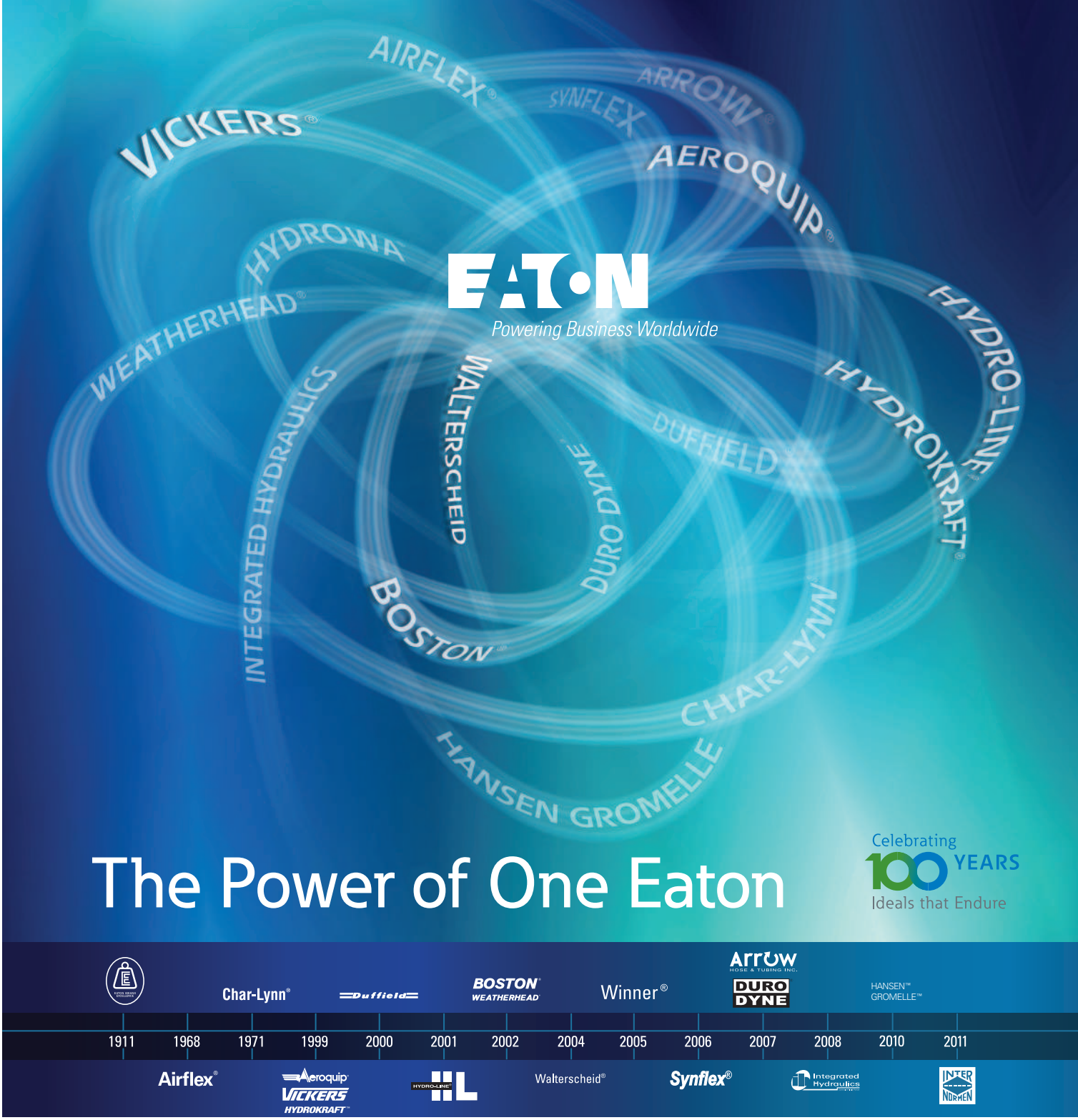
V Series - Low Noise Vane Pumps

High Performance Intravane Pumps
For Industrial Applications



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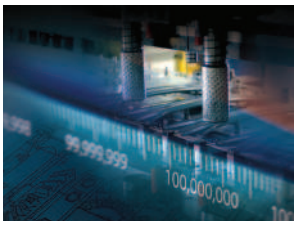
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Eaton technologies can make your driving operation more successful. Greater comfort and productivity help increase driver retention, while reduced emissions, leaks, and noise improve environmental performance. Increased efficiencies overall mean lower costs and higher net revenue.



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Understanding and helping our customers succeed

- Listening and understanding to requirements and business drivers
- Delivering solutions with value propositions to solve the critical business needs

Knowing what's important to our customers and integrating that knowledge into the fabric of our business

- ...to deliver innovative, quality products
- ...to respond fast
- ...to provide dedicated customer service and support around the globe

Our strength is global reach with local responsiveness and support

- Customers served in more than 150 countries
- Diverse channels ensure reliable availability and support
- Design and engineering teams provide support for standard products and custom solutions
- Eaton experts offer efficient product and application training

Introduction

Vickers offers the most complete line of hydraulic intravane pumps for industrial applications. A wide variety of single and multiple configurations enables you to select the precise pump or combination best suited for your application.

Your choice of pump is backed by more than 70 years of Vickers engineering and manufacturing skill.

Performance

These cost–effective pumps provide volumetric efficiencies of more than 90% and sound levels as low as 62 dB(A) with operating pressures to 207 bar (3000 psi).

General Description

Intravane pumps provide longer life, increased productivity and application versatility. Extremely low sound levels are compatible with the most demanding industrial applications.

Compact size and ease of service allow maximum equipment design flexibility. Pumps are available in single, double and thru-drive configurations.

Features and Benefits

- High operating pressure capabilities in compact packages provide high power to weight ratios and lower installed costs.
- Low noise characteristics inherent in intravane design enhance operator comfort.
- Twelve vane system provides low amplitude flow pulsations resulting in low system noise characteristics.
- Hydraulic balancing, designed to prevent internally-induced radial shaft and bearing loads, provides long life.
- Double pumps and thru-drive arrangements save installation space and cost by eliminating double shaft extension electric motors or by reducing the number of motors and drive couplings.
- Thru-drive models provide valuable circuit design flexibility, such as having fixed and variable displacement models on a single input drive.
- Sixteen flow displacements and high operating pressure capabilities provide optimum selection and single-source capability for your complete range of flow and pressure requirements.
- Factory tested cartridge kits provide new pump performance upon installation.
- The cartridge kit design offers fast and efficient field serviceability. The cartridge is independent of the drive shaft, allowing for easy change of flow capacity and servicing without removing the pump from its mounting.
- Inlet and outlet ports can be oriented in four different positions relative to each other, providing greater installation flexibility and ease of machine design.

Table of Contents

Model	Maximum Geometric Displacements cm^3/r (in^3/r)	Rated Speed r/min	Maximum Pressure bar (psi)
Single Pumps Installation			
20V	45 (2,8)	1800	207 (3000) 21
25V	67 (4.1)	1800	172 (2500) 22
35V	121 (7.4)	1800	172 (2500) 22
45V	193 (11.7)	1800	172 (2500) 22
Double Pumps Installation			
2520V	67 (4.1) shaft end	1800	172 (2500) 23
	45 (2.8) cover end	1800	207 (3000)
2525V	67 (4.1) shaft end	1800	172 (2500) 24
	67 (4.1) cover end	1800	172 (2500)
3520V	121 (7.4) shaft end	1800	172 (2500) 23
	45 (2.8) cover end	1800	207 (3000)
3525V	121 (7.4) shaft end	1800	172 (2500) 23
	67 (4.1) cover end	1800	172 (2500)
4520V	193 (11.7) shaft end	1800	172 (2500) 23
	45 (2.8) cover end	1800	207 (3000)
4525V	193 (11.7) shaft end	1800	172 (2500) 23
	67 (4.1) cover end	1800	172 (2500)
4535V	193 (11.7) shaft end	1800	172 (2500) 24
	121 (7.4) cover end	1800	172 (2500)
Thru-Drive Pumps Installation			
25VT	67 (4.1)	1800	172 (2500) 26
35VT	121 (7.4)	1800	172 (2500) 26
45VT	193 (11.7)	1800	172 (2500) 26
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Performance Data Single, Double & Thru-Drive Vane Pumps

Pressure limits, inlet port - bar (psi):

Minimum -0,17 bar (5" Hg) for anti-wear oil
-0,10 bar (3" Hg) for water containing fluids and phosphate esters

Maximum 1,4 bar (20 psi) all fluids

Range 0 to 0,35 bar (0 to 5 psi) all fluids

Maximum continuous pressures in bar (psi), outlet ports

Model	Code	Using anti-wear oil or phosphate ester fluid*	Using water-in-oil emulsions	Using water glycol fluid
20V	2	138 (2000)	69 (1000)	138 (2000)
20V	5,8,11	207 (3000)	69 (1000)	159 (2300)
**20V	12	159 (2300)	69 (1000)	159 (2300)
**20V	14	138 (2000)	69 (1000)	138 (2000)
25V	10,12,14,17,21	172 (2500)	69 (1000)	159 (2300)
25VT	12,14,17,21	172 (2500)	69 (1000)	159 (2300)
25**V	12,14,17,21	172 (2500)	69 (1000)	159 (2300)
**25V	12,14,17,21	172 (2500)	69 (1000)	159 (2300)
35V	25,30,35,38	172 (2500)	69 (1000)	159 (2300)
35VT	25,30,35,38	172 (2500)	69 (1000)	159 (2300)
35**V	25,30,35,38	172 (2500)	69 (1000)	159 (2300)
**35V	25,30,35,38	172 (2500)	69 (1000)	159 (2300)
45V	42,45,50,60	172 (2500)	69 (1000)	159 (2300)
45VT	42, 50, 60	172 (2500)	69 (1000)	159 (2300)
45**V	42, 50, 60	172 (2500)	69 (1000)	159 (2300)

* A transient (peak) pressure 10% over the continuous pressure rating for 0.5 seconds or less duration is allowed.

Speed limits

Minimum speed, all models and fluid combinations ..... 600 rpm

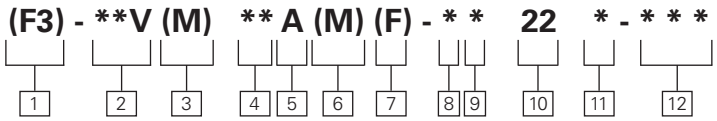
Maximum speed - standard models using anti-wear fluid..... 1800 rpm

Standard models using synthetic and water-in-oil emulsions..... 1200 rpm*

Models using water glycol fluid..... 1500 rpm*

* See Vickers brochure #579.

Single Pump Model Code



1 F3 - Viton Seals

Omit if not required

2 Series Designation

20V – 7 to 45 cm^3/r (0.43 to 2.78 in^3/r)
25V – 33 to 67 cm^3/r (2.0 to 4.1 in^3/r)
35V – 81 to 121 cm^3/r (4.9 to 7.4 in^3/r)
45V – 138 to 193 cm^3/r (8.4 to 11.6 in^3/r)

3 Pilot Designation

Omit - Standard pilot
S – SAE per ISO 3019/1 (SAE J744) (N/A on 20V pump).
M – Metric per ISO 3019/2 100A2HW codes (N/A on 20V pump).

4 Geometric Displacement

Rated capacity (USgpm) at 1200 rpm, 6,9 bar (100 psi)

Frame Size	Code (USgpm)	cm^3/r	in^3/r
20V	2	7	0.43
	5	18	1.10
	8	27	1.67
	9	30	1.85
	11	36	2.22
	12	40	2.47
	14	45	2.78
25V	10	33	2.01
	12	39	2.47
	14	45	2.78
	17	55	3.39
	21	67	4.13
35V	25	81	4.94
	30	97	5.91
	35	112	6.83
	38	121	7.37
45V	42	138	8.41
	45	147	8.95
	50	162	9.85
	60	193	11.75

5 Port Connections

A – SAE 4-bolt flange

6 Port Connection Modifier

Omit – Inch thread port connection (4-bolt flange).

M – Metric port connection (4-bolt flange - N/A on 20V)

7 Mounting

Omit - Flange mounting
F – Foot mounting

8 Shafts

Std. Pilot Shafts

Model	Str. Key	HD Str. Key	Spline
20V	1	N/A	151
25V thru 45V	1	86	11

"S" SAE Pilot & "M" Metric ISO Pilot Shafts

Model	Str. Key	HD Str. Key	Metric Str. Key	Spline
25VS - 45VS	202	203	N/A	297
25VM - 45VM	N/A	N/A	292N	N/A

9 Outlet Postions

(Viewed from cover end of pump)
A – Opposite inlet port
B – 90° CCW from inlet
C – Inline with inlet
D – 90° CW from inlet

10 Design

11 Rotation

(Viewed form shaft end of pump)
L – Left hand for counterclockwise
R – Right hand for clockwise

12 Special Suffix

167 – 2-bolt, 5.00" dia. pilot (25V only - N/A for VS or VM models)

Note: For options other than listed in the model code, i.e. shafts, ports, displacements and mountings, contact your Vickers representative.

Double Pump Model Code

(F3) - ****V (M) ** A (M) ** (F) - * ** 22 * - *

1 2 3 4 5 6 7 8 9 10 11 12 13

1 F3 - Viton Seals

Omit if not required

2 Series Designation

Displacements cm^3/r (in^3/r)

Model	Shaft End	Cover End
2520V -	33 - 67	7 - 45
	(2.0 - 4.1)	(0.45 - 2.8)
2525V -	(2.0 - 4.1)	33 - 67
	(0.45 - 2.8)	33 - 67
3520V -	(2.0 - 4.1)	81 - 121
	(2.0 - 4.1)	7 - 45
3525V -	(4.9 - 7.4)	81 - 121
	(0.45 - 2.2)	33 - 67
4520V -	(4.9 - 7.4)	138 - 193
	(2.0 - 4.1)	7 - 45
4525V -	(8.4 - 11.8)	138 - 193
	(0.45 - 2.2)	33 - 67
4535V -	(8.4 - 11.8)	138 - 193
	(2.0 - 4.1)	81 - 121
	(8.4 - 11.8)	(4.9 - 7.4)

3 Pilot Designation

Omit - Standard pilot
S – SAE per ISO 3019/1 (SAE J744) (N/A on 2525V)
M – Metric per ISO 3019/2 100A2HW (N/A on 2525V)

4 Geometric Displacement - Shaft End Pump

Rated capacity (USgpm) at 1200 rpm, 6,9 bar (100 psi)

Frame Size	Code (USgpm)	cm^3/r	in^3/r
25**V	10	33	2.0
	12	40	2.5
	14	45	2.8
	17	55	3.4
	21	67	4.1
35**V	25	81	4.9
	30	97	5.9
	35	112	6.8
	38	121	7.4
45**V	42	138	8.4
	45	147	9.0
	50	162	9.9
	60	193	11.8

5 Port Connections

A - SAE 4-bolt flange

6 Port Connection Modifier

Omit - Inch thread port connection (4-bolt flange)
M - Metric port connection (4-bolt flange)

7 Geometric Displacement - Cover End Pump

Rated capacity (USgpm) at 1200 rpm, 6,9 bar (100 psi)

Frame Size	Code (USgpm)	cm^3/r	in^3/r
**20V	2	7	0.43
	5	18	1.1
	8	27	1.7
	9	30	1.9
	11	36	2.2
	12	40	2.5
	14	45	2.8
**25V	10	33	2.0
	12	40	2.5
	14	45	2.8
	17	55	3.4
	21	67	4.1
4535V	25	81	4.9
	30	97	5.9
	35	112	6.8
	38	121	7.4

8 Mounting

Omit - Flange mounting
F – Foot mounting

9 Shaft

Std. Pilot Shafts

Model	Str. Key	HD Str. Key	Spline
25**V - 45**V	1	N/A	151

"S" SAE Pilot & "M" Metric ISO Pilot Shafts

Model	Str. Key	HD Str. Key	Metric Str. Key	Spline
25**VS - 45**VS	202	203	N/A	297
25**VM - 45**VM	N/A	N/A	292N	N/A

10 Port Orientation

(Viewed from cover end of pump)
All series except 2525V & 4535V
With No. 1 outlet opposite inlet:
AA - No. 2 outlet 135 CCW from inlet
AB - No. 2 outlet 45 CCW from inlet
AC - No. 2 outlet 45 CW from inlet
AD - No. 2 outlet 135 CW from inlet
With No.1 outlet 90 CCW from inlet:
BA - No. 2 outlet 135 CCW from inlet
BB - No. 2 outlet 45 CCW from inlet
BC - No. 2 outlet 45 CW from inlet
BD - No. 2 outlet 135 CW from inlet
With No.1 outlet inline with inlet:
CA - No. 2 outlet 135 CCW from inlet
CB - No. 2 outlet 45 CCW from inlet
CC - No. 2 outlet 45 CW from inlet
CD - No. 2 outlet 135 CW from inlet
With No.1 outlet 90 CW from inlet:
DA - No. 2 outlet 135 CCW from inlet
DB - No. 2 outlet 45 CCW from inlet
DC - No. 2 outlet 45 CW from inlet
DD - No. 2 outlet 135 CW from inlet

Series 2525V & 4535V
With No.1 outlet opposite inlet:
AA - No. 2 outlet opposite inlet
AB - No. 2 outlet 90 CCW from inlet
AC - No. 2 outlet inline with inlet
AD - No. 2 outlet 90 CW from inlet
With No.1 outlet 90 CCW from inlet:
BA - No. 2 outlet opposite inlet
BB - No. 2 outlet 90 CCW from inlet
BC - No. 2 outlet inline with inlet
BD - No. 2 outlet 90 CW from inlet
With No.1 outlet inline with inlet:
CA - No. 2 outlet opposite inlet
CB - No. 2 outlet 90 CCW from inlet
CC - No. 2 outlet inline inlet
CD - No. 2 outlet 90 CW from inlet
With No.1 outlet 90 CW from inlet:
DA - No. 2 outlet opposite inlet
DB - No. 2 outlet 90 CCW from inlet
DC - No. 2 outlet inline with inlet
DD - No. 2 outlet 90 CW from inlet

11 Design

12 Rotation

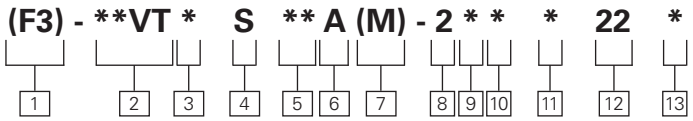
(Viewed form shaft end of pump)
L – Left hand for counter clockwise
R – Right hand for clockwise

13 Special Suffix

167 – 2-bolt, 5" dia. pilot (25**V only - N/A for VS or VM models)

Note: For options other than listed in the model code, i.e. shafts, ports, displacements and mountings, contact your Vickers representative.

Thru-Drive Pump Model Code



1 F3 - Viton Seals

Omit if not required

2 Series Designation

25VT – 33 to 67 cm³/r (2.0 to 4.1 in³/r)
35VT – 81 to 121 cm³/r (4.9 to 7.4 in³/r)
45VT – 138 to 193 cm³/r (8.4 to 11.8 in³/r)

3 Rear Pump Mounting

SAE (ISO 3019/1) 2-bolt
A – SAE "A"
B – SAE "B"
C - SAE "C" (35VT & 45VT only)
BP - SAE "B" to mount PVE12/19/21 piston pump

4 Pilot Designation

M – Metric per ISO 3019/2 100A2HW
S – Standard pilot per ISO 3019/1 (SAE J744)

5 Geometric Displacement

Rated capacity (USgpm) at 1200 rpm, 6,9 bar (100 psi)

Frame Size	Code (USgpm)	cm³/r	in³/r
25VT	10	33	2.01
	12	40	2.47
	14	45	2.78
	17	55	3.39
	21	67	4.13
35VT	25	81	4.94
	30	97	5.91
	35	112	6.83
	38	121	7.37
45VT	42	138	8.41
	45	147	8.95
	50	162	9.85
	60	193	11.75

6 Port Connections

A – SAE 4-bolt flange

7 Port Connection Modifier

Omit – Inch thread port connection (4-bolt flange).
M – Metric port connection (4-bolt flange)

8 Thru-Drive Coupling

2 – Coupling with pump (included)

Pump Series	Tail shaft pump Requirements
**VTA	SAE "A" size w/30&#2; involute spline, 9T 16/32 D.P.
**VTB	SAE "B" size w/30&#2; involute spline, 13T 16/32 D.P.
**VTC	SAE "C" size w/30&#2; involute spline, 14T 12/24 D.P.

9 Shaft

Model	SAE Str. Key	ISO Str. Key	SAE Spline	HD Str. Key
25VT	202	292N	297	203
35VT	N/A	292N	297	203
45VT	N/A	292N	297	203

10 Outlet Postions

(Viewed from cover end of pump)
A – Opposite end
B – 90° CCW from inlet
C – Inline with inlet
D – 90° CW from inlet

11 Thru-Drive Adapter Orientation

(Viewed from cover end of pump)
SAE - A Adaptor
A - Rotate 45° CW with respect to pump mounting flange
B - Rotate 45° CCW with respect to pump mounting flange
SAE - B, BP or C adaptor
A – Inline with pump mounting flange
B – Rotate 90 with respect to pump mounting flange

12 Design

13 Rotation

(Viewed form shaft end of pump)
L – Left hand for counterclockwise
R – Right hand for clockwise

Note: For options other than listed in the model code, i.e. shafts, ports, displacements and mountings, contact your Vickers representative.

Operating Data

Sound Levels

Average sound levels are at 138 bar (2000 psi) using SAE 10W (26 cSt) – (128 SUS) oil at 50°C (120°F).

Model	dB(A) - 1200 rpm	1500 rpm	- 1800 rpm
20V	62	64	66
25V	63	65	67
35V	64	66	69
45V	67	69	71

Sound levels for double pumps are on the average 1 to 3 dB(A) higher when both pumping sections are pressurized.

Sound levels are per NFPA T3.970.12 test standards.

Hydraulic Fluids

Use antiwear industrial hydraulic oils or automotive crankcase oils having letter designations SC, SD, SE or SF with viscosity grades of 32 to 68 cSt at 40° C (140° F). Preferred viscosity at rated speed and pressures:

Minimum	13 cSt (70 SUS)
Maximum	54 cSt (251 SUS)

Minimum	49°C (120°F)
Maximum	65°C (150°F)

Cold Starts

When operating with SAE 10W oil in the 860 to 54 cSt (4000 to 251 SUS) range, the speed and pressure should be limited to 50% or less of their respective rated values until the system has warmed up. Extreme caution must be used when starting units when fluid viscosities are greater than 860 cSt (4000 SUS). Care should be exercised to warm up the entire system, including remote cylinders and motors.

High Temperature

Viscosities must not be less than the respective minimum values listed for each series of pumps. Temperatures should not exceed 99° C (210° F) because the life expectancy of cartridge kits and elastomers will decrease.

Water-in-oil Emulsions

Water-in-oil emulsions may be used. However, they require careful selection and monitoring of the fluid. For assistance contact your Vickers representative. Soluble oil-in-water solutions are not recommended.

Synthetic Fire Resistant Fluids

Phosphate esters and their blends with operating viscosity of the petroleum oil described above may be used. These fluids are generally compatible with fluorocarbon and silicone elastomers. Add F3 prefix to the model code for special seals.

For operating conditions exceeding recommendations listed in this section, consult your Vickers representative. For details, refer to Vickers data sheet I-286-S, M-2950-S or GB-B-920, "Hydraulic Fluid and Temperature Recommendations."

Filtration Requirements

For satisfactory service life of components, use full flow filtration to provide fluid cleanliness conforming to ISO code (see next page). Vickers OFP, OFR and OFRS series filters are recommended. Contact your Vickers representative for further filtration advice.

Drive Data

Pumps are assembled for CW or CCW rotation. Right hand or clockwise rotation and left hand or counterclockwise rotation is viewed from the shaft end. Inlet and outlet ports remain the same regardless of the direction of shaft rotation. Assembly change of internal parts is necessary, when change of shaft rotation is required.

Pump Drive

Direct coaxial drive is recommended. If drives imposing radial shaft loads are considered, please consult your Vickers representative.

Air Bleed

At the time of first-starting, if the pump does not immediately prime, air should be bled from the pump delivery line. This may be accomplished by loosening a connection in the delivery line close to the pump until oil flows – indicating the pump has primed. An air bleed valve is available for this purpose.

CAUTION: – No Case Drain The pump is drained internally into its inlet. System pressure at the pump inlet connection may not exceed 1,4 bar (20 psi).

CAUTION: – Low Outlet Pressure Do not run a pump with the outlet pressure lower than the inlet pressure. This causes operating noise and vane instability.

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 suction connection to pump inlet. It is good practice to clean up the system by flushing and filtering using an external slave pump.

Before starting the pump, fill with fluid through one of the ports. This is particularly important if the pump is above the fluid level of the reservoir.

When initially starting the pump, remove all trapped air from the system. This can be accomplished by loosening the pump outlet fittings or connections before starting the pump or by using an air bleed valve. All inlet connections must be tight to prevent air leaks.

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

Add fluid to the reservoir to bring it up to the proper fill level.

Application Data

Fluid Cleanliness

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.

Essential information on the correct methods for treating hydraulic fluid is included in Vickers publication 561 "Vickers Guide to Systemic Contamination Control" available from your local Vickers distributor or by contacting Vickers, Incorporated. Recommendations on filtration and the selection of products to control fluid condition are included in 561.

Recommended cleanliness levels, using petroleum oil under common conditions, are based on the highest fluid pressure levels in the system and are coded in the chart below. Fluids other than petroleum, severe service cycles, or temperature extremes are cause for adjustment of these cleanliness codes. See Vickers publication 561 for exact details.

Vickers products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Other manufacturers will often recommend levels above those specified. Experience has shown, however, that life of any hydraulic component is shortened in fluids with higher cleanliness codes than those listed below. These codes have been proven to provide a long, trouble-free service life for the products shown, regardless of the manufacturer.

Product	System Pressure Level bar (psi)		
	<70 (<1000)	**70-207 (1000-3000)**	**207+ (3000+)**
Vane Pumps – Fixed	20/18/15	19/17/14	18/16/13
Vane Pumps – Variable	18/16/14	17/15/13	
Piston Pumps – Fixed	19/17/15	18/16/14	17/15/13
Piston Pumps – Variable	18/16/14	17/15/13	16/14/12
Directional Valves	20/18/15	20/18/15	19/17/14
Pressure/Flow Control Valves	19/17/14	19/17/14	19/17/14
CMX Valves	18/16/14	18/16/14	17/15/13
Servo Valves	16/14/11	16/14/11	15/13/10
Proportional Valves	17/15/12	17/15/12	15/13/11
Cylinders	20/18/15	20/18/15	20/18/15
Vane Motors	20/18/15	19/17/14	18/16/13
Axial Piston Motors	19/17/14	18/16/13	17/15/12
Radial Piston Motors	20/18/14	19/17/13	18/16/13

Fluids and Seals

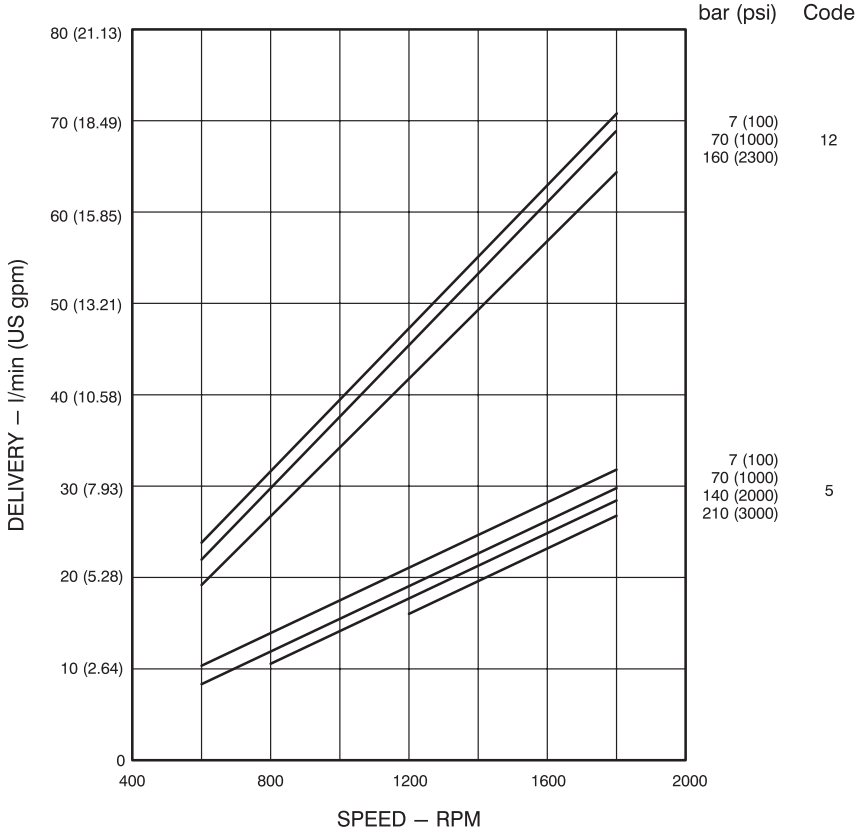
Flourocarbon seals are available and are suitable for use with phosphate ester type fluids or their blends, water glycol, water-in-oil emulsion fluids and petroleum oil.

20V Performance Characteristics

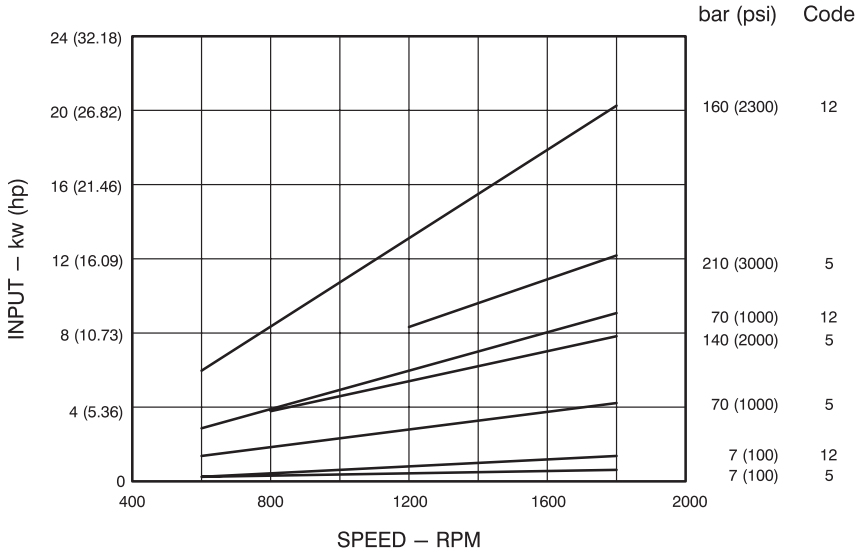
20V Cartridge Performance

Typical flows at 50° C (120° F), 10W oil (26cSt) - (128 SUS),
0 psi inlet at specified speeds

Codes 5 and 12 Displacement



Codes 5 and 12 Input kw (hp)

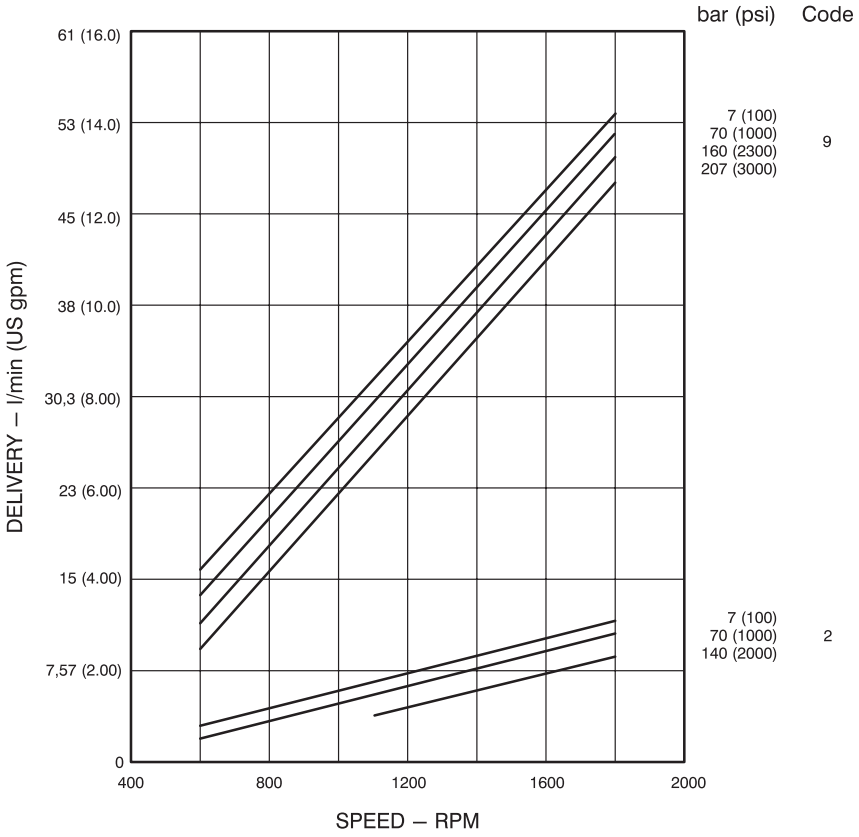


20V Performance Characteristics

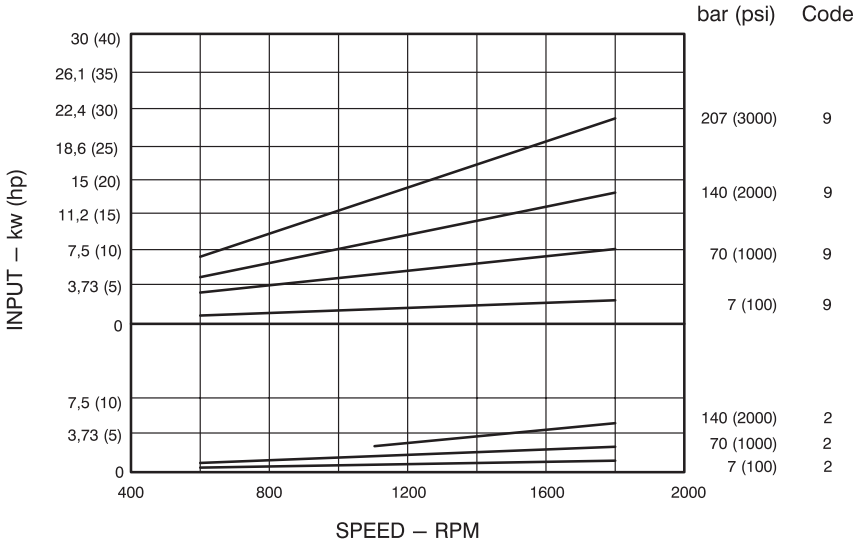
20V Cartridge Performance

Typical flows at 50° C (120° F), 10W oil (26cSt) - (128 SUS),
0 psi inlet at specified speeds

Codes 2 and 9 Displacement

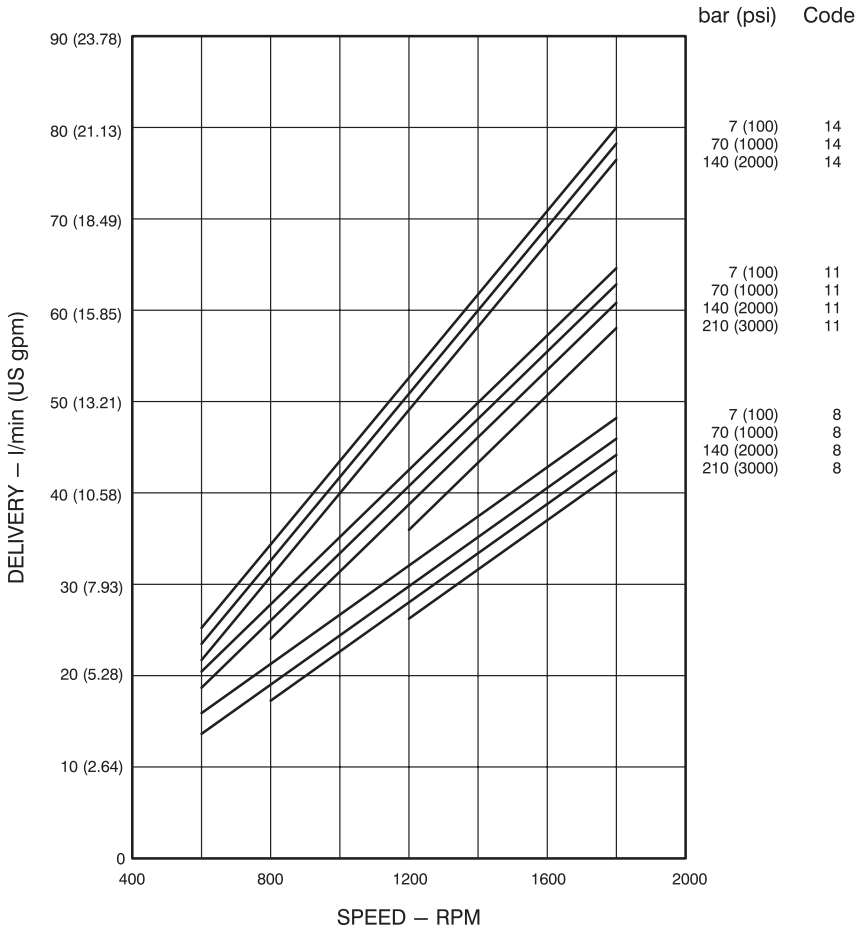


Codes 2 and 9 Input kw (hp)

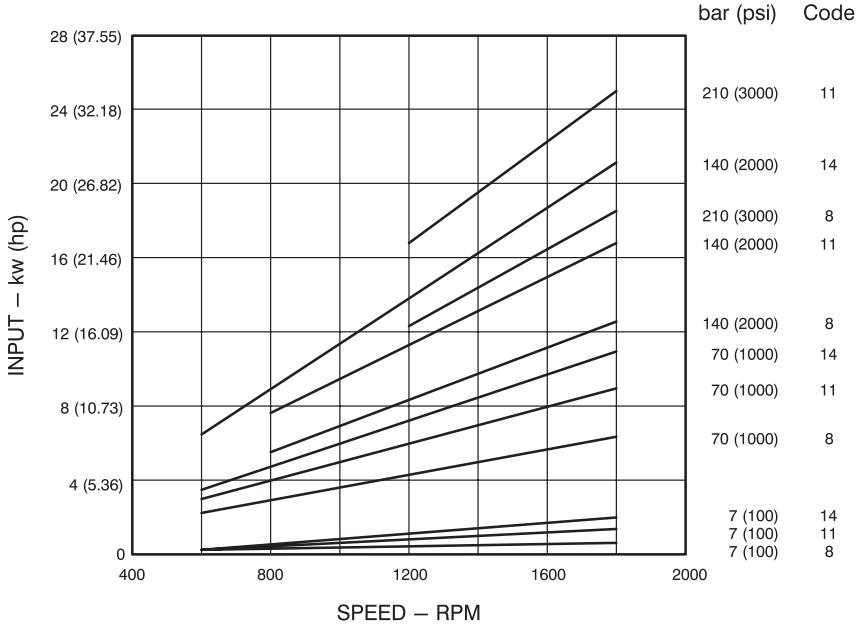


20V Performance Characteristics

Codes 8, 11, and 14 Displacement



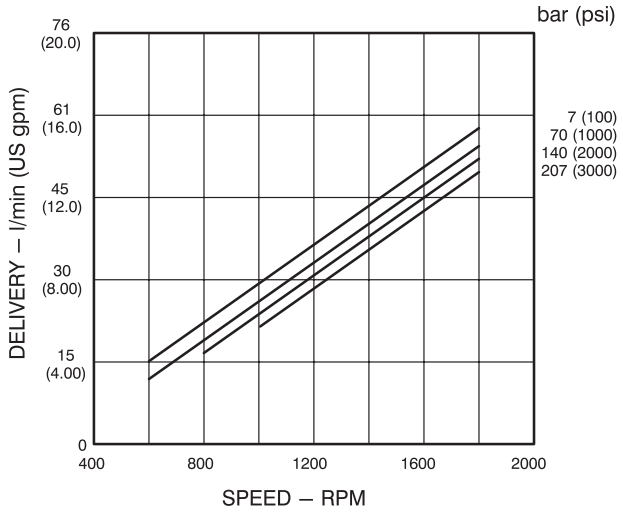
Codes 8, 11, and 14 Input



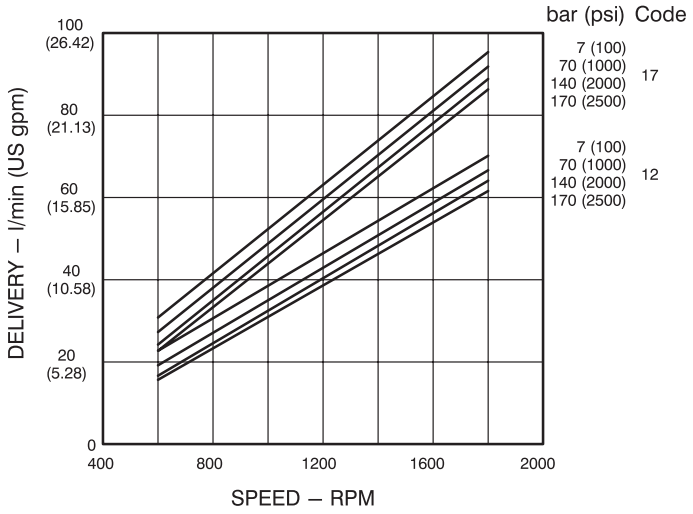
25V(T), 25**V, & **25V
Performance Characteristics

25V(T), 25**V, and **25V

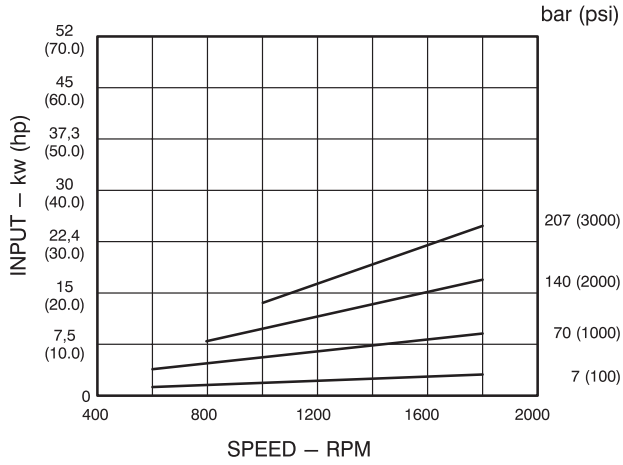
Code 10 Displacement



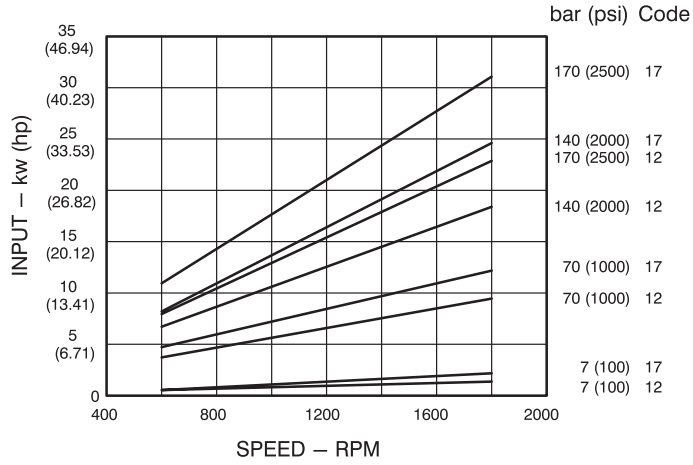
Codes 12 and 17 Displacement



Code 10 Input

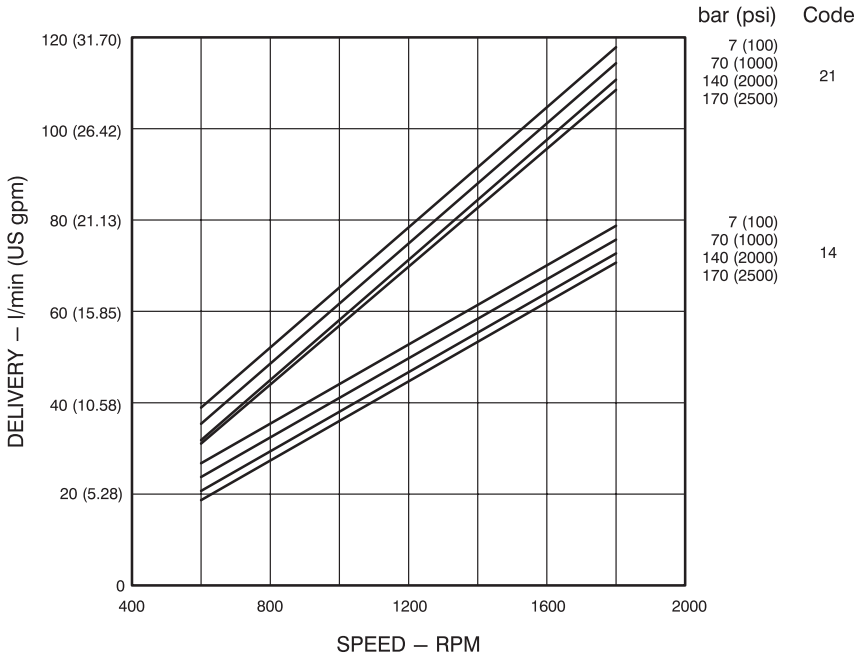


Codes 12 and 17 Input

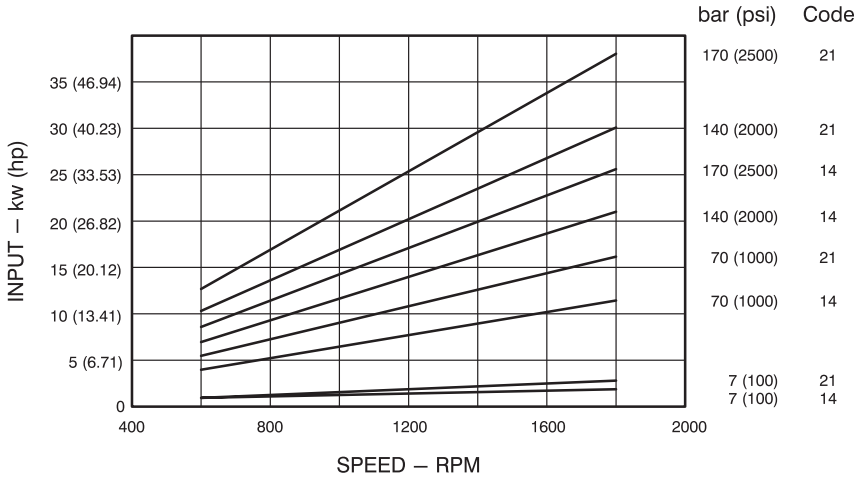


25V(T), 25**V, & **25V
Performance Characteristics

Codes 14 and 21 Displacement



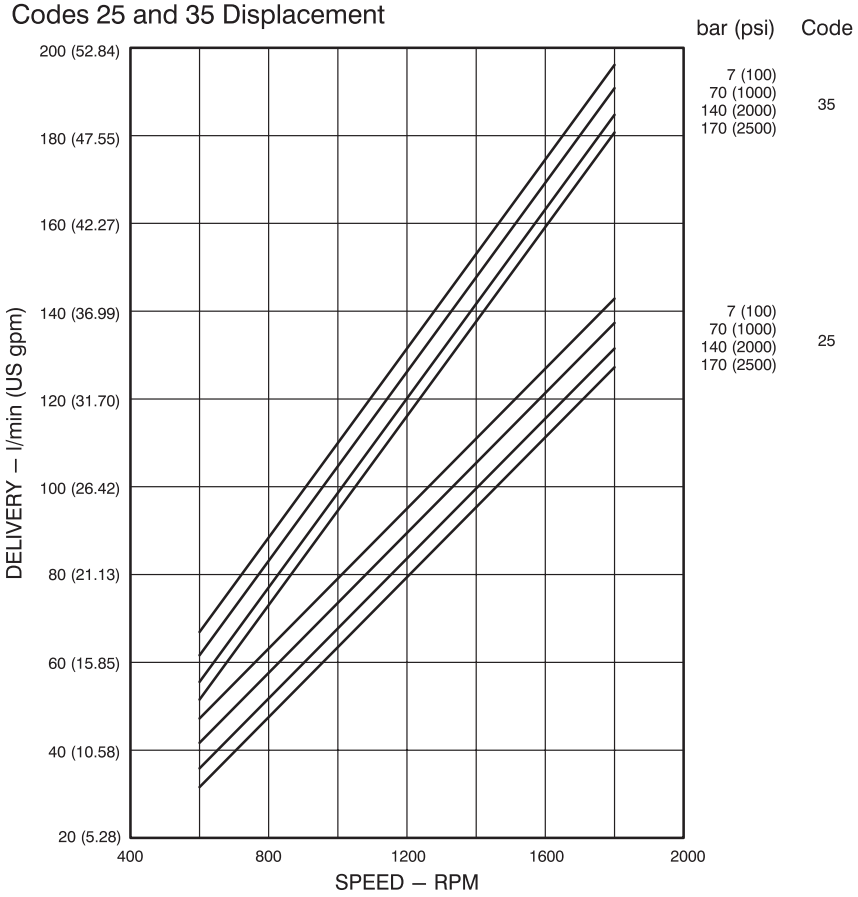
Codes 14 and 21 Input



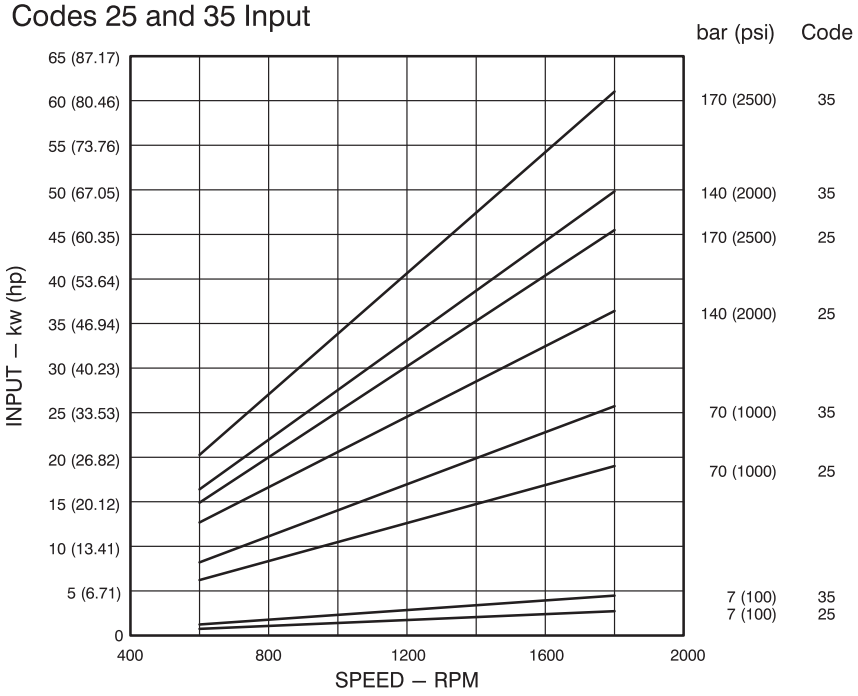
35V(T), 35**V, & **35V
Performance Characteristics

35V(T), 35**V, and **35V

Codes 25 and 35 Displacement

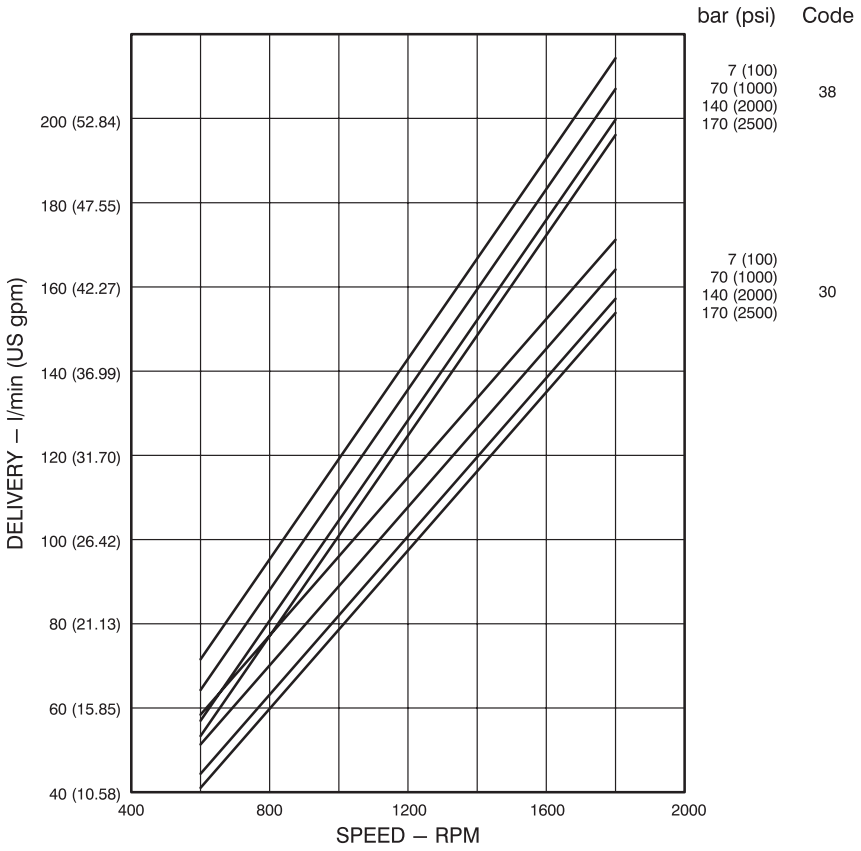


Codes 25 and 35 Input

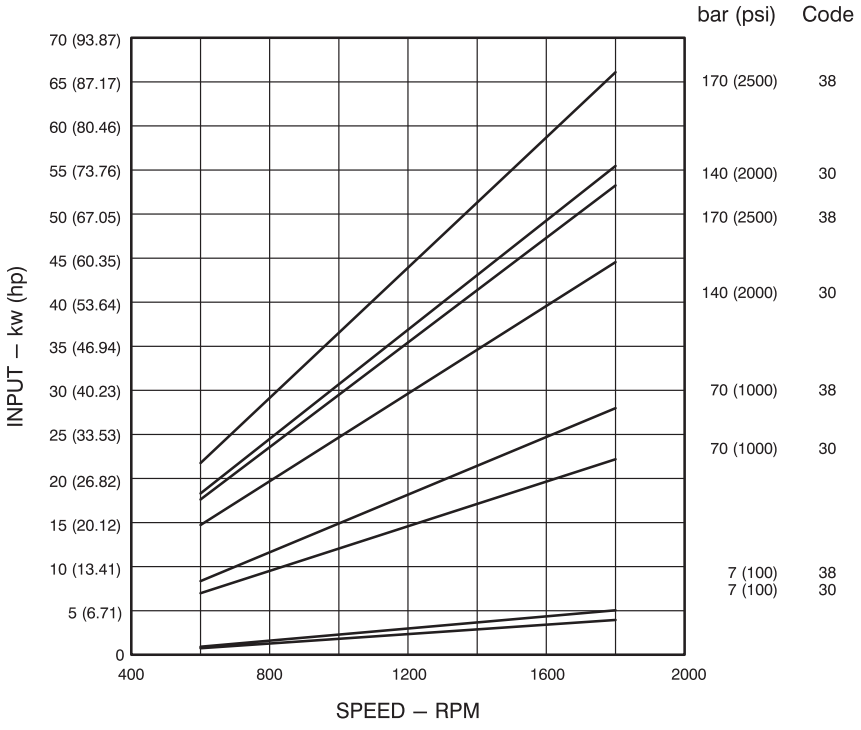


35V(T), 35**V, & **35V
Performance Characteristics

Codes 30 and 38 Displacement



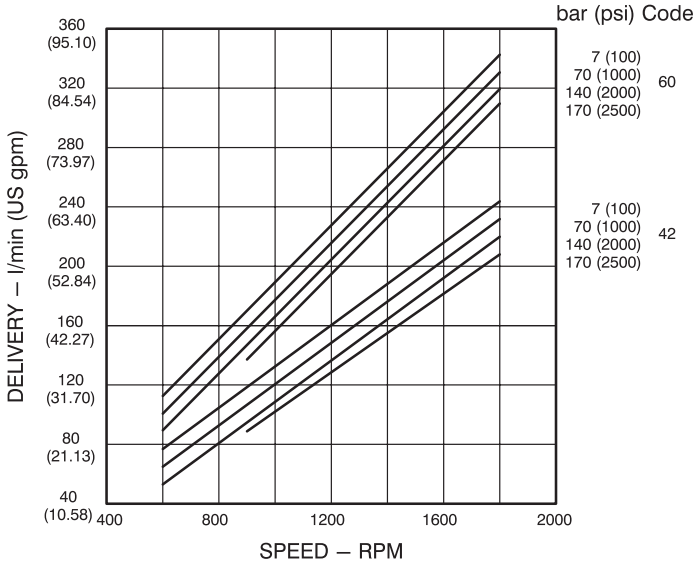
Codes 30 and 38 Input



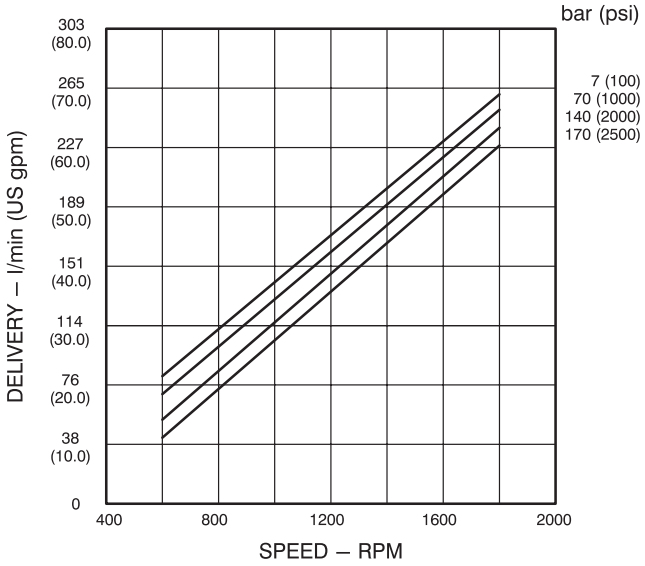
45V(T), 45**V
Performance Characteristics

45V(T) and 45**V

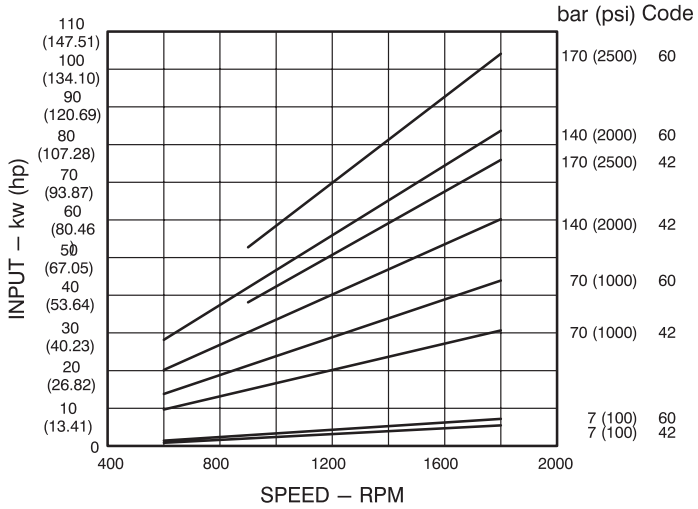
Codes 42 and 60 Displacement



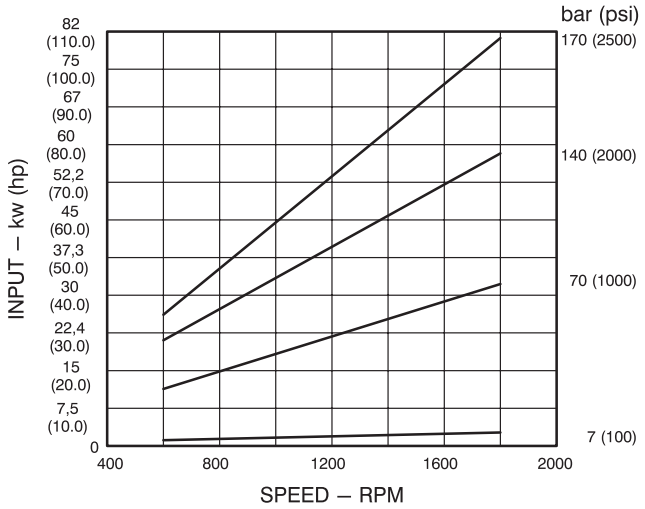
Code 45 Displacement



Codes 42 and 60 Input

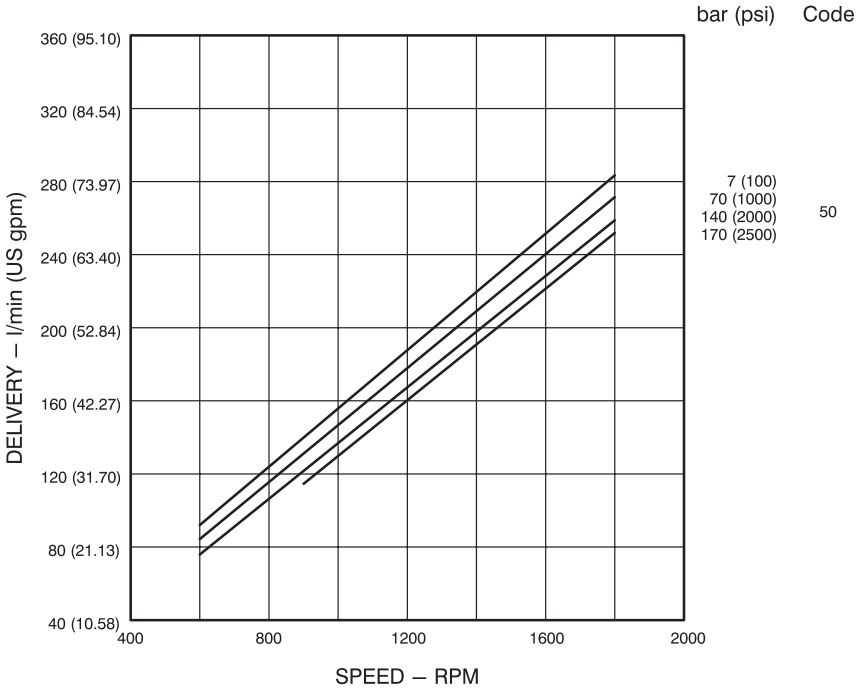


Code 45 Input

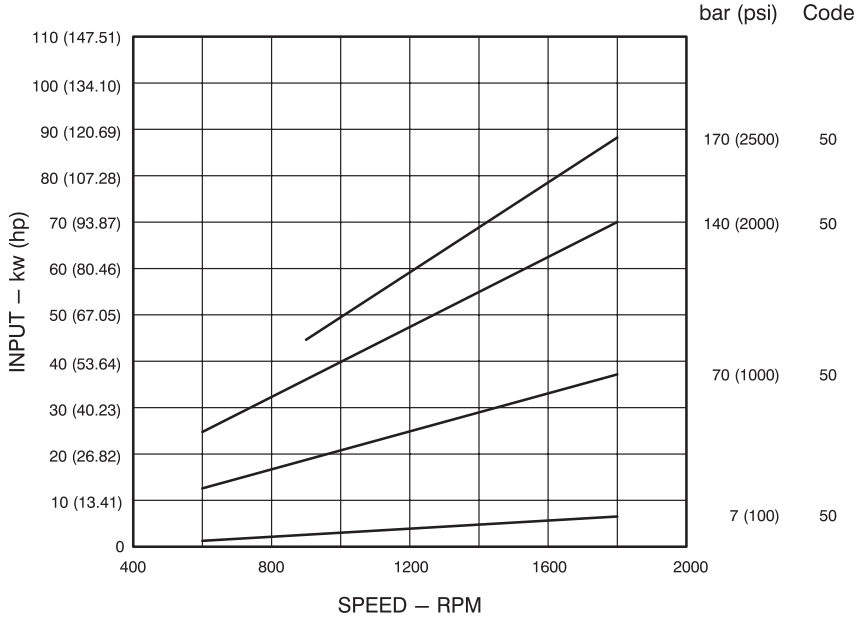


45V(T), 45**V
Performance Characteristics

Code 50 Displacement

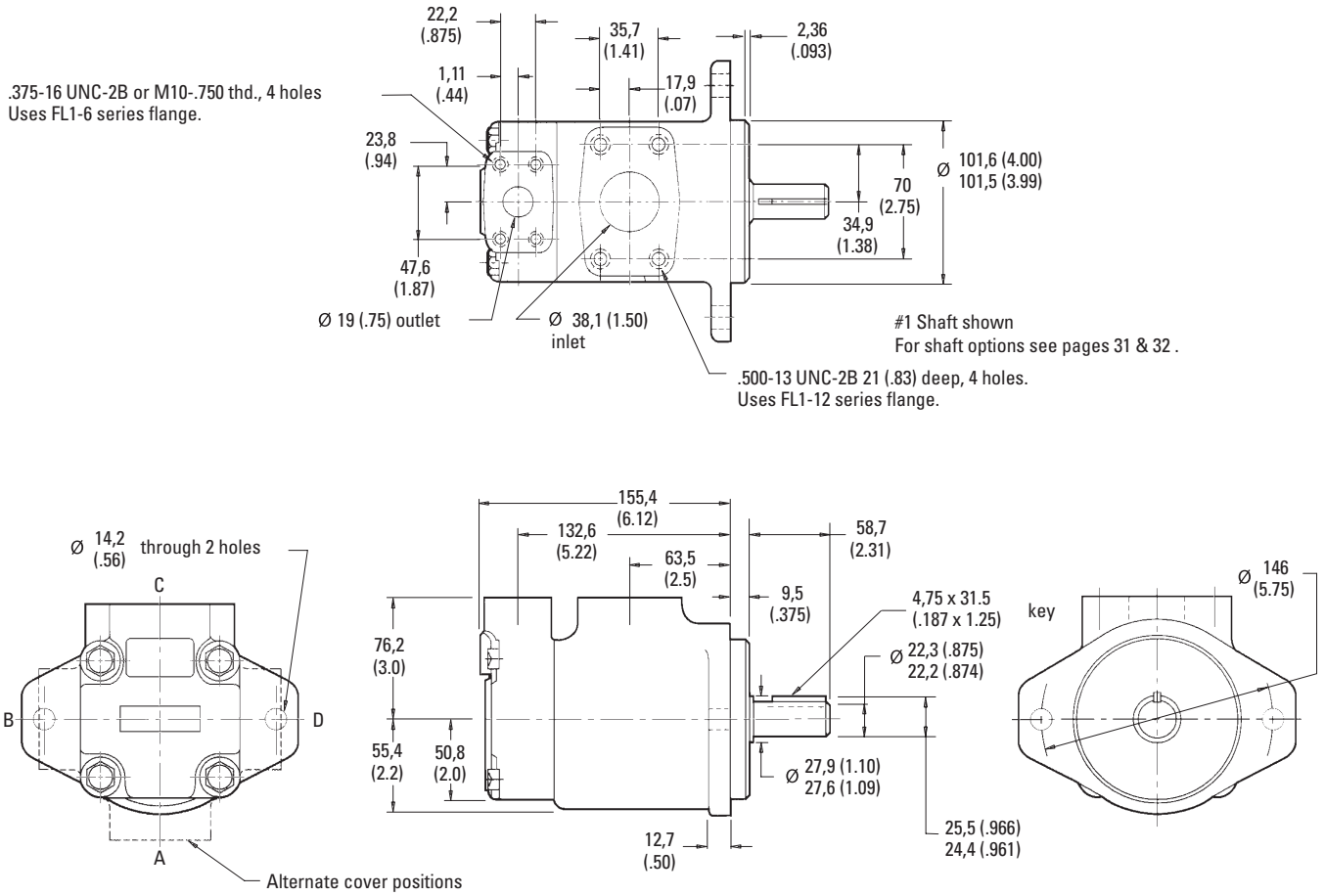


Code 50 Input



20V Installation Dimensions

20V Series Single Pumps
Millimeters (inches)

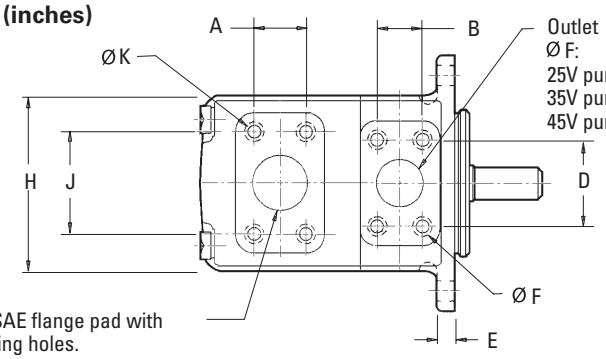


For mounting bracket dimensions see page 36.

25V, 35V, 45V
Installation Dimensions

25V, 35V and 45V Single Pumps

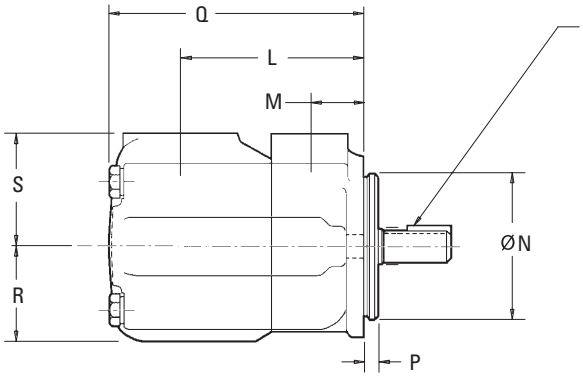
Millimeters (inches)



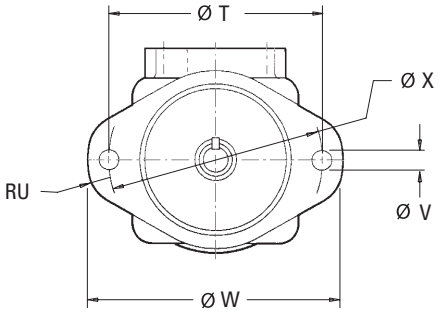
Outlet Ø C, SAE flange pad with 4 mounting holes.
Ø F:
25V pumps use FL-8 flange
35V pumps use FL-10 flange
45V pumps use FL-12 flange

Inlet Ø G, SAE flange pad with four mounting holes.
Ø K:
25V pumps use FL-12 flange
35V pumps use FL-16 flange
45V pumps use FL-24 flange

For mounting bracket dimensions see page 36.



For shaft options see pages 31 & 32.
For metric pilot flange dimensions see page 33



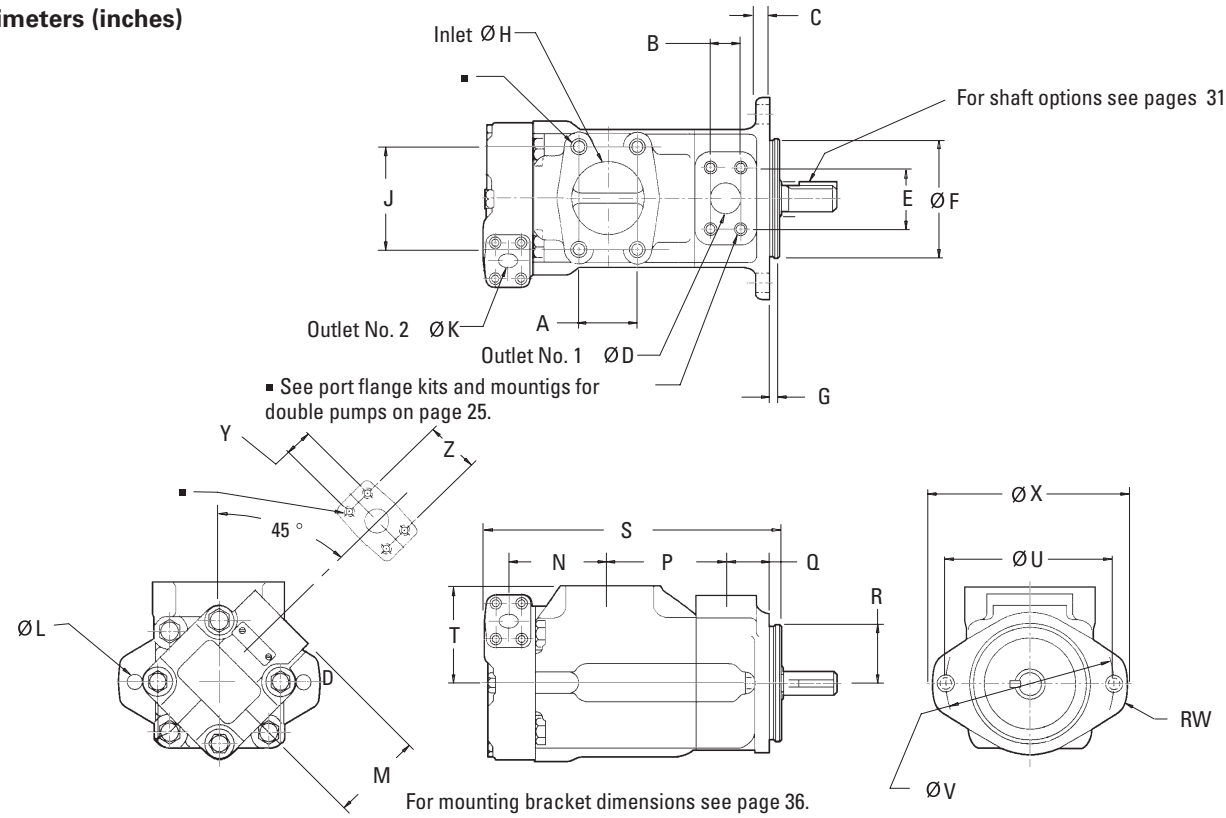
Model	ø F x full thread depth, 4 holes	ø K x full thread depth, 4 holes
25V(*)-**AM	M10 x 19,0 (0.75)) deep	M12 x 23,8 (0.94) deep
25V(*)-**A	⅜"-16UNC-2B x 19 (0.75) deep	½"-13UNC-2B x 23,8 (0.94) deep
35V(*)-**AM	M12 x 22,3 (0.88) deep	M12x22,3 (0.88) deep
35V(*)-**A	0.43"-14UNC-2B x 22,3 (0.88)deep	½ "-13UNC-2B x 22,3 (0.88) deep
45V(*)-**AM	M12 x 23,8 (0.94) deep	M16 x 30 (1.18) deep
45V(*)-**A	½"-13UNC-2B x 23,8 (0.94) deep	⅝"-11UNC-2B x 30 (1.18) deep

Model	A	B	øC	D	E	øG	H	J	L	L for (**VS & **VM)	M	øN	P	P for (**VS)	P for (**VM)
25V	35,7	26,2	25,4	52,4	12,7	38,1	118	69,9	121	149	38,1	101,6 (4.00)	9,53	9,53	9,25
	(1.41)	(1.03)	(1.00)	(2.06)	(0.50)	(1.50)	(4.62)	(2.75)	(4.76)	(5.88)	(1.50)	101,5 (3.99)	(0.38)	(0.38)	(.364)
35V	42,9	30,2	31,8	58,7	16	50,8	140	77,8	125,5	133,4	38,1	127,0 (5.00)	9,53	12,7	9.11
	(1.69)	(1.19)	(1.25)	(2.31)	(0.63)	(2.00)	(5.50)	(3.06)	(4.94)	(5.25)	(1.50)	126,9 (4.99)	(0.38)	(0.50)	(.359)
45V	61,9	35,7	38,1	69,9	16	76,2	159	106,4	153	164	43	127,0 (5.00)	12,7	12,7	9.11
	(2.43)	(1.41)	(1.50)	(2.75)	(0.63)	(3.00)	(6.25)	(4.19)	(6.03)	(6.44)	(1.69)	126,9 (4.99	(0.50)	(0.50)	(.359)

Model	Q	Q for (**VS)	Q for (**VM)	R	S	øT	RU	øV	øW	øX
25V	162,1 (6.38)	171,7 (6.76)	171,7 (6.76)	63,5 (2.50)	76,2 (3.00)	146 (5.75)	14 (0.55)	14,2 (0.56)	175 (6.88)	121 (4.76)
35V	185 (7.28)	193 (7.59)	193 (7.59)	69,9 (2.75)	82,6 (3.25)	181 (7,13)	16 (0.63)	17,5 (0.69)	213 (8.38)	148 (5.83)
45V	216 (8.50)	226 (8.91)	226 (8.91)	82,6 (3.25)	93,7 (3.69)	181 (7.13)	16 (0.63)	17,5 (0.69)	213 (8.38)	148 (5.83)

2520V, 35**V, 452*V
Installation Dimensions

2520V, 35**V and 452*V Double Pumps
Millimeters (inches)



Model	A	B	C	øD▲	E	øF	G	G for (****VS)	G for (****VM)	øH▲	J	øK▲	øL	M	N
2520V	50,8 (2.00)	26,2 (1.03)	12,7 (0.50)	25,4 (1.00)	52,4 (2.06)	101,6 (4.0) 101,5 (3.9)	9,53 (0.38)	9,53 (0.38)	9,25 (.364)	63,5 (2.50)	88,9 (3.50)	19,1 (0.75)	14,2 (0.56)	76,2 (3.00)	88,1 (3.47)
3520V	62 (2.44)	30,1 (1.19)	15,9 (0.62)	31,7 (1.25)	58,7 (2.31)	127 (5.00) 126 (4.99)	9,53 (0.38)	12,7 (0.50)	9,12 (.359)	76,2 (3.00)	106,3 (4.19)	19,1 (0,75)	17,5 (0.69)	76,2 (3.00)	99,6 (3.92)
3525V	62 (2.44)	30,1 (1.19)	15,9 (0.62)	31,7 (1.25)	58,7 (2.31)	127 (5.00) 126 (4.99)	9,53 (0.38)	12,7 (0.50)	9,12 (.359)	76,2 (3.00)	106,3 (4.19)	25,4 (1.00)	17,5 (0.69)	74,7 (2.94)	109,5 (4.31)
4520V	69,9 (2.75)	35,7 (1.41)	15,9 (0.62)	38,1 (1.50)	69,9 (2.75)	127 (5.00) 126 (4.99)	12,7 (0.50)	12,7 (0.50)	9,12 (.359)	88,9 (3.50)	120,6 (4.75)	19,1 (0.75)	17,5 (0.69)	76,2 (3.00)	102 (4.72)
4525V	69,9 (2.75)	35,7 (1.41)	15,9 (0.62)	38,1 (1.50)	69,9 (2.75)	127 (5.00) 126 (4.99)	12,7 (0.50)	12,7 (0.50)	9,12 (.359)	88,9 (3.50)	120,6 (4.75)	25,4 (1.00)	17,5 (0.69)	74,7 (2.94)	136 (5.35)

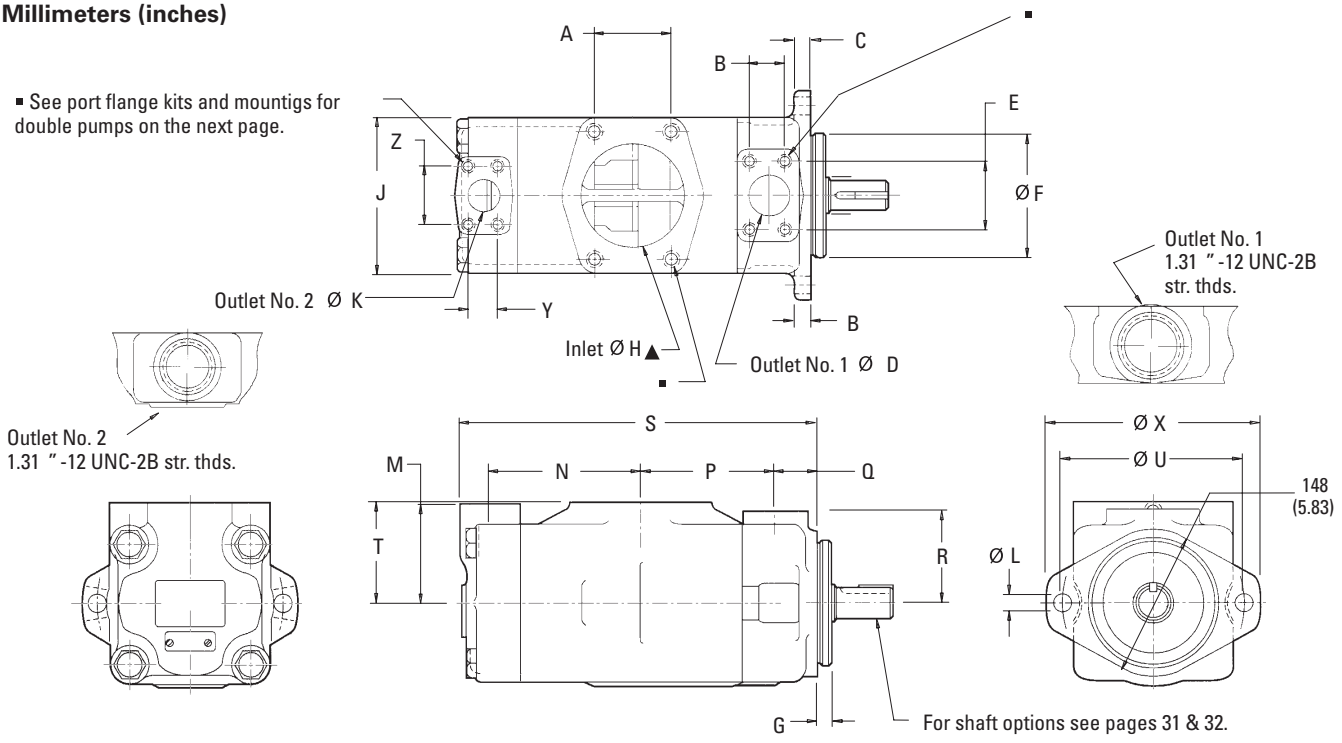
Model	P	P for (***VS & VM)	Q	R	S	S for (***VS)	S for (***VM)	T	øU	øV	RW	øX	Y	Z
2520V	101,6	111,3 (4.38)	38,1	76,2	250	259	259	85,3	146,1	175	14	174,7	22,2	47,6
	(4.00)		(1.50)	(3.00)	(9.81)	(10.2)	(10.2)	(3.38)	(5.75)	(6.88)	(0.55)	(6.88)	(0.88)	(1.88)
3520V	114,3	122,2 (4.81)	38,1	82,6	273,3	285	282	88,9	181	148	16	213	22,2	47,6
	(4.50)		(1.50)	(3.25)	(10.8)	(11.2)	(11.1)	(3.50)	(7.13)	(5.83)	(0.63)	(8.38)	(0.88)	(1.88)
3525V	114,3	122,2 (4.81)	38,1	82,6	287,3	260	254	88,9	181	148	16	213	26,2	52,4
	(4.50)		(1.50)	(3.25)	(9.81)	(10.2)	(10.0)	(3.50)	(7.13)	(5.83)	(0.63)	(8.38)	(1.03)	(2.06)
4520V	119,4	129,7 (5.11)	42,9	93,7	303,5	314	310	102,4	181	148	16	213	22,2	47,6
	(4.70)		(1.69)	(3.69)	(11.95)	(12.4)	(12.2)	(4.03)	(7.13)	(5.83)	(0.63)	(8.38)	(0.88)	(1.88)
4525V	119,4	129,7 (5.11)	42,9	93,7	325	336	332	102,4	181	148	16	213	26,2	52,4
	(4.70)		(1.69)	(3.69)	(12.8)	(13.2)	(13.1)	(4.03)	(7.13)	(5.83)	(0.63)	(8.38)	(1.03)	(2.06)

▲ Nominal port size, also see next page "port flange kits and mountings for double pumps.

2525V, 4535V
Installation Dimensions

2525V and 4535V Series Double Pumps
Millimeters (inches)

▪ See port flange kits and mountigs for double pumps on the next page.



For shaft options see pages 31 & 32.

For mounting bracket dimensions see page 36.

▲ Nominal port size, also see next page port flange kits and mountings for double pumps.

Model	A	B	C	øD▲	E	øF	G	øH▲	J	øK▲	øL	M	N
2525V	50,8 (2.00)	26,2 (1.03)	12,7 (0.50)	25,4 (1.00)	52,4 (2.06)	101,6 (4.0) 101,5 (3.9)	9,53 (0.38)	63,5 (2.50)	88,9 (3.50)	25,4 (1.00)	14,2 (0.56)	76,2 (3.00)	97,5 (3.84)
4535V	77,8 (3.06)	35,7 (1.41)	15,9 (0.62)	38,1 (1.50)	69,9 (2.75)	127 (5.00) 126 (4.99)	12,7 (0.50)	101,6 (4.00)	130,2 (5.13)	31,7 (1.25)	17,5 (0.69)	101,6 (4.00)	148,3 (5.84)
4535VM							9,12 (.359)						

Model	P	Q	R	S	T	øU	øV	RW	øX	Y	Z
2525V	101,6 (4.00)	38,1 (1.50)	76,2 (3.00)	263 (10.4)	84 (3.31)	146,1 (5.75)	175 (6.88)	14 (0.55)	174,7 (6.88)	26,2 (1.03)	52,4 (2.06)
4535V	133,3 (5.25)	42,9 (1.69)	93,7 (3.69)	353 (13.9)	102,4 (4.03)	181 (7.13)	148 (5.83)	–	213 (8.38)	30,2 (1.19)	58,7 (2.31)
4535VS & 4535VM	144 (5.66)			364 (14.3)							

Port Flange Kits /Mtg for Double Pumps

▪ Port Flange Kits and Mountings for Double Pumps

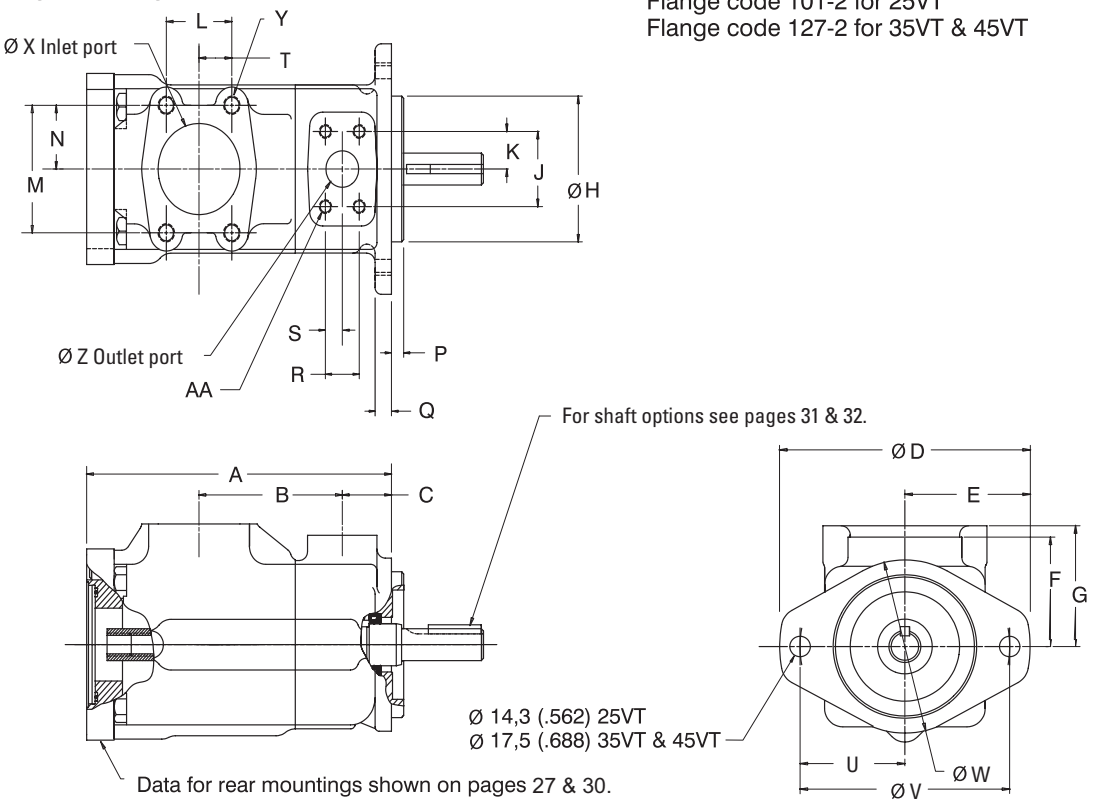
Pump	Inlet		Outlet No. 1, Shaft end		Outlet No. 2, Rear end	
	Flange Kits	**Mounting Bolt Tap & Full Thread Depth**	**Flange Kits**	**Mounting Bolt Tap & Full Thread Depth**	**Flange Kits**	**Mounting Bolt Tap & Full Thread Depth**
2520V-**AM-	N/A from Vickers	M12 x 23,8 (0.94)	N/A from Vickers	M10 x 20,1 (0.79)	N/A from Vickers	M10 x 20,1 (0.79)
2520V-**A-	FL1-20-	.50" - 13UNC-2B x 23,8 (0.94)	FL1-8-	.375" - 16UNC-2B x 20,1 (0.79)	FL1-6	.375" - 16UNC-2B x 20,1 (0.79)
2525V-**AM-	N/A from Vickers	M12 x 23,8 (0.94)	N/A from Vickers	M10 x 20,1 (0.79)	N/A from Vickers	M10 x 20,1 (0.79)
2525V-**A-	FL1-20-	.50" - 13UNC-2B x 23,8 (0.94)	FL1-8-	.375" - 16UNC-2B x 20,1 (0.79)	FL1-8-	.375" - 16UNC-2B x 20,1 (0.79)
3520V-**AM-	N/A from Vickers	M16 x 30,0 (1.18)	N/A from Vickers	M16 x 30,0 (1.18)	N/A from Vickers	M10 x 20,1 (0.79)
3520V-**A-	FL1-24-	.625" - 11UNC-2B x 30,0 (1.18)	FL1-10-	.437" - 14UNC-2B x 30,0 (1.18)	FL1-6-	.375" - 16UNC-2B x 20,1 (0.79)
3525V-**AM-	N/A from Vickers	M16 x 30,0 (1.18)	N/A from Vickers	M16 x 30,0 (1.18)	N/A from Vickers	M10 x 20,1 (0.79)
3525V-**A-	FL1-24-	.625" - 11UNC-2B x 30,0 (1.18)	FL1-10-	.437" - 14UNC-2B x 30,0 (1.18)	FL1-8-	.375" - 16UNC-2B x 20,1 (0.79)
4520V-**AM-	N/A from Vickers	M16 x 30,0 (1.18)	N/A from Vickers	M12 x 23,8 (0.94)	N/A from Vickers	M10 x 20,1 (0.79)
4520V-**A-	FL1-28-	.625" - 11UNC-2B x 30,0 (1.18)	FL1-12-	.50" - 13UNC-2B x 23,8 (0.94)	FL1-6-	.375" - 16UNC-2B x 20,1 (0.79)
4525V-**AM-	N/A from Vickers	M16 x 30,0 (1.18)	N/A from Vickers	M12 x 23,8 (0.94)	N/A from Vickers	M10 x 20,1 (0.79)
4525V-**A-	FL1-28-	.625" - 11UNC-2B x 30,0 (1.18)	FL1-12-	.50" - 13UNC-2B x 23,8 (0.94)	FL1-8-	.375" - 16UNC-2B x 20,1 (0.79)
4535V-**AM-	N/A from Vickers	M16 x 30,0 (1.18)	N/A from Vickers	M12 x 23,8 (0.94)	N/A from Vickers	M10 x 20,1 (0.79)
4535V-**A-	FL1-32-	.625" - 11UNC-2B x 30,0 (1.18)	FL1-12-	.50" - 13UNC-2B x 23,8 (0.94)	FL1-10-	.437" - 14UNC-2B x 30,0 (1.18)

**VT Thru Drives
Installation Dimensions

**VT Series Thru-Drives

For metric pilot flanges see page 33.

Conforms to SAE J744
Flange code 101-2 for 25VT
Flange code 127-2 for 35VT & 45VT

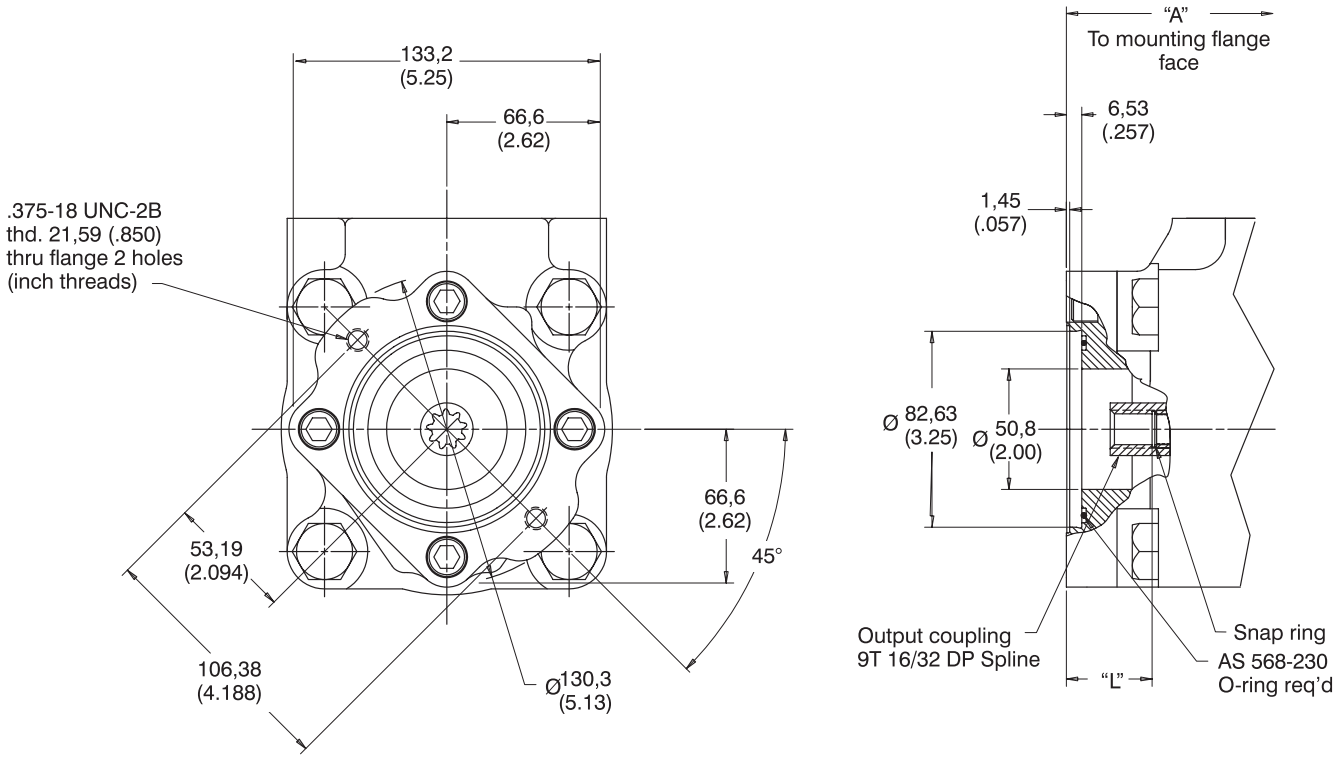


Model	A	B	C	øD	E	F	G	øH	J	K	L	M	N
25VT	See page .	111,1 (4.38)	38,1 (1.50)	174,8 (6.88)	87,4 (3.44)	76,2 (3.00)	84,1 (3.31)	101,6 (4.00) 101,5 (3.99)	52,4 (2.06)	26,2 (1.03)	50,8 (2.00)	88,9 (3.50)	44,5 (1.75)
35VT	See page .	122 (4.81)	38,1 (1.50)	213 (8.38)	106,2 (4.18)	82,6 (3.30)	88,9 (3.50)	127,0 (5.00) 126,9 (4.99)	58,7 (2.31)	29,4 (1.16)	61,9 (2.44)	106,4 (4.19)	53,2 (2.09)
45VT	See page .	129,9 (5.11)	42,9 (1.69)	213 (8.38)	106,2 (4.18)	93,7 (3.69)	102,3 (4.03)	127,0 (5.00) 126,9 (4.99)	69,9 (2.75)	34,9 (1.38)	69,9 (2.75)	120,7 (4.75)	60,3 (2.38)

Model	P	Q	R	S	T	U	øV	øW	øX	Y	øZ	AA
25VT	9,52 (0.375)	12,7 (0.50)	26,2 (1.03)	13,1 (0.52)	25,4 (1.00)	73 (2.88)	146 (5.75)	120,6 (4.75)	63,5 (2.50)	.500-13 UNC-2B or M12 thd. 23,8 (.938) deep 4 holes	25,4 (1.00)	.375-16 UNC-2B or M16 thd. 20,1 (0.79) deep 4 holes
35VT	12,5 (0.49)	15,7 (0.62)	30,2 (1.19)	15,1 (0.59)	30,9 (1.22)	90,5 (3.56)	180,9 (7.13)	147,6 (5.81)	76,2 (3.00)	.625-11 UNC-2B or M16 thd. 30,0 (1.18) deep 4 holes	31,8 (1.25)	.437-14 UNC-2B or M16 thd. 30,0 (1.18) deep 4 holes
45VT	12,5 (0.49)	15,7 (0.62)	35,7 (1.41)	17,9 (0.70)	35,9 (1.38)	90,5 (3.56)	181 (7.13)	147,6 (5.81)	88,9 (3.50)	.625-11 UNC-2B or M16 thd. 30,0 (1.18) deep 4 holes	38,1 (1.50)	.500-13 UNC-2B or M12 thd. 22,2 (.875) deep 4 holes

**VT Thru–Drive Rear Mountings Installation Dimensions

**VT Thru-Drive Rear Mountings
"A" Rear Mounting



	Dimension "A"		
Pump Model	****VTAS Models**	****VTAM Models**	**Dimension "L"***
25VTA	236,5 (9.3)	236,5 (9.3)	32,6/31,0 (1.28/1.22) 33,0 (1.30) Maximum
35VTA	259,1 (10.2)	259,1 (10.2)	32,6/31,0 (1.28/1.22) 35,6 (1.40) Maximum
45VTA	291,6 (11.5)	321,8 (12.7)	32,6/31,0 (1.28/1.22) 35,3 (1.39) Maximum

* Caution: Dimension "L" is important and must be observed.

NOTE: This unit **accepts** a hydraulic pump which conforms to flange and shaft codes specified in ISO 3019/1 (SAE J744 Jul88).

Flange Code	Shaft Code	SAE J744C (Ref)
82-2	16-4	A

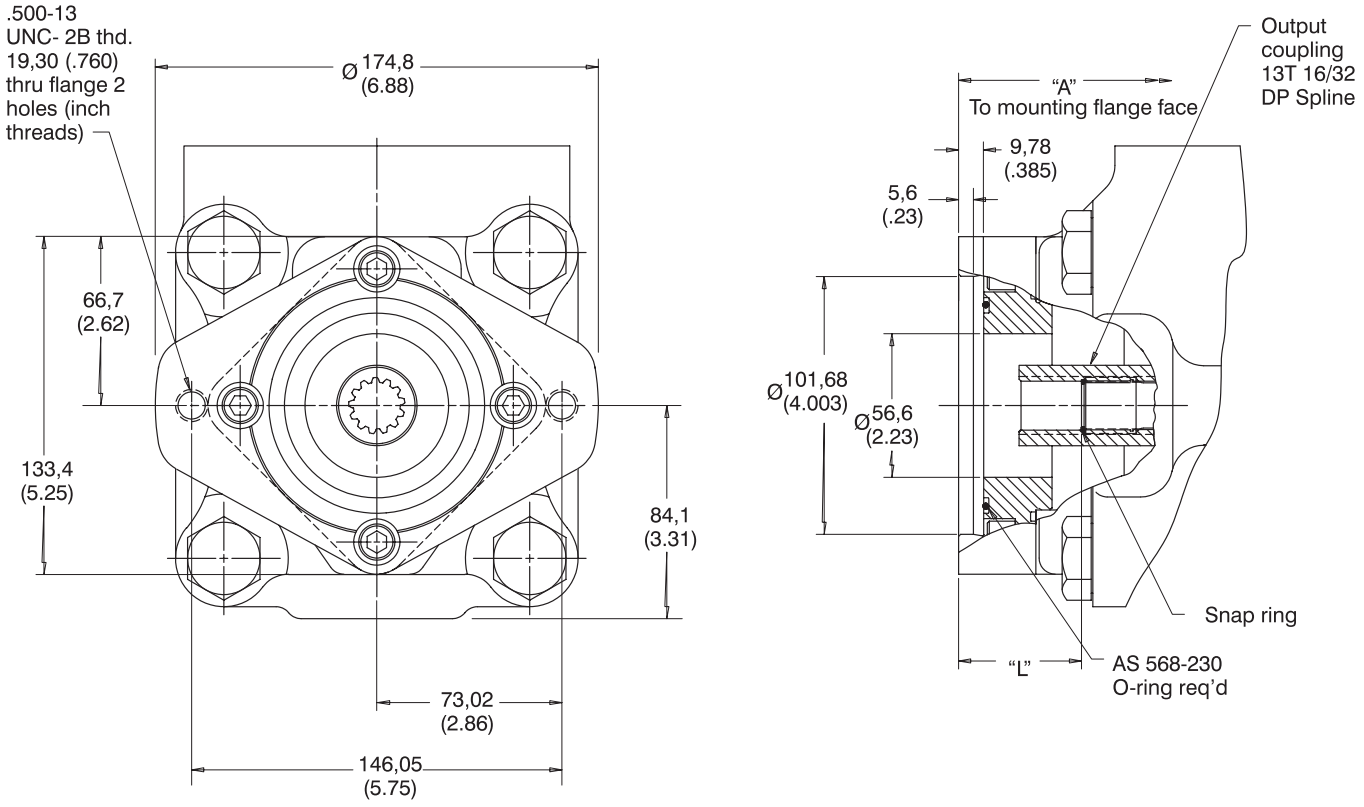
****VTA**

The following Vickers shaft selection will comply with the above:

Rear Pump Model	Shaft
V10 Vane pump	11
V20 Vane pump	62
PVB5/6 Piston pump	S124

**VT Thru–Drive Rear Mountings Installation Dimensions

**VT Thru-Drive Rear Mountings
"B" Rear Mounting



	Dimension "A"		
Pump Model	****VTBS Models**	****VTBM Models**	**Dimension "L"***
25VTB	245,8 (9.67)	245,8 (9.67)	42,3/39,9 (1.67/1.57) 45,2 (1.78) Maximum
35VTB	268,2 (10.56)	268,2 (10.56)	42,3/39,9 (1.67/1.57) 46,7 (1.84) Maximum
45VTB	300,7 (11.84)	331,0 (13.03)	42,3/39,9 (1.67/1.57) 46,2 (1.82) Maximum

* Caution: Dimension "L" is important and must be observed.

NOTE: This unit **accepts** a hydraulic pump which conforms to flange and shaft codes specified in ISO 3019/1 (SAE J744 Jul88).

Flange Code	Shaft Code	SAE J744C (Ref)
101-2	22-4	B

****VTB**

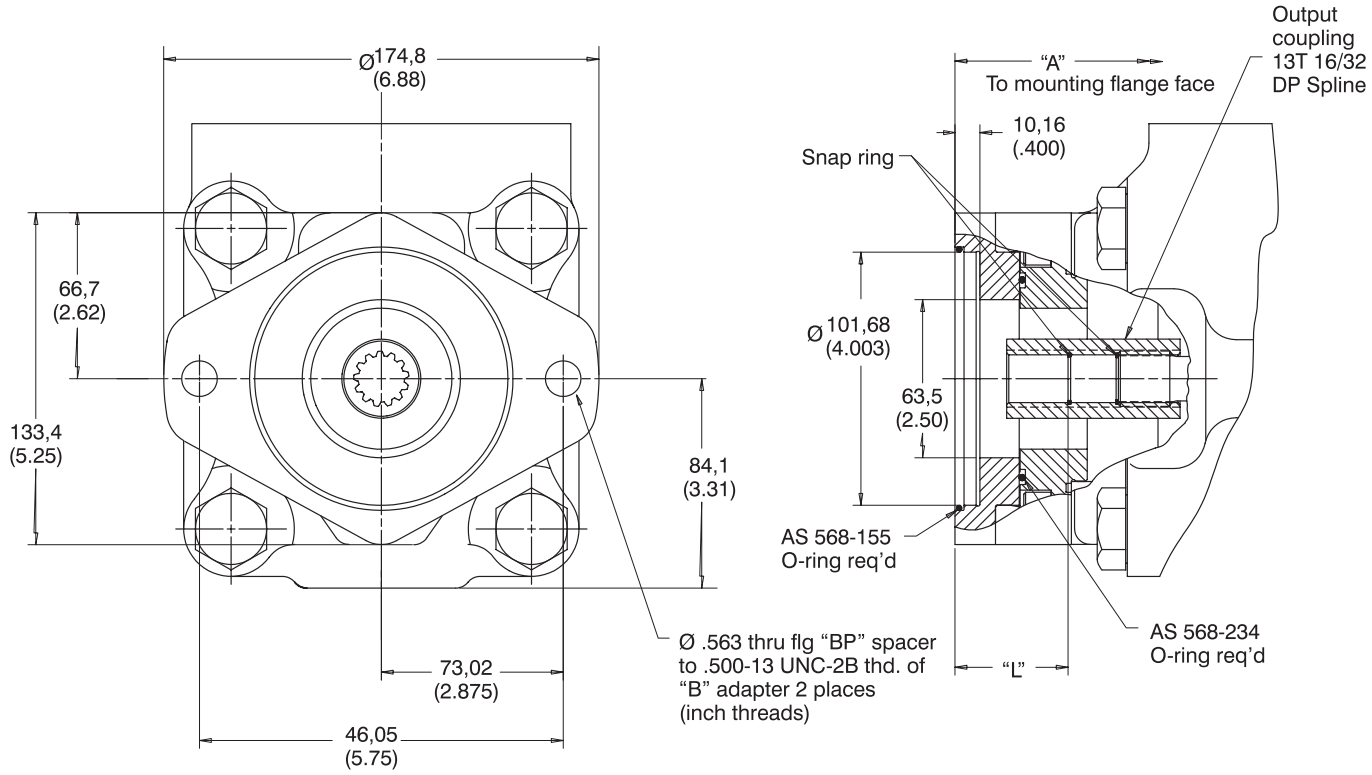
The following Vickers shaft selection will comply with the above:

Rear Pump Model	Shaft
PVB10/15 Piston pump	S124
V2010/2020 Double pump	11
20V Vane pump	151
25V Vane pump	11
2520V Double pump	11

**VT Thru–Drive Rear Mountings Installation Dimensions

**VT Thru-Drive Rear Mountings

"BP" Rear Mounting



	Dimension "A"		
Pump Model	****VTBPS**	****VTBPM**	**Dimension "L"***
25VTBP	261,9 (10,31)	261,9 (10,31)	45,6/43,2 (1,80/1.70) Not SAE std.
35VTBP	284,5 (11,20)	284,5 (11,20)	45,6/43,2 (1,80/1.70) Not SAE std.
45VTBP	317,0 (12.48)	347,2 (13,67)	45,6/43,2 (1,80/1.70) Not SAE std.

* Caution: Dimension "L" is important and must be observed.

NOTE: These units accept a Vickers pump as below which conforms to flange code 101-2 in ISO 3019/1 (SAE J744C Ju188) and has a Vickers type 9 shaft

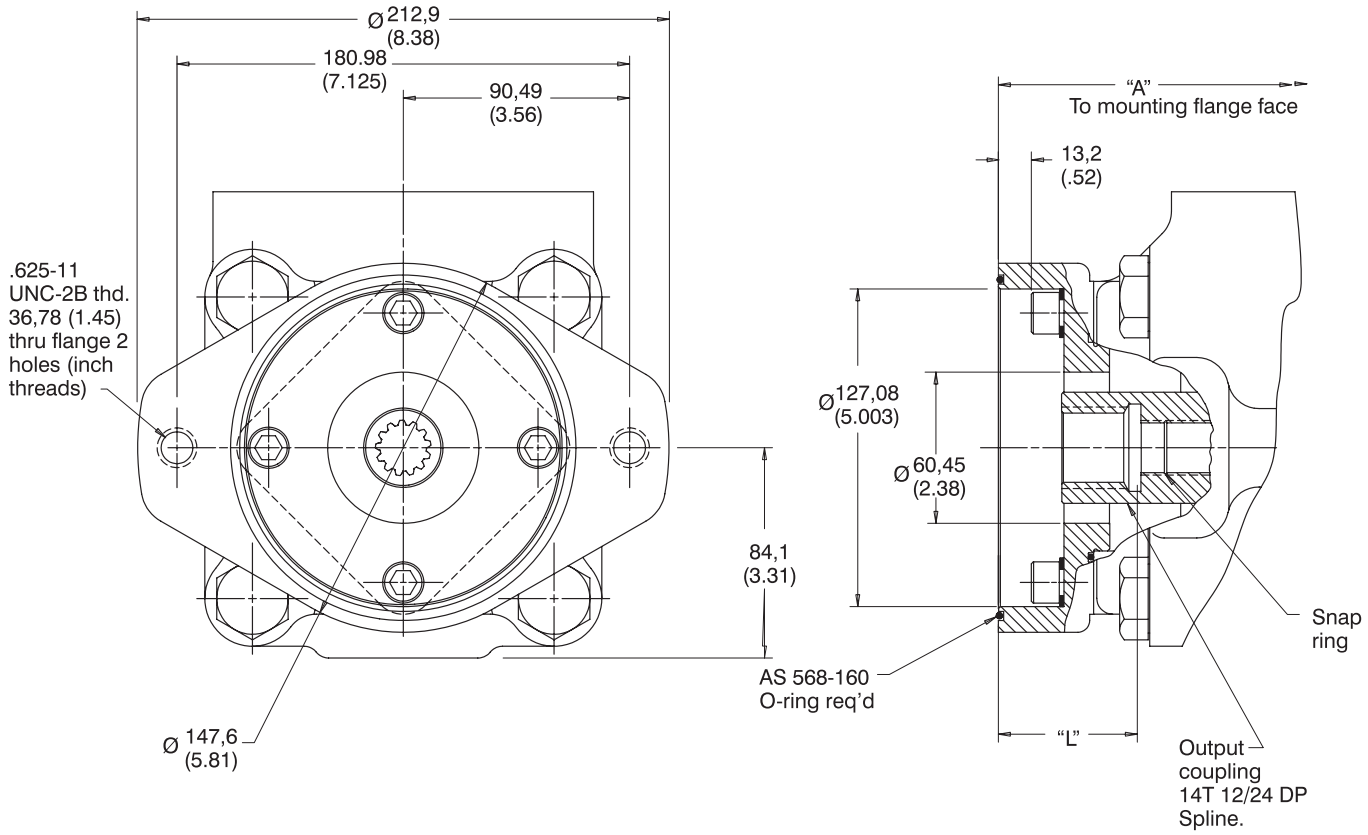
****VTBP**

The following Vickers shaft selection will comply with the above:

Rear Pump Model	Shaft
PVE12/19/21 Piston pump	9

**VT Thru Drive Rear Mountings Installation Dimensions

**VT Thru-Drive Rear Mountings
"C" Rear Mounting



	Dimension "A"		
Pump Model	****VTCS Models**	****VTCM Models**	**Dimension "L"***
35VTC	275,8 (10,86)	275,8 (10,86)	56,6/54,2 (2,23/2,13) 61,2 (2.41) Maximum
45VTC	308,4 (12,14)	338,6 (13,33)	56,6/54,2 (2,23/2,13) 61,5 (2.42) Maximum

* Caution: Dimension "L" is important and must be observed.

NOTE: This unit **accepts** a hydraulic pump which conforms to flange and shaft codes specified in ISO 3019/1 (SAE J744 Jul88),

Flange Code	Shaft Code	SAE J744C (Ref)
127-2	32-4	C

****VTC**

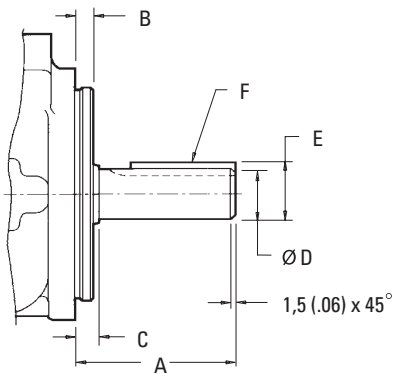
The following Vickers shaft selection will comply with the above:

Rear Pump Model	Shaft
35V Vane pump	11
3520/3525V Double pumps	11
45V Vane pump	11

Optional Shafts

Straight Key Shafts

Thru-drive shafts, see pages 34.

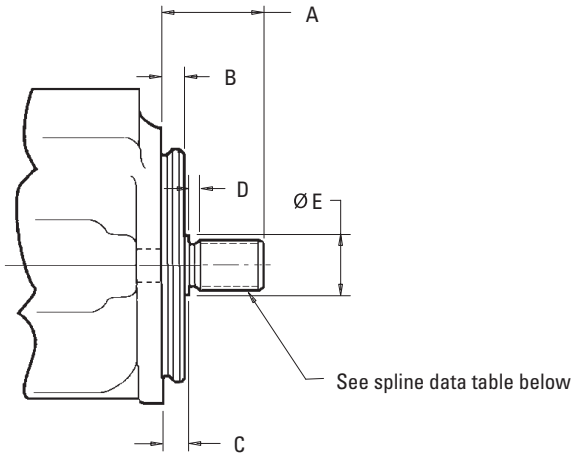


Pump	Shaft Code	A	B	C	øD	E	F key width x length
20V	1	59 (2.32)	9,53 (.375)	12,1 (.476)	22,23 (.875) 22,20 (.874)	24,5 (.966) 24,4 (.961)	4,75 (.817) x 32 (1.25)
25V 2520V	1	59 (2.32)	9,53 (.375)	11,1 (.435)	22,23 (.875) 22,20 (.874)	24,5 (.966) 24,4 (.961)	4,75 (.817) x 32 (1.25)
25V 252*V	86	78 (3.06)	9,53 (.375)	11,1 (.435)	25,37 (.999) 25,35 (.998)	28,3 (1.11) 28,1 (1.10)	6,36 (.250) x 50,8 (2.00)
25VM 252*VM 25VT*M	292N	52,3 (2.06)	9,25 (.364)	10,4 (.41)	25,02 (.985) 25,00 (.984)	28,02 (1.10) 27,81 (1.09)	8,00 (.314) x 28 (1.10)
25VT*S 25VS	202	71,4 (2.81)	9,53 (.375)	7,9 (.310) ▲	22,23 (.875) 22,20 (.874)	25,15 (.990) 24,90 (.980)	6,36 (.250) x 50,8 (2.00)
252*VS	203	77,7 (3.06)	9,53 (.375)	7,9 (.310) ▲	25,40 (1.00) 25,35 (.998)	28,20 (1.11) 27,94 (1.10)	6,36 (.250) x 50,8 (2.00)
35V 352*V	1	73,2 (2.88)	9,53 (.375)	11,1 (.435)	31,75 (1.25) 31,70 (1.24)	35,36 (1.39) 34,10 (1.38)	7,94 (.313) x 38,1 (1.50)
	86	86 (3.88)	9,53 (.375)	11,1 (.435)	34,90 (1.374) 34,87 (1.373)	38,6 (1.52) 38,3 (1.51)	7,92 (.312) x 54 (2.13)
35VM 352*VM 35VT*M	292N	68,4 (2.70)	9,12 (.359)	10,4 (.41)	37,01 (1.457) 36,75 (1.447)	35,00 (1.378) 34,80 (1.370)	10 (.394) x 45 (1.77)
35VS 352*VS	202	84,1 (3.31)	12,7 (.50)	10,4 (.41)	31,75 (1.25) 31,70 (1.24)	35,36 (1.39) 34,10 (1.38)	7,94 (.313) x 45 (1.77)
35VT*S 35VS 352*VS	203	84,1 (3.31)	12,7 (.50)	7,9 (.310) ▲	34,90 (1.374) 34,87 (1.373)	38,56 (1.518) 38,30 (1.508)	7,92 (.312) x 54 (2.125)
45V 45**V	1	62 (2.44)	12,7 (.500)	14,22 (.560)	31,75 (1.25) 31,70 (1.24)	35,36 (1.39) 34,10 (1.38)	7,92 (.312) x 28,5 (1.12)
	86	87,4 (3.44)	12,7 (.500)	14,22 (.560)	38,07 (1.499) 38,05 (1.498)	42,4 (1.67) 42,1 (1.66)	9,53 (.375) x 50,8 (2.00)
45VS 45**VS	202	84,1 (3.31)	12,7 (.500)	14,22 (.560)	31,75 (1.25) 31,70 (1.24)	35,36 (1.39) 34,10 (1.38)	7,94 (.313) x 63 (2.48)
45VM 452*VM 45VT*M	292N	92 (3.62)	9,12 (.359)	10,0 (.394)	40,01 (1.575) 39,99 (1.574)	43,0 (1.693) 42,8 (1.685)	12 (.472) x 63 (2.48)
45VT*S 45VS 45**VS	203	87,4 (3.44)	9,14 (.360)	7,9 (.310) ▲	38,07 (1.499) 38,05 (1.498)	42,4 (1.67) 42,1 (1.66)	9,53 (.375) x 57,1 (2.25)

▲ Shaft shoulder inside recess in pilot.

Optional Shafts

Splined Shafts



Pump	Shaft Code	A	B	C	D	øE	Spline Data (see below)
20V	151	41,1 (1.62)	9,53 (.375)	11,1 (.437)	3,9 (.156)	27,8 (1.09)	A
25V 2520V	11	44,5 (1.75)	9,53 (.375)	11,1 (.437)	3,9 (.156)	27,8 (1.09)	A
2525V	174	59,9 (2.36)	9,53 (.375)	17,3 (.68)	3,0 (.12)	29,2 (1.15)	B
25VT*S 25VS 252*VS	297	41,1 (1.62)	9,14 (.36)	7,9 (.31)	4,1 (.16)	27,8 (1.09)	C
35V 352*V	11	58,7 (2.31)	9,53 (.375)	11,1 (.437)	6,35 (.25)	35,1 (1.38)	D
35VT*S 35VS 352*VS	297	55,5 (2.19)	9,14 (.360)	7,9 (.310)	5,5 (.21)	35,1 (1.38)	E
45V 45**V	11	61,9 (2.44)	12,7 (.500)	14,3 (.565)	9,7 (.38)	39,6 (1.56)	D
45VT*S 45VS 45**VS	297	55,5 (2.19)	9,14 (.360)	7,9 (.310)	9,7 (.38)	39,6 (1.56)	E

Spline Data Table

(Involute splines from above chart)

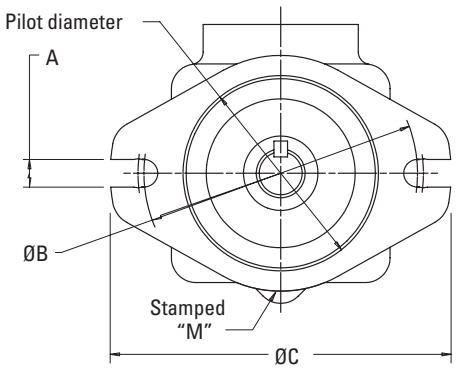
Spline Data Reference	Number of Teeth	Pitch	Major Diameter	Form Diameter	Minor Diameter	Minor Diameter
A	13	16/32	22,17 (.873) 22,15 (.872)	19,03 (.749)	18,63 (.734) 18,35 (.723)	Major dia. fit
B	14	12/24	31,22 (1.23) 31,11 (1.22)	27,48 (1.08)	27,0 (1.063) 26,7 (1.05)	Side fit
C	13	16/32	22,2 (.875) 21,7 (.853)	19,03 (.749)	18,4 (.725)	Side fit
D	14	12/24	31,7 (1.25) 31,67 (1.247)	27,2 (1.07)	26,99 (1.06) 26,64 (1.05)	Major dia. fit
E	14	12/24	31,6 (1.25) 31,1 (1.22)	27,48 (1.08)	26,7 (1.05)	Side fit

Optional Shafts

Optional ISO 3019/2 Metric Pilot Flange Mounting Options for "VM" & "VT*M" Pumps

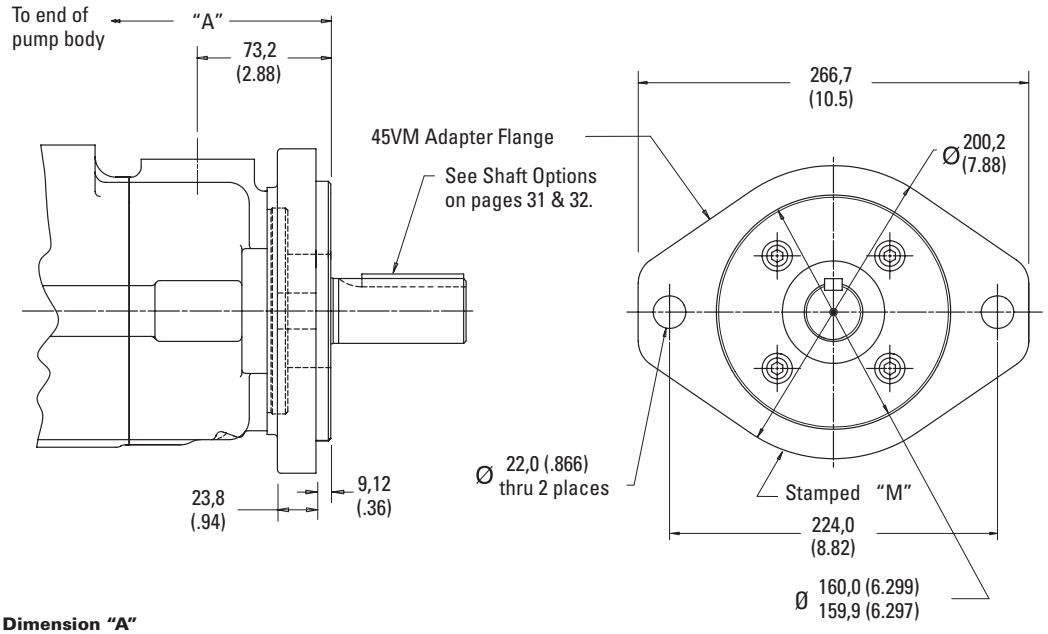
25 and 35 Size Pumps

Model	A	ØB	ØC	Pilot diameter
25VM Single Pumps				
25VT*M Thru-drive Pumps	14,27	140	175	100,0 (3.937)
25**VM Double Pumps	(.562)	(5.51)	(6.87)	99,95 (3.935)
35VM Single Pumps				
35VT*M Thru-drive Pumps	18,34	180	212	125,02 (4.922)
35**VM Double Pumps	(.722)	(7.09)	(8.33)	124.97 (4.920)



45 Size Pumps

45VM Single Pumps
45VT*M Thru-drive Pumps
45**VM Double Pumps



45VT** Thru-drive Pumps	Dimension "A"	
Rear Mounting Type	**45VT*S Pumps**	**45VT*M Pumps**
A	291,6 (11.48)	321,8 (12.67)
B	300,7 (11.84)	331,0 (13.03)
BP	317,0 (12.48)	347,2 (13.67)
C	308,4 (12.14)	338,6 (13.33)

Torque Loading for Direct Drives

Single pumps (not thru–drive models) All listed shafts are satisfactory up to maximum pressures in "Pressure and speed limits" in operating data for each series.

Double pumps

Where both cartridges are to be on-load together, check that the sum of their separate torques, taken from the graph below (right), does not exceed the torque limit in shaft torque Table 1.

Thru–drive pumps **VT* models Where both the thru-drive pump and its rear–mounted pump are to be on-load together, check that the sum of the torques generated will never exceed the torque limit in shaft torque Table 2. Also check that the torque required on the rear-mounted pump never exceeds the thru-drive torque limit in shaft torque Table 2.

Table 1
Single & Double Pumps Shaft Torque Ratings

Pump Model	Shaft No.	Maximum input torque Nm (lb-in)
25V or 25**V	1	250 (2200)
	11	250 (2200)
	86	400 (3560)
	174	550 (4900)
	292N	316 (2800)
35V or 35**V	1	400 (3560)
	11	580 (5100)
	86	600 (5300)
	292N	400 (3560)
45V or 45**V	1	400 (5300)
	11	820 (7200)
	86	820 (7200)
	292N	820 (7200)

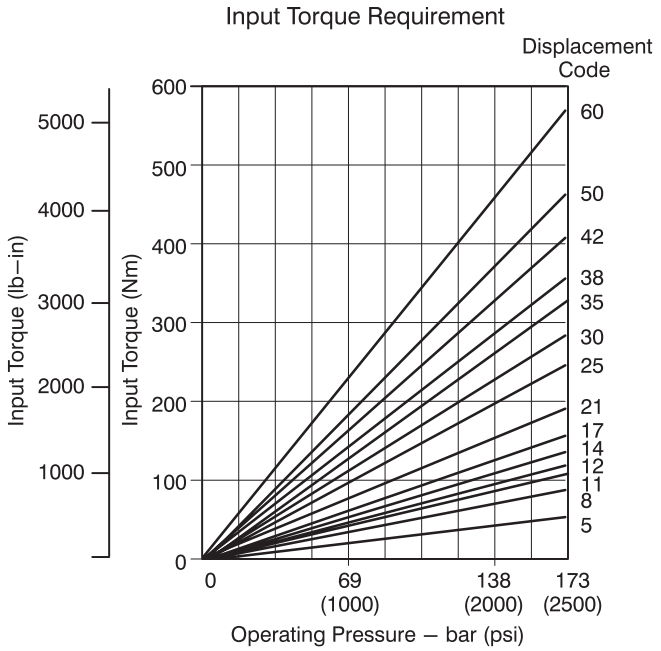
Example:

A 3525V38A17 pump operating at 172 bar (2500 psi) front section and 138 bar (2000 psi) rear section will require over 450 Nm (4000 lb-in) input torque. Therefore, all listed shafts are acceptable except No.1.

Table 2 Thru-Drive Pumps
Shaft Torque Ratings

Pump Model	Shaft No.	Max. Input Torque Nm (lb-in)*	Thru-drive connection	Max. Thru-drive Torque Nm (lb-in)
25VT*S 25VS 242*VS	202	250 (2200)	A	131 (1160)
			B	250 (2200)
	203	400 (3560)	A	131 (1160)
			B	316 (2800)
	297	316 (2800)	A	131 (1160)
			B	316 (2800)
	292N	316 (2800)	A	131 (1160)
			B	316 (2800)
35VT*S 35VS 352*VS	292N	400 (3560)	A	131 (1160)
			B	316 (2800)
			C	400 (3560)
	203	600 (5300)	A	131 (1160)
			B	316 (2800)
			C	437 (3870)
	297	790 (7000)	A	131 (1160)
			B	316 (2800)
			C	437 (3870)
45VT*S 45VS 45**VS	292N	904 (8000)	A	131 (1160)
			B	384 (3400)
			C	702 (6210)
	203	810(7200)	A	131 (1160)
			B	384 (3400)
			C	702 (6210)
	297	1020 (9000)	A	131 (1160)
			B	384 (3400)
			C	702 (6210)

* Combined torque of Vickers "VT" pump and thru-drive pump.



Drives

Recommended Drives

Vickers units are designed for use on direct coaxial drives using spline connections and/or flexible couplings. If drives imposing radial and/or axial loads, or key drives are being considered, consult your Vickers representative for additional information.

Drive Alignment

Concentricity and angular alignment of shafts are important to pump life. Misalignment can induce heavy loads on bearings, causing premature failure. Flexible coupling halves must be aligned according to the coupling manufacturer's recommendations.

Universal Joints

When using double universal joint couplings, the shafts must be parallel and the yokes must be in line. The offset should be kept as low as possible. Maximum allowable offset will, of course, vary with application conditions. The pump shaft to universal joint diametral fit should be close (major diameter fit) with no appreciable looseness.

Mounting Pad Accessory Drives

A splined shaft is recommended on applications where the pump shaft is coupled directly into a transmission or gear box. Spline drives should be lubricated. The possibility of interference between the shaft and transmission splines, due to tolerance stack-up, can exist. To reduce this possibility, side tooth spline fits should be used. A side tooth fit and short length of engagement permits more flexibility and less tendency for side loading than does a major diameter fit spline or long spline engagement.

Mounting Dimensions

Requirements

Dimensional control requirements of the customer's mounting pad to which the pump or motor is affixed are as follows.

Pilot Diameter

Concentricity of the customer's female pilot diameter relative to the effective axis of the female drive must be within .10 mm (.004") total indicator reading. The clearance between the male and female pilot diameters must be +.0127 to .0508 mm (+.0005 to +.0020 inch).

Mounting Face

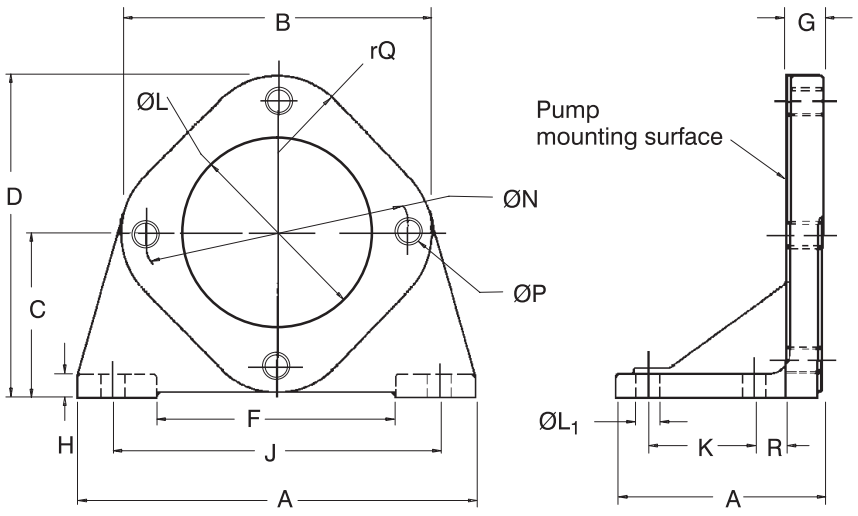
The customer's mounting face to which the pump or motor is affixed must be square to the axis of the female drive within .04 mm per 25 mm (.0015 inch per inch).

Shafts

Dimensions of keyed shaft receivers must be between +.002554 and +.0254 mm (+.0001 and +.0010) of the maximum shaft diameter shown on the respective Vickers installation drawing.

Foot Mounting Bracket Option

(Not suitable for thru-drive pumps)
Salts for mounting pump are supplied with bracket.



Part No.	A	B	C	D	E	F	G	H	J
422583	171 (6.75)	178 (7.00)	92 (3.625)	181 (7.125)	93 (3.656)	98 (3.858)	17,4 (.687)	13 (.50)	146 (5.750)
422584	265 (10.43)	212 (8.37)	109,5 (4.312)	216 (8.50)	129 (5.06)	164 (6.46)	19 (.750)	16 (.62)	235 (9.250)

Part No.	K	øL	øL1	øN	øP	rQ	R
422583	50,8 (2.00)	101,6 (4.00)	11,1 (.593)	146 (5.750)	1/2"-13 UNC	51 (2.00)	13
422584	76,2 (3.00)	127 (5.00)	17,5 (.68)	180,7 (7.125)	3/8"-11 UNC	64 (2.52)	19

422583 for use with frame sizes 20, 25 and .2520 pumps. Weighs 2,7 kg (6 lbs.)
422584 for use with frame sizes 35, 45, 35** and 45** pumps. Weighs 5,9 kg (13 lbs.)

Application Data

Moment of Inertia

Model	Nm/sec²	Moment lb-in-sec²
25V	0,000757	(.00670)
35V	0,001395	(.01235)
45V	0,003073	(.02720)
2520V	0,001309	(.01159)
2525V	0,001469	(.01300)
3520V	0,001629	(.01495)
3525V	0,002042	(.01807)
4520V	0,003186	(.02820)
4525V	0,003732	(.03303)
4535V	0,004554	(.04031)

Vane Pump Approximate Weights

Frame size	kg (lbs.)	
20V	12.0	(26)
25V	14.8	(33)
25V(T)	19.4	(43)
35V	22.7	(50)
35V(T)	28.7	(63)
45V	34.0	(75)
45V(T)	38.1	(84)
2520V	20.5	(45)
2525V	23,1	(51)
3520V	34.0	(75)
3525V	34.5	(76)
4520V	43.0	(95)
4525V	46.0	(101)
4535V	53.5	(118)

Mounting Options

Mounting attitude of all pumps is unrestricted except for any limitations in respect to rear-end pumps to be titled to **VT pumps. Such limitations will be found in the technical literature for those specific pumps.

Ordering Procedure

State full model designation(s) when ordering pumps. Port flange kits are available from Vickers and must be ordered as separate items.

Specify "BP" adapter when coupling PVE12119/21 as second pump on thru-drives.

Existing "B" thru-drives can be converted to "BP" using the following kits:

25VT: 941295 Adapter kit

452865 Coupling

35VT/45VT: 941295 Adapter kit only

Note: Adaptor kit and couplings are included with unit when ordered with "BP" designation in model code.

Service Information

Refer to specific Vickers part drawing or overhaul manual (below) for service information or consult your Vickers representative.

Service Literature:

20V	1-3195-5
25V	1-3196-5
35V	1-3197-5
45V	1-3199-5
2520V	1-3200-5
2525V	1-3212-5
3520V	1-3202-5
3525V	1-3203-5
4520V	1-3204-5
4525V	1-3208-5
4535V	1-3209-5
25VT	1-3154-5
35VT	1-3149-5
45VT	1-3151-5

Overhaul Manuals:

25V	1-3157-5
25VT	1-3157-5
35V	1-3157-5
35VT	1-3157-5
45V	1-3157-5
45VT	1-3157-5
2520V	1-3155-5
3520V	1-3155-5
3525V	1-3155-5
4520V	1-3155-5
4525V	1-3155-5
4535V	1-3155-5

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Powering Business Worldwide

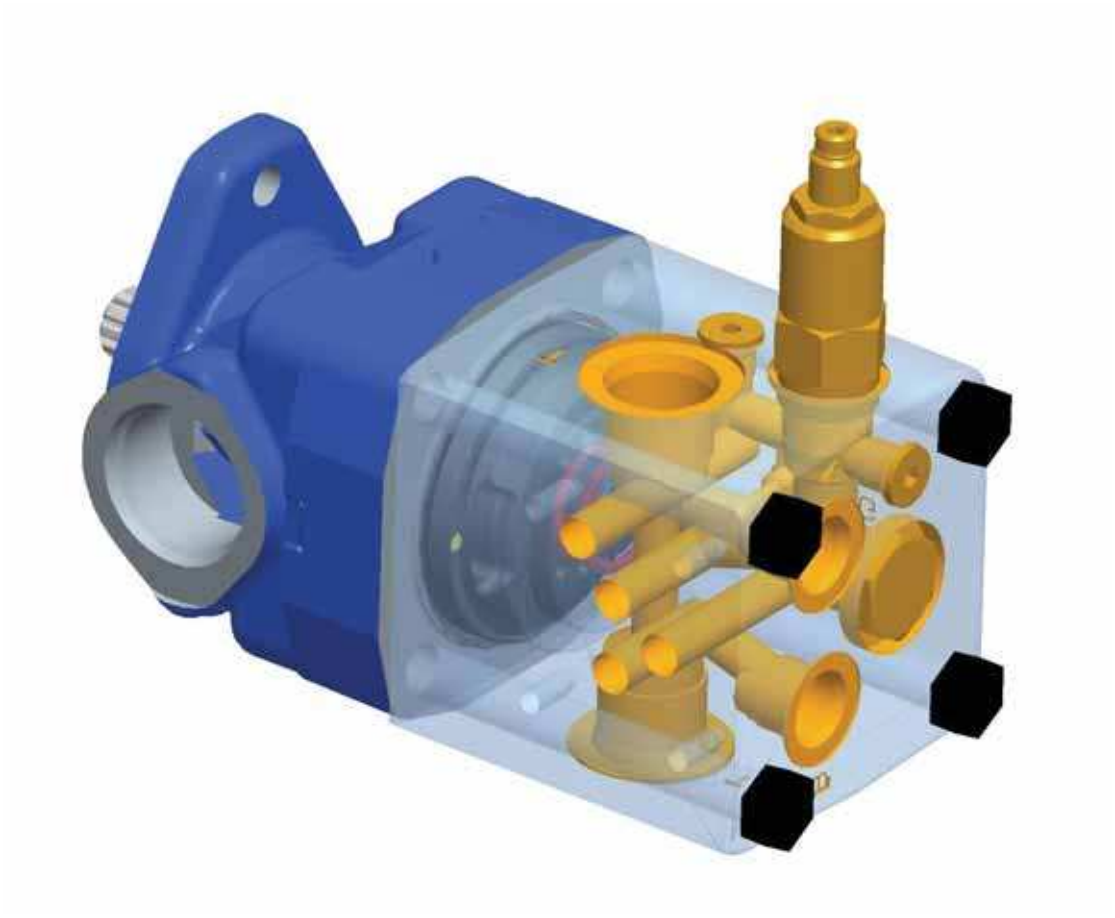
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EATON | Vickers

V20D

Technical Focus

DG Ready Vane Pump



Introduction

V20D Vane Pumps

Compact

Simple

Flexible

Reliable

Durable

Cost Savings

DG Ready

Features

- Four cover orientations, two choices of tank ports
- Less leakage points
- Durable cast-iron structure
- Space saving – only 2.8 inch longer than standard pump
- Popular standard cartridge valves
- Modular pump design

Benefits

- Quiet, reliable, long life and consistent high performance overlife
- Cost savings
- Installation labor savings
- No need for sub-plate for valve mount
- Eliminate hose/pipe connection between pump and valves
- Easy maintenance/repair
- Flexible installation



Standard V20 Vane Pump

Displacement: 16 – 42cc

SAE A & B mount

NPT, Straight Tread, and 2 Bolt Ports

Key, Spline, Key Thread and Woodruff Shafts



Special Pump Cover Block

D03 and D05 DG Valve Interface

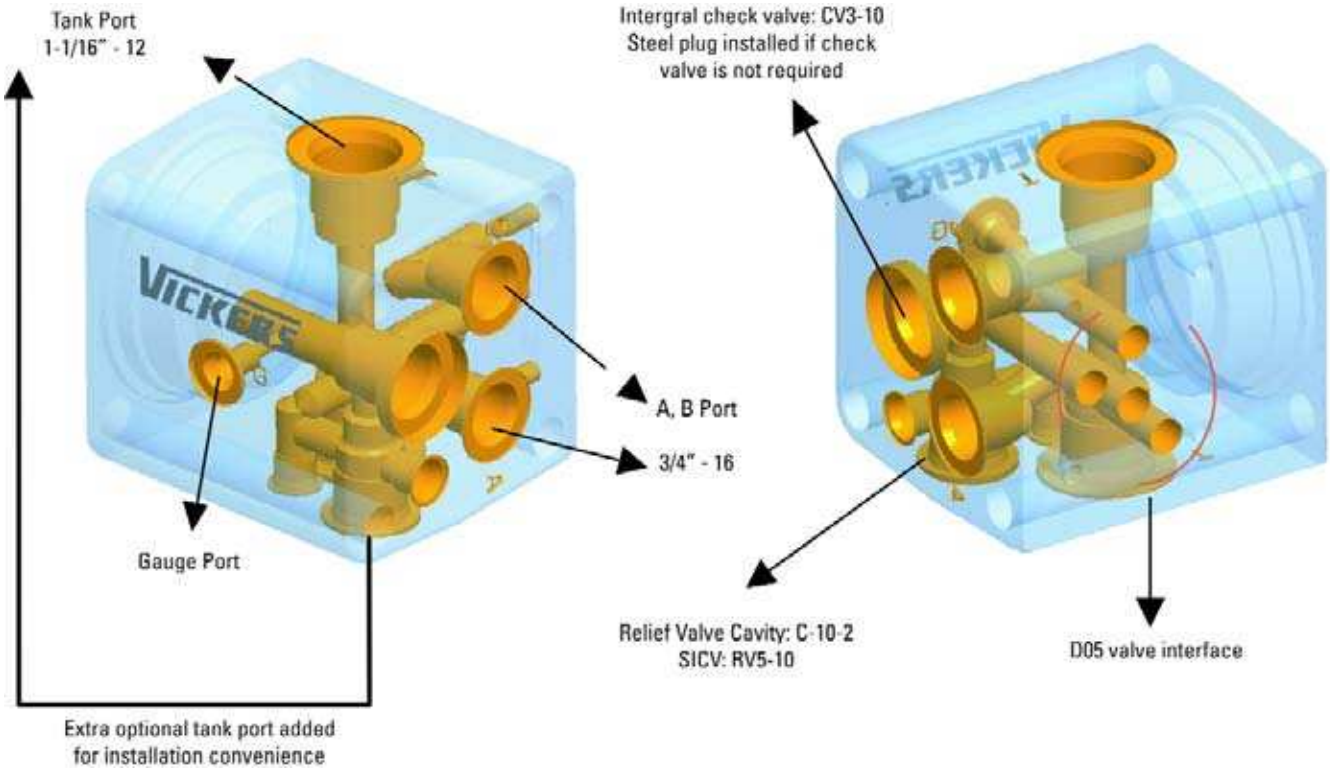
Screw-in Cartridge Relief Valve

Optional Check Valve

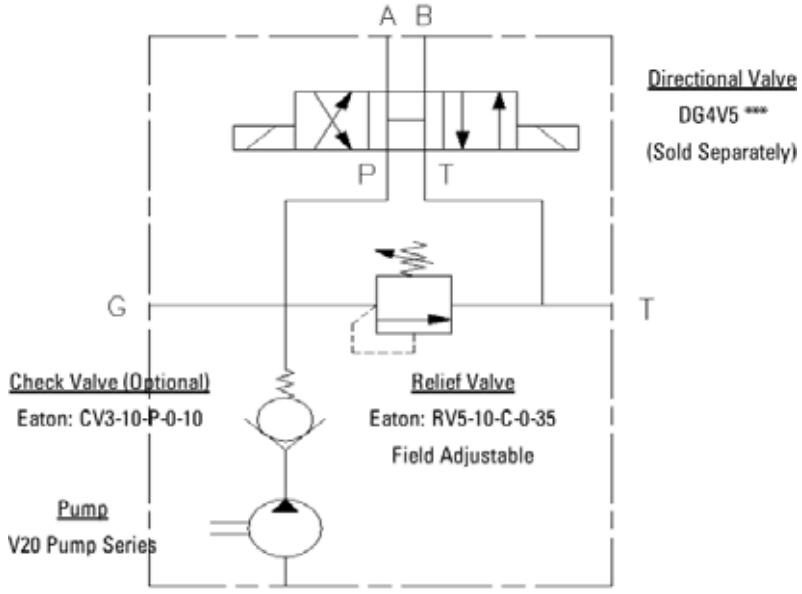
Gauge Ports

Ea
14
Ed
US
Te
Fa
w

V20D Cover Block



Cover Block - Circuity



Model Codes

V20D Pump

V20D	1	S	13	S	1	A	K	11	R	129
1	2	3	4	5	6	7	8	9	10	11

1 Pump Name

2 Pump Mount

1 – SAE A mount
6 – SAE B mount

3 Inlet Port

S – 1-5/8"–12
P – 1-1/4" NPT thread
E – 1-1/2" 2 bolt flange
B – G (BSP) 1-1/4"

4 Flow

13 – US gpm (1200 rpm & 100psi) 5, 6,7,8,9,11,12,13

5 Outlet Port

S – SAE O ring port (J514)
A, B port: 3/4" – 16
Tank port: 1-1/16" – 12
Gauge port: 7/16 – 20

6 Shaft

1 – Key
62 – Spline 9T
38 – Spline 11T
39 – Spline 13T
3 – Key tread
22 – Woodruff

7 Cover position (View from cover end)

A – DG interface opposite of inlet
B – DG interface 90˚ CCW from inlet
C – DG interface in line with inlet
D – DG interface 90˚ CW from inlet

8 Relief Valve Setting

A – 250psi
B – 500psi
C – 750psi
D – 1000psi
E – 1250psi
F – 1500psi
G – 1750psi
H – 2000psi
J – 2250psi
K – 2500psi
L – 2750psi
M – 3000psi

9 Design code

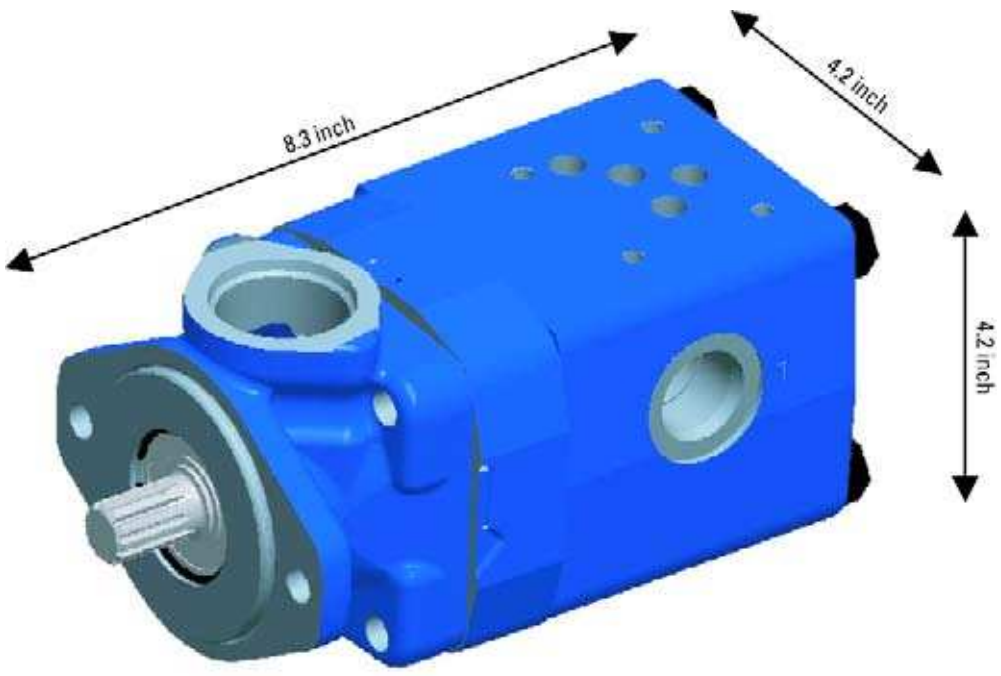
10 Rotation (View from shaft end)

L – Left hand
R – Right hand

11 Suffix

129 – D05 w/o check
130 – D05 w/ check
136 – D03 w/o check
137 – D03 w/ check

Basic Dimensions



Why Use Vane Pumps?

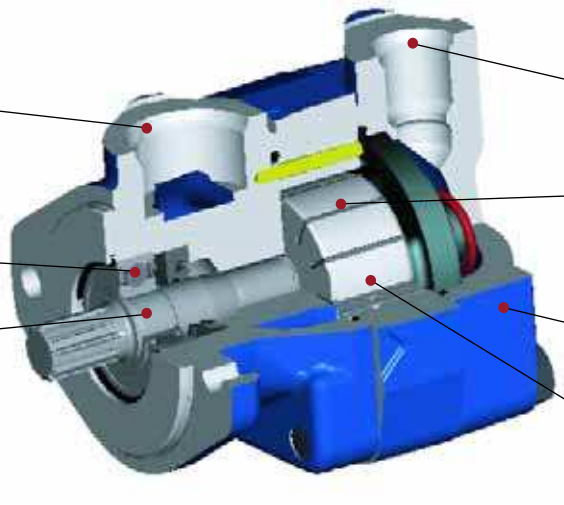
Design Benefits

Flexible Displacement Change
- Easy repair or reconfiguration

Ball Bearing
- Long life

Hydraulic Balanced Design
- No shaft fatigue caused by side load

Low pressure ripple
- Quiet operation



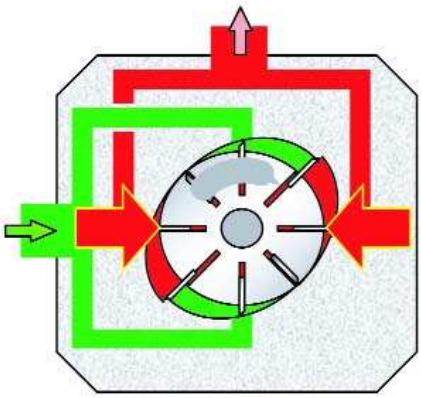
Flexible Porting
- Easy installation

Vane Self-wear Compensation
- No performance degradation over life

Cast Iron Structure
- Durable

Floating Rotor
- Less chance of side plate smearing

Ring profile generates smooth pressure transition for the oil trapped between the adjacent two vanes



Pressure balanced rotor

Vickers Vane Pump Family

Reliable, Quiet, Compact, Long Life

Economical

V10/V20 Square
- 3000psi [210 Bar]
- 0.2in3 [3.3cc] - 2.59in3 [42cc]
- Single, Double Pumps
- Optional integral valves



Comprehensive

V/VQ(H)
- Up to 3500 psi [240 Bar]
- 1.1in3 [18cc] – 20.9in3 [343cc]
- Cartridge-kit Design
- Industrial V and Mobile VQ(H)
- Single, Double and Thru-Drive Pumps



Tough

VMQ
- Up to 4250psi [280 Bar]
- 0.6in3 [10cc] – 13.1in3 [215cc]
- Cartridge-kit Design
- Bi-metal wafer plate
- Single, Double and Thru-Drive Pumps



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Germany
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Fax: (49) 7221 682-788



Vickers

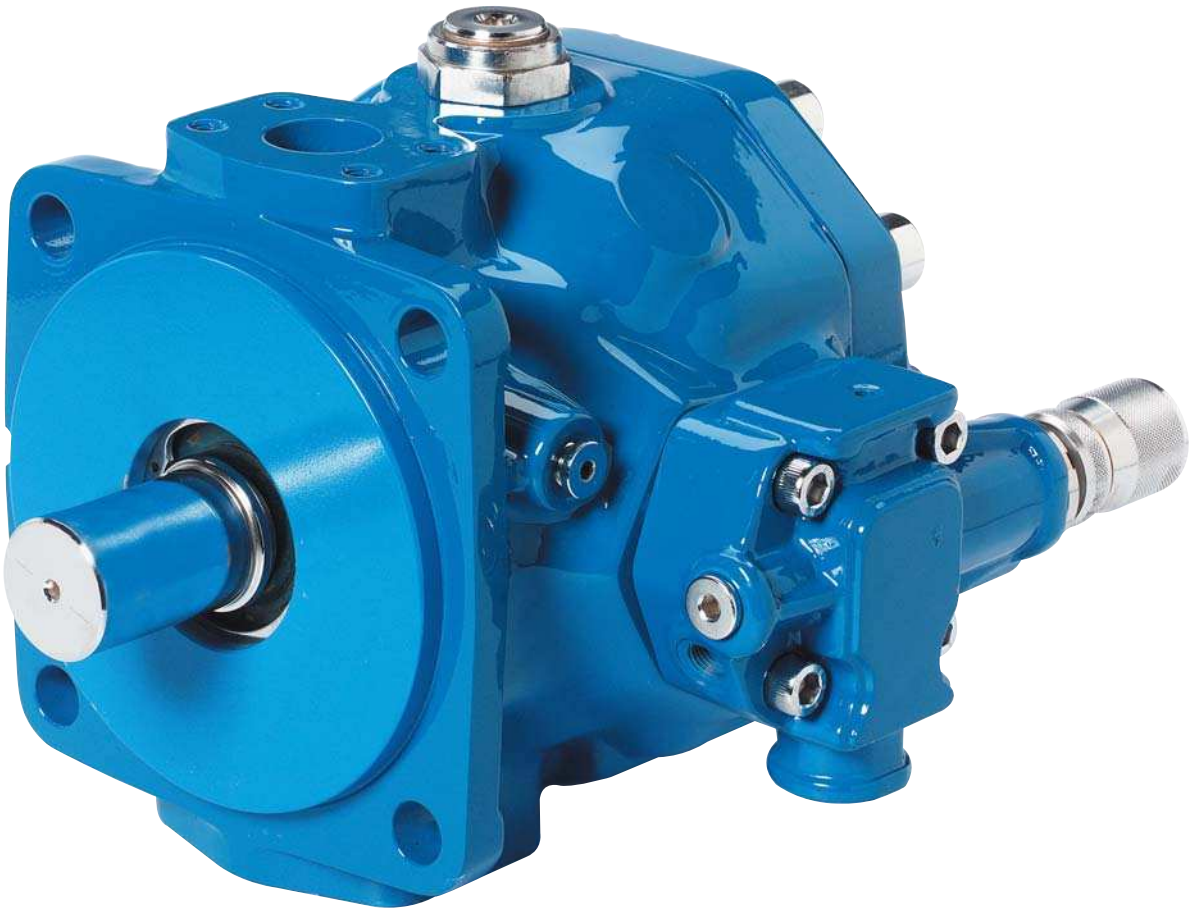
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June 2006

EATON | Vickers

VVS/VVP Series Vane Pumps

Technical Catalog

Variable Displacement,
For Industrial
Applications



VICKERS®

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Introduction

Description

Maximum displacements to 100 cm^3/r (6.1 in^3/r).

Maximum pressures to 160 bar (2300 psi).

Vickers variable displacement vane pumps are available in four nominal sizes (0-1-2-3) and are divided into three displacements. Each size, while retaining the same pump body, is available in two versions: low pressure VVS (100 bar, 1500 psi) with mechanical pressure regulator, and high pressure VVP (160 bar, 2300 psi) with hydraulic pressure regulator. The rotor shaft of Vickers pumps is pre-arranged for mounting an additional pump. By removing the rear cover, the secondary pump can be easily attached (see items A and B on page 4). Combining standard pumps eliminates the need for many "special application" pumps.

As shown in the cross-sectional views, pumps consist of:

(1) Body

(2) One-piece shaft and rotor

(3) Vanes

(4) Pressure ring that changes the eccentricity and therefore the displacement of the pump, at hydrostatic axial compensation

(5) Pressure plate stator to provide the passage of oil from the suction port to the pressure port

(6) Guide block balancing adjustment screw

(7) Displacement adjustment piston that regulates the maximum pressure compensated flow

(8) Maximum volume adjustment screw (optional feature - see model code pages 5 and 15).

(9) Pressure regulator

(10) Pressure regulator adjustment

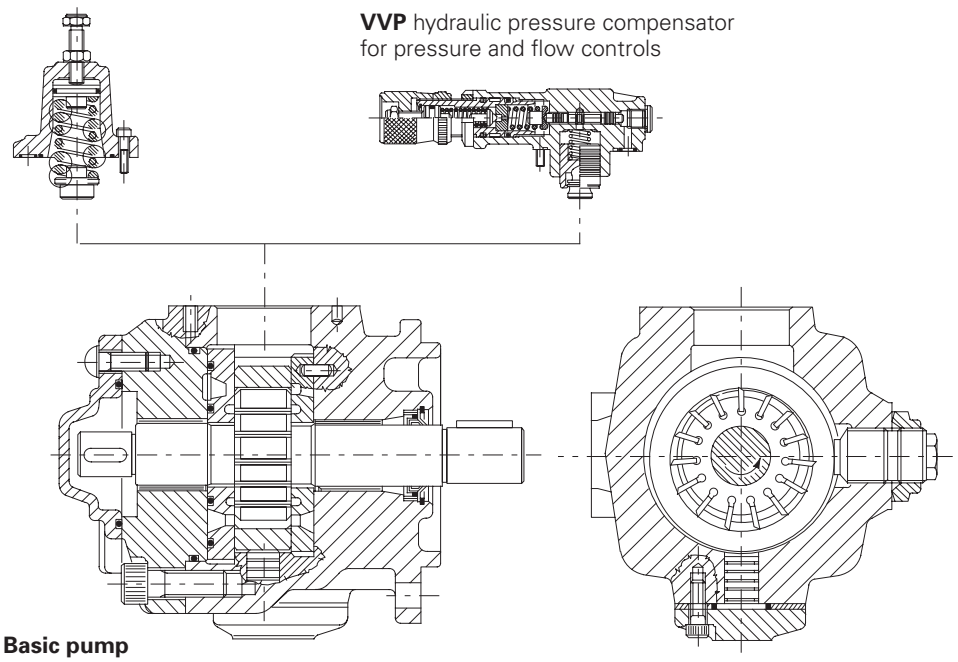
Features and Benefits

- Long pump life resulting from manufacturing material characteristics, hydrodynamic lubrication of bearings, and hydrostatic balancing of distribution plates.
- Quiet pump operation from 55 to 73 dB(A).
- Simplifies hydraulic circuit by eliminating maximum pressure relief valves and heat exchangers. Pumps can be supplied with various pressure regulators to control the maximum system pressure.
- Standard ISO and SAE mountings.
- Combinations of standard pumps provide flexibility and cost effective pump packages.

Modular Construction

VVS mechanical pressure compensator

VVP hydraulic pressure compensator for pressure and flow controls

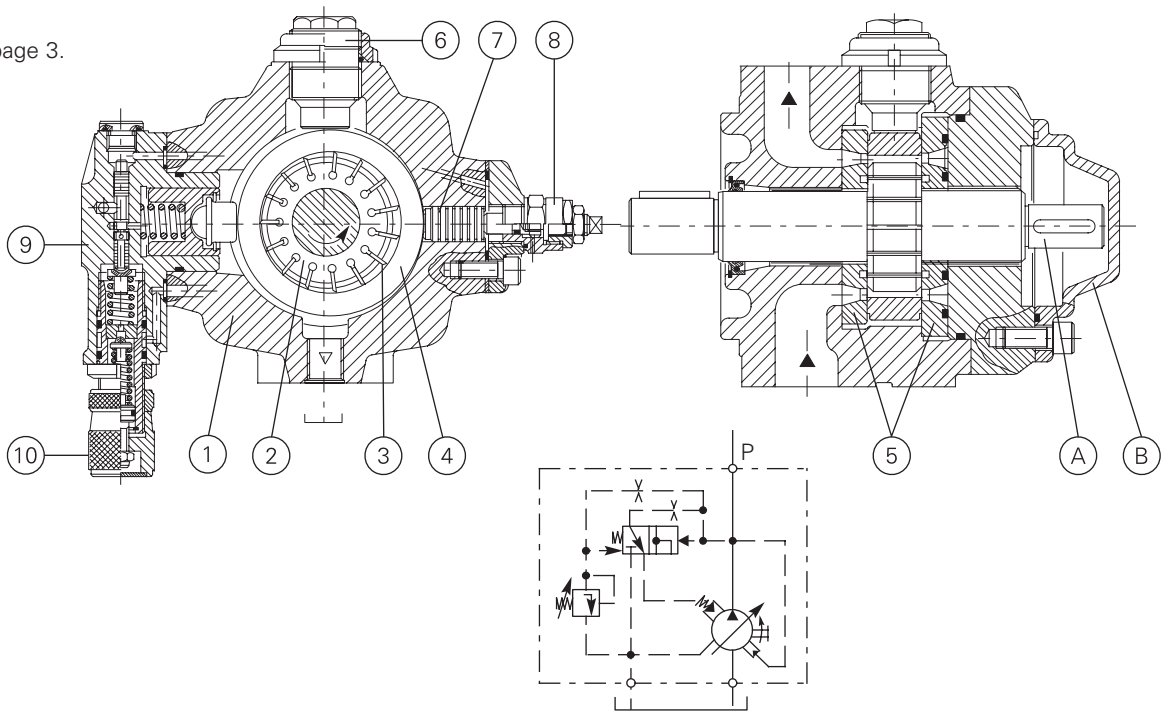


Basic pump

Sections and Symbols

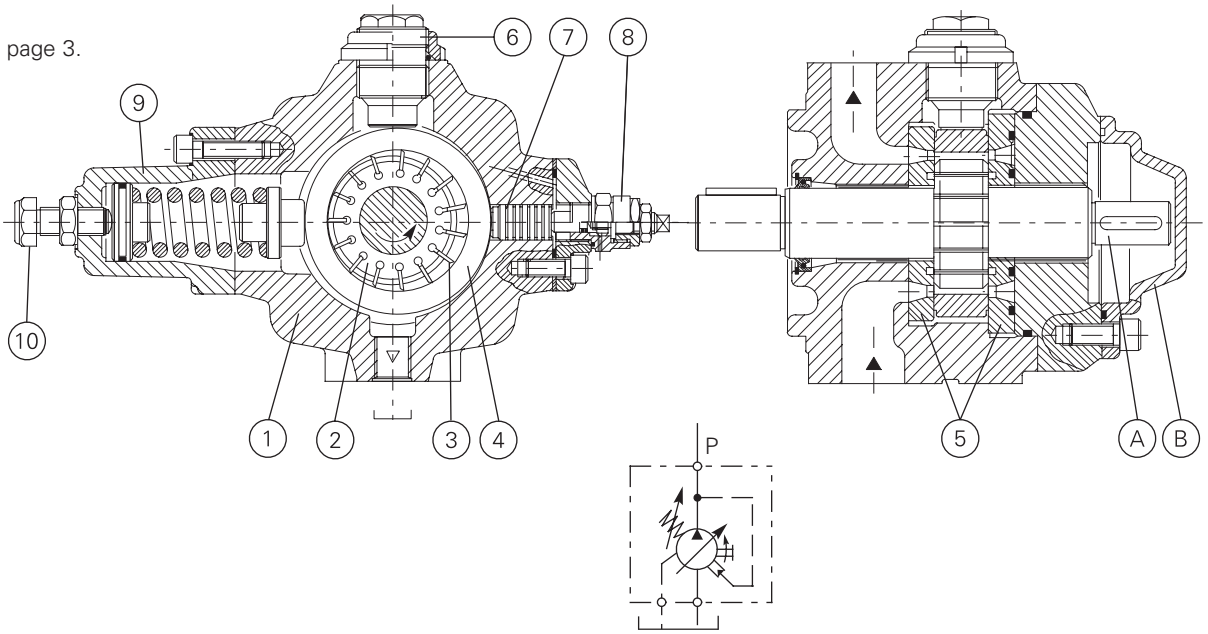
VVP Pump

See description on page 3.



VVS Pump

See description on page 3.



Model Code
VVS Series

VVS 1 - 16 - (S) R R M - *0 - C - D W - 10 - **

1 2 3 4 5 6 7 8 9 10 11 12 13

1 Variable Vane Pump

2 Frame Size / Max. Pressure

0 - 6.3, 10, 12.5 cm³/r Max. pressure 150 bar (2200 psi)

1 - 16, 20, 25 cm³/r Max. pressure 100 bar (1500 psi)

2 - 31.5, 40, 50 cm³/r Max. pressure 100 bar (1500 psi)

3 - 63, 80, 100 cm³/r Max. pressure 80 bar (1200 psi)

3 Nominal Size / Geometric Displacement

06 - 6.3 cm³/r (0.38 in³/r)
10 - 10 cm³/r (0.61 in³/r)
12 - 12.5 cm³/r (0.76 in³/r)
16 - 16 cm³/r (0.98 in³/r)
20 - 20 cm³/r (1.22 in³/r)
25 - 25 cm³/r (1.53 in³/r)
32 - 31.5 cm³/r (1.92 in³/r)
40 - 40 cm³/r (2.44 in³/r)
50 - 50 cm³/r (3.05 in³/r)
63 - 63 cm³/r (3.84 in³/r)
80 - 80 cm³/r (4.88 in³/r)
100 - 100 cm³/r (6.10 in³/r)

4 Adjust. Max. Displacement Stop

S - With stop

(Omit if not required.)

5 Mounting Flange / Port Connections

Code	Frame Size	Mounting flange	Port connections
R	Size 0 or 1	ISO 3019/2 with straight keyed shaft (size 0 is only available as a single or secondary pump)	G (BSPF) thread.
RF	Size 2 or 3	ISO 3019/2 with straight keyed shaft	SAE 4-bolt flange with metric mounting bolts
PS	Size 0	ISO 3019/2 with straight keyed shaft (for size 0 pumps only). Size 0 is only available as a single or secondary pump.	SAE UNF thread.
	Size 1	SAE B 4-bolt with straight keyed shaft (for size 1 pumps only)	
PF	Size 2 or 3	SAE C 2-bolt with straight keyed shaft (only available on a primary or single pump)	SAE 4-bolt flange with UNC mounting bolts
PX	Size 2 or 3	ISO 3019/2 with straight keyed shaft (available only on secondary pump)	SAE 4-bolt flange with UNC mounting bolts
B	Sizes 1, 2 or 3	Base plate mounting (available only as single pump)	O-ring sealed

Note: See page 36 for detailed dimensional listing for mounting flanges, shafts and ports.

6 Rotation Viewed From Shaft End

R - Right hand (clockwise) only

7 Fluid Compatibility

M - Mineral oil

E - Phosphate esters

8 Pump Design Number

30 - All models except

Subject to change. Installation dimensions remain unaltered for designs *0-*9.

9 Pressure Control

C - Standard pressure compensator

10 Control Pressure Setting

A - 15-50 bar (215-700 psi) (all frame sizes)

B - 30-80 bar (430-1200 psi) (frame size 3)

C - 30-100 bar (430-1500 psi) (frame sizes 0, 1 and 2)

D - 80-150 bar (1200-2200 psi) (frame size 0)

11 Adjustment Device

W - Screw with locknut

KL - Screw with key lock

12 Control Design Number

10 - For all models.

Subject to change. Installation dimensions remain unaltered for designs 10-19.

13 Special Features Suffix

Nominal size	Size 0	Size 1	Size 2	Size 3
Displacement according to ISO 3662 - cm^3/r (in^3/r)	6.3 (0.384)	16 (0.976)	31.5 (1.922)	63 (3.844)
	10 (0.610)	20 (1.220)	40 (2.441)	80 (4.882)
	12.5 (0.763)	25 (1.526)	50 (3.051)	100 (6.102)
Actual displacement - cm^3/r (in^3/r)	6.9 (0.421)	17.9 (1.092)	34.5 (2.105)	69 (4.211)
	11 (0.671)	22.1 (1.349)	42.8 (2.612)	86.2 (5.260)
	13.1 (0.799)	26.9 (1.642)	53.1 (3.240)	105.5 (6.438)
Mounting flange type (See model code, page 5.)	ISO 3019/2 4-bolt	ISO 3019/2 4-bolt Base plate	ISO 3019/2 SAE C 2-bolt Base plate	ISO 3019/2 SAE C 2-bolt Base plate
Maximum working pressure - bar (psi)	150 (2200)	100 (1500)	100 (1500)	80 (1200)
Allowed maximum drain port pressure - bar (psi)	1 (14.5)			
Inlet pressure (absolute) - bar (psi)	0.8-1.5[11.6-21.8]			
Speed range - r/min	800 to 1800			
Rotation direction (viewed from shaft end)	Right-hand (clockwise)			
Loads on drive shaft	No radial or axial loads allowed			
Maximum torque on primary shaft - Nm (lbf-in) (See pages 28 and 30 for torque requirements of combined pumps.)	110 (974)	197 (1744)	400 (3540)	740 (6550)
Hydraulic fluid	Mineral oil - HM according to ISO 6743/4 - HLP according to DIN 51524/2 Organic ester HFD-V according to ISO 6743/4 (QUINTOLUT-SRIC N822-300)			
Viscosity range at working temperature - mm^2/s (cSt)	23 to 68			
Recommended viscosity - mm^2/s (cSt) at 50°C (122°F)	32			
Viscosity index	100 minimum			
Fluid temperature range - °C (°F)	-10/+50 [14/122]			
Maximum fluid contamination level	Class 9 per NAS 1638, or class 18/16/13 per ISO 4406			
Weight - kg (lb)	6.5 (14.3)	12 (26.5)	32 (70.5)	44 (97)
In case of different operating conditions, contact Eaton Hydraulics.				

Performance Characteristics
VVS0

Performance with:

Speed 1450 r/min

Oil per ISO 6743/4

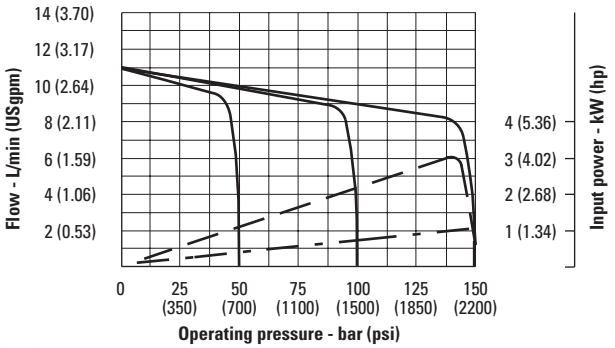
Viscosity 32 mm²/s (cSt)

Temperature 50°C (122°F)

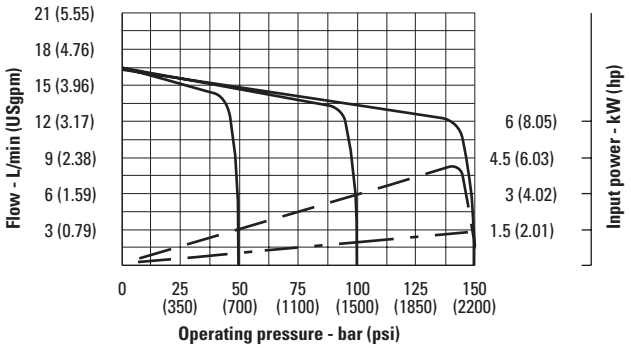
Power consumption with maximum flow — — — — — —

Power consumption with zero flow setting — · — · — · — ·

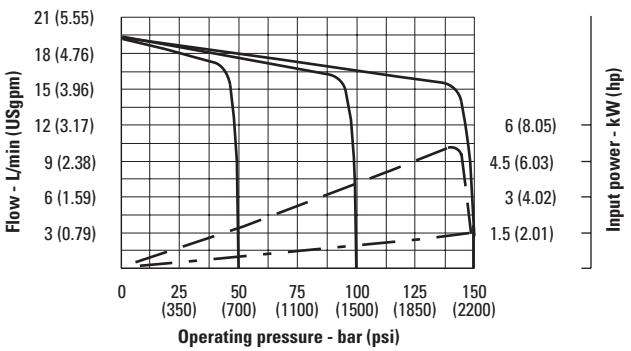
VVS0-06



VVS0-10

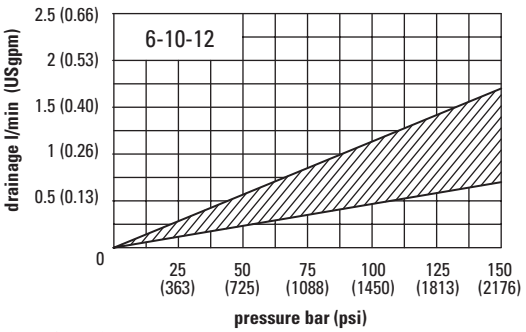


VVS0-12



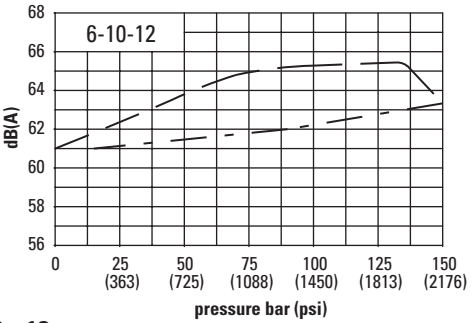
VVS0-06, -10, -12

Values established with zero flow setting



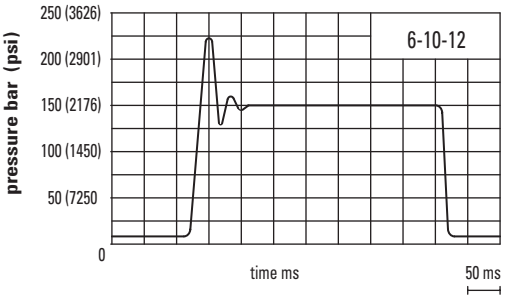
VVS0-06, -10, -12

Maximum noise level measured with sound-level meter placed at 1 meter [39.37"] from pump, flexible coupling.



VVS0-06, -10, -12

Response time and pressure peak



Performance Characteristics
VVS1

Performance with:

Speed 1450 r/min

Oil per ISO 6743/4

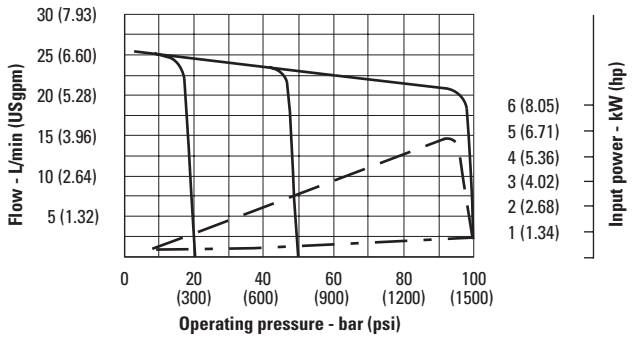
Viscosity 32 mm²/s (cSt)

Temperature 50°C (122°F)

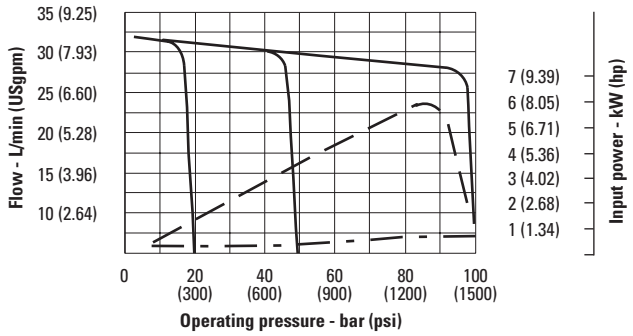
Power consumption with maximum flow

Power consumption with zero flow setting

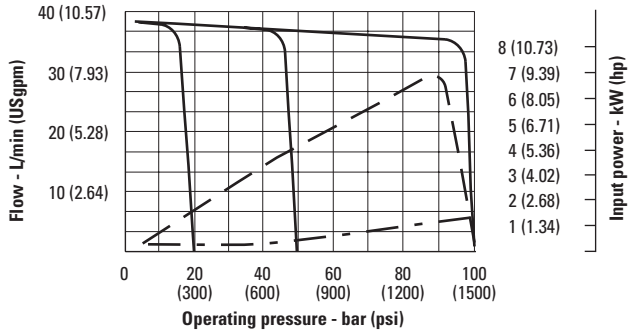
VVS1-16



VVS1-20

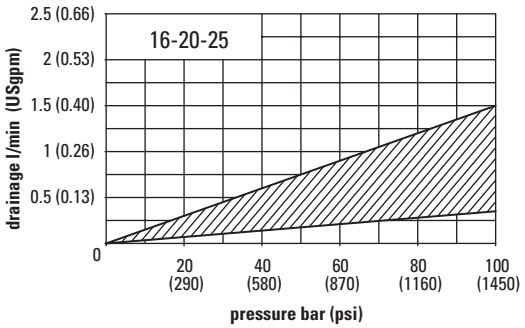


VVS1-25



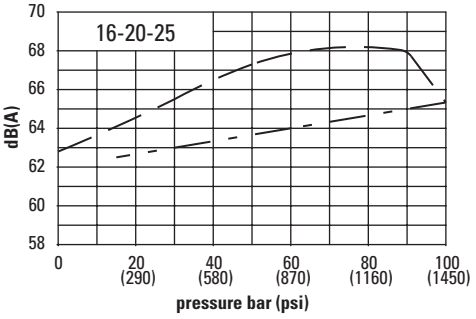
VVS1-16, -20, -25

Values established with zero flow setting



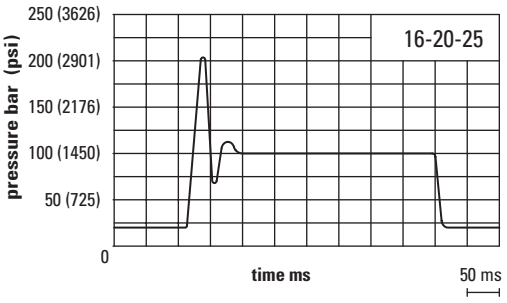
VVS1-16, -20, -25

Maximum noise level measured with sound-level meter placed at 1 meter [39.37"] from pump, flexible coupling.



VVS1-16, -20, -25

Response time and pressure peak



Performance Characteristics
VVS2

Performance with:

Speed 1450 r/min

Oil per ISO 6743/4

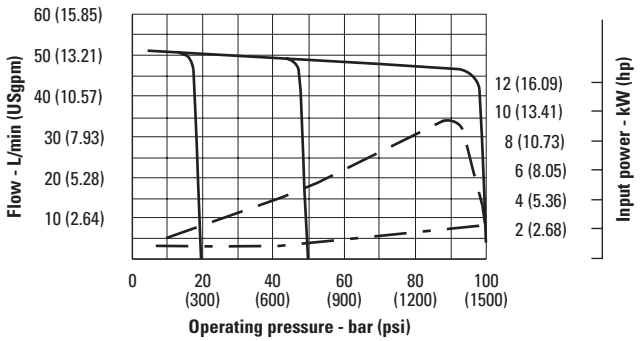
Viscosity 32 mm²/s (cSt)

Temperature 50°C (122°F)

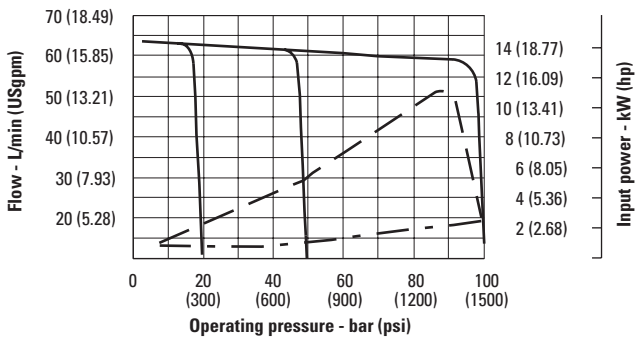
Power consumption with maximum flow — — — — — —

Power consumption with zero flow setting — · — · — · — ·

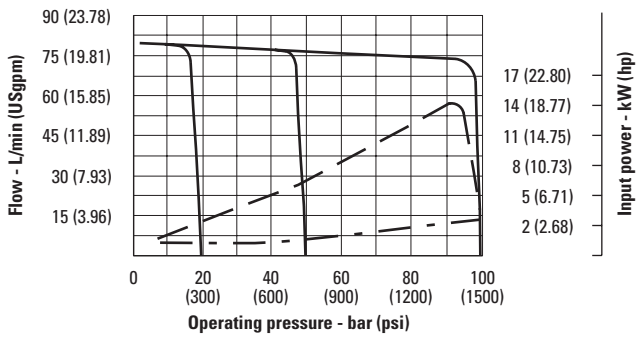
VVS2-32



VVS2-40

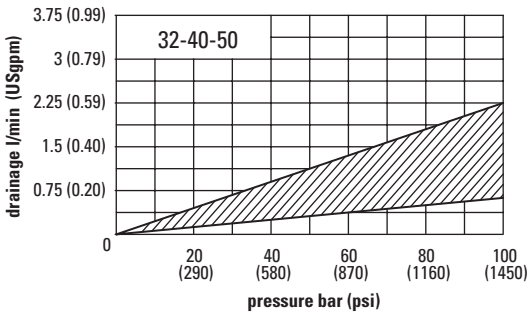


VVS2-50



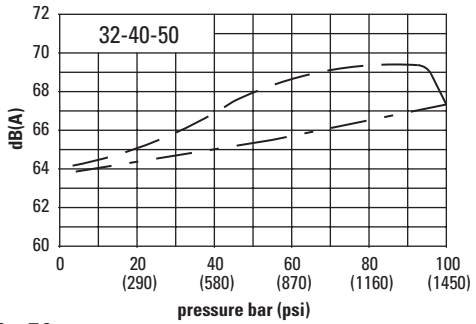
VVS2-32, -40, -50

Values established with zero flow setting



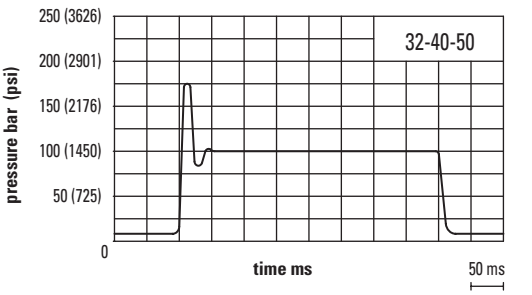
VVS2-32, -40, -50

Maximum noise level measured with sound-level meter placed at 1 meter [39.37"] from pump, flexible coupling.



VVS2-32, -40, -50

Response time and pressure peak



Performance Characteristics
VVS3

Performance with:

Speed 1450 r/min

Oil per ISO 6743/4

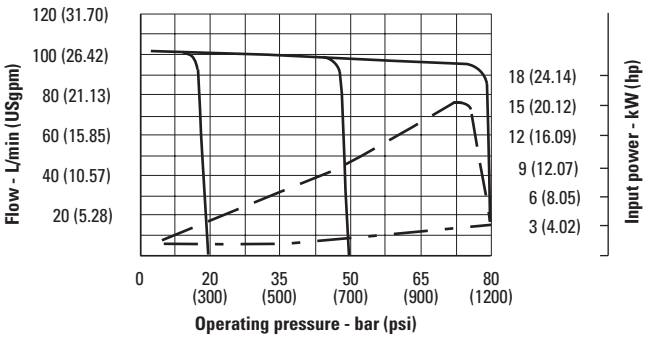
Viscosity 32 mm²/s (cSt)

Temperature 50°C (122°F)

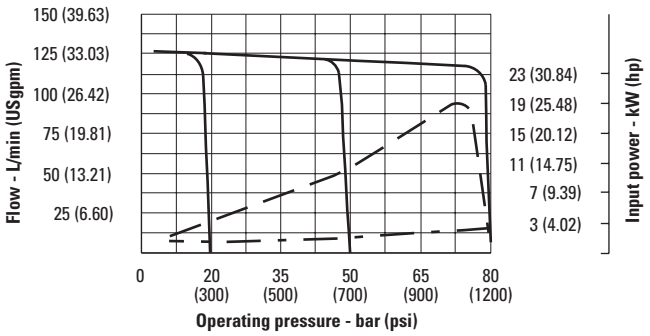
Power consumption with maximum flow — — — — — —

Power consumption with zero flow setting — · — · — · — ·

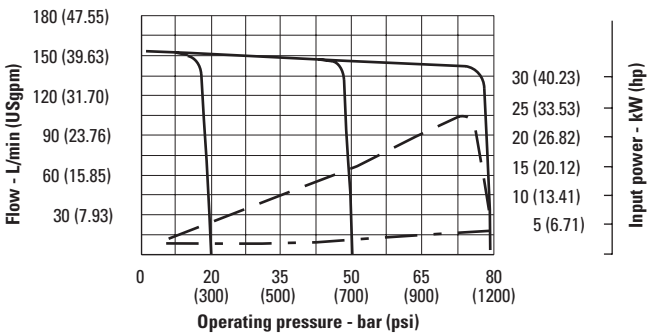
VVS3-63



VVS3-80

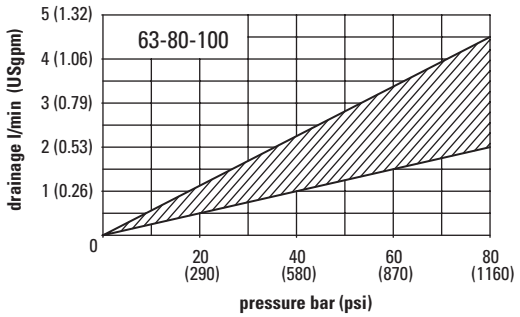


VVS3-100



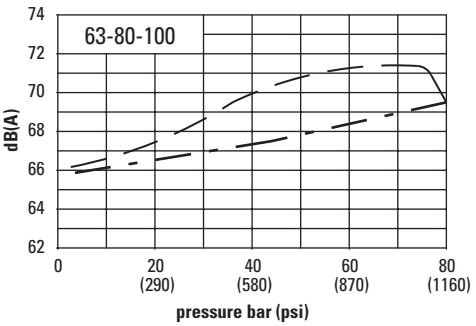
VVS3-63, -80, -100

Values established with zero flow setting



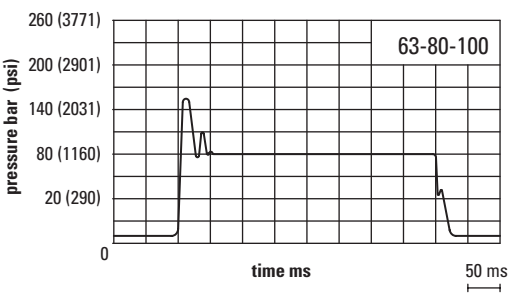
VVS3-63, -80, -100

Maximum noise level measured with sound-level meter placed at 1 meter [39.37"] from pump, flexible coupling.



VVS3-63, -80, -100

Response time and pressure peak

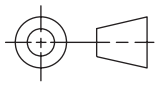


VVS0
With ISO Mounting Flange

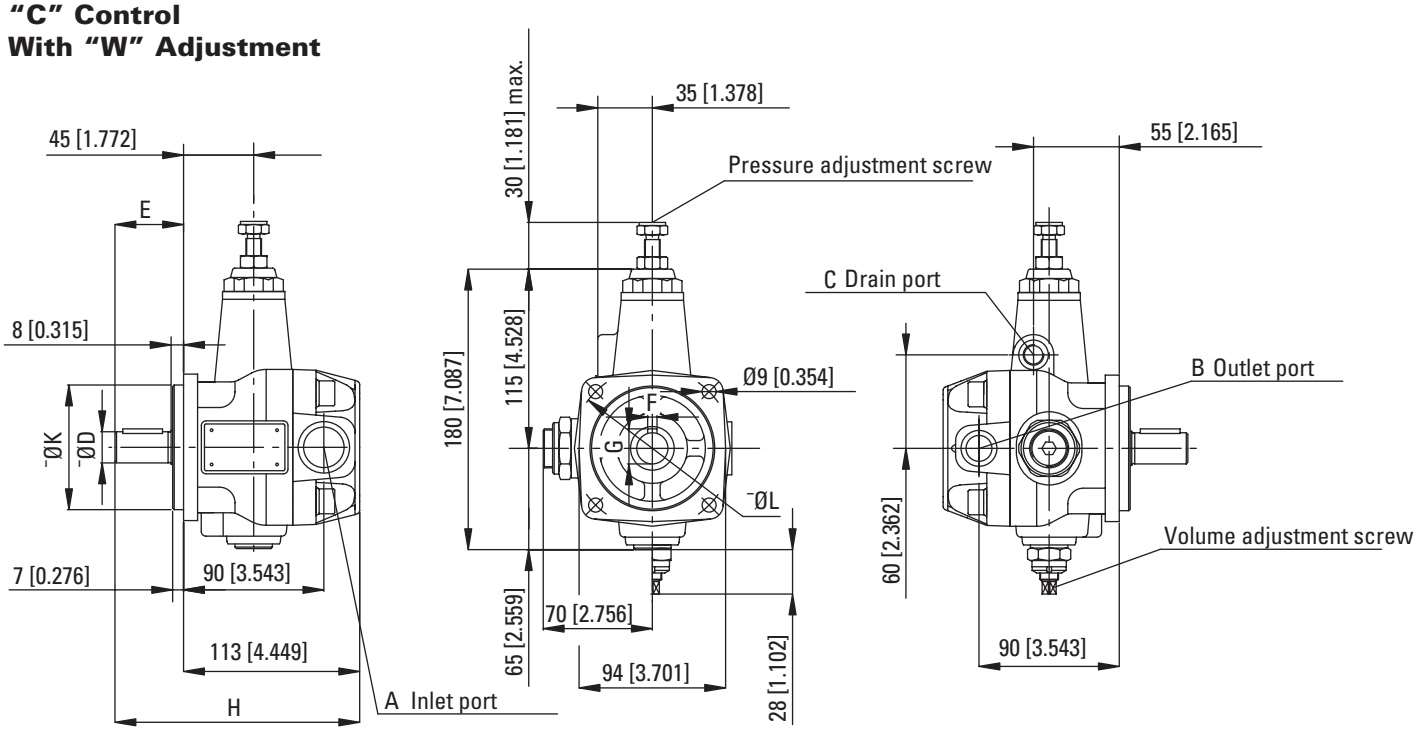
Installation Dimensions
in mm (in)

All mounting flange, port and shaft options are listed on page 36.

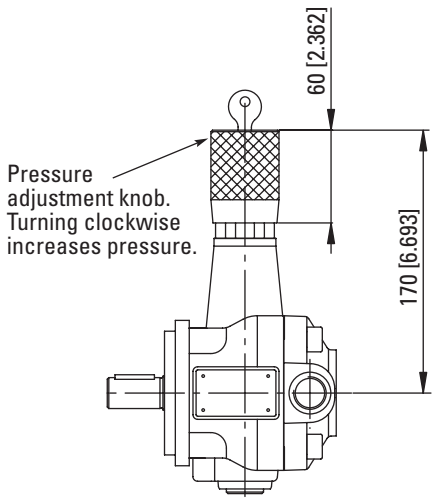
3rd angle projection



"C" Control With "W" Adjustment



"C" Control With "KL" Adjustment



MOUNTING FLANGE AND PORTS CODE▲	B	C	F	G	Ø D	A	H	E	Ø K	Ø L
R	3/8" BSP	1/4" BSP	6 (0.236)	22.5 (0.886)	20 (0.787)	3/4" BSP	157 (6.18)	44 (1.73)	80 (3.150)	103 (4.055)
PS	0.750-16 UNF-2B	0.500-20 UNF-2B	4.76 (0.187)	17.9 (0.705)	15.88 (0.625)	1.063-12 UNF-2B	136 (5.35)	32 (1.25)	80 (3.150)	103 (4.055)

▲ See model code, page 5.

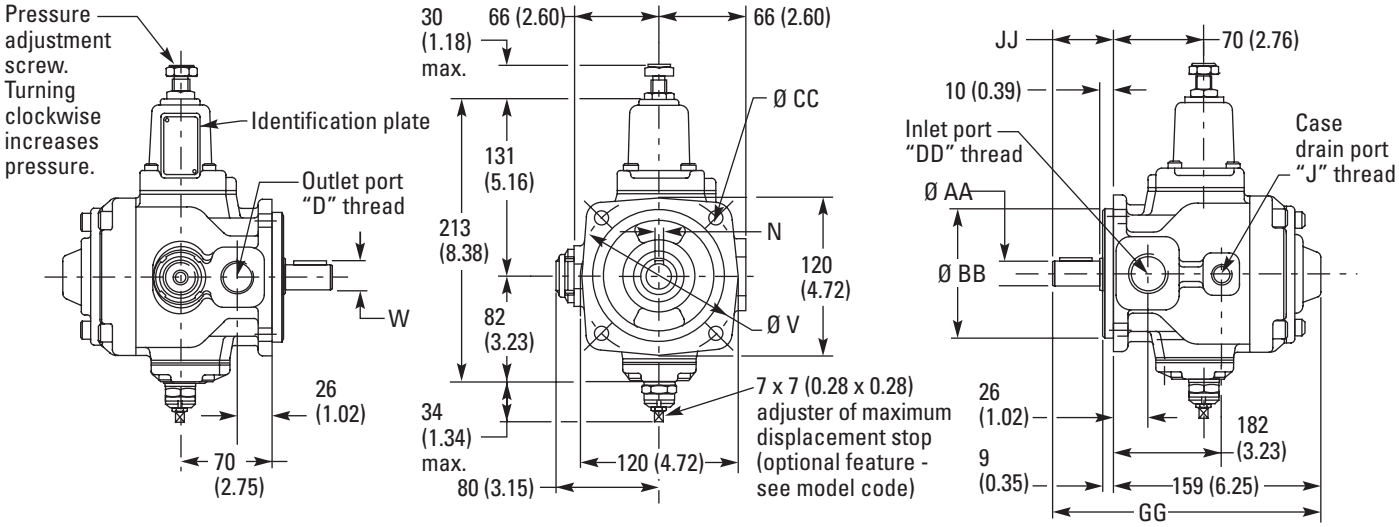
VVS1
With ISO or SAE Mounting Flange

Installation Dimensions
in mm (in)

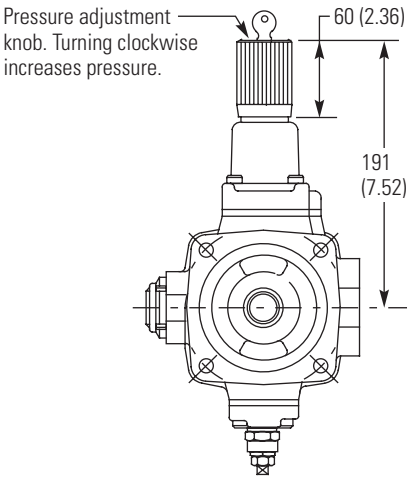
All mounting flange, port and shaft options are listed on page 36.

3rd angle projection

"C" Control With "W" Adjustment



"C" Control With "KL" Adjustment



MOUNTING FLANGE AND PORTS CODE ▲	D	J	N	Ø V	W	AA	Ø BB	Ø CC	DD	GG	JJ
R (ISO)	3/4" BSP	3/8" BSP	8	125	28	25	100	11	1" BSP	205	46
			(0.315)	(4.921)	(1.102)	(0.984)	(3.937)	(0.43)		(8.07)	(1.81)
PS (SAE)	1.0625-12	0.5625-18	6.35	127	28.17	25.4	101.6	14.3	1.3125-12	207	48
	UNF-2B	UNF-2B	(0.250)	(5.000)	(1.109)	(1.000)	(4.000)	(0.56)	UNF-2B	(8.15)	(1.89)

▲ See model code, page 5.

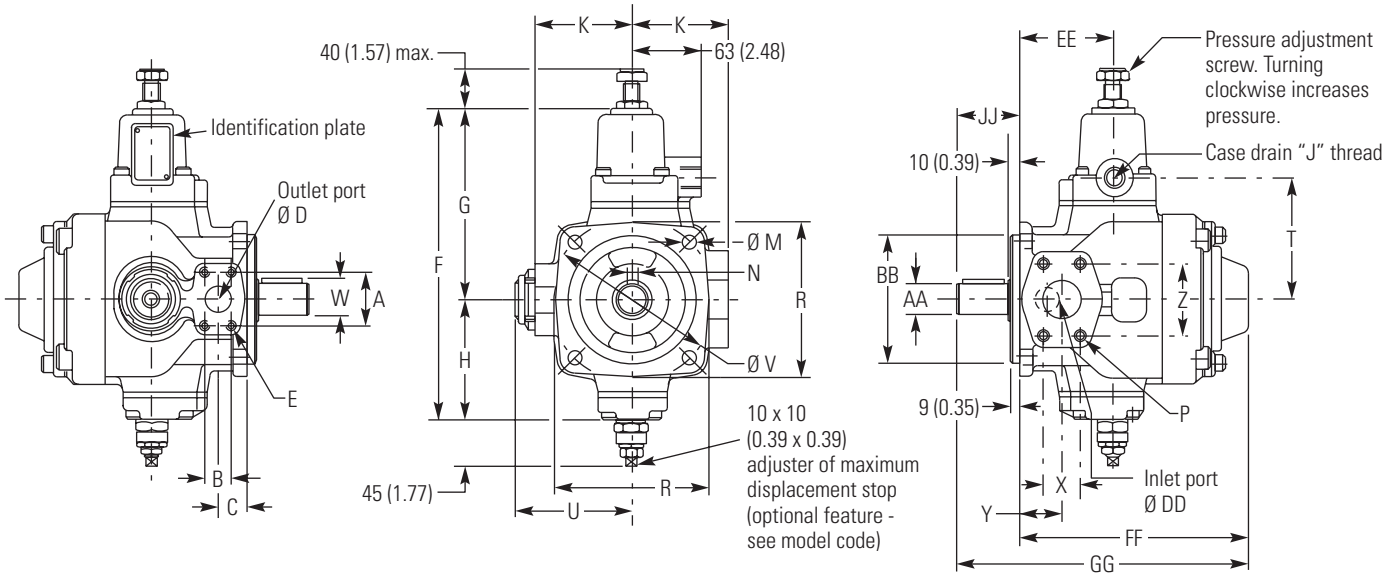
VVS2 and VVS3 With ISO Mounting Flange

Installation Dimensions
in mm (in)

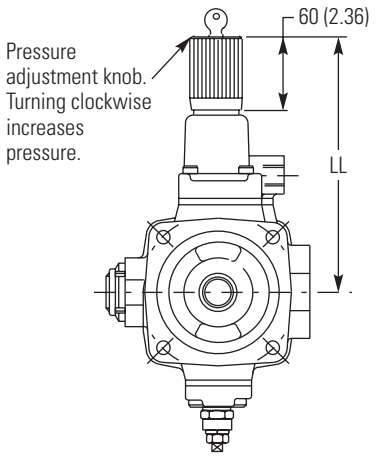
All mounting flange, port and shaft options are listed on page 36.

3rd angle projection

"C" Control With "W" Adjustment



"C" Control With "KL" Adjustment



MODEL	A	B	C	Ø D	E	F	G	H	J	K	Ø M	N	P	R
VVS2	52.4 (2.06)	26.2 (1.03)	30 (1.18)	25 (0.98)	M10 or 0.375-16 UNC-2B ▲	285 (11.22)	175 (6.89)	110 (4.33)	1/2" BSP or 0.875-14 UNF-2B ▲	95 (3.74)	14 (0.55)	10 (0.39)	M12 or 0.500-13 UNC-2B ▲	150 (5.91)
VVS3	58.7 (2.31)	30.2 (1.19)	35 (1.378)	32 (1.26)	M10 or 0.4375-14 UNC-2B ▲	305 (12.01)	185 (7.28)	120 (4.72)	1/2" BSP or 0.875-14 UNF-2B ▲	105 (4.13)	18 (0.71)	12 (0.47)	M12 or 0.500-13 UNC-2B ▲	185 (7.28)

▲ See mounting flange/port connections codes RF and PX, page 5.

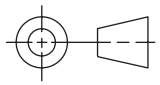
MODEL	T	U	Ø V	W	X	Y	Z	Ø AA	Ø BB	Ø DD	EE	FF	GG	JJ	LL
VVS2	115 (4.53)	114 (4.488)	160 (6.30)	35 (1.38)	35.7 (1.41)	40 (1.58)	70 (2.76)	32 (1.26)	125 (4.92)	38 (1.50)	91 (3.58)	219 (8.62)	279 (10.98)	60 (2.36)	235 (9.25)
VVS3	125 (4.92)	123 (4.84)	200 (7.87)	43 (1.69)	43 (1.69)	46 (1.81)	77.8 (3.06)	40 (1.57)	160 (6.30)	51 (2.01)	105 (4.13)	245 (9.65)	313 (12.32)	68 (2.68)	245 (9.65)

VVS2 and VVS3 With SAE Mounting Flange

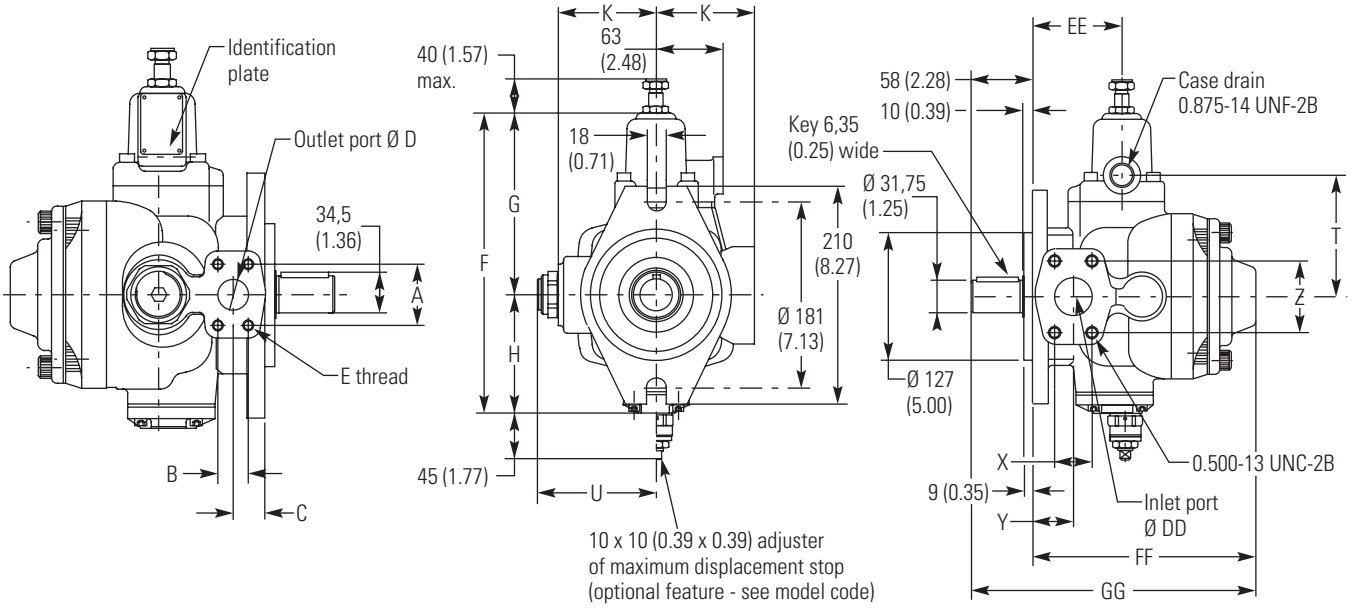
Installation Dimensions
in mm (in)

All mounting flange, port and shaft options are listed on page 36.

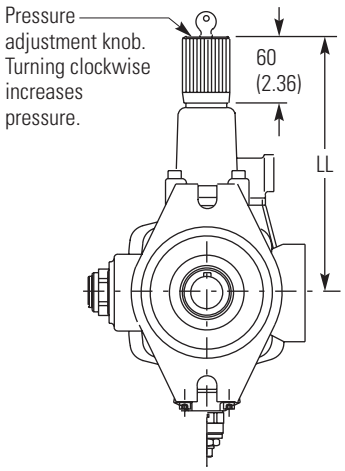
3rd angle projection



"C" Control With "W" Adjustment



"C" Control With "KL" Adjustment



MODEL	A	B	C	Ø D	E	F	G	H	K	T
VVS2	52.4	26.2	27	25	0.375-16 UNC-2B	285	175	110	95	115
	(2.06)	(1.03)	(1.06)	(0.98)		(11.22)	(6.89)	(4.33)	(3.74)	(4.53)
VVS3	58.7	30.2	35	32	0.4375-14 UNC-2B	305	185	120	105	125
	(2.31)	(1.19)	(1.38)	(1.26)		(12.01)	(7.28)	(4.72)	(4.13)	(4.92)

MODEL	U	X	Y	Z	Ø DD	EE	FF	GG	LL
VVS2	114	35.7	40	70	38	91	219	279	235
	(4.49)	(1.41)	(1.58)	(2.76)	(1.50)	(3.58)	(8.622)	(10.984)	(9.25)
VVS3	123	43	46	77.8	51	105	245	303	245
	(4.84)	(1.69)	(1.81)	(3.06)	(2.01)	(4.13)	(9.65)	(11.93)	(9.65)

Model Code
VVP Series

VVP 1 - 20 - (S) R R - M - 30 - CVTCE (03) - B * - 04 - 15 - 10 - **

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

1 Variable Vane Pump

2 Frame Size / Max. Pressure

1 - 16, 20, 25 cm³/r Max. pressure 160 bar (2300 psi)

2 - 31.5, 40, 50 cm³/r Max. pressure 160 bar (2300 psi)

3 - 63, 80, 100 cm³/r Max. pressure 150 bar (2200 psi)

3 Nominal Size / Geometric Displacement

16 - 16 cm³/r (0.98 in³/r)

20 - 20 cm³/r (1.22 in³/r)

25 - 25 cm³/r (1.53 in³/r)

32 - 31.5 cm³/r (1.92 in³/r)

40 - 40 cm³/r (2.44 in³/r)

50 - 50 cm³/r (3.05 in³/r)

63 - 63 cm³/r (3.84 in³/r)

80 - 80 cm³/r (4.88 in³/r)

100 - 100 cm³/r (6.10 in³/r)

4 Adjust. Max. Displacement Stop

S - With stop

(Omit if not required.)

5 Mounting Flange / Port Connections

Code	Frame Size	Mounting flange	Port connections
R	Size 1	ISO 3019/2 with straight keyed shaft	G (BSPF) thread
RF	Size 2 or 3	ISO 3019/2 with straight keyed shaft	SAE 4-bolt flange with metric mounting bolts
PS	Size 1	SAE B 4-bolt with straight keyed shaft	SAE UNF thread
PF	Size 2 or 3	SAE C 2-bolt with straight keyed shaft (only available on a primary or single pump)	SAE 4-bolt flange with UNC mounting bolts
PX	Size 2 or 3	ISO 3019/2 with straight keyed shaft (available only on secondary pump)	SAE 4-bolt flange with UNC mounting bolts
B	All	Base plate mounting (available only as single pump)	O-ring sealed

Note: See page 36 for detailed dimensional listing for mounting flanges, shafts and ports.

6 Rotation Viewed From Shaft End

R - Right hand (clockwise) only

7 Seal Type

M - Buna N

E - Viton

8 Pump Design Number

30 - All models

Subject to change. Installation dimensions remain unaltered for designs 30-39.

9 Pump Controls

C - Standard pressure compensator

CR - Remote controlled pressure control

CD1 - Dual pressure control with non-adjustable min. pressure

CD2 - Dual adjustable pressure control

CE - Proportional pressure control

CVP - Load sensing compensator

CVPR - Remote controlled load sensing control

CVPD1 - Load sensing control with dual pressure with fixed minimum pressure

CVPD2 - Load sensing control with dual adjustable pressure control

CVPCE - Load sensing control with proportional pressure control

CVT - Torque limiter

CVTR - Remote controlled torque limiter

CVTD - Torque control with dual adjustable pressure control

CVTCE - Torque control with proportional pressure control

10 Electrical Rating And Wiring Connection

For CD*, CVPD*, CVTD pump controls, five options below apply; for CE, CVPCE, CVTCE, only option 03 applies.

00 - No control valve fitted

01 - 220V AC 50 Hz with DIN 43650 plug connection

02 - 115V AC 60 Hz with ½" NPT conduit box

03 - 24V DC with DIN 43650 plug connection

04 - 115V AC 60 Hz with DIN 43650 plug connection

(Omit if not required.)

11 Control Pressure Setting

B - 30-160 bar (430-2300 psi) (frame sizes 1 and 2)

C - 30-150 bar (430-2200 psi) (frame size 3)

12 Adjustment Device

Omit for CR, CE, CVPR, CVTD, CVPCE and CVTCE pump controls.

K - Micrometer knob (standard)

KL - Micrometer knob with key lock

13 Maximum Power Setting In kW

Applies to CVT pump control only.

** - Factory setting of power limit in kilowatt; for example 04 = 4 kW

14 Maximum Pressure Setting

Applies to CVT pump control only.

** - Factory setting of pressure for zero flow in 10 bar increments; for example 15 = 150 bar

15 Control Design Number

10 - For all models. Subject to change. Installation dimensions remain unaltered for designs 10-19.

16 Special Features Suffix

Nominal size	Size 1	Size 2	Size 3
Displacement according to ISO 3662 - cm^3/r (in^3/r)	16 (0.976)	31.5 (1.922)	63 (3.844)
	20 (1.220)	40 (2.441)	80 (4.882)
	25 (1.526)	50 (3.051)	100 (6.102)
Actual displacement - cm^3/r (in^3/r)	17.9 (1.092)	34.5 (2.105)	69 (4.211)
	22.1 (1.349)	42.8 (2.612)	86.2 (5.260)
	26.9 (1.642)	53.1 (3.240)	105.5 (6.438)
Mounting flange type (See model code, page 15.)	ISO 3019/2	ISO 3019/2	ISO 3019/2
	SAE 4-bolt	SAE C 2-bolt	SAE C 2-bolt
	Base plate	Base plate	Base plate
Maximum working pressure - bar (psi)	160 (2300)	160 (2300)	150 (2200)
Allowed maximum drain port pressure - bar (psi)	1 (15)		
Inlet pressure (absolute) - bar (psi)	0.8 to 1.5 [11.6 to 21.8]		
Speed range - r/min	800 to 1800		
Rotation direction (viewed from shaft end)	Right-hand (clockwise)		
Loads on drive shaft	No radial or axial loads allowed		
Maximum torque on primary shaft - Nm (lbf-in) (See pages 28 and 30 for torque requirements of combined pumps.)	197 (1744)	400 (3540)	740 (6550)
Hydraulic fluid	Mineral oil - HM according to ISO 6743/4 - HLP according to DIN 51524/2 Organic ester HFD-U according to ISO 6743/4 (QUINTOLUBRIC N-822-300)		
Viscosity range at working pressure - mm^2/s (cSt)	22 to 68		
Recommended viscosity - mm^2/s (cSt) at 50°C (122°F)	32		
Viscosity index	100 minimum		
Fluid temperature range - °C (°F)	-10/+50 [14/122]		
Maximum fluid contamination level	Class 9 per NAS 1638, or class 18/15 per ISO 4406		
Weight - kg (lb)	13 (28.7)	33 (72.8)	45 (99.2)

In case of different operating conditions, contact Eaton Hydraulics.

Controls for VVP Pumps

VVP pumps offer a wide selection of electrohydraulic controls for the regulation of pressure and volume.

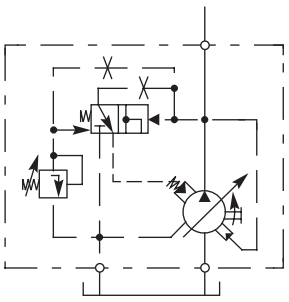
In addition to the various pressure regulating controls, a hydraulic load-sensing control is available to provide pumps with maximum flexibility for use in energy saving systems.

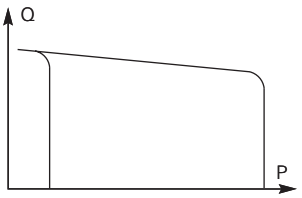
The load sensing compensator control receives a signal pressure directly after an external throttle and before an actuator. When a variation in pressure is sensed (with a fixed fall in pressure Δp = 20 bar (300 psi), the control will automatically change the pump's displacement independent of pressure variations that occur in the circuit.

The load sensing control produces a notable reduction in displaced power and is recommended for use in applications where there are notable variations in torque (or force) and speed.

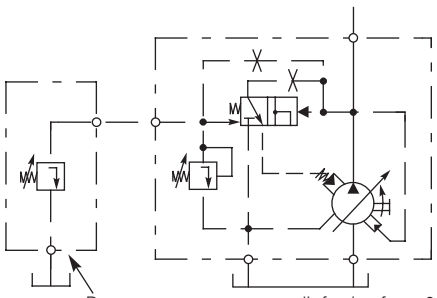
Pressure Regulation

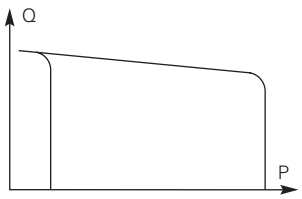
Pump With Standard Pressure Compensator Model Code "C"





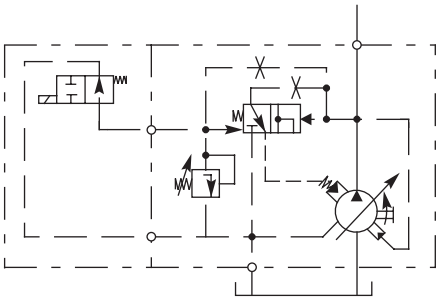
Pump With Remote Pressure Control Model Code "CR"

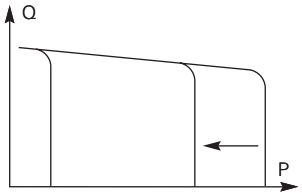




Remote max. pressure relief valve from 0 to 5 L/min (0 to 1.3 USgpm) not supplied.
Length of pilot line between compensator and relief valve should not exceed 5m (16 ft).

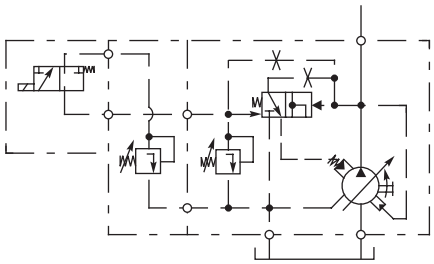
Pump With Two Stages of Pressure of Which One With Fixed Setting (At Minimum Pressure Level of Pump) Model Code "CD1"

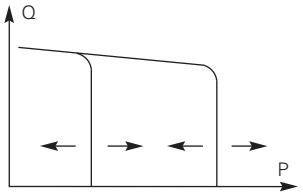




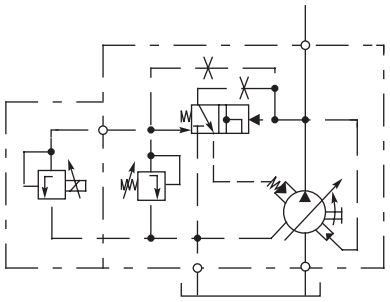
Controls for VVP Pumps (continued)

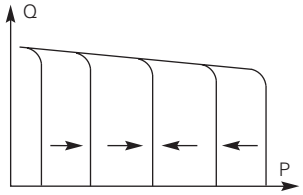
Pump With Two Adjustable Stages of Pressure Model Code "CD2"





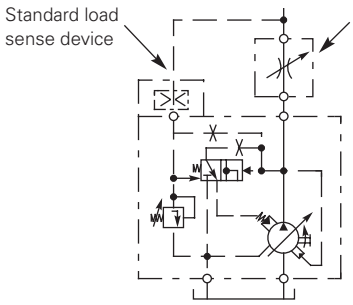
Pump With Proportional Pressure Control Model Code "CE"

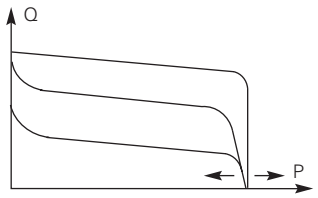




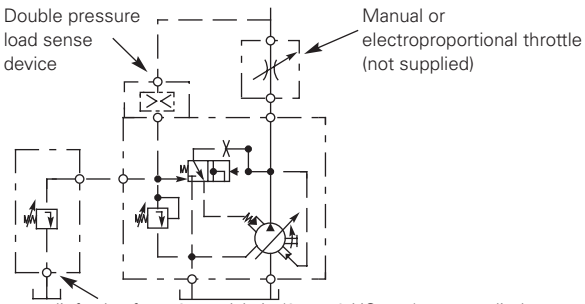
Load Sensing and Pressure Regulation

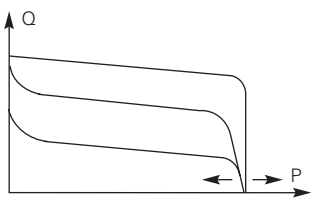
Load Sensing Pump for Standard Flow Control Model Code "CVP"





Load Sensing Pump With Remote Pressure Control Model Code "CVPR"

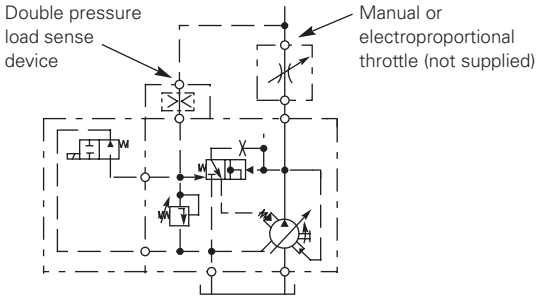


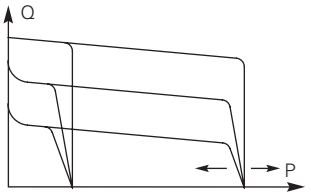


Max. pressure relief valve from 0 to 5 L/min (0 to 1.3 USgpm) not supplied.
Length of pilot line between compensator and relief valve should not exceed 5m (16 ft).

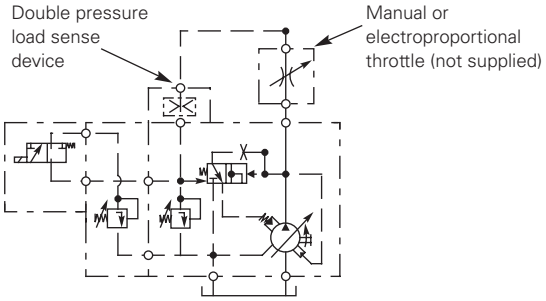
Controls for VVP Pumps (continued)

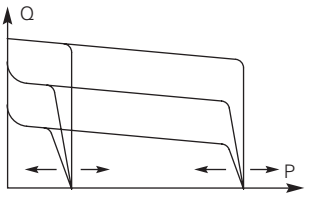
Load Sensing Pump With Two Stages of Pressure of Which One With Fixed Setting (At Min. Pressure Level of Pump)
Model Code "CVPD1"



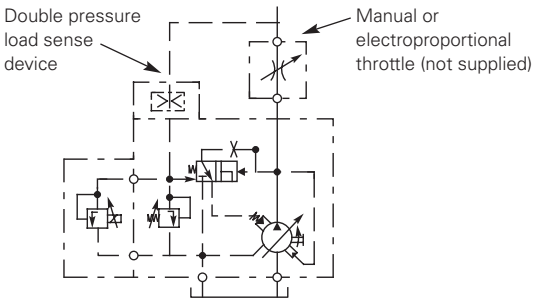


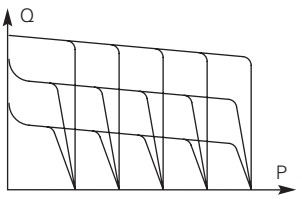
Load Sensing Pump With Two Adjustable Stages of Pressure
Model Code "CVPD2"





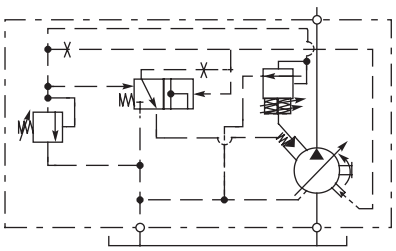
Load Sensing Pump With Proportional Pressure Control
Model Code "CVPCE"

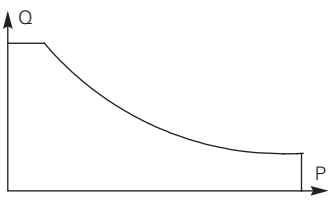




Pressure Regulation with Torque Sensing

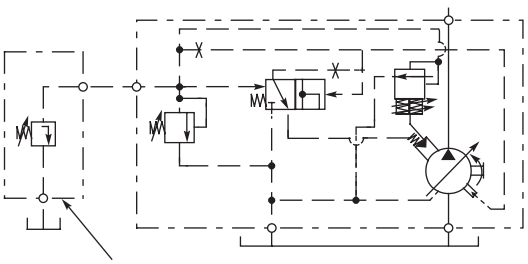
Torque Limiter
Model Code "CVT"



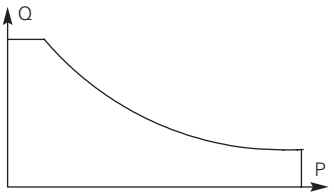


Controls for VVP Pumps (continued)

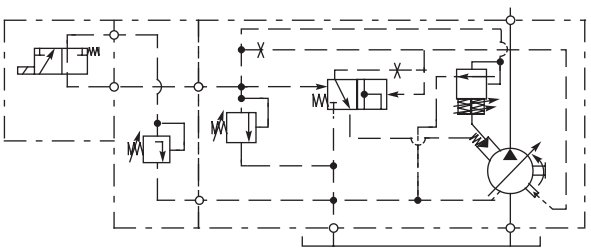
Remote Controlled Torque Limiter
Model Code "CVTR"

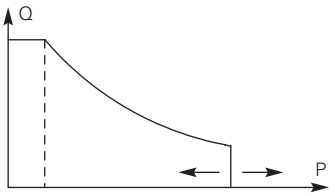


Remote max. pressure relief valve from 0 to 5 L/min (0 to 1.3 USgpm) not supplied. Length of pilot line between compensator and relief valve should not exceed 5m (16 ft).

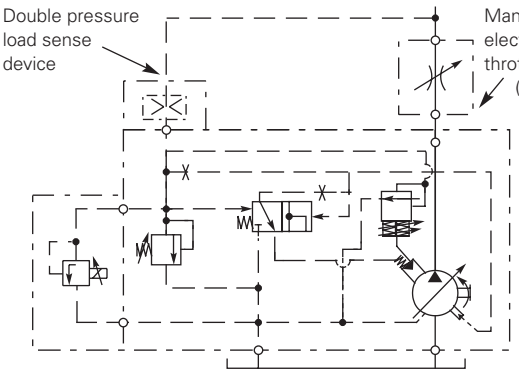


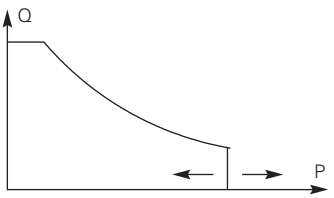
Torque Control With Dual Pressure Control
Model Code "CVTD"
(Fixed Minimum Pressure)





Torque Control With Proportional Pressure Control
Model Code "CVTCE"





Performance Characteristics
VVP1

Performance with:

Speed 1450 r/min

Oil per ISO 6743/4

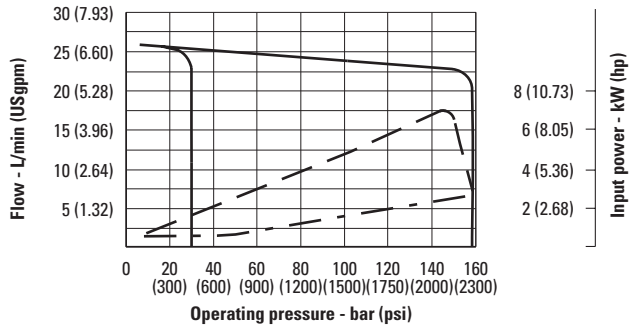
Viscosity 32 mm²/s (cSt)

Temperature 50°C (122°F)

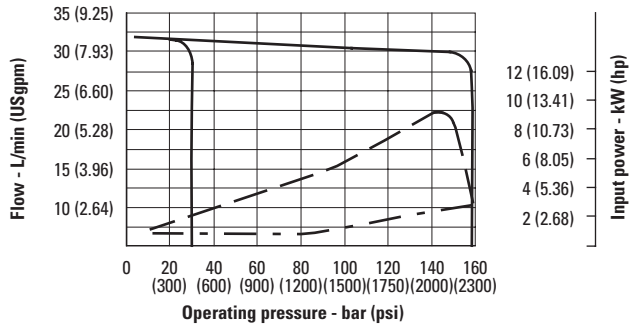
Power consumption with maximum flow — — — — — —

Power consumption with zero flow setting — · — · — · — ·

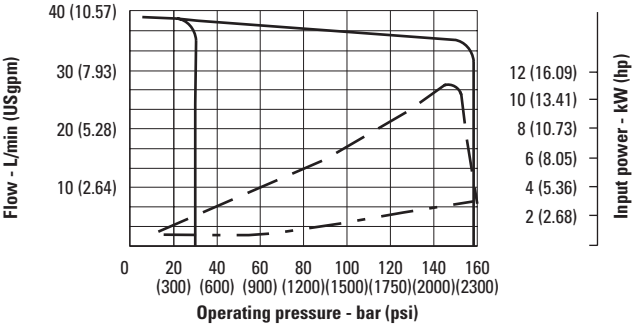
VVP1-16



VVP1-20

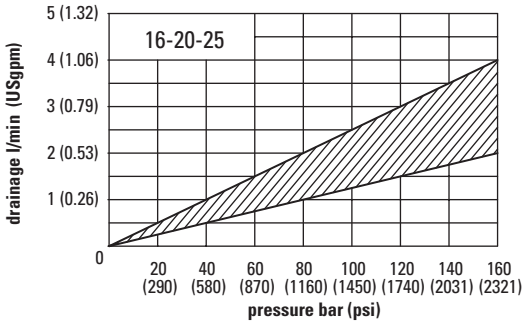


VVP1-25



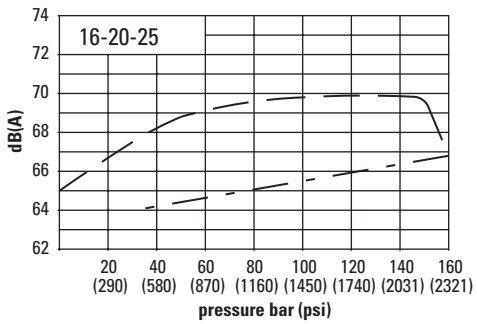
VVP1-16, -20, -25

Values established with zero flow setting



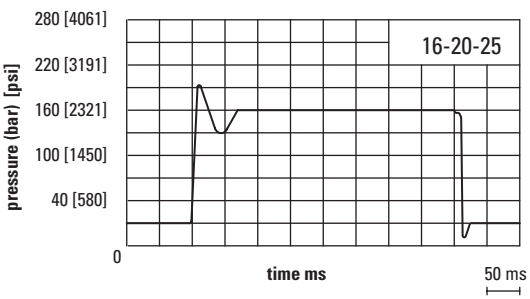
VVP1-16, -20, -25

Maximum noise level measured with sound-level meter placed at 1 meter [39.37"] from pump, flexible coupling.



VVP1-16, -20, -25

Response time and pressure peak



Performance Characteristics
VVP2

Performance with:

Speed 1450 r/min

Oil per ISO 6743/4

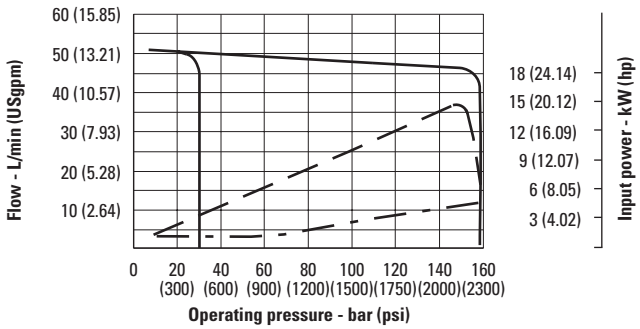
Viscosity 32 mm²/s (cSt)

Temperature 50°C (122°F)

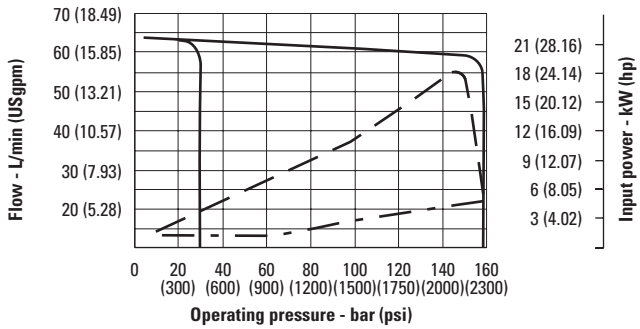
Power consumption with maximum flow — — — — — —

Power consumption with zero flow setting — · — · — · — ·

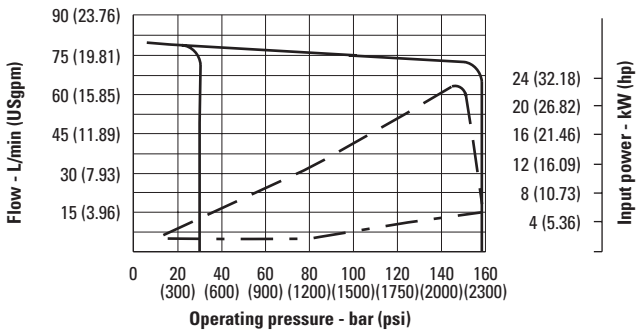
VVP2-32



VVP2-40

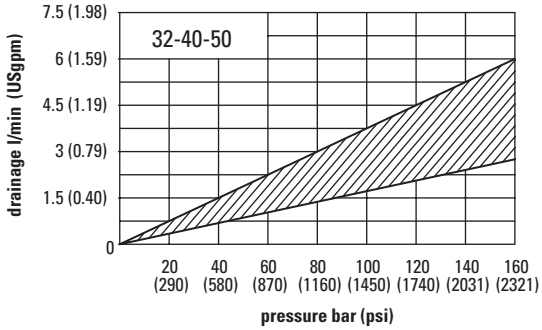


VVP2-50



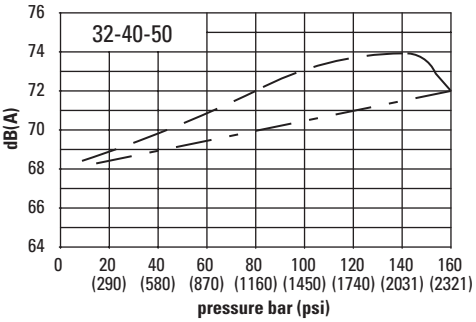
VVP2-32, -40, -50

Values established with zero flow setting



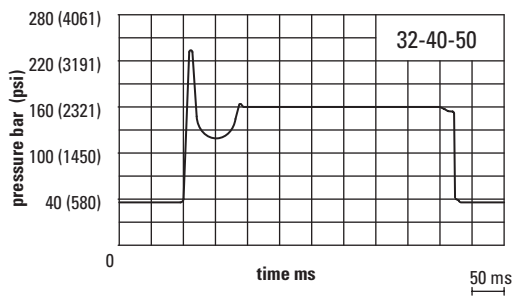
VVP2-32, -40, -50

Maximum noise level measured with sound-level meter placed at 1 meter [39.37"] from pump, flexible coupling.



VVP2-32, -40, -50

Response time and pressure peak



Performance Characteristics
VVP3

Performance with:

Speed 1450 r/min

Oil per ISO 6743/4

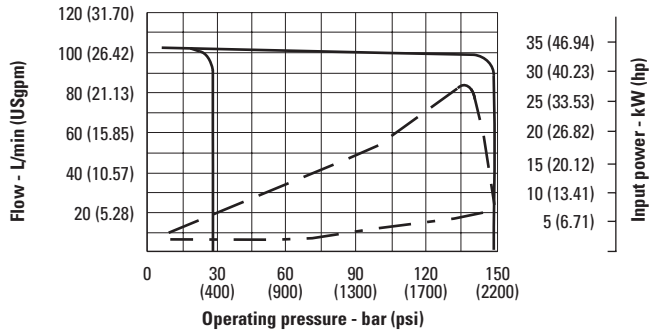
Viscosity 32 mm²/s (cSt)

Temperature 50°C (122°F)

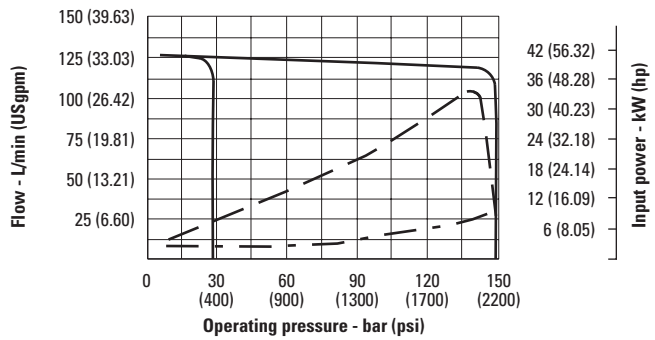
Power consumption with maximum flow — — — — — —

Power consumption with zero flow setting — · — · — · — ·

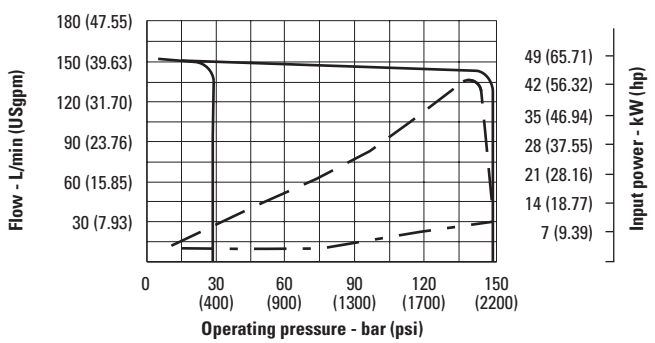
VVP3-63



VVP3-80

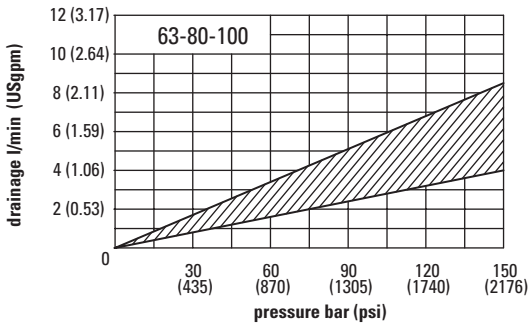


VVP3-100



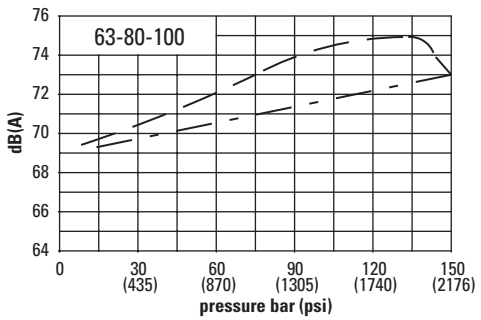
VVP3-63, -80, -100

Values established with zero flow setting



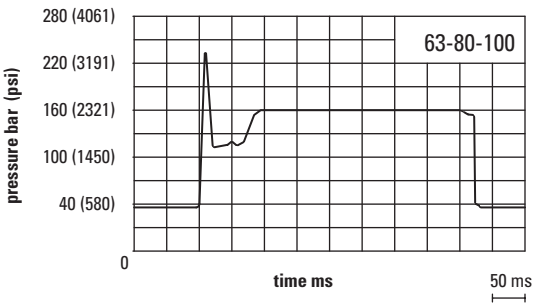
VVP3-63, -80, -100

Maximum noise level measured with sound-level meter placed at 1 meter [39.37"] from pump, flexible coupling.



VVP3-63, -80, -100

Response time and pressure peak



VVP1
With ISO or SAE Mounting Flange

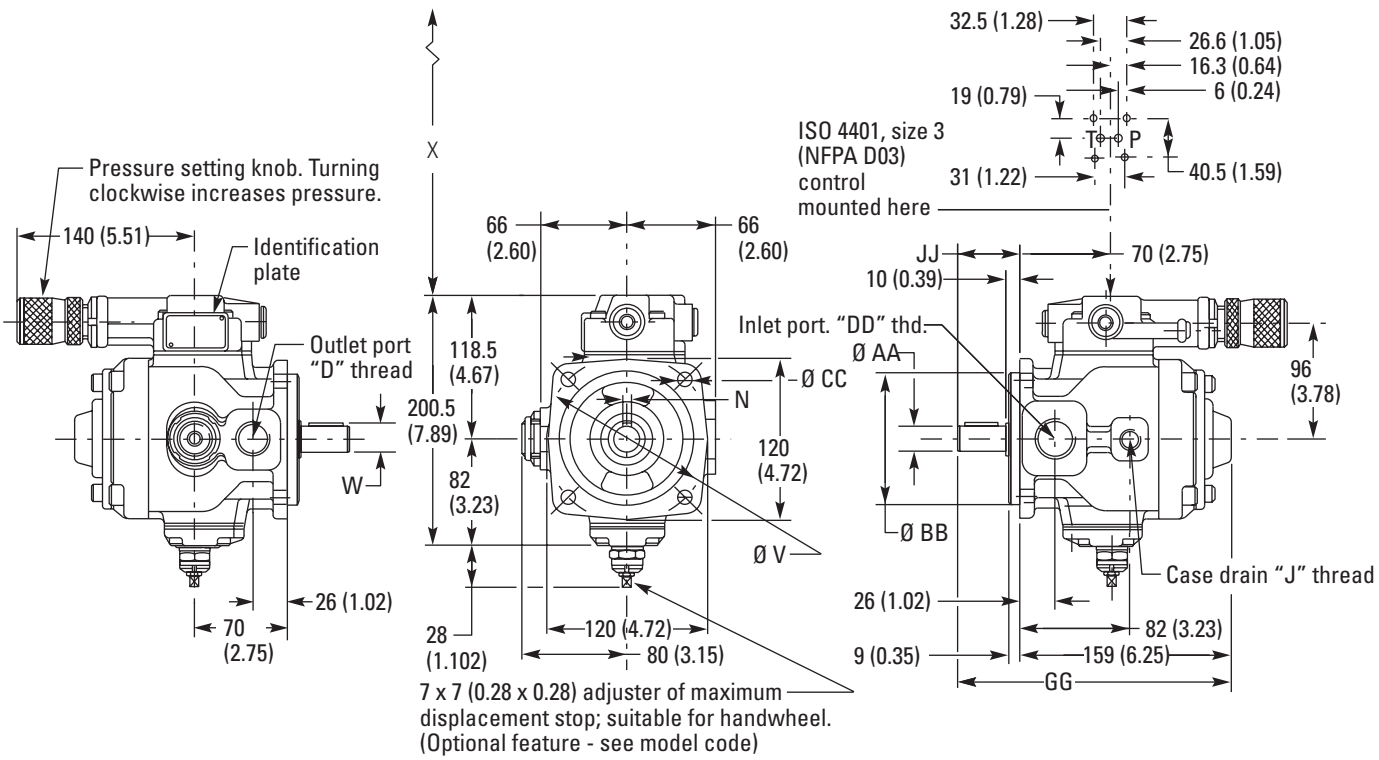
Installation Dimensions
in mm (in)

All mounting flange, port and shaft options are listed on page 36.

3rd angle projection

"C" Control With "K" Adjustment

"KL" adjustment is shown on page 35.



Thread for remote control connection, type CR = dimension "F".
Thread for load sense connection, type CV* = dimension "F".

MOUNTING FLANGE AND PORTS CODE ▲	D	F	J	N	Ø V	W	Ø AA	Ø BB	Ø CC	DD	GG	JJ
R (ISO)	3/4" BSP	1/4" BSP	3/8" BSP	8 (0.315)	125 (4.921)	28 (1.102)	25 (0.984)	100 (3.937)	11.0 (0.433)	1" BSP	205 (8.07)	46 (1.81)
PS (SAE)	1.0625-12 UNF-2B	0.500-20 UNF-2B	0.5625-18 UNF-2B	6.35 (0.250)	127 (5.000)	28.17 (1.109)	25.4 (1.000)	101.6 (4.000)	14.3 (0.56)	1.3125-12 UNF-2B	207 (8.15)	48 (1.89)

▲ See model code, page 15.

VVP CONTROL	CR	CD1	CD2	CE	CVP	CVPR	CVPD1	CVPD2	CVPCE	CVT(*)
Dimension "X"	20.0 (0.79)	100.0 ◆ (3.94) ◆	146.0 ◆ (5.75) ◆	125.5 ◆ (4.94) ◆	20.0 (0.79)	40.0 (1.57)	120.0 ◆ (4.72) ◆	166.0 ◆ (6.54) ◆	145.5 ◆ (5.73) ◆	115.0 (4.55)

◆ Includes 13 (0.51) for removal of DIN connector.

VVP2 and VVP3 With ISO Mounting Flange

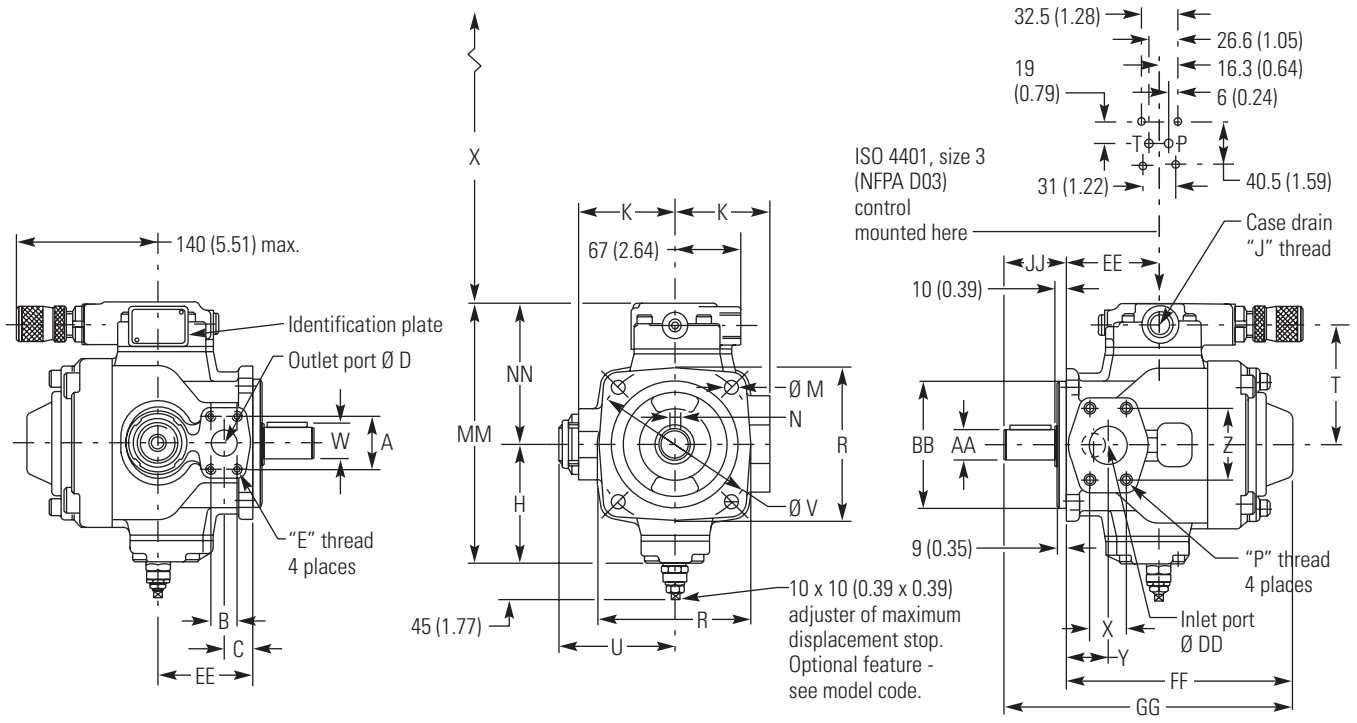
Installation Dimensions
in mm (in)

All mounting flange, port and shaft options are listed on page 36.

3rd angle projection

"C" Control With "K" Adjustment

"KL" adjustment is shown on page 35.



Thread for remote control or load sense connection, type CR or CV* = 1/4" BSP.

MODEL	A	B	C	D	E	H	J	K	Ø M	N	P	R	T
VVP2	52.4 (2.06)	26.2 (1.03)	30 (1.18)	25 (0.98)	M10 or 0.375-16 UNC-2B ▲	110 (4.33)	3/4" BSP or 1.0625-12 UNF-2B ▲	95 (3.74)	14 (0.55)	10 (0.39)	M12 or 0.500-13 UNC-2B ▲	150 (5.91)	123 (4.84)
VVP3	58.7 (2.31)	30.2 (1.19)	35 (1.378)	32 (1.26)	M10 or 0.4375-14 UNC-2B ▲	120 (4.72)	3/4" BSP or 1.0625-12 UNF-2B ▲	105 (4.13)	18 (0.71)	12 (0.47)	M12 or 0.500-13 UNC-2B ▲	185 (7.28)	133 (5.24)

▲ See mounting flange/port connections codes RF and PX, page 15.

MODEL	U	Ø V	W	X	Y	Z	Ø AA	Ø BB	Ø DD	EE	FF	GG	JJ	MM	NN
VVP2	114 (4.49)	160 (6.30)	35 (1.38)	35.7 (1.41)	40 (1.58)	70 (2.76)	32 (1.26)	125 (4.92)	38 (1.50)	91 (3.58)	219 (8.62)	279 (10.98)	60 (2.36)	255.5 (10.06)	145.5 (5.728)
VVP3	123 (4.84)	200 (7.87)	43 (1.69)	43 (1.69)	46 (1.81)	77.8 (3.06)	40 (1.57)	160 (6.30)	51 (2.01)	105 (4.13)	245 (9.65)	313 (12.32)	68 (2.68)	275.5 (10.85)	155.5 (6.12)

VVP CONTROL	CR	CD1	CD2	CE	CVP	CVPR	CVPD1	CVPD2	CVPCE	CVT(*)
Dimension "X"	20.0 (0.79)	100.0 ◆ (3.94) ◆	146.0 ◆ (5.75) ◆	125.5◆ (4.94) ◆	20.0 (0.79)	40.0 (1.57)	120.0 ◆ (4.72) ◆	166.0 ◆ (6.54) ◆	145.5 ◆ (5.73) ◆	115.0 (4.55)

◆ Includes 13 (0.51) for removal of DIN connector.

VVP2 and VVP3 With SAE Mounting Flange

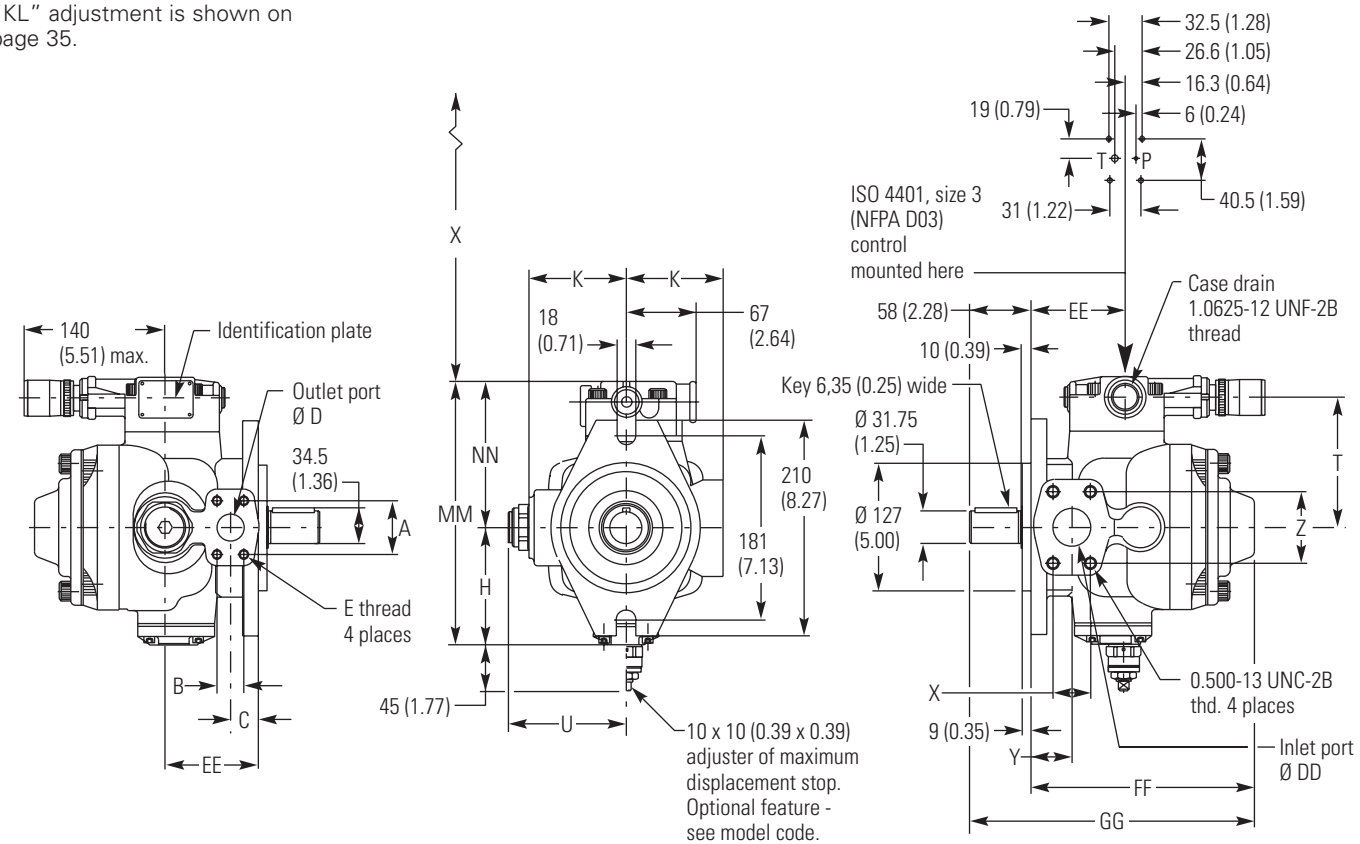
Installation Dimensions
in mm (in)

All mounting flange, port and shaft options are listed on page 36.

3rd angle projection

"C" Control With "K" Adjustment

"KL" adjustment is shown on page 35.



Thread for remote control or load sense connection, type CR or CV* = 0.500-20 UNF-2B

MODEL	A	B	C	D	E	H	K	T	U
VVP2	52.4 (2.06)	26.2 (1.03)	27 (1.06)	25 (0.98)	0.375-16 UNC-2B	110 (4.33)	95 (3.74)	123 (4.84)	114 (4.49)
VVP3	58.7 (2.31)	30.2 (1.19)	35 (1.38)	32 (1.26)	0.4375-14 UNC-2B	120 (4.72)	105 (4.13)	133 (5.24)	123 (4.84)

MODEL	X	Y	Z	Ø DD	EE	FF	GG	MM	NN
VVP2	35.7 (1.41)	40 (1.58)	70 (2.76)	38 (1.50)	91 (3.58)	219 (8.62)	279 (10.98)	256 (10.08)	145.5 (5.73)
VVP3	43 (1.69)	46 (1.81)	77.8 (3.06)	51 (2.00)	105 (4.13)	245 (9.65)	303 (11.93)	275.5 (10.85)	155.5 (6.12)

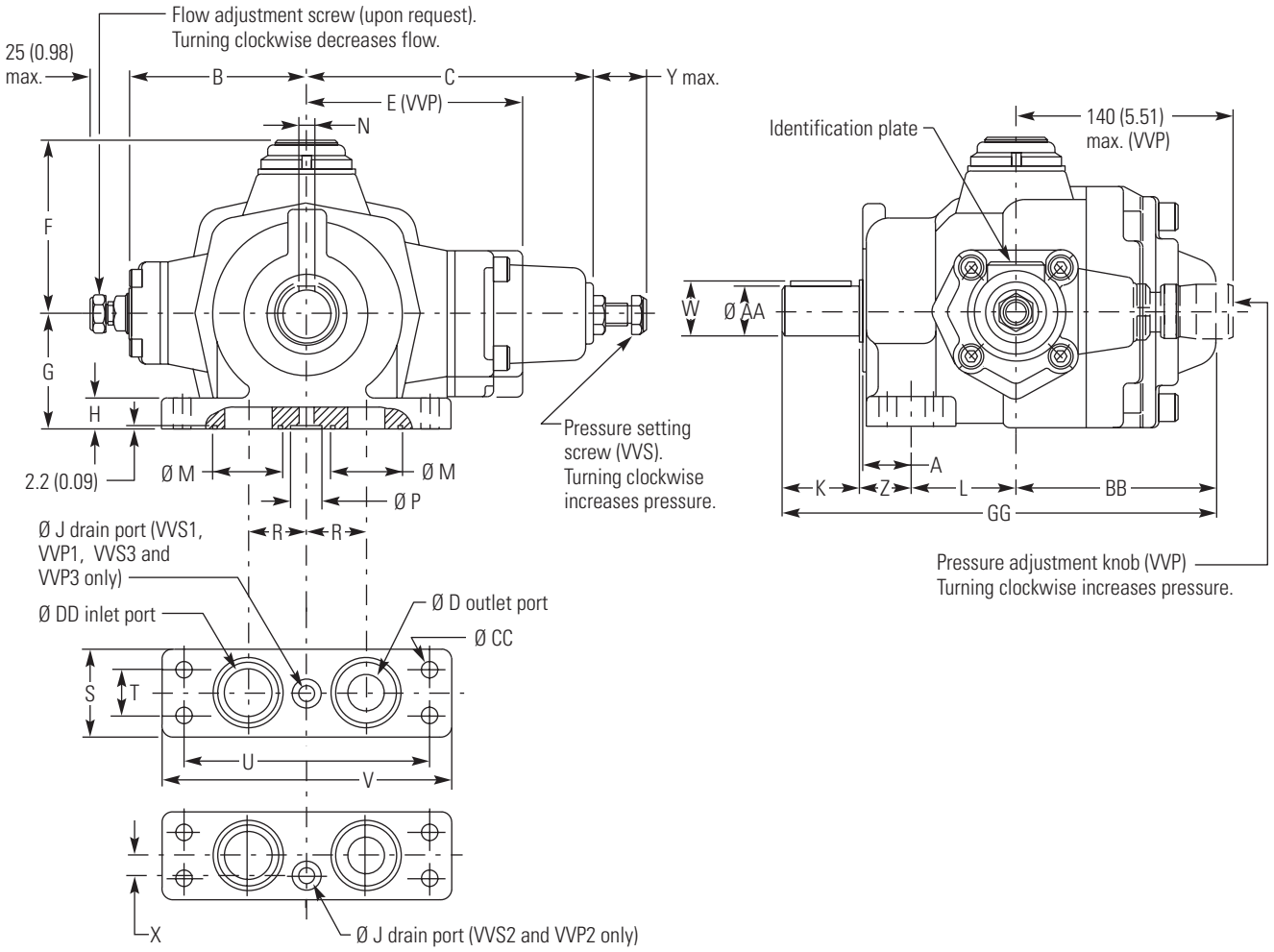
VVP CONTROL	CR	CD1	CD2	CE	CVP	CVPR	CVPD1	CVPD2	CVPCE	CVT(*)
Dimension "X"	20.0 (0.79)	100.0 ◆ (3.94) ◆	146.0 ◆ (5.75) ◆	125.5 ◆ (4.94) ◆	20.0 (0.79)	40.0 (1.57)	120.0 ◆ (4.72) ◆	166.0 ◆ (6.54) ◆	145.5 ◆ (5.73) ◆	115.0 (4.55)

◆ Includes 13 (0.51) for removal of DIN connector.

VVS and VVP
Based Mounted

Installation Dimensions
in mm (in)

3rd angle projection



MODEL	A	B	C	Ø D	E	F	G	H	Ø J	K	L	Ø M	N	Ø P
VVS1 VVP1	25 (0.98)	82 (3.23)	131 (5.16)	14 (0.55)	118.5 (4.67)	80 (3.15)	54 (2.13)	13 (0.51)	6 (0.24)	32 (1.26)	52.5 (2.07)	32.5 (1.28)	5 (0.20)	14 (0.55)
VVS2 VVP2	31 (1.22)	110 (4.33)	175 (6.89)	24 (0.94)	145.5 (5.73)	113 (4.45)	75 (2.95)	20 (0.79)	10 (0.39)	50 (1.97)	68 (2.68)	45.5 (1.79)	10 (0.39)	20.5 (0.81)
VVS3 VVP3	53.5 (2.11)	120 (4.72)	185 (7.28)	28 (1.10)	155.5 (6.12)	123 (4.84)	114 (4.49)	21 (0.83)	13 (0.51)	47 (1.85)	57.5 (2.26)	48 (1.89)	6.35 (0.25)	28 (1.10)

MODEL	R	S	T	U	V	W	X	Y	Z	AA	BB	Ø CC	Ø DD	GG
VVS1 VVP1	25.5 (1.00)	46 (1.81)	25.5 (1.00)	121 (4.76)	140 (5.51)	21 (0.83)	-	30 (1.18)	27 (1.06)	19 (0.75)	89.5 (3.52)	11 (0.43)	21 (0.83)	201 (7.91)
VVS2 VVP2	38 (1.50)	57 (2.24)	30 (1.18)	159 (6.26)	190 (7.48)	35 (1.38)	12.5 (0.49)	40 (1.57)	33 (1.30)	32 (1.26)	129 (5.08)	11 (0.43)	32 (1.26)	280 (11.02)
VVS3 VVP3	57 (2.24)	76 (2.99)	51 (2.01)	247.5 (9.74)	273 (10.75)	27.5 (1.08)	-	40 (1.57)	55.5 (2.19)	25.37 (1.00)	140 (5.51)	13 (0.51)	35 (1.38)	300 (11.81)

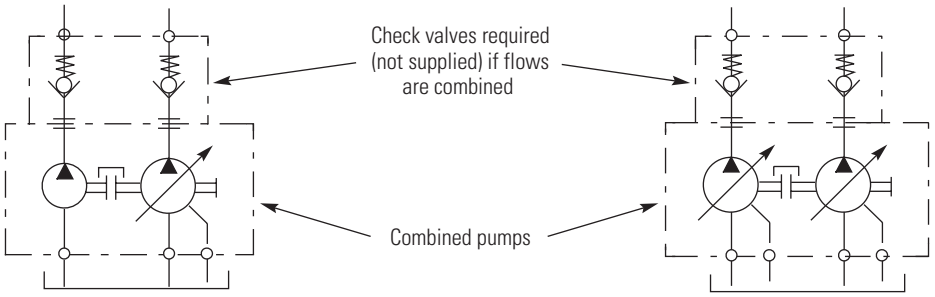
Combined Pumps

The rotor shaft of Vickers(™) variable vane pumps is pre-arranged for mounting an additional pump. Simply take off the rear cover to easily attach the secondary pump. (See items A and B on sectional view, page 4.)

Vickers(™) combined standard pumps (see table below) eliminate the need for many "special application" pumps.

For solutions other than those shown in the table, contact your Eaton representative.

Typical Pump Combinations



Components for Combining Pumps

PRIMARY PUMP	SECONDARY PUMP	ADAPTER KIT	PART NO.	MAX. TORQUE ON DRIVE SHAFT FOR SECONDARY PUMP
VV*1-***-R/PS	VVS0-R	AK-VVS/VVP1-0-R	02-358847	55 Nm (487 lbf-in)
	VVS0-PS	AK-VVS/VVP1-0-PS	02-358848	
	VV*1-R	AK-VVS/VVP1-1-R	02-358849	
	VV*1-PS	AK-VVS/VVP1-1-PS	02-358850	
	SAE A 2-bolt ▲	AK-VVS/VVP1-SAE-A	02-358851	
VV*2/3-RF/PF	VVS0-R	AK-VVS/VVP2/3-0-R ●	02-358852	110 Nm (974 lbf-in)
	VVS0-PS	AK-VVS/VVP2/3-0-PS ●	02-358853	
	VV*1-R	AK-VVS/VVP2/3-1-R ●	02-358717	
	VV*1-PS	AK-VVS/VVP2/3-1-PS ●	02-358854	
	VV*2-RF/PX	AK-VVS/VVP2/3-2-RF/PX ●	02-358855	
	SAE A 2-bolt ▲	AK-VVS/VVP2/3-SAE-A ●	02-358856	
	SAE B 2-bolt ▲	AK-VVS/VVP2/3-SAE-B ●	02-358857	
VV*3-RF/PF	VV*3-RF/PX	AK-VVS/VVP3-3-RF/PX	02-358858	180 Nm (1593 lbf-in)

▲ SAE A and B 2-bolt are generic interfaces. Secondary pump with SAE A or B mount should conform to dimensions on the following page.

● Adapter kits for same displacements within frame sizes 2 and 3 primary pumps are identical.

Ordering Combined Pumps

Order pumps and coupling unit in progressive order of coupling.
Example:

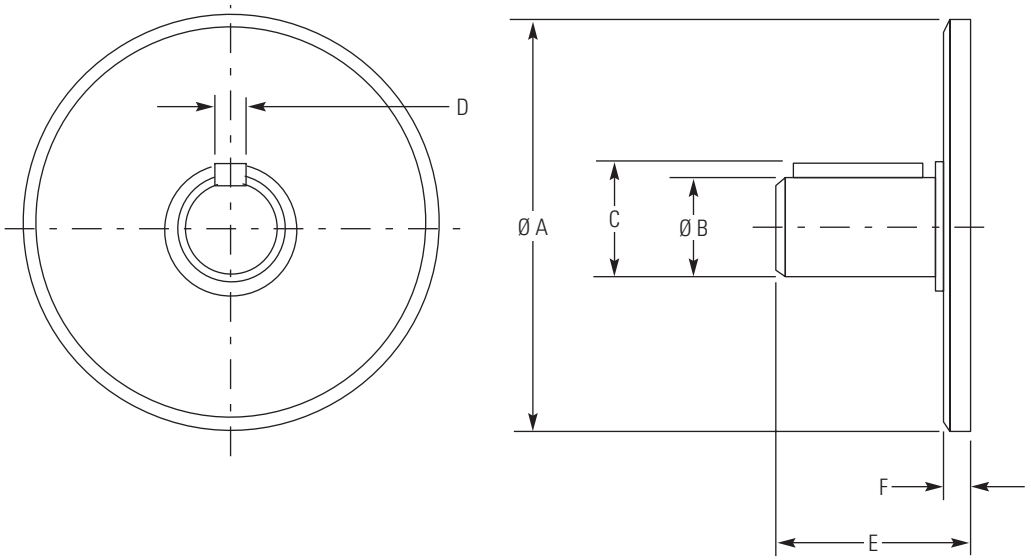
One (1) VVP1-20-RR-M-30-CVTCE03B-15-10 Primary Pump

One (1) AK-VVS/VVP1-0-R Adapter Kit

One (1) VVS0-10-RR-M-40-CCW-10 Secondary Pump

Combined Pumps (continued)

Secondary pumps with SAE A or B 2-bolt mounts should conform to the dimensions below. Dimensions in millimeters (inches).



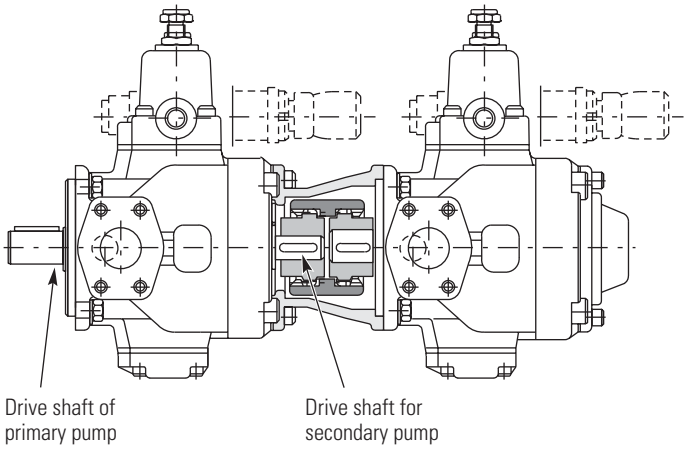
PRIMARY PUMP	2-BOLT FLANGE OF SECONDARY PUMP ▲	ADAPTER KIT	Ø A	Ø B	C	D	E MAX.	F
VVS1 VVP1	SAE A	AK-VVS/VVP1-SAE-A	82.5 (3.25)	19.05 (0.75)	21.1 (0.83)	4.8 (0.19)	50 (1.97)	7 (0.28)
VVS2 VVP2	SAE A	AK-VVS/VVP2/3-SAE-A	82.5 (3.25)	19.05 (0.75)	21.1 (0.83)	4.8 (0.19)	60 (2.36)	7 (0.28)
VVS3 VVP3	SAE B	AK-VVS/VVP2/3-SAE-B	101.6 (4.00)	22.2 (0.87)	25.1 (0.99) ●	6.375 (0.25) ●		9.5 (0.37)
					25.5 (1.00) ●	4.8 (0.19) ●		

▲ Secondary pumps with ISO mounting flange are listed on page 28.

● Both shafts are accommodated within same coupling.

Torque Requirements
Combined Pumps

Combined pumps must be installed in decreasing order of displacement. Torque requirements and limitations of single and combined pumps must not exceed the values shown in the tables below.



Pump Frame Size 1

PUMP TYPE	REQUIRED TORQUE FOR PRIMARY PUMP Nm (lbf-in)	MAXIMUM TORQUE ON DRIVE SHAFT FOR SECONDARY PUMP Nm (lbf-in)
VVS1-16	30 (266)	
VVS1-20	37 (327)	
VVS1-25	46 (407)	55 (487)
VVP1-16	47 (416)	
VVP1-20	58 (513)	
VVP1-25	73 (646)	

Pump Frame Size 2

PUMP TYPE	REQUIRED TORQUE FOR PRIMARY PUMP Nm (lbf-in)	MAXIMUM TORQUE ON DRIVE SHAFT FOR SECONDARY PUMP Nm (lbf-in)
VVS2-32	57 (504)	
VVS2-40	73 (646)	
VVS2-50	91 (805)	110 (974)
VVP2-32	92 (814)	
VVP2-40	117 (1036)	
VVP2-50	146 (1292)	

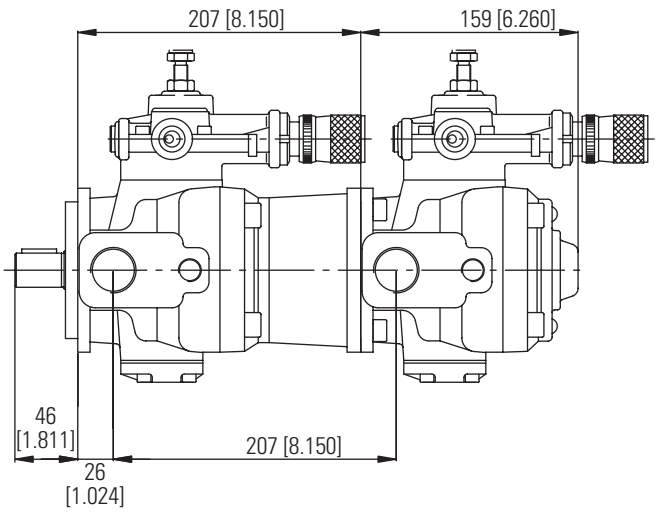
Pump Frame Size 3

PUMP TYPE	REQUIRED TORQUE FOR PRIMARY PUMP Nm (lbf-in)	MAXIMUM TORQUE ON DRIVE SHAFT FOR SECONDARY PUMP Nm (lbf-in)
VVS3-63	92 (814)	
VVS3-80	117 (1036)	
VVS3-100	146 (1292)	180 (1593)
VVP3-63	172 (1522)	
VVP3-80	219 (1938)	
VVP3-100	273 (2416)	

Dimensions
Combined Pumps

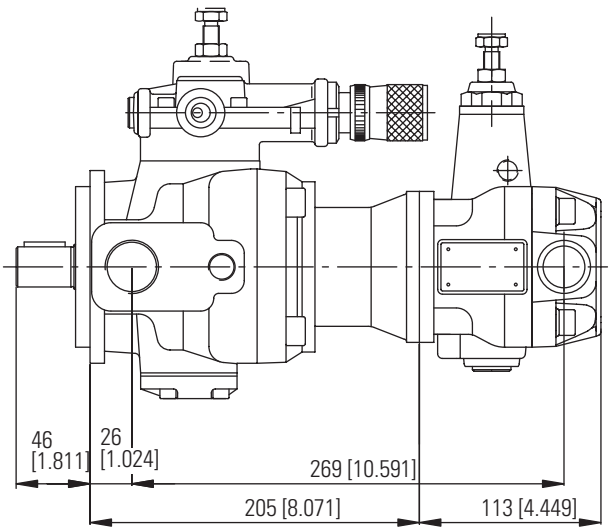
Installation Dimensions
in mm (in)

VVS1 or VVP1 Primary Pump With VVS1 or VVP1 Secondary Pump



MOUNTING FLANGE & PORT CODE	A
R	46 (1.81)
PS	48 (1.89)

VVS1 or VVP1 Primary Pump With VVS0 Secondary Pump



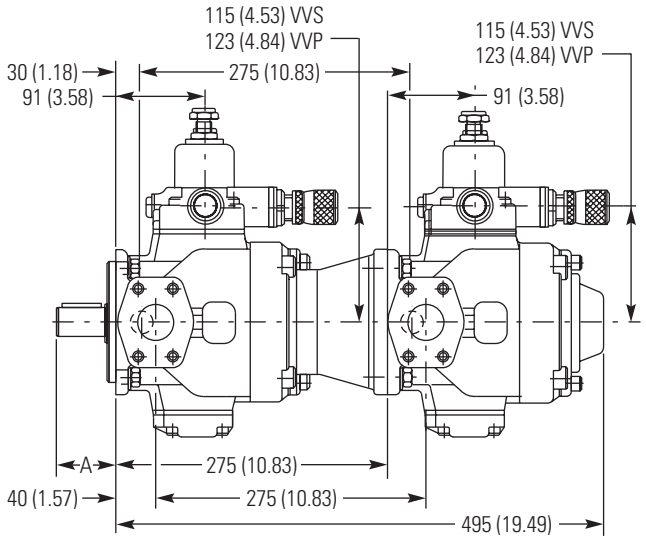
MOUNTING FLANGE & PORT CODE	A
R	46 (1.81)
PS	48 (1.89)

Dimensions

Combined Pumps (continued)

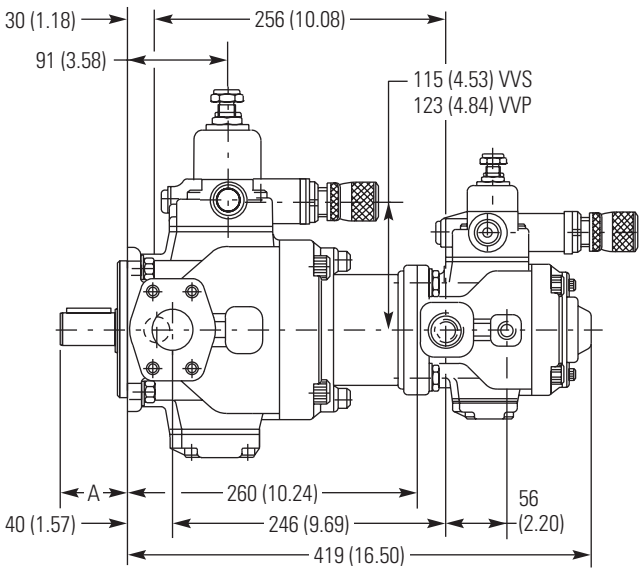
Installation Dimensions
in mm (in)

VVS2 or VVP2 Primary Pump With VVS2 or VVP2 Secondary Pump



MOUNTING FLANGE & PORT CODE	A
RF	60 (2.36)
PF	58 (2.28)

VVS2 or VVP2 Primary Pump With VVS1 or VVP1 Secondary Pump



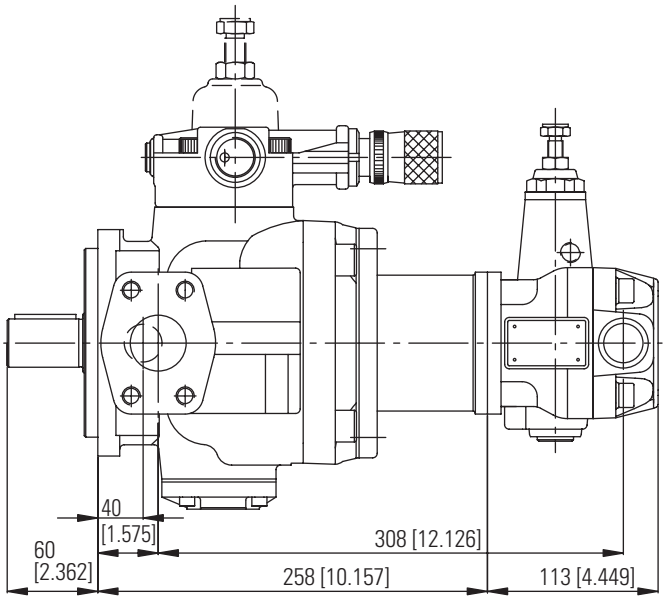
MOUNTING FLANGE & PORT CODE	A
RF	60 (2.36)
PF	58 (2.28)

Dimensions

Combined Pumps (continued)

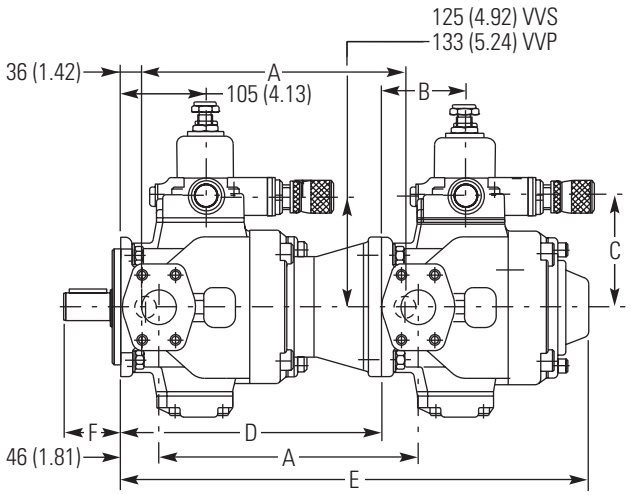
Installation Dimensions
in mm (in)

VVS2 or VVP2 Primary Pump With VVS0 Secondary Pump



MOUNTING FLANGE & PORT CODE	A
RF	60 (2.86)
PF	58 (2.28)

VVS3 or VVP3 Primary Pump With VVS3, VVP3, VVS2 or VVP2 Secondary Pump



MOUNTING FLANGE & PORT CODE	F
RF	68 (2.68)
PF	58 (2.28)

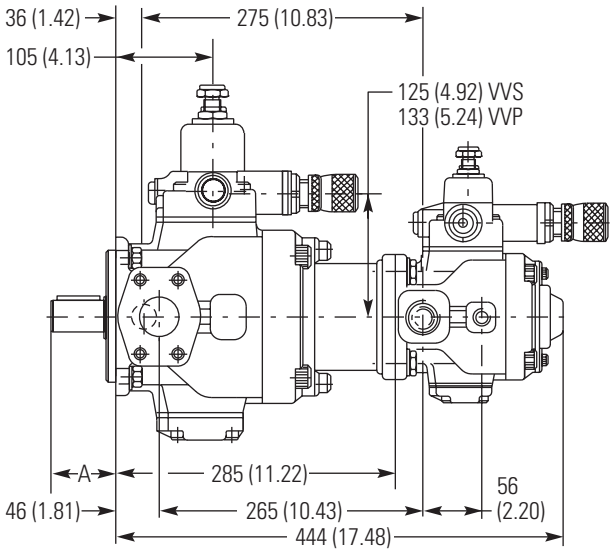
SECONDARY PUMP	A	B	C	D	E
VVS3, VVP3	315 (12.40)	105 (4.13)	125 (4.92) VVS3 133 (5.24) VVP3	315 (12.40)	560 (22.05)
VVS2, VVP2	294 (11.57)	91 (3.58)	115 (4.53) VVS2 123 (4.84) VVP2	300 (11.81)	520 (20.47)

Dimensions

Combined Pumps (continued)

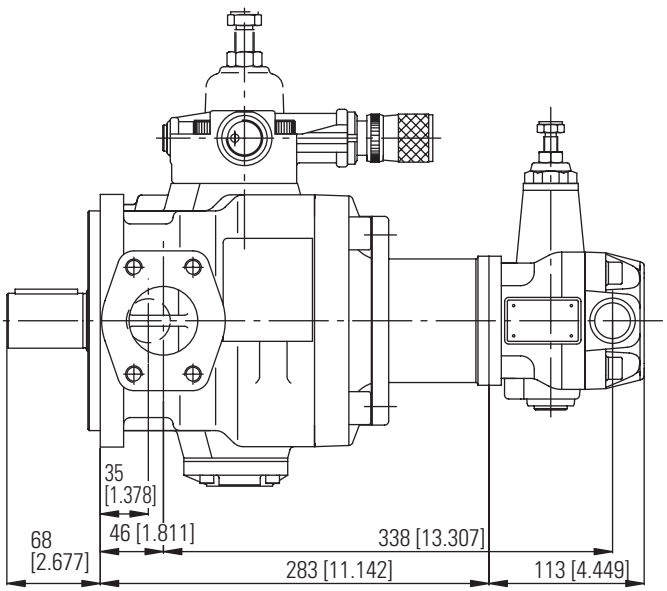
Installation Dimensions
in mm (in)

VVS3 or VVP3 Primary Pump With VVS1 or VVP1 Secondary Pump



MOUNTING FLANGE & PORT CODE	A
RF	68 (2.68)
PF	58 (2.28)

VVS3 or VVP3 Primary Pump With VVS0 Secondary Pump



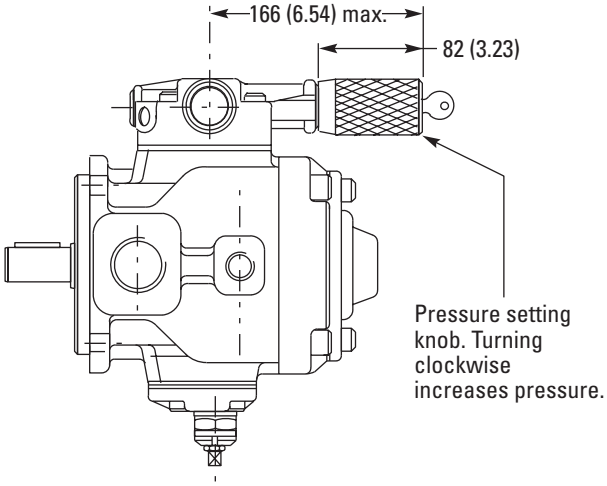
MOUNTING FLANGE & PORT CODE	A
RF	68 (2.68)
PF	58 (2.28)

Key Lock Adjustment for VVP Pumps

Installation Dimensions
in mm (in)

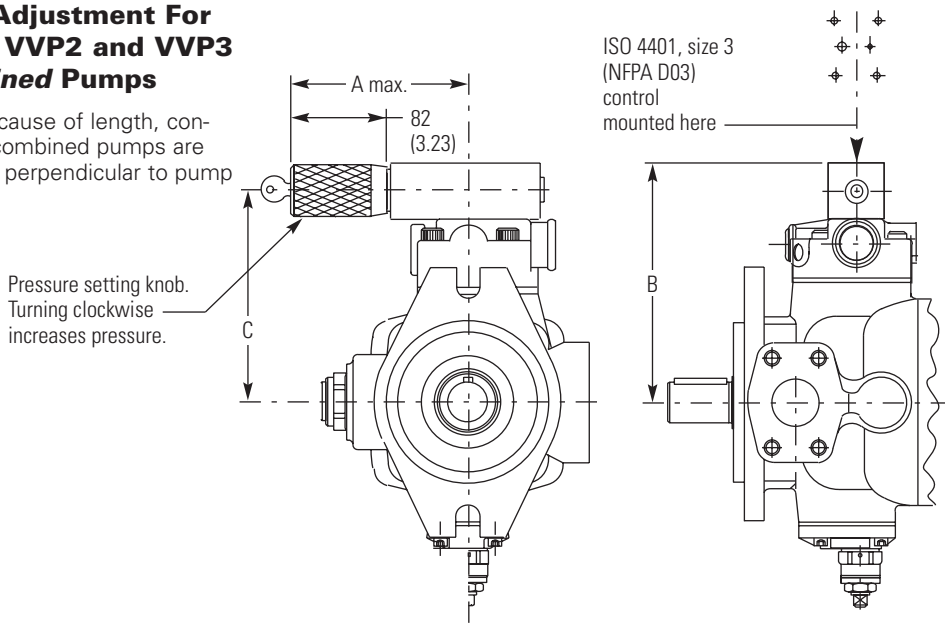
3rd angle projection

"KL" Adjustment For VVP1, VVP2 and VVP3 *Single* Pumps



"KL" Adjustment For VVP1, VVP2 and VVP3 *Combined* Pumps

Note: Because of length, controls on combined pumps are mounted perpendicular to pump shaft.



PUMP	A	B	C
VVP1	162 (6.38)	162 (6.38)	139 (5.47)
VVP2	155 (6.10)	189 (7.44)	166 (6.54)
VVP3	155 (6.10)	199 (7.83)	176 (6.93)

Mounting, Shaft and Port Options

Installation Dimensions
in mm (in)

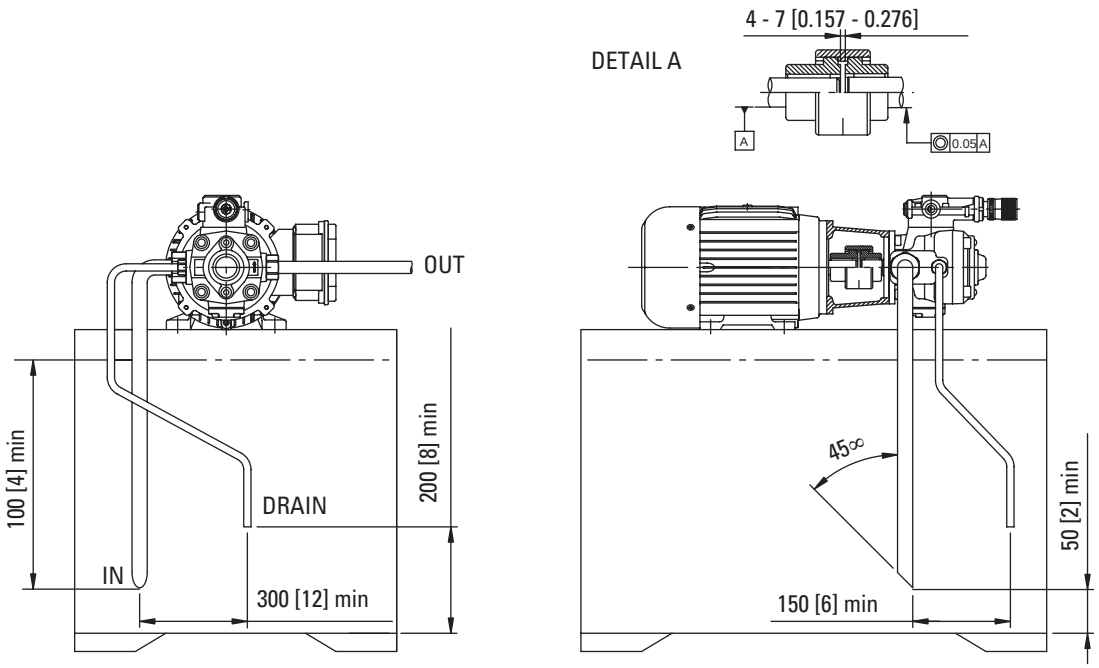
Mountings and Shafts

FRAME SIZE	MTG. FLANGE & PORTS CODE	ISO MOUNTING FLANGE		SAE MOUNTING FLANGE		FRONT END DIAMETER	SHAFT LENGTH	REAR END DIAMETER	SHAFT LENGTH
		PILOT DIA.	BOLT CIRCLE DIA.	PILOT DIA.	BOLT CIRCLE DIA.				
0	R	80 (3.15)	103 (4.06)	-	-	20 (0.79)	36 (1.42)	-	-
	PS	80 (3.15)	103 (4.06)	-	-	15.88 (0.625)	24 (0.938)	-	-
1	B	-	-	-	-	19 (0.75)	32 (1.26)	-	-
	R	100 (3.94)	125 (4.92)	-	-	25 (0.98)	36 (1.42)	20 (0.79)	26 (1.02)
	PS	-	-	101.6 (4.000)	127 (5.000)	25.4 (1.00)	38 (1.50)	20 (0.79)	26 (1.02)
2	B	-	-	-	-	32 (1.26)	50 (1.97)	-	-
	RF	125 (4.92)	160 (6.30)	-	-	32 (1.26)	50 (1.97)	28 (1.10)	45 (1.77)
	PF	-	-	127 (5.000)	180 (7.09)	31.75 (1.25)	48 (1.88)	28 (1.10)	45 (1.77)
	PX	125 (4.92)	160 (6.30)	-	-	32 (1.26)	50 (1.97)	28 (1.10)	45 (1.77)
3	B	-	-	-	-	25.37 (1.00)	47 (1.85)	-	-
	RF	160 (6.30)	200 (7.87)	-	-	40 (1.57)	58 (2.28)	28 (1.10)	45 (1.77)
	PF	-	-	127 (5.000)	180 (7.09)	31.75 (1.25)	48 (1.88)	28 (1.10)	45 (1.77)
	PX	160 (6.30)	200) (7.87)	-	-	40 (1.57)	58 (2.28)	28 (1.10)	45 (1.77)

Ports

FRAME SIZE	MTG. FLANGE & PORTS CODE	INLET PORT	OUTLET PORT	DRAIN PORT VVS PUMPS	DRAIN PORT VVP PUMPS	REMOTE PRESSURE CONTROL, LOAD SENSING AND DUAL-PRESSURE LOAD SENSING PORTS
0	R	G 3/4" BSP	G 3/8" BSP	G 1/4" BSP	-	-
	PS	1.0625-12 UNF-2B	0.750-16 UNF-2B	0.500-20 UNF-2B	-	-
1	B	21 (0.83)	14 (0.55)	6 (0.24)	6 (0.24)	-
	R	G 1" BSP	G 3/4" BSP	G 3/8" BSP	G 3/8" BSP	G 1/4" BSP
	PS	1.3125-12 UNF-2B	1.0625-12 UNF-2B	0.5625-18 UNF-2B	0.5625-18 UNF-2B	0.500-20 UNF-2B
2	B	32 (1.26)	24 (0.94)	10 (0.39)	10 (0.39)	-
	RF	1.50 SAE 4-bolt flange with M12 x 45 deep mounting holes	1.00 SAE 4-bolt flange with M10 x 35 deep mounting holes	G 1/2" BSP	G 3/4" BSP	G 1/4" BSP
	PF PX	1.50 SAE 4-bolt flange with 0.500 UNC x 1.75 deep mounting holes	1.00 SAE 4-bolt flange with 0.375-16 UNC x 1.50 deep mounting holes	0.875-14 UNF-2B	1.0625-12 UNF-2B	0.500-20 UNF-2B
3	B	35 (1.38)	28 (1.10)	13 (0.51)	13 (0.51)	-
	RF	2.00 SAE 4-bolt flange with M12 x 45 deep mounting holes	1.25 SAE 4-bolt flange with M10 x 40 deep mounting holes	G 1/2" BSP	G 3/4" BSP	G 1/4" BSP
	PF PX	2.00 SAE 4-bolt flange with 0.500 UNC x 1.75 deep mounting holes	1.25 SAE 4-bolt flange with 0.375-16 UNC x 1.75 deep mounting holes	0.875-14 UNF-2B	1.0625-12 UNF-2B	0.500-20 UNF-2B

1) Pump frame sizes 0 and 1 can be mounted in any position. Pump frame sizes 2 and 3 **must** be mounted with horizontal axis and the compensator device upward (see figure). When the pump is installed over the tank oil level, it is recommended to pay attention to the inlet pressure. The minimum section of the inlet pipe must be equal to the section of the thread inlet port of the pump. The inlet pipes should be as short as possible, with a small number of bends and without inside section changes.
2) All return and drain pipes must be placed so that the oil will be not re-sucked directly from the pump (see figure). The oil tank must be suitably sized in order to exchange the thermal power generated to the system components and to have a low re-cycle speed. To ensure maximum pump working life, inlet oil temperature must never be above 50°C (122°F). In the systems where the pump runs for a long time in zero flow setting condition, it is recommended to install a heat exchanger in the drain line. The pressure on the drain port must never be in excess of the specified value. The drain pipe must always be independent of other return lines, connected directly to the tank and extended sufficiently inside the tank so as to be below the minimum oil level in order to avoid generating foam. Moreover, the drain pipe must be free of restrictions and as far as possible away from the inlet pipe.
3) Motor-pump coupling must be made with a self-aligning coupling with convex teeth and with cam in polyamide material. When assembling, maximum attention must be given to the distance between the two half-couplings which must imperatively fall within the value specified in the diagram below (detail "A"). Other types of motor - pump couplings are not permitted. No induced RADIAL or AXIAL LOADS are allowed on the pump shaft.
4) During the first installation, the pump must be run in maximum flow condition (P connected to T), with the oil flowing directly into the tank, thus to induce air bleeding. For sizes 2 and 3 there is an air bleed placed on the compensator device. This phase must go on for several minutes. Pump priming (oil output to the delivery side) must occur within a few seconds, otherwise the pump must be turned off and the operation repeated. Subsequent start-ups in zero flow setting conditions are admissible only with pressure not exceeding 30 bar (435 psi), and at condition that the system and pump be completely filled up with oil. During the starting operations, both the first and the followings, the difference between the oil temperature and the environment temperature (body pump temperature) must not exceed by more than 20°C (68°F).



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August 2004

Vickers® VMQ Vane Pumps

Single-10 (0.62) to 240 cm^3/r (14.65 cm^3/r)
Double-20 (1.23) to 398 cm^3/r (24.29 in^3/r)
Triple-110 (6.71) to 488 cm^3/r (29.78 in^3/r)

Fixed Displacement
Industrial and
Mobile Applications



EATON
Powering Business Worldwide

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Introduction
VMQ Series



The latest state-of-the-art Vickers® VMQ fixed displacement vane pumps from Eaton set new standards of performance and efficiency for both industrial and mobile applications. The new VMQ series features design enhancements in all areas, resulting in a unique combination of higher pressure capabilities and outstanding low noise levels.

Vickers® VMQ pumps provide continuous pressure ratings up to 293 bar (4250 psi) for the 25 frame size and displacements up to 488 cm3/r (29.78 in3/r) with the triple pump version. In addition, further reductions in noise levels of an intrinsically quiet design offer real possibilities in traditional internal gear pump applications.

The highly seizure-resistant surface of the bronze wafer plate is particularly forgiving in cold start-up applications.

Performance

Eaton's Vickers® VMQ pumps meet global SAE and ISO standards. Three single-pump and three thru-drive frame sizes are available in 20 displacements, ranging from 10 cm^3/r (0.62 in^3/r) to 240 cm^3/r (14.65 in^3/r). Four double-pump configurations offer combined displacements from 20 cm^3/r (1.23 in3/r) up to 398 cm^3/r (24.29 in^3/r). Two triple-pump configurations can combine displacements from 110 cm^3/r (6.71 in^3/r) to 488 cm^3/r (29.78 in^3/r).

Continuous outlet pressure ratings reach 293 bar (4250 psi), with permissible peak pressures up to 310 bar (4500 psi).

Features and Benefits

- Hydraulically balanced design (no internal radial forces) gives almost limitless shaft and bearing life.
- Extremely low noise levels enhance operator comfort.
- Shafts easily handle maximum pressures, ensuring exceptionally long shaft life.
- Unique bi-metallic wafer plate allows for cold start-ups.
- Efficient design means pumps perform under the harshest speed, temperature and cyclical loading conditions.
- Removable cartridges, usually with pump in-line, facilitate maintenance or flow changes.
- Increased power density
- Common inlet allowing for fewer ports and reducing the cost of redundant hose and fittings.
- Twenty-two displacements allow selection of the best flow output for optimum use of energy.
- Interchangeable cartridges between single, thru-drive, double and triple pumps, simplify cartridge selection and reduce inventory.
- High volumetric efficiencies, which increases productivity and reduces energy and operating costs.
- Compatible with a wide variety of fluids, including fire resistant and biodegradable fluids.
- Shaft seal options: single seal design for "dry mount" applications, or double seal design for fluid separation in "wet mount" applications such as gearboxes or where lubricant is always present. (Wet mount applications extend shaft life.)

Applications

- Oil and Gas
- Metal Cutting
- Dump Truck
- Wheel Loader
- Plastic Injection Molding







Notes on Installment

Pump Characteristics

Minimum Speed

Minimum recommended starting speed, under fluid conditions stated on page 7, is generally 600 r/min. However, the pump size, system characteristics and environmental conditions can raise or lower this speed. A lower speed can often be achieved after the pump has primed.

If low starting or operating speeds are required, consult your Eaton Hydraulics representative.

Rated Pressure

Pumps should not be operated at or near rated pressures at idle speeds for extended periods. Localized overheating and damage can result.

Never assume pumps in a double, triple or thru-drive pump assembly can be simultaneously loaded to rated pressure. Shaft loading must be checked for excessive torque. **Never load or unload a VMQ pump at rates greater than 10,342 bar/sec (150,000 psig/sec), because pump instability could occur. If unloading pump at rates over 5,171 bar/sec (75,000 psig/sec), make sure inlet pressure does not fall below 0.83 bar (12 psi) absolute.**

Drive Alignment

Concentricity and angular alignment of shafts are important to pump life. Misalignment can induce heavy loads on bearings, causing premature failure. Flexible coupling halves must be aligned according to the coupling manufacturer's recommendations.

Universal Joints

When using double universal joint couplings, the shafts must be parallel and the yokes must be in line. The offset should be kept as low as possible. Maximum allowable offset will, of course, vary with application conditions. The pump shaft to universal joint diametral fit should be close (major diameter fit) with no looseness.

Mounting Pad Accessory Drives

A splined shaft is recommended on applications where the pump shaft is coupled directly into a transmission or gearbox. Spline drives should be lubricated.

The possibility of interference between the shaft and transmission splines, due to tolerance stack-up, can exist.

To reduce this possibility, side tooth spline fits should be used. A side tooth fit and short length of engagement permits more flexibility and less tendency for side loading than does a major diameter fit spline or long spline engagement. As a general rule, the minimum spline engagement should not be less than 85% of the spline pitch diameter to ensure maximum shaft torque rating.

Mounting Dimensions Requirements

Dimensional control requirements of the customer's mounting pad to which the pump or motor is affixed are as follows.

Pilot Diameter

Concentricity of the customer's female pilot diameter relative to the effective axis of the female drive must be within 0,10 mm (0.004 in.) total indicator reading. The clearance between the male and female pilot diameters must be +0,01 to +0,05 mm (+0.0005 to +0.0020 in.).

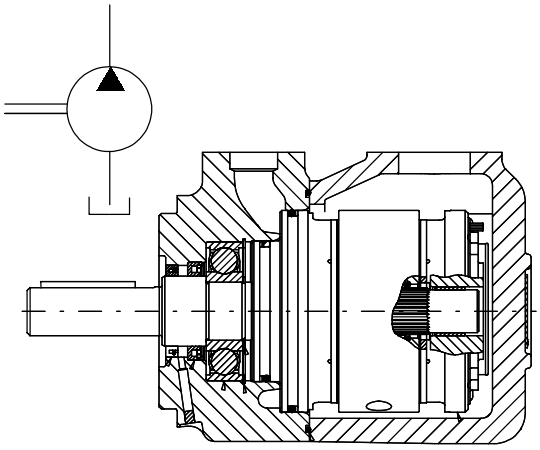
Mounting Face

The customer's mounting face to which the pump or motor is affixed must be square to the axis of the female drive within 0,0381 mm per mm (0.0015 inch per inch).

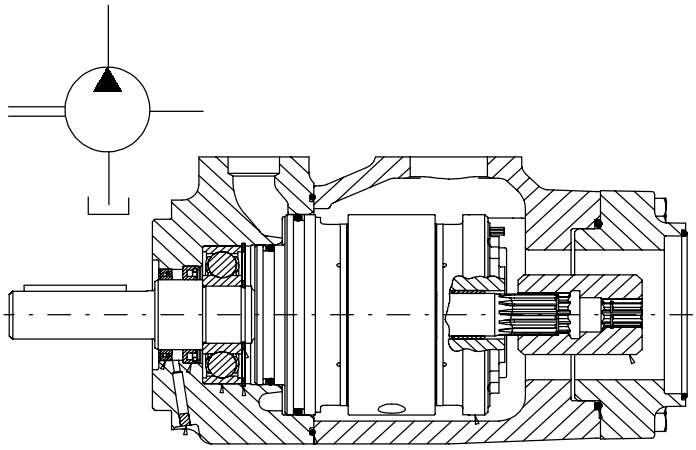
Shafts

Dimensions of keyed shaft receivers must be between +0,003 and +0,03 mm (+0.0001 and +0.0010 in.) of the maximum shaft diameter shown on pages 68 and 70.

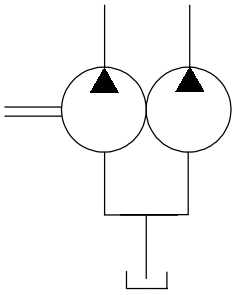
Typical Sections

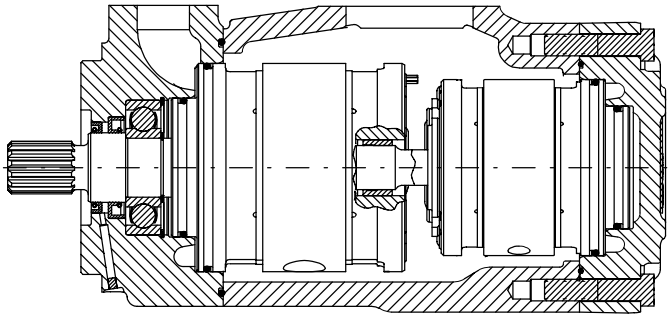


Single pump example

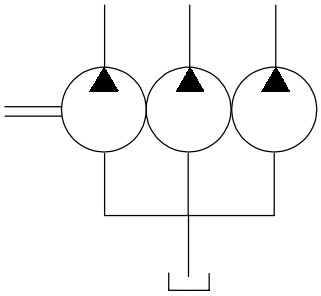


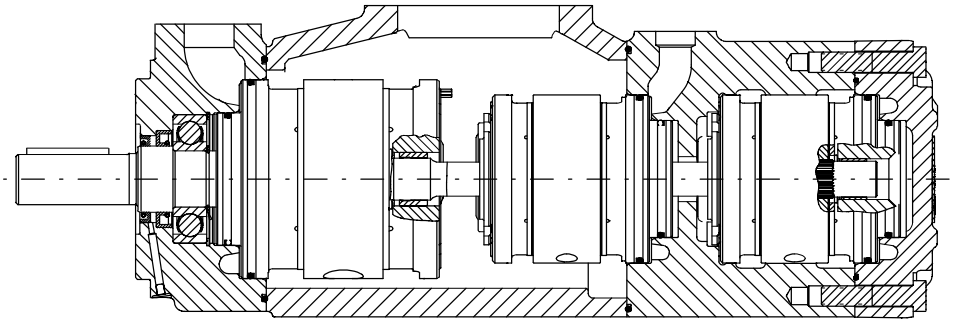
Thru-drive pump example





Double pump example





Triple pump example

Description

General

Pumps in this series are used to develop hydraulic fluid flow for the operation of Industrial and Mobile equipment. The positive displacement pumping cartridges are of the rotary vane type with shaft side loads hydraulically balanced. The flow rate depends on the pump size and the speed at which it is driven.

All units are designed so that the direction of rotation, pumping capacity and port positions can be readily changed to suit particular applications.

Assembly and Construction

The pump illustrated in Figure 1 is representative of all single pumps in this series. The unit consists principally of an inlet cover, outlet body, driveshaft and pumping cartridge.

The principal components of the cartridge are an elliptical cam ring, a slotted rotor splined to the driveshaft, an inlet and outlet support plate, two wafer side plates, and 10/12 vanes and 10/12 pins fitted to the rotor slots. Fluid enters the cartridge through the inlet port in the cover and is discharged through the outlet port in the body.

What is a Vane Pump?

Pumping Cartridge

The action of the cartridge is illustrated in Figure 2. The rotor is driven within the ring by the driveshaft, which is coupled to a power source. As the rotor turns, centrifugal force on the vanes, aided by under-vane pressure fed from the outlet port, causes the vanes to follow the elliptical inner surface of the ring.

Radial movement of the vanes and turning of the rotor causes the chamber volume between the vanes to increase as the vanes pass the inlet sections of the ring. This results in a low pressure condition which allows atmospheric pressure to force fluid into the chambers.

An additional inlet fluid path exists through a drilled hole in the cam ring. This hole connects the inlet port directly to the inlet areas of the cam ring and provides an additional flow path for fluid to get into the cartridge.

Fluid is trapped between the vanes and carried past a sealing land to the outlet section of the ring. As the outlet section is approached, the chamber volume decreases and the fluid is forced out into the system. System pressure is fed under the vanes, assuring their sealing contact against the ring during normal operation.

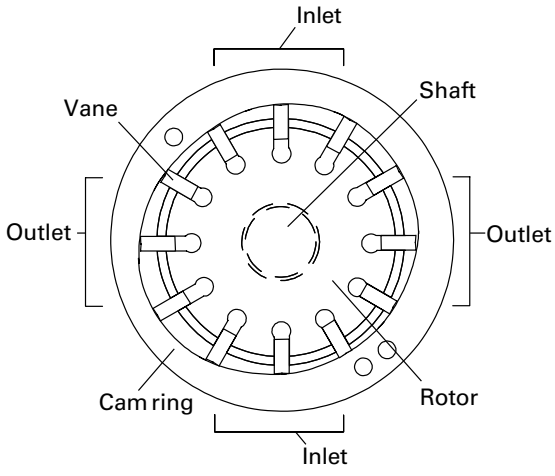


Figure 1

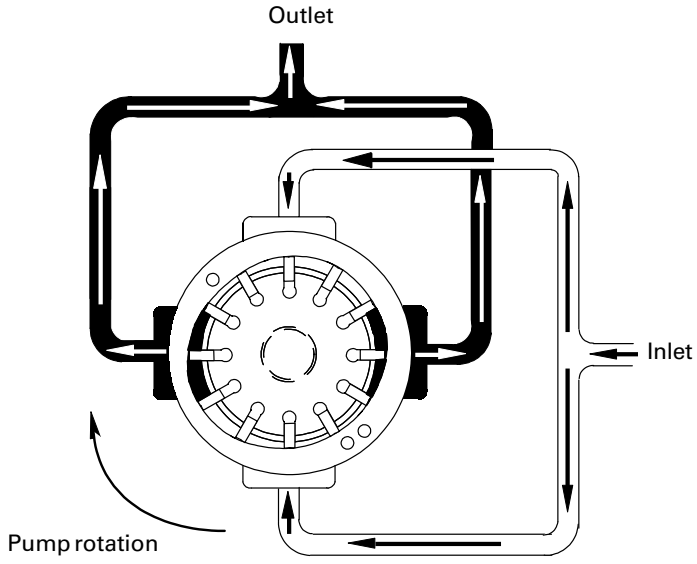


Figure 2

Operational Recommendations

Cold Starts

When operating with a fluid viscosity of over 54 cSt in industrial conditions, the outlet pressure should not exceed 50% of the maximum rating for the VMQ pump until the system has warmed up. When operating with a fluid viscosity of over 100cSt in mobile conditions, the speed and outlet pressure should not exceed 50% of the maximum ratings for the VMQ pump until the system has warmed up.

Example for industrial conditions:

10 wt. oil at 90ºF (32ºC) will have a viscosity of 55 cSt. When the system fluid has a viscosity lower than 55 cSt, it is considered warmed up.

Extreme caution must be used when starting pumps with fluid viscosities greater than 860 cSt (4000 SUS). Care should be exercised to warm up the entire system, including remote cylinders and motors.

High Temperatures

Viscosities must not be less than the minimum values shown in the table below. Temperatures should not exceed 99ºC (210ºF) because the life expectancy of cartridge kits and elastomers will decrease.

Drive Data

Pumps are assembled for right hand (clockwise) rotation or left hand (counterclockwise) rotation. Rotation is viewed from the shaft end. Inlet and outlet ports remain the same regardless of the direction of shaft rotation.

Pump Drive

Direct coaxial drive is recommended. Refer to pages 71-72 if imposing radial shaft loads are required.

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 suction connection to pump inlet. It is good practice to clean up the system by flushing and filtering using an external slave pump.

Before starting the pump, fill with fluid through one of the ports. This is particularly important if the pump is above the fluid level of the reservoir.

When initially starting the pump, remove all trapped air from the system. This can be accomplished by loosening the pump outlet fittings or connections before starting the pump or by using an air bleed valve. All inlet connections must be tight to prevent air leaks. An air bleed valve is available for this purpose.
(Refer to catalog 690.)



CAUTION:

No Case Drain.

These pumps are drained internally into their inlet. System pressure at the pump inlet connection may not exceed 1,4 bar (20 psi). Also, the inlet hose should be sized large enough to provide a fluid velocity no greater than 2.44 m/s (8 ft/sec)

CAUTION:



Low Outlet Pressure.

The minimum pressure differential between the outlet and inlet must be 6.9 bar (100 psig), otherwise, the pump may fail prematurely.

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, 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.

Operating Guidelines

Inlet Pressure and Operating Temperature Requirements

	Minimum Inlet Pressure Absolute bar (PSI)	Recommended Operating Inlet Pressure - Gage bar (PSI)	Maximum Positive Inlet Pressure - Gage bar (PSI)	Maximum Continuous Operating Temp. ˚C (˚F)	Maximum Intermittent Operating Temp. ˚C (˚F)
Industrial	0.83 (12.0)	0 to 0.35 (0 to 5.0)	1.4 (20)	66 (150)	74 (165)
Mobile	1.0 (14.5)	0 to 0.35 (0 to 5.0)	1.4 (20)	82 (180)	99 (210)

Fluid Cleanliness Recommendations

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.

Recommendations on contamination control methods and the selection of products to control fluid condition are included in publication 9132 or 561, "Guide to Systemic Contamination Control". The book also includes information on the concept of "ProActive Maintenance". The following recommendations are based on ISO cleanliness levels at 2 µm, 5 µm and 15 µm.

Eaton products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Other manufacturers will often recommend levels above those specified.

Experience has shown, however, that life of any hydraulic components is shortened in fluids with higher cleanliness codes than those listed above. These codes have been proven to provide a long trouble-free service life for the products shown, regardless of the manufacturer.

Product	**System Pressure Level bar (psi)**		
	<140 (<2000)	**140-210 (2000-3000)**	**210+ (3000+)**
Vane pumps, fixed	20/18/15	19/17/14	18/16/13
Vane pumps, variable	18/16/14	17/15/13	
Piston pumps, fixed	19/17/15	18/16/14	17/15/13
Piston pumps, variable	18/16/14	17/15/13	16/14/12
Directional valves	20/18/15	20/18/15	19/17/14
Proportional valves	17/15/12	17/15/12	15/13/11
Servo valves	16/14/11	16/14/11	15/13/10
Pressure/Flow controls	19/17/14	19/17/14	19/17/14
Cylinders	20/18/15	20/18/15	20/18/15
Vane motors	20/18/15	19/17/14	18/16/13
Axial piston motors	19/17/14	18/16/13	17/15/12
Radial piston motors	20/18/14	19/17/13	18/16/13

Hydraulic Fluid Recommendations

Viscosity Requirements

	Minimum Intermittent Viscosity	Minimum Continuous Viscosity	Optimum Operating Viscosity Range	Maximum Viscosity at Full Pressure	Viscosity Range Requiring <50% Outlet Pressure	Maximum Viscosity at Startup
	cSt	cSt	cSt	cSt	cSt	cSt
Industrial	10	13	16-40	54	54-860	860
Mobile	6.5	9	16-40	100	100-2000	2000

Fluid Selection

Fluid in a hydraulic system performs the multiple functions of transmission of power, lubrication of components, and cooling. It is a vital factor in a hydraulic system and proper selection is a necessity for satisfactory operation and life of components.

Basic requirements of a good petroleum oil for hydraulic systems are:

1. sufficient anti-wear additives,
2. proper viscosity at the operating temperature,

   and
3. adequate rust and oxidation inhibitors.

A good quality fluid from reputable sources will provide these characteristics.

Two specific types of oil meet the requirements of modern hydraulic systems:

- Anti-wear type hydraulic oils that comply with the pump wear tests of ASTM-D-2882
- Automotive crankcase oils having the letter designations "SC", "SD", "SE", "SF" or "SG" per SAE J183 JUN89.

For additional information on the correct viscosity and proper selection of fluids for hydraulic systems, refer to Eaton publication 694.

Moments of Inertia

Pump	Moment Of Inertia $N*M*SEC^2$	$(LB*IN*SEC^2)$
VMQ125 (10-32 cm^3r)	0,00075	(0.0066)
VMQ125 (40-80 cm^3/r)	0,00103	(0.0091)
VMQ135	0,0025	(0.022)
VMQ145	0,0050	(0.0441)
VMQ22525	0,0019	(0.017)
VMQ23525	0,0043	(0.038)
VMQ24525	0,0059	(0.0522)
VMQ24535	0,0072	(0.0637)
VMQ3352525	0,00403	(0.0354)
VMQ3453525	0,00773	(0.0679)

Weights

Size	KG	(LB)
25	20,4	(45)
35	34,0	(75)
45	54,4	(120)
25T	27,2	(60)
35T	45,4	(100)
45T	63,5	(140)
2525	36,3	(80)
3525	49,9	(110)
4525	72,6	(160)
4535	79,4	(175)
352525	79,4	(175)
453525	102,1	(225)

Conversion Factors

To Convert → / Into ←		Into → / To Convert →		Multiply By / Divide By
Unit	**Symbol**	**Unit**	**Symbol**	**Factor**
Atmospheres	Atm	bar	bar	1,013250
BTU/hour	Btu/h	kilowatts	kW	0,293071 x 10^{-3}
Cubic centimeters	cm^3	litres	l	0,001
Cubic centimetres	cm^3	millilitres	ml	1,0
Cubic feet	ft^3	cubic metres	m^3	0,0283168
Cubic feet	ft^3	litres	l	28,3161
Cubic inches	in^3	cubic centimetres	cm^3	16,3871
Cubic inches	in^3	litres	l	0,0163866
Degrees (angle)	°	radians	rad	0,0174533
Fahrenheit	°F	Celsius (centigrade)	°C	■
Feet	ft	metres	m	0,3048
Feet of water	ft H2O	bar	bar	0,0298907
Fluid ounces, UK	UK fl oz	cubic centimetres	cm^3	28,413
Fluid ounces, US	US fl oz	cubic centimetres	cm^3	29,5735
Foot pounds f	ft lbf	joules	J	1,35582
Foot pounds/minute	ft lbf/min	watts	W	81,3492
Gallons, UK	UK gal	litres	l	4,54596
Gallons, US	US gal	litres	l	3,78531
Gallons, US	US gal	cubic inches	in^3	231
Horsepower	hp	BTU/min	BTU/min	42,2
Horsepower	hp	foot pounds/minute	ft lb/min	33,000
Horsepower	hp	kilowatts	kW	0,7457
Inches of mercury	in Hg	millibar	mbar	33,8639
Inches of water	in H20	millibar	mbar	2,49089
Inches	in	centimetres	cm	2,54
Inches	in	millimetres	mm	25,4
Kilogramme force	kgf	newtons	N	9,80665
Kilogramme f. metre	kgf m	newton metres	Nm	9,80665
Kilogramme f./sq. centimetre	kp/cm^2	bar	bar	0,980665
Metric horsepower*	*	kilowatts	kW	0,735499
Microinches	µin	microns	µm	0,0254
Millimetres of mercury	mm Hg	millibar	mbar	1,33322
Millimetres of water	mm H2O	millibar	mbar	0,09806
Newtons/square centimetre	N/cm^2	bar	bar	0,1
Newtons/square metre	N/m^2	bar	bar	0.00001
Pascals (newtons/sq metre)	Pa	bar	bar	0.00001
Pints, UK	UK pt	litres	l	0,568245
Pints, US	US liq pt	litres	l	0,473163
Pounds (mass)	lb	kilogrammes	kg	0,4536
Pounds/cubic foot	lb/ft^3	kilogrammes/cubic metre	kg/m^3	16,0185
Pounds/cubic inch	lb/in^3	kilogrammes/cubic centimetre	kg/cm^3	0,0276799
Pounds force	lbf	newtons	N	4,44822
Pounds f. feet	lbf ft	newton metres	Nm	1,35582
Pounds f. inches	lbf in	newton metres	Nm	0,112985
Pounds f./square inch	lbf/in^2	bar	bar	0,06894
Revolutions/minute	r/min	radians/second	rad/s	0,104720

Additional Data (cont.)

Conversion Factors (cont.)

To Convert → Into		Into → To Convert		Multiply By / Divide By
Unit	**Symbol**	**Unit**	**Symbol**	**Factor**
Square feet	ft^2	square metres	m^2	0,092903
Square inches	in^2	square metres	m^2	$6{,}4516 \times 10^{-4}$
Square inches	in^2	square centimetres	cm^2	6,4516

■ ˚C = 5 (˚F - 32)/9

* In German, Pferdestarke (PS)

In French, cheval vapeur (ch) or (CV)

Fluid Power Equivalents

1 bar = 10^5 N/m²

1 bar = 10 N/cm² = 1 dN/mm²

1 pascal = 1 N/m²

1 litre = 1000 cm³

1 centistoke (cSt) = 1 mm²/s

1 joule = 1 wattsecond (Ws)

1 US gallon = 231 in³

Hertz (Hz) = cycles/second

Atmospheric pressure at sea level = 1,01 bar (14.7 psi). Atmospheric pressure decreases approximately 0,028 bar (0.41 psi) for each 305m (1000 feet) of elevation to 7015m (23000 feet)

Pressure (bar) = head (m) x 0.1 x specific gravity

Pressure (psi) = head (ft) x 0.433 x specific gravity

Specific gravity of petroleum-based oil is approximately 0.85

Practical Hydraulic Formula

Geometric flow rate (pumps and motors)	l/min	$= \frac{cm^3/r \times r/min}{1000}$
	USgpm	$= \frac{in^3/r \times r/min}{231}$
Theoretical shaft torque (pumps and motors)	Nm	$= \frac{cm^3/r \times bar}{20\pi}$
	lbf in	$= \frac{in^3/r \times psi}{2\pi}$
Hydraulic power	kW	$= \frac{l/min \times bar}{600}$
	hp	$= \frac{USgpm \times psi}{1714}$
Velocity of fluid in pipe	m/s	$= \frac{l/min \times 21{,}22}{D^2}$ where D= inside diameter of pipe in mm
	ft/s	$= \frac{0.4084 \times USgpm}{D^2}$ where D= inside diameter of pipe in inches
Volumetric efficiency	(pump)	$= \frac{\text{Output l/min (USgpm)}}{\text{Theoretical l/min (USgpm)}} \times 100$
	(motor)	$= \frac{\text{Theoretical l/min (USgpm)}}{\text{Input l/min (USgpm)}} \times 100$
Overall efficiency		$\frac{\text{Output kW (hp)}}{\text{Input kW (hp)}}$

Typical Performance Data - Industrial

49ºC (120ºF), SAE 10W oil,
26 cSt (128 SUS)

Frame Size	Displacement		Pressure Rating (Maximum)				Maximum Speed Rating at 0 bar (0 psig) inlet	Outlet Flow at 1800 r/min 210 bar (3000 psi)		Input Power at 1800 r/min 210 bar (3000 psi)	
			Continuous		Peak ■						
	cm^3/r	(in^3/r)	bar	(psi)	bar	(psi)	r/min	l/min	(USgpm)	kW	(hp)
25	10	(0.62)	293	(4250)	310	(4500)	1800	14,3	(3.8)	6,6	(8.9)
	16	(0.98)	293	(4250)	310	(4500)	1800	24,9	(6.6)	10,4	(14.0)
	20	(1.23)	293	(4250)	310	(4500)	1800	32,7	(8.6)	13,1	(17.6)
	25	(1.58)	293	(4250)	310	(4500)	1800	42,7	(11.3)	16,8	(22.6)
	32	(1.96)	293	(4250)	310	(4500)	1800	53,3	(14.1)	20,9	(28.1)
	40	(2.44)	293	(4250)	310	(4500)	1800	61,6	(15.9)	25,8	(34.4)
	45	(2.75)	293	(4250)	310	(4500)	1800	71,0	(18.3)	29,1	(38.8)
	50	(3.05)	293	(4250)	310	(4500)	1800	80,0	(20.6)	32,2	(43.0)
	63	(3.84)	293	(4250)	310	(4500)	1800	103,9	(26.8)	40,6	(54.1)
	71	(4.33)	293	(4250)	310	(4500)	1800	118,7	(30.6)	45,8	(61.0)
	80	(4.88)	293	(4250)	310	(4500)	1800	136,1	(35.1)	51,6	(68.8)
	90	(5.49)	262	(3800)	276	(4000)	1800	153,9	(40.65)	71,9	(96.5)
35	90	(5.49)	262	(3800)	276	(4000)	1800	149,7	(38.6)	58,7	(78.3)
	100	(6.10)	262	(3800)	276	(4000)	1800	168,1	(43.4)	65,2	(87.0)
	112	(6.83)	262	(3800)	276	(4000)	1800	190,1	(49.1)	73,0	(97.4)
	125	(7.63)	262	(3800)	276	(4000)	1800	214,3	(55.3)	81,6	(108.8)
	135	(8.24)	262	(3800)	276	(4000)	1800	233,9	(60.4)	88,1	(117.5)
	140	(8.47)	220	(3200)	241	(3500)	1800	240,0	(63.42)	92,8	(124.4)
	158	(9.64)	220	(3200)	241	(3500)	1800	272,6	(72.02)	109,7	(147.1)
45	140	(8.54)	262	(3800)	276	(4000)	1800	232,0	(60.0)	92,5	(123.3)
	160	(9.76)	262	(3800)	276	(4000)	1800	269,3	(69.5)	105,7	(141.0)
	180	(10.98)	262	(3800)	276	(4000)	1800	306,2	(79.0)	118,9	(158.6)
	195	(11.89)	262	(3800)	276	(4000)	1800	332,0	(86.0)	128,8	(171.7)
	215	(13.12)	220	(3200)	241	(3500)	1800	362,6	(95.8)	139.7	(187.4)
	240	(14.65)	68.9	(1000)	75.8	(1100)	1800	435.7*	(115.1)*	55.9*	(75)*

■ Peak pressure < 0.5 seconds

* Outlet pressure = 1000 psig

Typical Performance Data - Mobile

82ºC (180ºF), SAE 10W oil,
9 cSt (55 SUS)

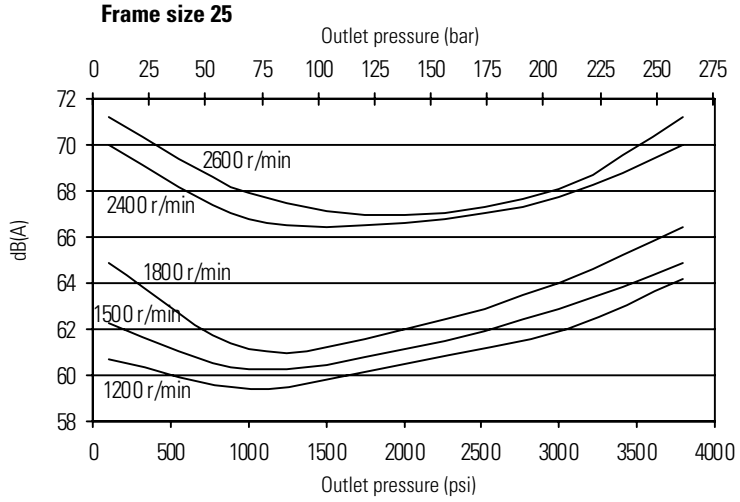
Frame Size	Displacement		Pressure Rating (Maximum)				Maximum Speed Rating at 0 bar (0 psig) inlet	Outlet Flow at Maximum r/min, 210 bar (3000 psi)		Input Power at Maximum r/min, 210 bar (3000 psi)	
			Continuous		Peak ■						
	cm³/r	(in³/r)	bar	(psi)	bar	(psi)	r/min	l/min	(USgpm)	kW	(hp)
25	10	(0.62)	280	(4060)	310	(4500)	3000	21,1	(5.6)	11,1	(14.8)
	16	(0.98)	280	(4060)	310	(4500)	3000	38,8	(10.3)	17,6	(23.4)
	20	(1.23)	280	(4060)	310	(4500)	3000	51,1	(13.5)	22,0	(29.4)
	25	(1.58)	280	(4060)	310	(4500)	3000	68,3	(18.0)	28,3	(37.7)
	32	(1.96)	280	(4060)	310	(4500)	3000	88,4	(23.4)	35,1	(46.8)
	40	(2.44)	280	(4060)	310	(4500)	2600	77,4	(20.4)	38,1	(50.1)
	45	(2.75)	280	(4060)	310	(4500)	2600	90,6	(23.9)	42,9	(57.6)
	50	(3.05)	280	(4060)	310	(4500)	2600	103,3	(27.3)	47,6	(63.5)
	63	(3.84)	280	(4060)	310	(4500)	2600	137,0	(36.2)	59,9	(79.9)
	71	(4.33)	280	(4060)	310	(4500)	2600	157,9	(41.7)	67,6	(90.1)
	80	(4.88)	280	(4060)	310	(4500)	2600	182,3	(48.2)	77,3	(102.9)
	90	(5.49)	248	(3600)	276	(4000)	2200	172,5	(48.57)	85,8	(115.0)
35	90	(5.49)	250	(3625)	276	(4000)	2400	180,2	(47.6)	79,1	(105.4)
	100	(6.10)	250	(3625)	276	(4000)	2400	204,2	(53.9)	87,9	(117.2)
	112	(6.83)	250	(3625)	276	(4000)	2400	232,9	(61.5)	98,4	(131.2)
	125	(7.63)	250	(3625)	276	(4000)	2400	264,4	(69.8)	109,9	(146.5
	135	(8.24)	250	(3625)	276	(4000)	2200	259,0	(68.4)	113,5	(144.8)
	140	(8.47)	210	(3000)	220	(3200)	2200	275,1	(72.66)	112,9	(151.5)
	158	(9.64)	210	(3000)	220	(3200)	2200	326,2	(86.18)	134,4	(180.2)
45	140	(8.54)	250	(3625)	276	(4000)	2200	268,2	(70.9)	113,5	(151.4)
	160	(9.76)	250	(3625)	276	(4000)	2200	312,1	(82.5)	129,8	(173.0)
	180	(10.98)	250	(3625)	276	(4000)	2200	356,1	(94.1)	146.0	(194.6)
	195	(11.89)	250	(3625)	276	(4000)	2200	379,7	(100.3)	158,1	(210.8)
	215	(13.12)	220	(3200)	241	(3500)	2200	425,5	(112.4)	171,5	(230)

■ Peak pressure < 0.5 seconds

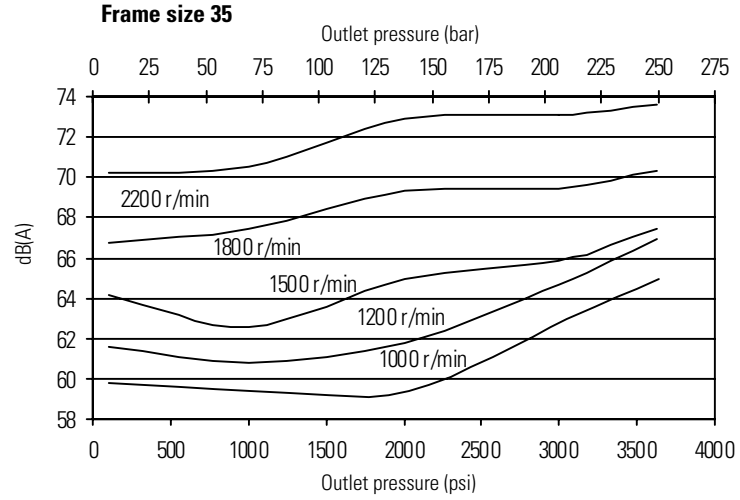
Typical Sound Data

49°C (120°F), SAE 10W oil,
0 bar (0 psig) inlet

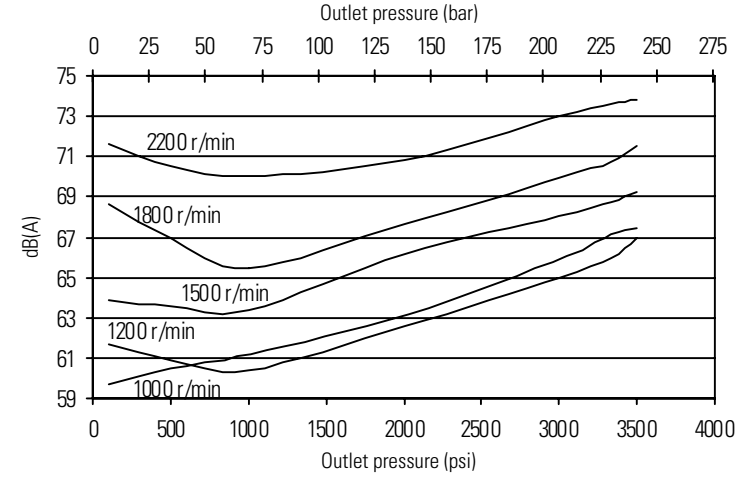
Frame size 25



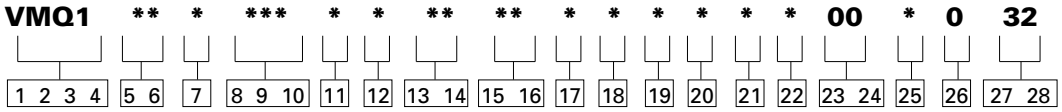
Frame size 35



Frame size 45



Model Code - Single and Thru-Drive Pumps



1 2 3 4 Series Designation

VMQ1 – Vane Pump Single Series

5 6 Frame Size

25 – 10-90 cm³/r (0.62-5.49 in³/r)

35 – 90-158 cm³/r (5.49-9.64 in³/r)

45 – 140-240 cm³/r (8.54-14.65 in³/r)

7 Pump Type

S – Single

T – Thru-drive

(Options at model codes 12 and 15 16 must be specified for thru-drive units)

8 9 10 Displacement

Frame size 25

010– 10 cm ³/r (0.62 in ³/r)
016– 16 cm ³/r (0.98 in ³/r)
020– 20 cm ³/r (1.23 in ³/r
025– 25 cm ³/r (1.58 in ³/r)
032– 32 cm ³/r (1.96 in ³/r)
040– 40 cm ³/r (2.44 in ³/r)
045– 45 cm ³/r (2.75 in ³/r)
050– 50 cm ³/r (3.05 in ³/r)
063– 63 cm ³/r (3.84 in ³/r)
071– 71 cm ³/r (4.33 in ³/r)
080– 80 cm ³/r (4.88 in ³/r)
090– 90 cm ³/r (5.49 in ³/r)

Frame size 35

090– 90 cm ³/r (5.49 in ³/r)
100– 100 cm ³/r (6.10 in ³/r)
112– 112 cm ³/r (6.83 in ³/r)
125– 125 cm ³/r (7.63 in ³/r)
135– 135 cm ³/r (8.24 in ³/r)
140– 140 cm ³/r (8.54 in ³/r)
158– 158 cm ³/r (9.64 in ³/r)

Frame size 45

140– 140 cm ³/r (8.54 in ³/r)
160– 160 cm ³/r (9.76 in ³/r)
180– 180 cm ³/r (10.98 in ³/r)
195– 195 cm ³/r (11.89 in ³/r)
215– 215 cm ³/r (13.12 in ³/r)
240– 240 cm ³/r (14.65 in ³/r)

11 Front Flange Mounting Style

A – (Frame size 25 only) SAE B 2-bolt
101,60 (4.000) x 9,4 (0.37) pilot
14,4 (0.57) slots on 146,0 (5.75) bolt circle

B – (All frame sizes) SAE C 2-bolt
127,00 (5.000) x 12,4 (0.49) pilot
17,6 (0.69) slots on 181,0 (7.13) bolt circle

C – (Frame size 25 only) ISO 3019/2 100A2HW 2-bolt
100,00 (3.937) x 9,2 (0.36) pilot
14,1 (0.56) slots on 140,0 (5.51) bolt circle

D – (Frame sizes 35 & 45 only) ISO 3019/2 125A2HW 2-bolt
125,00 (4.921) x 9,2 (0.36) pilot
18,1 (0.71) slots on 180,0 (7.09) bolt circle

12 Rear Mounting Flange and Orientation

Viewed from cover end of pump (Adapter end for thru-drive units, model code 7 = T)

0 – None (non thru-drive)

SAE A

A – In-line with mounting flange (frame sizes 25 & 45)

B – 90° to mounting flange (frame sizes 25 & 45)

C – 45° CCW to mounting flange (frame size 35)

D – 45° CW to mounting flange (frame size 35)

SAE B

E – In-line with mounting flange (frame sizes 25, 35 & 45)

F – 90° to mounting flange (frame sizes 25 & 45)

G – 45° CCW to mounting flange (frame size 35)

H – 45° CW to mounting flange (frame size 35)

SAE C

J – In-line with mounting flange (frame sizes 35 & 45)

K – 90° to mounting flange (frame size 35)

L – 45° CCW to mounting flange (frame size 45)

M – 45° CW to mounting flange (frame size 45)

13 14 Input Shaft Type*

01 – SAE J744 keyed
Frame size 25: 25,40 (1.000)
Frame size 35: 31,75 (1.250)
Frame size 45: 38,10 (1.500)

02 – SAE J744 splined
Frame size 25: B-B
Frame size 35: C
Frame size 45: C-C

03 – ISO 3019/2 keyed
Frame size 25: 25,00 (0.984)
Frame size 35: 32,00 (1.260)
Frame size 45: 40,00 (1.575)

05 – SAE J744 keyed
Frame size 25: 31,75 (1.250)
Frame size 35: 38,10 (1.500)
Frame size 45: 44,45 (1.750)

06 – SAE J744 splined
Frame size 25: C
Frame size 35: C-C
Frame size 45: D

07 – ISO 3019/2 keyed
Frame size 25: 32,00 (1.260)
Frame size 35: 40,00 (1.575)

09 – SAE J744 splined
Frame size 25: B
Frame size 45: C
(Not available on thru-drive units)

15 16 Output Shaft Coupling

Thru-drive units, model code 7 = T

00 – None (non thru-drive)

16 – SAE J744 16-4 A-spline shaft

22 – SAE J744 22-4 B-spline shaft

25 – SAE J744 25-4 B-B-spline shaft

32 – SAE J744 32-4 C-spline shaft (frame sizes 35 & 45 only)

17 Inlet Port Type

A – SAE J518 4-bolt split flange

B – ISO 6162 4-bolt split flange

18 Outlet Port Type

A – SAE J518 4-bolt flange

B – ISO 6162 4-bolt flange

19 Outlet Port Position

Viewed from cover end of pump (Adapter end for thru-drive units)

A – Opposite inlet port

B – 90° CCW to inlet port

C – In-line with inlet port

D – 90° CW to inlet port

20 Shaft Seal

A – Single, primary

B – Double, secondary (spring side out) Recommended for wet mount applications

21 Seal Type

N – Buna N

V – Viton

W – Buna N with Viton shaft seal(s)

22 Shaft Rotation

Viewed from shaft end of pump

L – Left hand (CCW)

R – Right hand (CW)

23 24 Special Features

00 – None

25 Paint

0 – None

A – Blue

26 Customer Identification

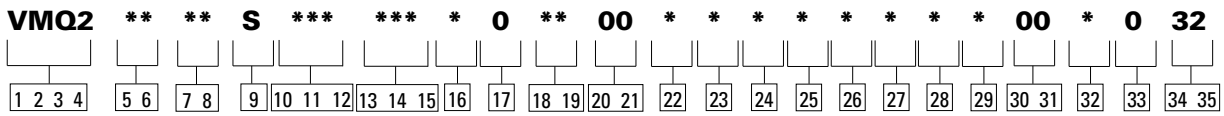
0 – None

27 28 Design Code

32 – 32 design
Installation dimensions remain unchanged for design numbers 30 to 39 inclusive.

* Verify shaft torque ratings meet or exceed input torque requirements (see pg. 74).

Model Code - Double Pumps



1 2 3 4 Series Designation

VMQ2 – Vane Pump Double Series

5 6 Frame Size (front section)

25 – 10-90 cm³/r (0.62-5.49 in³/r)

35 – 90-158 cm³/r (5.49-9.64 in³/r)

45 – 140-240 cm³/r (8.54-14.65 in³/r)

7 8 Frame Size (rear section)

25 – 10-90 cm³/r (0.62-5.49 in³/r)

35 – 90-158 cm³/r (5.49-9.64 in³/r)

9 Pump Type

S – Standard

10 11 12 Displacement (Front Section)

Frame size 25

010 – 10 cm ³/r (0.62 in ³/r)
016 – 16 cm ³/r (0.98 in ³/r)
020 – 20 cm ³/r (1.23 in ³/r
025 – 25 cm ³/r (1.58 in ³/r)
032 – 32 cm ³/r (1.96 in ³/r)
040 – 40 cm ³/r (2.44 in ³/r)
045 – 45 cm ³/r (2.75 in ³/r)
050 – 50 cm ³/r (3.05 in ³/r)
063 – 63 cm ³/r (3.84 in ³/r)
071 – 71 cm ³/r (4.33 in ³/r)
080 – 80 cm ³/r (4.88 in ³/r)
090 – 90 cm ³/r (5.49 in ³/r)

Frame size 35

090 – 90 cm ³/r (5.49 in ³/r)
100 – 100 cm ³/r (6.10 in ³/r)
112 – 112 cm ³/r (6.83 in ³/r)
125 – 125 cm ³/r (7.63 in ³/r)
135 – 135 cm ³/r (8.24 in ³/r)
140 – 140 cm ³/r (8.54 in ³/r)
158 – 158 cm ³/r (9.64 in ³/r)

Frame size 45

140 – 140 cm ³/r (8.54 in ³/r)
160 – 160 cm ³/r (9.76 in ³/r)
180 – 180 cm ³/r (10.98 in ³/r)
195 – 195 cm ³/r (11.89 in ³/r)
215 – 215 cm ³/r (13.12 in ³/r)
240 – 240 cm ³/r (14.65 in ³/r)

13 14 15 Displacement (Rear Section)

Frame size 25

010 – 10 cm ³/r (0.62 in ³/r)
016 – 16 cm ³/r (0.98 in ³/r)
020 – 20 cm ³/r (1.23 in ³/r)
025 – 25 cm ³/r (1.58 in ³/r)
032 – 32 cm ³/r (1.96 in ³/r)
040 – 40 cm ³/r (2.44 in ³/r)
045 – 45 cm ³/r (2.75 in ³/r)
050 – 50 cm ³/r (3.05 in ³/r)
063 – 63 cm ³/r (3.84 in ³/r)
071 – 71 cm ³/r (4.33 in ³/r)
080 – 80 cm ³/r (4.88 in ³/r)
090 – 90 cm ³/r (5.49 in ³/r)

Frame size 35

090 – 90 cm ³/r (5.49 in ³/r)
100 – 100 cm ³/r (6.10 in ³/r)
112 – 112 cm ³/r (6.83 in ³/r)
125 – 125 cm ³/r (7.63 in ³/r)
135 – 135 cm ³/r (8.24 in ³/r)
140 – 140 cm ³/r (8.54 in ³/r)
158 – 158 cm ³/r (9.64 in ³/r)

16 Front Flange Mounting Style

A – (Frame size 25 only) SAE B 2-bolt
101,60 (4.000) x 9,4 (0.37) pilot
14,4 (0.57) slots on 146,0 (5.75) bolt circle

B – (All frame sizes) SAE C 2-bolt
127,00 (5.000) x 12,4 (0.49) pilot
17,6 (0.69) slots on 181,0 (7.13) bolt circle

C – (Frame size 25 only) ISO 3019/2 100A2HW 2-bolt
100,00 (3.937) x 9,2 (0.36) pilot
14,1 (0.56) slots on 140,0 (5.51) bolt circle

D – (Frame sizes 35 & 45 only) ISO 3019/2 125A2HW 2-bolt
125,00 (4.921) x 9,2 (0.36) pilot
18,1 (0.71) slots on 180,0 (7.09) bolt circle

17 Adapter Flange

0 – None (standard double pump)

18 19 Input Shaft Type*

01 – SAE J744 keyed
Frame size 25: 25,40 (1.000)
Frame size 35: 31,75 (1.250)
Frame size 45: 38,10 (1.500)

02 – SAE J744 splined
Frame size 25: B-B
Frame size 35: C
Frame size 45: C-C

03 – ISO 3019/2 keyed
Frame size 25: 25,00 (0.984)
Frame size 35: 32,00 (1.260)
Frame size 45: 40,00 (1.575)

05 – SAE J744 keyed
Frame size 25: 31,75 (1.250)
Frame size 35: 38,10 (1.500)
Frame size 45: 44,45 (1.750)

06 – SAE J744 Splined
Frame size 25: C
Frame size 35: C-C
Frame size 45: D

07 – ISO 3019/2 Keyed
Frame size 25: 32,00 (1.260)
Frame size 35: 40,00 (1.575)

09 – SAE J744 Spline
Frame size 25:B
Frame size 45° C

20 21 Output Shaft Coupling

00 – None (standard double pump)

22 Inlet Port Type

A – SAE J518 4-split flange
B – ISO 6162 4-bolt flange

23 Front Outlet Port Type

A – SAE J518 4-bolt flange
B – ISO 6162 4-bolt flange

24 Rear Outlet Port Type

A – SAE J518 4-bolt flange
B – ISO 6162 4-bolt flange

25 Front Outlet Port Position

Viewed from cover end of pump

A – Opposite inlet port
B – 90° CCW to inlet port
C – In-Line with front inlet port
D – 90° CW to inlet port

26 Rear Outlet Port Position

Viewed from cover end of pump

A – 135° CCW to inlet port (not available with 2525)
B – 45° CCW to inlet port (not available with 2525)
C – 45° CW to inlet port (not available with 2525)
D – 135° CW to inlet port (not available with 2525)
E – Opposite inlet port (2525 only)
F – 90° CCW to inlet port (2525 only)
G – In-line with inlet port (2525 only)
H – 90° CW to inlet port (2525 only)

27 Shaft Seal

A – Single, primary
B – Double, secondary (spring side out) Recommended for wet mount applications

28 Seal Type

N – Buna-N
V – Viton
W – Buna-N with Viton shaft seal(s)

29 Shaft Rotation

Viewed from shaft end of pump

L – Left Hand (CCW)
R – Right Hand (CW)

30 31 Special Features

00 – None

32 Paint

O – None
A – Blue

33 Customer Identification

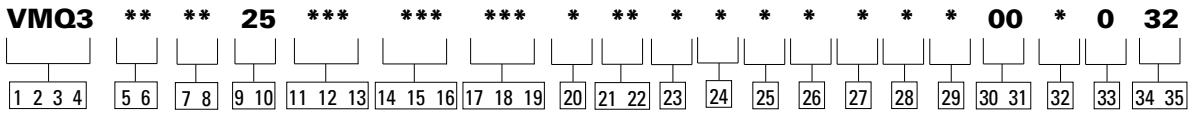
O – None

34 35 Design Code

32 – 32 design
Installation dimensions remain unchanged for design numbers 30 to 39 inclusive.

* Verify shaft torque ratings meet or exceed input torque requirements (see page 74).

Model Code - Triple Pumps



1 2 3 4 Series Designation

VMQ3 – Vane pump triple series

5 6 Frame Size (Front Section)

35 – 90-158 cm 3/r (5.49-9.64 in 3/r) (Compatible with 25 middle section frame size below)

45 – 140-240 cm ³/r (8.54-14.65 in ³/r) (Compatible with 35 middle section frame size below)

7 8 Frame Size (Middle Section)

25 – 10-90 cm ³/r (0.62-5.49 in³/r)

35 – 90-158 cm ³/r (5.49-9.64 in ³/r)

9 10 Frame Size (Rear Section)

25 – 10-90 cm ³/r (0.62-5.49 in³/r)

11 12 13 Displacement (Front Section)

Frame size 35

090 – 90 cm ³/r (5.49 in ³/r)
100 – 100 cm ³/r (6.10 in ³/r)
112 – 112 cm ³/r (6.83 in ³/r)
125 – 125 cm ³/r (7.63 in ³/r)
135 – 135 cm ³/r (8.24 in ³/r)
140 – 140 cm ³/r (8.54 in ³/r)
158 – 158 cm ³/r (9.64 in ³/r)

Frame size 45

140 – 140 cm ³/r (8.54 in ³/r)
160 – 160 cm ³/r (9.76 in ³/r)
180 – 180 cm ³/r (10.98 in ³/r)
195 – 195 cm ³/r (11.89 in ³/r)
215 – 215 cm ³/r (13.12 in ³/r)
240 – 240 cm ³/r (14.65 in ³/r)

14 15 16 Displacement (Middle Section)

Frame size 25

010 – 10 cm ³/r (0.62 in ³/r)
016 – 16 cm ³/r (0.98 in ³/r)
020 – 20 cm ³/r (1.23 in ³/r
025 – 25 cm ³/r (1.58 in ³/r)
032 – 32 cm ³/r (1.96 in ³/r)
040 – 40 cm ³/r (2.44 in ³/r)
045 – 45 cm ³/r (2.75 in ³/r)
050 – 50 cm ³/r (3.05 in ³/r)
063 – 63 cm ³/r (3.84 in ³/r)
071 – 71 cm ³/r (4.33 in ³/r)
080 – 80 cm ³/r (4.88 in ³/r)
090 – 90 cm ³/r (5.49 in ³/r)

Frame size 35

090 – 90 cm 3/r (5.49 in 3/r)
100 – 100 cm 3/r (6.10 in 3/r)
112 – 112 cm 3/r (6.83 in 3/r)
125 – 125 cm 3/r (7.63 in 3/r)
135 – 135 cm ³/r (8.24 in ³/r)
140 – 140 cm ³/r (8.47 in ³/r)
158 – 158 cm ³/r (9.64 in ³/r)

17 18 19 Displacement (Rear Section)

Frame size 25

010 – 10 cm ³/r (0.62 in ³/r)
016 – 16 cm ³/r (0.98 in ³/r)
020 – 20 cm ³/r (1.23 in ³/r)
025 – 25 cm ³/r (1.58 in ³/r)
032 – 32 cm ³/r (1.96 in ³/r)
040 – 40 cm ³/r (2.44 in ³/r)
045 – 45 cm ³/r (2.75 in ³/r)
050 – 50 cm ³/r (3.05 in ³/r)
063 – 63 cm ³/r (3.84 in ³/r)
071 – 71 cm ³/r (4.33 in ³/r)
080 – 80 cm ³/r (4.88 in ³/r)
090 – 90 cm ³/r (5.49 in ³/r)

20 Front Flange Mounting Style

A – SAE C 2-bolt SAE J744 127-2
127,00 (5.000) x 12,4 (0.49) pilot
17,6 (0.69) slots on 181,0 (7.13) bolt circle

B – ISO 3019/2 125A2HW 2-bolt
125,00 (4.921) x 9,2 (0.36) pilot
18,1 (0.71) slots on 180,0 (7.09) bolt circle

21 22 Input Shaft Type*

01 – SAE J744 keyed
Frame size 35: 31,75 (1.250)
Frame size 45: 38,10 (1.500)

02 – SAE J744 splined
Frame size 35: C
Frame size 45: C-C

03 – ISO 3019/2 keyed
Frame size 35: 32,00 (1.260)
Frame size 45: 40,00 (1.575)

05 – SAE J744 keyed
Frame size 35: 38,10 (1.500)
Frame size 45: 44,45 (1.750)

06 – SAE J744 splined
Frame size 35: C-C
Frame size 45: D

07 – ISO 3019/2 keyed
Frame size 35: 40,00 (1.575)

23 Port Type

A – Inlet: SAE J518 4-bolt flange
Front outlet: SAE J518 4-bolt flange
Middle outlet: SAE J518 4-bolt flange
Rear outlet: SAE J518 4-bolt flange

B – Inlet: ISO 6162 4-bolt flange
Front outlet: ISO 6162 4-bolt flange
Middle outlet: ISO 6162 4-bolt flange
Rear outlet: ISO 6162 4-bolt flange

24 Front Outlet Port Position

Viewed from cover end of pump

A – Opposite inlet port
B – 90° CCW to inlet port
C – In-line with inlet port
D – 90° CW to inlet port

25 Middle Outlet Port Position

Viewed from cover end of pump

A – Opposite inlet port
B – 90° CCW to inlet port
C – In-line with inlet port
D – 90° CW to inlet port

26 Rear Outlet Port Position

Viewed from cover end of pump

352525 Units

A – 135° CCW to inlet port
B – 45° CCW to inlet port
C – 45° CW to inlet port
D – 135° CW to inlet port

453525 units

E – Opposite inlet port
F – 90° CCW to inlet port
G – In-line with inlet port
H – 90° CW to inlet port

27 Shaft Seal

A – Single, primary
B – Double, secondary (spring side out) Recommended for wet mount applications

28 Seal Type

N – Buna N
V – Viton
W – Buna N with Viton shaft seal(s)

29 Shaft Rotation

Viewed from shaft end of pump

L – Left hand (CCW)
R – Right hand (CW)

30 31 Special Features

00 – None

32 Paint

0 – None
A – Blue

33 Customer Identification

0 – None

34 35 Design Code

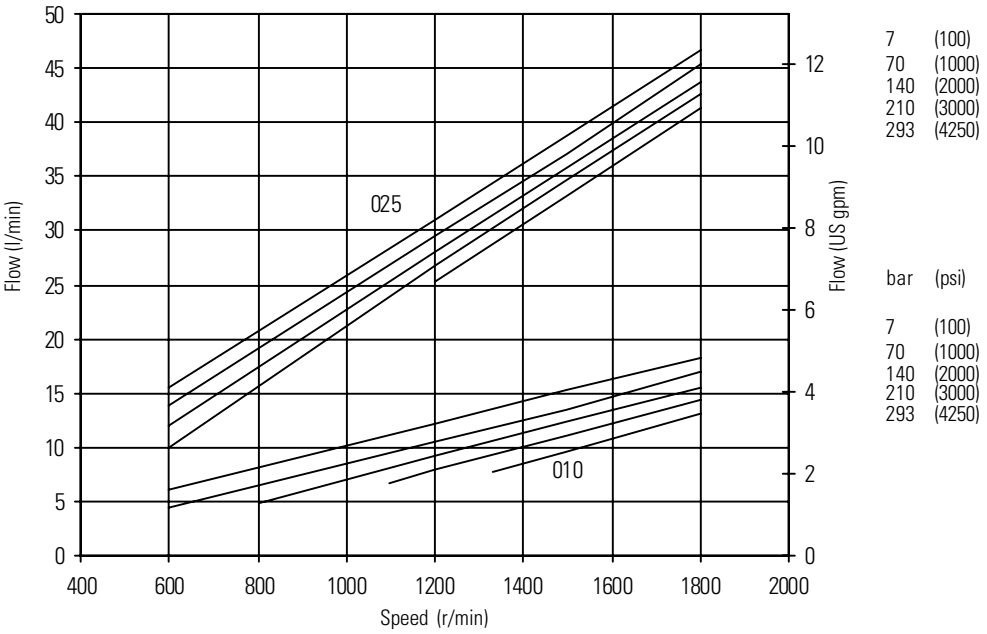
3**2** – 32 design
Installation dimensions remain unchanged for design numbers 31 to 39 inclusive.

* Verify shaft torque ratings meet or exceed input torque requirements (see page 74).

Typical Output Flow - Industrial

49ºC (120ºF), SAE 10W oil,
26 cSt (128 SUS)

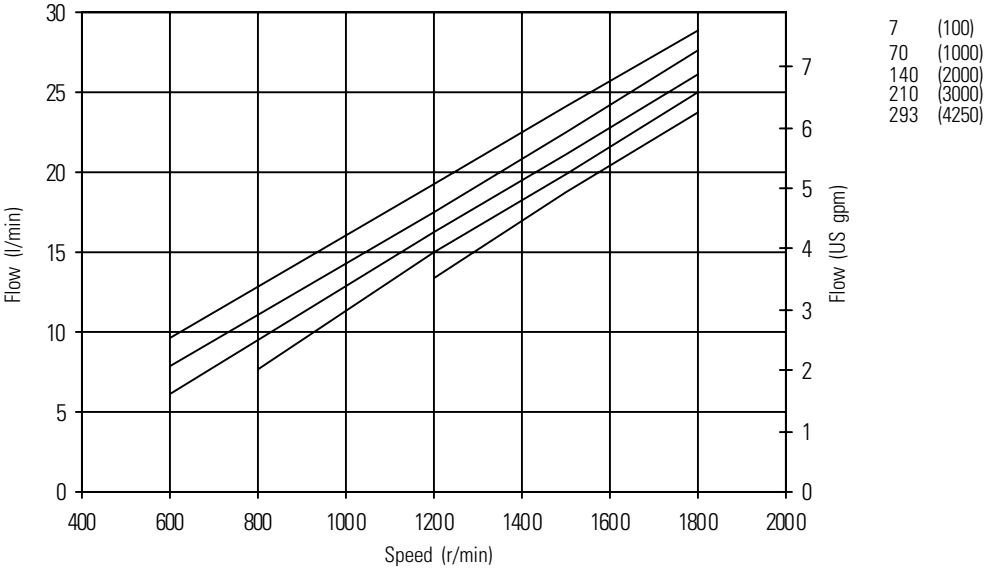
Frame size 25: 10 and 25 cm³/r



bar	(psi)
7	(100)
70	(1000)
140	(2000)
210	(3000)
293	(4250)

bar	(psi)
7	(100)
70	(1000)
140	(2000)
210	(3000)
293	(4250)

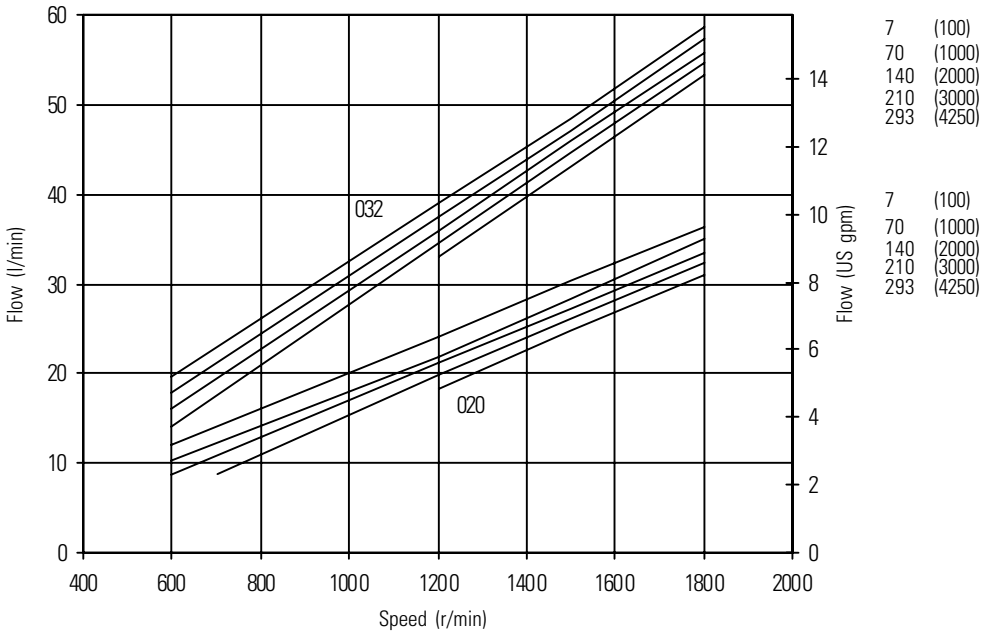
Frame size 25: 16 cm³/r



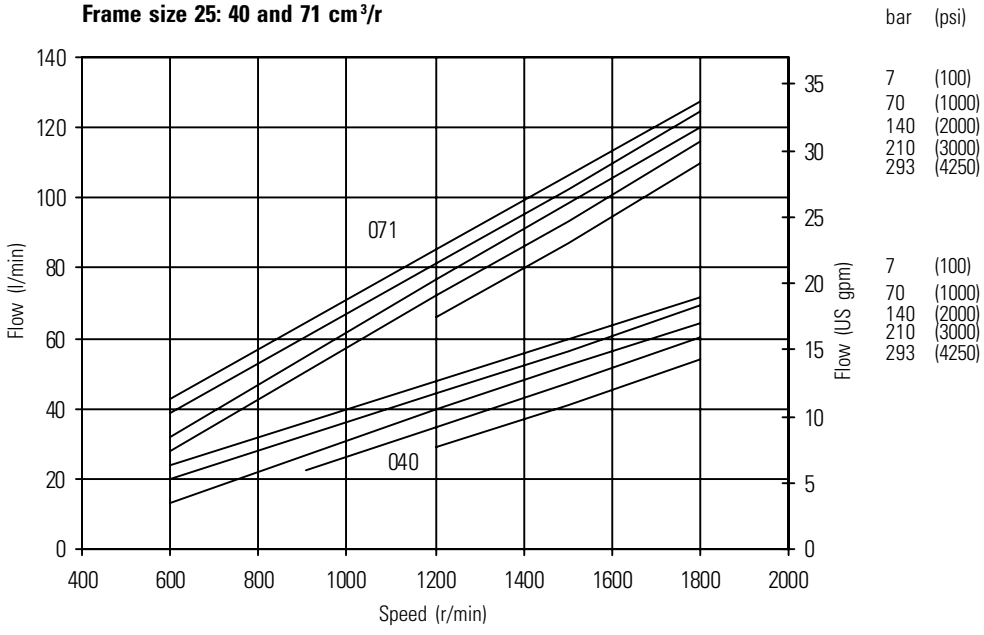
bar	(psi)
7	(100)
70	(1000)
140	(2000)
210	(3000)
293	(4250)

Typical Output Flow - Industrial (cont.)

Frame size 25: 20 and 32 cm³/r

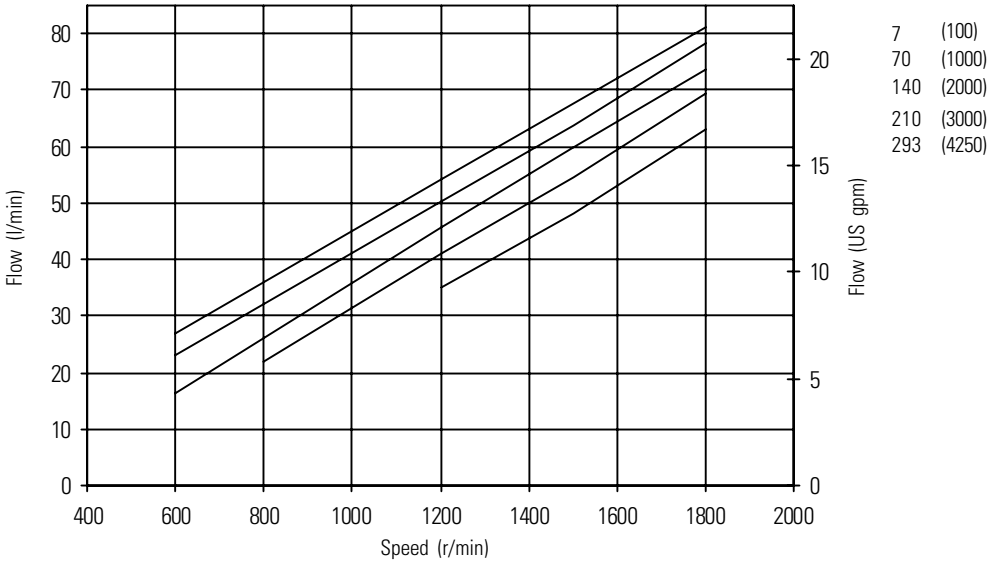


Frame size 25: 40 and 71 cm³/r

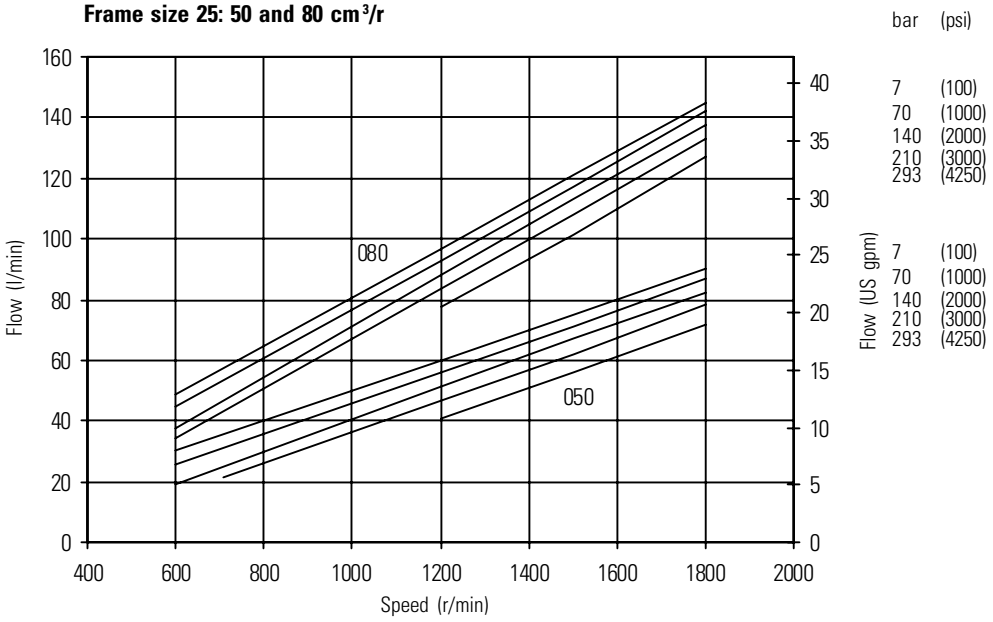


Typical Output Flow - Industrial (cont.)

Frame size 25: 45 cm³/r

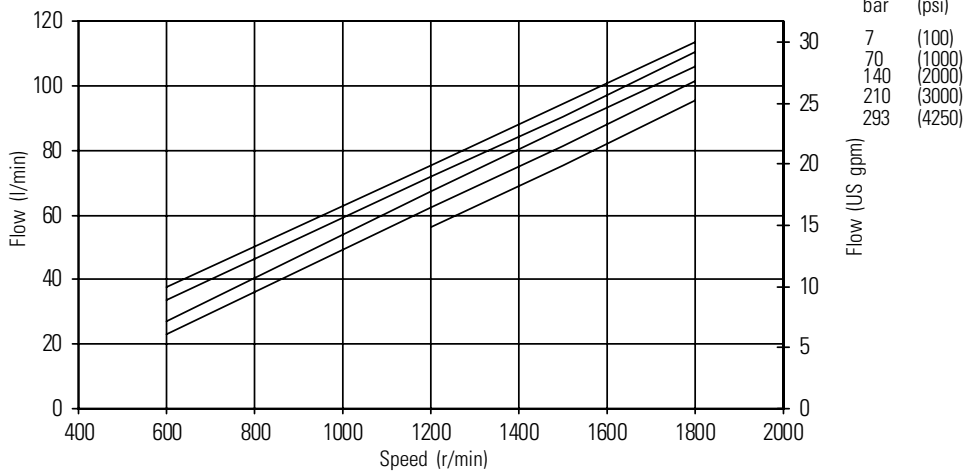


Frame size 25: 50 and 80 cm³/r

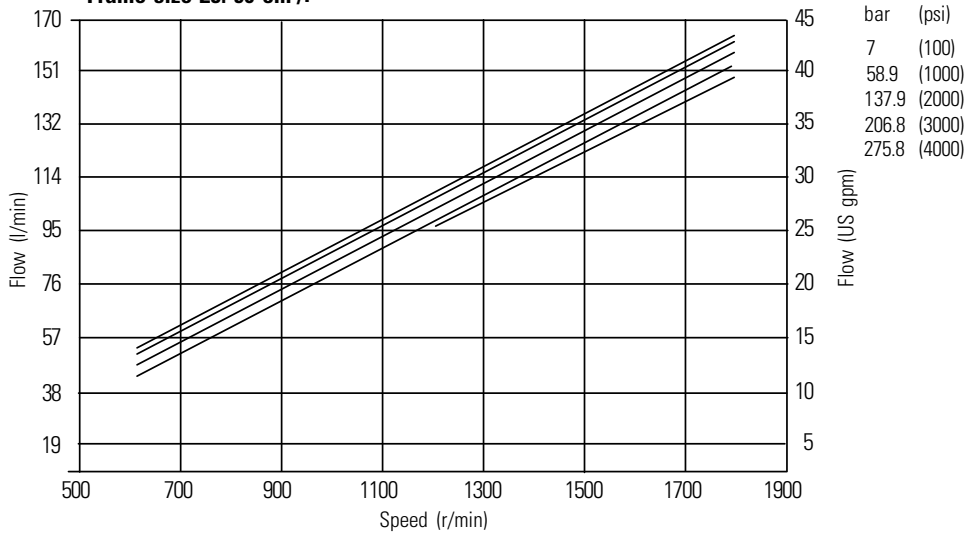


Typical Output Flow - Industrial (cont.)

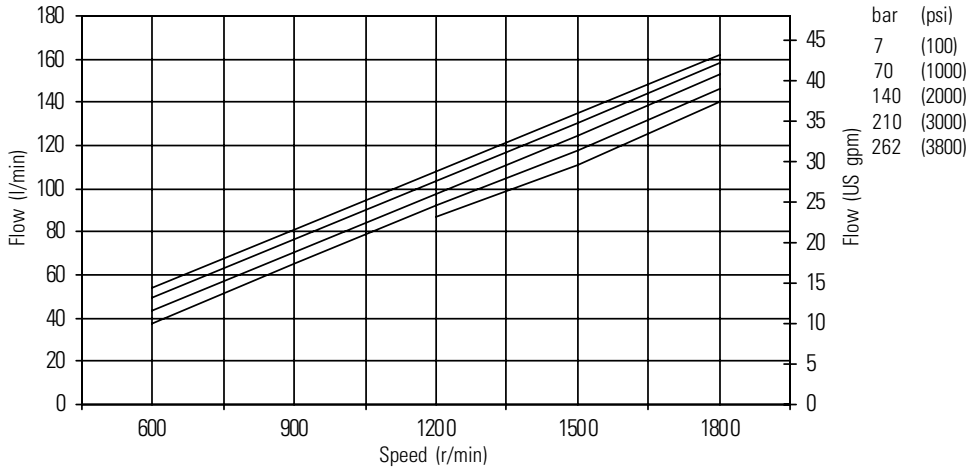
Frame size 25: 63 cm³/r



Frame size 25: 90 cm³/r

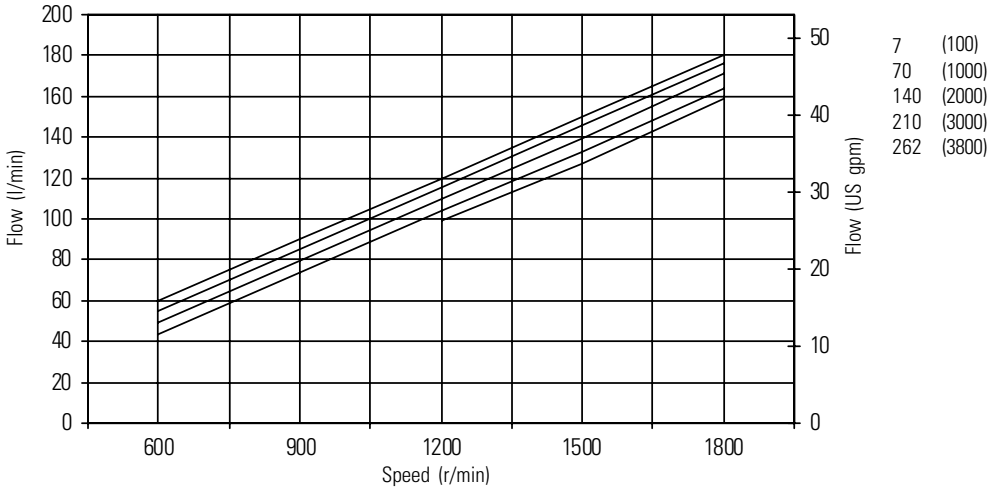


Frame size 35: 90 cm³/r

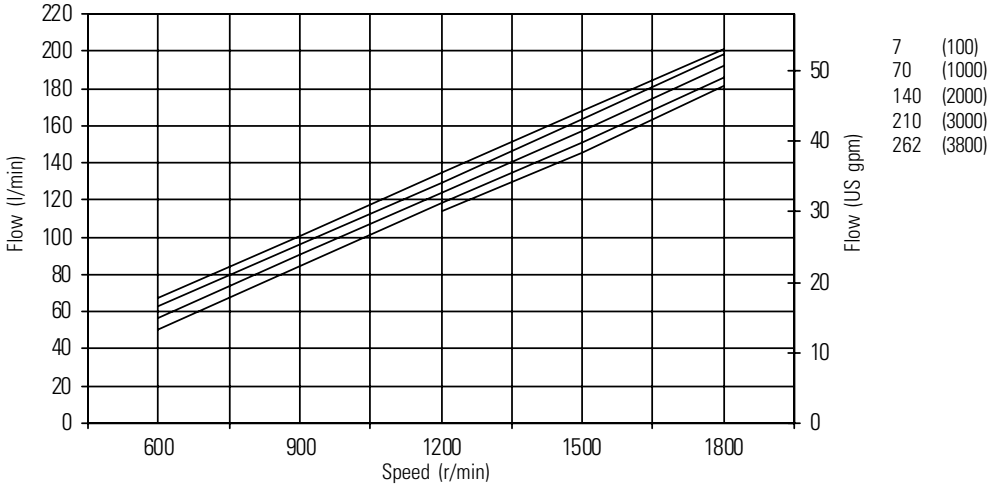


Typical Output Flow - Industrial (cont.)

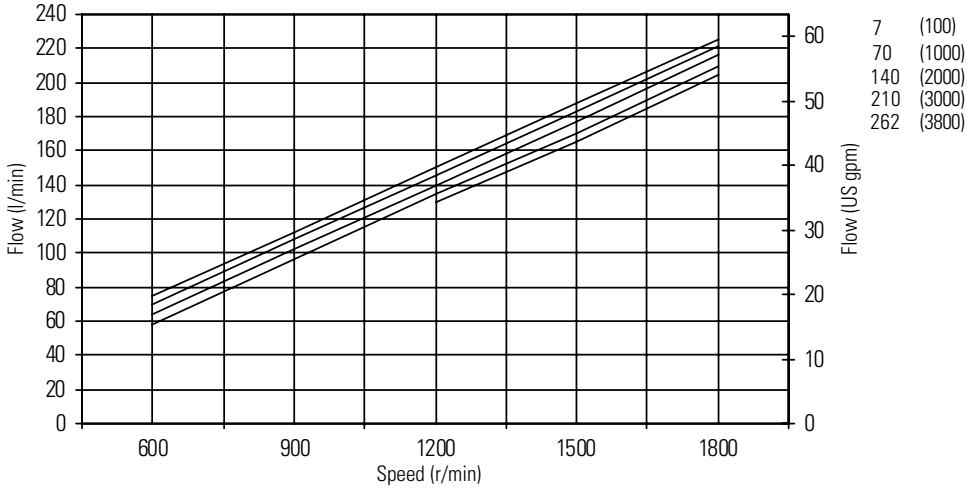
Frame size 35: 100 cm³/r



Frame size 35: 112 cm³/r

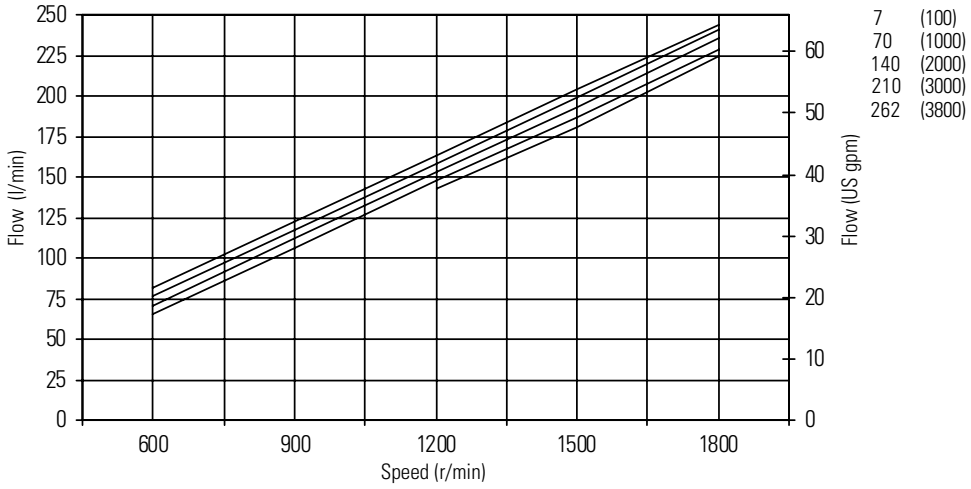


Frame size 35: 125 cm³/r

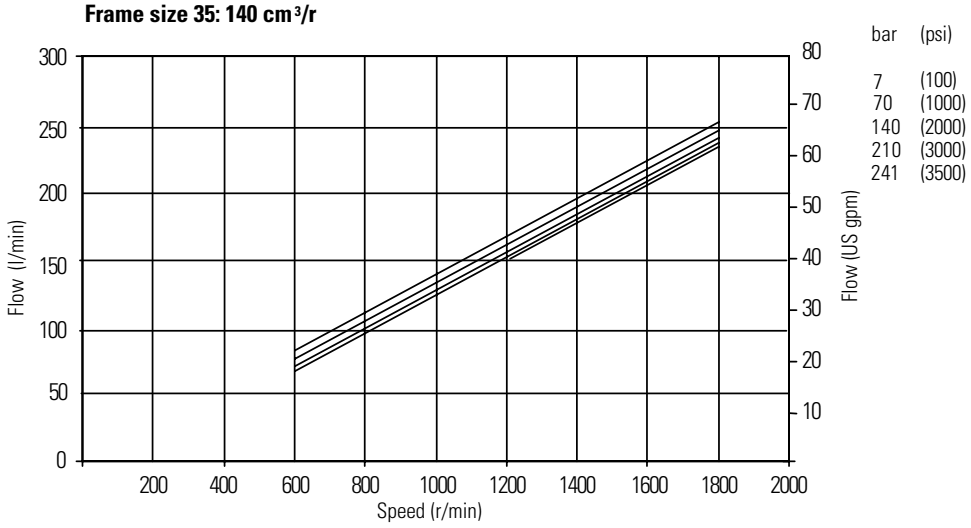


Typical Output
Flow - Industrial
(cont.)

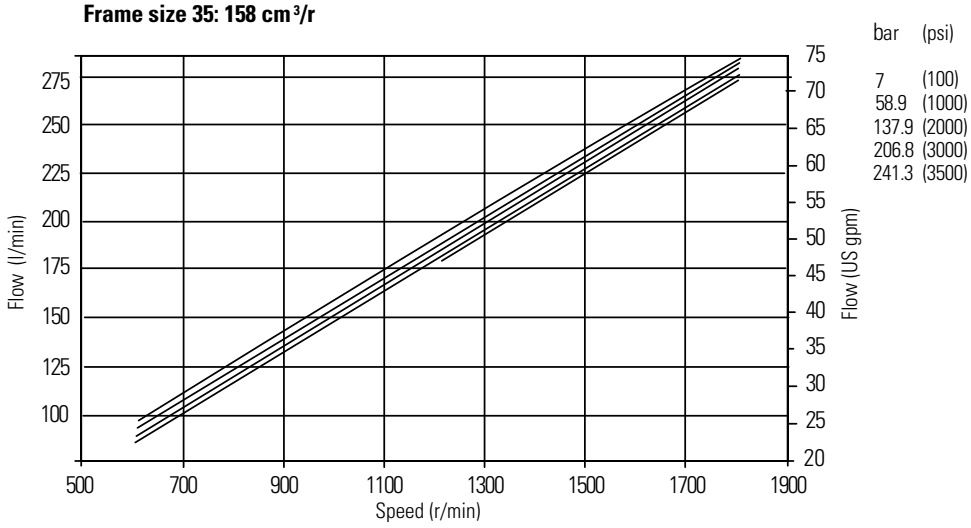
Frame size 35: 135 cm³/r



Frame size 35: 140 cm³/r

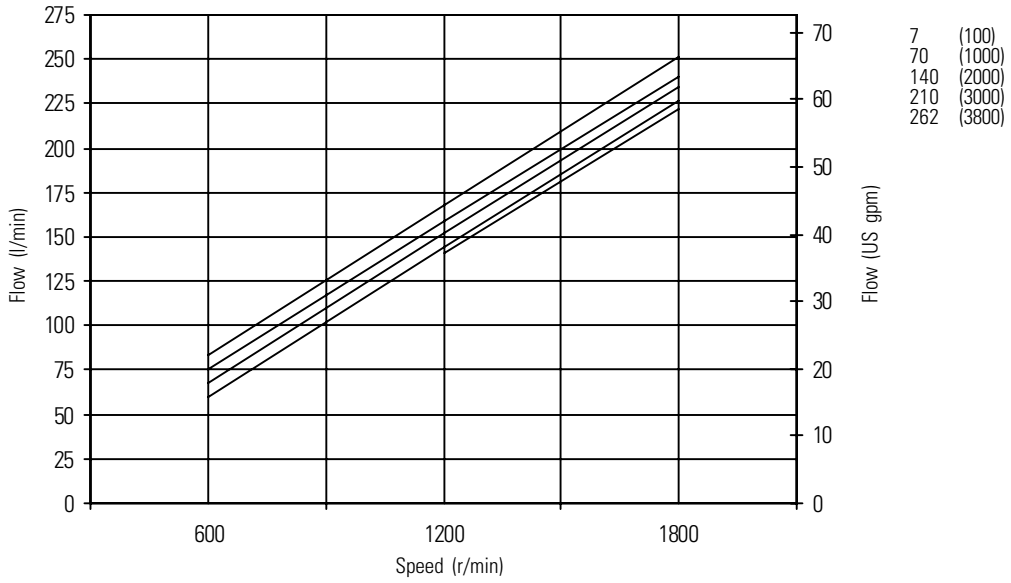


Frame size 35: 158 cm³/r

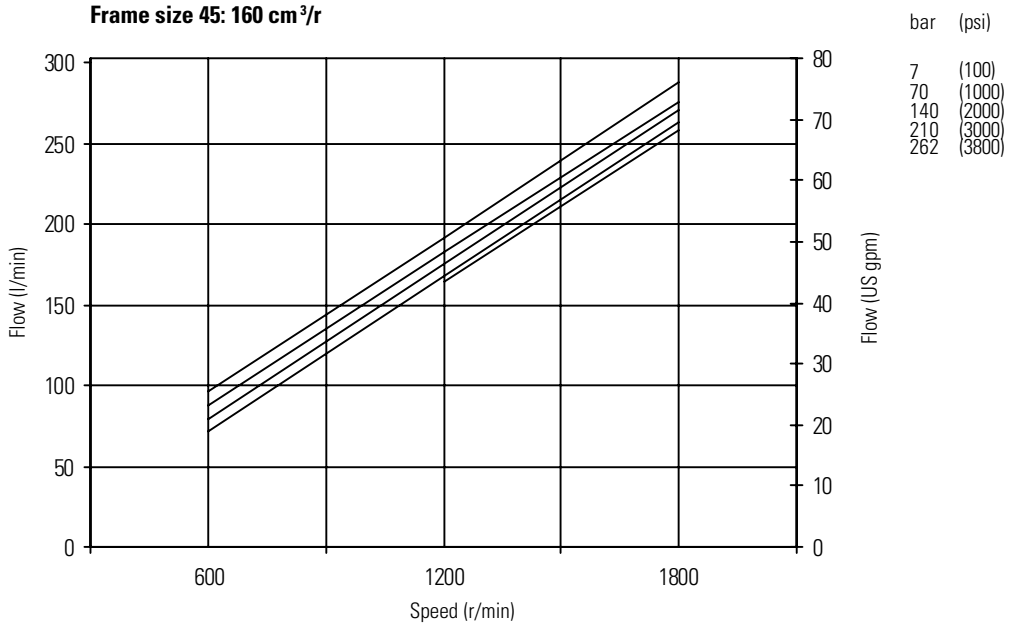


Typical Output Flow - Industrial (cont.)

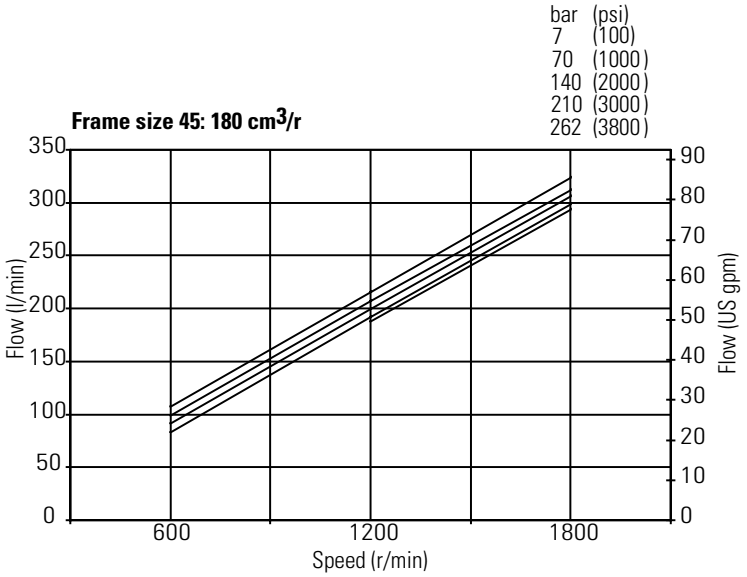
Frame size 45: 140 cm³/r

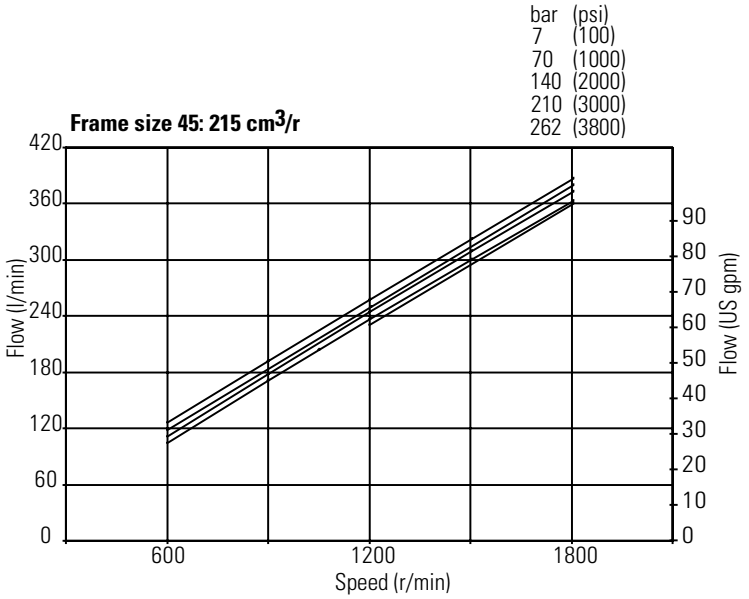


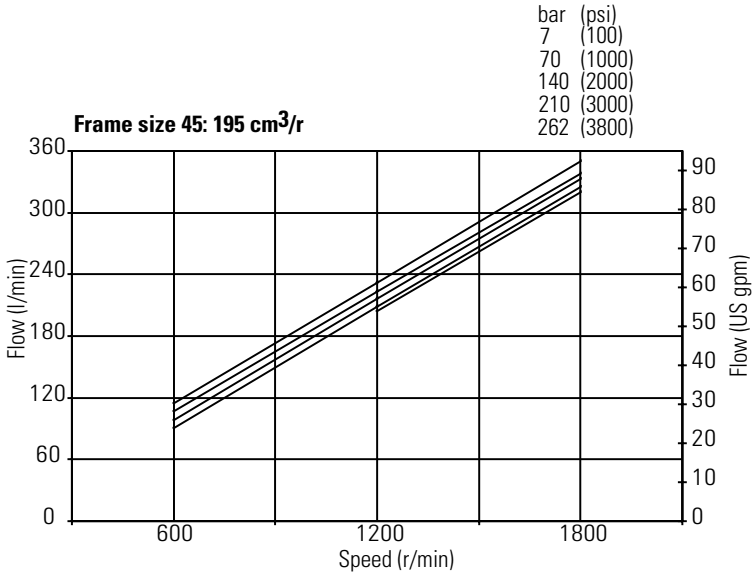
Frame size 45: 160 cm³/r

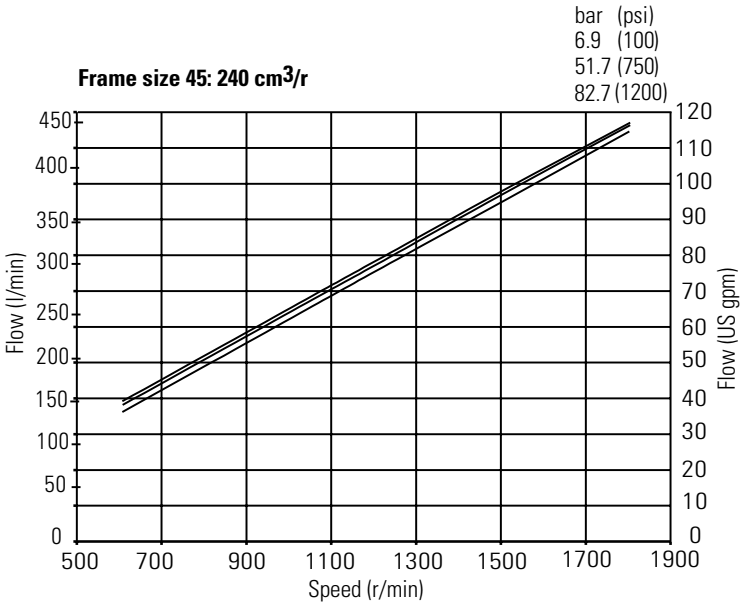


Typical Output Flow - Industrial (cont.)





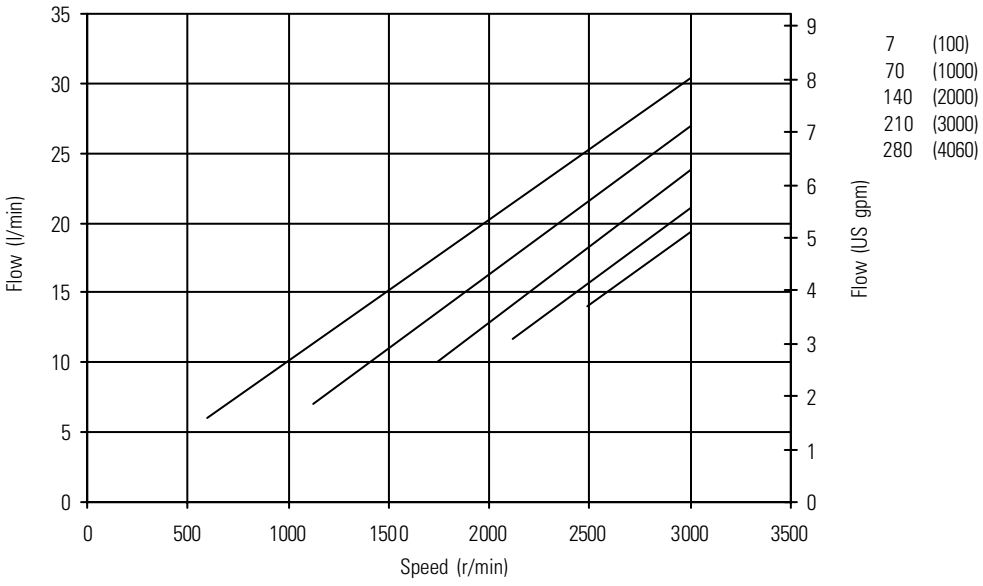




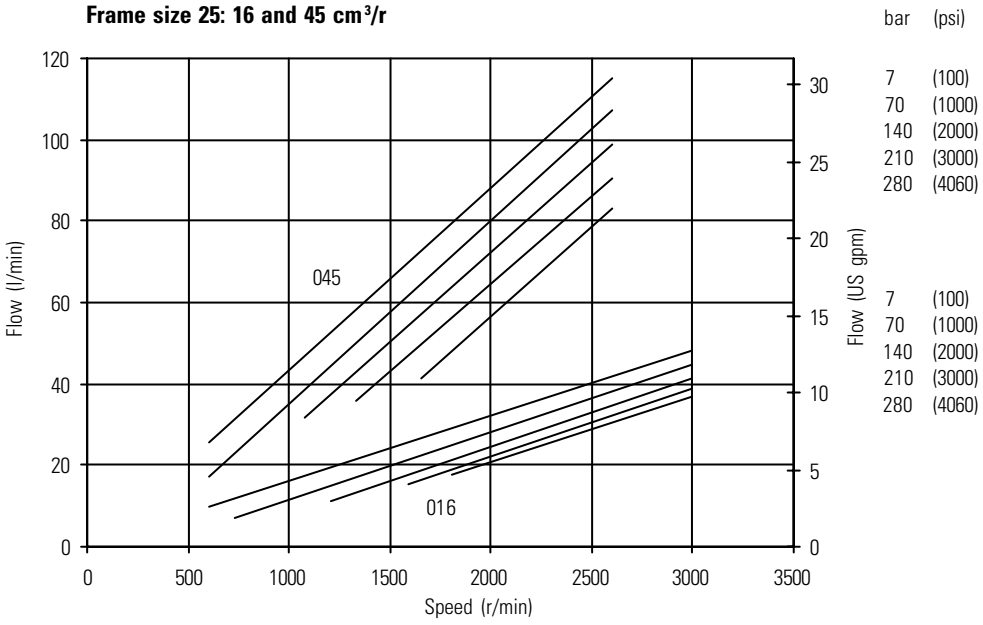
Typical Output Flow - Mobile

82°C (180°F), SAE 10W oil,
9 cSt (55 SUS)

Frame size 25: 10 cm³/r

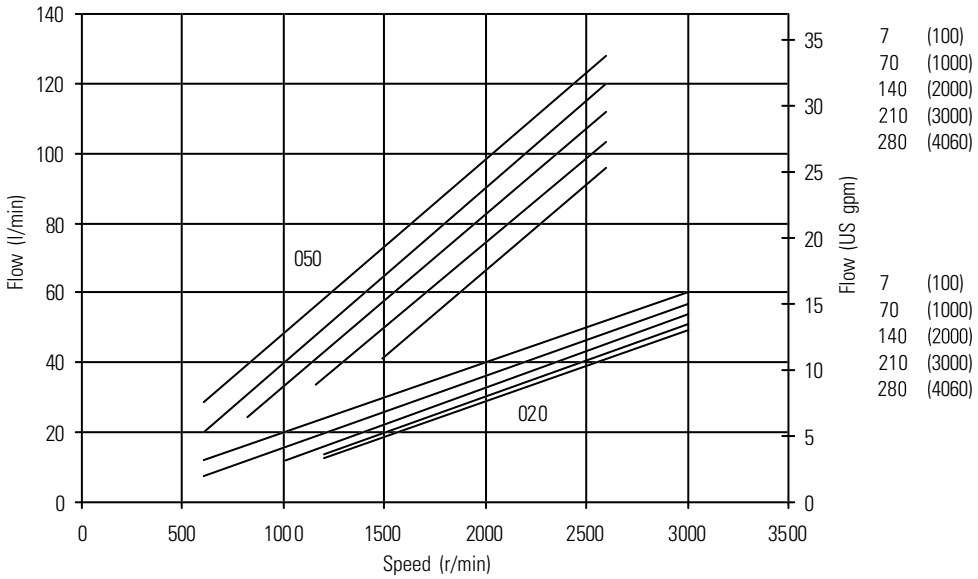


Frame size 25: 16 and 45 cm³/r

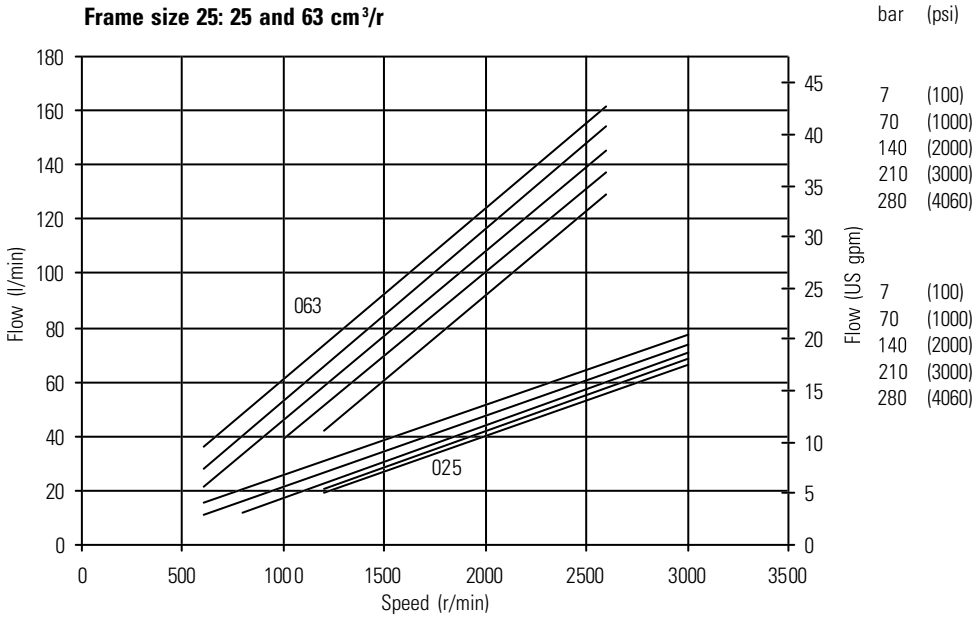


Typical Output Flow - Mobile (cont.)

Frame size 25: 20 and 50 cm³/r

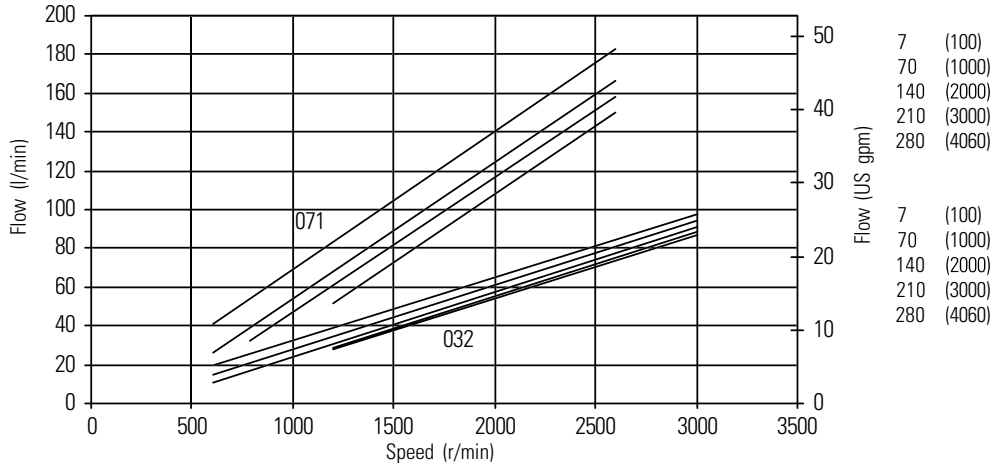


Frame size 25: 25 and 63 cm³/r

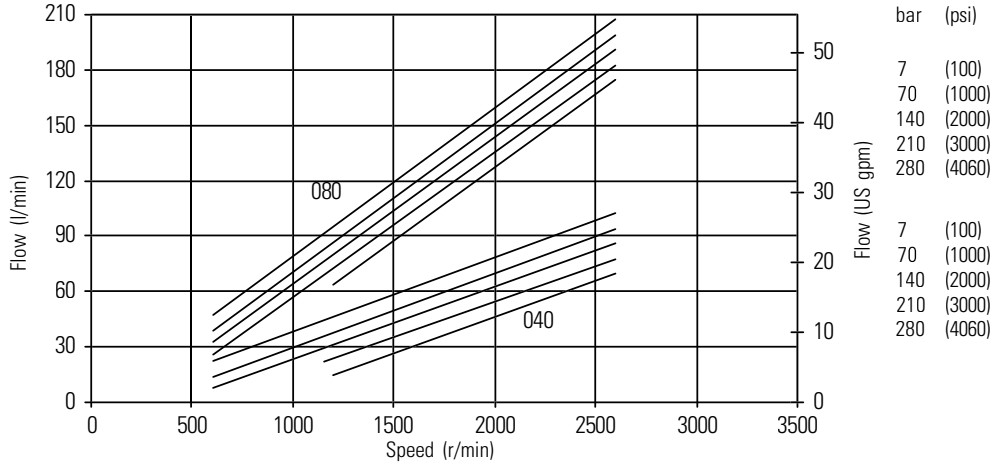


Typical Output Flow - Mobile (cont.)

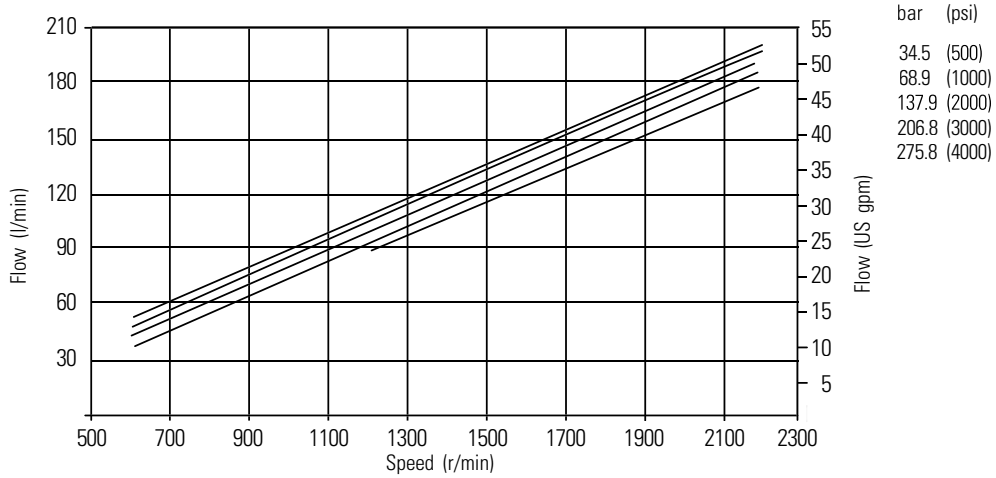
Frame size 25: 32 and 71 cm³/r



Frame size 25: 40 and 80 cm³/r

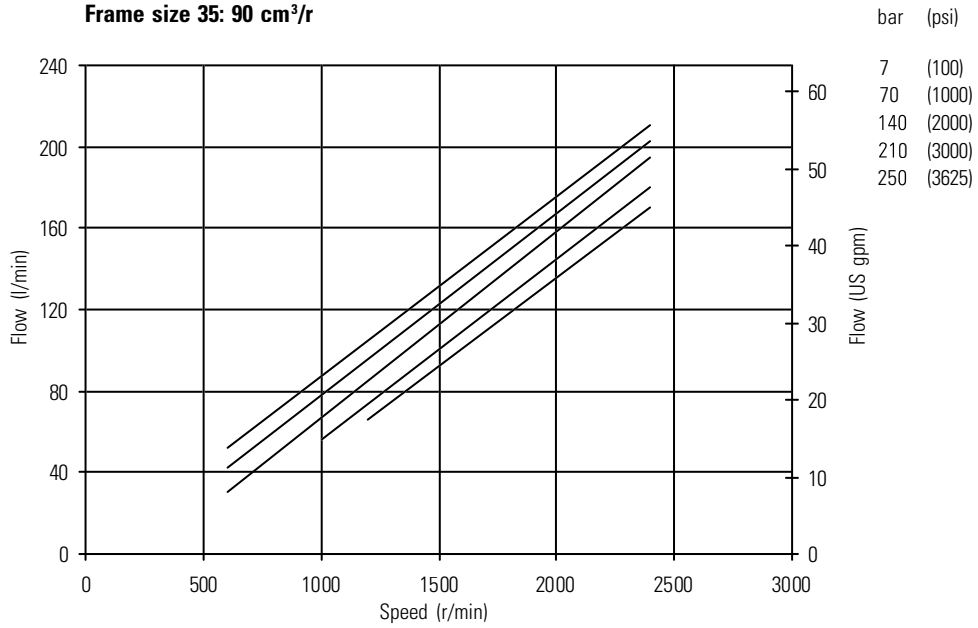


Frame size 25: 90 cm³/r

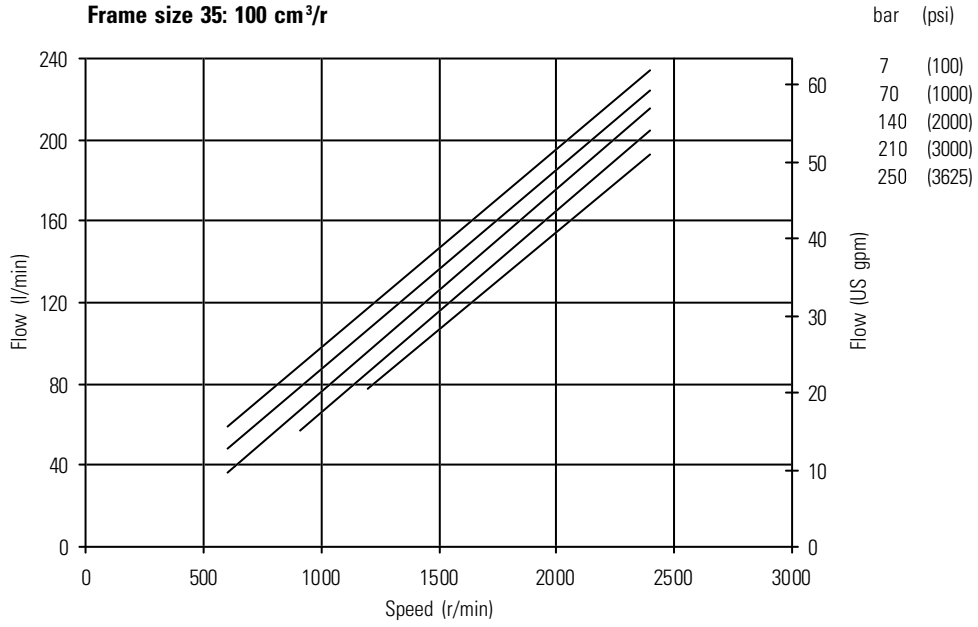


Typical Output Flow - Mobile (cont.)

Frame size 35: 90 cm³/r

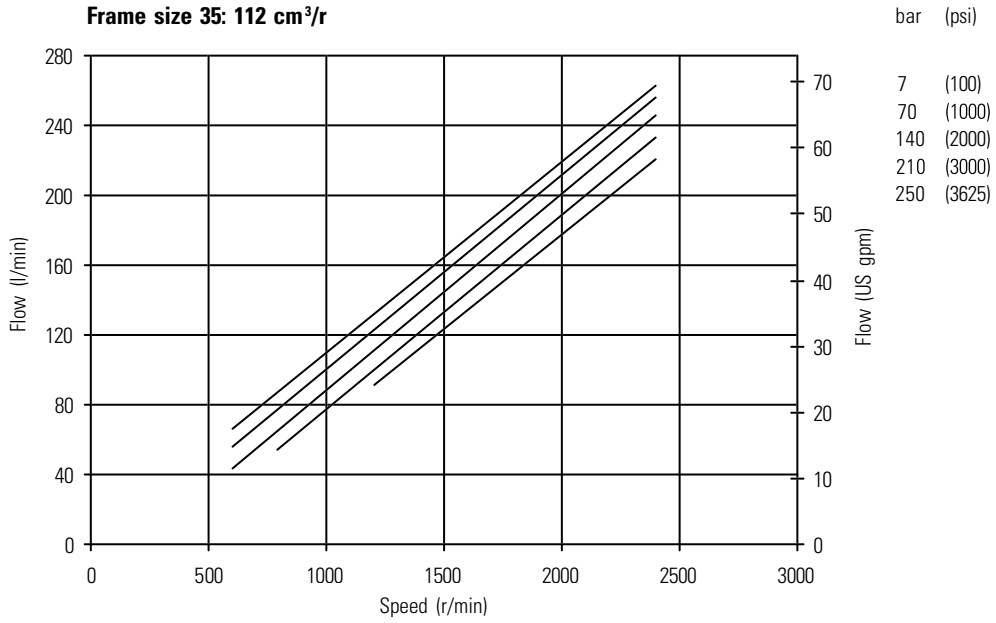


Frame size 35: 100 cm³/r

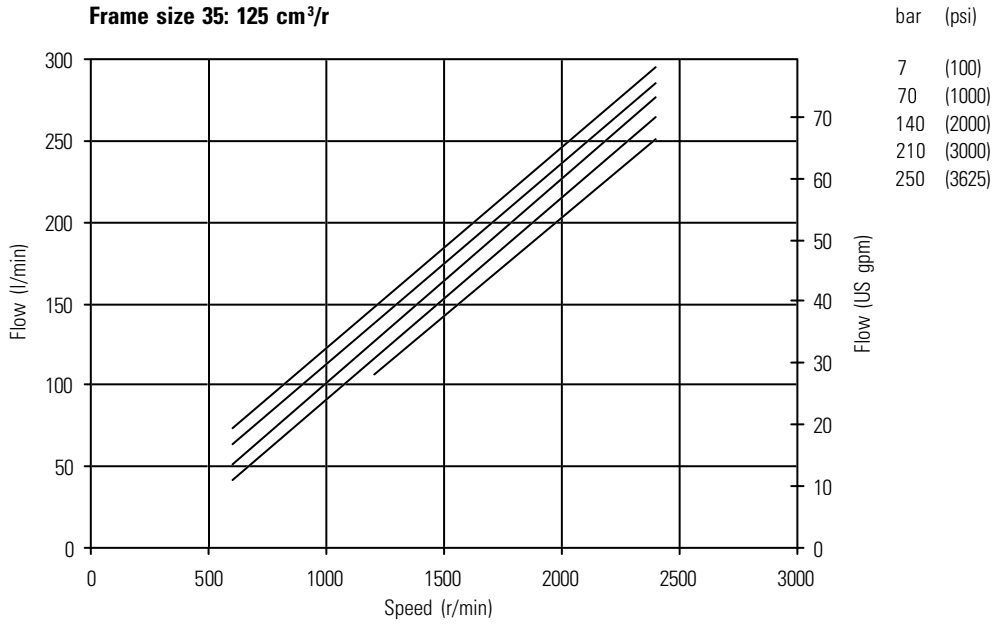


Typical Output Flow - Mobile (cont.)

Frame size 35: 112 cm³/r

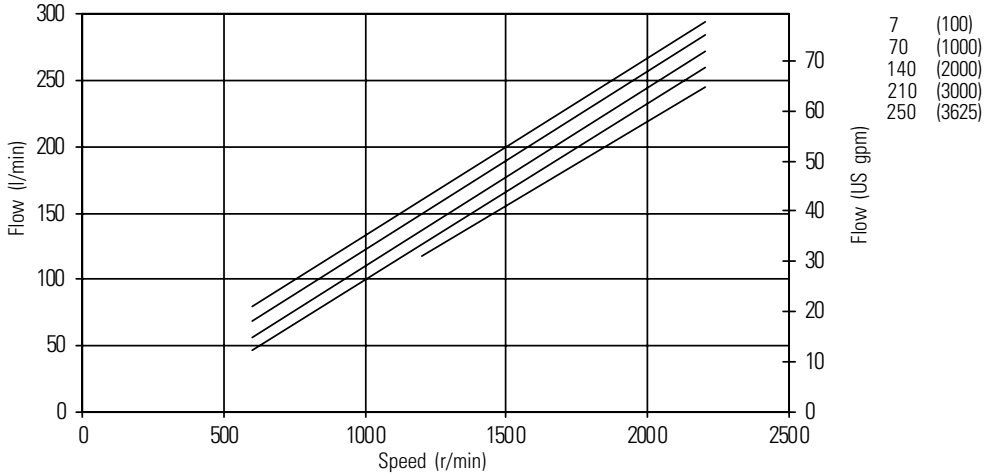


Frame size 35: 125 cm³/r

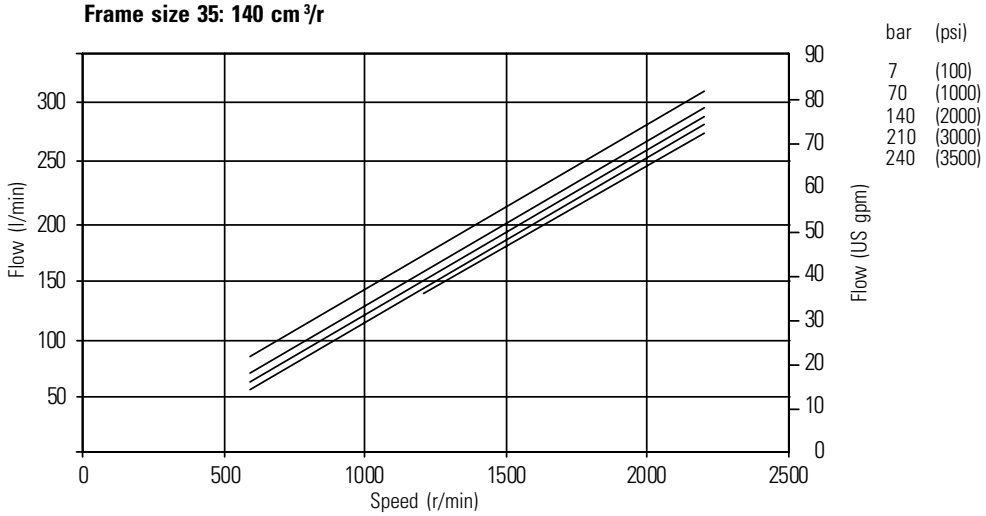


Typical Output Flow - Mobile (cont.)

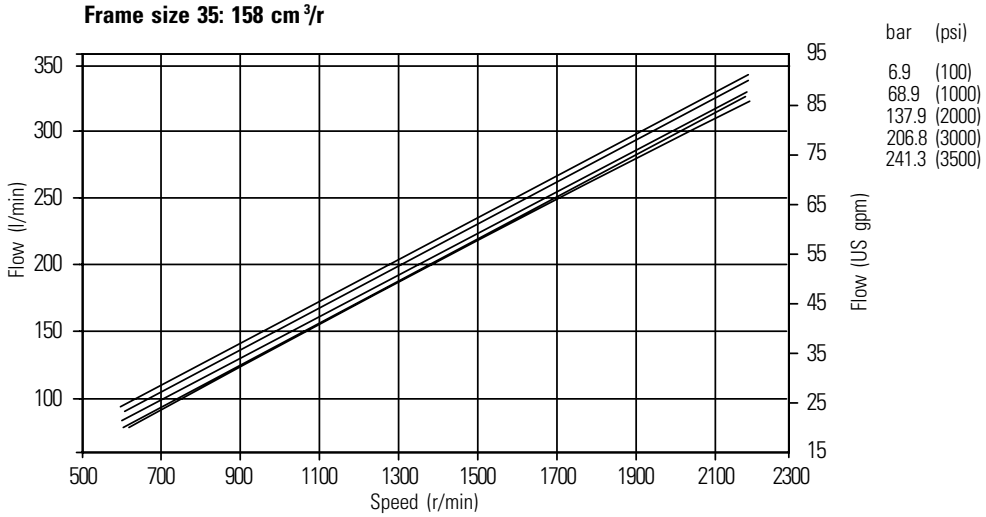
Frame size 35: 135 cm³/r



Frame size 35: 140 cm³/r

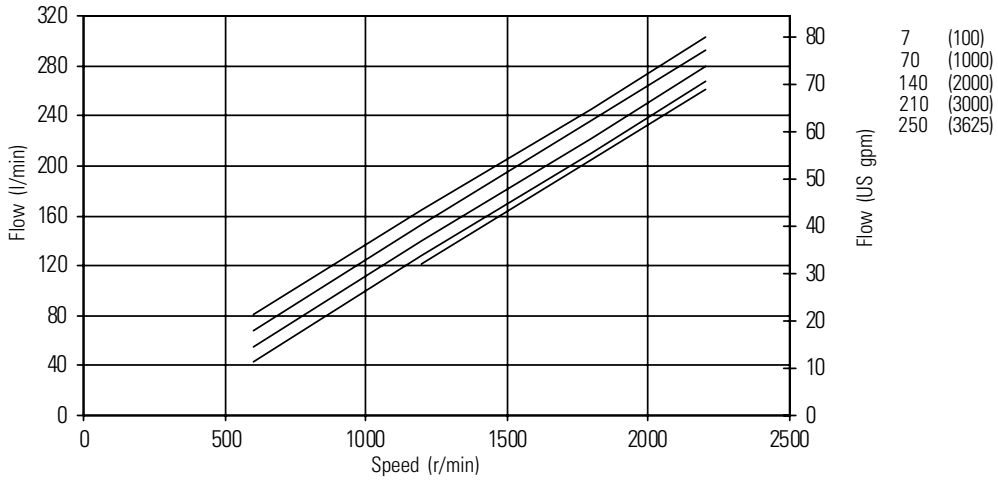


Frame size 35: 158 cm³/r

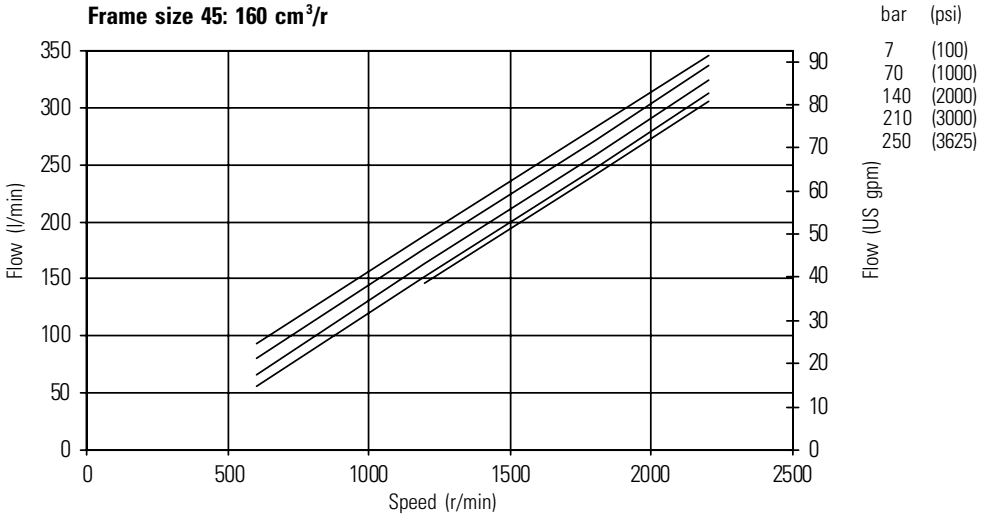


Typical Output Flow - Mobile (cont.)

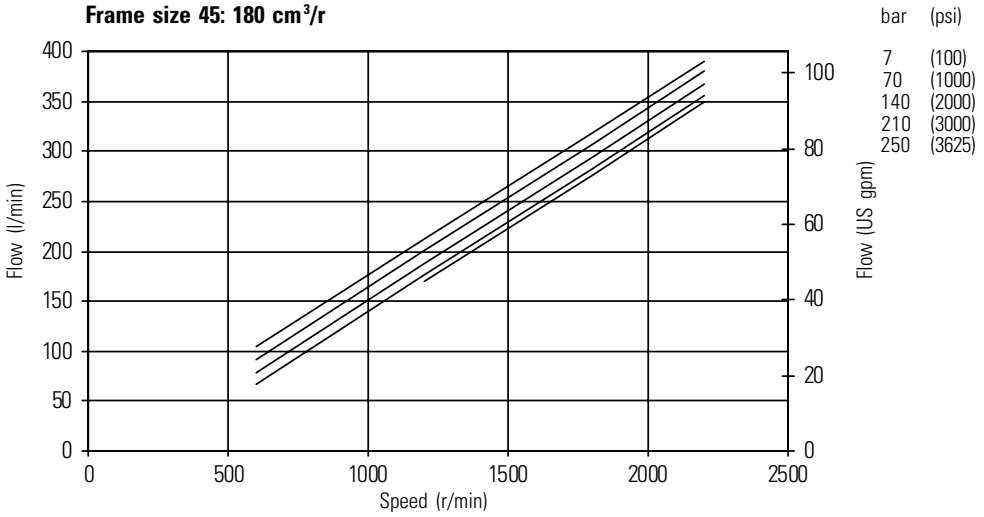
Frame size 45: 140 cm³/r



Frame size 45: 160 cm³/r

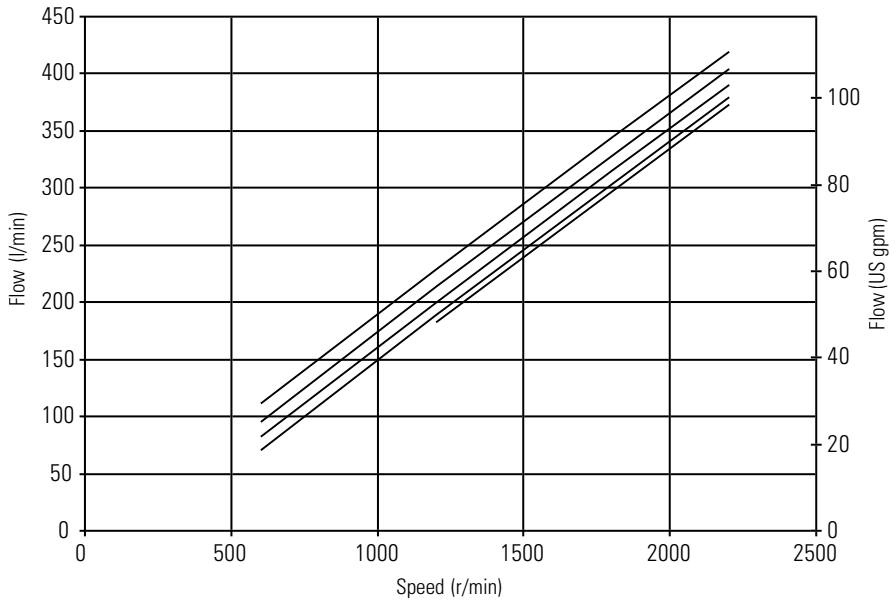


Frame size 45: 180 cm³/r



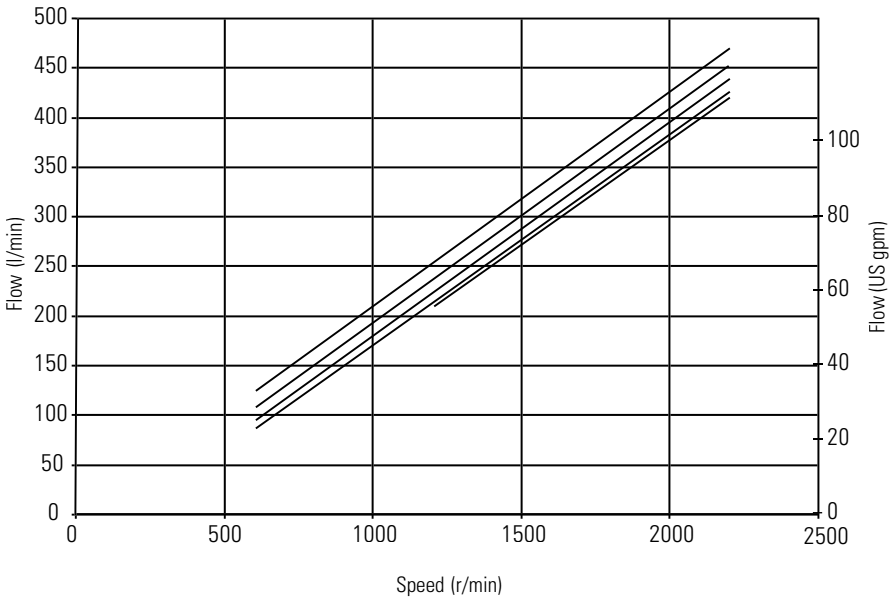
Typical Output Flow - Mobile (cont.)

Frame size 45: 195 cm³/r



bar	(psi)
7	(100)
70	(1000)
140	(2000)
210	(3000)
250	(3625)

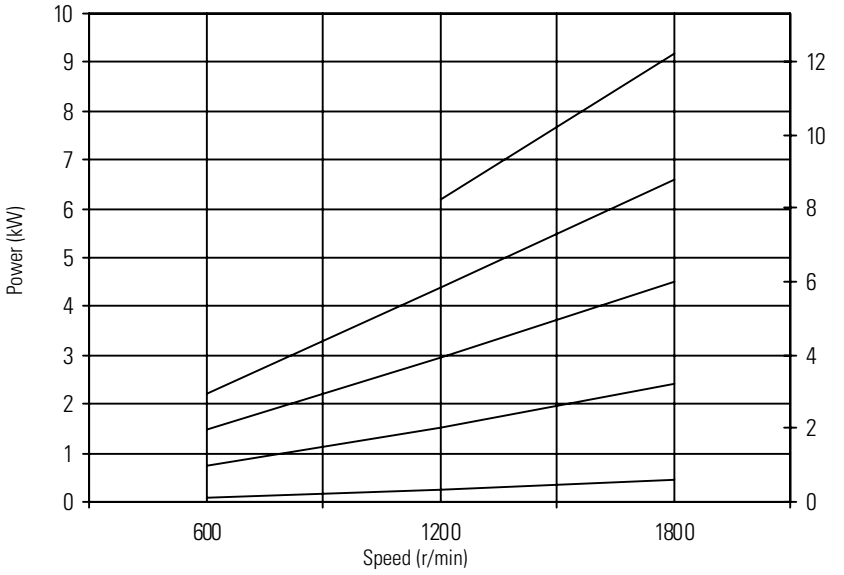
Frame size 45: 215 cm³/r



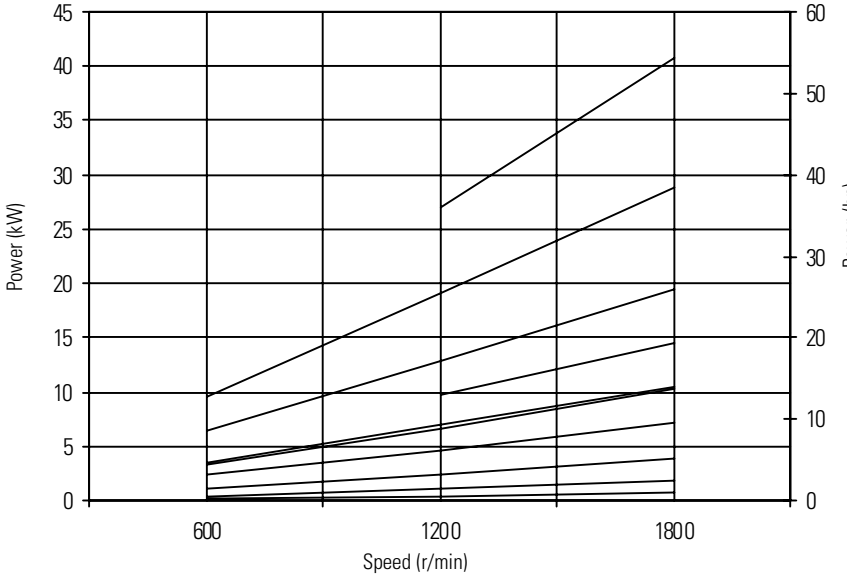
bar	(psi)
7	(100)
70	(1000)
140	(2000)
210	(3000)
250	(3625)

Typical Input Power - Industrial

Frame size 25: 10 cm³/r

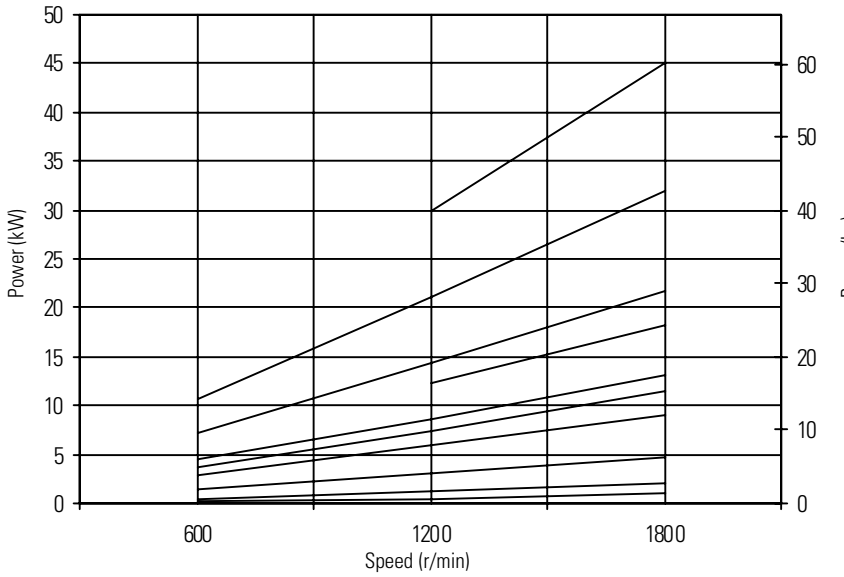


Frame size 25: 16 and 45 cm³/r



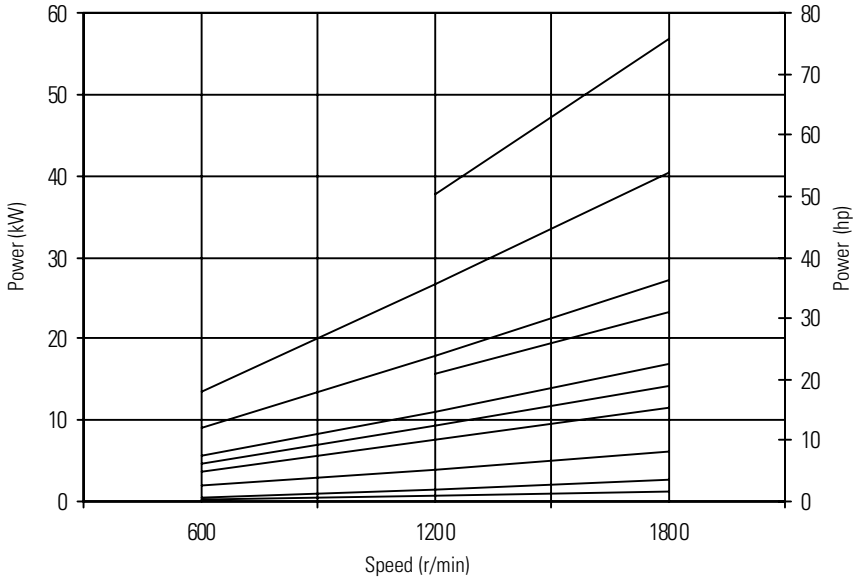
Typical Input Power - Industrial (cont.)

Frame 25: 20 and 50 cm³/r



bar	(psi)	code
293	(4250)	050
210	(3000)	050
140	(2000)	050
293	(4250)	020
210	(3000)	020
70	(1000)	050
140	(2000)	020
70	(1000)	020
7	(100)	050
7	(100)	020

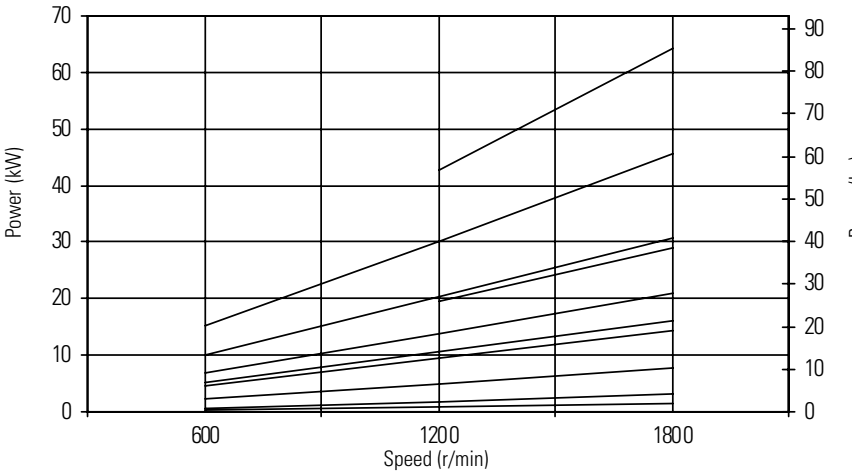
Frame size 25: 25 and 63 cm³/r



bar	(psi)	code
293	(4250)	063
210	(3000)	063
140	(2000)	063
293	(4250)	025
210	(3000)	025
70	(1000)	063
140	(2000)	025
70	(1000)	025
7	(100)	063
7	(100)	025

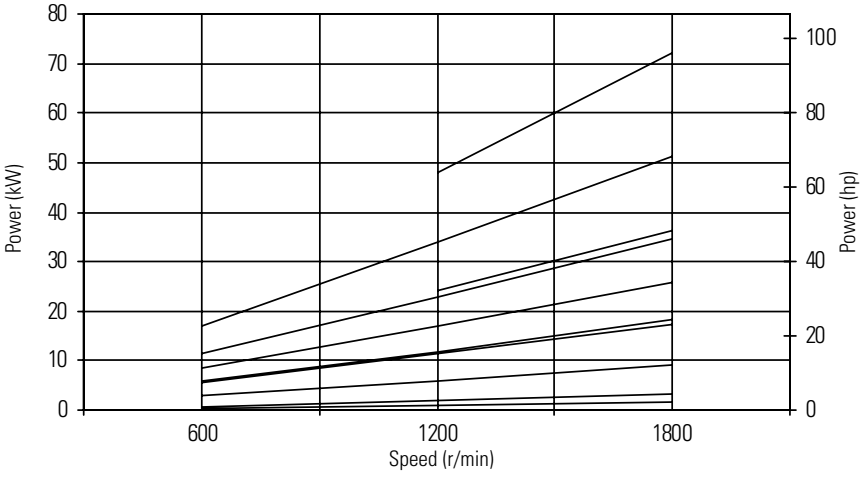
Typical Input Power - Industrial (cont.)

Frame size 25: 32 and 71 cm³/r



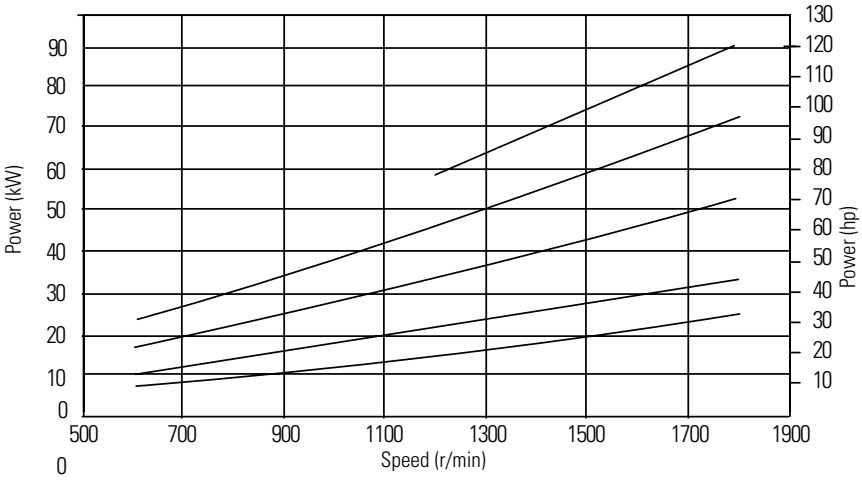
bar	(psi)	code
293	(4250)	071
210	(3000)	071
140	(2000)	071
293	(4250)	032
210	(3000)	032
70	(1000)	071
140	(2000)	032
70	(1000)	032
7	(100)	071
7	(100)	032

Frame size 25: 40 and 80 cm³/r



bar	(psi)	code
293	(4250)	080
210	(3000)	080
293	(4250)	040
140	(2000)	080
210	(3000)	040
70	(1000)	080
140	(2000)	040
70	(1000)	040
7	(100)	080
7	(100)	040

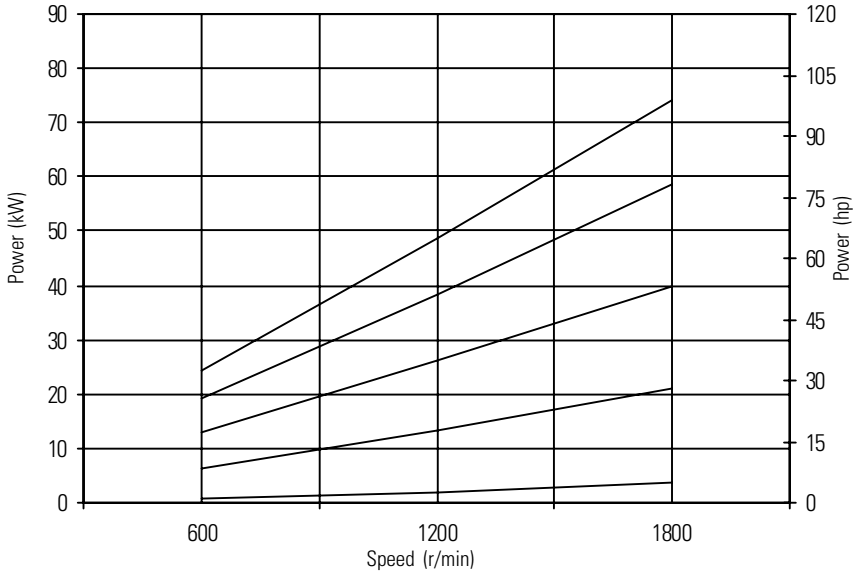
Frame size 25: 90 cm ³/r



bar	(psi)	code
275.8	(4000)	090
206.8	(3000)	090
137.9	(2000)	090
68.9	(1000)	090
34.5	(500)	090

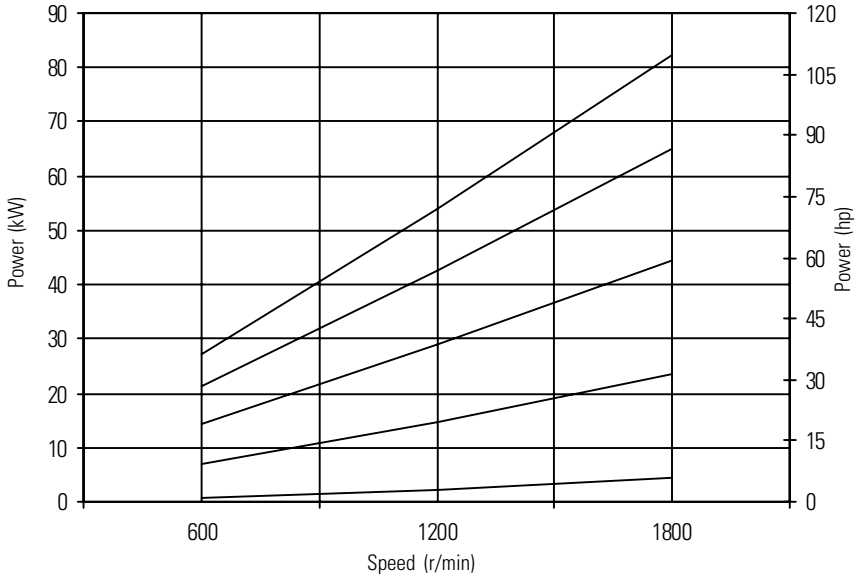
Typical Input Power - Industrial (cont.)

Frame size 35: 90 cm³/r



bar	(psi)	code
262	(3800)	090
210	(3000)	090
140	(2000)	090
70	(1000)	090
7	(100)	090

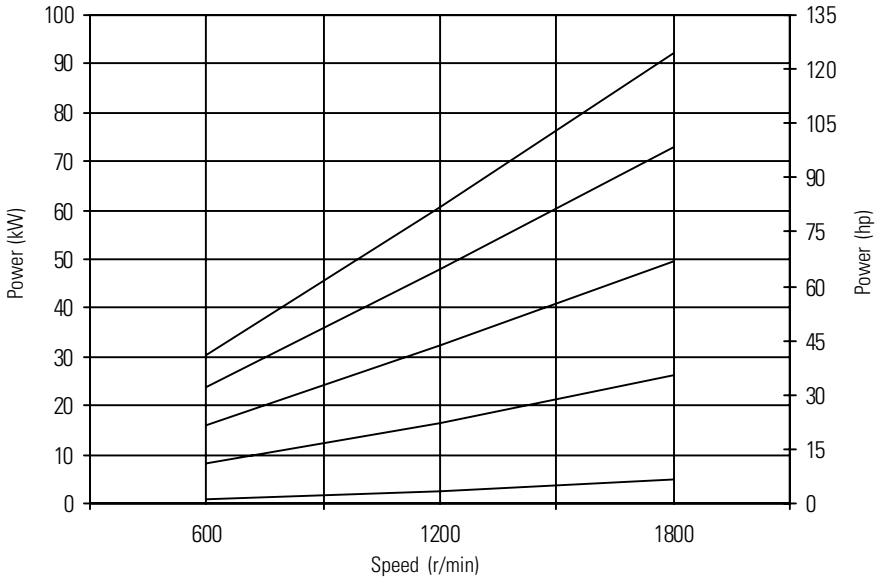
Frame size 35: 100 cm³/r



bar	(psi)	code
262	(3800)	100
210	(3000)	100
140	(2000)	100
70	(1000)	100
7	(100)	100

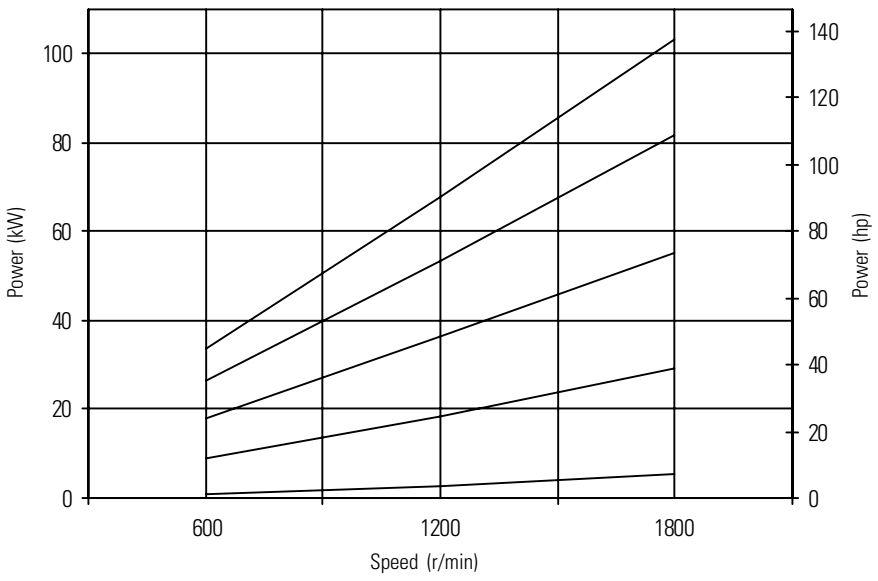
Typical Input Power - Industrial (cont.)

Frame size 35: 112 cm³/r



bar	(psi)	code
262	(3800)	112
210	(3000)	112
140	(2000)	112
70	(1000)	112
7	(100)	112

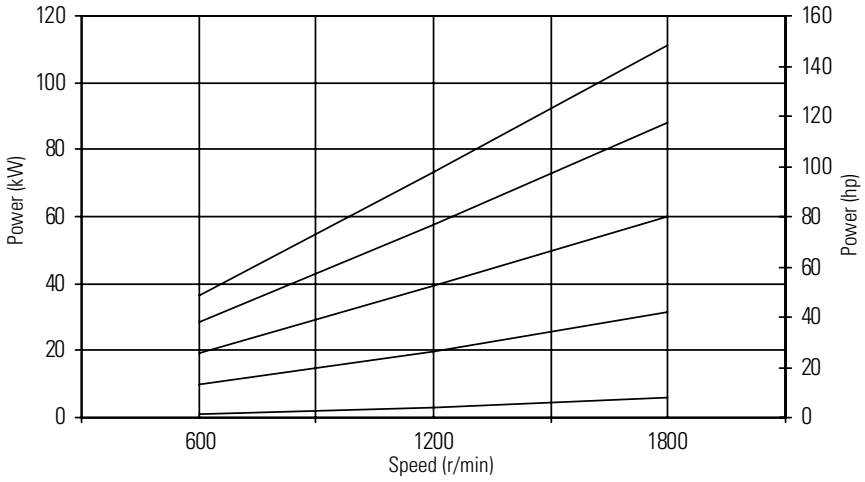
Frame size 35: 125 cm³/r



bar	(psi)	code
262	(3800)	125
210	(3000)	125
140	(2000)	125
70	(1000)	125
7	(100)	125

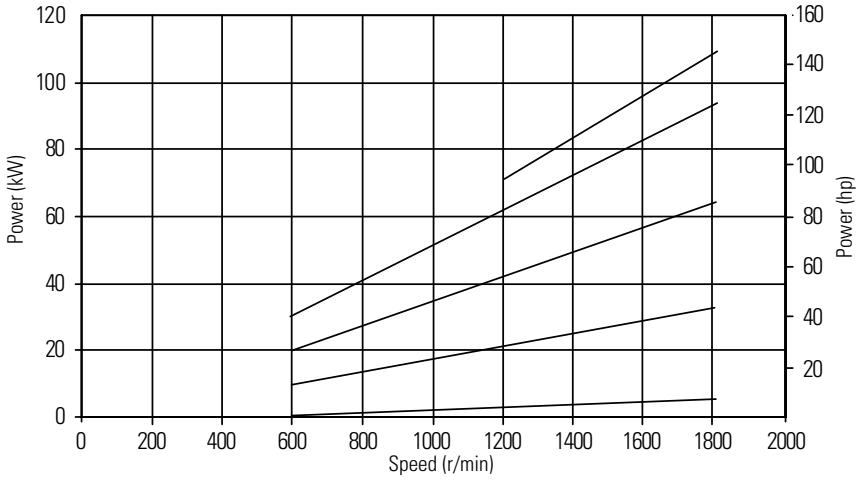
Typical Input Power - Industrial (cont.)

Frame size 35: 135 cm³/r



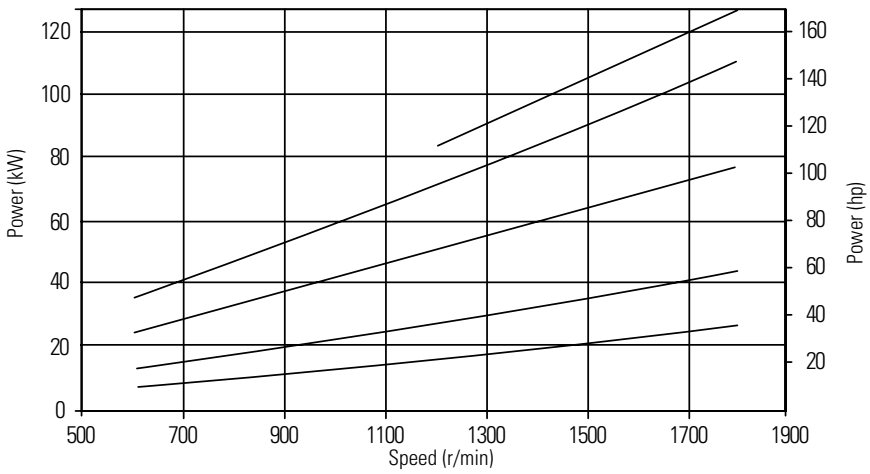
bar	(psi)	code
262	(3800)	135
210	(3000)	135
140	(2000)	135
70	(1000)	135
7	(100)	135

Frame size 35: 140 cm³/r



bar	(psi)	code
240	(3500)	140
210	(3000)	140
140	(2000)	140
70	(1000)	140
7	(100)	140

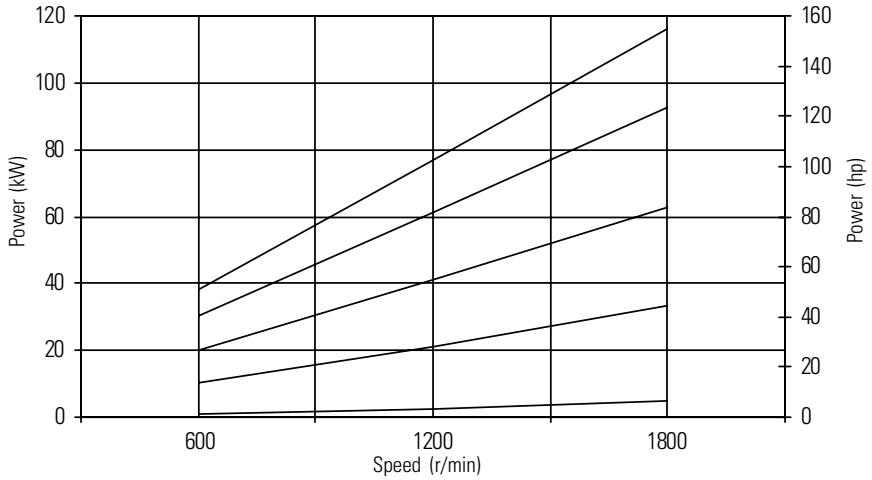
Frame size 35: 158 cm³/r



bar	(psi)	code
241.3	(3500)	158
206.8	(3000)	158
137.9	(2000)	158
68.9	(1000)	158
34.5	(500)	158

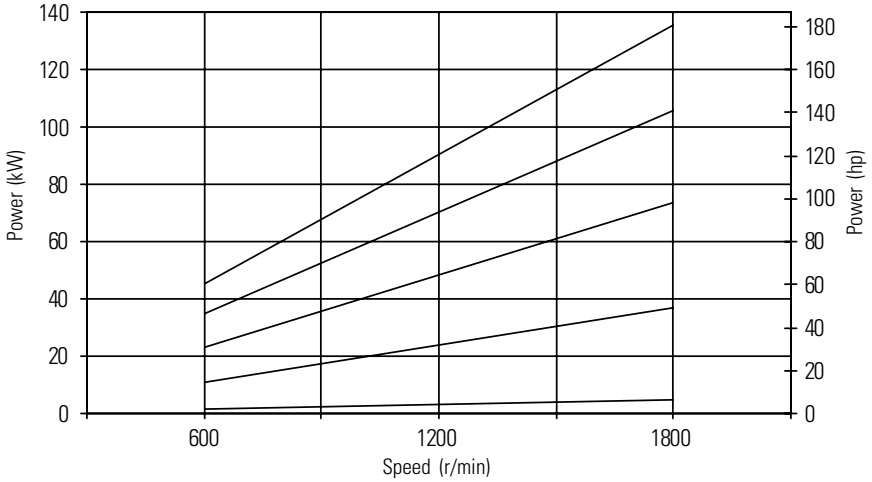
Typical Input Power - Industrial (cont.)

Frame size 45: 140 cm³/r



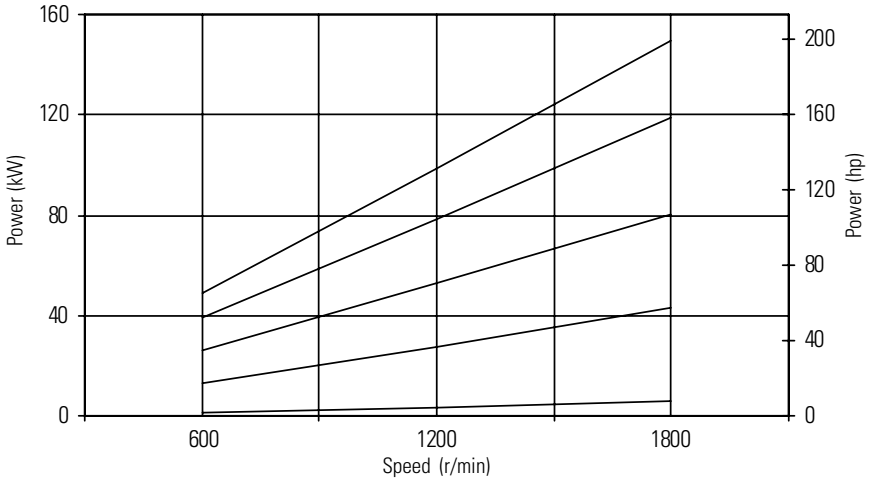
bar	(psi)	code
262	(3800)	140
210	(3000)	140
140	(2000)	140
70	(1000)	140
7	(100)	140

Frame size 45: 160 cm³/r



bar	(psi)	code
262	(3800)	160
210	(3000)	160
140	(2000)	160
70	(1000)	160
7	(100)	160

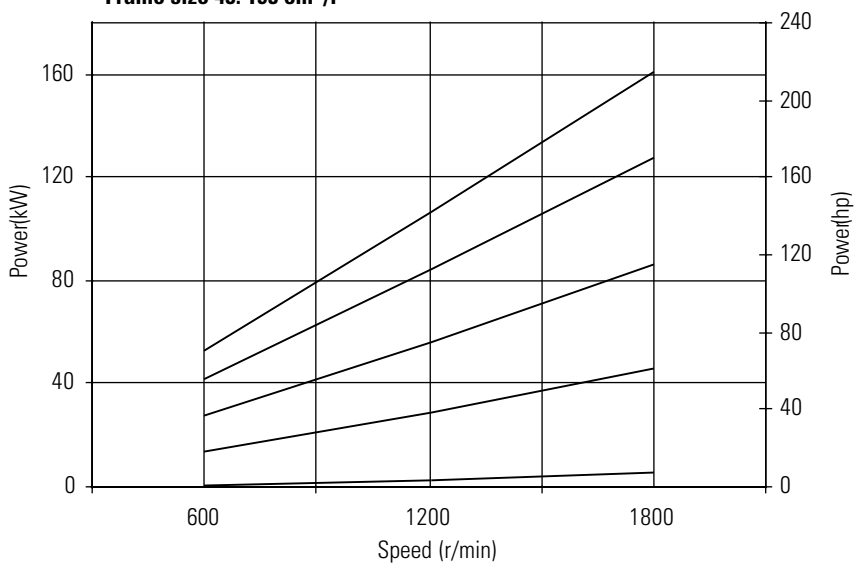
Frame size 45: 180 cm³/r



bar	(psi)	code
262	(3800)	180
210	(3000)	180
140	(2000)	180
70	(1000)	180
7	(100)	180

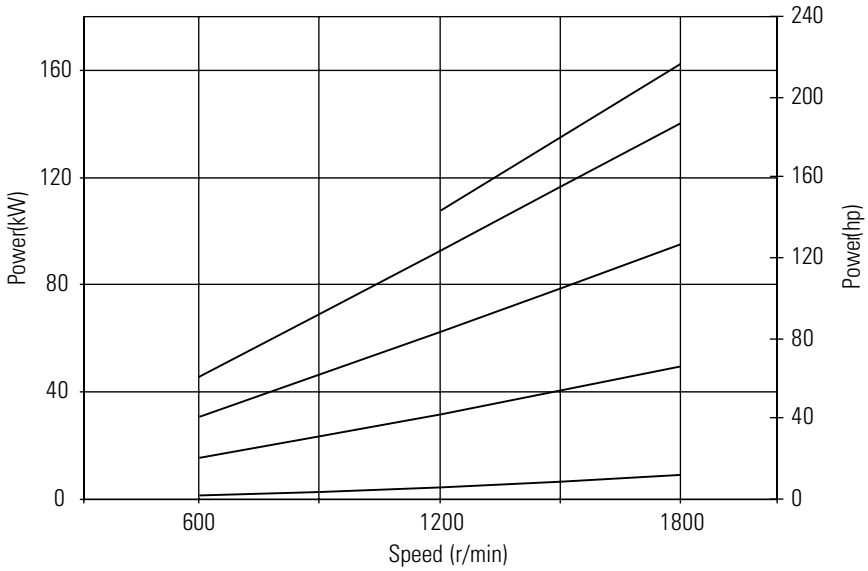
Typical Input Power - Industrial (cont.)

Frame size 45: 195 cm³/r



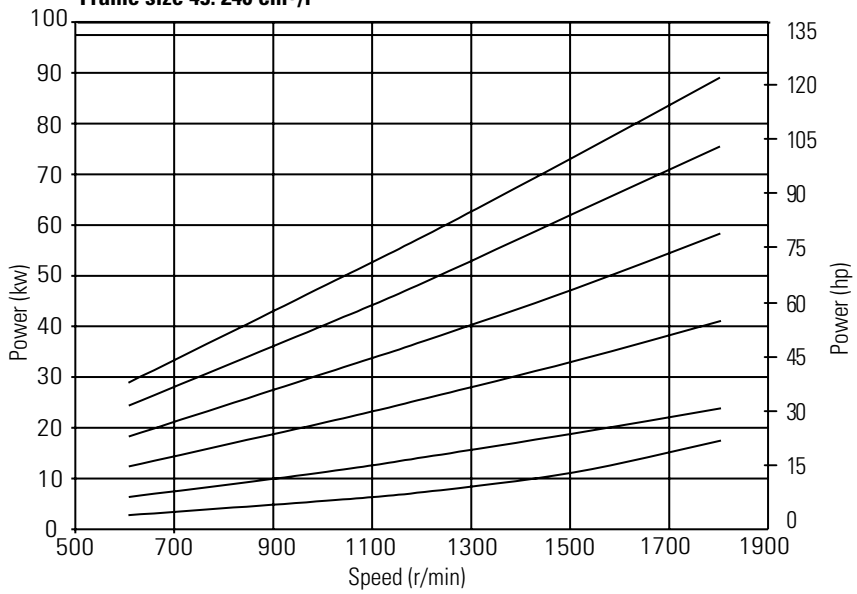
bar	(psi)	code
262	(3800)	195
210	(3000)	195
140	(2000)	195
70	(1000)	195
7	(100)	195

Frame size 45: 215 cm³/r



bar	(psi)	code
262	(3800)	215
210	(3000)	215
140	(2000)	215
70	(1000)	215
7	(100)	215

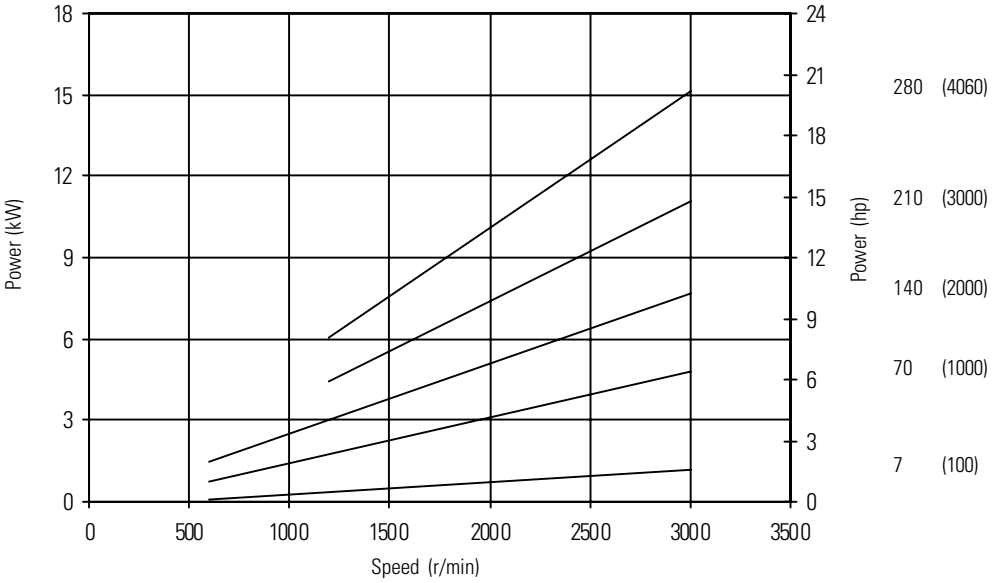
Frame size 45: 240 cm³/r



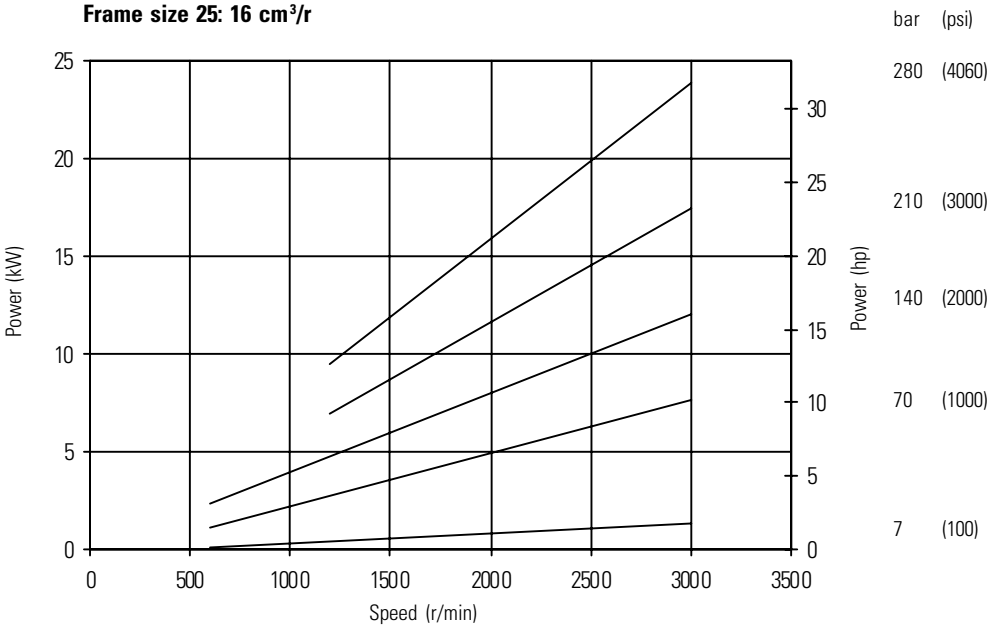
bar	(psi)	code
82.7	(1200)	240
68.9	(1000	240
51.7	(750	240
34.4	(500	240
17.2	(250)	240
6.9	(100)	240

Typical Input Power - Mobile

Frame size 25: 10 cm³/r

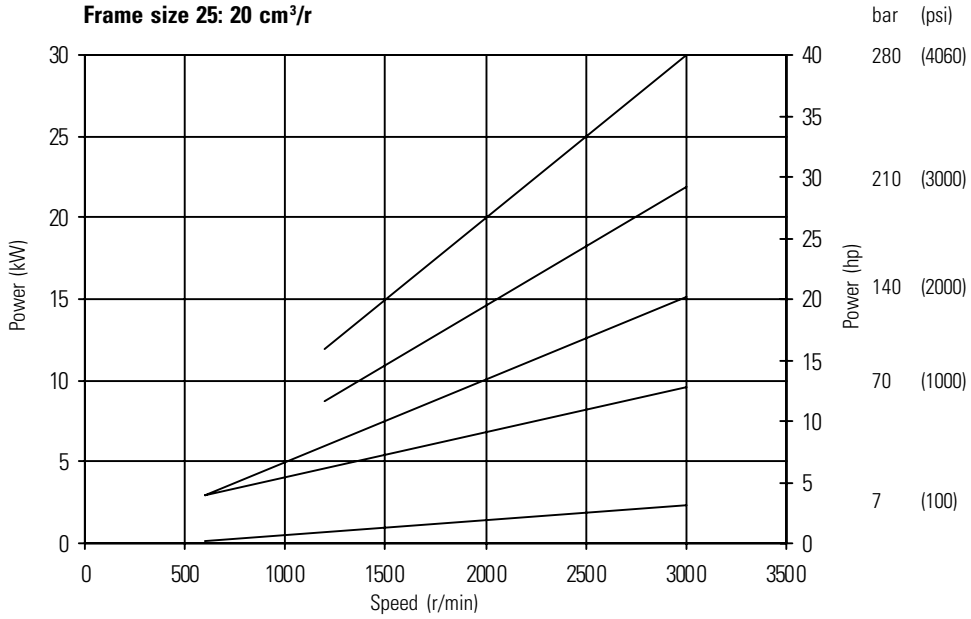


Frame size 25: 16 cm³/r

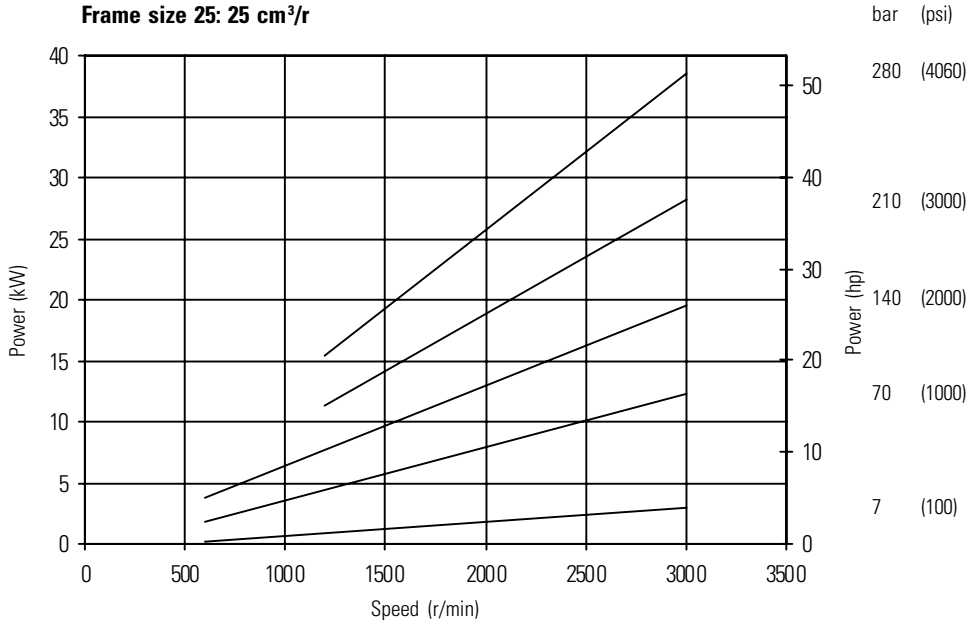


Typical Input Power - Mobile (cont.)

Frame size 25: 20 cm³/r

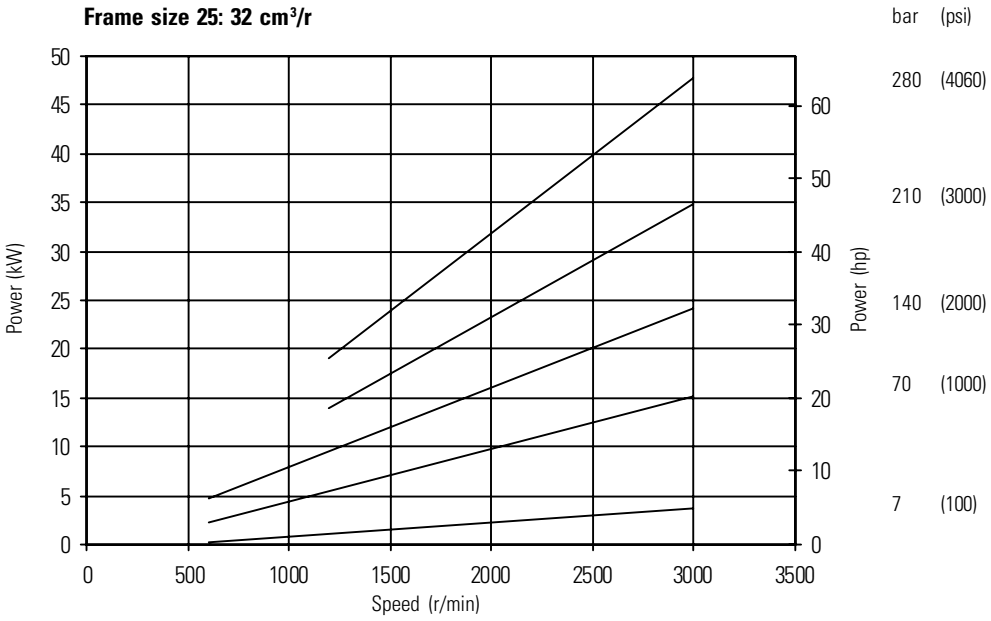


Frame size 25: 25 cm³/r

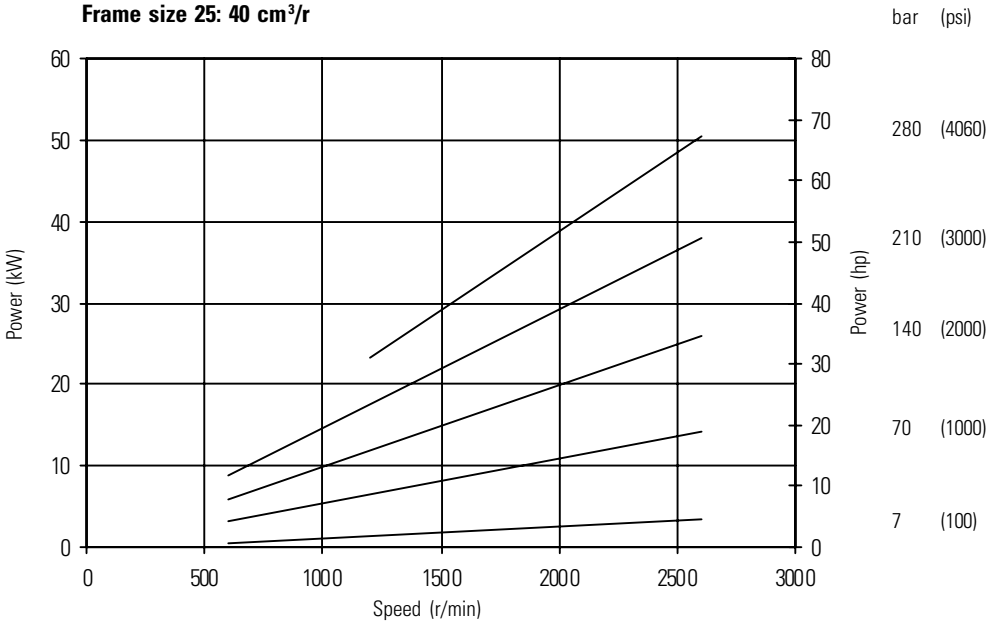


Typical Input Power - Mobile (cont.)

Frame size 25: 32 cm³/r

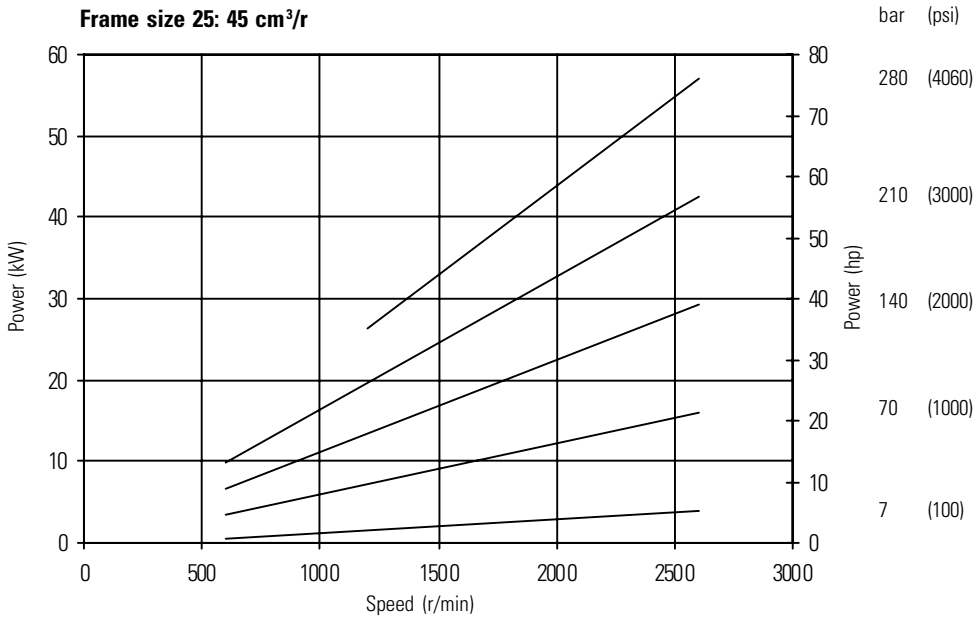


Frame size 25: 40 cm³/r

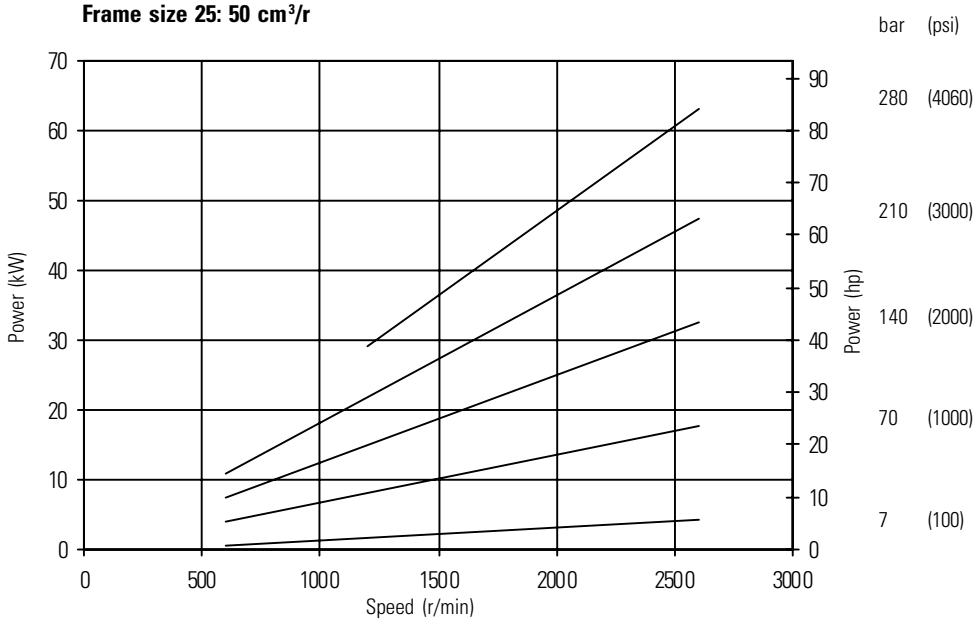


Typical Input Power - Mobile (cont.)

Frame size 25: 45 cm³/r

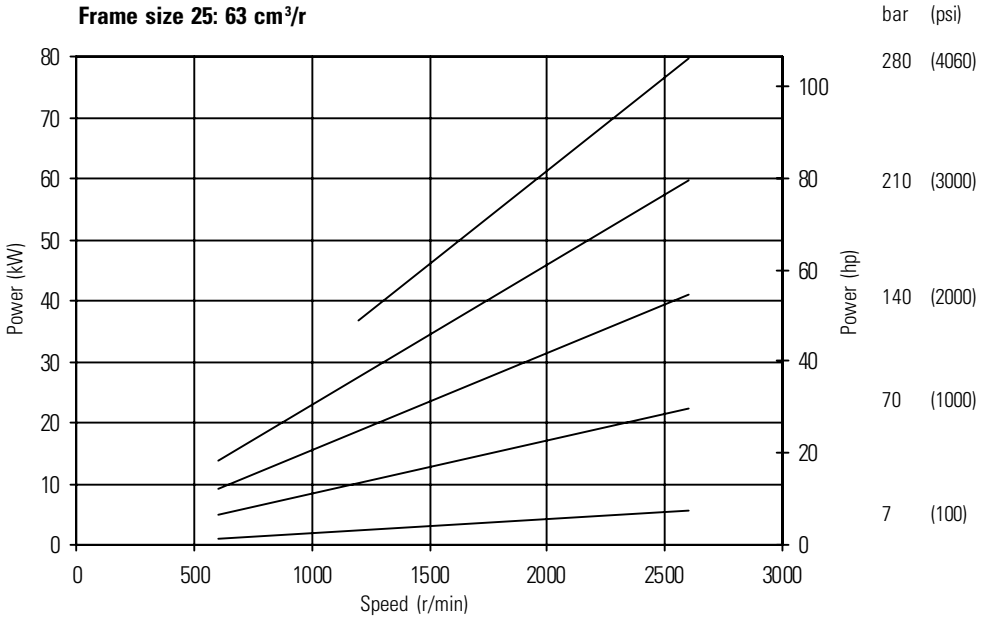


Frame size 25: 50 cm³/r

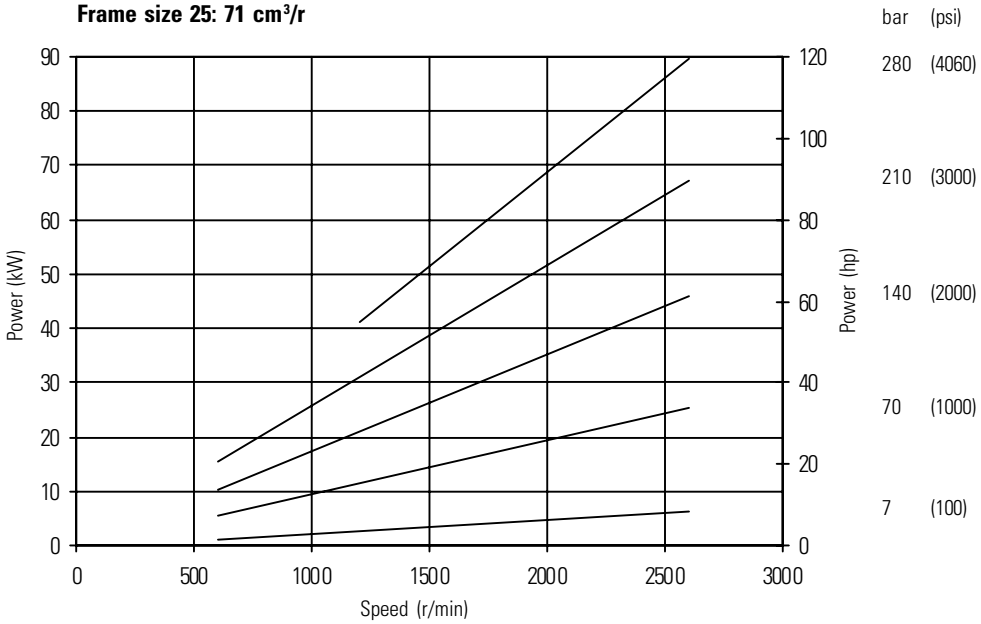


Typical Input Power - Mobile (cont.)

Frame size 25: 63 cm³/r

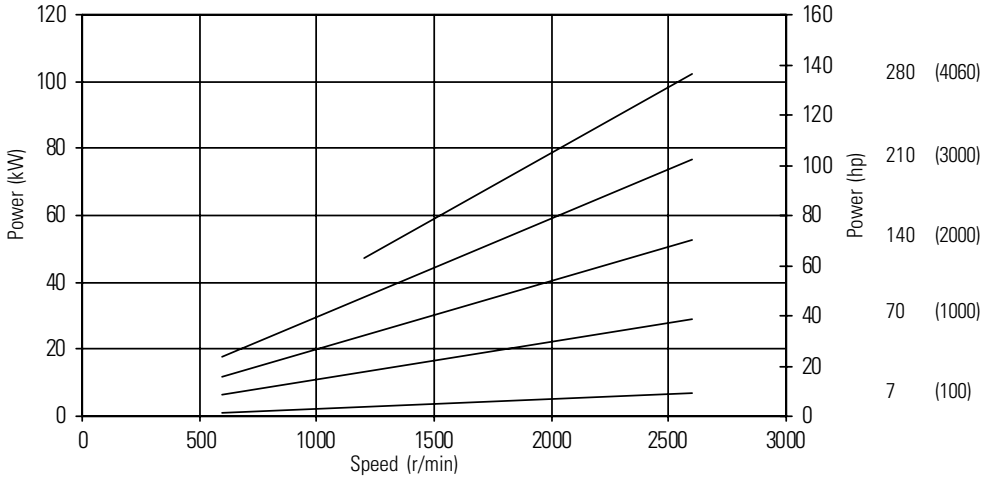


Frame size 25: 71 cm³/r

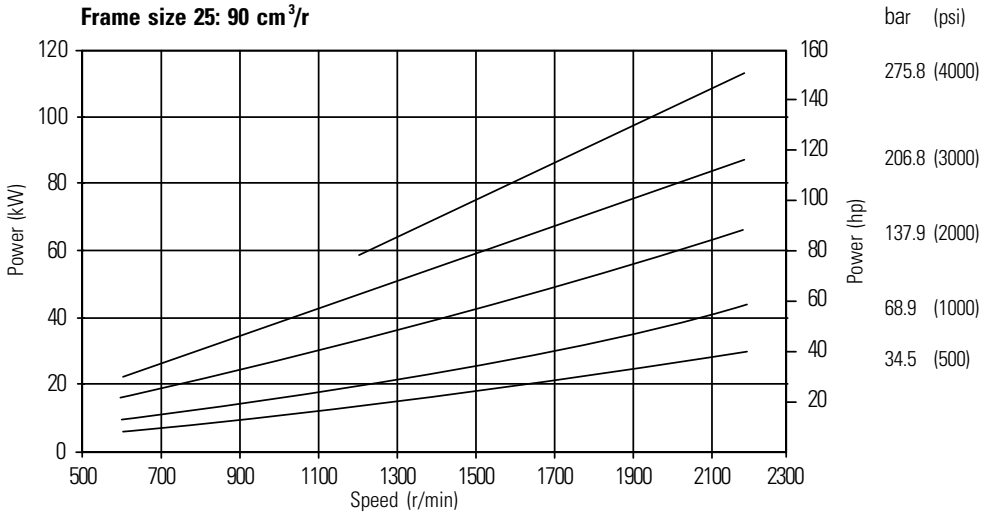


Typical Input Power - Mobile (cont.)

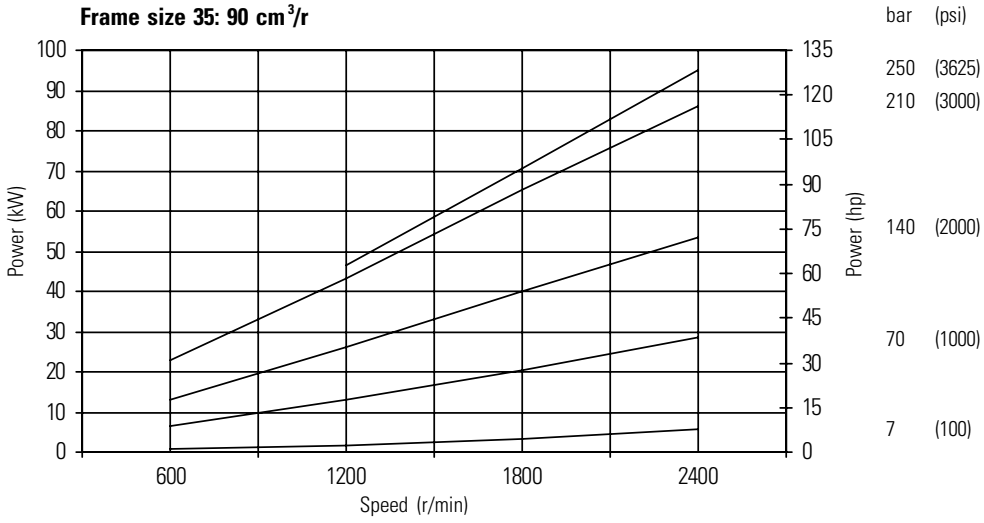
Frame size 25: 80 cm³/r



Frame size 25: 90 cm³/r

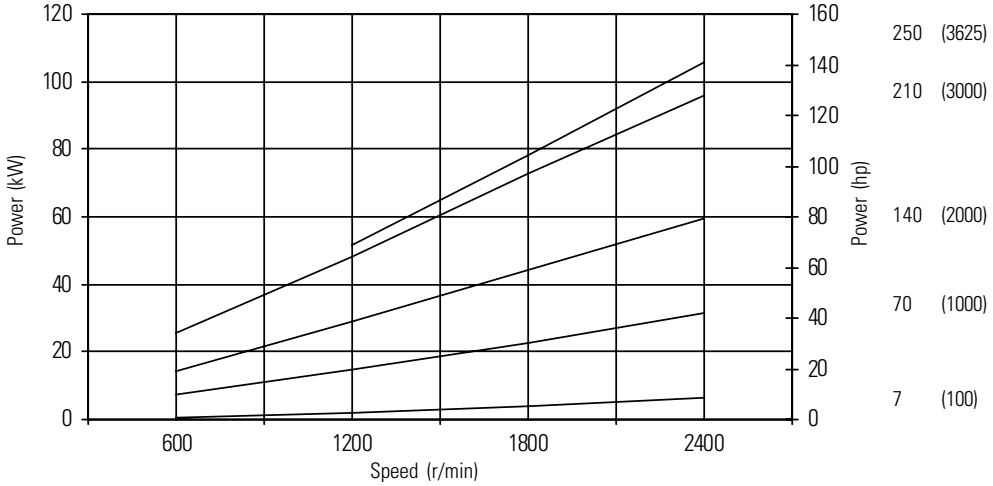


Frame size 35: 90 cm³/r

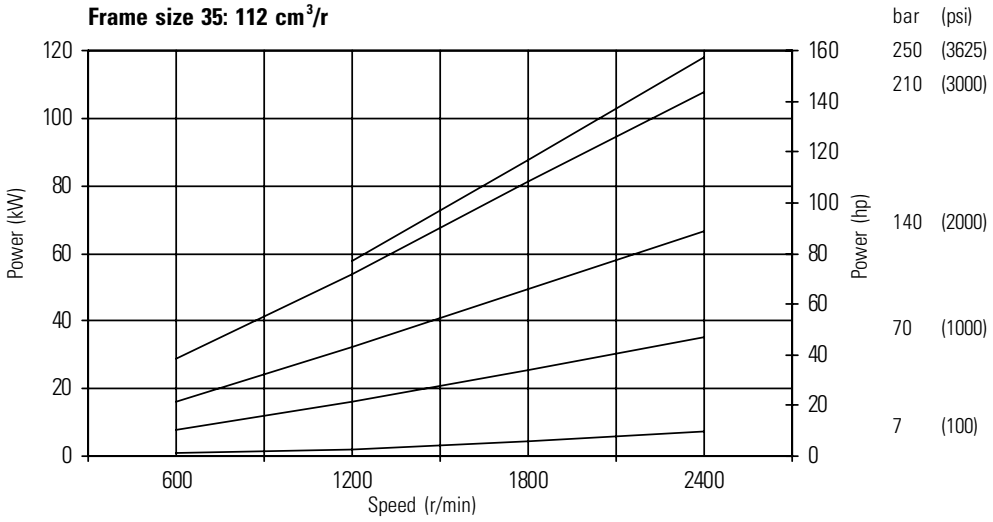


Typical Input Power - Mobile (cont.)

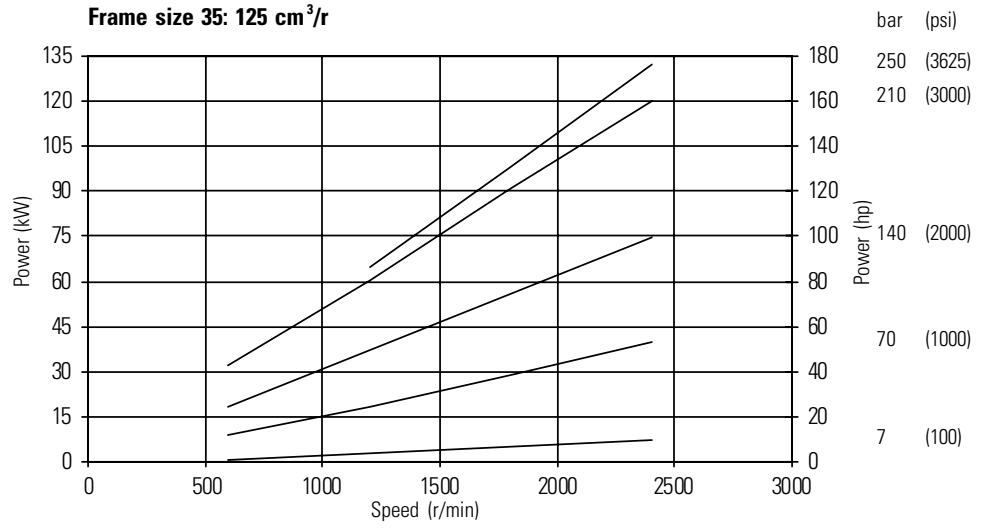
Frame size 35: 100 cm³/r



Frame size 35: 112 cm³/r

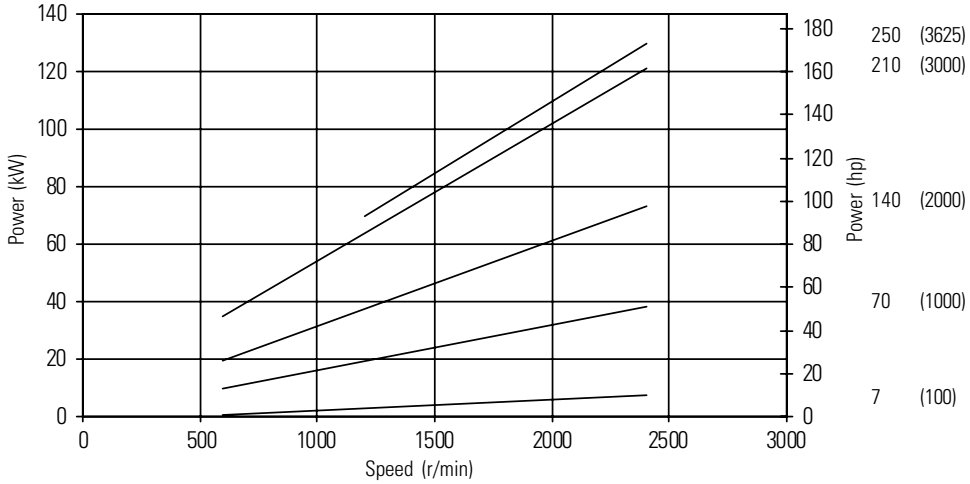


Frame size 35: 125 cm³/r

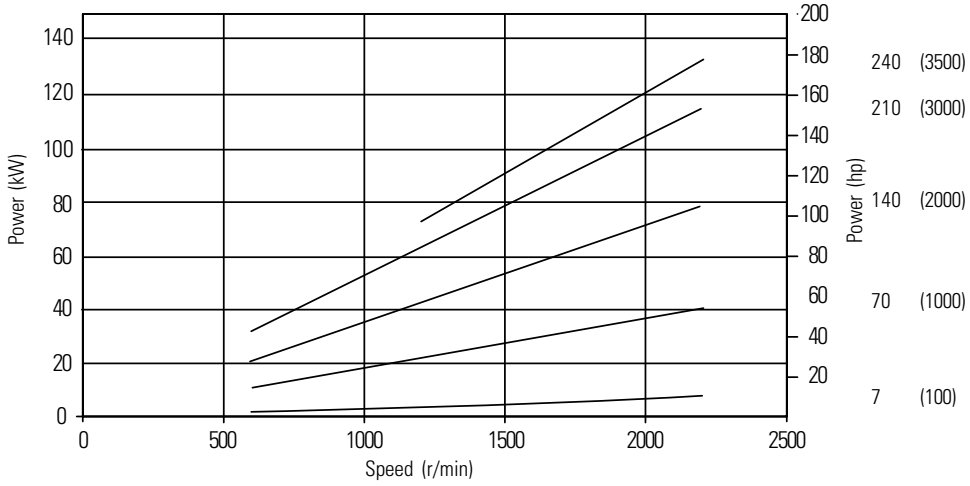


Typical Input Power - Mobile (cont.)

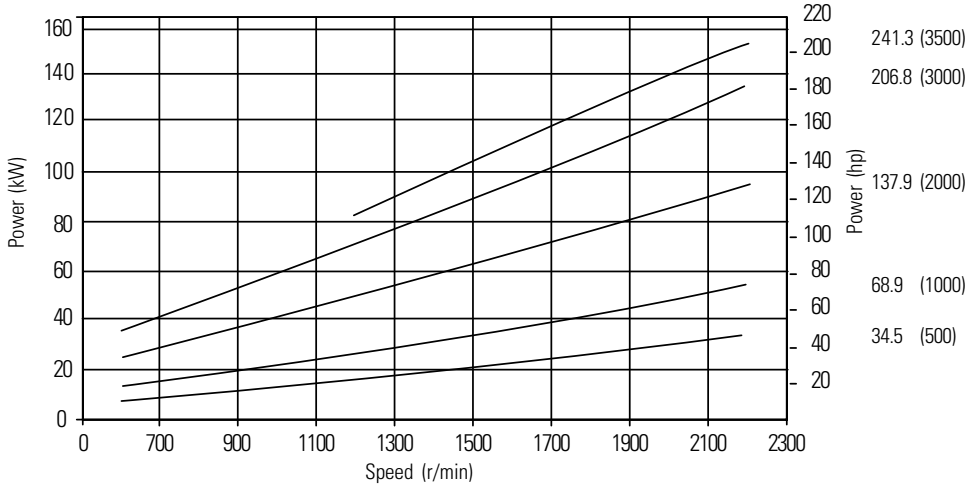
Frame size 35: 135 cm³/r



Frame size 35: 140 cm³/r

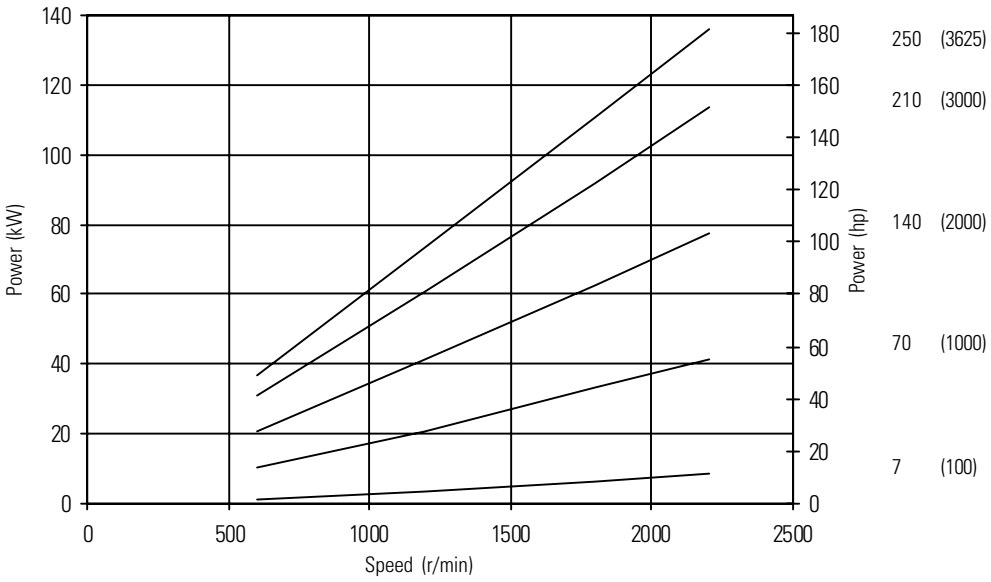


Frame size 35: 158 cm³/r

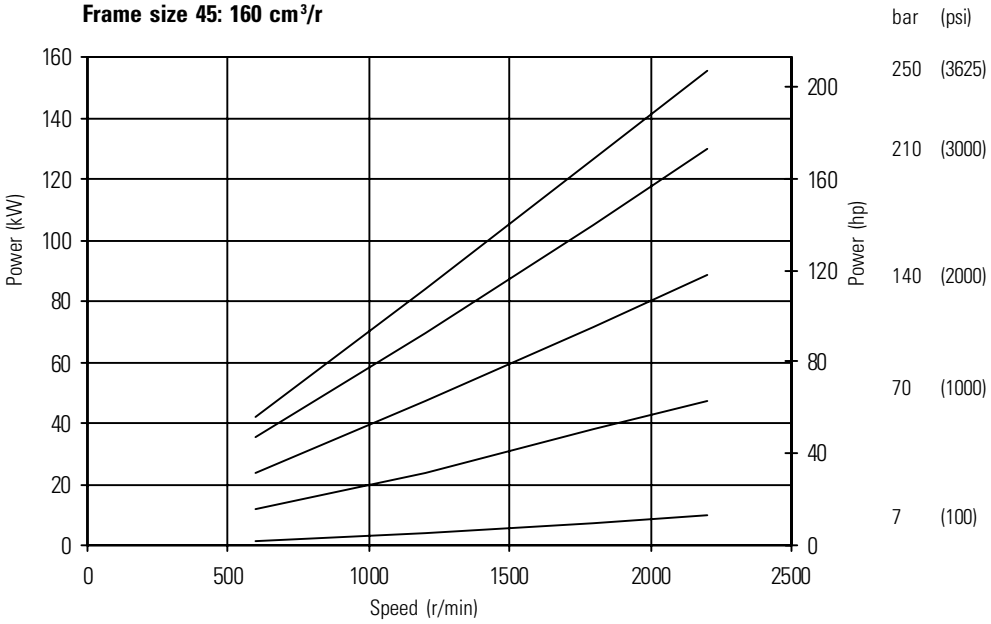


Typical Input Power - Mobile (cont.)

Frame size 45: 140 cm³/r

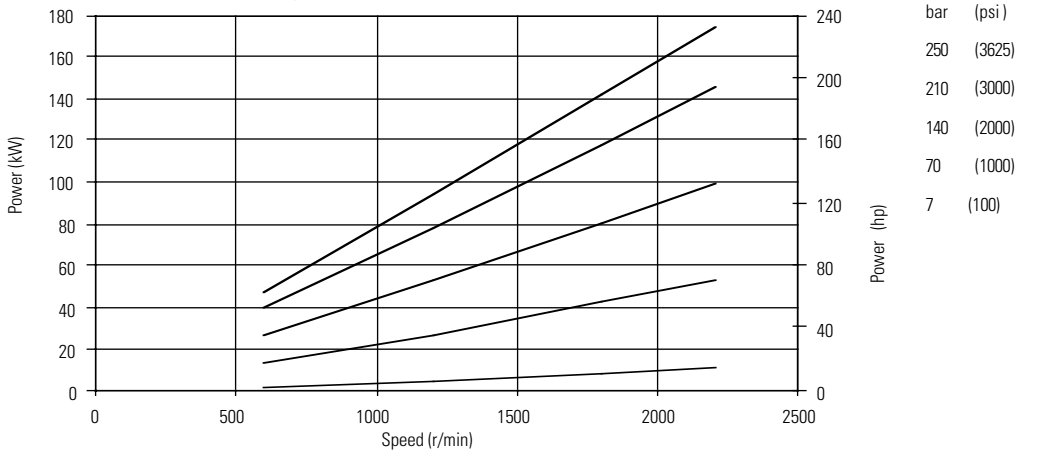


Frame size 45: 160 cm³/r

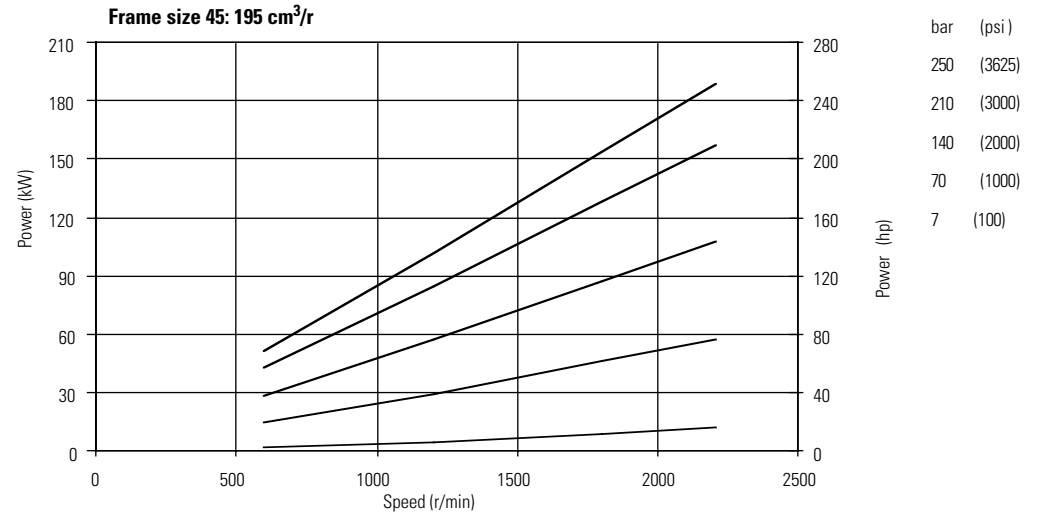


Typical Input Power - Mobile (cont.)

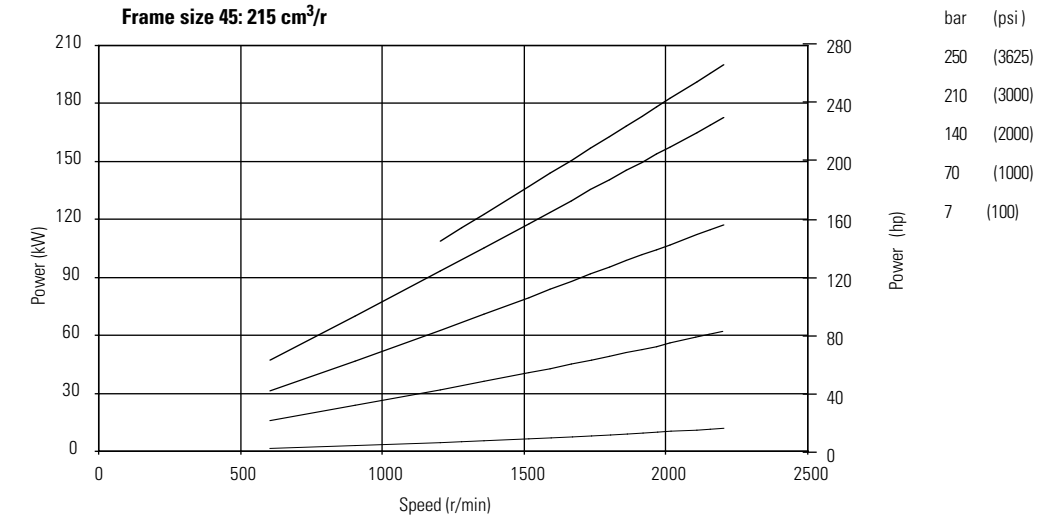
Frame size 45: 180 cm³/r



Frame size 45: 195 cm³/r



Frame size 45: 215 cm³/r



VMQ1 25
Single Pumps

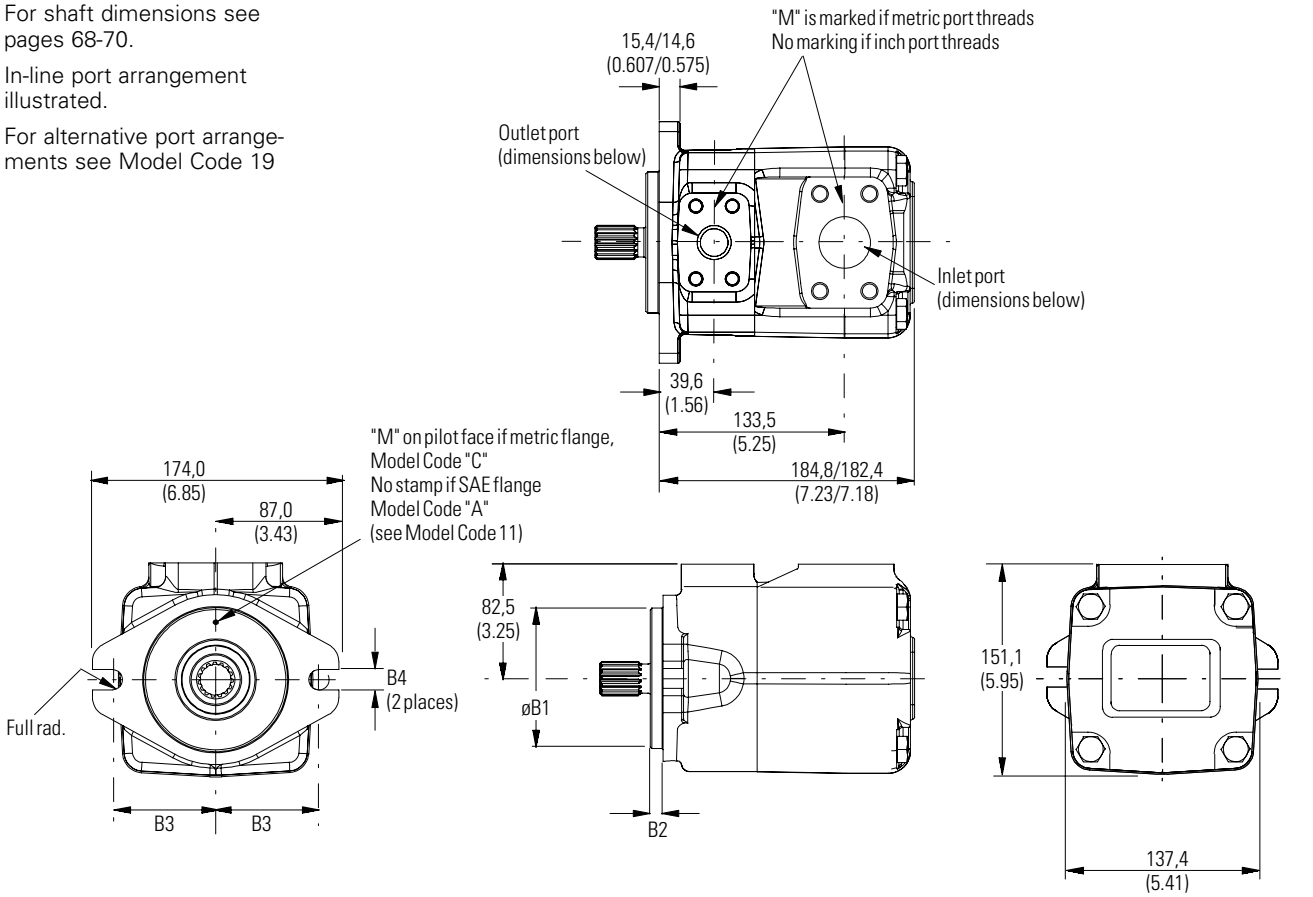
Installation Dimensions
in mm (in)

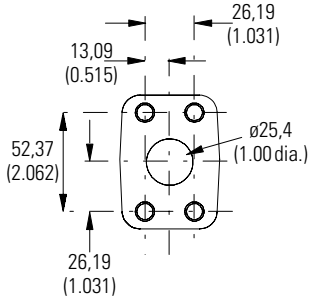
For shaft dimensions see pages 68-70.

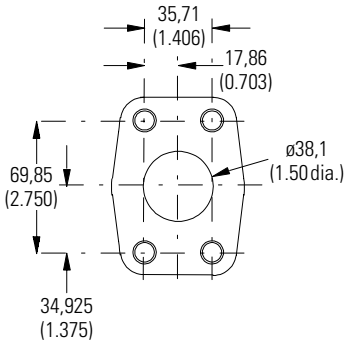
In-line port arrangement illustrated.

For alternative port arrangements see Model Code 19

3rd angle projection







Outlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 3/8"-16UNC-2B, 22,0 (0.87) min. depth
Code B: M10 x 1.5, 17,0 (0.67) min. depth

Inlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 1/2"-13UNC-2B, 27,0 (1.06) min. depth
Code B: M12 x 1.75, 19,5 (0.77) min. depth

Model Code 11	Flange Type	Ø B1	B2	B3	B4
A	SAE 101-2	101,55/101,6 (3.998/4.000)	9,19/9,70 0.362/0.382)	73,00 (2.874)	14,17/14,55 (0.558/0.573)
C	ISO 3019/2 100A2HW	99,946/100,0 (3.935/3.937)	9,00/9.50 (0.354/0.374)	70,00 (2.756)	14,00/14,27 (0.551/0.562)

VMQ1 35
Single Pumps

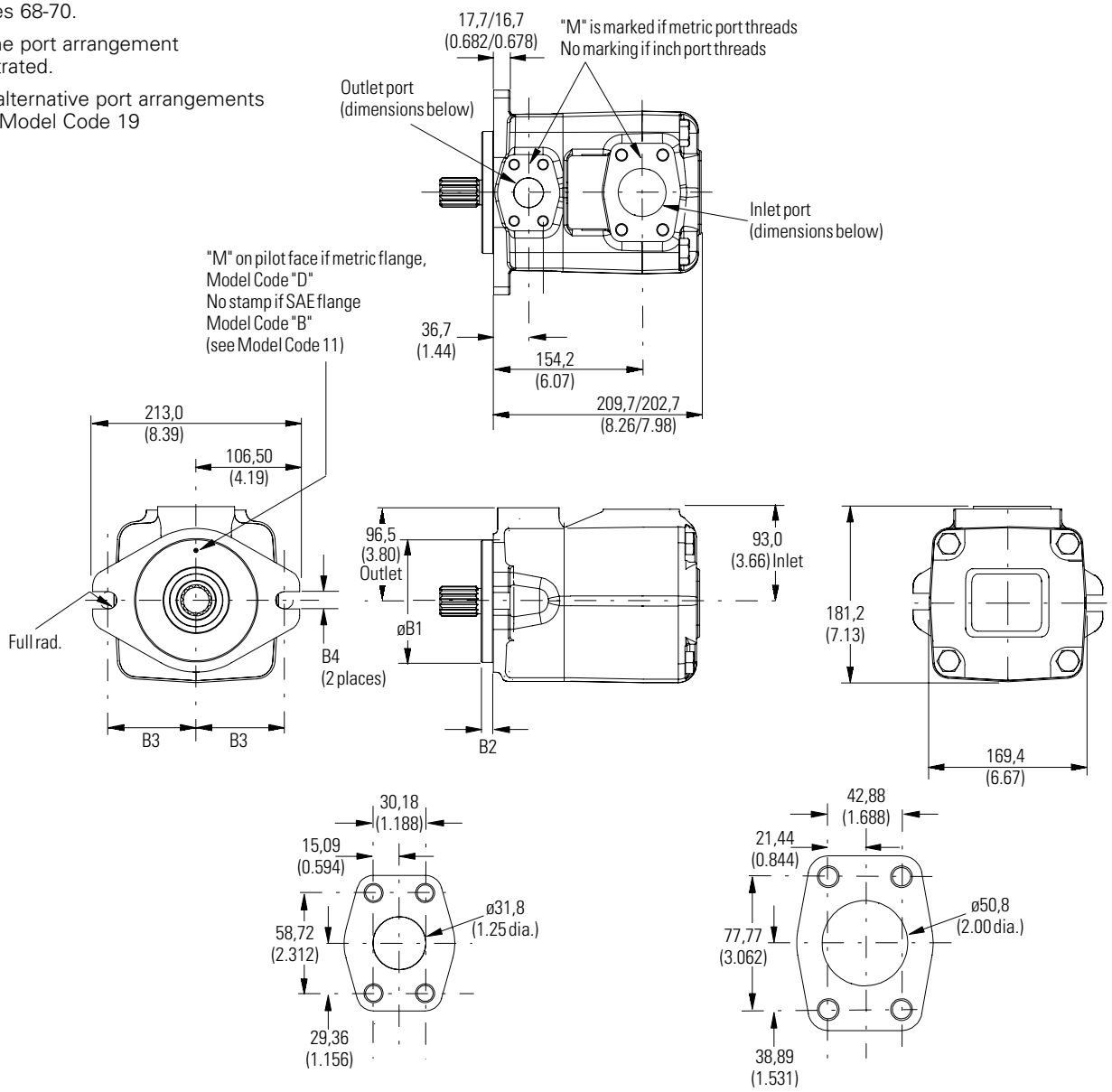
Installation Dimensions
in mm (in)

3rd angle projection

For shaft dimensions see pages 68-70.

In-line port arrangement illustrated.

For alternative port arrangements see Model Code 19



Outlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: $^{7}/_{16}$"-14UNC-2B, 28,4 (1.12) min. depth
Code B: M10 x 1.5, 17,0 (0.67) min. depth

Inlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: $^{1}/_{2}$"-13UNC-2B, 27,0 (1.06) min. depth
Code B: M12 x 1.75, 20,0 (0.79) min. depth

Model Code 11	Flange Type	ØB1	B2	B3	B4
B	SAE 127-2	126,95/127,00 (4.998/5.000)	12,19/12,70 (0.480/0.500)	90,50 (3.563)	17,37/17,75 (0.684/0.699)
D	ISO 3019/2 125A2HW	124,94/125,00 (4.919/4.921)	9,00/9,50 (0.354/0.374)	90,00 (3.543)	18,00/18,27 (0.709/0.719)

VMQ1 45
Single Pumps

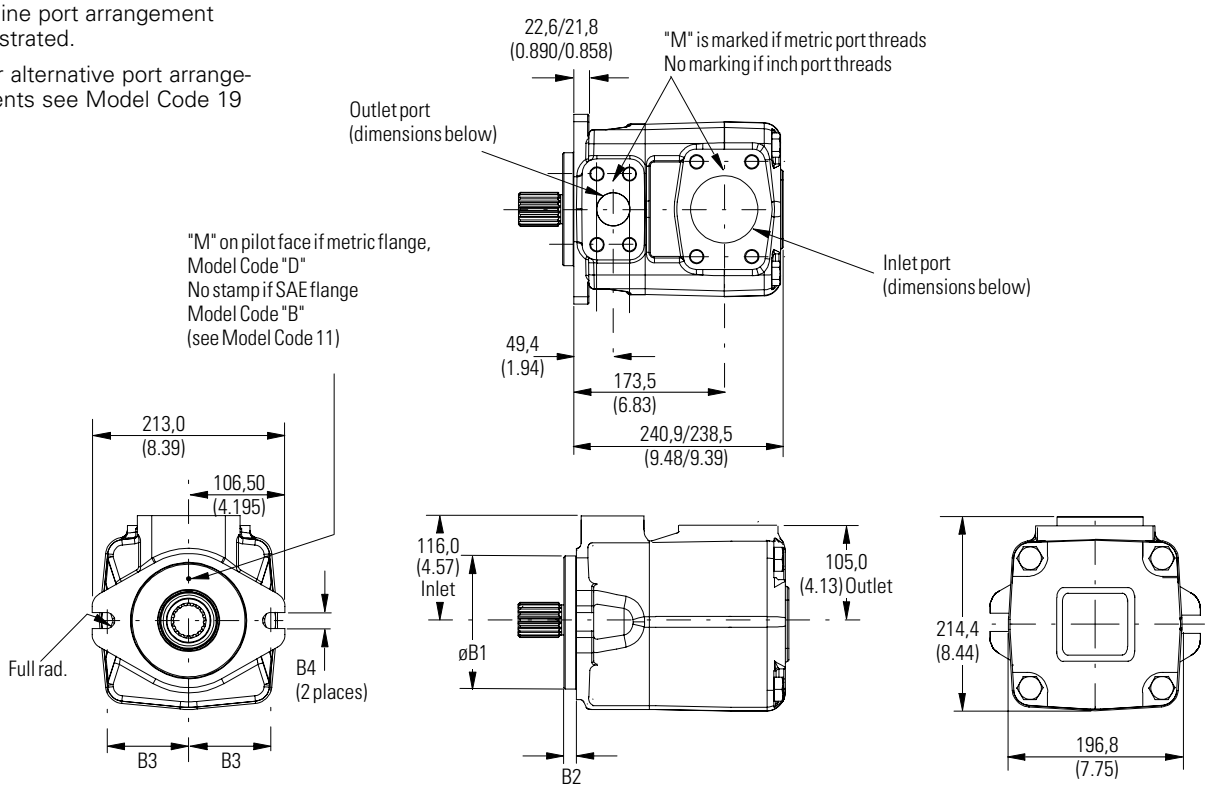
Installation Dimensions
in mm (in)

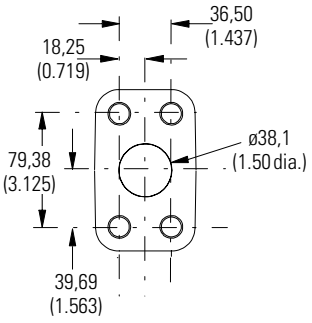
For shaft dimensions see pages 68-70.

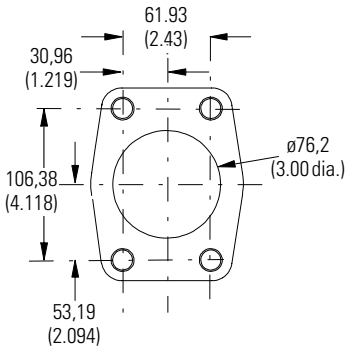
In-line port arrangement illustrated.

For alternative port arrangements see Model Code 19

3rd angle projection







Outlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 5/8"-11UNC-2B, 35,0 (1.38) min. depth
Code B: M16 x 2,0, 25,5 (1.00) min. depth

Inlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 5/8"-11UNC-2B, 30,2 (1.19) min. depth
Code B: M16 x 2,0, 28,5 (1.12) min. depth

Model Code 11	Flange Type	ØB1	B2	B3	B4
B	SAE 127-2	126,95/127,00 (4.998/5.000)	12,19/12,70 (0.480/0.500)	90,50 (3.563)	17,37/17,75 (0.684/0.699)
D	ISO 3019/2 125A2HW	124,94/125,00 (4.919/4.921)	9,00/9,50 (0.354/0.374)	90,00 (3.543)	18,00/18,27 (0.709/0.719)

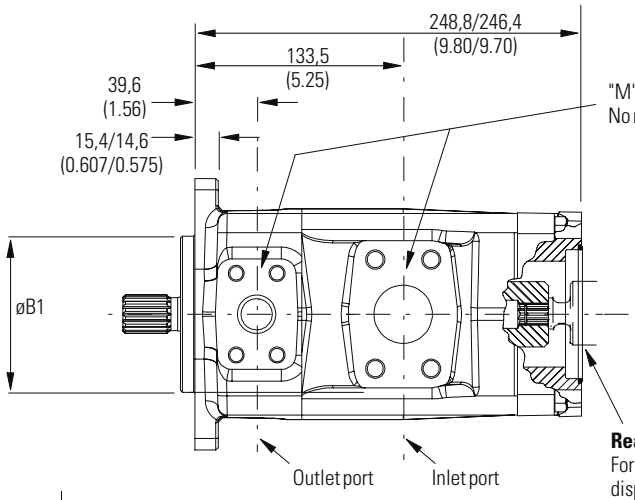
VMQ1 25T
Thru-Drive Pumps

Installation Dimensions
in mm (in)

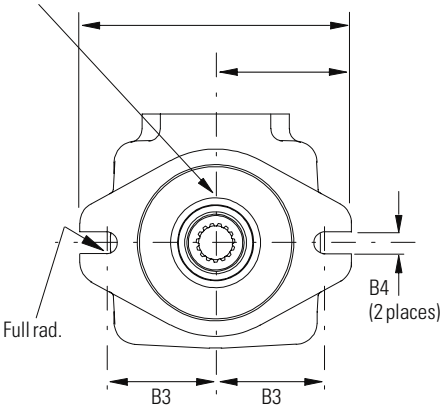
Illustration shows assembly with port configuration C (outlet in line with inlet) as per Model Code 19

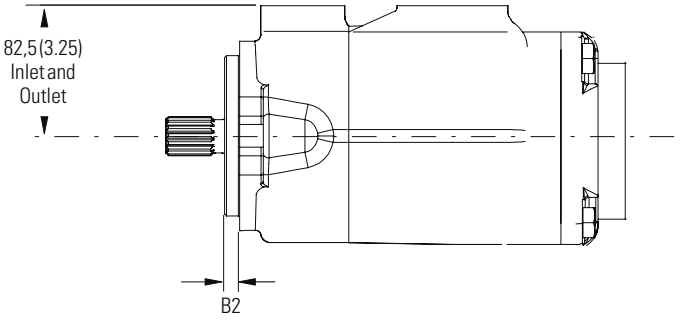
For shaft dimensions see pages 68-70.

3rd angle projection

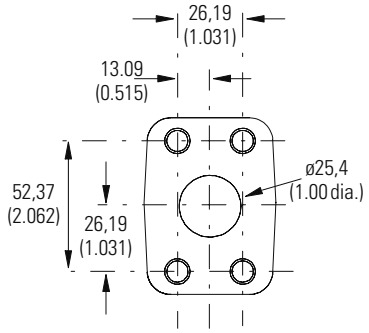


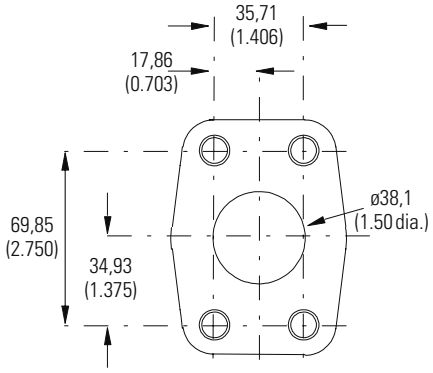
"M" on pilot face if metric flange, Model Code "C"
No stamp if SAE flange Model Code "A"
(see Model Code 11)





Rear Mount Pumps
For list of suitable fixed and variable displacement Vickers™ pumps, see page 56.
For details of rear mount and coupling options, see next page.





Outlet port
Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 3/8"-16UNC-2B, 22,0 (0.87) min. depth
Code B: M10 x 1,5, 17,0 (0.67) min. depth

Inlet port
Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 1/2"-13UNC-2B, 27,0 (1.06) min. depth
Code B: M12 x 1,75, 19,5 (0.77) min. depth

Model Code 11	Flange Type	ØB1	B2	B3	B4
A	SAE 101-2	101,55/101,60 (3.998/4.000)	9,19/9,70 0.362/0.382)	73,00 (2.874)	14,17/14,55 (0.558/0.573)
C	ISO 3019/2 100A2HW	99,946/100,00 (3.935/3.937)	9,00/9,50 (0.354/0.374)	70,00 (2.756)	14,00/14,27 (0.551/0.562)

VMQ1 25T
Thru-Drive Pumps Rear Mount/ Coupling Details

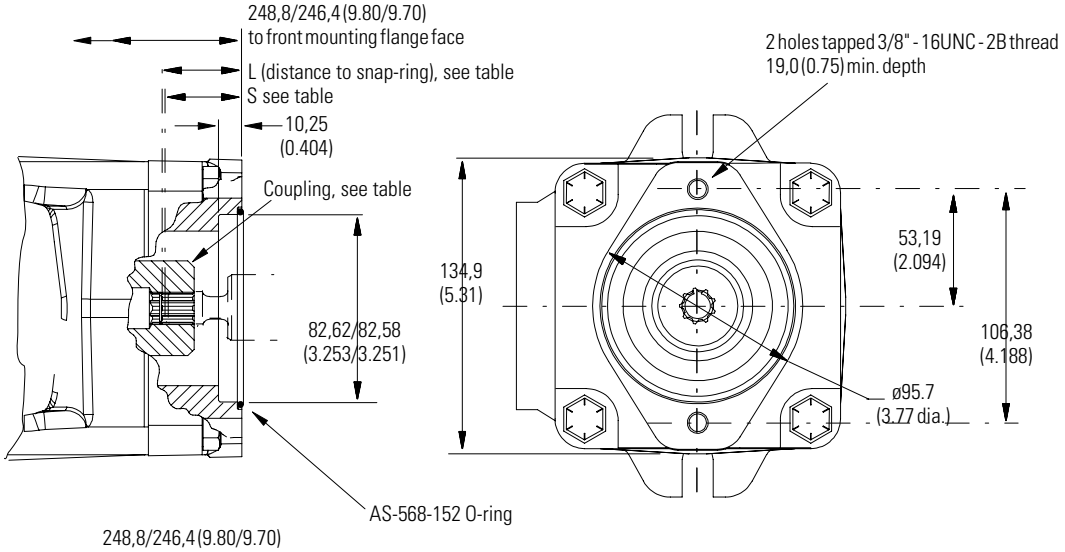
3rd angle projection

Installation Dimensions in mm (in)

Detail of SAE A flange per Model Code 12 = A

(SAE flange in line with mounting flange.)

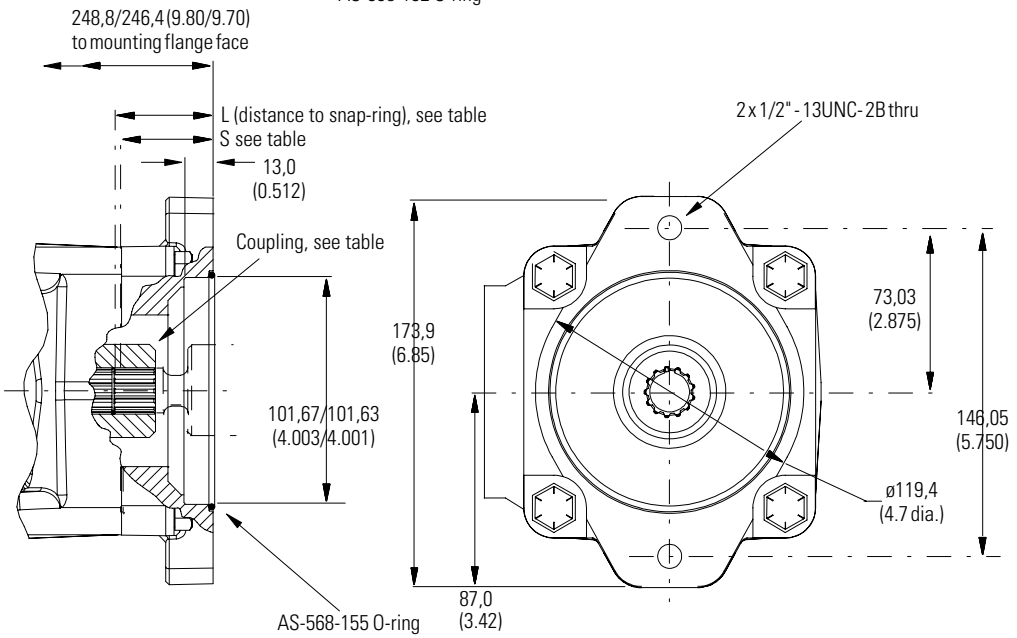
Coupling options per Model Code 15 16 and details are given in table below.



Detail of SAE B flange per Model Code 12 = E

(SAE B flange in line with mounting flange.)

Coupling options per Model Code 15 16 and details are given in table below.



Coupling Code	Description	Shaft Extension S L	
16	For pump shaft of SAE "A" size with 30˚ involute splined shaft (per SAE std J744 JUL88) 9T 16/32 DP (per ANSI B92.1a 1976)	32,8/31,2 (1.263/1.257)	33,5 (1.32) min.
22	For pump shaft of SAE "B" size with 30˚ involute splined shaft (per SAE std J744 JUL88) 13T 16/32 DP (per ANSI B92.1a 1976)	41,8/40,2 (1.64/1.58)	42,5 (1.67) min.
25	For pump shaft of SAE "B-B" size with 30˚ involute splined shaft (per SAE std J744 JUL88) 15T 16/32 DP (per ANSI B92.1a 1976)	46,8/45,2 (1.84/1.78)	47,4 (1.87) min.

VMQ1 35T
Thru-Drive Pumps

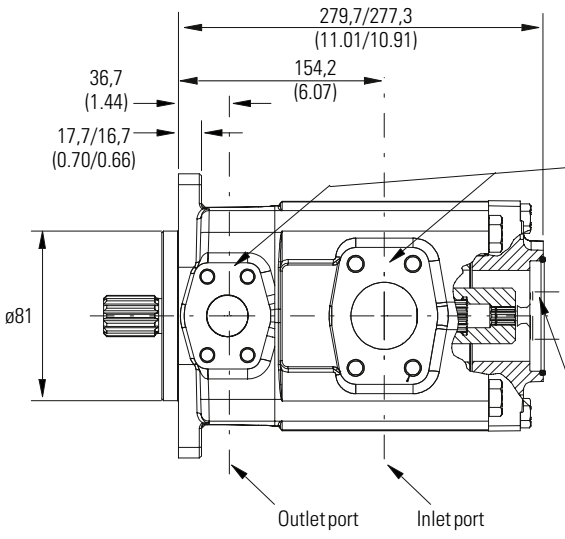
Installation Dimensions
in mm (in)

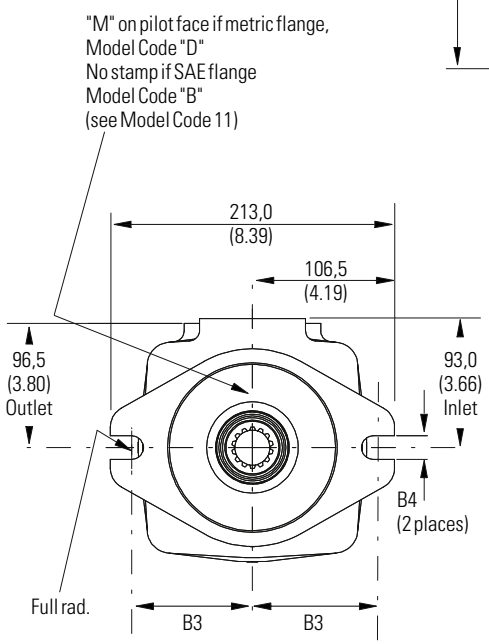
Illustration shows assembly with port configuration C

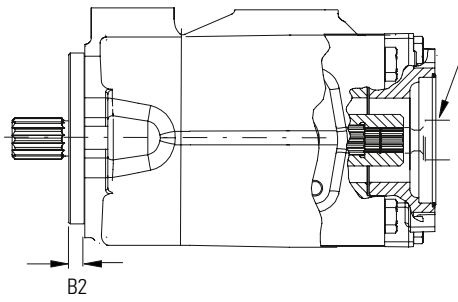
(outlet in line with inlet) as per Model Code 19

For shaft options see pages 68-70.

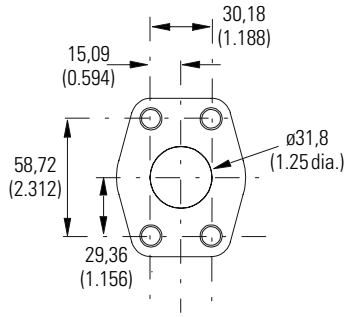
3rd angle projection

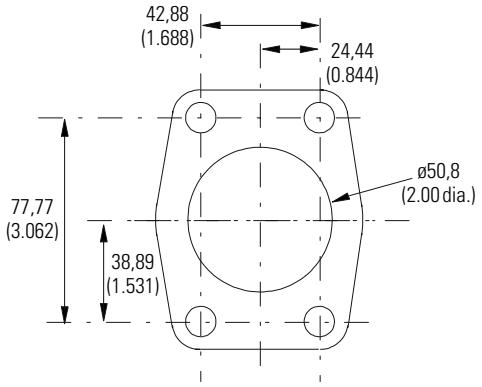






Rear Mount Pumps
For list of suitable fixed and variable displacement Vickers™ pumps, see page 56. For details of rear mount and coupling options, see pages 54 and 55.





Outlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: $^{7}/_{16}$"-14UNC-2B, 28,4 (1.12) min. depth
Code B: M10 x 1,5, 17,0 (0.67) min. depth

Inlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: $^{1}/_{2}$"-13UNC-2B, 27,0 (1.06) min. depth
Code B: M12 x 1,75, 20,0 (0.79) min. depth

Model Code 11	Flange Type	ØB1	B2	B3	B4
B	SAE 127-2	126,95/127,00 (4.998/5.000)	12,19/12,70 (0.480/0.500)	90,50 (3.563)	17,37/17,75 (0.684/0.699)
D	ISO 3019/2 125A2HW	124,94/125,00 (4.919/4.921)	9,00/9,50 (0.354/0.374)	90,00 (3.543)	18,00/18,27 (0.709/0.719)

VMQ1 45T
Thru-Drive Pumps

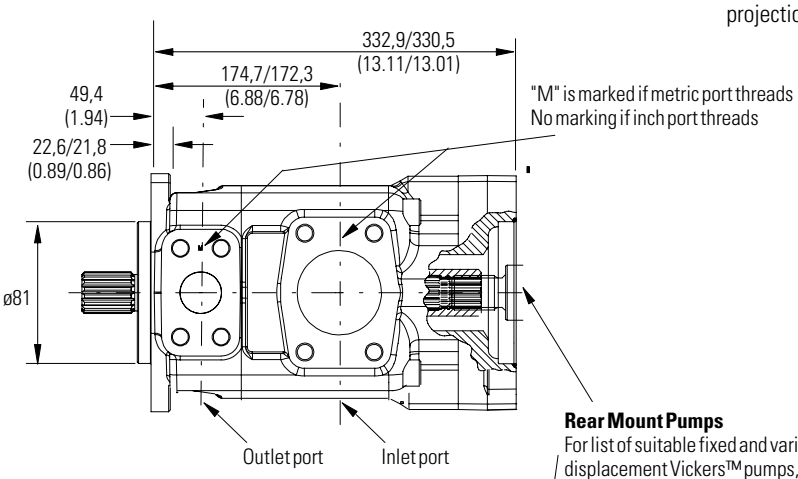
Installation Dimensions
in mm (in)

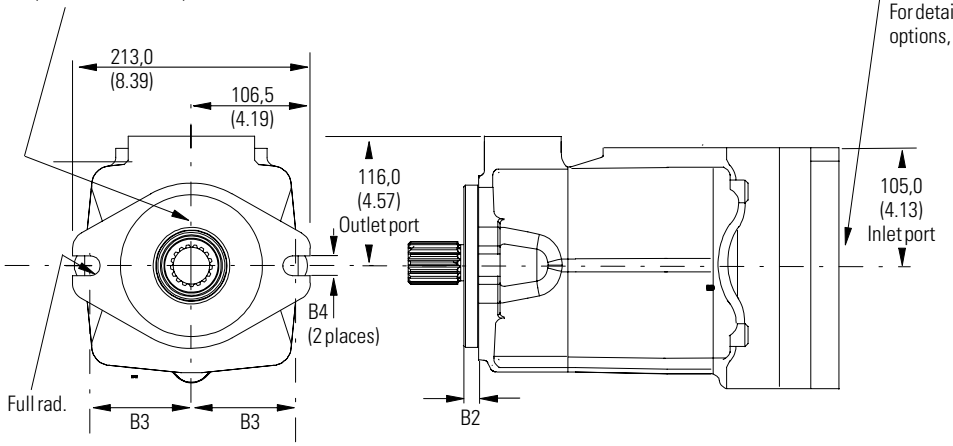
Illustration shows assembly with port configuration C

(outlet in line with inlet) as per Model Code 19

For shaft options see pages 68-70.

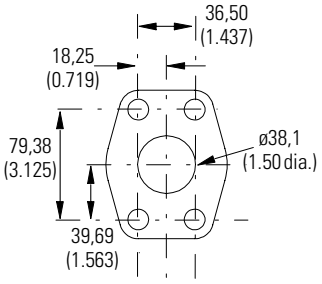
3rd angle projection

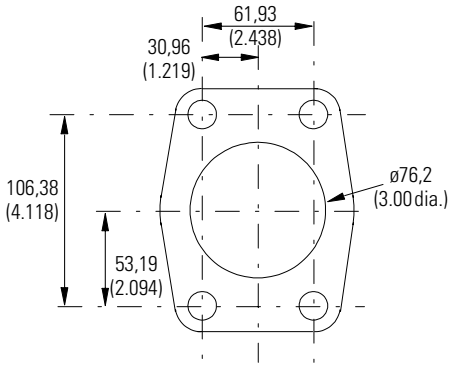




Rear Mount Pumps

For list of suitable fixed and variable displacement Vickers™ pumps, see page 56. For details of rear mount and coupling options, see pages 54 and 55.





Outlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 5/8"-11UNC-2B, 35,0 (1.38) min. depth
Code B: M16 x 2,00, 25,5 (1.00) min. depth

Inlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 5/8"-11UNC-2B, 30,2 (1.19) min. depth
Code B: M16 x 2,00, 28,5 (1.12) min. depth

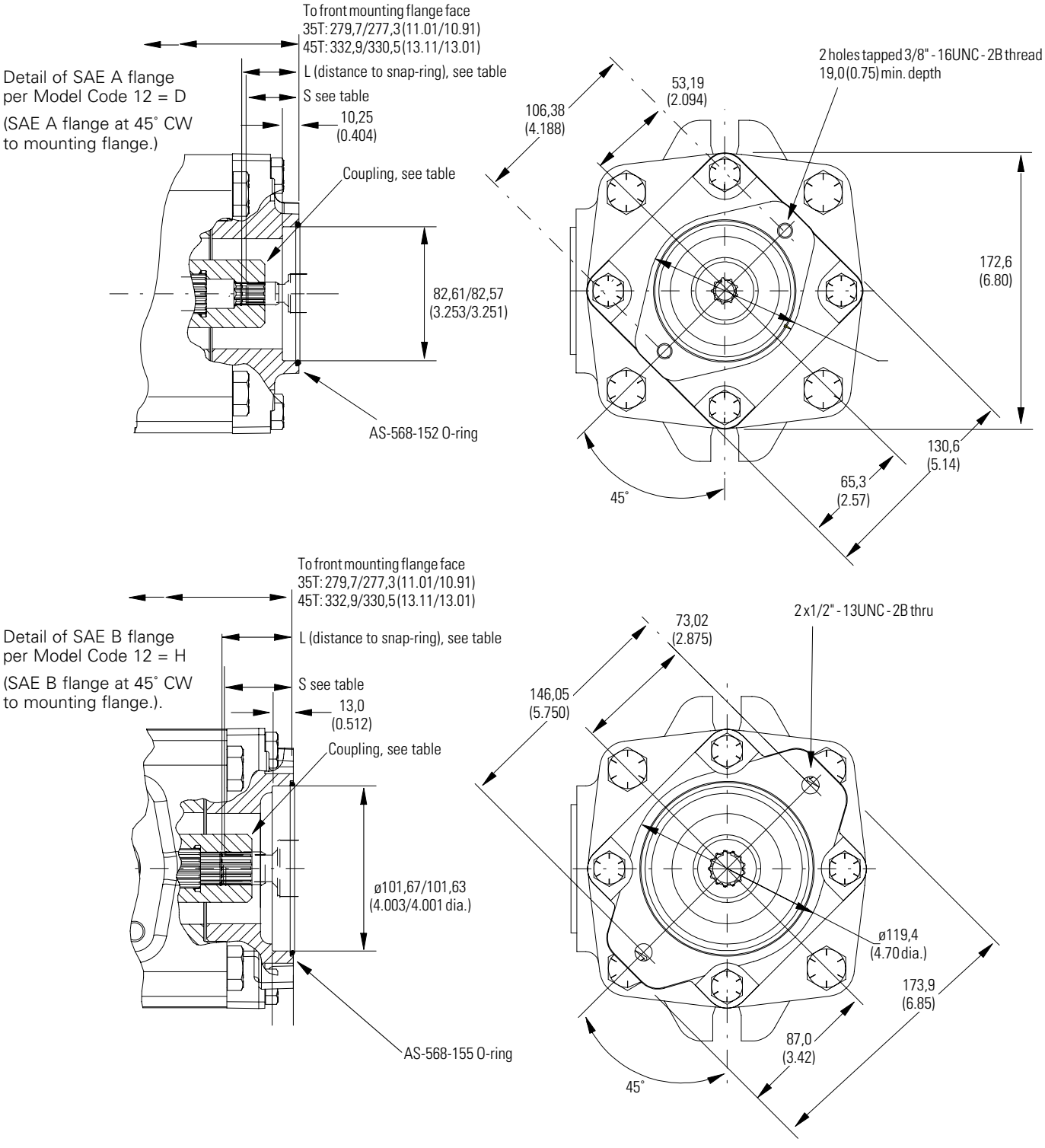
Model Code 11	Flange Type	ØB1	B2	B3	B4
B	SAE 127-2	126,95/127,00 (4.998/5.000)	12,19/12,70 (0.480/0.500)	90,50 (3.563)	17,37/17,75 (0.684/0.699)
D	ISO 3019/2 125A2HW	124,94/125,00 (4.919/4.921)	9,00/9,50 (0.354/0.374)	90,00 (3.543)	18,00/18,27 (0.709/0.719)

VMQ1 35T/45T

Thru-Drive Pumps
Rear Mount/Coupling Details

Installation Dimensions
in mm (in)

3rd angle projection

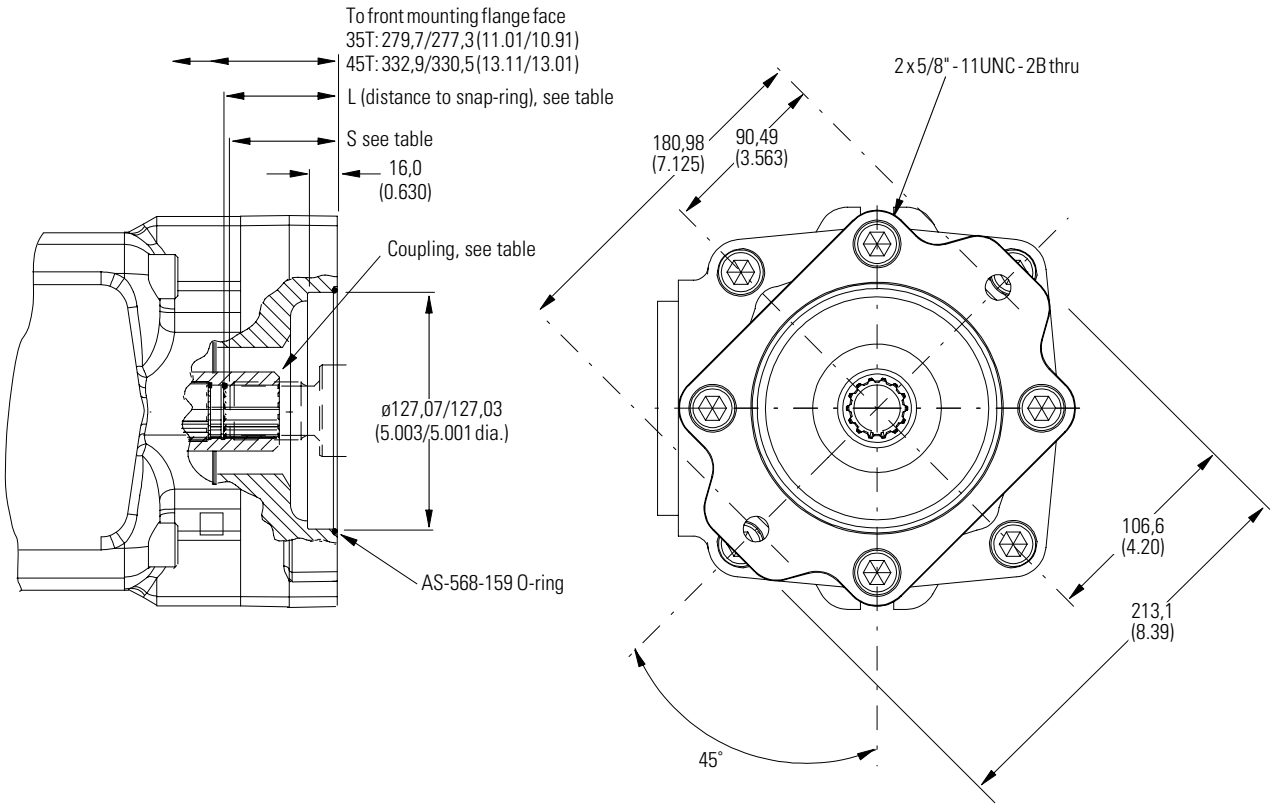


VMQ1 35T/45T

Thru-Drive Pumps Rear Mount/ Coupling Details

Installation Dimensions
in mm (in)

3rd angle projection



Coupling Code	Description	Shaft Extension	S 35T	L 45T
16	For pump shaft of SAE "A" size with 30° involute splined shaft (per SAE std J744 JUL88) 9T 16/32 DP (per ANSI B92.1a 1976)	32,8/31,2 (1.29/1.23)	33,3 (1.31) min.	34,2 (1.35) min.
22	For pump shaft of SAE "B" size with 30° involute splined shaft (per SAE std J744 JUL88) 13T 16/32 DP (per ANSI B92.1a 1976)	41,8/40,2 (1.64/1.58)	42,3 (1.67) min.	43,2 (1.70) min.
25	For pump shaft of SAE "B-B" size with 30° involute splined shaft (per SAE std J744 JUL88) 15T 16/32 DP (per ANSI B92.1a 1976)	46,8/45,2 (1.84/1.78)	47,4 (1.87) min.	48,3 (1.90) min.
32	For pump shaft of SAE "C" size with 30° involute splined shaft (per SAE std J744 JUL88) 14T 12/24 DP (per ANSI B92.1a 1976)	56,8/55,2 (2.23/2.17)	58,5 (2.30) min.	58,8 (2.31) min.

Selection of Vickers™ Pumps for Mounting on Thru-Drive Models

VMQ1 Thru-drive Model	Mating Pump	Mating Pump Shaft Code
25VMQT	V10	11
	V20	62
	PVB5/6 piston pump	S124
	PVM018/020	03
	V2010/2020 double pump	11
	20V(Q)	151
	25V(Q)	167
	2520V(Q) double pump	167
	PVB10/15 piston pump	S124
	PVM018, 020, 045, 050, 057	07
	VMQ125	09
35VMQT	V10	11
	V20	62
	PVB5/6 piston pump	S124
	PVM018/020	03
	V2010/2020 double pump	11
	20V(Q)	151
	25V(Q)	11
	2520V(Q) double pump	11
	PVB10/15 piston pump	S124
	VMQ125	09
	35V(Q)	11
	35**V(Q) double pump	11
	45V(Q)	11
	45**V(Q) double pump	11
	PVM057, 063, 131, 141	11
	VMQ135	02
45VMQT	V10	11
	V20	62
	PVB5/6 piston pump	S124
	PVM018/020	03
	V2010/2020 double pump	11
	20V(Q)	151
	25V(Q)	11
	2520V(Q) double pump	11
	PVB10/15 piston pump	S124
	VMQ125	09
	VMQ22525 double pump	02
	35V(Q)	11
	35**V(Q) double pump	11
	45V(Q)	11
	45**V(Q) double pump	11
	PVM057, 063, 131, 141	11
	VMQ135	02
	VMQ145	09
	VMQ23525 double pump	02
	VMQ245** double pump	09

VMQ2 2525
Double Pumps

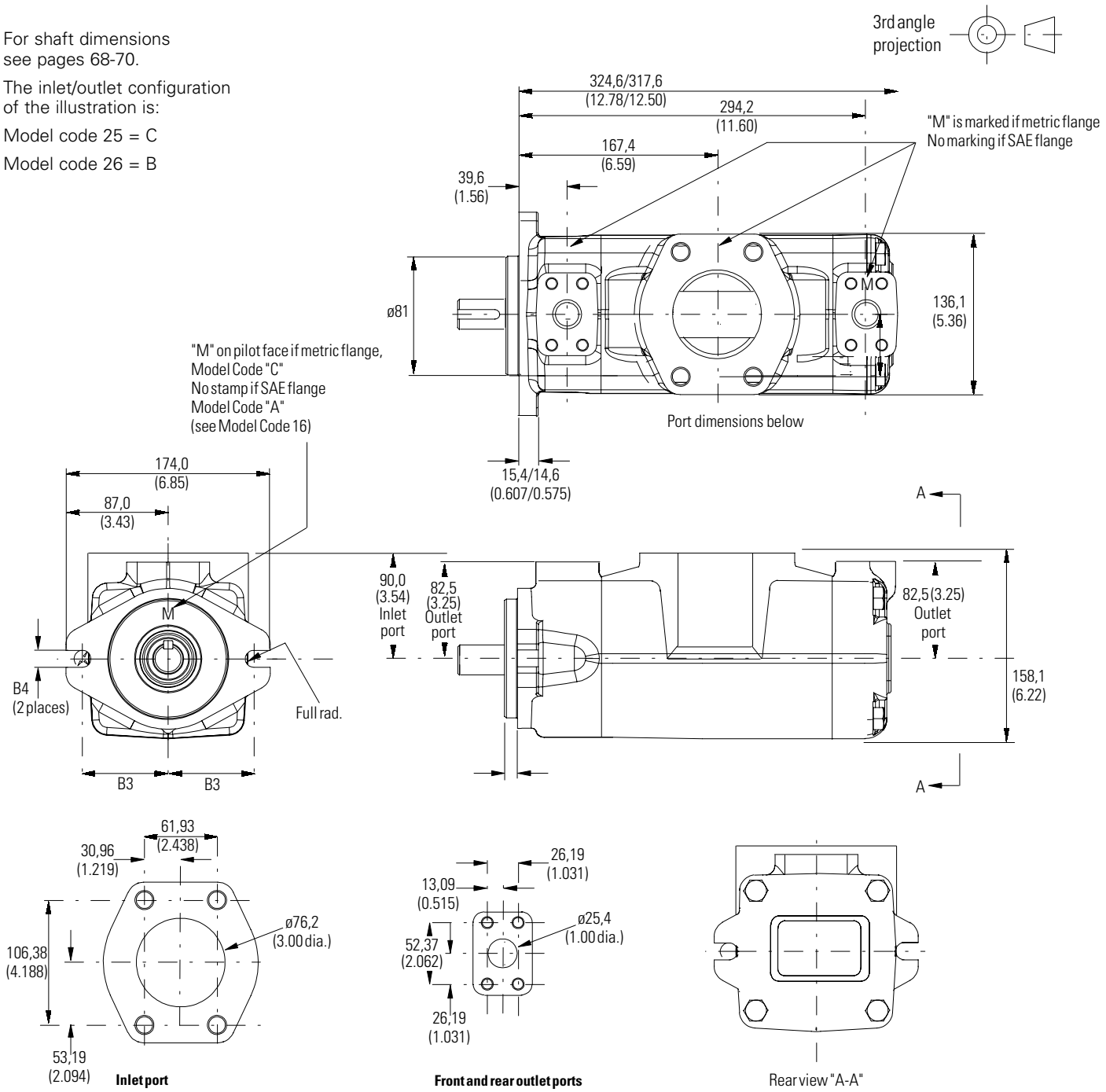
Installation Dimensions
in mm (in)

For shaft dimensions
see pages 68-70.

The inlet/outlet configuration
of the illustration is:

Model code 25 = C

Model code 26 = B



Inlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 5/8"-11UNC-2B, 30,2 (1.19) min. depth
Code B: M16 x 2,0, 28,5 (1.12) min. depth

Front and rear outlet ports

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 3/8"-16UNC-2B, 22,0 (0.87) min. depth
Code B: M10 x 1,5, 17,0 (0.67) min. depth

Model Code 16	Flange Type	ØB1	B2	B3	B4
A	SAE 101-2	101,55/101,60 (3.998/4.000)	9,19/9,70 0.362/0.382)	73,00 (2.874)	14,17/14,55 (0.558/0.573)
C	ISO 3019/2 100A2HW	99,946/100,00 (3.935/3.937)	9,00/9.50 (0.354/0.374)	70,00 (2.756)	14,00/14,27 (0.551/0.562)

VMQ2 3525
Double Pumps

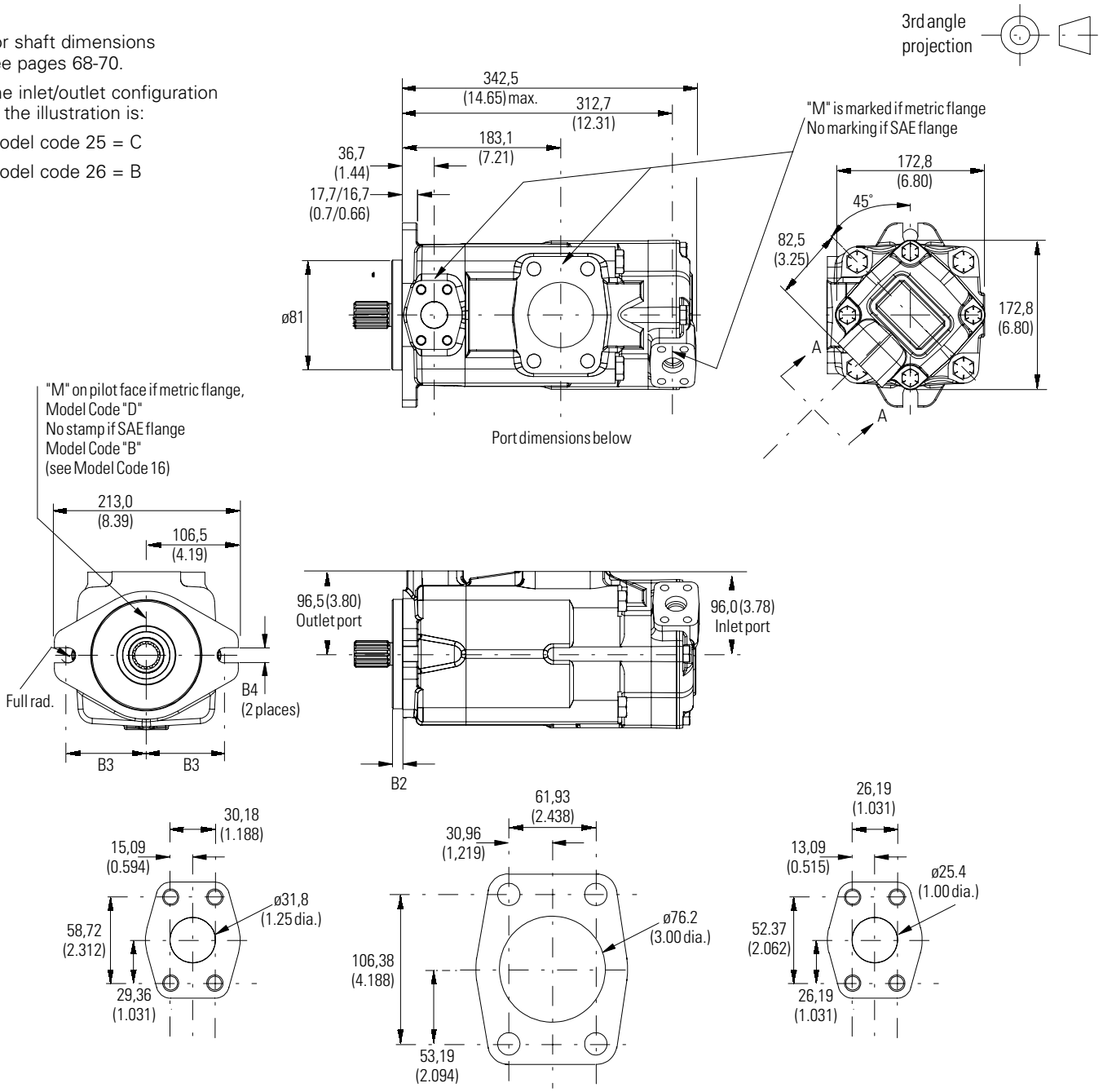
Installation Dimensions
in mm (in)

For shaft dimensions
see pages 68-70.

The inlet/outlet configuration
of the illustration is:

Model code 25 = C

Model code 26 = B



Front outlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: $^{7}/_{16}$"-14UNC-2B, 28,4 (1.12) min. depth
Code B: M10 x 1,5, 17,0 (0.67) min. depth

Inlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: $^{5}/_{8}$"-11UNC-2B, 30,2 (1.19) min. depth
Code B: M16 x 2,0, 25,4 (1.00) min. depth

Rear outlet port (view "A-A")

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: $^{3}/_{8}$"-16UNC-2B, 22,0 (0.87) min. depth
Code B: M10 x 1,5, 17,0 (0.67) min. depth

Model Code 16	Flange Type	ØB1	B2	B3	B4
B	SAE 127-2	126,95/127,00 (4.998/5.000)	12,19/12,70 (0.480/0.500)	90,50 (3.563)	17,37/17,75 (0.684/0.699)
D	ISO 3019/2 125A2HW	124,94/125,00 (4.919/4.921)	9,00/9,50 (0.354/0.374)	90,00 (3.543)	18,00/18,27 (0.709/0.719)

VMQ2 4525
Double Pumps

Installation Dimensions
in mm (in)

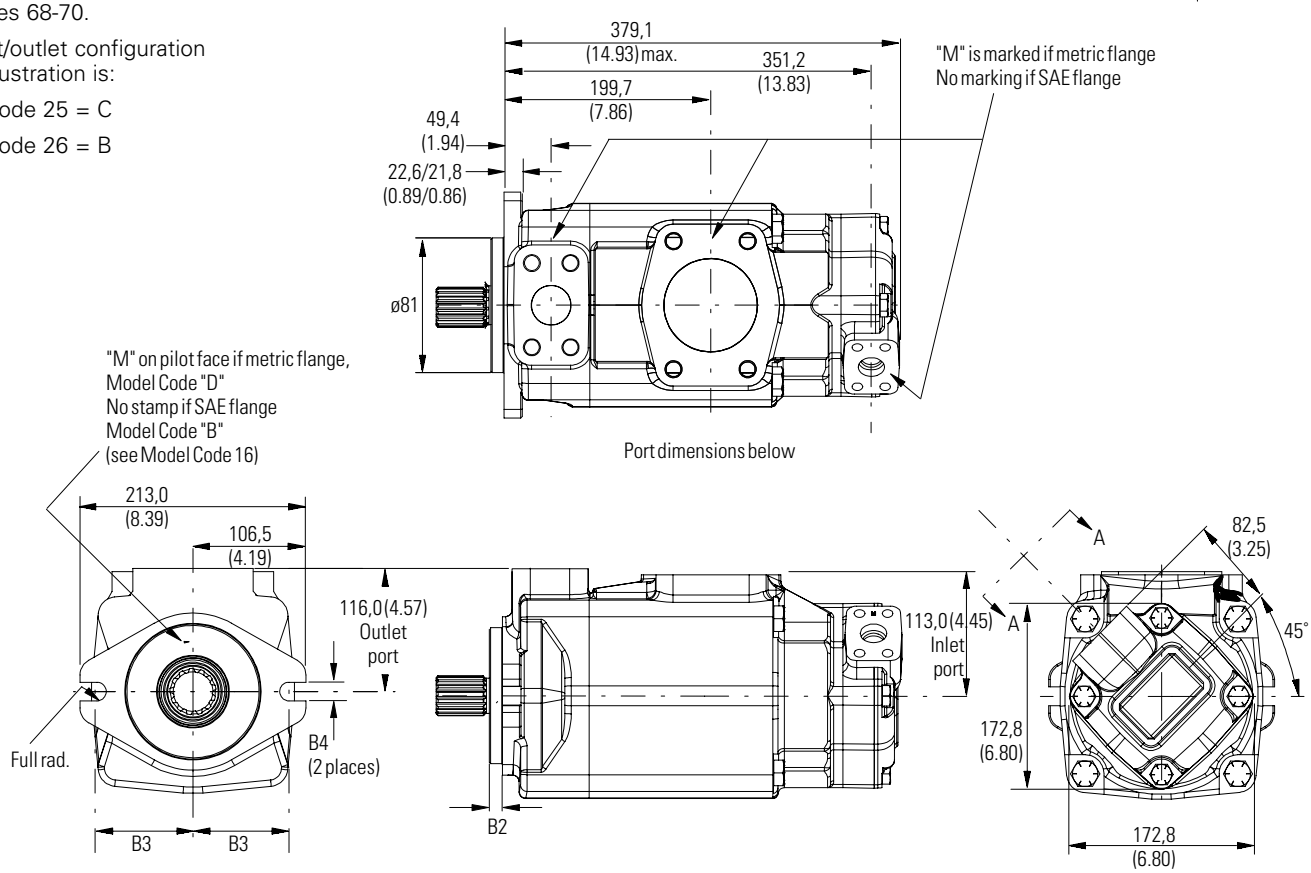
For shaft dimensions
see pages 68-70.

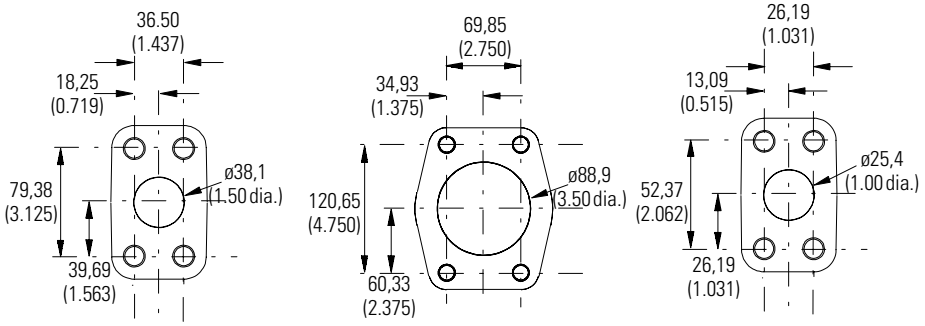
The inlet/outlet configuration of the illustration is:

Model code 25 = C

Model code 26 = B

3rd angle projection





Front outlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 5/8"-11UNC-2B, 35,0 (1.38) min. depth
Code B: M16 x 2,0, 25,5 (1.00) min. depth

Inlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 5/8"-11UNC-2B, 33,0 (1.31) min. depth
Code B: M16 x 2,0, 25,4 (1.00) min. depth

Rear outlet port (view "A-A")

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 3/8"-16UNC-2B, 22,0 (0.87) min. depth
Code B: M10 x 1,5, 17,0 (0.67) min. depth

Model Code 16	Flange Type	ØB1	B2	B3	B4
B	SAE 127-2	126,95/127,00 (4.998/5.000)	12,19/12,70 (0.480/0.500)	90,50 (3.563)	17,37/17,75 (0.684/0.699)
D	ISO 3019/2 125A2HW	124,94/125,00 (4.919/4.921)	9,00/9,50 (0.354/0.374)	90,00 (3.543)	18,00/18,27 (0.709/0.719)

VMQ2 4535
Double Pumps

Installation Dimensions
in mm (in)

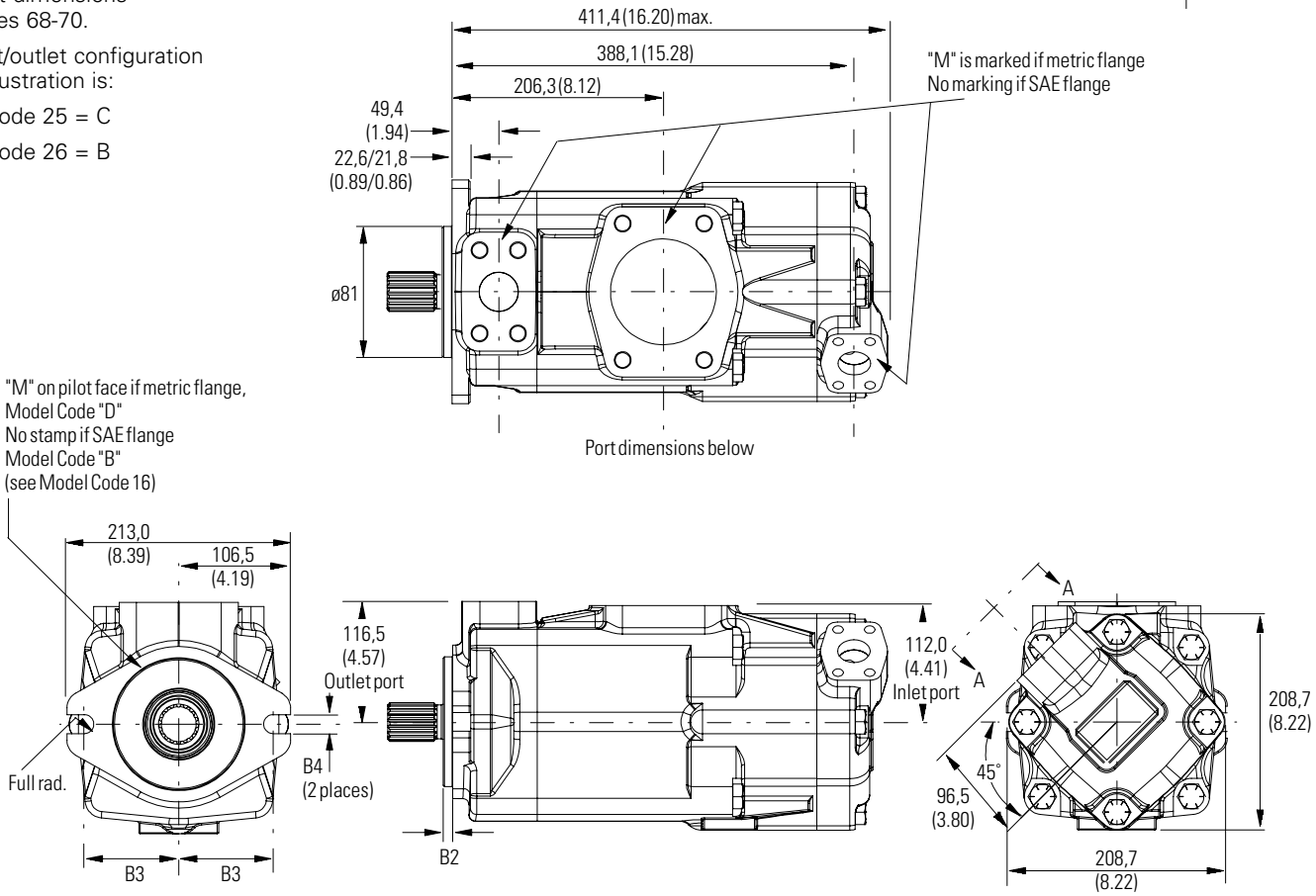
For shaft dimensions
see pages 68-70.

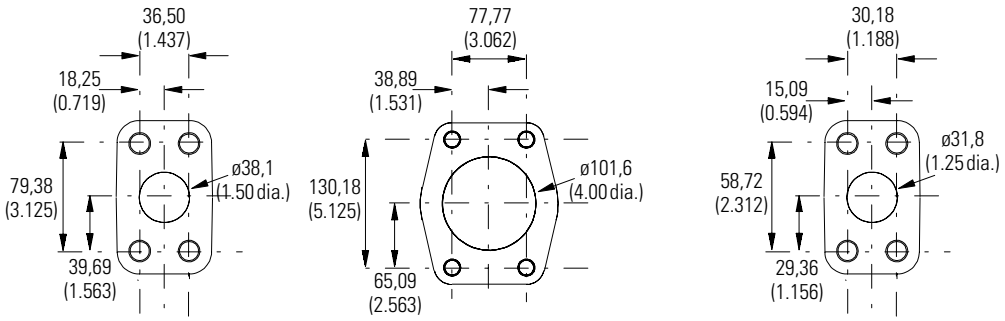
The inlet/outlet configuration
of the illustration is:

Model code 25 = C

Model code 26 = B

3rd angle projection





Front outlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 5/8"-11UNC-2B, 35,0 (1.38) min. depth
Code B: M16 x 2,0, 25,5 (1.00) min. depth

Inlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 5/8"-11UNC-2B, 30,2 (1.19) min. depth
Code B: M16 x 2,0, 25,4 (1.00) min. depth

Rear outlet port (view "A-A")

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 5/8"-11UNC-2B, 28,4 (1.12) min. depth
Code B: M10 x 1,5, 17,0 (0.67) min. depth

Model Code 16	Flange Type	ØB1	B2	B3	B4
B	SAE 127-2	126,95/127,00 (4.998/5.000)	12,19/12,70 (0.480/0.500)	90,50 (3.563)	17,37/17,75 (0.684/0.699)
D	ISO 3019/2 125A2HW	124,94/125,00 (4.919/4.921)	9,00/9,50 (0.354/0.374)	90,00 (3.543)	18,00/18,27 (0.709/0.719)

VMQ3 352525
Triple Pumps

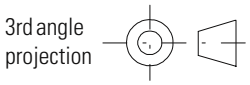
Installation Dimensions
in mm (in)

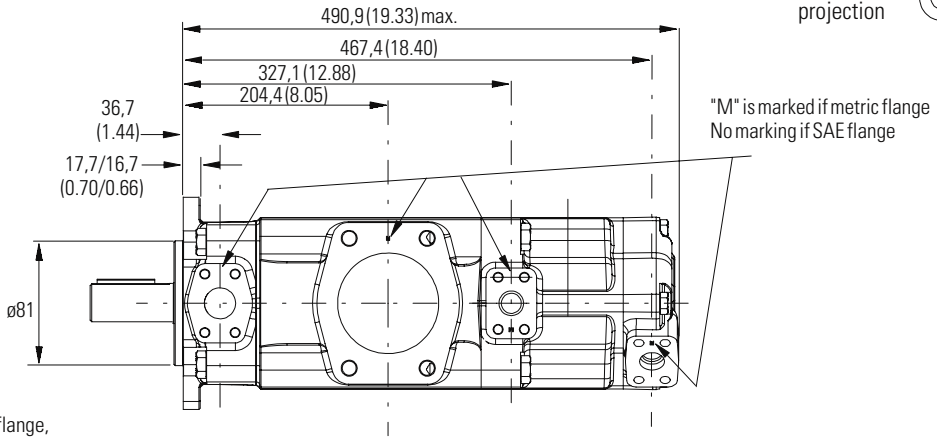
For shaft dimensions
see pages 68-70.

The inlet/outlet configuration
of the illustration is:

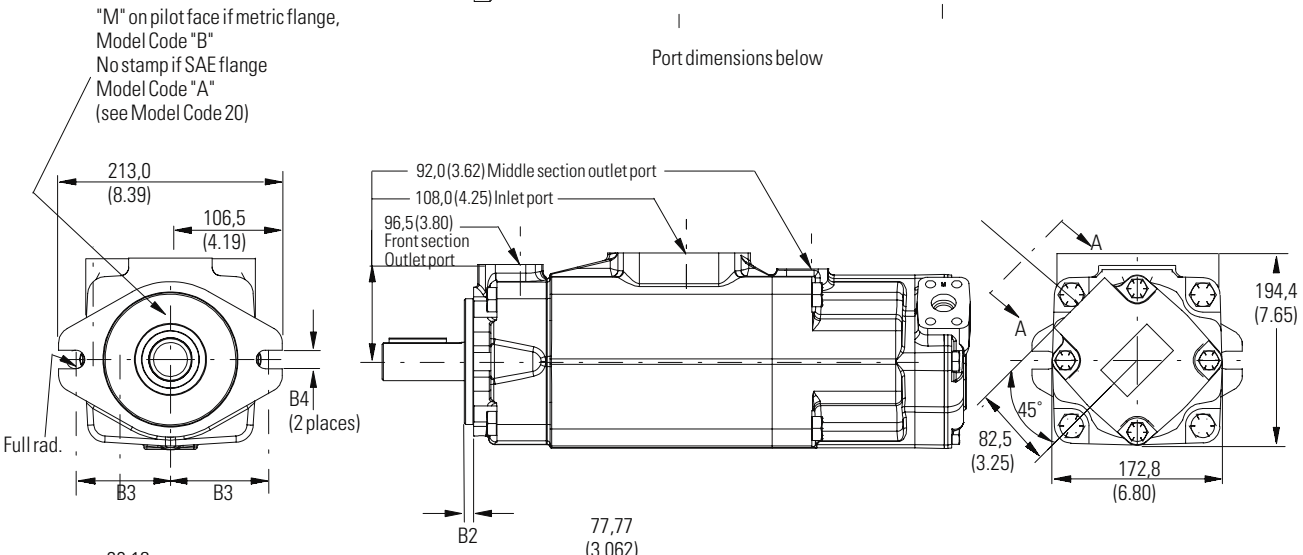
Model code 25 = C

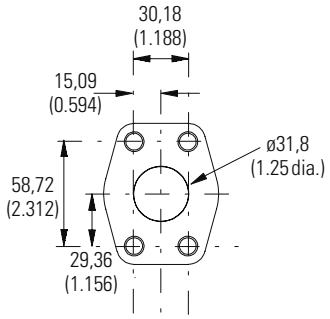
Model code 26 = B

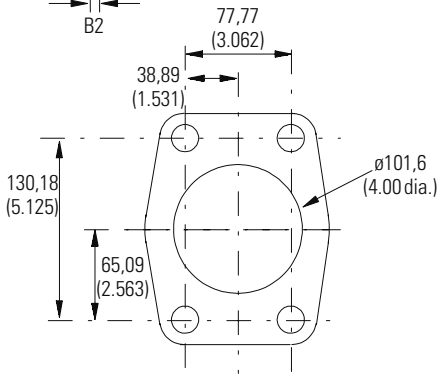


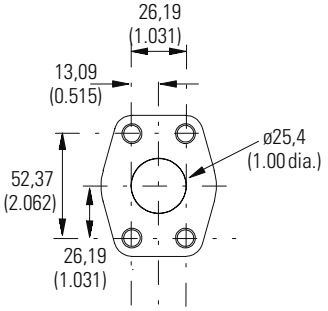


Port dimensions below









Outlet port, front section

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: $^{7}/_{16}$"-14UNC-2B, 28,4 (1.12) min. depth
Code B: M10 x 1,5, 17,0 (0.67) min. depth

Inlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: $^{5}/_{8}$"-11UNC-2B, 30,2 (1.19) min. depth
Code B: M16 x 2,0, 25,4 (1.00) min. depth

Outlet port, middle section and outlet port, rear section (view "A - A")

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: $^{3}/_{8}$"-16UNC-2B, 22,0 (0.87) min. depth
Code B: M10 x 1,5, 17,0 (0.67) min. depth

Model Code 20	Flange Type	ØB1	B2	B3	B4
A	SAE 127-2	126,95/127,00 (4.998/5.000)	12,19/12,70 (0.480/0.500)	90,50 (3.563)	17,37/17,75 (0.684/0.699)
B	ISO 3019/2 125A2HW	124,94/125,00 (4.919/4.921)	9,00/9,50 (0.354/0.374)	90,00 (3.543)	18,00/18,27 (0.709/0.719)

VMQ3 453525
Triple Pumps

Installation Dimensions
in mm (in)

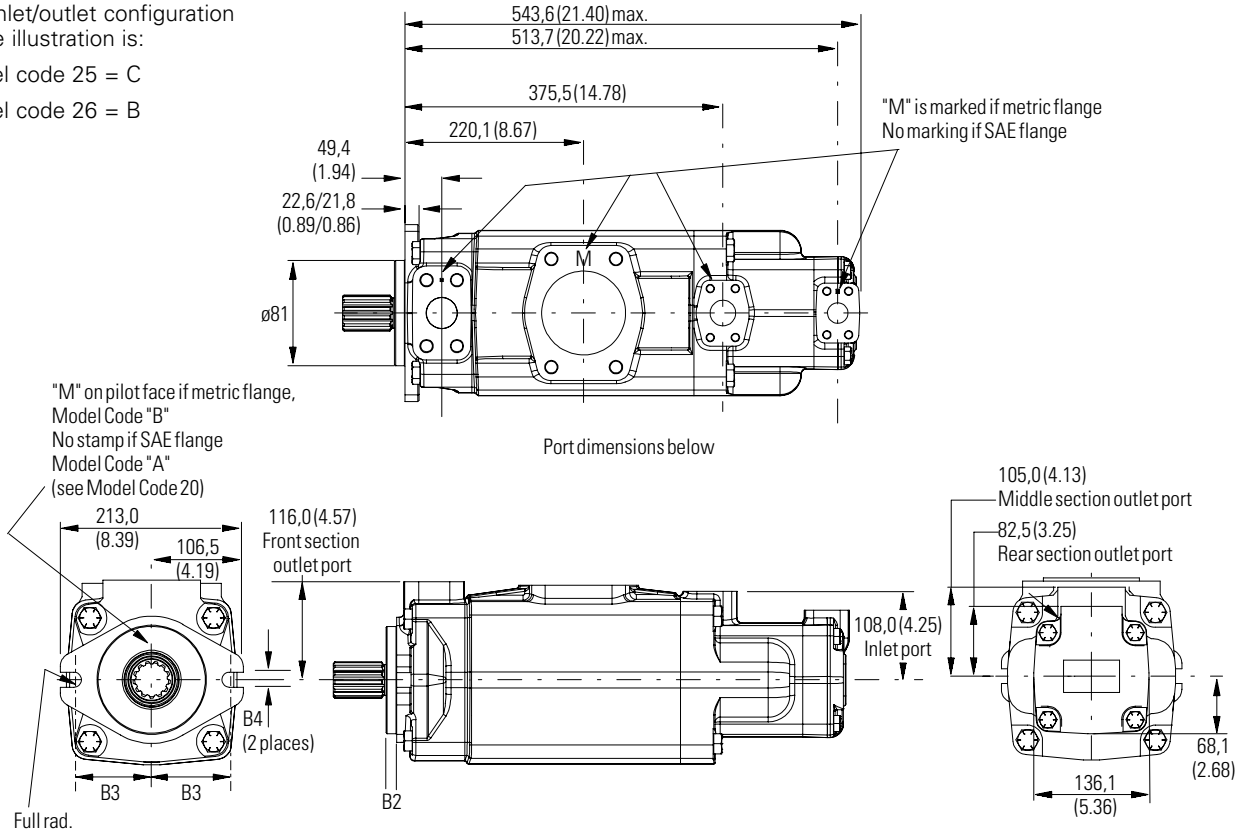
3rd angle projection

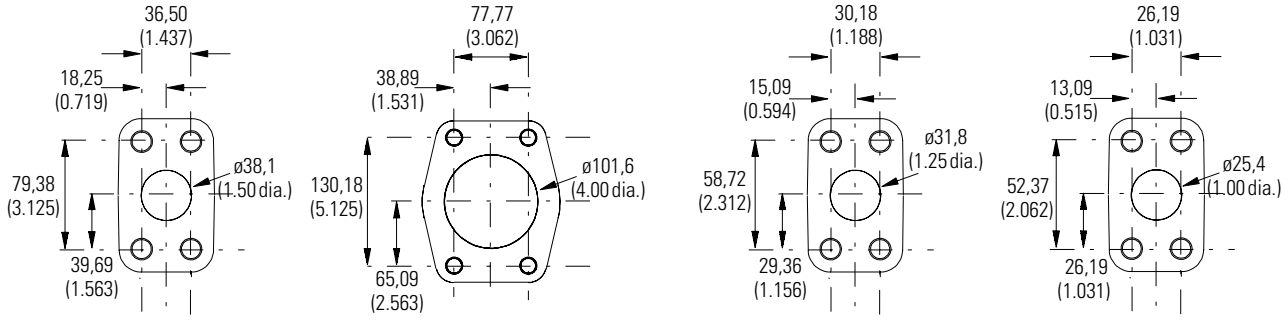
For shaft dimensions see pages 68-70.

The inlet/outlet configuration of the illustration is:

Model code 25 = C

Model code 26 = B





Outlet port, front section

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 5/8"-11UNC-2B, 35,0 (1.38) min. depth
Code B: M16 x 2,0, 25,4 (1.00) min. depth

Inlet port

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 5/8"-11UNC-2B, 30,2 (1.19) min. depth
Code B: M16 x 2,0, 25,4 (1.00) min. depth

Outlet port, middle section

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 7/16"-14UNC-2B, 28,4 (1.12) min. depth
Code B: M10 x 1,5, 17,0 (0.67) min. depth

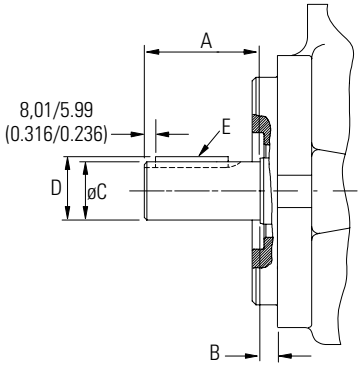
Outlet port, rear section

Code A: SAE J518 4-bolt flange
Code B: ISO 6162 4-bolt flange
Threads:
Code A: 3/8"-16UNC-2B, 22,0 (0.87) min. depth
Code B: M10 x 1,5, 17,0 (0.67) min. depth

Model Code 20	Flange Type	ØB1	B2	B3	B4
A	SAE 127-2	126,95/127,00 (4.998/5.000)	12,19/12,70 (0.480/0.500)	90,50 (3.563)	17,37/17,75 (0.684/0.699)
B	ISO 3019/2 125A2HW	124,94/125,00 (4.919/4.921)	9,00/9,50 (0.354/0.374)	90,00 (3.543)	18,00/18,27 (0.709/0.719)

Shaft Options

Straight, Keyed Shafts



Pump Size	Shaft Code	Shaft Designation	A	B	ØC	D	E Key Width X Length
25(T)	01	SAE J744	70,00 (2.756)	8,84/7,22 (0.348/0.284)	25,40/25,36 (1.000/0.998)	28,23/27,99 (1.112/1.102)	6,363 (0.2505) x 49,23 (1.938)
	03	ISO 3019/2	42,00 (1.654)	11,04/9,42 (0.435/0.371)	25,013/24,911 (0.9848/0.9839)	27,97/27,73 (1.102/1.092)	7,982 (0.3142) x 18,00 (0.709)
	05	SAE J744	76,00 (2.992)	8,84/7,22 (0.348/0.284)	31,75/31,71 (1.250/1.248)	35,33/35,09 (1.391/1.381)	7,950 (0.3130) x50,80 (2.000)
	07	ISO 3019/2	58,00 (2.283)	11,04/9,42 (0.435/0.371)	32,027/32,003 (1.2609/1.2599)	34,99/34,75 (1.378/1.368)	9,982 (0.3930) x 34,00 (1.339)
35(T)	01	SAE J744	76,00 (2.992)	8,81/7,19 (0.347/0.283)	31,75/31,71 (1.250/1.248)	35,33/35,09 (1.391/1.381)	7,950 (0.3130) x 50,80 (2.000)
	03	ISO 3019/2	58,00 (2.283)	11,01/9,39 (0.434/0.370)	32,027/32,003 (1.2609/1.2599)	34,99/34,75 (1.378/1.368)	9,982 (0.3930) x 34,00 (1.339)
	05	SAE J744	83,00 (3.268)	8,81/7,19 (0.347/0.283)	38,10/38,06 (1.500/1.498)	42,40/42,16 (1.665/1.659)	9,538 (0.3755) x 57,15 (2.250)
	07	ISO 3019/2	82,00 (3.228)	11,01/9,39 (0.434/0.370)	40,027/40,003 (1.5759/1.5749)	42,98/42,71 (1.693/1.682)	11,979 (0.4716) x 56,00 (2.205)
45(T)	01	SAE J744	83,00 (3.268)	8,82/7,20 (0.347/0.283)	38,09/38,05 (1.500/1.498)	42,40/42,16 (1.669/1.659)	9,538 (0.3755) x 57,15 (2.250)
	03	ISO 3019/2	82,00 (3.228)	11,02/9,40 (0.434/0.370)	40,027/40,003 (1.5759/1.5749)	43,03/42,79 (1.695/1.685)	11,979 (0.4716) x 56,00 (2.205)
	05	SAE J744	92,00 (3.622)	8,82/7,20 (0.347/0.283)	44,45/44,41 (1.750/1.748)	49,43/49,19 (1.947/1.937)	11,125 (0.4380) x 57,15 (2.250)
2525	01	SAE J744	70,00 (2.756)	8,84/7,22 (0.348/0.284)	25,40/25,36 (1.000/0.999)	28,23/27,99 (1.112/1.102)	6,350 (0.2500) x 49,23 (1.938)
	03	ISO 3019/2	42,00 (1.654)	11,04/9,42 (0.435/0.371)	25,013/24,99 (0.9848/0.9838)	27,97/27,73 (1.102/1.092)	7,964 (0.3135) x 18,00 (0.709)
	05	SAE J744	76,00 (2.992)	8,84/7,22 (0.348/0.284)	31,75/31,71 (1.250/1.248)	35,33/35,09 (1.391/1.381)	7,938 (0.3125) x 50,80 (2.000)
	07	ISO 3019/2	58,00 (2.283)	11,04/9,42 (0.435/0.371)	32,027/32,003 (1.2609/1.2599)	34,99/34,75 (1.378/1.368)	9,964 (0.3923) x 34,00 (1.339)
3525	01	SAE J744	76,00 (2.992)	8,81/7,19 (0.347/0.283)	31,75/31,71 (1.250/1.248)	35,33/35,09 (1.391/1.381)	7,950 (0.3130) x 50,80 (2.000)
	03	ISO 3019/2	58,00 (2.283)	11,01/9,39 (0.434/0.370)	32,027/32,003 (1.2609/1.2599)	34,99/34,75 (1.378/1.368)	9,982 (0.3930) x 34,00 (1.339)
	05	SAE J744	83,00 (3.268)	8,81/7,19 (0.347/0.283)	38,10/38,06 (1.500/1.498)	42,40/42,16 (1.669/1.659)	9,538 (0.3755) x 57,15 (2.250)
	07	ISO 3019/2	81,99 (3.228)	11,02/9,40 (0.434/0.370)	40,037/40,003 (1.5759/1.5749)	42,98/42,71 (1.693/1.682)	11,98 (0.472) x 56,00 (2.205)

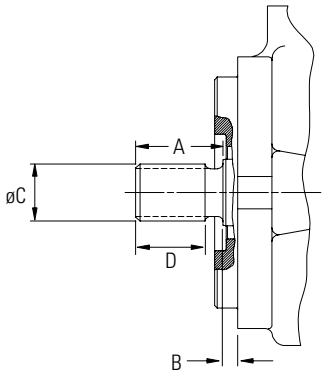
Shaft Options (cont.)

Straight, Keyed Shafts (cont.)

Pump Size	Shaft Code	Shaft Designation	A	B	ØC	D	E Key Width X Length
4525	01	SAE J744	83,00 (3.268)	8,82/7,20 (0.347/0.283)	38,10/38,06 (1.500/1.498)	42,40/42,16 (1.669/1.659)	9,538(0.3755) x 57,15 (2.250)
	03	ISO 3019/2	82,00 (3.228)	11,02/9,40 (0.434/0.370)	40,27/40,003 (1.5759/1.5749)	43,03/42,79 (1.695/1.685)	11,979 (0.4716) x 56,00 (2.205)
	05	SAE J744	92,00 (3.622)	8,82/7,20 (0.347/0.283)	44,45/44,41 (1.750/1.748)	49,43/49.19 (1.947/1.937)	11,125 (0.4380) x 57,15 (2.250)
4535	01	SAE J744	83,00 (3.268)	8,82/7,20 (0.347/0.283)	38,10/38,06 (1.500/1.498)	42,40/42,16 (1.669/1.659)	9,538 (0.3755) x 57,15 (2.250)
	03	ISO 3019/2	82,00 (3.228)	11,02/9,40 (0.434/0.370)	40,027/40,003 (1.5759/1.5749)	43,03/42,79 (1.695/1.685)	11,979 (0.4716) x 56,00 (2.205)
	05	SAE J744	92,00 (3.622)	8,82/7,20 (0.347/0.283)	44,45/44,41 (1.750/1.748)	49,43/49,19 (1.947/1.937)	11,125 (0.4380) x 57,15 (2.250)
352525	01	SAE J744	76,00 (2.992)	8,81/7,19 (0.347/0.283)	31,75/31,71 (1.250/1.248)	35,33/35,09 (1.391/1.381)	7,950 (0.3130) x 50,80 (2.000)
	03	ISO 3019/2	58,00 (2.283)	11,01/9,39 (0.434/0.370)	32,027/32,003 (1.2609/1.2599)	34,99/34,75 (1.374/1.368)	9,982 (0.3930) x 34,00 (1.339)
	05	SAE J744	83,00 (3.268)	8,81/7,19 (0.347/0.283)	38,10/38,06 (1.500/1.498)	42,40/42,16 (1.669/1.659)	9,538 (0.3755) x 57,15 (2.250)
453525	01	SAE J744	83,00 (3.268)	8,82/7,20 (0.347/0.283)	38,10/38,06 (1.500/1.498)	42,40/42,16 (1.669/1.659)	9,538 (0.3755) x 57,15 (2.250)
	03	ISO 3019/2	82,00 (3.228)	11,02/9,40 (0.434/0.370)	40,027/40,003 (1.5759/1.5749)	43,03/42,79 (1.695/1.685)	11,979 (0.4716) x 56,00 (2.205)
	05	SAE J744	92,00 (3.622)	8,78/7,16 (0.346/0.282)	44,45/44,41 (1.750/1.748)	49,43/49,19 (1.947/1.937)	11,125 (0.4380) x 57,15 (2.250)

Shaft Options (cont.)

Splined Shafts

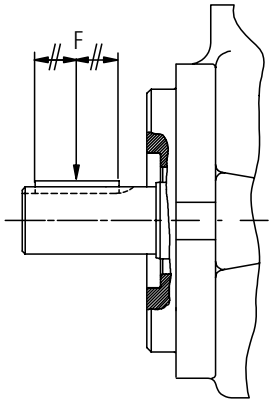


Pump Size	Shaft Code	A	B	ØC	D	Shaft Type (See Page 68)
25(T)	02	38,00 (1.496)	8,84/7,22 (0.348/0.284)	24,99 (0.984)	28,00 (1.102)	B-B
	06	48,00 (1.890)	8,84/7,22 (0.348/0.284)	31,22 (1.229)	38,00 (1.496)	C
25	09	33,00 (1.299)	8,37/7,70 (0.330/0.303)	21,28 (0.859)	23,00 (0.906)	B
35(T)	02	48,00 (1.890)	8,81/7,19 (0.347/0.283)	31,22 (1.229)	38,00 (1.496)	C
	06	54,00 (2.126)	8,81/7,19 (0.347/0.283)	37,57 (1.479)	44,00 (1.732)	C-C
45(T)	02	54,00 (2.126)	8,82/7,20 (0.347/0.283)	37,57 (1.479)	44,00 (1.732)	C-C
	06	48,00 (1.890)	8,82/7,20 (0.347/0.283)	43,71 (1.721)	57,00 (2.244)	D
	09	48,00 (1.890)	8,70/7,30 (0.28/0.34)	31,22 (1.229)	38,00 (1.496)	C
2525	02	38,00 (1.496)	8,84/7,22 (0.348/0.284)	24,99 (0.984)	28,00 (1.102)	B-B
	06	48,00 (1.890)	8,84/7,22 (0.348/0.284)	31,22 (1.229)	38,00 (1.496)	C
	09	33,00 (1.299)	8,37/7,70 (0.330/0.303)	21,28 (0.859)	23,00 (0.906)	B
3525	02	48,00 (1.890)	8,81/7,19 (0.347/0.283)	31,22 (1.229)	38,00 (1.496)	C
	06	54,00 (2.126)	8,81/7,19 (0.347/0.283)	37,57 (1.479)	44,00 (1.732)	C-C
4525	02	54,00 (2.126)	8,82/7,20 (0.347/0.283)	37,57 (1.479)	44,00 (1.732)	C-C
	06	67,00 (2.638)	8,82/7,20 (0.347/0.283)	43,71 (1.721)	57,00 (2.244)	D
	09	48,00 (1.890)	8,70/7,30 (0.28/0.34)	31,22 (1.229)	38,00 (1.496)	C
4535	02	54,00 (2.126)	8,82/7,20 (0.347/0.283)	37,57 (1.479)	44,00 (1.732)	C-C
	06	67,00 (2.638)	8,82/7,20 (0.347/0.283)	43,71 (1.721)	57,00 (2.244)	D
	09	48,00 (1.890)	8,70/7,30 (0.28/0.34)	31,22 (1.229)	38,00 (1.496)	C
352525	02	48,00 (1.890)	8,81/7,19 (0.347/0.283)	31,22 (1.229)	38,00 (1.496)	C
	06	54,00 (2.126)	8,81/7,19 (0.347/0.283)	37,57 (1.479)	44,00 (1.732)	C-C
453525	02	54,00 (2.126)	8,82/7,20 (0.347/0.283)	37,57 (1.479)	44,00 (1.732)	C-C
	06	67,00 (2.638)	8,82/7,20 (0.347/0.283)	43,71 (1.721)	57,00 (2.244)	D

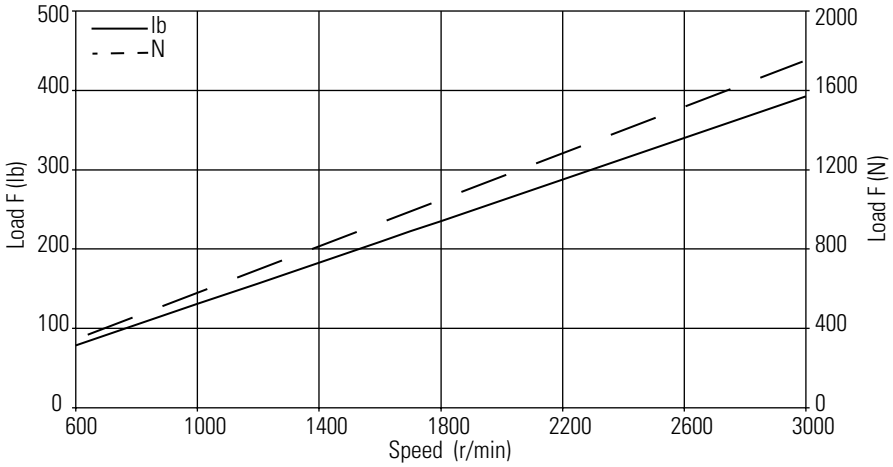
Theoretical Permissible Equivalent Radial Load

82˚C (180˚F), SAE 10W oil,
9 cSt (55 SUS)
01 Keyed Shaft shown

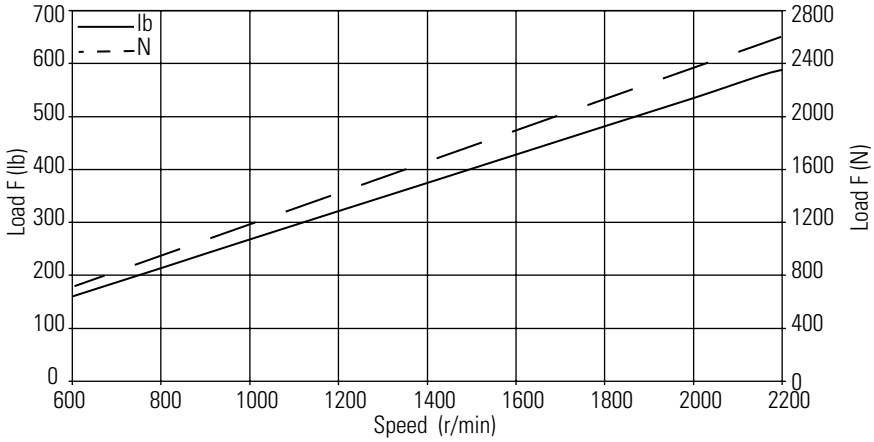
Note: Graphs based on B-10 life of 3000 hours



Frame size 25

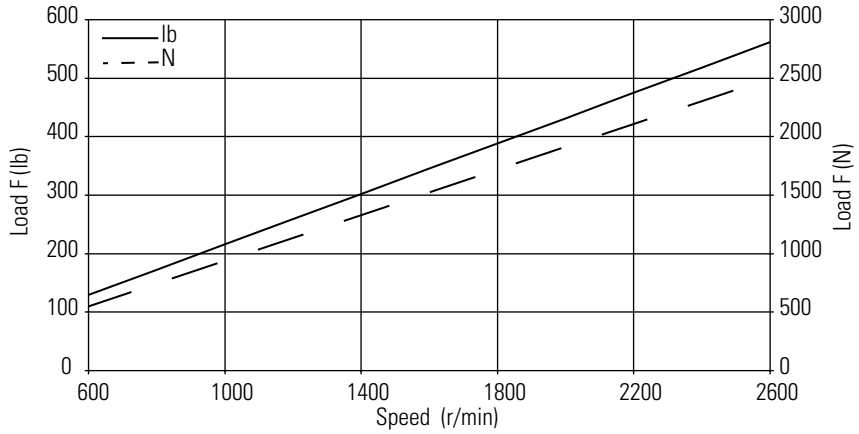


Frame size 2525

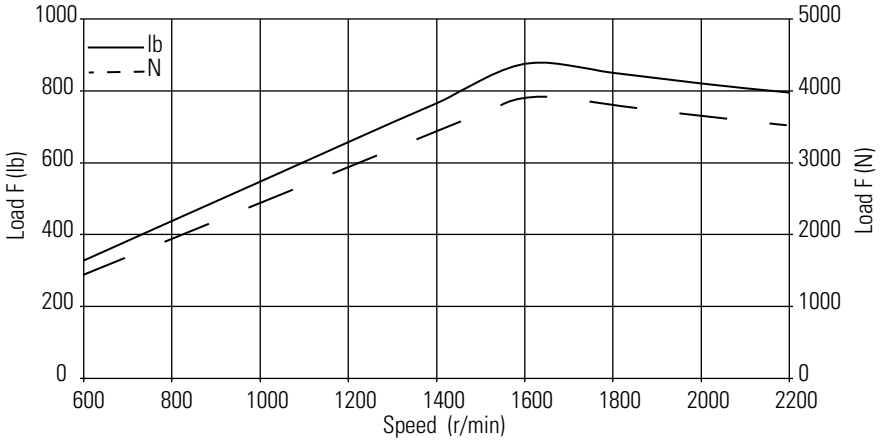


Theoretical Permissible Equivalent Radial Load (cont.)

Frame size 35, 3525, 352525



Frame size 45, 4525, 4535, 453525



Spline Data

External involute spline tolerance class 7 ANSI B921A-1976 30˚ pressure angle, flat root, side fit.

Shaft Type	No.of Teeth	Pitch	Pitch Dia.	Major Dia.	Form Dia.	Minor Dia. (Max)	Base Dia.
B	13	16/32	20,637 (0.8125)	22,23/22,17 (0.875/0.873)	19,02 (0.749)	18,16 (0.715)	17,87 (0.7036)
B-B	15	16/32	23,812 (0.9375)	24,99/24,80 (0.984/0.978)	22,15 (0.872)	21,38 (0.840)	20,62 (0.8119)
C	14	12/24	29,63 (1.1667)	32,22/31,06 (1.229/1.223)	27,48 (1.082)	26,41 (1.040)	25,66 (1.0104)
C-C	17	12/24	35,98 (1.4167)	37,57/37,41 (1.479/1.473)	33,76 (1.329)	32,77 (1.290)	31,16 (1.2269)
D	13	8/16	41,27 (1.6250)	43,71/43,56 (1.721/1.715)	38,13 (1.501)	36,63 (1.442)	35,75 (1.4073)

Torque Loading for Direct Drives

Single Pumps (not thru-drive models)

All listed shafts are satisfactory up to maximum pressures in "Typical performance data" for each series.

Double and Triple Pumps

Where multiple cartridges are to be on-load together, check that the sum of their separate torques, taken from the graph on next page, does not exceed the torque limit in Table 1.

Thru-drive Pumps (VMQ1T models)**

Where both the thru-drive pump and its rear-mounted pump are to be on-load together, check that the sum of the torques generated will never exceed the torque limit in Table 2.
Also check that the torque required on the rear-mounted pump never exceeds the thru-drive torque limit in Table 2.

Example:

A VMQ2 3525 135 040 operating at 240 bar (3480 psi) front section and 280 bar (4060 psi) rear section will require over 700 Nm (6196 lb.in) input torque. Therefore, all listed shafts for the VMQ2 3525 will be acceptable.

Table 1

Single, Double and Triple Pumps Shaft Torque Ratings

Frame Size	Shaft Type	Type	SAE Code	Size Mm	No. Of Teeth	Torque Rating Nm	(Lb. In.)
25, 2525	01	Keyed		25,40	N/A	407	(3600)
25, 2525	02	Splined	B-B	24,99	15	621	(5500)
25, 2525	03	Keyed		25,00	N/A	407	(3600)
25, 2525	09	Splined	B	21,82	13	328	(2900)
25, 2525	05	Keyed		31,75	N/A	814	(7200)
25, 2525	06	Splined	C	31,22	14	814	(7200)
25, 2525	07	Keyed		32,00	N/A	814	(7200)
35, 3525, 352525	01	Keyed		31,75	N/A	814	(7200)
35, 3525, 352525	02	Splined	C	31,22	14	1017	(9000)
35, 3525, 352525	03	Keyed		32,00	N/A	814	(7200)
35, 3525, 352525	05	Keyed		38,10	N/A	1130	(10000)
35, 3525, 352525	06	Splined	C-C	37,57	17	1130	(10000)
35, 3525, 352525	07	Keyed		40,00	N/A	1130	(10000)
45, 45**, 453525	01	Keyed		38,10	N/A	1130	(10000)
45, 45**, 453525	02	Splined	C-C	37,57	17	1808	(16000)
45, 45**, 453525	03	Keyed		40,00	N/A	1130	(10000)
45, 45**, 453525	05	Keyed		44,45	N/A	1638	(14500)
45, 45**, 453525	06	Splined	D	43,71	13	1808	(16000)
45, 45**, 453525	09	Splined	C	31,22	14	1017	(9000)

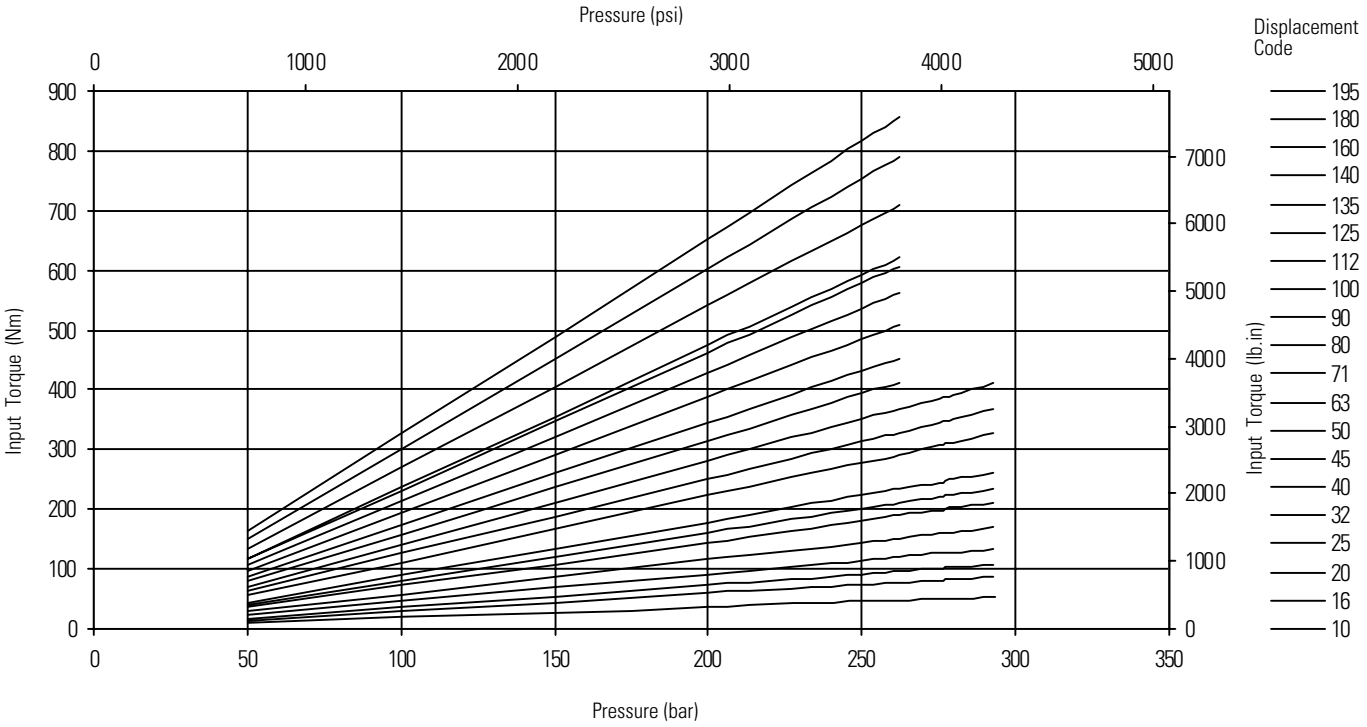
Table 2

Thru-Drive Pumps Shaft Torque Ratings

Pump	Shaft	Max. Input Torque Nm	(Lb. In.)	Max. Thru-drive Torque Nm	(Lb. In.)
VMQ125T	01	407	(3600)	350	(3100)
	02	621	(5500)	350	(3100)
	03	407	(3600)	350	(3100)
	05	814	(7200)	350	(3100)
	06	814	(7200)	350	(3100)
	07	814	(7200)	350	(3100)
VMQ135T	01	814	(7200)	678	(6000)
	02	1017	(9000)	678	(6000)
	03	814	(7200)	678	(6000)
	05	1130	(10000)	678	(6000)
	06	1130	(10000)	678	(6000)
	07	1130	(10000)	678	(6000)
VMQ145T	01	1130	(10000)	1130	(10000)
	02	1808	(16000)	1130	(10000)
	03	1130	(10000)	1130	(10000)
	05	1638	(14500)	1130	(10000)
	06	1808	(16000)	1130	(10000)

Torque Loading for Direct Drives (cont.)

Input Torque Requirement



Note

To realize the high input torque levels for keyed shafts (nos. 01, 03, 05 and 07), the corners of the key must be chamfered 0,76 to 1,02 mm (0.030 to 0.040 in) x 45° to clear the radii in the keyway. (Eaton ships keyed shafts with the corners of the key already chamfered.) Also, the key must be installed in the keyway 8,01/5,99 mm (0.316/0.236 in) back from the end of the shaft as shown on page 68.

Spline shaft ends (nos. 02, 06 and 09) must be lubricated by gearbox lubricant or anti-seizure grease to prevent spline wear and fretting.

Water Glycol Guidelines

Viscosity & Speed Requirements

Operating Speed	Minimum Intermittent Viscosity	Minimum Continuous Viscosity	Optimum Operating Viscosity Range	Maximum Viscosity at Full Pressure	Viscosity Range Requiring < 50% Outlet Pressure	Maximum Viscosity at Startup	Maximum/ Minimum
	cSt	cSt	cSt	cSt	cSt	cSt	RPM
Industrial	18	20	20-54	54	54-860	860	1800/900

Pressure & Operating Temperature Requirements

	Minimum Inlet Pressure Absolute bar (PSI)	Recommended Operating Inlet Pressure - Gage bar (PSI)	Maximum Positive Inlet Pressure - Gage bar (PSI)	Max. Continuous Operating Temperature C (F)	Max. Transient Operating Temperature C (F)	Max. Steady State Outlet Pressure - Gage bar (PSI)	Max. Transient Outlet Pressure (<0.5s) - Gage bar (PSI)
Industrial	0.9 (13.2) 1.0 (14.7)- 45VMQ	0 to 0.36 (0 to 5.0)	1.4 (20)	55 (131)	60 (140)	228 (3300)-25VMQ 207(3000)- 35&45VMQ	250 (3625)-25VMQ 228 (3300)- 35&45VMQ

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February 2009

Powering Business Worldwide

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Hydrokraft Transmission Piston Pumps

Technical Catalog

TVW

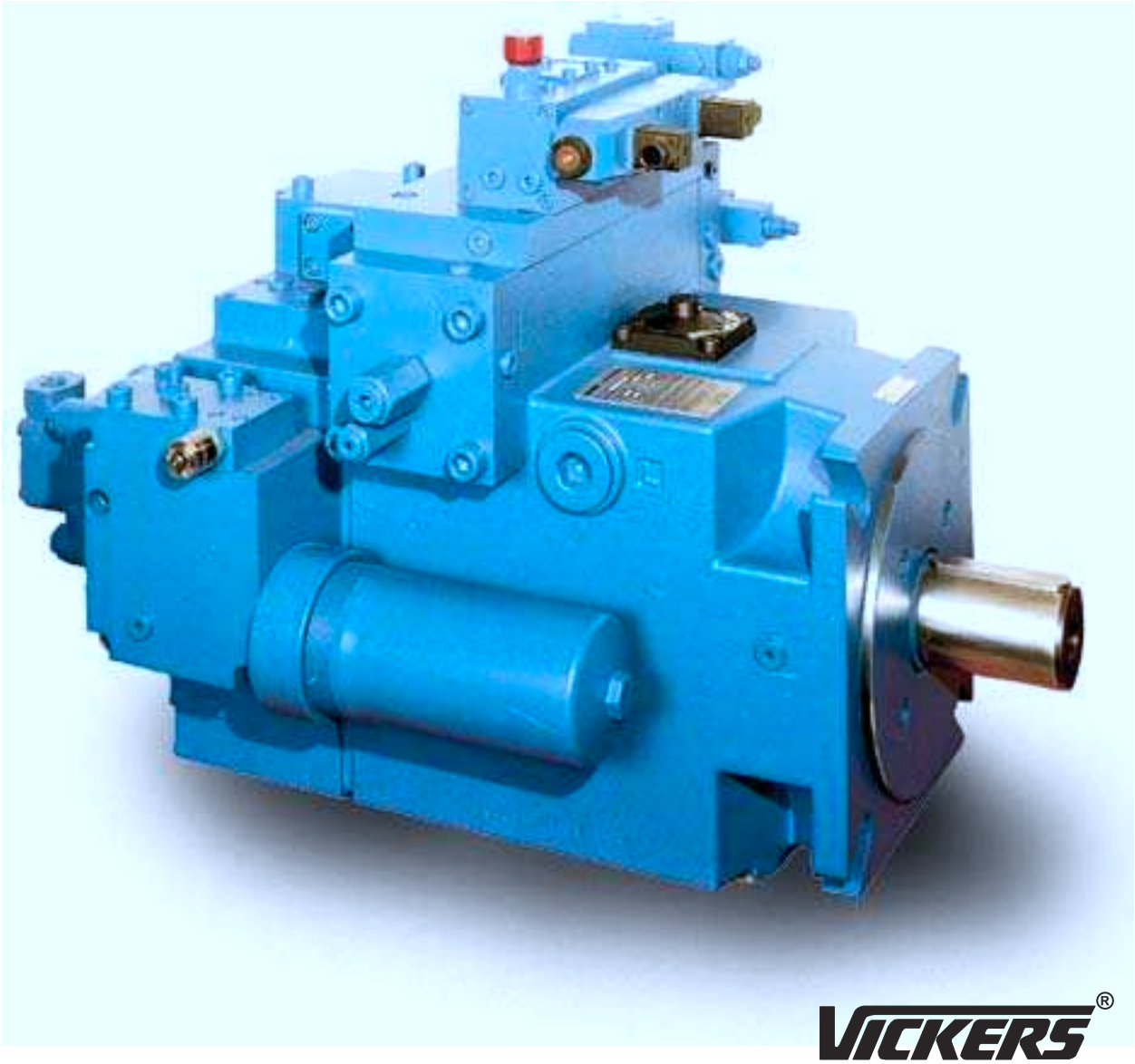


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Introduction

- Axial piston pumps with swash plate design for reliable operation and long life.
- Rotating and pressure loaded parts are pressure balanced.
- Wide range of available integrated charge and pilot pressure pump combinations for single and combination units.
- Special design for closed loop application.
- Oversize shaft and shaft bearings.
- Standard available transmission circuits with integrated valves and filters to build complete closed loop system. For charge flow and flushing.
- Through drive enable multiple pump installation from a single shaft. Multiple pump combinations are also available.
- Pressure up to 420 bar. Rated speed up to 1800 rpm. Higher speeds possible.
- Large charge flow rates for low system temperature.
- Fast response times.

AVAILABLE DISPLACEMENT SIZES
130 ccm
180 ccm
250 ccm
360 ccm
500 ccm
750 ccm

Displacement controls:

ES - Electric motor displacement control

HG - Handwheel displacement control (Special feature)

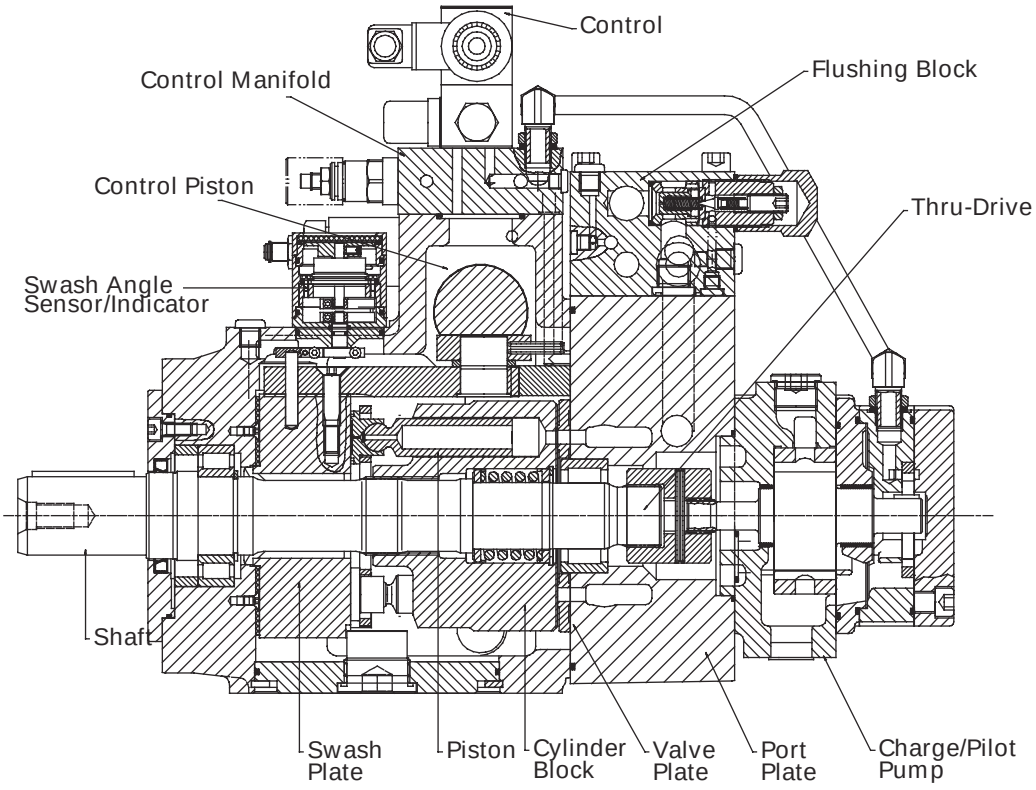
FE - Screw adjustment control (Special feature)

SP, SM - Displacement proportional to electric signal

DP - Displacement proportional to pressure signal

Extra functions available for SP, SM & DP: Pressure Limitation and/or power control overriding function.

Typical Section of Transmission Pump



Dimensional information listed in this catalog is subject to change without notice.

Model Code

Transmission Pumps

"W" Series

Form Page

The following 55-digit coding system has been developed to identify all of the configuration options for the "W" Series Transmission (Closed Loop) pumps. Use this model code to specify a unit with the desired features. All 55-digits must be present when ordering. You may want to photocopy the matrix below to ensure, that each number is entered in the correct box. If adjustments other than the standard settings (character 47...50) or special features (character 51..53) are needed, please provide the information when ordering. At the end of this section you may need to provide an additional model code if a combination unit is needed. In case of a combination unit, each single pump section must be specified separately using this or other Eaton catalog information.

In the model code string below some characters are already filled out and shown on this and the following pages. For such characters there is no option available.

Explanation for each character can be found as follows:

	CHARACTER	PAGE
Basic Pump Model Code	1.....27	6
Control Options	28.....46	7 - 10
Customer Adjustment Specification	47.....50	7 - 10
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Combination Model Code	1..... 39	12

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
T	V	W		–				M									1	R			S	V				

28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
																										1	0

SPECIFY NON STANDARD ADJUSTMENT BELOW

SPECIFY SPECIAL FEATURE BELOW

Model Code

Transmission Pumps

"W" Series - Basic Pump

T	V	W	*	—	*	*	*	M	*	*	*	*	*	*	*	*	1	R	*	*	S	V	*	*	*	*	#
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

1 Pump

T – Transmission Pump

2 Displacement

V – Variable displacement

3 Pump Series

W – "W" Series (was 30 design)

4 Configuration

S – Single Unit
F – Front Unit
M – Middle Unit
R – Rear Unit

5 Separator

– – Separator

6 7 8 Displacement Size

130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

9 Basic standard

M – Metric

10 11 Mounting flange

05 – ISO 3019/2 - 160B4HW (130 and 180 cm³/r)
07 – ISO 3019/2 - 200B4HW (250 and 360 cm³/r)
08 – ISO 3019/2 - 250B4HW (500 and 750 cm³/r)

12 Rotation Direction

R – Right hand [CW]
L – Left hand [CCW]

13 Adjustment stop

0 – No adjustment stop
4 – Fixed mechanical Adjustment stop side A
5 – Fixed mechanical Adjustment stop side B
6 – Fixed mechanical Adjustment stop side A and B

14 15 16 17 Thru-Drive Options

0000 – None
000A – SAE A
000B – SAE B
000C – SAE C
000D – ISO 3019/2 - 125A2HW
000E – ISO 3019/2 - 160A2HW
000F – ISO 3019/2 - 125B4HW
000G – ISO 3019/2 - 160B4HW
000H – ISO 3019/2 - 200B4HW
000J – ISO 3019/2 - 250B4HW
000P – Pilot pump (8 cm³/r)
000T – Charge pump (~25% of unit displacement size)
00TP – Charge pump (~25% of unit displacement size) and Pilot pump (8 cm³/r)
00PP – Double pilot pump (8 cm³/r + 8 cm³/r)

18 Main Ports

1 – SAE Port - Metric bolts

19 Main Port Orientation

R – Radial (side ports)

20 21 Main Drive Shaft End

01 – ISO straight key
02 – ISO spline

22 Drive Shaft Seal Configuration

S – Single shaft seal

23 Seal Material

V – Viton*

* Viton is a trademark of E.I. Dupont (other materials available, contact your Eaton Representative)

24 Yoke Position Indicator

0 – No position indicator
V – Visual position indicator
P – Position sensor
L – Position limit switch
M – Position sensor and visual indicator

25 Housing surface finish

A – Blue painted

26 Transmission Circuit

0 – No transmission circuit
1 – Block filter, optical dirt indicator
2 – Block, filter, electrical dirt indicator
3 – Block without filter

27 Zero Position Valve

0 – No Zero Position Valve

28 Add Control Model Code

Code (characters 28...50) on the following pages

Model Code

Transmission Pumps

"W" Series - ES Control

E	S	*	0	0	*	0	0	0	0	0	0	0	0	0	*	*	*	*	*	*	*	#
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51

28 29 Control type

ES – Electric motor displacement control

30 Displacement Adjustment Options

M – Electric Motor - Fast response

N – Electric Motor - Medium response

P – Electric Motor - Slow response

31 32 Electronic Controls

00 – Not required

33 Yoke Displacement Zone

A – Single side of center "A"

C – Over center

34 Extra Functions

0 – Not available

35 Pressure Control Options

0 – Not available

36 37 38 39 40 41 Power Control Options

000000 – Not required

42 Pilot Oil Filter

0 – Not required

43 Fail Safe Valve

0 – Not required

44 Position Monitoring

A – 4 limit switches

B – 8 limit switches

P – 4 limit switches + sensor

T – 8 limit switches + sensor

45 Electric Motor Type

2 – Motor with brake (IP54)

3 – Motor without brake (Explosion proof)

46 Control Voltage of Zero Position Valve and Directional Control Valve

0 – Not applicable

B – 110 AC 50 Hz/120 AC 60 Hz

D – 220 AC 50 Hz/240 AC 60 Hz

G – 12 VDC

H – 24 VDC

47 48 49 50 Customer Adjustment Specification

0000 – None

???? – Yes (final number will be assigned by Eaton. Specify on table below)

51 Special Features - Add special feature description (characters 51..55) on page 11 if required.

Response Time (sec) for Zero to Max. Displacement

SIZE	130		180		250		360		500		750	
Frequency	**50 Hz**	**60 Hz**	**50 Hz**	**60 Hz**	**50 Hz**	**60 Hz**	**50 Hz**	**60 Hz**	**50 Hz**	**60 Hz**	**50 Hz**	**60 Hz**
Fast	10	8	10	8	8	7	11	9	10	8	14	12
Medium	20	17	20	17	20	17	27	23	24	20	35	29
Slow	50	42	50	42	40	33	55	46	48	40	70	58

CUSTOMER ADJUSTMENT SPECIFICATIONS	UNIT	STANDARD SETTING	CUSTOMER ADJUSTMENT OPTION	REMARKS
All Revolution Adjustments below set at ...	rpm	1500	–	
Pressure Relief Valve Side A	bar	350		
Pressure Relief Valve Side B	bar	350		
Charge Pressure Relief Valve	bar	20	–	
Flushing (Low) Pressure Relief Valve	bar	10	–	
Mechanical Adjustment Stop Side A	L/min	Q_{max}		
Mechanical Adjustment Stop Side B	L/min	Q_{min}		
Displacement Adjusted to ...	L/min	-50% Q_{max} Side A		
Position Monitoring Switch 1	L/min	0 from A		
Position Monitoring Switch 2	L/min	95% Q_{max} Side A		> 95% not possible
Position Monitoring Switch 3	L/min	0 from B		
Position Monitoring Switch 4	L/min	95% Q_{max} Side B		> 95% not possible
Position Monitoring Switch 5	L/min	–		
Position Monitoring Switch 6	L/min	–		
Position Monitoring Switch 7	L/min	–		
Position Monitoring Switch 8	L/min	–		

Model Code

Transmission Pumps

"W" Series - DP Control

D	P	*	0	0	*	*	*	*	*	*	*	*	*	*	0	0	0	*	*	*	*	*	#
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51

28 29 Control type

DP – Pressure signal displacement control

30 Displacement Adjustment Options

G – Mounting interface Cetop 3 only
H – Remote port G 1/4
J – Proportional relief inc. electronics
K – Proportional relief inc. electr. & dir. control

31 32 Electronic Controls

00 – Not required

33 Yoke Displacement Zone

A – Single side of center "A"
C – Over center

34 Extra Functions

0 – Not required for this control type
1 – Pressure limiter overriding function side A
2 – Pressure limiter overriding function side B
3 – Pressure limiter overriding function side A and B
4 – Pressure limiter and power control overriding function side A
5 – Pressure limiter and power control overriding function side B
6 – Pressure limiter and power control overriding function side A and B
7 – Pressure limiter function side A and B power control function side A
8 – Pressure limiter function side A and B power control function side B

35 Pressure Control Options

0 – Not required for this control type
F – Remote port, only side A
G – Remote port, only side B
H – Remote port, only side A and B
A – Electro Proportional Relief Valve Side A
B – Electro Proportional Relief Valve Side B
K – Electro Proportional Relief Valve Side A and B

36 37 38 39 40 41 Power Control Options

000000–Not required for this control type
???000– ??? kW at 1500 RPM Side A
000???– ??? kW at 1500 RPM Side B

42 Pilot Oil Filter

0 – Not applicable
V – Filter with visual indicator
E – Filter with electrical indicator

43 Fail Safe Valve

0 – Not applicable

44 Position Monitoring

0 – No position monitoring

45 Electric Motor Type

0 – No electric motor

46 Control Voltage of Zero Position Valve and Directional Control Valve

0 – Not applicable
B – 110 AC 50 Hz/120 AC 60 Hz
D – 220 AC 50 Hz/240 AC 60 Hz
G – 12 VDC
H – 24 VDC

47 48 49 50 Customer Adjustment Specification

0000 – None

???? – Yes (final number will be assigned by Eaton. Specify on table below)

51 Special Features - Add special feature description (characters 51..55) on page 11 if required

CUSTOMER ADJUSTMENT SPECIFICATIONS	UNIT	STANDARD SETTING	CUSTOMER ADJUSTMENT OPTION	REMARKS
All Revolution Adjustments below set at ...	rpm	1500	–	–
Pressure Relief Valve Side A	bar	350		
Pressure Relief Valve Side B	bar	350		
Charge Pressure Relief Valve	bar	20	–	
Flushing (Low) Pressure Relief Valve	bar	10	–	
Pilot Pressure Size 130, 180, 250, 360	bar	60	–	
Pilot Pressure Size 500 & 750	bar	80	–	
Mechanical Adjustment Stop Side A	L/min	Q_{max}		
Mechanical Adjustment Stop Side B	L/min	Q_{min}		
Max. Stop by Control Side A	L/min	95% Q_{max}		
Max. Stop by Control Side B	L/min	95% Q_{max}		
Pressure Override Side A	bar	90		
Pressure Override Side B	bar	90		

Model Code

Transmission Pumps

"W" Series - SP Control

S	P	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	*	*	*	*	*	#
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51

28 29 Control type

SP – Proportional valve displacement control

30 Displacement Adjustment Options

C – With Cetop 3 valve KDG4V S

F – With Cetop 5 Proportional valve

31 32 Electronic Controls

03 – ER 9.3 - 10 (Cetop 3)

04 – ER 9.4 - 10 (Cetop 5)

33 Yoke Displacement Zone

A – Single side of center "A"

C – Over center

34 Extra Functions

0 – Not required for this control type

1 – Pressure limiter overriding function side A

2 – Pressure limiter overriding function side B

3 – Pressure limiter overriding function side A and B

4 – Pressure limiter and power control overriding function side A

5 – Pressure limiter and power control overriding function side B

6 – Pressure limiter and power control overriding function side A and B

7 – Pressure limiter function side A and B power control function side A

8 – Pressure limiter function side A and B power control function side B

35 Pressure Control Options

0 – Not required for this control type

F – Remote port, only side A

G – Remote port, only side B

H – Remote port, only side A and B

A – Electro Proportional Relief Valve Side A

B – Electro Proportional Relief Valve Side B

K – Electro Proportional Relief Valve Side A and B

36 37 38 39 40 41 Power Control Options

000000– Not required for this control type

???000– ??? kW at 1500 RPM Side A

000???– ??? kW at 1500 RPM Side B

42 Pilot Oil Filter

0 – Not applicable

V – Filter with visual indicator

E – Filter with electrical indicator

43 Fail Safe Valve

0 – Not applicable

1 – With solenoid valve

44 Position Monitoring

0 – No position monitoring

45 Electric Motor Type

0 – No electric motor

46 Control Voltage of Fail Safe Valve

0 – Not applicable

B – 110 AC 50 Hz/120 AC 60 Hz

D – 220 AC 50 Hz/240 AC 60 Hz

G – 12 VDC

H – 24 VDC

47 48 49 50 Customer Adjustment Specification

0000 – None

???? – Yes (final number will be assigned by Eaton. Specify on table below)

51 Special Features

Add special feature description (characters 51..55) on page 11 if required

CUSTOMER ADJUSTMENT SPECIFICATIONS	UNIT	STANDARD SETTING	CUSTOMER ADJUSTMENT OPTION	REMARKS
All Revolution Adjustments below set at ...	rpm	1500	–	–
Pressure Relief Valve Side A	bar	350		
Pressure Relief Valve Side B	bar	350		
Charge Pressure Relief Valve	bar	20	–	
Flushing (Low) Pressure Relief Valve	bar	10	–	
Pilot Pressure Size 130, 180, 250, 360	bar	60	–	
Pilot Pressure Size 500 & 750	bar	80	–	
Mechanical Adjustment Stop Side A	L/min	Q_{max}		
Mechanical Adjustment Stop Side B	L/min	Q_{min}		
Max. Stop by Control Side A	L/min	95% Q_{max}		
Max. Stop by Control Side B	L/min	95% Q_{max}		
Ramp Time 0 _ A	sec	0	El. Card Adjustment Done by Customer	Refer to El. card manual
Ramp Time A _ 0	sec	0	El. Card Adjustment Done by Customer	Refer to El. card manual
Pressure Override Side A	bar	90		
Pressure Override Side B	bar	90		

Model Code

Transmission Pumps

"W" Series - SM Control

S	M	0	0	0	*	*	*	*	*	*	*	*	*	0	0	0	0	0	*	*	*	*	#
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51

28 29 Pump

SM – El. servo displacement control - mechanical feedback

30 Displcement Adjustment Option

0 – Not required for this control type

31 32 Electronic Controls

00 – Not required for this control type

33 Yoke Displacement Zone

A – Single side of center "A"
C – Over center

34 Extra Functions

0 – Not required for this control type
1 – Pressure limiter overriding function side A
2 – Pressure limiter overriding function side B
3 – Pressure limiter overriding function side A and B
4 – Pressure limiter and power control overriding function side A
5 – Pressure limiter and power control overriding function side B
6 – Pressure limiter and power control overriding function side A and B
7 – Pressure limiter function side A and B power control function side A
8 – Pressure limiter function side A and B power control function side B

35 Pressure Control Options

0 – Not required for this control type
F – Remote port, only side A
G – Remote port, only side B
H – Remote port, only side A and B
A – Electro Prop. Relief Valve Side A
B – Electro Prop. Relief Valve Side B
K – Electro Prop. Relief Valve Side A and B

36 37 38 39 40 41 Power Control Option

000000 – Not required for this control type
???000 – ??? kW at 1500 RPM Side A
000??? – ??? kW at 1500 RPM Side B

42 Pilot Oil Filter

0 – Filter has to be installed by customer

43 Fail Safe Valve

0 – Not required for this control type

44 Position Monitoring

0 – Not required for this control type

45 Electric Motor Type

0 – Not required for this control type

46 Control Voltage of Zero Position Valve

0 – Not required for this control type

47 48 49 50 Customer Adjustment Specification

0000 – None

???? – Yes (final number will be assigned by Eaton. Specify on table below)

51 Special Features

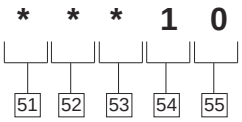
Add special feature description (characters 51..55) on page 11 if required

CUSTOMER ADJUSTMENT SPECIFICATIONS	UNIT	STANDARD SETTING	CUSTOMER ADJUSTMENT OPTION	REMARKS
All Adjustment below set at ...	RPM	1500	-	
Pressure Relief Valve Side A	bar	350		
Pressure Relief Valve Side B	bar	350		
Charge Pressure Relief Valve	bar	20	-	
Flushing (low) Pressure Relief Valve	bar	10	-	
Pilot Pressure Size 130, 180, 250, 360	bar	60	-	
Pilot Pressure Size 500 and 750	bar	80	-	
Max. Mechanical Stop Side A	l/min	Qmax		
Max. Mechanical Stop Side B	l/min	Qmax		
Pressure Override Side A	bar	90		
Pressure Override Side B	bar	90		

Model Code

Transmission Pumps

"W" Series -
Special Features



51 52 53 **Special Features**

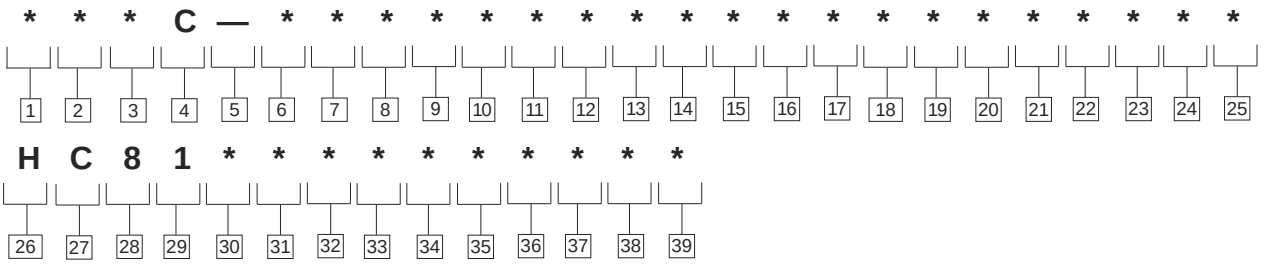
000 - None
*** - Defined by Eaton

54 55 **Design Number**

10 - Design Number

Model Code

Combination Units



1 Combination Unit

P – Pump
T – Transmission Pump
M – Motor

2 Displacement

F – Filled
V – Variable

3 Pump Series

W – "W" Series (was 30 design)
X – "X" Series (was 20 design)

4 Combination Unit

C

5 Separator

6 7 8 First Displacement cm3/r

066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

9 10 First Control Type

00 – No Control (for Fixed Displacement Only)
DF – Pressure Compensator
LR – Power Control
ES – Electric Motor Control
HG – Handwheel Displacement Control
FE – Screw Adjustment Displacement Control
SM – Servo Adjustment Displacement Control - Mech Feedback
DP – Pressure Signal Displacement Control
SP – Proportional Valve Displacement Control

11 12 13 Second Displacement cm3/r

066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

14 15 Second Control Type

00 – No Control (for Fixed Displacement Only)
DF – Pressure Compensator
LR – Power Control
ES – Electric Motor Control
HG – Handwheel Displacement Control
FE – Screw Adjustment Displacement Control
SM – Servo Adjustment Displacement Control - Mech Feedback
DP – Pressure Signal Displacement Control
SP – Proportional Valve Displacement Control

16 17 18 Third Displacement cm3/r

000 – Not Required
066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

19 20 Third Control Type

00 – No Control (for Fixed Displacement Only)
DF – Pressure Compensator
LR – Power Control
ES – Electric Motor Control
HG – Handwheel Displacement Control
FE – Screw Adjustment Displacement Control
SM – Servo Adjustment Displacement Control - Mech Feedback
DP – Pressure Signal Displacement Control
SP – Proportional Valve Displacement Control

21 22 23 Fourth Displacement cm³/r

000 – Not Required
066 – 66 cm³/r [4.0 in³/rev]
090 – 90 cm³/r [5.5 in³/rev]
130 – 130 cm³/r [7.9 in³/rev]
180 – 180 cm³/r [11.0 in³/rev]
250 – 250 cm³/r [15.3 in³/rev]
360 – 360 cm³/r [22.0 in³/rev]
500 – 500 cm³/r [30.5 in³/rev]
750 – 750 cm³/r [45.8 in³/rev]

24 25 Fourth Control Type

00 – No Control (for Fixed Displacement Only)
DF – Pressure Compensator
LR – Power Control
ES – Electric Motor Control
HG – Handwheel Displacement Control
FE – Screw Adjustment Displacement Control
SM – Servo Adjustment Displacement Control - Mech Feedback
DP – Pressure Signal Displacement Control
SP – Proportional Valve Displacement Control

26 27 28 29 Assembly Numbers

HC81 – Defined By Eaton

30 31 32 33 34 35 36 37 38 39 Assembly Numbers

Defined By Eaton

- For a combination of two or more units fill out this Combination Model Code.
- Start with the biggest size unit for the first displacement.
- For each unit included in this combination, a separate model code must be chosen. Use the form on page 5.
- Character 26 to 39 will be P/N of the combination. This number will be defined by Eaton and provided in the order acknowledgement.
- Charge and Pilot Pump through drive option must be specified on the rear unit of the combination (as a special feature).
- Front and middle units shall have the through drive option of the following unit in the combination.

Model Code

Examples for
Combination Units

Example 1: Combination of two closed loop pumps

Model Code Front Unit	TVWF-500M08R0000H1R02SVMA20SPC03C00000000E100H000000010
Model Code Rear Unit	TVWR-250M07R000PP1R02SVMA20SPC03C00000000E100H000000010
Model Code Combination Unit	TVWC-500SP250SP0000000000HC81**********

Example 2: Combination of one closed loop - and two open loop pumps (For open loop model code refer to the according catalog)

Mode Code Front Unit	TVWF-500M08R0000H1R02SVMA20SPC03C00000000E100H000000010
Model Code Middle Unit	PVWM-250M07R00E1R02SV0ADF000A0000000000000000010
Model Code Rear Unit	PFXR-130M02R00P1A02SV0A00000A0000000000000000010
Model Code Combination Unit	TVWC-500SP250DF1300000000HC81**********

Pump Specifications - US

MODEL			TVW 130	TVW 180	TVW 250	TVW 360	TVW 500	TVW 750
Design			Swash plate - Axial piston pump					
Type of mounting			Flange or foot-mounted. Combination units foot mounted only					
Pipe connection SAE/Flange	B A	psi	1-1/4"-6000	1-1/4"-6000	1-1/2"-6000	1-1/2"-6000	2"-6000	2"-6000
Direction of rotation			Clockwise when viewing shaft end of pump Counterclockwise available on request					
Speed range	n_{min} n_{max}	rpm	150 1800					 1500[1)]
Installation position			Optional, see mounting information					
Ambient temperature range	min max	°F	-4 122					
Weight	m	lb	353	364	518	529	926	1014
Mass of inertia	J	lb ft²	1.07	1.07	3.46	3.61	11.9	13.1

HYDRAULIC CHARACTERISTICS

Nominal pressure (100% duty cycle)	p_N	psi	5075					
Input pressure	p_{1min} p_{1max}	psi psi	58 abs Pressure can be applied to the pump inlet but the sum of p1 and p2 must not exceed the maximum value of 6090 psi					
Max. pressure to DIN 24312	p_{2max}	psi	6090					
Hydraulic fluid			Hydraulic oil to DIN 51524 part 2. Refer to section Application Data-Fluid Recommendations					
Hydraulic fluid temperature range	min max	°F	-13 194					
Viscosity range for continuous operation	min max	cSt cSt	10 150					
Max. permissible start viscosity	max	cSt	1000[2)]					
Filtering	ISO 4406		18/15/13					
Maximum geometric displacement	V_g	in³	7.9	11	15.2	22	30.5	45.7
Max. geom. pump flow n= 1500 rpm n= 1800 rpm	Q_g	USgpm	51.5 62	71 85.5	99 119	142 171	198 238	297 297[1]
Case pressure	$p_{v\ max}$	psi	max. 7.2 psi over p1. pmax = 58 psi abs.					

HYDRAULIC CHARACTERISTIC OF CHARGE AND PILOT PUMP

Displacement charge pump	$V_{g\ Sp}$	in³	2.44	2.44	3.91	4.88	7.63	12.2
Charge pressure	$p_{N\ Sp}$	psi	145/290	145/290	145/290	145/290	174/290	232/348
Input pressure charge & pilot pump	$p_{min\ Sp/St}$	psi	11.6 absolute					
Displacement pilot pump	$V_{g\ St}$	in³	0.5					
Pilot pressure	p_{St}	psi	870	870	870	870	1160	1160

DRIVE

Max. driving torque - single unit (p2 max., h= 100%)	$M_{1\ Single}$	lb.ft.	642	888	1232	1774	2463	3688
Max. power consumption - single unit (p2 max., h= 100%; n= 1800 rpm)	$P_{1\ Single}$	hp	220	304	422	608	845	1055[1]
Max. driving torque - comb. unit	$M_{1\ Comb.}$	lb.ft.	2x642	2x888	2x1232	2x1774	3688	3688

1) TVW - 750 at 1800 rpm reduced to 38.1 in³

2) When pressure below 1450 psi and flow below 25% of max. flow

Pump Specifications - Metric

MODEL			TVW 130	TVW 180	TVW 250	TVW 360	TVW 500	TVW 750
Design			Swash plate - Axial piston pump					
Type of mounting			Flange or foot-mounted. Combination units foot mounted only					
Pipe connection SAE/Flange	B A	psi	1-1/4"-6000	1-1/4"-6000	1-1/2"-6000	1-1/2"-6000	2"-6000	2"-6000
Direction of rotation			Clockwise when viewing shaft end of pump Counterclockwise available on request					
Speed range	n_{min} n_{max}	min^{-1}	150 1800					 1500[1)]
Installation position			Optional, see mounting information					
Ambient temperature range	min max	°C	-20 50					
Weight	m	kg	160	165	235	240	420	460
Mass of inertia	J	$kg\ m^2$	0,045	0,045	0,146	0,152	0,5	0,55

HYDRAULIC CHARACTERISTICS								
Nominal pressure (100% duty cycle)	p_N	bar	350					
Input pressure	p_{1min} p_{1max}	bar bar	4 Pressure can be applied to the pump inlet but the sum of p1 and p2 must not exceed the maximum value of 420 bar					
Max. pressure to DIN 24312	p_{2max}	psi	420					
Hydraulic fluid			Hydraulic oil to DIN 51524 part 2. Refer to section Application Data-Fluid Recommendations					
Hydraulic fluid temperature range	min max	°C	-25 90					
Viscosity range for continuous operation	min max	cSt cSt	10 150					
Max. permissible start viscosity	max	cSt	1000[2)]					
Filtering	ISO 4406		18/15/13					
Maximum geometric displacement	V_g	cm^3	130	180	250	360	500	750
Max. geom. pump flow n= 1500 min^{-1} n= 1800 min^{-1}	Q_g	l/min	195 234	270 324	375 450	540 648	750 900	1125 1125[1]
Case pressure	$p_{v\ max}$	bar	max. 0,5 bar over p1. pmax = 4 bar abs.					

HYDRAULIC CHARACTERISTIC OF CHARGE AND PILOT PUMP								
Displacement charge pump	$V_{g\ Sp}$	cm^3	40	40	64	80	125	200
Charge pressure	$p_{N\ Sp}$	bar	10/20	10/20	10/20	10/20	12/20	16/24
Input pressure charge & pilot pump	$p_{min\ Sp/St}$	bar	0,8 absolute					
Displacement pilot pump	$V_{g\ St}$	cm^3	8					
Pilot pressure	p_{St}	bar	60	60	60	60	80	80

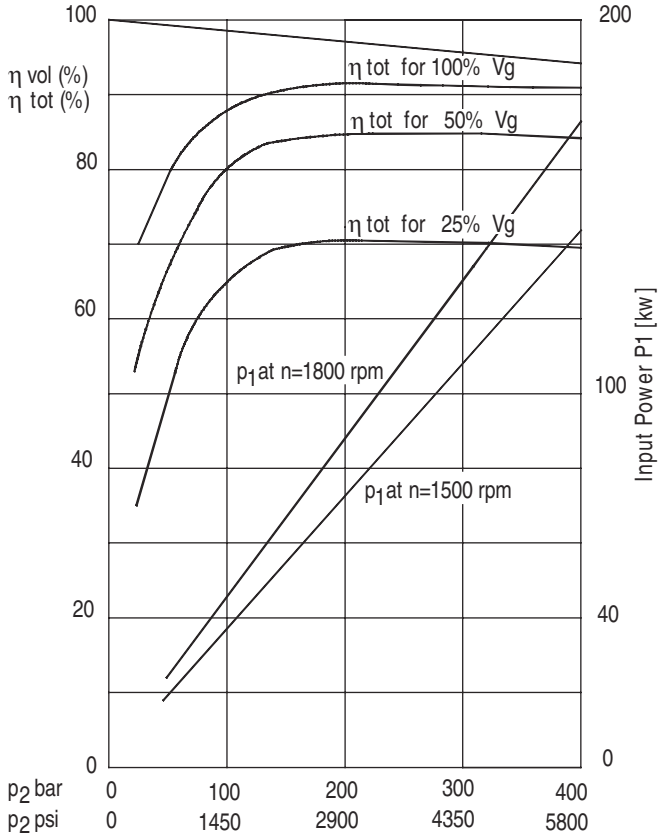
DRIVE								
Max. driving torque - single unit (p2 max., h= 100%)	$M_{1\ Single}$	Nm	870	1204	1670	2405	3340	5000
Max. power consumption - single unit (p2 max., h= 100%; n= 1800 min^{-1})	$P_{1\ Single}$	kW	164	227	315	454	630	787[1]
Max. driving torque - comb. unit	$M_{1\ Comb.}$	Nm	2x870	2x1204	2x1670	2x2405	5000	5000

1) TVW - 750 at 1800 min^{-1} reduced to 625cm^3

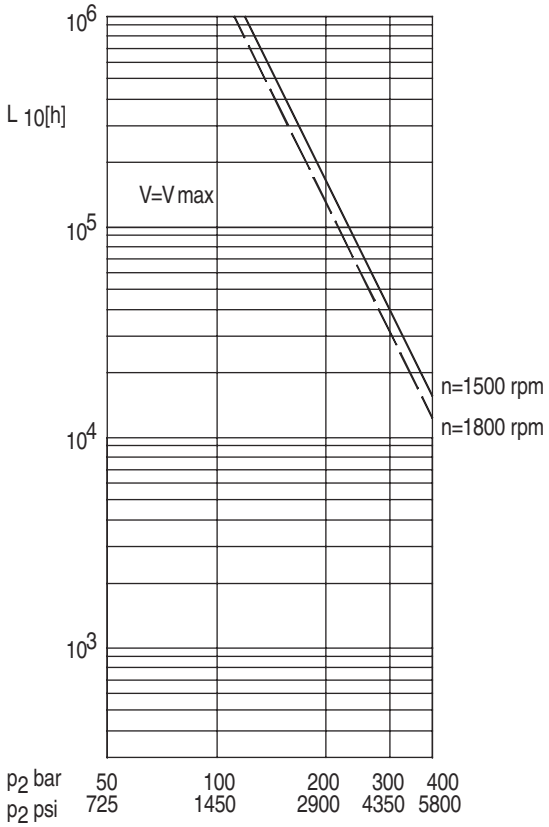
2) When pressure below 100 bar and flow below 25% of max. flow

Performance Curves - 130 Series

Power efficiency performance curve



Roller bearing life



Combination units

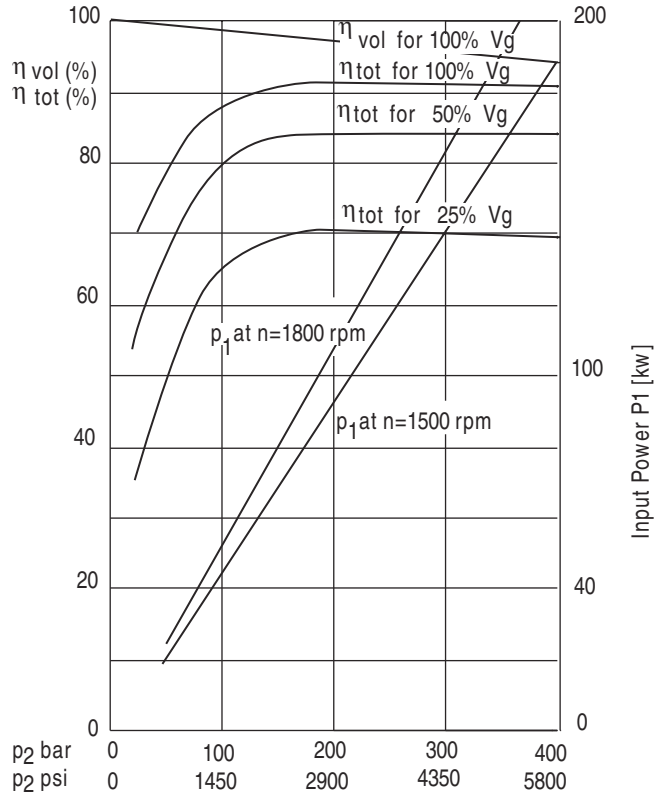
For combination pumps the characteristic values are as for the individual units.

For reduced swash-angle:

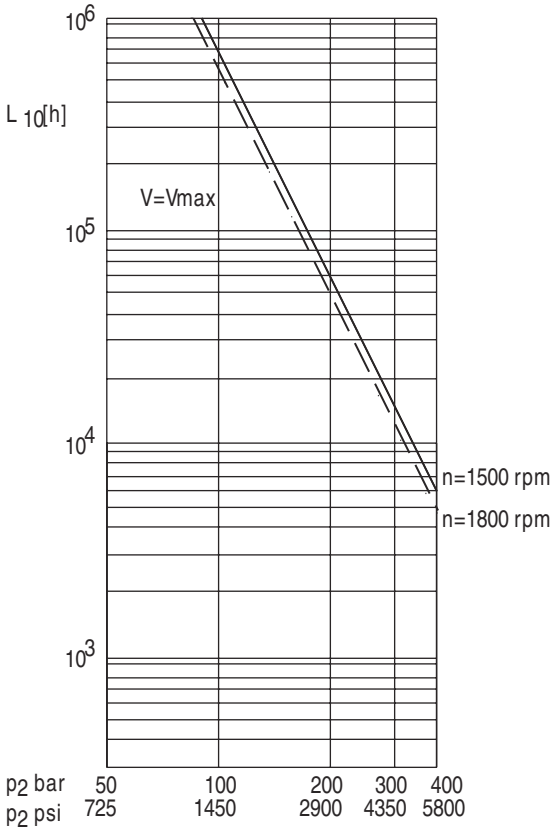
$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

Performance Curves - 180 Series

Power efficiency performance curve



Roller bearing life



Combination units

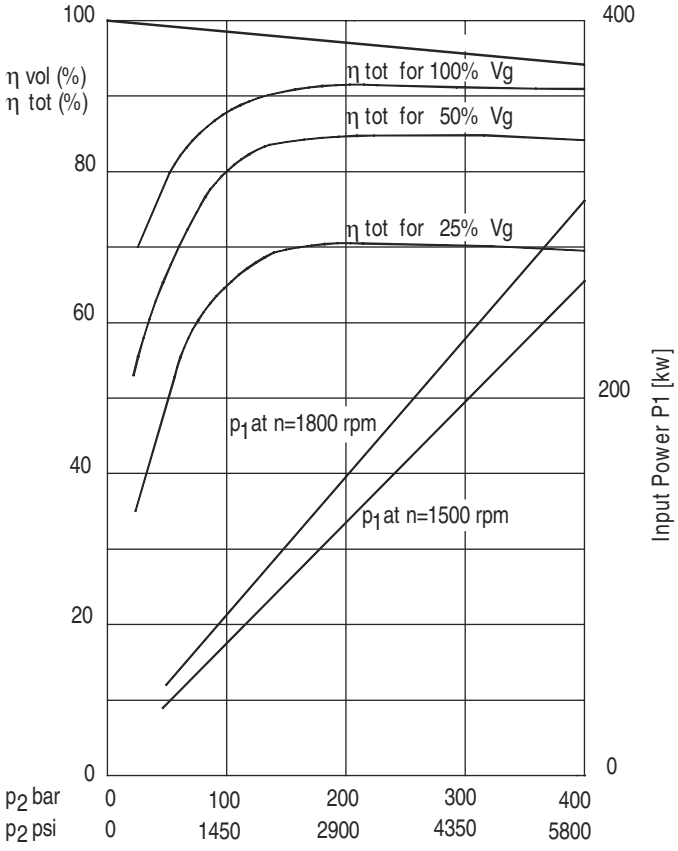
For combination pumps the characteristic values are as for the individual units.

For reduced swash-angle:

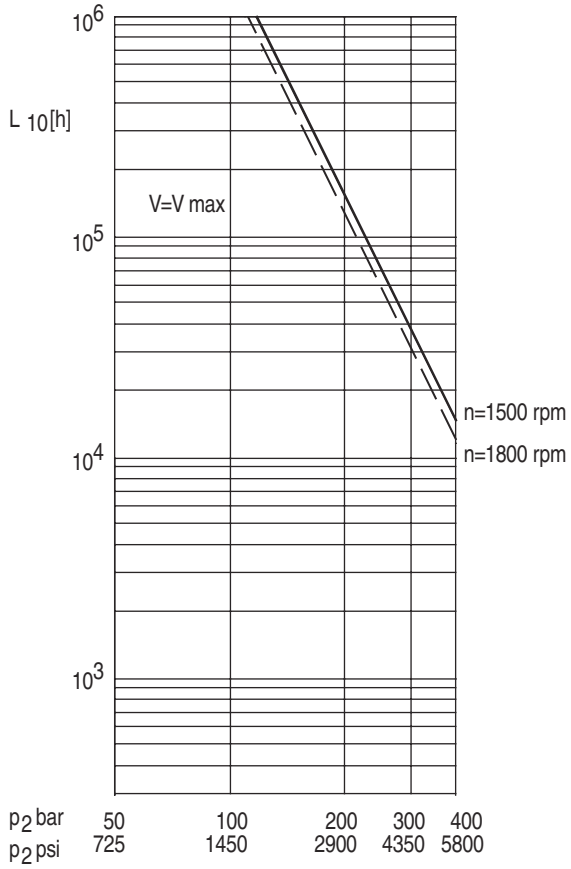
$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

Performance Curves - 250 Series

Power efficiency performance curve



Roller bearing life



Combination units

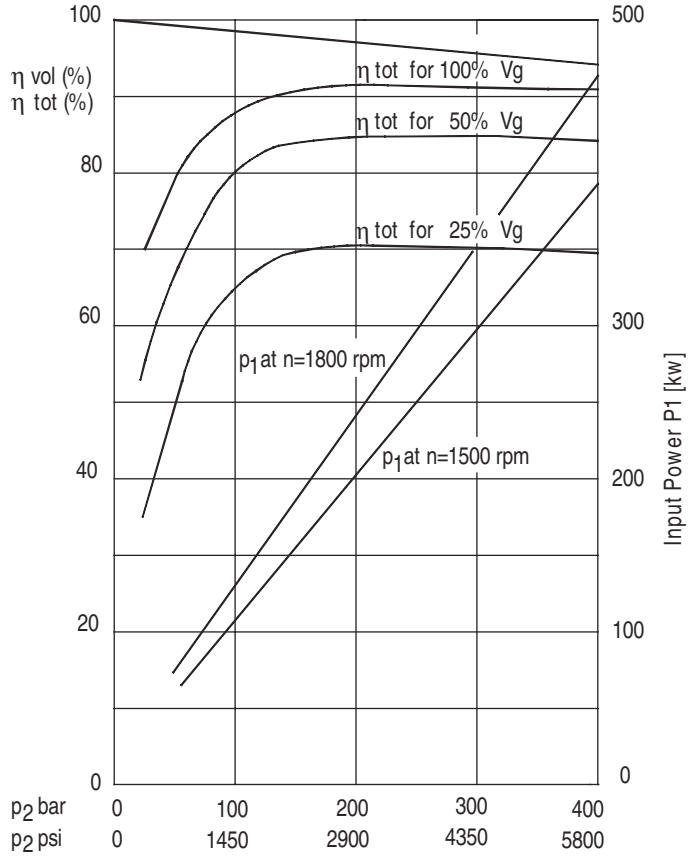
For combination pumps the characteristic values are as for the individual units.

For reduced swash-angle:

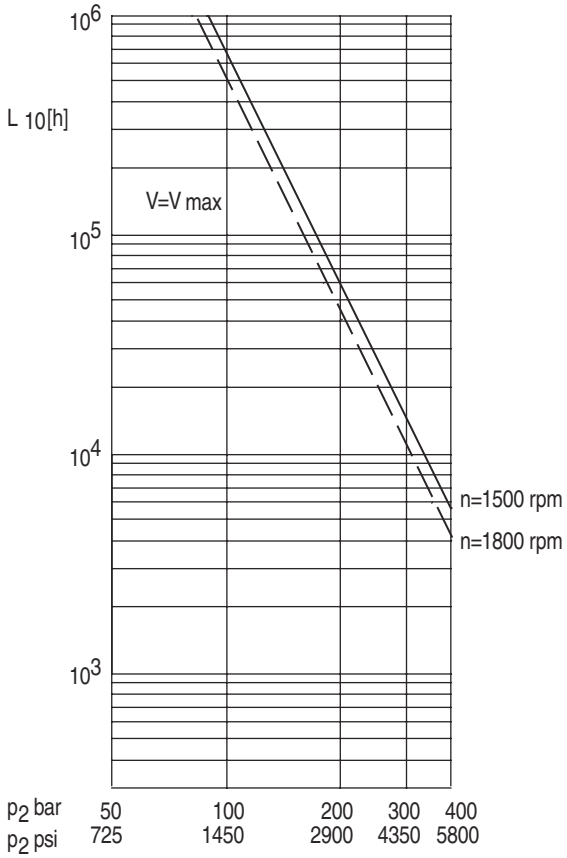
$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

Performance Curves - 360 Series

Power efficiency performance curve



Roller bearing life



Combination units

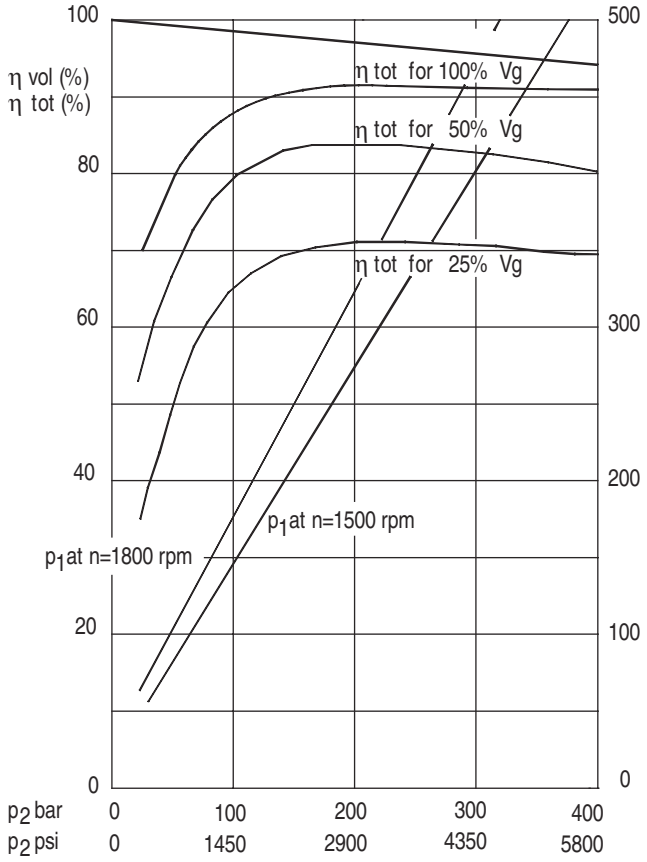
For combination pumps the characteristic values are as for the individual units.

For reduced swash-angle:

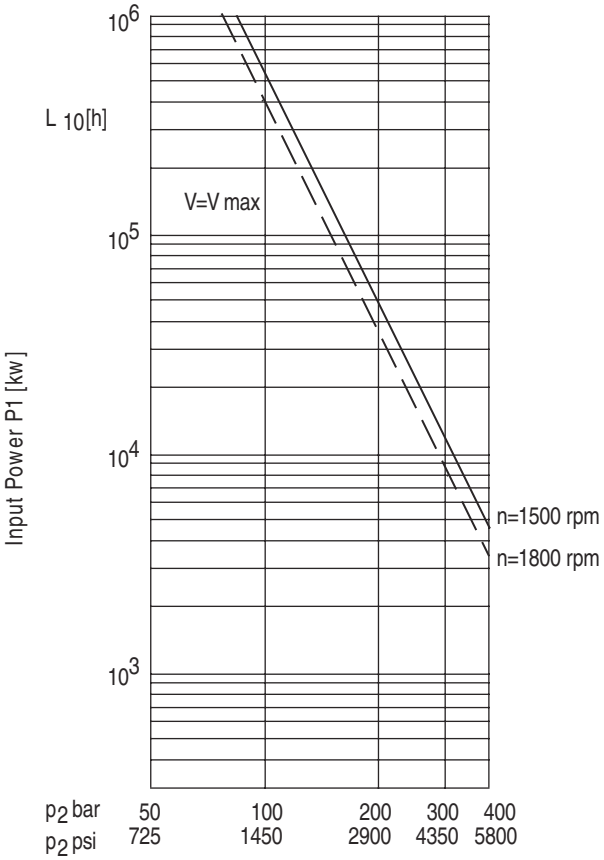
$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

Performance Curves - 500 Series

Power efficiency performance curve



Roller bearing life



Combination units

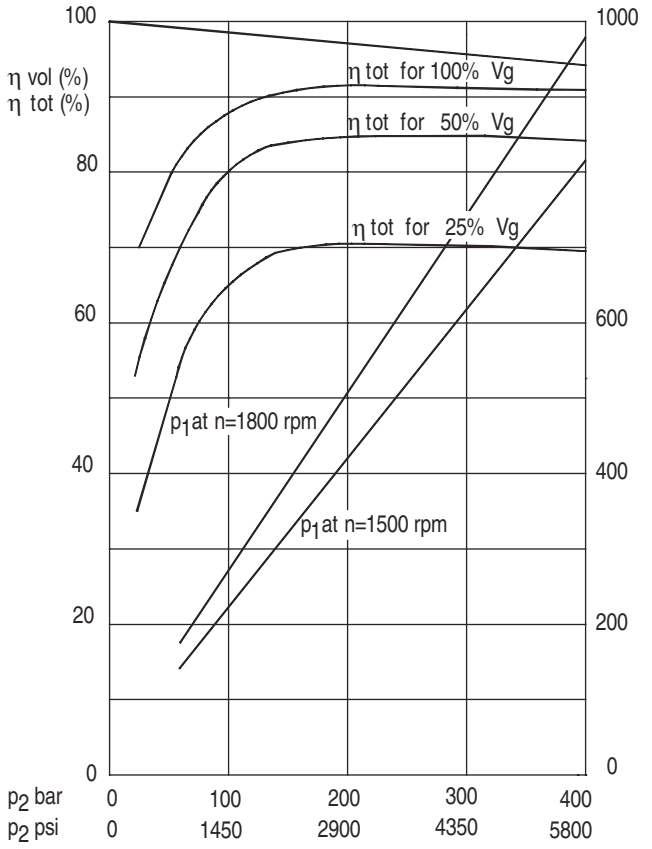
For combination pumps the characteristic values are as for the individual units. Only the torque M_1 is limited to 5000 Nm.

For reduced swash-angle:

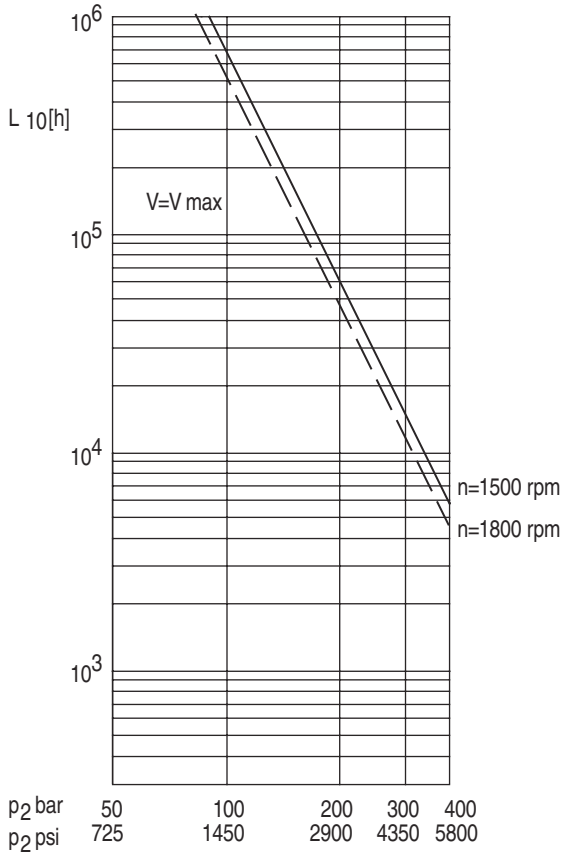
$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

Performance Curves - 750 Series

Power efficiency performance curve



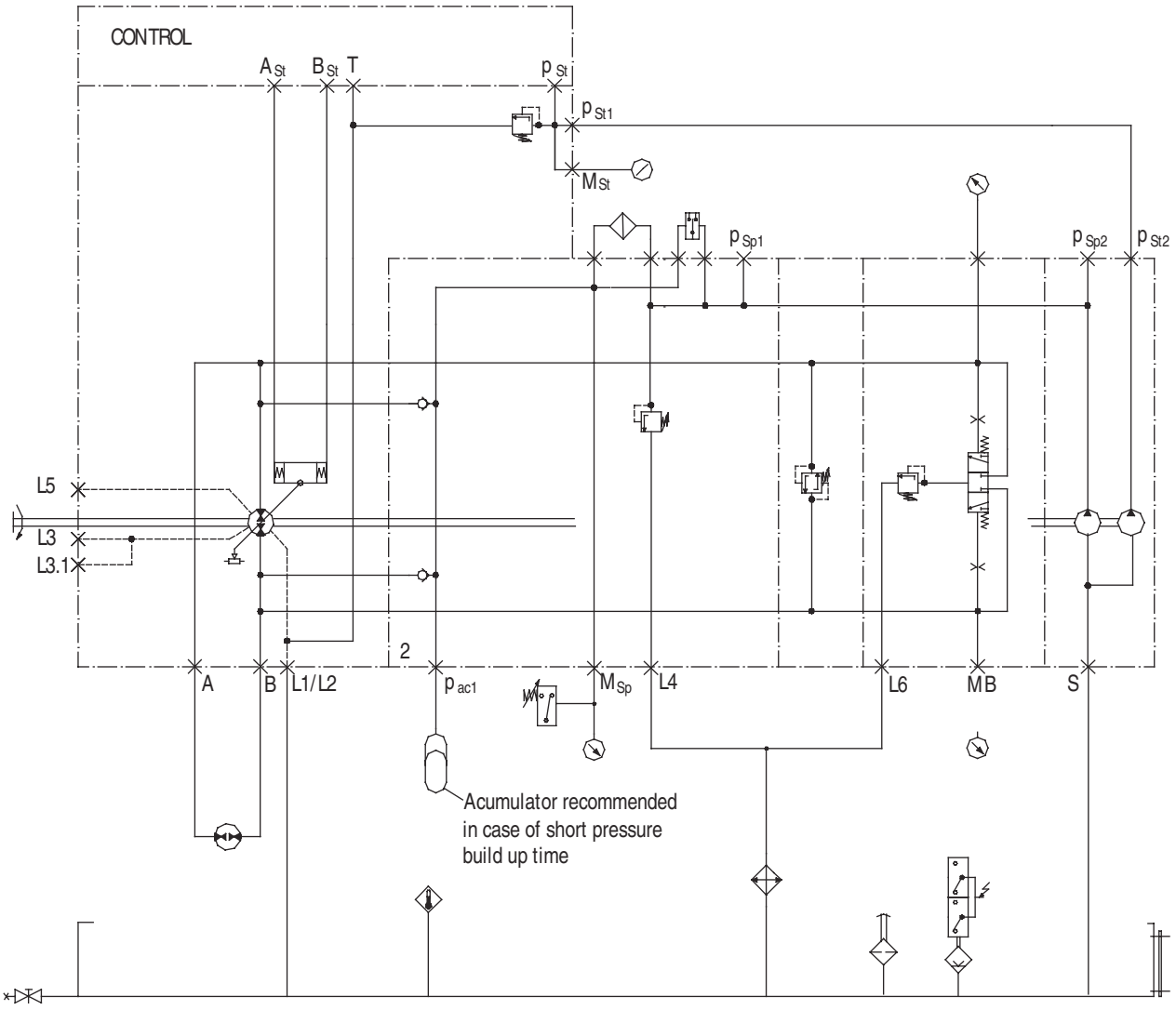
Roller bearing life



For reduced swash-angle:

$$L_h = (L \text{ at } V_{max}) \times \frac{1}{\left(\frac{V}{V_{max}}\right)^{\frac{10}{3}}}$$

Hydraulic Transmission Circuit

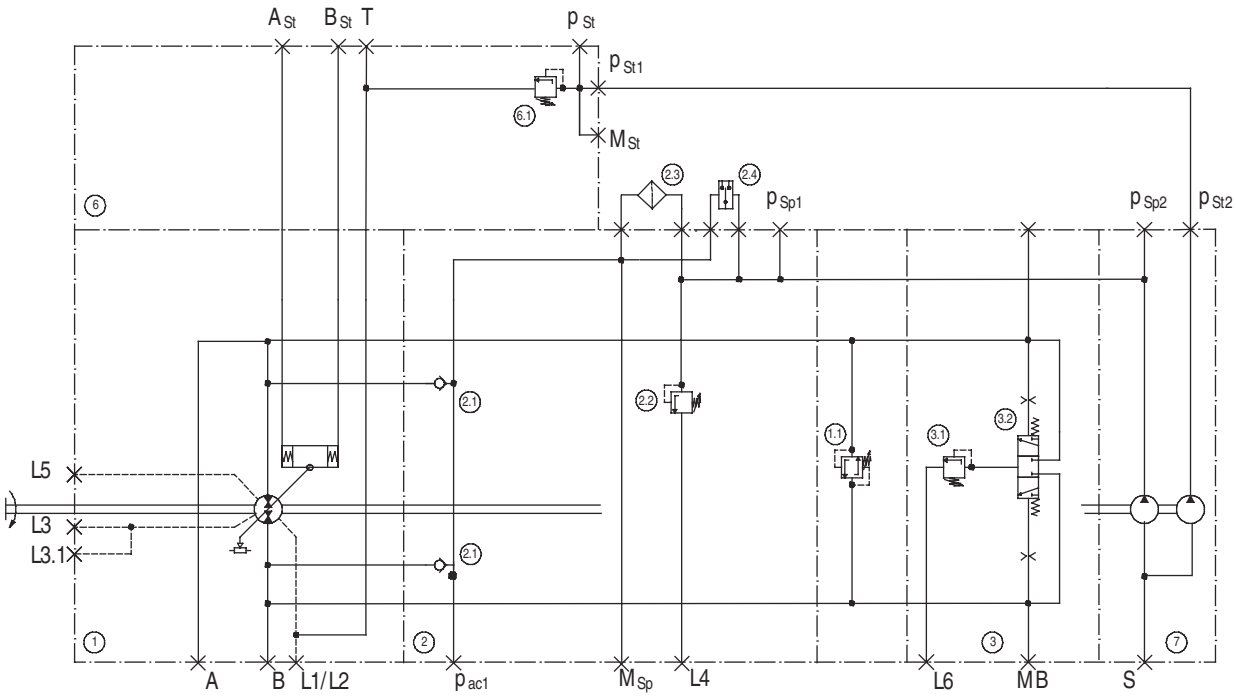


A, B	System port	L4	Return line charge flow	M_{Sp}	Gauge port charge pressure	p_{St2}	Pilot pump outlet port
A_{St}, B_{St}	Control	L5	Oil filling plug	M_{St}	Gauge port pilot pressure	S	Suction port for charge and pilot pump
L1, L2	Drain port	L6	Return line charge flow	p_{ac1}	Accumulator port	T	Tank port
L3	Ventilation port for vertical mounting	MA, MB	Gauge port system pressure	p_{Sp1}, p_{Sp2}	Port for external charge flow		
L3.1	Air bleeding port for vertical mounting			p_{St1}	Port for pilot flow		
				p_{St}	Port for pilot flow to control		

Hydraulic Transmission Circuit

with Charge Flow Filter

Size 130 ..... 500.
(Not available for 750)



A, B	System port
A_{St}, B_{St}	Control
L1, L2	Drain port
L3	Ventilation port for vertical mounting
L3.1	Air bleeding port for vertical mounting
L4	Return line charge flow
L5	Oil filling plug
L6	Return line charge flow

MA, MB	Gauge port system pressure
M_{Sp}	Gauge port charge pressure
M_{St}	Gauge port pilot pressure
p_{ac1}	Accumulator port
p_{Sp1}, p_{Sp2}	Port for external charge flow
p_{St1}	Port for pilot flow
p_{St}	Port for pilot flow to control
p_{St2}	Pilot pump outlet port

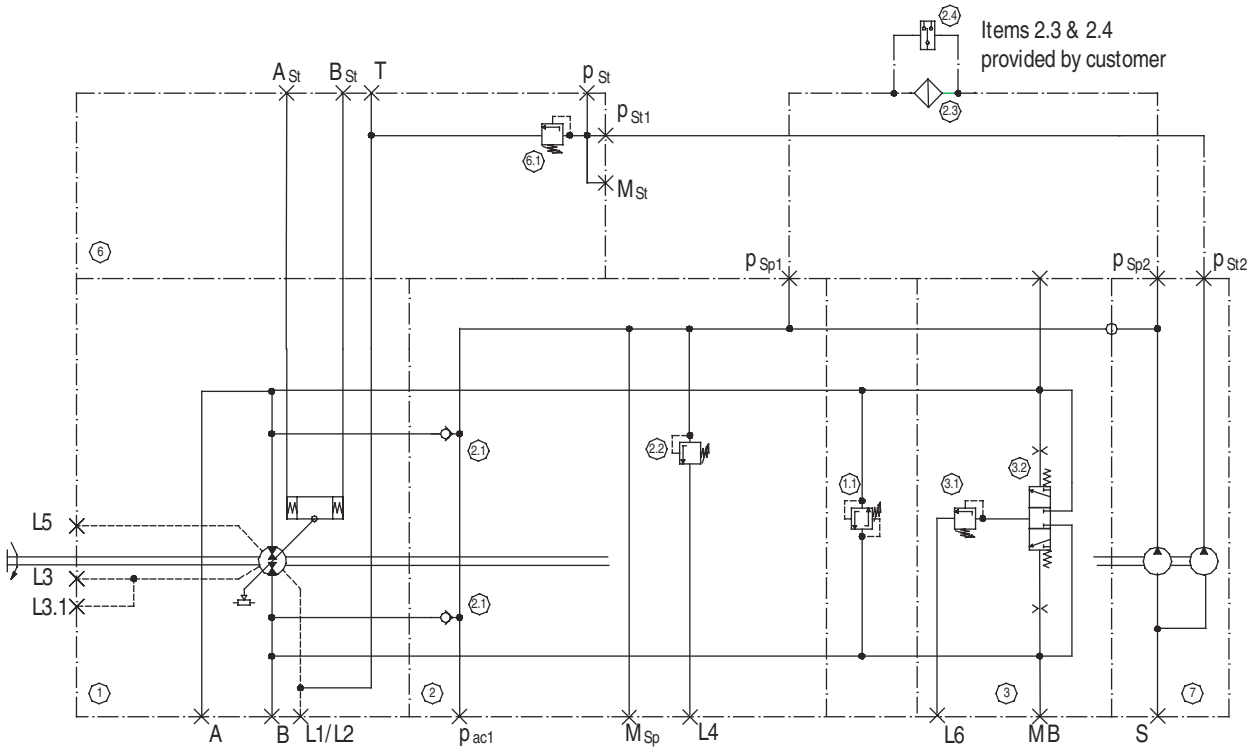
S	Suction port for charge and pilot pump
T	Tank port
1	Basic pump
1.1	High pressure relief valve
2	Charge block
2.1	Charge check valve
2.2	Charge pressure relief valve
2.3	Charge flor filter

2.4	Clogging indicator for charge flow filter
3	Flushing block
3.1	Low pressure relief valve
3.2	Flushing flow shuttle valve
6	Manifold
6.1	Pilot pressure relief valve
7	Charge/pilot pump

Hydraulic Transmission Circuit

without Charge Flow Filter

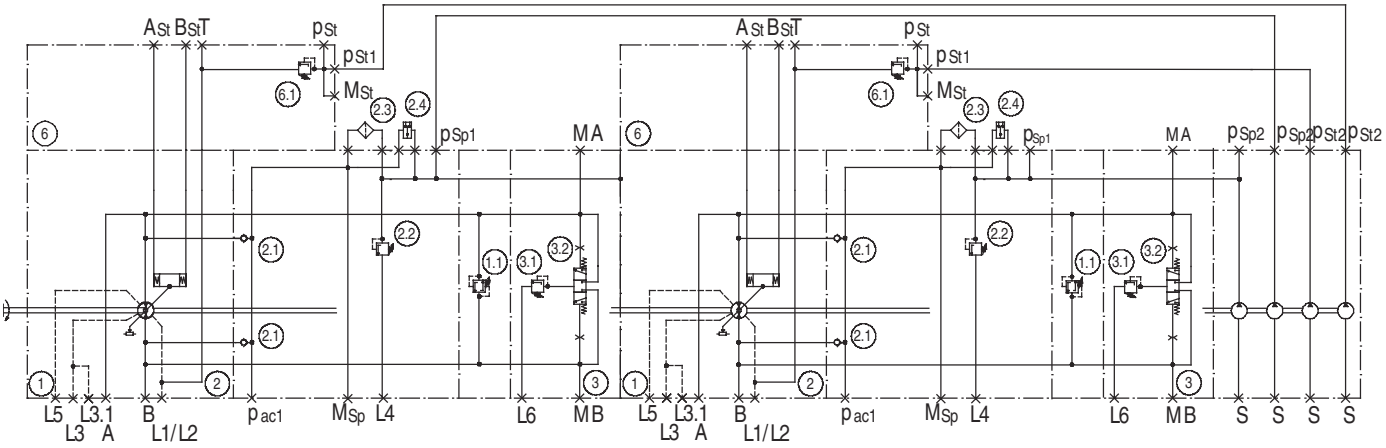
Size 130 750



A, B	System port	MA, MB	Gauge port system pressure	S	Suction port for charge and pilot pump	3	Flushing block
A_{St}, B_{St}	Control	M_{Sp}	Gauge port charge pressure	T	Tank port	3.1	Low pressure relief valve
L1, L2	Drain port	M_{St}	Gauge port pilot pressure	1	Basic pump	3.2	Flushing flow shuttle valve
L3	Ventilation port for vertical mounting	p_{ac1}	Accumulator port	1.1	High pressure relief valve	6	Control Manifold
L3.1	Air bleeding port for vertical mounting	p_{Sp1}	Port for external charge flow	2	Charge block	7	Charge/pilot pump (option)
L4	Return line charge flow	p_{St1}	Port for pilot flow	2.1	Charge check valve		
L5	Oil filling plug	p_{St2} port	Pilot pump outlet	2.2	Charge pressure relief valve		
L6	Return line charge flow						

Hydraulic Transmission Circuit

Combination of Two Pumps



A, B	System port	MA, MB	Gauge port system pressure	p_{St2}	Pilot pump outlet port	2.2	Charge pressure relief valve
A_{St}, B_{St}	Control	M_{Sp}	Gauge port charge pressure	S	Suction port for charge and pilot pump	3	Flushing block
L1, L2	Drain port	M_{St}	Gauge port pilot pressure	T	Tank port	3.1	Low pressure relief valve
L3	Ventilation port for vertical mounting	p_{ac1}	Accumulator port	1	Basic pump	3.2	Flushing flow shuttle valve
L3.1	Air bleeding port for vertical mounting	p_{Sp1}	Port for external charge flow	1.1	High pressure relief valve	6	Control manifold
L4	Return line charge flow	p_{Sp2}	Charge pump outlet pump	2	Charge block	6.1	Pilot pressure relief valve
L5	Oil filling plug	p_{St1}	Port for pilot flow	2.1	Charge check valve		
L6	Return line charge flow						

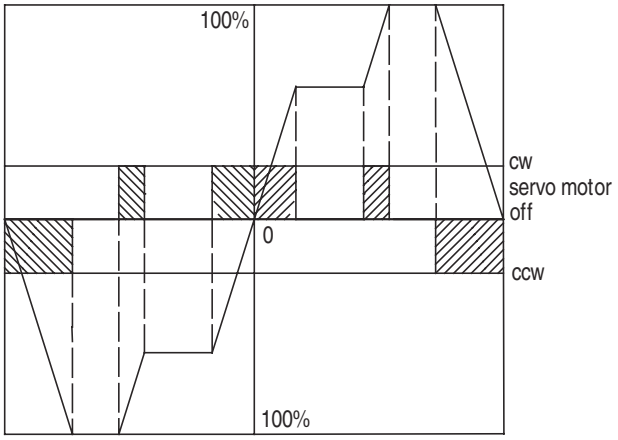
Controls – Electric Motor Displacement Control ES

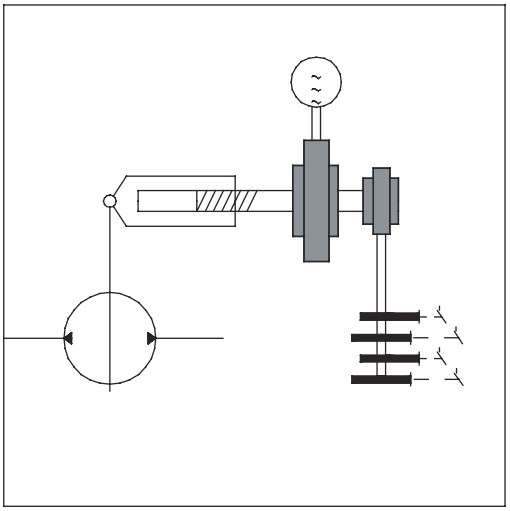
The unit is used for stepless flow adjustment. It has a three phase electric servo motor, worm gearing and a switch box with 4 and 8 limit switches for 4 or 8 positions. A potentiometer is also available.

The response times from zero to maximum depends on the chosen ratio and the speed of the servo motor (this means that during operation the response times are not variable.

No pressure/power limiter possible.

Explosion protection version are also available.





THEORETICAL RESPONSE TIME (SEC) FOR MAX. DISPLACEMENT

Size	130		180		250		360		500		750	
Freq. Hz	50	60	50	60	50	60	50	60	50	60	50	60
Fast	10	8	10	8	8	7	11	9	10	8	14	12
Medium	20	17	20	17	20	17	27	23	24	20	35	29
Slow	50	42	50	42	40	33	55	46	48	40	70	58

Response time from 0 to $+Q_{max}$ or 0 to $-Q_{max}$

Controls – Controls for Position/ Displacement DP, SP, SM

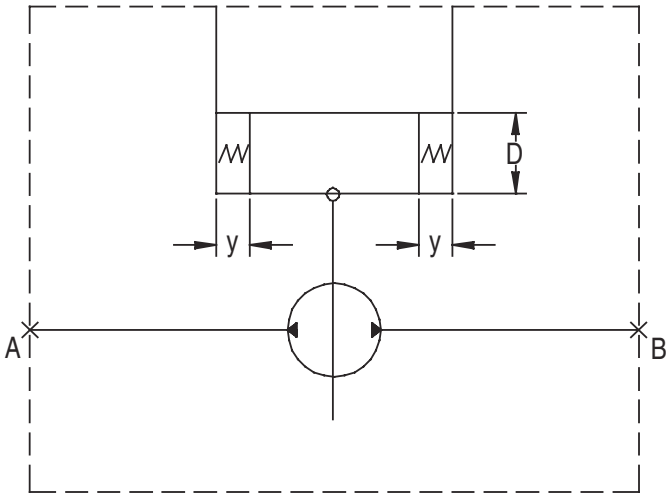
The electro or pressure proportional hydraulic displacement control will operate a hydrostatic drive in all four quadrants and work without throttle losses within either electrically or hydraulically adjustable limits. This done by controlling delivery flow respect; ie. swash angle.

The displacement of the axial piston unit is proportional to the swash plate angle and can be adjusted by a spring centered servo piston.

The servo piston is controlled by the required input signal with a mechanical, hydraulic or electrical control device.

Economical and energy saving drives can be produced with the "building block" principle for open loop and closed circuits as well.

Note: setting the pressure compensator or a control or a constant power, lower than the adjusted pilot oil pressure ps min= 60/80 bar (870/1160 psi), is not possible.



Pressure Limitation:

Each of the servo controls DP, SM and SP can be combined with a hydromechanical pressure limitation control. This destrokes the swash plate when the system pressure reaches a control setting. The response time for de-stroking the the pump is much faster than that of the servo control alone.

The pressure limitation control can also operate the unit in the motor mode of operation. This means when the hydraulic motor delivers energy to the system e.g. from energy stored in a flywheel, the pump goes over-center thus acting as a motor delivering mechanical energy to the drive, as in a mooring control function.

For each of the system sides, A and B, a separate pressure control is required. This control consist of a main stage valve conducting the system pressure to the pump actuator piston a pressure relief valve where the pressure is set. The minimum setting of this valve cannot be lower than the pilot pressure.

Power Limitation (Torque Control):

An additional power limitation valve can be used in conjunction with the pressure limitation control. This senses the position of the pump actuator piston which is proportional to the swash plate angle. In accordance with the swash plate angle the pressure adjustment is set to a determined level to follow a hyperbolic relationship between flow and pressure.

High Flow - Low Pressure

Low Flow - High Pressure

The power level, a function of the product of flow and pressure, is hence adjustable.

Controls – Pressure Signal Displacement Control DP

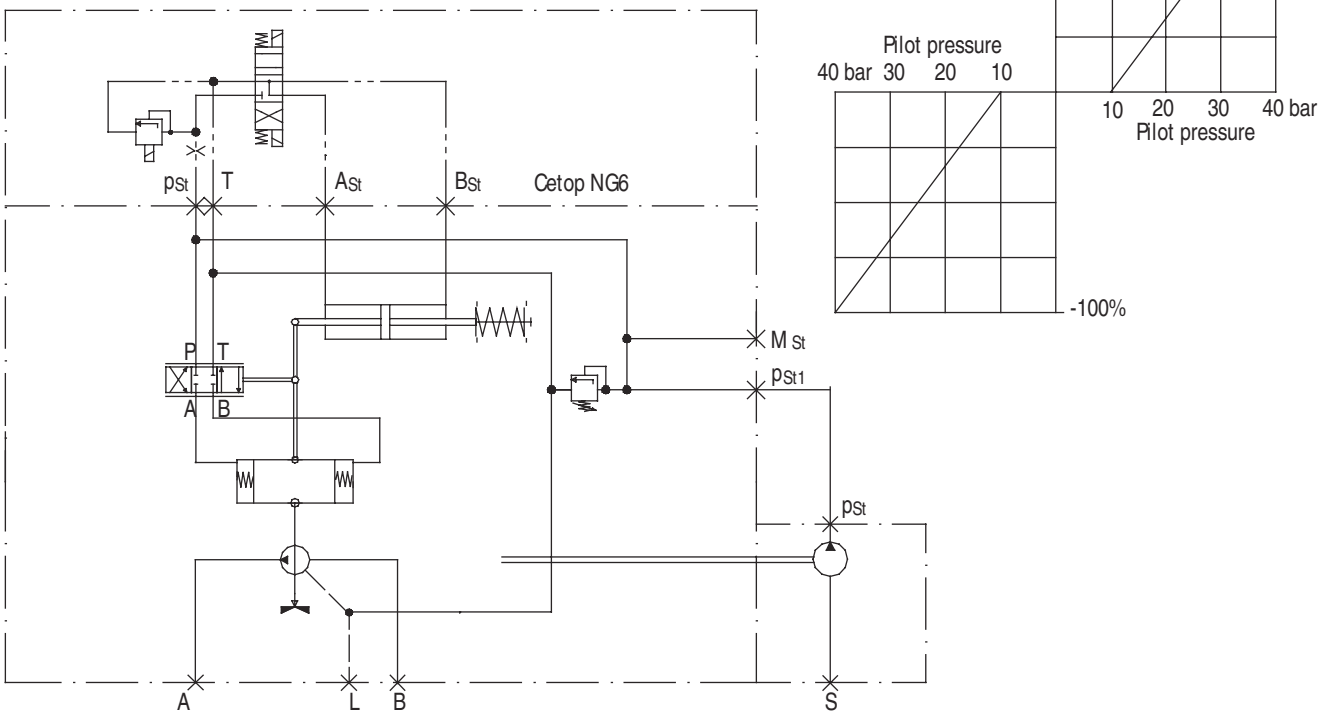
The output flow of the pump is proportional to the pilot pressure. Each of the two pilot ports is responsible for an output flow direction.

A separate pilot oil circuit is necessary with p_{min} 60/80 bar, Q_{St} = 12 l/min (3.17 USgpm). From this the control pressure is reduced to the desired set value by means of a suitable circuit.

For exchange with:

Pressure limiting valve (mechanical or proportional) from P to T line and throttle in P line 0,8 Dia. (0.03)

The pressure proportional adjustment can also be supplied with a pressure and/or power limitation.



Pressure proportional adjustment DP

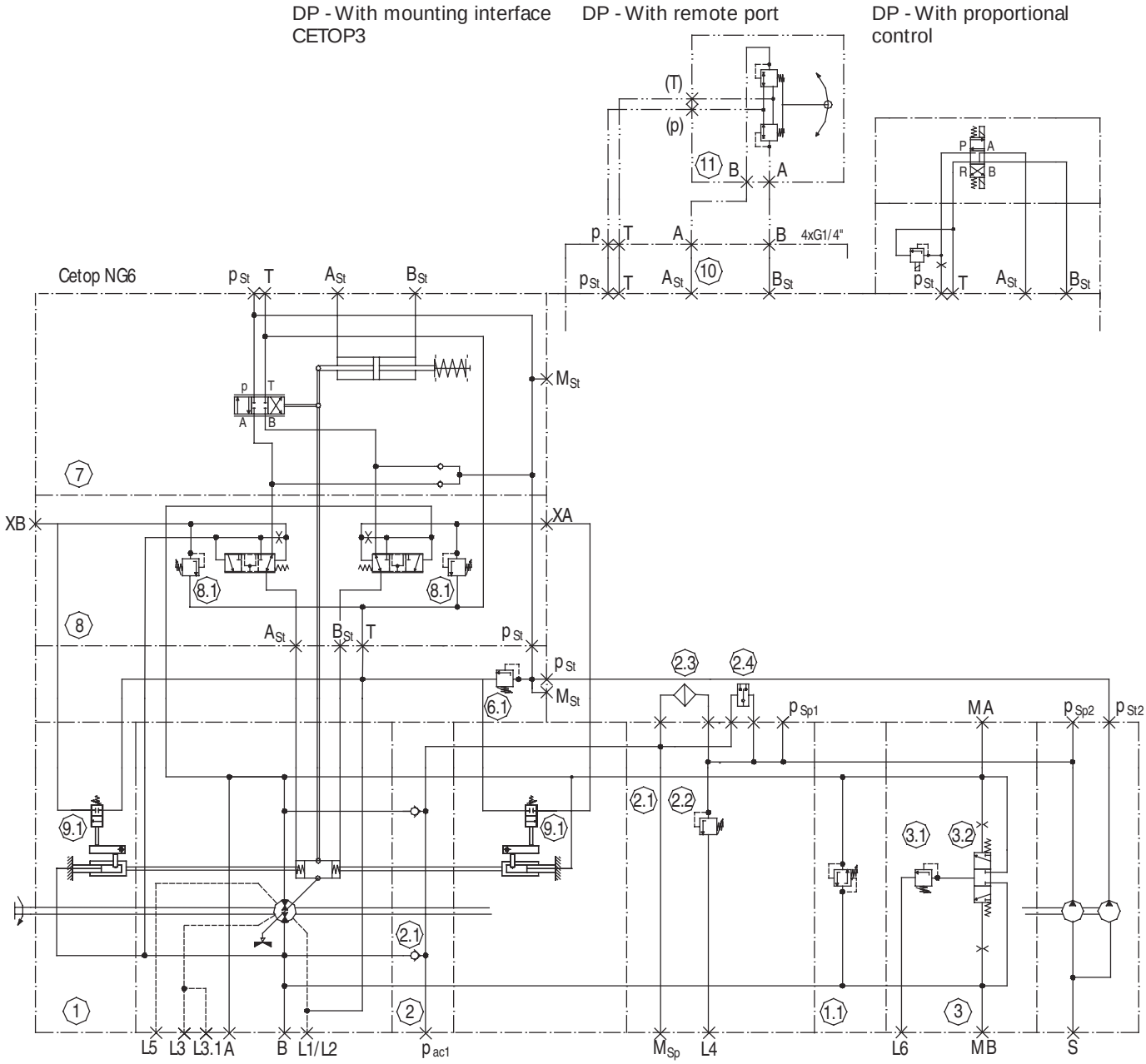
The output flow of the pump is proportional to the pilot pressure. Each of the two pilot ports is responsible for an output flow direction.

SIZE	RESPONSE TIME (S) 12 L/MIN	RESPONSE TIME* (S) PRESSURE CONTROL DESTROKING	PILOT PRESSURE P_{ST} BAR
130/180	0.8	0.07	60
250/360	1.0	0.08	60
500/750	2.2	0.110	80

*Measured with a 2m pressure line of diameter 50 mm

Controls – Example for TVW - DP Control

with Pressure - & Power Limiter



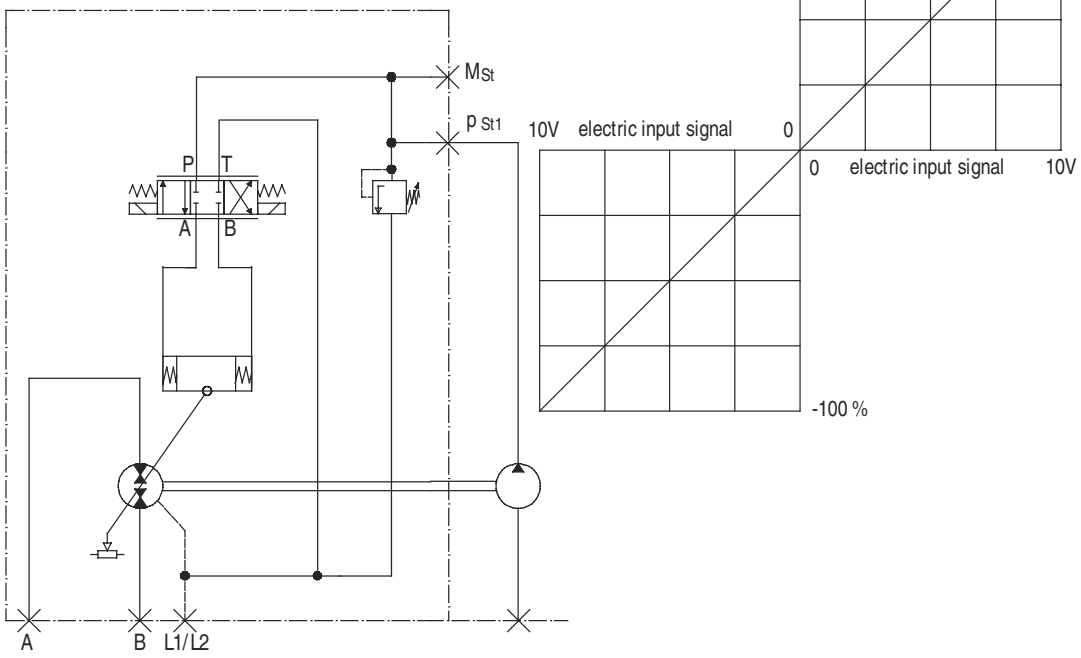
A, B	System port	MA, MB	Gauge port system pressure	S	Suction port for charge and pilot pump	2.3	Filter
A_{St}, B_{St}	Control	M_{Sp}	Gauge port charge pressure	T	Tank port	2.4	Clogging indicator
L1, L2	Drain port	M_{St}	Gauge port pilot pressure	XA, XB	Pilot port pressure control	3	Flushing block
L3	Ventilation port for vertical mounting	p_{ac1}	Accumulator port	1	Basic pump	3.1	Low pressure relief valve
L3.1	Air bleeding port for vertical mounting	p_{Sp1}	Port for external charge flow	1.1	High pressure relief valve	3.2	Flushing flow shuttle valve
L4	Return line charge flow	p_{St1}	Port for pilot flow	2	Charge block	6	Control manifold
L5	Oil filling plug	$p_{St1.1}$	Port for pilot flow	2.1	Charge check valve	6.1	Pilot pressure relief valve
L6	Return line charge flow	p_{St2}	Pilot pump outlet port	2.2	Charge pressure relief valve	7	DP-Control
						8.1	Pressure limiter 100 to 350 bar

Controls – Proportional Valve Displacement Control SP

The electro hydraulic displacement control will operate a hydrostatic drive in all four quadrants and work without throttle losses within electrically adjustable limits.

This is done by controlling delivery flow with swash plate angle feedback.
All control valves are recorded as an electrical signal and lead back to the control card. The proportional valve or servo valve and servo piston transform the output signal of the control card to the desired setting.

This results in a very precise and dynamic control



Electrohydraulic servo adjustment SP
The electro hydraulic displacement control will operate a hydrostatic drive in all four quadrants and work without throttle losses within electrically adjustable limits. This is done by controlling delivery flow swash plate angle feedback

PROPORTIONAL VALVE

	NOMINAL FLOW		CONTROL PRESSURE PST	CONTROL ELECTRONICS	RESPONSE TIME	UNIT SIZE	SERVO PISTON		VOLUME
	L/MIN (USGPM)	AT ΔP BAR (PSI)	BAR (PSI)		0 < > VMAX [MS]	CM³ (IN³)	DIAMETER MM (IN)	STROKE MM (IN)	CM³ (IN³)
Medium response (CETOP 3)	12 (3.17)	10 (150)	60 (870) to 80 (1160)	ER 9.0 - 10	250 to 800	130 (7.9)	60 (2.36)	21 (.83)	59 (3.60)
						180 (11)	60 (2.36)	21 (.83)	59 (3.60)
						250 (15.2)	75 (2.95)	18 (.71)	79 (4.82)
						360 (22)	75 (2.95)	25 (.98)	110 (6.71)
						500 (30.5)	75 (2.95)	22 (.87)	97 (5.92)
						750 (45.7)	75 (2.95)	30 (1.18)	132 (8.06)
High response (CETOP 5)	40 (11) to 80 (21)	70 (1000)	80 (1160) to 100 (1450)	ER 9.4 - 10	40 to 150	130 (7.9)	60 (2.36)	21 (.83)	59 (3.60)
						180 (11)	60 (2.36)	21 (.83)	59 (3.60)
						250 (15.2)	75 (2.95)	18 (.71)	79 (4.82)
						360 (22)	75 (2.95)	25 (.98)	110 (6.71)
						500 (30.5)	75 (2.95)	22 (.87)	97 (5.92)
						750 (45.7)	75 (2.95)	30 (1.18)	132 (8.06)

Controls – Control Cards

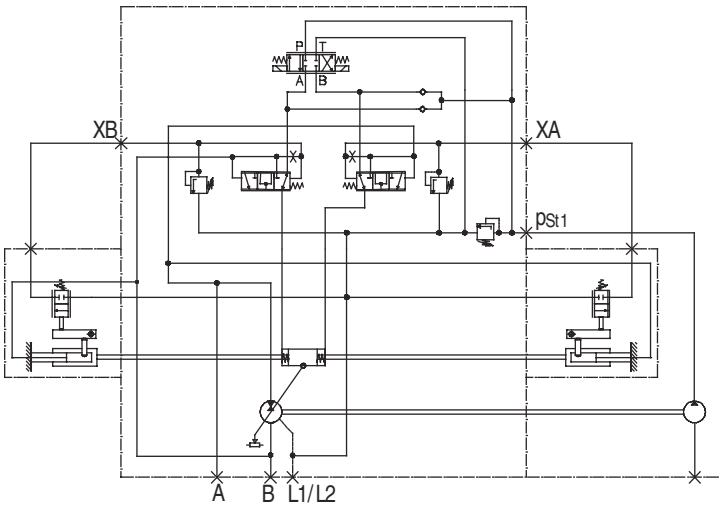
SP - Control with Pressure and Power Limitation

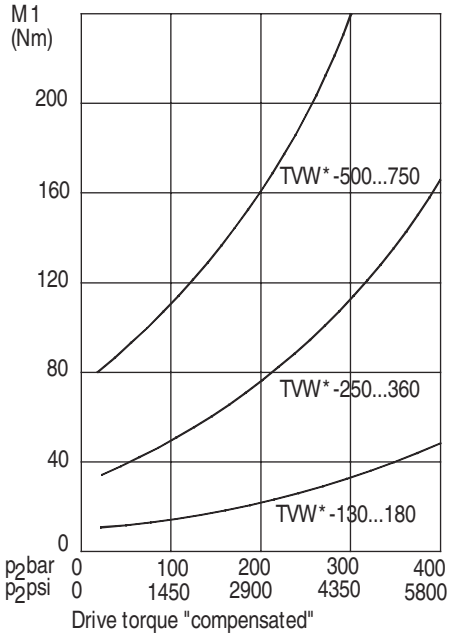
Control Cards

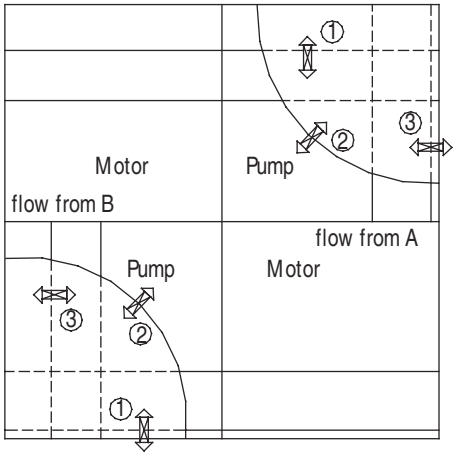
The ER 9.3 - 10 and ER 9.4 - 10 Digital control cards are available and optimized for use with the SP - Control. Software is available for parameter setting and storing (Database function).

Contact Eaton to request the free of charge manual- and software CD.

SP - Control with pressure and power limitation







① Pressure limiter setting

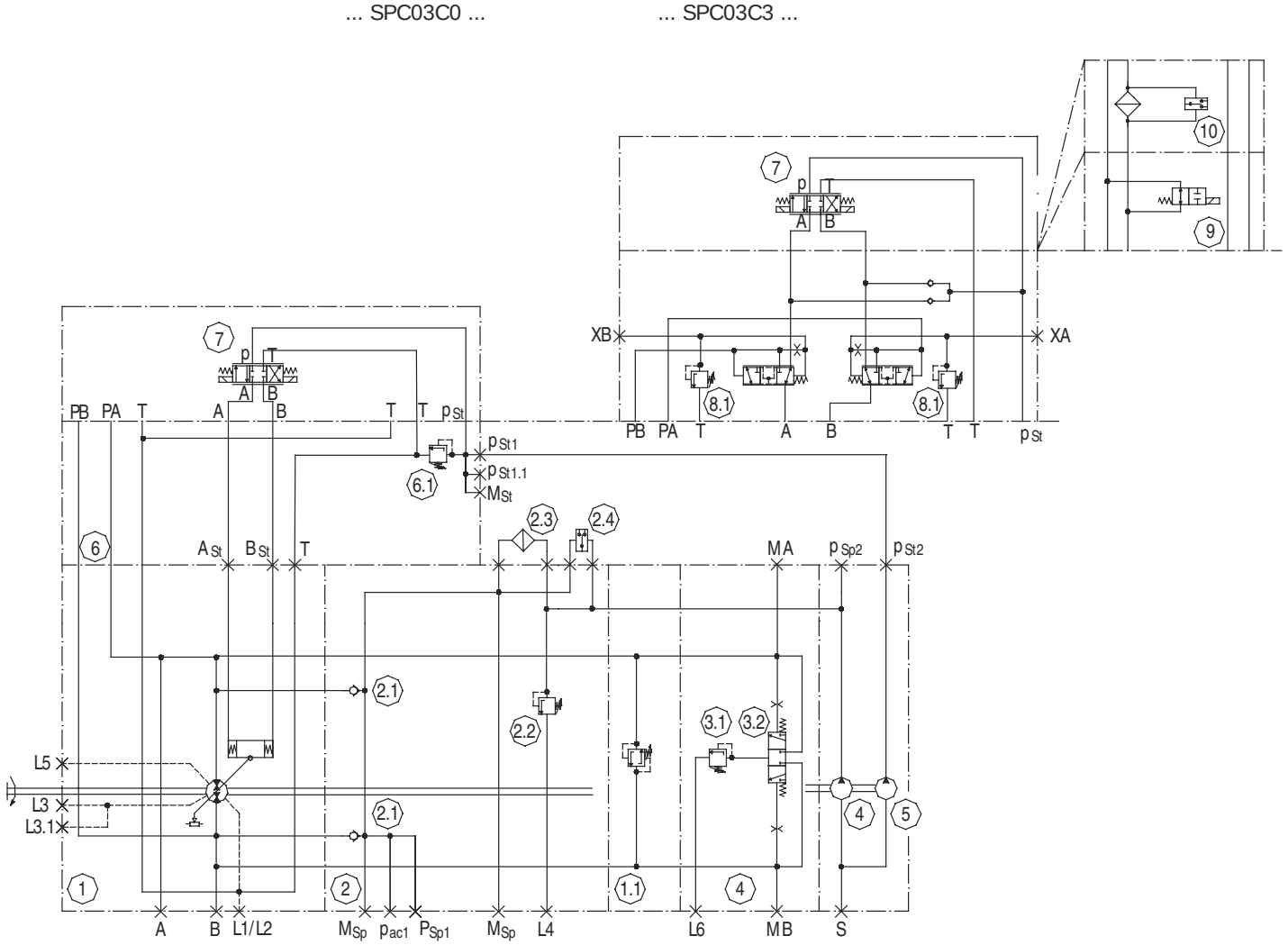
② Power limiter setting

③ SP Displacement control

The patented circuit provides extremely short response times for the pressure compensator regardless of the servo control used: The response time is independent from the particular flow characteristic!

FRAME SIZE	RESPONSE TIME WHEN COMPENSATING FROM +/- V_{MAX} — 0
130/180	80 ms
250/360	90 ms
500/750	110 ... 130 ms

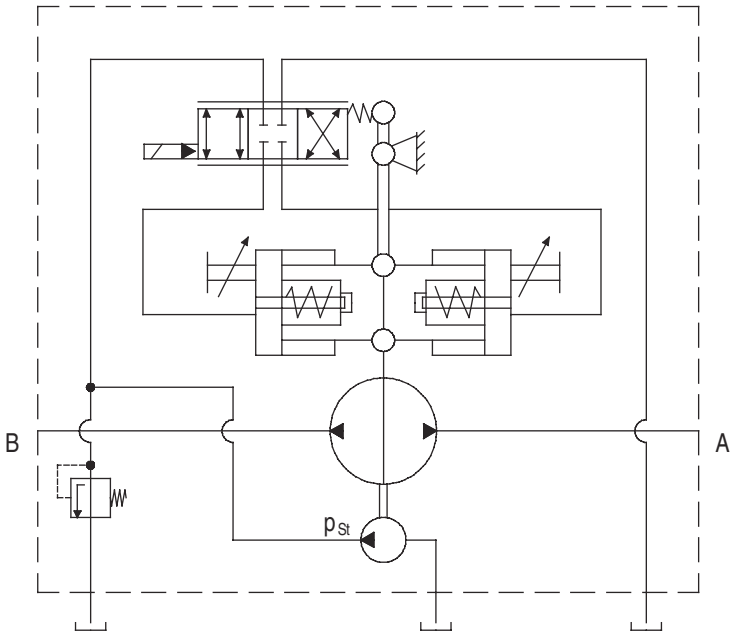
Controls –
SP Control with and without Pressure Limitation
Example for TVWS

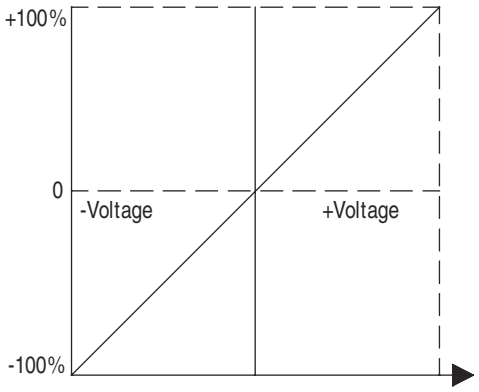


A, B	System port	M_{Sp}	Gauge port charge pressure	S	Suction port for charge and pilot pump	3.1	Low pressure relief valve
A_{St}, B_{St}	Pilot oil port pump side A, B	M_{St}	Gauge port pilot pressure	T	Tank port	3.2	Flushing flow shuttle valve
L1, L2	Drain port	p_{ac1}	Accumulator port	XA, XB	Pilot port pressure control	4	Charge pump
L3	Ventilation port for vertical mounting	p_{Sp1}	External port charge flow	1	Basic pump	5	Pilot pump
L3.1	Air bleeding port	p_{Sp2}	Additional charge pump outlet port	1.1	High pressure relief valve	6	Connection plate for SP-Control
L4	Drain port (charge oil)	p_{St1}	Port for pilot pressure	2	Charge block	6.1	Pilot pressure relief valve
L5	Oil filling plug	$p_{St1.1}$	Port for pilot pressure	2.1	Charge check valve	7	Proportional valve
L6	Drain port (flushing oil)	p_{St2}	Piston pump outlet port	2.2	Charge pressure relief valve	8.1	Pressure limiter 100 to 350 bar
L7	Port for return line of control circuit			3	Flushing block	9	Fail safe valve intermeditate plate
MA, MB	Gauge port system pressure					10	Pilot oil filter

Controls – Servo Adjustment Displacement Control with Mechanical Feedback SM

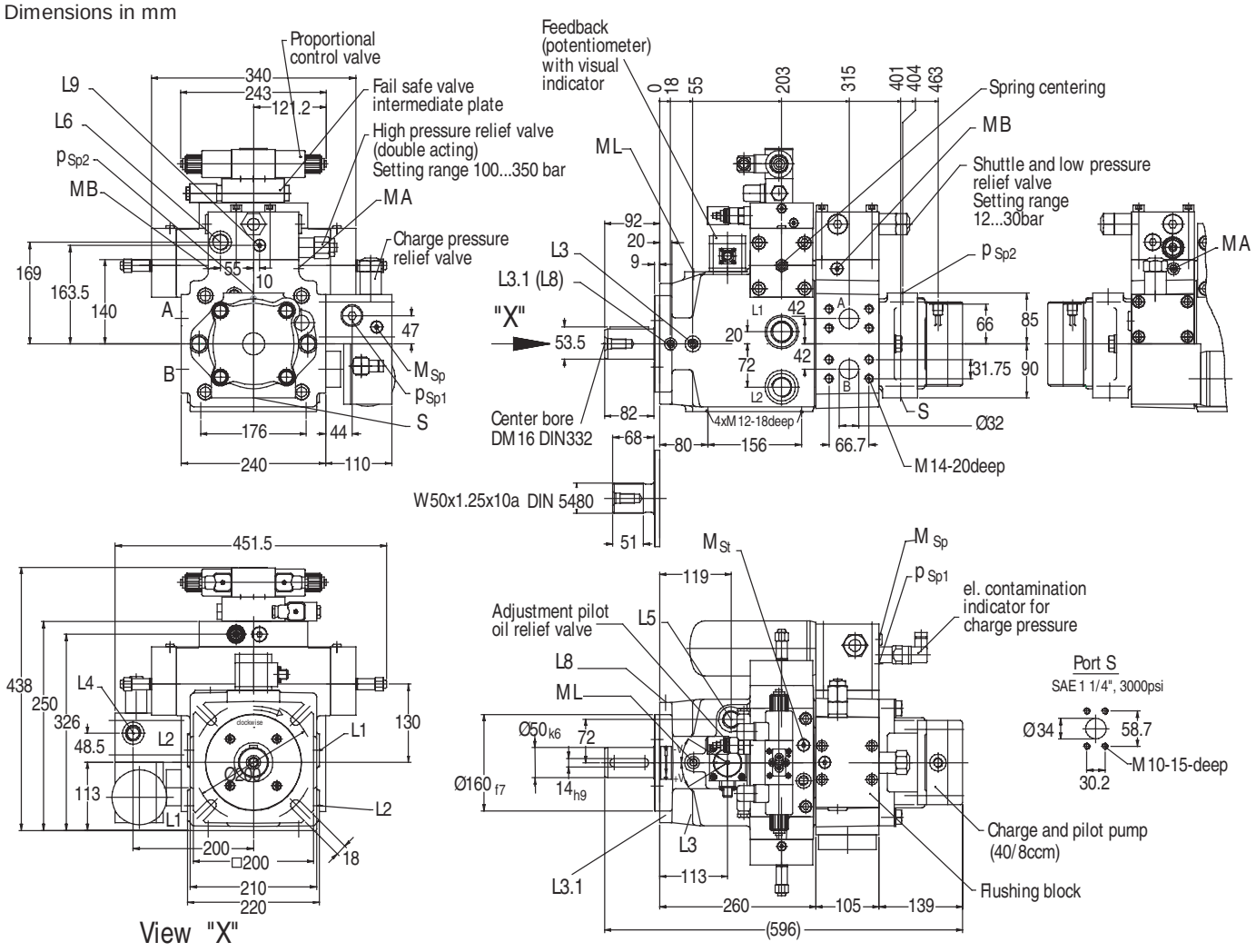
- Servo control with integrated mechanical feedback of swash plate position. Mainly used in hazardous environments.
- No electronic control card necessary
- Input signal ± 50 mA (linear coil connection) ; ± 100 mA (parallel coil connection)
- Hysteresis, repeatability: 8% of end value
- Available in explosion proof class Eex i II version for hazardous duty.
- Pressure/power limitation available





Pump Dimensions - TVWS 130/180

Dimensions in mm



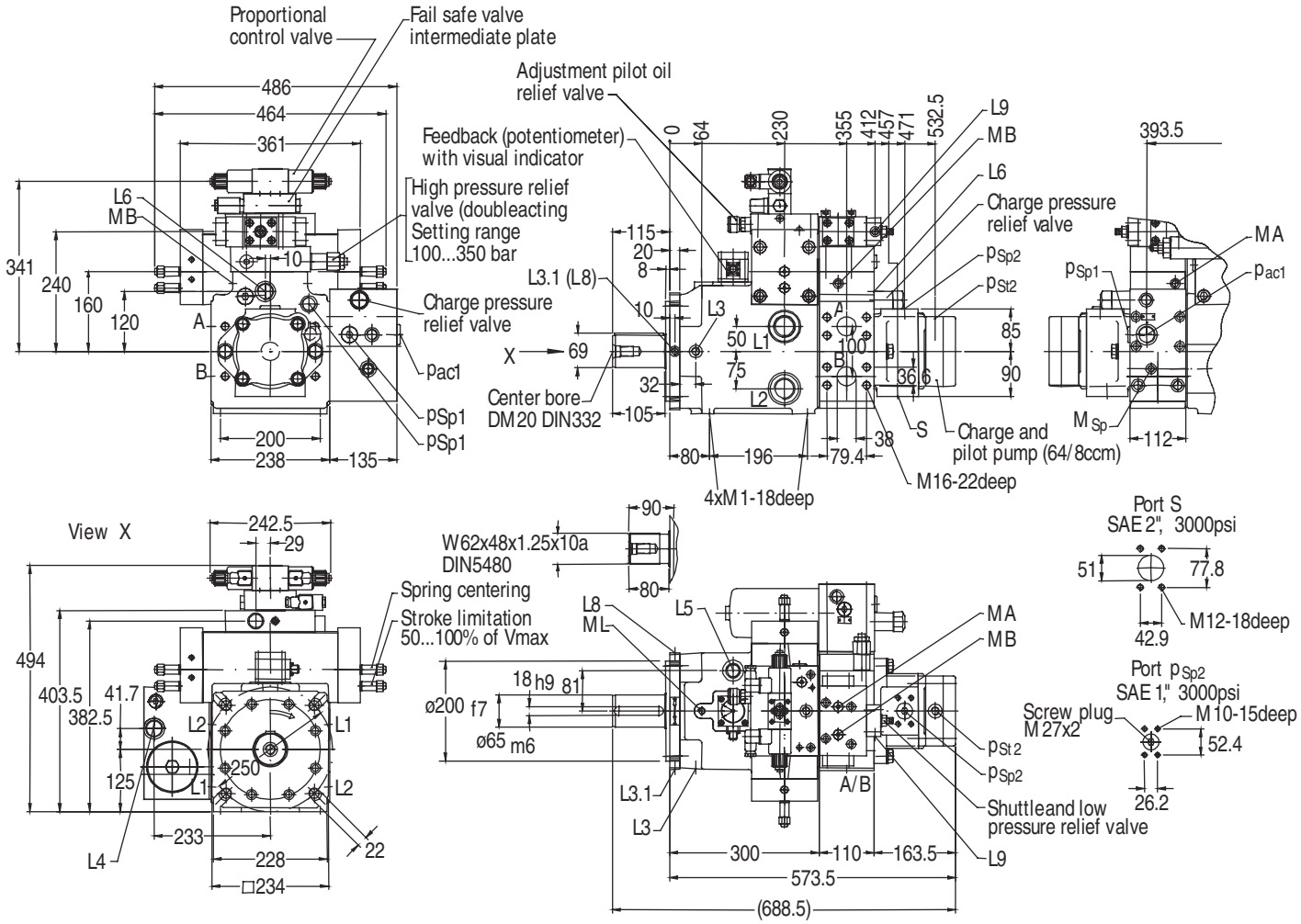
DIRECTION OF ROTATION	RANGE OF SWASH ANGLE	INPUT	OUTPUT
Right Hand Rotation	To + V_{max}	B	A
	To - V_{max}	A	B

For left hand rotation a special setup of charge and pilot pump is required!

A	System pressure port SAE 1 1/4", 6000 psi	L4	Drain port G 3/4" (charge oil)	(MB)	Gauge port system pressure G 1/4"	p_{Sp2}	Additional charge pump outlet port G 3/4" (closed)
(L1)	Drain port 1 1/16" - 12 UNF-2B (according to mounting position use upper port)	L5	Oil filling plug 1 1/16" - 12 UNF-2B	(ML)	Gauge port of case pressure G 1/4"	S	Suction port of charge and pilot pump SAE 1 1/4", 3000 psi (common port)
L2	Drain port G 1" (according to mounting position use upper port)	L6	Drain port G 3/4" (flushing oil)	(M_{Sp})	Gauge port of charge pressure G 1/4"	(...)	Normally plugged
(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(L8)	Air bleeding port G 1/4"	(M_{St})	Gauge port of pilot pressure G 1/4"		
		(L9)	Drain port for low pressure relief valve G 1/4"	p_{Sp1}	External port of charge pressure G 3/4"		
		(MA)	Gauge port system pressure G 1/4"				

Pump Dimensions - TVWS 250

Dimensions in mm



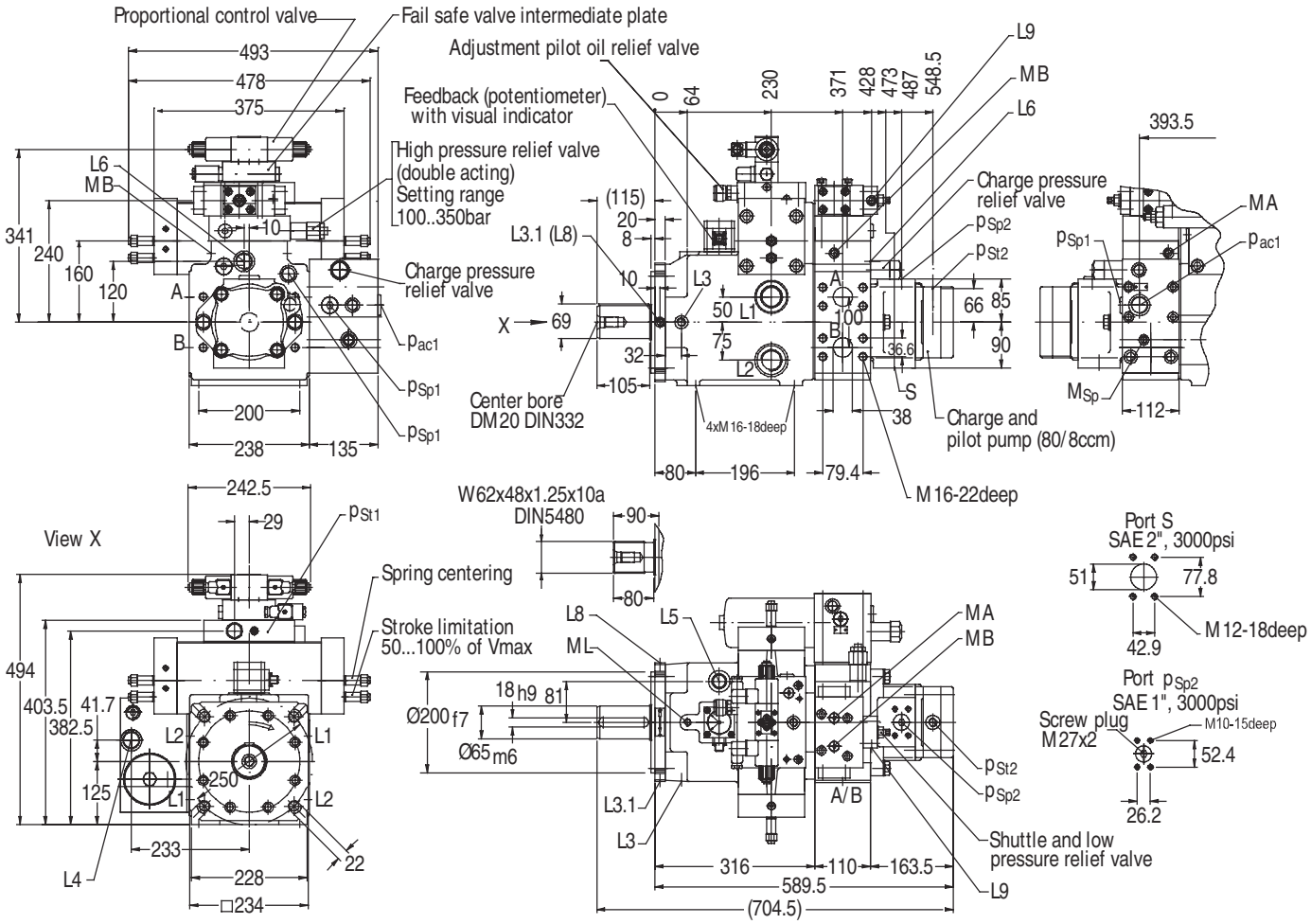
DIRECTION OF ROTATION	RANGE OF SWASH ANGLE	INPUT	OUTPUT
Right Hand Rotation	To + V_{max}	B	A
	To - V_{max}	A	B

For left hand rotation a special setup of charge and pilot pump is required!

A	System pressure port SAE 1 1/2", 6000 psi	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(L9)	Drain port for low pressure relief valve G 1/4"	(p_{Sp1})	External port of charge pressure G 3/4"
B	System pressure port SAE 1 1/2", 6000 psi	(L3.1)	Port G 1/8"	(MA)	Gauge port system pressure G 1/4"	(p_{Sp2})	Additional charge pump outlet port M27x2
(L1)	Drain port 1 5/8" - 12 UNF-2B (according to mounting position use upper port)	L4	Drain port G 1" (charge oil)	(MB)	Gauge port system pressure G 1/4"	p_{St2}	Pilot pump outlet port G 3/8"
L2	Drain port G 1 1/4" (according to mounting position use upper port)	(L5)	Oil filling plug 1 1/16" - 12 UNF-2B	(ML)	Gauge port of case pressure G 1/4"	S	Suction port of charge and pilot pump SAE 2", 3000 psi (common port)
		L6	Drain port G1" (flushing oil)	(M_{Sp})	Gauge port of charge pressure G 1/4"		
		(L8)	Air bleeding port G 1/4"	(p_{ac1})	Accumulator port G 1"	(...)	Normally plugged

Pump Dimensions - TVWS 360

Dimensions in mm



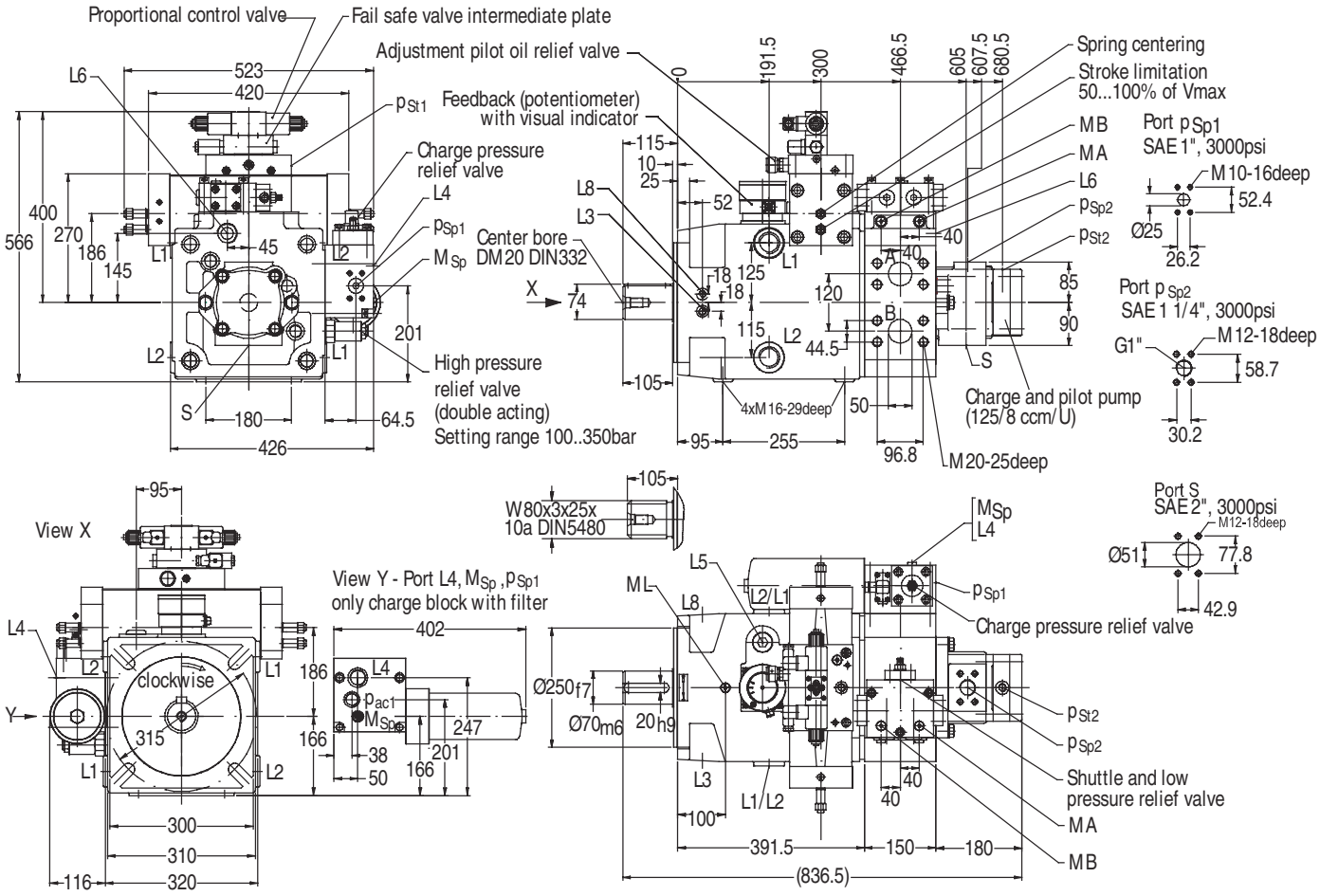
DIRECTION OF ROTATION	RANGE OF SWASH ANGLE	INPUT	OUTPUT
Right Hand Rotation	To + V_{max}	B	A
	To - V_{max}	A	B

For left hand rotation a special setup of charge and pilot pump is required!

A	System pressure port SAE 1 1/2", 6000 psi	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"	(p_{Sp2})	Additional charge pump outlet port M27x2
B	System pressure port SAE 1 1/2", 6000 psi	(L3.1)	Port G 1/8"	(MB)	Gauge port system pressure G 1/4"	p_{St2}	Pilot pump outlet port G 3/8"
(L1)	Drain port 1 5/8" - 12 UNF-2B (according to mounting position use upper port)	L4	Drain port G 1" (charge oil)	(ML)	Gauge port of case pressure G 1/4"	S	Suction port of charge and pilot pump SAE 2", 3000 psi (common port)
L2	Drain port G 1/4" (according to mounting position use upper port)	(L5)	Oil filling plug 1 1/16" - 12 UNF-2B	(M_{Sp})	Gauge port of charge pressure G 1/4"	(...)	Normally plugged
		L6	Drain port G 1" (flushing oil)	(p_{ac1})	Accumulator port G 1"		
		(L8)	Air bleeding port G 1/4"	(p_{Sp1})	External port of charge pressure G 3/4"		
		(L9)	Drain port for low pressure relief valve G 1/4"				

Pump Dimensions - TVWS 500

Dimensions in mm



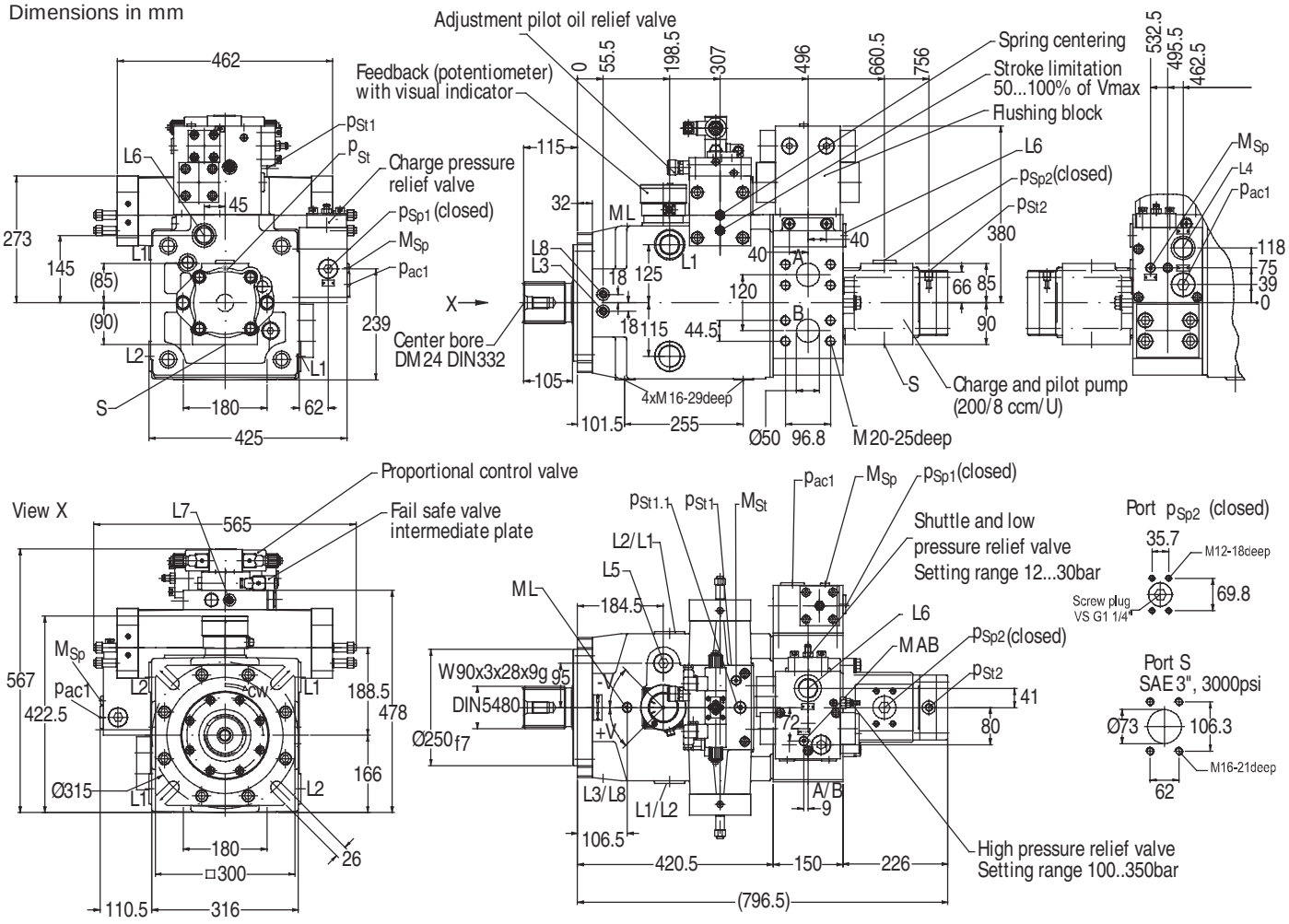
DIRECTION OF ROTATION	RANGE OF SWASH ANGLE	INPUT	OUTPUT
Right Hand Rotation	To + V_{max}	B	A
	To - V_{max}	A	B

For left hand rotation a special setup of charge and pilot pump is required!

A	System pressure port SAE 2", 6000 psi	(L3)	Ventilation port for vertical mounting G 3/8" (shaft upwards)	(MA)	Gauge port system pressure G 1/4"	(p_{Sp2})	Additional charge pump outlet port M27x2
B	System pressure port SAE 2", 6000 psi	(L3.1)	Port G 1/8"	(MB)	Gauge port system pressure G 1/4"	p_{St1}	Port of pilot pressure G 1/2"
(L1)	Drain port 1 5/8" - 12 UNF-2B (according to mounting position use upper port)	L4	Drain port G 1" (charge oil)	(ML)	Gauge port of case pressure G 1/4"	p_{St2}	Pilot pump outlet port G 3/8"
L2	Drain port G 1/2" (according to mounting position use upper port)	(L5)	Oil filing plug 1 1/16" - 12 UNF-2B	(M_{Sp})	Gauge port of charge pressure G 1/4"	S	Suction port of charge and pilot pump SAE 2", 3000 psi (common port)
		L6	Drain port G 1" (flushing oil)	(M_{St})	Gauge port of pilot pressure G 1/4"		
		(L8)	Air bleeding port G 1/4"	(p_{ac1})	Accumulator port G 1"	(...)	Normally plugged
		(L9)	Drain port for low pressure relief valve G 1/4"	(p_{Sp1})	External port of charge pressure G 3/4"		

Pump Dimensions - TVWS 750

Dimensions in mm



DIRECTION OF ROTATION	RANGE OF SWASH ANGLE	INPUT	OUTPUT
Right Hand Rotation	To + V_{max}	B	A
	To - V_{max}	A	B

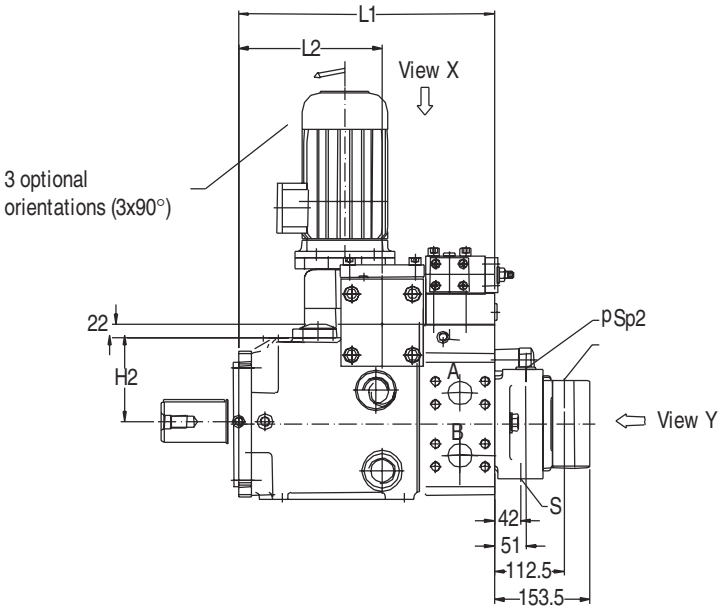
For left hand rotation a special setup of charge and pilot pump is required!

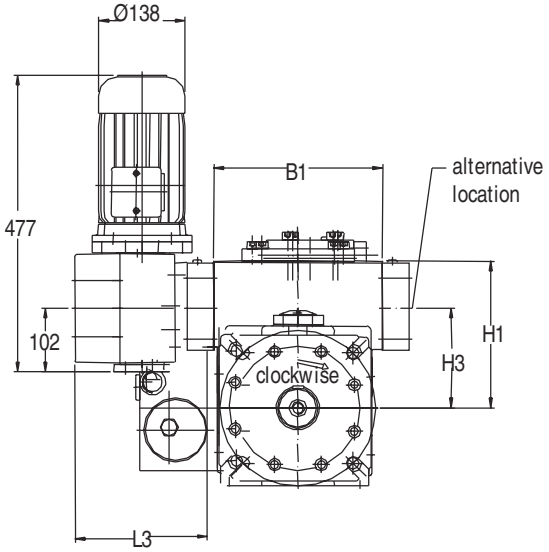
A	System pressure port SAE 2", 6000 psi	L6	Drain port G 1 1/4" (flushing oil)	(p_{ac1})	Accumulator port G 1 1/4"	p_{St2}	Pilot pump outlet port G 3/8" ***
B	System pressure port SAE 2", 6000 psi	L7	Port G 3/8" for return line of control circuit	(p_{ac2})	Accumulator port G1 1/4" (optional)	S	Suction port of charge and pilot pump SAE 3", 3000 psi (common port)
(L1)	Drain port 1 5/8" - 12 UNF-2B*	(L8)	Air bleeding port G 1/4"	(p_{Sp1})	External port of charge pressure G 1" (Port of charge pressure internal)	(...)	Normally plugged
L2	Drain port G 1 1/2" *	(MAB)	Gauge port system pressure G 1/4"	(p_{Sp2})	Additional charge pump outlet port G 1/4"	*)	According to mounting position use upper port
(L3)	Ventilation port for vertical mounting G 3/8" **	(ML)	Gauge port of case pressure G 1/4"	p_{St1}	Port of pilot pressure G 1/2" ***	**)	Shaft upwards
L4	Drain port G 1 1/4" (charge oil)	(M_{Sp})	Gauge port of charge pressure G 1/4"	($p_{St1.1}$)	Port of pilot pressure G 3/8" ***	***)	Piping by HYDROKRAFT (alternatively p_{St1} or $p_{St1.1}$)
(L5)	Oil filling plug 1 1/16" - 12 UNF-2B	(M_{St})	Gauge port of pilot pressure G 1/4"				

Control Dimensions - TVWS 130/180/250/360/ 500/750

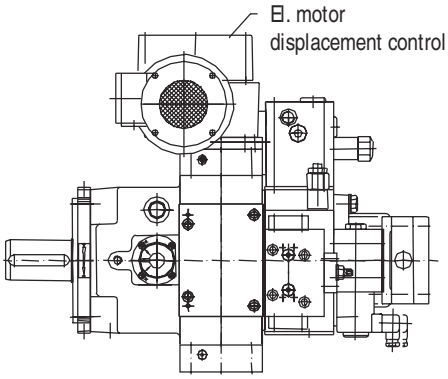
ES Control

Dimensions in mm

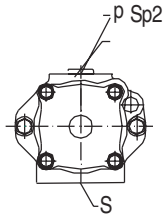




View X



View Y



	L1	L2	L3	B1	H1	H2	H3
130*	365	203	216,5	256	192	120	130
180*	365	203	216,5	256	192	120	130
250	410	230	222	271	236	135	160
360	426	230	222	285	236	135	160
500	541,5	300	222	330	267,5	172	186
750	571	307	222	372	270	172	188,5

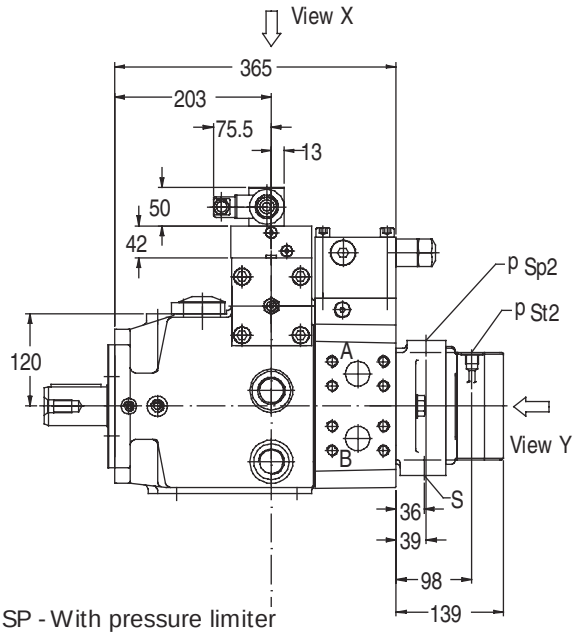
* Only alternative location possible.

DISPLACEMENT (CCM)	
Pump Size	**Charge Pump**
130	40
180	40
250	63
360	87
500	125
750	200

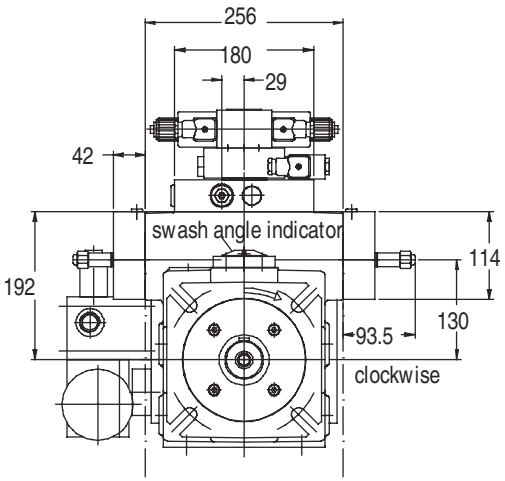
Control Dimensions - TVWS 130/180 SP Control

Dimensions in mm

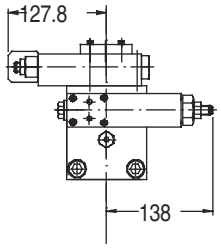
SP - With Prop. Valve
CETOP 3



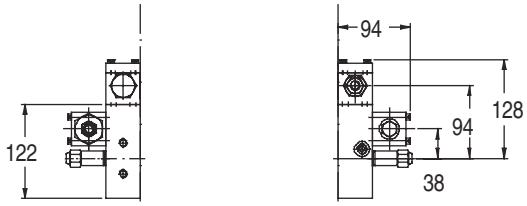
SP - With Prop. Valve
CETOP 3 + Fail safe valve



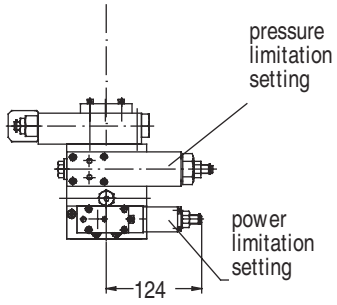
SP - With pressure limiter overriding function



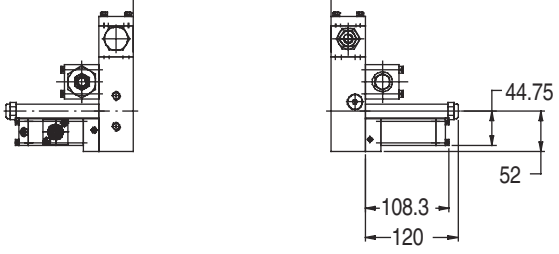
SP - With pressure limiter overriding function



SP - With pressure limiter and power control overriding function



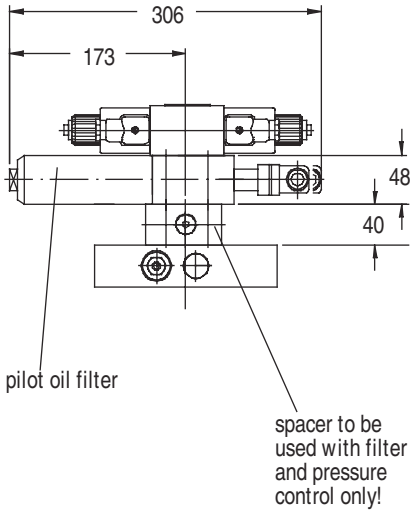
SP - With pressure limiter and power control overriding function



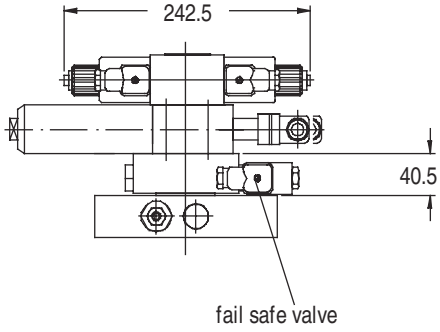
Control
Dimensions - TVWS 130/180
SP Control

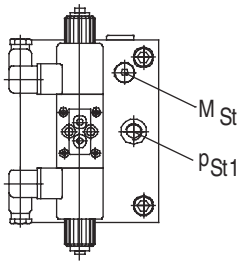
Dimensions in mm

SP - With Prop. Valve CETOP
3 + filter with el. indicator

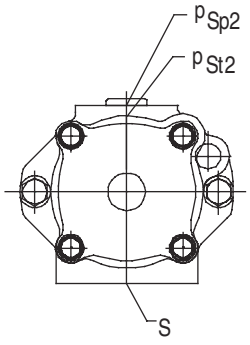


SP - With Prop. Valve CETOP
3 + filter with visual indicator
+ fail safe valve





View Y

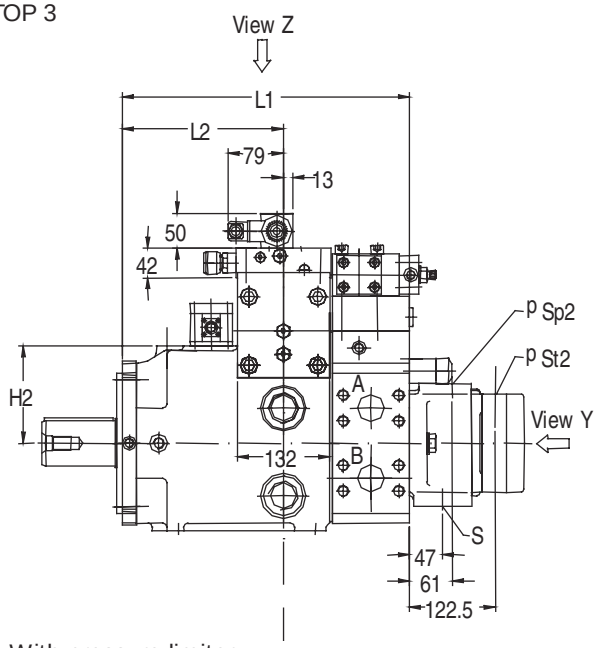


charge & pilot
pump 40/8ccm

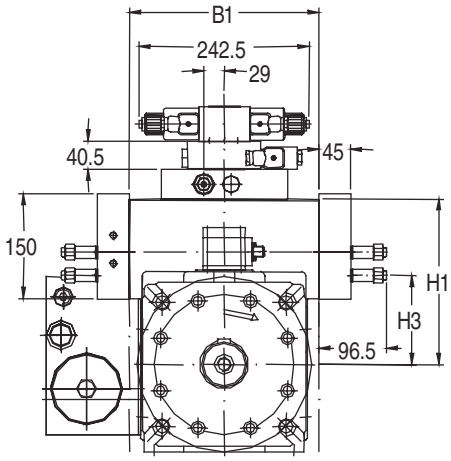
Control
Dimensions - TVWS 250/360/500/750 SP Control

Dimensions in mm

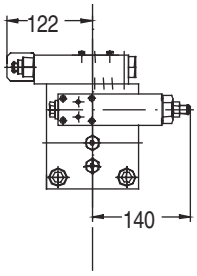
SP - With Prop. Valve
CETOP 3



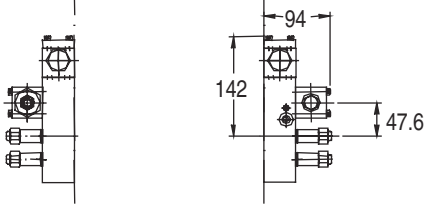
SP - With Prop. Valve
CETOP 3 + Fail safe valve



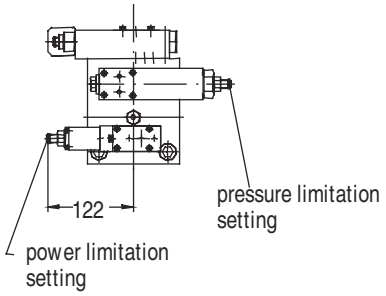
SP - With pressure limiter overriding function



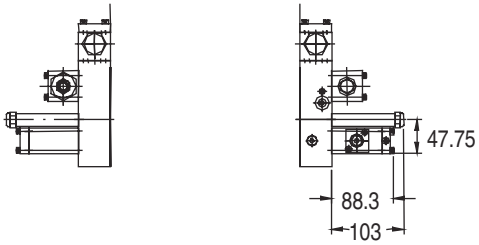
SP - With pressure limiter overriding function



SP - With pressure limiter and power control overriding function



SP - With pressure limiter and power control overriding function

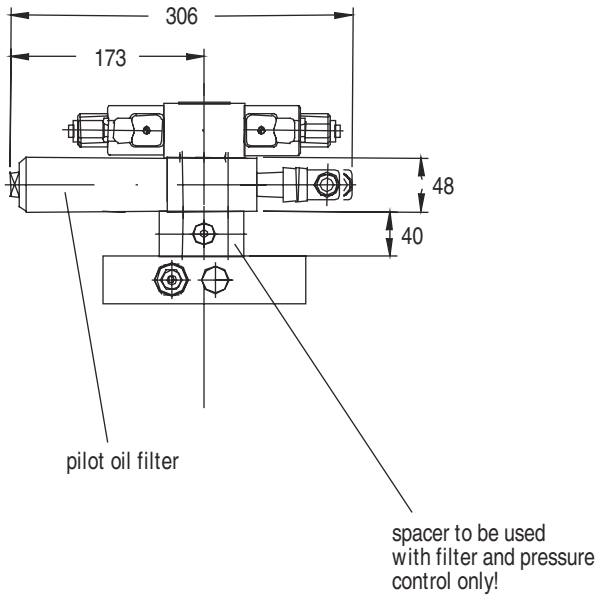


	L1	L2	B1	H1	H2	H3
250	410	230	271	236	135	160
360	426	230	285	236	135	160
500	541,5	300	330	267,5	172	186
750	571	307	372	270	172	188,5

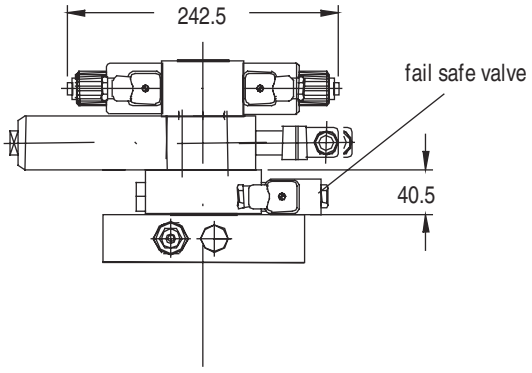
Control Dimensions - TVWS 250/360/500/750 SP Control

Dimensions in mm

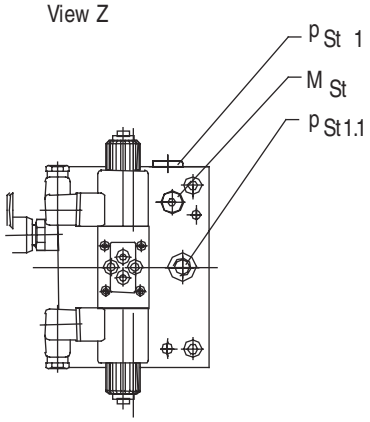
SP - With Prop. Valve CETOP
3 + filter with el. indicator



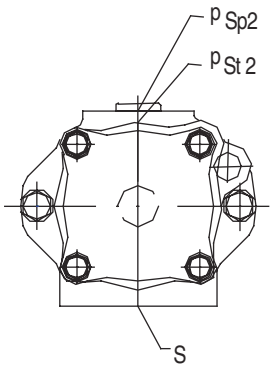
SP - With Prop. Valve CETOP
3 + filter with visual indicator
+ fail safe valve



View Z



View Y



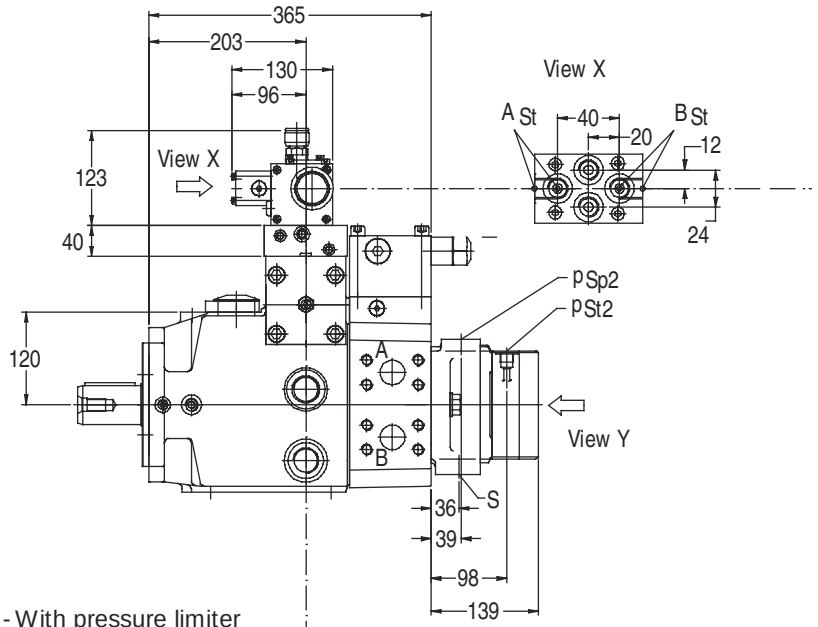
DISPLACEMENT FOR CHARGE PILOT PUMPS (CCM)

Pump Size	Charge Pump	Pilot Pump
250	64	8
360	80	8
500	125	8
750	200	8

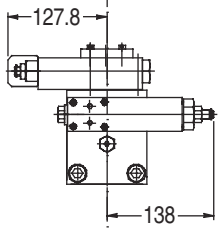
Control Dimensions - TVWS 130/180 DP Control

Dimensions in mm

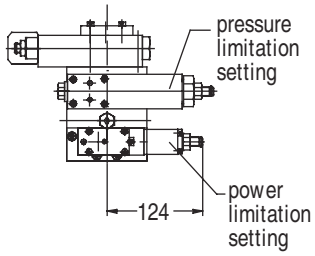
DP - With remote control



DP - With pressure limiter overriding function



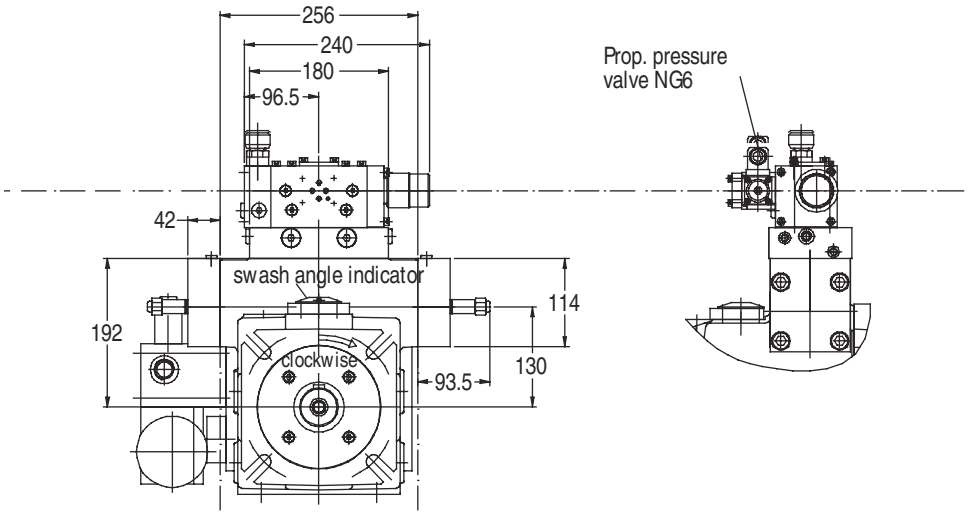
DP - With pressure limiter and power control overriding function



Control
Dimensions - TVWS 130/180 DP Control

Dimensions in mm

DP - With mounting interface CETOP 3

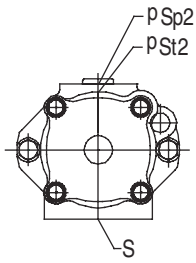


DP - With prop. relief

DP - With pressure limiter overriding function

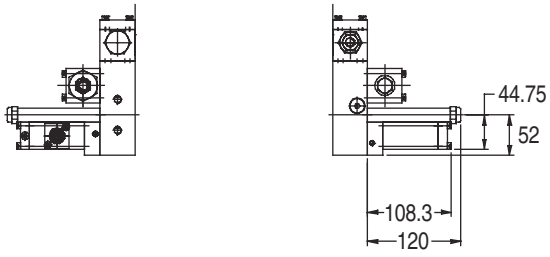


View Y



charge & pilot pump 40/8ccm

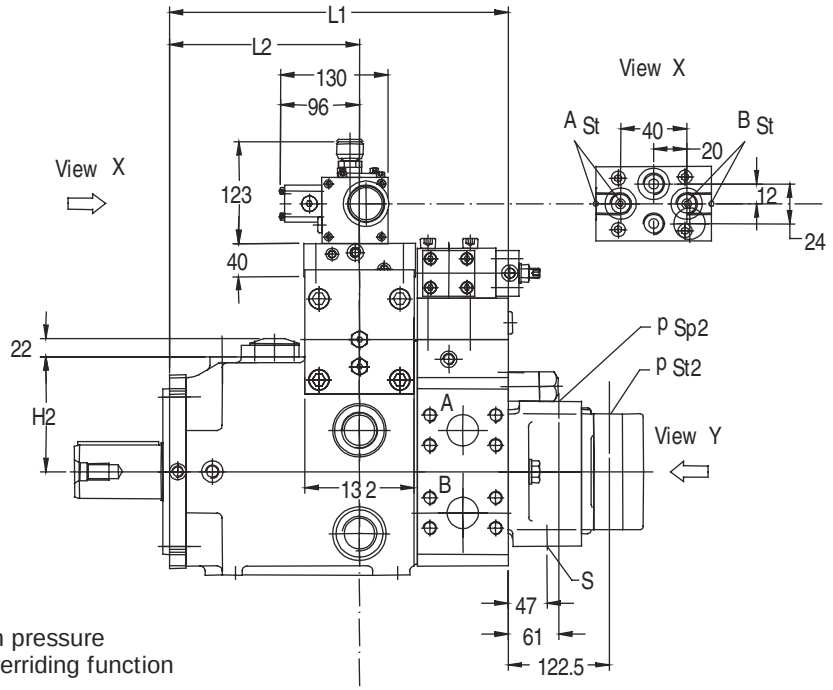
DP - With pressure limiter and power control overriding function



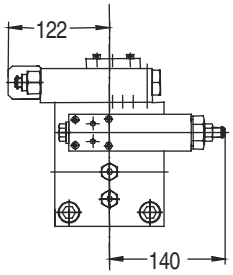
Control
Dimensions - TVWS 250/360/500/750 DP Control

Dimensions in mm

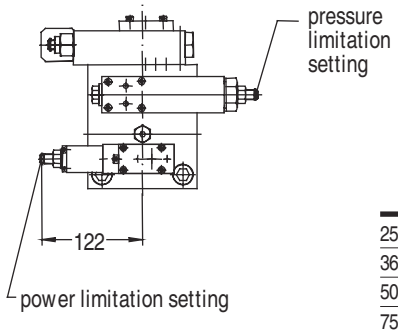
DP - With remote port



DP - With pressure limiter overriding function



DP - With pressure limiter and power control overriding function

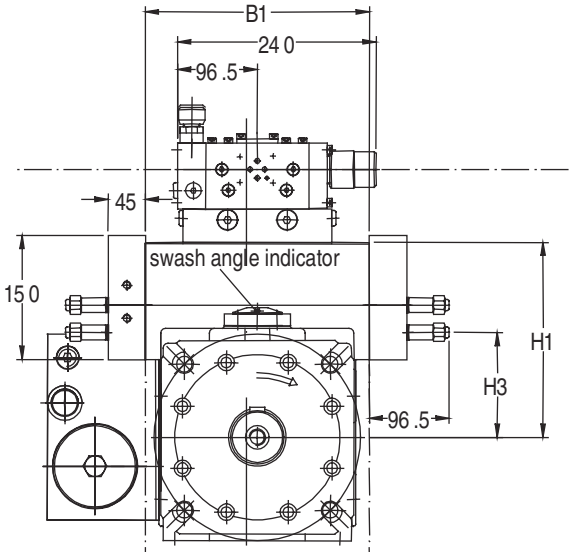


	L1	L2	B1	H1	H2	H3
250	410	230	271	236	135	160
360	426	230	285	236	135	160
500	541,5	300	330	267,5	172	186
750	571	307	372	270	172	188,5

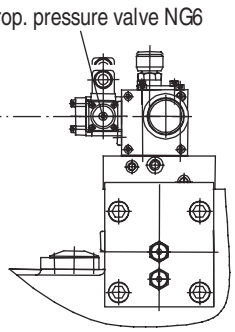
Control Dimensions - TVWS 250/360/500/750 DP Control

Dimensions in mm

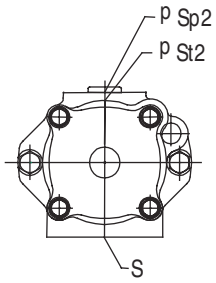
DP - With mounting interface CETOP 3



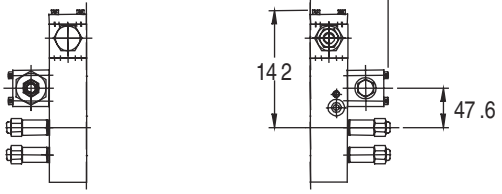
DP - With prop. relief



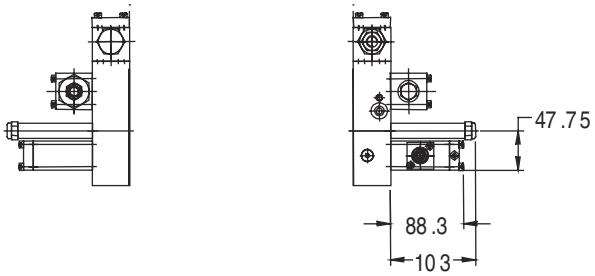
View Y



DP - With pressure limiter overriding function



DP - With pressure limiter and power control overriding function

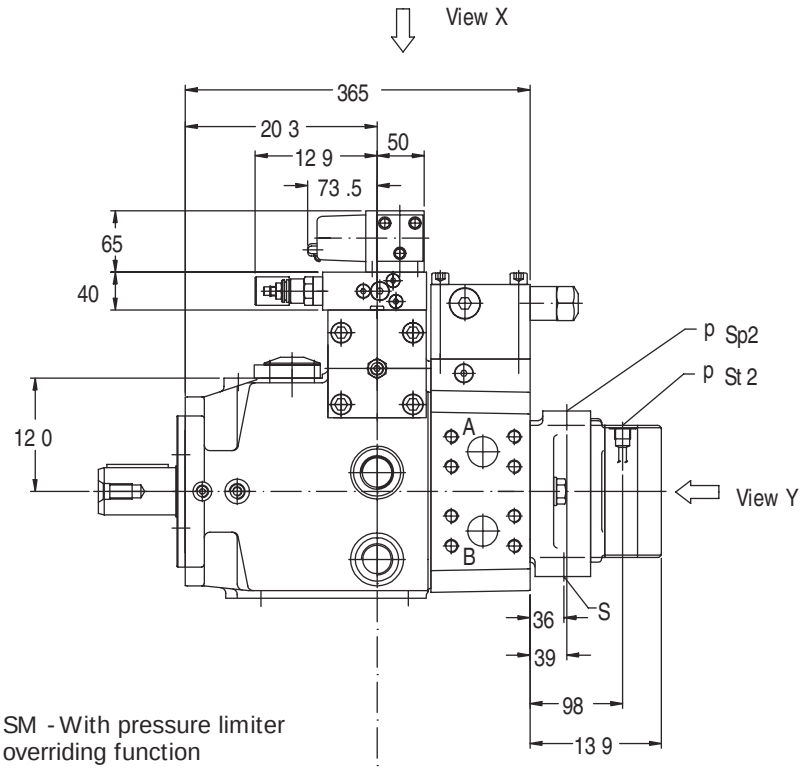


DISPLACEMENT FOR CHARGE PILOT PUMPS (CCM)

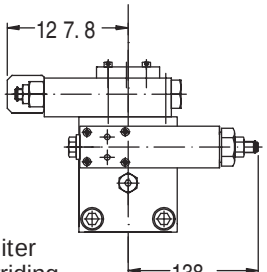
Pump Size	Charge Pump	Pilot Pump
250	64	8
360	80	8
500	125	8
750	200	8

Control
Dimensions - TVWS 130/180
SM Control

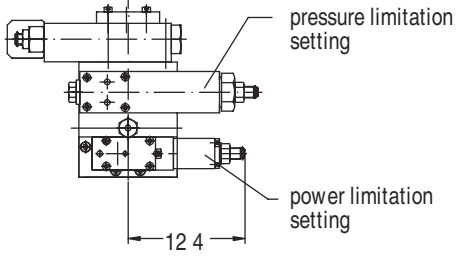
Dimensions in mm



SM - With pressure limiter overriding function

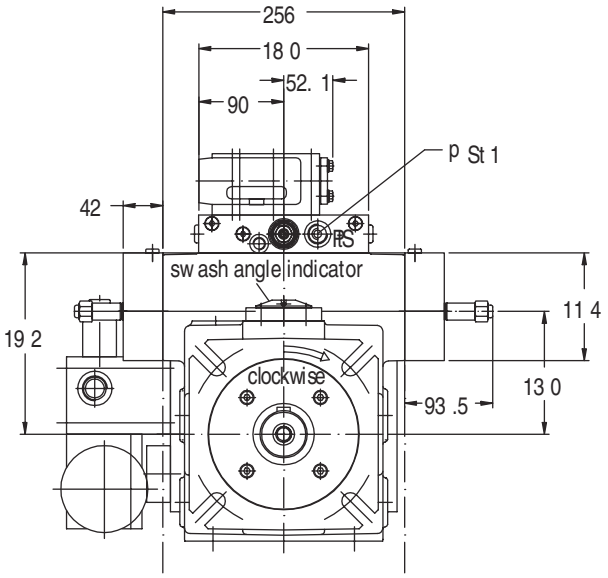


SM - With pressure limiter and power control overriding function

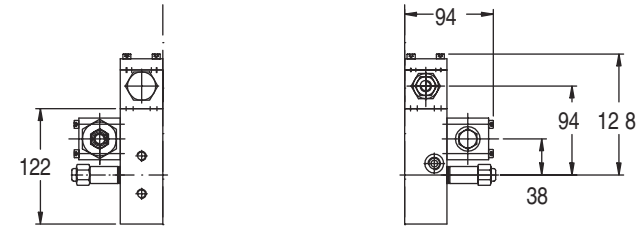


Control Dimensions - TVWS 130/180 SM Control

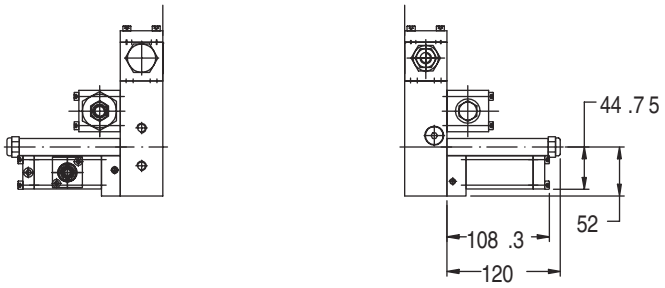
Dimensions in mm



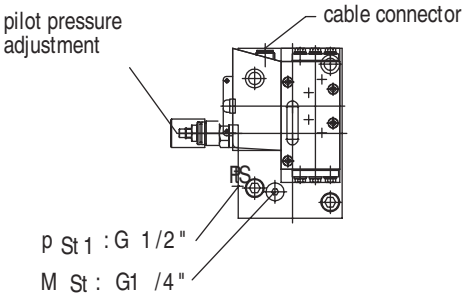
SM - With pressure limiter overriding function



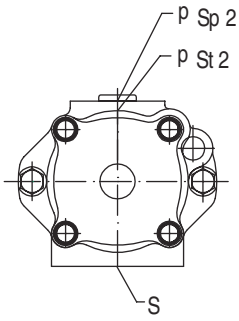
SM - With pressure limiter and power control overriding function



View X



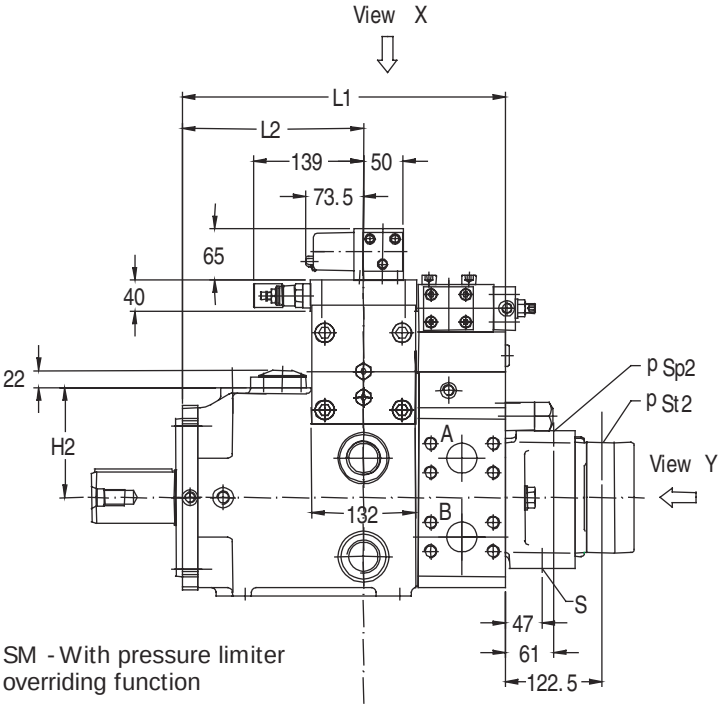
View Y



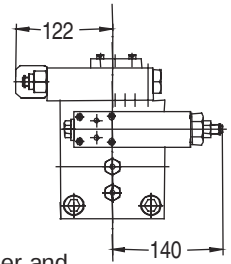
ch arge & pilo t pump 4 0 /8 ccm

Control
Dimensions - TVWS 250/360/500/750 SM Control

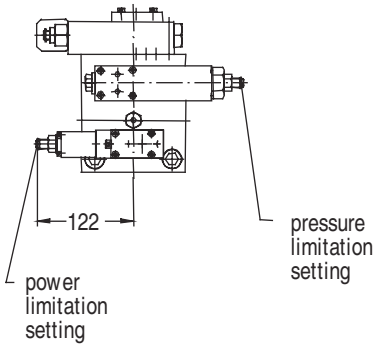
Dimensions in mm



SM - With pressure limiter overriding function



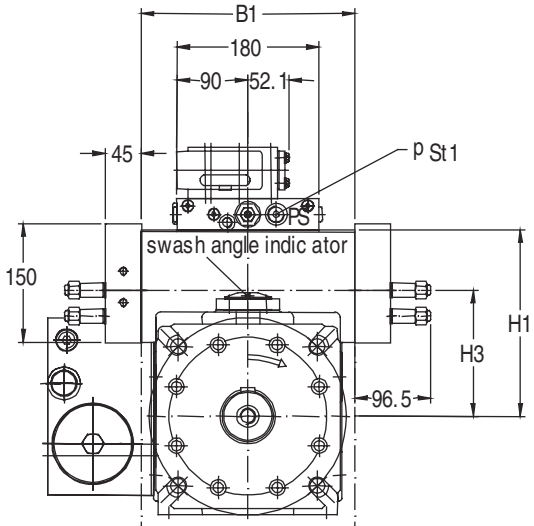
SM - With presure limiter and power control overriding function



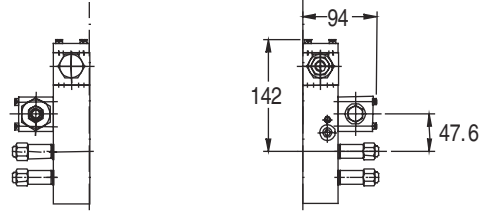
	L1	L2	B1	H1	H2	H3
250	410	230	271	236	135	160
360	426	230	285	236	135	160
500	541,5	300	330	267,5	172	186
750	571	307	372	270	172	188,5

Control Dimensions - TVWS 250/360/500/750 SM Control

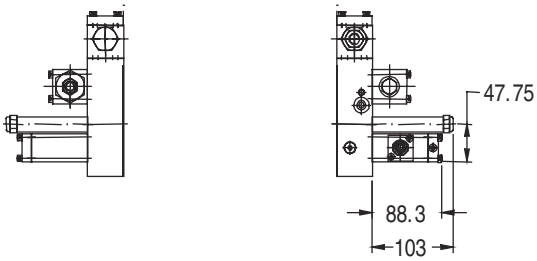
Dimensions in mm



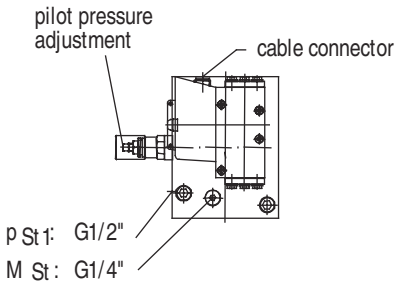
SM - With pressure limiter overriding function



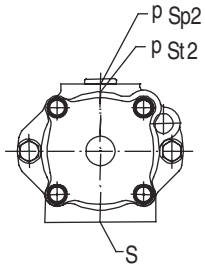
SM - With presure limiter and power control overriding function



View X



View Y



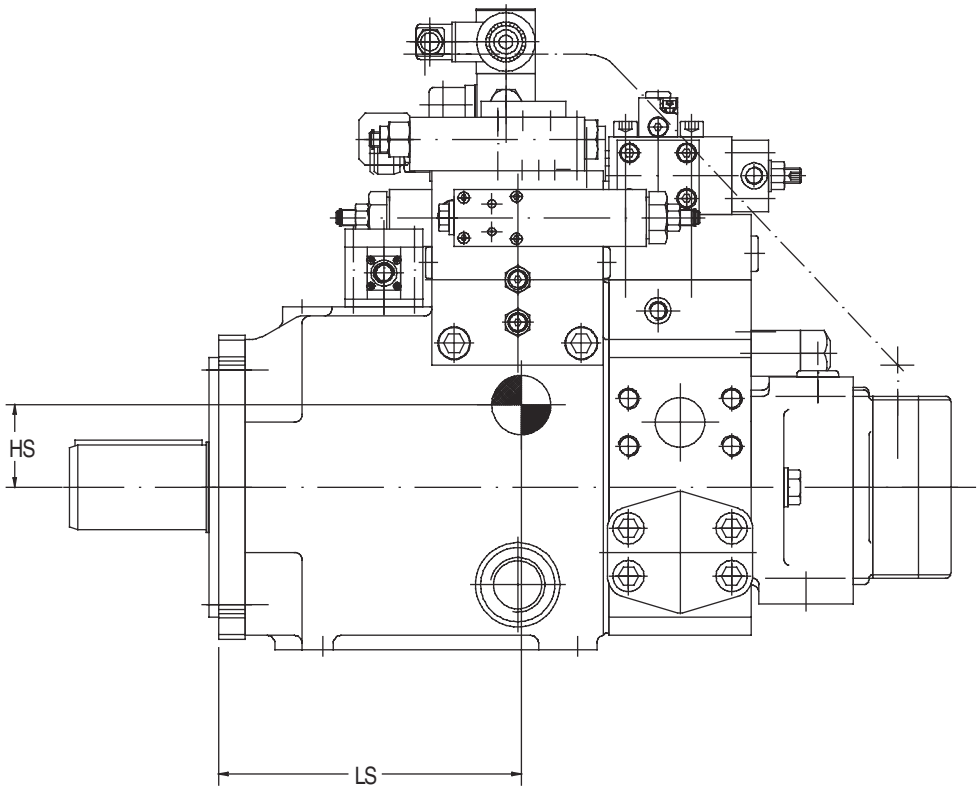
DISPLACEMENT FOR CHARGE PILOT PUMPS (CCM)

Pump Size	Charge Pump	Pilot Pump
250	64	8
360	80	8
500	125	8
750	200	8

Control Dimensions - TVWS Position of Center of Gravity

130/180/250/360/500/750
SP - DR

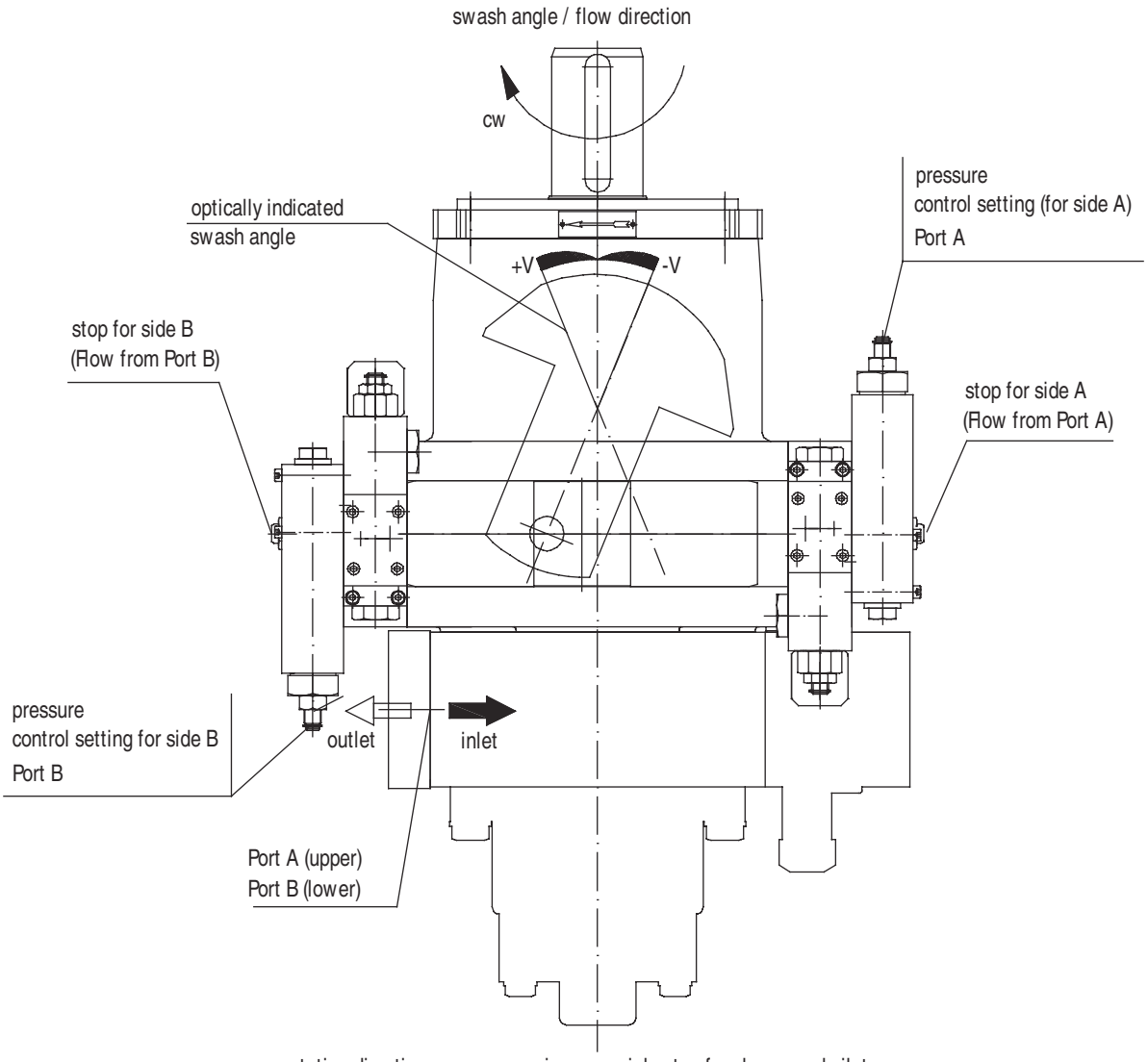
Dimensions in mm



TVW SIZE	WEIGHT KG	LS MM	HS MM
130	160	205	55
180	165	205	55
250	235	233	63
360	240	250	63
500	420	306	55
750	460	318	65

TVW - Swash Angle/ Flow Direction

Dimensions in mm

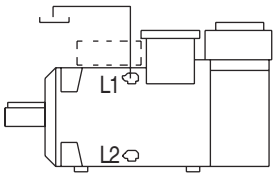
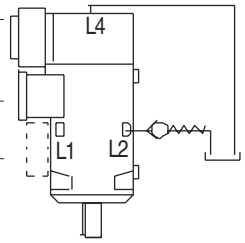


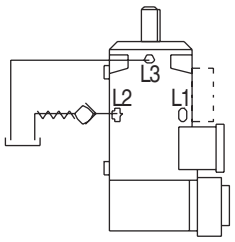
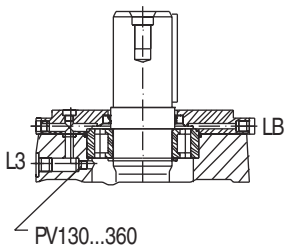
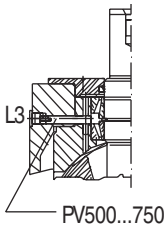
rotation direction: cw, ccw requires aspezial setup for charge and pilot pump

	ACTUATOR PISTON STOP A (+V)	STOP B (-V)
Inlet port	B	A
Outlet port	A	B

Installation position

Installation position is optional however note bearing lubrication with respect to mounting

INSTALLATION POSITION	DRAIN PIPING	INSTALLATION POSITION	DRAIN PIPING
Shaft horizontal		Shaft pointed downwards	
Pump can be rotated freely about the lateral axis		Use ventilation line L_4 Prime main case drain connection L_2 (L_1) with 0,2 bar (2.9 psi)	
Use the highest case drain connection L_1 or L_2			

INSTALLATION POSITION	DRAIN PIPING	INSTALLATION POSITION	DRAIN PIPING
Shaft pointed upwards		Vertically mounted	Internal connection to be closed with pin no. HC46082101401
Use ventilation line L_3		Internal connection close with plug G 1/8”	
Pre load drain port case drain connection L_2 (L_1) with 0.2 bar (2.9 psi)		Horizontally mounted	
		Internal connection open L_3 plugged	
			

Case Flushing Requirements

A check valve must not be used in the drain pipe. The drain pipe must interminate below the oil level in the reservoir.

For all other conditions with low pressure < 20 bar (<300 psi) and low flow (<10% of Qmax) case flushing is required.

For operation with special fluids HFB and HFC, case flushing is recommended.

Flushing Flow

Flushing flow via the pump case should be >1% of maximum pump flow. Maximum flushing flow depends on case pressure.

Notes:

- All listed ratings are based on the use of a good quality fluid.
- Alternative fluids have a reduced tolerance for contamination over petroleum base fluids. Good filtration is therefore critical.
- The pumps will provide exceptional life when used with a good quality clean fluid at the pump ratings specified for that fluid.

Fluids

Pumps in the catalogue are primarily designed to operate with conventional petroleum based hydraulic oil. Alternative fluids and restrictions:

- Fluid maintenance is critical to the durability of all hydraulic components, and particularly so with hydraulic pumps. This becomes even more of a factor when alternative fluids are used. All types of alternative fluids require extensive maintenance in order to maintain proper levels of water content, acidity, viscosity and contamination.

Fluid Cleanliness

These pumps are rated for anti-wear petroleum fluids with a contamination level of 18/15/13 per ISO 4406. Operation in fluids with levels more contamination than this is not recommended and may reduce the life of the pump components. Fluids other than petroleum, severe service cycles, or temperature extremes are cause for adjustment of these codes. Please contact your Eaton representative for special duty cycle recommendations.

Eaton pumps, as well as 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 optimised 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 inclusion of air.

Essential information on the correct methods for treating hydraulic fluid is included in Eaton publication 561- "Vickers Guide to Systemic Contamination Control"- available from your local Eaton distributor.

In this publication, filtration and cleanliness levels for extending the life of axial piston pumps and other system components are listed. Included is an excellent discussion of the selection of products needed to control fluid condition.

Ordering Procedure

When ordering please specify full model designation of items required; see "Model Codes" section of this catalogue..

Note the following:

- Designation of variable displacement pumps must include the supplementary designation of the required control

FLUIDS

TYPE	CLASSIFICATION	MAX. PRESSURE BAR	MAX. SPEED RPM	RECOMMENDED SEAL MATERIAL	MAX OPERATING TEMPERATURE °C	BEARING LIFE
Oil in Water Emulsion	HFAE	Not Rated				0
Water in oil Emulsion	HFB	250	1800	Fluorocarbon	49	50%
Water Glycol	HFC	250	1800	Fluorocarbon	49	25%
Phosphate Ester	HFDR	350/420	1800	Fluorocarbon	66	100%
Polyol Ester	HFDU	350/420	1800	Fluorocarbon	66	100%

*Refer to the general specifications for the displacement speed limitation

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