EATON | Vickers

Single, Double, Triple, and Thru-Drive Pumps

Overhaul Service Manual

VMQ125S
VMQ135S
VMQ145S
VMQ125T
VMQ135T
VMQ145
VMQ22525
VMQ23525
VMQ24525
VMQ24535
VMQ3352525
VMQ3453525
Series – 30 Design

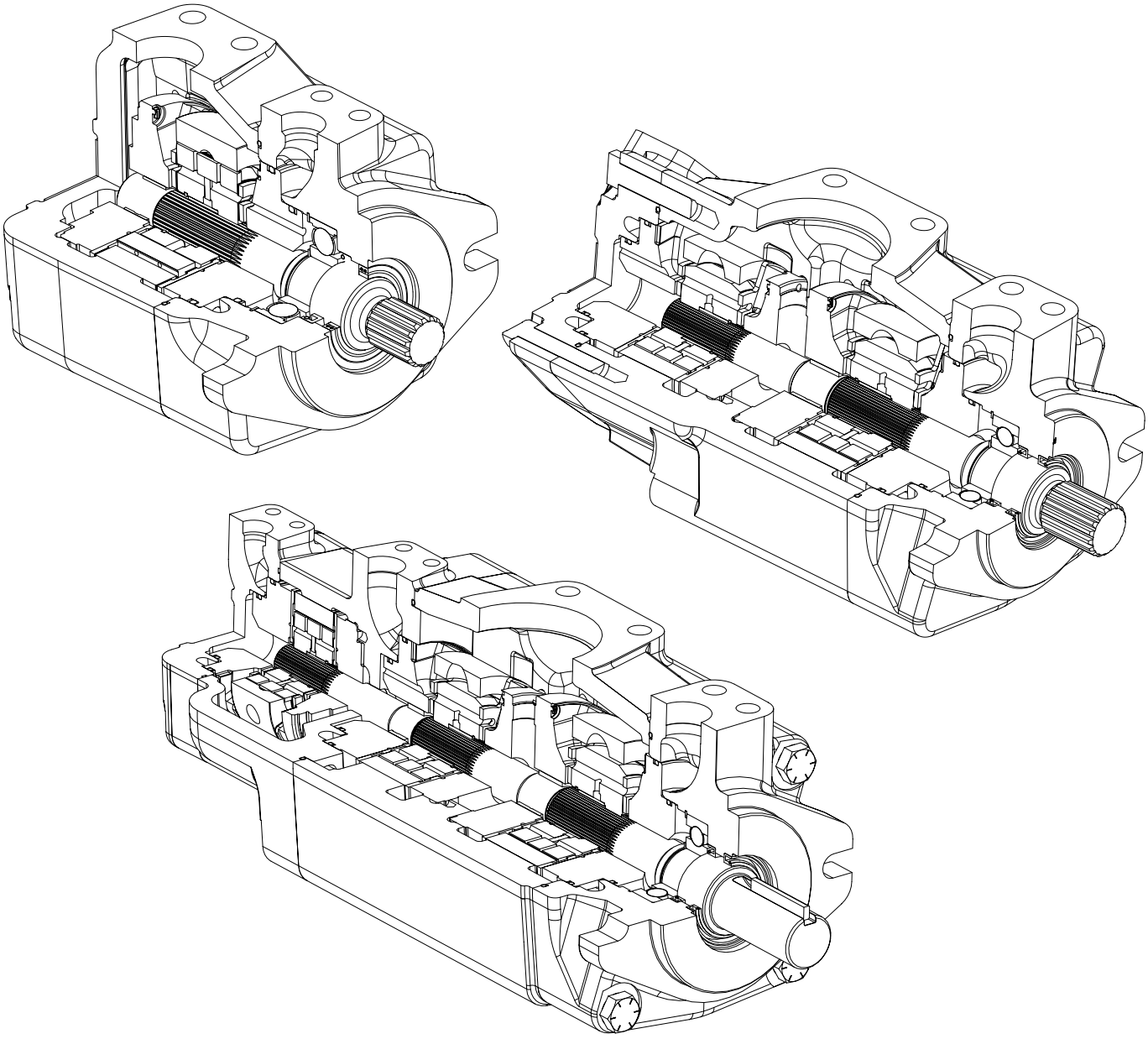

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Table of Contents

Section I — Introduction

A. Purpose of Manual

This manual has been prepared to assist the users of Eaton's high performance VMQ single pumps in properly installing, maintaining and repairing their unit. The single, double, and triple pumps are described in detail and their theory of operation is discussed in addition to instructions for installation, maintenance, and overhaul.

The general series of models covered are VMQ125S, VMQ135S, VMQ145S, VMQ125T, VMQ135T, VMQ145T, VMQ22525, VMQ23525, VMQ24525, VMQ24535, VMQ3352525, and VMQ3453525. The information given applies to the 30-39th Design VMQ.

B. General Information

Related Publications – Service parts information and installation dimensions are not contained in this manual. The parts catalogs and installation drawings are available from authorized distributors or Eaton sales engineers.

Model Codes – There are many variations within each basic model series, which are covered by variables in the model code. A complete breakdown of the codes covering these units is in Tables 1–3 on pages 5–7. Service inquiries should always include the complete unit model number as stamped on the pump cover.

Section II – Description

A. 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.

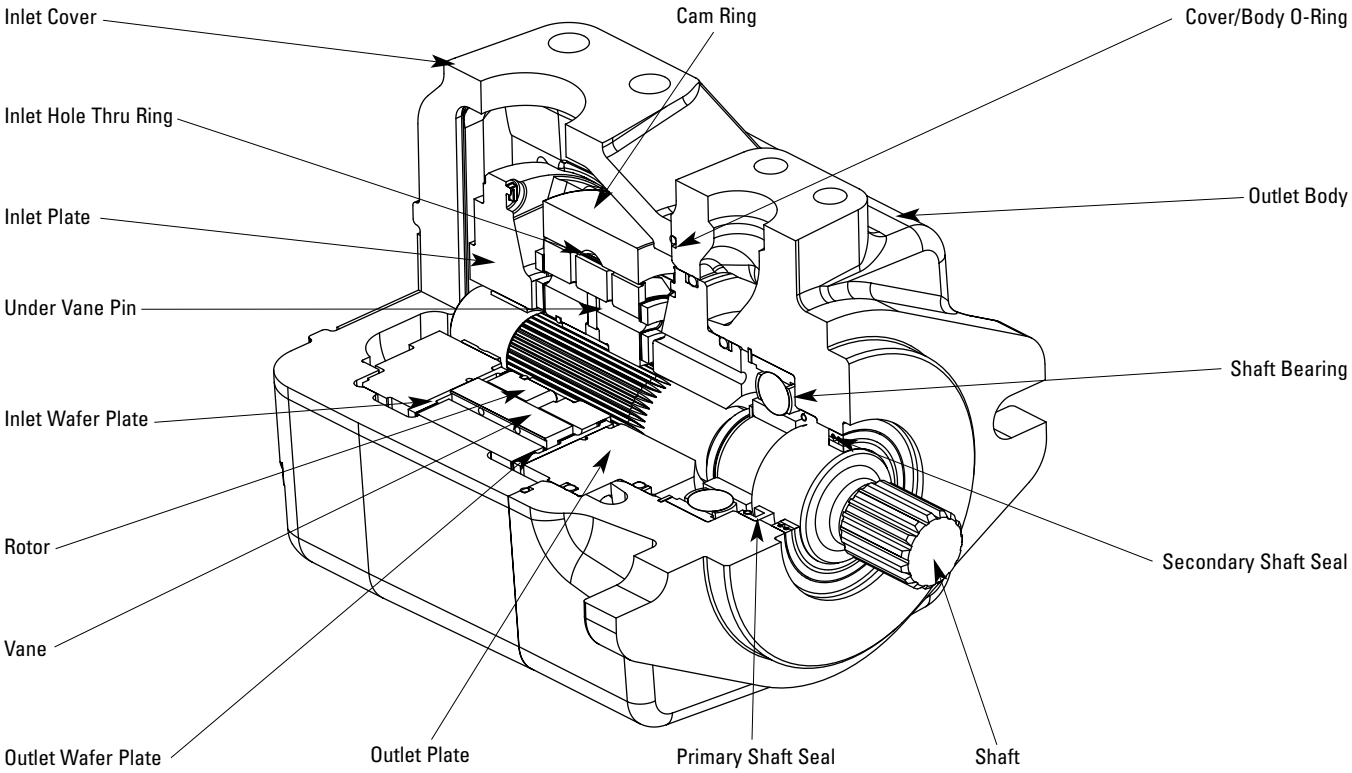


Figure 1a. Cutaway View of Typical High Performance VMQ Single Vane Pump

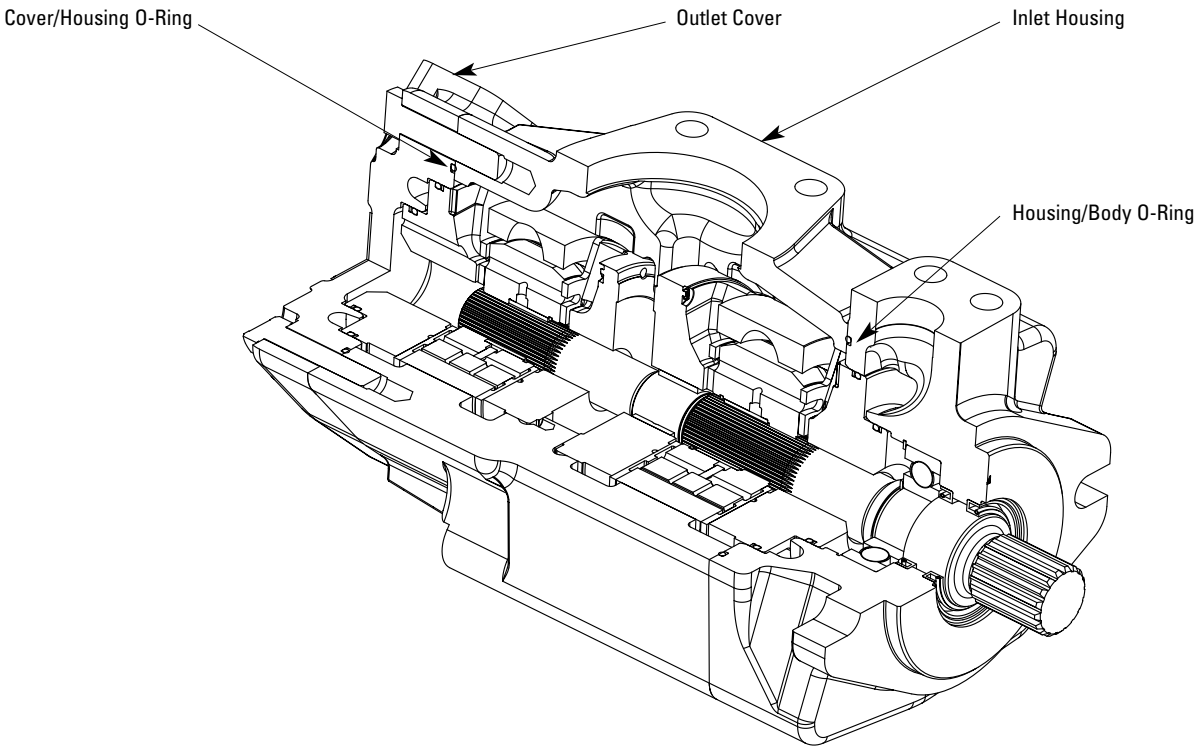


Figure 1b. Cutaway View of Typical High Performance VMQ Double Vane Pump

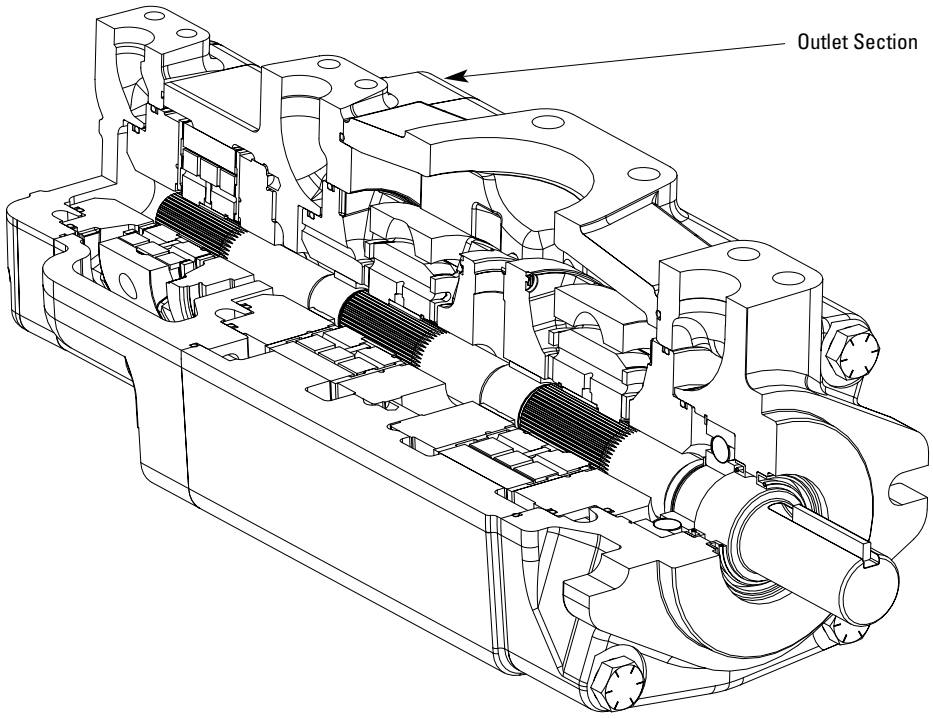


Figure 1c. Cutaway View of Typical High Performance VMQ Triple Vane Pump

Model Code — Single and Thru-Drive Pumps

VMQ1 ** * * * * ** ** * * * * * * 00 * 0 30**

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 4 Series designation

VMQ1 – Vane pump single series

5 6 Frame size

25 – 10-90 cm^3/r (0.62-5.49 in^3/r)

35 – 90-158 cm^3/r (5.49-9.64 in^3/r)

45 – 140-215 cm^3/r (8.54-13.12 in^3/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)

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 – (Frame sizes 35 & 45 only) 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 & 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 size 35)
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

30 – 30 design
Installation dimensions remain unchanged for design numbers 30 to 39 inclusive.

* Verify shaft torque ratings meet or exceed input torque requirements

Table 1. Model Code Breakdown

Model Code — Double Pumps

VMQ2 ** ** S * *** * 0 ** 00 * * * * * * * * 00 * 0 30**

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

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 – 140-215 cm³/r (8.54-13.12 in³/r)

7 8 Frame size (rear 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 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)

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 – (Frame sizes 35 & 45 only) 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 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

0 – None
A – Blue

33 Customer identification

0 – None

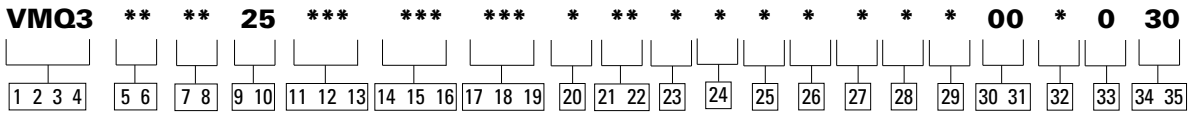
34 35 Design code

30 – 30 design
Installation dimensions remain unchanged for design numbers 30 to 39 inclusive.

* Verify shaft torque ratings meet or exceed input torque requirements

Table 2. Model Code Breakdown

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)

45 – 140-215 cm ^{3}/r (8.54-13.12 in ^{3}/r)

7 8 Frame size (middle section)

25 – 10-90 cm ^{3}/r (0.62-5.49 in^3/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 in^3/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)

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 (8.54 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

30 – 30 design
Installation dimensions remain unchanged for design numbers 31 to 39 inclusive.

* Verify shaft torque ratings meet or exceed input torque requirements

Table 3. Model Code Breakdown

B. Assembly and Construction

Basic Pumps. The pump illustrated in Figure 1 is representative of all single pumps in this series. The pump consists principally of an inlet housing, outlet body, drive shaft, and pumping cartridge. The principal components of a cartridge are an elliptical cam ring, a slotted rotor splined to the drive shaft, an inlet and outlet support plate, two wafer plates on either side of the cam ring, and twelve vanes and under vane pins fitted to the rotor slots. Fluid enters the cartridge through the inlet port in the cover and is discharged through the outlet wafer plate and support plate to the outlet port in the body.

C. Application

VMQ Pumps can be used in both industrial and mobile applications. For pump ratings, methods of installation or other application information, refer to the applicable sales installation drawing or consult an application engineer.

Section III – Principles of Operation

A. Pumping Cartridge

As mentioned in Section II, fluid flow is developed in the pumping cartridge. The action of the cartridge is illustrated in Figure 3. 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. See Figure 2.

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 fluid is forced out into the system. System pressure is fed under the vanes via the under vane pins, assuring their sealing contact against the ring during normal operation.

B. Vane Pressure Feed

The pin-vane design provides a means of controlling outward thrust of the vane against the ring and maintains tip loads within reasonable limits. In the pin-vane cartridge, full system pressure is continuously applied only to the cross sectional area of the pin. This area is small and thrust is correspondingly light. This selective application of pressure assures that the vanes will always be in contact with the cam ring. A detailed drawing of the VMQ rotating group can be seen in Figure 4.

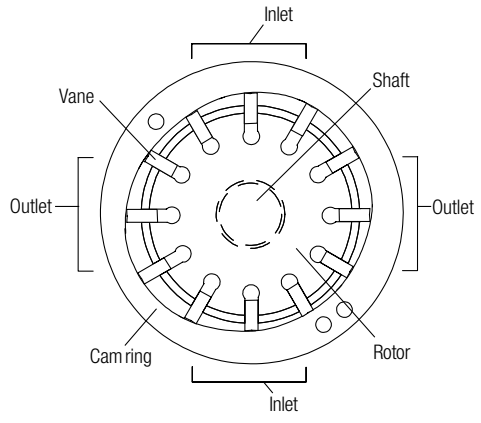


Figure 2

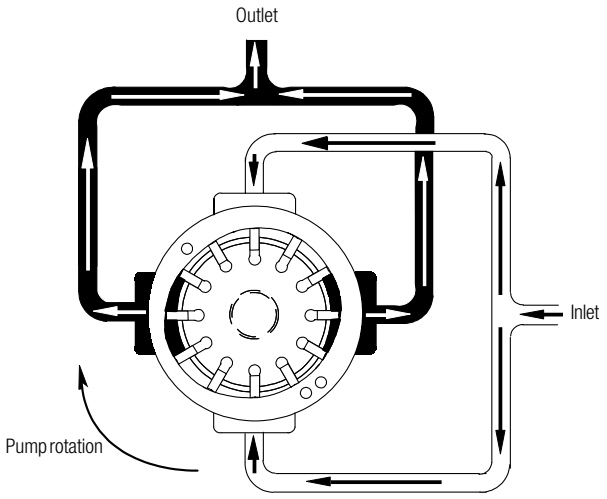


Figure 3

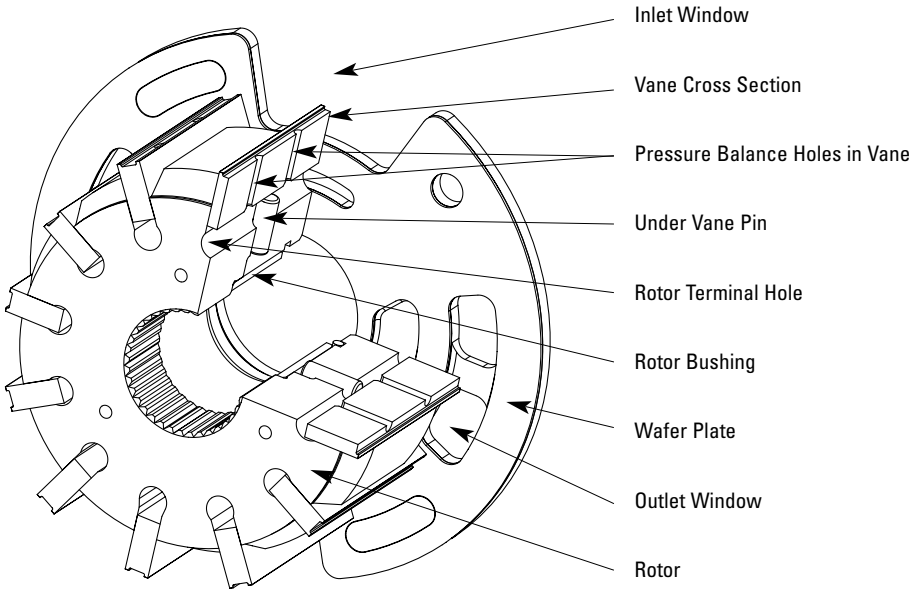


Figure 4. VMQ Wafer Plate, Rotor and Vanes

C. Hydraulic Balance

The pump ring is shaped so the two pumping chambers are formed 180 degrees apart (Figure 3). Thus, opposing hydraulic forces which develop side loads on the shaft cancel out.

D. Wafer Plate Operation

The main function of the wafer plates is to control the pressure timing of the pump. Machined cavities in the wafer plates distribute high pressure from the outlet ports to the terminal holes in the rotor. These cavities also feed high pressure through the rotor to the pins behind the vanes. With high pressure distributed through the rotor and applied to the under vane pins, the forces between the vane tip and cam are regulated. Finally, metering grooves in the plates are positioned in such a way to reduce excess cavitation, thus limiting the overall sound level of the pump. The position of the wafer plates in the cartridge kit can be seen in Figure 5.

VMQ wafer plates have a bronze finish that rides next to the rotor and provides excellent wear and thermal shock characteristics.

The inlet and outlet support plates hold the wafer plates in position and contain passages which allow fluid to pass from the inlet port to the pumping cartridge and from the cartridge to the outlet port.

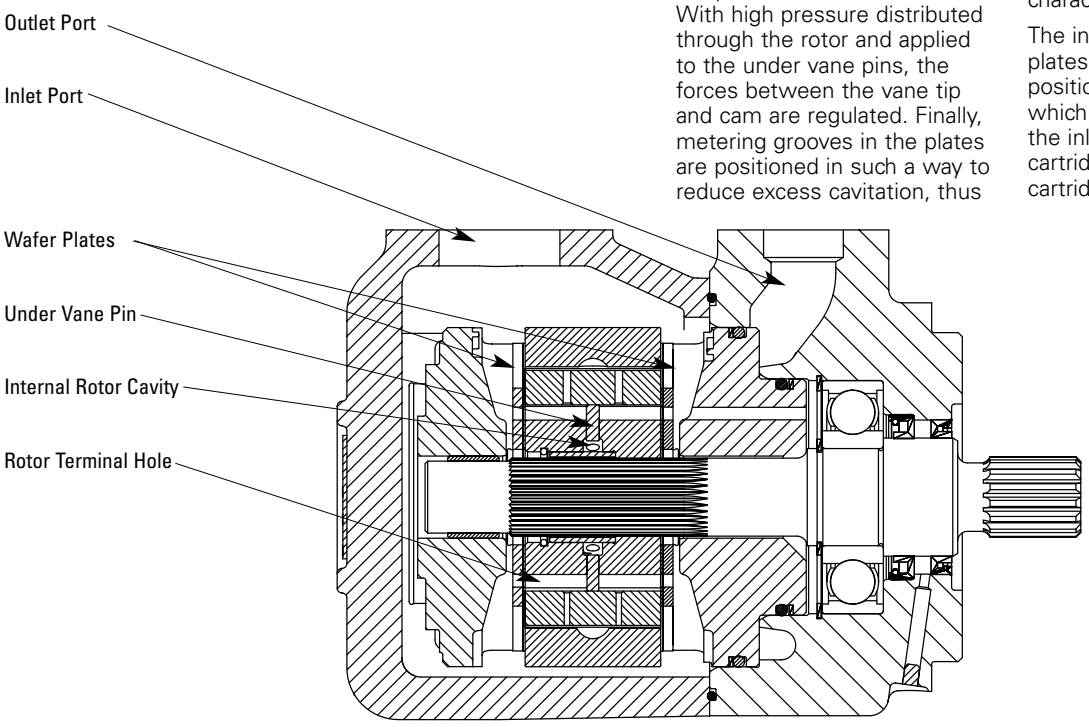


Figure 5. Wafer Plate Operation

Section III — Principles of Operation (cont.)

E. Outlet Bodies

Two outlet body configurations and two shaft seal arrangements are available for the series 30 VMQ pumps. See Figures 6a and 6b.

Double shaft seal models utilize a drain hole opening between the two seals. This drain hole is used to prevent cross contamination between the gearbox and the pump.

If one seal were to fail, the fluid would drain through the hole and not past the opposing seal. Series 30 VMQ pumps use shaft seals that are rated at 20 PSIG (1.38 bar). Higher pressure shaft seals are available. See your Eaton sales representative for further details.

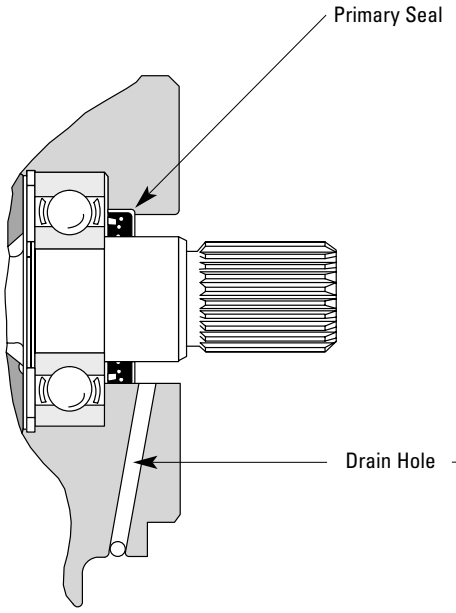


Figure 6a. Single Shaft Seal Models

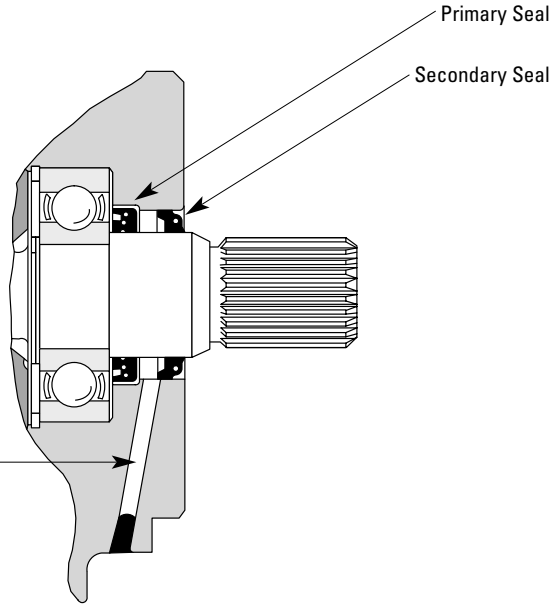


Figure 6b. Double Shaft Seal Models

Section IV – Installation and Operating Instructions

A. Installation Drawings

See the series 30 VMQ product catalog for installation dimensions.

B. Mounting and Drive Connections

Eaton high performance vane pumps are designed for foot or flange mounting.

1. Direct Drive. A pilot on the pump mounting flange (Figure 7) assures correct mounting and shaft alignment, provided the pilot is firmly seated in the accessory pad of the power source. Care should be exercised in tightening all flange mounting screws to prevent misalignment.

If gaskets are used between flanges, they should be installed carefully so as to lie flat and should not be the type that will take a set. Shaft keys and couplings must be properly seated to avoid slipping and possible shearing.

Proper coupling alignment is essential to prolong pump life.

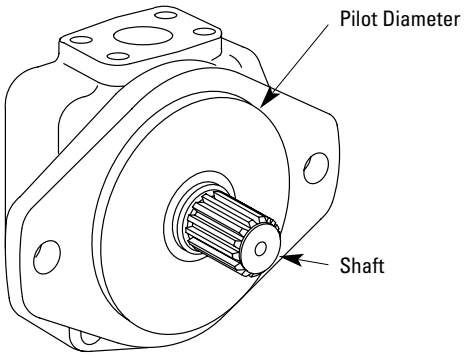


Figure 7. Pilot Diameter

CAUTION

Pump shafts are designed to be installed in couplings with a slip fit or very light press. Pounding the coupling on the shaft can ruin the bearings. Shaft tolerances are shown on the pump installation drawings.

2. Indirect Drive. Indirect drive is not recommended for these pumps.

C. Shaft Rotation

NOTE

Pumps are normally assembled for right hand (clockwise) rotation as viewed from the shaft end. A pump made for left hand rotation is identified by an "L" in the model code. (See Table 1)

NOTE

If it is desired to reverse the direction of drive rotation, it is necessary to disassemble the pump and reverse the location of the cartridge cam ring and wafer plates. (See Section VI, Part C)

CAUTION

Never drive a pump in the wrong direction of rotation. Seizure may result, necessitating extensive repairs.

D. Piping and Tubing

1. All pipes and tubing must be thoroughly cleaned before installation. Recommended methods of cleaning are sandblasting and wirebrushing.

2. To minimize flow resistance and the possibility of leakage, use only as many fittings and connections as necessary for proper installation.

3. The number of bends in tubing should be kept to a minimum to prevent excessive turbulence and friction of oil flow. Tubing must not be bent too sharply. The recommended radius for bends is three times the inside diameter of the tube.

E. Hydraulic Fluid Recommendations

General Data

Oil in a hydraulic system performs the dual function of lubrication and transmission of power. It constitutes a vital factor in a hydraulic system and careful selection of it should be made with the assistance of a reputable supplier. Proper selection of oil assures satisfactory life and operation of system components with particular emphasis on hydraulic pumps. Any oil selected for use with pumps is acceptable for use with valves or motors.

See the Series 30 VMQ product catalog for hydraulic fluid guidelines.

Where special considerations indicate a need to depart from the recommended oils or operating conditions, see your Eaton representative.

Cleanliness

Clean fluid is the best insurance for long service life. Eaton recommends a fluid cleanliness of ISO 18/16/13 or better. To insure your hydraulic system is clean, perform the following steps.

1. Clean (flush) entire new system to remove paint, metal chips, welding shot, etc.

2. Filter each change of oil to prevent introduction of contaminants into the system.

3. Provide continuous oil filtration to remove sludge and products of wear and corrosion generated during the life of the system.

4. Provide continuous protection of system from entry of airborne contamination, by sealing the system and/or by proper filtration of the air.

5. Proper oil filling and servicing of filters, breathers, reservoirs, etc., cannot be overemphasized.

6. Good system and reservoir design will insure that aeration of the oil is kept to a minimum.

E. Hydraulic Fluid Recommendations (cont.)

Sound Level

Noise is indirectly affected by the fluid selection, but the condition of the fluid is of paramount importance in obtaining optimum reduction of system sound levels.

Some of the major factors affecting fluid conditions that cause the loudest noises in a hydraulic system are:

1. Very high viscosities at start-up temperatures can cause pump noises due to cavitation.

2. Running with a moderately high viscosity fluid will slow the release of entrained air. The fluid will not be completely purged of such air in the time it remains in the reservoir and air will be recycled through the system.

3. Aerated fluid can also be caused by ingestion of air through the pipe joints of inlet lines, high velocity discharge lines, cylinder rod packings, or by fluid discharging above the fluid level in the reservoir. Air in the fluid causes a noise similar to cavitation.

4. Contaminated fluids can cause excessive wear of internal pump parts, which may result in increased sound levels.

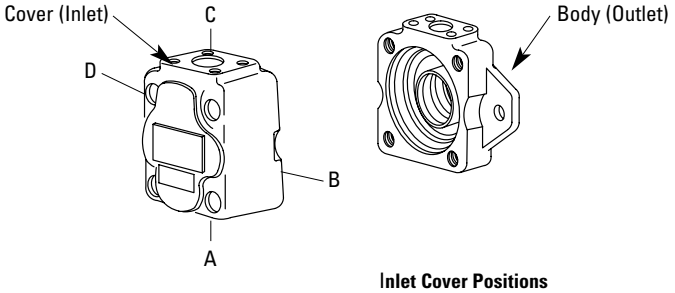
F. Overload Protection

Relief valves must be installed in the system as close to the pump outlets as possible. The relief valve limits pressure in each system to a prescribed maximum and protects components from excessive pressure. Each relief valve pressure setting depends on the work requirements of the circuit being fed.

G. Port Positions

The pump cover can be assembled in four positions with respect to the body. A letter in the model code identifies the orientation of the inlet and outlet ports. The cover position of a VMQ single pump is shown in Figure 8 as an example.

Disassembly and assembly procedures are in Section VI-B and E.



Model	Inlet Cover Positions (Viewed from cover end)
VMQ1* **A* * 030	Opposite Outlet Port
VMQ1* **B* * 030	90°Clockwise from Outlet
VMQ1* **C* * 030	Inline with Outlet
VMQ1* **D* * 030	90° Counterclockwise from Outlet

Figure 8. Cover Positions

H. Start-Up

Whenever it is possible to do so, fill the pump ports with system hydraulic fluid. This will make it easier for the pump to prime when it is first started.

Self priming: With a minimum drive speed of 600 RPM, a pump should prime immediately. Failure to prime within a short length of time may result in damage due to lack of lubrication. Inlet lines must be tight and free from air leaks. However, it may be necessary to loosen a fitting on the outlet side of the pump to purge entrapped air.

No load starting: These pumps are designed to start up with no load on the pressure ports. They should never be started against a load or a closed center valve.

Section V — Inspection and Maintenance

A. Inspection

Periodic inspection of the fluid condition and tube or piping connections reduce time consuming breakdowns and unnecessary parts replacement. The following should be checked regularly.

1. All hydraulic connections must be kept tight. A loose connection in a pressure line will permit the fluid to leak out. If the fluid level becomes so low as to uncover the inlet pipe opening in the reservoir, extensive damage to the pump can result. In suction or return lines, loose connections permit air to be drawn into the system, resulting in noisy and/or erratic operation.

2. Clean fluid is the best insurance for long service life. Therefore, the reservoir should be checked periodically for dirt or other contaminates. If the fluid becomes contaminated, the system should be thoroughly drained and the reservoir cleaned before new fluid is added.

3. Filter elements also should be checked and replaced periodically. A clogged filter element results in a higher pressure drop. This can force particles through the filter which would ordinarily be trapped, or can cause the bypass to open, resulting in a partial or complete loss of filtration.

4. Air bubbles in the reservoir can ruin the pump and other components. If bubbles are seen, locate the source of the air and seal the leak. (See Table 3)

5. A pump which is running excessively hot or noisy is a potential failure. Should a pump become noisy or over-heated, the machine should be shut down immediately and the cause of improper operation corrected.

B. Adding Fluid to the System

When hydraulic fluid is added to replenish the system, it should always be poured through a fine wire screen (200 mesh or finer) or preferably pumped through a 10 micron (absolute) filter.

It is important that the fluid be clean and free of any substance which could cause improper operation or wear of the pump or other hydraulic units. Therefore, the use of cloth to strain the fluid should be avoided to prevent lint from getting into the system.

C. Adjustments

No periodic adjustments are required, other than to maintain proper shaft alignment with the driving medium.

D. Lubrication

Internal lubrication is provided by the fluid in the system. Lubrication of the shaft coupling should be as specified by their manufacturers.

E. Replacement Parts

Reliable operation throughout the specified operating range is assured only if genuine Vickers parts are used. Sophisticated design processes and materials are used in the manufacture of our parts. Substitutions may result in early failure.

F. Product Life

The longevity of these products is dependent upon environment, duty cycle, operating parameters and system cleanliness. Since these parameters vary from application to application, the ultimate user must determine and establish the periodic maintenance required to maximize life and detect potential component failure.

G. Troubleshooting

Table 4 lists the common difficulties experienced with vane pumps and hydraulic systems. It also indicates the probable causes and remedies for each of the troubles listed.

It should always be remembered that many apparent pump failures are actually due to the failure of other parts of the system. The cause of improper operation is best diagnosed with adequate testing equipment and a thorough under-standing of the complete hydraulic system.

Table 4. Troubleshooting Chart

TROUBLE	PROBABLE CAUSE	REMEDY
Pump not delivering fluid.	Driven in the wrong direction of rotation.	The drive direction must be changed immediately to prevent seizure. Refer to Section VI.C. for the correct ring position for each direction of rotation.
	Coupling or shaft sheared or disengaged.	Disassemble the pump and check the shaft and cartridge for damage. (See Section VI) Replace the necessary parts.
	Fluid intake pipe in reservoir restricted.	Check all strainers and filters for dirt and sludge. Clean if necessary.
	Fluid viscosity too heavy to pick up prime.	Completely drain the system. Add new filtered fluid of the proper viscosity.
	Air leaks at the intake. Pump not priming.	Check the inlet connections to determine where air is being drawn in.Tighten any loose connections. See that the fluid in the reservoir is above the intake pipe opening. Check the minimum drive speed which may be too slow to prime the pump.
	Vane(s) stuck in the rotor slots(s).	Disassemble the pump. Check for dirt or metal chips. Clean the parts thoroughly and replace any damaged pieces. If necessary, flush the system and refill it with clean fluid.
Insufficient pressure build-up.	System relief valve set too low.	Use a pressure gage to correctly adjust the valve.
Pump making noise.	Pump intake partially blocked.	Service the intake strainers. Check the fluid condition and, if necessary, drain and flush the system. Refill with clean fluid.
	Air leaks at the intake or shaft seal. (Oil in reservoir would probably be foamy.)	Check the inlet connections and seal to determine where air is being drawn in.tighten any loose connections and replace the seal if necessary. See that the fluid in the reservoir is above the intake pipe opening.
	Pump drive speed too slow or too fast.	Operate the pump at the recommended speed.
	Coupling misalignment.	Check if the shaft seal bearing or other parts have been damaged. Replace any damaged parts. Realign the coupled shafts.

Figure 9a. Exploded View of VMQ Single Pump

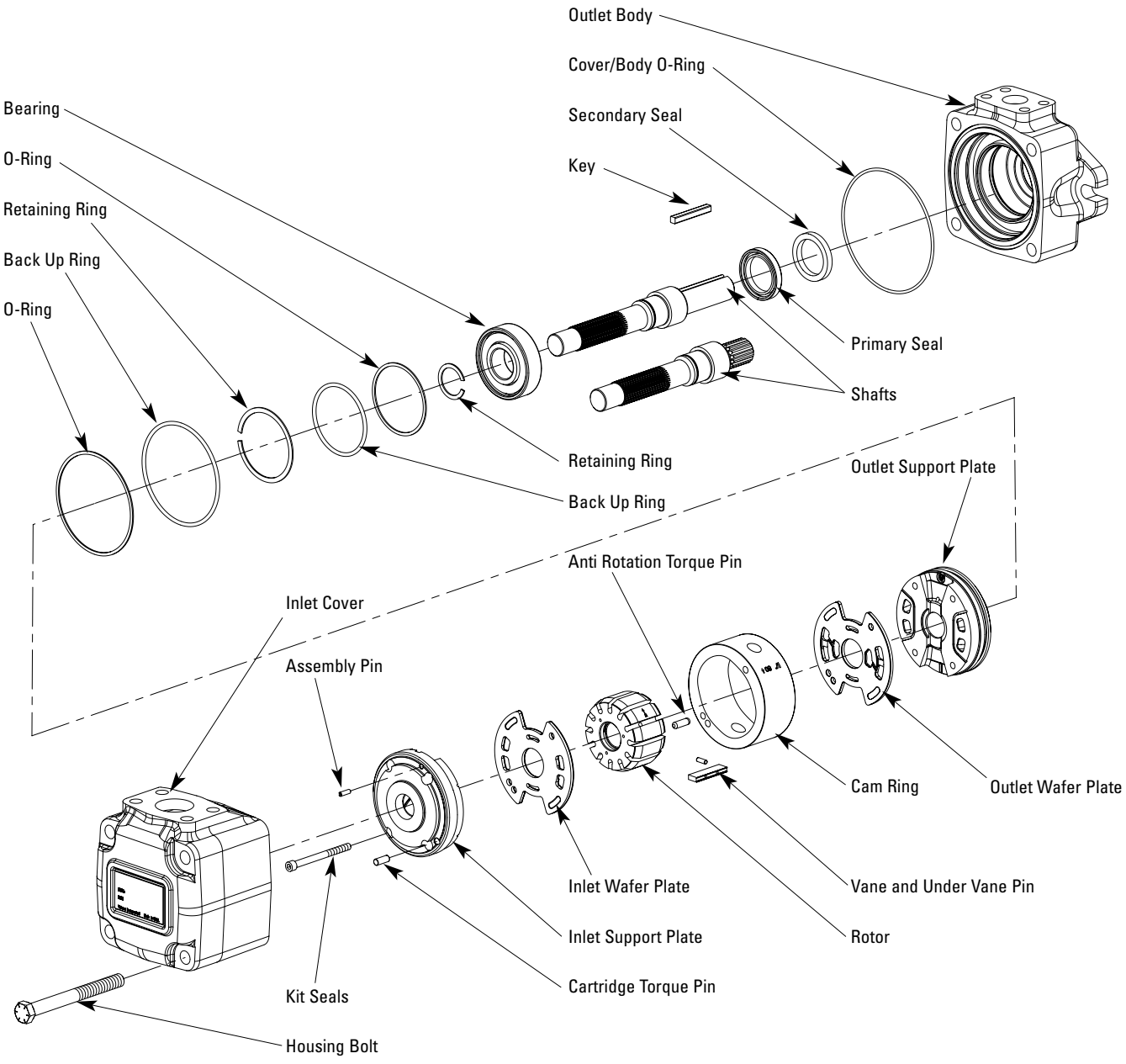


Table 5 - Single Pump Housing Torque Specs

	ISO (NM)		SAE (ft-lb)	
	Dry	**Oiled**	**Dry**	**Oiled**
VMQ125	153 ± 16	115 ± 12	113 ± 11	85 ± 9
VMQ135	305 ± 31	229 ± 23	225 ± 23	169 ± 17
VMQ145	305 ± 31	229 ± 23	225 ± 23	169 ± 17

Figure 8b. Exploded View of VMQ Thru-Drive Pump

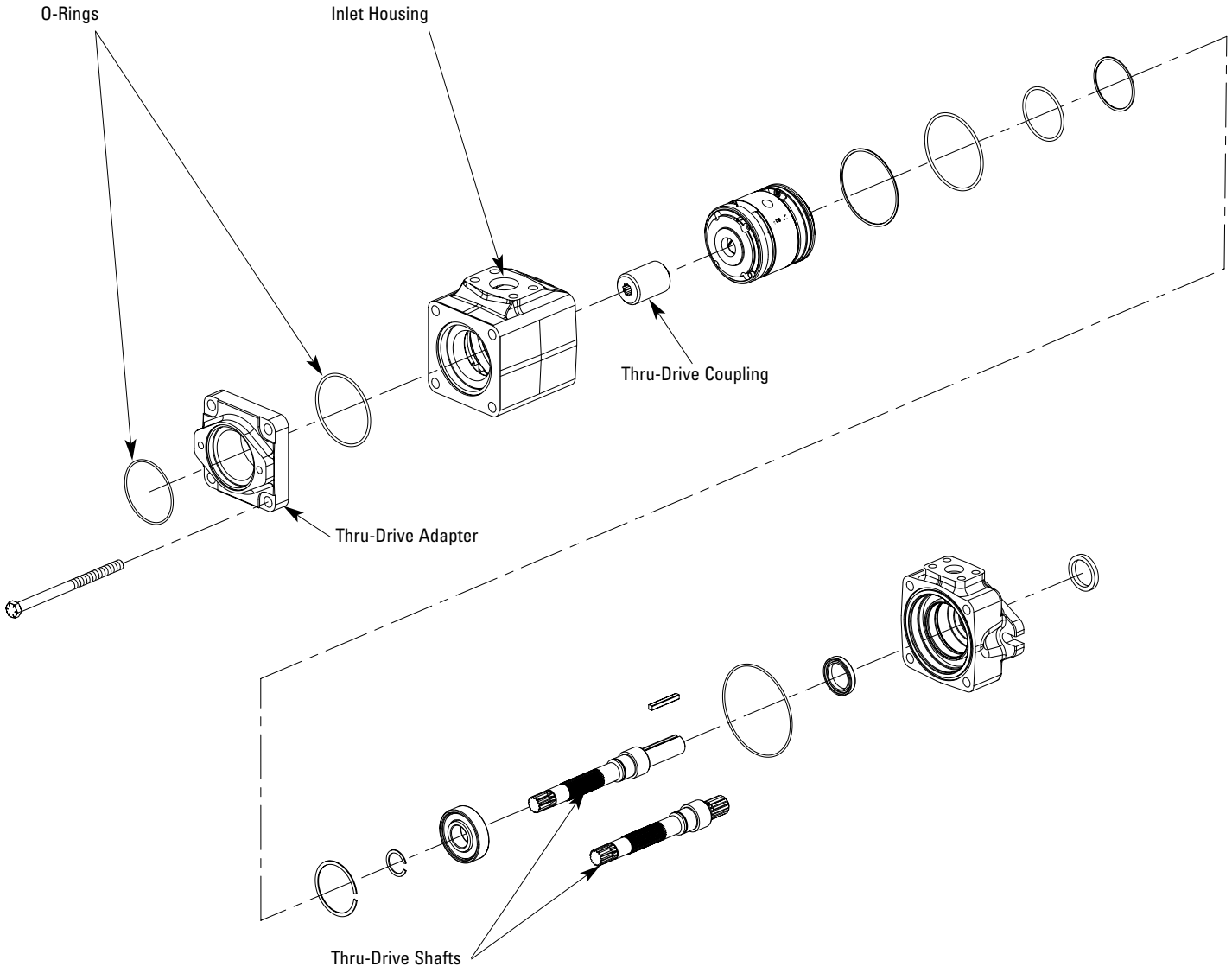


Table 6 - Thru-Drive Pump Housing Torque Specs

	INLET HOUSING				THRU-DRIVE ADAPTOR (SAE A & SAE B)				THRU-DRIVE ADAPTOR (SAE C)			
	ISO (NM)		SAE (ft-lb)		ISO (NM)		SAE (ft-lb)		ISO (NM)		SAE (ft-lb)	
	Dry	Oiled	Dry	Oiled	Dry	Oiled	Dry	Oiled	Dry	Oiled	Dry	Oiled
VMQ125T	153+/-16	115+/-12	113+/-11	85+/-9	—	—	—	—	—	—	—	
VMQ135T	305+/-31	229+/-23	225+/-23	169+/-17	153+/-16	115+/-12	113+/-11	85+/-9	305+/-31	229+/-23	225+/-23	169+/-17
VMQ145T	305+/-31	229+/-23	225+/-23	169+/-17	153+/-16	115+/-12	113+/-11	85+/-9	305+/-31	229+/-23	225+/-23	169+/-17

Figure 9c. Exploded View of VMQ Double Pump

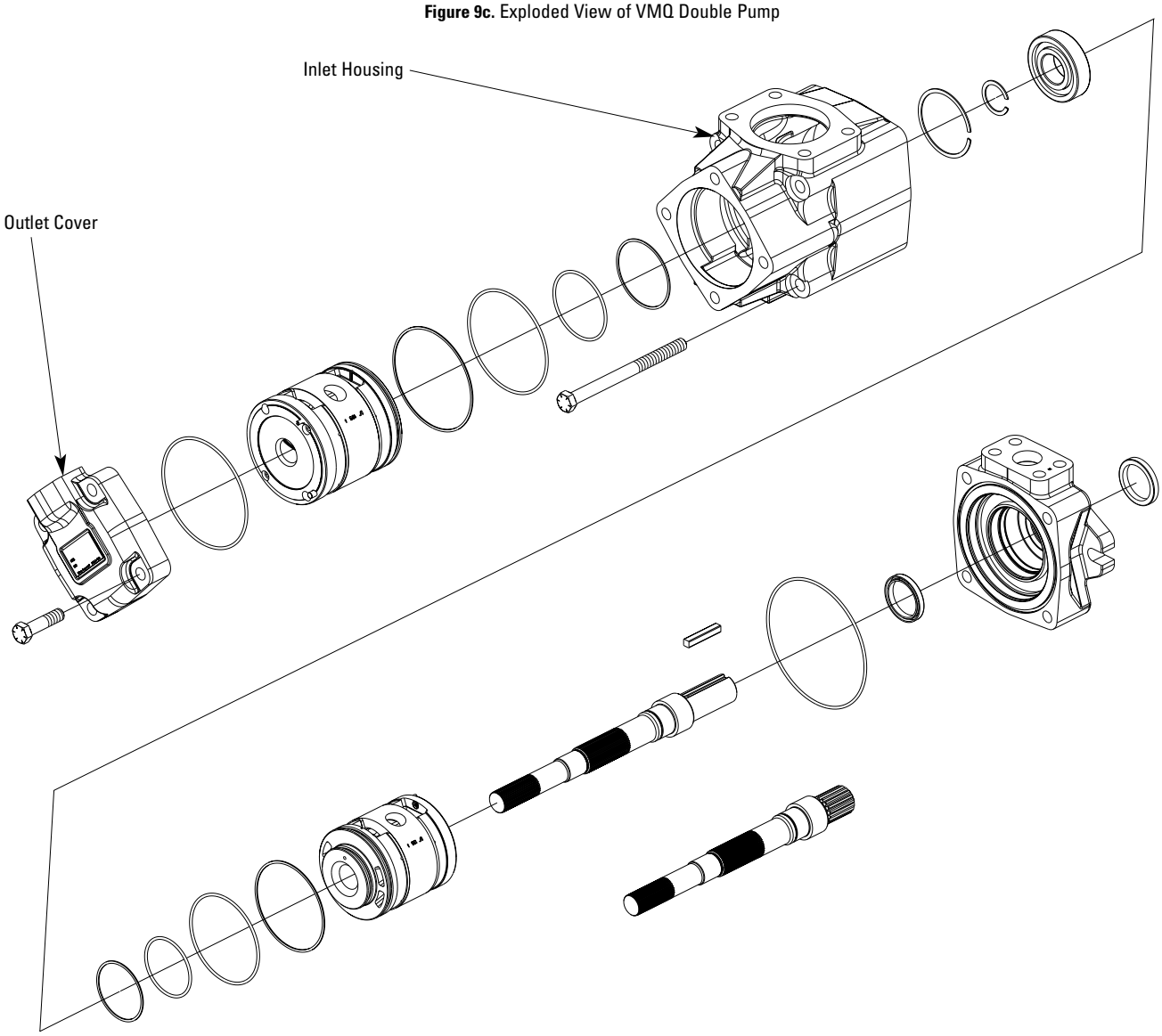


Table 7 - Double and Triple Pump Housing Torque Specs

	INLET HOUSING				OUTLET COVER				OUTLET SECTION			
	ISO (NM)		SAE (ft•lb)		ISO (NM)		SAE (ft•lb)		ISO (NM)		SAE (ft•lb)	
	Dry	Oiled	Dry	Oiled	Dry	Oiled	Dry	Oiled	Dry	Oiled	Dry	Oiled
VMQ22525	153+/-16	115+/-12	113+/-11	85+/-9	—	—	—	—	—	—	—	—
VMQ23525	305+/-31	229+/-23	225+/-23	169+/-17	153+/-16	115+/-12	113+/-11	85+/-9	—	—	—	—
VMQ24525	305+/-31	229+/-23	225+/-23	169+/-17	153+/-16	115+/-12	113+/-11	85+/-9	—	—	—	—
VMQ24535	305+/-31	229+/-23	225+/-23	169+/-17	305+/-3	229+/-23	225+/-23	169+/-17	—	—	—	—
VMQ3352525	305+/-31	229+/-23	225+/-23	169+/-17	153+/-16	115+/-12	113+/-11	85+/-9	305+/-31	229+/-23	225+/-23	169+/-17
VMQ3453525	305+/-31	229+/-23	225+/-23	169+/-17	153+/-16	115+/-12	113+/-11	85+/-9	305+/-31	229+/-23	225+/-23	169+/-17

Figure 9d. Exploded View of VMQ Triple Pump

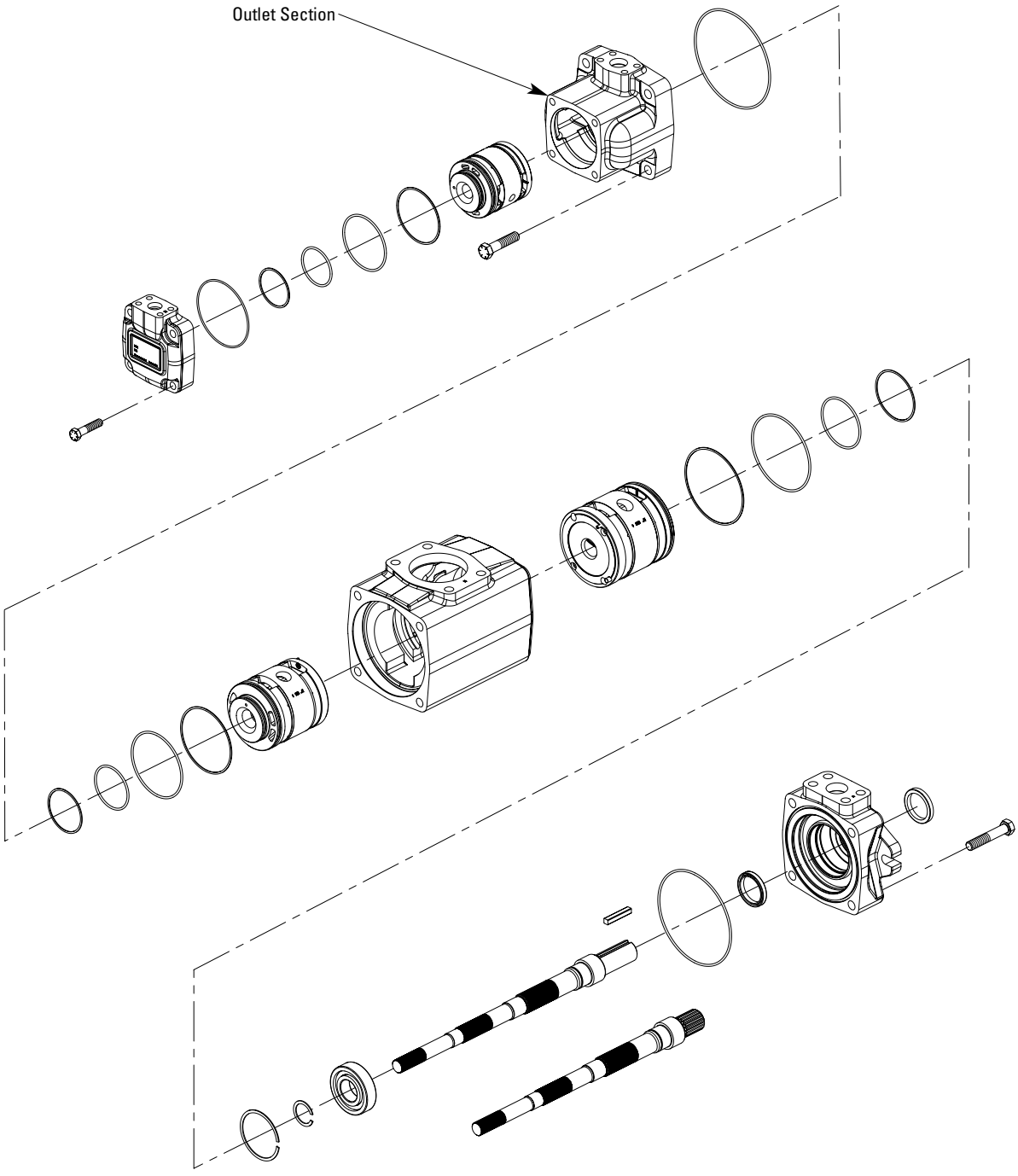


Table 7 - Double and Triple Pump Housing Torque Specs

	INLET HOUSING				OUTLET COVER				OUTLET SECTION			
	ISO (NM)		SAE (ft•lb)		ISO (NM)		SAE (ft•lb)		ISO (NM)		SAE (ft•lb)	
	Dry	Oiled	Dry	Oiled	Dry	Oiled	Dry	Oiled	Dry	Oiled	Dry	Oiled
VMQ22525	153+/-16	115+/-12	113+/-11	85+/-9	—	—	—	—	—	—	—	—
VMQ23525	305+/-31	229+/-23	225+/-23	169+/-17	153+/-16	115+/-12	113+/-11	85+/-9	—	—	—	—
VMQ24525	305+/-31	229+/-23	225+/-23	169+/-17	153+/-16	115+/-12	113+/-11	85+/-9	—	—	—	—
VMQ24535	305+/-31	229+/-23	225+/-23	169+/-17	305+/-3	229+/-23	225+/-23	169+/-17	—	—	—	—
VMQ3352525	305+/-31	229+/-23	225+/-23	169+/-17	153+/-16	115+/-12	113+/-11	85+/-9	305+/-31	229+/-23	225+/-23	169+/-17
VMQ3453525	305+/-31	229+/-23	225+/-23	169+/-17	153+/-16	115+/-12	113+/-11	85+/-9	305+/-31	229+/-23	225+/-23	169+/-17

Section VI — Overhaul

NOTE
Complete cartridges are available in service kits for rebuilding these pumps. Refer to the Series 30 VMQ Parts catalog for part numbers.

WARNING

Before breaking a circuit connection, make certain that power is off and system pressure has been released. Lower all vertical cylinders, discharge accumulators and block any load whose movement could generate pressure. Plug all removed units and cap all lines to prevent the entry of dirt into the system.

A. General

During disassembly, pay particular attention to identification of the parts, especially the cartridges, for correct assembly. Figure 9 is an exploded view which shows the proper relationship of parts for disassembly and assembly. Refer to Figure 9 for the correct assembled relationship of the parts. Various steps in the overhaul process are shown in Figures 10 through 17.

B. Disassembly

Basic Pump. Remove the foot mounting and shaft key if used. Support the pump on blocks or clamp the body in a vise as shown in Figure 10. If a vise is used, use protective jaws to avoid damage to the body and its machined surfaces. Mark the pump body and cover for correct reassembly. Remove the necessary screws to disassemble the housing.

Remove all Housing O-Rings. Pull and/or pry out the cartridge(s) as shown in Figure 11.

Remove the large spirolox ring and pull the shaft and bearing from the body. Drive the shaft seals out of the body. If it is necessary to remove the shaft bearing, first remove the small snap ring and then press the shaft out of the bearing while supporting the bearing inner race.

C. Drive Reversal

The rotation of Eaton cartridge kits can easily be changed from clockwise to counterclockwise, or vice versa, by following the steps outlined below:

NOTE: A double or triple VMQ pump will contain cartridge kits that mirror one another. The rotation direction of each kit is specific to the pump configuration. See Table 8 for application details.

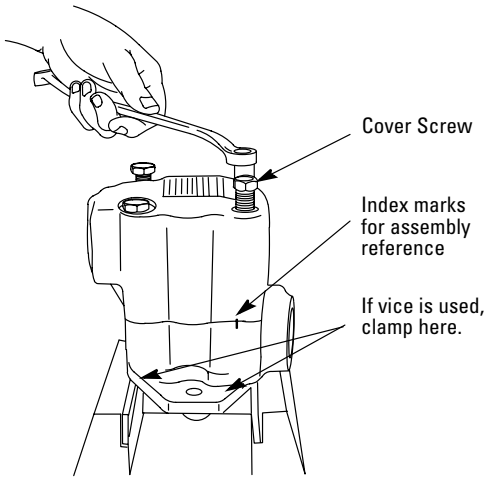


Figure 10. Beginning disassembly

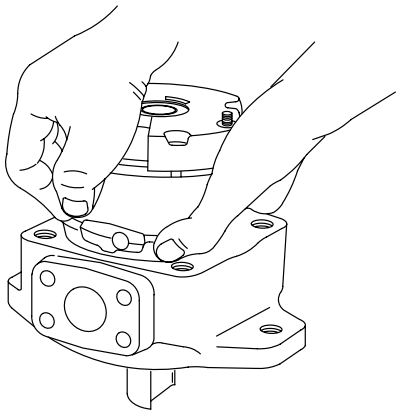


Figure 11. Cartridge removal

Figure 12

C. Drive Reversal (cont.)

TABLE 8. CARTRIDGE KIT BUSHING LOCATIONS AND KIT ROTATION SETUP

(location of bushing in cartridge kit, assuming a right hand rotation shaft)

R = right hand rotation kit L = left hand rotation kit

Pump	Shaft End Kit	Center Kit	Cover End Kit
25, 35, 45 Single & Thru-Drive (R)	Inlet Plate (R)	—	—
2525 Double (R)	No Bushing (R)	—	Outlet plate (L)
3525 Double (R)	Inlet Plate (R)	—	No Bushing (L)
4525 Double (R)	Inlet Plate (R)	—	No Bushing (L)
4535 Double (R)	Inlet Plate (R)	—	No Bushing (L)
352525 Triple (R)	Inlet Plate (R)	No Bushing (L)	Outlet Plate (L)
453525 Triple (R)	Inlet Plate (R)	Outlet Plate (L)	No Bushing (L)

***Note:** The opposite rotating kits would be used in a (L) pump.

See figures 12 - 20 for a pictorial explanation.

1. Once the cartridge kit has been removed from the housing, place the kit on a clean flat bench, outlet support plate down. (Figure 12)

2. Remove the two socket head cap screws holding the kit together. Note the location of the two screws in the inlet plate. When the kit is reassembled in the opposite direction, these screws will be installed in the opposite set of inlet plate holes. (Figure 13)

3. Slide the inlet support plate off of the inlet wafer plate. (Figure 14)

4. Remove the inlet wafer plate, cam ring, rotor, vanes, and outlet wafer plate as one unit from the outlet support plate. (Figure 15)

5. Rotate this group of components 180 degrees and place it back on the outlet support plate. The etched arrow in the ring should be pointing the opposite direction as before. Do not attempt to remove the vanes. They should be contained between the wafer plates as the 180° rotation is performed. (Figure 16)

6. Align the inlet windows of the wafer plates to the inlet windows of the outlet support plate.Place the inlet support plate back on the rotating group, aligning its inlet windows with the rest of the kit. Reinstall and finger tighten the socket head cap screws in the opposite set of holes as before. In order for the kit to fit back in the housing, it must first be aligned. This can be done by placing the kit on its side and rolling it on a hard, flat, clean bench. While the kit is on its side, tighten the SCHS snug. Finally, place the kit upright and tighten the screws to the torque specs below (Figures 17-20):

25 VMQ → 20 in.lb. (2.28 Nm)

35 VMQ → 20 in.lb. (2.28 Nm)

45 VMQ → 40 in.lb. (4.55 Nm)

D. Inspection and Repair

All parts must be thoroughly clean and kept clean during inspection and assembly.

1. Remove the shaft seal(s), O-rings, back-up rings and seal pack subassemblies. Use a new seal kit for reassembly. Refer to the VMQ parts catalog for kit numbers.

2. If the pump has demonstrated poor performance or loud noise, the cartridge kit must be replaced. These problems were a result of a poor system condition. Check inlet conditions, fluid cleanliness, and other system components that may be faulty before installation of a new cartridge kit.

NOTE:
Pre-assembled replacement cartridge kits are available. If the old cartridge is worn extensively, a new kit should be used.

3. Rotate the bearing while applying pressure to check for wear, looseness and pitted or cracked races.

4. Inspect seal and bushing mating surfaces on shaft for scoring or wear. Replace the shaft if marks cannot be removed by light polishing.

Figure 13

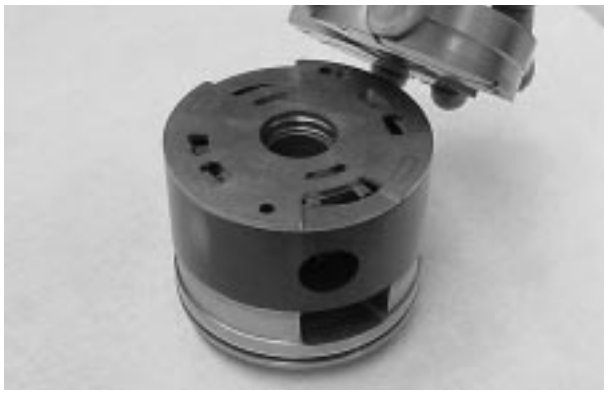


Figure 14

Figure 15

Figure 16

E. Assembly

Basic pump: Clamp the body in a vise or place on 2 x 4 wood blocks to facilitate assembly. See figures 10 and 11.

1. Lubricate primary shaft seal with petroleum jelly and place in position within the body, garter spring up. See Figure 6 for seal arrangements.

2. Press the seal into the body until it bottoms out.

NOTE:
Two shaft seal arrangements are available in the VMQ pump series. See Figure 6 and Table 1 – 3. If the pump model code (Table 1–3) indicates that a secondary seal is required, perform the following step.

3. Lubricate secondary seal with petroleum jelly and place the seal in position opposite of the seal previously installed in the body (Figure 6). Use a small hardwood block to drive the seal into the body. Installation is complete when the seal face is flush with the front of the body. *Do not* drive the seal past flush as it can block the body drain opening.

NOTE:
If shaft bearing was defective, install a new bearing as follows:

4. Press shaft into the new bearing with an arbor press while supporting the bearing inner race. Install a small snap ring behind the bearing.

5. Use a "bullet" or plastic tape over the end to prevent damage to the seal(s). Lubricate the "bullet" with petroleum jelly and carefully push the shaft through the seal(s) until the bearing is within the body. Install the large spiralox ring into the body snap ring groove behind the bearing.

6. Install the O-rings and back-up ring on the cartridge outlet support plate hub.

7. Check the rotor for bind by inserting your index finger through the shaft opening of inlet support plate. Hold the cartridge kit in a horizontal shaft position and lift the rotor with your finger. The rotor should move freely back and forth within the cartridge. If the rotor binds, open the kit, clean and stone all possible areas of bind, then reassemble using the aforementioned procedure. The rotor *must* move freely within the cartridge when assembled.

8. Carefully install the cartridge into the body so the torque pin in the cartridge kit lines up with the hole in the cover housing. The kit should always be oriented so the inlet windows of the kit line up with the inlet port of the housing.

NOTE:
VMQ Cartridge kits are manufactured with shaft bushings located in the inlet plate or outlet plate depending on the configuration of the pump. See Table 8 for application details.

9. Lubricate and install the housing O-rings.

10. Install the cover housing in position; move back and forth until the cartridge pin drops into the cover hole.

11. Oil and install the housing bolts. Torque to the value noted in Figure 9.

12. Turn the pump shaft by hand to verify freedom of the cartridge.

Figure 17

Figure 18

Figure 19

Figure 20

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