# Medium Duty Closed Circuit Piston Motors

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General Overview

Introduction

Eaton Medium Duty Piston Motors convert hydraulic energy supplied by the pump to mechanical energy. These motors are uniquely suited to fit any application that requires continuous rotary motion at a remote location from the power source. Axial piston motors share the design advantages of piston pumps to provide long-lasting power in a lightweight, easily serviceable package.

The table below provides an overview of features. For a complete list of options, refer to the Model Code section of a given motor displacement.

Typical Applications

Agriculture Equipment
• Harvesters
• Sprayers
• Feed Mixers

Forestry Equipment
• Log Skidders
• Bark Removers
• Limb Removers

Construction Equipment
• Mini Backhoe
• Asphalt Paver
• Fan Drives
• Sweepers

Turf Care Equipment
• Mowers
• Lawn Tractors

Industrial Equipment
• Lift Trucks
• Scissor Lifts
• Telescopic lifts

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<th>MOUNT 2 BOLT</th>
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<th>SHAFT KEYED</th>
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<td>741XX Models SAE “A”</td>
<td>74111</td>
<td>12.3 cm³/r [0.75 in³/r]</td>
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<td>74115</td>
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<tr>
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<td>74119</td>
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<td>746XX Models “B-B”</td>
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<td>Variable Motor SAE “B”</td>
<td>71392</td>
<td>40.6 to 21.0 cm³/r [2.48 to 1.28 in³/r]</td>
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<td>Servo Control 72450</td>
<td>72450</td>
<td>40.6 to 21.0 cm³/r [2.48 to 1.28 in³/r]</td>
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<td>SAE “B”</td>
<td>49.2 to 24.6 cm³/r [3.0 to 1.5 in³/r]</td>
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Fixed Displacement Motors

Features & Benefits

- Compact - Ease of Installation
- Efficient axial piston design
- Numerous Options - Shafts, Ports, Shuttle Valves, Speed Pickup
- Wide Displacement range: 9.8 cc (0.60 cid) to 82.6 cc (5.04 cid)
- Optional shuttle, back pressure valve - improved loop cooling, flushing
- Optional Speed Sensor Available (9 pulse/rev.) - 50 RPM min
- Good in reliability & performance
- Worldwide sales & services

2 Bolt SAE “A” Mount - 741XX Series

9.8 cm³/r [0.60 in³/r] Displacement
20.3 cm³/r [1.24 in³/r] Displacement

2 Bolt SAE “B” Mount - 743XX Series

32.9 cm³/r [2.01 in³/r] Displacement
40.6 cm³/r [2.48 in³/r] Displacement
49.2 cm³/r [3.00 in³/r] Displacement

2 Bolt SAE “B-B” Mount - 746XX Series

82.6 cm³/r [5.04 in³/r] Displacement
Model 741XX Fixed Displacement Motor

2 Bolt SAE A Mount
9.8 cm³/r [0.60 in³/r] Displacement
20.3 cm³/r [1.24 in³/r] Displacement

Identification numbers – Fixed Displacement Motor - Closed Circuit
Stamped on each unit.

7 4 1 X X - D A A - 01
A B C D

A – Product Number Description
74111 = 12.3 cm³/r [0.75 in³/r]
74115 = 16.6 cm³/r [1.01 in³/r]
74118 = 20.3 cm³/r [1.24 in³/r]
74119 = 9.8 cm³/r [0.60 in³/r]
74148 = 20.3 cm³/r [1.24 in³/r] with Thru Shaft Back-plate
74149 = 12.3 cm³/r [0.75 in³/r] with Thru Shaft Back-plate

B – Rotation
D = Dual

C – Sequential Letter

D – Design Code number

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<td>12.3 cm³/r [0.75 in³/r]</td>
<td>20.3 cm³/r [1.24 in³/r]</td>
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<td>Maximum Rated Speed</td>
<td>4500 RPM</td>
<td>3600 RPM</td>
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<td>Nominal Pressure Rating †</td>
<td>350 bar [5076 lbf/in²]</td>
<td>350 bar [5076 lbf/in²]</td>
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<tr>
<td>Peak Pressure Rating ††</td>
<td>370 bar [5400 lbf/in²]</td>
<td>370 bar [5400 lbf/in²]</td>
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<td>Input Flow at Rated Speed and Pressure</td>
<td>66.37 l/min [14.6 GPM]</td>
<td>87.74 l/min [19.3 GPM]</td>
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<td>Output Power at Rated Speed and Pressure</td>
<td>32.30 kW [43.28 hp]</td>
<td>42.65 kW [57.25 hp]</td>
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<td>Output Torque at Rated Speed and Temperature</td>
<td>68.55 N•m [606.21 lbf•in]</td>
<td>113.14 N•m [1002.27 lbf•in]</td>
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<td>Continuous Allowable Case Pressure</td>
<td>1.7 bar [25 lbf/in²]</td>
<td>1.7 bar [25 lbf/in²]</td>
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<td>Continuous Inlet Temperature</td>
<td>107° C [225° F]</td>
<td>107° C [225° F]</td>
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<td>Weight/Single Motor (approximate)</td>
<td>4.9 kg [11 lbs]</td>
<td>4.9 kg [11 lbs]</td>
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† Nominal Pressure: Max. delta system pressure at which component fatigue does not occur (motor life estimated by bearing life).
†† Peak Pressure: Max. operation pressure which is permissible for a short duration of time [t < 1 sec].
Model 741XX Fixed Displacement Motor

Compact axial piston design with de-stroked 9.8, 12.3, 14.96, 16.6 & 20.3 cm³/r displacement options. Uses lightweight aluminum housing & end cover with same side & opposite side porting options. Numerous output shafts with through drive capabilities for brake mounting.

End cover houses main ports and gauge ports. Improved thrust load capacities.*

Attached cross section view shows major components of the motor.

*Contact Eaton representative.
Model 741XX Fixed Displacement Motor

Model Code

12.3 cm³/r [0.75 in³/r] Displacement
20.3 cm³/r [1.24 in³/r] Displacement

Fixed displacement piston motors are specified by the following model code. Once a motor is built from the model code, a product number will be assigned to that configuration. Make sure all positions are selected within the 15 digit code for each motor.

### Model Code

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### Code Title

1. **AAV** - 20.3 cm³/r [1.24 in³/r] Fixed displacement piston motor frame size

### Output Shaft

1. **AA** - 13 Tooth 16/32 spline with snap ring groove, min. full spline 22.1 [0.87], shaft extension 41.1 [1.62], (std.)
2. **AE** - Straight shaft, dia. 22.2 [0.875], keyway 6.35 [0.25] x 25.4 [1.00], shaft extension 41.1 [1.62] (key included), (std.)
3. **AH** - Diameter 22.3 [0.88] taper .125:1, keyway 6.35 X 25.4 [0.25 X 1.00], .625-18 UNF-2A, shaft extension 66.5 [2.62] (key included)

### Main Port, Size, & Location

1. **A** - 1-1/16-12 UNF-2B straight thread O-ring ports opposite sides, (std.)
2. **B** - 1-1/16-12 UNF-2B straight thread O-ring ports- rear, (std.)
3. **C** - 1-1/16-12 UNF-2B straight thread O-ring ports- same side, only with through shaft, (opt.)
4. **D** - .875-14 UNF-2B SAE O-ring ports opposite sides

### Drain Port, Size, & Location

1. **A** - 9/16-18 UNF-2B straight thread O-ring port - upper rear, (std.)
2. **B** - 9/16-18 UNF-2B straight thread O-ring port - lower rear, (std.)
3. **C** - 9/16-18 UNF-2B straight thread O-ring port - bottom rear, with through shaft only (pos. 8, selection 1), (std.)

### Auxiliary Mounting Features (rear)

1. **0** - No Auxiliary Mounting Feature
2. **1** - Straight through shaft, dia. 19 [.75], with keyway 4.8 x 31 [.189 x 1.22], 209. 3 [8.42] from mounting flange (Key included), 5/16 - 18 UNC-2B mounting holes 14. 2 [.56] deep min. full thread, (opt.)

### Displacement Options

1. **0** - As given in code title. - Model 74118 or 74148, (std.)
2. **A** - 16.6 cm³/r [1.01 in³/r] destroked from 20.3 cm³/r [1.24 in³/r], (opt.)
3. **B** - 12.3 cm³/r [0.75 in³/r] destroked from 20.3 cm³/r [1.24 in³/r] - Model 74111 or 74149, (std.)
4. **C** - 9.8 m³/r [.60 in³/r] destroked from 20.3 cm³/r [1.24 in³/r], (opt.)
5. **D** - 14.96 m³/r [.91 in³/r] destroked from 20.3 cm³/r [1.24 in³/r], (opt.)

### Special Features

1. **00** - No Special Features, (std.)
2. **AF** - Reduced drive shaft end play, Internal case drain with check, 2 degree valving, and no drive shaft key
3. **AK** - Rotating group and bearing for high speed application
4. **AR** - 5000 rpm speed rating and components (for 20.3 cc)

### Paint

1. **0A** - Primer, (std.)
2. **0B** - Black Paint, (std.)

### Identification

1. **0** - Standard, (std.)

### Design Code

1. **B** - Valve Plate
Model 74111 & 74118 Fixed Displacement Motor
Output Shafts and Installation Drawings

Output Shaft
Used For All 741XX Models
(Code Position 4, 5)

Splined Shaft
Selection AA
Maximum Torque on Shaft
209.3 N-m [1,852 lbf-in]

Keyed Shaft
Selection AE
Maximum Torque on Shaft
209.3 N-m [1,852 lbf-in]

Keyed Shaft
Selection AH
Maximum Torque on Shaft
209.3 N-m [1,852 lbf-in]

Installation Drawing
Opposite Side Porting
(Code position 6, Selection A)

Note: All ports are SAE (J1926) O-ring ports. Dimensions are in millimeters [inches], unless otherwise specified.
Model 74148 & 74149 Fixed Displacement Motor
Installation Drawings

Rear Porting
(Code position 6, Selection B)

Through Shaft and Same side porting
(Code position 6, Selection C)

Note: All ports are SAE (J1926) O-ring ports. Dimensions are in millimeters [inches], unless otherwise specified.
Model 743XX Fixed Displacement Motor

2 Bolt SAE B Mount
24.6 cm³/r [1.50 in³/r] Displacement
40.6 cm³/r [2.48 in³/r] Displacement
49.2 cm³/r [3.00 in³/r] Displacement

Identification numbers – Fixed Displacement Motor - Closed Circuit
Stamped on each unit.
A – Product Number Description
74315 = 32.9 cm³/r [2.01 in³/r]
74318 = 40.6 cm³/r [2.48 in³/r]
74328 = 49.2 cm³/r [3.00 in³/r]
74348 = 40.6 cm³/r [2.48 in³/r] with thru shaft backplate
B – Rotation
D = Dual
C – Sequential Letter

TYPICAL PRODUCT NUMBER MODEL CODE

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<th>MODEL CODE</th>
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SPECIFICATIONS

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<th>MODEL 74318/74348</th>
<th>MODEL 74328</th>
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<td>40.6 cm³/r</td>
<td>49.2 cm³/r</td>
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<td>Maximum Rated Speed</td>
<td>3600 RPM</td>
<td>3600 RPM</td>
<td>3000 RPM</td>
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<tr>
<td>Nominal Pressure Rating†</td>
<td>350 bar [5000 lbf/in²]</td>
<td>350 bar [5000 lbf/in²]</td>
<td>315 bar [4570 lbf/in²]</td>
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<td>Peak Pressure Rating ††</td>
<td>370 bar [5400 lbf/in²]</td>
<td>370 bar [5400 lbf/in²]</td>
<td>345 bar [5000 lbf/in²]</td>
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<td>Input Flow at Rated Speed and Pressure</td>
<td>142.43 l/min [31.33 GPM]</td>
<td>175.71 l/min [38.65 GPM]</td>
<td>177.12 l/min [38.96 GPM]</td>
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<td>Output Power at Rated Speed and Pressure</td>
<td>69.13 kW [92.80 hp]</td>
<td>85.30 kW [114.50 hp]</td>
<td>77.53 kW [104.61 hp]</td>
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<td>Output Torque at Rated Speed and Pressure</td>
<td>183.36 N·m [1624.64 lbf·in]</td>
<td>226.27 N·m [2004.54 lbf·in]</td>
<td>246.78 N·m [2197.68 lbf·in]</td>
</tr>
<tr>
<td>Continuous Allowable Case Pressure</td>
<td>1.7 bar [25 lbf/in²]</td>
<td>1.7 bar [25 lbf/in²]</td>
<td>1.7 bar [25 lbf/in²]</td>
</tr>
<tr>
<td>Continuous Inlet Temperature</td>
<td>107° C [225° F]</td>
<td>107° C [225° F]</td>
<td>107° C [225° F]</td>
</tr>
<tr>
<td>Weight/Single Motor (approximate)</td>
<td>9.1 kg [20 lbs]</td>
<td>9.1 kg [20 lbs]</td>
<td>9.1 kg [20 lbs]</td>
</tr>
</tbody>
</table>

† Nominal Pressure: Max delta system pressure at which component fatigue does not occur (motor life estimated by bearing life).
†† Peak Pressure: Max operation pressure which is permissible for a short duration of time (t < 1 sec).
Model 74315 Fixed Displacement Motor

Compact axial piston design with de-stroked 24.6, 29.5, 32.9, 40.6 and 49.3 cm³/r displacement options. Uses lightweight aluminum housing with speed sensor mounting option. End cover with same side, rear side & opposite side working ports. Numerous output shafts with through drive capabilities for brake mounting. End cover houses main ports, gauge ports, shuttle valve back pressure relief valve. Improved thrust load capacities.*

Attached cross section view shows major components of the motor.
*Contact Eaton representative.
Model 743XX Fixed Displacement Motor

Model Code

2 Bolt SAE B Mount
32.9 cm³/r [2.01 in³/r] Displacement
40.6 cm³/r [2.48 in³/r] Displacement
49.2 cm³/r [3.00 in³/r] Displacement

Fixed displacement piston motors are specified by the following model code. Once a motor is built from the model code, a product number will be assigned to that configuration.

**A** - 1-1/16-12 UN-2B straight thread O-ring ports- same side, Top, (opt.)  
**B** - 1-5/16-12 UN-2B straight thread O-ring ports- rear, (opt.)  
**C** - 1-5/16-12 UN-2B straight thread O-ring ports- rear, (opt.)  

**D** - 1-5/16-12 UN-2B straight thread O-ring ports- same side, Top, (opt.)  

**E** - 1-1/16-12 UN-2B straight thread O-ring ports- rear, (opt.)  

**J** - 1-1/16-12 UN-2B straight thread O-ring ports- same side, Top, (opt.)  

**M** - M33 X 2 Metric O-ring ports - Top

**F** - Straight shaft, dia. 22.23 [.875], keyway 6.4 X 55.6 [.25 X 2.19], shaft extension 71.4 [2.81] (Key included)

**G** - 3/4-16 UNF-2B straight thread O-ring port - upper rear of Backplate, (opt.)

**H** - 9/16-18 UNF-2B straight thread O-ring port-upper rear of Backplate, (opt.)

**C** - 32.9 cm³/r [2.01 in³/r] destroked from 40.6 cm³/r [2.48], (opt.)

**J** - 9/16-18 UNF-2B straight thread O-ring port-upper rear of Backplate, (opt.)

**M** - M33 X 2 Metric O-ring ports - Top

**F** - Straight shaft, dia. 22.23 [.875], keyway 6.4 X 55.6 [.25 X 2.19], shaft extension 71.4 [2.81] (Key included)

**K** - Cast iron housing, shuttle valve and orificed back pressure valve set at 14.8-16.2 bar [215-235 lbf/in²], 1.0-1.5 gal/min flow to case, and 2X M12 X 1.5 metric O-ring diagnostic ports (position 9 should have “0")

**L** - Speed sensor magnetic pickup (9 Pulse), 3 pin weather pack connector with 127 [5.0] lead wire

**P** - Speed sensor magnetic pickup (9 Pulse), 3 pin metric-pack connector with 127 [5.0] lead wire

**Q** - 6.20 bar [90.0 lbf/in²] Static seal with adaptor and unidirectional RH (CW) rotation with anti-cavitation check valve

**R** - 6.20 bar [90.0 lbf/in²] Static seal with adaptor and unidirectional LH (CCW) rotation with anti-cavitation check valve

**S** - 6.20 bar [90.0 lbf/in²] Static seal with adaptor and unidirectional LH (CCW) rotation with anti-cavitation check valve
Model 74315, 74318 and 74328 Fixed Displacement Motor
Output Shafts

Used for all 743XX Models
(Code position 4, 5)

**Spline Shaft Selection AA**
Maximum Torque on Shaft
209.3 N•m [1,852 lbf•in]

**Spline Shaft Selection AB**
Maximum Torque on Shaft
337.5 N•m [2,987 lbf•in]

**Straight Shaft Selection AD**
Maximum Torque on Shaft
337.5 N•m [2,987 lbf•in]

**Spline Shaft Selection BF**
Maximum Torque on Shaft
209.3 N•m [1,852 lbf•in]

**Note:** Dimensions are in millimeters [inches], unless otherwise specified.
Model 74315, 74318 and 74328
Fixed Displacement Motor

Installation Drawings

Opposite Side Porting
(Code position 6, selection A or B)

Rear Porting
(Code position 6, selection C)

Same Side Porting
(Code position 6, selection D)

Directional arrow, stamped on side of case next to work port, shows motor rotation relationship to work port when port is pressurized.

Directional arrow, stamped on side of case next to work port, shows motor rotation relationship to work port when port is pressurized.

Directional arrow, stamped on side of case next to work port, shows motor rotation relationship to work port when port is pressurized.

<table>
<thead>
<tr>
<th>TYPE OF PORT</th>
<th>SIZE AND DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Port</td>
<td>1- 1/16 - 12 UN-2B SAE O-ring</td>
</tr>
<tr>
<td></td>
<td>1- 5/16 - 12 UN-2B SAE O-ring</td>
</tr>
<tr>
<td></td>
<td>M33 X 2 Metric O-ring</td>
</tr>
<tr>
<td></td>
<td>G1 BSPP Straight thread</td>
</tr>
<tr>
<td>Drain Port</td>
<td>3/4 - 16 UN-2B SAE O-ring</td>
</tr>
<tr>
<td></td>
<td>7/8-14 UNF-2B SAE O-ring</td>
</tr>
<tr>
<td></td>
<td>9/16 -18 UNF-2B SAE O-ring</td>
</tr>
<tr>
<td></td>
<td>M18 X 1.5 Metric O-ring port</td>
</tr>
<tr>
<td></td>
<td>G 38 BSPP Straight Thread</td>
</tr>
</tbody>
</table>

Note: All ports are SAE (J1926) O-ring ports. Dimensions are in millimeters [inches], unless otherwise specified.
Model 74348 Fixed Displacement Motor
Installation Drawings

Same Side Porting with Through shaft for brake mounting
(Code position 6, selection D)
(Code position 8, selection 3)

<table>
<thead>
<tr>
<th>TYPE OF PORT</th>
<th>SIZE AND DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Port</td>
<td>1-1/16 - 12 UN-2B SAE O-ring</td>
</tr>
<tr>
<td></td>
<td>1-5/16 - 12 UN-2B SAE O-ring</td>
</tr>
<tr>
<td>Drain Port</td>
<td>3/4 - 16 UNF-2B SAE O-ring</td>
</tr>
<tr>
<td></td>
<td>7/8-14 UNF-2B SAE O-ring</td>
</tr>
<tr>
<td></td>
<td>9/16 - 18 UNF-2B SAE O-ring</td>
</tr>
<tr>
<td></td>
<td>M18 X 1.5 Metric O-ring</td>
</tr>
<tr>
<td></td>
<td>G 3/8 BSPP straight Thread</td>
</tr>
</tbody>
</table>

743XX Motor
Anti-Cavitation Check Valve
Position 10, 11

Anti-Cavitation check valve is used for application such as Fan drive control. When there is a need to reduce the motor speed during operation, the pump flow to motor is reduced, but due to the inertia of the load (Fan), the motor still runs at certain high speed. It is for a very short period of time.

This causes motor to suck more oil from pump port and may lead to cavitation in pump high pressure line.

To avoid this, oil from the low pressure side of the motor is circulated to the its high pressure side. A check valve is installed to connect the two motor ports.

Note: All ports are SAE (J1926) O-ring ports. Dimensions are in millimeters [inches], unless otherwise specified.
### Model 74315, 74318 and 74328 Fixed Displacement Motor

#### Installation Drawings

**Same Side Porting with Shuttle Valve and Charge Pressure Relief Valve**  
(Code position 10, 11 selection AD or AM)

<table>
<thead>
<tr>
<th>TYPE OF PORT</th>
<th>SIZE AND DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Port</td>
<td>1-1/16 - 12 UN-2B SAE O-ring</td>
</tr>
<tr>
<td></td>
<td>1-5/16 - 12 UN-2B SAE O-ring</td>
</tr>
<tr>
<td></td>
<td>M33 X 2 Metric O-ring</td>
</tr>
<tr>
<td>Drain Port</td>
<td>3/4 - 16 UNF-2B SAE O-ring</td>
</tr>
<tr>
<td></td>
<td>7/8-14 UNF-2B SAE O-ring</td>
</tr>
<tr>
<td></td>
<td>9/16 - 18 UNF-2B SAE O-ring</td>
</tr>
<tr>
<td></td>
<td>M18 X 1.5 Metric O-ring port</td>
</tr>
</tbody>
</table>

Directional arrow, stamped on side of case next to work port, shows motor rotation relationship to work port when port is pressurized.

For Shaft Configuration, see separate shaft installation drawings

Mounting hole for 14.53 (.572) Dia. Bolts (2)

---

**TYPE OF PORT** | **SIZE AND DESCRIPTION**
---|---
Work Port | 1-1/16 - 12 UN-2B SAE O-ring
 | 1-5/16 - 12 UN-2B SAE O-ring
 | M33 X 2 Metric O-ring
Drain Port | 3/4 - 16 UNF-2B SAE O-ring
 | 7/8-14 UNF-2B SAE O-ring
 | 9/16 - 18 UNF-2B SAE O-ring
 | M18 X 1.5 Metric O-ring port
**Shuttle Valve and Charge Pressure Relief Valve:**

The shuttle and charge pressure valve work together to bypass closed loop oil. This allows the oil to be cooled, filtered, and returned to tank.

The circuit shows the shuttle valve and the charge pressure relief valve. Stroking the variable displacement pump creates system pressure on one side of the closed loop. This system pressure shifts the shuttle valve, opening the low pressure side of the loop to the second charge pressure relief valve. The charge pressure relief valve located in the charge pump will now close as it has a higher valve setting. This closed valve will now cause total charge pump flow to enter the low pressure side through the lower check valve. The charge pump flow first replenishes the lubrication fluid lost from the closed loop. The remaining charge flow will then displace an equivalent volume of hotter fluid in the low pressure side. This displaced fluid passes through the shuttle valve and second charge pressure relief valve directly into the motor case, pump case, heat exchanger and back into the reservoir. By continuously replacing the hotter loop fluid with the cool fluid, the closed loop temperature is stabilized.

The shuttle valve flow is listed below in relationship to the charge pressure valve setting.

<table>
<thead>
<tr>
<th>CHARGE PRESSURE</th>
<th>FLOW</th>
<th>CODE SELECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 to 12 bar</td>
<td>5.68 to 9.46 l/m</td>
<td>AM</td>
</tr>
<tr>
<td>[145 to 175 lbf/in2]</td>
<td>[1.5 to 2.5 gal/min]</td>
<td></td>
</tr>
<tr>
<td>15 to 17 bar</td>
<td>9.46 to 13.25 l/m</td>
<td>AD</td>
</tr>
<tr>
<td>[220 to 250 lbf/in2]</td>
<td>[2.5 to 3.5 gal/min]</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** All ports are SAE (J1926) O-ring ports. Dimensions are in millimeters [inches], unless otherwise specified. For other charge pressure options please contact Eaton representative.
Fixed motors are available with a speed sensor for measurement of motor output speed. This sensor will operate with a supply voltage of 4.5 to 15 Vdc, and requires a current of 12 mA at 5.0 Vdc (minimum) under no load. Refer following table for specifications. The sensor is available with a Packard Electrical Weather-Pack series.

The Hall Effect speed sensor is compatible with the mobile vehicle electrical systems and gives a reliable digital on/off signal over a wide speed and temperature range.

The rugged design is fully protected against reverse polarity or short circuit hook up. A built-in pull up resistor simplifies installation with control systems.

The motor speed sensor is a factory installed option.

---

**SPECIFICATION**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage (Vs)</td>
<td>8 to 28 Volt DC</td>
</tr>
<tr>
<td>Supply Current (Is)</td>
<td>20 mA (including internal pull up resistor)</td>
</tr>
<tr>
<td>Switching Frequency</td>
<td>7 to 3K Hz</td>
</tr>
<tr>
<td>Output Voltage High</td>
<td>Supply Voltage minus 0.5 Volt DC min.</td>
</tr>
<tr>
<td></td>
<td>(Open Collector with 10k Ω pull up resistor)</td>
</tr>
<tr>
<td>Output Voltage Low</td>
<td>0.5 Volt DC Maximum at 10 mA</td>
</tr>
<tr>
<td>Min. Shaft Speed</td>
<td>50 RPM</td>
</tr>
<tr>
<td>Pulses per Revolution</td>
<td>9</td>
</tr>
</tbody>
</table>

**CONNECTOR REQUIREMENTS**

- Cable: 18 AWG irradiated PVC-single conductor wires standard OR equivalent wall (Refer SAE J-1128 Type GXL) 1 black, 1 red, 1 white.
- Packard Electric Weather Pack Series: Mating female connector assembly #12110293 and # 12048074 terminal (3X).

---

Eaton has developed a speed sensor, based on the field proven technology of our Hall Effect and Magnetic sensor.

Output – Digital signals from NPN transistors (open collector output with internal 10K pull up resistors).

This sensor has reverse polarity protection, short circuit protection, load dump protection, and EMC (Electrical Magnetic Capability) protection (the customer should qualify the EMC protection in their specific application)

Supply Voltage: 8 to 24 Volt DC (compatible with 12V vehicle conditions)
Model 746XX Fixed Displacement Motor

2 Bolt SAE B-B Mount
82.6 cm³/r [5.04 in³/r] Displacement

Identification numbers – Fixed Displacement Motor - Closed Circuit
Stamped on each unit.

A – Product Number Description
74624 = 82.6 cm³/r [5.04 in³/r] (W/Bearing Upgrade)
74644 = 82.6 cm³/r [5.04 in³/r] Through Shaft for Brake Mount (W/Bearing Upgrade)

B – Rotation
D = Dual

C – Sequential Letter

Single Motor - Product Number

7 4 6 2 4 - D A H

A B C

TYPICAL PRODUCT NUMBER MODEL CODE

<table>
<thead>
<tr>
<th>TYPICAL PRODUCT NUMBER</th>
<th>MODEL CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>74624-DAH</td>
<td>AAZAAAA0000A0B</td>
</tr>
<tr>
<td>74624-DAV</td>
<td>AAZAABB0000A0B</td>
</tr>
<tr>
<td>74644-DAJ</td>
<td>AAZABBA0000A0B</td>
</tr>
<tr>
<td>74644-DAB</td>
<td>AAZADA0000A0B</td>
</tr>
<tr>
<td>74644-DAJ</td>
<td>AAZABBA0000A0B</td>
</tr>
</tbody>
</table>

Serial Number Code

10 05 06 XXX 1 000

Specific Number of the Pump
Shift Number
Manufacturing Cell

Last Two Digits of Year Built. (10 for 2010 etc.)
Month Built (two digits)
Day Built (two digits)

SPECIFICATIONS

<table>
<thead>
<tr>
<th>SPECIFICATIONS</th>
<th>MODEL 74624/74644</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Displacement</td>
<td>82.6 cm³/r [5.04 in³/r]</td>
</tr>
<tr>
<td>Maximum Rated Speed</td>
<td>1500 RPM</td>
</tr>
<tr>
<td>Nominal Pressure Rating †</td>
<td>250 bar [3626 lbf/in²]</td>
</tr>
<tr>
<td>Peak Pressure Rating ††</td>
<td>265 bar [3900 lbf/in²]</td>
</tr>
<tr>
<td>Input Flow at Rated Speed and Pressure</td>
<td>150.0 l/min [33 GPM]</td>
</tr>
<tr>
<td>Output Power at Rated Speed and Pressure</td>
<td>52 kW [70 hp]</td>
</tr>
<tr>
<td>Output Torque at Rated Speed and Pressure</td>
<td>329 N•m [2910 lbf•in]</td>
</tr>
<tr>
<td>Continuous Allowable Case Pressure</td>
<td>7 bar [100 lbf/in²]</td>
</tr>
<tr>
<td>Continuous Inlet Temperature</td>
<td>107° C [225° F]</td>
</tr>
<tr>
<td>Weight/Single Motor (approximate)</td>
<td>10.9 kg [24 lbs]</td>
</tr>
</tbody>
</table>

† Nominal Pressure: Max delta system pressure at which component fatigue does not occur (motor life estimated by bearing life).
†† Peak Pressure: Max operation pressure which is permissible for a short duration of time (t < 1 sec).
Model 74624 Fixed Displacement Motor

The dual piston design with combination of solid and hollow pistons which gives displacement of 82.6 cm³/r, provides power dense package. Uses lightweight aluminum housing, end cover with rear & top side working ports. Numerous output shafts with through drive capabilities for brake mounting. End cover houses main ports, gauge ports. Attached cross section view shows major components of the motor.
Model 746XX Fixed Displacement Motor
82.6 cm³/r [5.04 in³/r] Displacement

High torque fixed displacement piston motors are specified by the following model code. Once a motor is built from the model code, a product number will be assigned to that configuration. Make sure all positions are selected within the 14 digit code for each motor.

Code Title
AAZ - 82.6 cm³/r [5.04 in³/r]
High Torque Fixed displacement piston motor frame size

Output Shaft
AA - Straight Shaft, dia. 25.4 [1.00], keyway 6.35 [250] X 38.1 [1.50], shaft extension 63.5 [2.50] (key included), (std.)
AD - 15 Tooth 16/32 spline with snap ring groove, shaft extension 46 [1.81], (std.)
AE - 13 Tooth 16/32 spline, shaft extension 41.1 [1.62], (std.)

Main Port, Size, & Location
A - 1-1/16-12 UN-2B straight thread O-ring ports- rear, std.)
B - 1-1/16 UN-2B straight thread O-ring ports same side, top, (opt.)

Drain Port, Size, & Location
A - 9/16-18 UNF-2B straight thread O-ring port - Horizontal top rear of unit, (std.)
B - 9/16-18 UNF-2B Straight thread O-ring port – Vertical top rear of unit, (opt.)
D - Through drain into mounting flange (Front)

Auxiliary Mounting Features (rear)
0 - No Auxiliary Mounting Feature - Model 74624, (std.)
A* - Straight through shaft, dia. 25.4 [1.00], with keyway 6.35 x 25.4 [.250 x 1.00], Shaft length from mounting flange 274.3 [10.80] (key included); 2 mounting holes 5/16- 18 UNC-2B Thd, 13.3 [.53] min. full thread (bottom rear of unit) - Model 74644, (opt.)
B - 15 Tooth 16/32 spline, with .375-16 UNC-2B thread, 18.3 [.72] min full thread, shaft length from mounting flange 274.3 [10.80]; 2 mounting holes .3125-18 UNC-2B thread, 13.3 [.53] min full thread (Bottom rear of unit)

Special Features
00 - No Special Features, (std.)

Paint
0A - Primer, (std.)
0B - Black Paint, (std.)

Identification
0 - Standard, (std.)

Design Code
B - Bearing Upgrade

Note: All ports are SAE (J1926) O-ring ports.
Model 74624 and 74644 Fixed Displacement Motor

Output Shaft Options
(Code Position 4,5)

Used for all 746XX models

**Straight Shaft**
(Code selection AA)
Maximum Torque on Shaft.
337.5 N•m [2,987 lbf•in]

**Spline Shaft**
(Code selection AD)
Maximum Torque on Shaft.
337.5 N•m [2,987 lbf•in]

**Spline Shaft**
(Code selection AE)
Maximum Torque on Shaft.
209.3 N•m [1,852 lbf•in]

15 Tooth, 16/32 DP, 30° involute flat root, class 1 side fit spline SAE J498b (effective 1972)
Model 74624 Fixed Displacement Motor
Installation Drawings

Rear Porting
(Code position 6, selection A)

Directional arrow stamped next to work ports, shows motor rotation relationship to work port when port is pressurized.

Same Side Porting
(Code position 6, selection B)

Directional arrow, stamped next to work port, shows motor rotation relationship to work port when port is pressurized.

Through Shaft for Brake Mounting
(Code position 8, selection A or C)

### TYPE OF PORT | SIZE AND DESCRIPTION
---|---
Work Port | 1- 1/16 - 12 UN-2B SAE O-ring
Drain Port | 9/16 - 18 UN-2B SAE O-ring

**Note:** All ports are SAE (J1926) O-ring ports. Dimensions are in millimeters [inches], unless otherwise specified.
Varible Displacement Motors

Features & Benefits

- Compact - Ease of Installation
- Numerous Options - Shafts, Ports, Shuttle Valves, speed pickup
- Displacement range: 7.3cc (0.45cid) to 49.2cc (3.0cid)
- Hydraulic De-stroke, Servo Control for remote control

2 Bolt SAE “B” Mount - 71392 Series
40.6 to 21.0 cm3/r [2.48 to 1.28 in3/r] Displacement

2 Bolt SAE “B” Mount - 72450 Series
40.6 cm3/r [2.48 in3/r] Displacement
49.2 cm3/r [3.0 in3/r] Displacement
Model 71392 Variable Motor

40.6 to 21.0 cm$^3$/r [2.48 to 1.28 in$^3$/r] Displacement

Identification numbers – Fixed Displacement Motor - Closed Circuit Stamped on each unit.

**7 1 3 X X - D AA**  
A – Product Number Description  
71302 / 71392 = Variable Motor 40.6 cm$^3$/r [2.48 in$^3$/r]  
B – Rotation  
D = Dual  
C – Sequential Letter

**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)

**Typical Product Number**

<table>
<thead>
<tr>
<th>Typical Product Number</th>
<th>Model Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>71392-DAE</td>
<td>AAMGA110M000A0C</td>
</tr>
<tr>
<td>71392-DAC</td>
<td>AAMGA210D000A0C</td>
</tr>
<tr>
<td>71392-DAJ</td>
<td>AAMGA210H000A0C</td>
</tr>
<tr>
<td>71392-DAB</td>
<td>AAMGA260H000A0C</td>
</tr>
</tbody>
</table>

**Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Model 71302/71392</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Displacement</td>
<td>40.6 to 21.0 cm$^3$/r [2.48 to 1.28 in$^3$/r]</td>
</tr>
</tbody>
</table>
| Maximum Rated Speed                | 3600 RPM at 17° Control Angle  
                                         4500 RPM at 9° Control Angle |
| Nominal Pressure Rating †          | 350 bar [5076 lbf/in$^2$] |
| Peak Pressure Rating ††            | 370 bar [5400 lbf/in$^2$] |
| Input Flow at Rated Speed and Pressure | 175.71 l/min [38.65 GPM] at  
                                         17° Control Angle |
| Output Power at Rated Speed and Pressure | 85.30 kW [114.50 hp] at  
                                         17° Control Angle |
| Output Torque at Rated Speed and Pressure | 226.27 N•m [2004.54 lbf•in] at  
                                         17° Control Angle |
| Continuous Allowable Case Pressure | 1.7 bar [25 lbf/in$^2$] |
| Continuous Inlet Temperature        | 107°C [225°F] |
| Weight/Single Motor (approximate)   | 9.5 kg [21 lbs] |

† Nominal Pressure: Max delta system pressure at which component fatigue does not occur (motor life estimated by bearing life).  
†† Peak Pressure: Max operation pressure which is permissible for a short duration of time (t < 1 sec).

**Working Principle**

Axial piston motor uses a variable cam / swash plate to change the motor displacement. Shuttle valve mounted on end cover, ports high pressure oil from either side to the control piston. When the control valve is energized, ports E and F are connected and therefore contain equal pressure. The area differential (rod side vs back side of the piston) creates a force that pushes the piston to the right, taking the motor to max displacement. High side system pressure (not charge pressure) must be used to actuate the cylinder. Most of the flow from the pump goes to turn the rotating kit, leaving only a small amount of flow to go across the shuttle valve and into the cylinder. Therefore, there is no issue with too much flow going into the cylinder and having nowhere to go. Schematic shows motor in de-stroked condition (min cam).
Model 71392 Variable Motor

40.6 cm³/r [2.48 in³/r] Displacement

Variable displacement piston motors are specified by the following model code. Once a motor is built from the model code, a product number will be assigned to that configuration.

Make sure all positions are selected within the 15 digit code for each motor.

<table>
<thead>
<tr>
<th>Code Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAM</td>
<td>40.6 cm³/r [2.48 in³/r] Variable displacement piston motor frame size 2 Bolt B- SAE</td>
</tr>
</tbody>
</table>

**Control Options**

- **F** - Hydraulic De-stroke Control, Remote Port Down - Model 71392, (opt.)
- **G** - Hydraulic De-stroke Control, Remote Port Up - Model 71392, (opt.)

**Output Shaft**

- **A** - 13 Tooth 16/32 spline, shaft extension 41.1 [1.62], (std.)
- **B** - 13 Tooth 16/32 spline, with snap ring groove, shaft extension 41.1 [1.62], (opt.)

**Main Port, Size & Location**

- **1** - 1 1/16-12 UN-2B straight thread O-ring ports - Rear, (std.)
- **2** - 1 1/16-12 UN-2B straight thread O-ring ports - Opposite Sides, (std.)

**Drain Port, Size & Location**

- **1** - 9/16-18 UNF-2B straight thread O-ring port - Right Side, (std.)
- **2** - .750-16 UNF-2B SAE O-ring port - right side
- **3** - 9/16-18 UNF-2B straight thread O-ring port - Rear of Backplate, (opt.)
- **6** - 9/16-18 UNF-2B straight thread O-ring port - Top, (opt.)

**Min-Max Displacements & Control Angles**

- **0** - 00.0-40.6 cm³/r [0.00-2.48 in³/r] minimum - 0° maximum -17°
- **D** - 17.9 to 40.6 cm³/r [1.09 to 2.78 in³/r], minimum 7° 40’ maximum 9° 0’ (std.)
- **G** - 20.5-40.6 cm³/r [1.25-2.48 in³/r] minimum 8° 45’ maximum 17° 0’ (std.)
- **H** - 21.0 to 40.6 cm³/r [1.28 to 2.48 in³/r], minimum 9° 0’ maximum 17° 0’ (std.)
- **Z** - 40.6 cm³/r [2.48 in³/r] 17 deg 0 min minimum displacement and control angle determined by 2.6 [.102] shim thickness

**Auxiliary Mounting Features (rear)**

- **0** - No Auxiliary Mounting Feature, (std.)
- **1** - 13 Tooth 16/32 Ext. Tapered spline with tapped hole, bottom pad with 5/16-18 UNC-2B mounting holes, (opt.)
- **1** - Requires the selection of opposite side porting only

**Special Features**

- **00** - No special feature, (std.)
- **AA** - No V Notches

**Paint**

- **0A** - Primer, (std.)
- **0B** - Black Paint, (std.)

**Identification**

- **0** - Standard, (std.)

**Design Code**

- **C** - Valve plate

Note: All ports are SAE (J1926) O-ring ports.
Model 71392 Variable Motor
Installation Drawing

Note: All ports are SAE (J1926) O-ring ports. Dimensions are in millimeters [inches], unless otherwise specified.

<table>
<thead>
<tr>
<th>TYPE OF PORT</th>
<th>SIZE AND DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Port</td>
<td>1/16 - 12 UN-2B SAE O-ring</td>
</tr>
<tr>
<td>Drain Port</td>
<td>9/16 - 18 UN-2B SAE O-ring</td>
</tr>
</tbody>
</table>
Model 71392 Variable Motor
Control Options and Output Shafts

Hydraulic De-stroke Control
(Code position 4, selection F or G)
The Hydraulic De-stroke Control feature allows the operator to control the motor without any mechanical linkage to the motor. A normally closed valve is required to provide maximum displacement to the motor. The valves must be rated for maximum system pressure.

Control Port up
(Code position 4, Selection G)

Control Port Down
(Code position 4, Selection F)

Output Shafts
(Code Position 5)

Selection A
Maximum Torque on Shaft
209.3 N•m [1,852 lbf•in]

Selection B
Maximum Torque on Shaft
209.3 N•m [1,852 lbf•in]

Selection D
Maximum Torque on Shaft
337.5 N•m [2,987 lbf•in]

Note: All ports are SAE (J1926) O-ring ports. Dimensions are in millimeters [inches], unless otherwise specified.
Model 72450 Variable Servo Motor
Installation Drawings

Features
- SAE B- B, 2 Bolt Mount, Cradle Swashplate
- Bi-directional rotation
- Auxiliary through-drive shaft available for brake mounts
- Standard SAE splined shafts, Optional taper shafts
- Same Side ports
- System pressure gauge ports
- Optional shuttle valve available

<table>
<thead>
<tr>
<th>Identification numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stamped on each unit.</td>
</tr>
<tr>
<td>A – Product Number Description</td>
</tr>
<tr>
<td>B – Rotation</td>
</tr>
<tr>
<td>D = Dual</td>
</tr>
<tr>
<td>C – Sequential Letter</td>
</tr>
<tr>
<td>D – Design Code number</td>
</tr>
</tbody>
</table>

Model 72450 Variable Servo Motor
Installation Drawings

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>SPECIFICATIONS</th>
<th>MODEL 72450</th>
<th>MODEL 72450</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Displacement</td>
<td>40.6 cm³/r [2.48 in³/r]</td>
<td>49 cm³/r [3.00 in³/r]</td>
</tr>
<tr>
<td>Maximum Rated Speed</td>
<td>4500 RPM at minimum stroke angle</td>
<td>4500 RPM at minimum stroke angle</td>
</tr>
<tr>
<td></td>
<td>3600 RPM at maximum stroke angle</td>
<td>3600 RPM at maximum stroke angle</td>
</tr>
<tr>
<td>Nominal Pressure Rating †</td>
<td>350 bar [5076 lbf/in²]</td>
<td>290 bar [4061 lbf/in²]</td>
</tr>
<tr>
<td>Peak Pressure Rating ††</td>
<td>372 bar [5395 lbf/in²]</td>
<td>310 bar [4496 lbf/in²]</td>
</tr>
<tr>
<td>Input Flow at Rated Speed and Pressure</td>
<td>175.71 l/min [38.65 GPM]</td>
<td>212.53 l/min [46.75 GPM]</td>
</tr>
<tr>
<td>Output Power at Rated Speed and Pressure</td>
<td>85.30 kW [114.50 hp]</td>
<td>82.36 kW [110.81 hp]</td>
</tr>
<tr>
<td>Output Torque at Rated Speed and Pressure</td>
<td>226.27 N•m [2004.54 lbf•in] at 17° Control Angle</td>
<td>218.47 N•m [1940 lbf•in] at 17° Control Angle</td>
</tr>
<tr>
<td>Continuous Allowable Case Pressure</td>
<td>1.7 bar [25 lbf/in²]</td>
<td>1.7 bar [25 lbf/in²]</td>
</tr>
<tr>
<td>Continuous Inlet Temperature</td>
<td>107° C [225° F]</td>
<td>107° C [225° F]</td>
</tr>
</tbody>
</table>

† Nominal Pressure: Max delta system pressure at which component fatigue does not occur (motor life estimated by bearing life).
†† Peak Pressure: Max operation pressure which is permissible for a short duration of time (t < 1 sec).
Model 72450 Variable Servo Motor

![Diagram of Model 72450 Variable Servo Motor]

**Working Principle**

Servo piston mounted on top of the motor is connected to cam/swash plate and is used to change the cam angle. This in turn varies the motor displacement. Servo piston is actuated by means of external pilot pressure acting on either side of the piston.

There are two options available to actuate the piston, Min-Max position piston and spring biased servo piston.

In min-max displacement option, external pilot pressure moves the piston from minimum cam to maximum cam angle. No intermittent position is achievable. Displacement limiters are provided on both sides of the piston to set the maximum and minimum cam angle.

In spring biased servo piston design, external servo pressure works against servo spring force. As pressure inside servo cavity increases, servo piston moves towards maximum displacement and vise-versa.
Variable displacement piston motors are specified by the following model code. Once a motor is built from the model code, a product number will be assigned to that configuration. Make sure all positions are selected within the 16 digit code for each motor.

### Code Title

**ACT** - 40.6 cm³/r [2.48 in³/r] Servo Controlled Variable Displacement piston motor

*** - 49.2 cm³/r [3.00 in³/r] Servo Controlled Variable Displacement motor.

**Note:** see position 13,14 special features.

### Output Shaft

A - 13 Tooth 1/32 spline, Shaft extension 41.4 [1.62]

B - 13 Tooth 16/32 spline, with snap ring groove, shaft extension 41.1[1.62]

C - 15 Tooth 16/32 spline, shaft extension 46 [1.81]

### Auxiliary Mounting Features (rear)

0 - No Auxiliary Mounting Features

A - Diameter 22.22 mm (.875 in) taper shaft

### Main Port, Size, & Location

1 - 5-16/12 UN-2B SAE O-ring (A&B) same side (right side)

2 - 1-5/16-12 UN-2B SAE O-ring (A&B) same side (left side)

4 - 1 1/16 -12 UN-2B SAE O-ring port (A & B) – same side (left side)

6 - Dash 12 STC Type II+ direct port (A & B) – left side

### Control Assembly

00 - No control assembly Port plate control

### Min-Max Displacements

3 - 13.5-40.6 cm³/r [0.82-2.48 in³/r] 5 deg 48 minutes min - 17 deg 0 minutes max

A - 20.5-40.6 cm³/r (1.25-2.48 in³/r) 8° 45 minutes min. - 17° 0 minutes max.

D - 26.7-36.7 cm³/r [1.63-2.24 in³/r] 11 deg 20 minutes min - 15 deg 24 minutes max

F - 24.5-49.2 cm³/r [1.49-3.00 in³/r] 8° 34 minutes min. - 17° 0 minutes max.

L - 14.7-40.6 cm³/r [0.90-2.48 in³/r] 6 deg 20 minutes min - 17 deg 0 minutes max

### Paint

0A - Primer, (std.)

0B - Black Paint, (std.)

### Special Features

00 - None

03 - Shuttle valve and backpressure valve set 15.2-17.2 Bar (220-250 PSI) rear facing S1, S2 servo control ports

***04 - Ref. code title

11 - Biased to maximum displacement ; rear facing s1 port only.

12 - 9.2 cm³/r [3.00 in³/r] rotating group; biased to maximum displacement ; rear facing s1 port only.

### Customer Identification

0 - Standard, (std.)

B - Eaton assigns current design code, (std.)

### Design Code

Taper Shaft Selection A

Maximum through torque 209.3 Nm [1882 lbf-in]

---

**Model 72450 Variable Servo Motor**
Model 72450 Variable Servo Motor

Installation Drawings

Port Right Side
(Code Position 7, Selection 1)

Port Left Side
(Code Position 7, Selection 2)

TYPE OF PORT | SIZE AND DESCRIPTION
---|---
Work Port (A, B) | 1-1/16 - 12 UN-2B SAE O-ring
Dash 12 STC Type II + Direct Ports
Drain Port (D1, D2, D3) | 7/8-14 UNF - 2B SAE O-ring
1-1/16 - 12 UN-2B SAE O-ring
Servo Control Pressure Port | 7/16 - 20 UN-2B SAE O-ring

WARNING - Do not attempt to adjust screw or nut tampering with factory settings may void the warranty and cause system failure

Do not paint
Model 72450 Variable Servo Motor
Shuttle and Charge Pressure Relief Valve
(Code Position 13,14 Selection 03)

Variable motor incorporate integral shuttle valve. The shuttle and charge pressure valve work together to bypass closed loop oil. This allows the oil to be cooled, filtered, and returned to tank. Refer page 19 for further details.

The shuttle valve flow is listed below in relationship to the charge pressure valve setting.

For 72450 series motor:

<table>
<thead>
<tr>
<th>Charge Pressure</th>
<th>Flow</th>
<th>Code Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.2-17.2 bar</td>
<td>9.46 to 13.25 l/m</td>
<td>03</td>
</tr>
<tr>
<td>[220-250 psi]</td>
<td>[2.5 to 3.5 gal/min]</td>
<td></td>
</tr>
<tr>
<td>22.1-23.4 bar</td>
<td>14.0 to 17.8 l/m</td>
<td>05</td>
</tr>
<tr>
<td>[320-340 psi]</td>
<td>[3.7 to 4.7 gal/min]</td>
<td></td>
</tr>
<tr>
<td>20.0-21.4 bar</td>
<td>12.5 to 16.27 l/m</td>
<td>08</td>
</tr>
<tr>
<td>[290-310 PSI]</td>
<td>[3.3 to 4.3 gal/min]</td>
<td></td>
</tr>
</tbody>
</table>

Speed Sensor
(Code Position 13,14 Selection 13)

Eaton has developed a speed sensor, based on the field proven technology of our Hall Effect and Magnetic sensor. Output – Digital signals from NPN transistors (open collector output with internal 10K pull up resistors).

This sensor has reverse polarity protection, short circuit protection, load dump protection, and EMC (Electrical Magnetic Capability) protection (the customer should qualify the EMC protection in their specific application)

Supply Voltage: 8 to 24 Volt DC (compatible with 12V vehicle conditions)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature Limit</td>
<td></td>
<td>-40° to 150°C [-40° to 302° F ]</td>
</tr>
<tr>
<td>Sensor Resistance</td>
<td>25°C (77° F)</td>
<td>1.5 K To 3.5 K Ohms</td>
</tr>
<tr>
<td>Sensor Inductance</td>
<td>25°C (77° F)</td>
<td>0.6 to 3.7 H</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>25°C (77° F) 9.3 Hz @ 2.29mm [.090 inch] Gap</td>
<td>400 mVpp Min</td>
</tr>
<tr>
<td>300 Hz @ 0.25mm [.010 inch] Gap 80 Vpp Max.</td>
<td></td>
<td>80 Vpp Max.</td>
</tr>
<tr>
<td>Air Gaps</td>
<td>0.26 to 2.28 mm [.010 to .090 inch]</td>
<td></td>
</tr>
<tr>
<td>Vibration Voltage</td>
<td>15G random Vibration</td>
<td>0.4V P-P Max</td>
</tr>
</tbody>
</table>

Note: Dimensions are in millimeters [inches], unless otherwise specified.
Component Selection

The long service life of Eaton hydrostatic transmissions is largely dependent on the proper selection and installation of the components 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.

Output Flow (Q)

\[
\text{lpm} = \frac{\text{cm}^3/\text{r} \times \text{rpm}}{1000} \quad \text{gpm} = \frac{\text{in}^3/\text{r} \times \text{rpm}}{231}
\]

Input Power (P)

\[
\text{kW} = \frac{\text{l/min} \times \text{bar}}{600} \quad \text{hp} = \frac{\text{gpm} \times \text{psi}}{1714}
\]

Shaft Torque (M)

\[
\text{N-m} = \frac{\text{bar} \times \text{cm}^3/\text{r}}{62.8} \quad \text{lb-in} = \frac{\text{psi} \times \text{in}^3/\text{r}}{6.28}
\]

Shaft Speed (n)

\[
\text{rpm} = \frac{1000 \times \text{l/min}}{\text{cm}^3/\text{r}} \quad \text{RPM} = \frac{231 \times \text{gpm}}{\text{in}^3/\text{r}}
\]

Output Power (P)

\[
\text{kW} = \frac{\text{N-m} \times \text{RPM}}{9549} \quad \text{hp} = \frac{\text{lb-in} \times \text{rpm}}{63,025}
\]

Volumetric Displacement

\[
\text{cm}^3/\text{r} = \frac{\text{lpm} \times 1000}{\text{rpm}} \quad \text{in}^3/\text{r} = \frac{\text{gpm} \times 231}{\text{rpm}}
\]

Efficiencies

\[
\text{Volumetric Nv} = \frac{\text{gpm actual}}{\text{gpm theoretical}}
\]

\[
\text{Mechanical Nm} = \frac{\text{lb-in actual}}{\text{lb-in theoretical}}
\]

Total \( N_t = N_v \times N_m \)

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...
Component Selection

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 80°C [180°F] for most hydraulic fluids. The maximum fluid temperature should not exceed 107°C [225°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. Medium duty case pressure up to 2 bar [25 psil], 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, ATF, UTTOs, etc., also contain VII, 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 polychloroolefins (PAO) are also used to formulate hydraulic fluids, engine oils, ATF, and UTTO. 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.

For more details, refer to Eaton Fluid Recommendation Document # 03-401-2010.

Contact your Eaton representative, if you have specific questions about the fluid requirements of Eaton hydraulic components.
Hydraulic Fluid Recommendations

Viscosity & Cleanliness Recommendation

<table>
<thead>
<tr>
<th>Product</th>
<th>Minimum *</th>
<th>Optimum</th>
<th>Maximum</th>
<th>ISO Cleanliness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Duty Piston Pumps</td>
<td>6.0 cSt (45 SUS)</td>
<td>10 – 39 cSt (60-180 SUS)</td>
<td>2158 cSt (10000 SUS)</td>
<td>21/18/13</td>
</tr>
<tr>
<td>and Motors Charged Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 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.