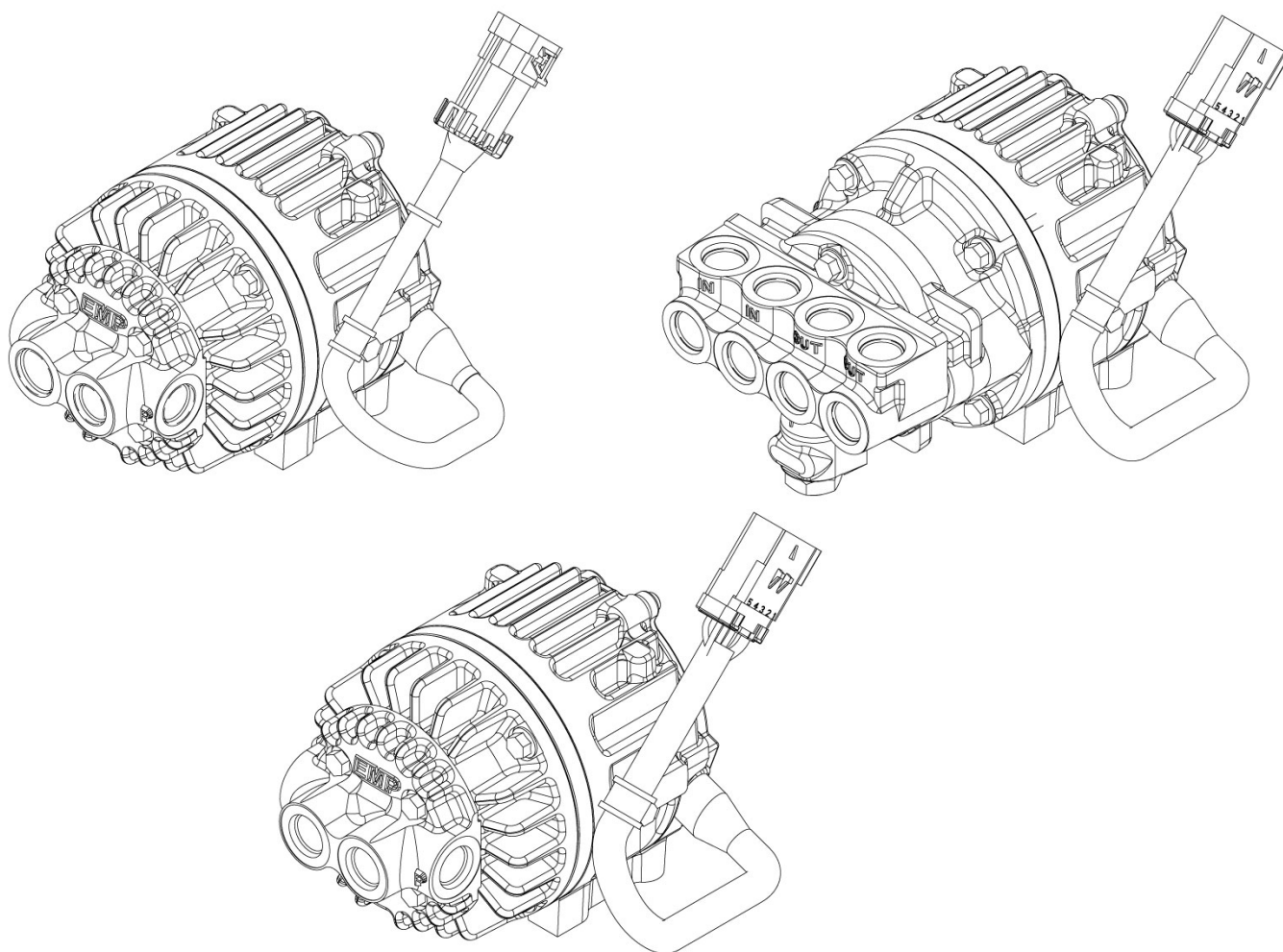


## Quick Start Guide OP80, OP40, and OP3530 Electric Oil Pumps



This manual is effective for consumer installations of EMP OP80, OP40 and OP3530 oil pumps.  
OEM installers must contact EMP for production requirements.

Rev	Rev By	Date	Description of Change	Approved By
B	ME	6/23/21	Revisions	ECN7292
C	ME	1/5/23	Revisions	ECN7799


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## Product Overview

The EMP OP product line are electrically powered fluid pumps available in 12V DC and 24V DC configurations. Proper installation of the pump will help ensure the performance and reliability of the electric pump while reducing the risk of damage to other components in the system.

 **CAUTION:** Do not use these pumps for transferring any fluids other than those for which they were designed; to do so may damage the pump and will void the warranty.

The information contained in this manual is updated periodically. While great care is taken in compiling the information contained in this manual, Engineered Machined Products, Inc. cannot assume liability for losses of any nature arising from any errors and/or omissions.

The information and specifications contained throughout this manual are up to date at the time of publication. Engineered Machined Products, Inc. reserves the right to change the content of this manual at any time without notice.

## Table of Contents

Product Overview .....	2
Introduction.....	4
Purpose .....	4
Service Technician Responsibilities .....	4
Liability Disclaimer .....	4
Additional Information .....	4
Technical Help .....	4
About This Document .....	5
Warnings, Cautions and Notes.....	5
Definition of Terms .....	5
Product Safety Warnings.....	6
Specifications .....	7
OP80.....	7
OP40.....	8
OP3530.....	9
Dimensions and Mounting .....	10
OP80.....	10
OP40.....	11
OP3530.....	11
Identification .....	12
EMP Oil Pump Model Decoder.....	13
Installation .....	14
Mounting .....	14
Plumbing.....	14
Wiring.....	15
Connector Information.....	15
Electrical Connections.....	18
On/Off – Single Speed Control.....	18
System Fill Procedure .....	19
Fluids Fill.....	19
Final Item Check List.....	19
EMPower Connect™ Service Tool .....	20
Routine Maintenance.....	21
Troubleshooting.....	21

## Introduction

### **Purpose**

The purpose of this quick start guide is to present information related to the pump dimensions, electrical specifications, fluid guidelines, recommended plumbing, mounting orientation, and routine maintenance.

For production applications, the full installation specifications must be met. Contact EMP to request documentation.

9970115018	<i>Installation and Operation Manual OP80 Electric Oil Pump</i>
9970094015	<i>Installation and Operation Manual OP40 Electric Oil Pump</i>
9970105025	<i>Installation and Operation Manual OP3530 Electric Oil Pump</i>

To determine if the oil pump was successfully installed, reference *Installation Checklist for EMP Oil Pumps*, EMP document 9890094024.

### **Service Technician Responsibilities**

Ensure that all safety messages and information messages are read and understood before installation, maintenance, or repairs are performed. It is important to use caution when service work is performed. Knowledge of impacted systems and their operation are important before the removal or disassembly of any component. Knowledge of hazards present and risk of injury to the service technician while working on these systems is critical to personal safety.

### **Liability Disclaimer**

EMP cannot anticipate every possible circumstance that might involve a potential hazard. The safety messages in this document, in related manuals, and on the product are therefore not all inclusive. If a tool, procedure, work method, or operating technique that is not specifically recommended by EMP is used, you must satisfy yourself that it is safe for you and for others. You should ensure that the product will not be damaged or be made unsafe by the operation, maintenance, or repair procedures that you choose.

### **Additional Information**


Access <https://www.emp-corp.com/support/> for service software, service bulletins, service manuals, service drawings, and other documents related to your installed EMP systems and components. First time users may create a free customer login at <https://www.emp-corp.com/account/register/>.

### **Technical Help**

Contact EMP Technical Service for technical help at +1 (906) 789-7497 or [service@emp-corp.com](mailto:service@emp-corp.com).

## About This Document

### **Warnings, Cautions and Notes**

Two headings are used in this document to stress your safety and safe operation of the system. They are styled with a graphic bullet and bold, uppercase text:  **WARNING** and  **CAUTION**. Warnings highlight risks to personnel — hazards, unsafe conditions and practices that can result in personal injury or death. Cautions indicate conditions or practices that can cause damage to components, systems, or other equipment.

A third heading, styled as **NOTE**, calls attention to additional information about components and procedures discussed in the document.


### **Definition of Terms**


**EMP-Link**..... EMP LIN based proprietary serial data bus.


**R20C** ..... EMP components with CAN, temperature input and on/off control.


**R20L** ..... EMP components with PWM, on/off and EMP-Link control.


## Product Safety Warnings

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 **WARNING:** Ensure that all safety messages and information messages are read and understood before installation, maintenance, or repairs are performed. It is important to use caution when service work is performed. Knowledge of impacted systems and their operation are important before the removal or disassembly of any component. Knowledge of hazards present and risk of injury to the service technician while working on these systems is critical to personal safety


 **WARNING:** Ensure that the equipment cannot move before doing any work or diagnostic procedures on the EMP component, system, or vehicle.

 **WARNING:** When working on or near electrical components, ensure that they have been disconnected from their energy source, cannot be accidentally re-energized, and verify the system is in a zero energy state.


 **WARNING:** Use extreme caution when working on systems under pressure (i.e. coolant, hydraulic fluids, air, fire suppression, etc.).

 **WARNING:** Ensure the work area is ventilated and well lit.

 **WARNING:** Ensure charged fire extinguishers are in the work area.

 **WARNING:** Ensure all safety guards, shields, and covers are reinstalled when tasks are completed.

 **WARNING:** Ensure all tools, parts and service equipment are removed from the work area.

 **WARNING:** Ensure that all system power and ground connection points are torqued to EMP and/or OEM specifications to prevent system damage. Failure to follow specified torque requirements can result in loose connections which can damage electronic components and will void EMP warranty.

## Specifications

**NOTE:** Performance will be reduced at lower operating temperatures when using lower voltage power supplies and when using heavier weight oils.

### OP80

Component Construction	Cast Aluminum	
Performance	Model: 12V and 24V	
Theoretical Displacement	0.468 in <sup>3</sup> /rev (7.67 cm <sup>3</sup> /rev)	
Flow Capacity Maximum*	8.0 gal/min (30 L/min)	
Operating Pressure Maximum*	80 psi (5.5 Bar)	
Operating Temperature Maximum (Air)	203 °F (95 °C)	
Operating Temperature Maximum (Oil)	212 °F (100 °C)	
Operating Temperature Minimum	32 °F (0 °C)* (*Sub-zero operation is application dependent)	
Oil Viscosity Maximum	~5000 cSt (Current models optimized for lighter weight oils like ATF)	
Motor Speed Maximum	5000 rpm	
Motor Speed Minimum	500 rpm	
Motor Speed Default	4000 rpm (configurable)	
Mechanical Connections	Model: 12V and 24V	
Suction	SAE STOR -10 (7/8-14 UNF-2B)	
Discharge	SAE STOR -8 (3/4-16 UNF-2B)	
Weight	Model: 12V and 24V	
Component Weight	9.5 lbs (4.3 kg)	
Electrical	Model: 12V	Model: 24V
Input Voltage	9–16 V DC (14 V nominal)	18–32 V DC (28 V nominal)
Operating Current Draw Maximum	25 A	25 A
Thermal Protection	Auto self-protect shutdown	Auto self-protect shutdown

## OP40

Component Construction	Cast Aluminum	
Performance	Model: 12V and 24V	
Theoretical Displacement	0.192 in <sup>3</sup> /rev (3.14 cm <sup>3</sup> /rev)	
Flow Capacity Maximum*	4.0 gal/min (15 L/min)	
Operating Pressure Maximum*	100 psi (6.9 Bar)	
Operating Temperature Maximum (Air)	203 °F (95 °C)	
Operating Temperature Maximum (Oil)	212 °F (100 °C)	
Operating Temperature Minimum	-40 °F (-40 °C) (Sub-zero operation is application dependent)	
Oil Viscosity Maximum	~5000 cSt (Current models optimized for lighter weight oils like ATF)	
Motor Speed Maximum	5000 rpm	
Motor Speed Minimum	500 rpm	
Motor Speed Default	4000 rpm (configurable)	
Mechanical Connections	Model: 12V and 24V	
Suction	SAE STOR -8 (3/4-16 UNF-2B)	
Discharge	SAE STOR -8 (3/4-16 UNF-2B)	
Weight	Model: 12V and 24V	
Component Weight	9.5 lbs (4.3 kg)	
Electrical	Model: 12V	Model: 24V
Input Voltage	9–16 V DC (14 V nominal)	18–32 V DC (28 V nominal)
Operating Current Draw Maximum	25 A	25 A
Thermal Protection	Auto self-protect shutdown	Auto self-protect shutdown



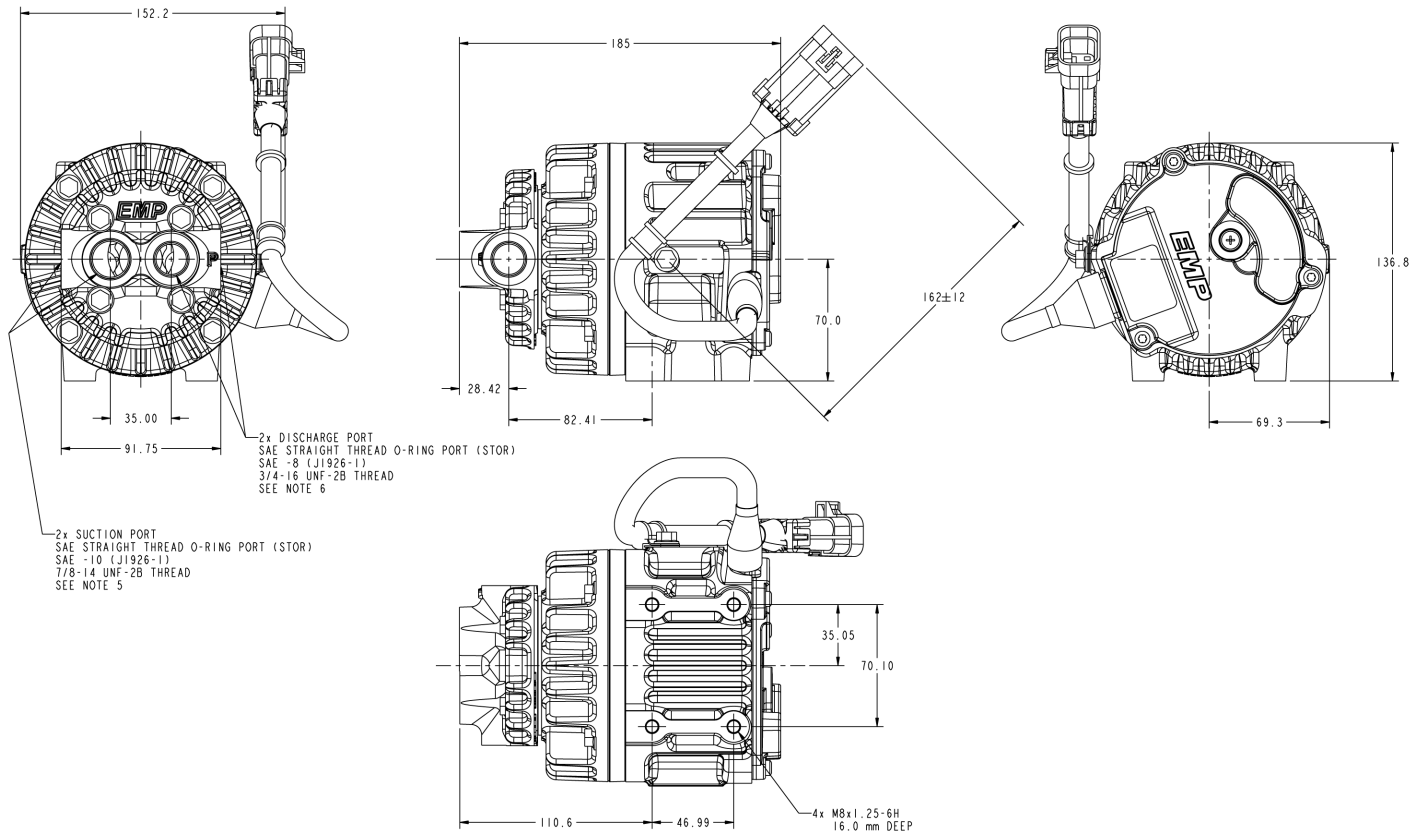
## OP3530

Component Construction	Cast Aluminum	
Performance	Model: 12V and 24V	
Theoretical Displacement	Scavenge Stage – 0.237 in <sup>3</sup> /rev (3.88 cm <sup>3</sup> /rev) Feeder Stage – 0.204 in <sup>3</sup> /rev (3.34 cm <sup>3</sup> /rev)	
Flow Capacity Maximum*	Scavenge Stage – 3.9 gal/min (14.8 L/min) Feeder Stage – 3.3 gal/min (12.5 L/min)	
Operating Pressure Maximum*	60 psi (4.1 Bar) – (Feeder Stage Only) 25 psi (1.7 Bar) Relief Valve Standard (other relief pressures available)	
Operating Temperature Maximum (Air)	203 °F (95 °C)	
Operating Temperature Maximum (Oil)	212 °F (100 °C)	
Operating Temperature Minimum	-4 °F (-20 °C) (Sub-zero startability and operation is application dependent)	
Oil Viscosity Maximum	~2000 cSt (Current models optimized for lighter weight oils like ATF)	
Motor Speed Maximum	4000 rpm	
Motor Speed Minimum	500 rpm	
Motor Speed Default	4000 rpm (configurable)	
Mechanical Connections	Model: 12V and 24V	
Fluid Ports	SAE STOR -8 (3/4-16 UNF-2B)	
Weight	Model: 12V and 24V	
Component Weight	11.5 lbs (5.2 kg)	
Electrical	Model: 12V	Model: 24V
Input Voltage	9–16 V DC (14 V nominal)	18–32 V DC (28 V nominal)
Operating Current Draw Maximum	25 A	25 A
Thermal Protection	Auto self-protect shutdown	Auto self-protect shutdown

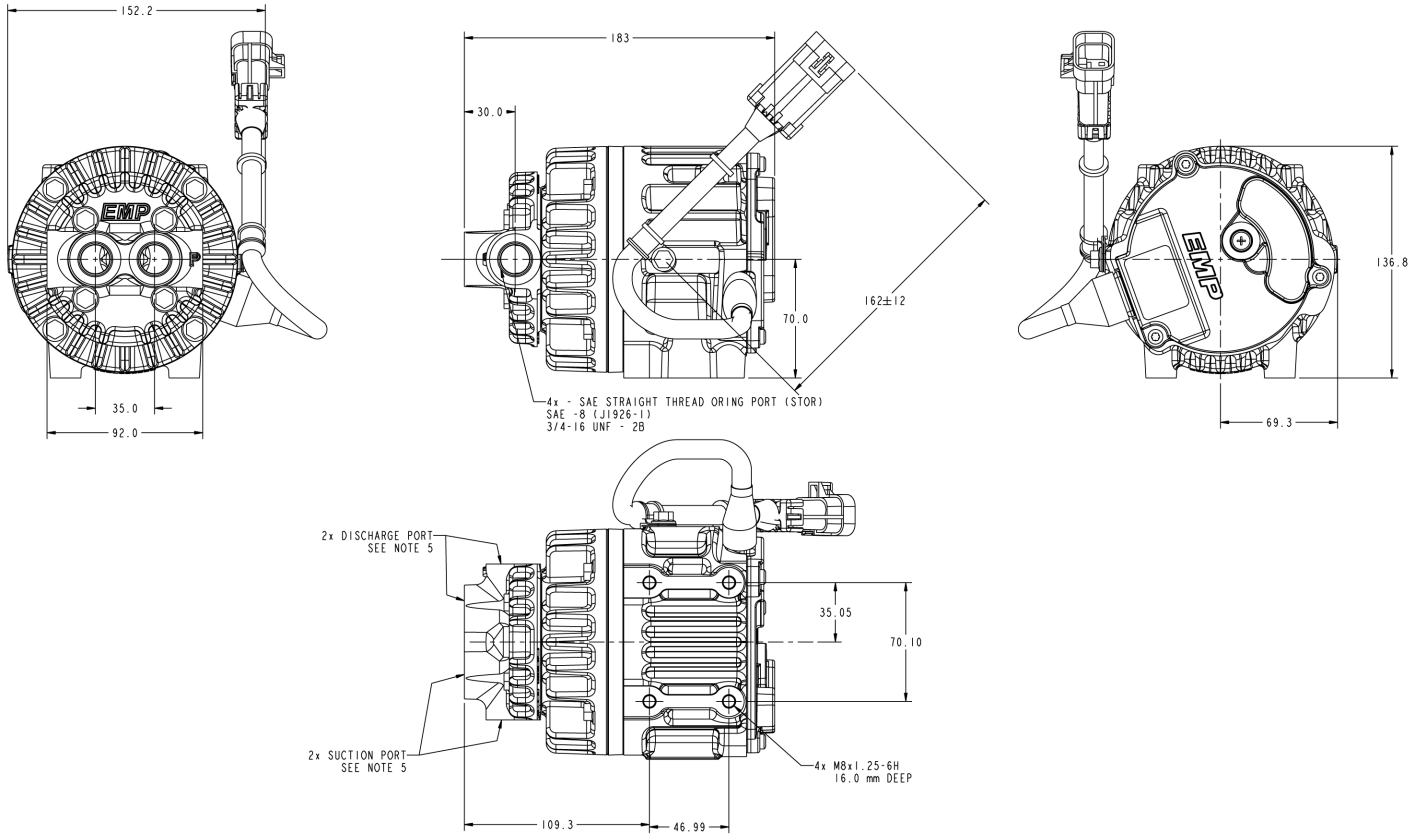
## Dimensions and Mounting

**NOTE:** Dimensions are given in millimeters (mm).

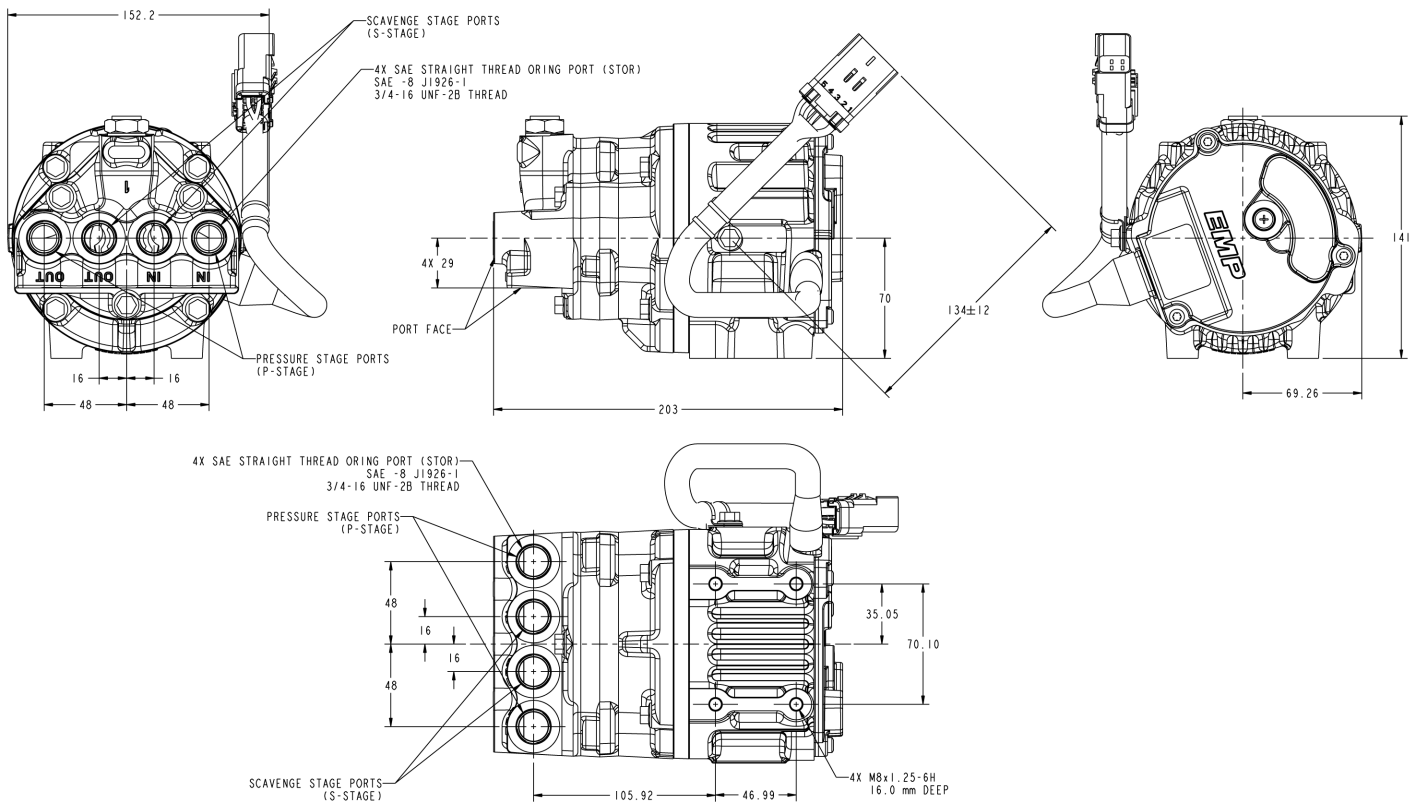
### OP80



**OP40**

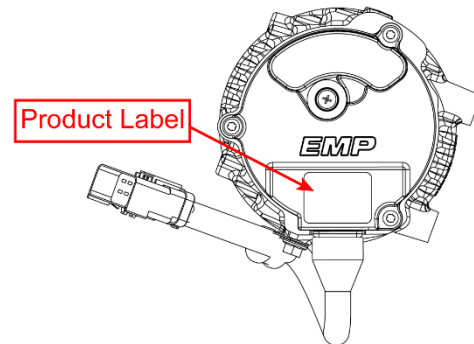
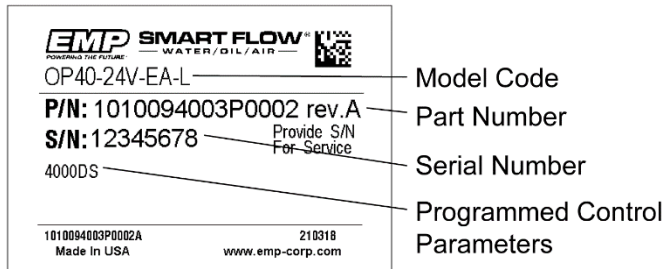


**OP3530**



## Identification

The product identification label is attached to the controller housing next to the electrical interface of the pump. The product label contains model information and serial number. The serial number can be used to trace the component hardware configuration, software calibration, the date of manufacture, and manufacturing data.



## EMP Oil Pump Model Decoder

Example: OP3530-24V-EA-M [OEM] [Cert][Suffix]

1	2	3	4	5	6	7	8	9	10	11	12					
OP	3	5	3	0	-	2	4	V	-	E	A	-	M	[OEM]	[Cert]	[Suffix]

1	<b>Component</b> OP = Oil Pump	5	<b>Voltage</b> 12V = 12 volt 24V = 24 volt	9	<b>I/O</b> Omit if n/a A = Address Input C = Temperature Input B = Address or Temp Input (Specified in Calibration) P = Pressure M = PWM High (modulated) L = PWM Low (modulated)
2	<b>Scavenge Flow Rate</b> In 0.1 gallons per minute 35 = 3.5 gpm (13.2 lpm) Omit for single stage pumps	6	<b>Mounting</b> E = External Mount C = Cartridge Mount	10	<b>OEM</b> Omit if n/a
3	<b>Pressure Flow Rate</b> In 0.1 gallons per minute 30 = 3.0 gpm (11.4 lpm) 40 = 4.0 gpm (15.1 lpm) 80 = 8.0 gpm (30.3 lpm)	7	<b>Orientation (degrees)</b> A = 0 B = 90 C = 180 D = 270 See manual for definition	11	<b>Certification</b> Omit if n/a E = E-Mark C = CSA U = UL
4	<b>Communication</b> C = CAN Omit for on/off or PWM	8	<b>Relief Valve Cracking Pressure</b> Omit if n/a 05 = 5 psi 15 = 15 psi 25 = 25 psi 30 = 30 psi 70 = 70 psi	12	<b>Suffix</b> Omit if n/a Denotes model variation

**OP3530-24V-EA-M** = Oil Pump. 3.5 gpm scavenge/3.0 gpm pressure, on/off/PWM communication, 24 Volt External Mount at 0 degrees, no relief valve, uses PWM High input for commands.

**NOTE:** Not every option combination is available.

**NOTE:** All current pump models are optimized for use with lighter weight oils like ATF. Performance will be reduced for heavier weight oils.

## Installation

**⚠ WARNING:** To avoid serious personal injury, possible death, or damage to the vehicle, disconnect the power supply, main negative battery cable, and/or switch off the battery disconnect switch before installation or servicing. When working on or near the electric components, ensure battery power is off or lock out vehicle ignition, so the system cannot activate unexpectedly.

**⚠ WARNING:** To avoid burn injuries, allow time for parts to cool to a safe working temperature before removing or installing any components.

**⚠ CAUTION:** To avoid potential damage to the wiring and/or hoses, route all wires and hoses away from any sharp edges, moving objects, and heat sources.

**⚠ CAUTION:** All wires should be secured every 12–18 inches and anywhere motion could result in wires rubbing against any other surface. All zip ties must be placed over wire loom/convoluted tubing and not over bare wires.

## Mounting

- Operating temperature limits must be considered during installation.
- When possible, the pump should be mounted so that the wiring harness grommet is angled down to shed water.
- For best performance, select a mounting location as close as possible to the oil supply (minimize height differences and supply line lengths).
- Ensure there is a minimum of 13mm (1/2") of clearance to ensure there is no rubbing or interference during operation.
- Securely attach pump to frame or mounting bracket by using (4) M8 x 1.25 fasteners. The mounting holes are tapped to a depth of 16mm. Be aware of the bracket thickness when selecting the fastener length to ensure a minimum thread engagement of 12mm while not bottoming out in the pump housing. Tighten fasteners to a torque of 20 N m.

## Plumbing

**NOTE:** Inlet and outlet ports are identified under the Dimensions and Mounting section.

**NOTE:** All pump connections rely on an O-ring sealing method, do not use thread sealant or tape.

- For optimal performance, it is recommended that hose or lines be no smaller than minimum recommended diameter. The supply hose (suction) should be kept as short as possible.
- Minimum recommended diameters:

OP80	3/4" ID
OP40	5/8" ID
OP3530	5/8" ID
- Avoid restrictions such as sharp bends and undersized fittings in lines.
- Avoid routing hoses/lines in areas that would cause chafing. All hoses should be secured to prevent rubbing against any surfaces.
- Ensure all fittings, lines, and hoses are selected based on appropriate ratings for the application (temperature, pressure, fluid type, etc.).
- It is recommended that the fluid quality meets ISO cleanliness code 20/18/15. This is representative of the nominal filtration of 20 microns or better.
- It is recommended that a strainer on the suction side of the pump be used. The strainer will keep foreign matter from entering the pump and reduce the risk of the pumping element seizing up. The strainer mesh size should be large enough so that it does not cause excessive pressure drop, but fine enough to protect the pump.

## Wiring

- For proper controller operation, the ignition enable line must not be tied to power. It must be supplied from a separate DC switched source which allows the pump to be turned off before power is removed. Failure to do so prevents the controller from going through its normal shutdown routine.
- The maximum current draw for EMP OP oil pumps is 25 amps. The actual pump current draw varies with oil viscosity and the pressure required to pump the oil through the system. It is recommended to install a properly sized fuse, not less than 30A on the power supply line to protect installed wiring.
- Although the pump connector and mating connector are environmentally sealed, care must still be taken to prevent water from pooling up on the pump connector or the sealing grommet on the pump motor housing. This can be achieved through proper wire harness routing.
- Route motor lead harness down and away from the pump sealing grommet. Ensure that there is a minimum of approximately 1.5 inches (38 mm) of straight wire length exiting the sealing grommet prior to changing wire routing directions.
- Care should be taken to ensure no stress or strain is placed on the interface between the wires and the connectors else the sealing mechanism could be compromised.
- It is good practice to incorporate drip loops into the wire routing design. Always ensure the connectors are not located in the bottom of the loop as the water runs off at the lowest point in the harness.
- It is recommended that the pump connector(s) are oriented so that water flows down and past the connectors.. This will prevent water from pooling on the seal between the mating connectors.
- The voltage drop between the battery or power supply and the pump should not exceed 5% of the rated voltage. This should be verified at the pump's maximum current draw once all electrical connections are completed. Systems with excessive voltage drops will yield reduced pump performance.

## Connector Information

The following notes apply to all connectors:

**NOTE:** All cavities in the mating connector must either be terminated or plugged to prevent moisture from entering the component.

**NOTE:** Ensure wires are sized appropriately for the application. Wire gauges and circuit protection shown in this document are suggestions.

**NOTE:** Do not disconnect the component while it is running; stop running the component prior to disconnecting the connector.

R20L components use a 7-way Delphi Metri-Pack connector. R20C components use either a single 10-way connector or separate 2-way and 6-way connectors.

## R20L Component Connector Information

### Connector Greasing

**NOTE:** See *Service Bulletin Approved Grease* EMP document 9910039075, for a list of dielectric grease products that have been approved for use in maintenance and service. The document can be obtained on the [EMP website](#) by searching for the document number.

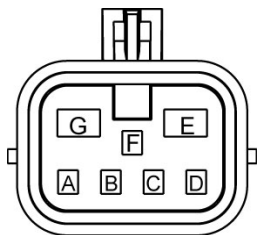
**NOTE:** Only use clean dielectric grease.

1. Apply dielectric grease to each harness side electrical connector. See the table below for specified grease amounts.

**Dielectric Grease Reference Quantities**

Grease	Description
1.25 g	Delphi 7-way mating connector

### 7-Way Male Delphi Metripack 150/480 Sealed



Pin	Purpose	Wire Size and Color
A	Unused	16 AWG Black/Tan
B	Optional (Ground for TACH_OUT)	16 AWG Black/Yellow
C	Ignition enable	16 AWG Black/Purple
D	Optional (TACH_OUT)	16 AWG Black/Green
E	Battery power	10 AWG Black/Red
F	Unused	16 AWG Black/White
G	Ground	10 AWG Black

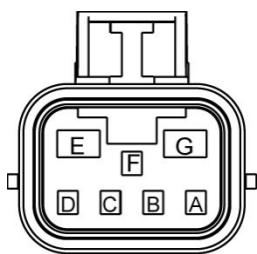
### R20L Mating Connector Information

**NOTE:** All cavities in the mating connector must either be terminated or plugged to prevent moisture from entering the component.

### 7-Way Female Delphi Metripack 150/480 Sealed

The connector on the component is a sealed Delphi 480/150 Metripack mixed connector with male terminals.

**NOTE:** A service kit containing all parts needed for one mating connector is available from EMP. The service kit part number is 1370036093, and the service kit drawing is available on the EMP website and can be obtained at <https://www.emp-corp.com/support/documents/> by searching for the service kit part number.

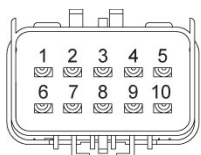


Item	Delphi Part Number
Connector	12059472
TPA	12052486
480 Terminal	12052139
150 Terminal	12048074
480 Seal	15324990
150 Seal	15324973
150 Plug	12059168



## R20C Component Connector Information

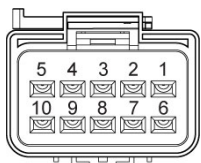
### 10-Way Male Apex 2.8mm Sealed



Pin	Purpose	Wire Size and Color
1	Battery power	10 AWG Black/Red
2	Plugged	Plugged
3	Unused	16 AWG Black/White
4	Unused	16 AWG Black/Tan
5	Unused	16 AWG Black/Yellow
6	Ignition enable	16 AWG Black/Purple
7	Plugged	Plugged
8	Ground	10 AWG Black
9	Plugged	Plugged
10	Unused	16 AWG Black/Green

## R20C Mating Connector Information

### Power/Ground/Communication Connector: 10-Way Female Apex 2.8mm



Detail	Apex Part Number	Alternative Part Number
Connector	54201009	15316895
Terminal, Apex 2.8mm, Socket, 10 – 12 AWG	54001000	10762802
Terminal, Apex 2.8mm, Socket, 14 – 16 AWG	54001400	10762803
Terminal, Apex 2.8mm, Socket, 18 – 20 AWG	54001800	10757690
Apex 2.8mm Grey Plug	54200005	N/A

**NOTE:** A service kit containing all parts needed for one mating connector is available from EMP. The service kit part number is 1370106076.

## Electrical Connections

Power is supplied from a 12V or 24V DC (nominal) source depending on model type. The component receives power through the battery power pin of the connector (Reference the appropriate section of [Connector Information](#) for component pin descriptions). The ignition enable is a switched power source which is sent from your system to initiate operation of the component. This can be wired directly to a vehicle ignition, to a PLC output, through a manual switch or through a thermal switch. This line will draw less than 10 mA of current. All switches on this line can be sized based on this amperage requirement. This input should be fused close to the source to protect the vehicle or system wiring.

## On/Off – Single Speed Control

**NOTE:** All cavities in the mating connector(s) must either be terminated or plugged to prevent moisture from entering the component.

**NOTE:** EMP parts kit 1370056018 includes a mini-fuse holder, cover, fuses, and the wiring parts required for installation of the holder.

**NOTE:** 10 AWG wire can be used for power and ground. Use Delphi 480 cable seal #15324990.

## Example On/Off Mating Connection (7-way connector)

Pin	Description
A	Plugged
B	Plugged
C	Switched, fused, ignition enable source
D	Plugged
E	Fused power connection
F	Plugged
G	Ground

## Operation


When power is on and ignition enable is on, the component will run in an on/off, single speed manner. The speed at which the component will run will be the pre-configured default speed.

EMP OP pumps are also available with CAN, PWM, temperature input and EMP-Link control. Contact EMP for more information.

**NOTE:** For assistance with component calibrations and settings, please contact EMP Technical Service at [service@emp-corp.com](mailto:service@emp-corp.com) and provide a serial number for the part in question.

## System Fill Procedure

### *Fluids Fill*

 **CAUTION:** Do not use these pumps for transferring any fluids other than those for which they were designed; to do so may damage the pump and will void the warranty.

System fill instructions must be developed, documented, and verified by the system integrator. Communicate these procedures to the end customer in maintenance documentation.

Follow these instructions each time the system is drained:

1. Caution must be taken to ensure the system is refilled properly to ensure effective priming of the pump. (For new pumps, pour oil into the pump discharge port to wet the pumping element.)
2. Use care to avoid contaminating oil with debris when working on the system or pump.

### *Final Item Check List*

- Are all hoses, fittings, and lines appropriately sized?
- Are the oil supply and delivery lines to and from the pump securely fastened?
- Is the pump supplied with the appropriate voltage?
- Is the pump securely mounted?
- Are all wires and/or hoses routed away from sharp edges, moving objects, and heat sources?
- Is the ignition enable on a switched source and not tied to power?

## EMPower Connect™ Service Tool

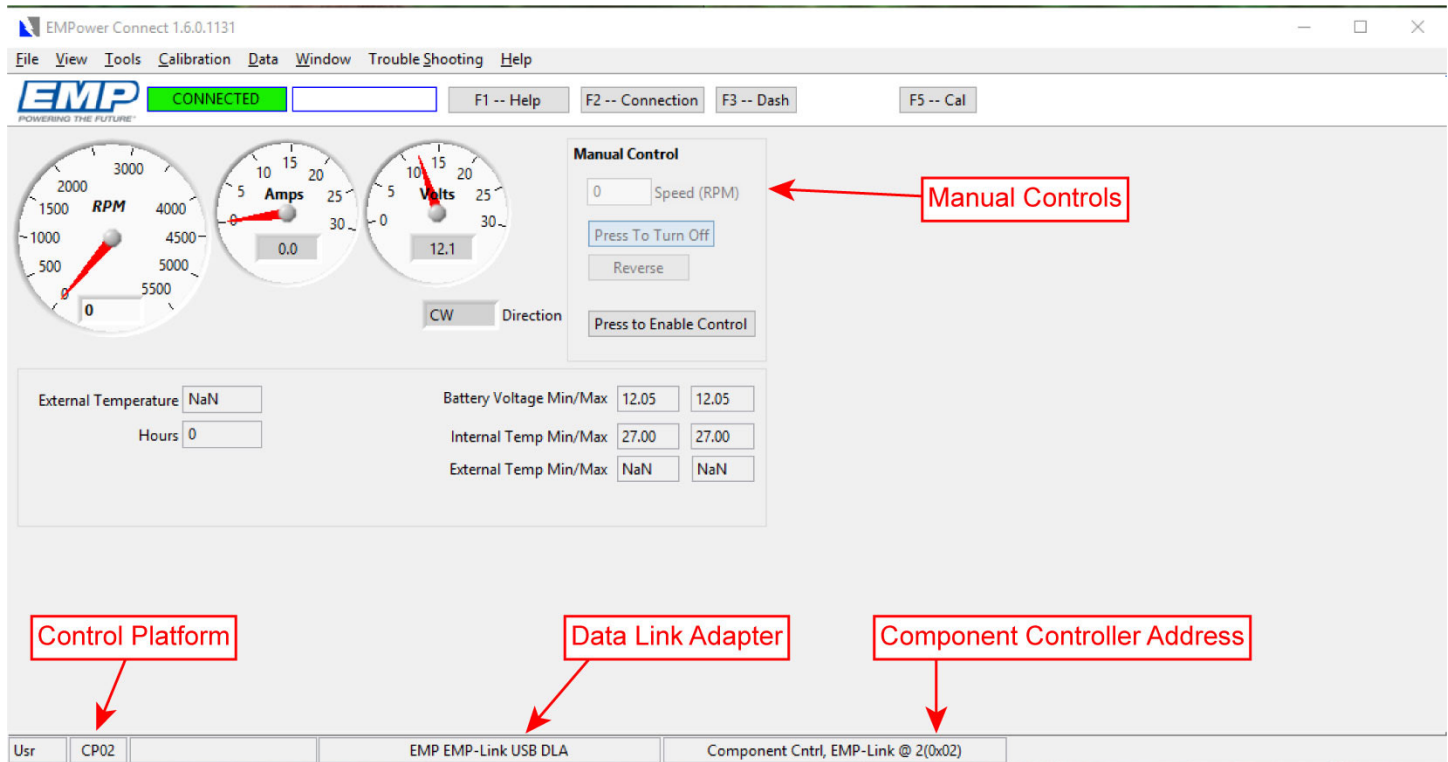
EMP Service Suite is available at no cost on the [EMP website](#). To use the EMPower Connect service tool, download and install the Service Suite software on a Windows PC. EMPower Connect software allows the user to monitor operation, manually control the component and collect history data from the controller.

Use breakout harness 3180036020 to interface with the 7-pin component connector and an EMP TTL/EMP-Link data link adapter 3640036049. These are available together in diagnostic kit number 7500038004.

For CAN components use breakout harness 3170073176 to interface with the power and ground and communication connectors and an RP1210 compatible data link adapter.

The *Service Suite User Guide and Tutorial*, including connection and control instructions, is embedded in the software and available on the [EMP website](#).

To view diagnostic code lists or troubleshooting guides when not connected to a component, select the guide matching the control platform of the component from the Trouble Shooting menu.



## Routine Maintenance

Frequency	Action
When checking/filling vehicle fluids	Ensure fluid levels are correct.
Every oil change	Inspect system for leaks. If a leak is suspected, before removing the pump, clean the area to properly locate the leak source. Sample oil and check to ensure oil meets recommended oil cleanliness (ISO 20/18/15).
Every three months or more often if conditions are harsh	Visually inspect exterior of pump for evidence of leaks or damage. Check wires for wear or frayed insulation. Ensure all electrical connections are tight.
Annually	Ensure plumbing connections are tightened to proper torque rating. Ensure all wires and pin connections are intact. Inspect support structure for any damage or loose hardware.

## Troubleshooting

Symptom	Probable Cause
Pump will not run	<ul style="list-style-type: none"> <li>• Incorrect supply voltage.</li> <li>• Blown fuse.</li> <li>• Electrical connection issue.</li> <li>• Pumping gear seized with debris.</li> <li>• Problem with ignition switch.</li> <li>• Operating temperatures out of spec.</li> </ul>
Pump not running at commanded speed	<ul style="list-style-type: none"> <li>• This may be normal operation due to the system design. An application that has a high downstream circuit flow restriction and/or a low fluid operating temp (increased fluid viscosity) will result in a pump reaching its electrical current limit and will thus roll back its speed to not exceed this limit. This speed limitation is a result of the motor controller protecting the electronics from a condition where excessive heat may build up in the controller. For pumps on CAN, the controller will always provide a status reason why the motor is not at commanded speed.</li> <li>• Using heavier weight oil.</li> </ul>
Pump won't prime	<ul style="list-style-type: none"> <li>• Clogged suction screen/strainer.</li> <li>• Inlet circuit leak.</li> <li>• Outlet circuit is blocked.</li> <li>• Low fluid level.</li> <li>• Incompatible fluid.</li> <li>• Worn or damaged pumping gear.</li> </ul>
Low flow rate	<ul style="list-style-type: none"> <li>• Clogged suction screen/strainer.</li> <li>• Inlet circuit leak.</li> <li>• Incompatible fluid.</li> <li>• Worn or damaged pumping gear.</li> <li>• Low supply voltage.</li> </ul>