RAVEN

*Simply improving your position.*[SM]

# Service Manual

## Injection Pump

### 1-40 oz./min. & 5-200 oz./min.

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016-0159-975

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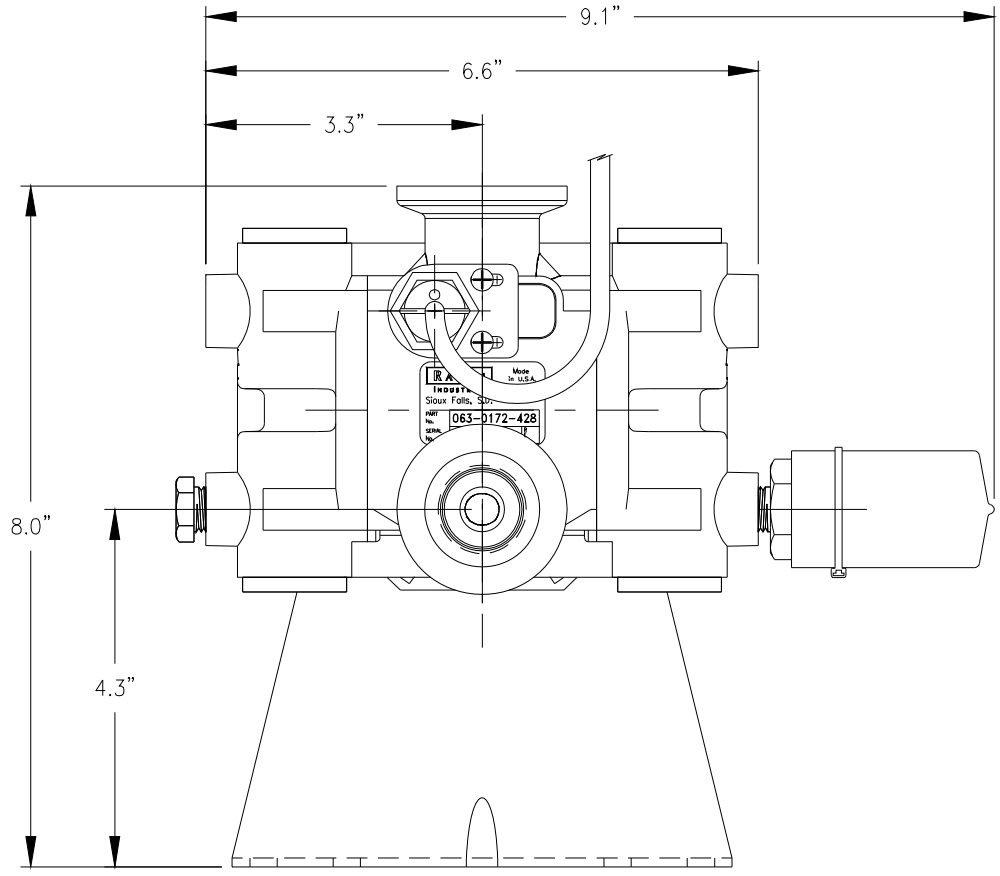
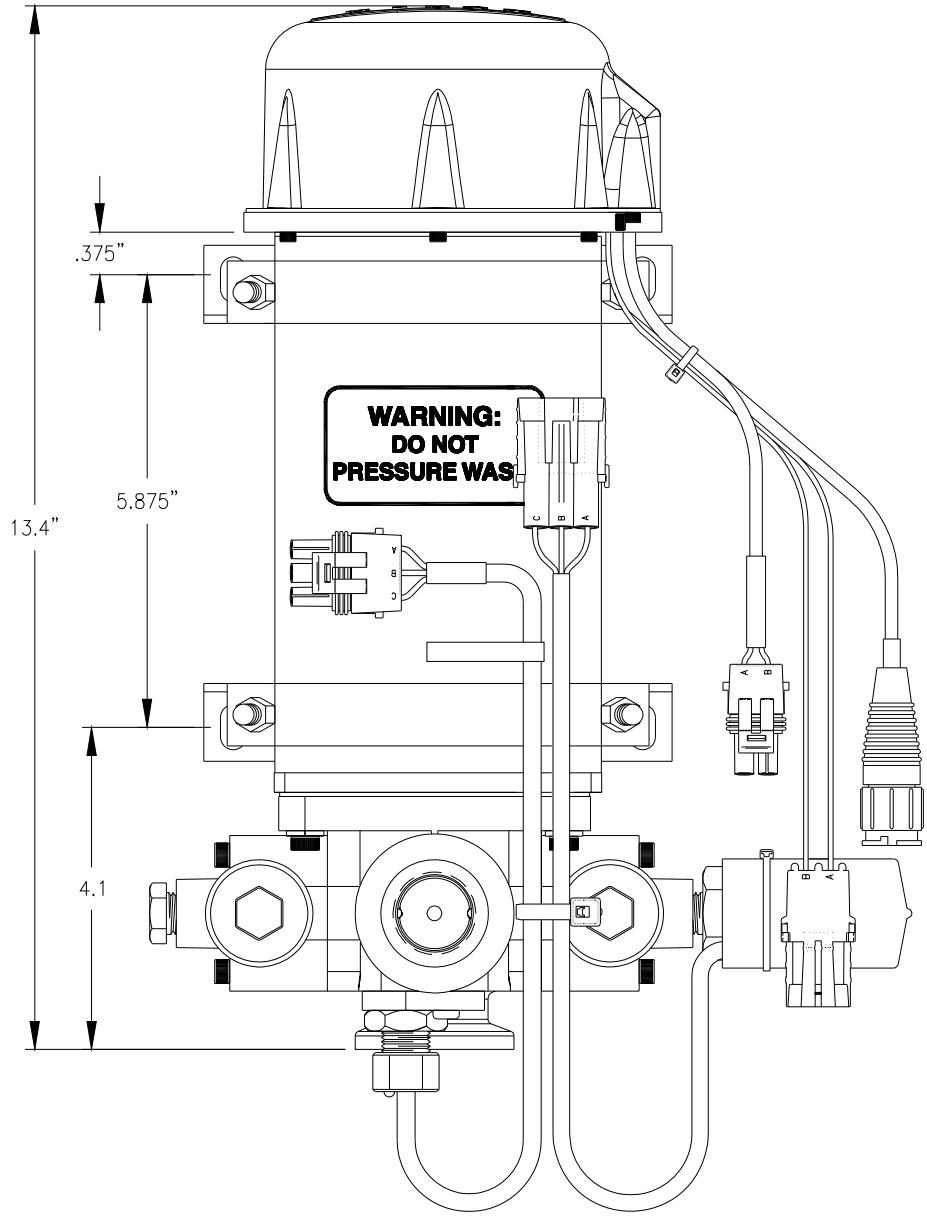
# GENERAL INFORMATION

The Raven Injection Pump is a positive displacement, piston pump. See Pump Maintenance section for details.

# SPECIFICATIONS

| | |
|---|---|
| Dimensions | See drawing below and on next page |
| Pistons | 1 @ .750" Dia. |
| Maximum Stroke Length | .390 in. |
| Flow Output Range | P/N 063-0172-428 5-200 oz/min P/N 063-0172-510 1-40 oz/min |
| Maximum Operating Pressure | 150 psi |
| Maximum Power Required | 1/4 Hp |
| Maximum Recommended Suction Lift | 2 ft. |
| Inlet & Outlet Plumbing | Mates with Banjo M100 Flange & 3/4" Female NPT |
| Wetted Parts | Polypropylene Stainless Steel |
| Body Material | Polypropylene |
| Wetted Seals/O-Rings | V965-80 Viton & Graphite Filled Teflon |






# INJECTION PUMP

## 1. PRIMING PROCEDURE

Injection Pump priming is required:

**1)** At initial start up.
**2)** If product tank has run empty.
**3)** When changing from one product to another.

To prime the Injection Pump, complete the following procedure.

**1)** Position the Injection Module hand valve for recirculation of product to Injection Module tank.
**2)** Run the Injection Pump at moderate speed for 3 minutes.
**3)** Return the Injection Module hand valve to operating position.

# 2. CALIBRATION VERIFICATION PROCEDURE

The Raven Injection Pump has been factory calibrated to constant listed on the calibration tag shown below in FIGURE 1. This should be verified periodically. Calibration verification is detailed for below. This tag is located on Metering Sensor cable of Injection Pump.

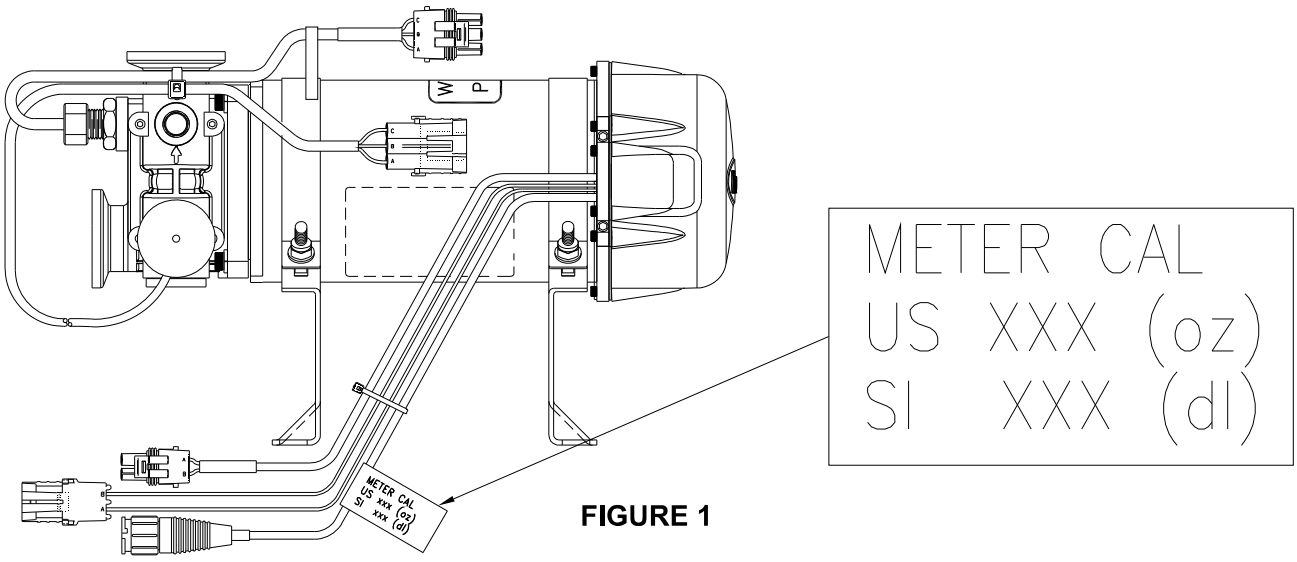



**FIGURE 1**

| **NOTE:** | The keys referenced in the steps below refer to using this pump with the Raven SIDEKICK system. |
|---|---|

**1.** Enter 50 oz. [15 dL] into the METER CAL key on the SCS SIDEKICK Console.

**2.** Place 3-way valve handle on Injection Pump to recirculate position.

**3.** Place BOOM and MASTER switches ON. Place the OFF/HOLD/RUN switch to RUN.

**4.** Run pump until liquid appears from tank return hose. Place OFF/HOLD/RUN switch to HOLD.

**5.** Enter "0" into TOTAL VOLUME key.

**6.** Place tank return hose into measuring container.

**7.** Place OFF/HOLD/RUN switch to RUN until 50 oz. [15 dL] of measured product is pumped. The number displayed in TOTAL VOLUME is the new METER CAL.

**8.** Enter this new METER CAL number in METER CAL key.

**9.** Enter "0" in TOTAL VOLUME key.

**10.** Place OFF/HOLD/RUN switch to RUN until 50 oz. [15 dL] of measured product is pumped.

**11.** The number in TOTAL VOLUME should be 50 (+/- 1) oz. [15 (+/- 1) dL].If not, repeat calibration procedures.

12. Empty tank return hose into measuring container.

13. Pour product caught in measuring container back into Injection Module Tank.

**NOTE:**

A. Typical causes for Injection System to under apply are:
   1. Fouled Pump Check Valves.
   2. Air leaks on Injection Pump inlet plumbing.
   3. Air entrained in chemical.
   4. Plugged inlet strainer.
   5. Chemical is too thick to flow thru inlet plumbing.

B. Typical cause for over application:
   Incorrect calibration data entered into Console.

CALIBRATION FLASK
106–0159–454

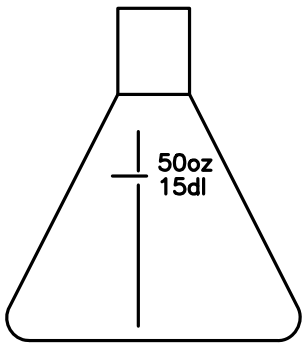



**FIGURE 2**

# 3. RECOMMENDED INJECTION PUMP FLUSH SYSTEM

The recommended flush system is shown in FIGURE 3. Strainers are recommended for the product and flush system water. Strainers suitable for concentrated product are typically 20 mesh stainless steel. It is recommended that a flush system be incorporated with the injection system. This will enhance the performance of the injection pump. The basic components are shown below and are available through your local spraying equipment supplier. This system shall be installed as shown and operated per the following instructions. The required frequency of flushing may vary per the product being injected.

**1)** Drain or empty Product Injection Tank. (Valve #2)

**2)** Place VALVE #3 in Recirculation position.

**3)** Place VALVE #1 in position to let clean water circulate thru Injection Pump from flush pump. **VENT CHEMICAL TANK.** Start flush System, pump approximately 1/2 gallon into Injection Tank.

**4)** Reposition VALVE #1 and VALVE #3 to allow rinse mixture to be injected. Spray rinse mixture at normal recommended rate.

**5)** Repeat this procedure until Pump and Tank are clean. (i.e. Triple rinse).

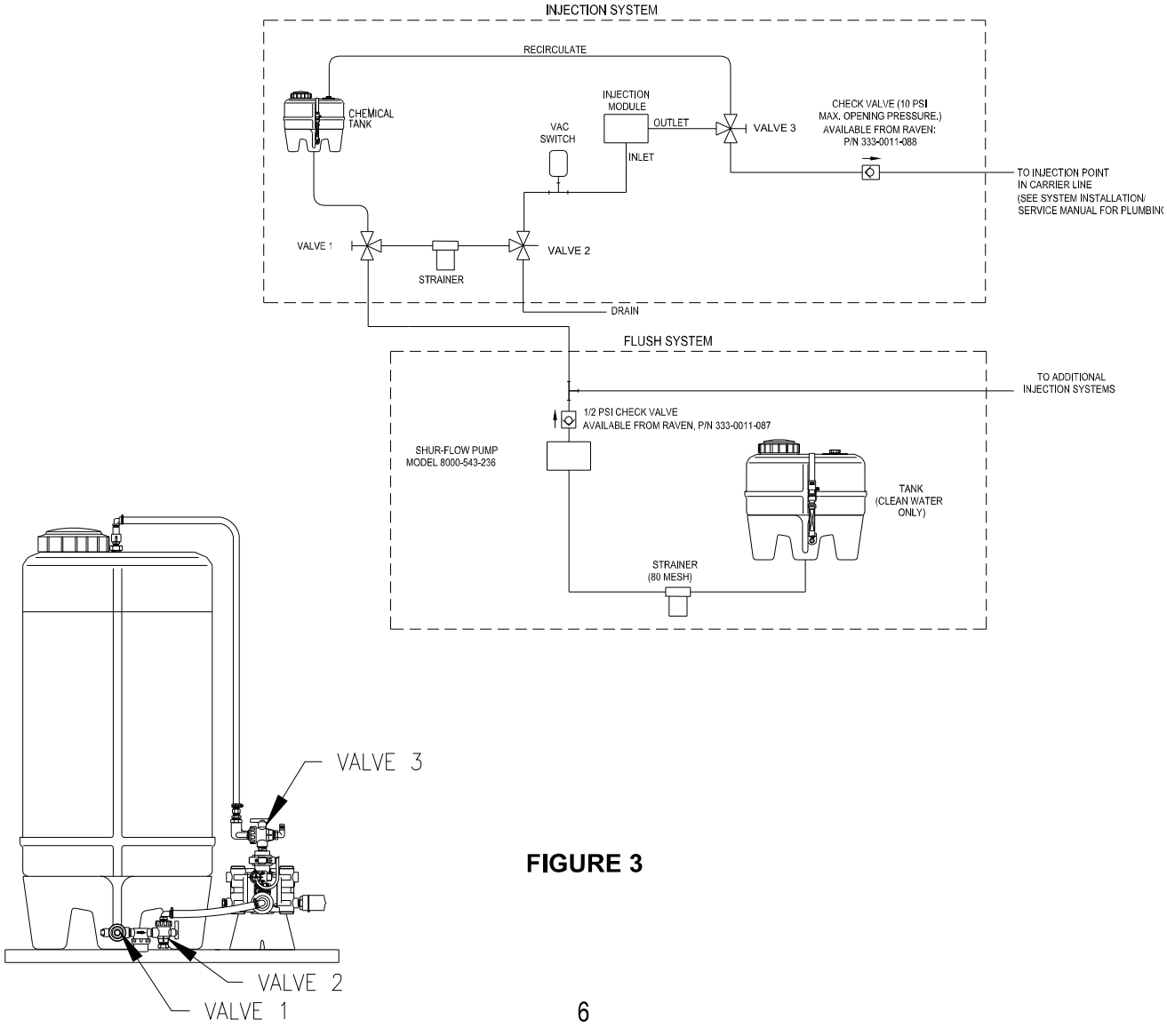



**FIGURE 3**

# MAINTENANCE

## 1. CLEANING OR REPLACING CHECK VALVE O-RINGS

Small particles of rust, sand, or grit may get trapped in the check valve seats. If this happens, the operator will notice a change in accuracy of application rate. It will be necessary to clean or replace the check valve o-rings. New o-rings are furnished in kit P/N 117-0159-987, which is available through your dealer. Complete the following procedure. Reference FIGURE 4 on page 8.

**1)** Empty any product from the Injection Module tank. Flush Pump with water.

**2)** Carefully remove the intake and discharge plugs from the Pump.

**3)** Examine o-ring around outside of valve assembly. Replace if cut or nicked. See note below.

| | |
|---|---|
| **NOTE:** | These o-rings are made of a chemical resistant compound and should only be replaced with o-rings supplied by your Dealer. |

**4)** Disassemble check valve assemblies per instructions on page 8. To prevent loss of parts place valve assembly inside clear plastic bag prior to doing this procedure. Examine the guide, spring, and poppet. Examine the poppet o-ring. Check for wear, pits, swelling, or foreign matter. Clean or replace if necessary. See note above.

**5)** Reassemble check valve assemblies per instructions on page 8. Do not interchange springs from the discharge and intake valves. The heavy spring is for the discharge valve (top), and the light spring is for the intake valve (bottom).

**6)** Apply petroleum jelly to valve body o-rings. Press check valve assemblies into the Pump head. Tighten plug.

## CLEANING PUMP CAM AND BEARING

1) Chemicals may seep into bearing cavity. Remove pump from motor and clean surfaces of cam and bearing. Apply a heavy coating of automotive grease to the area where the piston engages the cam bearing and re-assemble pump to motor.

**2)** Replace sealed bearing if needed.

# 2. PUMP VALVE ORDER OF ASSEMBLY AND REPLACEMENT PARTS

**CAUTION:** WHERE SAFETY GLASSES DURING ALL ASSEMBLY AND DISASSEMBLY OF VALVES.

Reference FIGURE 4.

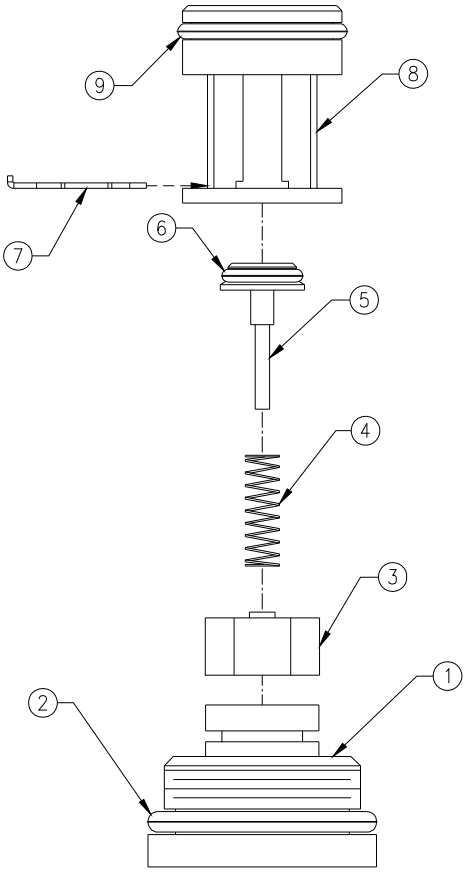
| ITEM | DESCRIPTION | RAVEN PART # |
|---|---|---|
| 1 | Fitting, Plug | 107-0171-519 |
| 2 | O-Ring | 219-0002-912 |
| 3 | Guide, Poppet | 107-0159-934 |
| 4 | Spring | 314-0000-006 |
| 5 | Poppet | 107-0159-935 |
| 6* | O-Ring (Viton) | 219-0007-011 |
| 7 | Clip, Retainer | 107-0171-576 |
| 8 | Valve Body, Discharge | 106-0159-621 |
| 9* | O-Ring (Viton) | 219-0002-018 |

* O-Rings included in kit P/N 117-0159-987

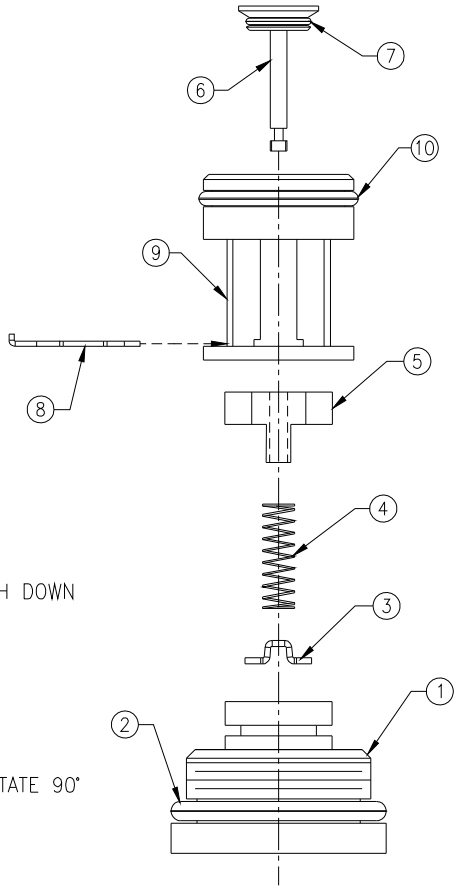
| ITEM | DESCRIPTION | RAVEN PART # |
|---|---|---|
| 1 | Fitting, Plug | 107-0171-519 |
| 2 | O-Ring | 219-0002-912 |
| 3 | Retainer, Intake | 107-0171-459 |
| 4 | Spring | 314-0000-005 |
| 5 | Guide, Poppet | 107-0171-092 |
| 6 | Stem, Poppet | 107-0171-447 |
| 7* | O-Ring (Viton) | 219-0007-011 |
| 8 | Clip, Retainer | 107-0171-576 |
| 9 | Valve, Body Intake | 106-0159-622 |
| 10* | O-Ring (Viton) | 219-0002-018 |

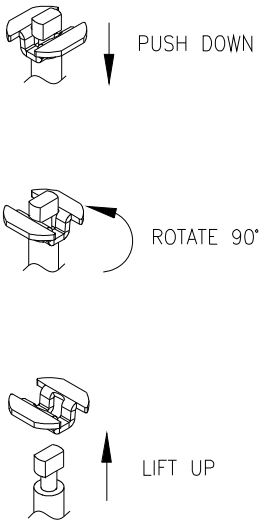
* O-Rings included in kit P/N 117-0159-987

DISCHARGE VALVE ASSY (063-0172-504)




INTAKE VALVE ASSY (063-0172-503)




SPRING RETAINER DETAIL

**FIGURE 4**

# 3. REPLACEMENT OF PISTON SEALS

Install new seals when Pump leaks excessive product. Leakage will be through weep hole on the underside of the pump housing. New seals are furnished in kit 117-0159-987, which is available through your dealer. To install the seal kit, complete the following Steps.

| For reference diagrams during this procedure see:<br>Figures 4, 5, AND 6 |
|---|

**1)** Empty any product from the Injection Module tank. Flush the Pump with water.

**2)** Disconnect the plumbing and wiring from the pump. Take the pump to a work bench. Separate the pump from the motor by removing 4 socket head screws.

**3)** Loosen and remove the four socket head cap screws that secure each Pump head to the crankcase. Remove the heads. Take care not to damage the finish on the exposed piston. Watch for a stainless steel ball in case it would fall out during removal of the pump head (ref. Fig 6). Remove the 2 balls and magnet assembly from the pump.

**4)** Remove the slipper seals and o-rings from the pump. The slipper seal and o-rings may stay in the pump head or stay on the piston.

| **NOTE:** | These o-rings are made of a chemical resistant compound and should only be replaced with o-rings supplied by your Dealer. |
|---|---|

**5)** Inspect the piston for scratches. Piston must be smooth. If not, replace the piston.

**6)** Inspect the piston bearing for wear. Replace if necessary.

SEAL INSTALLATION
Refer to Figure 6. Complete one side before starting the other.

**7)**
a. Start by installing the slipper seal (item 3) onto the piston.
b. Use some general purpose grease to lubricate o-ring (item 2). Place this o-ring over the slipper seal.
c. Install o-rings (item 1) in head. If they tend to fall out before head is installed, use more lubricant on o-ring.
d. Install head on side just completed.
e. Install stainless steel balls, magnet assembly and spring in correct order. Ref. Figure 6.
f. Repeat process on remaining side of pump.

**8)** Tighten bolts to torque specified in Figures 5 and 6.

# 4. SEALS

Reference Figures 5 & 6.

| ITEM | DESCRIPTION | RAVEN PART # | QTY |
|---|---|---|---|
| 1 | O-ring, Viton | 219-0002-015 | 4 |
| 2 | O-ring, Compound 117965-80 | 219-0007-117 | 2 |
| 3 | Seal, Slipper 3/4" | 219-0000-125 | 2 |
| 4* | O-ring (check valve poppet) | 219-0007-011 | 4 |
| 5* | O-ring (check valve plug) | 219-0002-018 | 4 |

Seals/O-rings listed above are available in kit P/N 117-0159-987

* See Figure 6 below for assembly of items 1-3. Refer to Figure 4 on page 8 for installation.

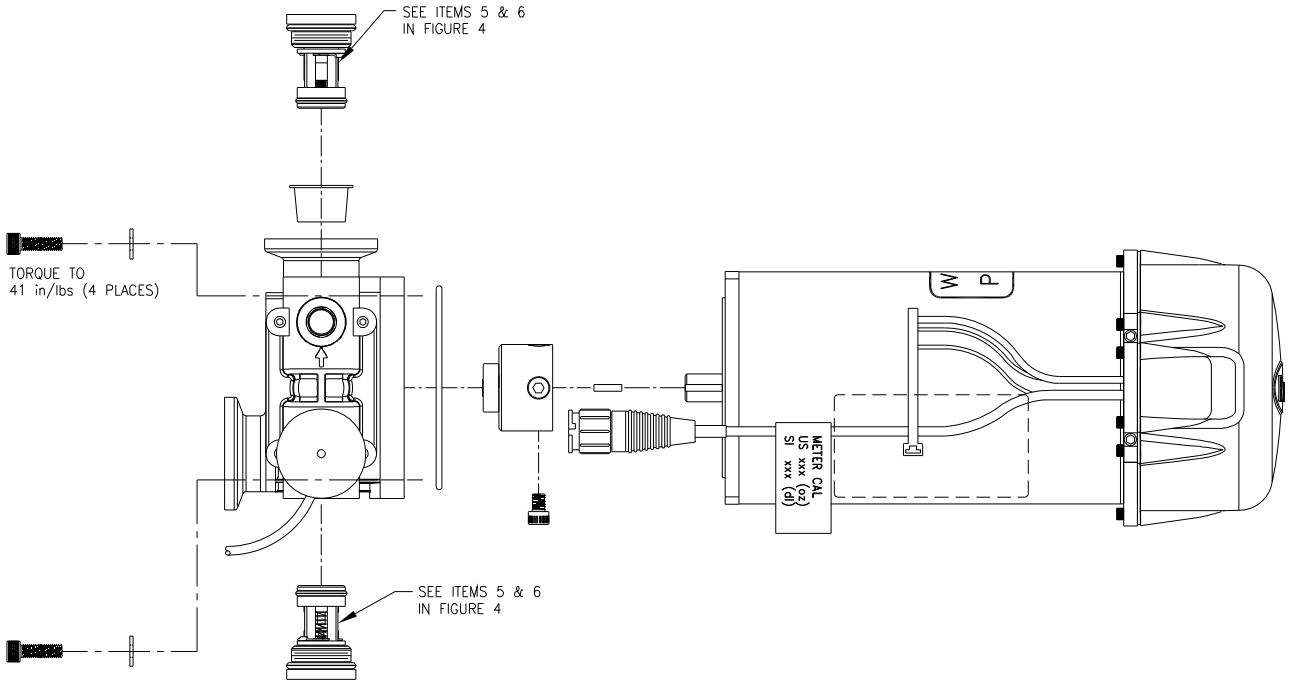



**FIGURE 5**

**PUMP SEPARATION FROM MOTOR**

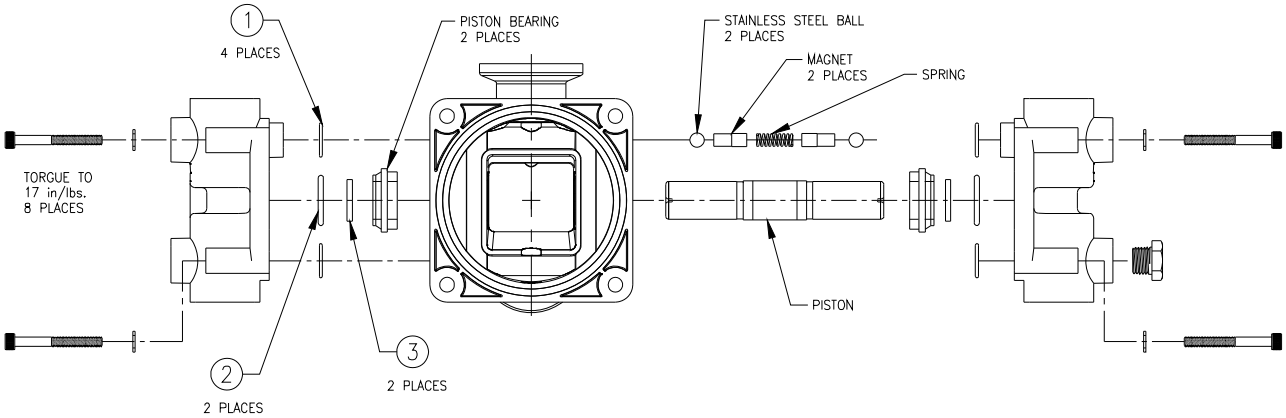



**FIGURE 6**

**SEAL INSTALLATION**

# 5. LUBRICATION

No lubrication is required. Pump bearing is permanently lubricated.

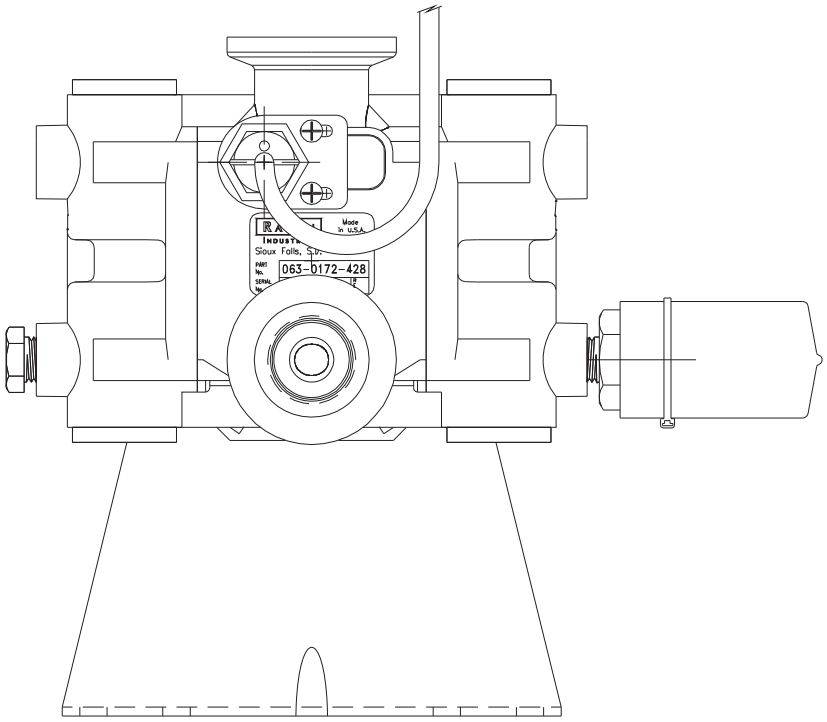



**FIGURE 7**

# 6. STORAGE & MAINTENANCE

Prepare the Injection Pump for storage as follows:

**1)** Flush any product remaining in the pump by recirculating water through the Injection Module. Flush the system with kerosene or fuel oil to remove hardened product clumps.

Remove, clean and inspect the discharge and intake valve cartridges from the pump. It is best to perform maintenance on each valve cartridge independently to ensure each valve cartridge is re-installed correctly. **Be sure to re-install the discharge and intake valves in the correct ports on the pump.**

**2)** Recirculate a 50% water and 50% automotive antifreeze mixture through the Injection Module.

**3)** Chemicals may seep into bearing cavity. Remove pump from motor and clean surfaces of cam and bearing. Apply a heavy coating of automotive grease to the area where the piston engages the cam bearing and re-assemble pump to motor.

**4)** Failure to perform seasonal maintenance may result in damage to components.

# 7. SENSITIVITY ADJUSTMENT PROCEDURE, MANIFOLD FLOW MONITOR

**1.** Position injection modules hand valve to recirculate. Run pump to prime system. Inspect for any leaks. Repair as necessary.

**2.** Monitor volume per minute. Manually adjust pump output, Hi Vol - 5 oz. per min / Lo Vol - 1 oz. per min.

**3.** Visually monitor LED on manifold sensor. Adjust manifold sensor left or right until LED flashes. Tighten screws on bracket. Ref. Figure 8.

**4.** Verify LED continues to flash.

**5.** Manually adjust pump output to 40 oz/min. Verify LED continues to flash.

**6.** During normal operation LED shall flash. If pump pumps on only one cylinder, LED will no longer flash. Flow error message will be displayed on console.

**7.** Return hand valve to injection position.

**NOTE:** To read vol/min, refer to SIDEKICK CONSOLE Manual.

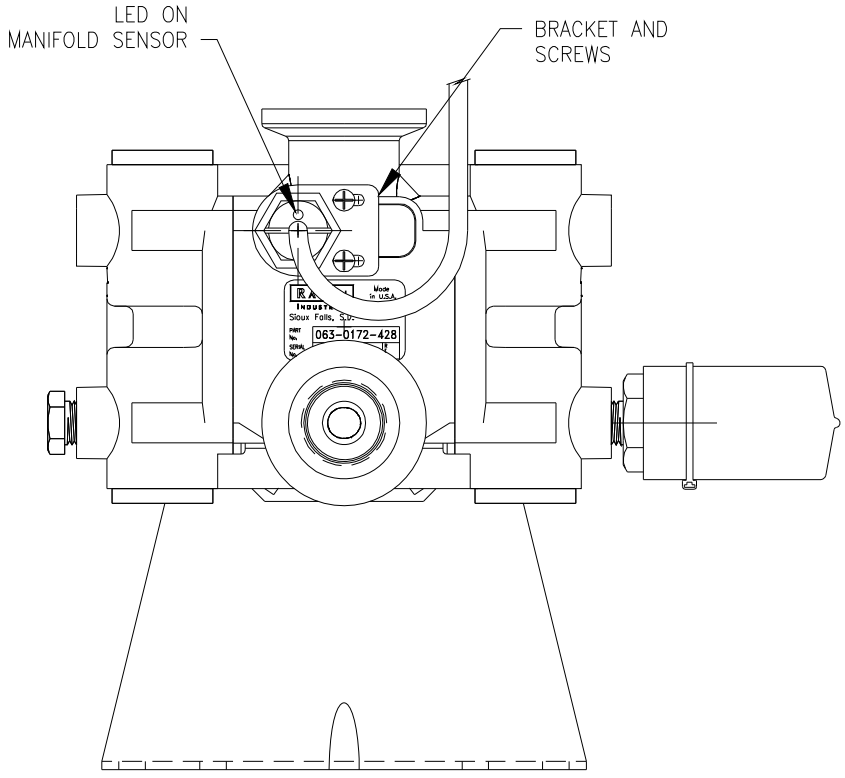
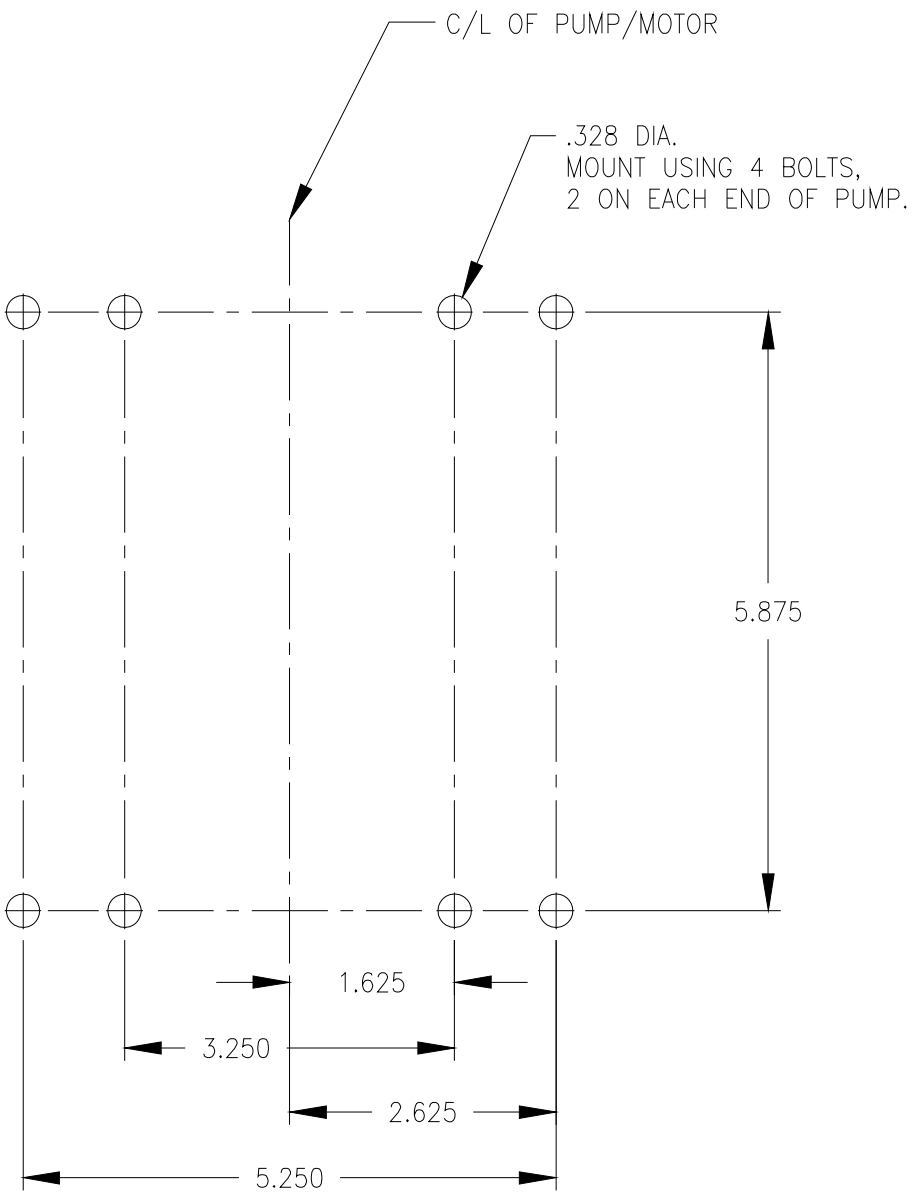
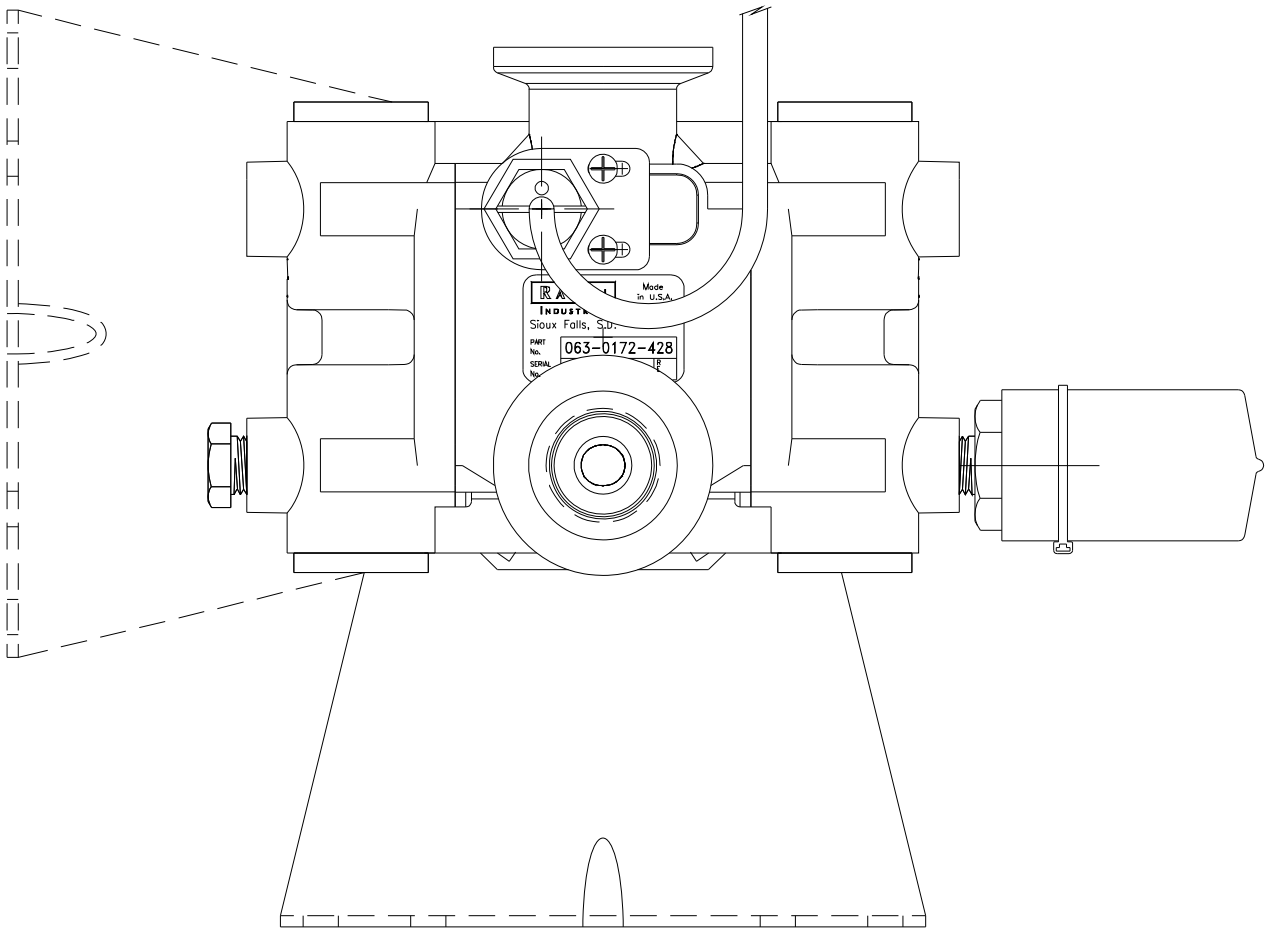



**FIGURE 8**

# PUMP MOUNTING PATTERN



# PUMP MOUNTING

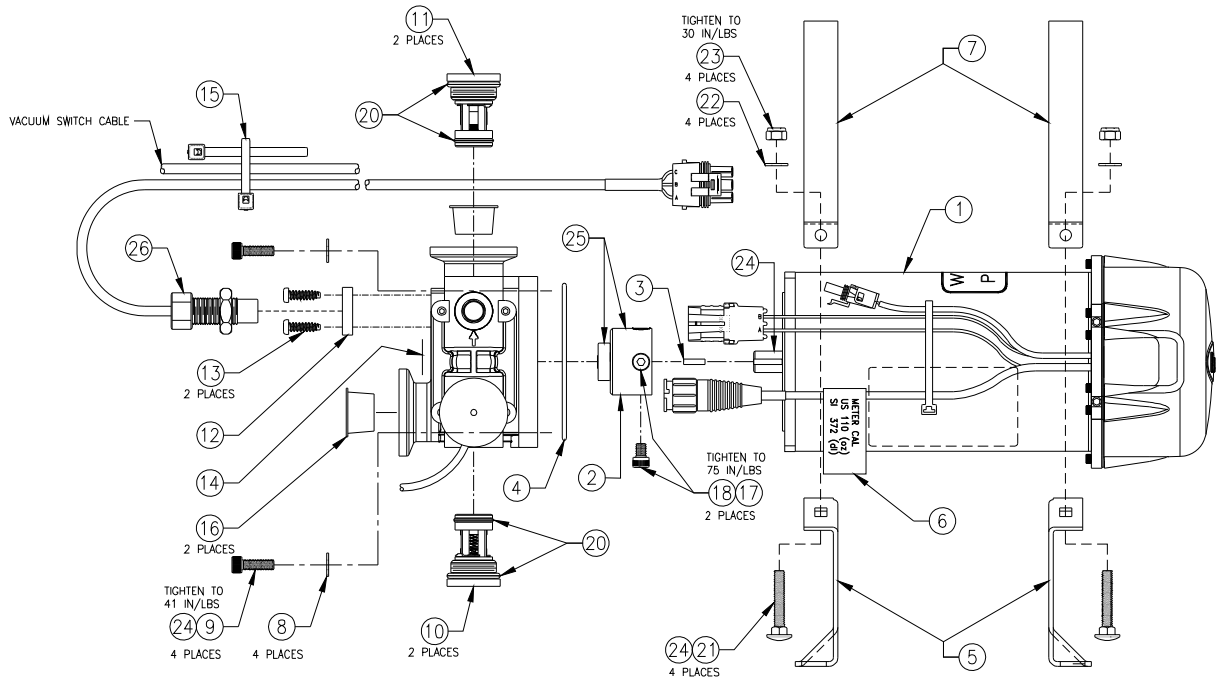



MOUNTING BRACKET MAY BE ROTATED TO ACCOMODATE SIDE MOUNTING, HOWEVER PUMP MUST REMAIN LEVEL AND PERPENDICULAR TO THE GROUND AS SHOWN.

# RAVEN INJECTION PUMP , 5-200 oz/min.
# REPLACEMENT P ARTS

063-0172-428

| ITEM | DESCRIPTION | RAVEN PART # |
|---|---|---|
| 1 | Motor/Tach Assembly | 063-0172-500 |
| 2 | Bearing Assembly | 063-0172-501 |
| 3 | Key | 107-0171-588 |
| 4 | O-Ring | 219-0001-153 |
| 5 | Bracket, Mounting, Pump/Motor | 107-0171-589 |
| 6 | Label, Meter Cal | 041-0159-718 |
| 7 | Strap | 107-0171-594 |
| 8 | Washer, Internal Tooth, Lock 1/4” SS | 313-3000-017 |
| 9 | Screw, Socket Heat, Cap 1/4”-20 x 3/4” | 311-0073-066 |
| 10 | Cartridge, Intake | 063-0172-503 |
| 11 | Cartridge, Discharge | 063-0172-504 |
| 12 | Bracket, Sensor | 106-0159-539 |
| 13 | Screw | 311-0004-040 |
| 14 | Label, Serial | 041-0159-710 |
| 15 | Tie, Cable | 435-1000-003 |
| 16 | Cap, Tapered | 118-0159-041 |
| 17 | Thread Sealant Loctite #242 | 222-1001-029 |
| 18 | Screw, Cap, Hex Socket Head 1/4-20 x 1/4 | 311-0068-060 |
| 19 | Manual (Not Shown) | 016-0159-975 |
| 20 | Grease, Lubricating, Versilube | 222-0000-002 |
| 21 | Bolt, 1/4”-20 x 1” | 311-0069-004 |
| 22 | Washer | 313-2300-009 |
| 23 | Nut | 312-4000-057 |
| 24 | Anti-Sieze Compound, Nickel | 222-1001-079 |
| 25 | Grease | 222-1001-114 |
| 26 | Sensor, Universal, Flowmonitor | 063-0172-525 |

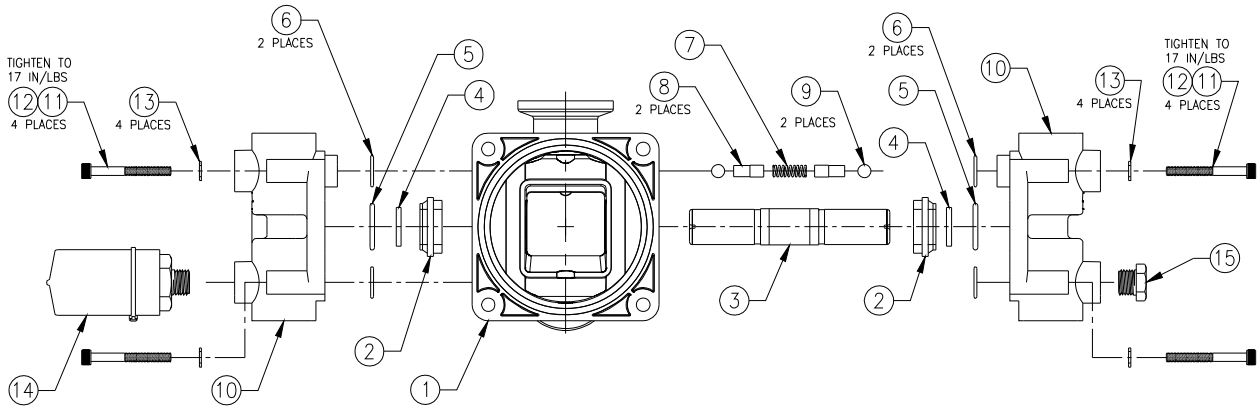



054-0159-290

# RAVEN INJECTION PUMP , 5-200 oz/min.
# REPLACEMENT P ARTS

063-0172-428

| ITEM | DESCRIPTION | RAVEN PART # |
|---|---|---|
| 1 | Housing, 3/4" Injection Pump | 107-0171-523 |
| 2 | Bearing, Piston | 325-0000-018 |
| 3 | Piston, 3/4" Pump | 107-0171-531 |
| 4 | Seal, Slipper | 219-0000-125 |
| 5 | O-Ring | 219-0007-117 |
| 6 | O-Ring | 219-0002-015 |
| 7 | Spring | 314-0000-012 |
| 8 | Magnet Assembly | 063-0172-518 |
| 9 | Ball | 321-0000-313 |
| 10 | Head, 3/4" Pump | 107-0171-526 |
| 11 | Screw 10-24 x 1 1/2" SS | 311-0068-191 |
| 12 | Anti-Sieze Compound, Nickel | 222-1001-079 |
| 13 | Washer, Internal Tooth Lock | 313-3000-014 |
| 14 | Switch, Vacuum | 063-0171-035 |
| 15 | Plug, Hex, Pipe | 333-0009-061 |
| 16 | Seal Kit (Not Shown) | 117-0159-987 |

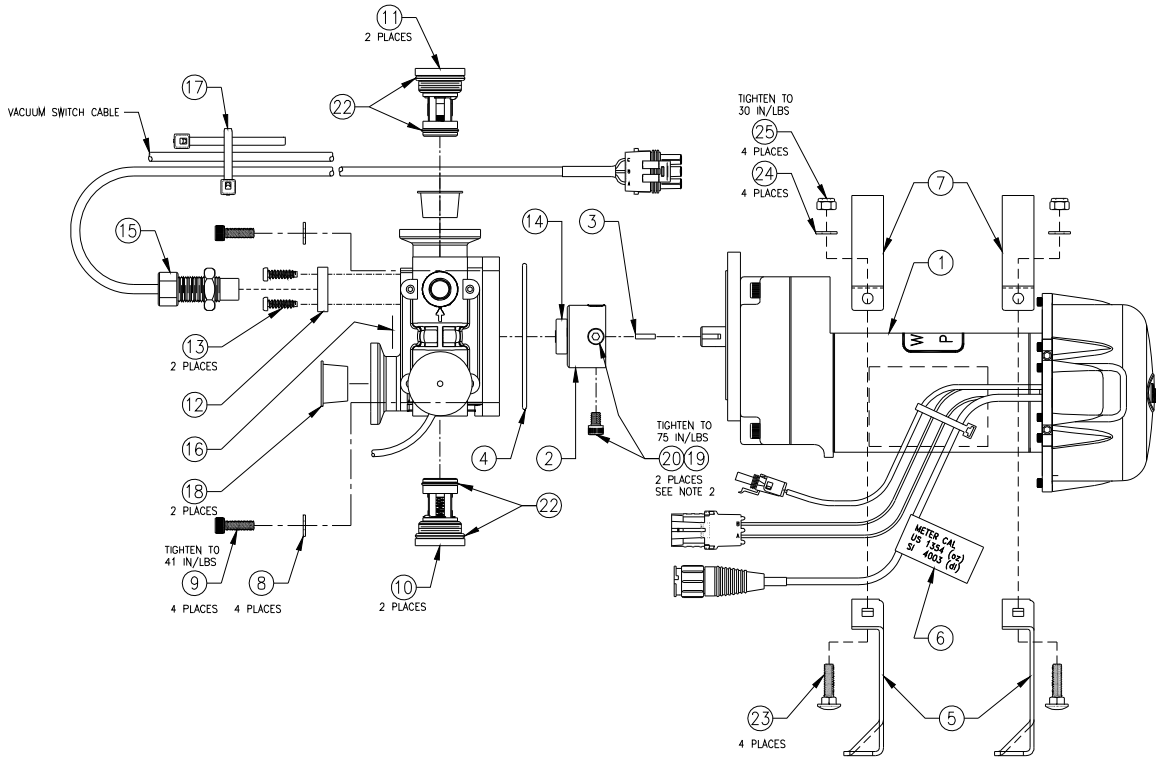



054-0159-290

# RAVEN INJECTION PUMP , 1-40 oz/min.
# REPLACEMENT P ARTS

063-0172-510

| ITEM | DESCRIPTION | RAVEN PART # |
|---|---|---|
| 1 | Motor/Tach Assembly | 063-0172-527 |
| 2 | Bearing Assembly | 063-0172-501 |
| 3 | Key | 107-0171-588 |
| 4 | O-Ring | 219-0001-153 |
| 5 | Bracket, Mounting, Pump/Motor | 107-0171-599 |
| 6 | Label, Meter Cal | 041-0159-720 |
| 7 | Strap | 107-0171-600 |
| 8 | Washer, Internal Tooth, Lock 1/4” SS | 313-3000-017 |
| 9 | Screw, Socket Heat, Cap 1/4”-20 x 3/4” | 311-0073-066 |
| 10 | Cartridge, Intake | 063-0172-503 |
| 11 | Cartridge, Exhaust | 063-0172-504 |
| 12 | Bracket, Sensor | 106-0159-539 |
| 13 | Screw | 311-0004-040 |
| 14 | Grease | 222-1001-114 |
| 15 | Sensor, Universal, Flowmonitor | 063-0172-525 |
| 16 | Label, Serial | 041-0159-721 |
| 17 | Tie, Cable | 435-1000-003 |
| 18 | Cap, Tapered | 118-0159-041 |
| 19 | Thread Sealant Loctite #242 | 222-1001-029 |
| 20 | Screw, Cap, Hex Socket Head 1/4-20 x 1/4 | 311-0068-060 |
| 21 | Manual (Not Shown) | 016-0159-975 |
| 22 | Grease, Lubricating, Versilube | 222-0000-002 |
| 23 | Bolt, 1/4”-20 x 1” | 311-0069-004 |
| 24 | Washer | 313-2300-009 |
| 25 | Nut | 312-4000-057 |

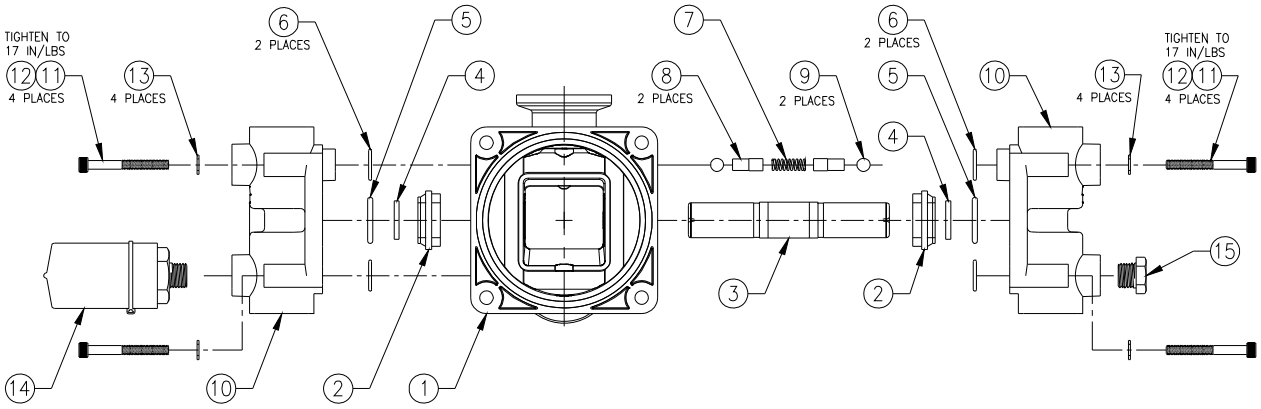



054-0159-291

# RAVEN INJECTION PUMP , 1-40 oz/min.
# REPLACEMENT P ARTS

063-0172-510

| ITEM | DESCRIPTION | RAVEN PART # |
|---|---|---|
| 1 | Housing, 3/4” Injection Pump | 107-0171-523 |
| 2 | Bearing, Piston | 325-0000-018 |
| 3 | Piston, 3/4” Pump | 107-0171-531 |
| 4 | Seal, Slipper | 219-0000-125 |
| 5 | O-Ring | 219-0007-117 |
| 6 | O-Ring | 219-0002-015 |
| 7 | Spring | 314-0000-012 |
| 8 | Magnet Assembly | 063-0172-518 |
| 9 | Ball | 321-0000-313 |
| 10 | Head, 3/4” Pump | 107-0171-526 |
| 11 | Screw 10-24 x 1 1/2” SS | 311-0068-191 |
| 12 | Anti-Sieze Compound, Nickel | 222-1001-079 |
| 13 | Washer, Internal Tooth Lock | 313-3000-014 |
| 14 | Switch, Vacuum | 063-0171-035 |
| 15 | Plug, Hex, Pipe | 333-0009-061 |

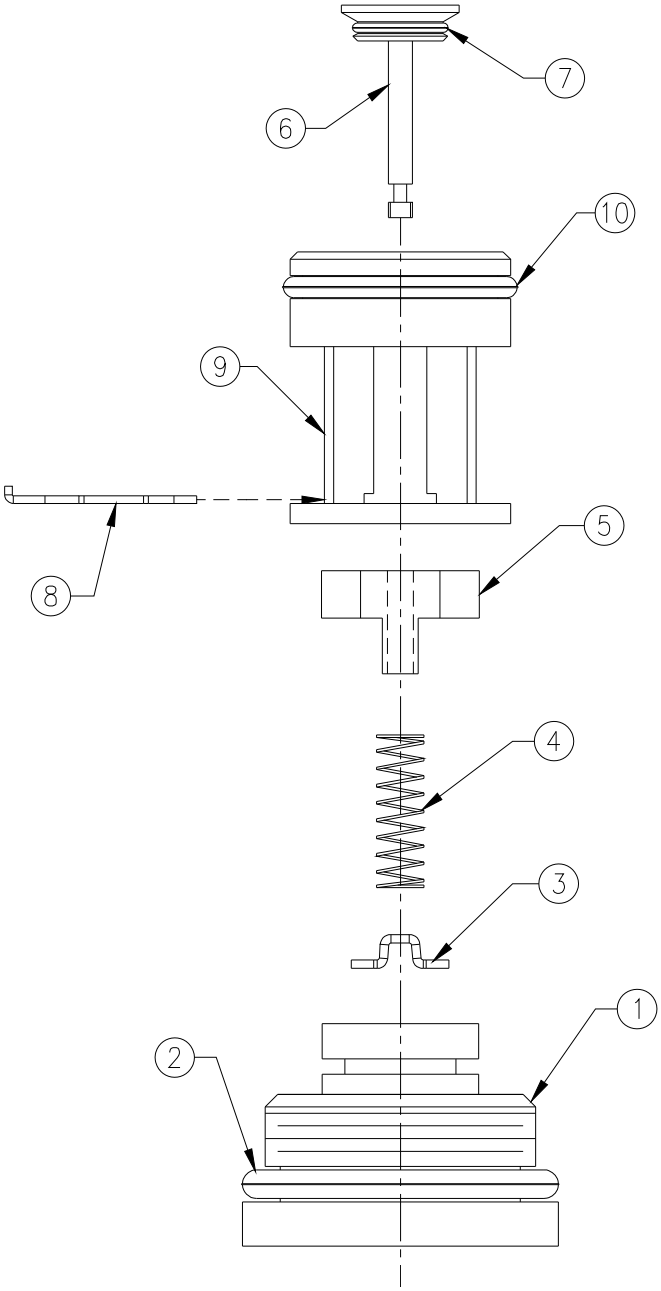



054-0159-291

# INTAKE V ALVE REPLACEMENT P ARTS

063-0172-503

| ITEM | DESCRIPTION | RAVEN PART # |
|---|---|---|
| 1 | Fitting, Plug | 107-0171-519 |
| 2 | O-Ring | 219-0002-912 |
| 3 | Retainer, Intake | 107-0171-459 |
| 4 | Spring | 314-0000-005 |
| 5 | Guide, Poppet | 107-0171-092 |
| 6 | Stem, Poppet | 107-0171-447 |
| 7 | O-Ring | 219-0007-011 |
| 8 | Clip, Retainer | 107-0171-576 |
| 9 | Valve, Body Intake | 106-0159-622 |
| 10 | O-Ring | 219-0002-018 |

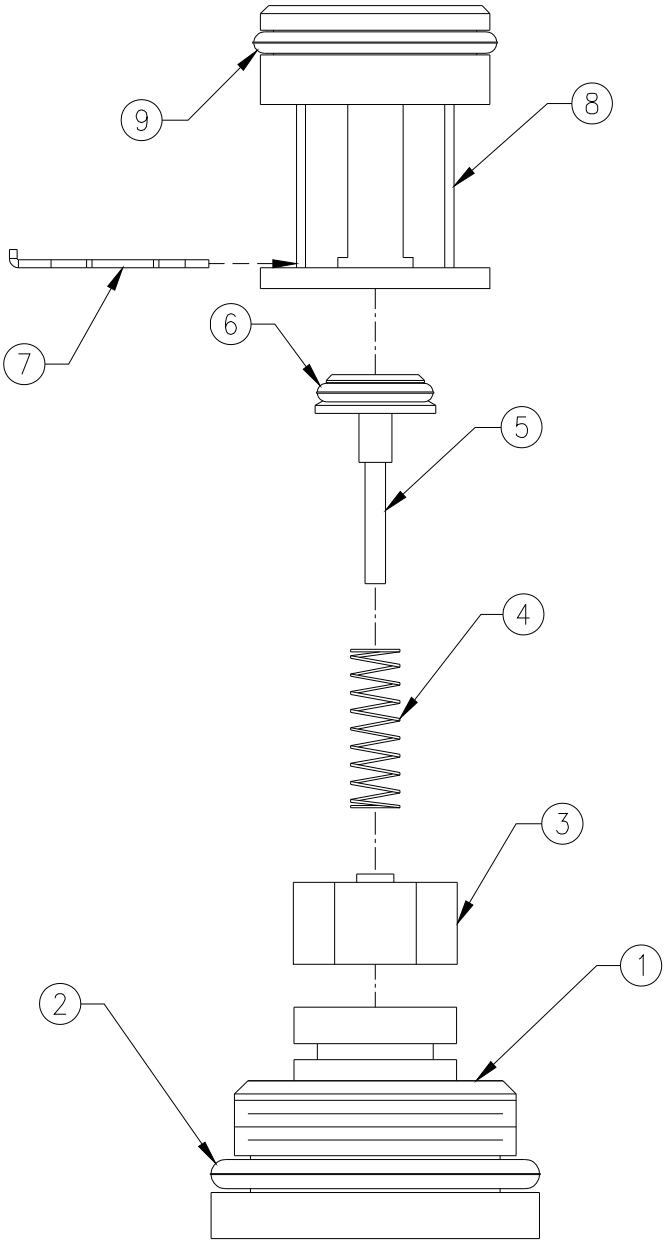



054-0159-292

# DISCHARGE V ALVE REPLACEMENT  P ARTS

063-0172-504

| ITEM | DESCRIPTION | RAVEN PART # |
|---|---|---|
| 1 | Fitting, Plug | 107-0171-519 |
| 2 | O-Ring | 219-0002-912 |
| 3 | Guide, Poppet | 107-0159-934 |
| 4 | Spring | 314-0000-006 |
| 5 | Poppet | 107-0159-935 |
| 6 | O-Ring | 219-0007-011 |
| 7 | Clip, Retainer | 107-0171-576 |
| 8 | Valve, Body Discharge | 106-0159-621 |
| 9 | O-Ring | 219-0002-018 |

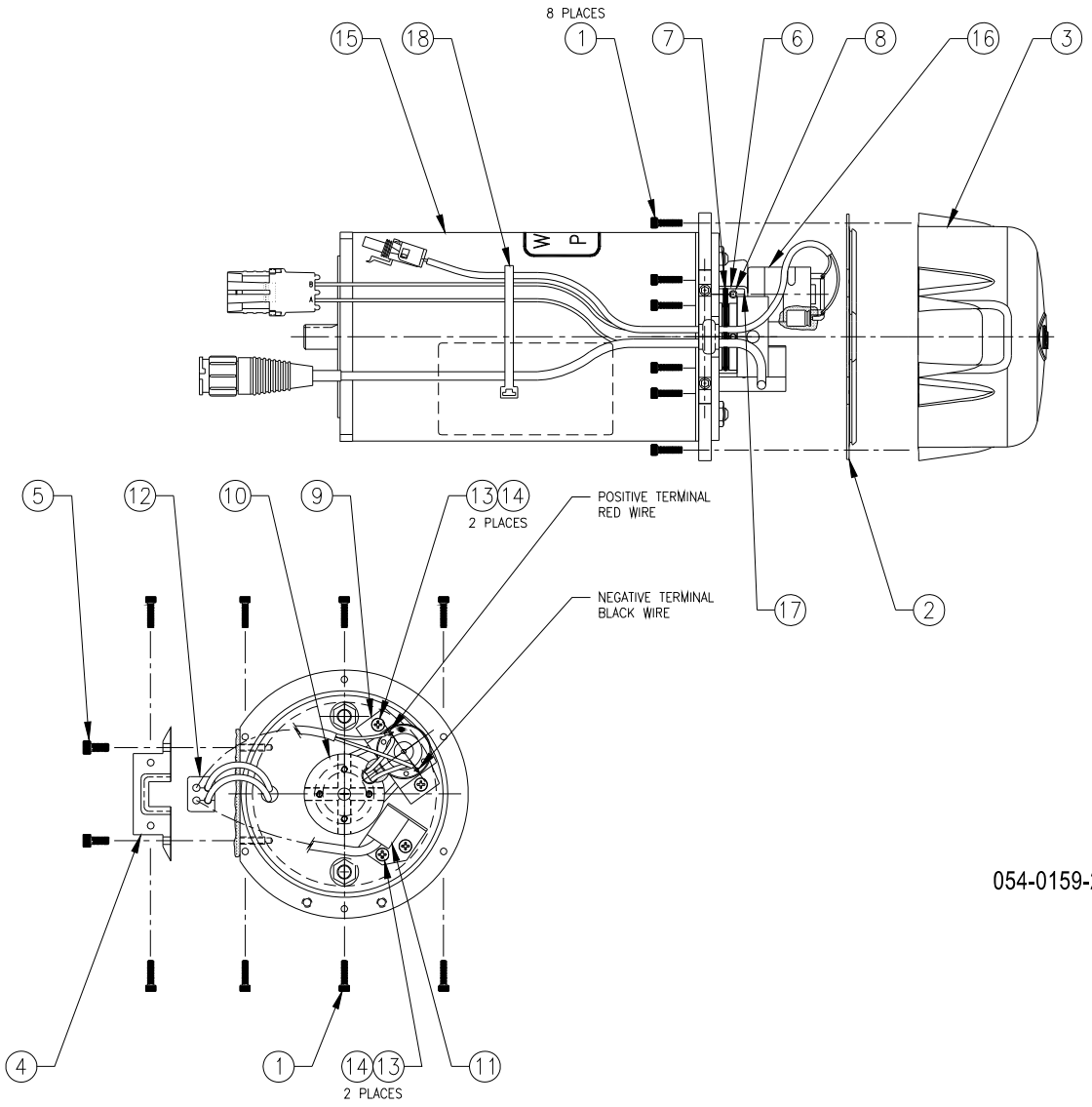



054-0159-293

# MOTOR/TACH ASSEMBLY 5-200 oz/min.
# REPLACEMENT PARTS

063-0172-500

| ITEM | DESCRIPTION | RAVEN PART # |
|---|---|---|
| 1 | Screw, Socket Head Cap #4-40 x 1/2" | 311-0068-007 |
| 2 | Gasket, Enclosure | 106-0159-576 |
| 3 | Enclosure | 106-0159-577 |
| 4 | Clamp, Strain Relief | 107-0171-470 |
| 5 | Screw, Socket Head Cap #6-32 x 1/2" | 311-0068-025 |
| 6 | Pulley, Small | 107-0171-437 |
| 7 | O-Ring | 219-0003-126 |
| 8 | Screw, Hex Cap #4-40 unc 2A x 1/4" LG | 311-0068-003 |
| 9 | Bracket, Mounting | 107-0171-473 |
| 10 | Assembly, Pulley | 063-0172-306 |
| 11 | Sensor, Speed | 063-0172-351 |
| 12 | Strain Relief/Grommet | 107-0171-478 |
| 13 | Screw, Phillips Pan Head #6-32 x 1/4" | 311-0004-005 |
| 14 | Washer, Lock, Internal #6 | 313-3000-007 |
| 15 | Motor, Electric | 416-0000-033 |
| 16 | Tach Assembly | 063-0172-312 |
| 17 | Screw, Metric Machine M2.6 x 6.0 mm | 311-0070-004 |
| 18 | Tie, Cable | 435-1000-002 |

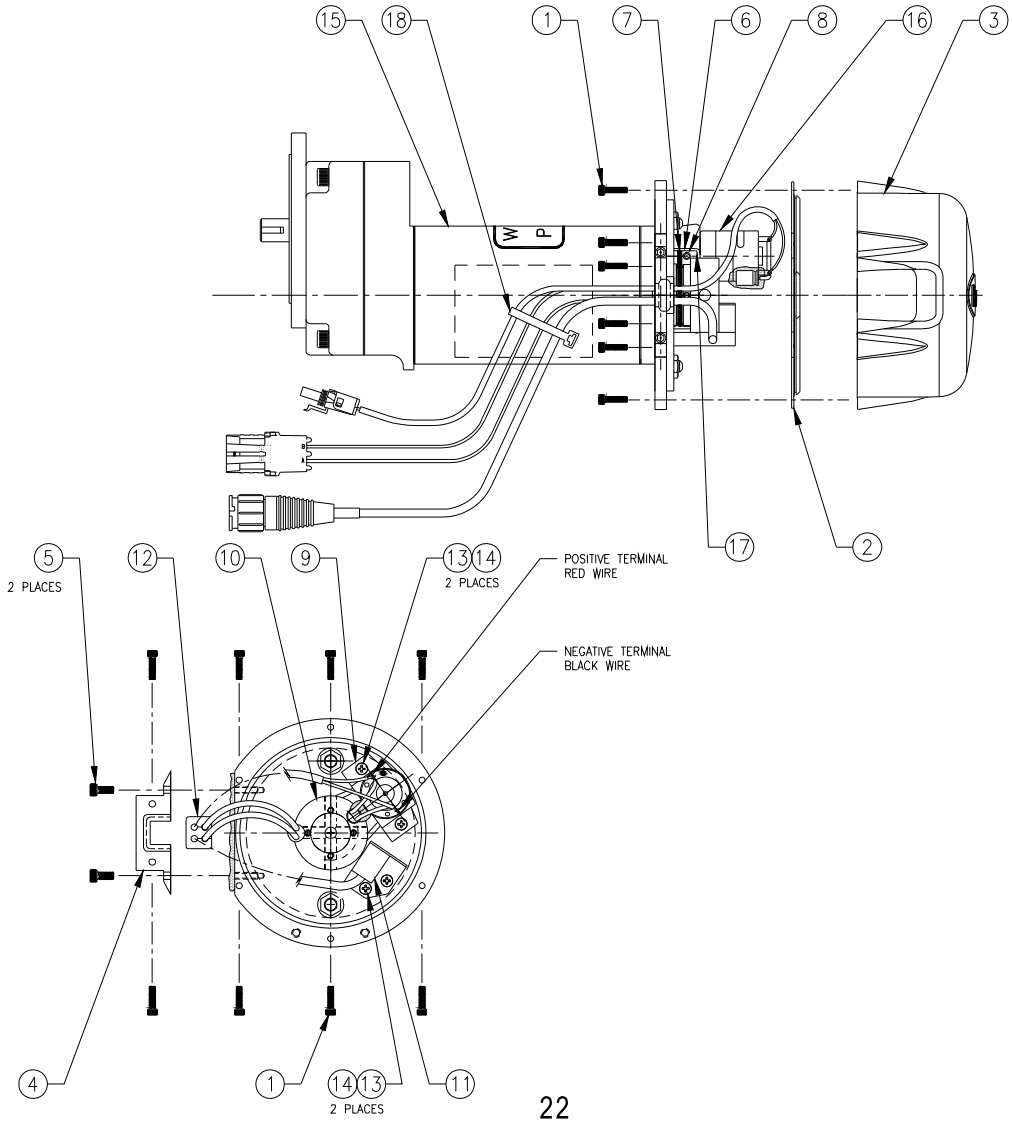



054-0159-294

# MOTOR/TACH ASSEMBLY 1-40 oz/min.
# REPLACEMENT PARTS

063-0172-527

| ITEM | DESCRIPTION | RAVEN PART # |
|---|---|---|
| 1 | Screw, Socket Head Cap #4-40 x 1/2" | 311-0068-007 |
| 2 | Gasket, Enclosure | 106-0159-576 |
| 3 | Enclosure | 106-0159-577 |
| 4 | Clamp, Strain Relief | 107-0171-470 |
| 5 | Screw, Socket Head Cap #6-32 x 1/2" | 311-0068-025 |
| 6 | Pulley, Small | 107-0171-639 |
| 7 | O-Ring | 219-0013-121 |
| 8 | Screw, Hex Cap #4-40 unc 2A x 1/4" LG | 311-0068-003 |
| 9 | Bracket, Mounting | 107-0171-775 |
| 10 | Assembly, Pulley | 063-0172-761 |
| 11 | Sensor, Speed | 063-0172-351 |
| 12 | Strain Relief/Grommet | 107-0171-478 |
| 13 | Screw, Phillips Pan Head #6-32 x 1/4" | 311-0004-005 |
| 14 | Washer, Lock, Internal #6 | 313-3000-007 |
| 15 | Motor, Electric | 416-0000-038 |
| 16 | Tach Assembly | 063-0172-935 |
| 17 | Screw, Metric Machine M2.6 x 6.0 mm | 311-0070-004 |
| 18 | Tie, Cable | 435-1000-002 |




054-0159-295

**Notes:**

**Notes:**

RAVEN

# RAVEN INDUSTRIES

## Limited Warranty

### *What Does this Warranty Cover?*

This warranty covers all defects in workmanship or materials in your Raven Applied Technology Product under normal use, maintenance, and service.

### *How Long is the Coverage Period?*

Raven Applied Technology Products are covered by this warranty for 12 months after the date of purchase. This warranty coverage applies only to the original owner and is nontransferable.

### *How Can I Get Service?*

Bring the defective part and proof of purchase to your Raven Dealer. If your Dealer agrees with the warranty claim, the Dealer will send the part and proof of purchase to their distributor or to Raven Industries for final approval.

### *What Will Raven Industries Do?*

Upon confirmation of the warranty claim, Raven Industries will, at our discretion, repair or replace the defective part and pay for return freight.

### *What is not Covered by this Warranty?*

Raven Industries will not assume any expense or liability for repairs made outside our facilities without written consent. Raven Industries is not responsible for damage to any associated equipment or products and will not be liable for loss of profit or other special damages. The obligation of this warranty is in lieu of all other warranties, expressed or implied, and no person or organization is authorized to assume any liability for Raven Industries.

Damages caused by normal wear and tear, misuse, abuse, neglect, accident, or improper installation and maintenance are not covered by this warranty.

RAVEN

*Simply improving your position.*℠

(Injection Pump (1-40 oz./min. & 5-200 oz./min.)
Service Manual
(P/N 016-0159-975 Rev E 01/10 E15586)

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Applied Technology Division
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