

# SUMMIT™

# VV40

Installation, Operation, and Maintenance Manual  
Model: VV40 & VV40B Internal Gear Pump



# Internal Gear Pump



**SUMMIT™**  
PUMP, Inc

[www.SUMMITPUMP.com](http://www.SUMMITPUMP.com)

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**i. WARRANTY**

Pumping units assembled by Summit Pump, Inc., Green Bay, WI are guaranteed to be free from defects in material and workmanship for one year from date of shipment from factory in Green Bay, WI. The obligation under this warranty, statutory or otherwise, is limited to replacement or repair at Green Bay, WI, of such part as shall appear to us upon inspection at such point, to have been defective in material or workmanship.

This warranty does not obligate Summit Pump, Inc. to bear the cost of labor or transportation charges in connection with replacement or repair of defective parts; nor shall it apply to a pump upon which repairs or alterations have been made unless authorized by Summit Pump, Inc.

No warranty is made in respect to engines, motors, or trade accessories, such being subject to warranties of their respective manufacturers.

No express implied or statutory warranty, other than herein set forth is made or authorized to be made by Summit Pump, Inc.

In no event shall Summit Pump, Inc. be liable for consequential damages or contingent liabilities arising out of the failure of any Summit Pump, Inc. pump or parts thereof to operate properly.

**ii. LIABILITY**

Summit Pump, Inc. shall not be liable for personal physical injury, damage or delays caused by failure to follow the instructions and procedures for installation, operation and maintenance contained in this manual.

The equipment is not for use in or with any nuclear facility or fire sprinkler system. Buyer accepts the responsibility for insuring that the equipment is not used in violation and Buyer shall indemnify and hold Seller harmless from any and all liability (including such liability resulting from seller's negligence) arising out of said improper use.

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# 1 CONTENTS

I.	WARRANTY .....	III	7.2.3	Grease .....	15
II.	LIABILITY .....	III	7.3	PACKING .....	15
III.	COPYRIGHT .....	III	7.3.1	Packing Adjustment.....	16
<b>1</b>	<b>CONTENTS.....</b>	<b>IV</b>	7.3.2	Packing Lubrication .....	16
<b>2</b>	<b>INTRODUCTION.....</b>	<b>1</b>	7.4	MECHANICAL SEALS.....	17
<b>3</b>	<b>SAFETY .....</b>	<b>2</b>	7.5	FIRST RUN CHECK.....	17
3.1	PUMP SAFETY WARNINGS .....	2	7.5.1	Start Up .....	18
<b>4</b>	<b>NOMENCLATURE.....</b>	<b>4</b>	7.5.2	Shut Down .....	18
4.1.1	Model Size .....	4	<b>8</b>	<b>MAINTENANCE TIMETABLE..</b>	<b>19</b>
4.1.2	Seal Type & Material .....	4	8.1	DAILY MAINTENANCE .....	19
4.1.3	Materials of Construction.....	4	8.2	THREE MONTH MAINTENANCE .....	19
4.1.4	Additional Items .....	5	8.3	SIX MONTH MAINTENANCE .....	19
4.1.5	Special to Application .....	5	8.4	YEARLY MAINTENANCE.....	19
<b>5</b>	<b>RECEIPT AND STORAGE .....</b>	<b>7</b>	<b>9</b>	<b>TROUBLESHOOTING .....</b>	<b>20</b>
5.1	RECEIVING THE PUMP .....	7	9.1	PUMP PROBLEMS .....	20
5.2	STORING THE PUMP.....	7	9.2	PROBABLE CAUSE AND REMEDY.....	20
5.2.1	Temporary .....	7	<b>10</b>	<b>EXPLODED VIEWS .....</b>	<b>21</b>
5.2.2	Long Term.....	7	10.1	VV40G CAST IRON .....	21
5.3	HANDLING.....	7	10.2	VVB40G CAST IRON – BEHIND ROTOR MECHANICAL SEAL .....	22
5.4	LIFTING.....	7	10.3	VV40H & VV40HL CAST IRON.....	23
<b>6</b>	<b>INSTALLATION.....</b>	<b>8</b>	10.4	VV40H & VV40HL STAINLESS STEEL.....	24
6.1	GENERAL.....	8	10.5	VVB40H & VVB40HL CAST IRON & STAINLESS STEEL – BEHIND ROTOR MECHANICAL SEAL.....	25
6.2	LOCATION .....	8	10.6	VV40: K, KK, L, LL, LQ & LS CAST IRON & STAINLESS STEEL .....	26
6.3	BASE PLATE .....	8	<b>11</b>	<b>DISASSEMBLY MODEL VV40.27</b>	
6.4	FOUNDATION.....	8	11.1	HEAD AND CASING.....	28
6.4.1	Concrete Sub-Base.....	8	11.2	BEARING HOUSING .....	28
6.5	BASE PLATE GROUTING.....	9	11.3	REMOVING SEALS .....	29
6.6	ORIENTATION AND ROTATION.....	11	11.3.1	Packing .....	29
6.6.1	Casing Orientation .....	11	11.3.2	Component Mechanical Seal.....	29
6.7	PIPING CONNECTION – SUCTION / DISCHARGE .....	12	11.3.3	Behind the Rotor Component Seal.	30
6.7.1	Suction Piping .....	12	11.4	BRACKET AND CASING .....	30
6.7.2	Discharge Piping .....	12	11.5	INTERNAL RELIEF VALVE .....	30
6.8	ALIGNMENT .....	13	<b>12</b>	<b>ASSEMBLY MODEL VV40.....</b>	<b>31</b>
6.8.1	Coupling Connected Units .....	13	12.1	BRACKET & IDLER BUSHINGS .....	31
6.8.2	Belt Driven Units.....	13	12.1.1	Normal installation.....	32
6.8.3	Alignment Checks .....	13	12.1.2	Heated installation .....	32
<b>7</b>	<b>OPERATION.....</b>	<b>14</b>	12.1.3	Bushing Temperature Limits .....	33
7.1	CHECKING ROTATION .....	14	12.2	BRACKET AND CASING .....	33
7.2	LUBRICATION .....	14	12.3	INSTALLING SEALS .....	33
7.2.1	Packing.....	14	12.3.1	Packing .....	33
7.2.2	Bearings .....	15	12.3.2	Component Mechanical Seal.....	34



12.3.3 Behind the Rotor Component	
Mechanical Seal.....	35
12.4 BEARING HOUSING .....	36
12.5 HEAD AND CASING .....	37
12.6 ADJUSTING END CLEARANCE .....	37
12.6.1 Measured Rotation Method.....	37
12.6.2 Dial Indicator Method .....	39
12.7 INTERNAL RELIEF VALVE .....	41
12.7.1 Mounting valve on head.....	41
12.7.2 Setting pressure.....	42
<b>13 APPENDIX A – REFERENCE</b>	
<b>TABLES .....</b>	<b>43</b>
13.1 TORQUE GUIDELINES.....	43
13.1.1 Bolt Torques .....	43
13.1.2 Locknut Torques .....	43
<b>14 PUMP INFORMATION.....</b>	<b>45</b>

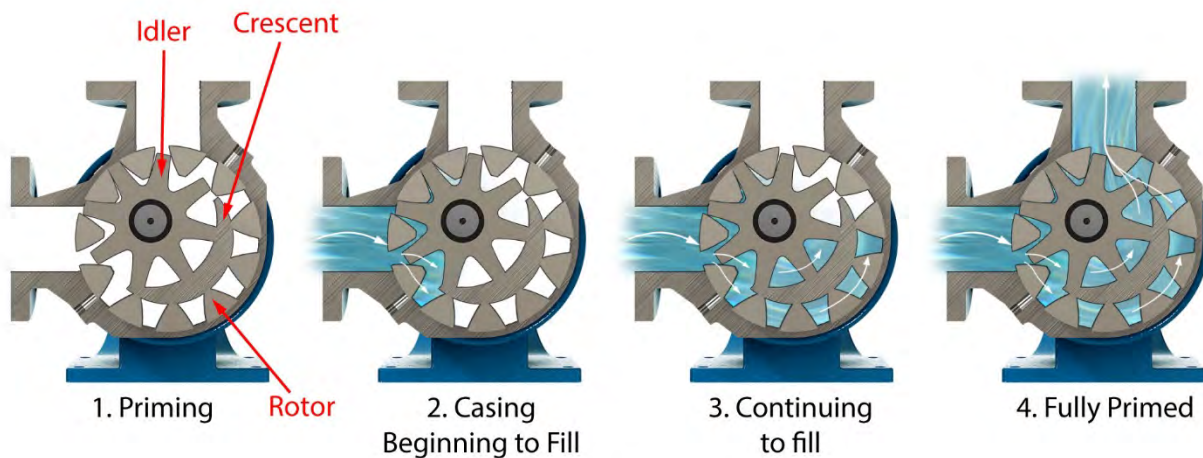


## 2 INTRODUCTION

This installation, operation, and maintenance manual is designed to help you achieve the best performance and longest life from your Summit Pump.

This pump is a positive displacement internal gear type. The pump's drive shaft turns a ring gear (rotor), with internal teeth, which rotates the external gear (idler). The idler rotates on a pin and meshes its external teeth with the rotor's internal teeth.

The crescent is integrated with the pump head and spaced between the internal teeth and external teeth. As the gear teeth disengage at the intake port, liquid enters and is trapped in the space of each gear tooth. The liquid is carried to the discharge port. The meshing of the two gears and the space reduction, forces the liquid from the pump through the discharge port. Figure 2-1 below illustrates the internal gear pump design principle.



**Figure 2-1: Priming cycle and gear pump design principle**


If there are any questions regarding this pump or its application, which are not covered in this manual, please contact your local Summit Pump, Inc. Distributor.


For information or technical assistance on the driver service, contact the driver manufacturer's local dealer or representative.


### 3 SAFETY

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The following message types are used in this manual to alert maintenance personnel to procedures that require special attention for the protection and safety of both personnel and equipment:

 <b>DANGER</b>
Imminently hazardous situation which, if not avoided, will result in death or serious injury.


 <b>WARNING</b>
Potentially hazardous situation which, if not avoided, could result in death or serious injury.


 <b>CAUTION</b>
Potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

<b>NOTICE</b>
Includes Information on operation, maintenance, rules or directions. May indicate possible property damage.

#### 3.1 PUMP SAFETY WARNINGS

The safety information below should be followed and observed to prevent damage to equipment or injury to operators:

 <b>DANGER</b>
Ensure discharge line is open and free of clogs before operation. Negligent acts may result in serious injury or death.

 <b>CAUTION</b>
Feeding very hot or very cold fluid into the pump at room temperature may result in fracture of pump wet end.



**⚠ WARNING**

Follow all auxiliary equipment (motors, drives, couplings etc.) manufacturer's manuals, instructions or procedures during installation, operation and maintenance of the pump.

***NOTICE***

Check all end clearances, drive to shaft alignments, fastener torques, equipment lubrication, gaskets and seals for leaks and all equipment is fastened into place before operation.

## 4 NOMENCLATURE

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On page 45 of this manual, record the nameplate data from your pump. This will assist with any maintenance questions or pump identification in the future.

As where “sections” are stated in section 4, NOMENCLATURE, refer to Page 6 for clarification.

Summit internal gear pumps are essentially identified by **Model Size** (sections 1 & 2, i.e. VV40LL). The remaining format consists of the **Seal Type & Material** (section 3, i.e. “PK”), **Materials of Construction** (sections 4 & 5, i.e. “CC”), **Additional Items** (sections 6, 7 & 8, i.e. “1NS”), and finally **Special to Application** (section 9, if applicable, i.e. “X”). These items together represent the complete identification of the pump and should be stated when ordering repair parts.

### 4.1.1 Model Size

(“VV40LL”, Sections 1 & 2) The format consists of the pump model (section 1) and the pump size (section 2).

Section 1 specifies a specific group or style of gear pump. This value changes when the style of gear pump is altered. For this manual section 1 is “VV40” or “VVB40”. This section coincides with section 6.

Section 2 identifies a specific pump size within the gear pump model. Sizes are justified via the capacity (GPM) of the pump. (i.e. “LL”)

### 4.1.2 Seal Type & Material

(“PK”, Section 3) Section 3 identifies how the pump is sealed and with what materials. Options are packing, type 1 or type 9 component mechanical seals, or a cartridge mechanical seal.

### 4.1.3 Materials of Construction

(“CC”, Sections 4 & 5) Section 4 identifies the materials of the working internals and cast parts of the pump. Each letter represents a relationship with these components. See Table 4-1 for specific item materials of construction.

Section 5 identifies the type of bushing used in the bracket and idler. Options are either carbon graphite or bronze.

**Table 4-1: Materials of Construction; Reference Summit Pump VV40 nomenclature**

MODEL VV40 MATERIALS OF CONSTRUCTION					
ITEM		SECTION "4" EXTERNAL COMPONENTS IN NOMENCLATURE			
		(C) CAST IRON	(D) DUCTILE IRON	(W) STEEL	(S) STAINLESS STEEL
CASING		CAST IRON	DUCTILE IRON	STEEL	STAINLESS STEEL
HEAD		CAST IRON	DUCTILE IRON	STEEL	STAINLESS STEEL
JACKET HEAD PLATE		CAST IRON	STEEL	STEEL	CAST IRON
BRACKET		CAST IRON	DUCTILE IRON	STEEL	STAINLESS STEEL
IDLER		*CAST IRON	*CAST IRON	*CAST IRON	STAINLESS STEEL
ROTOR	STANDARD MATERIAL	**CAST IRON	**CAST IRON	**CAST IRON	STAINLESS STEEL
	STEEL CONSTRUCTION	(“E” in NOMENCLATURE)	(“F” in NOMENCLATURE)	(“Y” in NOMENCLATURE)	
SHAFT		STEEL	STEEL	STEEL	STAINLESS STEEL
IDLER PIN		HARDENED STEEL	HARDENED STEEL	HARDENED STEEL	HARD COATED STAINLESS STEEL
IDLER BUSHING & BRACKET BUSHING	PACKED	BRONZE	BRONZE	BRONZE	CARBON GRAPHITE
	MECHANICAL SEAL	CARBON GRAPHITE	CARBON GRAPHITE	CARBON GRAPHITE	
INTERNAL PRESSURE RELIEF VALVE		CAST IRON	STEEL	STEEL	STAINLESS STEEL

\* STEEL FOR Q AND QS STEEL FITTED OPTION. G, H AND HL ARE POWERED METAL  
 \*\* KK, LS, QS HAVE DUCTILE IRON ROTOR

**4.1.4 Additional Items**

(“INS”, Sections 6, 7 & 8) These sections define additional information about the options of the pump.

Section 6 identifies the sealing location, either behind the rotor or in the stuffing box.

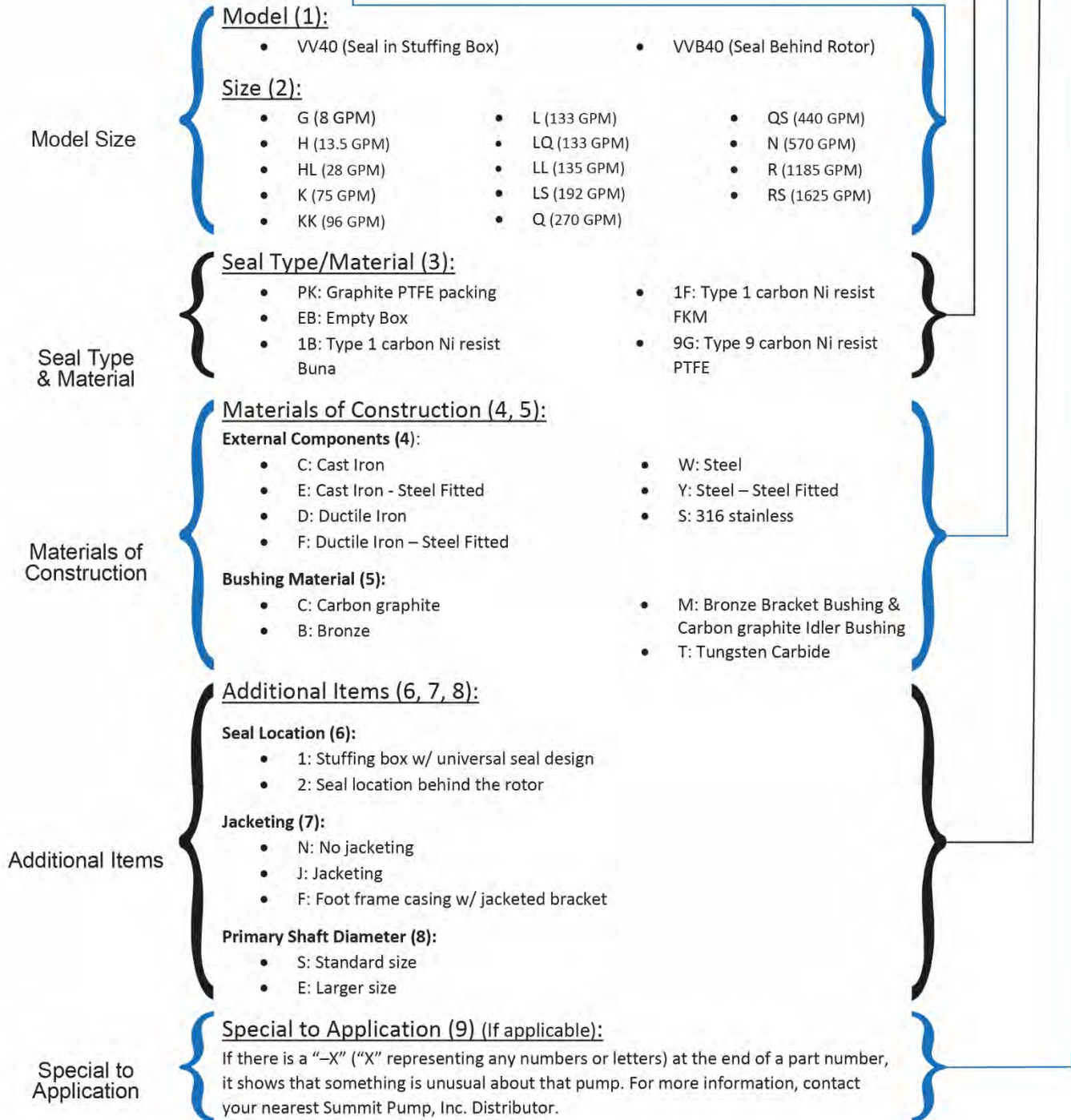
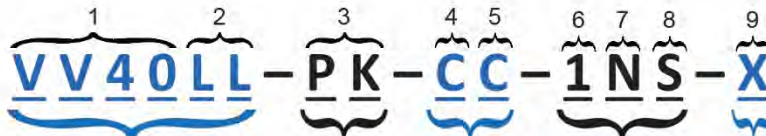
Section 7 identifies the type of bracket and casing. There is an option to jacket these parts to induce a heat exchanger for high temp applications.

Section 8 identifies the standard or larger shaft diameter.

**4.1.5 Special to Application**

(“X”, Section 9) Section 9 may or may not be present. Usually, there will be no “X” following the pump identification. If there is an “X”, you will need to contact your nearest Summit Pump, Inc. Distributor to determine exactly what makes this pump special.

*See following page for nomenclature definitions and examples*



**Example:**

**Summit Model Number:**

**VV40LL-PK-CC-1NS**

**Viking® Model Number:**

**LL-124A**

## 5 RECEIPT AND STORAGE

### 5.1 RECEIVING THE PUMP

Immediately upon arrival, carefully inspect the pump for evidence of damage during transit. Immediately report any damage to your local Summit Pump, Inc. Distributor.

### 5.2 STORING THE PUMP

#### 5.2.1 Temporary

Temporary storage: less than six months.

1. Flush the pump with clean water. If pumped product is water reactive, remove the pump head, and with compressed air blow all liquid from cavity. Lightly cover all internal metal parts with oil and replace the head.
2. Store pump in a clean, dry place, free from extreme swings in temperature and humidity.
3. Cover with a protective covering to reduce dust contamination.
4. Loosen the packing gland nuts; remove the gland, packing rings and lantern ring. Apply grease to the stuffing box I.D. and packing rings. Return the packing and lantern rings to their position in the stuffing box. Snug down the packing gland nuts finger tight. Do not use grease if gland is water flushed. Only a small amount of light oil should be applied in this scenario.
5. Rotate the shaft once a week to protect the bearings from being indented into the raceway.

#### 5.2.2 Long Term

Long Term Storage: more than six months.

1. Follow temporary storage guidelines 1-5.
2. Coat all unpainted and machined surfaces with a rust inhibitor, such as LPS-3.

### 5.3 HANDLING

Pump unit boxes and crates may be unloaded using a forklift or slings depending on size and package construction.

**⚠ WARNING**

Pump and assemblies are heavy, improper handling could result in serious injury.

### 5.4 LIFTING

To avoid damage to pump and/or motor use a nylon, chain, or a wire rope sling. The slings should be placed so lift is equally supported at four or more points.

**⚠ WARNING**

Be sure all components are securely fastened to baseplate before lifting.

## 6 INSTALLATION

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### 6.1 GENERAL

Summit Pumps are fully assembled at the factory. The pumps are ready to be installed and put into service. Follow all instruction tags on the pump.

### 6.2 LOCATION

If the pump is going to have a water flush, it should be located as close as possible to the supply of water. Other location considerations are: easy access for inspection, maintenance and ample overhead space for lifting with crane or hoist.

### 6.3 BASE PLATE

Each pump unit should be mounted on a fabricated steel base plate. Common base configurations are inline, piggyback and L-shape. The base plate should be mounted on a concrete sub base 4" to 8" longer and wider than the fabricated base plate.

### 6.4 FOUNDATION

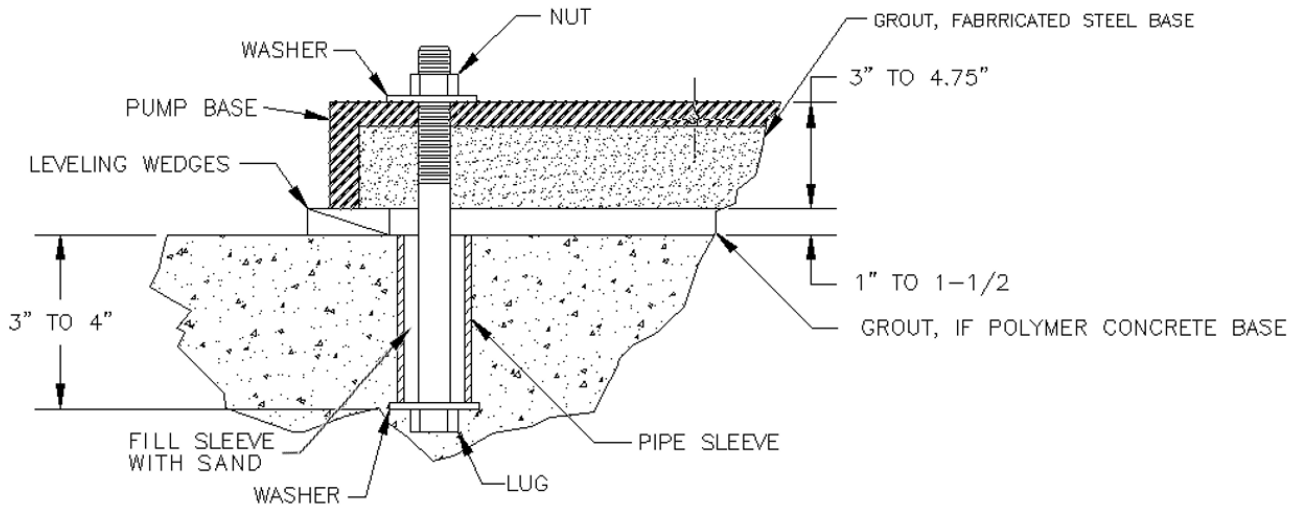
#### 6.4.1 Concrete Sub-Base

The concrete sub foundation performs a number of functions. It must support the weight of the entire pump assembly, maintain the alignment of all system components, and absorb the loads, forces and vibrations that are developed under normal operating conditions. The concrete material used must be top quality and conform to local building codes as well as the contractor's strength requirements. Reinforcing bars and mesh should be used as required. The mounting surface of the concrete foundation must be flat and level beneath the footprint of the sub-base, or the pump could be installed out of square. This could create problems aligning the piping, place extra loads on the couplings and bearings, and alter the operating levels of lubricants or hydraulic fluids in the system. It is recommended that the top surface of the slab be held flat and level to at least F50 according to American Concrete Institute (#117) and the Canadian Standards Association (#A23.1) which is approximately 1/8" per 10 foot. The sub base height is usually determined by the process piping runs and elevation.

The weight of the sub foundation should be 3-5 times the weight of the pump, motor and baseplate. Dimensionally, it should be 4" to 8" longer and wider than the polymer concrete or fabricated steel base plate. Anchor bolts are installed in pipe sleeves. The pipe diameter is 2.5 times larger than the anchor bolt diameter. This sleeve/bolt assembly is embedded in the base when poured.

The pipe sleeve should be filled with sand or plastic foam to the top of the sleeve. This will prevent the grout material from spilling into the sleeve and reducing the movement of the sleeve when pouring the grout.

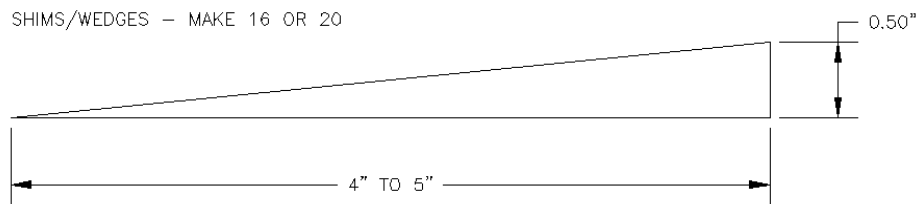
Anchor bolt sizes: 1"-8UNC. Length is 7.5" to 10", depending on base thickness and overall size.



**Figure 6-1: Anchor Bolt configuration**

## 6.5 BASE PLATE GROUTING

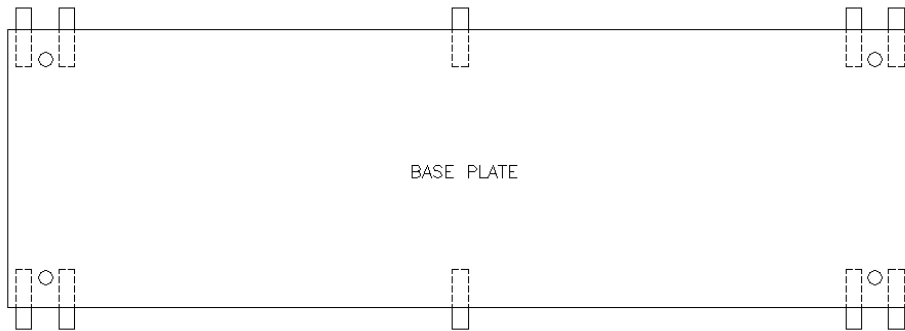
1. This grouting instruction assumes a concrete sub base has been put in place to accept the baseplate. The subbase should be clean of dirt, oil and any other debris.
2. Shims/wedges should be wood.



**Figure 6-2: Wooden Wedges**

3. Shims/wedges should be placed on the sub base, as shown in **Figure 6-3**. Use 2 to 3 per stack to obtain desired gap between baseplate and sub-base. Normal gap is 1" to 1-1/2".
4. Carefully lower baseplate with pump and motor onto sub base over anchor bolts.
5. Level baseplate to 0.125" over length and 0.088" in over width.
6. When leveling is complete, uniformly hand tighten the anchor bolts.

7. Build a plywood form around baseplate supported on the sub base. It should be 3” high and 1” to 1.5” larger than the baseplate. Its size should be large enough to include the shims or wedges that are left in place.



**Figure 6-3: Wedge Locations**

SHIM PLACEMENT

8. Use a high quality non-shrinking epoxy grout, following manufacturer’s mixing and installation instructions.
9. When grout has cured, per grout manufacturer’s recommended cure time, tighten anchor bolts till secure.
10. When grouting is complete, check coupling alignment and re-align as necessary.



## 6.6 ORIENTATION AND ROTATION

There are four main different wet end configurations for the VV40 pump. Refer to Figure 6-4 for the different configurations. The configurations are dependent on two variables, casing orientation and shaft rotation. The configurations are important to understand when installing the casing to the bracket and the internal relief valve on the head. The internal relief valve must be positioned correctly or the valve will not work correctly, potentially damaging equipment, severely injuring or causing death to personnel.

**⚠ DANGER**

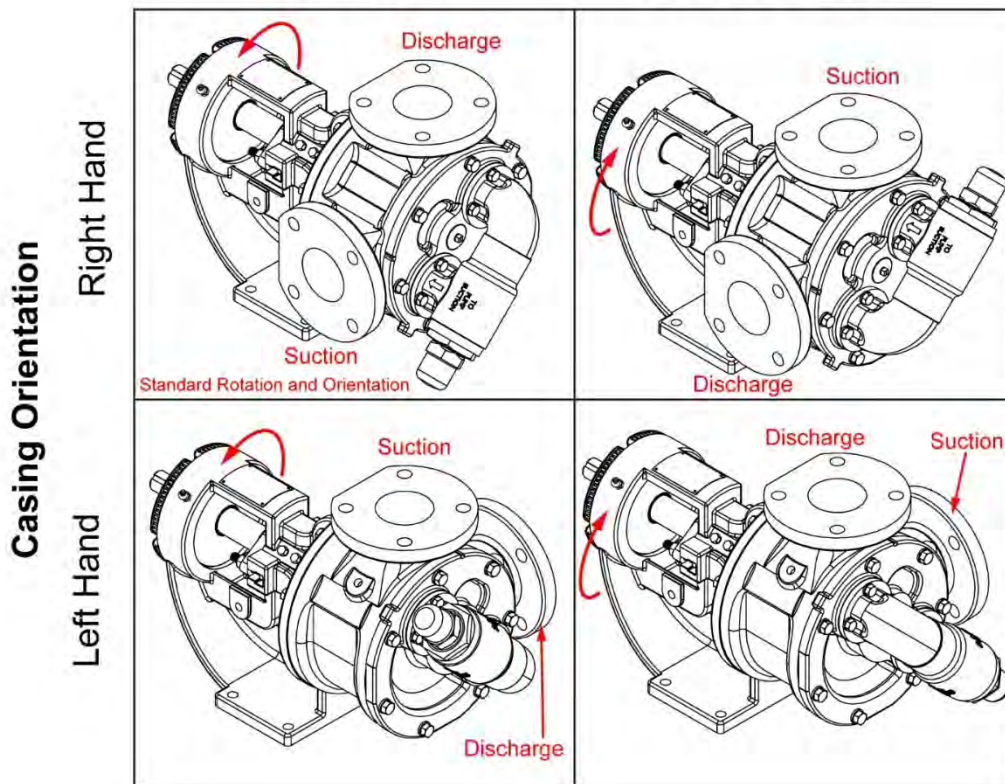
Install pressure relief valve correctly to avoid equipment failure, severe injury or death.

### Shaft Rotation

(As viewed from motor)

Clockwise

Counter Clockwise



**Figure 6-4: Wet end configurations**

### 6.6.1 Casing Orientation

To change the casing orientation, unbolt the casing from the bracket and rotate the casing and head 90-degrees. Be careful as not to damage the idler, rotor or crescent shape inside the casing. The head plate should rotate with the casing.

**NOTICE**

Rotate casing carefully as to not damage internal parts.

## 6.7 PIPING CONNECTION – SUCTION / DISCHARGE

**⚠ DANGER**

Lock out driver power before beginning to work on pump.

Connect piping in a manner that is as short and direct as possible. Independent pipe supports and anchors must be used in all installations. **Never support piping with pump flanges or threaded connections.** Ideally, you should place a short length of flexible or bellows type spool directly adjacent to the pump flange.

**⚠ CAUTION**

Never use force to align piping to the pump flanges or threaded connections.

### 6.7.1 Suction Piping

The piping used should be as short as possible from suction source. Piping line size should be the same diameter as the suction nozzle. Although, this may not always be the case, as high viscosity, flow velocity or system constraints may cause a change in size. All elbows 90° or 45° should be a long-sweep. Any piping that causes air to become trapped should be avoided.

### 6.7.2 Discharge Piping

Generally, the diameter of the discharge piping should be the same diameter as the discharge nozzle. In certain circumstances, this will not be the case, as the fluid being pumped will cause the use of a different sized pipe. In these circumstances, the use of a threaded or flanged reducer/expansion fitting is needed.

It is recommended to install an isolation discharge valve to isolate the pump from the system when down for maintenance.

## 6.8 ALIGNMENT

### NOTICE

Careful alignment is extremely important to ensure long pump life.

#### 6.8.1 Coupling Connected Units

In-line configurations are shipped with the pump and motor leveled on the base plate with the coupling disconnected. If the pump and driver were aligned at the factory, that alignment will be disturbed during shipment. Alignment must be rechecked. If alignment is necessary, align the motor to the pump not the pump to the motor. Check both parallel and angular alignments. Final alignment should be within 0.005" in all planes at operating temperature.

#### 6.8.2 Belt Driven Units

Check belt and sleeve alignment. Check belts for proper belt tension. Tension requirements will vary with the type of belt, centerline distance and belt speeds. Consult belt manufacturer for specific recommendations.

#### 6.8.3 Alignment Checks

Alignment checking needs to be done several times prior to pump start up. Alignment is accomplished by adding or removing shims under the motor feet and moving the motor as required eliminating the misalignment. Those alignment recommendations are as follows:

### ⚠ DANGER

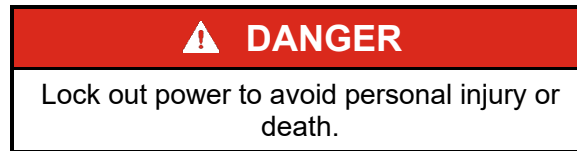
Lock out driver power before beginning to work on pump.

1. Prior to grouting, to remedy misalignment caused by transportation.
2. After grouting, to correct any changes that occurred during grouting.
3. After piping is connected, check alignments to ensure possible pipe strains have not changed alignment.
4. Hot alignment, after the pump has reached operating temperature, if the pump is used in high temperature service.

## 7 OPERATION

### 7.1 CHECKING ROTATION

The pump can operate equally well in a clockwise or counterclockwise rotation. The desired port to be suction determines shaft rotation. Port closest to where pumping elements (gear teeth) come out of mesh is suction port. If fitted with a pressure relief valve ensure the adjustment knob is near the suction port. See Figure 6-4 for illustration.



1. Lockout power to drive.
2. Remove coupling guard.
3. Remove coupling grid/sleeve element so that the motor half of coupling can spin free from the pump half.
4. Unlock power to motor.
5. Clear personnel from immediate area, jog motor just enough to determine direction of rotation.
6. If the motor is rotating in the wrong direction the electrical wiring will need to be adjusted by qualified personnel. Then repeat Step 4, 5 and 6.
7. Once rotation is in the desired direction, lockout motor and reassemble coupling grid/sleeve to connect pump half.
8. Check alignment and install coupling guard.
9. Unlock motor, pump is ready to run.

### 7.2 LUBRICATION

#### 7.2.1 Packing

The packing should be greased with 2 to 3 pumps of grease for grease lubricated packing. Acceptable greases are shown in Table 7-1. Lubrication intervals may vary depending on application. In general, re-grease the packing every 500 hours or every six months using the stuffing box grease zerk shown in Figure 7-1. See Section 7.3.2 for more details.

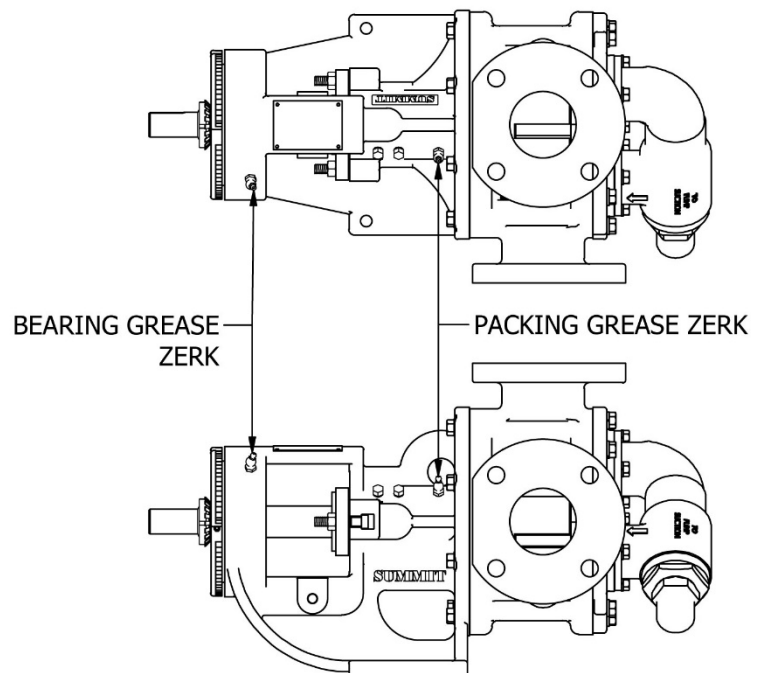


Figure 7-1: Lubrication locations

**NOTICE**

Packing is not greased at the factory.  
Lubricate packing before operation.

**7.2.2 Bearings**

The bearing(s) on Summit’s VV40 pumps are grease lubricated at the factory. The “G” size has sealed bearings and does not require additional grease. Depending on pump application, speed and size of bearing(s), the amount the bearing(s) is lubricated changes. In general, re-grease the bearing(s) every 500 hours or every six months using the bearing grease zerk shown in Figure 7-1. Bearing housing “free” volume should approximately be 50% full of grease, higher percentage in lower speed applications and lower percentage in higher speed applications.

**NOTICE**

Avoid over greasing bearings. This will induce heat and damage bearing(s).

If pump is disassembled ensure bearing is cleaned and repacked with fresh grease. Ensure all dirt and foreign matter is removed before reassembly. When pump is assembled use a hand grease gun to grease port shown in Figure 7-1.

**7.2.3 Grease**

Recommended grease lubrication for bearings and packing is NLG1 No. 2 for pumping temperatures -60°F to 350°F. Any type of Ep Lithium soap based grease is acceptable. Sodium or Calcium based grease is not acceptable. A list of some acceptable bearing grease is shown in **Table 7-1**.

**Table 7-1: Acceptable Bearing Greases NLG1 No. 2 Grade**

Acceptable Greases	
Citgo	Mystic EP2
Keystone	81EP2
Mobil	Mobilux EP2
Mobil Synthetic	SCH 100

**NOTICE**

Grease lubricated pumps are intended to use grease only. Do NOT add oil

**7.3 PACKING**

Packing must be lubricated and adjusted correctly to avoid seizing of packing and failure. Greased packing is standard and is not lubricated at the factory. Packing lubrication must be done before operation.

**⚠ DANGER**

Lock out power to avoid personal injury or death when working on pump.

**7.3.1 Packing Adjustment**

There are many variables that go into packing a pump correctly. Refer to the packing manufacture to correctly set packing for specific application and material.

In general, before installing the packing, ensure all surfaces are clean of debris and packing size and material are correct for specific application. Packing has a break-in period which is approximately two hours of operation. During this time, allow liberal leakage which will set up a good sealing job.

After the break-in period, gradually tighten the packing gland using small incremented adjustments. Patience is required between adjustments, having the gland too loose, rather than over tight, is ideal for reducing shaft/packing wear resulting in sealing issues. A general drip rate guideline is 10 drops per minute per inch of shaft diameter. (*Example: 2.5 inch diameter shaft = 25 drops per minute*)

**7.3.2 Packing Lubrication**

Packing can be grease lubricated or water lubricated. Water lubrication can be supplied from either an external source or from the pumped product.

**⚠ CAUTION**

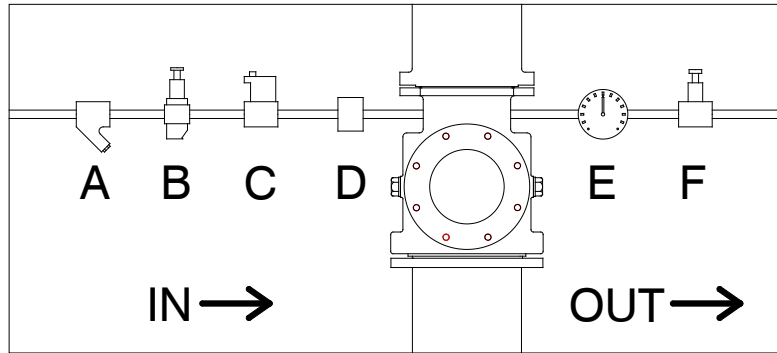
Packing must be lubricated to avoid seizing of packing and sealing failure.

**7.3.2.1 Greased Lubricated Packing (Standard)**

A grease zerk is located in Figure 7-1. The packing should be greased after 500 hours of operation or sooner when needed. More details can be found in Section 7.2.1

**7.3.2.2 Water Lubricated Packing**

A water flush is recommended when highly abrasive material is being pumped. The flush will prevent packing leakage and excessive shaft wear. A clean water flush system is shown in Figure 7-2. Replace the grease zerk with customer's choice of fitting. The outlet can either be a tapped NPT hole in the stuffing box opposite the inlet line or allow the water to leak out near the gland and into the casing. In either case, this discharge of the flush water should be approximately 10-15 psi higher than the pressure in the casing.



**Figure 7-2: Water Flush System**

- A) Y-strainer
- B) Pressure regulating valve
- C) Sight flow meter
- D) Solenoid valve
- E) Pressure gauge
- F) Needle valve

#### 7.4 MECHANICAL SEALS

For maximum seal life it is recommended to install a water flush line to keep seal faces free of debris. A general example of a water flush system is shown in Figure 7-2 on page 17. Follow the steps necessary for water flushed packing and apply to water flushed mechanical seals.

For component mechanical seal assembly refer to section 12.3.2 on page 34 and disassembly in section 11.3.2 on page 29.

#### 7.5 FIRST RUN CHECK

Several items need to be checked before you put your pump into service. Each of the following items needs to be addressed to make certain that your equipment is correctly installed.

1. Proper alignment of pump, coupling, driver and sheaves. Also ensure pump clearances have been set for the application.
2. All electrical connections.
3. All instruments and gauges should be in working order.
4. Water flush connection to the stuffing box (if applicable).
5. Correct pump rotation as desired, see Figure 6-4 on page 17.
6. Open the valves on the suction and discharge.

**⚠ DANGER**

This is a positive displacement pump.  
NEVER operate it against a closed valve or  
clogged discharge.

**NOTICE**

Do not operate pump dry. Dry operation can cause premature damage to pump internals.

**7.5.1 Start Up**

1. Before operating the pump it must be filled with liquid. This can be done by removing the piping or pipe plugs (item 30 in Figure 10-6 on page 26) and fill with pumping liquid or water. (Only use water if it will not contaminate the pumping liquid.)
2. Ensure the motor rotation coincides with desired pump rotation. Refer to Section 6.6 on page 11 and 11 for specific shaft rotation direction.
3. If an internal relief valve is installed, make sure the threaded adjustment side is closest to the suction side of the pump. See Figure 6-4 on page 11 for illustration.
4. If water flushed, turn on water to the stuffing box.
5. Start the pump.

**⚠ DANGER**

Do not operate the pump without the proper coupling guard. See ANSI/ASME B15.1-1996.

**7.5.2 Shut Down**

1. If possible, flush the pump with clean water. (Only use water if it will not contaminate the pumping liquid.)
2. Shut down the pump.
3. If water flushed or water lubricated packing, turn off water to the stuffing box.
4. Close both the discharge and suction valves.



## **8 MAINTENANCE TIMETABLE**

---

### **8.1 DAILY MAINTENANCE**

1. Check the lip seals (05, Figure 10-6 on page 26) in the bearing housing for tears, worn areas and/or leaks.
2. Inspect the packing or mechanical seal for correct flow, drip rate, noise and pressure.

### **8.2 THREE MONTH MAINTENANCE**

1. Daily maintenance and the following:
2. Inspect and adjust packing so that drips are as stated in section 7.3.1 on page 16. If packing is grease lubricated, lube the packing with 2 to 3 grease gun pumps, after 500 hours of operation or sooner when needed.

### **8.3 SIX MONTH MAINTENANCE**

1. Daily maintenance and the following:
2. The packing should be replaced.
3. Check lip seal (05, Figure 10-6 on page 26) and drive shaft for wear. The suction and discharge piping spool pieces should be inspected internally for their condition.
4. Lubricate all grease fittings using a hand grease gun.

### **8.4 YEARLY MAINTENANCE**

1. All of the above and the following:
2. Depending on the fluid pumped and pump operating hours, check pump performance with published performance curve. These inspections can range from once a year, to once every three to five years.

## 9 TROUBLESHOOTING

### 9.1 PUMP PROBLEMS

Pump turns, no flow.	1,2,3,10,12,13,14,15,16,17,18
Pump flow rate below expected capacity.	1,2,3,4,5,6,7,10,11,12,13,16,17,18,22,25
Pump will not produce rated pressure.	1,2,3,4,11,13,16,17,18,22,29
Pump develops too much pressure.	6,7,9,12,17,21,23
Pump no longer self-primed.	2,3,4,5,7,10,11,13,14,15,16,17,18,20,24,26
Pump won't turn/motor overloads.	5,6,7,12,15,17,19,21,24,26,27,29
Pump is very noisy/excessive vibration.	1,2,3,5,6,7,10,11,13,14,18,20,21,26,27,28
Pump runs hot.	4,5,6,7,12,17,18,19,21,22,24,26,27,29
Pump seals short life.	1,2,3,4,5,6,7,9,10,11,12,13,17,18,19,20,21,22,23,24,26,27,28
Packing short life.	2,3,4,6,7,9,10,11,12,13,14,17,18,19,20,21,24,27,28
Excessive internal wear.	1,2,3,6,7,8,9,12,13,14,16,17,18,19,21,23,24,26,27,28

### 9.2 PROBABLE CAUSE AND REMEDY.

NPSHA not sufficient.	1
Pump has run dry.	2
Air leaking into the pump.	3
Liquid temperature higher than stated.	4
Viscosity higher than stated.	5
Pump running too fast for application.	6
Abrasives in liquid.	7
Parts not hardened.	8
Suction or differential pressure too high.	9
Suction valve not open.	10
Suction valve partially open.	11
Discharge valve not open or partially open.	12
Clogged strainer.	13
Supply vessel empty.	14
Pump rotation wrong.	15
Incorrect head placement.	16
Wrong clearance setting for application.	17
Worn pump internals.	18
Packing gland too tight or skewed.	19
Improper seal installed.	20
Inadequate lubrication.	21
Relief valve improper pressure setting.	22
Relief valve reversed.	23
Material compatibility.	24
Bad bearing (thrust).	26
Drive misalignment	27
Base plate loose	28
Drive not sized for horsepower required.	29

## 10 EXPLODED VIEWS

Use below figures and tables with respect to Section 11 DISASSEMBLY MODEL VV40 and Section 12 ASSEMBLY MODEL VV40

### 10.1 VV40G Cast Iron

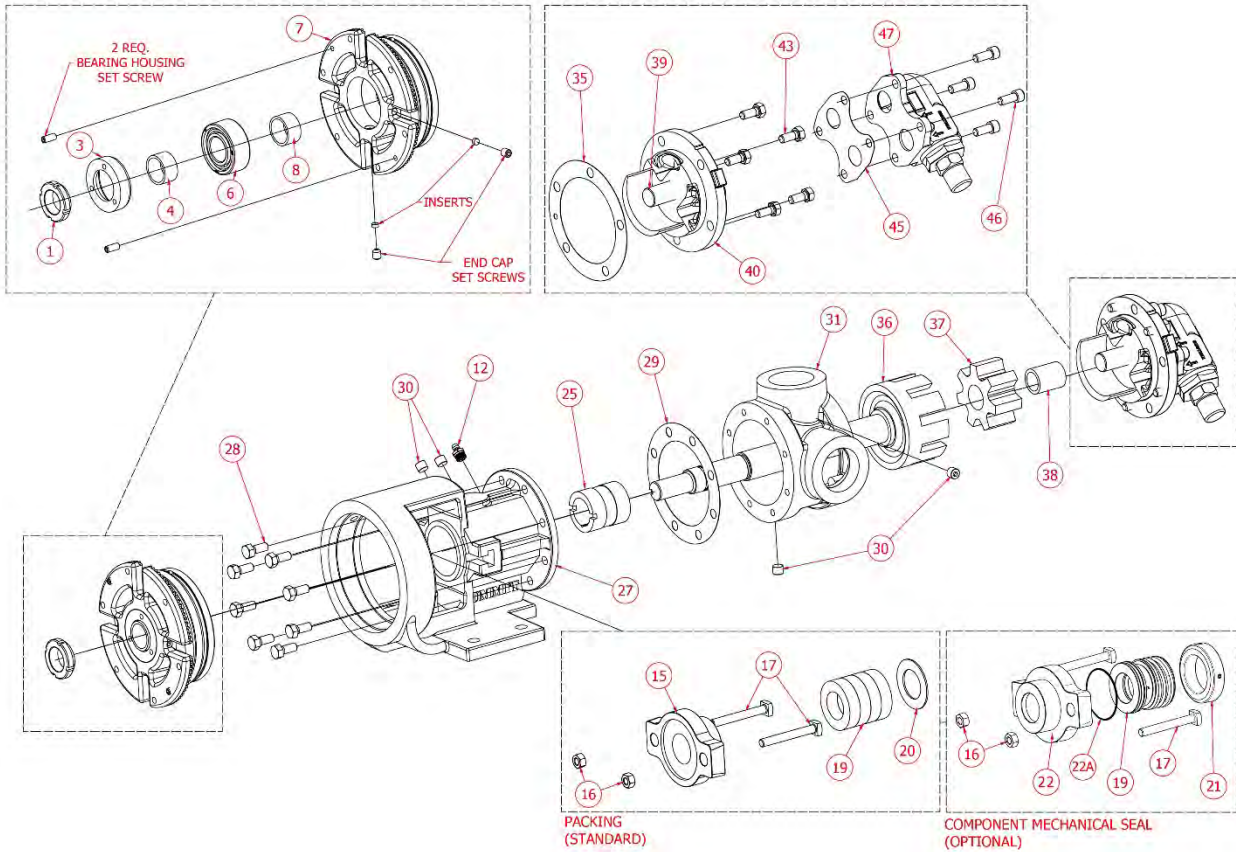


Figure 10-1: VV40G Exploded View - Cast Iron

Table 10-1: Itemized Parts

MODEL VV40G INTERNAL GEAR PUMP					
01	LOCK NUT	20	RETAINING RING	36	ROTOR AND SHAFT
03	END CAP FOR BEARING HOUSING	21	MECHANICAL SEAL COLLAR	37	IDLER AND BUSHING ASSEMBLY
04	BEARING SPACER COLLAR (OB)	22	SEAL HOLDER	38	IDLER BUSHING
06	BALL BEARING	22A	O-RING, SEAL HOLDER	39	IDLER PIN
07	BEARING HOUSING	25	BRACKET BUSHING	40	HEAD AND IDLER PIN ASSEMBLY
08	BEARING SPACER COLLAR (IB)	27	BRACKET AND BUSHING	43	CAP SCREW FOR HEAD
12	GREASE FITTING	28	CAP SCREW FOR BRACKET	45	RELIEF VALVE GASKET
15	PACKING GLAND	29	BRACKET GASKET	46	CAP SCREW FOR VALVE
16	NUT, SELF LOCKING	30	PIPE PLUG	47	RELIEF VALVE
17	PACKING GLAND CAP SCREW	31	CASING		
19	PACKING RING/MECHANICAL SEAL	35	HEAD GASKET		
1	BEARING HOUSING ASSEMBLY (COMPLETE)				
THROUGH 8	INCLUDES BEARING HOUSING SET SCREW, INSERTS, END CAP SET SCREW				

10.2 VVB40G Cast Iron – Behind Rotor Mechanical Seal

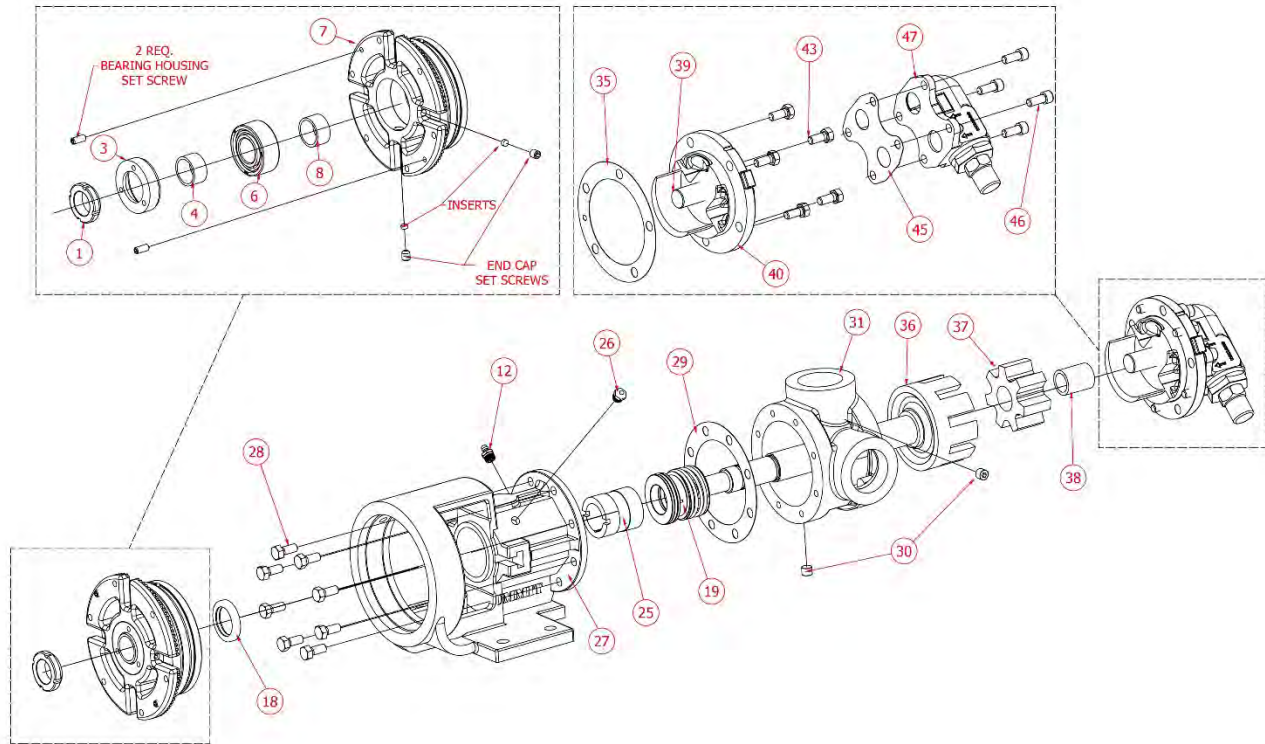


Figure 10-2: VVB40G Behind Rotor Seal

Table 10-2: Itemized Parts

BEHIND ROTOR SEAL: VVB40G INTERNAL GEAR PUMP					
01	LOCK NUT	25	BRACKET BUSHING	37	IDLER AND BUSHING ASSEMBLY
03	END CAP FOR BEARING HOUSING	26	PRESSURE RELIEF PLUG	38	IDLER BUSHING
04	BEARING SPACER COLLAR (OB)	27	BRACKET AND BUSHING	39	IDLER PIN
06	BALL BEARING	28	CAP SCREW FOR BRACKET	40	HEAD AND IDLER PIN ASSEMBLY
07	BEARING HOUSING	29	BRACKET GASKET	43	CAP SCREW FOR HEAD
08	BEARING SPACER COLLAR (IB)	30	PIPE PLUG	45	RELIEF VALVE GASKET
12	GREASE FITTING	31	CASING	46	CAP SCREW FOR VALVE
18	LIP SEAL, BRACKET	35	HEAD GASKET	47	RELIEF VALVE
19	COMPONENT MECHANICAL SEAL	36	ROTOR AND SHAFT		
1 THROUGH 8	BEARING HOUSING ASSEMBLY (COMPLETE) INCLUDES BEARING HOUSING SET SCREW, INSERTS, END CAP SET SCREW				

10.3 VV40H & VV40HL Cast Iron

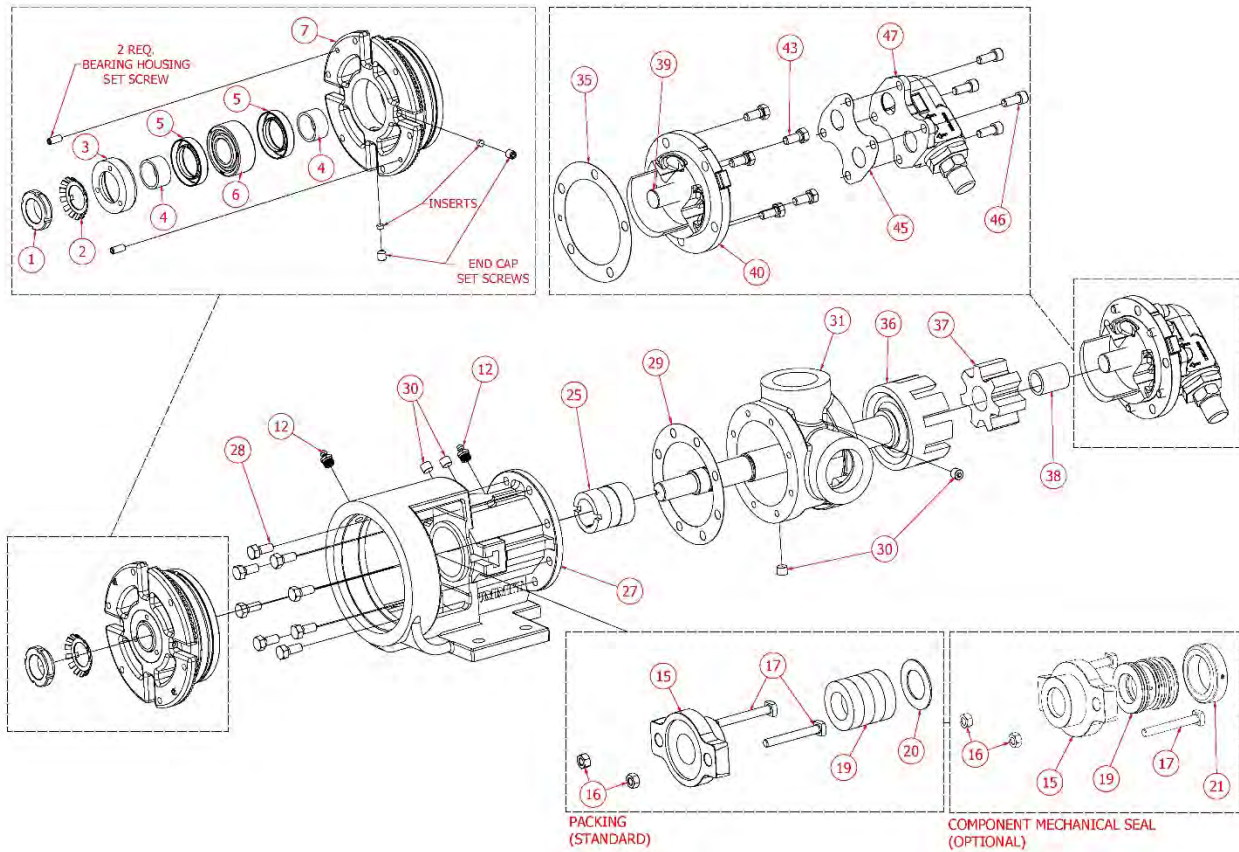


Figure 10-3: VV40H & VV40HL Exploded View – Cast Iron

Table 10-3: Itemized Parts

MODEL VV40H & HL INTERNAL GEAR PUMP					
01	LOCK NUT	17	PACKING GLAND CAP SCREW	35	HEAD GASKET
02	LOCK WASHER	19	PACKING RING/MECHANICAL SEAL	36	ROTOR AND SHAFT
03	END CAP FOR BEARING HOUSING	20	RETAINING RING	37	IDLER AND BUSHING ASSEMBLY
04	BEARING SPACER COLLAR	21	MECHANICAL SEAL COLLAR	38	IDLER BUSHING
05	LIP SEAL	25	BRACKET BUSHING	39	IDLER PIN
06	BALL BEARING	27	BRACKET AND BUSHING	40	HEAD AND IDLER PIN ASSEMBLY
07	BEARING HOUSING	28	CAP SCREW FOR BRACKET	43	CAP SCREW FOR HEAD
12	GREASE FITTING	29	BRACKET GASKET	45	RELIEF VALVE GASKET
15	PACKING GLAND	30	PIPE PLUG	46	CAP SCREW FOR VALVE
16	NUT, SELF LOCKING	31	CASING	47	RELIEF VALVE
1 THROUGH 7	BEARING HOUSING ASSEMBLY (COMPLETE) INCLUDES BEARING HOUSING SET SCREW, INSERTS, END CAP SET SCREW				

10.4 VV40H & VV40HL Stainless Steel

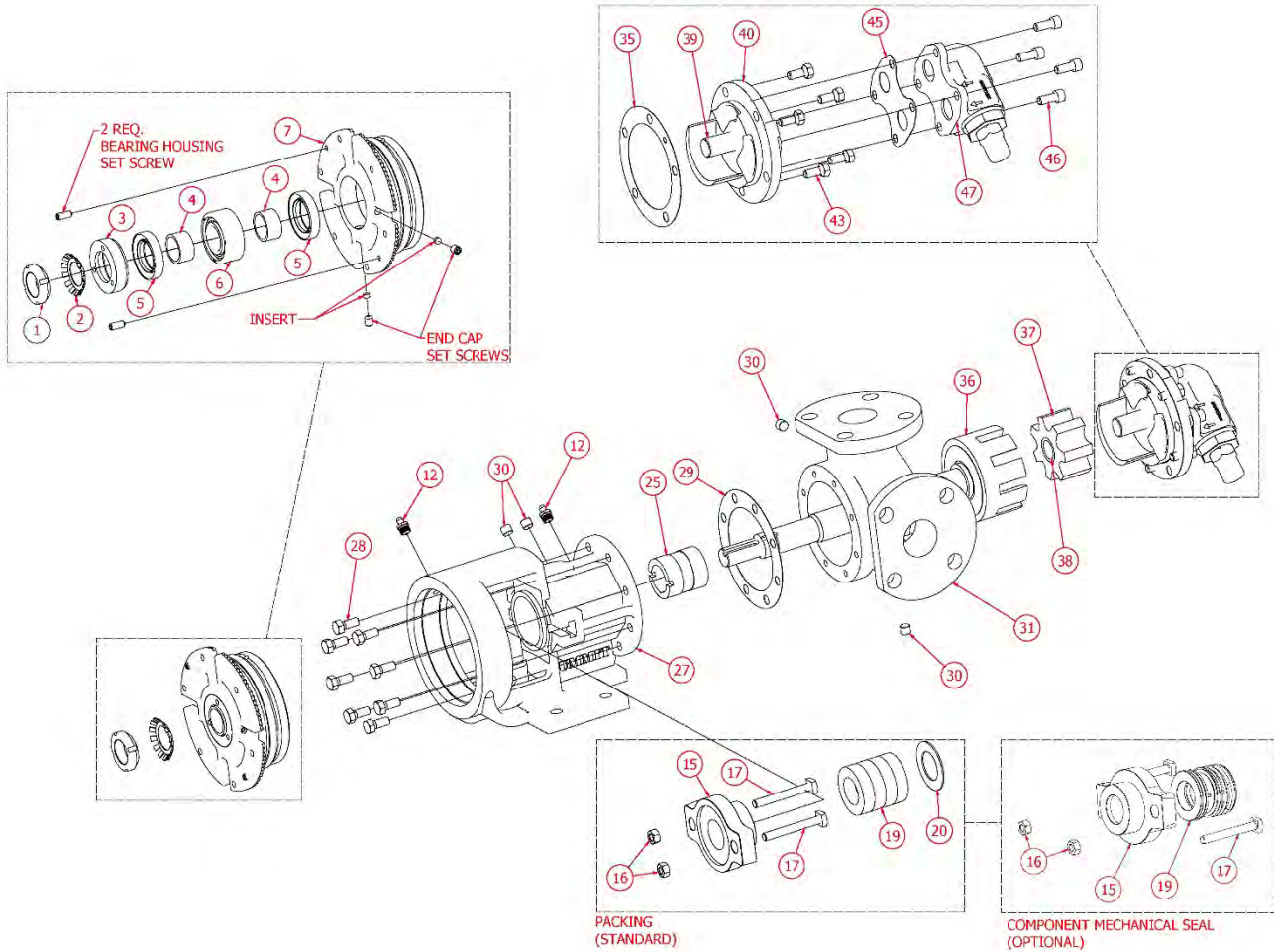
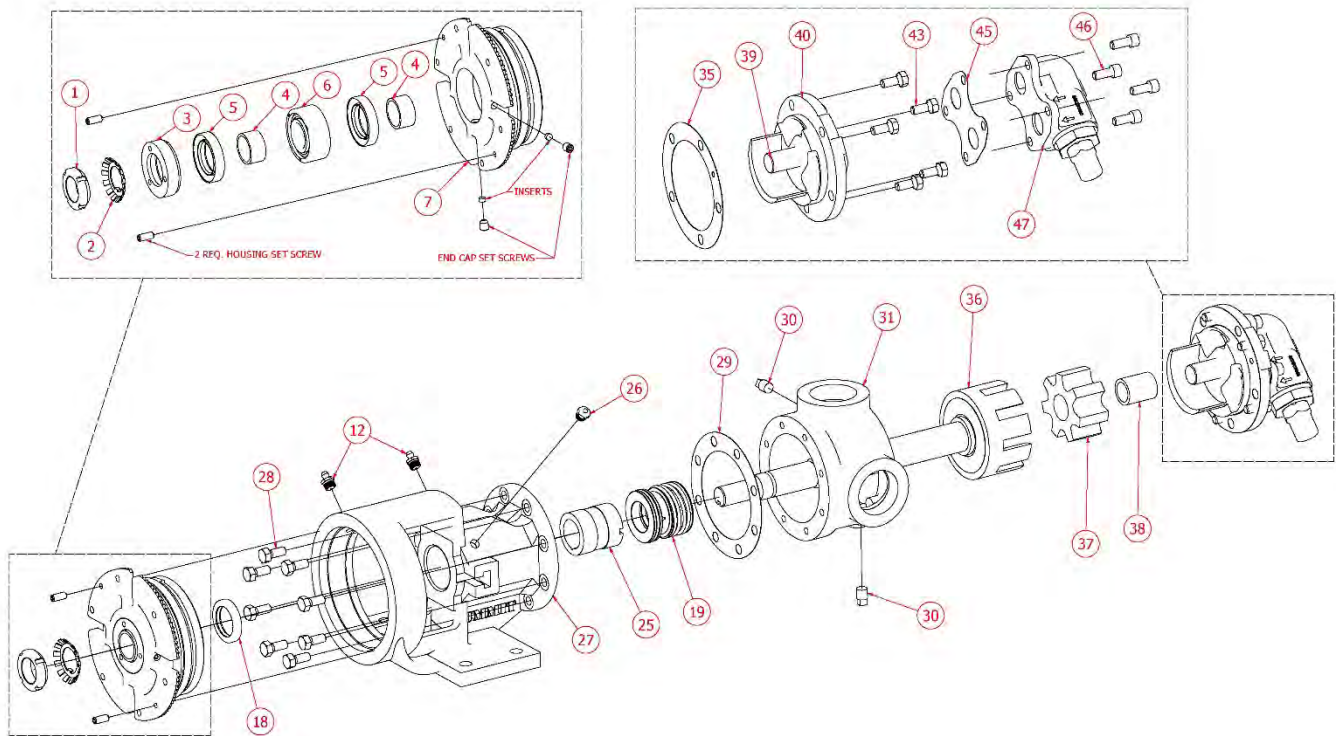


Figure 10-4: VV40H & VV40HL Exploded View - Stainless Steel

Table 10-4: Itemized Parts

MODEL VV40H VV40HL INTERNAL GEAR PUMP					
01	LOCK NUT	17	PACKING GLAND CAP SCREW	36	ROTOR AND SHAFT
02	LOCK WASHER	19	PACKING RING/MECHANICAL SEAL	37	IDLER AND BUSHING ASSEMBLY
03	END CAP FOR BEARING HOUSING	20	RETAINING RING	38	IDLER BUSHING
04	BEARING SPACER COLLAR	25	BRACKET BUSHING	39	IDLER PIN
05	LIP SEAL	27	BRACKET AND BUSHING	40	HEAD AND IDLER PIN ASSEMBLY
06	BALL BEARING	28	CAP SCREW FOR BRACKET	43	CAP SCREW FOR HEAD
07	BEARING HOUSING	29	BRACKET GASKET	45	RELIEF VALVE GASKET
12	GREASE FITTING	30	PIPE PLUG	46	CAP SCREW FOR VALVE
15	PACKING GLAND	31	CASING	47	RELIEF VALVE
16	NUT, SELF LOCKING	35	HEAD GASKET		
1 THROUGH 7	BEARING HOUSING ASSEMBLY (COMPLETE) INCLUDES BEARING HOUSING SET SCREW, INSERTS, END CAP SET SCREW				

**10.5 VVB40H & VVB40HL Cast Iron & Stainless Steel – Behind Rotor Mechanical Seal**



**Figure 10-5: VVB40H & VVB40HL Behind Rotor Seal**

**Table 10-5: Itemized Parts**

BEHIND ROTOR SEAL : VVB40H & VVB40HL INTERNAL GEAR PUMP					
01	LOCK NUT	19	COMPONENT MECHANICAL SEAL	36	ROTOR AND SHAFT
02	LOCK WASHER	25	BRACKET BUSHING	37	IDLER AND BUSHING ASSEMBLY
03	END CAP FOR BEARING HOUSING	26	PRESSURE RELIEF PLUG	38	IDLER BUSHING
04	BEARING SPACER COLLAR	27	BRACKET AND BUSHING	39	IDLER PIN
05	LIP SEAL	28	CAP SCREW	40	HEAD AND IDLER PIN ASSEMBLY
06	BALL BEARING	29	BRACKET GASKET	43	CAPSCREW FOR HEAD
07	BEARING HOUSING	30	PIPE PLUG	45	RELIEF VALVE GASKET
12	GREASE FITTING	31	CASING	46	CAP SCREW FOR VALVE
18	LIP SEAL (FOR CHAMBER)	35	HEAD GASKET	47	RELIEF VALVE
1 THROUGH 7	BEARING HOUSING ASSEMBLY (COMPLETE) INCLUDES: BEARING HOUSING SET SCREW, INSERTS & END CAP SET SCREW				

10.6 VV40: K, KK, L, LL, LQ & LS Cast Iron & Stainless Steel

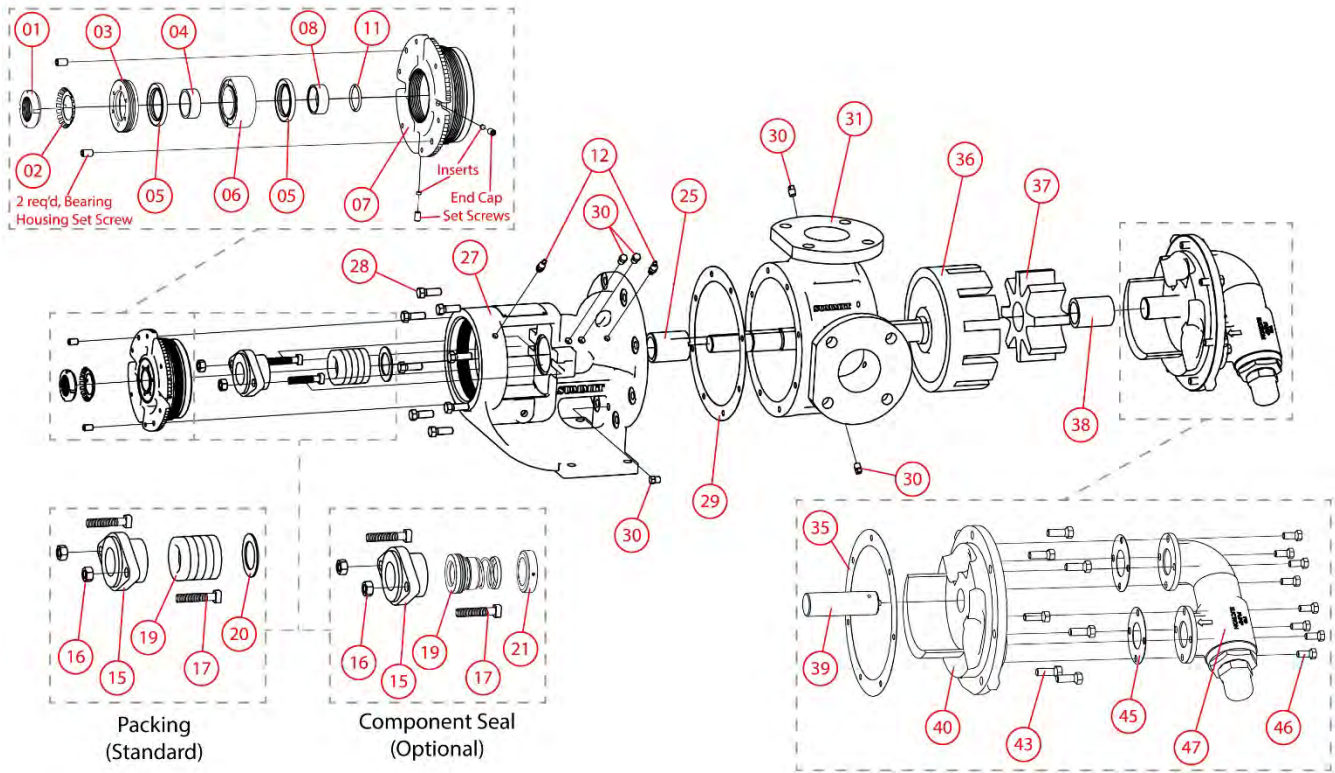


Figure 10-6: VV40: K, KK, L, LL, LQ, LS Exploded view Cast Iron and Stainless Steel. Note: VV40L is not available in Stainless

Table 10-6: Itemized Parts

MODEL VV40 INTERNAL GEAR PUMP					
ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION
01	LOCK NUT	19	PACKING	36	ROTOR AND SHAFT
02	LOCK WASHER		COMPONENT MECHANICAL SEAL	37	IDLER AND BUSHING ASSEMBLY
03	END CAP FOR BEARING HOUSING	20	PACKING RETAINING WASHER	38	IDLER BUSHING
04	BEARING SPACER COLLAR (OUTER)	21	MECHANICAL SEAL COLLAR	39	IDLER PIN
05	LIP SEAL	22**	SEAL HOLDER	40	HEAD AND IDLER PIN ASSEMBLY
06	BEARING(S)	23**	SEAL HOLDER PLATE	41*	O-RING FOR JACKET HEAD PLATE
07	BEARING HOUSING	25	BRACKET BUSHING	42*	JACKET HEAD PLATE
08	BEARING SPACER COLLAR (INNER)	27	BRACKET AND BUSHING	43	CAP SCREW FOR PLAIN OR VALVE TYPE HEAD
11	RING, HALF ROUND	28	CAP SCREW FOR BRACKET	45	RELIEF VALVE GASKET
12	GREASE FITTING	29	BRACKET GASKET	46	CAP SCREW FOR VALVE
15	PACKING/MECHANICAL SEAL GLAND	30	PIPE PLUG	47	INTERNAL RELIEF VALVE
16	PACKING/SEAL GLAND NUT SELF LOCKING	31	CASING	1 THROUGH 11	BEARING HOUSING ASSEMBLY
17	PACKING/SEAL GLAND CAP SCREW	35	HEAD GASKET		BEARING HOUSING SET SCREW
					INSERTS
					END CAP SET SCREW

\* NOT SHOWN

\*\* NOT SHOWN; LS, Q AND QS SIZES ONLY

K and KK Cast Iron sizes have NPT ports on Casing (31)

Note: Item 21 is not present with Stainless Steel externals



## 11 DISASSEMBLY MODEL VV40

This section will cover sizes: G, H, HL, AK, AL, K, KK, L, LQ, LL, LS, Q, and QS. It must be noted that although there are slight differences within these sizes, the disassembly and assembly procedures follow the same progression. Use the following steps as a general guideline, as it is impractical to cover every situation.

Refer to Section 10 EXPLODED VIEWS for part's item number reference.

Notes:

- Sizes G through L, for cast iron externals, have a NPT suction and discharge port. Ductile iron, steel and stainless steel externals may or may not have a NPT pipe connections. Although, this will not affect disassembly or assembly of the pump, it will alter how piping will be connected and disconnected.
- Sizes Q and QS have two tapered roller bearings (06). These sizes also utilize threaded studs and nuts for piping connections, as well as head (40) to casing (31) connections. For Q and QS component seals, item number (15) becomes items: seal holder (22) and seal holder plate (23). During assembly or disassembly refer to item (15) as items (22) and (23).
- The casing on size QS will have suction and discharge ports 180 degrees apart from each other versus 90 degrees on other sizes.
- Item 36, rotor and shaft (36) is one piece. This may be referenced as “shaft (36)”, “rotor (36)” or “rotor and shaft (36)”.

**⚠ DANGER**

Lock out power to avoid personal injury or death when working on packing.

**⚠ DANGER**

Properly vent any pressure in pump, fittings and connecting lines.

**⚠ WARNING**

Understand material being pumped. Obtain MSDS information for product. Take all necessary precautions.

**⚠ WARNING**

Wear eye protection and proper personal protective equipment.

**NOTICE**

Secure pump before disassembly to avoid damage. Pump's center of gravity changes when removing parts.

### 11.1 HEAD AND CASING

1. Remove pipe plug (30) in lower section of bracket (27) to drain fluid from casing and piping.
2. Mark head (40) and casing (31) orientation using a permanent marker before disassembly. It is critical to keep head (40) and casing (31) orientation the same for proper performance.
3. Remove cap screws (43), head (40) and, if equipped, internal relief valve (47) (Instructions for internal relief valve disassembly refer to Section 11.5). Take care not to damage the head gasket (35) and idler (37). When removing, tilt the head (40) away from the casing to avoid the idler (37) falling off the idler pin (39), to avoid damaged.

If pump is jacketed, remove jacket head plate (42) and O-ring (41) at this point. *Note: Items (42) and (41) are not shown in Figure 10-6.*

4. Remove idler and bushing assembly (37). Visually check for wear and damage, replace if needed. If necessary, remove idler bushing (38) using a press. Refer to Section 12.1 on page 31 for more bushing details.
5. Separate head gasket (35) from head (40) and set aside, replace if damaged or needed. Press out idler pin (39) if needed.

### 11.2 BEARING HOUSING

1. Bend up the locking tang on the lock washer (02). To remove locknut (01) place a hard wood board or a soft brass bar through the suction or discharge ports and into the teeth of the rotor (36). This will keep the rotating components from moving. Using a spanner wrench turn the locknut (01) counter-clockwise to remove and discard.
2. Slide off lock washer (02) and discard. Upon reassembly replace with a new lock washer (02). *Note: The VV40G and VVB40G do not have lock washers (02).*
3. Remove set screws (Bearing Housing Set Screw) on bearing housing (07) flange and set aside. Remove the bearing housing (07) assembly by rotating counter-clockwise (as viewed from the drive end).
4. Remove set screws (End Cap Set Screws) and white inserts (Inserts) in the bearing housing (07) flange. This will allow the end cap (03) to be removed. Rotate the end cap (03) counter-clockwise to remove from the bearing housing (07).

**NOTICE**

Do not change positions of inner and outer tapered roller bearing – for Q and QS sizes.

5. Remove outboard lip seal (05), outer bearing spacer collar (04), bearing (06), inboard lip seal (05), inner bearing spacer collar (08) and half round ring (11). Check all components for wear or damage, it is recommended to replace lip seals (05). *Note: half round ring (11) is not present for G, H, HL, Q and QS sizes. Lip seals (05) are not present for G size.*

### 11.3 REMOVING SEALS

1. Remove the packing/seal gland nuts (16) and packing/seal gland cap screw (17).
2. Slide the packing/mechanical seal gland (15) off the rotor and shaft (36) and place next to gland nuts (16) and gland cap screw (17).

Continue to step three in sections 11.3.1 and 11.3.2 for packing or component mechanical seal respectively.

#### 11.3.1 Packing

3. Using a packing hook, remove the packing (19) from the stuffing box. Be careful not to damage stuffing box bore. Refer to packing manufacturer for recommended hours of use before needing replacement.
4. Remove packing retaining washer (20).
5. With a mirror, inspect the shaft (36) for wear. If worn, the shaft (36) will need to be replaced; see Section 11.4 for rotor and shaft (36) removal. *Note: Rotor and shaft (36) is one piece.*

#### 11.3.2 Component Mechanical Seal

3. Remove the mechanical seal (19) from the bracket (27) being careful not to damage the elastomers or sealing faces.
4. To remove the mechanical seal collar (21), remove pipe plugs (30) from the bracket (27) located on the stuffing box to access the set screws on the mechanical seal collar (21). Rotate the rotor and shaft (36) to line up set screws with the pipe plug (30) hole opening. Use a hex-head wrench on the mechanical seal collar's (21) set screws and loosen all set screws.
5. It is a good idea to mark the shaft (36) where the mechanical seal collar (21) was originally set to assist with reassembly. Slide the mechanical seal collar (21) off the rotor and shaft (36).
6. Inspect bracket (27), rotor and shaft (36) and mechanical seal (19) for damage or wear. If needed replace parts.

### 11.3.3 Behind the Rotor Component Seal

For pumps with a behind the rotor seal, identified by a “2” in the section six and by “VVB40” in section 1 of the pump nomenclature. Reference Figure 10-2 and Figure 10-5 for behind the rotor seal item numbers:

1. Carefully slide out rotor and shaft (36) as not to damage the bracket bushing (25). **Do not separate rotor and shaft (36).**
2. Remove the spring and rotary member of the mechanical seal (19) from the rotor and shaft assembly (36).
3. Remove the stationary member of the mechanical seal (19) from the pump bracket (27). The lip seal (18) can now be removed. It may be necessary to remove the bracket bushing (25).

### 11.4 BRACKET AND CASING

1. Carefully slide out rotor and shaft (36) as not to damage the bracket bushing (25). **Do not separate rotor and shaft (36).**
2. Remove cap screws (28) from the bracket (27). Support the weight of the casing (31) as not to damage threads on cap screws (28) or the casing (31) when removing.
3. Remove bracket gasket (29), replace if damaged.
4. Remove bracket bushing (25), if needed, utilizing a press.

### 11.5 INTERNAL RELIEF VALVE

1. Mark the orientation of the internal relieve valve (47) with the head (40). Note the side with the adjustment screw is always nearest the suction port. If installed improperly the valve will act as a plug and will not bypass fluid when pressure limit is reached.



2. Remove cap screws (46) and pull off internal relief valve (47). Be careful as not to damage relief valve gaskets (45).

## 12 ASSEMBLY MODEL VV40

This section will cover sizes: G, H, HL, AK, AL, K, KK, L, LQ, LL, LS, Q, and QS. It must be noted that although there are slight difference within these sizes the disassembly and assembly procedures follow the same progression. Use the following steps as a general guideline as it is impractical to cover every situation.

It is vital during assembly to ensure cleanliness. Especially for bearings, mechanical seal, packing and lip seals. Check all parts for damage, nicks and wear. Inspect all tapped holes; chase threads as needed. If damage or wear is found, replace parts to avoid premature failure.

Notes:

- Sizes G through L, for cast iron externals, have a NPT suction and discharge port. Ductile iron, steel and stainless steel externals may or may not have a NPT pipe connections. Although, this will not affect disassembly or assembly of the pump, it will alter how piping will be connected and disconnected.
- Sizes Q and QS have two roller bearings (06). These sizes also utilize threaded studs and nuts for piping connections and head (40) to casing (31) connections. For Q and QS component seals, item number (15) becomes items, seal holder (22) and seal holder plate (23). During assembly or disassembly refer to item (15) as items (22) and (23).
- The casing on size QS will have suction and discharge ports 180 degrees apart from each other versus 90 degrees on other sizes.

<b>⚠ DANGER</b>
Lock out power to avoid personal injury or death.

<b>NOTICE</b>
Secure pump before assembly to avoid damage. Pump's center of gravity changes when adding parts.

<b>⚠ DANGER</b>
Operation of any positive displacement pump with a clogged discharge or closed discharge valve generates a pressure vessel. Ensure a safety valve is fitted correctly in system.

### 12.1 BRACKET & IDLER BUSHINGS

The following steps are written in terms of the bracket bushing (25) and bracket (27). When installing the idler bushing (38) with the idler (37), replace the verbiage: “bracket bushing (25)” with “idler bushing (38)” and “bracket (27)” with “idler (38)”.

These steps are both written for bronze and carbon graphite bushings. Take extreme care with the carbon graphite bushing, as they are very brittle and easily cracked.

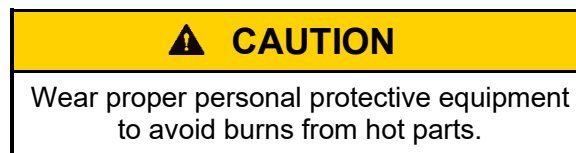
### 12.1.1 Normal installation

1. Inspect bracket (27) for wear or damage and clean to avoid contamination of bearings and bracket bushing (25).
2. Chamfer the leading edge of bracket bushing (25) and the bore entry on bracket (27), if not already. This will assist with lining up both parts. Lubricate bracket bushing's (25) outer diameter and bracket's (27) inner diameter.
3. Use a press to install bracket bushing (25). Ensure both parts are square to each other and if bracket bushing (25) has a groove install bushing so that groove is in the 6-o'clock position.

Once pressing, do not stop until bracket bushing (25) is located in the proper position; which is even with the bracket's (27) machined surface. Starting and stopping will crack the bracket bushing (25) and cause premature failure.

4. Check for cracks in the bracket bushing (25). Any cracks will reduce bushing life and increase shaft wear. It is recommended to remove and replace bushing if any cracks are detected.

### 12.1.2 Heated installation



This is the recommended installation process for the carbon graphite bushing. Since the carbon graphite bushing is very brittle, there is less risk of cracking in this process.

1. Inspect bracket (27) for wear or damage and clean to avoid contamination of bearing and bracket bushing (25).
2. Slowly and thoroughly heat bracket (27) in the bracket bushing (25) installation location. The lower the bracket (27) temperature the higher the risk of cracking the bushing.
3. Use a press to install a cool bracket bushing (25). Ensure both parts are square to each other and if bracket bushing (25) has a groove install bushing so that groove is in the 6-o'clock position.

Once pressing, do not stop until bracket bushing (25) is located in the proper position; which is even with the bracket's (27) machined surface. Starting and stopping will crack the bracket bushing (25) and cause premature failure.

4. Check for cracks in the bracket bushing (25). Any cracks will reduce bushing life and increase shaft wear. It is recommended to remove and replace bushing if any cracks are detected.

**12.1.3 Bushing Temperature Limits**

Table 12-1 shows fluid temperature limits for Bronze and Carbon Graphite bushings when installed in corresponding idler (37) and bracket (27) materials for different pump sizes.

The carbon graphic temperature limits are based on thermal expansion rates and the requirement of an interference fit. The temperature limit with the bronze bushing is a limit of the bronze material and not an interference fit issue.

**Table 12-1: Fluid temperature limits for bushings in VV40 & VVB40 pumps.**

Bushing Material		Carbon Graphite		Bronze
		Iron	Stainless Steel	All
Pump Material		Temperature (°F)		
Pump Size	G	725	475	450
	H, HL	600	375	450
	K, KK	575	350	450
	L, LQ, LL	525	350	450
	LS	540	345	450
	Q, QS	400	270	450

**12.2 BRACKET AND CASING**

1. Install new bracket gasket (29), hold in place by conservatively applying compatible light grease or oil.
2. Attach casing (31) and orientate casing in desired configuration as shown in Figure 6-4 on page 11.
3. Support casing (31) while attaching cap screws (28) and hand tighten. Sequence tighten cap screws (28) and tighten per bolt torque in Table 13-1 in Section 13.1.
4. Clean shaft and rotor (36). Closely inspect for wear or damage paying particular attention to the bearing journal.
5. Carefully slide shaft and rotor (36) though bracket bushing (25) as not to damage the bracket bushing (25). Slide shaft and rotor (36) until rotor mates with the bracket (27). If assembling a behind the rotor seal pump (i.e. VVB40) skip to section 12.3.3 before installing the shaft and rotor (36) into the pump.

**12.3 INSTALLING SEALS**

There are three primary ways to seal the VV40 pumps; packing (standard), component mechanical seal or cartridge mechanical seal. For third party mechanical seal assembly and disassembly, refer to seal manufacturer’s installation and operation manual.

**12.3.1 Packing**

1. Inspect the stuffing box for debris or damage. If needed, replace the bracket (27). Clean bracket (27) and shaft (36) thoroughly to avoid any sealing issues.

2. Choose packing carefully, depending on pumped fluid. Follow all packing manufacturer's instructions.
3. Prepare packing rings by wrapping the packing around a mandrel which has the same diameter as the shaft (36). The number of wraps should equal the number of rings needed for the particular pump as shown in Table 12-2. Cut packing at a 45 degree or 90 degree angle.
4. Install packing retaining washer (20) into the stuffing box, followed by packing (19) rings. Install one ring at a time ensuring a square fit. If desired, lubricate packing (19) and shaft (36) conservatively with compatible grease. When adding packing (19) rings, allow ring joints to be kept at least 90 degrees apart from adjacent ring joints.

**Table 12-2: Packing sizes and number of rings**

Model and Size	VV40G	VV40H VV40HL	VV40AK VV40AL VV40K VV40KK VV40L VV40LQ VV40LL	VV40L VV40LQ "E" sized shaft (1 5/8")	VV40LS	VV40Q VV40QS
Number of Rings	4	5	6	6	7	7
Packing Size	7/16"	7/16"	7/16"	3/8"	3/8"	1/2"

5. When final packing (19) ring is installed, slide packing/seal gland cap screw (17) into bracket (27).
6. Install the packing/mechanical seal gland (15) and secure using the packing/seal gland nut (16) finger tight. More adjustments will be needed during operation to achieve desired drip rate.

For Q and QS sizes, do not tighten packing/mechanical seal gland nuts (16) until after the cap screw (03) has been installed and properly tightened per instructions in Section 12.4 step 8. If gland nuts (16) are tight it will make it difficult to rotate shaft by hand.

**12.3.2 Component Mechanical Seal**

The component mechanical seal is a type 1 or type 9 mechanical seal. It is an alternative to packing or a cartridge seal.

1. Inspect the stuffing box for debris or damage. Clean bracket (27) and shaft (36) thoroughly to avoid any sealing issues, if needed, replace parts. It is recommended that component seals be replaced each time pump is rebuilt.
2. Remove pipe plugs (30) from the bracket (27) located on the stuffing box. These are the access ports to lock down the mechanical seal collar (21) to the shaft (36).
3. Install the mechanical seal collar (21) over the shaft (31) and into the stuffing box. Line up the locking set screws in the mechanical seal collar (21) with the previous marks on the shaft (36) or marked location created during disassembly. If no marks are visible, approximate the mechanical seal collar (21) set distance.



4. Tighten the set screw in the mechanical seal collar (21) with a hex wrench via pipe plug ports located on the stuffing box. Rotate the shaft to access the set screws in the mechanical seal collar (21).
5. Coat the shaft (36), tapered installation sleeve, and mating parts of the component mechanical seal (19) with a generous amount of compatible lubricant; grease is not recommended.
6. Slide the component mechanical seal (19) over the shaft and tapered installation sleeve into the stuffing box until set against the mechanical seal collar (21). Be careful not to bump the threads on the shaft (36) potentially damaging the elastomers on the component mechanical seal (19). If holding clips are present to hold spring in place, remove clips to free spring after seal is installed.
7. Remove the tapered installation sleeve and replace pipe plugs (30) from bracket (27) located on the stuffing box.
8. Install the packing/mechanical seal gland (15) and secure using packing/seal gland nut (16) finger tight.

### **12.3.3 Behind the Rotor Component Mechanical Seal**

For pumps with a behind the rotor seal, identified by a “2” in the section six and by “VVB40” in section 1 of the pump nomenclature. Reference Figure 10-5 for behind the rotor seal item numbers.

1. Inspect the stuffing box for debris or damage. Clean bracket (27) and shaft (36) thoroughly to avoid any sealing issues, if needed, replace parts. It is recommended that component and lip seals be replaced each time pump is rebuilt.
2. Ensure bracket bushing (25) is installed before installing the stationary seat of the mechanical seal (19).
3. Install the stationary seat of the mechanical seal (19) with the machined seal face pointed towards the casing. Apply an appropriate lubricate for the rubber O-ring around the stationary seat of the mechanical seal (19). When pressing into the machined bore give caution as not to damage the O-ring.
4. Slide the spring of the mechanical seal (19) over the Shaft (36) all the way to the backside of the Rotor (36). If there is a spring retainer with the mechanical seal (19), install this over the shaft (19) before the spring. The spring retainer is supplied as a non-critical component and should be used if the spring does not fit securely around the shoulder on the Rotor (36).
5. Lubricate the elastomer of the rotating member of the mechanical seal (19). Slide the rotating member over the shaft (36) with the machined sealing surface pointed away from the Rotor (36).
6. Install the shaft and rotor (36) with component mechanical seal (19) into the casing (31) and bracket (27). Take care as not to damage the stationary seat of the mechanical seal (19) and the bracket bushing (25).
7. Install the bracket lip seal (18) with the lip towards the casing (31) (the spring should be not visible once installed).

## 12.4 BEARING HOUSING

This section will cover the assembly of parts with item numbers 01 to 11. Carefully examine all parts for wear or damage and replace when needed. Replace locknut (01), lock washer (02) and lip seals (05) with new parts.

1. Slide on half round rings (11) on to shaft (36) to shoulder with radial groove. Hold half round rings (11) in place with one hand. *Note: sizes G, H, HL, Q and QS do not have half round rings (11).*
2. Orientate inner bearing spacer collar (08) with the other hand so that the recessed end is facing the casing (31). Slide inner bearing spacer collar (08) over the shaft and mate with half round rings (11). *Note: sizes G, H, HL, Q and QS inner bearing spacer collar (08) will not have recessed end.*
3. Install lip seal (05) into the bearing housing (07). Position lip seal (05) with sealing lip facing the drive end (spring side open to the drive end). Slide lip seal (05) into the bearing housing (07) until the lip seal (05) rests against the deepest shoulder. *Note: Size G does not have lip seals (05).*
4. Position the bearing housing (07) over the shaft and thread in the bearing housing (07) to the bracket (27). Be careful as not to damage the lip seal (05) on the threads for the locknut (01).
5. Pack the ball bearing (06) with acceptable grease. Acceptable grease is stated in Section 7.2.3 on page 15. Position the bearing (06) over the shaft and push or press into the bearing housing (07). *Note: Size G will not need grease as the bearing is sealed for life.*

Q and QS have two bearings and they are tapered roller bearings (06), orientation does matter for installation. Large end of inner raceways must mate together letting the rollers angle away from each other. This is commonly known as a “Face-to-Face” arrangement.

6. Slide the outer bearing spacer collar (04) over the drive end side of the shaft (36) and mate it with the bearing (06).
7. Install lip seal (05) in the end cap (03) with sealing lip facing the drive end when end cap (03) is installed (spring should be open to the drive end side after installation of end cap (03)).
8. Thread the end cap (03) into the bearing housing (07) and tighten with a spanner wrench against the bearing (06). Insert inserts and end cap set screws to lock the end cap (03) in place.

Q and QS sizes have tapered roller bearings and preload must be set for proper operation. Preload is set by turning the end cap (03) in or out of the bearing housing (07).

- a. Thread in end cap (03) until it lightly touches the bearing (06).
  - b. Turn the shaft (36) by hand to reference the amount of resistance while rotating.
  - c. Thread in the end cap (03) with a spanner wrench until the shaft (36) is no longer able to turn by hand.
  - d. Back out the end cap (03) until the shaft (36) is able to turn again with slight but noticeable resistance.
9. Place lock washer (02) and locknut (01) over the shaft. Tighten locknut to corresponding values in Table 13-2 on page 43. Once locknut (01) is properly torqued, bend down tang on lock washer (02) to prevent locknut (01) from rotating. *Note: Size G does not have a lock washer (02).*

Install bearing housing set screws after adjusting the end clearance.

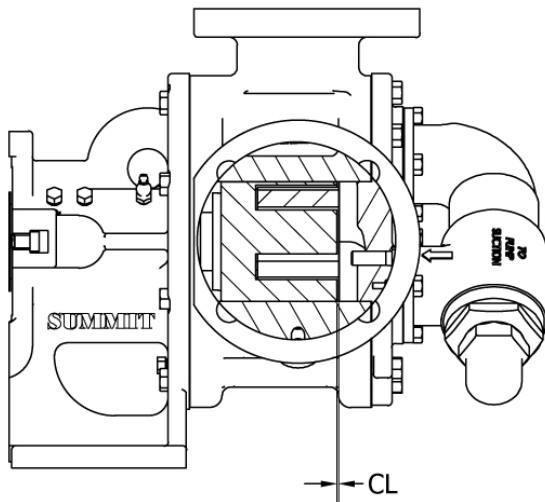
## 12.5 HEAD AND CASING

1. Press idler pin (39) into the head (40). If idler pin (39) is lube type, ensure the end with the threaded hole is facing outward away from the casing (31).
2. Fit a new head gasket (35) onto the head (40). Add a small amount of grease or oil to keep head gasket (35) in place.
3. Slide idler and bushing assembly (37) over idler pin (39). If idler bushing (38) is not installed in idler (37) refer to Section 12.1 BRACKET & IDLER BUSHINGS on page 31 for installation of idler bushing (38).
4. Identify orientation marks that were made during disassembly in Section 11.1 on page 28. It is critical to get head (40) orientation correct for proper pump performance. As rule-of-thumb, the crescent shape on the head (40) should be about 135 degrees away from 90 degree discharge and suction ports and 90 degrees away from 180 degree suction and discharge ports.
5. Once head (40) is in the correct orientation, mate head (40) with the casing (31) lining up the cap screw (43) holes. Hold head (40) in place and hand tighten cap screws (43). Torque the cap screws (43) in proper sequence to torque values shown in Table 13-1 on page 43.

If pump is jacketed, install jacket head plate (42) and O-ring (41) at this point using cap screws (43).

*Note: Items (42) and (41) are not shown in Figure 10-6.*

## 12.6 ADJUSTING END CLEARANCE



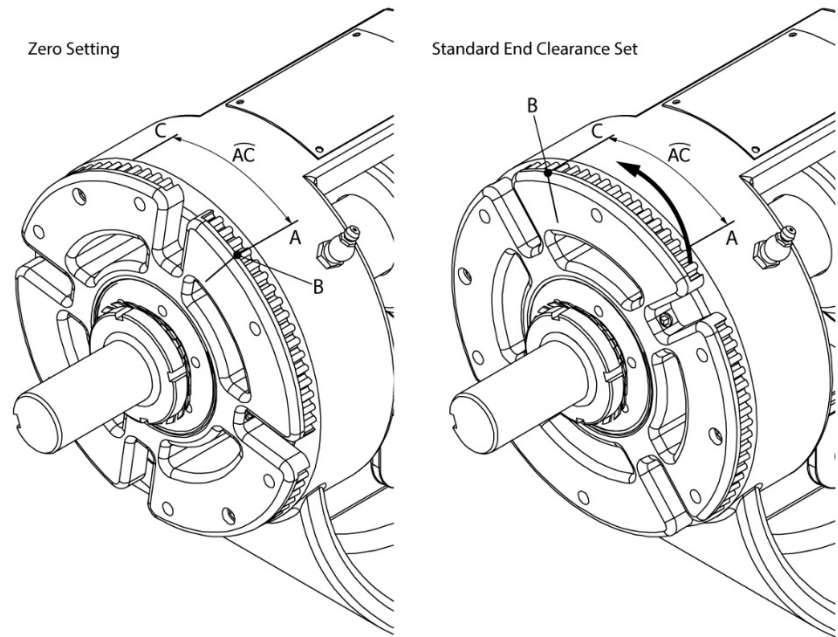
**Figure 12-1: Dimension CL defined**

### 12.6.1 Measured Rotation Method

Standard end clearance is set at the factory. End clearance adjustment is needed to provide proper pump performance and spacing between the rotor (36), idler (37) and head (40).

End clearance is adjusted by rotating the bearing housing (07) clockwise or counter clockwise. Clockwise to make tighter clearances and counter clockwise to open clearances. The following steps explain the process of setting the correct end clearance.

1. Loosen bearing housing set screws, if installed, on the flange of the bearing housing (07).
2. Rotate bearing housing (07) clockwise by hand until it can no longer be turned. Ensure rotor and shaft (36) cannot be rotated by hand.
3. Rotate bearing housing (07) counter clockwise until shaft (36) can be turned with only a slight noticeable drag. This will be the “zero” setting.
4. Table 12-3 shows the standard end clearances for available VV40 and VVB40 models. To set end clearance, rotate bearing housing (07) counter-clockwise as indicated by arc length “AC” in Table 12-3.



**Figure 12-2: Dimension AC defined**

5. After setting end clearance, replace bearing housing set screws to lock bearing housing (07) in place during operation. Tighten set screws evenly, if not, this could set the bearing housing (07) out of parallel to the shaft and cause premature failure. Be sure to rotate shaft and listen and feel for rubbing. Reset end clearance if rubbing is present.
6. It may be necessary to add extra end clearance for higher viscosity fluids. Contact your local Summit Pump, Inc. Distributor for specifications.

**Table 12-3: End clearances, arc lengths and arc lengths per 0.001” of end clearance.**

Model and Size	Material	Standard End Clearance (in)	Distance on OD of Bracket for Standard End Clearance (in)	Distance on Bracket OD for 0.001" End Clearance (in)
		Dimension		
		CL	AC	AC for CL=0.001"
VV40G	(C) Cast Iron	0.003	0.600	0.20
VV40H VV40HL	(C) Cast Iron, (D) Ductile Iron, (W) Steel	0.003	0.750	0.25
	(S) Stainless Steel	0.005	1.125	0.23
VV40AK VV40AL VV40K VV40KK VV40L VV40LQ VV40LL	(C) Cast Iron, (D) Ductile Iron, (W) Steel	0.005	1.250	0.25
	(S) Stainless Steel	0.008	2.000	0.25
VV40LS	(C) Cast Iron, (D) Ductile Iron, (W) Steel	0.005	1.250	0.25
	(S) Stainless Steel (C) Cast Iron w/ "E" sized shaft (1 5/8")	0.010	2.500	0.25
VV40Q VV40QS	(C) Cast Iron, (D) Ductile Iron, (W) Steel, (S) Stainless Steel	0.010	3.100	0.31
	(C) Cast Iron w/ "E" sized shaft (1 5/8")	0.015	4.650	0.31

Note: Values are the same for VVB40 sizes

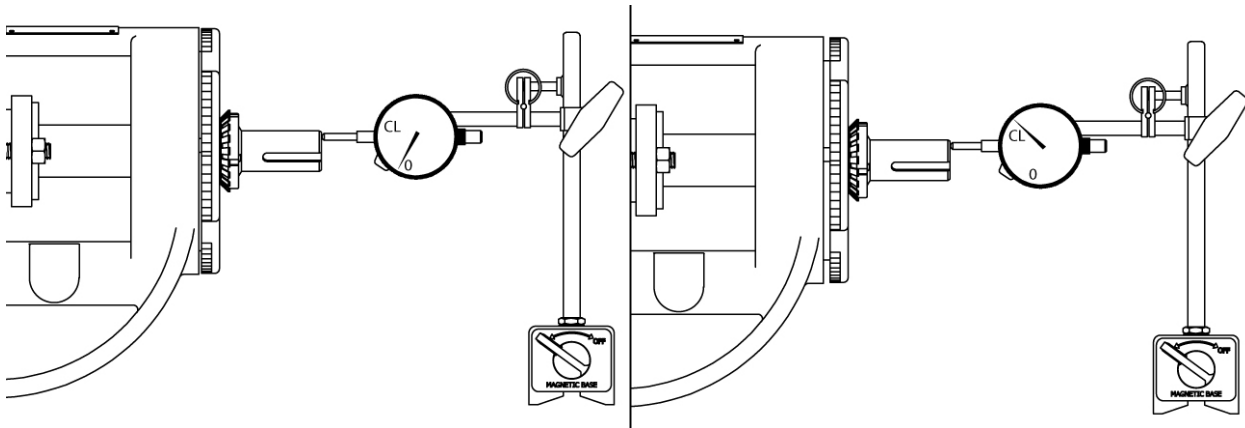
**12.6.2 Dial Indicator Method**

The dial indicator method measures the distance the shaft moves from the “zero” point to the set clearance distance (CL), shown in Table 12-3 on page 15. To set the end clearance using a dial indicator follow the procedure below.

1. Loosen bearing housing set screws, if installed, on the flange of the bearing housing (07).
2. Rotate bearing housing (07) clockwise by hand until it can no longer be turned. Ensure rotor and shaft (36) cannot be rotated by hand.
3. Rotate bearing housing (07) counter clockwise until shaft (36) can be turned with only a slight noticeable drag. This will be the “zero” setting.

4. Secure the dial indicator to either the pump’s base plate or bracket (27). Position the probe on the end of the shaft as shown in Figure 12-3.
5. Refer to Table 12-3 on page 39 to determine the standard end clearances (CL) for corresponding size and material.
6. Set the indicator to “zero”.
7. Turn the bearing housing (07) counter-clockwise, as viewed from the drive end, until the dial indicator reads the desired end clearance (CL).

8. After setting the end clearance, replace bearing housing set screws to lock bearing housing (07) in place during operation.
9. It may be necessary to add extra end clearance for higher viscosity fluids. Contact your local Summit Pump, Inc. Distributor for specifications.



**Figure 12-3: Dial Indicator Position**

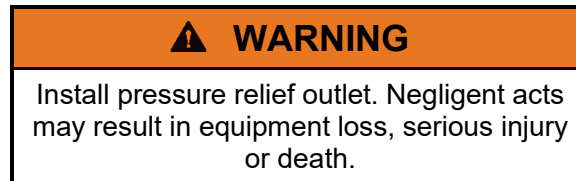
**NOTICE**

End clearance must be set for proper performance. Incorrect settings could damage pump internals.

## 12.7 INTERNAL RELIEF VALVE

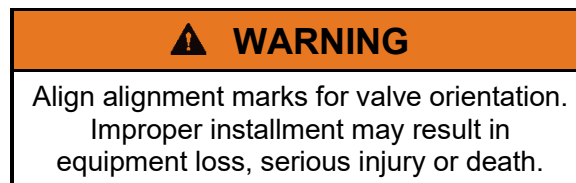
There are two sets of instructions for internal relief valve (47) assembly. One is to adjust the pressure setting of the valve and the other is attaching the internal relief valve (47) to the head (40).

If pump is not equipped with an internal relief valve, there must be other means of system pressure release. All positive displacement pumps operate at the pressure required of the system with a constant flow rate. If there is a clog or closed valve in the system, the pump will keep building pressure until a way of pressure release is found.



### 12.7.1 Mounting valve on head

It is critical to mount the internal relief valve (47) in the correct orientation on the head (40). Align marks created in Section 11.5 on page 30. If installed incorrectly the valve will not work properly. The system will exceed valve set pressure setting, causing damage to equipment, serious injury or death.



If no alignment marks have been made, the adjusting screw of the internal relief valve (47) should always be closest to the suction port. See Figure 6-4 on page 11 for illustration.

1. Inspect internal relief valve (47) for damage or debris. Check mating parts for damage, replace if needed.
2. Place relief valve gaskets (45) on internal relief valve (47) flanges. Applying a light coating of grease or oil may be necessary to hold relief valve gaskets (45) in place.
3. Position internal relief valve on head in correct configuration as determined by alignment marks or as shown in Figure 6-4 on page 11.
4. Secure internal relief valve (47) using cap screws (46) and tighten by hand. Torque cap screws (46) in a tightening sequence to torque values shown in Table 13-1 on page 43.

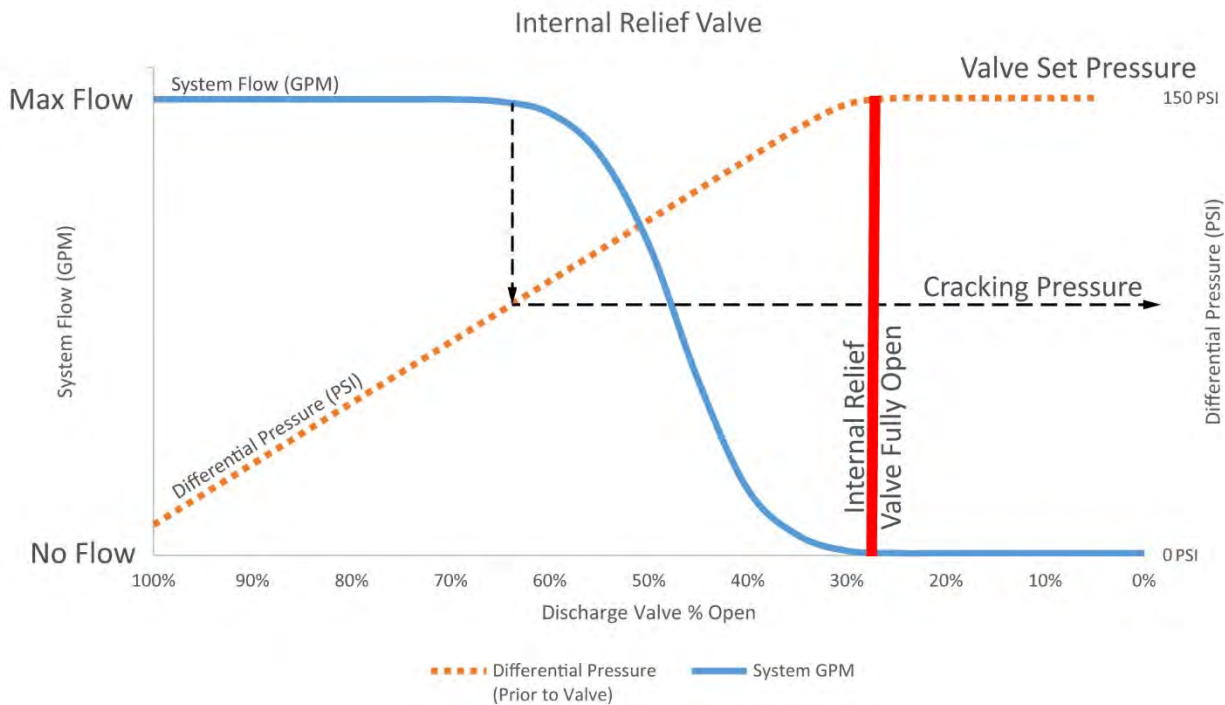
**12.7.2 Setting pressure**

The internal pressure relief valve (47) pressure setting is set at the factory to a standard 100 psi when the valve is fully open. Relief valve pressures are only set differently if stated on customer’s purchase order.

The valve will begin to open at a lower pressure than the pressure setting; this is called the “cracking pressure”. A percentage of pump capacity will be lost from the discharge line once the cracking pressure is reached.

For example, the internal relief valve (47) is set to 150 psi. Observe the differential pressure (between suction and discharge) and the system flow meter while slowly closing a valve beyond the discharge pressure gauge. Figure 12-4 shows the pressure and flow rate relationship when increasing the pressure in the piping system (i.e. closing the discharge valve).

*Note: Figure 12-4 shows a general relationship and not actual tested data.*



**Figure 12-4: Internal relief valve (47) effects on system flow when differential pressure approaches internal relief valve (47) set pressure.**



## 13 APPENDIX A – Reference Tables

### 13.1 TORQUE GUIDELINES

#### 13.1.1 Bolt Torques

**Table 13-1: General bolt torque values**

Stainless Steel Bolts		Carbon Steel Bolts	
ASTM F593		Grade 5	
Size	Max. Torque	Size	Max. Torque
10-24	22 inlb	N/A	
1/4-20	45 inlb	1/4-20	8 ftlb
5/16-18	92 inlb	5/16-18	17 ftlb
3/8-16	14 ftlb	3/8-16	30 ftlb
7/16-14	22 ftlb	7/16-14	49 ftlb
1/2-13	33 ftlb	1/2-13	75 ftlb
9/16-12	48 ftlb	9/16-12	110 ftlb
5/8-11	66 ftlb	5/8-11	150 ftlb
3/4-10	120 ftlb	3/4-10	265 ftlb

#### 13.1.2 Locknut Torques

**Table 13-2: VV40 Locknut torque values**

Model and Size	Torque (ft-lbs)	Locknut Size	Lock Washer Size
VV40G	20-30	5/8" Self-Locking	N/A
VV40H VV40HL	50-70	#N-05	#W-05
VV40AK VV40AL VV40K VV40KK VV40L VV40LQ VV40LL	100-130	#N-07	#W-07
VV40LS	120-150	#N-08	#W-08
VV40Q VV40QS	170-190	#N-11	#TW-111

*Note: Values for VVB40 sizes are equal*



## 14 PUMP INFORMATION

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Purchase Date: \_\_\_\_\_

Purchase Order#: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Equipment Number: \_\_\_\_\_

PO Box 12145 Green Bay, WI 54307  
[www.summitpump.com](http://www.summitpump.com)

Rev. 09/2020



