

SUMMIT™

VV95

Installation, Operation, and Maintenance Manual
Model: VV95 Internal Gear Pump

VV95



Internal Gear Pump



SUMMIT™
PUMP, Inc

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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.

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

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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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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.

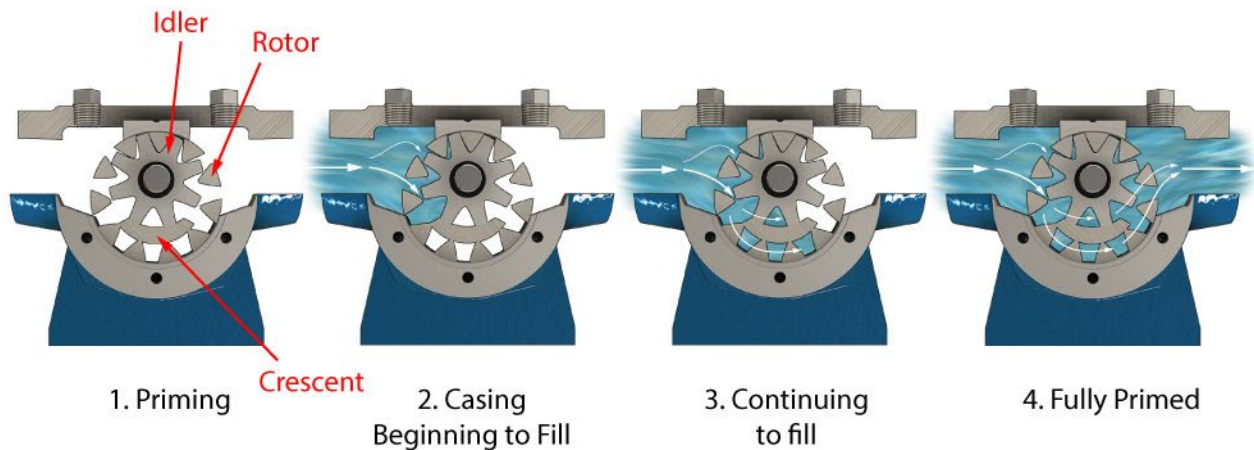


Figure 2-1: Priming cycle and gear pump design principle

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

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:

⚠ DANGER
Imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING
Potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION
Potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE
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:

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

⚠ CAUTION
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

On page 37 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. VV95HL). The remaining format consists of the **Seal Type & Material** (section 3, i.e. “2B”), **Materials of Construction** (sections 4 & 5, i.e. “CC”), and finally **Special to Application** (section 6, 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

(“VV95HL”, 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 “VV95”.

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

4.1.2 Seal Type & Material

(“2B”, Section 3) Section 3 identifies how the pump is sealed and with what materials. Options are type 2 carbon nickel buna, type 2 carbon nickel fluoroelastomer or type 9 carbon nickel PTFE component mechanical seals.

Table 4-1: Materials of Construction

MODEL VV95 MATERIALS OF CONSTRUCTION			
ITEM	SECTION "4" EXTERNAL COMPONENTS IN NOMENCLATURE		
	(C) CAST IRON	(E) CAST IRON - STEEL FITTED	(S) STAINLESS STEEL
CASING	CAST IRON	CAST IRON	STAINLESS STEEL
HEAD	CAST IRON	CAST IRON	STAINLESS STEEL
ROTOR	CAST IRON	CAST IRON	STAINLESS STEEL
IDLER	**CAST IRON	*STEEL	STAINLESS STEEL
SHAFT	STEEL	STEEL	STAINLESS STEEL
IDLER PIN	HARDENED STEEL	HARDENED STEEL	HARD COATED STAINLESS STEEL
IDLER BUSHING	CARBON GRAPHITE	CARBON GRAPHITE	CARBON GRAPHITE
INTERNAL PRESSURE RELIEF VALVE	CAST IRON	CAST IRON	STAINLESS STEEL

* IRON FOR GG, HJ & HL SIZES

** STEEL FOR AS, AK & AL SIZES

4.1.3 Materials of Construction

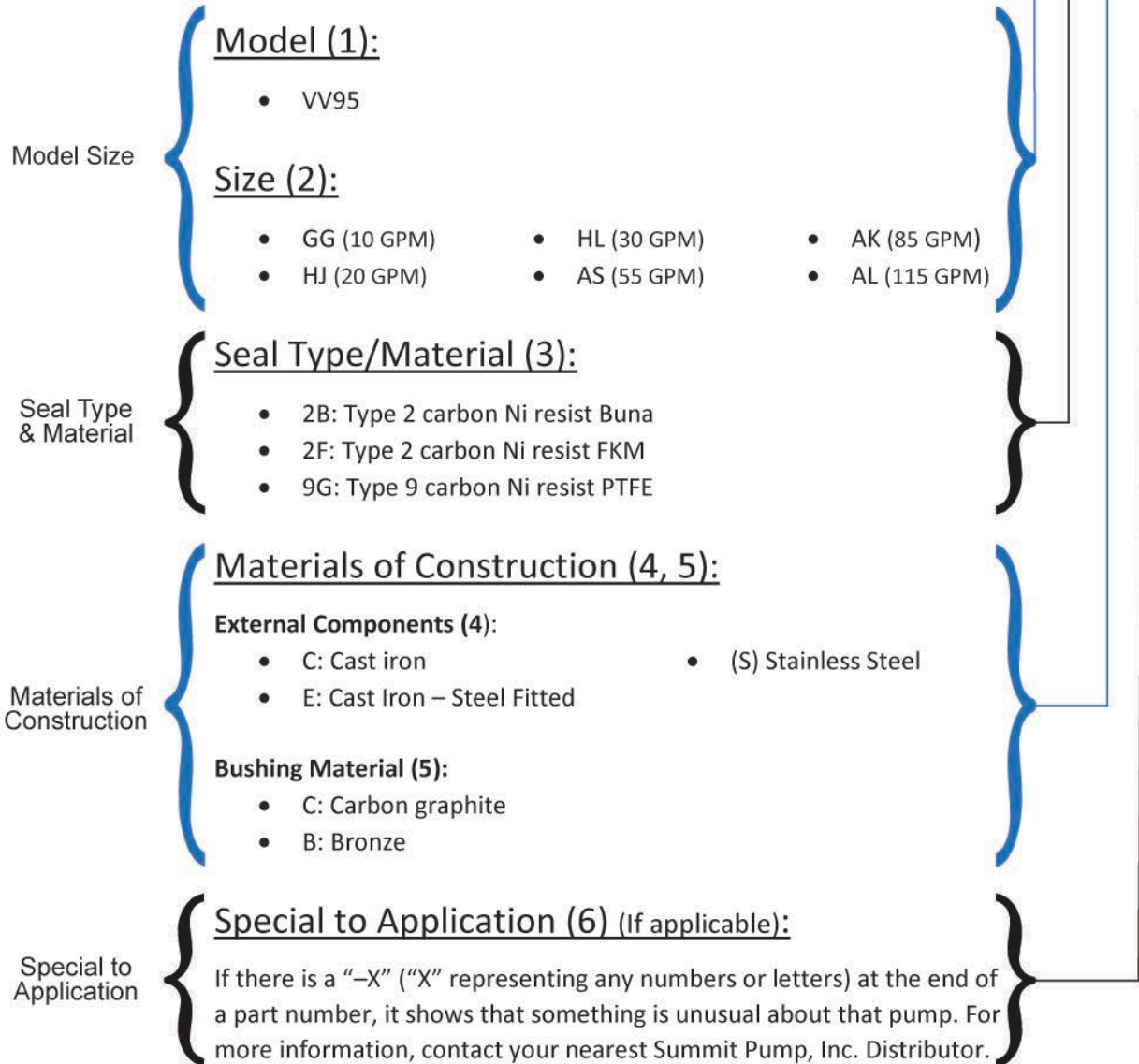
(“CC”, Sections 4 & 5) Section 4 identifies the materials of the working internals and cast parts of the pump. Each letter represents a relationship with these components. See Table 4-1 for specific item’s materials of construction.

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

4.1.4 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: VV95HL-2B-CC
Viking® Model Number: HL 4195

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 temperature variance and humidity.
3. Cover with a protective covering to reduce dust contamination.
4. 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 1-4.
2. Coat all unpainted and machined surfaces with a rust inhibitor, such as LPS-3.
3. Coat shaft coupling end with grease to keep free from dirt and oxidation.

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, dyneema or a wire rope sling. The slings should be placed such that lift is equally supported at four or more points.

WARNING

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

6 INSTALLATION

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

Location considerations are: easy access for inspection, maintenance and ample overhead space for lifting with crane or hoist. Pump should be located to keep suction lines as short as possible.

6.3 BASE PLATE

Each pump unit should be mounted on a cast iron, polymer concrete or 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 cast iron, 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.

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

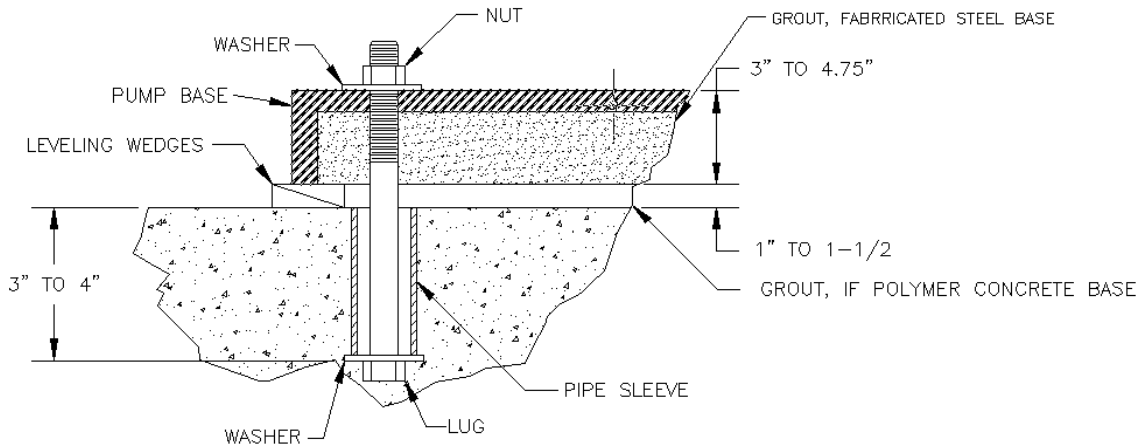


Figure 6-1: Anchor Bolt configuration

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.

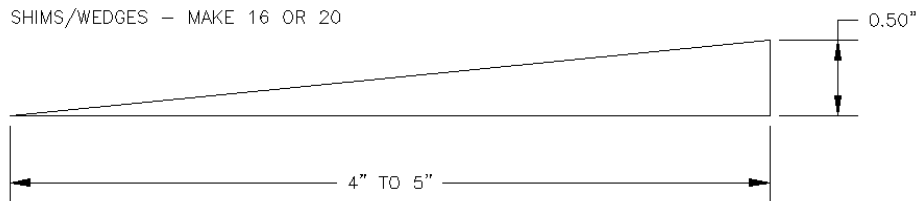


Figure 6-2: Wooden Wedges

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 the 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.

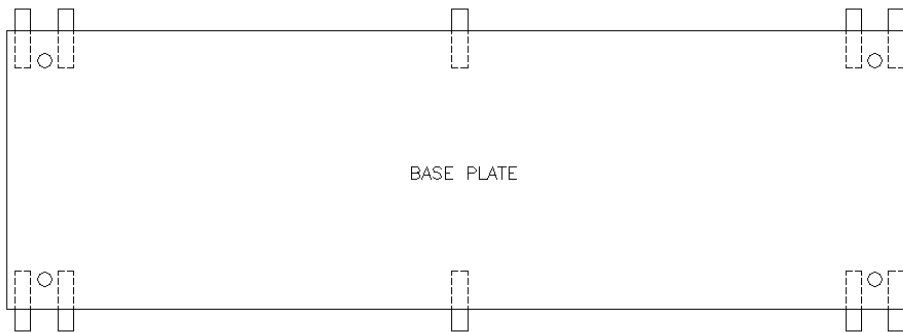
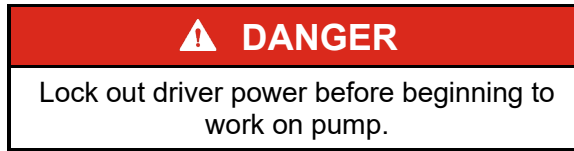


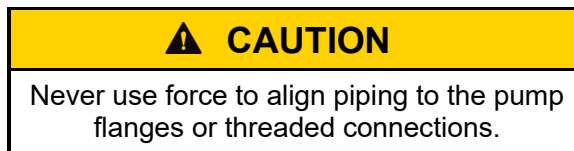
Figure 6-3: Wedge Locations

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 PIPING CONNECTION – SUCTION / DISCHARGE



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.



6.6.1 Suction Piping

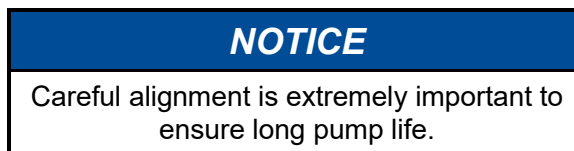
The piping used should be as short as possible from suction source. Piping line size should be the same diameter or one size larger as the suction port. Although, this may not always be the case, as high viscosity, flow velocity or system constraints may cause a change in size. All elbows 45° or 90°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

6.6.2 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.

6.7 ALIGNMENT



6.7.1 Coupling Connected Units

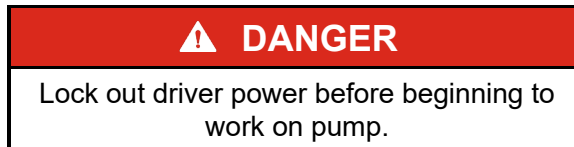
In-line configurations are shipped with the pump and motor leveled on the base plate with the coupling disconnected. Alignment is not done at the factory. If the pump and driver were aligned at the factory, that alignment will be disturbed during shipment. Alignment must be checked. Align the motor to 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.

6.7.2 *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.

6.7.3 *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:

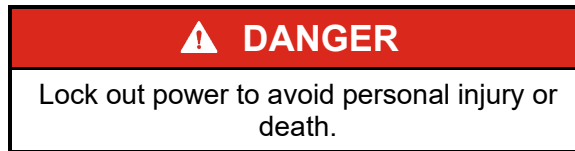


1. Prior to grouting, to remedy misalignment caused by transportation.
2. After grouting, to correct any changes that occurred during grouting.
3. After piping is connected, check alignments to ensure possible pipe strains have not changed alignment.
4. Hot alignment, after the pump has reached operating 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 the suction, determines shaft rotation. The port closest to where pumping elements (gear teeth) come out of mesh is the suction port. If fitted with a pressure relief valve, ensure the adjustment knob is nearest the suction port. See Figure 7-1 for illustration.



1. Lockout power to drive.
2. Remove coupling guard.
3. Disconnect coupling to the motor half allowing the motor to 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 to reconnect pump half.
8. Check alignment and install coupling guard.
9. Unlock motor, pump is ready to run.

7.1.1 Pressure Relief Valve

If changing shaft rotation, the internal pressure relief valve must change orientation as well. The adjustment knob must always point towards the suction side of the pump to ensure proper functionality. Refer to Figure 7-1 for definition of shaft rotation and pressure relief valve orientation.

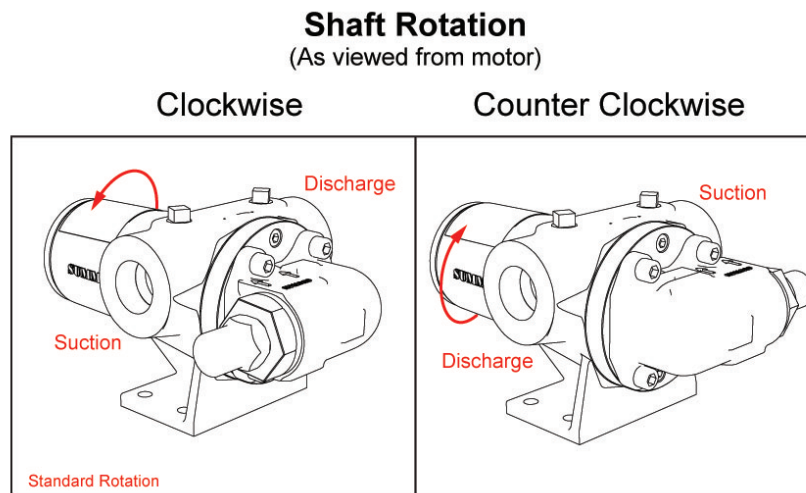


Figure 7-1: Shaft rotation and PRV orientation

7.2 LUBRICATION

7.2.1 Bearings

The bearing(s) on Summit’s VV95 pumps are greased-for-life. These bearings are greased from the bearing manufacture with a measured amount of grease in a clean environment. Never open the bearing seal to regrease the bearing. It is better to replace the bearing than to regrease a greased-for-life bearing.

If pump is disassembled ensure bearing is clean, free of debris and checked for damage. Ensure all dirt and foreign matter is removed before reassembly.

7.2.2 Grease

Recommended grease, if needed for storage, is NLG1 No. 2. 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 Greases NLG1 No. 2 Grade

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

7.3 MECHANICAL SEALS

VV95 model pumps have simple and robust component mechanical seal designs. Water flushed systems are not required nor able to be applied to the pump.

For component mechanical seal assembly refer to section 12.2.1 on page 27 and disassembly in section 11.4 on page 24.

7.4 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.
2. All electrical connections.
3. All instruments and gauges should be in working order.
4. Correct pump rotation as desired, see Figure 7-1 on page 12.
5. Open the valves on the suction and discharge lines.

⚠ 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.

7.4.1 Start Up

1. Before operating the pump it must be filled with liquid. This can be done by removing the piping or pipe plugs (08, 09, 13) and filling 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 7.1 on page 12 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 7-1 on page 12 for illustration.
4. Start the pump.

⚠ DANGER

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

7.4.2 Shut Down

1. If possible, flush the pump with clean water. (Only use water if it will not contaminate the pumping liquid). If pumping concrete, tar or some material that will harden if cooled or dried, it is especially important to flush or clean the pump as soon as possible.
2. Shut down the pump.
3. Close both the discharge and suction valves.

8 MAINTENANCE TIMETABLE

8.1 DAILY MAINTENANCE

1. Check the lip seals, if applicable, in the bearing housing for tears, worn areas and/or leaks.
2. Inspect the mechanical seal for leaks or excessive noise.
3. Check pump performance by confirming correct flow and pressure.

8.2 THREE MONTH MAINTENANCE

1. Daily maintenance and the following:
2. Keep exterior of pump clean to assist with identifying possible leaks.

8.3 SIX MONTH MAINTENANCE

1. Daily maintenance and the following:
2. Check lip seal and mechanical seal for wear and leaks. The suction and discharge piping spool pieces should be inspected internally for their condition.
3. Lubricate all grease fittings, if applicable, using a hand grease gun.

8.4 YEARLY MAINTENANCE

1. All of the above and the following:
 - a. 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

When parts are referenced in this manual there will be three item numbers associated with one description, i.e. Rotor and Shaft (10, 11, 15). This is stating to use the first item number referencing Table 10-1, second item number referencing Table 10-2 and the third item number should be used for all materials of the VV95AS, VV95AK and VV95AL.

10.1 VV95GG Cast Iron

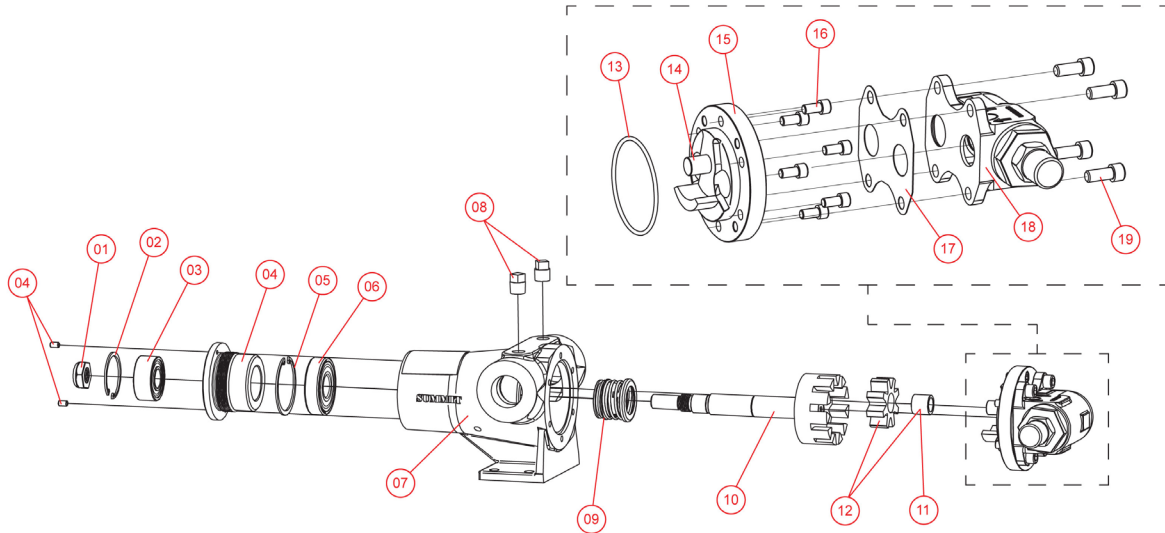


Figure 10-1: VV95GG Cast Iron Exploded View

Table 10-1: VV95GG Parts List

MODEL VV95GG INTERNAL GEAR PUMP			
ITEM	DESCRIPTION	ITEM	DESCRIPTION
01	LOCK NUT	11	IDLER BUSHING
02	SNAP RING (OUTER)	12	IDLER AND BUSHING
03	BALL BEARING (OUTER)	13	O-RING GASKET FOR HEAD
04	BEARING HOUSING W/ SET SCREWS	14	IDLER PIN PLAIN
05	SNAP RING (INNER)	15	HEAD
06	BALL BEARING (INNER)	16	CAP SCREW FOR VALVE TYPE HEAD
07	CASING	17	RELIEF VALVE GASKET
08	PIPE PLUG, 1/4"	18	INTERNAL RELIEF VALVE (COMPLETE)
09	MECHANICAL SEAL (COMPLETE)	19	CAP SCREW FOR VALVE
10	ROTOR AND SHAFT		

10.2 VV95GG, VV95HJ & VV95HL Stainless Steel

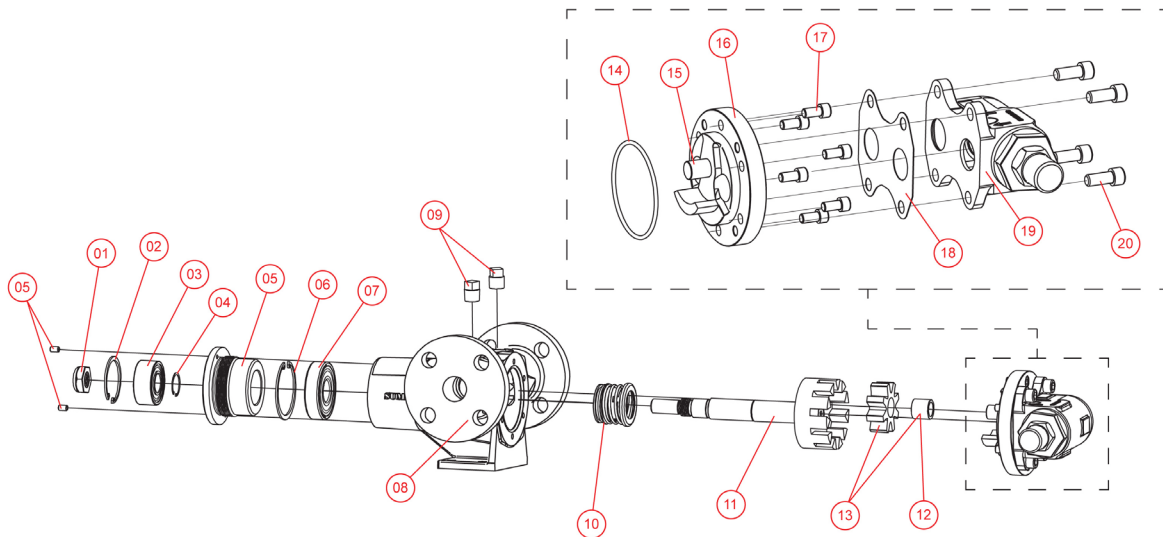


Figure 10-2: VV95GG, VV95HJ & VV95HL Stainless Steel Exploded View

10.3 VV95HJ & VV95HL Cast Iron

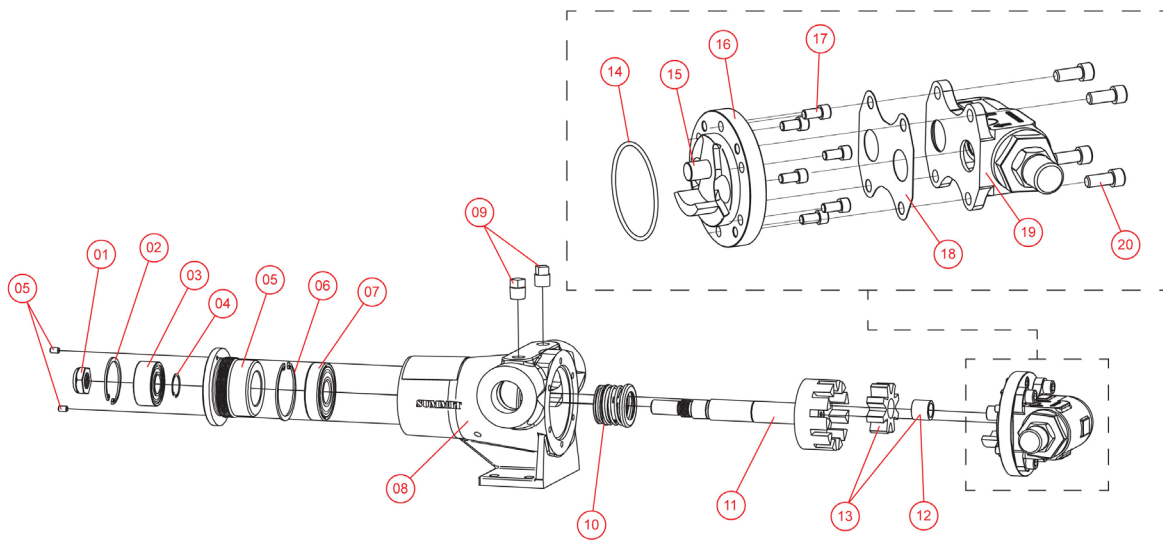


Figure 10-3: VV95HJ & VV95HL Cast Iron Exploded View

Table 10-2: VV95GG Stainless Steel, VV95HJ & VV95HL Cast Iron and Stainless Steel Parts List

MODEL VV95GG STAINLESS STEEL, VV95HJ & VV95HL CAST IRON AND STAINLESS STEEL INTERNAL GEAR PUMPS			
ITEM	DESCRIPTION	ITEM	DESCRIPTION
01	LOCK NUT	11	ROTOR AND SHAFT
02	SNAP RING (OUTER)	12	IDLER BUSHING
03	BALL BEARING (OUTER)	13	IDLER AND BUSHING
04	SNAP RING FOR SHAFT	14	O-RING GASKET FOR HEAD
05	BEARING HOUSING W/ SET SCREWS	15	IDLER PIN PLAIN
06	SNAP RING (INNER)	16	HEAD
07	BALL BEARING (INNER)	17	CAP SCREW FOR VALVE TYPE HEAD
08	CASING	18	RELIEF VALVE GASKET
09	PIPE PLUG, 1/4"	19	INTERNAL RELIEF VALVE (COMPLETE)
10	MECHANICAL SEAL (COMPLETE)	20	CAP SCREW FOR VALVE

10.4 VV95AS, VV95AK & VV95AL Cast Iron & Stainless Steel

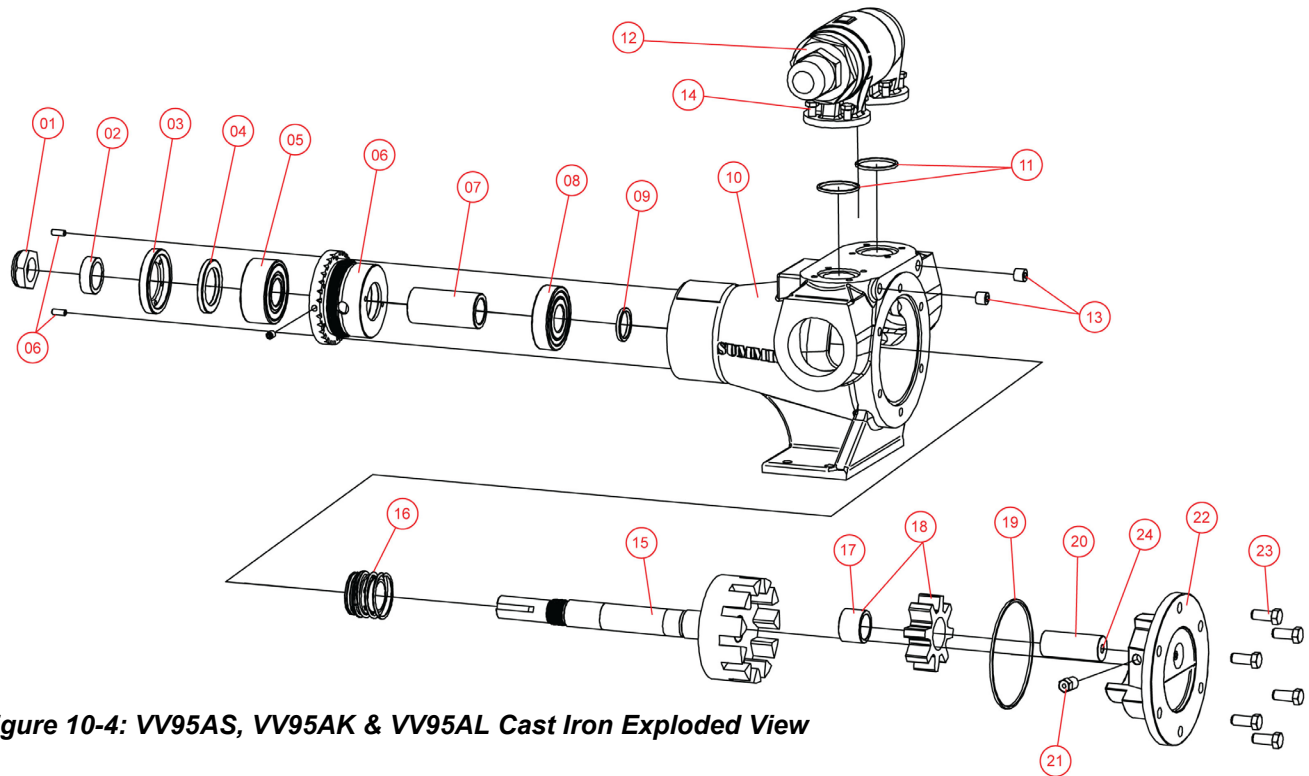


Figure 10-4: VV95AS, VV95AK & VV95AL Cast Iron Exploded View

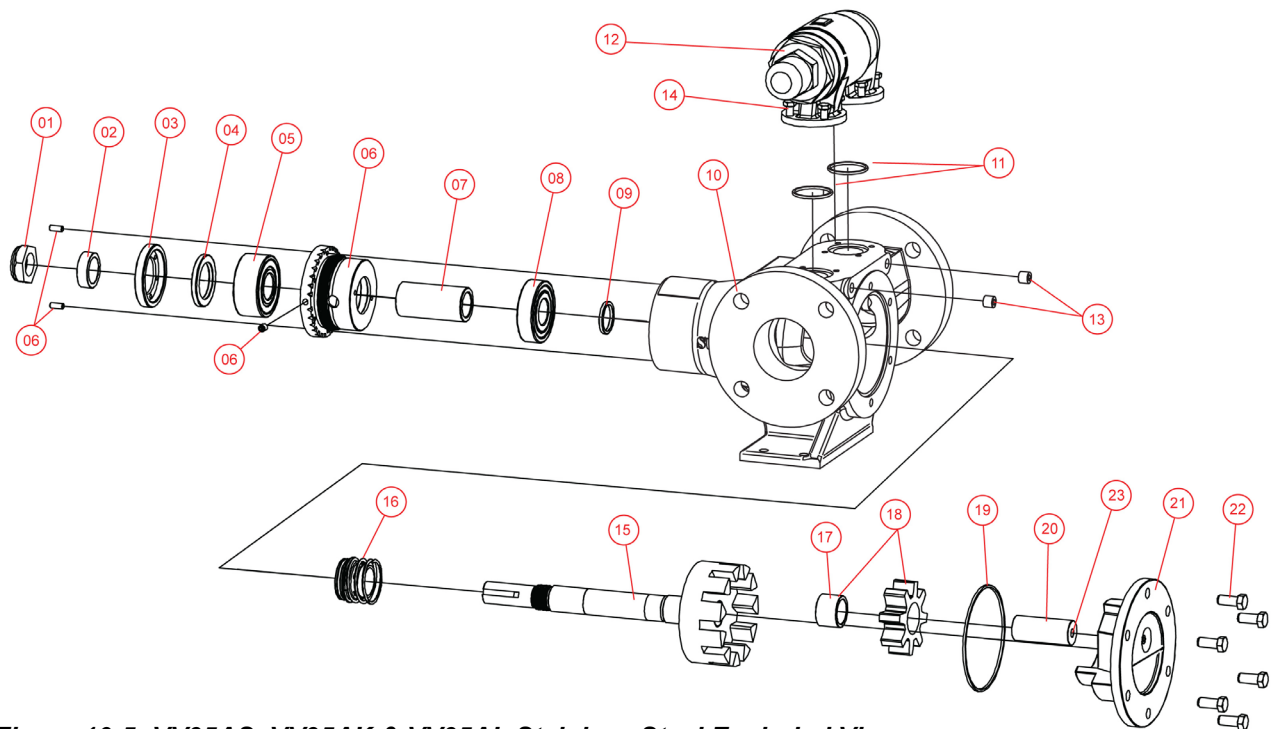


Figure 10-5: VV95AS, VV95AK & VV95AL Stainless Steel Exploded View

Table 10-3: VV95AS, VV95AK & VV95AL Cast Iron Parts List

MODEL VV95AS, VV95AK & VV95AL INTERNAL GEAR PUMPS CAST IRON			
ITEM	DESCRIPTION	ITEM	DESCRIPTION
01	LOCK NUT	13	PIPE PLUG, 1/4"
02	BEARING SPACE COLLAR	14	CAPSCREW FOR VALVE
03	END CAP FOR BEARING HOUSING	15	ROTOR AND SHAFT
04	LIP SEAL FOR BEARING HOUSING	16	MECHANICAL SEAL (COMPLETE)
05	BALL BEARING (OUTER)	17	IDLER BUSHING
06	BEARING HOUSING WITH SET SCREWS	18	IDLER AND BUSHING
07	BEARING SPACER	19	O-RING GASKET FOR HEAD
08	BALL BEARING (INNER)	20	IDLER PIN, LUBE
09	BEARING RETAINER WASHER	21	CHECK VALVE
10	CASING	22	HEAD
11	O-RING VALVE GASKET	23	CAP SCREW FOR HEAD
12	INTERNAL RELIEF VALVE (COMPLETE)	24	PIPE PLUG, 1/8"

Table 10-4: VV95AS, VV95AK & VV95AL Stainless Steel Parts List

MODEL VV95AS, VV95AK & VV95AL INTERNAL GEAR PUMPS STAINLESS STEEL			
ITEM	DESCRIPTION	ITEM	DESCRIPTION
01	LOCK NUT	13	PIPE PLUG, 1/4"
02	BEARING SPACE COLLAR	14	CAPSCREW FOR VALVE
03	END CAP FOR BEARING HOUSING	15	ROTOR AND SHAFT
04	LIP SEAL FOR BEARING HOUSING	16	MECHANICAL SEAL (COMPLETE)
05	BALL BEARING (OUTER)	17	IDLER BUSHING
06	BEARING HOUSING WITH SET SCREWS	18	IDLER AND BUSHING
07	BEARING SPACER	19	O-RING GASKET FOR HEAD
08	BALL BEARING (INNER)	20	IDLER PIN, LUBE
09	BEARING RETAINER WASHER	21	HEAD
10	CASING	22	CAP SCREW FOR HEAD
11	O-RING VALVE GASKET	23	PIPE PLUG, 1/8"
12	INTERNAL RELIEF VALVE (COMPLETE)		

11 DISASSEMBLY MODEL VV95

This section will cover sizes: GG, HJ, HL, AS, AK and AL for all material types. It must be noted that although there are slight differences within these sizes and materials, 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.

When parts are referenced in this manual there will be three item numbers associated with one description, i.e. Rotor and Shaft (10, 11, 15). This is stating to use the first item number referencing Table 10-1, second item number referencing Table 10-2 and the third item number should be used for all materials of the VV95AS, VV95AK and VV95AL.

Notes:

- Sizes GG through AL for cast iron externals have a NPT suction and discharge ports. Stainless steel externals have flanged ports. Although, this will not affect disassembly or assembly of the pump, it will alter how piping will be connected and disconnected.
- Sizes AS through AL utilize O-rings (, , 11) for sealing the pressure relief valve. These sizes also use sleeves for bearing alignment instead of C-clips.
- Rotor and Shaft (10, 11, 15) is one piece. This may be referenced as “Shaft (10, 11, 15)”, “Rotor (10, 11, 15)” or “Rotor and Shaft (10, 11, 15)”.

⚠ 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. Flush with clean water and drain the pump before removing piping. If pump fluid is toxic, take necessary precautions for material handling. Follow recommendations of MSDS (Material Safety Data Sheet) for pumped liquid.
2. Mark Head (15, 16, 22) relative orientation to the Casing (07, 08, 10) to ensure correct crescent position upon reassembly. See Section 2 on page 1.
3. Remove Cap Screws (16, 17, 23) from Head (15, 16, 22). Remove Head (15, 16, 22) from Casing (07, 08, 10). Tilt the outboard end of the Head (15, 16, 22) away from the pump keeping the Idler (12, 13, 18) on the Idler Pin (14, 15, 20) to prevent damage if fallen off.

Note: Relief valve on the VV95GG needs to be removed to access the Cap Screws (16, 17, 23). Refer to Section 11.4 INTERNAL RELIEF VALVE for disassembly procedure.

4. Remove O-ring Gasket (13, 14, 19) from Head (15, 16, 22). Check for damage and replace if needed.
5. Slide Idler and Idler Bushing (12, 13, 18) off Idler Pin (14, 15, 20).
6. Press out Idler Bushing (11, 12, 17) only if in need of replacing. Assembly requires heat and a press for installation.

11.2 BEARING HOUSING

1. To remove Locknut (01, 01, 01), wedge a crescent wrench between the coupling key on the Shaft (10, 11, 15) and the work bench table top. This will keep the rotating components from moving. Using a combination wrench, turn the Locknut (01, 01, 01) counter clockwise to remove from the Shaft (10, 11, 15). Upon reassembly replace with new Locknut (01, 01, 01).
2. Loosen Set Screws (04, 05, 06), this will allow the Bearing Housing (04, 05, 06) to rotate. Thread out the Bearing Housing (04, 05, 06) by rotating counter clockwise and remove from the Casing (07, 08, 10).

11.2.1 VV95GG – VV95HL

3. Remove Snap Ring (02, 02, _) and push out Ball Bearing (03, 03, _) being careful not to scratch the bearing surfaces or housing.
4. *VV95HJ & VV95HL only:* Remove Snap Ring (_, 04, _) from Shaft (_, 11, _).

11.2.2 VV95AS – VV95AL

3. Remove the set screw which locks the End Cap (_, _ 03) in place from the Bearing Housing (_, _ 06).

4. Use a spanner wrench to remove the End Cap (__, 03) from the Bearing Housing (__, 06) by rotating counter clockwise. This will remove the Bearing Space Collar (__, 02) and the Lip Seal (__, 04).
5. Check for damage or wear on the Lip Seal (__, 04) and replace if necessary. To remove, use a flat faced punch tool to tap out the Lip Seal (__, 04) via holes in the End Cap (__, 03) moving in a star shaped pattern.
6. Push out Ball Bearing (__, 05) from the Bearing Housing (__, 06) being careful not to scratch the bearing or housing.

11.3 MECHANICAL SEAL, ROTOR & SHAFT

1. Slide out Rotor and Shaft (10, 11, 15) being careful not to damage the Mechanical Seal (09, 10, 16). **Do not separate Rotor and Shaft (10, 11, 15).**
2. If rotating end of Mechanical Seal (09, 10, 16) did not slide out with Rotor and Shaft (10, 11, 15) remove from the casing. Use extra caution not to touch or damage the sealing faces of the Mechanical Seal (10, 11, 15). Stationary seat should still be in casing at this point.

11.3.1 VV95GG – VV95HL

3. Remove Snap Ring (05, 06,_) from Casing (07, 08,_)
4. Slide out Ball Bearing (06, 07,_).

11.3.2 VV95AS – VV95AL

3. Remove Bearing Spacer (__, 07) from Casing (07, 08,_).
4. Pull out Ball Bearing (__, 08) and Bearing Retainer Washer (__, 09).
5. Push out stationary seat of the Mechanical Seal (09, 10, 16) from the coupling end of the Casing (07, 08, 10). A flat end punch and a rubber hammer moving in a circular pattern is satisfactory for removal.

11.4 INTERNAL RELIEF VALVE

1. Mark the orientation of the Internal Relief Valve (18, 19, 12) with the Head (15, 16,_) for VV95GG-VV95HL sizes, or the Casing (__, 10) for VV95AS-VV95AL sizes. 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 system is pressurized.



2. Remove Cap Screws (19, 20, 14) and remove Internal Relief Valve (18, 19, 12). *Note: VV95GG-VV95HL have a Relief Valve Gasket (17, 18,_) and VV95AS-VV95AL have O-rings (__, 11) for sealing.*

12 ASSEMBLY MODEL VV95

This section will cover sizes: GG, HJ, HL, AS, AK and AL. 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.

It is vital during assembly to ensure cleanliness. Especially for bearings, mechanical seal, 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:

- For cast iron externals, pumps have a NPT suction and discharge port and stainless steel externals have flanged pipe connections. Although, this will not affect disassembly or assembly of the pump, it will alter how piping will be connected and disconnected.
- Sizes AS through AL utilize O-rings (, ,11) for sealing the pressure relief valve. These sizes also use sleeves for bearing alignment instead of C-clips.
- Rotor and shaft (10, 11, 15) is one piece. This may be referenced as “Shaft (10, 11, 15)”, “Rotor (10, 11, 15)” or “Rotor and Shaft (10, 11, 15)”.

⚠ DANGER
Lock out power to avoid personal injury or death.

NOTICE
Secure pump before assembly to avoid damage. Pump’s center of gravity changes when adding parts.

⚠ DANGER
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 IDLER BUSHING

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.

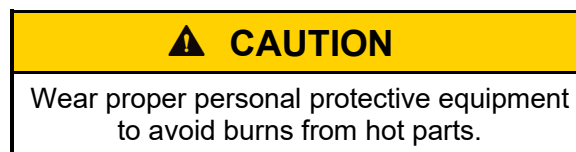
12.1.1 Normal installation

1. Inspect Idler (12, 13, 18) for wear or damage and clean to avoid premature failure of the Idler Bushing (11, 12, 17).
2. Chamfer the leading edge of the Idler Bushing (11, 12, 17) and the bore entry on Idler (12, 13, 18), if not already. This will assist with lining up both parts. Lubricate Idler Bushing's (11, 12, 17) outer diameter and Idler's (12, 13, 18) inner diameter.
3. Use a press to install Idler Bushing (11, 12, 17). Ensure both parts are square to each other.

Once pressing, do not stop until Idler Bushing (11, 12, 17) is located in the proper position; which is even with the Idler's (12, 13, 18) machined surface. Starting and stopping will crack the Idler Bushing (11, 12, 17) and cause premature failure.

4. Check for cracks in the Idler Bushing (11, 12, 17). Any cracks will reduce bushing life and increase 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. The carbon graphite bushing is very brittle, there is less risk of cracking in this process.

1. Inspect Idler (12, 13, 18) for wear or damage and clean to avoid premature failure of the Idler Bushing (11, 12, 17).
2. Slowly and thoroughly heat Idler (12, 13, 18). A bearing heater will be ideal for this process. The lower the Idler (12, 13, 18) temperature, the higher the risk of cracking the bushing.
3. Use a press to install a cool Idler Bushing (11, 12, 17). Ensure both parts are square to each other.

Once pressing, do not stop until Idler Bushing (11, 12, 17) is located in the proper position; which is even with the Idler's (12, 13, 18) machined surface. Starting and stopping will crack the Idler Bushing (11, 12, 17) and cause premature failure.

4. Check for cracks in the Idler Bushing (11, 12, 17). Any cracks will reduce bushing life and increase 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 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.

Bushings Material		Carbon Graphite		Bronze
Pump Material		Iron	Stainless Steel	All
		Temperature (°F)		
Pump Size	VV95GG	725	475	450
	VV95HJ	600	375	450
	VV95HL			
	VV95AS	575	350	450
	VV95AK			
VV95AL				

12.2 INSTALLING SEALS

VV95's are sealed with component mechanical seals only. These seals are a simple design and need little maintenance if installed correctly. Follow the instructions below for installing the seal.

12.2.1 Component Mechanical Seal

The component mechanical seal is a type 1 or type 9 mechanical seal. The lapped surfaces are critical to keep clean. Avoid touching or scratching these surfaces for superior seal life. SAE 30 WT oil can be used for lubrication of the seal, make sure lubrication will not contaminate pumped fluid. Grease is not recommended for the seal.

1. Inspect the stuffing box for debris or damage. Clean Casing (07, 08, 10) and Shaft (10, 11, 15) thoroughly to avoid any sealing issues, if needed, replace parts. It is recommended that the Mechanical Seal (09, 10, 16) be replaced each time the pump is rebuilt.
2. Lubricate the outer diameter of the stationary seat. Using two fingers in the ID of the stationary seat, begin to push the seat into the Casing (07, 08, 10). If unable to push entirely into the bore, cover the lapped surface with a clean piece of cardboard and gently tap in the stationary seat with a brass or wooden bar. Ensure seat is sitting flat.
3. Lubricate the Shaft (10, 11, 15) and rotating members of the Mechanical Seal (09, 10, 16). Slide the spring and rotating members over the Shaft (10, 11, 15) until the spring mates with the Rotor (10, 11, 15). Next slide the lapped rotating member over the shaft and onto the spring end piece with the lapped surface facing away from the spring. Ensure the notched grooves line up with the tabs in the end piece. This keeps the rotating member rotating on the seal faces.
4. Carefully, install the Rotor and Shaft (10, 11, 15) into the Casing (07, 08, 10). Do not allow lapped rotating member to fall out of the notches provided.

12.3 HEAD AND CASING

1. Slide Idler and Bushing (12, 13, 18) onto the Idler Pin (14, 15, 20) until Idler (12, 13, 18) mates with the Head (15, 16, 22)
2. Inspect the O-ring (13, 14, 19) for damage and replace if necessary. Place around the Head (15, 16, 22).
3. Line up the marks made in Step 2 of Section 11.1 HEAD AND CASING on Page 23 to ensure proper crescent alignment. If no marks are visible, the crescent should be of equal distance from the suction and discharge ports. In the case of the VV95GG to VV95AL this is the 6 o'clock position.
4. Mesh the tooth profiles of the Rotor (10, 11, 15) and the Idler (12, 13, 18) with correct Head (15, 16, 22) orientation. Push the Head (15, 16, 22) in until the flange meets the Casing (07, 08, 10), compressing the spring for the Mechanical Seal (09, 10, 16).
5. Bolt the Head (15, 16, 22) in place using Cap Screws (16, 17, 23). Tighten in a star pattern to torque values listed in Section 13.1.1 on Page 35.

12.4 BEARING HOUSING

This section will cover the assembly of bearings and the bearing housing. Carefully examine all parts for wear or damage and replace when needed. Replace Locknut (01, 01, 01), and Lip Seal (__,_,04) with new replacement parts.

12.4.1 VV95GG – VV95HL

1. Slide Ball Bearing (06, 07,_) over the Shaft (10, 11,_) and into the casing until Ball Bearing (06, 07,_) is seated tightly against the intended bore.
2. Install the Snap Ring (05, 06,_) to hold Ball Bearing (06, 07,_) in place.
3. Install the Snap Ring (__, 04,_) in the designated groove. *(Note: Skip this step for VV95GG Cast Iron)*
4. Insert Ball Bearing (03, 03,_) into the Bearing Housing (04, 05,_) . Ensure bearing is set square into its designated bore. Install Snap Ring (02, 02,_) in the Bearing Housing (04, 05,_) holding the Ball Bearing (03, 03,_) in place.
5. Thread on Locknut (01, 01,_) . Wedge a crescent wrench onto the coupling end against the coupling key and table top to keep rotating parts from moving when tightening the Locknut (01, 01,_) . Avoid using a vise grips or pipe wrench as this will damage the shaft and coupling key.

Using a torque wrench, torque the Locknut (01, 01,_) to the specified value in Table 13-2 on Page 35.

6. Install bearing housing set screws after adjusting the end clearance.

12.4.2 VV95AS – VV95AL

1. Insert Bearing Retainer Washer (__,_, 09) into the Casing (__,_, 10) over the Shaft (__,_, 15).

2. Ensure Ball Bearing (__, 08) is clean of debris and bearing seals are not damaged. Install Ball Bearing (__, 08) over the Shaft (__, 15) and seated against the Bearing Retainer Washer (__, 09).
3. Slide the Bearing Spacer (__, 07) over the Shaft (__, 15) and rest against the Ball Bearing (__, 08).
4. Separately, install the Ball Bearing (__, 05) into the Bearing Housing (__, 06); ensure a square fit within the bore. Make sure Ball Bearing (__, 05) is clean of debris and seals are not damaged.
5. Install the Lip Seal (__, 04) into the End Cap (__, 03) with the spring faced towards the coupling end of the pump. Thread in the End Cap (__, 03) into the Bearing Housing (__, 06) and tighten with a spanner wrench. Lock the End Cap (__, 03) in place by tightening the set screw on the outside edge of the Bearing Housing (__, 06) flange.
6. Push in the Bearing Space Collar (__, 02) in to be sealed by the Lip Seal (__, 04).
7. Slide the assembled Bearing Housing (__, 06) into the Casing (__, 10) until the threads on the outer diameter of the Bearing Housing (__, 06) engage. Turn the Bearing Housing (__, 06) clockwise until snug.
8. Install bearing housing set screws after adjusting the end clearance.

12.5 ADJUSTING END CLEARANCE

12.5.1 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 (10, 11, 15), Idler (12, 13, 18) and Head (15, 16, 22).

End clearance is adjusted by rotating the Bearing Housing (04, 05, 06) 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 (04, 05, 06).
2. Rotate Bearing Housing (04, 05, 06) clockwise by hand until it can no longer be turned. Ensure Rotor and Shaft (10, 11, 15) cannot be rotated by hand.
3. Rotate Bearing Housing (04, 05, 06) counter clockwise until Shaft (10, 11, 15) can be turned with only a slight noticeable drag. This will be the “zero” setting.
4. Table 12-2 shows the standard end clearances for available VV95 models. To set end clearance, rotate

Table 12-2: Standard VV95 end clearances

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"
VV95GG	(C) Cast Iron	0.003	0.438	0.15
	(S) Stainless Steel	0.005	0.750	0.15
VV95H VV95HJ VV95HL	(C) Cast Iron	0.003	0.563	0.19
	(S) Stainless Steel	0.005	0.938	0.19
VV95AS VV95AK VV95AL	(C) Cast Iron	0.003	0.500	0.17
	(S) Stainless Steel	0.008	1.333	0.17

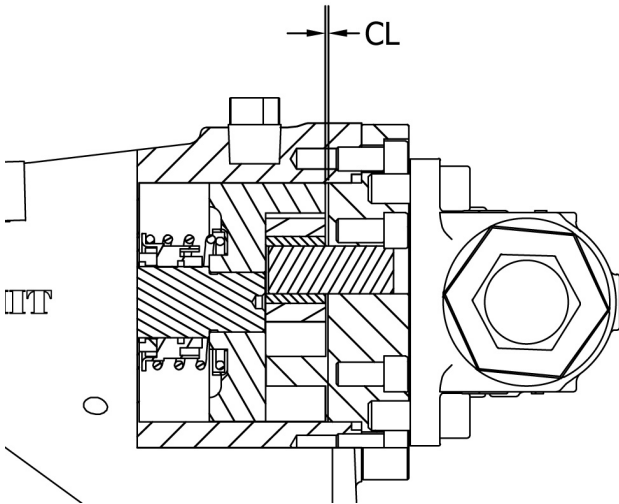


Figure 12-1: End clearance location definition

Bearing Housing (04, 05, 06) counter-clockwise as indicated by arc length “AC” in Table 12-2.

5. After setting end clearance, replace bearing housing set screws to lock the Bearing Housing (04, 05, 06) in place during operation.
6. It may be necessary to add extra end clearance for higher viscosity fluids and temperature. Contact your local Summit Pump, Inc. Distributor for specifications.

12.5.2 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 12-2 on page 29. 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 (04, 05, 06).
2. Rotate Bearing Housing (04, 05, 06) clockwise by hand until it can no longer be turned. Ensure Shaft (10, 11, 15) cannot be rotated by hand.

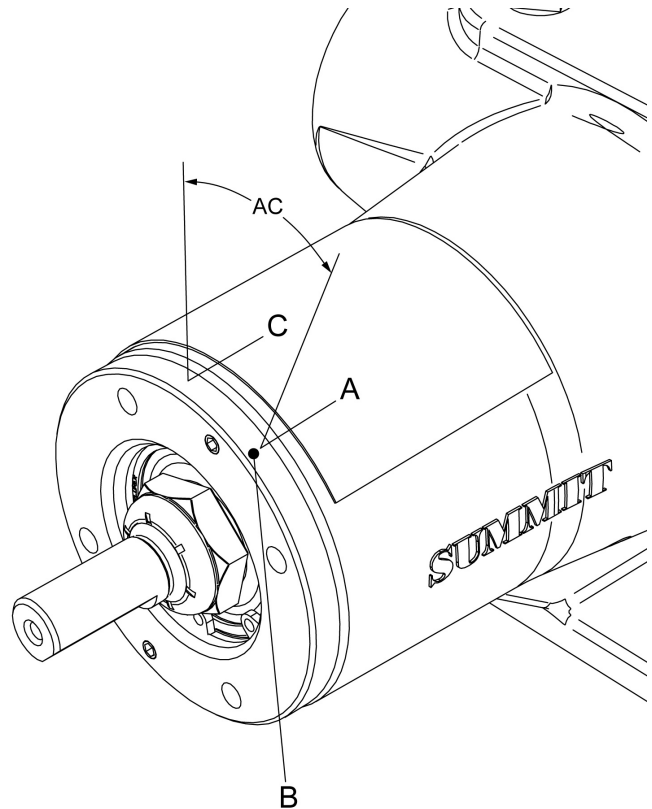


Figure 12-2: “Zero” setting. Mark at point “B”.

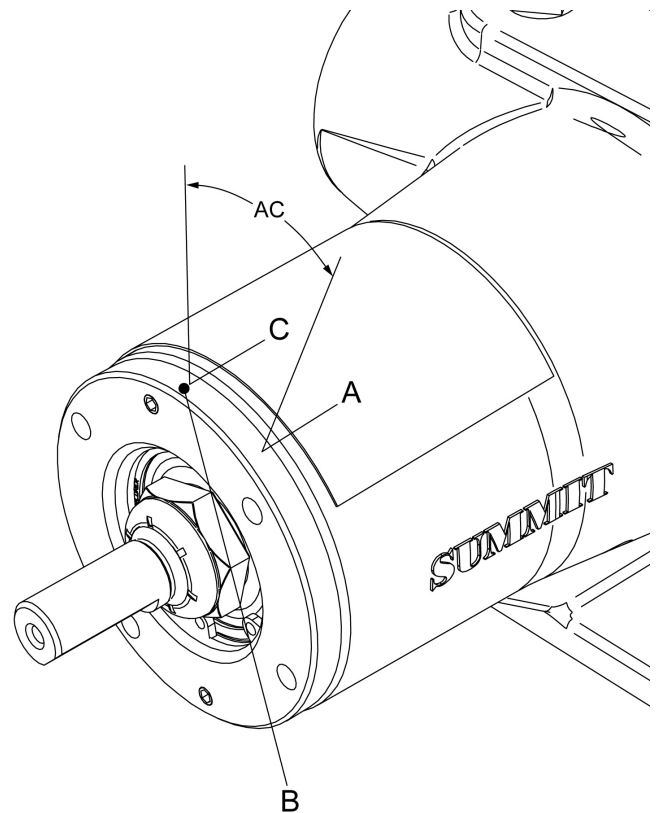


Figure 12-3: Standard end clearance is set

3. Rotate Bearing Housing (04, 05, 06) counter clockwise until Shaft (10, 11, 15) can be turned with only a slight noticeable drag. This will be the “zero” setting.

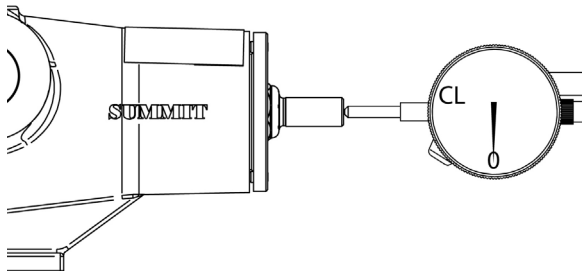


Figure 12-4: "Zero" Setting

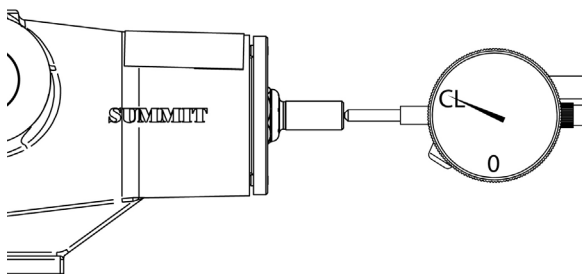


Figure 12-5: Standard end clearance is set.

4. Secure the dial indicator to either the pump’s base plate or Casing (07, 08, 10). Position the probe on the end of the shaft as shown in Figure 12-4.
5. Refer to Table 12-2 on page 29 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 (04, 05, 06) in place during operation.
9. It may be necessary to add extra end clearance for higher viscosity fluids and temperature. Contact your local Summit Pump, Inc. Distributor for specifications.

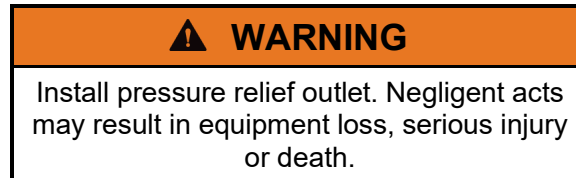
NOTICE

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

12.6 INTERNAL RELIEF VALVE

There are two sets of instructions for Internal Relief Valve (18, 19, 12) assembly. One is to adjust the pressure setting of the valve and the other is attaching the Internal Relief Valve (18, 19, 12) to the pump.

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.



12.6.1 Mounting valve on head

It is critical to mount the Internal Relief Valve (18, 19, 12) in the correct orientation on the pump. Align the marks created in Section 11.4 on page 24. If installed incorrectly, the valve will not work properly. The system could exceed valve set pressure, causing damage to equipment, serious injury or death.



If no alignment marks have been made, the adjusting screw of the Internal Relief Valve (18, 19, 12) should always be closest to the suction port. See Figure 7-1 on page 12 for illustration.

1. Inspect Internal Relief Valve (18, 19, 12) for damage or debris. Check mating parts for damage, replace if needed.
2. Install Relief Valve Gasket (17, 18,_) or O-rings (_,_, 11) .
3. Position Internal Relief Valve (18, 19, 12) on pump in correct configuration as determined by alignment marks or as shown in Figure 7-1 on page 12.
4. Secure Internal Relief Valve (18, 19, 12) using Cap Screws (19, 20, 14) and tighten by hand. Torque Cap Screws (19, 20, 14) in a tightening sequence to torque values shown in Table 13-1 on page 35.

12.6.2 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 (18, 19, 12) 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 12-6 shows the pressure and flow rate relationship when increasing the pressure in the piping system (i.e. closing the discharge valve).

Note: Figure 12-6 shows a general relationship and not actual tested data.

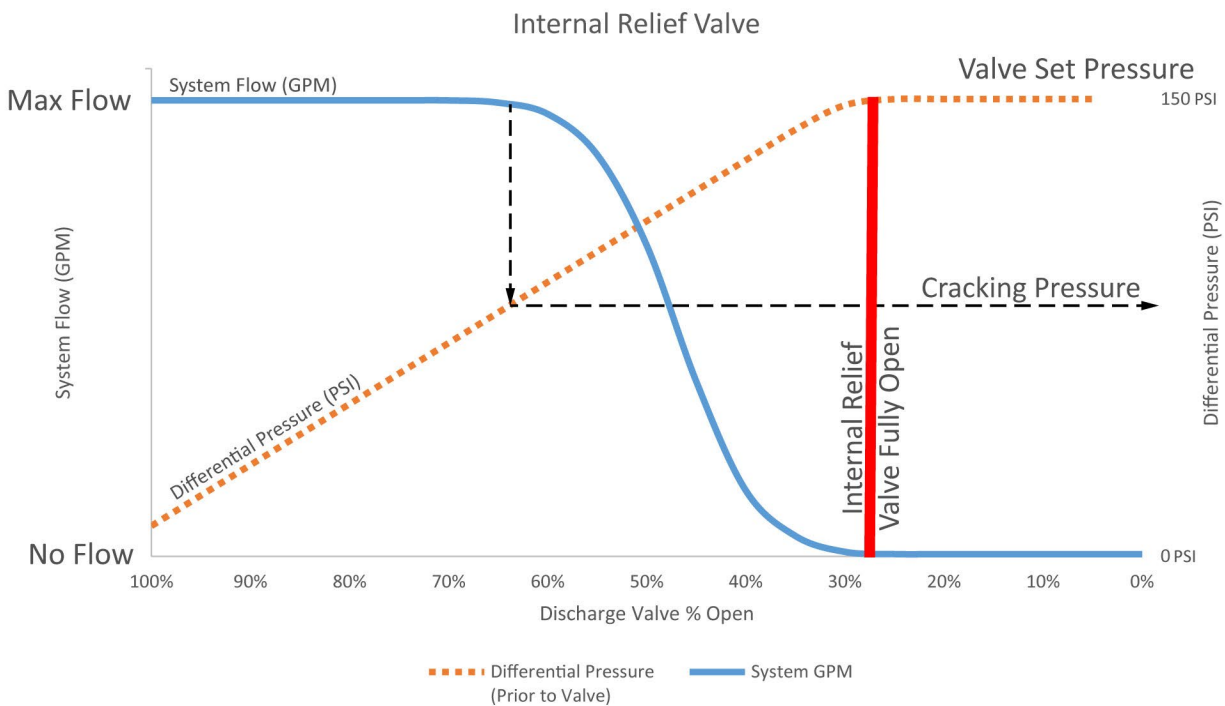


Figure 12-6: Internal relief valve (47) effects on system flow when differential pressure approaches internal relief valve (47) set pressure.

When setting pressure, consult your company’s procedure for adjusting pressure relief valves. Below is an exploded view of a Internal Relief Valve (18, 19, 12). To adjust pressure setting, release locknut and turn adjustment bolt clockwise for higher pressure and counter clockwise for lower pressure.

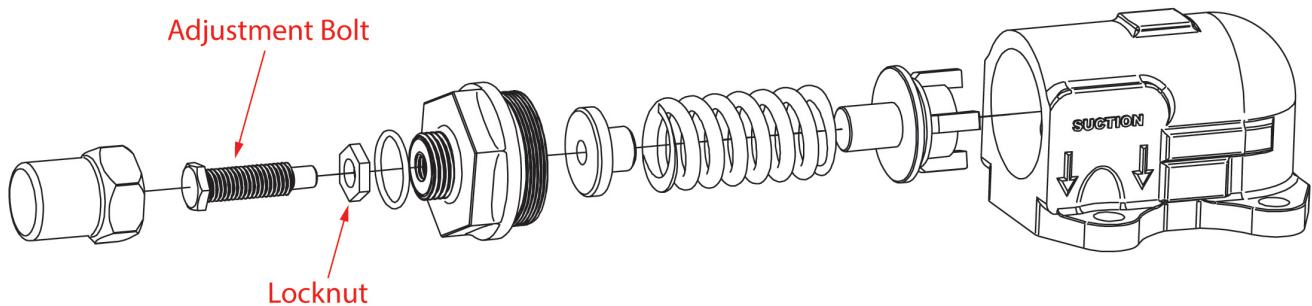


Figure 12-7: Internal Relief Valve components

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13 APPENDIX E – 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		SAE 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: VV95 Locknut torques

Model and Size	Torque (ft-lbs)	Locknut Size
VV95GG	70-90	5/8"-18 UNF
VV95HL VV95HJ	200-270	7/8"-14 UNF
VV95AS VV95AK VV95AL	330-430	1-1/8"-12 UNF

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14 PUMP INFORMATION

Purchase Date: _____

Purchase Order#: _____

Serial Number: _____

Equipment Number: _____

PO Box 12145 Green Bay, WI 54307
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