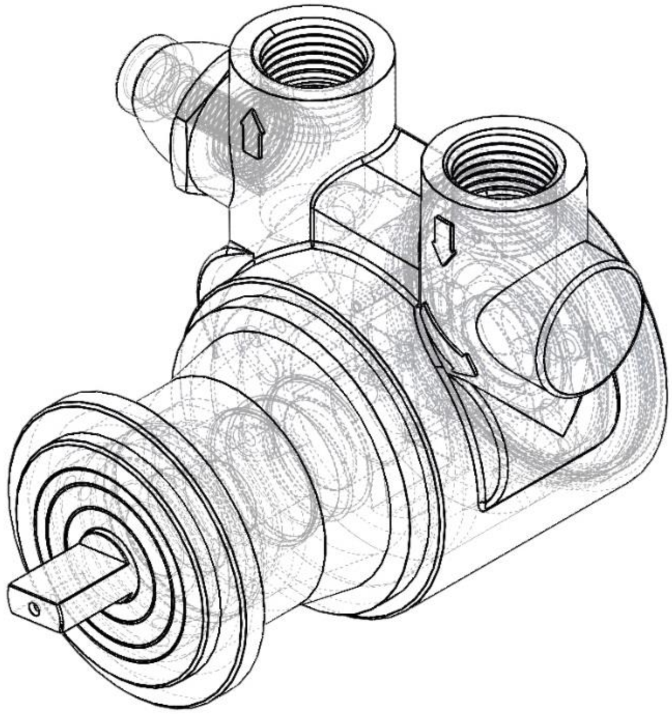

Rotary Vane Pump

REBUILD MANUAL

Fluid-o-Tech

POWER THE FLOW

Fluid-o-Tech International, Inc. 161 Atwater Street, Plantsville, CT 06479 860.276.9270

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Disclaimer

The following procedures shall be carried out with caution and at one's own risk. Proper eye protection is required and all tool manufacturer safety guidelines must be followed. All warranty claims should be handled directly by Fluid-o-Tech International, Inc. Opening the pump will void any manufacturer's warranty. Read these instructions completely before beginning the rebuild procedure.

Introduction

The Fluid-o-Tech 070-400 Series Rotary Vane Pumps are positive displacement liquid transfer devices used in a wide variety of applications. Although the robust design lends itself to a long, trouble-free service life, eventual component wear and subsequent loss of performance will require the rebuild or replacement of the unit. With the proper equipment and skill, rebuilding can be a cost effective means of restoring the factory specified performance to the pump.

This manual details all steps required to rebuild a 070-400 series vane pump. The rebuild procedure entails preparation, removal of all internal components, cleaning, reassembly of the pump with new components, and testing the functionality of the pump. Rebuild of the pump will require all items listed below in *Materials Required* as well as the technical skill to carry out all tasks detailed in this manual.

Materials Required

- Rotary Vane Pump
- Vane Pump Rebuild Kit
- Towels and Cleaning Solution
- Ethyl Alcohol
- Spanner Wrench
- Forceps
- Arbor Press
- Housing Support*
- Extraction Pin*
- Seal Installation Tool*
- Counterface Installation Tool*
- Bearing Installation Tool*

*Specialty tools. See Appendix for tool drawings.

Vane Pump Rebuild Kit Contents Checklist

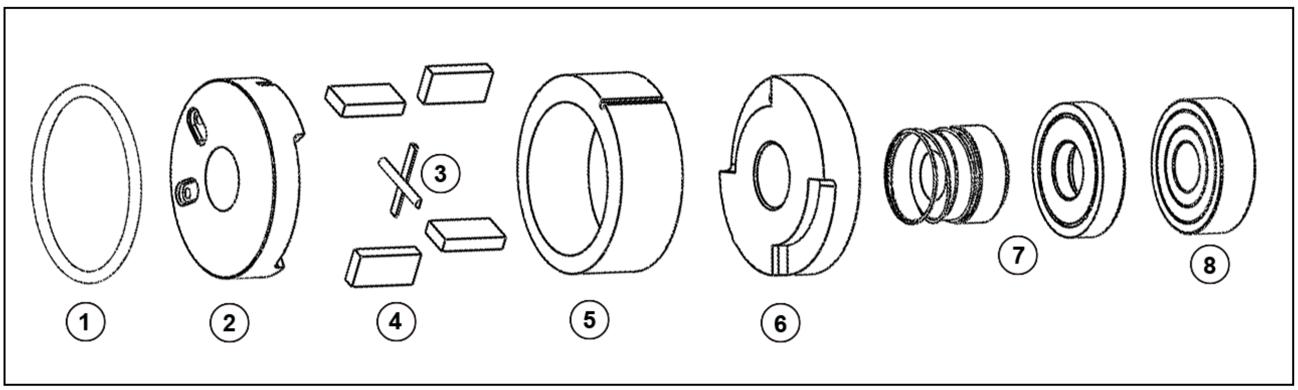
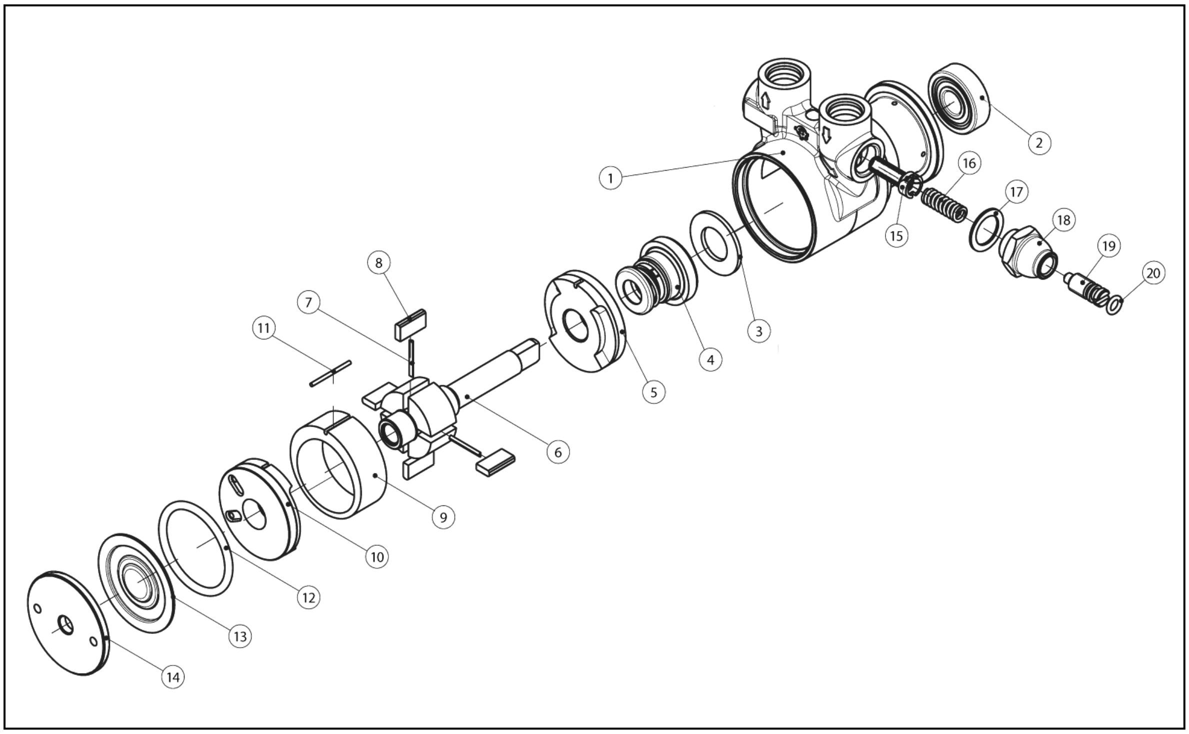


Figure 1 Breakdown of all components included in standard rebuild kit.

1. Cap O-ring
2. Front Flange
3. Vane Pins, 2 qty, when applicable
4. Vanes, 4 qty
5. Liner
6. Rear Flange
7. Mechanical Seal
8. Ball Bearing

Parts Breakdown Diagram, 070-400 Series



DWG #	Description	Material	Part #
1	Housing	Brass or SS	22-01-01
2	Ball Bearing	Steel	90-22-01
3	Washer	Stainless Steel	22-03-02
4	Mechanical Seal	NBR, EPDM, Viton	90-40-01
5	Rear Flange	Graphite	22-03-08
6	Rotor	Stainless Steel	22-02-01
7	Vane Pin	Stainless Steel	22-08-05
8	Vane	Graphite	22-04-03
9	Liner	Graphite	22-05-24
10	Front Flange	Graphite	22-03-06
11	Alignment Pin	Stainless Steel	22-07-01
12	Cap O-Ring	NBR, EPDM, Viton	90-23-13
13	Shaped Disc	Stainless Steel	22-70-01
14	Threaded Cap	Aluminum	22-08-03
15	Bypass Valve	PPS, Brass, or SS	22-16-01
16	Bypass Spring	Stainless Steel	22-50-05
17	Bypass Washer	Nylon	22-12-01
18	Bypass Nut	Brass or SS	22-20-01
19	Bypass Screw	Brass or SS	22-17-03
20	Bypass O-Ring	NBR, EPDM, Viton	90-23-16

Rebuild Procedure

I. Preparation

Step 1: Clean workstation and gather required materials

Before beginning the rebuild procedure, adequate preparations must be made. The work area must be cleaned and the presence of all required materials should be verified. The materials required for this step include a towel and cleaning solution. First, all dirt and debris will need to be removed from the workstation. This serves to ensure that potentially damaging foreign material does not enter into the pump during the rebuild procedure. Clean all tools and work surfaces thoroughly.

Next, the presence of all required materials should be confirmed. Using the *Materials Required* list provided above, ensure that each item on the list is present in its entirety and is in working condition.

II. Disassembly

Step 2.1: Remove Cover Plate, Shaped Disc, and O-Ring

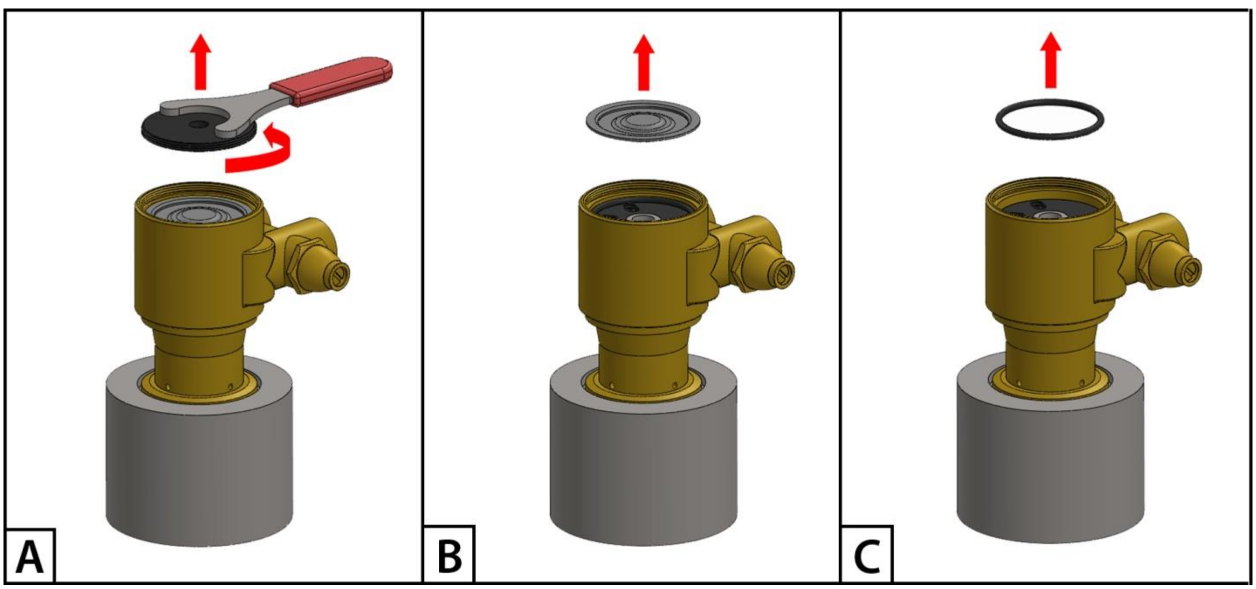


Figure 2 Diagram illustrating the tasks required to carry out Step 2.1.

The rebuild procedure begins with the disassembly of the pump. Disassembly will allow the worn or damaged components to be removed from the pump so that new components may be installed. The first step of disassembly is the removal of the Threaded Cap (DWG 14), Shaped Disc (DWG 13), and Cap O-Ring (DWG 12). Refer to the Parts Breakdown Diagram for identification of all components that will be referenced in this document.

***CAUTION*:** Many components will be reused during the rebuild and no component should be discarded until the entire procedure has been successfully completed.

The materials required for this task include, the Pump, Spanner Wrench, Arbor Press, and Housing Support. The following steps are required:

2.1.1 Remove the round metallic label from the threaded cap.

2.1.2 Place the housing support on the work surface and set the pump on top of the housing support with the threaded cap facing upwards, as shown in Figure 2a.

2.1.3 Engage the spanner wrench into the two holes of the threaded cap, as shown in Figure 2a.

2.1.4 Apply torque to the spanner wrench in a counterclockwise direction, as shown in Figure 2a. Once loosened, the cap can be unscrewed and removed by hand.

2.1.5 Remove the shaped disc that was exposed by the removal of the threaded cap, as shown in Figure 2b.

2.1.6 Remove the O-Ring that was exposed by the removal of the shaped disc, as shown in Figure 2c.

Step 2.2: Remove Rotor, Pins, Vanes, and Front Flange

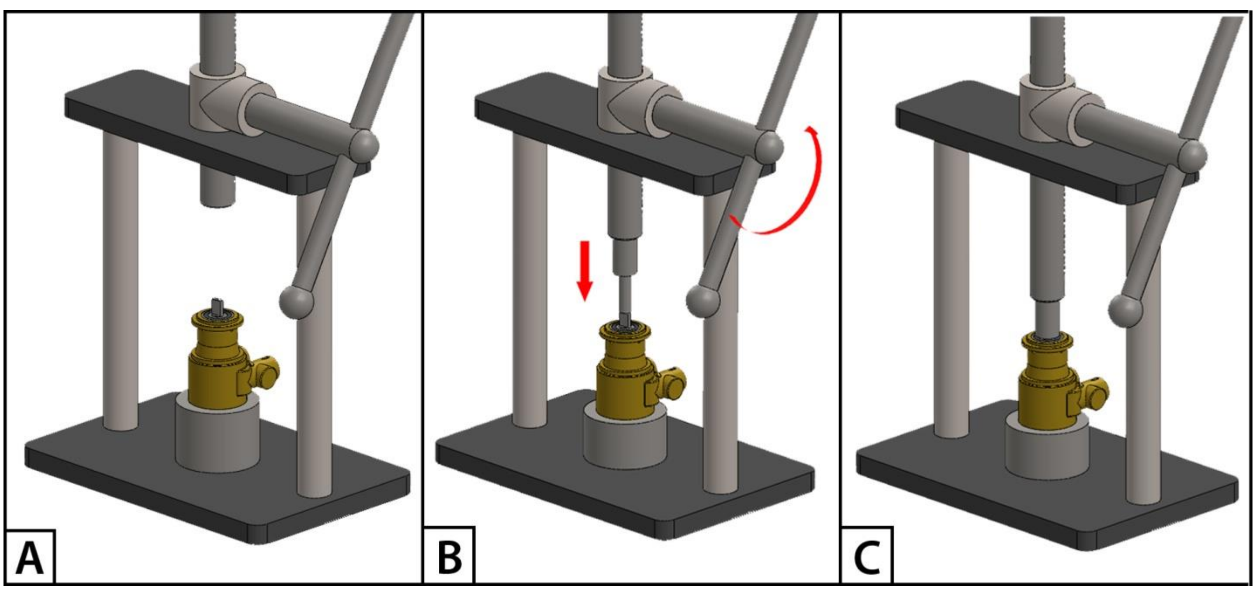


Figure 3 Diagram illustrating the tasks required to carry out Step 2.2.

This step will continue the disassembly process with the removal of the Rotor (DWG 6), Vane Pins (DWG 7), Vanes (DWG 8), and Front Flange (DWG 10). The materials required for this task include the Pump, Arbor Press, Housing Support, and Extraction Pin. The following steps are required:

2.2.1 Flip the pump housing and place it in the housing support with the bearing end facing upwards, as shown in Figure 3.

2.2.2 Position the pump on the arbor press base, aligning the press ram and pump shaft center axes, as shown in Figure 3a.

2.2.3 Position the extraction pin above the pump shaft and begin to feed down the press ram until contact is made with the pin, as shown in Figure 3b.

2.2.4 Continue feeding the press ram against the shaft until the rotor, vane pins, vanes, and front flange exit the pump body, as shown in Figure 3c.

Step 2.3: Remove Bearing and Remaining Components

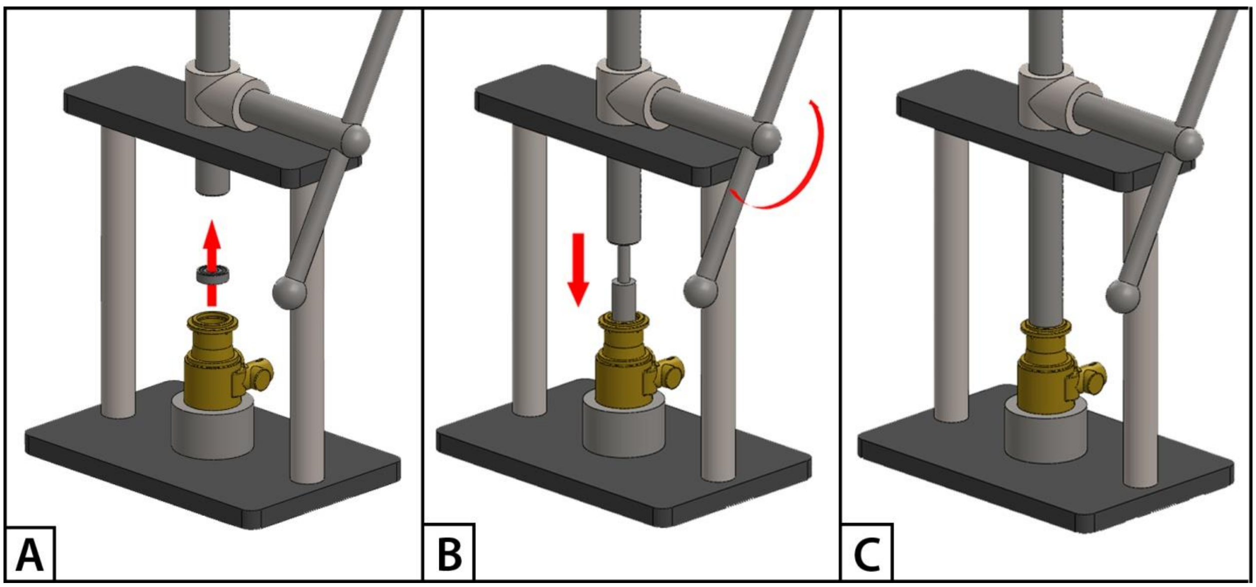


Figure 4 Diagram illustrating the tasks required to carry out Step 2.3.

This step will conclude the disassembly process with the removal of the Bearing (DWG 2), Washer (DWG 3), Mechanical Seal (DWG 4), Rear Flange (DWG 5), Alignment Pin (DWG 11), and Liner (DWG 9). The materials required for this task include the Pump, Arbor Press, Housing Support, and Extraction Pin. The following steps are required:

2.3.1 The ball bearing can be removed by pulling upward with an extraction tool, as indicated in Figure 4a. Alternatively, the pump can be flipped over and a small rod can be used to press the bearing out from the inside.

2.3.2 Once the bearing has been removed, position the extraction pin above the washer, as shown in Figure 4b. Feed the press ram downward until all remaining components exit the pump, as shown in Figure 4c.

III. Inspection

Evaluation of Components

During the rebuild process, it is often desirable to determine the cause of failure. Common failure modes will be presented here for reference. Any warranty evaluations must always be carried out by Fluid-o-Tech International, Inc. Disassembly of the pump will void the manufacturer warranty.

Abrasive Wear

Abrasive wear occurs as a result of particulates in the fluid passing through the pump. As they pass through, the relative motion between the particulates and the components while under load results in damage to the components. Abrasive wear typically shows up as fine wear lines that follow the direction of relative motion between the components.

Ideally, the fluid being pumped would contain no solid particles. Realistically, almost all fluids contain some level of particulate contamination. Filtration can often help reduce particulate contamination issues. However, the use of filtration is not reason to disregard source fluid quality or clean fluid handling practices. In particularly difficult cases, abrasive wear may continue even with filtration in place. It is also important to properly size and maintain any filter used in the system in order to prevent cavitation.

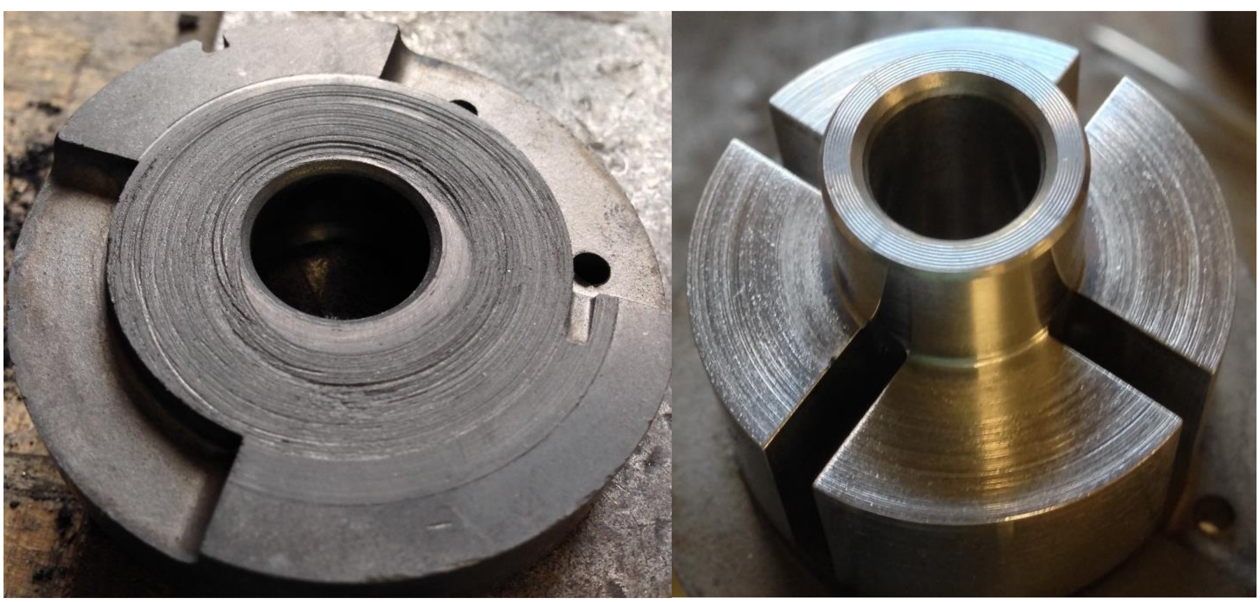


Figure 5.1 Examples of abrasive wear on a front flange (left) and a rotor (right).

Debris

Damage as a result of debris can in many cases be very similar to that from particulate wear. Debris generally refers to a larger particle size, and these larger particles can result in several additional forms of damage. Minimal clearance exists between the rotor and the liner at their closest point. Debris that enters this area can cause serious issues as it wedges between the vane, liner, and rotor. Commonly the result is gouging or cracking of the graphite or jamming of the pump. Large debris can usually be sequestered by a sufficient filter or mesh screen installed prior to the pump. It is important to properly size and maintain the filter to prevent cavitation.

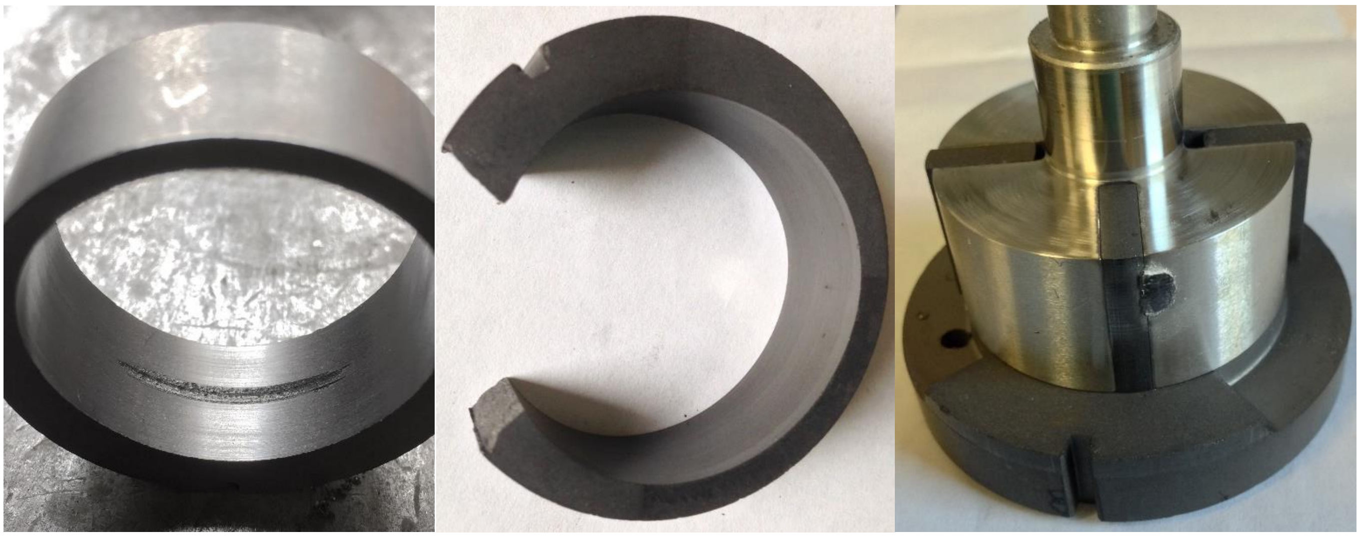


Figure 5.2 Examples of damage caused by debris in the pump: Gouged Liner (left), Cracked Liner (center), Rotor jammed by debris (right)

Cavitation

Cavitation occurs when the NPSHa at the inlet of the pump falls below the NPSHr for a given fluid and a given temperature. The concept of cavitation is similar to the concept of boiling water under various conditions. Under standard conditions, water boils at 212 degrees F. However, that same pot of water on top of Mount Everest, where the atmospheric pressure is much lower, would boil around 160 degrees F. The boiling point of a fluid is a function of atmospheric pressure. A fluid boils when the atmospheric pressure equals the vapor pressure of the fluid at a given temperature. As a fluid flows from the source to the pump, pressure decreases as a result of frictional losses in the plumbing as well as height and velocity changes. If the pump is drawing from a reservoir at atmospheric pressure, by the time it reaches the inlet, a vacuum condition is present. In some cases this vacuum condition can be quite significant. If the absolute pressure in the line reaches the vapor pressure of the fluid, the fluid will actually begin to vaporize. As a result, numerous vapor bubbles will form within the fluid. It is important to note that this is not atmospheric air entrained in the system, but rather the fluid itself that has entered the gas phase. As this vapor bubble filled fluid passes to the high pressure side of the pump, these vapor bubbles are no longer stable under the increased pressure. Many will return to the liquid state at this point. The transition from vapor to liquid under these conditions is relatively violent. The rapidly imploding bubbles impact the surrounding surfaces with extremely high pressures. As a result, the internal components suffer a distinct pitting type damage. A buzzing noise can often be heard when cavitation is taking place.

Cavitation can be avoided by monitoring the inlet pressure and ensuring the NPSHa is at or above the NPSHr. See appendix for NPSH charts. NPSHa can usually be increased by increasing pipe size, decreasing run length, decreasing plumbing restriction, raising the supply source height or pressure, or choosing a smaller pump for a given system.

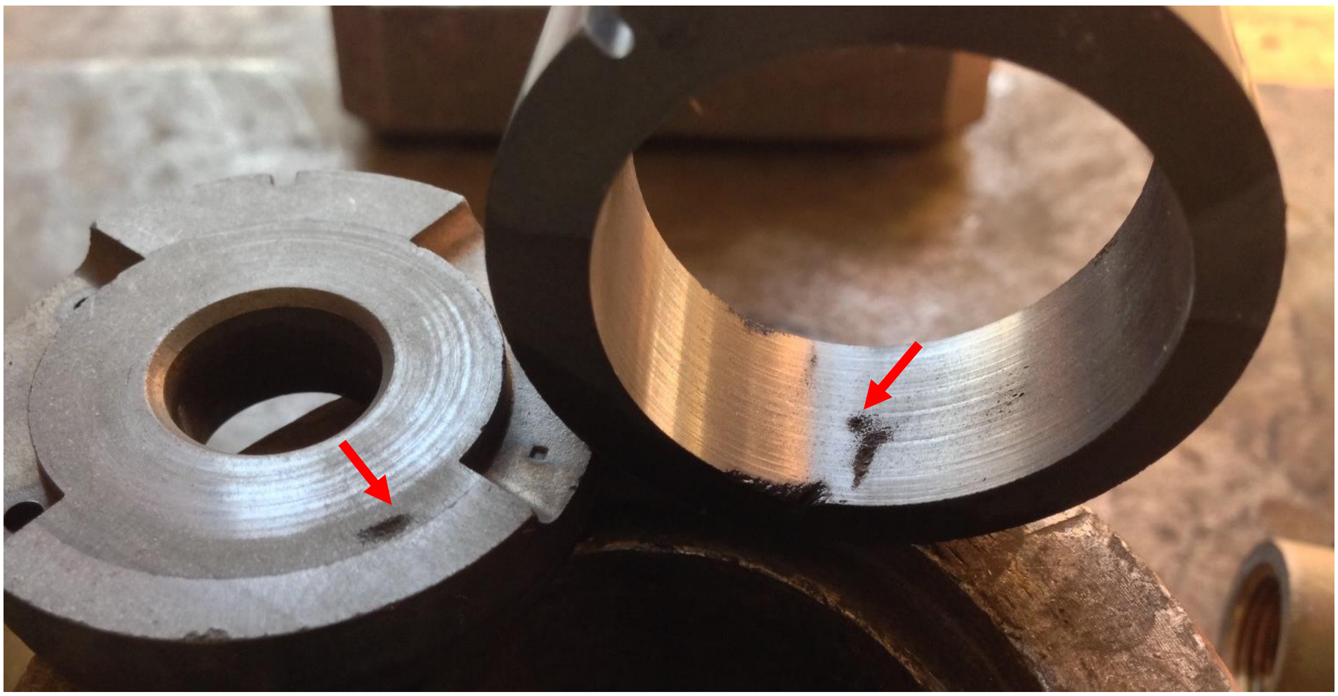


Figure 5.3 Examples of pitting damage caused by cavitation.

Bypass Damage

The internal bypass is designed to be used as a safety relief valve. It is meant to open in the unexpected event of an overly restricted outlet while the pump is operating. The opened valve allows recirculation of the fluid between the outlet and inlet preventing excess pressure buildup in the system. If the bypass is used instead as a pressure or flow regulator, it will operate continuously in the partially open condition. This can result in excess heat buildup in the pump or erosion damage to the valve components themselves. Resulting wear is typically found at the base of the bypass poppet taper and at the perimeter of the bypass hole. The resulting rough surface prevents the bypass from fully seating, allowing fluid to slip through and reducing pump performance. If the pump is brass, and if the damage is very light, it can sometimes be repaired by replacing the poppet and reseating the hole. To reseat the hole, place a ½" steel ball bearing into the hole and tap carefully with a rod and hammer to reform a clean edge on the hole.

Bypass damage can be avoided by using the bypass as intended. It should not be used as a flow regulator. The bypass should be set at least 40 psi above the maximum operating pressure of the pump to ensure that it does not open during normal operation.

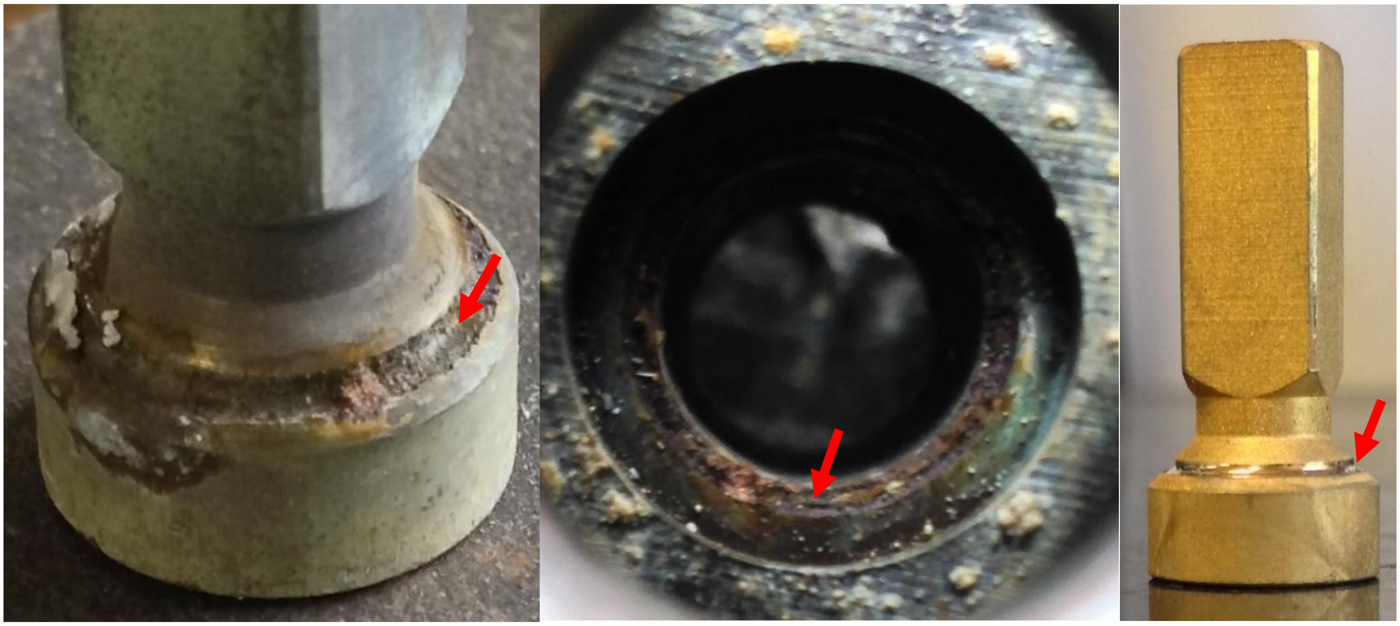


Figure 5.4 Examples of bypass damage as a result of long term operation in the open condition.

Scale or Gum Buildup

Hard water or gummy fluids can be problematic when used in rotary vane pumps. Fluids like hard water with a high amount of dissolved solids can cause an issue if these dissolved components precipitate out and buildup inside the pump. This condition is much like the lime scale buildup seen in water heaters or household plumbing. These deposits can result in a number of problems for the pump. The scale itself is an abrasive material that can cause the same issues mentioned in the particulate and debris sections. The scale or gummy fluid can also buildup and act as an adhesive which can prevent the rotor from turning or the vanes from moving properly in their slots. Scale or gum can also be quite problematic if it builds up on the sensitive mechanical seal surfaces and results in a leak. A scaly or gummy rotor can often be salvaged by using a descaling agent or a solvent to clean the rotor before returning to service.

Preventing issues caused by gummy fluids or hard water is not always simple. Sometimes the fluid can be pretreated to remove or reduce scale causing components before they reach the pump. If possible, the pump can be run at more frequent intervals or flushed with clean fluid before long idle periods to prevent adhesive buildup.

Figure 5.5 Examples of scale buildup (left) and gummy deposits (right).

Rotor Damage

The rotor is located in the center of the pumping chamber and can be damaged by many of the same mechanisms previously mentioned. It can be abraded by particulates, nicked by debris, or damaged by cavitation. If rotor damage resulted in a rough surface finish, the rotor should not be reused as it may abrade and prematurely wear mating components. If rotor damage is limited to a small edge nick, the rotor can often be repaired. The protruding material may be carefully filed away as long as the remaining surfaces remain unharmed.

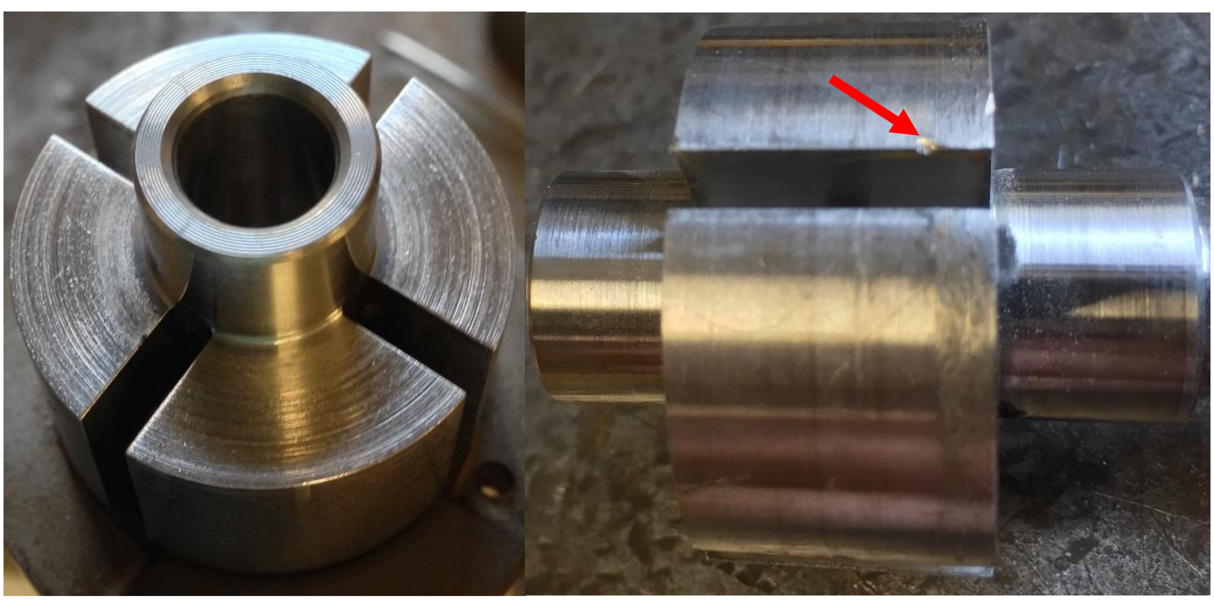


Figure 5.6 Examples of rotor damage. Left: Significant abrasive wear, not reusable. Right: Small nick, likely repairable

Spun Graphite

Most components inside the pump must be installed in a very specific orientation. Refer to the parts breakdown diagram for details. Some of these components are held in place by friction. Given the right conditions, it is possible that some components may move out of the proper orientation during operation. In particular, the front flange, liner, and rear flange can spin out of the correct orientation, resulting in loss of pump performance. This generally only occurs when the pump is subjected to excessive shock loading. For example, many systems are designed to close a solenoid on the outlet at the same time that the pump-motor is shut off. The solenoid closes almost instantly while the pump-motor requires a short period to spool down, resulting in a brief deadhead condition. During this period, a high pressure spike can result. Each pressure spike has the potential to slightly spin the graphite components in the housing. Eventually the graphite can move far enough out of position that it misaligns with the ports, resulting in loss of proper function. This can be repaired by reinstalling the components in the correct orientation. This can be prevented by avoiding shock loading of the pump.

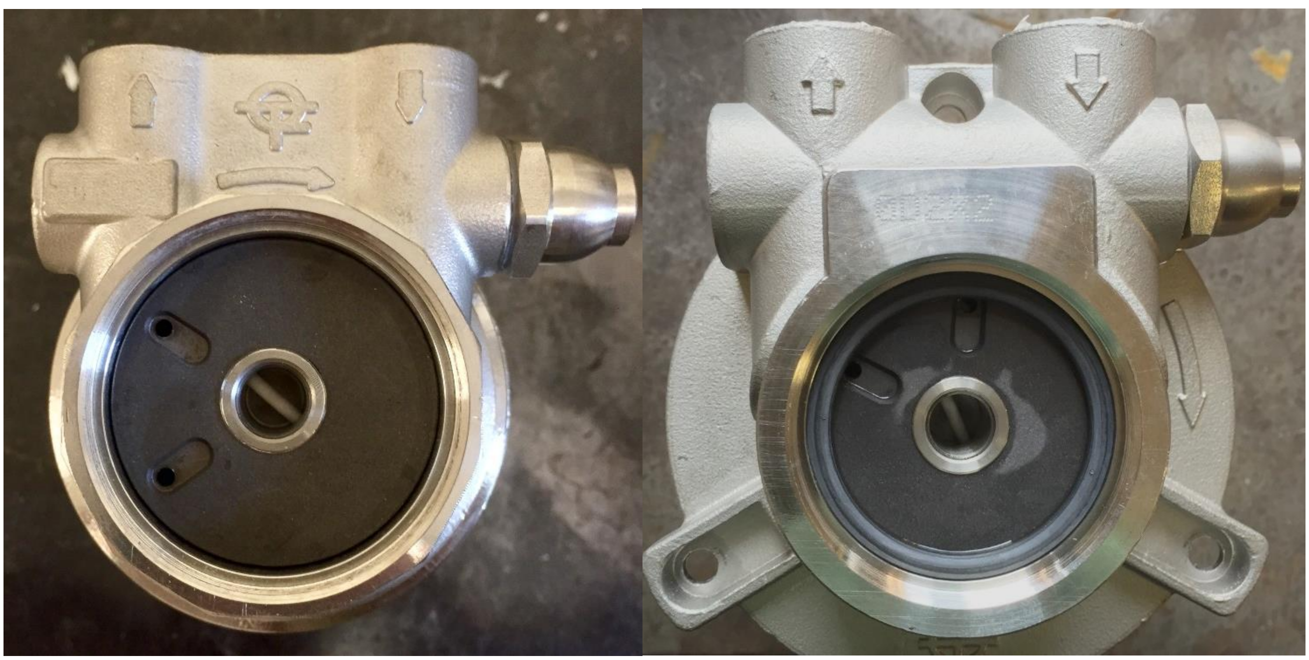


Figure 5.7 Examples of correct and incorrect graphite orientation. Left: Correct orientation, Right: Spun graphite in incorrect orientation.

IV. Cleaning

Step 4: Housing, Rotor, and Workstation Cleaning

Before the reassembly process begins, it is critical that the reusable components, work area, and tools be cleaned of dirt and debris. This step will ensure that the tools, components, and work area are sufficiently clean to carry out the rebuild. Even relatively small debris trapped in inopportune locations of the pump can have detrimental effects on pump functionality and must be avoided. Thoroughly clean the work area, tools, and all reusable components.

V. Reassembly

Step 5.1: Assemble Graphite Cartridge

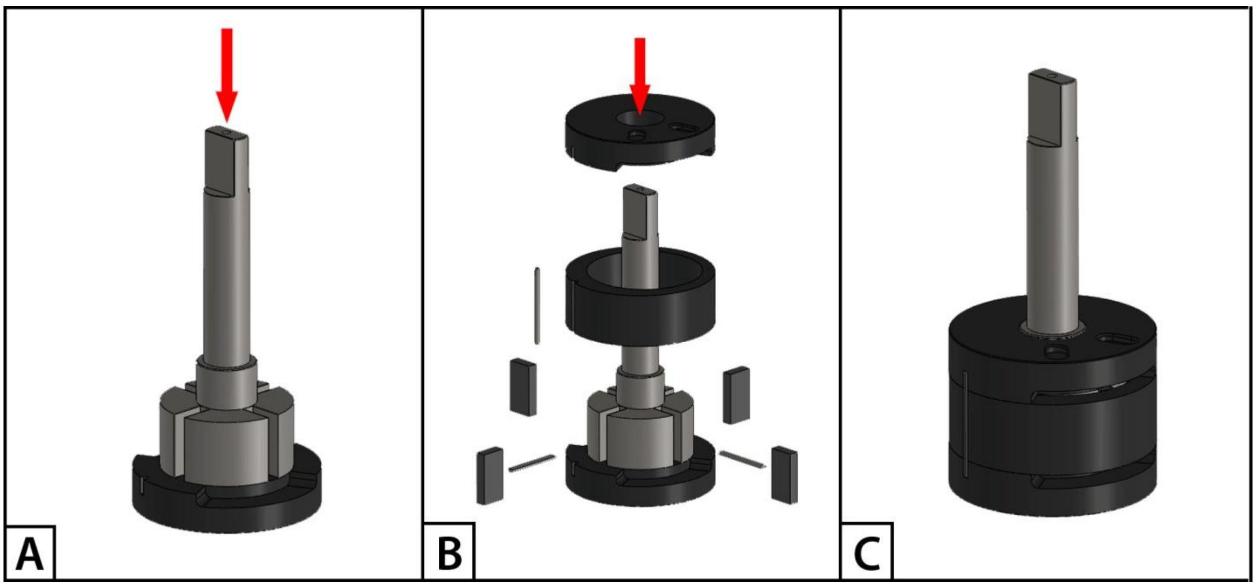


Figure 6 Diagram illustrating the tasks required to carry out Step 5.1.

The reassembly process begins with the mounting of the graphite components onto the rotor. For this step, the original rotor will be reused while all remaining components will be sourced from the repair kit.

***CAUTION*:** The proper orientation of and location of all components must be followed in accordance with the parts diagram. Deviation could result in pump damage or failure.

In this step, the Rotor (DWG 6), Vane Pins (DWG 7), Vanes (DWG 8), Rear Flange (DWG 5), Liner (DWG 9), Front Flange (DWG 10), and Alignment Pin (DWG 11) will be mated together. The materials required for this task include the Rotor (DWG 6), Repair Kit, and Forceps. The following steps are required:

5.1.1 Place the front flange on the work surface, flat-side down.

5.1.2 Insert the rotor journal into flange bore, as shown in Figure 6a.

5.1.3 Insert one vane pin into each of the two holes at the base of the rotor slots using forceps, as shown in Figure 6b. The pins should be perpendicular with flats sides together.

5.1.4 Insert the vanes into rotor slots, as shown in Figure 6b. The chamfered or radiused edge of the vanes should be facing outward.

5.1.5 Place the liner around rotor and vanes, as shown in Figure 6c.

5.1.6 Insert the rotor journal into rear flange bore, flat side up, as shown in Figure 6c.

5.1.7 Align the axial alignment grooves of the flanges and liner, as shown in Figure 6c.

5.1.8 Insert the alignment pin into the alignment grooves as shown in Figure 6c.

Step 5.2: Install Mechanical Seal

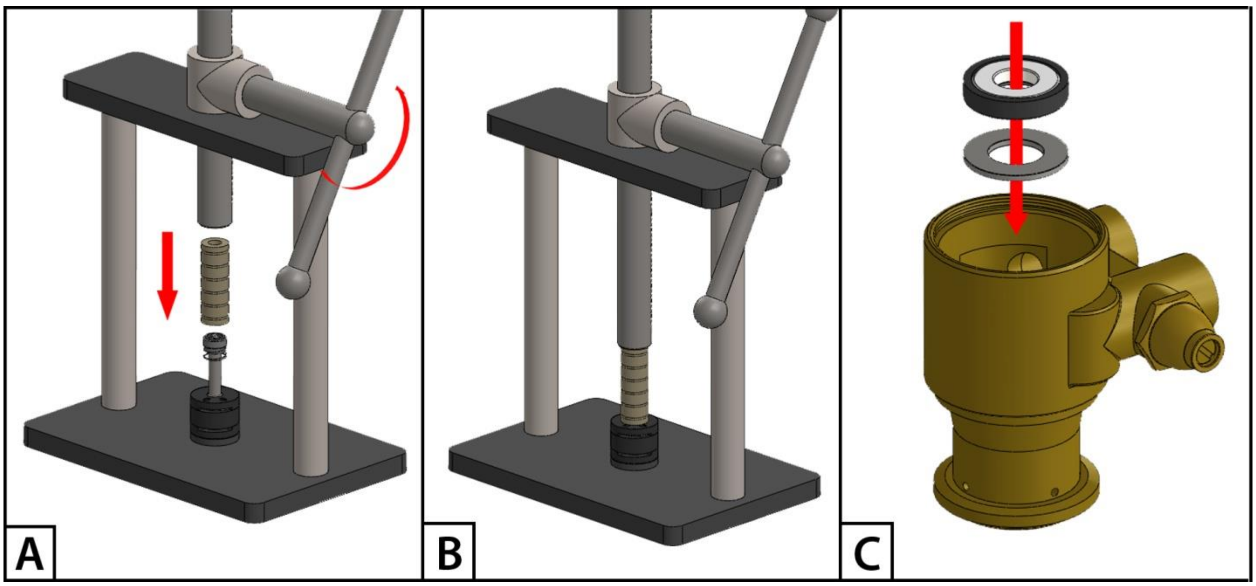


Figure 7 Diagram illustrating the tasks required to carry out Step 5.2.

In this step, the Mechanical Seal (DWG 4) components will be installed into the Housing (DWG 1) and onto Rotor (DWG 6). The materials required for this task include the Arbor Press, Seal Installation Tool, Housing Support, Ethyl Alcohol, and Repair Kit. The following steps are required:

5.2.1 Place the rotor and graphite cartridge assembly from Step 4a onto the arbor press base beneath the press ram, as shown in Figure 7a.

5.2.2 Wet the mechanical seal and rotor shaft liberally with ethyl alcohol.

5.2.3 Place the mechanical seal onto the top of the rotor shaft with the graphite ring facing up, as shown in Figure 7a.

5.2.4 Place the seal installation tool on top of the spring loaded seal, bore side down, as shown in Figure 7a.

5.2.5 Feed the press ram down against the seal installation tool, continuing until the base of the tool makes contact with the rear flange, as shown in Figure 7b. The resulting distance from the top of the seal ring to the back of the rear flange should be 0.865 in.

5.2.6 Set the housing support on the work surface and place the pump housing, bearing side down, into the housing support, as shown in Figure 7c.

5.2.7 Place the washer into the pump housing, as shown in Figure 7c. Ensure that it seats flush against the retaining shoulder in the body.

5.2.8 Wet the counterface rubber portion and the inside diameter of the pump neck liberally with ethyl alcohol.

5.2.9 Using the counterface installation tool, press the counterface into the housing until seated completely against the washer, as shown in Figure 7c.

Step 5.3: Install Graphite Cartridge into Housing

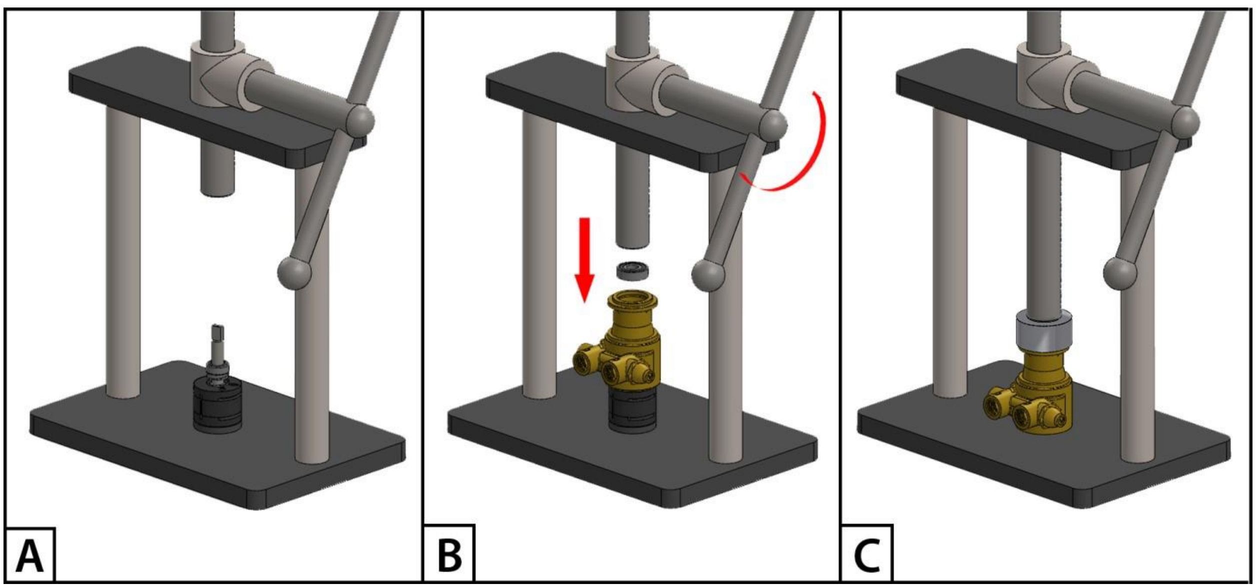


Figure 8 Diagram illustrating the tasks required to carry out Step 5.3.

In this step, the graphite and housing sub-assemblies will be mated together in continuation of the reassembly process. For a detailed view of the required orientation of these components, refer to the parts diagram. The required materials for this step include the graphite and rotor cartridge assembled in Step 4.1, the housing assembled in Step 4.2, the ball bearing (DWG 2), the bearing installation tool, and the arbor press. The following steps are required:

5.3.1 Place the rotor cartridge assembly on the arbor press base beneath the ram ensuring that the alignment pin is facing the operator, as shown in Figure 8a.

5.3.2 Place the pump housing on top of the rotor cartridge, ensuring that the ports are facing the operator. Refer to Parts Diagram for proper of orientation.

5.3.3 Place the ball bearing into the top bore of the housing, as shown in Figure 8b.

5.3.4 Place the bearing installation tool onto the bearing and housing.

5.3.4 Feed press ram downward until it contacts the installation tool. Continue feeding until the pump housing contacts the press base and the bearing has seated, as seen in Figure 8c.

Step 5.4: Install O-Ring, Shaped Disc, and Threaded Cap

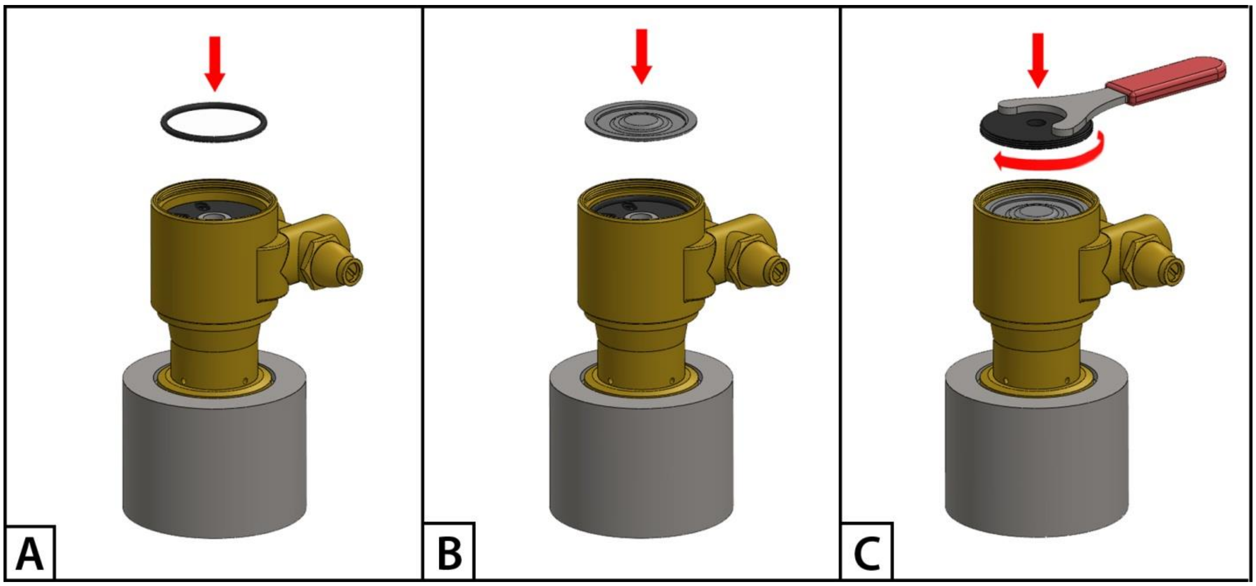


Figure 9 Diagram illustrating the tasks required to carry out Step 5.4.

In this final reassembly step, the Cap O-Ring (DWG 12), Shaped Disc (DWG 13), and Threaded Cap (DWG 14) will be installed into the pump. The materials required for this step include the Spanner Wrench and Housing Support. The following steps are required:

5.4.1 Place the housing support on the work surface, as shown in Figure 9a.

5.4.2 Place the pump housing on top of the housing support, as shown in Figure 9a.

5.4.3 Place the o-ring into the pump housing, ensuring that it sits flush against the front flange, as shown in Figure 9a.

5.4.4 Place the shaped disc into the housing on top of the o-ring, as shown in Figure 9b.

5.4.5 Place the threaded cap on top of the shaped disc, and thread it into the housing in the clockwise direction until hand-tight.

5.4.6 Engage the spanner wrench pins in the two holes of the threaded cap.

5.4.7 Support the pump body by hand and apply torque to the spanner wrench in a clockwise direction until threaded cap seats against the shaped disc, as shown in Figure 9c.

VI. Testing

Step 6: Verify Pump Functionality

The final procedure in the rebuild process is to verify the functionality of the rebuilt pump. A series of hydraulic tests should be run to ensure that the pump meets all required specifications before returning it to service. The pump should be tested for priming capability, flowrate, leaks, and bypass setting. A simple hydraulic layout for pump testing is shown below in Figure 9:

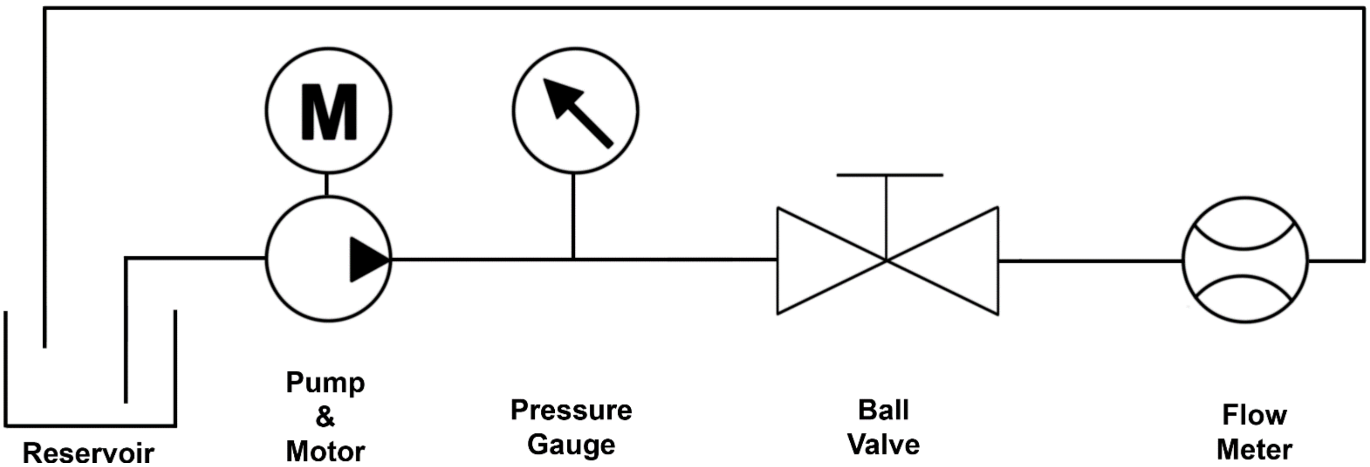


Figure 10 Basic hydraulic layout for rotary vane pump testing.

Reservoir: The reservoir provides a steady source of fluid to the pump inlet. An unpressurized source allows the pump to be tested for self-priming ability. The fluid surface height should be within 3 feet below the pump inlet. The fluid used must be clean and free of debris. It is also strongly recommended that the fluid contain minimal dissolved content to avoid scale or precipitate buildup in the pump or circuit. Distilled or RO water is recommended. The outlet tube of the reservoir should be located lower than the return to the reservoir to avoid drawing in air from the agitated return area.

Tubing: Tubing or pipe is used to hydraulically link the elements of the circuit. The tubing used should be sized according to the flowrate of the pump and the length of the run. It should be plumbed accordingly to ensure that the NPSHa at the inlet of the pump does not fall below the NPSHr for the given fluid and conditions. Excessively restrictive plumbing on the inlet line can lead to cavitation and damage to the pump. See appendix for NPSHr charts. The outlet tubing should be sized according to the acceptable pressure build for the given system. Clear tubing provides a visual indication of fluid level and air or other particles that may be in the system.

Motor: The motor used should be sized to run the pump at the desired speed under the required loading. The direct drive vanes pumps are typically run at 1750 RPM with 60 Hz power (1450 RPM at 50 Hz). The run speed of direct drive pumps must not exceed 1800 RPM to avoid excessive wear to the mechanical seal. The motor power required will be determined by the pump size, motor speed, and the maximum differential pressure to be applied across the pump. See horsepower chart in appendix for recommendation. 48Y motors, also known as carbonator motors, are most commonly employed and allow for direct mounting to the motor without the need for any additional hardware. NEMA 56C motors are also commonly used but will require a coupling (91-81-11) and adapter (92-80-03) to mount the pump.

Pressure Gauge: The pressure gauge should be selected to have a suitable range for the anticipated maximum outlet pressure. Liquid filled gauges are recommended to avoid the damaging effects of pressure pulsations in the line as well as to make pressure readings easier and more accurate.

Valve: The ball valve should be sized according to the tubing size chosen and its full open restriction. The valve type is not critical. A ball, needle, gate, or other type of valve may be used if desired. The main requirement is that the valve be able to apply and remove restriction to the line. If the bypass is to be tested, the valve must be able to fully close.

Flow Meter: The flow meter should be sized according to the flowrate of the pump to be tested. See appendix for pump flowrate specifications.

Testing Procedure

Initiation: Although not required, it is recommended to wet the internal components to reduce dry wear at startup. Mount the pump to the motor using the supplied v-band clamp. Plumb the inlet and outlet into the hydraulic circuit appropriately. Wipe down the pump and nearby plumbing with a dry cloth to ensure that no fluid remains on the surface. This will eliminate the likelihood of a false reading when checking for leaks later in the testing process. Ensure that the ball valve is in the open position. Apply power to the motor. The pump should begin drawing fluid from the reservoir. Allow sufficient time for the pump to prime itself and purge the air from the system.

Bypass Setting: Once the pump is operating in steady state, the bypass should be adjusted, if the pump is equipped with one. To begin, unscrew the bypass screw counterclockwise until it is flush with the end of the acorn nut in order to ensure a relatively low setting. Slowly begin to close down the ball valve in order to increase outlet pressure. Continue closing the valve until it is fully closed, ensuring that pressure is not allowed to exceed system limits. Once the ball valve is fully closed, the bypass can be set. Screwing the bypass screw in or out will increase or decrease the bypass set point. Clockwise rotation of the screw will increase the bypass setting. Counterclockwise rotation of the screw will decrease the setting. The screw must not be set so low as to expose the o-ring seal. The bypass set point should be at least 40 psi higher than the maximum pressure that the pump will encounter in service. If the bypass setting is too close to the working pressure of the pump, the bypass will operate in a partially open condition and could result in permanent damage to the pump over time. Once the desired set pressure is reached, the ball valve can be opened to once again allow free flow through the system.

Load Testing: With the pump running and the ball valve fully open, the flow and pressure should be recorded. The ball valve should then slowly be closed down to increase the pressure to the maximum allowed by the system and motor. At this point, a second flow and pressure reading should be recorded. These two data points should be compared to the specifications given in the corresponding data sheet in the appendix.

Leak Check: In order to check for leaks, it is recommended to run the pump under load for a period of time. With the pump running, slowly close down the ball valve until the outlet pressure is at least 50 psi. Allow the pump to run under pressure for at least 1 hour before inspecting for leaks. Although most leaks will surface within the first 15 minutes, small leaks may not become apparent until an hour or so of running. There are three main sealing points in the pump: the cap, the bypass, and the mechanical shaft seal. To check the bypass seal, inspect around the base and head of the acorn nut for signs of fluid leaks. To check the cap seal, inspect around the perimeter and three holes of the threaded cap for signs of fluid leaks. To check the mechanical seal, inspect the 4 weep holes found on the neck of the pump next to the v-band clamp for signs of fluid leaks. It may be necessary to blow compressed air through the top hole or tap the neck in order to ensure that no traces of leaked fluid remain hidden in the neck cavity. Fluid coming out of any of these points is an indication of a faulty seal and should be inspected.

Conclusion: After the pump has completed the testing procedures, it can be flushed of fluid, removed from the test stand, and the rebuild procedure is complete.

Troubleshooting

Shaft Very Difficult to Turn

- Debris stuck between rear flange and pump housing
- Graphite components coated with a gummy or scaly substance
- O-ring or mechanical seal swelled by incompatible fluid
- Graphite components not pressed fully into the housing
- Damaged Rotor interfering with graphite components
- Incorrect size vane pins or liner installed
- Bearing rusted stuck

Flow Lower Than Specs

- Incorrect Graphite Liner
- Graphite worn
- Bypass is worn, stuck open, or set too close to operating pressure
- Motor speed low
- Shaft or coupling slipping or damaged
- Flow reading inaccurate
- Inlet is clogged or restricted

Flow Higher Than Specs

- Incorrect Graphite Liner
- Motor speed high
- Flow reading inaccurate

Pump Noisy While Running

- Cavitation as a result of insufficient NPSHa
- Damaged or misaligned couple between pump and motor
- One or more vanes “sticking” and causing pulsation in the flow
- Motor is defective
- Bypass is open and resonating resulting in squealing noise
- Front and Rear Flanges installed backwards

Pump Leaks from Bypass

- Bypass O-ring damaged
- Bypass acorn nut hole is damaged
- Nylon washer at base of acorn nut is damaged or nut is not tightened
- Bypass screw is protruding out too far and exposing the o-ring

Pump Leaks from Cap

- Cap O-ring is damaged, defective, swelled, or otherwise in poor condition

- Cap O-ring is improperly seated, ie. pinched between cap and edge
- Threaded cap is loose (070-400 series only)
- Stainless steel shaped disc is damaged (070-400 series only)
- Graphite front flange is damaged along the edge against which the o-ring seats
- Cap bulged and deformed as a result of overpressurization (500-1000 series only)

Pump Leaks from Weep Holes

- Mechanical seal is worn or damaged
- Mechanical seal is improperly installed
- Possibly the result of condensation if pump runs cold

Pulsation While Running

- One or more vanes “sticking” and causing pulsation in the flow
- Cavitation, as a result of insufficient NPSHa

Pump Will Not Prime

- Leak in the inlet plumbing
- Worn graphite
- Improperly assembled pump
- Bypass damaged or stuck open
- Body cavity damaged allowing internal leak path
- Vanes stuck in their slots

Fluid Pumps Backwards

- Motor spinning in incorrect direction
- Graphite components in incorrect orientation

Motor Overloading

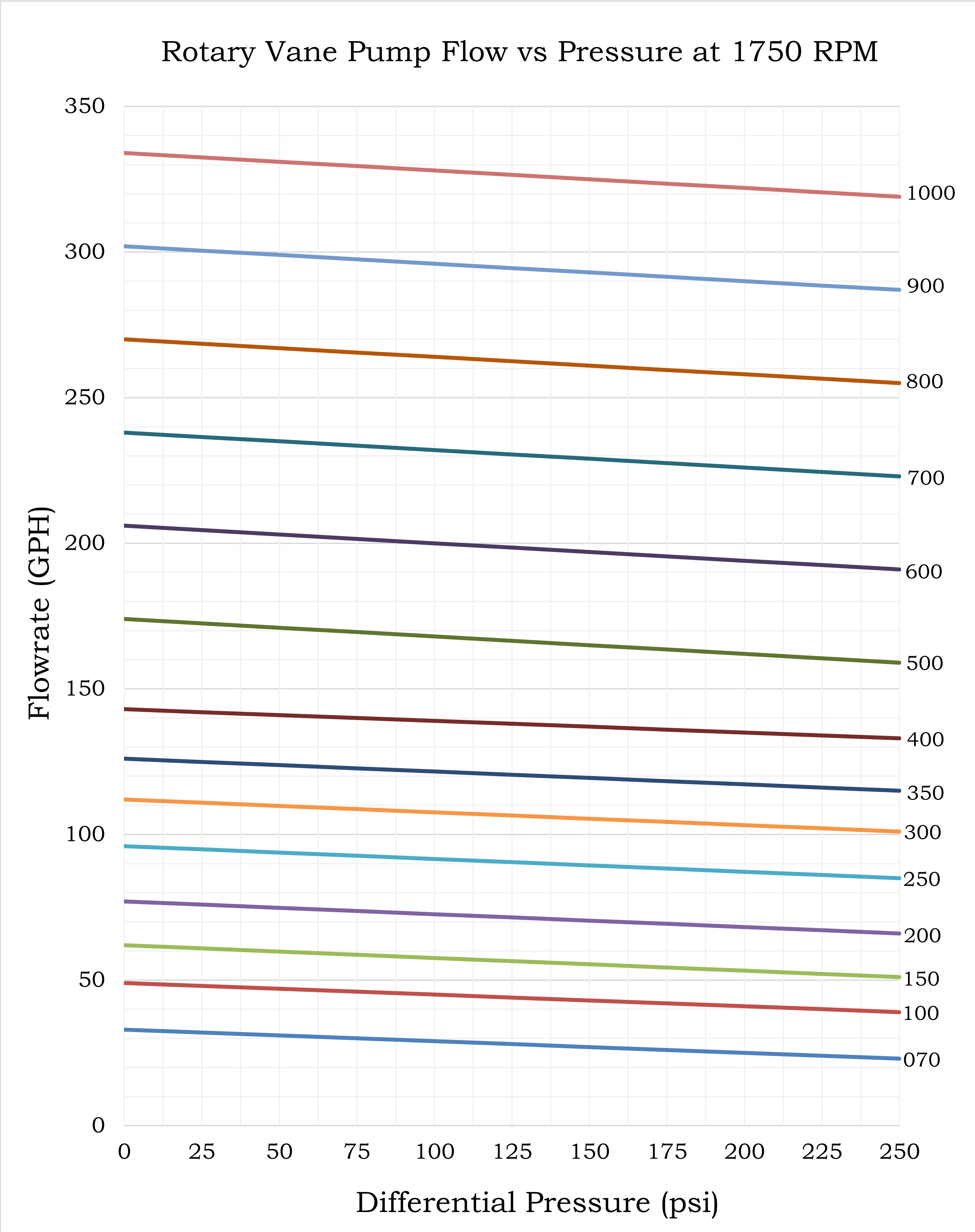
- Improperly sized motor for the application
- Motor wired for incorrect voltage
- Pump shaft difficult to turn (see above)

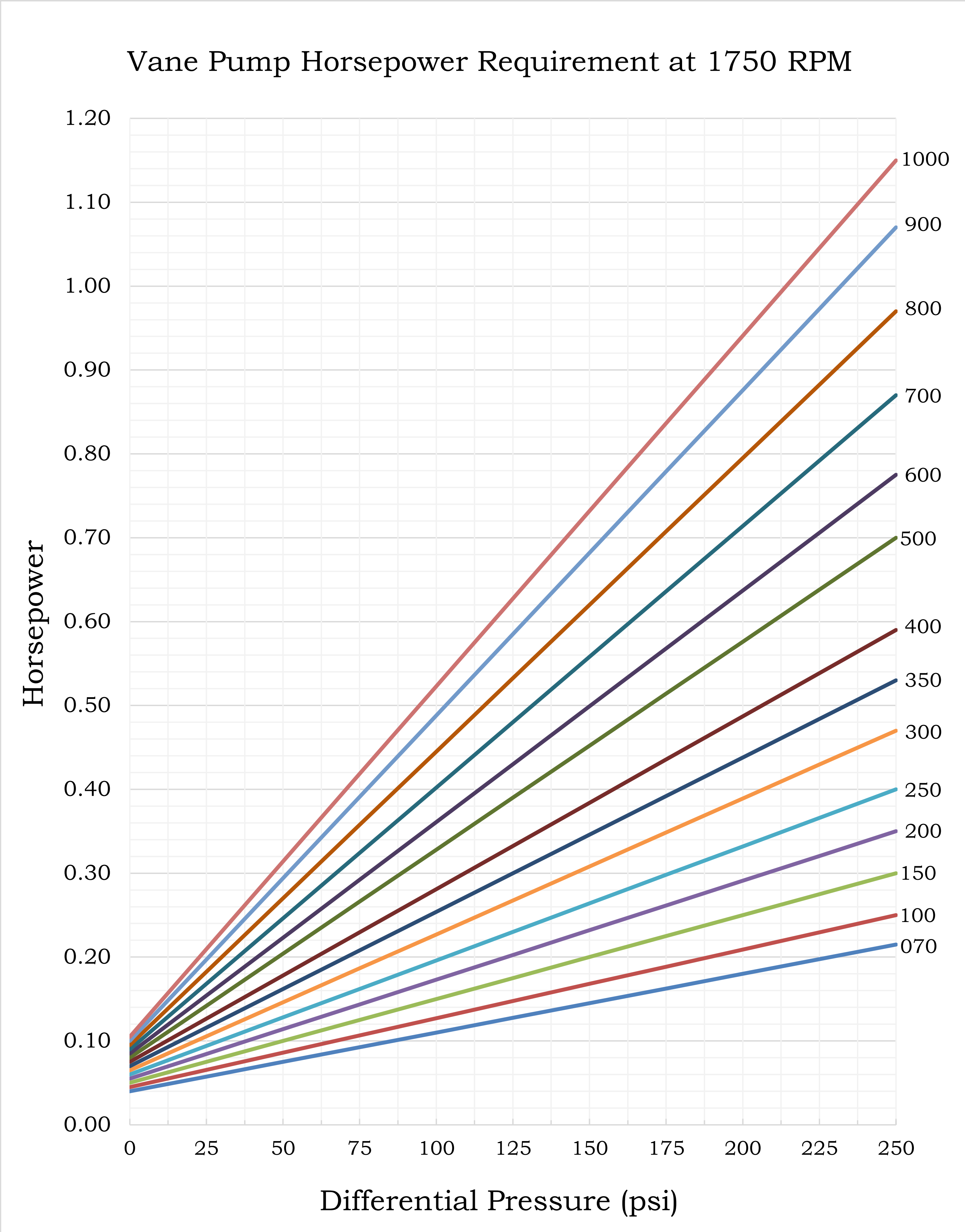
Pressure will not increase

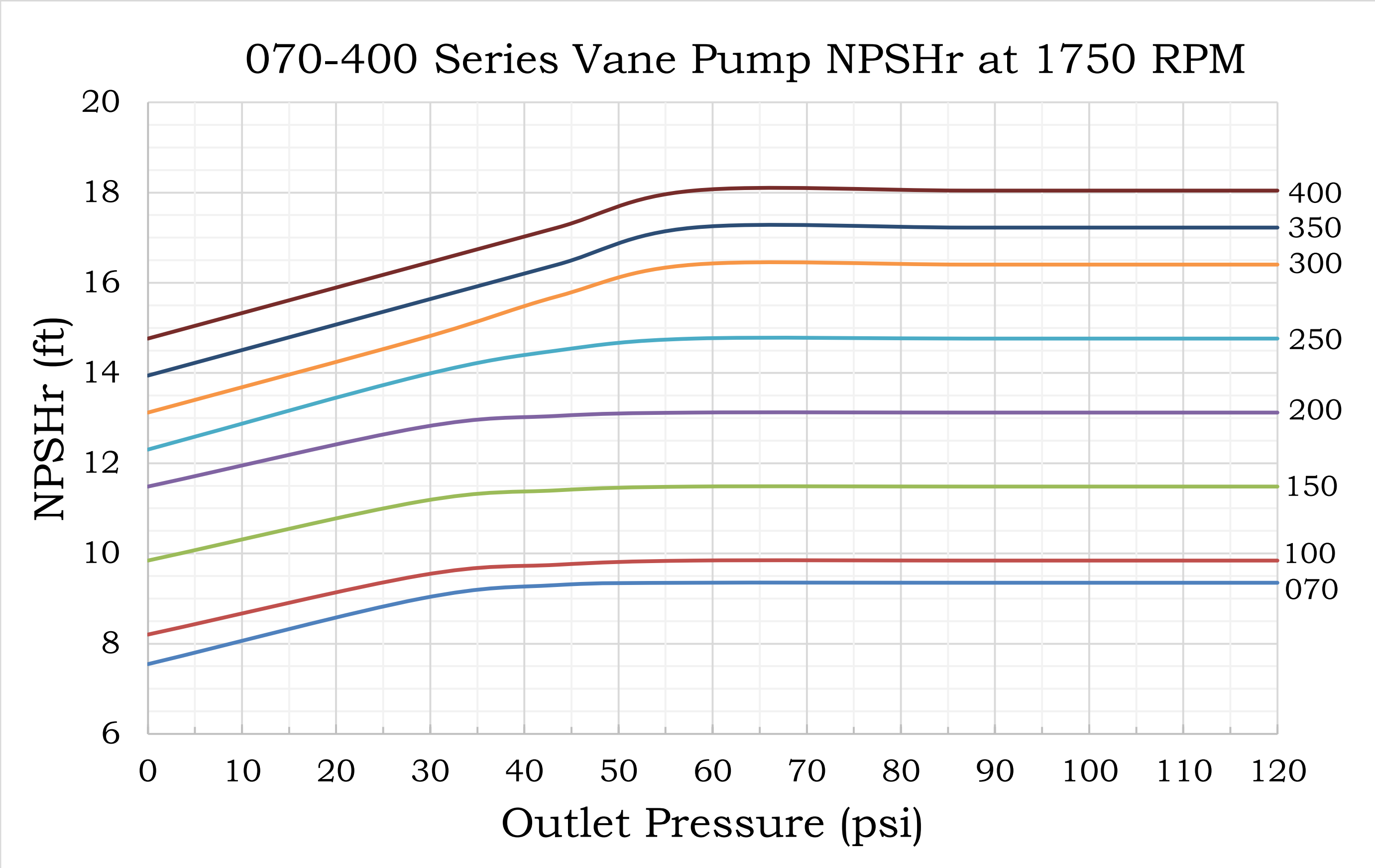
- Bypass is set too low preventing pressure from increasing above set point
- Pump flowrate too low to build desired pressure at given system resistance
- Graphite worn
- Pressure reading inaccurate

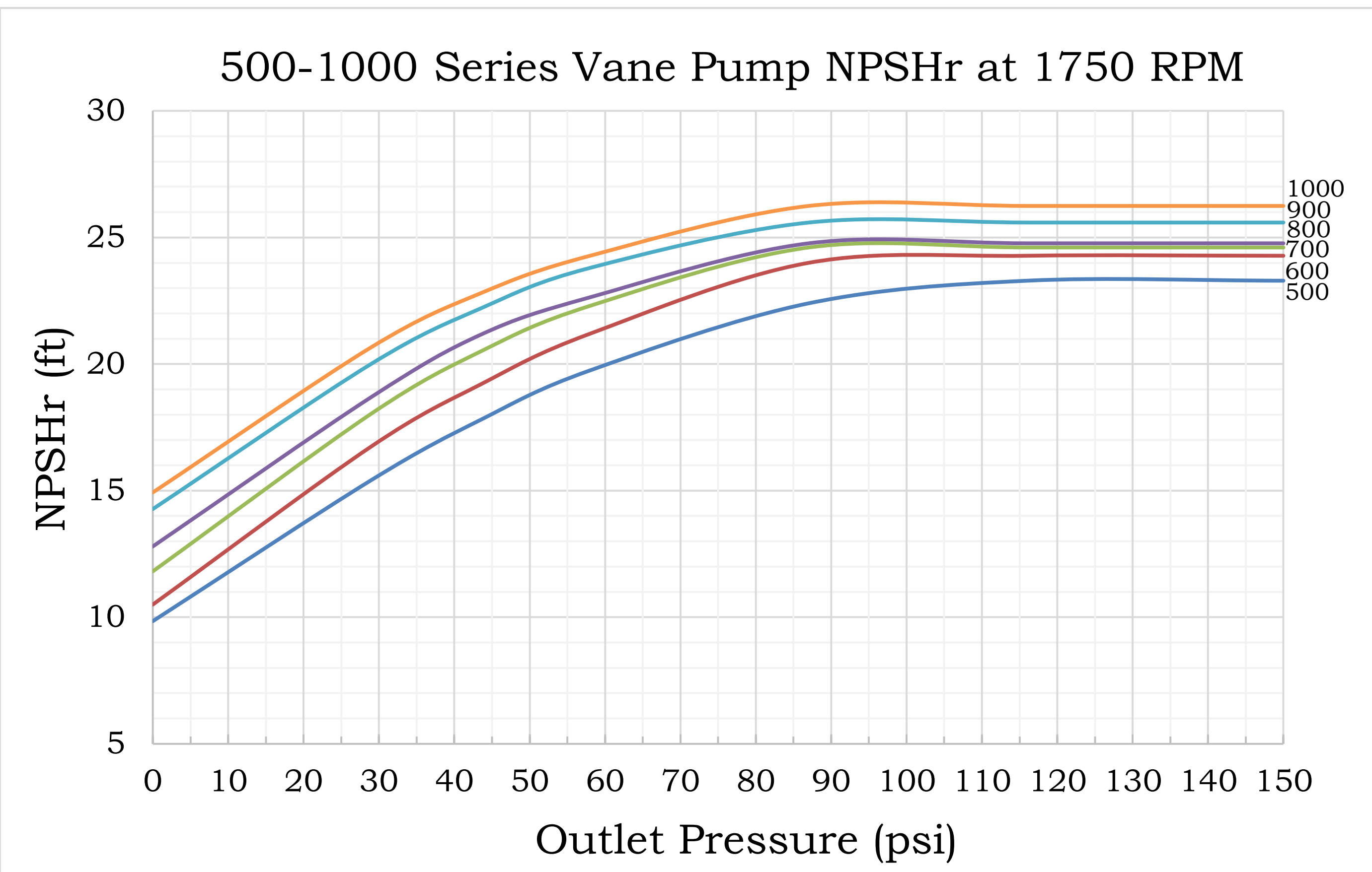
Pressure will not decrease

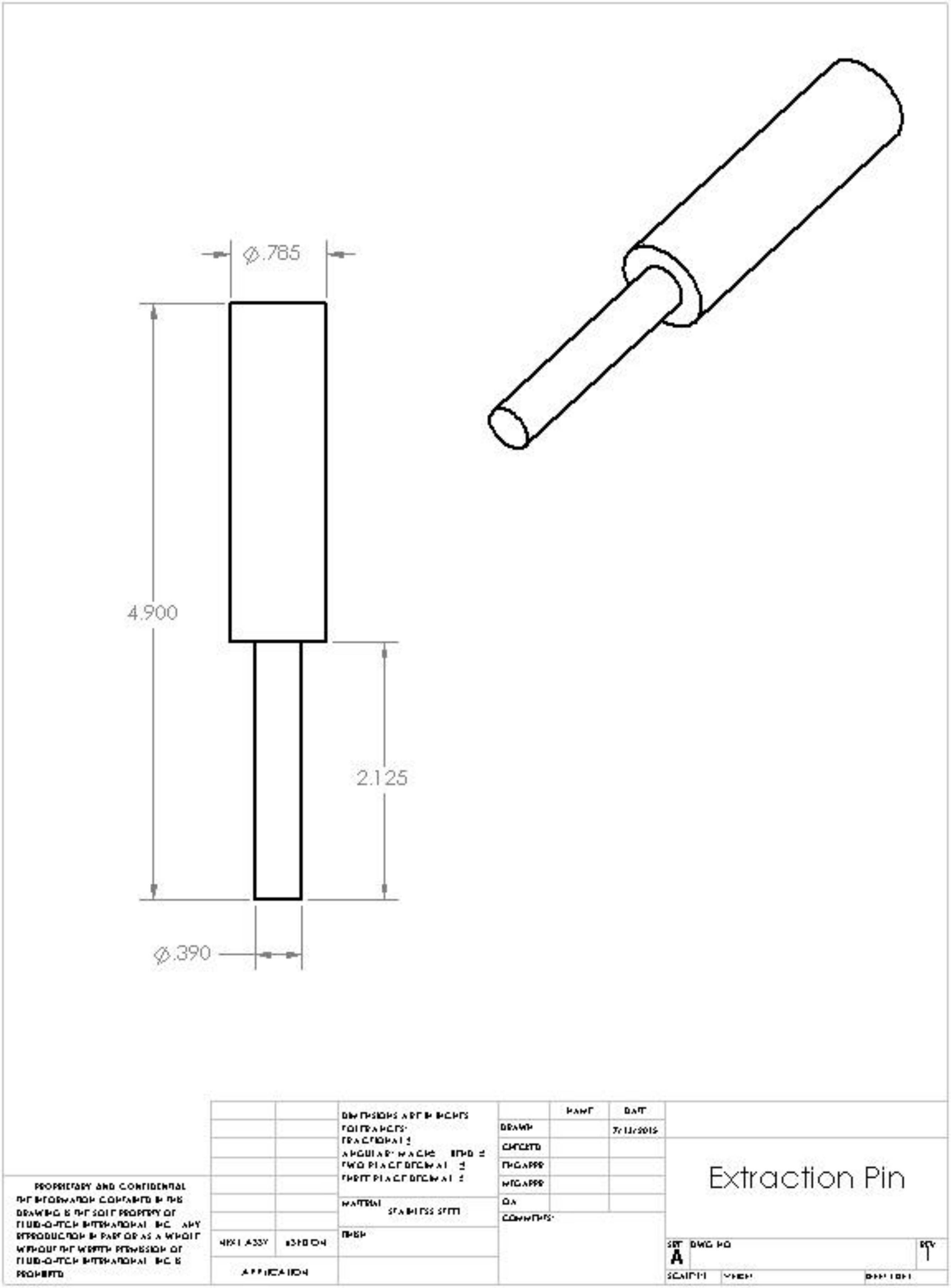
- Obstruction or excess restriction in fluid circuit
- Pump flowrate too high to reach desired pressure at given system resistance
- Pressure reading inaccurate
- Bypass spring obstructed by fitting


Rotary Vane Pump Flow vs Pressure at 1750 RPM
Flowrate (GPH)
Differential Pressure (psi)
350
300
250
200
150
100
50
0
0
25
50
75
100
125
150
175
200
225
250
1000
900
800
700
600
500
400
350
300
250
200
150
100
070

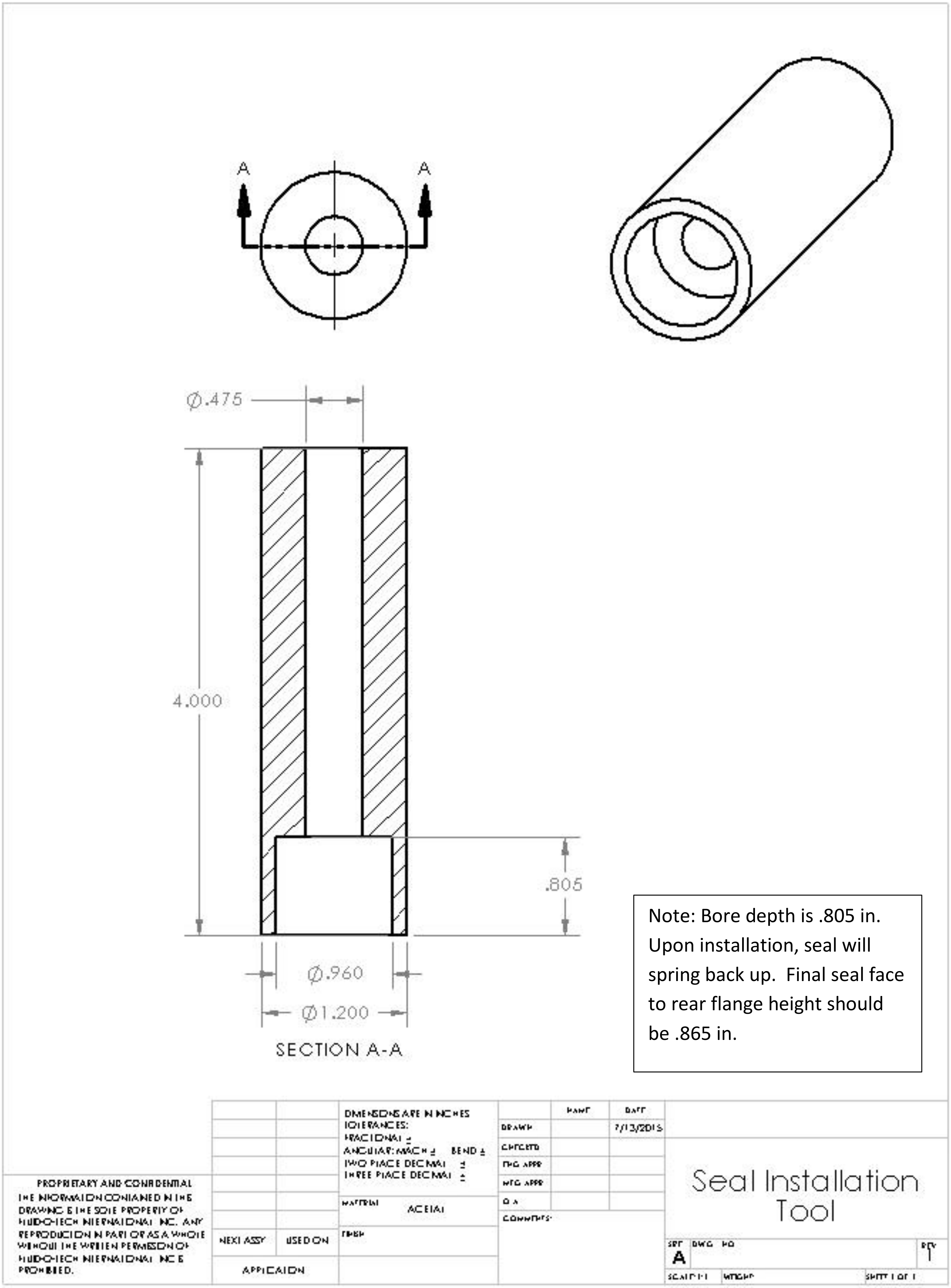

Vane Pump Horsepower Requirement at 1750 RPM
Horsepower
Differential Pressure (psi)
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0
25
50
75
100
125
150
175
200
225
250
1000
900
800
700
600
500
400
350
300
250
200
150
100
070

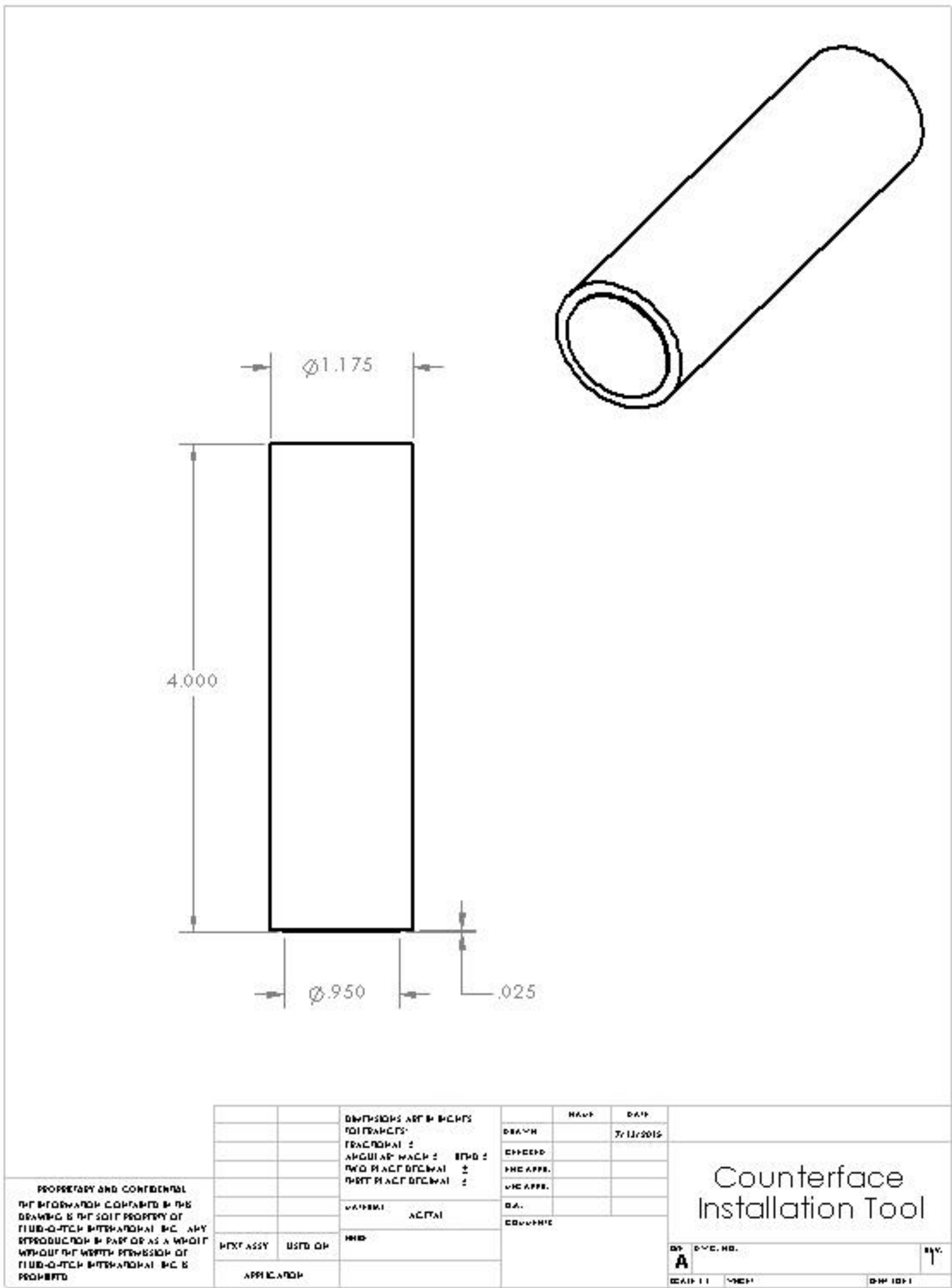

070-400 Series Vane Pump NPSHr at 1750 RPM
NPSHr (ft)
Outlet Pressure (psi)
400
350
300
250
200
150
100
070


500-1000 Series Vane Pump NPSHr at 1750 RPM
NPSHr (ft)
Outlet Pressure (psi)
1000
900
800
700
600
500

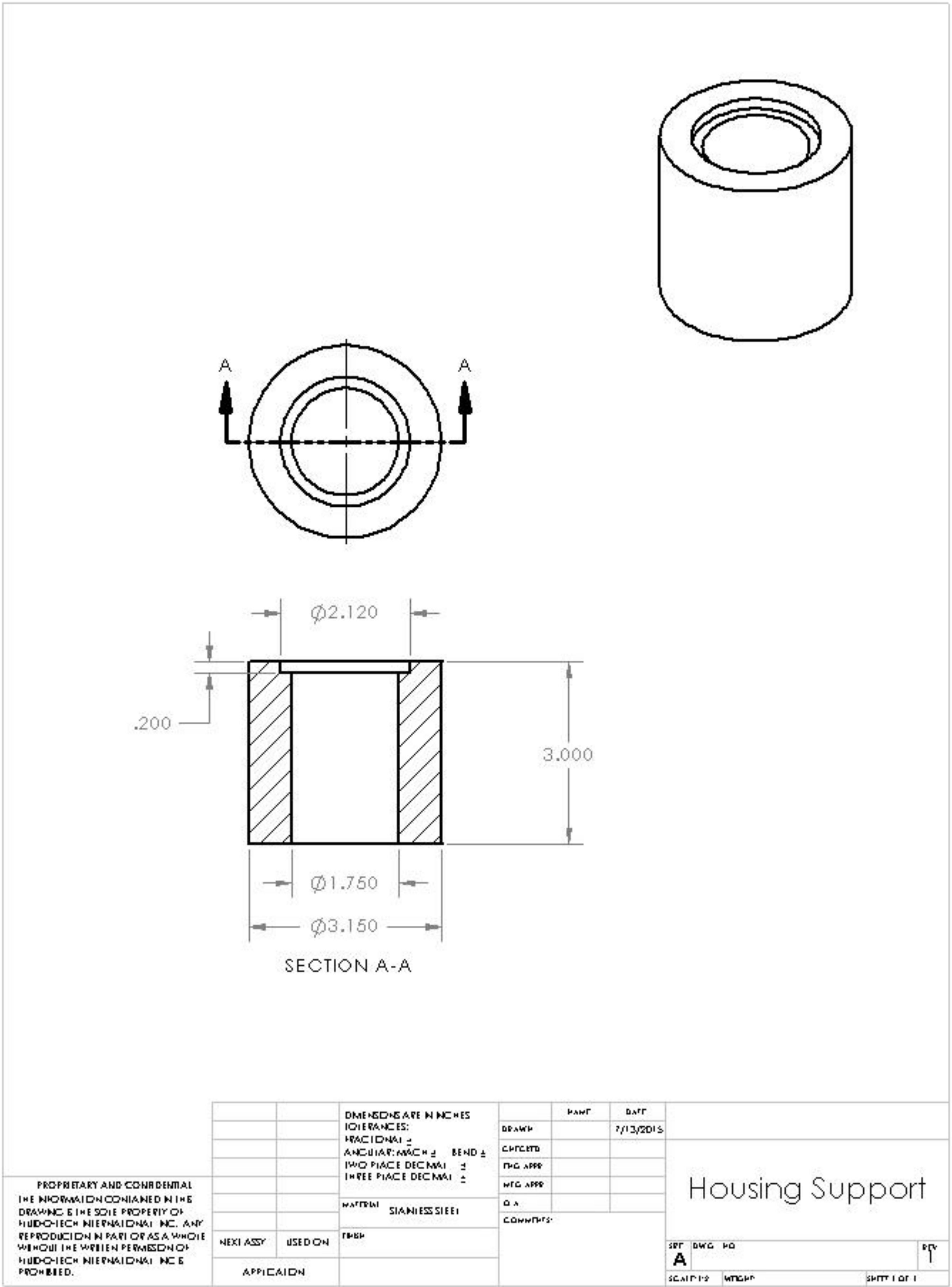


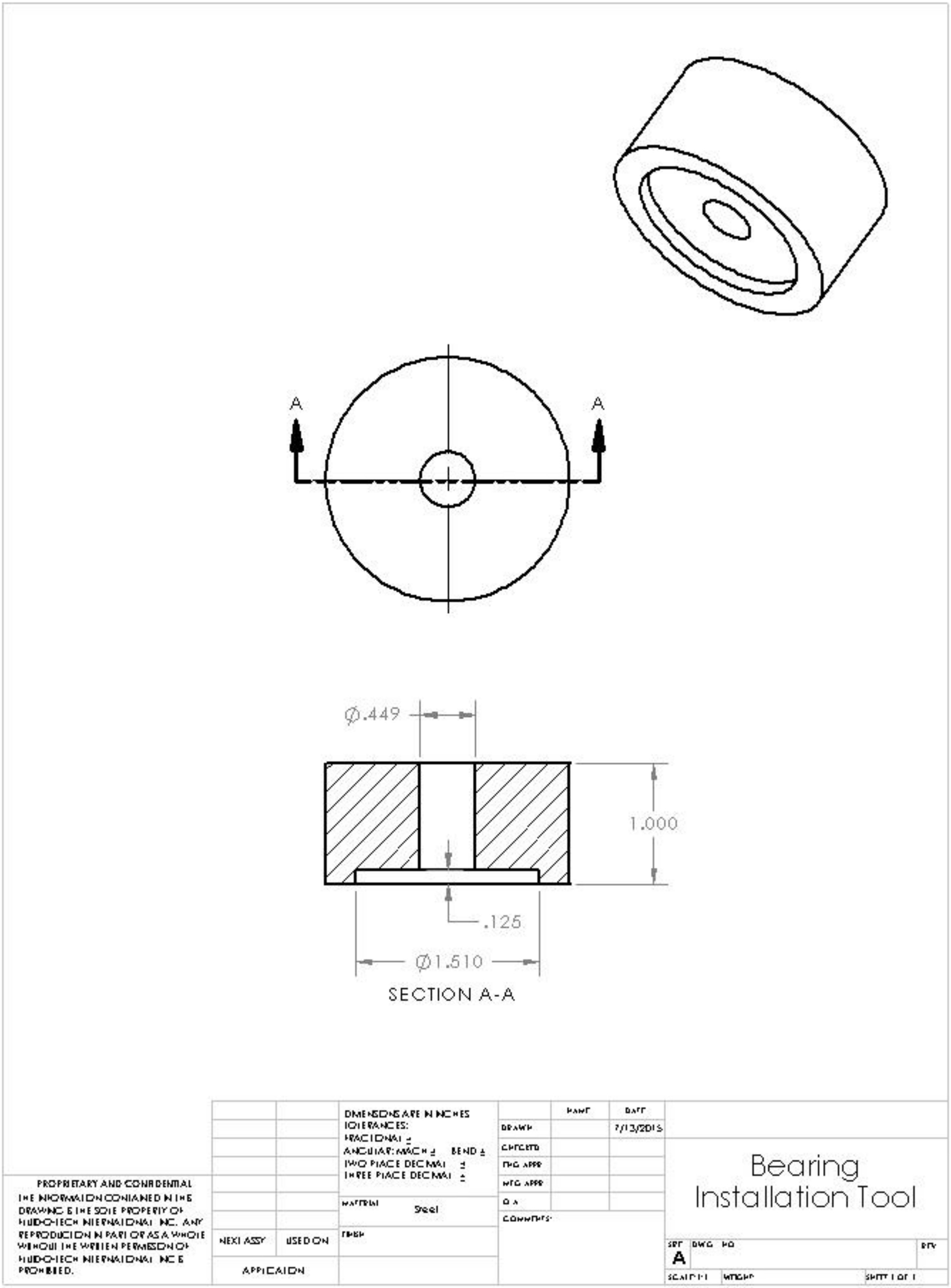
⌀.785
4.900
2.125
⌀.390
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
MATERIAL
STAINLESS STEEL
FINISH
NAME
DATE
DRAWN
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
PROPRIETARY AND CONFIDENTIAL
NEXT ASSY
USED ON
APPLICATION
Extraction Pin
SIZE
A
DWG. NO.
REV
SCALE
WEIGHT
SHEET


A
A
Ø.475
4.000
.805
Ø.960
Ø1.200
SECTION A-A
Note: Bore depth is .805 in. Upon installation, seal will spring back up. Final seal face to rear flange height should be .865 in.
PROPRIETARY AND CONFIDENTIAL
DIMENSIONS ARE IN INCHES
TOLERANCES:
NEXT ASSY
USED ON
APPLICATION
ACETAL
7/13/2015
Seal Installation Tool
A



Ø1.175
4.000
Ø.950
.025
PROPRIETARY AND CONFIDENTIAL
ACETAL
Counterface
Installation Tool
A
1


A
A
Ø2.120
.200
3.000
Ø1.750
Ø3.150
SECTION A-A
PROPRIETARY AND CONFIDENTIAL
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
MATERIAL STAINLESS STEEL
FINISH
NEXT ASSY
USED ON
APPLICATION
NAME
DATE
DRAWN
7/13/2015
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
Housing Support
SIZE DWG. NO.
A
REV
1
SCALE: 1:2
WEIGHT:
SHEET 1 OF 1


A
A
Ø.449
1.000
.125
Ø1.510
SECTION A-A
PROPRIETARY AND CONFIDENTIAL
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
NAME
DATE
DRAWN
7/13/2015
CHECKED
MATERIAL
Steel
FINISH
NEXT ASSY
USED ON
APPLICATION
COMMENTS:
Bearing
Installation Tool
SIZE
A
DWG. NO.
REV
SHEET 1 OF 1