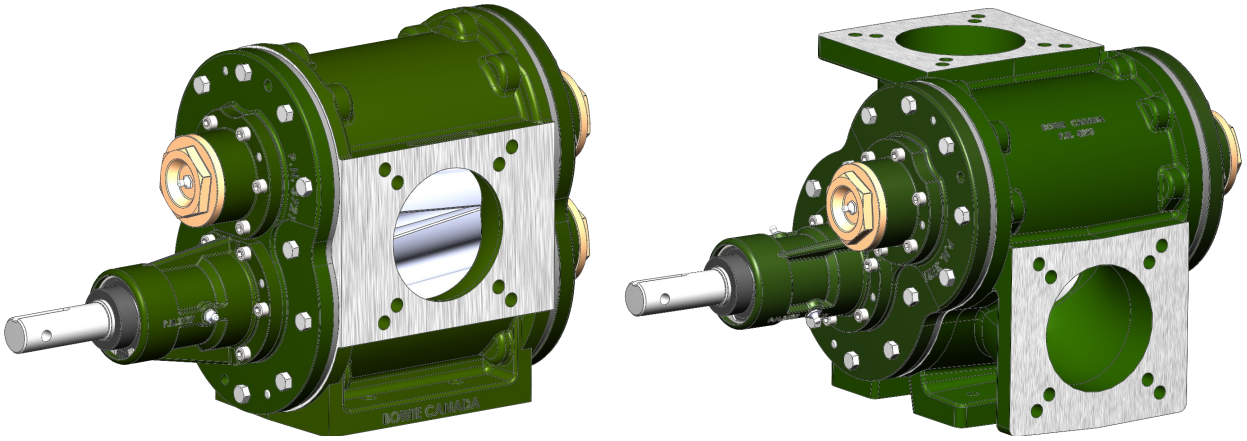
INSTALLATION, OPERATION AND MAINTENANCE MANUAL



DuraSeal™ SERIES

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Manuals, parts lists, and technical information available at:
www.bowiepumps.com

These are SAFETY ALERT SYMBOLS.

When you see these symbols, be alert to the potential for personal injury, death or major property damage.

Warns of hazards that WILL cause serious personal injury, death or major property damage.

Warns of hazards that CAN cause serious personal injury, death or major property damage.

Warns on hazards that CAN cause personal injury or property damage.

NOTICE:
Indicates special instructions which are very important and must be followed.

NOTICE:

Bowie pumps MUST only be installed in systems which have been designed by qualified engineering personnel. The system MUST conform to all applicable local and national regulations and safety standards.

This manual is intended to assist in the installation and operation of the Bowie DuraSeal™ Series pumps, and when possible kept with the pump.

Pump service shall be performed by qualified technicians ONLY. Service shall conform to all applicable local and national regulations and safety standards.

Thoroughly review this manual, all instructions and hazard warnings BEFORE performing any work on the pump.

PUMP DATA

PUMP IDENTIFICATION

Pump serial number and model designation will be supplied with each pump. It is recommended that this data be recorded and filed for future reference. This data should be supplied to a Bowie representative when replacement parts, repair work, or information pertaining to the pump is required.

PUMP INFORMATION

Model No.: _____

Serial No.: _____

Date of Installation: _____

TECHNICAL DATA

Operating Criteria	Buna-N Rubber Gears	Progressive Helical Steel Gears
Maximum Operating Temperature*	70°C	160°C
Maximum Speed*	500 RPM	750 RPM
Maximum Viscosity*	60000 SSU	
Maximum Differential Pressure*	125 psi	150 psi
Maximum Working Pressure*	125 psi	150 psi

* Pressures must be measured no farther than 6" from the discharge port. Maximum operating limits are dependent on the materials of construction and application design requirements.

Noise levels for all pumps will not exceed 95dB at a distance of one meter from the pump.

PUMP DESCRIPTION

Our ingeniously simple combination seal and bearing design pump. They have been created for those that want it all. Durability day-in and day-out. High volume output. Exceptional leak resistance. Ease of repair. All at a reasonable price.

Dura-Seal pumps simply Outperform and Outlast the competition.

PUMP DIMENSIONS, EXPLODED VIEWS, AND OTHER TECHNICAL INFORMATION

All technical information, including pump dimensional diagrams, exploded views with part listings, and other technical information are available at www.bowiepumps.com.

INSTALLATION



Operation without guards in place can cause serious personal injury, property damage, or death.

NOTICE:

Bowie pumps must be installed only in systems design by qualified engineering personnel. Bowie pumps should only be installed in duties for which Bowie Pumps of Canada Ltd. have specified the attributes of the pump. System design must conform to all applicable regulations and codes and provide warning of all system hazards.

NOTICE:

PTO and hydraulically driven units MUST use speed control devices to limit the shaft from exceeding maximum RPM specifications, regardless of unloading speeds. If fluid flow is less than expected, consult the "General Pump Troubleshooting" section.

PRE-INSTALLATION CLEANING

Any large foreign matter that enters the pump WILL cause extensive damage. The supply tank and piping MUST be cleaned and flushed before pump installation and operation.

GENERAL MOUNTING

Mount the unit on a rigid, heavy base to provide support and absorb shock. Bases should be designed for high rigidity, not just strength.

The pump feet were not designed for mounting to concrete and do not have enough contact area to prevent concrete from failing. When mounting to cement or concrete, use a steel base plate (supplied by others) to distribute the mounting stress over an area large enough to prevent the cement from failing.

TRUCK MOUNTING

Bowie pumps are designed to be installed in a horizontal position with base plates mounted and parallel to ground on a flat surface. The pump should be installed with access to both the drain plugs and multiple grease fittings on the pump. The pump may be bolted to the truck frame or on a saddle hung below the frame, however it MUST be grouted and bolted, ensuring firm fixing and a reduction in noise and vibration. The pump should be installed with access to both drain plugs and multiple grease fittings.

LOCATION AND PIPING

1. Locate the pump as close to the source of supply as possible to maximize intake.
2. Piping MUST have proper support to prevent any load being placed on the pump.
3. Piping and fittings MUST be at least the same diameter as the pump port.
4. Minimize the number of intake line fittings and piping turns or bends to maximize performance.
5. Install a strainer or screen on the suction line to prevent large foreign matter from entering the pump. Place the strainer in an accessible location for frequent cleaning.
6. It is recommended to install a suitable device to prevent over-pressurization of the system. Bowie Pumps of Canada Ltd. supplies a bi-directional pressure relief plate (BP7000) for this purpose.
7. Suction and discharge lines and piping MUST be free of all leaks.

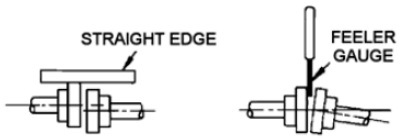
INSTALLATION



Operation without guards in place can cause serious personal injury, property damage, or death.

NOTICE:

Drive shaft angular and axial alignment can be determined using a straight edge and feeler gauges.



POWER TAKE OFF (PTO) DRIVE

Bowie pumps may be driven by a PTO drive. A direct drive shaft with a universal joint on each end of the shaft is used to connect the pump to the drive. A sleeve joint can be used to compensate for any play caused by road conditions.

General guidelines for proper pump drive:

1. The angle of drive shaft between pump and PTO must be NO LESS than 3° and NO GREATER than 20° to ensure proper performance and protect from premature pump failure.
2. Use the least number of jackshafts as is practical.
3. Use an even number of universal joints (U-joints).
4. The yokes of the universals at both ends of the jackshaft must be in phase and parallel.
5. The angle between the jackshaft and the pump shaft must be NO LESS than 3° and NO GREATER that 20° (refer to guideline 1).
6. The PTO shaft must be balanced and maintained to manufacturers specifications.
7. The PTO shaft RPM must not exceed the recommended pump RPM for operation.

Failure to follow these guidelines may result in excessive wear on the U-joints, bearing, seals and internal components of the pump. This will result in improper performance and may result in premature pump failure. Failure to follow these guidelines may also result in uneven turning of the gears, in turn causing a surging vibration to the fluid system.

HYDRAULIC DRIVE

Bowie pumps may be hydraulically driven. The hydraulic motor should be well supported with the drive shaft in-line with the pump shaft in all respects. A sleeve joint is recommended to compensate for any play caused by road conditions. Bowie Pumps of Canada provides a Hydraulic Mount Adapter for this purpose. Please contact your nearest Bowie agent for more information.

General guidelines for proper pump drive:

1. The shaft of the hydraulic motor should be aligned with the Bowie pump drive shaft. The two shafts should be parallel and concentric.

2. Alignment of the hydraulic motor shaft and the Bowie pump drive shaft can be measured using a straight edge and feeler gauges, or a taper gauge or caliper.

3. Axial misalignment (in which the shafts are parallel but are not concentric) is measured at the coupling. The maximum allowable axial misalignment is 0.050”.

4. Angular misalignment (in which the shafts are concentric but are not parallel) is measured at the coupling. The maximum allowable angular misalignment is 1.0°.

Failure to follow these guidelines may result in excessive wear on the internal components of the pump. This will result in improper performance and may result in premature pump failure. Failure to follow these guidelines may also result in uneven turning of the gears, in turn causing a surging vibration to the fluid system.

PUMP OPERATION



Disconnecting fluid or pressure containment components during pump operation can cause serious personal injury, death or major property damage.



Pumps operating against a closed valve can cause system failure resulting in personal injury and property damage



Pumping hazardous or toxic fluids can cause personal injury and property damage.

PRE-START UP CHECK LIST

1. Check alignment and connections of all piping/tubing to the pump. Pipes must be supported to prevent drop down or pressurized recoil when the pump flanges or unions are disconnected.
2. Inspect complete piping/tubing system ensuring that no external piping loads are being placed on the pump.
3. Secure appropriate hose connections.
4. Check all nuts and bolts, flanges, and base mounting fixtures for tightness.

NOTICE:

If difficulties or issues are experienced during start up, please consult the "General Pump Troubleshooting" section.

NOTICE:

"Dry running" the pump WILL result in gear and pump damage.

NOTICE:

The range of temperatures that pump surfaces will develop is dependent upon factors such as product temperature and ambient temperature of operation. There may be instances where the external pump surface can exceed 50°C. In these situations, proper warnings/guards MUST be used.

NOTICE:

High Viscosity fluids and / or low fluid levels will lead to high suction at start up. This will cause a "dry run" situation. The pump must be adequately primed by adding fluid to the inner pump area through drain plug openings in the back plate.

START UP PROCEDURES

1. Ensure appropriate valves are open in the inlet and discharge lines.
2. Start the pump. Priming should occur within one minute.
3. Inspect all associated piping, fittings and system equipment for issues such as leaks, noise, vibration and overheating.
4. Check flow rate to ensure the pump is operating within expected limits.
5. If equipped, check the relief valve pressure setting by momentarily closing a valve in the discharge line and reading the pressure gauge. This pressure must be a minimum of 20-30 psi (1.4-2.1 Bar) higher than the maximum system operating pressure or pressure relief plate setting, and must not exceed 150 psi. **DO NOT operate the pump against a closed discharge valve for more than 15 seconds.** If adjustments need to be made, refer to the "Relief Valve Setting and Adjustment" section of this manual.

PUMP OPERATION



Disconnecting fluid or pressure containment components during pump operation can cause serious personal injury, death or major property damage.



Pumps operating against a closed valve can cause system failure resulting in personal injury and property damage



Pumping hazardous or toxic fluids can cause personal injury and property damage.

NOTICE:

Properly dispose of all waste fluids in accordance with appropriate codes and regulations.

NOTICE:

After flushing the pump some residual fluid will remain in the pump and piping.

NOTICE:

Only lubricating, non-corrosive fluids may be left in the pump for an extended period of time. Any other fluids must be flushed from the pump immediately.

NOTICE:

Threaded drain plug holes on the back plate can be used to flush the pump.

FLUSHING THE PUMP

1. Evacuate as much existing fluid as possible from the pump.

2. Run cleaning fluid through the pump intake. The cleaning fluid should be compatible with the pump O-rings and gear material. In situations with “sticky” fluids that solidify within the pump (i.e. waxes, adhesives etc.) use a fluid that prevents solidification of the fluid to facilitate flushing.

BI-DIRECTIONAL PRESSURE RELIEF PLATE OPERATION



Pressure Relief locking caps are exposed to and retain some pumped fluids

NOTICE:

Any internal pump relief valve is designed to protect the pump from excessive pressure and must NOT be used as a system pressure control valve. See your local Bowie dealer for a list of Bowie manufactured system pressure control valves.

BI-DIRECTIONAL PRESSURE RELIEF PLATE

An available bi-directional pressure relief plate is manufactured and can be supplied by Bowie Pumps of Canada Ltd. This will set a different maximum pressure for each direction of fluid flow. Initial pressure is set at the factory to the customer's specifications, based on the specific operating rotational speed of the pump's drive shaft.

NOTICE:

Adjustment of pressure settings by any party other than a specified BPOC repair or warranty agent will void all warranty of BPOC products.

NOTICE:

Both Pressure Relief locking caps come with a control marker listing the existing pressure setting. Removal of the control marker will void all warranty of BPOC products.

BI-DIRECTIONAL PRESSURE RELIEF PLATE SETTING

The Bi-Directional Pressure Relief Plate pressure setting should be set a minimum of 20-30 psi higher than the operating pressure. When adjusting the pressure setting, the correct locking cap must be adjusted for the correct direction of flow at operating rotational speed of the pump's drive shaft. Pressure may be adjusted within a range of approximately 20 psi per spring. Additional springs are available for higher psi changes. Contact your BPOC repair or warranty agent for more information.

Adjusting the PRESSURE SETTING:

1. **To INCREASE the pressure setting**, remove the correct locking cap (see selecting the correct locking cap). Loosen the locking nut, and then rotate the setting screw clockwise. Record the difference between original and new settings. Tighten the locking nut, and replace the locking cap.

2. **To DECREASE the pressure setting**, remove the correct locking cap (see selecting the correct locking cap). Loosen the locking nut, and then rotate the setting screw counterclockwise. Record the difference between original and new settings. Tighten the locking nut, and replace the locking cap.

Selecting the CORRECT LOCKING CAP viewing the front plate of the pump:

To adjust flow pressure for CLOCKWISE shaft rotation:

a) The drive shaft below the idler shaft. Adjustments must be made to the **RIGHT side spring**.

b) The drive shaft above the idler shaft. Adjustments must be made to the **LEFT side spring**.

To adjust flow pressure for COUNTERCLOCKWISE shaft rotation:

a) The drive shaft below the idler shaft. Adjustments must be made to the **LEFT side spring**.

b) The drive shaft above the idler shaft. Adjustments must be made to the **RIGHT side spring**.

PREVENTATIVE MAINTENANCE



Failure to set vehicle emergency brake and chock wheels before performing service can cause severe personal injury or property damage.



Failure to disconnect and lockout electrical power or engine drive prior to performing service can cause personal injury or property damage.



Failure to relieve system pressure prior to performing service can cause personal injury and property damage



If pumping hazardous or toxic fluids, pump must be flushed before service.

NOTICE:

Any maintenance should follow the appropriate procedures and warnings presented in this manual.

NOTICE:

Strainers must be cleaned regularly to avoid pump starvation. Schedule is dependent upon the application and conditions.

NOTICE:

Some volume of bearing grease MAY access the main chamber and contact the pumping liquid. Any compatibility issues between grease and liquid should be investigated prior to use of pump.

NOTICE:

To avoid possible injury or entanglement with moving parts, do not lubricate pump bearings, couplings or any other parts while the pump is running.

NOTICE:

For operating conditions ABOVE NORMAL, Bowie recommends 2-4 ounces of grease applied approximately every eight (8) operating hours in the front drive neck of the pump. For all other grease fitting locations, we recommend 1-2 ounces of grease applied every two (2) operating hours. The actual amount of grease to be applied can be identified as the point when high resistance to further greasing has been achieved.

LUBRICATION

Bowie's Dura-Seal™ pumps are designed with a system of high-performance elastomeric seals, Viton® seals along with a combination of high-load capacity ball bearings. These pumps contain five (5) easily accessible grease fittings which allow grease to lubricate the bearings and leap seals. The pumps come fully lubricated with Metalon® Hi-Tech EP 1.5 grease and are ready for use. This grease's penetration rating bridges the NLGI #1 and #2 grades. Once your pump is in operation, it is absolutely critical that a regular lubrication program be followed to allow the pump to operate as designed and to prevent premature failure.

We recommend the following lubrication 'Best Practices':

- **Lubricant:** Select grease with the following properties: water resistance, rust and corrosion protection, extreme pressure protection and film strength and stability through temperatures ranging from -40°C/-40°F to 300°C/570°F.
- **Quantity and Time for Normal Operating Conditions:** Bowie recommends 2-4 ounces of grease applied approximately every sixteen (16) operating hours in the front drive neck of the pump. For all other grease fitting locations, we recommend 1-2 ounces of grease applied every sixteen (16) operating hours. The actual amount of grease to be applied can be identified as the point when high resistance to further greasing has been achieved. For operating conditions above those specified refer to the above notice.

Normal operating conditions for greasing practices are:

- Operating Temperature ≤ 90° C (Progressive Helical Steel Gears) or ≤ 50° C (Buna-N rubber Gears)
- Rotation Speed ≤ 500 RPM
- Discharge Pressure ≤ 70 PSI

PREVENTATIVE MAINTENANCE



Failure to set vehicle emergency brake and chock wheels before performing service can cause severe personal injury or property damage.



Failure to disconnect and lockout electrical power or engine drive prior to performing service can cause personal injury or property damage.



Failure to relieve system pressure prior to performing service can cause personal injury and property damage



If pumping hazardous or toxic fluids, pump must be flushed before service.

NOTICE:

Check and inspect all components thoroughly for damage/wear and replace as necessary.

STORAGE

Short Term Storage (6 months or less)

For storage less than 6 months the following steps are strongly advised:

1. Store pumps indoors. If this is not possible, then provide adequate protective covering. **DO NOT** allow moisture to collect around the pump.
2. Remove the drain plugs, if fitted. Remove any fitted inspection plates to ensure that the pump housing is dry.
3. See Manufacturer's Instructions for motor/gearbox/drive instructions for storage procedures.

Long Term Storage (6 months or more)

For storage longer than 6 months in addition to following the short term storage steps, the following procedures should be carried out every 2-3 weeks.

1. Rotate the pump several full revolutions to avoid the gears setting in the housing.
2. If corrosion is present, apply light oil to all rotating parts and repeat step 1.

CORRECTIVE MAINTENANCE



Failure to set vehicle emergency brake and chock wheels before performing service can cause severe personal injury or property damage.



Failure to disconnect and lockout electrical power or engine drive prior to performing service can cause personal injury or property damage.



Failure to relieve system pressure prior to performing service can cause personal injury and property damage



If pumping hazardous or toxic fluids, pump must be flushed before service.

NOTICE:

Follow all hazard warnings and instructions shown in the "Maintenance" section of this manual. Pump should be dissembled using a Bowie Dura-Seal™ Series Tool Kit, or at a registered Bowie Repair Depot, listed at www.bowiepumps.com.

NOTICE:

Check and inspect all components thoroughly for damage/wear and replace as necessary.

PUMP DISASSEMBLY

1. Remove the two drain plugs (3318) from the back plate (4722)
2. Remove three bronze threaded end plugs (3608) and snap rings (3632).
3. Unbolt and remove small bolt-on end caps (4734). Use bearing or regular puller.
4. Unlock the main drive bearing (4726).
5. Unbolt and remove the drive bolt-on end cap. (4727)
6. Remove Viton O-rings (3730) and any remaining sealant from the end caps.
7. Remove spacers (4713, 4713D) and seals (4725V) from both shafts.
8. Unbolt both the front plate (4721) and the back plate (4722).
9. Remove the end plates and any wear plates (3307HWP) and gaskets (3306).
10. Remove the pressure relief plate if equipped.
11. Remove idler gear with shaft (4701A) from housing.
12. Remove drive gear with shaft (4702A) from housing.
13. Remove bearings from the drive and small bolt-on end caps. Use the extraction tool to remove the bearings.
14. Remove bushings from the small bolt-on end caps.
15. Clean and examine dismantled components.

CORRECTIVE MAINTENANCE

NOTICE:

Follow all hazard warnings and instructions shown in the "Maintenance" section of this manual. Pump should be dissembled using a Bowie Signature™ Series Tool Kit, or at a registered Bowie Repair Depot, listed at www.bowiepumps.com.

NOTICE:

Check and inspect all components thoroughly for damage/wear and replace as necessary.



Failure to set vehicle emergency brake and chock wheels before performing service can cause severe personal injury or property damage.



Failure to disconnect and lockout electrical power or engine drive prior to performing service can cause personal injury or property damage.



Failure to relieve system pressure prior to performing service can cause personal injury and property damage



If pumping hazardous or toxic fluids, pump must be flushed before service.

PUMP ASSEMBLY

Center Casing/Housing

1. Locate gears with shafts inside of the center case.
2. Install one housing gasket (3306) on the front plate (inserted centering pins will ease the process). Install one hardened wear plate (3307HWP) on front plate. Install one housing gasket shim on hardened wear plate.
3. Mount front plate (3721/4721) with four bolts tightening in a cross pattern.
4. Install one housing gasket (3306) on back plate (inserted centering pins will ease the process). Install one hardened wear plate (3307HWP). Install housing gaskets on to hardened wear plate(5 for steel gears and 8 for rubber gears).
5. Mount back plate (3722/4722) with four bolts tightening in a cross pattern.
6. Turn drive shaft to ensure proper meshing of gears and acceptable clearances between the gears and plates. Adding or removing number of housing gaskets will adjust clearances.
7. Finish installing the remainder of the bolts for the back plate and tighten in a cross pattern.
8. Finish installing the remainder of the bolts for the front plate and tighten in a cross pattern.

Drive Shaft Front Plate

1. Carefully install the main drive bronze seal spacer (for 4"- 4713D, for 2", 3" - 3713).
2. Carefully install the Viton lip seals (for 4"- 4725V, for 2, 3" - 3325).
3. Carefully install the seal housing Viton O-ring (3647) and the drive seal housing (4716).
4. Install the inner drive bearing (4726).
5. Install the drive seals (SK4727).
6. Install the drive bolt-on end cap (4727KIT) using liquid gasket and tighten the bolts.

Idler Shaft Front and Back Plate, Drive Shaft Back Plate

1. Carefully install the bronze seal spacer (4713).
2. Carefully install the Viton lip seals (4725V).
3. Install the end cap Viton O-ring (SK4734).
4. Install the Viton lip seal (4725V) facing inward towards the pump center housing (●303).
5. Install the small bolt-on end caps with liquid gasket (4734KIT).
6. Tighten the small bolt-on end caps (4734).
7. Install the drain plugs in the back plate (3318).
8. Grease the pump using the grease fittings.

TROUBLESHOOTING

NOTICE:

Any maintenance should follow the appropriate procedures and warnings presented in this manual

Reduced Fluid Flow	Noise	Damaged Gears	Damaged Shaft	Probable Causes
■		■	■	Pump speed too low for viscosity.
■				Leaks pump and / or connecting components
■				Restriction or blockage in the suction line
■	■			Restriction or blockage in the discharge line.
■	■			Damaged or worn parts.
■	■		■	Pressure Relief Plate is set too low or attached incorrectly (if installed).
	■			Pump speed is too fast for viscosity or volatility of the liquid.
	■			Pump not securely mounted.
	■			Loose/undersized piping and fittings.
	■			Pump is too far from fluid source.
	■		■	Improper drive or hydraulic connection.
		■		Dry running the pump.
		■		Excessive heat in the pump.
		■	■	Excessive discharge pressure.
		■		Cavitation.
		■		Normal end of gear life.
		■		Abrasive wear from fluid in pump.
		■		Relief valve malfunctioning or blocked.
		■		Chemical attack, causing rubber gears to swell.
		■	■	Foreign objects entering the pump.
			■	Excessively worn pump center case or end plates.
			■	Settled or solidified material in the pump at start up.

Bowie Pumps of Canada Ltd. manuals and parts lists may be obtained from **www.bowiepumps.com.**

CONTACT INFORMATION

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