



HAYWARD GORDON ULC

Pumps·Mixers·Strainers
Engineered Systems and Controls

Operation and Maintenance Manual

Vertical Bearing ANSI Pumps

PROJECT:

EQUIPMENT:

MODEL:

QUANTITY:

SERIAL #:

LOCAL REPRESENTATIVE:

CONTRACTOR:

DATE:

FOR INFORMATION, VISIT: www.haywardgordon.com

FOR SERVICE AND INFORMATION, CONTACT:

TORONTO	MONTREAL	CALGARY	VANCOUVER
Head Office & Plant			(US West)
Tel: (905)-693-8595	(514)-697-6445	(403)-253-2737	(604)-986-8764
Fax: (905)-693-1452	(514)-697-1164	(403)-253-1353	(604)-986-8794

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THE HAYWARD GORDON GUARANTEE

HAYWARD GORDON ULC endeavours to supply equipment of the highest quality both in materials and workmanship. However, within one year from date of startup or eighteen (18) months from date of shipment (whichever comes first) if any part of the equipment manufactured by HAYWARD GORDON ULC is proven to have been defective in material or workmanship, HAYWARD GORDON ULC shall have the right and obligation to promptly repair or replace such part F.O.B its works. Pumps or parts to be considered for warranty repair or replacement must be returned freight prepaid to Hayward Gordon's factory at Halton Hills, ON. We reserve the right to require the return of defective parts before any claim is recognized.

Materials are certified to be of the specified composition, however, the materials are not guaranteed against chemical attack or wear.

No other warranty or condition, whether statutory or otherwise, is made, intended or to be implied and, except for its obligation to repair or replace defective parts as provided for above, HAYWARD GORDON ULC will not be responsible for any costs or damages, direct or indirect, which may result to the Purchaser from any defect in the equipment (whether of workmanship, material, design or otherwise) or from any breakage or stoppage thereof. Such costs specifically include, but are not limited to, equipment removal, re-installation, and freight. In any event, the liability of HAYWARD GORDON ULC arising through the supply of defective equipment shall not exceed the purchase price of the equipment.

For equipment included in this unit but manufactured by others, HAYWARD GORDON ULC will endeavor to assign to the purchaser, the guarantee extended by such manufacturers to HAYWARD GORDON ULC.

No modifications to this guarantee may be extended without the written authorization of a signing officer of HAYWARD GORDON ULC.

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**I. INSTALLATION****A. Inspection**

Examine equipment for broken, cracked, bent or missing parts. Carefully check:

1. Coverplate
2. Motor, pedestal and coupling
3. Column, flush line and discharge pipe
4. Pump Casing

Report all damage or loss to transportation company and Hayward Gordon ULC.

B. Storage

If the pump is not to be installed and operated shortly after arrival (more than two weeks), sufficient preparation for storage should be made.

1. Spray the pumps internally with a long term rust preventive-done at the factory.
2. Inspect pump on skid or open crate if applicable and check for any signs of damage due to shipment.
3. Protect exposed steel parts with a rust preventative-if required.
4. Cover all openings with wood.
5. Store pump in a dry location, protected from moisture, dirt, dust, pests and vibrations or rattles.
6. Cover pump with tarpaulin if area has no protective covering.
7. Rotate pump shaft at least 12 full revolutions every month to redistribute the grease in the bearings and prevent the balls in the bearings from developing flat spots from sitting in one position too long.
8. Add 2 Oz. of grease per bearing every 4 months and rotate the shaft.

C. Cleaning

Clean surfaces of discharge flange before installation. If pump was in storage, remove all grease and oil from top bearing. Flush bearing with kerosene or carbon tetrachloride and relubricate.

D. Location

Allow ample space for maintenance and inspection. Provide headroom and ventilation in a dry location. Do **not** locate near dangerous or harmful elements or temperatures.

E. Supporting Structure

Ensure the supporting structure is rigid enough to support the weight of the pump without sagging. The pump baseplate should be supported evenly to prevent misalignment and distortion.

**F. Mounting**

Using Hayward Gordon plans, check pump dimensions against foundation and piping dimensions to assure fit. The pump suction should not be located in the vicinity of any pipe that discharges fluids to the sump or in any other place where turbulence may cause air bubbles to enter the suction port.

CAUTION!

Never attach lifting devices to the motor, discharge pipe or eye bolts of the assembled unit. Use the appropriate equipment to safely lift the unit into place. Lower the complete assembly, using slings to evenly distribute the load.

G. Piping

Remove all foreign objects and debris from the piping. The independent support for the discharge piping should be near the pump to eliminate loads being transferred to the discharge pipe. Do not use the pump and coverplate to support piping and contents. Never draw piping into place by use of force at the flanged discharge connection.

The discharge piping should be as direct as possible with a minimum number of elbows and fittings. Provide expansion joints, bends, loops and hangers to prevent nozzle loading. Use a discharge pipe size which will reduce friction loss and the associated power wastage.



II. OPERATION

A. Pre-Starting

1. Prepare motor as outlined by the driver manufacturer and conform with wire and fuse sizes, types and recommendations.
2. Install all safety equipment including guards.
3. Rotate the pump by hand to check for binding or rubbing.
4. Check discharge piping, auxiliary cooling and flush line connections. Turn on external flush before starting pump.
5. Check Lubrication of driver and pump bearings.
6. All pumps are clockwise rotation if viewed from the motor towards the pump casing. The driver must rotate in agreement with the directional arrow on the pump. Jog the motor with the coupling removed to ensure wiring is properly connected.

B. Initial Starting

CAUTION!

Do not run pump dry as the rotating parts will seize without lubrication to the bearings.

1. Wait for any temperature differences between pump and liquid to stabilize if the unit has just been installed.
2. Check that the flush lines are providing fluid to the bearings.
3. Open discharge valve slightly to allow air to purge from the casing and discharge piping during starting.
4. Start the pump.
5. Open discharge valve slowly after the pump has fully primed and is at full speed to prevent water hammer. Adjust the valve to the specified operating point.

C. Necessary Checks

1. Pump should operate satisfactorily if Hayward Gordon ULC. Instructions have been followed.
2. Check the head and flow of the pump.
3. Check the amperage draw to the motor.
4. Check the temperature of the ball bearings.
5. Regular routine maintenance and inspection of the pump performance as well as the condition of the bearings and other parts is required. Record any performance deviations which could indicate wear or possible problems.



D. Stopping Pump

1. Stop the motor.
2. Close discharge valve.
3. Close external flush line.
4. Indefinite shutdown – flush and relubricate the pump and motor bearings. Provide a protective cover for the pump and motor. Drain casing and all piping if there is a possibility of liquid freezing.



III. TROUBLESHOOTING

Symptom	Probable Cause	Corrective Action
A. Vibration – Noise	1. Misalignment between pump and motor.	1. Re-align unit (see alignment section H)
	2. Loose foundation bolts	2. Tighten bolts, take care not to distort base
	3. Worn or insufficiently lubricated bearings.	3. Check lubricant level. Ensure pump rotates freely.
	4. Defective grout.	4. Remove grout and regROUT base (see grouting section I).
	5. Bent shaft.	5. Inspect shaft, replace if bent.
	6. Binding rotating equipment.	6. Ensure pump rotates freely.
	7. Gland too tight.	7. Loosen gland to allow 30 to 60 drips per minute of stuffing box leakage.
	8. Pumps too much liquid, head lower than rated.	8. Restrict discharge by partly closing valve.
	9. Cavitation on the suction side due to insufficient NPSH available.	9. Raise suction/liquid level or lower pump.
	10. Closed suction or discharge valve	10. Open suction or discharge valve.
B. Overheating Bearings (see Lubrication)	1. Misalignment between pump and driver.	1. Realign unit (see Alignment section)
	2. Bent shaft.	2. Inspect shaft, replace if bent.
	3. Binding rotating equipment.	3. Ensure pump rotates freely.
	4. Excessive lubricant.	4. See Bearing Lubrication section.
	5. Defective or contaminated bearings	5. Clean bearing and lubricate, replace if worn.



Symptom	Probable Cause	Corrective Action
C. Overheating Stuffing Box	1. Loss of sealing liquid to box.	1. Ensure liquid is reaching stuffing box
	2. Excessive gland pressure	2. Loosen gland to allow 30 to 60 drips per minute of stuffing box leakage.
	3. Inferior grade of packing	3. Check/change packing.
D. No Discharge Flow	1. Pump not primed.	1. Prime pump.
	2. Speed too low.	2. Check voltage and frequency.
	3. Required discharge head too high.	3. Reduce head or increase speed. Take care not to overload motor.
	4. Suction lift higher than pump rating.	4. Raise suction/liquid level or lower pump.
	5. Impeller or volute is blocked.	5. Ensure pump rotates freely.
	6. Suction port or filter is blocked.	6. Clear blockage/clean filter.
	7. Wrong rotation direction.	7. Reverse any 2 leads on 3-phase motor.



Symptom	Probable Cause	Corrective Action
E. Not Enough Discharge Flow	1. Excessive air leaks in suction pipe or stuffing box.	1. Tighten all flange bolts. Supply stuffing box with liquid.
	2. Speed too low.	2. Increase pump speed.
	3. Imposed discharge head too high.	3. Reduce head or increase speed. Take care not to overload motor.
	4. Suction lift too high.	4. Raise suction/liquid level or lower pump.
	5. Not enough suction head for hot or volatile liquids.	5. Raise suction/liquid level or lower pump.
	6. Mechanical defects.	6. Replace defective parts.
	7. Impeller damage.	7. Replace impeller.
	8. Foot valve too small.	8. Use larger foot valve.
	9. Not enough submergence of foot valve or suction opening.	9. Raise suction/liquid level. Lower foot valve or suction opening.
	10. Wrong rotation direction	10. Reverse any 2 leads on 3-phase motor.
	11. Insufficient NPSH available.	11. Raise suction/liquid level or lower pump.
	12. Impeller diameter too small/trimmed too much.	12. Check pump curve/change impeller.
	13. See also item "D" above.	13. See also item "D" above.
F. Speed Too Low	1. Check motor connections and if it is receiving full voltage.	1. Properly connect motor.
	2. Check Motor.	2. See motor manual.



Symptom	Probable Cause	Corrective Action
G. Loss of Prime	1. Leak in suction line.	1. Tighten suction line flange bolts.
	2. Loss of sealing liquid to stuffing box.	2. Ensure sealing liquid reaches stuffing box.
	3. Suction lift too high.	3. Raise suction level or lower pump.
	4. Too much air or gas in liquid.	4. Vent case.
	5. Defective casing gasket.	5. Replace gasket.
	6. Insufficient NPSH available.	6. Raise suction level or lower pump.



Symptom	Probable Cause	Corrective Action
H. High Power Consumption	1. Speed too high.	1. Lower pump speed.
	2. Pumps too much liquid, head lower than rating.	2. Restrict discharge by partly closing valve.
	3. Specific gravity or viscosity of liquid pumped too high.	3. Reduce pump speed. Reduce liquid specific gravity or viscosity.
	4. Bent shaft.	4. Inspect shaft, replace if bent.
	5. Binding rotating element.	5. Ensure pump rotates freely.
	6. Seal/packing gland too tight.	6. Loosen gland nuts.
	7. Coupling misalignment.	7. Recheck alignment.
	8. Impeller trim is not enough.	8. Trim and balance impeller.
	9. Speed too high.	9. Lower pump speed.
	10. Pumps too much liquid, head lower than rating.	10. Restrict discharge by partly closing valve.
	11. Specific gravity or viscosity of liquid pumped too high.	11. Reduce pump speed. Reduce liquid specific gravity or viscosity.
	12. Bent shaft.	12. Inspect shaft, replace if bent.
	13. Binding rotating element.	13. Ensure pump rotates freely.
	14. Seal/packing gland too tight.	14. Loosen gland nuts.
	15. Coupling misalignment.	15. Recheck alignment.



Symptom	Probable Cause	Corrective Action
I. Oil Seal Failure	1. Clogged air vent.	1. Clear air vent.
	2. Overfilling of powerframe.	2. Check oil level and adjust.
	3. 'Trico' adjustment sleeve high.	3. Readjust sleeve.
	4. Lip seal material too hard.	4. Change lip seals.
	5. Incorrect clearance between shaft and oil seal.	5. Recheck clearance.
	6. Burr on shaft.	6. Smooth shaft.
	7. Oil seal running dry on shaft.	7. Lubricate oil seals.
	8. Oil slinger in wrong position.	8. Recheck position.
	9. Improper grade of oil.	9. Change oil.
	10. Excessive shaft vibrations.	10. See item "A" above.
J. Too Much Stuffing Box Leakage: Packed Pump	1. Packing not properly installed.	1. Install packing per manual.
	2. Packing not suitable for pressure and temperature.	2. Change packing to a suitable grade.
	3. Packing subject to attack by liquid pumped.	3. Change packing to a suitable grade.
	4. Inner rings not seated properly, outer rings carrying entire load.	4. Change packing.
	5. Dirt or dust in stuffing box causing rapid scoring of shaft sleeve.	5. Change packing. Check sleeve. Ensure flush is on.
	6. Not enough gland pressure leakage.	6. Tighten gland nuts.
	7. Not enough packing in box.	7. Add additional ring of packing.
	8. Grooved shaft sleeve needs replacing.	8. Replace shaft sleeve.



Symptom	Probable Cause	Corrective Action
K. Mechanical Seal Failure: Sealed Pump	1. Scored or worn seal faces.	1. Replace seal.
	2. Gland bolted up unevenly.	2. Check straightness.
	3. Stationary insert face not perpendicular to shaft axis.	3. Check and re-align.
	4. Wobbling rotating seal ring.	4. Check set screws and align.
	5. Cracked or broken stationary insert.	5. Replace insert.
	6. Shaft run out through stuffing box.	6. Check shaft and replace if necessary.
	7. Foreign matter between seal faces.	7. Ensure flush is operating properly. Replace seal if necessary.
	8. Loose or released set screws.	8. Retighten set screws.
	9. Spring compression lost.	9. Check seal setting & spring.
	10. Mechanical seal improperly applied or installed.	10. Recheck installation with seal O&M.
	11. Improper materials of construction for the environment and/or temperature.	11. Contact Hayward Gordon or seal manufacturer to confirm proper seal to use.
	12. Differential or system pressure too high for seal.	12. See 12 above.

**IV. MAINTENANCE****A. Field Testing and Inspection**

1. Check the differential head by measuring the suction lift and the discharge pressure. Add the calculated discharge pipe losses to the differential head to achieve the Total Dynamic Head.
2. Check general operation of the pump with respect to noise and vibration.
3. Check speed and amperage draw of the motor.
4. If necessary, shut the discharge valve completely with the pump running and measure the shut-off pressure.
5. Check pump for unstable operation or excessive loading.

B. Grease Lube – Top Bearings

Bearings may appear to run hot when first started because the oil seals have not fully seated. The temperature should drop to normal after the lip seals ‘run-in’.

Use a Lithium base NLG1 Grade 2 grease to replenish the bearings with one ounce of grease every 2400 hours of continuous operation. Avoid over greasing the bearings.

Use a contact type thermometer mounted on the powerframe or bearing housing to measure the bearing temperature. Do not “test” temperatures by hand as 120°F and higher may feel hot to touch but bearing temperatures up to 140°F are normal, depending on ambient conditions. Grease lubricated bearings may be safely operated up to at least 140°F. A sudden increase in temperature indicates the possibility of damage that requires checking.

C. Driver Lubrication

See manufacturer’s special instructions for driver bearing lubrication.

**V. SERVICE & REPAIR****A. Disassembly of Pump**

Refer to General Assembly drawings during dismantling.

1. Unhook wires, discharge and flush lines.
2. If necessary, flush the pump to remove any hazardous pumpage.
3. Unbolt coverplate.
4. Lift pump unit out of the pit and lay it horizontally on floor, resting is on the casing and the coverplate edge.

WARNING

Never attach lifting devices to the motor, discharge pipe or eye bolts of the assembled unit.

5. Remove motor after taking out screws (B727).
6. Remove coupling.
7. Unbolt discharge pipe (423) from discharge port of pump casing (201).
8. Disconnect flush line (605) at all points on column.
9. Open the wet-end by unbolting volute casing (201).
10. Remove impeller bolt (F727) and pull impeller (202) off the shaft.
11. Remove all flush line nipples (A772) from the bearings.
12. Remove bottom bearing housing (C411) from bottom column.
13. Remove bottom column bolts (H727) and bottom column.
14. Remove intermediate bearing (A418) and housing (B411).
15. Continue in this manner and remove all columns and bearing housings.
16. Remove screws in top bearing housing (B730) and pull out shaft (A/B401) and top bearing housing assembly.
17. Grip shaft in vice lined with soft material. Remove set screws (B732), extension shaft (B401) and shaft coupling (403). Undo screws (A730) and remove bearing cap (410).
18. Push bearing housing (A411) back to expose bearing, locknut and lockwasher.
19. Wipe off grease, straighten locking clip on bearing lockwasher (521), and remove locknut (520) and bearing (501) from shaft.
20. Remove bearing housing (A411) from shaft.
21. Remove lip seals (A/B503) from bearing housing and cap.

**B. Parts Inspection**

1. Inspect ball bearings for damage and replace if necessary. If dirty, clean with kerosene or carbon tetrachloride and dry. Pack ball bearings with grease and protect until ready to use.
2. Replace impeller if there is sufficient wear from corrosion or abrasion to inhibit performance.
3. Replace pump volute if there is sufficient scoring or other wear which could inhibit performance.
4. Replace oil seals if worn or damaged. They are held by a press fit in the bearing cap and housing.
5. Check for bent shaft or damage to bearing and oil seal seats and replace if necessary. Seats must be in perfect condition for smooth operation.
6. Check sleeve surface for grooves or scoring and replace if necessary. Shaft sleeve is slip fitted to the shaft for easy removal.

C. Reassembly of Pump

Pump should be assembled from top to bottom.

1. Install inboard lip seal (B503) into bearing housing (A411) and outboard lip seal (A503) into bearing cap (410).
2. Grip shaft (401) in a vice lined with soft material. Install shaft coupling (403) and extension shaft (B401).

Note: Shaft sleeve coupling (403) must be secured to shaft with set screws (B732). Make sure to dimple shaft before set screws are installed.

3. Slide bearing housing (410) on the shaft taking care not to damage the lip seal when pushing it over the shoulder. Slide it back far enough on the shaft to have the bearing seat completely exposed.
4. Place any shims which were there at disassembly.
5. Install bearings (501) on shaft by tapping lightly on inner ring until it makes contact with shaft shoulder.
6. Lock bearing in position with lockwasher (521) and nut (520).
7. Slide bearing housing backwards over the outer bearing race.
8. Install bearing cap (410) taking care not to damage lip seal when sliding it over the shoulder. Use screws (A730) to fasten bearing cap to housing (A411).
9. Fasten the motor pedestal (421) to the coverplate (427) with bolts (C727).
10. Lay the coverplate on its side and attach the column (422) to the underside of the pedestal (421).
11. Slide the shaft into the column through the motor pedestal. Support the shaft bottom end when sliding the bearing housing into its seat. Make sure the jacking screws (732) are backed off to allow the bearing housing flange to directly contact the pedestal. Fasten the bearing housing to the pedestal with screws (B370).
12. Install the next column, clamping the intermediate bearing housing (not present on single column pumps) between the column flanges. Ensure the lubrication hole on the intermediate bearing housing lines up with the hole in the column. For best results, screw the flush line nipple into the bearing housing before tightening column bolts. All columns should have the flush holes lined up.
13. Install the bottom bearing housing (C411) onto the bottom column.
14. Install wear plate (212).



15. Install impeller (202) with the key (408) using the required bolt and washer(s) (A413, F727 & N746).
16. Close the wet-end by installing the volute (201) using the required bolts (A781).
17. Using jacking screws (A732) jack up top bearing housing (A411) till impeller back starts touching wear plate. Now move bearing housing forward by 1/16", thus setting impeller clearance between wear plate and impeller to 1/16". Make sure the bearing cap (410) is securely locked to prevent the bearing from sliding in the housing.
18. Check the flush lines (605, A772) for blockages and install.
19. Install the discharge pipe (423) making sure it is firmly secured to the coverplate. If the discharge pipe is provided separately, weld the coverplate flange to the discharge pipe at assembly to ensure an exact fit. No stress should be exerted on the pump when the discharge pipe is bolted to the coverplate.

WARNING

The pump should never be operated without a discharge pipe, with the discharge pipe unbolted at the coverplate or with flexible hose in place of the discharge pipe.

20. Attach coupling halves, but do not couple together.
21. Install the motor and fasten with screws (B727).
22. Lower the pump into the pit and fasten coverplate to the structural support.
23. Hook up discharge piping and flush lines. Open valve on flush line and hook up electrical connections making sure the motor rotation will be clockwise.
24. Engage the coupling.

D. Parts Inventory Guide

Refer to the General Assembly drawing and parts list.

Item	Qty	Description
201	1	Volute
202	1	Impeller
A418	1*	Intermediate Bearing
B418	1	Bottom Bearing
501	1	Top Bearing
A503	1	Outboard Lip Seal
B503	1	Inboard Lip Seal
520	1	Bearing Washer
521	1	Bearing Nut

* Quantity will vary with # of columns



E. Parts Ordering

Please provide the following information with all parts orders:

1. The serial number of the pump (on nameplate).
2. The part name and number (on general assembly drawing).
3. The quantity of parts needed.
4. The material of construction of the part.

Hayward Gordon may ship an interchangeable part that is not identical in appearance or symbol. This is done only if the part has been approved. Examine parts carefully upon receipt. If a motor or motor parts are ordered, specify name of drive manufacturer and all other data on the drive nameplate.



VI. GENERAL ASSEMBLY AND PARTS LIST