

Variable Speed Drives 6B & 8C-Hydroconstant® Type M, MP, MO, MX

Repair Instructions



Peerless Pump Company

2005 Dr. Martin Luther King Jr. St. (46202)

P.O. Box 7026

Indianapolis, IN 46207-7026

Phone (317) 925-9661

FAX (317) 924-7388

www.peerlesspump.com

Read this entire bulletin

before attempting to repair this drive. For installation and operation refer to instruction bulletin 2880549. Properly installed, your Peerless Pump variable speed drive will give you satisfactory, dependable service. We urge that you read carefully these step-by-step instructions, to simplify any problems of installation, operation or repair.

Failure to read and comply with installation and operating instructions will void the responsibility

of the manufacturer and may also result in bodily injury as well as property damage.

This bulletin is intended to be a permanent part of your drive installation and should be preserved in a convenient location for ready reference. If these instructions should become soiled obtain a new copy from Peerless Pump. Include drive size, and/or serial number with your request.

WARRANTY

New equipment manufactured by Seller is warranted to be free from defects in material and workmanship under normal use and service for a period of one year from date of shipment; Seller's obligation under this warranty being limited to repairing or replacing at its option any part found to its satisfaction to be so defective provided that such part is, upon request, returned to Seller's factory from which it was shipped, transportation prepaid. This warranty does not cover parts damaged by decomposition from chemical action or wear caused by abrasive materials, nor does it cover damage resulting from misuse, accident, neglect, or from improper operation, maintenance, installation, modification or adjustment. This warranty does not cover parts repaired outside Seller's factory without prior written approval. Seller makes no warranty as to starting equipment, electrical apparatus or other material not of its manufacture, since the same are usually covered by warranties of the respective manufacturers thereof.

In the event, notwithstanding the terms of this agreement, it is determined by a court of competent jurisdiction that an express warranty has been given by Seller to Purchaser with respect to the head, capacity or other like performance characteristics of said equipment, Seller's liability for breach of the same shall be limited to accepting return of such equipment F.O.B. plant of manufacture, refunding any amount paid thereon by Purchaser (less depreciation at the rate of 15% per year if Purchaser has used equipment for more than thirty (30) days) and canceling any balance still owing on the equipment.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, AND SELLER SPECIFICALLY DISCLAIMS ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.



Peerless Pump Company

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WARNING

The drives described in this bulletin must not be installed in any manner except as specified herein, and must not be operated at speeds, horsepower loads, or temperatures other than those specified when the drive was assembled by the factory. Failure to limit operation of the drives to the conditions specified could damage the drives and may cause malfunction or damage of interconnected equipment.

Violation of this warning will void the warranty and may result in serious property damage or grave personal injury.

ALLOWABLE HORSEPOWER LOADS

Hydraulic Coupling Size	Input Speed RPM Nominal	Output shaft Maximum	
		Horsepower	kW
8C	1800	7.3	5.4
6B	3600	5.0	3.7
8C	3600	24.0	17.9
8C	2900	13.8	10.3

OIL TEMPERATURE AND OIL LEVEL

Temperature above 155°F (68°C) will result in a Hydraulic reduction of the full output speed by several hundred RPM's along with a decrease in the operating life of Coupling internal oil hoses and bearings. Temperatures below 130° F (54° C) will increase the circulation HP losses. The oil sump should contain a maximum of 4 quarts (4 liters). The oil level should be visible in the sight gauge but not above it when the unit is at rest. Additional oil will significantly increase circulation HP losses (as much as 1.0 HP) which results in additional heat that must be carried away with additional cooling water.

INTRODUCTION

UPON RECEIPT OF HYDROCONSTANT DRIVE:

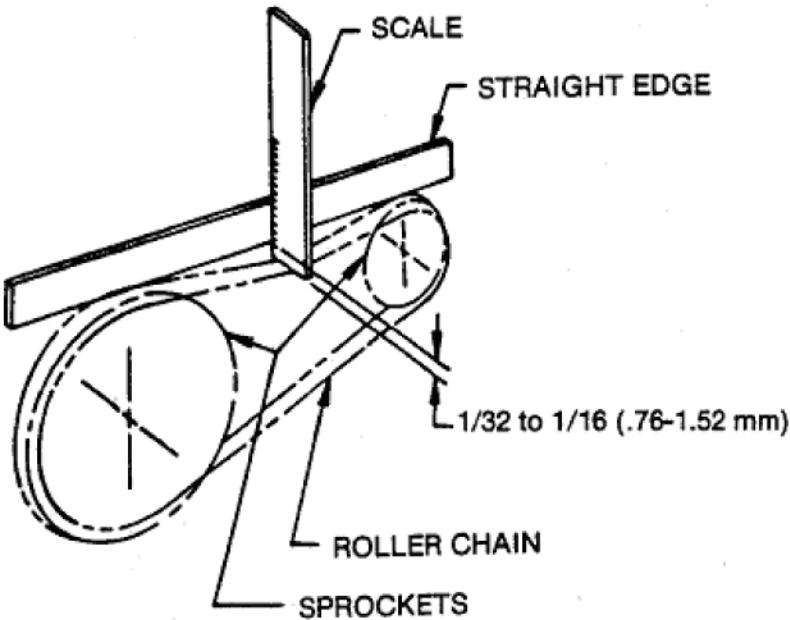
Check carefully to see that all of the equipment has been received. Report immediately any shortages or damages to the transportation company handling the shipment, noting the extent of the damage or shortage on the freight bill and bill of lading.

Do not leave the unit exposed to weather or construction hazards. The drive may become mechanically damaged. This drive is a well designed and carefully manufactured unit. It should be given the same attention accorded to any precision machine. The satisfactory operation of a pump and drive depends to a large extent upon proper installation. These instructions cannot answer every question that may arise as each installation will be different. The installer and the operator of this equipment must use good judgment to adapt these procedures to the installation.

DESCRIPTION: The 6B/8C Hydroconstant (see figure 1) drive consists of a fluid coupling designed to allow continuous, smooth variance of output shaft speed in direct response to a fluid pressure signal as may be generated by a centrifugal pump connected to the output shaft. The coupling input shaft rotates at the relatively constant speed of an electric motor.

The basic operating sequence is as follows:

Fluid pressure acts through the control mechanism to regulate the drive's output speed. The control mechanism varies the amount of oil, supplied by a gear pump, admitted to the coupling. As the oil continuously flows from the coupling through a fixed orifice, admission of more oil increases output shaft speed, less oil reduces output shaft speed. Stabilizing the pressure signal to the control mechanism will fix the output shaft speed at a pre-selected ratio (always less than one) of the input speed.



USE VERY LIGHT ("ONE POUND") (.5 Kg) FORCE TO DEPRESS CHAIN AT THE MID SPAN WHILE MEASURING DEFLECTION RE-POSITION THE OIL PUMP IF DEFLECTION IS NOT SHOWN.

Figure 6. Chain Tension Adjustment

- (a-continued) and chain tension (see Figure 6) and tighten screws on pump bracket. Recheck chain tension and alignment. If alignment and tension are not correct, life of chain and sprockets will be reduced. Torque set screws on oil pump sprocket and drive sprocket to 7lb-ft (9.5 N-M).
- Oil hose female swivel (110) fitting should be tightened on oil pump fitting.
 - Replace input coupling half (33) and key (36) and tighten with coupling washer (31) and screw (30).
 - Press shaft (27) and bearing assembly into pump flange (37).
 - Replace bearing cap (21)-matching assembly marks as noted in item 2 of Output Bearing Removal Section-and fasten uniformly with 3 cap screws and lock washers. Torque to 7 ft-lb (9.5 N-M)
 - Replace oil seal by following instructions in section of bulletin pertaining to Oil Seal Replacement.
 - Nest output coupling half (34) in coupling cover (35) and push onto output shaft (27) along with key (38). Fasten coupling half with coupling washer (31) and screw (30). Torque to 23 ft-lb. (31 N-M)
Replace coupling gasket (32) on input coupling half-a light coat of grease will retain it in place.
 - Tighten oil hose female swivel (11) fitting to injection nozzle fitting on bearing cap (21).
 - Replace output pump flange assembly and fasten to housing with 8 nuts and lock washers. Torque to 23 ft-lb. (31 N-M).
 - Align coupling cover (35), coupling gasket (32) and input coupling half (33) and attach with cap screws and nuts. Torque to 2.6 ft-lb. (3.5 N-M).
 - Fasten hoses to internal connections of units furnished with external heat exchangers.
 - Fill housing to proper level with recommended oil or equivalent. See "Oil Change", page 7.
 - Replace cover plate (18) assembly and fasten uniformly with 12 nuts and lock washers. Torque to 13lb-ft. (18 N-M).
 - For MP unit, reassemble pump parts as directed in pump bulletin 4846187.
 - Reinstall unit as directed in "Installation" at beginning of this bulletin.
- NOTICE:** Materials of construction, specifications, dimensions, design features, and application information, where shown in this bulletin, are subject to change and/or modification without notice by Peerless Pump at their option.

4. If necessary, use a rod of proper diameter to clean bleed hole of coupling cover. DO NOT increase diameter when cleaning. See size list, page 7.

INSPECTION: Visually inspect parts for damage affecting serviceability or sealing. Emphasize inspection of parts having relative motion-seal contact area on shaft OD must be smooth and free from any defect.

1. Replace damaged parts unless minor repair (removal of burrs, or scratches in non-critical surfaces) will restore to serviceability.
2. Replace bearings that bind, stick, are rough or noisy, or have flat spots.
3. Normally when the variable speed unit has been completely disassembled, all gaskets and seals should be replaced at reassembly.

ORDERING REPAIR PARTS: When ordering spares or asking for information on a particular drive, always specify the serial number, which is stamped on the drive nameplate. When ordering parts, give the item number, and name of the particular part desired (see Figure 5). This procedure will insure prompt and accurate service.

REASSEMBLY:

1. Press all bearings back on their respective shafts.
2. Apply force only on inner races. Make sure bearings rest against shaft shoulders.
3. Replace bearing retaining rings.
4. Re-torque the studs in the input and output flanges on the main housing to 20 ft lb (27 N-M) to prevent oil leaks and re-torque the studs on the top flange to 11 ft-lb (15 N-M) ..
5. Replace new clean gaskets on all external registers on the main housing. Do not coat gaskets with grease or any other compounds.
6. For MO and MX units:
 - a. Press shaft and bearing assembly into MO flange (45) bore.
 - b. Replace bearing cap (22) and fasten uniformly with 4 cap screws and lock washers. Tighten to 7 ft-lb (9.5 N-M) of torque.
 - c. Replace oil seal (39) by following instructions in section of bulletin pertaining to Oil Seal Replacement on page 12.
 - d. Replace MO flange assembly and fasten to housing with a nuts and lock washers.
 - e. Slide drive sprocket (42) onto input shaft but do not tighten set screw yet.

6. For M and MP units:

- a. Fasten motor flange (60) to motor with 4 cap screws and seal washers.

NOTE: Damaged seal washers must be replaced with new seal washers to prevent oil leaks.

- b. Install floating seat of mechanical seal (41) with lapped surface facing away from the flange seat.

CAUTION: Use care not to mar or scratch the lapped surfaces of floating seat or seal washer when installing mechanical seal. Damage to these surfaces will result in leakage and will require replacement of the entire seal.

- c. Lightly lubricate the motor shaft with any of the following materials: 3% detergent solution, glycerin, ethylene glycol or "p-80" rubber lubricant.

CAUTION: Make sure the keyway is free of sharp edges that might cut the seal ring during assembly.

- d. Carefully install spring bellows assembly (41) into shaft with lapped sealing washer towards the lapped seal seat.

NOTE: The seal spring will be compressed to its correct working length when the sprocket and spacer are slid into place on the motor shaft and the input coupling hub is tightened against the motor shaft shoulder.

- e. Slide the drive sprocket (42) on the motor shaft but do not tighten set screw. See Figure 5a for correct orientation of sprocket.
- f. Slide spacer (40) onto motor shaft. Do not push spacer past the motor shaft shoulder.
- g. Push input coupling half (33) on the shaft without key, and tighten against motor shaft shoulder with coupling washer (31) and coupling screw (30).
- h. Tighten set screw in the drive sprocket, then remove the coupling screw (30), coupling washer (31) and input coupling half (33).

7. FOR ALL UNITS:

- a. Place oil pump sprocket (43) on oil pump (17) shaft (see Figure 5c for correct orientation of sprocket)-Loop chain around oil pump sprocket-position oil pump in main housing by looping chain over the motor shaft and onto the drive sprocket. Rest the oil pump bracket (44) on top of the two bosses in the bottom of the main housing. Replace the two large flat washers and cap screws in bracket slots-shift oil pump and oil pump sprocket to prove proper alignment.

Fluid Coupling Sizes 6B & 8C Hydroconstant® Variable Speed Fluid Drives

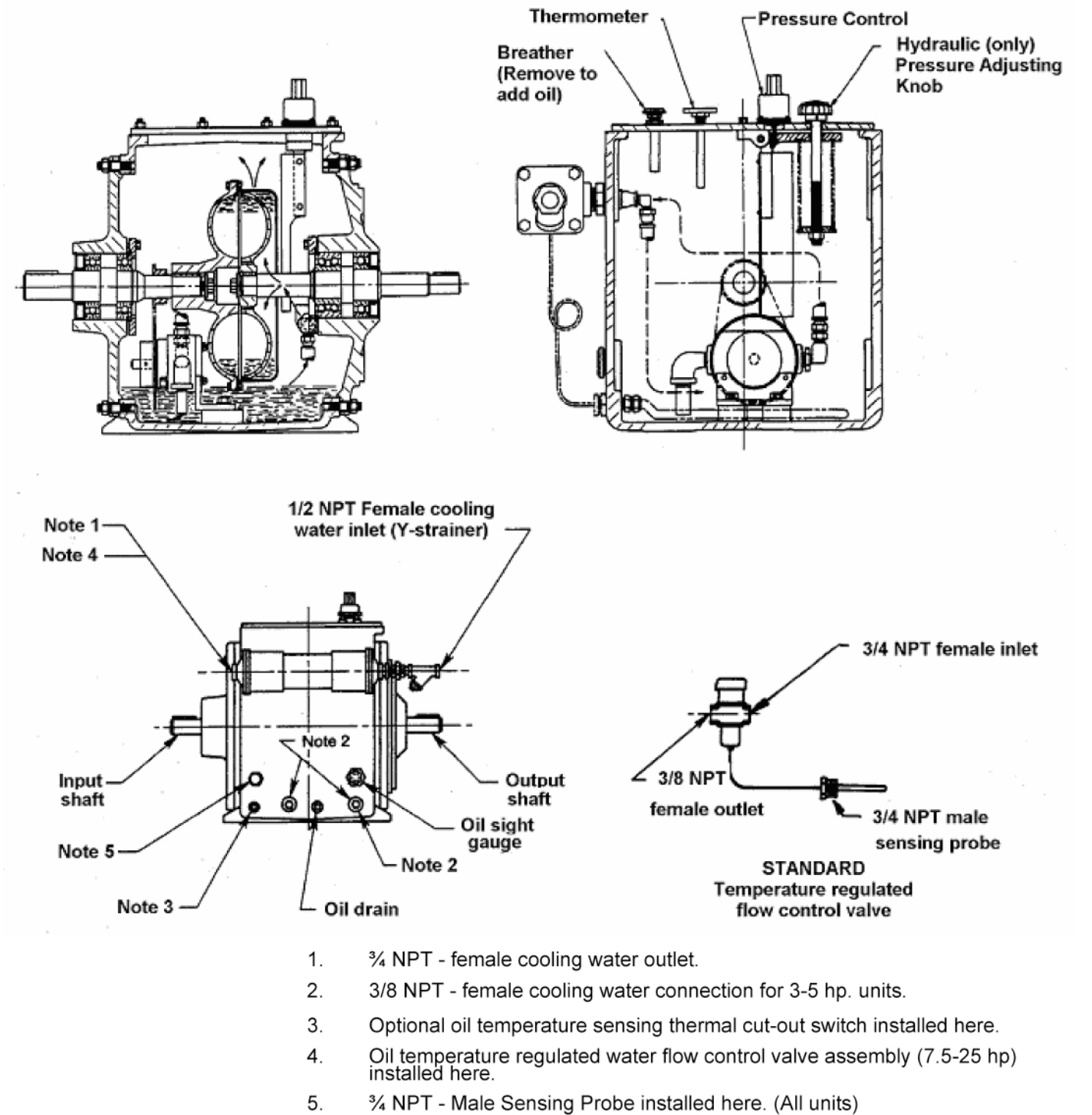


Figure 1

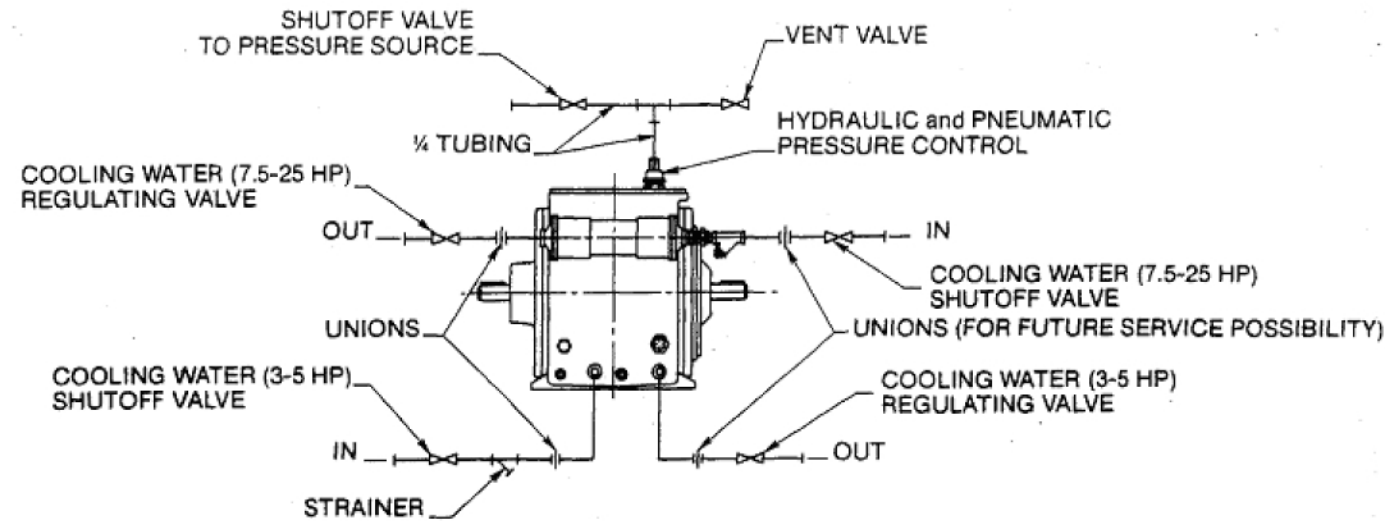


Figure 2. Recommended Piping

See text for size selection.

INSTALLATION

Refer to instruction bulletin 2880549 for installation of this drive. This bulletin will cover the following:

- Foundation
- Mounting
- Alignment (piping, and flexible coupling if used.)
- Grouting
- Piping

If a close coupled type MP unit without base is used, a firm level location with suitable anchor bolts for the feet under the drive is required.

LOCATION: The Hydroconstant unit should be installed in a clean, well drained and ventilated area, and be accessible for inspection and proper care. Ample room should be provided for installation and removal. Be sure the space is vented to outside atmosphere to avoid a rise of ambient temperature and collection of any oil vapor.

Exposure to freezing temperatures and extremely dusty conditions should be avoided. Water freeze-up can damage or burst heat exchanger tubes and pressure sensing lines. Dust contamination of Hydroconstant oil can impair running operation. Consult with the factory on methods of protection if exposure to adverse environmental conditions is unavoidable.

NOTE: Only the items listed in the customer order are furnished by Peerless Pump Company.

HEAT EXCHANGER CONNECTIONS: (see Figure 2)

Heat exchangers, or "oil coolers", are essential to the operation of all drive models.

Units driven by 3 HP (2.2 kW) and 5 HP (4 kW) motors will have an internal cooling coil with two 3/8-18 NPSF external female connections available for supply of clean cooling water.

Units driven by 7 1/2 HP (5.5 kW) to 25 HP (18.5 kW) motors will be furnished with an external heat exchanger.

A V-strainer is provided at the inlet connection of all externally mounted coolers to help keep particulate debris from entering and clogging water tubes. It is important that the strainer be cleaned regularly so that cooling water flow is not detrimentally reduced.

A strainer with a 20 mesh screen should be installed in the inlet line between the shutoff valve and the Hydroconstant on 3 HP (2.2 kW) and 5 HP (4 kW) units.

The manually set, thermally activated flow control valve is standard for all units. It is factory assembled on units with external heat exchangers, but must be installed by contractor at job site on units with internal cooling coil

OUTPUT BEARING REPLACEMENT

1. Remove coupling screw (30, Figure 5) and washer, pull coupling cover (35), output coupling shaft (34) and coupling key (38) off of output shaft (27).
2. Place a reassembly mark at top of bearing cap (21) and adjoining face on pump flange (37) to assist in re-orientation of injection nozzle.
3. Then remove 3 cap screws and lock washers and withdraw bearing cap (21) from pump flange (37).
4. Press bearings (23 and 25) and shaft (27) from pump flange (37) toward end opposite oil seal. Remove retaining ring (24). Support bearings on inner races and press out shaft.
5. Use a brass or wood rod to tap the oil seal (51) out of pump flange.

INPUT BEARING AND MECHANICAL SHAFT SEAL REPLACEMENT

6. Remove coupling screw and washer (32, Figure 5) from input shaft (53) (MO and MX units) or motor shaft (M and MP units).
7. Pull input coupling half (33) and key (36) off of shaft.
8. Remove 2 cap screws and large flat washers from bottom of oil pump bracket (44). Remove oil pump (17) and roller chain (16).
9. For type M and MP, remove spacer (40) from motor shaft.
10. Remove nuts and lock washers from outside circumference of the MO flange (45) or motor flange (60), then remove complete flange assembly from the main housing.
11. Loosen set screw in drive sprocket (42) and remove from input shaft.
12. For M and MP units - Mechanical Seal Replacement
 - a. Remove the mechanical shaft seal (41, Figure 5).
 - b. Remove 4 cap screws and seal washers joining the motor (62) and motor flange (60) and remove motor flange.
 - c. Push mechanical seal seat out of motor flange bore.
8. For MO and MX units - Input shaft and Bearing Replacement
 - a. Remove 4 cap screws and lock washers and remove bearing cap (22).
 - b. Press bearings (23 and 25) and input shaft (53) from MO flange (45) toward end opposite oil

seal.

- c. Remove retaining ring (24). Support bearings on
- d. inner races and press out shaft.
- e. Use a brass or wood rod to tap the oil seal (39) out of the MO flange (45)

WARNING

Petroleum-base cleaning solvents, are flammable. Smoking or open flames in the vicinity of these solvents is extremely hazardous and must not be permitted. Disregard of this warning could result in grave personal injury.

CLEANING: Clean all metal parts (except bearings) with a solvent. Use a bristle brush (NOT a metal or wire) to remove tightly adhering deposits. A fiber scraper may be used to remove gaskets from flanges.

1. Blow dry with clean, dry compressed air.
2. Clean ball bearings that have been removed in the following manner:
 - a. Place bearings in a wire basket so there is space for the solvent to reach all parts.
 - b. Immerse in clean Stoddard solvent. Agitate basket until sludge is thoroughly loosened and can be flushed out.
 - c. Place bearing on a screened surface.

WARNING

Never spin bearings. Spinning a dry bearing can cause damage. Spinning any bearing by an air blast can cause bearing to fly apart resulting in possible fatal injury.

- a. Using a spray gun with air filter and clean Stoddard solvent, flush each bearing until oil and sludge are removed.
 - b. Blow solvent out of bearings with dry filtered air.
 - c. Lubricate bearings immediately after cleaning with light spindle oil and place in a covered container.
2. Bearings not removed from shaft maybe cleaned in the following manner:
 - a. Flush with clean Stoddard solvent until all old oil and sludge are removed. Rotate bearings slowly (by hand) while flushing. Do not use kerosene or fuel oil for flushing.
 - b. Re-lubricate bearings immediately after cleaning with light spindle oil, and cover to protect from dirt.

- 3. Slide shaft coupling half from Hydroconstant shaft
- 4. Refer to section on all SEAL REPLACEMENT.
- 5. Replace shaft coupling half on Hydroconstant shaft, and mount motor on base.
- 6. Realign shaft couplings and tighten motor mounting bolts. Reposition shaft coupling halves and tighten set screws. Rotate shaft by hand to check for free running-no binding, scraping or sticking.

M, MO, MX and MP Output:

- 1. For MO and MX units, loosen shaft coupling halves between motor and Hydroconstant drive input shaft.
- 2. For MX units, unscrew bolts from motor feet and remove motor from base.
- 3. For M and MO units, loosen shaft coupling halves between Hydroconstant drive output shaft and pump shaft.
- 4. For MP and MX units, disconnect suction and discharge piping from pump.
- 5. For all units, unscrew bolts from Hydroconstant feet and remove drive from base.
- 6. For M and MO units, slide shaft coupling half from Hydroconstant output shaft.
- 7. For MP and MX units, follow instructions for PUMP DISASSEMBLY in bulletin 4846187. Mechanical seal can be replaced in pump if required.
- 8. For all units, refer to section on Oil SEAL REPLACEMENT.

OIL SEAL REPLACEMENT:

- 1. Carefully tap sharp chisel to catch in the outside diameter (OD) of the oil seal (18) and pry against the housing to force oil seal out of bore. Work in this manner in at least four places around the oil seal. When oil seal is free of the housing, remove by sliding along the output shaft (23) toward pump. Be careful not to nick or mar the shaft.
- 2. The oil seal contact area on the OD of shaft must be smooth and free of any defect.

lubricate entire length of shaft and inside of new oil seal. (Never install a used or defective seal.) Install the new oil seal over end of shaft with oil seal lip toward housing, using care not to damage lip of oil seal.
- 3. Slide oil seal along shaft to housing, checking that the oil seal lip does not buckle or curl under. Start oil seal squarely into the housing bore. Seat completely by lightly tapping outer face of the oil seal with a plastic-faced hammer. If desired, a brass tube may be used to

tap all around evenly to avoid cocking seal.

- 4. Rotate shaft by hand to check that no binding or scraping occurs. If noted, remove seal and install another new seal. Never install a used or defective oil seal.
- 5. Install driven unit, and motor if removed taking precautions to insure proper alignment of couplings.

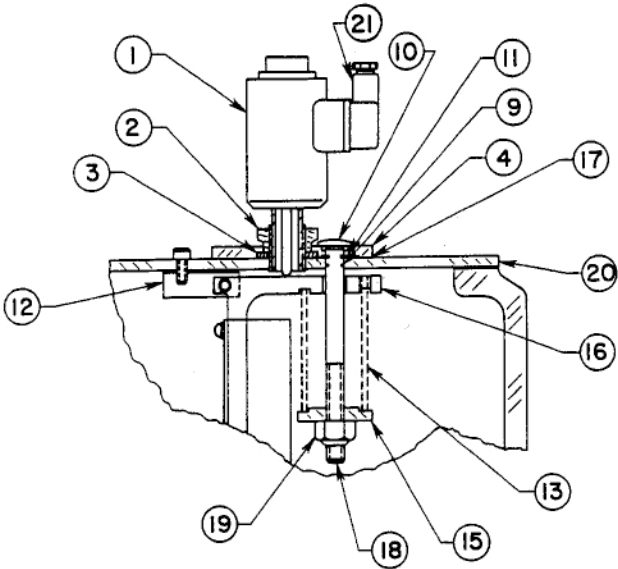
M and MP (Input)

- 1. Complete disassembly of the Hydroconstant housing is necessary to remove mechanical shaft seal from input motor shaft on M and MP units.
- 2. See next section on SHAFT BEARING REPLACEMENT for disassembly instructions.

DISASSEMBLY FOR SHAFT BEARING REPLACEMENT

- 1. **FOR ALL UNITS:** Complete PRELIMINARY PREPARATIONS (as noted on page 9).
- 2. **FOR M, MO, MX** units: Disconnect shaft couplings.
- 3. **FOR MP and MX** units: Disconnect suction and discharge lines from pump.
- 4. **FOR ALL UNITS:** After completion of step 1-3, remove bolts from fluid drive housing feet and remove housing to a convenient work area. (A wood block under motor feet may be required to keep unit from tipping during disassembly.)
- 5. **FOR MP and MX** units: Disassemble pump parts as directed in pump instruction bulletin 4846187 only if seals or bearings are to be replaced in pump (output) flange (37, Figure 5).
- 6. Remove square head drain plug and drain oil from housing.
- 7. For all units, remove 12 nuts from cover plate (18, Figure 5) and lift cover plate straight up until splitter (15) clears the top of main housing (29).
- 8. Disconnect oil lines near the top of the housing on units furnished with an external heat exchanger.
- 9. Remove the coupling cover screws (32) and nuts from the circumference of the fluid coupling (33).
- 10. Remove the 8 nuts holding the pump flange (37) to the main housing and withdraw entire rotating element

CAUTION: Disconnect oil line from bottom of bearing cap (21) on units furnished with internal cooling coil upon partial removal of pump flange (37).



1	Proportional Solenoid
2	Locking Nut
3	Thread Seal
4	Clamping Plate
9	D-Ring
10	Button Plug
11	Retaining Ring
12	Pivot Block
13	Spring
15	Adjusting Nut
16	Splitter Arm Assembly
17	Gasket
18	Adjustment Screw
19	Stop Nut
20	Cover Plate
21	Conduit Connector

Figure 3. Electric Control Parts

Keep pressure in cooling waterlines between 20 psig (140 kPa) minimum and 125 psig (860 kPa) maximum. Maximum cooling water temperature on the inlet side should not exceed 80° F (27° C). Use a pipe size adequate to supply 1 gpm (1 L/min) of cooling water for each 10 HP (7.5 kW) increment of motor rating.

Closed loop heat exchanger systems (cooling water returned to suction pipe, well or other main source) cannot be recommended in situations where pumpage is used for human or animal consumption, or in any application where oil contamination of pumpage can create problems, or where prohibited by local codes. If this method is employed, a check valve must be used between the cooling water regulating valve and the return location, and, a thermal safety valve set for 85° F. (30° C.) must be installed on the pump casing.

CAUTION: If cooling water is taken from pump discharge and hydraulic speed control is used, make sure pressure sensing line and heat exchanger lines are taken from separate locations. This will help avoid control problems.

Pressure Control Connections:

- 1. Hydraulic Control: Locate the pressure sensing source midway on a straight run section of discharge pipe that is a minimum of 12 pipe diameters in length. Connect a 1/4 inch (6mm) minimum O.D. pressure sensing line between the Hydroconstant pressure control (see Figure 2) and the pressure source on the pump discharge. Make or furnish provisions for bleeding entrapped air from the pressure sensing line. The pressure control is rated at 250 psi (1720 kPa) maximum working pressure and 250°F (121°C) maximum working temperature and is not suitable for corrosive liquids.
- 2. Pneumatic Control: connect a 1/4 inch (6mm) O.D. air line between the Hydroconstant pressure control and the air signal process controller (see Figure 2).
- 3. Electric Controls: **Read all instructions** furnished with panels, interface devices and process controls that may be part of this installation. Solenoid (1, Figure 3) must be connected to the D.C. voltage interface according to the furnished wiring diagram. The interface may be an integral part of the panel supplied. Pay strict attention to the terminal numbers. The conduit connector (21) is plastic and requires removal of elbow to connect wires.

CAUTION: This conduit connector (21) is not a connection for water. (Refer to leaflet 4848577).

OPERATION

BEFORE STARTING HYDROCONSTANT DRIVE:

- A. Refer to instruction bulletin 2880549 for priming pump and starting drive.
- B. Check that oil level is visible in, but not above the top of, the oil sight gauge on the side of the housing.

Start as follows:

1. Turn on power supply.
2. Open the shutoff valve in the control pressure sensing line.
3. Turn on water supply to heat exchanger.
4. Place Hand-Of-Automatic switch on Automatic. If water pressure in control line is below setting of control mechanism, motor should start and reach operating speed very quickly. Pump will come up to speed somewhat slower.

HYDRAULIC CONTROL: Proceed as follows:

1. When pump reaches nearly steady speed, open discharge valve part way to permit partial delivery to system.
2. As pump discharge pressure becomes nearly steady, carefully bleed air from the control pressure sensing line. Make several trials to be sure line is properly bled of all air bubbles.

WARNING

Any fluid under pressure, and/or at temperatures above 100° F. (38° C) may cause serious skin or eye injuries if sprayed on people.

3. Observe pressure gauge. Discharge pressure should become steady after a few minutes.
4. Carefully inspect unit for water and oil leaks.
5. Open discharge valve to permit maximum required system flow. Observe discharge pressure gauge. Discharge pressure should rise to the value observed in step 3 (after falling when valve is opened). Change the setting to suit operating condition by turning pressure adjusting knob (see Figure 1).

DISCHARGE PRESSURE ADJUSTMENT: Turn pressure adjusting knob on housing clockwise to increase system pressure, counterclockwise to decrease. Change the adjustment in small amounts and wait one minute to observe effect on pressure before another trial.

ELECTRICAL CONTROL: Proceed as follows:

1. When pump reaches nearly steady speed, open discharge valve part way to permit partial delivery to system.
2. Place system controller (in control panel) on manual position. Slowly vary the control signal to the solenoid (1, Figure 38). Pump discharge pressure should change in response to control signal changes.

NOTE: The solenoid (1, Figure 3) is a device which has a linear voltage to force relationship. The resistive force is provided by a spring which is factory adjusted for proper control. Do not attempt to readjust spring (13, Figure 3) tension without first reading, then following instruction pertaining to solenoid calibration (Leaflet 4848577).

3. Place system controller on automatic (see system controller instructions). Slowly change the automatic pressure setting. Recalibrate system controller according to system controller manufacturer's instructions to smooth out undesirable pressure fluctuations.

4. Carefully inspect unit for water and oil leaks.

PNEUMATIC CONTROL: Proceed as follows:

1. When pump reaches nearly steady speed, open discharge valve part way to permit partial delivery to system.
2. Observe pressure gauge. Discharge pressure should become steady after a few minutes.
3. Slowly adjust air signal controller output and observe discharge pressure changes.

NOTE: The pneumatic control is a device which has a linear air pressure signal to spring tension relationship. The internal spring is factory adjusted to give the optimum tension for proper control. Do not attempt to make adjustments on the spring or air control without first obtaining additional instructions from factory.

4. Observe unit for water, air or oil leaks.

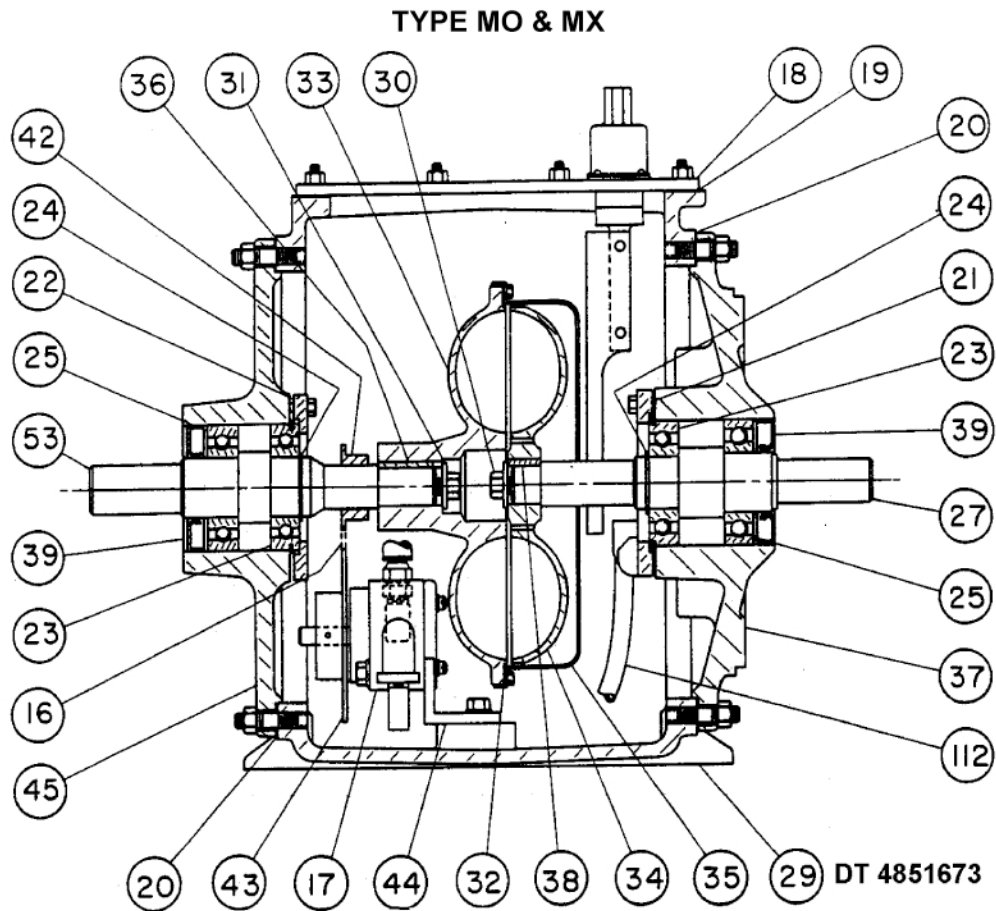


Figure 5c
*MO style illustrated

MATERIALS OF CONSTRUCTION

Item No.	Description	Material	Item No.	Description	Material
1	Pressure Control	Assembly	29	Main Housing	Cast Iron
2	Pressure Control Knob	Assembly	30	Coupling Screw	Steel
3	Diaphragm	Rubber/Synthetic Fiber. Fabric	31	Coupling Washer	Steel
4	Spacer	Steel	32	Coupling Gasket	Vegetable Fiber
5	Jam Nut	Steel	33	Input Coupling Half	Aluminum
6	Set Screw	Steel	34	Output Coupling Half	Aluminum
7	Pivot Block	Ductile Iron	35	Coupling Cover	Steel
8	Drive Pin	Steel	36	Input Coupling Key	Steel
9	"O" Ring Seal	Rubber	37	Pump Flange	Cast Iron
10	Splitter Arm	Ductile Iron	38	Output Coupling Key	Steel
11	Retaining Ring	Steel	39	Oil Seal	Assembly
12	Compression Spring	Steel	40	Spacer	Steel
13	Adjusting Screw	Steel	41	Mechanical Seal	Assembly
14	Spring Retainer	Steel	42	Drive Sprocket	Steel
15	Splitter	Steel	43	Oil Pump Sprocket	Steel
16	Chain	Assembly	44	Oil Pump Bracket	Steel
17	Oil Pump	Assembly	45	MO Flange	Cast Iron
18	Cover Plate	Steel	51	Oil Seal	Assembly
19	Cover Plate Gasket	Synthetic Fiber	53	Input Shaft	Steel
20	End Bell Gasket	Synthetic Fiber	60	Motor Flange	Cast Iron
21	Bearing Cap	Ductile Iron	62	Motor	Assembly
22	Bearing Cap	Steel	63	Heat Exchanger 7 Hp-25 Hp.	Assembly
23	Ball Bearing	Assembly	63A	Heat Exchanger 3-5 Hp.	Assembly
24	Bearing Retaining Ring	Steel	86	Breather	Steel Assembly
25	Ball Bearing	Assembly	104	Temp. Reg. Valve	Assembly
26	Oil Gauge	Assembly	105	Strainer	Assembly
27	Output Shaft	Steel	112	Hose	Assembly
28	Retaining Ring	Plated Steel	113	Thermometer	Assembly

Figure 5d

Type M and MP*

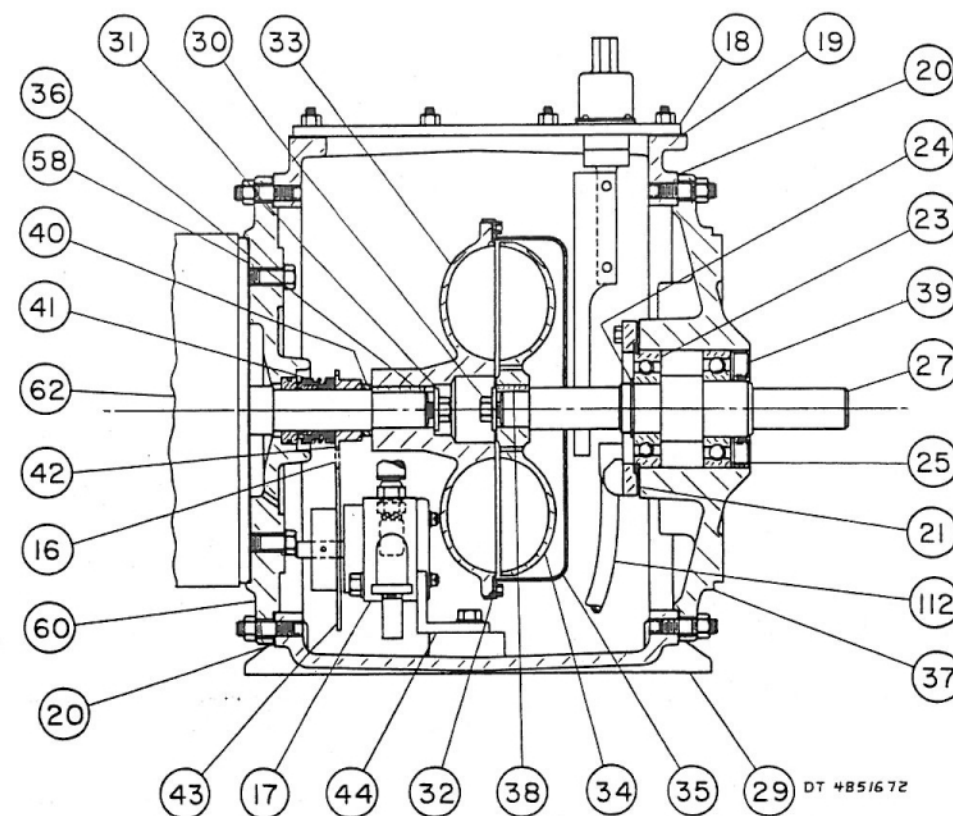


Figure 5a
*M style illustrated.

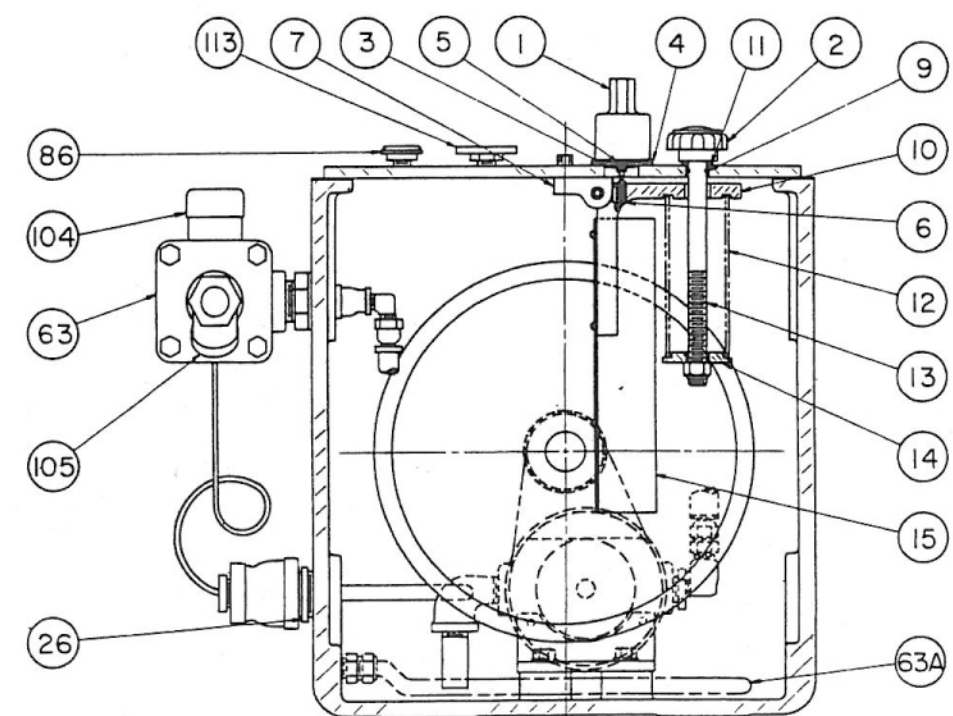


Figure 5b

END VIEW (From Pump End)

PERFORMANCE CHECK: After starting, allow unit to warm up to an oil temperature of 140° F. ± 10° F. (60° C. ± 60° C.). Adjust water flow in heat exchanger line so that oil temperature does not exceed 150° F. (65° C.).

CAUTION: Maximum heat generation will always occur when the drive output shaft is rotating at 2/3 full rated motor speed with the drive coupled to the job load. The cooling water regulating valve must be manually set to achieve the specified drive oil operating temperature at 33% slip speed. The thermally activated flow control valve will function automatically after that, adjusting the water flow to hold the drive oil temperature nearly constant. Prolonged operation with higher than recommended operating temperatures will decrease useful operating life of internal oil hoses and bearings, along with reduced output performance.

If unit fails to reach required speed, or will not slow down when necessary, proceed as follows:

1. Turn off the Hydroconstant unit and check the oil level. Level should be visible in the sight gauge glass but not above the top. Add oil if necessary. (See list on page 8 of bulletin for proper oils.)
2. Remove top plate (13, Figure 4) from housing.
3. Check that the bleed orifice in the coupling cover (35, Figure 5) is not clogged.

Using pins carefully determine that the single hole diameter is as follows

Hydraulic Coupling Size	Speed RPM	Orifice Diameter	
		Inches	mm
6B	3500	0.086	2.18
8C	1750	0.136	3.45
8C	3500	0.104	2.64
8C	2900	0.104	2.64

MAINTENANCE

WARNING

Before starting any repairs requiring dismantling of the Hydroconstant unit, open the disconnect switch to cut off power to the motor. Temporarily secure the switch so it cannot be closed. Attach note "Do not close switch - pump repair in process". Starting the motor during removal of the Hydroconstant unit could cause material damage and personal injury.

OIL CHANGE:

When run continuously, oil should be drained from the Hydroconstant drive once a year or 9,000 hours. After

4. Manually spin input coupling (33) and cover (35) in the direction of the pump unit rotation. Observe if oil flows slowly from the exit hole in the output bearing cap (21, Figure 5).
5. If oil does not flow from exit hole, proceed as follows:
 - a. Check all oil hose connections. Tighten as required.
 - b. Check the oil pump chain for proper tension (see Figure 6).
 - c. Make sure the oil pump sprocket (43) set screw is tight.
 - d. Make sure the motor shaft sprocket (42) set screw is tight.
6. Check position of splitter adjustment set screw (22, Figure 4). The end of this set screw provides a cone-shaped seat for the pressure control pointer (5). If the pointer is not resting in the center of the set screw cone, reposition the pointer. The free end of the splitter arm should be .06 inches (1.5 mm) away from top plate.
7. If the pointer is centered in the cone and the drive does not perform properly, the high and low speed limits may be restricted by the mechanical limits of the pressure control pointer movement. To increase maximum speed, rotate the set screw counterclockwise; to decrease minimum speed, rotate the set screw clockwise. Rotate one-half turn in the desired direction, reassemble, start the unit and compare performance with that desired.
8. Repeat step 7 as often as necessary to obtain proper performance.

shut down, remove square head drain plug and drain oil into a suitable container. Replace drain plug and fill with new, clean, suitable oil (oil level should be visible, but not over the top of the oil sight gauge). Approximate capacity is 4 quarts (4 liters).

CAUTION: Use only high quality non-detergent hydraulic or turbine type oil in Hydroconstant drives. This oil must have a viscosity of approximately 68 centistokes at 100° F. (38° C.) along with foam and oxidation resistant additives. Failure to use the proper oil will impair drive performance.

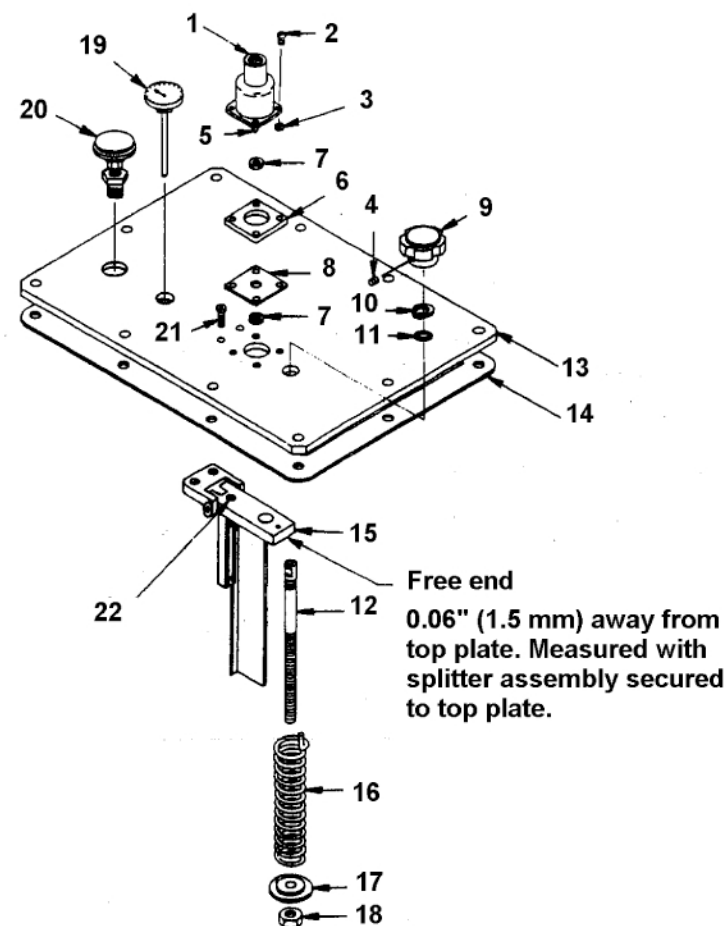


Figure 4. Top Plate and Controls

Some Acceptable Oils for Hydroconstant Variable Speed Drive Use:

Supplier	Product Name
Amoco	Rycon 68
Atlantic Richfield	Duro AW 68
Chevron	GST 68
Shell Oil Company	Tellus 68
Exxon	Terresstic 68
Standard Oil	Rycon 68
Texaco	Rando
Union Oil Company	Unax AW 68
Gulf	Harmony 68
Mobile	DTE 68

WARNING

Do not add or drain oil while Hydroconstant is running. Hot oil splash can cause permanent injury. Do not attempt repair or maintenance procedures or oil changes with oil temperatures above 90° F. (32° C.). Painful, hazardous burns may result.

LUBRICATION:

The internal parts of the Hydroconstant are splash lubricated with oil. Follow motor manufacturer's instructions to lubricate motor bearings. Lubricate

1.	Pressure control
2.	Machine Screw
3.	Flat washer
4.	Set screw
5.	Pressure control pointer
6.	Spacer
7.	Jam nut
8.	Diaphragm
9.	Pressure adjusting knob
10.	Snap ring
11.	O-Ring
12.	Adjusting screw
13.	Top plate
14.	Top plate gasket
15.	Splitter arm assembly
16.	Spring
17.	Spring retainer
18.	Nut
19.	Thermometer
20.	Breather assembly
21.	Machine screw
22.	Cone point set screw

pump bearings, if used, as instructed in appropriate pump bulletin.

PERIODIC INSPECTION:

At regular intervals inspect the unit as follows:

1. Check for leaks at all pressure points; oil, around drain plugs, end flanges and seals; water, control pressure sensing line, pump shaft and heat exchanger connections.
2. Check the inlet strainer in cooling line (if used) for accumulation of sediment. Clean as necessary to avoid cooling water stoppage.
3. Check operating temperature on all units, (thermometer on top of housing). Adjust cooling water regulating valve as required to maintain 140° F. (60° C. ± 6° C) operating temperature for optimum performance.

WARNING

Cleaning solvents are flammable. Open flame or smoking by personnel in the vicinity of these solvents is extremely hazardous and must not be permitted.

The heat exchanger may require periodic cleaning. The water side of the heat exchanger can be cleaned with water softeners or by removing the cast iron headers at the ends of the external heat exchanger and routing out the water tubes with rods or brushes. The oil side can be cleaned using a methylene chloride compound.

REPAIR: Normal repair of the Hydroconstant drive is limited to the replacement of shaft bearings or seals

DISASSEMBLY

This section outlines recommended disassembly and replacement procedures. Follow applicable steps for all M. MO. MP and MX models. In cases where complete disassembly is not necessary, the pump station operator or maintenance superintendent must make the decision as to which steps are applicable.

WARNING

Repair of some Hydroconstant parts requires the use of lifting equipment. Do not work under a heavy suspended object unless there is a positive support under it to stop its fall in the event of a sling or hoist failure. Disregard of this warning could result in grave personal injury.

PRELIMINARY PREPARATIONS: Proceed as follows:

1. **Read this entire bulletin.** Study all figures and illustrations.
2. Disconnect all power going into control panel. Mark and disconnect all electric wires going from control panel to motor and Hydroconstant.
3. Close pump suction and discharge line valves.
4. Hydraulic speed control; close shutoff valve in pressure sensing line and open vent to release pressure. Pneumatic speed control; release all pressure in air line going to controller.
5. Disconnect all cooling water lines, pressure sensing lines and pneumatic air lines from Hydroconstant.

PRESSURE CONTROL DIAPHRAGM REPLACEMENT:

NOTE: Diaphragm can be replaced without removing the top plate. Replacement is only necessary if oil is leaking out during operation. (Refer to Figure 4)

1. Remove 4 machine screws (2). Complete pressure control assembly (1-8) can now be removed. Be careful not to lose any of the 4 flat washers (3) during removal.
2. Remove 1 jam nut (7) from pressure control pointer (5).
3. Remove aid diaphragm from pressure control pointer.

when required. Refer to and follow disassembly and reassembly instructions in this bulletin. If the pump requires repair, refer to the applicable bulletin supplied with the equipment. Motor repair should only be made by a repair shop authorized by the specific motor manufacturers noted on the motor nameplate. Control panel repair should be made by factory service personnel or licensed electricians.

4. Do not remove the second jam nut (7). Make sure it is seated tightly on pressure control pointer.
 5. Turn pressure control body (1) with pointer in straight up position. Set square spacer (6) on pressure control flange with sharp edge of large hole towards pressure control flange.
 6. Slide diaphragm (8) against jam nut on pressure control pointer.
 7. Screw second jam nut (7) on pressure control pointer seating tightly against diaphragm.
- NOTE:** Diaphragm will rotate as you tighten second Jam nut. Therefore, rotate diaphragm counterclockwise about 30° before seating jam nut.

8. The 4 machine screw holes in the pressure control spacer and diaphragm should now be aligned. Place control assembly over mounting holes on top plate.
 9. Carefully raise the pressure control body (1) 1/16 inch (1.5 mm) and insert the 4 flat washers (3) between the pressure control body flange and the spacer plate (6).
- NOTE:** Diaphragm (8) must remain between the top plate (13) and spacer plate (6).
10. Fasten pressure control assembly to top plate with 4 machine screws (2).
 11. Replace pressure sensing lines.
 12. Reconnect power supply to motor.
 13. Start the drive as outlined under OPERATION.

DISASSEMBLY FOR SHAFT SEAL REPLACEMENT:

1. Complete PRELIMINARY PREPARATIONS as noted at the beginning of this section.
- MO and MX Input:**
1. Loosen shaft coupling halves between motor and drive input shaft.
 2. Unscrew bolts from motor feet and remove motor from base.