

OPERATION AND
MAINTENANCE MANUAL
HPL PLUNGER PUMP

ISSUE 1

REF. No.: om-manua\HPL.doc

25th October 1999

Grosvenor Pumps Limited
Trevoole, Praze,
Camborne,
Cornwall.
TR14 0PJ
England

Tel: 01209 831500
Fax: 01209 831939
Email: sales@grosvenorpumps.com

CONTENTS LIST

SECTION TITLE	PAGE
1. GENERAL DESCRIPTION	3
1.1. HPL Plunger Pump	4
2. TECHNICAL DATA	5
2.1. Pump	6
2.2. Material	7
2.3. Suction & Delivery Port	7
2.4. Motor - Standard	7
2.5. Dimensions	7
2.6. HPL Plunger Pump - Diagram of Parts	8
2.7. Installation Detail - HPL Plunger Pump - RG634 latest issue	9
2.8. Wiring Connection Diagram - Motors - GP 1204 latest issue	10
3. SAFETY	11
3.1. Standard Precautions	12
4. INSTALLATION, COMMISSIONING & OPERATION	13
4.1. Mounting	14
4.2. Pipe Connections	14
4.3. Gearbox Oil	14
4.4. Electrical	14
4.5. Commissioning	15
4.6. General Operation	15
4.7. Speed Variator & Flow Control	16
5. MAINTENANCE	17
5.1. Safety	18
5.2. General Maintenance	18
5.3. Motor	18
5.4. Speed Variator	18
5.5. Poppet Suction and Delivery Valve Assemblies	19
5.6. Ball Suction and Delivery Valve Assemblies	19
5.7. Pump head Assembly	20
5.8. Gearbox Assembly	20
5.9. Reassembling the Gearbox	21
5.10. Final Assembly	22
5.11. Spare Parts	22
5.12. Lubrication	22
5.13. Approved Lubricants	22

SECTION 1

GENERAL DESCRIPTION

1. GENERAL DESCRIPTION

1.1. HPL Plunger Pump

- 1.1.1. The HPL Plunger Pump is a fixed output single acting plunger pump. The pump consists of an electric motor driving a worm/worm wheel mesh gearbox with a crank/conrod mechanism. This reciprocates a plunger within a pump head assembly. Ball or poppet type suction and delivery valves are fitted to the pump head. The various engineering material options make the pump suitable for a wide range of chemicals. Typical applications are chemical injection, water treatment dosing, sampling or any other application where a positive liquid feed is required. The pump can be supplied stand alone or in a variety of custom built skid packages.
- 1.1.2. The standard pump duty range is 272 l/h at 248 bar to 1180 l/h at 59 bar. The pressure range is set by the electric motor power rating. Standard motors are 4 pole IP 55 with a 415 VAC 3 phase 50 Hz supply. This gives a stroke speed of 114 strokes/minute. Other motor options for hazardous environments or special projects are available on request.
- 1.1.3. The gearbox case is manufactured from cast iron. The standard construction of the pump head wetted parts is 316L stainless steel with a nitrile seals. Other materials are available on request. The standard units are suitable upto 100°C depending upon an adequate positive suction head.
- 1.1.4. The standard inlet and outlet ports can be screwed or flanged to either BS 4504 or BS1560. Other ports options are available to order.
- 1.1.5. A full range of accessories including loading valves, relief valves and electrical starters are available from Grosvenor Pumps.

SECTION 2

TECHNICAL DATA

2. TECHNICAL DATA

2.1. Pump Sizes

1" x 3"	272 l/h @ 66 Bar (3 kW)
	272 l/h @ 91 Bar (4 kW)
	272 l/h @ 124 Bar (5.5 kW)
	272 l/h @ 165 Bar (7.5 kW)
	272 l/h @ 248 Bar (11 kW)
1-1/8" x 3"	318 l/h @ 54 Bar (3 kW)
	318 l/h @ 74 Bar (4 kW)
	318 l/h @ 103 Bar (5.5 kW)
	318 l/h @ 137 Bar (7.5 kW)
1-1/4" x 3"	318 l/h @ 206 Bar (11 kW)
	430 l/h @ 44 Bar (3 kW)
	430 l/h @ 63 Bar (4 kW)
	430 l/h @ 86 Bar (5.5 kW)
	430 l/h @ 115 Bar (7.5 kW)
1-3/8" x 3"	430 l/h @ 173 Bar (11 kW)
	477 l/h @ 40 Bar (3 kW)
	477 l/h @ 51 Bar (4 kW)
	477 l/h @ 70 Bar (5.5 kW)
	477 l/h @ 92 Bar (7.5 kW)
1-1/2" x 3"	477 l/h @ 140 Bar (11 kW)
	568 l/h @ 34 Bar (3 kW)
	568 l/h @ 43 Bar (4 kW)
	568 l/h @ 59 Bar (5.5 kW)
	568 l/h @ 79 Bar (7.5 kW)
1-5/8" x 3"	568 l/h @ 118 Bar (11 kW)
	680 l/h @ 28 Bar (3 kW)
	680 l/h @ 35 Bar (4 kW)
	680 l/h @ 49 Bar (5.5 kW)
	680 l/h @ 66 Bar (7.5 kW)
1-3/4" x 3"	680 l/h @ 118 Bar (11 kW)
	795 l/h @ 24 Bar (3 kW)
	795 l/h @ 29 Bar (4 kW)
	795 l/h @ 40 Bar (5.5 kW)
	795 l/h @ 55 Bar (7.5 kW)
1-7/8" x 3"	795 l/h @ 84 Bar (11 kW)
	910 l/h @ 21 Bar (3 kW)
	910 l/h @ 26 Bar (4 kW)
	910 l/h @ 37 Bar (5.5 kW)
	910 l/h @ 49 Bar (7.5 kW)
2" x 3"	910 l/h @ 74 Bar (11 kW)
	1110 l/h @ 18 Bar (3 kW)
	1110 l/h @ 22 Bar (4 kW)

2" x 3-7/16"	1110 l/h @ 31 Bar (5.5 kW)
	1110 l/h @ 42 Bar (7.5 kW)
	1110 l/h @ 64 Bar (11 kW)
	1180 l/h @ 18 Bar (3 kW)
	1180 l/h @ 22 Bar (4 kW)
	1180 l/h @ 31 Bar (5.5 kW)
	1180 l/h @ 42 Bar (7.5 kW)
	1180 l/h @ 64 Bar (11 kW)

2.2. Material

Pump head	316L stainless steel
Seals	
Standard	Nitrile
Option	Viton

2.3. Suction and Delivery Port

1" x 3"	1/2"
1-1/8" x 3" to 1-3/4" x 3"	3/4"
1-7/8" x 3" to 2" x 3-7/16"	1"
Suction Condition	Flooded

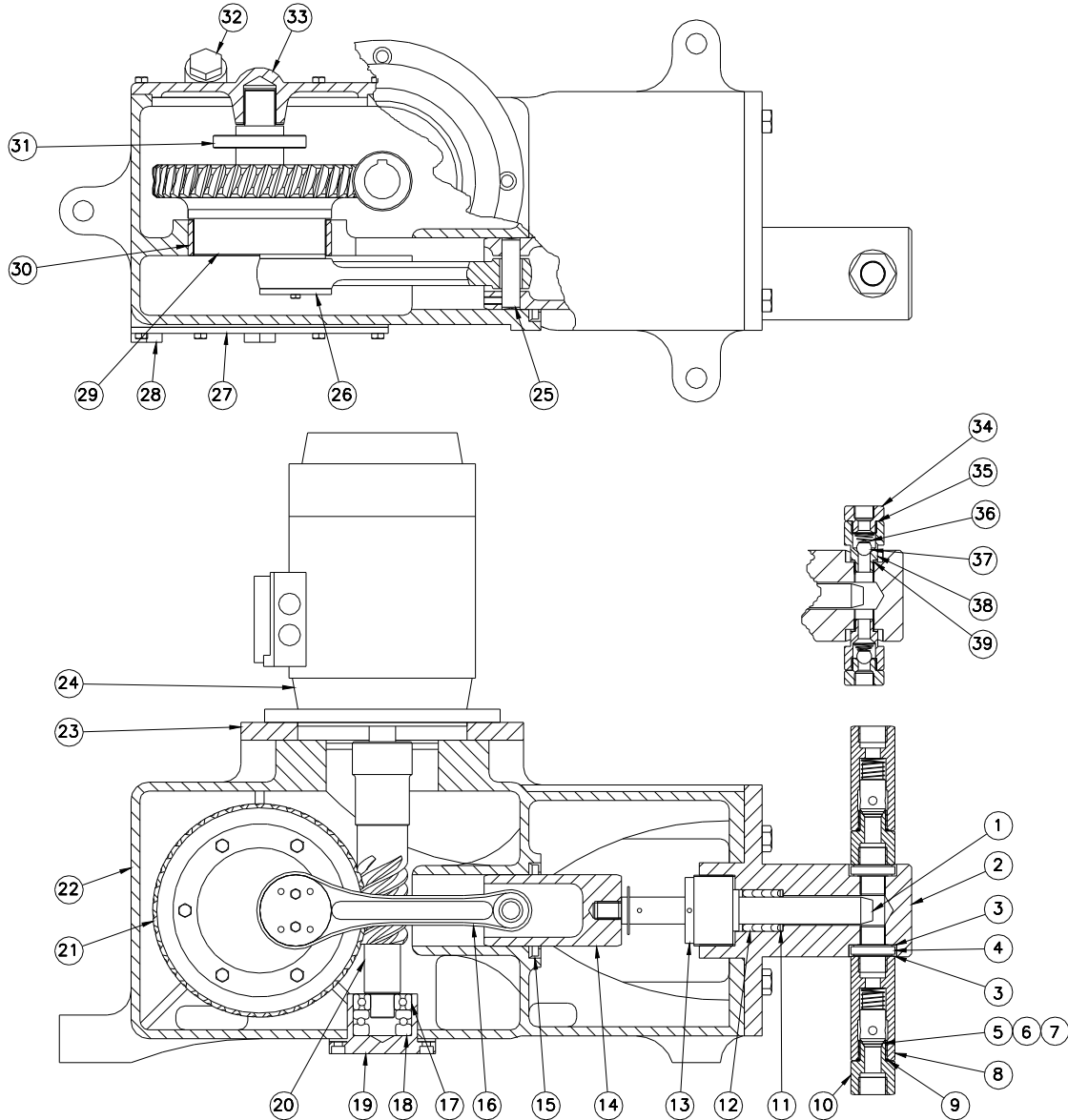
2.4. Motor - Standard

Type	IP 55 4 pole
Speed	1500 rev/min
Supply	
Standard	415 VAC/3 ph/50 Hz (star) 240 VAC/3 ph/50 Hz (delta)
Operation	Continuous

2.5. Dimensions

Weight	150 kg approx
Overall Length	905 mm
Overall Height	859 mm max.
Overall Width	406 mm

2.6. HPL Plunger Pump - Diagram of Parts



REF.	DESCRIPTION	PART No.	REF.	DESCRIPTION	PART No.
1	PLUNGER	968	20	WORM	1001
2	PUMP HEAD	940	21	WORM WHEEL	1006
3	BONDED SEAL	117	22	GEARBOX	501
4	UNION	122	23	ADAPTOR PLATE, MOTOR	500
5	POPPET	CV87	24	MOTOR	640
6	SPRING	CV84	25	CROSS HEAD PIN	516
7	O-RING, POPPET	1594	26	PLATE, CON ROD	513
8	VALVE BODY	CV83P	27	SIDE PLATE	519
9	O-RING, VALVE BODY	1525	28	DRAIN PLUG	71
10	VALVE SEAT	CV82P	29	CRANKSHAFT	1361
11	NECK RING	982	30	MAIN BEARING RING	520
12	PLUNGER SEAL PACKING	1473	31	OIL RING	526
13	GLAND NUT	961	32	FILL PLUG	470
14	CROSS HEAD	515	33	MAIN BEARING PLATE	520
15	OIL SEAL	518	34	VALVE TOP	742
16	CON ROD	512	35	O-RING, VALVE TOP	745
17	BEARING, BOTTOM	525	36	SPRING	684
18	BEARING, THRUST	523	37	BALL $\phi 5/8"$	752
19	BEARING HOUSING	506	38	VALVE BODY	1029
			39	BONDED SEAL, VALVE TOP	115

2.7. Installation Detail - HPL Plunger Pump - RG634 latest issue

DRAWING NUMBER: RG634/A3/6

PROJECTION

PUMP SIZE	BORE X STROKE	PORT SIZE BSP	DIMN 'B'	FLOW L/H	PRESSURE BAR				
					3 kW	4 kW	5.5 kW		
1" x 3"	1/2"	1/2"	286	272	66	91	124	165	248
1-1/8" x 3"	3/4"	3/4"	382	318	54	74	103	137	206
1-1/4" x 3"	3/4"	3/4"	386	430	44	63	86	115	173
1-3/8" x 3"	3/4"	3/4"	388	477	40	51	70	92	140
1-1/2" x 3"	3/4"	3/4"	392	568	34	43	59	79	118
1-5/8" x 3"	3/4"	3/4"	396	680	28	35	49	66	99
1-3/4" x 3"	3/4"	3/4"	398	795	24	29	40	55	84
1-7/8" x 3"	1"	1"	402	910	21	26	37	49	74
2" x 3"	1"	1"	404	1110	18	22	31	42	64
2" x 3-7/16"	1"	1"	404	1180	16	21	29	39	59
DIMN 'A'					660	674	724	724	859

MOTOR (STD)
 TEFC IP55 4 POLE
 SUPPLY 415 VAC/3 PHASE/50Hz
 OPERATION CONTINUOUS
 MOTOR CAN BE ROTATED 90° INCREMENTS TO PROVIDE ALTERNATIVE TERMINAL BOX POSITIONS.

MATERIAL
 PUMP HEAD 316L STAINLESS STEEL
 SEALS NITRILE

TEMPERATURE
 1°C MIN.
 100° MAX. - 316L

WEIGHT
 150 KG

DATA SHOWN IS FOR STANDARD ASSEMBLY ONLY.
 CONTACT GROSVENOR PUMPS FOR FULL DETAILS

4	20 OCT 99	REDRAWN	CHU
0	26 JUL 93	ORIGINAL ISSUE	JTL
ISSUE	DATE	ALTERATION	SIGN

THIS DRAWING IS CONFIDENTIAL AND THE PROPERTY OF GROSVENOR PUMPS LTD. AND MUST NOT BE REPRODUCED EITHER WHOLLY OR PARTLY WITHOUT PERMISSION. COPY RIGHTS ARE RESERVED.

REMOVE ALL BURRS AND SHARP EDGES.
 DO NOT SCALE IF IN DOUBT ASK.

FILE: \PUMP\HPI\INST\RG634
 DIMENSIONS IN MM
 ORIGINAL SCALE - 1:8

GROSVENOR PUMPS LTD
 8 SHAFTESBURY INDUSTRIAL CENTRE, THE RUNNINGS,
 CHELTENHAM, GLOS GL51 6NH, ENGLAND.

TITLE: HPL PLUNGER PUMP
 SHEET: 1 of 1
 PART NUMBER: RG634/A3/6
 DRAWING NUMBER: RG634/A3/6

2.8. Wiring Diagram GP1204 latest issue

DRAWING NUMBER GP1204/A3/1	PROJECTION 	<p>CONNECTION DIAGRAM FOR 3-PHASE SINGLE SPEED INDUCTION MOTOR</p> <p>6 LEADS FOR STAR (Y) OR DELTA (Δ)</p> <p style="text-align: center;">H HEATER</p>	SHEET 1 OF 1	TITLE WIRING CONNECTIONS ALL PUMPS & MIXER MOTORS
		CONNECT TO SINGLE PHASE VOLTAGE SUPPLY		
		FILE: \COMPNTS\MOTOR\GP1204 DIMENSIONS IN MM ORIGINAL SCALE N/A	<p>GROSVENOR PUMPS LTD 8 SHAFTESBURY INDUSTRIAL CENTRE, THE RUNNINGS, CHELTENHAM, GLOS GL51 9NH, ENGLAND.</p>	
		A3		
		REMOVE ALL BURRS AND SHARP EDGES. MUST NOT BE REPRODUCED WITHOUT PERMISSION. COPY RIGHTS ARE RESERVED.		
		THIS DRAWING IS CONFIDENTIAL AND IS THE PROPERTY OF GROSVENOR PUMPS LTD. AND MUST NOT BE REPRODUCED WITHOUT PERMISSION. COPY RIGHTS ARE RESERVED.		
		ISSUE DATE ALTERATION SIGN 1 14 MAY 98 REDRAWN CHU 0 4 FEB 93 ORIGINAL ISSUE JTL		

SECTION 3

SAFETY

3. SAFETY

3.1. Standard Precautions

- 3.1.1. To comply with normal safety standards, the following measures are to be taken:
- 3.1.2. A minimum issue of standard protective clothing to be available to all personnel involved in the handling of chemicals and operation of the dosing plant, consisting of:
- 3.1.3. Goggles - with wide-angle vision, contact the skin in complete seal around both eyes and adequately vented without allowing access to spillage.
- 3.1.4. Safety helmet - of metal or reinforced plastic to the relevant British Standard or equivalent.
- 3.1.5. Gloves - wrist length, of soft PVC or rubber permitting full flexure.
- 3.1.6. Overalls - to be worn in conjunction with the items above or a one-piece chemical suit.
- 3.1.7. Standard site safety provisions, safety precautions and first aid instructions, in condensed form shall be declared at site and in site vehicles. All employees shall be in possession of literature giving full details of safety precautions and first aid action.
- 3.1.8. Ensure that the nature and properties of the chemical being handled are known in advance.
- 3.1.9. Ensure that the correct precautions for the chemical being handled are observed. IF IN DOUBT ASK.
- 3.1.10. Treat all materials as harmful.
- 3.1.11. Do not touch chemicals or residues with bare hands.
- 3.1.12. Wash away accidental contact immediately.
- 3.1.13. Wash contaminated clothing before re-use.
- 3.1.14. Wash thoroughly after handling chemicals. Do not eat drink or smoke unless decontaminated.
- 3.1.15. Erect WARNING barriers where necessary.
- 3.1.16. Follow specific process instruction carefully.
- 3.1.17. Mix chemicals in the order specified.
- 3.1.18. **CAUTION: CHEMICALS CAN BE HARMFUL. PLEASE OBSERVE MANUFACTURER'S HANDLING AND STORAGE GUIDELINES.**
- 3.1.19. Health Hazards - Harmful in contact with the skin and irritating to the eyes.
- 3.1.20. Handling - Avoid contact with the skin and eyes. Wear suitable protective clothing gloves and eye protection. Wash out empty container thoroughly with water and add solution to system being treated.
- 3.1.21. Storage - Keep container in a cool, well ventilated place. Keep away from source of ignition. NO SMOKING.
- 3.1.22. Spillage and Disposal - Shut off all sources of ignition. Absorb spillage in earth and sand, collect up and remove all contaminated clothing. Eye exposure; in case of contact with eyes, rinse immediately with copious quantities of water. Ingestion; remove patient to fresh air, rest and warm. Administer oxygen or artificial respiration as necessary.

SECTION 4

INSTALLATION, COMMISSIONING & OPERATION

4. INSTALLATION, COMMISSIONING & OPERATION

4.1. Mounting

- 4.1.1. For maximum operating life, the pump should be located in a clean cool dry environment. If the site is classified as a hazardous area ensure the pump meets the site requirements. Position the pump on a rigid base preferably as low as possible relative to the supply for the optimum suction condition. Fix the pump gearbox firmly to the base using four suitable floor bolts.
- 4.1.2. If the pump is to be installed in an aggressive, hot, dirty environment, it is advisable to provide some cover. However it is essential to leave adequate ventilation for motor cooling. Do not obstruct the motor fan cover.

4.2. Pipe Connections

- 4.2.1. The suction pipe sizes should be larger than the port connection. The number of pipe bends should be kept to a minimum to reduce flow losses, pulsation and water hammer effects. Increase the pipe size if long pipe runs are unavoidable. If water hammer is present, fit a pulsation damper unit in the delivery pipe line as close to the pump as possible. For technical advice, please refer to Grosvenor Pumps.
- 4.2.2. In favourable conditions, the pump will self-prime. However, if difficulties are experienced with priming, loosen/remove the delivery valve sub-assembly, fill the pumping chamber with the pumped liquid and refit the valve. Appropriate care should be taken if the liquid is harmful.
- 4.2.3. Allow sufficient time while filling large diameter and/or long pipe lengths to build up hydraulic pressure. If the pressure does not increase, check:-
 - All joints are tight and fully sealed and any dump/flushing valves are shut.
 - The relief valve is adjusted to the correct pressure.
 - The suction and delivery lines are connected to the correct pump ports.
 - The liquid is free of large debris and contaminants. Large solids will reduce valve efficiency. Fit a suction strainer/filter.
 - Entrapped air pockets. Bleed the system.
- 4.2.4. If there is a high suction head present, a loading valve may be required to prevent syphoning.

4.3. Gearbox Oil

- 4.3.1. Note the pump gearbox is supplied without lubrication oil. Unscrew the breather unit and fill the gearbox with a sufficient quantity of suitable oil (refer to Section 5 - Maintenance for approved lubricants). The level should be no higher than the oil level plug.

4.4. Electrical

- 4.4.1. Before beginning any electrical work, isolate the supply at the mains.
- 4.4.2. Open the motor terminal box. Connect a suitably rated power supply to the motor. Use suitable power multi-core power cable with a cable gland nut. Fasten the power leads firmly to the terminal points. Always connect the supply earth lead.

- 4.4.3. Three phase motors can be controlled by a direct on-line starter or a frequency inverter. The standard motors can be wired in star or delta with a corresponding voltage variation e.g. either 415 VAC or 240 VAC. Therefore check the power supply.
- 4.4.4. The motor rotation should be clockwise when viewed from the fan side. For three phase supply, if the rotation is anti-clockwise, change any two of the three supply phases over.
- 4.4.5. As the pump will operate upto the motor stalling point, it is recommended that an electrical overload trip device is fitted and/or a hydraulic relief valve fitted in the delivery line. To allow for start-up current surge, current trips should be 6 to 7 times the full load motor current. If the supply is from a frequency inverter, the motor should be specified with a thermistor which is compatible with the frequency inverter. Unless a blower is fitted to the motor, turndown must be limited to 3:1 with an inverter.

4.5. Commissioning

- 4.5.1. After pipe and electrical installation has been completed run the pump between 30 and 60 minutes at minimum hydraulic load and flow. Examine the entire hydraulic system including the pump for any leakages. Check the pump for unusual noises and vibration. For the first 14 days operation, expect the pump gearbox to run at a temperature of 65-70°C. This will in no way affect the overall pump performance.
- 4.5.2. If difficulties are experienced with priming, remove the delivery valve, fill the pumping chamber with the pumped liquid and refit the valve. Appropriate care should be taken if the liquid is harmful.
- 4.5.3. Allow sufficient time to fill large diameter and/or long pipe lengths to build up hydraulic pressure. If the pressure does not increase, check:-
 - (i). All joints are tight and fully sealed and any dump/flushing valves are shut.
 - (ii). The relief valve is adjusted to the correct pressure.
 - (iii). The suction and delivery lines are connected to the correct pump ports.
 - (iv). The liquid is free of large debris and contaminants. Large solids will reduce valve efficiency. Fit a suction strainer/filter.
 - (v). Entrapped air pockets. Bleed the system.
- 4.5.4. If there is a high suction head present, a loading valve may be required to prevent syphoning.

4.6. General Operation

- 4.6.1. After successfully commissioning as detailed in Section 4.5., the pump can commence full operational duty. Before switching on the pump check all isolating valves are open. Likewise switch off the pump before closing an isolating valve.
- 4.6.2. To avoid damaging the plunger packing do not allow the pump to run dry.
- 4.6.3. Check the system for water and chemical leaks.
- 4.6.4. Check the pump for excessive noise, vibration and overheating.
- 4.6.5. Ensure that all associated instruments are functioning correctly and that their indications are accurate and meaningful.

- 4.6.6. Operate the pump within the duty specified in the original order. Please note that the performance data specified in section 2.1. is the maximum capable for each pump.
- 4.6.7. Check the pump will operate satisfactorily if it is to be used for another duty, i.e. different liquid, pressure, environment, power supply.
- 4.6.8. Always handle the pump by gripping the gearbox case and the pump head and not by the valves or any pipework attached to the pump head.

4.7. Speed Variator and Flow Control

- 4.7.1. The speed variator allows the flow to be varied by controlling the motor speed into the pump gearbox. The speed can be varied over a range of 0% to 100% by turning the handwheel. The number of rotations is shown on a gravity dial indicator set within the handwheel.
- 4.7.2. The orientation of the speed variator and the motor can be rotated in 90° increments to suit the individual application.

SECTION 5

MAINTENANCE

5. MAINTENANCE

5.1. Safety

- 5.1.1. **CAUTION: BEFORE STARTING ANY MAINTENANCE PROCEDURE, ENSURE THAT ALL SAFETY INSTRUCTIONS DETAILED IN THE CURRENT WORKS MANUAL AND STANDARD PROCEDURES HAVE BEEN COMPLIED WITH.**

5.2. General Maintenance

- 5.2.1. General maintenance is an oil change every 6 months. If the pump is in continuous operation at maximum duty, a detailed inspection of parts will be required at 12 month intervals. The pump unit is best dismantled in a fully tooled workshop. Full spares and any special tools are available from Grosvenor Pumps. Full refurbishment can be carried out by Grosvenor Pumps engineers. Contact Sales Dept for a quotation.

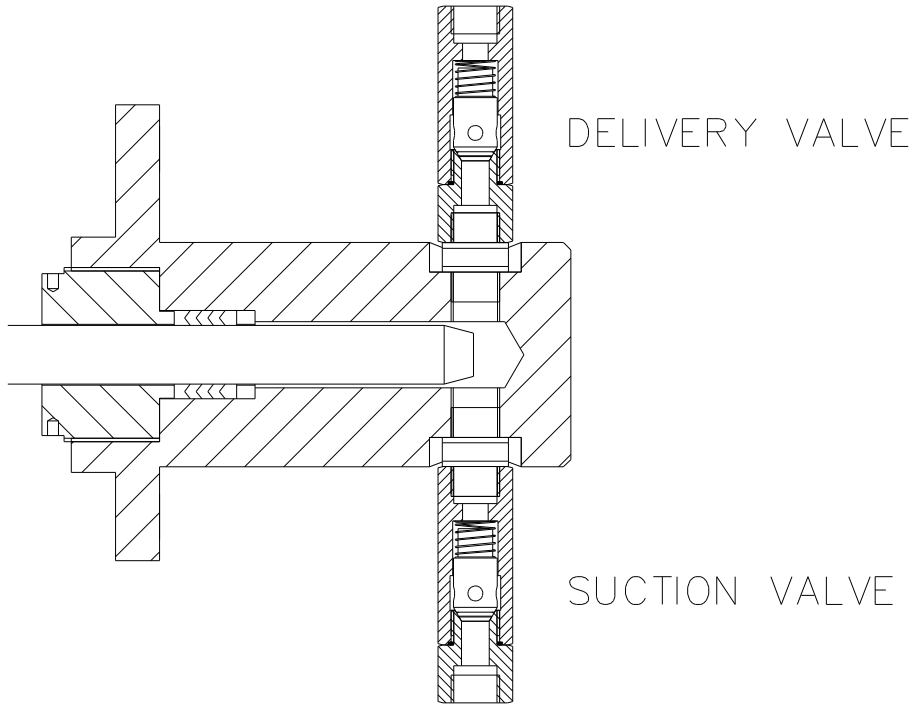
5.3. Motor

- 5.3.1. Isolate electric supply, disconnect wires from terminal box. After removing the flange bolts, the motor lifts off the mounting flange. The motor shaft is located in the worm with a close tolerance fit and may require some considerable force to separate it from the gearbox. The motor is non-serviceable.
- 5.3.2. To refit the motor, insert the shaft into the worm, ensuring the key (1086) is not displaced. Press the motor fully down onto the mounting flange. Retighten the motor flange bolts.
- 5.3.3. Reconnect the wiring to ensure rotation is clockwise when viewing motor on the fan end.

5.4. Speed Variator (if fitted)

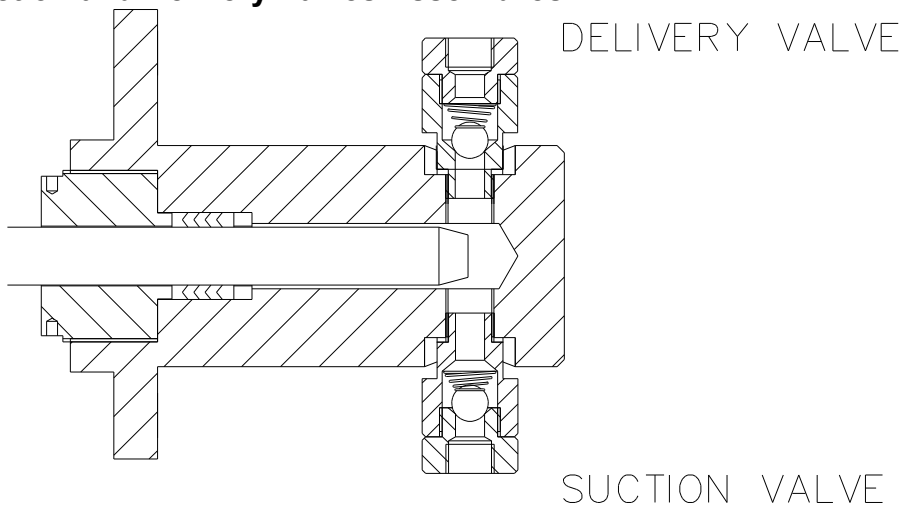
- 5.4.1. The speed variator can be removed from the pump gearbox by unscrewing the four screws. Normally the worm will lift off with the speed variator output shaft. It is a sliding fit but the worm can seize itself onto the variator output shaft. Use lever bars and releasing fluid to ease off the worm. Applying heat from a blow torch to the worm is permissible but care must be taken not to damage the speed variator aluminium body. Do not damage the worm teeth. The speed variator is non-serviceable.
- 5.4.2. To replace the speed variator, position the speed variator over the pump gearbox. Line up the speed variator output shaft key with the worm keyway and lower the speed variator onto the pump gearbox. Ensure the key is not displaced and the speed variator sits fully down on the gearbox flange before tightening the four screws.
- 5.4.3. The speed variator is non-serviceable. A replacement speed variator is available from Grosvenor Pumps.

5.5. Poppet Suction and Delivery Valves Assemblies



- 5.5.1. Note the orientation of the parts which make up the suction and delivery valve assemblies. Unscrew the valve assembly from the pump head. Separate the valve body (CV83P) from the valve seat (CV82P). Examine all parts for wear and/or damage. Always renew the valve body O-rings (1525) and valve poppet O-rings (1594).
- 5.5.2. Check the poppets and valve ends are replaced in the respective valve bodies in their correct suction or delivery orientation. Tighten the valve assemblies to 15 Nm.

5.6. Ball Suction and Delivery Valves Assemblies



- 5.6.1. Note the orientation of the parts which make up the suction and delivery valve assemblies. Unscrew the valve assembly from the pump head. Separate the valve body (1029) from the valve top (742). Examine all parts for wear and/or damage. Always renew the valve body O-rings (320).
- 5.6.2. Check the balls (752) and springs (684) are replaced in the respective valve bodies in their correct suction or delivery orientation. Tighten the valve assemblies to 15 Nm.

5.7. Pump Head Assembly

- 5.7.1. To remove the pump head assembly, first disconnect the suction and discharge piping at the pump valve connection.
- 5.7.2. Slacken the gland nut (961).
- 5.7.3. Remove the four screws securing the pump head (940) to the gearbox (501). All parts are now accessible for examination and replacement if necessary.
- 5.7.4. Unscrew the plunger (968) from the crosshead (515). Examine for surface wear. Light marking can be polished out with a fine metal polish. Deep scoring or corrosion damage will require a replacement plunger. Refit the plunger with a thread sealant e.g. Loctite 270 or an equivalent.
- 5.7.5. Unscrew the gland nut. Extract the chevron packing set (1473) and the neck ring (982) if fitted. Examine for wear damage and replace as required.
- 5.7.6. Reassemble in the reverse order ensuring the correct orientation of the chevron packing set and the neck ring. Screw the gland nut loosely back onto the pumphead. Wet the plunger and gently ease the pumphead assembly over the plunger. Secure the pumphead to the gearbox with the four screws retighten to 20 Nm.
- 5.7.7. Reconnect the suction and delivery pipework.
- 5.7.8. Check the chevron packing sealing integrity. Hand tighten the gland nut. Then give turn it 15°. Start the pump with minimum hydraulic load. Check for leakage at the gland nut. If the leakage is persistent, adjust 15° every 15 minutes until the leakage is reduced. When the pump is fully recommissioned it may be necessary to periodically retighten the gland nut. For long plunger packing life it is acceptable to have slight gland leakage. The packing relies on the liquid it is sealing for lubrication. Never overtighten the gland nut otherwise the packing will run dry and wear out. Should any gland leakage be greater than 1 drop per second, tighten the gland nut by 15°. Run the pump and observe any leakage. Repeat as required until the leakage is at an acceptable level. If the Gland still leaks badly after a full turn, the packing will need replacing.

5.8. Gearbox Assembly

- 5.8.1. It is impractical to service the gearbox assembly with the pump is still mounted on the skid base frame. Work is carried out after removing the complete motor as in 5.3. and pump head assembly 5.7..
- 5.8.2. Remove the Drain Plug (71) located at the right hand rear of the Gearbox. Drain the oil into a suitable container for disposal. Remove the Motor Adaptor Plate (500).

Remove the Worm (1001), the Bottom Thrust Bearing (523), Bottom Bearing (525) and the Bottom Bearing Housing (506). Examine all bearings, top and bottom worm journals for wear damage. Discard and replace if required. Remove the Side Cover Plate (519) on the right hand side of the gearbox giving access to the internals. Remove the two bolts holding the Connecting Rod Plate (513) to the crank pin on the Crankshaft (503). Remove the Main Bearing Plate (505), the three screws holding the Bearing Ring (520). Gently push out the crankshaft sub-assembly. Withdraw the Connecting Rod (512) and Crosshead (515) from the Gearbox crosshead bore. Separate the Connecting Rod from the Crosshead by releasing the Grubscrew and knocking out the Crosshead Pin (516). Examine the Crosshead, Connecting Rod, Crosshead Pin and the Crosshead Pin Bush (514) for wear. Replace as required. Remove the screws holding the Wormwheel (1006) to the Crankshaft. Examine the Wormwheel teeth for wear. Replace as required. Check the Main Bearing Ring (556) in the Gearbox. If it is badly worn the Main Bearing Ring will need to be pushed out with a hydraulic press and replaced.

5.8.3. Examine all parts for severe wear or damage. Replace any parts as required.

5.9 Reassembling the Gearbox

5.9.1. Reassembly of Gearbox is reverse of 5.8..

5.9.2. With a hydraulic press, fit the Main Bearing Ring into the Gearbox from the Crosshead bore side until within 1/16" (1.59 mm) of being flush to the housing. Ensure the main Bearing Ring oil hole is in alignment with the bottom Gearbox casing second groove oil hole. Check for a sliding fit between the Worm and Key on the motor shaft, the Crosshead in the Gearbox bore and the Connecting Rod to the Crankshaft. Secure the Wormwheel to the Crankshaft with the retaining screws and thread sealant. Attach the Connecting Rod to the Crosshead with the Crosshead Pin held in by the grubscrew and thread sealant. The Connecting Rod oil holes must be uppermost. Insert the Crankshaft sub-assembly into the Main Bearing Ring in the Gearbox from the opposite side to the Connecting Rod. Locate the Crankshaft pin through the Connecting Rod big end. Fit the Main Bearing Plate to the left hand face of the Gearbox with two gasket and three screws equispaced. The second gasket acts as a spacer and will later be removed. Press the Main Bearing Ring fully home against the Crankshaft and secure with the three retaining screws and thread sealant. Remove the Main Bearing Plate and take out one gasket. Refit the Main Bearing Plate, gasket and secure with the six screws and thread sealant. Fit the Connecting Rod Plate to the Crank Pin end with the two screws and thread sealant. Check for freedom of movement by rotating the Wormwheel by hand. Fit the Bottom Bearing Housing and gasket to the base of the Gearbox. Fit the Bottom Thrust and Bottom Bearings to the lower Worm journal with the Shim Washer (605) between the bearings. Ensure the Bottom Thrust Bearing is uppermost. Insert the worm through the top of the Gearbox to locate into the Bottom Bearing Housing. Turn the Worm by hand to check for freedom of rotation. Fit the Drain Plug, Side Cover Plate, gasket and secure with the six screws and thread sealant.

Undo the Fill Plug (470) located on the Main Bearing plate. Fill with oil upto the Fill Plug level. Refit the Fill Plug. If originally fitted, reassemble the Top Bearing Housing. Fit the Motor Adaptor Plate. Without dislodging the Key fit the Motor onto the Gearbox sub-assembly.

5.10. Final Assembly

- 5.10.1. Fit nameplate and crosshead guard
- 5.10.2. Connect wiring to give correct rotation.
- 5.10.3. Run-in the gearbox for 2 hours. Drain the gearbox and refill with fresh oil.
- 5.10.4. Replace pumphead and valve assemblies. The complete pump is ready for commissioning. Check the pump for unusual noises and vibration. For the first 14 days operation, expect the pump gearbox to run at a temperature of 65-70°C. This will in no way affect the overall pump performance.

5.11. Spare Parts

- 5.11.1. Spare parts can be identified to drawing by part number. Always quote pump serial number which can be found on pump crankcase cover. Parts should be ordered from:-

**Grosvenor Pumps Limited,
Trevoole, Praze,
Camborne, Cornwall. TR14 0PJ
Tel. 01209 831500 Fax. 01209 831939**

5.12. Lubrication

- 5.12.1. The pump is empty when supplied, but should be filled before commissioning. Recommended grades are shown on pump nameplate for major oil companies. Equivalent grades for other oil companies are listed here. The oil level is determined by level plug and should be checked weekly. Change approximately every 6 months. All gearbox parts are lubricated by splash. Motor bearings are fully charged with grease for life by manufacturer.

Oil capacity - 8 litres Approx.

5.13. Approved Lubricants

- 5.13.1. Oil grades based on ambient temperatures, suitable for normal applications. The recommendations are based on current information available and responsibility cannot be accepted for quality or suitability of oil supplied nor to any mechanical defect due to unsatisfactory lubrication.
- 5.13.2. Oils marked * contain mild E.P. additives and should not be used for units operating above 80°C normal running temperatures.
- 5.13.3. In general these oils should not be used below -4°C. If intended for such use, Grosvenor Pumps can recommend suitable oils for lower temperatures. Oils marked # are usually obtainable at most garages and motor factors.

SUPPLIER

BP Oil Ltd.

Burmah - Castrol (UK) Ltd.

Esso Petroleum Ltd.

Mobil Oil Co. Ltd.

Shell

Texaco Ltd.

OILS

Energol HLP 320

Energol CS 320 *

Hypogear 90 EP #

Alpha ZN 320

Castrol ST 90 #

Hypoy EP 90 #

Teresso 320

GX 85W/90

DTE AA

HD 140 #

GX 140 #

Vitrea 320 *

Macoma R 320 *

Tellus V320

HD 90/140#

Regal R & O 320