

OPERATION &
MAINTENANCE MANUAL

M-TYPE PISTON

ISSUE 1

REF. No.: om-manualm-type.doc

1st September 2010

**Grosvenor Pumps Limited
Trevoole, Praze,
Camborne,
Cornwall.
TR14 0PJ
United Kingdom**

CONTENTS LIST

SECTION TITLE	PAGE
1. GENERAL DESCRIPTION	3
1.1. M-Type Piston Pump	4
2. TECHNICAL DATA	5
2.1. Pump	6
2.2. Material	9
2.3. Port	9
2.4. Motor - Standard	9
2.5. Dimensions	9
2.6. M-Type Piston Pump - Diagram of Parts	10
2.7. Installation Detail - M-Type Piston Pump - RG225 latest issue	11
2.8. Wiring Connection Diagram - Motors - GP1204 latest issue	12
3. SAFETY	13
3.1. Standard Precautions	14
4. INSTALLATION AND COMMISSIONING	15
4.1. Mounting	16
4.2. Pipe Connections	16
4.3. Gearbox Oil	16
4.4. Electrical	16
4.5. Commissioning	17
4.6. General Operation	17
5. MAINTENANCE	18
5.1. Safety	19
5.2. General Maintenance	19
5.3. Motor	19
5.4. Suction and Delivery Valve Assemblies	19
5.5. Pumphead Assembly	19
5.6. Gearbox Assembly	20
5.7. Final Assembly	20
5.8. Spare Parts	21
5.9. Lubrication	21
5.10. Approved Lubricants	21

SECTION 1

GENERAL DESCRIPTION

1. GENERAL DESCRIPTION

1.1. M-Type Plunger Pump

- 1.1.1. The M-Type Plunger Pump is a fixed output double acting piston pump. The pump consists of an electric motor driving a worm/worm wheel mesh gearbox with a crank/conrod mechanism. This reciprocates a piston assembly within in a pumphead. Poppet type suction and delivery valves are fitted into the pumphead. 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 complete within packaged tank units or in a variety of standard or custom built assemblies.
- 1.1.2. The pump duties range from 295 l/h @ 20 bar to 2318 l/h @ 6.2 bar.
- 1.1.3. The standard 4 pole IP55 electric motor with a 415 VAC 3 phase 50 Hz supply gives a stroke speed of 100/160/240 strokes/minute depending on the gear ratio fitted. Power is dependent upon the duty pressure. Other motor options for hazardous environments or special projects are available on request.
- 1.1.4. The gearbox case is manufactured from cast iron. The standard wetted parts are cast iron pump head and brass valve assemblies with nitrile chevron packings. Other materials are available to special order. The standard units are suitable with liquids upto 100°C.
- 1.1.5. The standard inlet and outlet port connections are 1" BSP. Other connections, i.e. NPT, flanges are available on request.
- 1.1.6. A full range of accessories are available including loading valves, relief valves and electrical starters.

SECTION 2

TECHNICAL DATA

2. TECHNICAL DATA

2.1. Pump

2.1.1. Stroke speed - 100 min⁻¹

Pump Size Bore x Stroke	Output L/Hr at P max.	Pressure Bar	Speed SPM	Motor kW	Port Connections	Product Code	
						3 ph	1 ph
1.7/16" x 1"	295	20	100	0.37	1" BSP	6180	6181
1.1/4" x 1.1/2"	318	20	100	0.37	1" BSP	6182	6183
1.9/16" x 1.1/8"	377	20	100	0.37	1" BSP	6184	6185
1.3/4" x 1"	430	17.9	100	0.37	1" BSP	6186	6187
		20		0.55		6188	6189
1.3/4" x 1.1/8"	522	15	100	0.37	1" BSP	6190	6191
		20		0.55		6192	6193
2" x 1.1/8"	682	11.7	100	0.37	1" BSP	6194	6195
		17.2		0.55		6196	6197
		20		0.75		6198	6199
2" x 1.1/2"	840	8.3	100	0.37	1" BSP	6200	6201
		12.4		0.55		6202	6203
		17.2		0.75		6204	6205
		20		1.1		6206	6207
2.1/8" x 1.1/2"	1000	7.5	100	0.37	1" BSP	6208	6209
		11.7		0.55		6210	6211
		14.5		0.75		6212	6213
		19		1.1		6214	6215
		20		1.5		6216	6217

2.1.2. Stroke speed - 160 min⁻¹

Pump Size Bore x Stroke	Output L/Hr at P max.	Pressure Bar	Speed SPM	Motor kW	Port Connections	Product Code	
						3 ph	1 ph
1.7/16" x 1"	445	12.7	160	0.37	1" BSP	6116	6117
		14.5		0.55		6118	6119
		20		0.75		6120	6121
1.1/4" x 1.1/2"	522	12	160	0.37	1" BSP	6122	6123
		15.2		0.55		6124	6125
		20		0.75		6126	6127
1.9/16" x 1.1/8"	659	11.7	160	0.37	1" BSP	6128	6129
		17.2		0.55		6130	6131
		20		0.75		6132	6133
1.3/4" x 1"	730	10	160	0.37	1" BSP	6134	6135
		14.5		0.55		6136	6137
		18.6		0.75		6138	6139
		20		1.1		6140	6141
1.3/4" x 1.1/8"	863	8.3	160	0.37	1" BSP	6142	6143
		13.8		0.55		6144	6145
		16.5		0.75		6146	6147
		20		1.1		6148	6149
2" x 1.1/8"	1090	5.2	160	0.37	1" BSP	6150	6151
		8.3		0.55		6152	6153
		10		0.75		6154	6155
		12.4		1.1		6156	6157
		17.2		1.5		6158	6159
2" x 1.1/2"	1455	4.5	160	0.37	1" BSP	6160	6161
		6.2		0.55		6162	6163
		8.6		0.75		6164	6165
		11		1.1		6166	6167
		15.2		1.5		6168	6169
2.1/8" x 1.1/2"	1613	3.4	160	0.37	1" BSP	6170	6171
		5.5		0.55		6172	6173
		6.9		0.75		6174	6175
		10		1.1		6176	6177
		13.8		1.5		6178	6179

2.1.3. Stroke speed - 240 min⁻¹

Pump Size Bore x Stroke	Output L/Hr at P max.	Pressure Bar	Speed SPM	Motor kW	Port Connections	Product Code	
						3 ph	1 ph
1.7/16" x 1"	636	8.9	240	0.37	1" BSP	6048	6049
		12		0.55		6050	6051
		17		0.75		6052	6053
		20		1.1		6054	6055
1.1/4" x 1.1/2"	772	8.6	240	0.37	1" BSP	6056	6057
		12		0.55		6058	6059
		16		0.75		6060	6061
		20		1.1		6062	6063
1.9/16" x 1.1/8"	909	8.2	240	0.37	1" BSP	6064	6065
		11.7		0.55		6066	6067
		15		0.75		6068	6069
		20		1.1		6070	6071
1.3/4" x 1"	1025	7.2	240	0.37	1" BSP	6072	6073
		10.6		0.55		6074	6075
		13.4		0.75		6076	6077
		20		1.1		6078	6079
1.3/4" x 1.1/8"	1160	6.2	240	0.37	1" BSP	6080	6081
		9.6		0.55		6082	6083
		11.7		0.75		6084	6085
		17		1.1		6086	6087
2" x 1.1/8"	1636	20	240	1.5	1" BSP	6088	6089
		4.8		0.37		6090	6091
		6.9		0.55		6092	6093
		9		0.75		6094	6095
2" x 1.1/2"	2045	13.8	240	1.1	1" BSP	6096	6097
		19		1.5		6098	6099
		3.4		0.37		6100	6101
		5		0.55		6102	6103
2.1/8" x 1.1/2"	2318	6.9	240	0.75	1" BSP	6104	6105
		10		1.1		6106	6107
		14.5		1.5		6108	6109
		3		0.37		6110	6111
		4.8		0.55		6112	6113
		6.2		0.75		6114	6115

2.2. Material

Pump head	
Standard	Cast iron
Optional	316L stainless steel
Chevron packing	
Standard	Nitrile
Option	Viton
Option	PTFE (10 Bar maximum)
Valve assembly	
Standard	Brass
Optional	316L stainless steel

2.3. Ports

1 " BSP

2.4. Motor - Standard

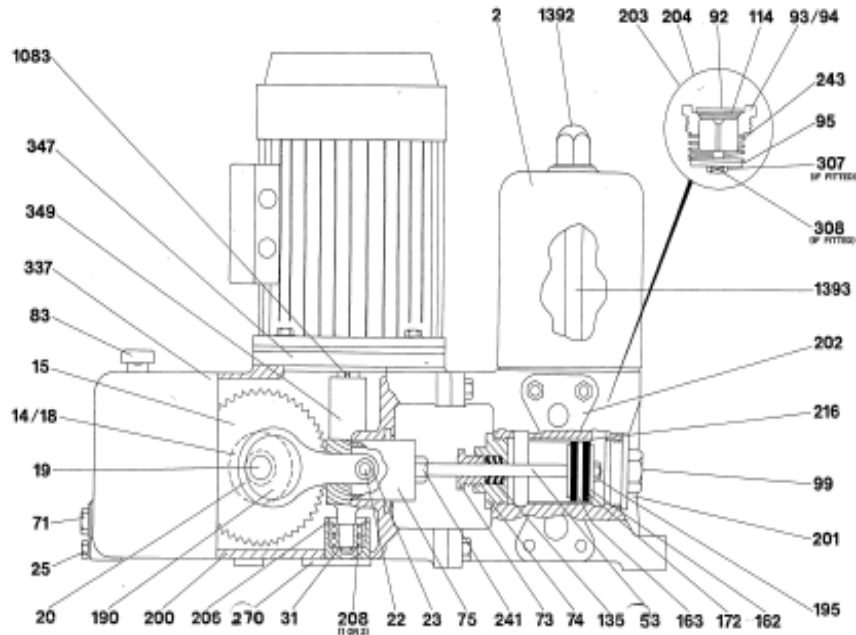
Above duties are based on the following motor parameters. Other motor specifications are available on request.

Type	IP55 4 pole TEFC
Speed	1500 rev/min
Supply	
Standard	415 VAC/3 ph/50 Hz (star)
	240 VAC/3 ph/50 Hz (delta)
Optional	240 VAC/1 ph/50 Hz
Operation	Continuous

2.5. Dimensions, Typical

Weight	50 kg nett
Overall Length	450mm
Overall Height	200mm
Overall Width	400mm

2.6. M-Type Piston Pump - Diagram of Parts



KEY TO DIAGRAM OF PARTS

Ref. No. Part Name	Ref. No. Part Name	Ref. No. Part Name
2 Air Vessel	83 Crankcase Breather	203 Valve Assembly — suction (2 off)
14 Main Bearing (long)	92 Valve	204 Valve Assembly — delivery (2 off)
15 Worm Wheel	93 Valve Seat — suction	206 Circlip 1 5/16"
18 Main Bearing (short)	94 Valve Seat — delivery	208 Bottom Bearing (1 or 2)
19 Main Spindle	95 Valve Spring Support	216 Cylinder Liner
20 Connecting Rod	99 Cylinder End Cover	241 Pump Rod Lock Nut
22 Crosshead Pin	114 Valve Seat "O" Seal	243 Valve Spring
23 Crosshead Pin Bush	127 Crosshead Oil Seal (if fitted)*	270 Bottom Bearing Housing
25 Drain Plug	135 Gland Packing Rings	307 Valve Lock Nut (if fitted)
31 Circlip 1/2"	162 Bucket Plate	308 Valve Split Pin (if fitted)
53 Pump Rod	163 Bucket Middle	337 Crankcase Cover
57 Gasket Set	172 Bucket Cups	347 Motor Adaptor Plate
69 Worm Top Bearing (if fitted)*	190 Eccentric	349 Worm
71 Oil Level/Filler Plug	195 Pump Rod Nut	1083 Motor Shaft Key
73 Gland Nut	200 Gearbox Case	1392 Air Vessel Nut
74 Stuffing Box	201 Pump End Body	1393 Air Vessel Stud
75 Crosshead	202 Companion Flange	

* Not Illustrated

Above Reference Numbers may differ from actual Part Numbers of spares supplied due to range of sizes made

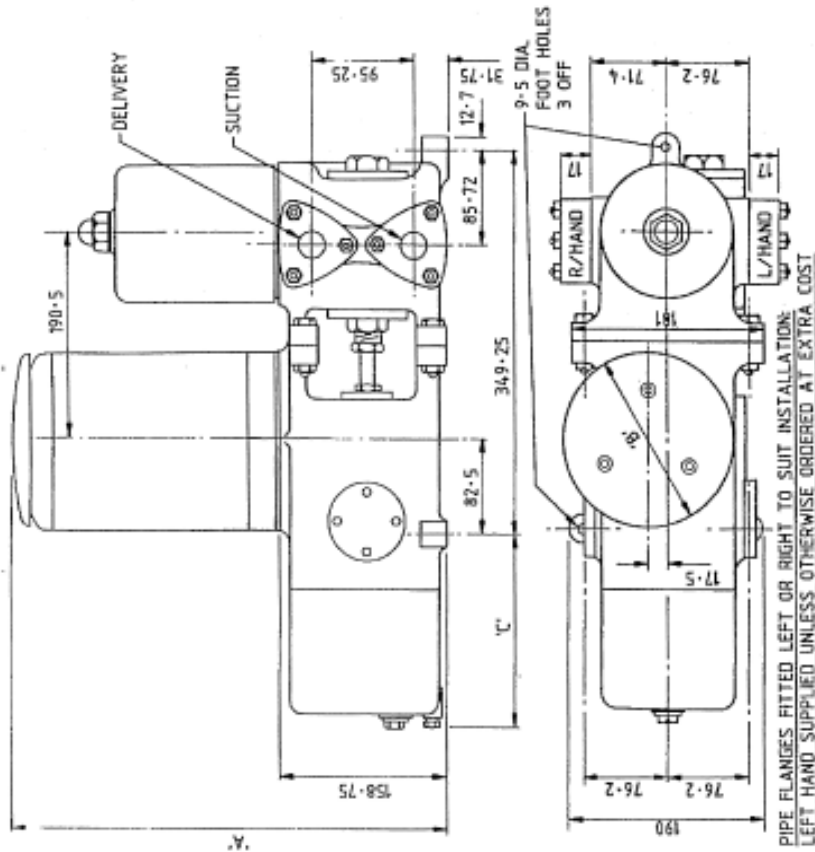
INSERT SERIAL NUMBER HERE

FOR FUTURE USE

ALWAYS QUOTE PUMP SERIAL NUMBER WHEN ORDERING PARTS

2.7. Installation Detail - M-Type Plunger Pump RG225 latest issue

M Type Piston Pump Installation Detail



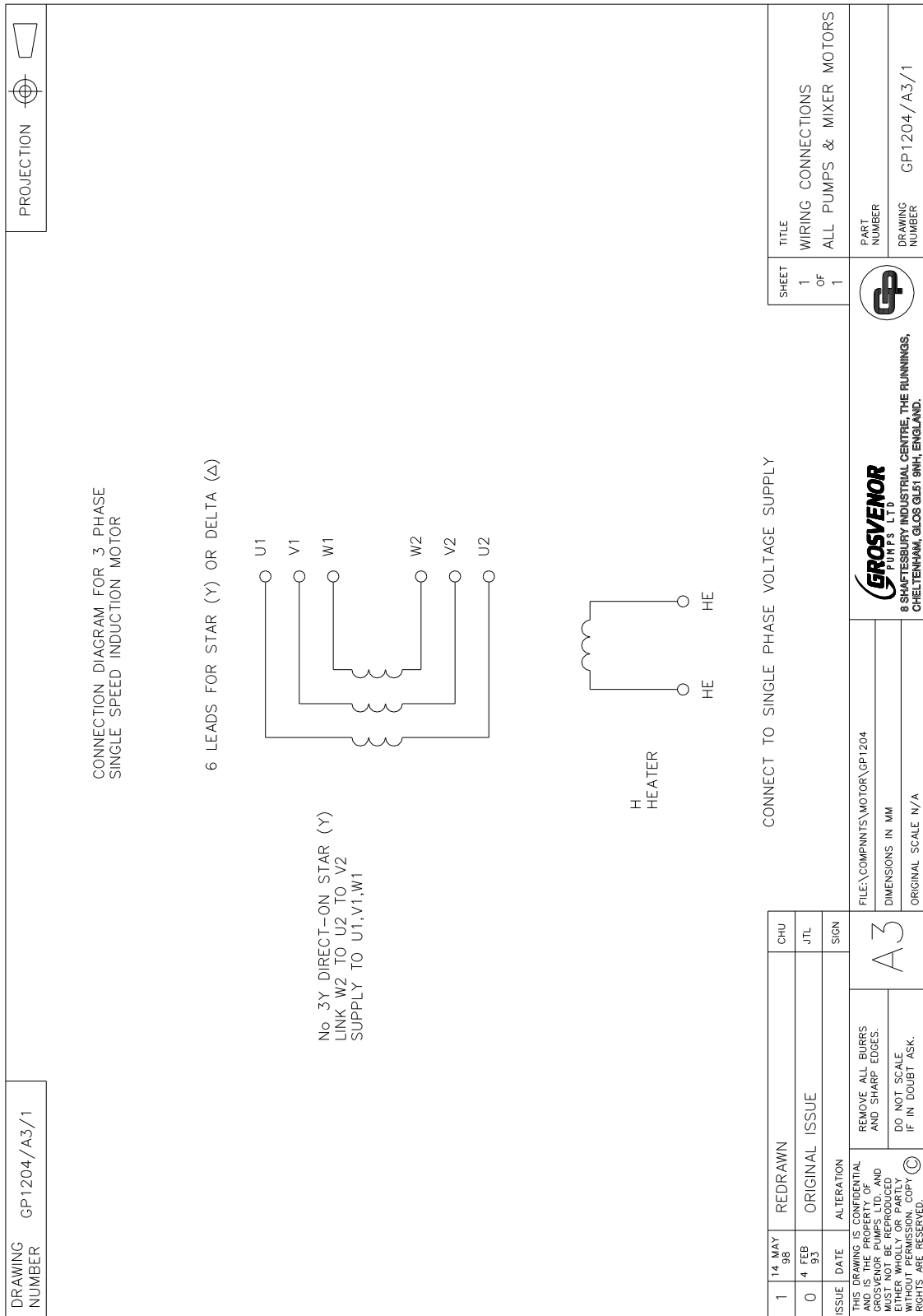
MOTOR SIZE	ELEC. SUPPLY	A DIMENSION		B DIM	C DIM
		IP44 (FHP-856)	IP55 METRIC		
0-18kW	240V	394		175	92
	415V	394			
0-37kW	240V	402		175	92
	415V	402			
0-55kW	240V	421	4.47	175	92
	415V	402	4.17		
0-75kW	240V		4.47	200	165
	415V		4.17		
1-1kW	240V		4.40	200	165
	415V		4.11		
1-5kW	240V		4.65	200	165
	415V		4.35		

NOTE:
 PIPE FLANGES CAN BE SUPPLIED 1/2" OR 1" B.S.P. TO SUIT PUMP OUTPUT AND INSTALLATION REQUIREMENTS
 2 PIPE FLANGES SUPPLIED WITH PUMP

DRG No. RG 225/A3/3

M Type Double Acting Piston Pump - Dimensional Drawing

2.8. Wiring Diagram - GP1204 latest issue



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 & COMMISSIONING

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. The pump is designed to be self-priming. 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 to fill large diameter and/or long pipe lengths to build up hydraulic pressure. If the pressure does not increase, check:-
 - 4.2.3.1. All joints are tight and fully sealed and any dump/flushing valves are shut.
 - 4.2.3.2. The relief valve is adjusted to the correct pressure.
 - 4.2.3.3. The suction and delivery lines are connected to the correct pump ports.
 - 4.2.3.4. The liquid is free of large debris and contaminants. Large solids will reduce valve efficiency. Fit a suction strainer/filter.
 - 4.2.3.5. 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 bottom thread of the larger 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 anti-clockwise when viewed from the fan side of the motor. For three phase supply, if the rotation is clockwise, change any two of the three supply phases over. The direction for single phase motors has been factory set to be anti-clockwise. However, if the rotation is clockwise interchange the blue and yellow leads on terminals 2 and 3.
- 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 forced ventilation 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 pressure and full 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.

4.6. General Operation

- 4.6.1. Operate the pump within the duty specified in the customer's order. Please note that the performance data specified in section 2.1. is the maximum capable for each pump.
- 4.6.2. Never run the pump dry for more than 5 minutes or the plunger chevron packing will wear out prematurely.
- 4.6.3. Check the pump will operate satisfactorily if it is to be used for another duty, i.e. different liquid, pressure, environment, power supply.
- 4.6.4. Always handle the pump by gripping the gearbox case and not by the pump head or any pipework attached to the pump head.
- 4.6.5. For long pump rod packing life it is acceptable for slight leakage at the gland. The packing relies on the liquid it is sealing for lubrication. Never overtighten the gland nut or the packing will run dry and wear out prematurely. Should 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 leakage is at an acceptable level. If the packings still leaks after a full turn, they will need replacing.
- 4.6.6. Check the pump for excessive vibration and overheating.
- 4.6.7. Ensure that all associated instruments are functioning correctly and the readings are meaningful. Periodically check the pump is maintaining delivery and pressure. Check the motor current is within its acceptable operation limit.

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 easily dismantled using standard engineers' tools, however a special tool is recommended to remove the valve assemblies.

5.2.2.

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. The motor 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 key (1083) 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 anti-clockwise when viewing motor on the fan end.

5.4. Suction Valve and Delivery Valve Assemblies

- 5.4.1. The suction valve (203) and delivery valve (204) assemblies are poppet type.
- 5.4.2. Drain and flush the suction and delivery pipe connections. Take extreme care if the chemical is harmful. Disconnect the suction and delivery pipe connections. Remove the 16mm domed nut(1392) and remove the air vessel (2) to reveal the delivery valve assemblies. Remove/unscrew both assemblies using a tubular spanner with cut outs to fit over the "ears" on the valve body. Under the delivery valve assemblies will be the suction valve assemblies. Remove these with the tubular spanner.
A special valve extraction spanner is available for unscrewing the valve assemblies.
- 5.4.3. To completely strip the valve assembly, straighten and pull out the split cotter pin (308). Unscrew the valve spring support (95) holding the valve (95). Examine all parts for wear and/or damage. Check smooth movement as the valve poppet slides in the valve seat. Always renew all O-ring seals.

5.5. Pump Head Assembly

- 5.5.1. The pump head assembly must be removed from the gearbox to replace the piston rod gland packing rings (135) or piston assembly. Rotate the motor by hand to move the pump rod to the back stroke position.

-
- 5.5.2. Remove the end cover(99). Slacken off the pump rod locknut(241). Unscrew piston assembly using pump rod nut (195). Remove the 4 off bolts/studs holding the pump end onto the gearbox casting. The pump end can now be separated from the gearbox.
- 5.5.3. Unscrew the gland nut (73) from the stuffing box (74). Remove the stuffing box from the pump body. The piston and pump rod assembly can now be removed from the pump body.
Examine the pump liner(217) for surface wear. Light marking can be polished out with a fine metal polish. Deep scoring or corrosion damage will require a replacement liner.
- 5.5.4. Remove the gland nut (73). Remove the gland packing rings (135). for wear Carefully inspect the bucket cups(172) and the bucket middle and plates(163 and 162) for excessive wear.
- 5.5.5. Reassemble the pump rod assembly by placing the rear bucket plate, the bucket cup and bucket middle onto the pump rod. Always fit new bucket cups when rebuilding the pump. Push the assembly in from the back of the pump body. Insert the second bucket cup and bucket plate in from the front end of the pump body and secure with the lock nut.
- 5.5.6. Fit new gland packing seals into the stuffing box and loosely fit the gland nut. Fit new gasket ring and place the stuffing box assembly over the pump rod and carefully screw the assembly over the thread onto the pump rod. Screw the stuffing box into the pump body and tighten. Screw the pump rod nut onto the pump rod down to the end of the thread. Position the gearbox crosshead to front dead centre. Secure the pump head to the gearbox with the four bolts.
NOTE: If the gearbox has been overhauled then it should be run in before the pump end is fitted. Please refer to sections 5.6 and 5.7.4.
- 5.5.7. Using the front lock nut, on the end of the pump rod, screw the pump rod assembly into the crosshead until the lip of the front bucket cup is approximately 2mm inside the chamfer of the pump liner. Tighten the pump rod nut against the crosshead. Finally tighten the front locknut securely, fit new gasket ring to the front cover and screw on the cover and tighten.
- 5.5.8. Using a non setting gasket cement, replace the two suction and two delivery valve assemblies using the tubular spanner. Do not overtighten. Using a new air vessel gasket, replace the air vessel and secure tightly with the domed nut.
- 5.5.9. Reconnect the suction and delivery pipework.
- 5.5.10. Check the chevron packing sealing integrity. Hand tighten the gland nut. Then give turn it a 15°. Start the pump with minimum hydraulic load. For long gland packing life it is acceptable to have gland leakage. As a guide, 1 drop per second is a maximum. The gland packing relies on the leakage as its only form of lubrication. 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. Never overtighten the gland nut. Otherwise the packing will run dry and wear out.

5.6. Gearbox Dismantling and Assembly

- 5.6.1. It is impractical to service the gearbox assembly while the pump is mounted on the skid base frame. Work is carried out after removing the complete motor as in 5.3. and pump head assembly 5.5..
- 5.6.2. Drain the gearbox oil by removing the drain plug (25). Remove the crankcase cover (337). If fitted, remove the motor adaptor plate (347). On the bottom face of the pump gearbox, unscrew the three countersunk head screws holding the bottom bearing housing (270). With a pair of internal circlip pliers remove the retaining circlip (206) holding the worm bearing (208) in the bottom bearing housing. After separating the bottom bearing housing, remove the circlip (31) holding the worm bearings to the worm (349). Remove the lock grub screw in the eccentric (190). Remove the long and short main bearings (14/18) and push the main shaft (19) out. Pull out the connecting rod (20) and crosshead (75). Remove the crosshead pin lock screw and push out the crosshead pin (22).
- 5.6.3. Examine all parts for severe wear or damage. Replace any parts as required.
- 5.6.4. Reassembly of gearbox is reverse of 6.6.2. Replace all gaskets and seals.

5.7. Final Assembly

- 5.7.1. Fit the motor.
- 5.7.2. Fit nameplate and crosshead guard
- 5.7.3. Connect wiring to give correct rotation. Note the directional arrow on the gearbox casing.
- 5.7.4. Run-in for the Gearbox for 2 hours. Drain the gearbox and refill with fresh oil.
- 5.7.5. Replace pump head 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.

5.8. Spare Parts

- 5.8.1. 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

5.9. Lubrication

- 5.9.1. 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 - 0.7 litres Approx. Always fill to the lower threads of the Oil level/Filler plug (71).

5.10. Approved Lubricants

- 5.10.1. 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.
- 5.10.2. Oils marked * contain mild E.P. additives and should not be used for units operating above 80°C normal running temperatures.
- 5.10.3. 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.

OILS

Energol HLP 320

Energol CS 320 *

Hypogear 90 EP #

Alpha ZN 320

Castrol ST 90 #

Hypoy EP 90 #

Esso Petroleum Ltd.

Teresso 320

GX 85W/90

Mobil Oil Co. Ltd.

DTE AA

HD 140 #

GX 140 #

Shell

Vitrea 320 *

Macoma R 320 *

Tellus V320

HD 90/140#

Texaco Ltd.

Regal R & O 320