

OPERATING & MAINTENANCE MANUAL

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ISSUE 3

GROSVENOR PYGME VARIFLOW DIAPHRAGM PUMP MK 3

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SECTION 1

GENERAL DESCRIPTION

1. GENERAL DESCRIPTION

1.1. Grosvenor Pygme Variflow Diaphragm Pump Mk 3

- 1.1.1. The Pygme Variflow Diaphragm Pump MK 3 is a variable output single acting diaphragm pump with high efficiency ball suction and delivery valves. High grade engineering plastics for wetted parts enable a wide range of aggressive liquids to be handled and the absence of any gland offers zero leakage. Drive from a vertical flange mounted motor is through a worm and wheel to an eccentric cam operating the diaphragm through a connecting rod.
- 1.1.2. The pumps are manufactured in two diaphragm sizes; 4" and 6" with stroke lengths of either 1/2" or 1". The pumps are complete with a standard IP 55 electric motor to give a stroke speed of 60 strokes/minute. For extreme hazardous environments, an air motor can be specified. Other motor options are available on request.
- 1.1.3. The gearbox case is manufactured from cast iron. The standard construction of the pump head is uPVC with PTFE diaphragm and valve balls of glass or 316L stainless steel. Other materials are available to special order. The standard units are suitable with liquids upto 60 °C.
- 1.1.4. The inlet and outlet port connections are available in 1/2" BSP for the 4" pump and 3/4" BSP for the 6" pump as a standard. Other port connections, i.e. NPT, flange ports are available on request.
- 1.1.5. Typical applications are chemical injection, water treatment dosing, sampling or any other application where an economical positive liquid feed is required. The pump can be supplied complete with packaged tank units or in a variety of standard or custom built assemblies.
- 1.1.6. Various accessories are available including loading valves, relief valves and electrical starters.

**SECTION 2
TECHNICAL DATA**

2. TECHNICAL DATA

2.1. Pump

Manufacturer	Grosvenor Pumps Limited
Type	Pygme Variflow Diaphragm MK 3
Sizes	4" x 1/2" - 0-70 L/Hr @ 0 Bar G 6" x 1/2" - 0-240 L/Hr @ 0 Bar G 6" x 1" - 0-350 L/Hr @ 0 Bar G
Material	uPVC pump body 316L stainless steel pump body PTFE pump body PTFE diaphragm (standard) Hytrel diaphragm (optional) Polyurethane diaphragm (optional) Glass valve balls (standard) PTFE valve balls (optional) 316L stainless steel valve balls (optional) Ceramic valve balls (optional)
Inlet Port Size	
4" Diaphragm Pump	1/2" BSP
6" Diaphragm Pump	3/4" BSP
Discharge Port Size	
4" Diaphragm Pump	1/2" BSP
6" Diaphragm Pump	3/4" BSP
Suction Condition	Flooded

2.2. Motor (Standard)

Type	IP 55 4 pole
Speed	1500 rev/min
Supply	415 VAC/3ph/50Hz
Operation	Continuous

SECTION 3

INSTALLATION

3. INSTALLATION

3.1. Pipe Connections

- 3.1.1. The pump should be mounted on a rigid base preferably as low as possible to achieve the best suction condition. The suction and discharge pipe sizes should be larger than the port connections. 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 pipe line as close to the pump as possible. For technical advice, please refer to Grosvenor Pumps.
- 3.1.2. The pump is designed to be self-priming. However, 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 in any way.
- 3.1.3. Delivery pipe bores of large diameters and lengths will require sufficient time before hydraulic pressure will build up. If the pressure does not increase, check that:-
All joints are tight and fully sealed.
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.
- 3.1.4. If there is a high suction head present, a loading valve may be required to prevent syphoning.

3.2. Electrical

- 3.2.1. The motor should be connected to the power supply to give anti-clockwise rotation when viewing the motor from the fan side. If not, then change any two of the three supply phases over. As the pump will operate upto the motor stalling point, it is recommended that electrical and hydraulic protection (overload release and relief valve) is provided.

3.3. General

- 3.3.1. 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 cowl.
- 3.3.2. To avoid damaging the micrometer stroke adjuster, do not use any tools i.e. mole grips, stilson spanners, to turn the micrometer stroke adjuster. Stroke adjustment must be done while the pump is moving. Do not turn the micrometer stroke adjuster while the pump is stationary.

SECTION 4

OPERATION

4. OPERATION

4.1. Standard Precautions

- 4.1.1. To comply with normal safety-standards the following measures are to be taken:
- 4.1.2. 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:
- 4.1.3. Goggles - with wide-angle vision, contact the skin in complete seal around both eyes and adequately vented without allowing access to spillage.
- 4.1.4. Safety Helmet - of metal or reinforced plastic to the relevant British Standard or equivalent.
- 4.1.5. Gloves - wrist length, of soft PVC or rubber permitting full flexure.
- 4.1.6. Overalls - to be worn in conjunction with the items above or a one-piece chemical suit.
- 4.1.7. Standard site safety provisions, safety precautions and first aid instructions, in condensed form shall be promulgated at site and in site vehicles. All employees shall be in possession of literature giving full details of safety precautions and first aid action.
- 4.1.8. The following personal precautions are to be taken when handling chemicals:
- 4.1.9. Wear standard protective clothing and equipment as detailed above.
- 4.1.10. Ensure that the nature and properties of the chemical being handled are known in advance.
- 4.1.11. Ensure that the correct precautions for the chemical being handled are observed. **IF IN DOUBT ASK.**
- 4.1.12. Treat all materials as harmful.
- 4.1.13. Do not touch chemicals or residues with bare hands.
- 4.1.14. Wash away accidental contact immediately.
- 4.1.15. Keep self and clothes clean.
- 4.1.16. Wash contaminated clothing before re-use.
- 4.1.17. Wash thoroughly after handling chemicals. Do not eat drink or smoke unless decontaminated.
- 4.1.18. Erect WARNING barriers where necessary.
- 4.1.19. Follow specific process instruction carefully.
- 4.1.20. Mix chemicals in the order specified.
- 4.1.21. **CAUTION: CHEMICALS CAN BE HARMFUL. PLEASE OBSERVE MANUFACTURER'S HANDLING AND STORAGE GUIDELINES.**
- 4.1.22. Health Hazards - Harmful in contact with the skin and irritating to the eyes.

- 4.1.23. 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.
- 4.1.24. Storage - Keep container in a cool, well ventilated place. Keep away from source of ignition. **NO SMOKING.**
- 4.1.25. 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.

IN ALL CASES SEEK MEDICAL ADVICE AS SOON AS POSSIBLE.

4.2. General

- 4.2.1. Check the system for water and chemical leaks, if the latter, follow the procedures detailed in sections 4.1.1.
- 4.2.2. Check the pump for excessive vibration and overheating.
- 4.2.3. Ensure that all associated instruments are functioning correctly and that their indications are meaningful.
- 4.2.4. 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. Do not exceed 10 Bar G and 5 Bar G for the 4" and the 6" diaphragm pumps respectively or the diaphragm may be ruptured.
- 4.2.5. Check the pump will operate satisfactorily if it is to be used for another duty, i.e. different liquid, pressure, environment, power supply.
- 4.2.6. Always handle the pump by gripping the gearbox case and not by the pump head, valves or any pipework attached to the pump head.
- 4.2.7. Stroke adjustment must be done while the pump is moving. Do not turn the micrometer stroke adjuster while the pump is stationary or damage will occur.

SECTION 5

MAINTENANCE

5. MAINTENANCE

5.1. Safety

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

5.2. Maintenance Interval

5.2.1. Maintenance should be carried at 12 month intervals. The pump unit is easily dismantled using standard engineers' tools. No special tools are required.

5.3. Removal of Motor

5.3.1. Isolate electric supply, disconnect wires from terminal box. The motor lifts off the drive unit after removing fastenings on motor flange. The motor is non-serviceable.

5.4. Replacement of Motor

5.4.1. Insert motor shaft into drive unit, ensuring key is not displaced and that motor goes fully down before tightening flange bolts.

5.4.2. Connect wiring to ensure rotation is anti-clockwise when viewing motor on fan end. (See Drawing GP 1204/A3/0)

5.5. Pump Gearbox

5.5.1. The **Pump Gearbox** is a simple mechanism requiring no special tools. Work is carried out after removing the complete **Motor** as in 5.3. and **Pump End** assembly as in 5.6.. It is impractical to service the **Gearbox** with the **Pump** still mounted in its installed environment.

5.5.2. Access to the internal parts is complete after removing **Crankcase Cover (647)**. The **Worm (1097)** is lifted out (if not already out on **Motor Shaft**). To remove internals first loosen lock screw in **Eccentric (648)** and punch out from either side the **Core Plugs (654)** with centre punch and drift **Main Shaft (650)** out through opposite side. The **Connecting Rod (649)** and the **Crosshead (701)** can be pulled out. Remove the locking screw holding the **Small End Pin (655)** in the **Crosshead** and push out the **Small End Pin**.

5.5.3. Reassembly of **Gearbox** is reverse of 5.5.5.. Refit new **Core Plugs** to each side with a suitable jointing compound.

5.5.4. Refill with the correct grade of oil, replace **Motor** and connect wiring to give correct rotation, 5.4.2. (b).

5.5.6.. Replace pump end assembly as in 5.6..

5.6. Pump Head and Valves

5.6.1. To remove **Pump Head (1768)**, first disconnect suction and discharge piping at the threaded BSPP connection.

5.6.2. Position the **Diaphragm Rod (1295)** to centre stroke.

5.6.3. Remove the six capscrews securing the **Pump Head** to the **Backplate (1242)**. The **Pump Head** can be removed.

- 5.6.4. Unscrew the **Diaphragm Nut (1205)** whilst firmly holding still the **Diaphragm Rod (1293)**. The **Diaphragm Support (Front) (1204D)** can be removed along with the **Diaphragm (1206)**.
- 5.6.5. During **Diaphragm** replacement, align the screw holes in the **Diaphragm** to the **Pump Head** holes. Refit the **Diaphragm Support (Front)**. Use a suitable thread sealant i.e. Loctite 222 on the **Diaphragm Nut** threads. Retighten the **Diaphragm Nut**. Refit the **Pump Head** and retighten the securing screws
- 5.6.6. The **Suction** and **Delivery Valve** assemblies can be removed and replaced complete or individual parts replaced. Unscrew the **Valve Body (1751)** from the **Pump Head**. Examine the **Valve Balls (1217)**, **Valve Body**, **Valve Seat (1749)** and **Valve Guide (1750)** for wear and/or damage. Always renew the **Valve Body O-Rings (745)**.
- 5.6.7. When refitting the **Valves**, ensure the **Valve Body O-Rings** are in positioned in their seats before fully tightening. Check that the **Valve Seats** and **Valve Guides** are replaced in the respective **Valve Bodies** in the correct suction or delivery orientation.

5.7. Stroke Adjuster Assembly

- 5.7.1. This unit is grease filled and requires no attention unless a seal leak has occurred and caused severe corrosion.
- 5.7.2. To dismantle the **Adjuster Assembly**, first remove the **Pump Head** as instructed in 5.6.. Remove the **Micrometer Screw (1151)**, **Shuttle Ball (1167)**. The **Shuttle (1154)** can be pushed out of the opposite to the **Circlip (1170)**. Reassemble in the reverse order. Pack the available space with grease.

5.8. Setting the Stroke Lost Motion to Zero

- 5.8.1. Rotate the **Motor** until the **Crosshead (701)** is exactly at the back of its stroke. Rotate the **Micrometer Screw (1151)** anti-clockwise until it reads just beyond the 100% mark. Rotate the **Push Rod (1157)** until contact is made with the **Plunger (1337)**, rotate back a quarter turn and tighten the **Locknut (1177)**.

5.9. Fitting Micrometer Screw or Resetting Calibration

- 5.9.1. To remove or replace the **Micrometer Screw (1151)**, first loosen the **Retaining Screw (1187)** in the **Body (1150)**. Set stroke lost motion to zero as detailed in 5.8.. Insert the **Ball (1167)** with a liberal amount of grease, followed by the **Micrometer Screw** with the **Lock Pad (499)** and **Spring (814)**. Check the loose **Micrometer Outer Sleeve (1152)** mark "0" lines up with the 100% mark on the **Micrometer Screw**. Fix the **Outer Sleeve** in place with a contact adhesive. Fully tighten the **Retaining Screw** and loosen it half a turn.

5.10. Spare Parts (Ref: Section 6.1. Key to Diagram of Parts)

- 5.10.1. Spare parts can be identified to drawing by part number. **ALWAYS QUOTE THE 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**

5.11. Lubrication - Pumps

- 5.11.1. Pumps are empty when supplied and should be filled before starting. 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 at least 2 years by manufacturer.

Oil capacity - Pumps - Approx. 0.3 litres

5.12. Approved Lubricants - Gearboxes

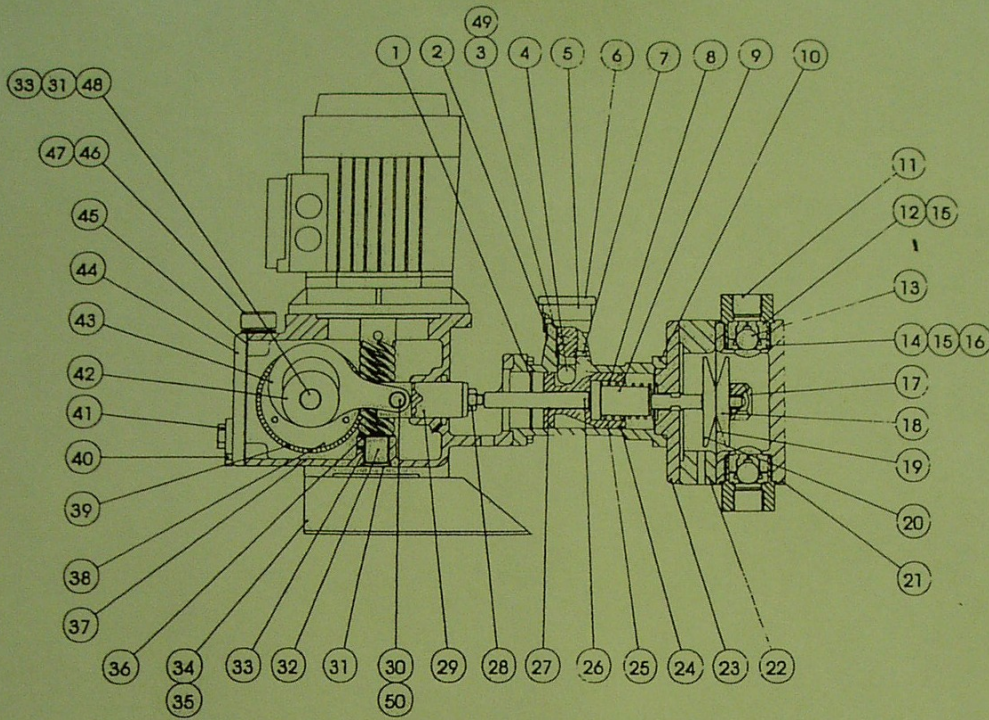
- 5.12.1. Oil grades based on ambient temperatures, suitable for normal applications. The recommendations are based on current information available and responsibility cannot be accepted for quality or suitability of oil supplied nor to any mechanical defect due to unsatisfactory lubrication.
- 5.12.2. Oils marked * contain mild E.P. additives and should not be used for units operating above 80°C normal running temperatures.
- 5.12.3. 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.
- 5.12.4. Oils marked # are usually obtainable at garages and motor factors.

<u>SUPPLIER</u>	<u>OILS</u>
Ampoll Ltd.	320
Baytoyle	320
BP Oil Ltd.	Energol HLP 320 Energol CS 320 *
Burmah - Castrol (UK) Ltd.	Hypogear 90 EP # Alpha ZN 320 Castrol ST 90 # Hypoy EP 90 #
Caltex (UK) Ltd.	Rando 320
Century Oils Ltd.	Centigear G *
Esso Petroleum Ltd.	Centlube UO Teresso 320 GX 85W/90
Gulf Oil (GB) Ltd.	Harmony 320
Kuwait Petroleum Int.	Q8 Verdi 320
Mobil Oil Co. Ltd.	DTE AA HD 140 # GX 140 #
Petrofina (UK) Ltd.	Solna 320 *
Shell	Vitrea 320 * Macoma R 320 * Tellus V320 HD 90/140#
Texaco Ltd.	Regal R & O 320
Total	Azolla ZS 320 Silva 20W/50 #

SECTION 6

PARTS AND DRAWING LIST

**6.1. Grosvenor Pygme Variflow Diaphragm Pump Mk 3
- Key To Diagram Of Parts**



KEY TO DIAGRAM OF PARTS

DRG. NO.	DESCRIPTION	PART REF. NO	DRG. NO.	DESCRIPTION	PART REF. NO
1	CIRCLIP	1170	26	PUSH ROD	1157
2	MICROMETER SLEEVE	1219	27	SHUTTLE BUSH	1168
3	NYLON LOCK PAD	499	28	PUSH ROD LOCK NUT	1177
4	SHUTTLE BALL	1167	29	CROSSHEAD	701
5	MICROMETER SLEEVE OUTER	1218	30	CROSSHEAD PIN	655
6	MICROMETER SCREW	1151	31	CORE PLUG	654
7	MICRO SCREW RETAINER	1187	32	WORM 14 mm BORE	1095
8	DIAPHRAGM RETURN SPRING	1149	33	BEARING BUSH	653S
9	DIAPHRAGM ROD	1293	34	STAND RHS	858
10	STROKE ADJUSTER BODY	1150	35	STAND LHS	859
11	VALVE BODY	1751	36	WORM THRUST WASHER	687
12	VALVE GUIDE	1750	37	GEARBOX CASE	717
13	VALVE BALL	1217	38	ECCENTRIC	822
14	VALVE SEAT	1749	39	WORM WHEEL	1093
15	VALVE BODY O RING	745	40	DRAIN PLUG	25
16	VALVE SEAL	1795	41	LEVEL PLUG	71
17	DIAPHRAGM NUT	1205	42	MAIN THRUST WASHER	686
18	DIAPHRAGM SUPPORT FRONT	1204D	43	CONNECTING ROD	649
19	DIAPHRAGM	1206	44	CRANKCASE COVER	647
20	DIAPHRAGM SUPPORT BACK	1204A	45	CRANKCASE GASKET	689
21	PUMP HEAD	1768	46	BREATHER BODY	730
22	BACK RING	1243	47	BREATHER CAP	731
23	BACK PLATE	1242	48	MAIN SPINDLE	650
24	SHUTTLE RING	1169	49	SPRING	814
25	SHUTTLE	1154	50	CROSSHEAD PIN BUSH	656S

Above Ref. Nos. may differ from Part No. due to range of sizes manufactured

ALWAYS QUOTE PUMP SERIAL NUMBER WHEN ORDERING PARTS

6.2. DRAWING LIST

6.2.1. **CAUTION: THE FOLLOWING DRAWINGS ARE NOT ORIGINAL AND ARE REDUCED IN SIZE FOR THE CONVENIENCE OF THE DOCUMENT USER. THEREFORE, WHERE APPLICABLE, THEY ARE NO LONGER TO SCALE.**

TITLE	DRAWING No.
(a). Pygme Variflow Diaphragm Pump 4" MK 3 - Installation Details	GP1531
(b). Pygme Variflow Diaphragm Pump 6" MK 3 - Installation Details	GP1530
(c). Wiring Connection Diagram - Motors	GP1204