

OPERATION &
MAINTENANCE MANUAL
PYGME VARIFLOW PLUNGER PUMP

ISSUE 9

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OPERATION AND MAINTENANCE MANUAL PYGME VARIFLOW PLUNGER PUMP

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**OPERATION AND MAINTENANCE MANUAL
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SECTION 1

GENERAL DESCRIPTION

OPERATION AND MAINTENANCE MANUAL PYGME VARIFLOW PLUNGER PUMP

1. GENERAL DESCRIPTION

1.1. Pygme Variflow Pump

- 1.1.1. The Pygme Variflow Pump is a variable output single acting positive displacement plunger pump. A wide range of wetted parts materials enable a broad number of applications to be handled. The prime mover is a vertical flange mounted motor driving a worm and wormwheel gear set. This turns an eccentric cam which reciprocates a plunger in and out of the pump head assembly. 0-100% flow control is given by turning a micrometer hand knob on a lost motion stroke adjuster.
- 1.1.2. The pumps are manufactured in a number of plunger diameters between 1/2", 3/4" and 1" 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 hazardous environments, an air motor can be specified. Other motor options are available on request.
- 1.1.3. The standard construction of the pump head is 316L stainless steel with nitrile wetted parts. Other materials are available to special order. The standard units are suitable with liquids upto 120°C.
- 1.1.4. The standard suction and delivery port connection is 1/4" BSP. Other ports options are available on request.
- 1.1.5. 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 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.

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SECTION 2

TECHNICAL DATA

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2. TECHNICAL DATA

2.1. Pump

Manufacturer	Grosvenor Pumps
Type	Pygme Variflow plunger
Size	0-5 l/hr @ 100 Bar G
	0-11 l/hr @ 100 Bar G
	0-24 l/hr @ 100 Bar G
	0-46 l/hr @ 55 Bar G
Inlet and outlet port Size	1/4" BSPP
Material	
Pump body	316L stainless steel
Gland Packing	
Standard	Nitrile
Optional	PTFE Viton
Valve balls	
Standard	316L stainless steel
Optional	PTFE Ceramic Glass
Suction Condition	Flooded

2.2. Motor - Standard

Type	IP55 4 pole
Power	0.18/0.37 kW
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

2.3. Dimensions

Weight	27 kg nett
Overall Length	495 mm
Overall Height	395 mm
Overall Width	165 mm

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SECTION 3

PARTS LIST & DRAWINGS

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3. PARTS & DRAWING LIST

3.1. PARTS LIST

3.1.1. Parts Schedule - Gearbox Assembly

<u>Drg. No.</u>	<u>Description</u>	<u>Qty.</u>	<u>Part No.</u>
1	GEARBOX	1	717
2	MAIN SHAFT	1	650
3	WORMWHEEL	1	689
4	ECCENTRIC	1	648
5	ECCENTRIC-COMPLETE (OPTION)	1	862
6	CONNECTING ROD	1	649
7	MAIN THRUST WASHER	1	686
8	M6-1 x 20 SKT HD CAP SCREW	3	
9	M8-1.25 GRUBSCREW	1	
10	BEARING BUSH	3	693
11	CORE PLUG	3	654
12	CROSSHEAD	1	701
13	SMALL END PIN	1	655
14	M5-0.8 GRUBSCREW	1	
15	WORM	1	727
16	WORM THRUST WASHER	2	687
17	CRANKCASE BREATHER BODY	1	730
18	CRANKCASE BREATHER CAP	1	731
19	No. 4 DRIVE SCREW	5	
20	CRANKCASE JOINT	1	699
21	CRANK CASE COVER	1	647
22/23	OIL LEVEL INDICATOR 1/2" BSP	1	1773
24/25	DRAIN PLUG 1/4" BSP	1	1771
26	M6-1 x 20 HEX HD SCREW	4	
27	M6 FORM A SPRING WASHER	4	
28	NAMEPLATE	1	66

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3.1.2. Parts Schedule - Micrometer Stroke Adjuster Assembly

<u>Drg. No.</u>	<u>Description</u>	<u>Qty.</u>	<u>Part No.</u>
1	STROKE ADJUSTER BODY	1	1150
2	CIRCLIP	1	1170
3	MICROMETER SCREW	1	1151
4	SPRING	1	814
5	LOCK PAD - NYLON	1	499
6	MICROMETER SLEEVE - OUTER	1	
7	MICROMETER SLEEVE - INNER	1	
8	MICROMETER SCREW RETAINER	1	1187
9	SHUTTLE BALL	1	1167
10	SHUTTLE BUSH	1	1168
11	SHUTTLE	1	1154
12	SHUTTLE RING	2	1169
13	PLUNGER	1	1338
14	RETURN SPRING - PLUNGER	1	1148
15	PUSH ROD	1	1157
16	LOCK NUT - PUSH ROD	1	1177
17	SCREWS - M8 x 25 LONG	4	

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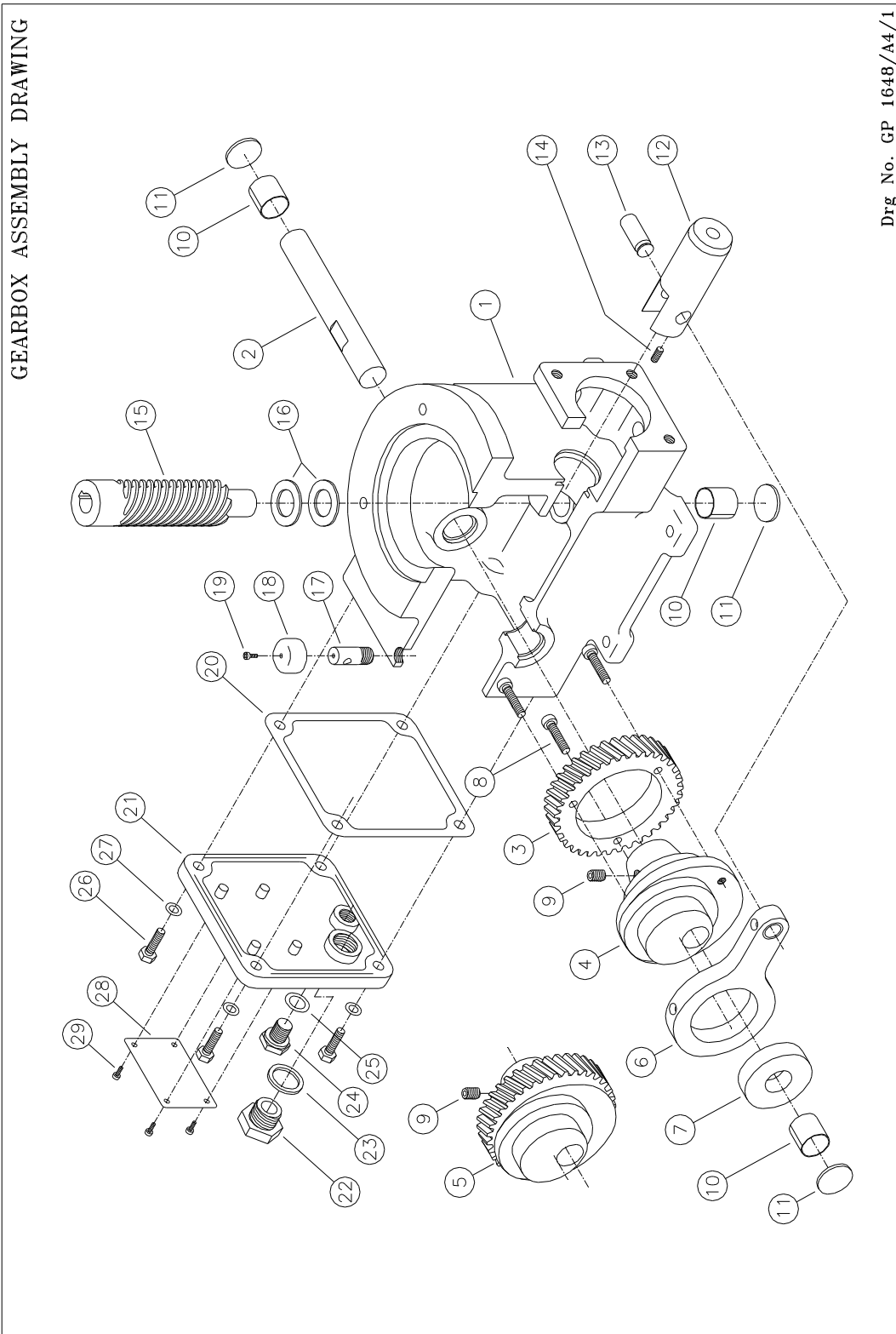
3.1.3. Parts Schedule - 1/2" to 1" Plunger Pump Head Assembly

<u>Drg. No.</u>	<u>Description</u>	<u>Qty.</u>	<u>Part No.</u>
1	PUMP END BODY	1	1165
2	VALVE HOUSING O-RING	2	815
3	DELIVERY VALVE HOUSING	1	809
4	3/16" STAINLESS STEEL BALL	2	812
5	5/16" STAINLESS STEEL BALL	2	813
6	VALVE SPRING	1	814
7	VALVE TOP O-RING	2	816
8	VALVE TOP	1	810
9	SUCTION VALVE WASHER	1	811
10	SUCTION VALVE HOUSING	1	808
11	MAIN SEAL	1	1161
12	GLAND COVER BUSH	1	1189
13	O-RING - GLAND COVER	1	343
14	GLAND COVER	1	1163
15	WIPER RING	1	1214
16	O-RING - WIPER HOUSING	1	1216
17	WIPER HOUSING	1	1211
18	DRAIN TUBE	1	1209
19	SPACER	1	1585
20	SCREWS - M8 x 25 LONG	4	

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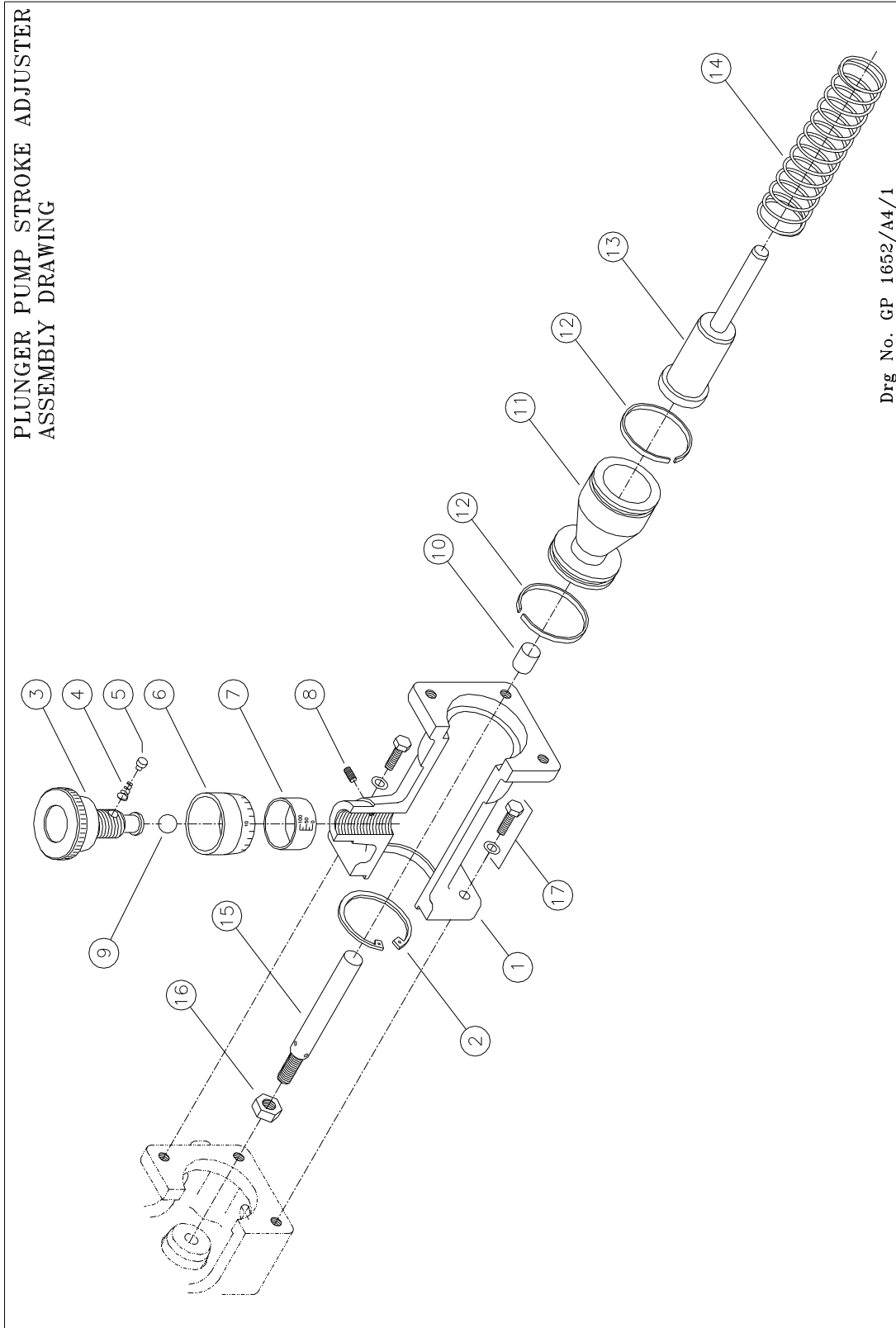
3.2. DRAWINGS LIST

3.2.1. Exploded Diagram - Gearbox Assembly



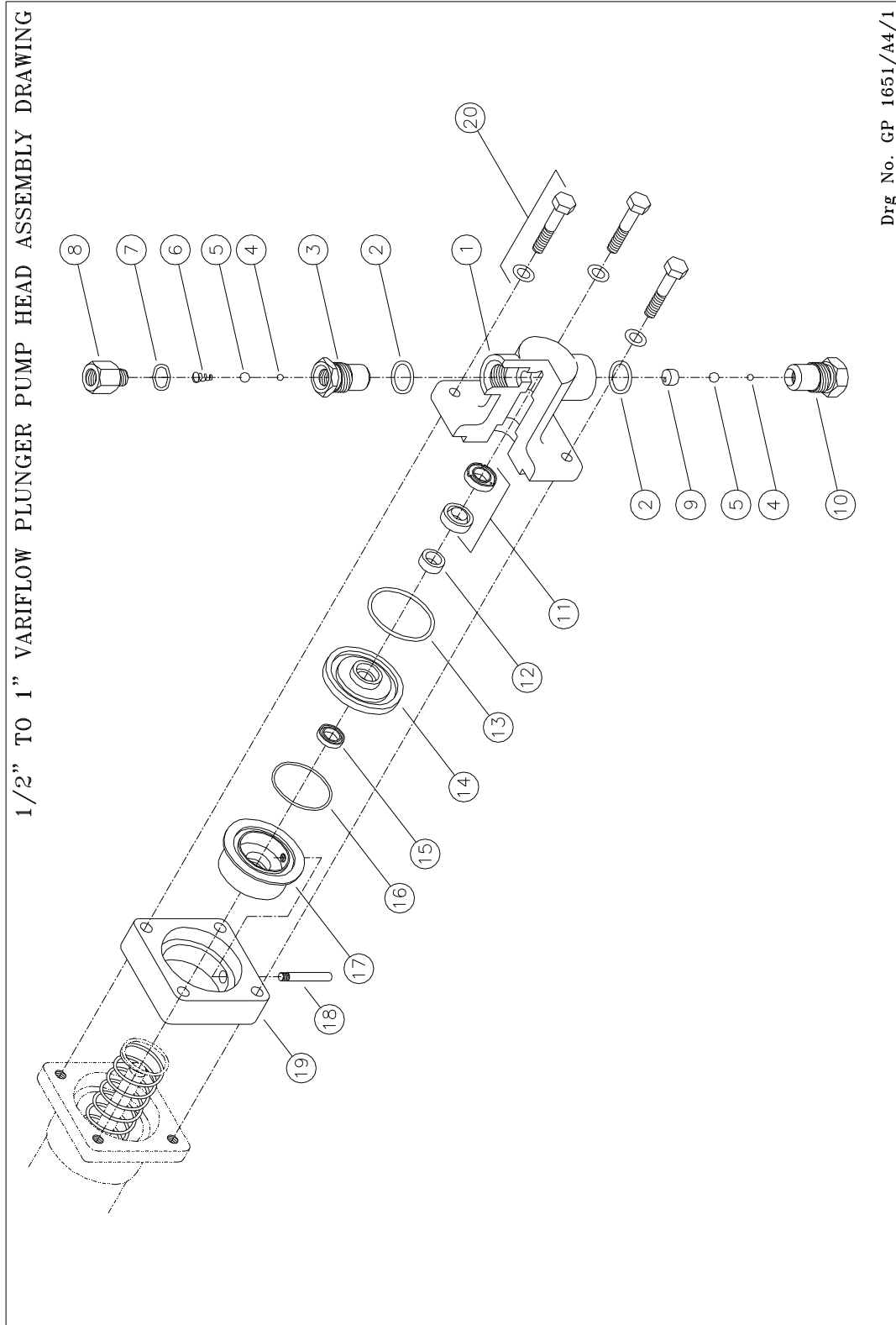
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3.2.2. Exploded Diagram - Stroke Adjuster Assembly



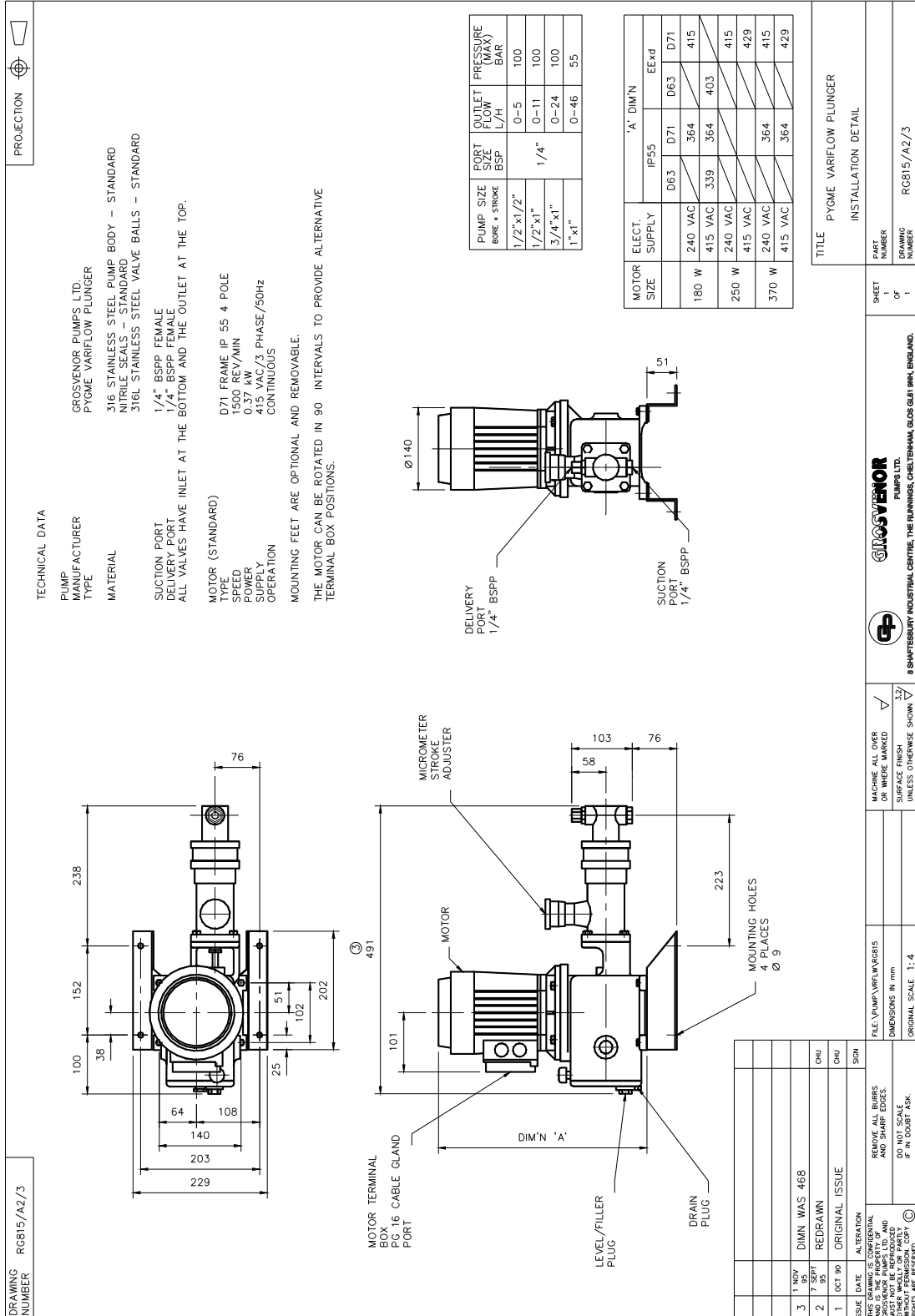
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3.2.3. Exploded Diagram - 1/2" to 1" Variflow Plunger Pump Head Assembly



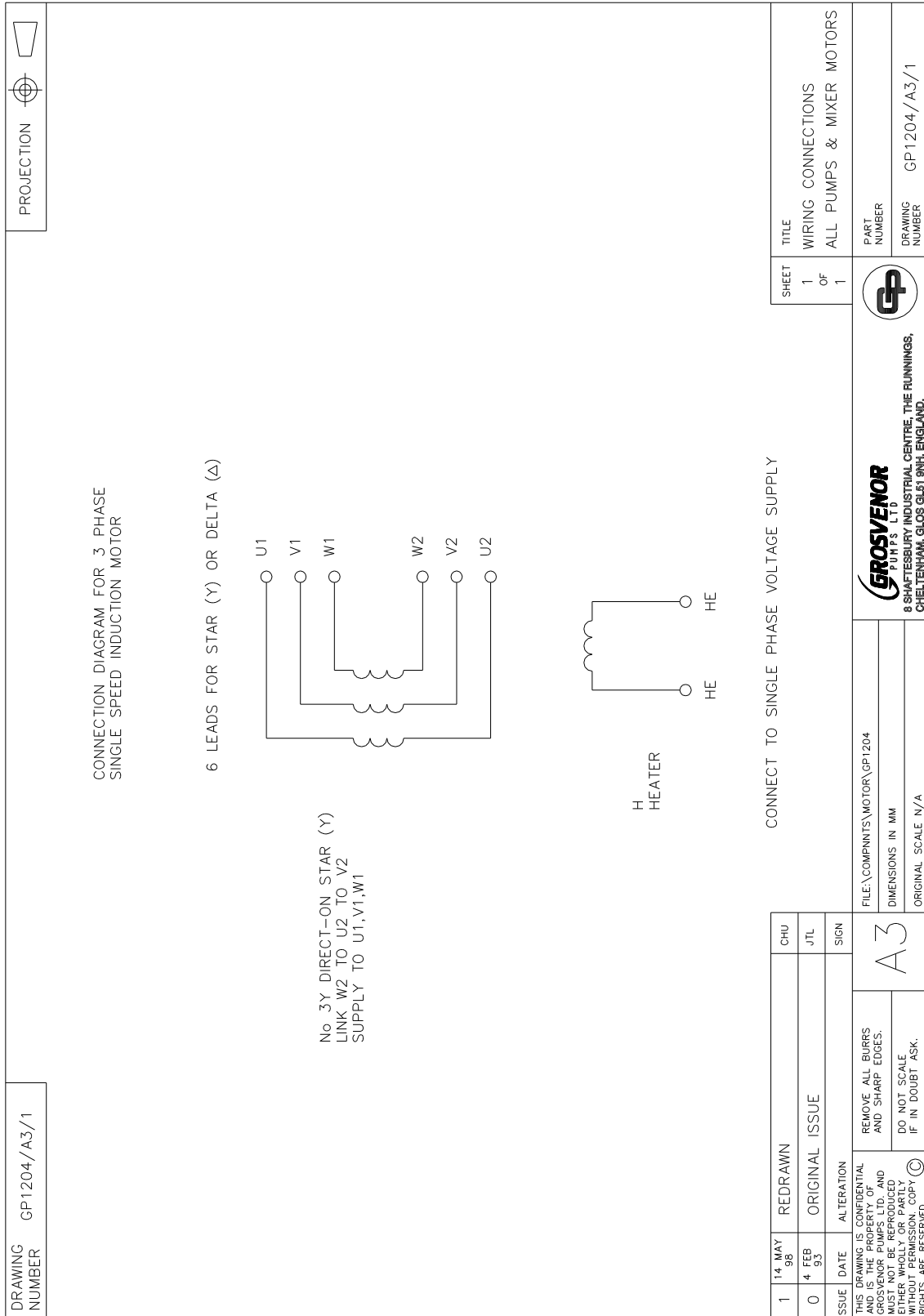
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3.2.4. Pygme Variflow Plunger Pump Installation Detail - RG 815



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3.2.5. Wiring Connection Diagram - Motors - GP 1204



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SECTION 4

SAFETY

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4. SAFETY

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 advertised 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.

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- 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.

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SECTION 5

**INSTALLATION, COMMISSIONING
& OPERATION**

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5. INSTALLATION, COMMISSIONING & OPERATION

5.1. Mounting

- 5.1.1. 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 M8-1.25 screws or suitable floor bolts.
- 5.1.2. 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.

5.2. Pipe Connections

- 5.2.1. 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.
- 5.2.2. 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.
- 5.2.3. Allow sufficient time to fill large diameter and/or long pipe lengths to build up hydraulic pressure. If the pressure does not increase, check:-
 - 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.
- 5.2.4. If there is a high suction head present, a loading valve may be required to prevent syphoning.

5.3. Gearbox Oil

- 5.3.1. Note the pump gearbox is supplied without lubrication oil. Unscrew the orange filler 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 half way up the oil level indicator glass.

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5.4. Electrical

- 5.4.1. Before beginning any electrical work, isolate the supply at the mains.
- 5.4.2. Open up the motor terminal box. Connect up 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.
- 5.4.3. 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.
- 5.4.4. The motor rotation should be anti-clockwise when viewed from the fan side. 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.
- 5.4.5. 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.

5.5. Commissioning

- 5.5.1. After pipe and electrical installation has been completed run the pump between 30 and 60 minutes at minimum hydraulic load 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.

5.6. General Operation

- 5.6.1. 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.
- 5.6.2. Never run the pump dry for more than 5 minutes or the plunger Main Seal will wear out prematurely.
- 5.6.3. Check the pump will operate satisfactorily if it is to be used for another duty, i.e. different liquid, pressure, environment, power supply.
- 5.6.4. Always handle the pump by gripping the gearbox case and not by the pump head or any pipework attached to the pump head.
- 5.6.5. For long plunger Main Seal life it is acceptable for slight leakage at the gland. The main Seal relies on the liquid it is sealing for lubrication. The gland seals are non-adjustable. Should gland leakage be greater than 1 drop per second, the Main Seal will need replacing.
- 5.6.6. Check the pump for excessive vibration and overheating.

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- 5.6.7. Ensure that all associated instruments are functioning correctly and the readings are meaningful.
- 5.6.8. Periodically check the pump is maintaining delivery and pressure. Check the motor current is within its acceptable operation limit.
- 5.6.9. 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. DO NOT USE TOOLS SUCH AS STILSON SPANNER, MOLE GRIPS TO TURN THE MICROMETER STROKE ADJUSTER.**

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SECTION 6

MAINTENANCE

OPERATION AND MAINTENANCE MANUAL PYGME VARIFLOW PLUNGER PUMP

6. MAINTENANCE

6.1. Safety

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

6.2. General Maintenance

- 6.2.1. 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. Special tool Bearing Bush mandrel - Grosvenor Part No. 1841 will be required. Full spares and any special tools are available from Grosvenor Pumps.

6.3. Motor

- 6.3.1. Isolate the electric power supply at the mains. Disconnect wires from the Motor terminal box. The Motor lifts off the Gearbox after removing the four screws on the motor flange. The Worm (727) will come away with the motor shaft. The Motor is non-serviceable. Examine for any wear and/or damage. Replace if necessary.
- 6.3.1. Reposition the Worm in the Gearbox. Insert Motor Shaft into the Worm shaft hole taking care not to dislodge the Key (1081). Press the Motor fully down onto the Gearbox before tightening the four flange screws.
- 6.3.2. Connect wiring to ensure rotation is anti-clockwise when viewing Motor on the fan end. Refer to Section 5.4.

6.4. Valve Assemblies

- 6.4.1. The Suction and Delivery Valve Assemblies 801 & 802 are fitted.

Part 801 & 802

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- 6.4.2. Before removing the Valve Assemblies, flush and drain the suction and delivery lines. Shut off any isolating valves. Unscrew the Valve Assemblies from the Pump Head noting the orientation of the components.
- 6.4.3. Examine all parts for wear or damage. Discard and replace as necessary. Always refit with new seals.
- 6.4.4. Reassemble the Valve Assemblies in their respective types and port orientation.

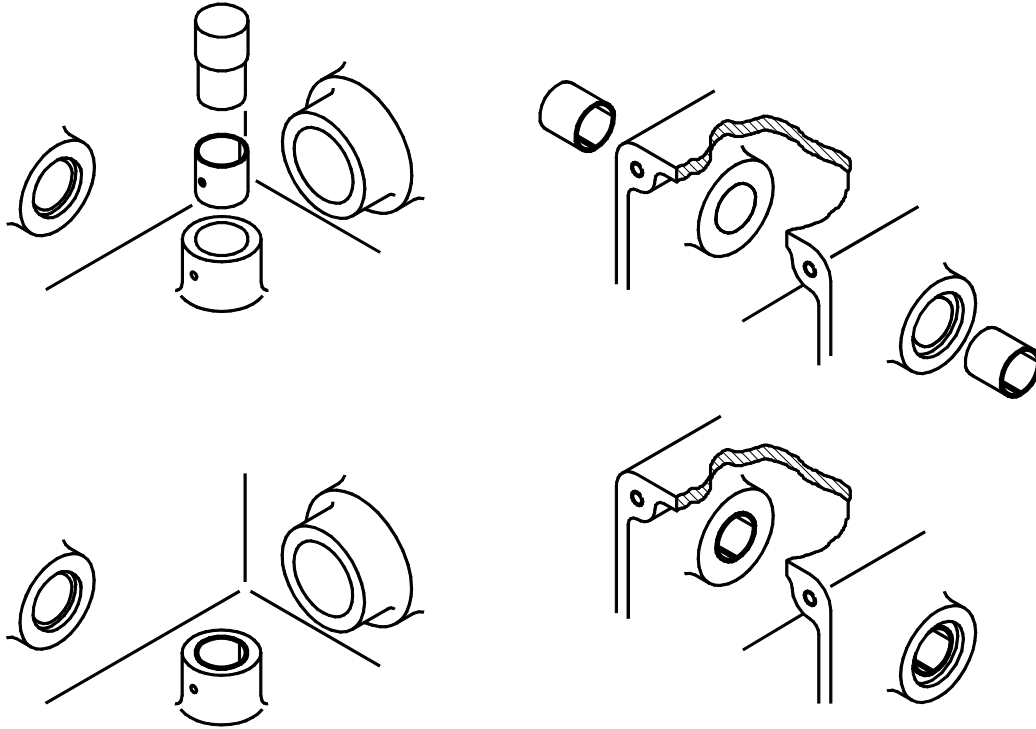
6.5. Pump Head Assembly

- 6.5.1. To replace Seals or Plunger (1337), return the Push Rod (1157) to the back of its stroke by rotating the Motor and setting the Stroke Adjuster to 100%. (Note reading for return to original setting).
- 6.5.2. Remove the four mounting screws holding the Pump Head (1175) to the Stroke Adjuster Body (1150). Remove Pump Head, Spacer (1585), and Seal Assembly with the Plunger and Plunger Return Spring (1148). All parts are now accessible for Seals replacement if necessary. Valve Assemblies (801 and 802) can be removed and replaced complete or the individual parts replaced. Always renew 'O rings'.
- 6.5.3. Push Rod (1157) can be unscrewed from Crosshead (701) and replacement fitted with Loctite 270 or equivalent.
- 6.5.4. Reassemble in the reverse order. Replace Pump Head assembly by sliding over Plunger and replacing the four screws.

6.6. Gearbox Assembly

- 6.6.1. Special tool Bearing Bush mandrel - Grosvenor Part No. 1841
- 6.6.2. It is impractical to strip the Gearbox Assembly with the Pump still mounted in its installed environment. Remove the Motor and Pump Head assembly.
- 6.6.3. Undo the drain Plug (1771) and drain and discard the gearbox oil.
- 6.6.4. Lift out the Worm (727) (if not already out on the Motor Shaft). Examine the Worm journal for wear damage. Discard and replace if required.
- 6.6.5. Removing the Crankcase Cover (647) allows access to internal parts. To remove internals first loosen the locking grub screw in the Eccentric (648). Turn the Gearbox on its side and with a centre punch, hammer out the Core Plugs (654) from either side. Ease out the Main Shaft (650). Pull out the Worm Wheel/Eccentric sub-assembly (689/648), Side Thrust Washer (686), Connecting Rod (649) and the Crosshead (701). Remove the locking screw holding the Small End Pin (655) in the Crosshead and push out the Small End Pin. Examine all parts for wear damage. Discard and replace any parts as required.
- 6.6.6. Examine the two Main Shaft, the Worm journal bearing bushes for wear and/or damage. If required press them out with the mandrel and replace.

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- 6.6.9. Coat waterproof sealant (Hermetite/liquid gasket) around the edge of a Core Plug and place it onto the gearbox bearing counterbore. Hammer the Core Plug firmly into place. Repeat for the remaining bearing bushes.
- 6.6.10. Refill with correct quantity and grade of oil,
- 6.6.11. Fit the Drain Plug, Oil Level Indicator and Filler Breather.
- 6.6.12. Fit the Worm with a Worm Thrust Washer into the Gearbox.
- 6.6.13. Pour in enough oil upto the Oil Level Indicator. Turn the Worm with the worm crank handle. Check for smoothness of operation.

6.7. Stroke Adjuster Assembly

- 6.7.1. This unit is grease filled and requires no attention unless a seal leak has occurred and caused severe corrosion.
- 6.7.2. 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.

6.8. Setting the Stroke Lost Motion to Zero

- 6.8.1. 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).

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6.9. Fitting Micrometer Screw or Resetting Calibration

- 6.9.1. 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.

6.10. Final Assembly

- 6.10.1. Fit the Motor.
6.10.2. Fit Nameplate and Crosshead Guard
6.10.3. Connect wiring to give correct rotation.
6.10.4. Run-in for the Gearbox for 2 hours. Drain the gearbox and refill with fresh oil.
6.10.5. Replace pumphead and valve assemblies. The complete pump is ready for commissioning.

6.11. Spare Parts

- 6.11.1. 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**

6.12. Lubrication

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

Oil capacity - 0.3 litres Approx.

6.13. Approved Lubricants

- 6.13.1. 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.
- 6.13.2. Oils marked * contain mild E.P. additives and should not be used for units operating above 80°C normal running temperatures.

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6.13.3. 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.

Gulf Oil (GB) Ltd.
Kuwait Petroleum Int.
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

Harmony 320

Q8 Verdi 320

DTE AA

HD 140 #

GX 140 #

Vitrea 320 *

Macoma R 320 *

Tellus V320

HD 90/140#

Regal R & O 320