Publication PB 0166

Installation and operating instructions
503P/RL, 603P/R, 701P/R pneumatic pumps

Pneumatic pumps

24 hour duty

Contents

Safety and information for returning pumps

In the interest of safety this pump and the tubing selected should only be used by competent, suitably trained personnel after reading and understanding this manual and considering any hazard involved.

Any person who is involved in the installation or maintenance of this equipment should be fully competent to carry out the work. This person in the UK should also be familiar with the Health and Safety at Work Act.

In the current situation of heightened concern over the handling of hazardous materials, any equipment which has been contaminated with, or exposed to, body fluids, toxic chemicals or any other substance hazardous to health must be **decontaminated** before it is returned to Watson-Marlow or its distributor.

A certificate (a suitable blank form is included at the rear of these operating instructions), or signed statement, must be attached to the **outside** of the shipping carton.

This certificate is required even if the pump is unused. If the pump has been used, the fluids that have been in contact with the pump, the cleaning procedure and that the equipment has been decontaminated must be specified.

Quick start-up guide

Ensure the pneumatic drive is connected to a suitable air line fitted with a filter and lubricator, to provide clean, dry, correctly lubricated air under conditions of maximum air consumption. Full details are given under the appropriate section.

An earth bonding circuit is fitted to the 701P to protect the unit from a static build up. Ensure it is connected to a suitable earthing point

Load tubing into the pumphead.

Start the pump with the on\off switch found on the rear panel for the 503P/R and on the front panel of the 603P/R and 701P/R.

The 503P/R and 603P/R operate in an anti-clockwise direction only. The 701P/R is reversible, the preferred direction of pumping is from left to right when you are facing the pumphead.

Set the running speed by using the front panel mounted regulator.

To stop the pump turn it off at the on\off switch.

Hints and tips

DO fit oil reclassifiers or coalescing filters to the pump exhaust if the residual oil in the air is a problem.

DO keep pump delivery and suction lines as short as possible.

DO use the minimum number of bends in rigid pipe runs. If there must be a bend use a swept bend and not a tight elbow

DO use suction and delivery pipelines with a bore equal to or larger than the tube bore fitted in the pumphead. When pumping ***viscous*** fluids the losses caused by increased friction losses can be counteracted by using pipe runs with a bore several times greater than the pumping element.

To overcome the common problem when dispensing viscous fluids, of poor accuracy and dripping delivery pipes, a great improvement will be noticed if rigid or semi-rigid pipe is used on the delivery side. The rigid tube is effective in reducing over-run because it does not expand during the pumping cycle, reverting to its original size after the pump has stopped.

DO run at a slow speed when pumping viscous fluids. Small tubes will generate a high friction pressure loss, so reducing the flow. Tube with a large bore will not have sufficient strength to restitute. Flooded delivery will be a great help

Some tube materials that will fit the 501RL are available with 2.4mm wall for speeds up to 100rpm. (The rotor will require re-setting to a roller gap of 3.8mm.)

DO use largest bore tube running at slow speed for longest tube life.

DO fit an extra length of pump tube in the system so that you can move the tube along from time to time, without needing to break the pumping circuit. This is particularly useful when involved in a long running sterile application.

DO keep the track and rollers clean and ensure that the rollers are free to rotate.

DO NOT fit valves in the suction or delivery line without considering that peristaltic pumps are self priming and will hold their prime up to several metres, so there may be no need for non-return or foot valves nor loading valves as used on many other kinds of pumps.

Any valves fitted must cause no restriction. If electrically actuated valves are fitted, they should be interlocked so that the pump will only run when the valves are open. Fit an automatic by-pass if manual valves are installed.

When using Marprene II or Bioprene, after about 30 minutes of running re-tension the tube in the pumphead by releasing the tube clamp on the delivery side a little and pulling the tube tight. This is to counteract the normal stretching that occurs with Marprene, which can go unnoticed, and result in poor tube life.

Tube selection The chemical compatibility list published in the Watson-Marlow catalogue is only a guide. If in doubt request a tube sample card for immersion trials. Remember the sample will be fully immersed, but the tube when in use will only be in contact with the inside of the tube. If the material swells but does not lose its strength it could be worth considering.

Two year warranty

Watson-Marlow Limited warrants, subject to the conditions below, through either Watson-Marlow Limited or its authorised distributors, to repair or replace free of charge, including labour, any part of this product which fails within two years of delivery of the product to the end user. Such failure must have occurred because of defect in material or workmanship and not as a result of operation of the product other than in accordance with the instructions given in this manual.

Conditions of and specific exceptions to the above warranty are:

- Consumable items such as tube and rollers are excluded.
- Products must be returned by prearrangement carriage paid to Watson-Marlow Limited or its authorised distributor.
- All repairs or modifications must have been made by Watson-Marlow Limited or its authorised distributors or with the express permission of Watson-Marlow Limited or its authorised distributors.
- Products which have been abused, misused, or subjected to malicious or accidental damage or electrical surge are excluded.
- Warranties purporting to be on behalf of Watson-Marlow Limited made by any person, including representatives of Watson-Marlow Limited or its distributors, which do not accord with the terms of this warranty shall not be binding upon Watson-Marlow Limited unless expressly approved in writing by a Director or Manager of Watson-Marlow Limited.

PART 1: 503P drive

Introduction

Thank you for buying this Watson-Marlow peristaltic pump which is designed and built to exceptionally high standards. This section is for use with either the 503P variable speed pneumatic drive, or with the 503P/RL variable speed pneumatic peristaltic pump which is made up of the 503P drive and the 501RL pumphead.

The 503P incorporates a powerful pneumatic motor safe for use where electric motors could present fire or explosion hazards. The 503P is controllable over a speed range of 20 percent to 100 percent from the front panel-mounted regulator and runs only in an anti-clockwise direction. The 503P can be combined with any of seven different pumpheads (303, 501RL, 505L, 502AA, 505LA or 300 and 500 Microcassette) to give from one to fifty channels, and flow rates from microlitres per minute to 1600 ml/min. The 501RL pumphead has an advanced twin-roller design which allows it to accept a wide range of tubing without adjustment and produces long tube life combined with accurate performance.

Installation

Air lines should be large enough to avoid excessive pressure loss under conditions of maximum air consumption of 7 litre/second at 6 bar (15 cubic feet/minute at 90psi).

It is essential that the 503P receives clean, dry, correctly lubricated air through a suitable filter and lubricator, fitted in the supply line as close to the pump as possible. Keep the lubrication bowl filled within the correct levels with a suitable pneumatic tool oil. We recommend the use of an ISO viscosity classified oil of grade ISO VG15, or any oil to BS 2626 (1965) Typical oils are Duckhams Zeroflo 2 or Century 198AW. The oil drip rate should be set to 3 drops per minute at full speed when using mist lubricators. If micro-fog lubricators such as the Norgren Olympian range are used, a large percent of the drip rate is not taken up by the air, the rate should be 15 drops per minute.

The 503P is supplied with a 1/4" BSP female fitting, and we recommended the use of at least a 10.0mm external diameter nylon air tubing. The tubing must be clean and free from debris before it is connected to the pump.

If the pump does not operate correctly, check that the air supply connections are properly made, that the pumphead is properly located and securely attached to the pump, and that the rotor is not stalled by incorrectly fitted tubing.

Flow rates

The 503P can be fitted with any of seven different pumpheads. For more information about the 501RL see Part 2 of this manual. For details of other pumpheads, please refer to the relevant operating instructions.

The flow rates given below were obtained using silicone tubing (except for the 202AA where vinyl tubing was used), with the pumphead rotating clockwise, pumping water at 20C with zero suction and delivery pressures (unless otherwise stated). Where an application is critical, the flow rate should be determined under operating conditions. The important factors are suction and delivery pressures, temperature, and fluid viscosity. Tube life will be reduced when pumping against pressure. The maximum numbers of pumpheads/channels permissible are also given.

501RL flow rates ml/min							
	Silicone tubing internal diameter						
	0.5mm	0.8mm	1.6mm	3.2mm	4.8mm	6.4mm	8.0mm
rpm	1/50"	1/32"	1/16"	1/8"	3/16"	1/4"	5/16"
30	1.3	3.7	13	55	120	190	300
160	6.7	20	70	293	640	1010	1600

303 flow rates (ml/min)							
	Silicone tubing internal diameter						
	0.5mm	0.8mm	1.6mm	3.2mm	4.8mm	6.4mm	8.0mm
rpm	1/50"	1/32"	1/16"	1/8"	3/16"	1/4"	5/16"
30	0.9	2.1	8.2	30	66	108	150
160	4.8	11	44	160	352	576	800

Maximum number of 303 pumpheads						
	Silicone tubing internal diameter					
	0.5mm	0.8mm	1.6mm	3.2mm	4.8mm	6.4mm
rpm	1/50"	1/32"	1/16"	1/8"	3/16"	1/4"
30	6	6	6	6	6	6
160	6	6	6	6	6	6
	Marprene II, Tygon, Neoprene and Viton tubing internal diameter					
	0.5mm	0.8mm	1.6mm	3.2mm	4.8mm	6.4mm
rpm	1/50"	1/32"	1/16"	1/8"	3/16"	1/4"
30	6	6	6	6	6	6
160	6	6	6	6	6	5

502AA flow rates (ml/min)							
	Tubing internal diameter						
	0.13mm	0.19mm	0.25mm	0.38mm	0.50mm	0.63mm	0.76mm
rpm	0.005"	0.007"	0.01"	0.015"	0.02"	0.025"	0.03"
30	0.014	0.037	0.085	0.145	0.235	0.342	0.462
160	0.077	0.198	0.452	0.772	1.25	1.83	2.47
	Tubing internal diameter						
	0.88mm	1.02mm	1.14mm	1.29mm	1.42mm	1.47mm	1.52mm
rpm	0.035"	0.04"	0.045"	0.05"	0.055"	0.058"	0.06"
30	0.655	0.865	1.11	1.35	1.73	1.88	2.05
160	3.49	4.61	5.92	7.20	9.25	10.1	10.9
	Tubing internal diameter						
	1.6mm	1.85mm	2.05mm	2.38mm	2.54mm	2.79mm	
rpm	0.065"	0.07"	0.08"	0.09"	0.1"	0.11"	
30	2.26	2.93	3.53	4.27	5.47	6.12	
160	12.0	15.6	18.8	22.8	29.2	32.7	

505L double tubing element flow rates (ml/min)						
	Tubing internal diameter					
	1.6mm	3.2mm	4.8mm	6.4mm	8.0mm	9.6mm
rpm	1/16"	1/8"	3/16"	1/4"	5/16"	3/8"
30	22	68	125	210	270	330
160	113	364	673	1120	1440	1760

304MC, 304MCX and 504MC2 flow rates (ml/min)								
	Tubing internal diameter							
	0.13mm	0.19mm	0.25mm	0.38mm	0.50mm	0.63mm	0.76mm	
rpm	0.005"	0.007"	0.01"	0.015"	0.02"	0.025"	0.03"	Channels
30	0.02	0.08	0.14	0.25	0.45	0.85	1.25	15
110	0.09	0.30	0.52	0.92	1.70	3.10	4.60	15
	Tubing internal diameter							
	0.88mm	1.02mm	1.14mm	1.29mm	1.42mm	1.47mm	1.52mm	
rpm	0.035"	0.04"	0.045"	0.05"	0.055"	0.058"	0.06"	Channels
30	1.75	2.20	2.70	3.60	4.50	4.90	5.20	15
110	6.40	8.10	9.90	13.0	17.0	18.0	19.0	15
	Tubing internal diameter							
	1.65mm	1.85mm	2.05mm	2.38mm	2.54mm	2.79mm		
rpm	0.065"	0.07"	0.08"	0.09"	0.1"	0.11"		Channels
30	6.00	7.50	9.00	11.0	13.0	14.5		15
110	22.0	28.0	33.0	40.0	47.0	53.0		15

308MC, 308MCX and 508MC2 flow rates (ml/min)								
	Tubing internal diameter							
	0.13mm	0.19mm	0.25mm	0.38mm	0.50mm	0.63mm	0.76mm	
rpm	0.005"	0.007"	0.01"	0.015"	0.02"	0.025"	0.03"	Channels
30	0.02	0.07	0.13	0.23	0.39	0.70	1.05	15
110	0.09	0.28	0.47	0.83	1.40	2.60	3.90	15
	Tubing internal diameter							
	0.88mm	1.02mm	1.14mm	1.29mm	1.42mm	1.47mm	1.52mm	
rpm	0.035"	0.04"	0.045"	0.05"	0.055"	0.058"	0.06"	Channels
30	1.45	1.80	2.40	2.85	3.30	3.60	3.80	15
110	5.30	6.60	8.80	10.0	12.0	13.0	14.0	15
	Tubing internal diameter							
	1.65mm	1.85mm	2.05mm	2.38mm	2.54mm	2.79mm		
rpm	0.065"	0.07"	0.08"	0.09"	0.1"	0.11"		Channels
35	4.50	5.50	6.50	8.00	9.00	10.0		15
110	17.0	20.0	24.0	29.0	33.0	36.0		15

Note 304MC, 504MC, 308MC, and 508MC pumpheads must not be run at speeds greater than 110rpm.

505LA flow rates (ml/min)								
	Tubing internal diameter							
	0.13mm	0.19mm	0.25mm	0.38mm	0.50mm	0.63mm	0.76mm	
rpm	0.005"	0.007"	0.01"	0.015"	0.02"	0.025"	0.03"	Channels
30	0.046	0.125	0.265	0.655	0.873	1.08	1.79	12
	Tubing internal diameter							
	0.88mm	1.02mm	1.14mm	1.29mm	1.42mm	1.47mm	1.52mm	
rpm	0.035"	0.04"	0.045"	0.05"	0.055"	0.058"	0.06"	Channels
30	1.98	3.31	3.86	5.1	5.78	6.33	6.65	12
	Tubing internal diameter							
	1.65mm	1.85mm	2.05mm	2.38mm	2.54mm	2.79mm		
rpm	0.065"	0.07"	0.08"	0.09"	0.1"	0.11"		Channels
30	7.42	8.67	11.5	14.1	16.3	17.6		12

Note 505LA pumpheads must not be run at speeds greater than 55rpm

Tubing range

Flow precision depends upon the accuracy and consistency of the tubing. All Watson-Marlow tubing is formulated, manufactured and quality controlled to our own specification

Tubing for 501RL and 303 pumpheads					
Bore					
mm	"	Marprene II	Bioprene	Silicone	Neoprene
0.5	1/50	902.0005.016	903.0005.016	910.0005.016	
0.8	1/32	902.0008.016	903.0008.016	910.0008.016	920.0008.016
1.6	1/16	902.0016.016	903.0016.016	910.0016.016	920.0016.016
3.2	1/8	902.0032.016	903.0032.016	910.0032.016	920.0032.016
4.8	3/16	902.0048.016	903.0048.016	910.0048.016	920.0048.016
6.4	1/4	902.0064.016	903.0064.016	910.0064.016	920.0064.016
8.0	5/16	902.0080.016	903.0080.016	910.0080.016	920.0080.016
Bore					
mm	"	Butyl *	Tygon	Viton	
1.6	1/16	930.0016.016	950.0016.016	970.0016.016	
3.2	1/8	930.0032.016	950.0032.016	970.0032.016	
4.8	3/16	930.0048.016	950.0048.016	970.0048.016	
6.4	1/4	930.0064.016	950.0064.016	970.0064.016	
8.0	5/16	930.0080.016	950.0080.016	970.0080.016	

* Butyl tubing not suitable for 303 pumpheads

505L double tubing elements			
mm	"	Silicone	Marprene II
1.6	1/16	910.E016.024	902.E016.024
3.2	1/8	910.E032.024	902.E032.024
4.8	3/16	910.E048.024	902.E048.024
6.4	1/4	910.E064.024	902.E064.024
8.0	5/16	910.E080.024	902.E080.024
9.6	3/8	910.E096.024	902.E096.024

Tubing for other pumpheads is listed in the relevant operating instructions.

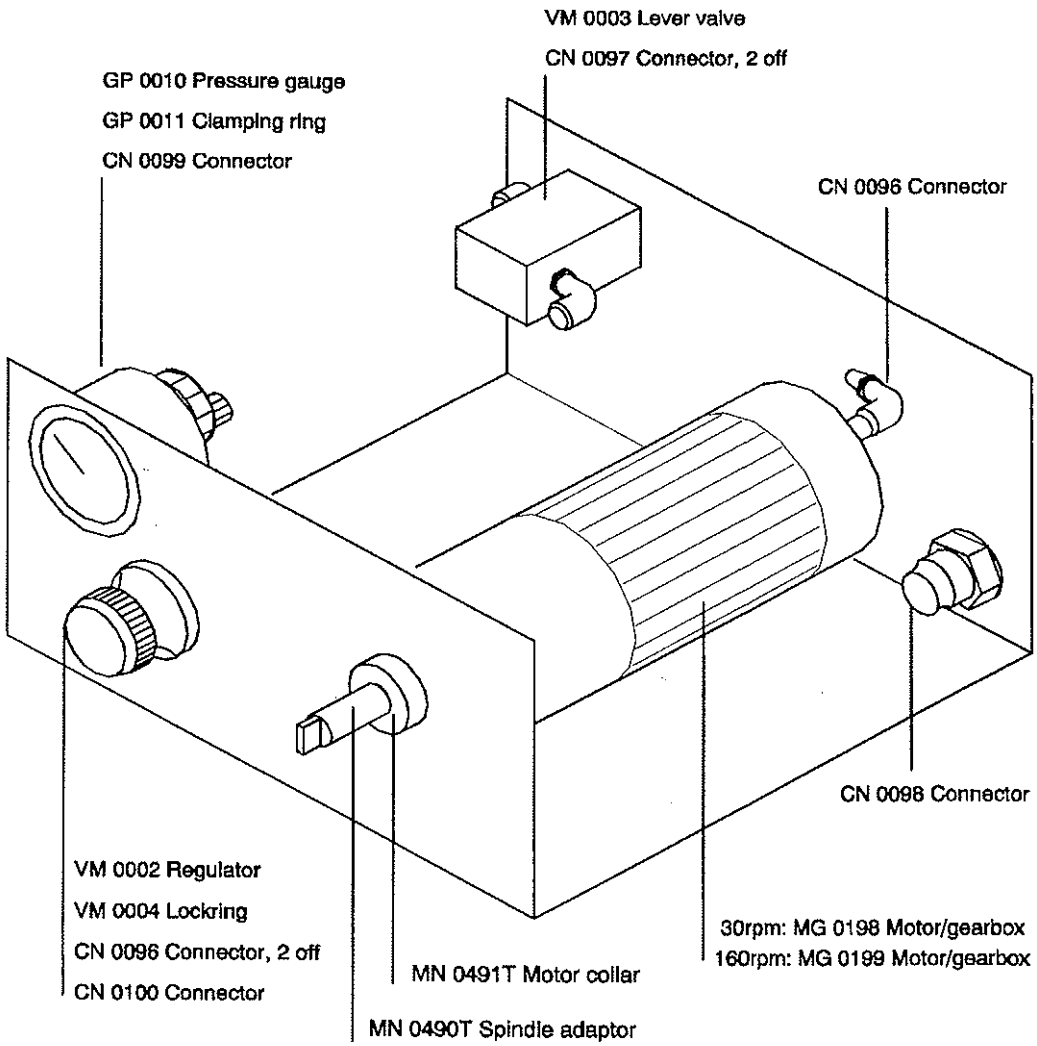
Care and maintenance

Scheduled maintenance of the 503P is not required if adequate filtration and lubrication is provided. When the pump needs cleaning, remove the pumphead and use a mild solution of detergent in water. Do not use strong solvents.

Specification

Motor type	Pneumatic
Nominal maximum rotor speeds	30, 160 rpm
Speed control range	20 to 100 percent
Air consumption	7 litres /sec at 6 bar 15 cubic feet /min at 90 psi
Noise level at 1m	fast response 75 dB A
Operating temperature	0 C to 37 C 32 F to 100 F
Storage temperature	-40 C to 70 C -40 F to 160 F
Direction of rotation	Anti-clockwise
Dimensions (including 501RL pumphead)	H125 x W225 x L300 mm H5" x W9" x L12"
Weight (including 501RL pumphead)	5.5 kg 81/2 lbs

Spares



Air hose required:

XX 0048 8mm OD Nylon. Total length = 0.75M

XX 0071 3/16" OD Nylon. Total length = 0.15M

Complete drive:

30rpm 056.2401.000

160rpm 056.2451.000

PART 2: 501RL pumphead

Description

The 501RL is set during manufacture to accept tubing with wall thicknesses of between 1.6mm and 2.0mm, and internal diameters up to 8.0mm. The 501RL pumphead is equipped with a "tool lockable" guard for increased safety. This should be locked shut whilst the pump is in use.

Positioning the pumphead

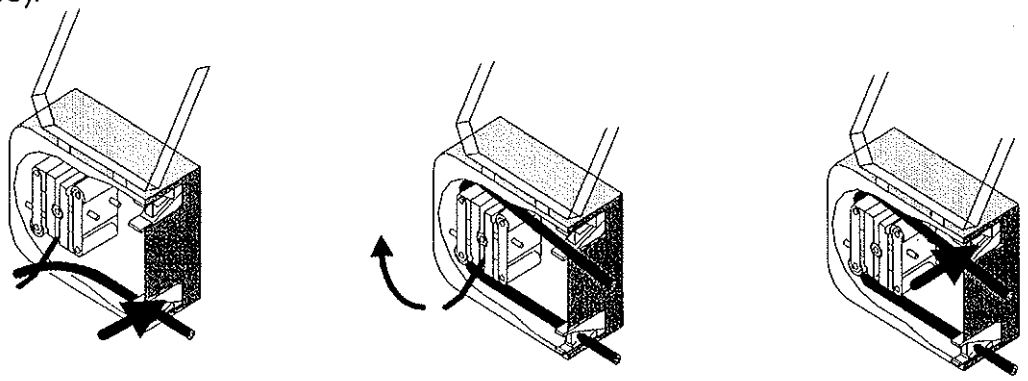
Any one of three tubing inlet/outlet positions can be selected depending on individual requirements. Only one screw is used to attach the track to the drive. To reposition the track; Remove any tubing from the pumphead, and swing out the crank handle to expose the rotor retaining screw. Turn the screw anticlockwise one turn to release the collet, and withdraw the rotor from the shaft. Remove the track locating screw, and lift clear the track. Rotate the track to the new position and replace the track locating screw.

Tube loading

Switch off the drive before loading the tube.

Unlock and open the hinged guard and swing out the rotor crank handle until it locks into position.

Select the length of tubing required, noting that approximately 240mm is required for the track system, (measured from the outside faces of the tube clamps).



Fit one end of the tubing into one of the spring loaded clamps, and then, whilst rotating the rotor with the crank handle, feed the tubing between the rollers and the track, aligning it within the rotor tube guides. The tubing must lie naturally against the track and must not be twisted or stretched.

Fit the other end of the tubing into the second spring loaded clamp, ensuring that the tubing is not slack in the pumphead, as this can reduce tube life. Close the crank handle and shut and lock the guard.

After the pump has been started, open the downstream clamp, for a short period, so that the tube can find its natural length.

The 501RL pumphead is fitted with four-position tube clamps which can be adjusted by pushing in or pulling out the bars at the top of the upper clamp and the bottom of the lower clamp. Set clamps so that the minimum necessary pressure is applied to the tubing.

Roller adjustment

The 501RL has a factory set gap of 2.6mm between the rollers and the track and is suitable for tubing having wall thicknesses between 1.6 and 2.0mm. Adjustment of the gap will be required if tubing having a wall thickness less than 1.6mm is to be used. There is an adjusting screw on each of the two roller arms, and each of these screws will require adjustment. The correct gap is twice the wall thickness less twenty percent. Correct adjustment is important: over occlusion will reduce tube life; under occlusion will reduce pumping efficiency.

To change the gap setting, turn each adjusting screw clockwise to increase the gap or anticlockwise to decrease the gap. A full turn changes the gap by 0.8mm.

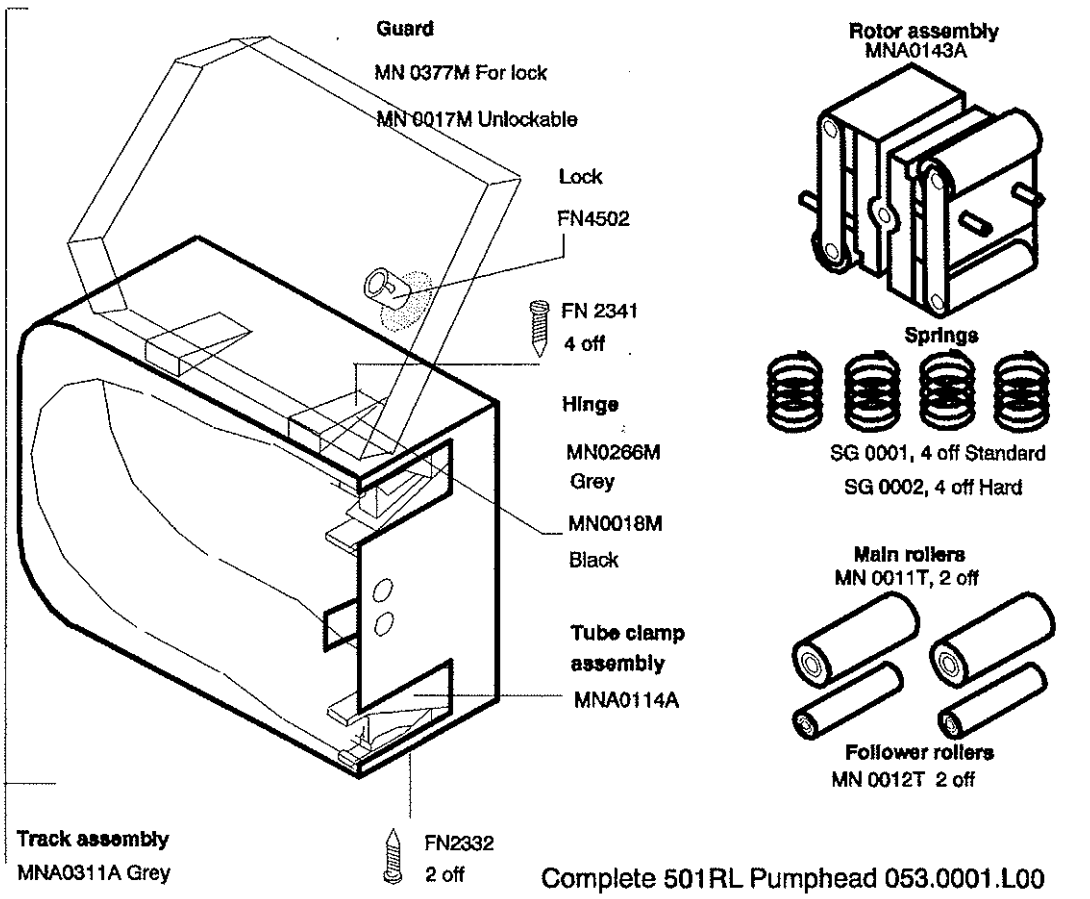
To restore the original settings of 2.6mm, turn the adjusting screws until both rollers are just touching the track, then tighten each screw by three and a quarter turns.

Care and maintenance

If aggressive liquids are spilled on to the pumphead, the head should be removed and cleaned. Remove any tubing from the pumphead, and swing out the crank handle to expose the rotor retaining screw. Turn the screw anticlockwise one turn to release the collet, and withdraw the rotor from the shaft. Unscrew the track retaining screw and detach the track from its spigot.

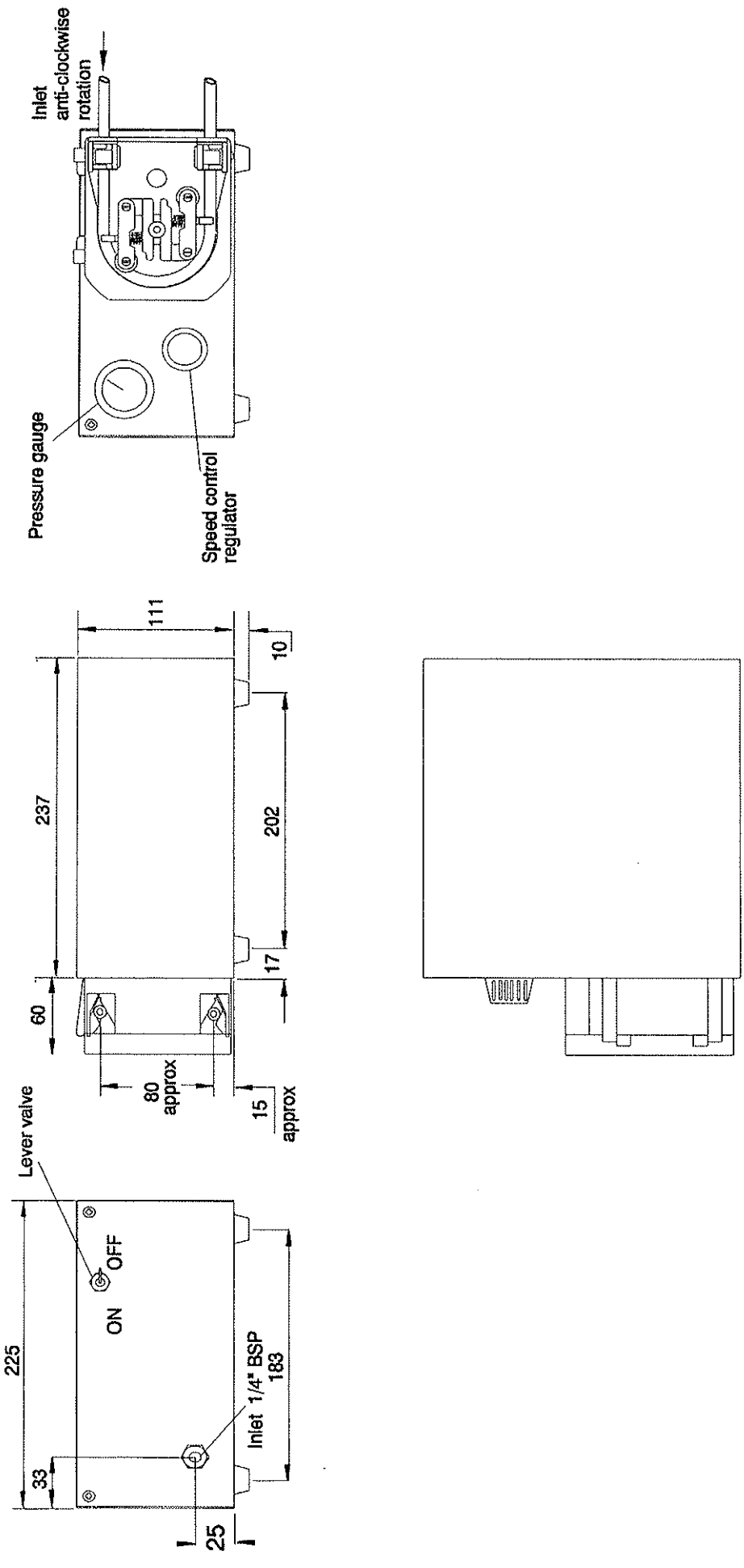
Check moving parts of the rotor from time to time for freedom of movement. Lubricate pivot points and rollers occasionally with a light lubricating oil.

501RL spares



Complete 501RL Pumphead 053.0001.L00

Outline drawing



Part 3: 603P/R

Introduction

Thank you for purchasing this 603P/R peristaltic pump which incorporates a powerful pneumatic motor, safe for use in areas where electric motors could create a risk of fire or explosion. It is fitted with the 601R pumphead which accepts 3.2mm wall thickness tubing up to 15.9mm internal diameter. Two speeds are available, 75rpm and 250rpm, each of which is controllable from 20 to 100 percent of maximum speed through the front panel mounted regulator, the direction of rotor rotation is anti-clockwise.

The 603P/R is one of the best high-flow pneumatic peristaltic pumps ever produced combining bench top size and ease of use with a performance only previously found in industrial pumps.

Installation

Air lines should be large enough to avoid excessive pressure loss under conditions of maximum air consumption of 9 litre/second at 6 bar

It is essential that the 603P/R receives clean, dry, correctly lubricated air through a suitable filter and lubricator fitted in the supply line as close to the pump as possible. Keep the lubrication bowl filled within the correct levels with a suitable pneumatic tool oil. We recommend the use of an ISO viscosity classified oil of grade ISO VG15, or any oil to BS 2626 (1965) such as Duckhams Zeroflo 2 or Century 198AW. The oil drip rate should be set to 3 drops per minute at full speed when using a mist lubricator. If micro-fog lubricators such as the Norgren Olympian range are used, a large percent of the oil is not taken up by the air, the rate should be 15 drops per minute.

The 603P/R is supplied with a 3/8" BSP female fitting, and we recommend the use of at least a 12.0mm external diameter nylon air tubing. The tubing must be clean and free from debris before it is connected to the pump.

If the pump does not operate correctly, check that the air supply connections are properly made, that the pumphead is properly located and securely attached to the pump, and that the rotor is not stalled

Operation

Before loading tubing into the pumphead, turn the pump off and isolate it from the air supply. The direction of rotation of the 603P/R is anti-clockwise. Pumphead speed is set at the front panel regulator and can be varied from 20 to 100 percent of the maximum speed of the pump.

Tube loading

The 603P/R is fitted with a spring loaded twin roller pumphead designed for tubing with a nominal wall thickness of 3.2mm and bore sizes of between 4.8mm and 15.9mm. The pumphead is fixed in one position. A length of 410mm of tubing is needed for the pumphead.

Switch off the pump and isolate it from the air supply before loading tubing.

Open the pumphead guard and fit one end of the tube into the bottom adjustable clamp. Tighten the lower serrated adjustment wheel. Then, whilst rotating the rotor clockwise (a spanner is provided for this purpose), feed the tube between the rollers and the track, ensuring that the tubing is not twisted or stretched. This is particularly important for the larger bore sizes of tubing. Fit the other end of the tube into the top adjustable clamp, ensuring that the tube is not slack in the pumphead. Clamp the tube very firmly by turning the upper adjustment wheel. Remove the spanner, then close and lock the guard.

Flow rates

The flow rates given below were obtained pumping water at 20C with zero suction and delivery pressures. Where flow rate is critical it should be measured under operating conditions. The major factors affecting flow rate are suction and delivery heads, fluid viscosity and temperature.

603P/R flow rates (litre/min) Minimum flows 20% of rates given					
	Tubing internal diameter (mm)				
	4.8	6.4	9.6	12.7	15.9
rpm	3/16"	1/4"	3/8"	1/2"	5/8"
75	0.7	1.1	1.8	3.2	4.7
250	2.3	3.5	6.4	10.5	15.8

Tubing range

Flow precision depends upon the accuracy and consistency of the tubing. All Watson-Marlow tubing is formulated, manufactured and quality controlled to our own specifications. We recommend Marprene II tubing wherever it is chemically compatible.

Bore		Marprene II	Bioprene	Silicone	Neoprene
4.8mm	3/16"			910.0048.032	
6.4mm	1/4"	902.0048.032	903.0048.032	910.0048.032	920.0064.032
9.6mm	3/8"	902.0096.032	903.0096.032	910.0096.032	920.0096.032
12.7mm	1/2"	902.0127.032	903.0127.032	910.0127.032	920.0127.032
15.9mm	5/8"	902.0159.032	903.0159.032	910.0159.032	920.0159.032
Bore		Butyl	Tygon	Viton	
4.8mm	3/16"				
6.4mm	1/4"	930.0064.032	950.0064.032	970.0064.032	
9.6mm	3/8"	930.0096.032	950.0096.032	970.0096.032	
12.7mm	1/2"	930.0127.032	950.0127.032	970.0127.032	
15.9mm	5/8"	930.0159.032	950.0159.032	970.0159.032	

Care and maintenance

If proper filtration and lubrication are provided there will be no need for scheduled maintenance of the 603P/R pump. If harmful liquids are spilled on to the pump, the pumphead should be removed and cleaned. This can be carried out quickly and easily after first ensuring that the pump is switched off. Remove any tubing in the pumphead.

Remove the rotor by unscrewing the retaining bolt one turn to release the collet, and withdrawing the rotor from the shaft. Remove the track by unscrewing the two retaining screws and detaching the track from its spigot.

All moving parts of the rotor should be checked from time to time for freedom of movement. Occasional lubrication of pivot points and rollers with light lubricating oil will aid trouble free operation. When the pump needs cleaning, use a cloth dampened with water and mild detergent. Do not use strong solvents.

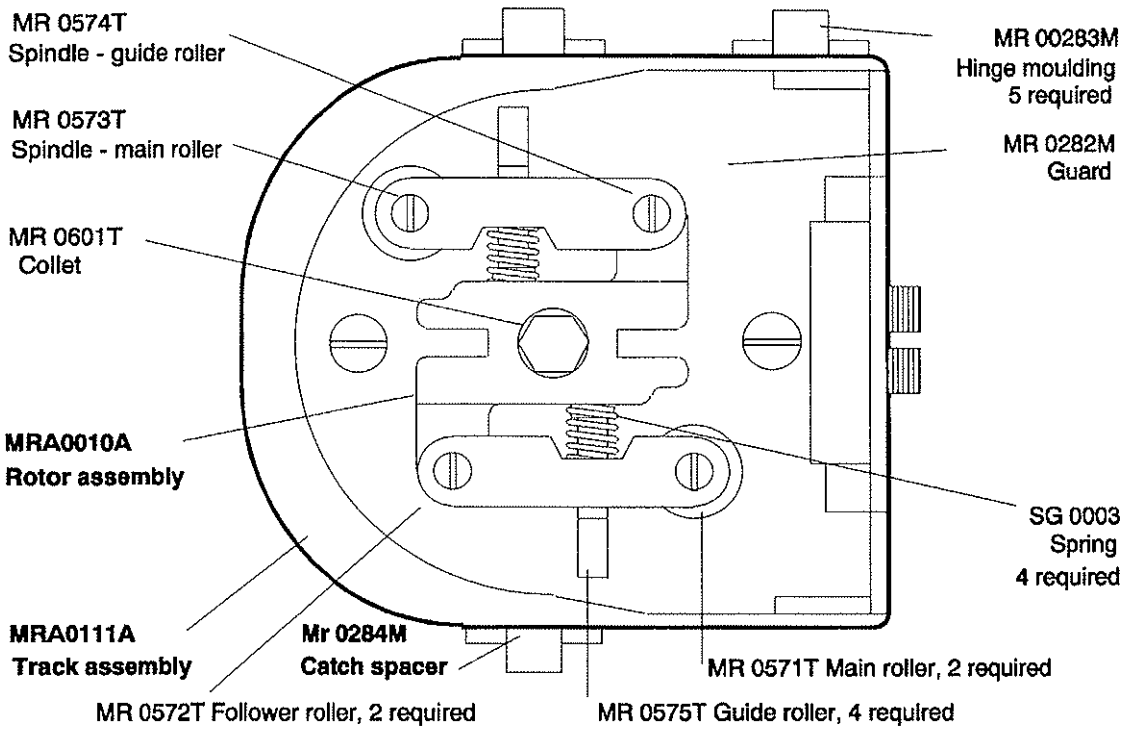
Adjustment of the pumphead rollers

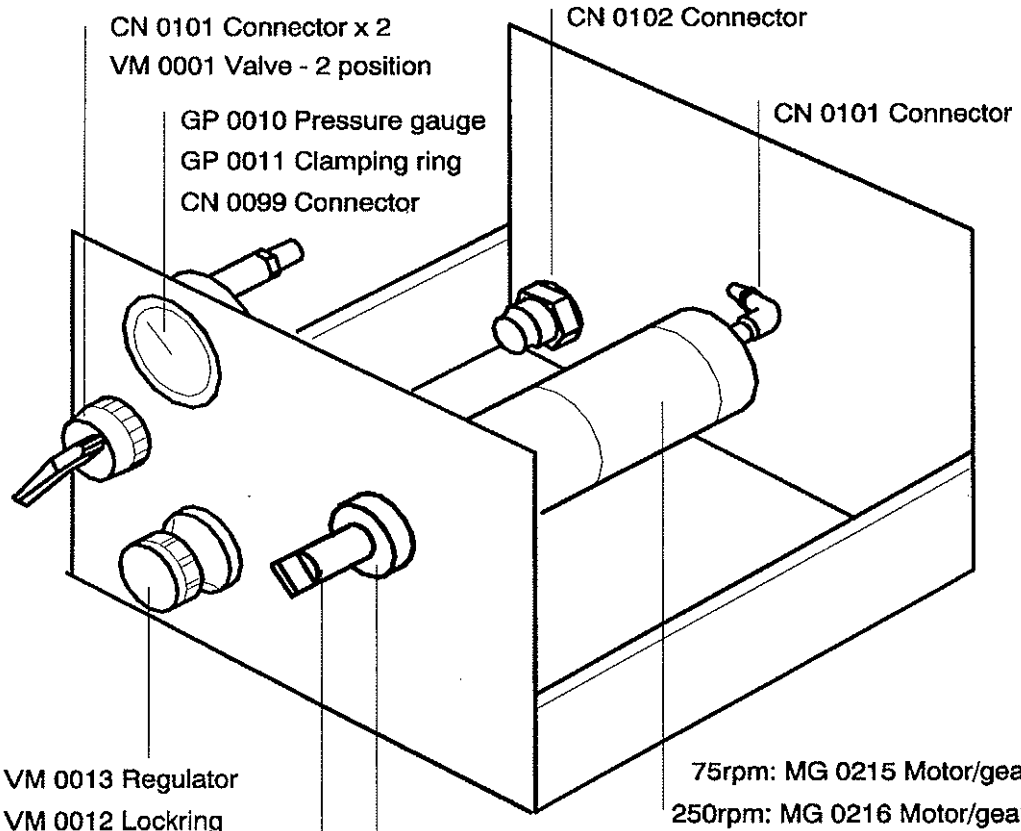
The two spring loaded rollers compensate for tolerance variations in the wall thickness of tubing, eliminating the manual adjustment normally required by peristaltic pumps, and, in general, there should be no need for the gap setting between the rollers and track to be adjusted.

Should it ever appear that the roller arms are not equally adjusted, the original factory setting can easily be restored. There is an adjustment screw on each of the two roller arms. The factory setting is 5.2mm 0.205" (13/64"). A drill blank can be used as a setting gauge. if you do not have a gauge the setting can be obtained by turning each screw anti-clockwise until both rollers are just in contact with the track, and then turn each screw clockwise by five turns. Correct and equal adjustment is important. Over-occlusion will reduce tube life. Under-occlusion will reduce pumping efficiency.

Specification

Motor type	Pneumatic
Nominal maximum rotor speeds	75, 250 rpm
Speed control range	20 to 100 percent
Air consumption	9 litre/second at 6 bar 19 cubic feet /min at 90 psi
Noise level at 1m	fast response 81 dB A
Operating temperature	0 C to 37 C 32 F to 100 F
Storage temperature	-40 C to 70 C -40 F to 160 F
Direction of rotation	Anti-clockwise
Dimensions	H194 x W264 x L400 mm H7 x W10 x L15 "
Weight	11.5 kg 25 lbs





Air hose required:

XX 0074 10mm OD Nylon. Total length = 1.0M

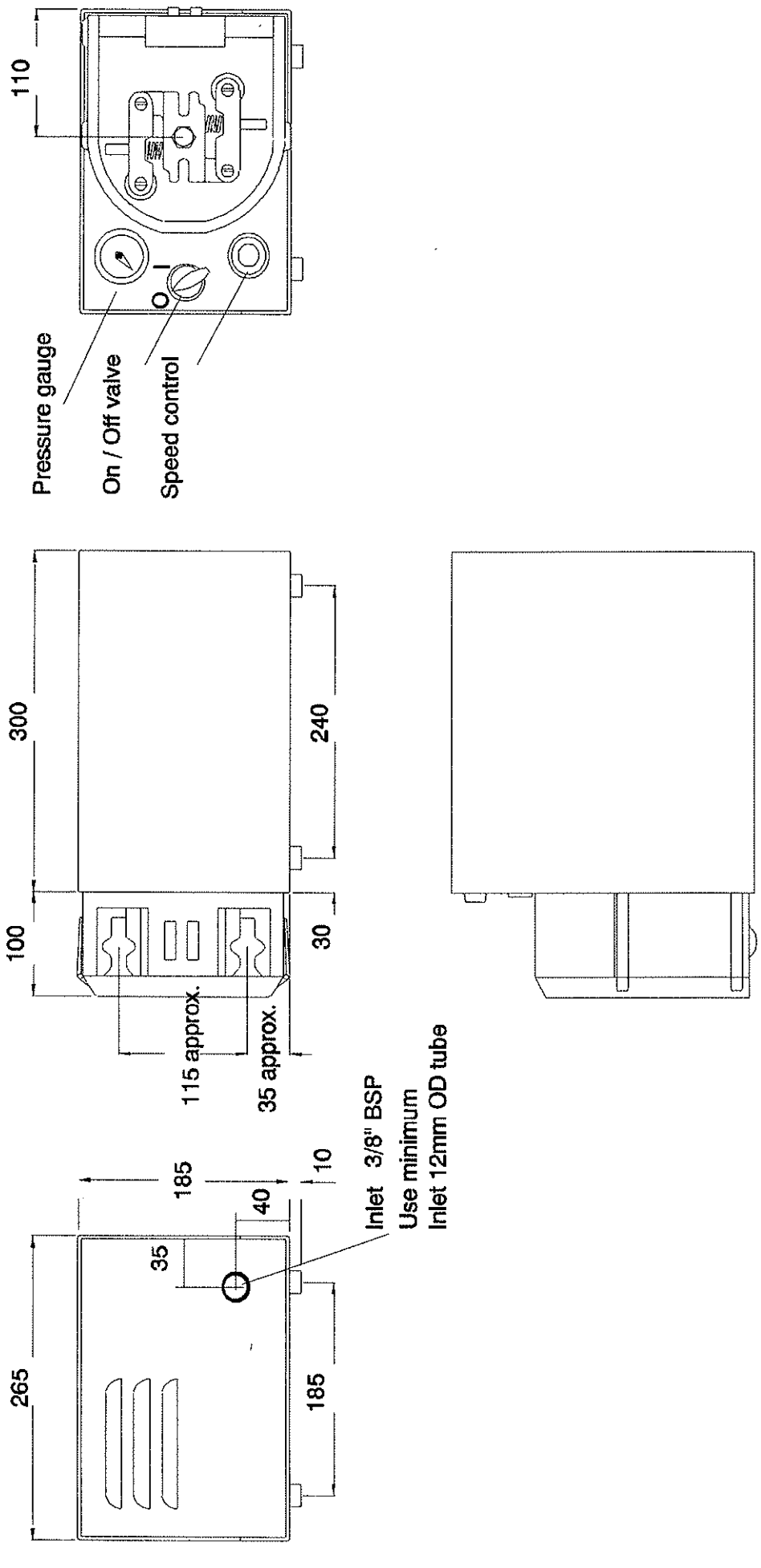
XX 0071 3/16" OD Nylon. Total length = 0.15M

Complete Pump

75rpm 060.0101.000

250rpm 060.0111.000

Outline drawing



Part 4: 701P/R

Introduction

Thank you for choosing this Watson-Marlow high-flow pneumatic peristaltic pump. The 701P/R pump incorporates a pumphead featuring driven rollers and a spring-loaded track which virtually eliminate friction-induced tube wear. This means that higher flow rates and longer tube life are now available. Tubing with wall thicknesses of 4.8 and internal diameters up to 25.4mm can be used to provide flow rates up to 2000 litre/hr. A 701RX extension pumphead can be fitted to double the maximum flow rate.

Installation

Air lines should be large enough to avoid excessive pressure loss under conditions of maximum air consumption of 26 litre/second at 6 bar (54 cubic feet/minute at 90psi).

It is essential that the 701P/R receives clean, dry, correctly lubricated air through a suitable filter and lubricator fitted in the supply line as close to the pump as possible. Keep the lubrication bowl filled within the correct levels with a suitable pneumatic tool oil. We recommend the use of an ISO viscosity classified oil of grade ISO VG15, or any oil to BS 2626 (1965). The oil drip rate should be set to suit the speed at which the pump is being run or to 5 drops per minute at full speed.

The 701P/R is supplied with a G1/2"(BSP) female fitting, and we recommend the use of at least a 12.0mm external diameter nylon air tubing. The tubing must be clean and free from debris before it is connected to the pump. A greater degree of silencing may be obtained by piping the exhaust away.

If the pump does not operate correctly, check that the air supply connections are properly made, that the pumphead is properly located and securely attached to the pump, and that the rotor is not stalled by incorrectly fitted tubing.

An earth bonding circuit is fitted to the pumphead to protect it from static build up. Ensure it is connected to a suitable earthing point.

Operation

Start the pump by turning the forward/off/reverse switch on the left hand side of the control panel to the desired direction of rotation. The preferred direction or rotation is clockwise (giving a flow direction of left to right when facing the pump), which will ensure the longest tube life. Set the pump speed on the top panel mounted regulator. The minimum speed will be 20% of the maximum.

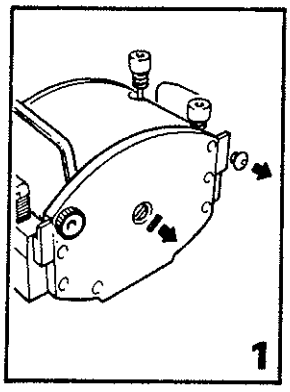
To stop the pump, turn the forward/off/reverse switch to its central position. To change the direction of flow, turn the forward/off/reverse switch through its central position to the other direction.

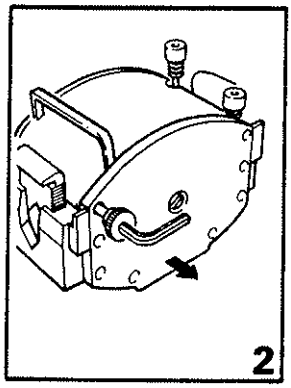
Fitting a second pumphead

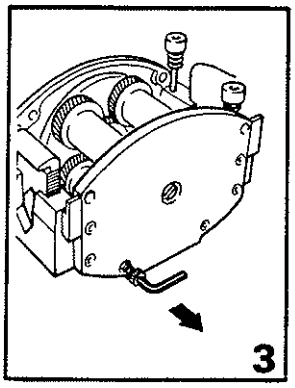
701P/R pump may be fitted with one 701RX extension pumphead to give two channels of flow. There is no restriction on the size of tube which can be used in each pumphead when two pumpheads are fitted, but if two tubes of 25.4mm bore and 4.8mm wall thickness are fitted, the maximum output pressure against which the pump can operate is 1.5 bar (22 psig).

- Remove the plug from the slot in the centre shaft of the first pumphead, and remove the plug from the tapped hole on the top right hand corner of the first pumphead.
- Remove the track securing bolt and the track from the first pumphead. Remove the M8 x 16 socket head cap screw from the bottom left (just above the left hand foot) of the first pumphead.

- Remove the track securing bolt and the track from the extension pumphead.



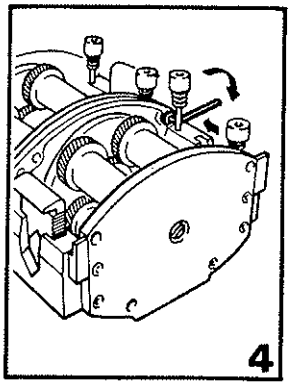


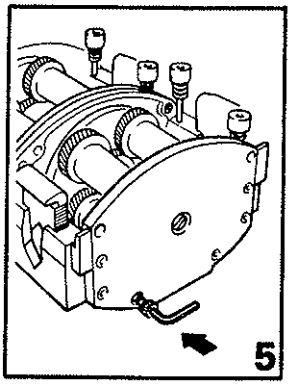


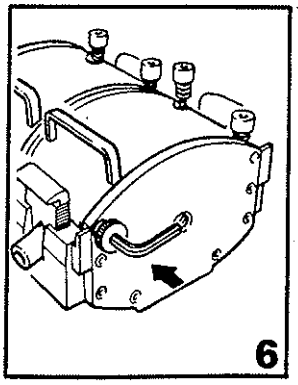
Important

Grease the drive shaft tongue of the extension pumphead with the grease supplied. Turn the centre shaft of the extension pumphead until its drive shaft tongue is aligned with the slot in the drive shaft of the first pumphead.

Apply thread locking compound to the M8 x 16 socket head cap screw in the top right hand corner of the back plate of the extension pumphead. Fit the 701RX extension pumphead to the first pumphead, ensuring that the back plate of the extension pumphead is flat against the front plate of the first pumphead.





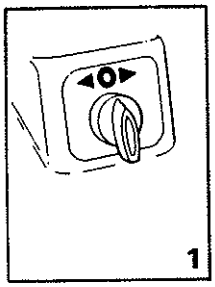


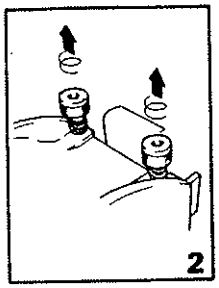
- Tighten the socket head cap screw in the top right hand corner of the extension pumphead with the modified Allen key supplied.

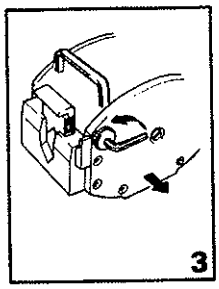
- Apply thread locking compound to the M8 x 170 socket head cap screw in the bottom left of the extension pumphead front plate, and tighten it with the Allen key supplied.

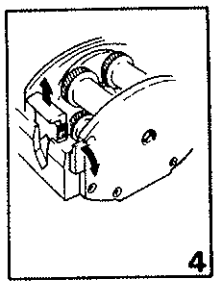
Follow the tube loading instructions in the next section for each pumphead, using the double length bolt to secure both tracks. Tighten the track securing bolt with the Allen key provided to prevent removal by hand.

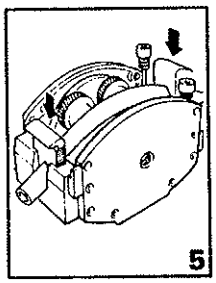
- If the pump is running, stop it by turning the forward/off/reverse switch to its central position. The track acts as a guard to the rotor, and should not e removed until the pump has been stopped.

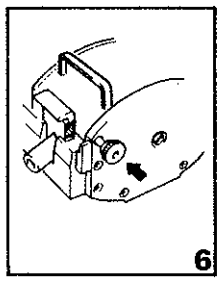


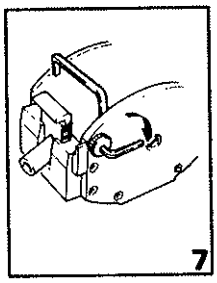












- Turn the knurled track compression spring knobs anti-clockwise about six turns. This raises the springs and aids both track removal and replacement.
- Release the track by unscrewing the track securing bolt on the left hand side of the pumphead and withdrawing the bolt fully. Lift the track by its handle and slide out the right hand side of the track from under the springs.
- Release in turn the two tube clamps by pulling on the release levers on either side of the front plate of the pumphead, and lift out both clamps.
- Lay the tubing across the pumphead and secure the upstream side by sliding in the first tube clamp (with its lip pointing outwards) and pressing it down firmly. Loosely fit the second tube clamp.
- Slip the right hand end of the track under the springs and position the left hand end so that the track securing bolt can be inserted.
- Tighten the track securing bolt with the Allen key provided to prevent removal by hand. The Allen key size is 6mm. Spare Allen keys are available from Watson-Marlow or its distributors.
- When the track has been fitted, tighten both of the sprung track knobs. ***Hint*** If the pump is to work against low pressures, longer tube life can be obtained by not tightening the track knobs fully.

- Start the pump, allow any excess tubing to work through the pumphead, and press the downstream tube clamp down firmly. Check the tube for movement when the pump is running. If there is any sign of the tube working its way through the pumphead, the tube should be more firmly clamped at its upstream end, the downstream end unclamped to release any excess tubing, and then firmly reclamped again.

In the case of Marprene II or Bioprene tubing, it is advised that the above procedure is carried out after about 30 minutes running after the tubing has been first loaded. If the direction of flow is reversed, the tube should again be checked for movement.

Flow rates

These flow rates were obtained using Watson-Marlow Marprene tubing pumping water at 20C with zero suction and delivery pressures (unless otherwise stated). Where an application is critical, the flow rate should be determined under operating conditions. The important factors are suction and delivery pressures, temperature, fluid viscosity and tube material.

Flow rates for 701P/R (litre/hr) Minimum flows 20% of rates given						
	Tubing internal diameter					
	mm	9.6	12.7	15.9	19.0	25.4
rpm	"	3/8	1/2	5/8	3/4	1
360		420	780	1080	1500	2000

Tubing range

Pump performance depends upon the accuracy and consistency of the tubing. Watson-Marlow tubing is specially formulated for peristaltic pumping and it is manufactured and quality controlled to our own specifications. We recommend Marprene II tubing whenever it is chemically suitable.

Bore		**Marprene II**	**Bioprene**	**Silicone**
9.6mm	3/8"	902.0096.048	903.0096.048	910.0096.048
12.7mm	1/2"	902.0127.048	903.0127.048	910.0127.048
15.9mm	5/8"	902.0159.048	903.0159.048	910.0159.048
19.0mm	3/4"	902.0190.048	903.0190.048	910.0190.048
25.4mm	1"	902.0254.048	903.0254.048	910.0254.048

Bore		**Neoprene**	**Butyl***	**Viton**
9.6mm	3/8"	920.0096.048		
12.7mm	1/2"	920.0127.048		
15.9mm	5/8"	920.0159.048		
19.0mm	3/4"	920.0190.048	930.0190.048	970.0190.048
25.4mm	1"	920.0254.048	930.0254.048	970.0254.048

* Butyl tubing should not be used at pumphead speeds greater than 200rpm

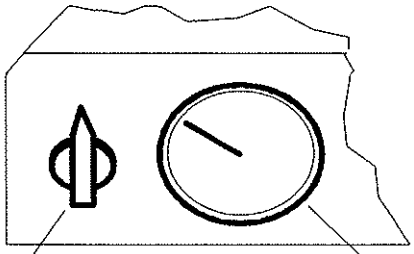
Specification

Motor type	Pneumatic
Direction	Reversible
Air consumption	26 litre/second at 6 bar 54 cubic feet/min at 90 psi
Noise at 1m	fast response 79 dB A
Nominal maximum rotor speed	360 rpm
Operating temperature range	0 C to 37 C 32 F to 100 F
Storage temperature range	-40 C to 70 C -40 F to 160 F
Weight	26 Kg 56 lb

Care and maintenance

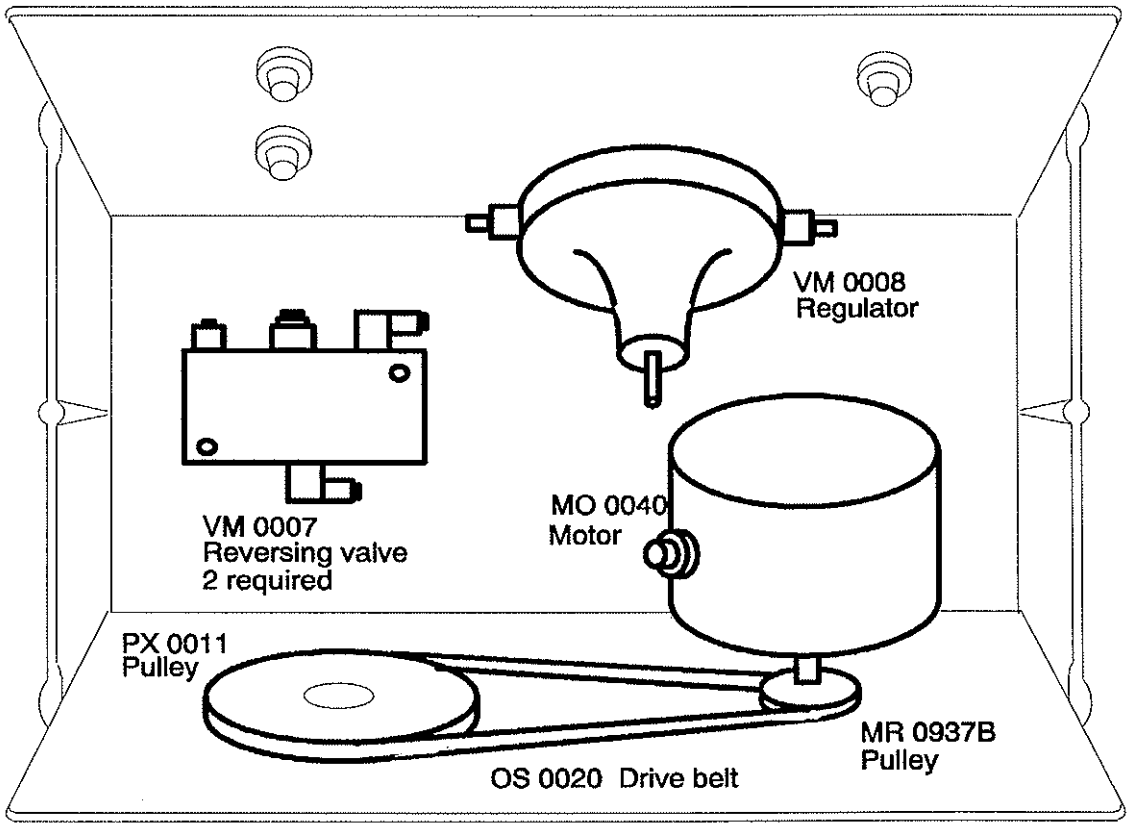
The sun gear of the gearbox in the pumphead should be lightly greased with a good gear grease every one thousand hours. If harmful liquids are spilled on to the pump, the case and pumphead should be thoroughly cleaned with detergent and water. Strong solvents should not be used. The sun gear of the gearbox in the pumphead should be lightly greased with a good gear grease after the pumphead has been cleaned.

Spares



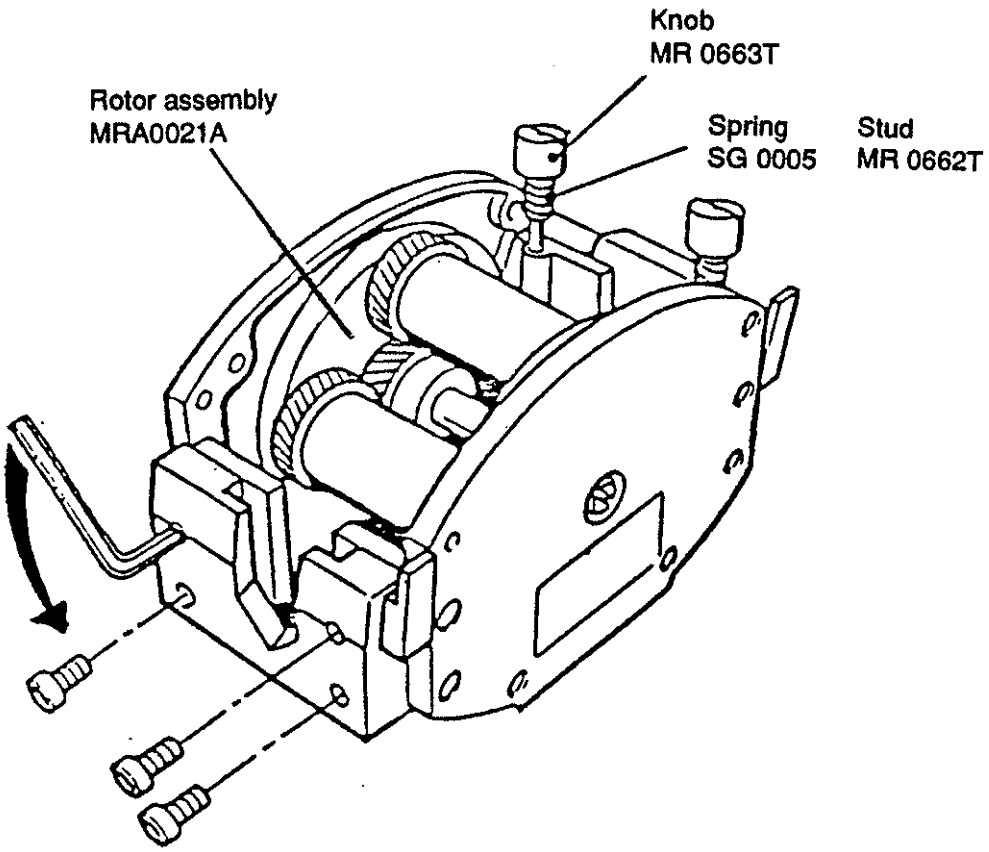
VM 0009 Pilot valve
VM 0010 Reversing switch

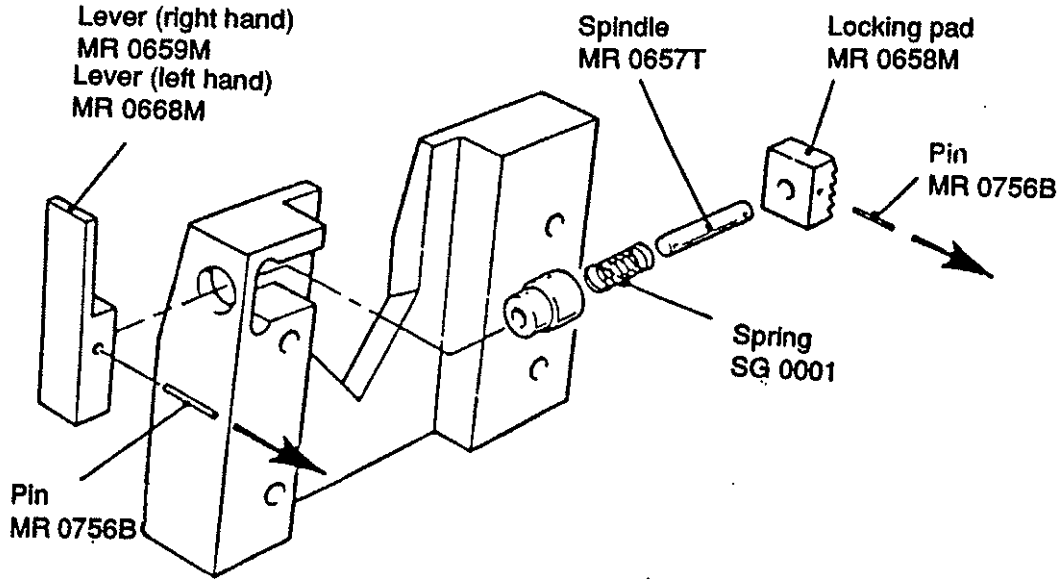
GP 0005 Pressure gauge

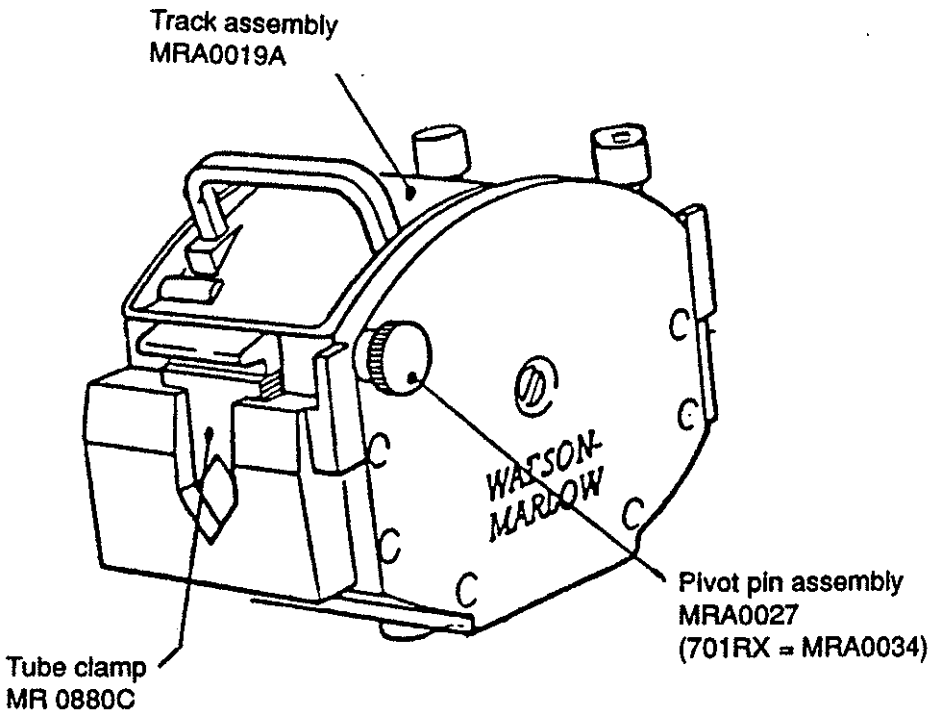


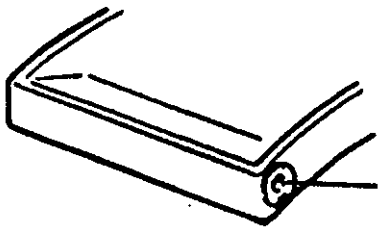
Tubing required:
XX 0047 4mm OD Nylon, 3 meters
XX 0048 8mm OD Nylon, 0.05 meters
XX 0049 12mm OD Nylon, 0.5 meters

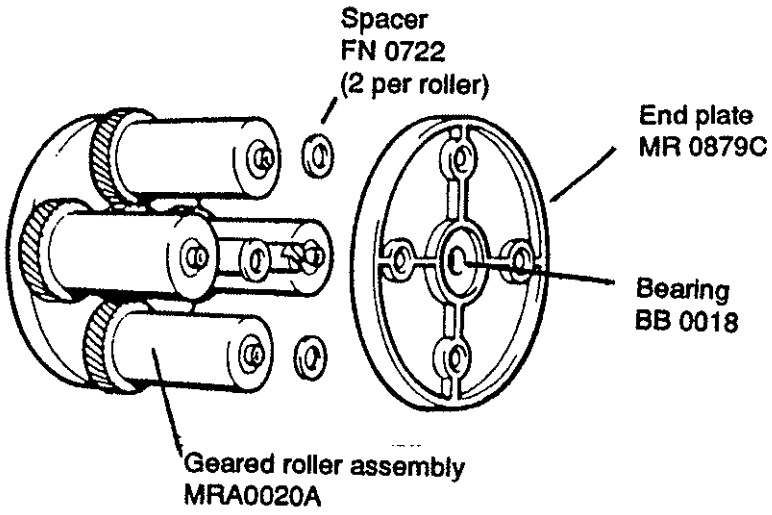
Complete pump
070.7001.000

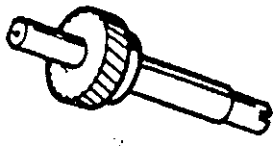

Knob
MR 0663T
Rotor assembly
MRA0021A
Spring
SG 0005
Stud
MR 0662T

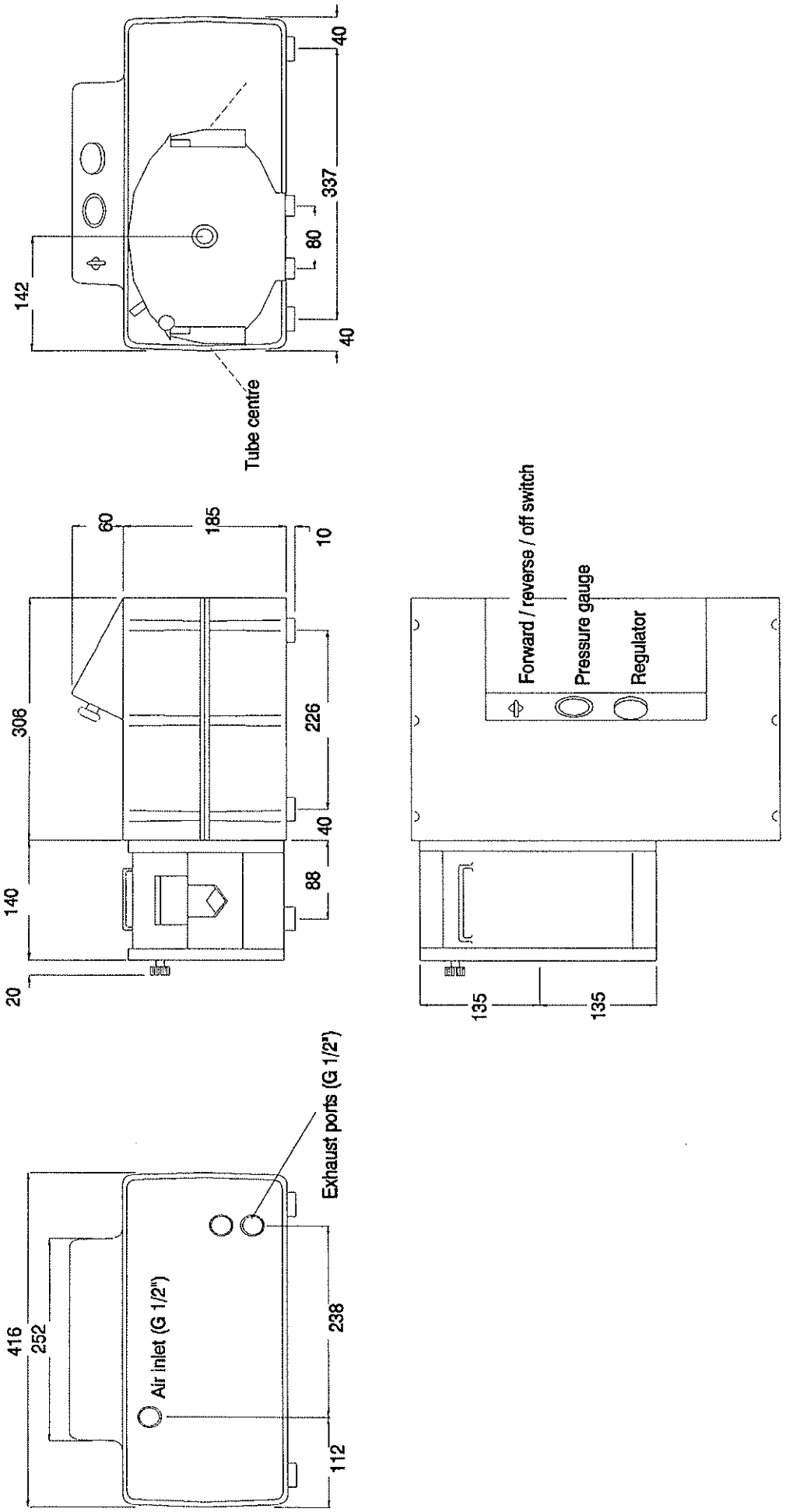

Lever (right hand)
MR 0659M
Lever (left hand)
MR 0668M
Spindle
MR 0657T
Locking pad
MR 0658M
Pin
MR 0756B
Spring
SG 0001
Pin
MR 0756B


Track assembly
MRA0019A
WATSON-MARLOW
Pivot pin assembly
MRA0027
(701RX = MRA0034)
Tube clamp
MR 0880C


Eccentric bush
MR 0882M


Spacer
FN 0722
(2 per roller)
End plate
MR 0879C
Bearing
BB 0018
Geared roller assembly
MRA0020A


Shaft/sungear assembly
MRA0039A
(701RX = MRA0040A)


142
40
337
80
40
Tube centre
60
185
10
306
226
40
140
88
20
Forward / reverse / off switch
Pressure gauge
Regulator
135
135
Exhaust ports (G 1/2")
416
252
Air inlet (G 1/2")
238
112

Declaration of incorporation

We declare that when any pump or drive unit listed below is used with any suitable Watson-Marlow pumphead (also listed below) and intended for installation into machines or is to be assembled with other machines for installations, it must not be put into service until the machinery into which it has been incorporated has been declared to be in conformity with the provisions of the:

Machinery Directive 89/392/EEC and EN60204-1

Drive units	Pumpheads			
503P	205AA	303D/A	501RL	601R
603P	205BA	303X	505L	605L
701P	205LA	304D/A	505LX	
	205AAX	304X		701R
	205BAX	306D/A	505AA	701RX
	205LAX	306X	505BA	701RE
			505LA	701REX
			505AAX	
			505BAX	
			505LAX	

WATSON MARLOW

Responsible person: Dr. R. Woods, Managing Director.
Watson-Marlow Limited, Falmouth, Cornwall, TR11 4RU, England.
Telephone 01326 370370 Fax 01326 376009

Declaration of conformity

We declare that when any drive unit listed below is used with any suitable Watson-Marlow pumphead (also listed below) to form a stand alone pump it conforms to the requirements of the:

Machinery Directive 89/392/EEC and EN60204-1

Drive units	Pumpheads			
503P	505AA	303D/A	501RL	601R
603P	505BA	303X	505L	605L
701P	505LA	304D/A	505LX	
	505AAX	304X		701R
	505BAX	306D/A	505AA	701RX
	505LAX	306X	505BA	701RE
			505LA	701RXE
			505AAX	
			505BAX	
			505LAX	

WATSON MARLOW

Responsible person: Dr. R. Woods, Managing Director.
Watson-Marlow Limited, Falmouth, Cornwall, TR11 4RU, England.
Telephone 01326 370370 Fax 01326 376009

Decontamination certificate

Watson-Marlow Limited Health and Safety Declaration

1.0 This procedure is a legal requirement in the UK and **must** be used when returning pumps and equipment for service at Watson-Marlow (or its distributor).

2.0 **Pumps returned for service must be cleaned. You are responsible for their decontamination.**

3.0 Either fax this form or send by first class post to Watson-Marlow (or its distributor) to **ensure** that we have the information **before** receipt of the equipment.

A further copy must be attached to the **outside** of the shipping case.

Failure to complete the form or comply with the procedure will cause delays in servicing the equipment.

4.0 Company .....
Address .....
..... Post Code.....
Telephone ..... Fax number.....

5.0 Please complete **all** the following sections

5.1 Pump Type.....

5.2 Serial number.....

5.3 Details of substances pumped

5.3.1 Chemical names:
(a) .....
(b) .....
(c) .....
(d) .....

5.3.2 Precautions to be taken in handling these substances:
(a) .....
(b) .....
(c) .....
(d) .....

5.3.3 Action to be taken in the event of human contact:
(a) .....
(b) .....
(c) .....
(d) .....

5.3.4 Cleaning fluid to be used if residue of chemicals is found during servicing:
(a) .....
(b) .....
(c) .....
(d) .....

5.4 If substances are not hazardous nor toxic, please complete section 5.4.1.
If substances are hazardous or toxic, please complete section 5.4.2.

5.4.1 I hereby confirm that the equipment specified has not pumped nor come into contact with any toxic or hazardous substances.

Signed.....
Name.....
Position.....
Date.....

5.4.2 I hereby confirm that the only toxic or hazardous substance(s) that the equipment specified has pumped or come into contact with are those named, and that the information given is correct and the carrier has been informed if the consignment is of a hazardous nature.

Signed.....
Name.....
Position.....
Date.....

5.5 Carrier to be used
.....
Delivery date
.....

5.6 Fault description or any other information
.....
.....
.....
.....
.....

IMPORTANT Before returning any product for service, this form **must** be completed and sent to Watson-Marlow, or its subsidiary, or its official distributor undertaking the service

Watson-Marlow Limited, Falmouth, Cornwall TR11 4RU, England. Tel 01326 370370, Fax 01326 376009