

501CC




501DF, 501DP, 501DFX, 501DV ATEX II 2 G T4



501F, 501P, 501X, 501V ATEX



Declarations

Declaration of conformity 	When this pump unit is used as a stand alone pump it complies with: Machinery Directive 2006/42/EC, EMC Directive 2004/108/EC.
Declaration of Incorporation	<i>When this pump unit is to be installed into a machine or is to be assembled with other machines for installations, it must not be put into service until the relevant machinery has been declared in conformity with the Machinery Directive 2006/42/EC.</i>

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



Two year warranty

Watson-Marlow Limited warrants, subject to the conditions below, through either Watson-Marlow Limited, its subsidiaries, 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 tubing and rollers are excluded.
- Products must be returned by pre-arrangement carriage paid to Watson-Marlow Limited, its subsidiaries, or its authorised distributor.
- All repairs or modifications must have been made by Watson-Marlow Limited, its subsidiaries, or its authorised distributors or with the express permission of Watson-Marlow Limited, its subsidiaries, 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, its subsidiaries, 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.

Information for returning pumps

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 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 and the cleaning procedure must be specified along with a statement that the equipment has been decontaminated.

Safety

In the interests of safety, this pump and the tubing selected should only be used by competent, suitably trained personnel after they have read and understood this manual, and considered 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. In the UK this person should also be familiar with the Health and Safety at Work Act 1974.

	<i>Fundamental work with regard to lifting, transportation, installation, starting-up, maintenance and repair should be performed by qualified personnel only. Make absolutely sure that no voltage is applied at all whilst work is being carried out on the geared motor. The motor must be secured against accidental start up.</i>
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Recommended operating procedures

- ON** variable speed models please note that the mechanical speed variator must not be adjusted whilst the pump is stationary.
- DO** keep delivery and suction lines as short and direct as possible using a minimum number of swept bends
- DO** site the pump just above the level of the product to be pumped.
- DO** keep the pipework at least equal in size to the bore size of the pump. Increase the bore size when fluids have a high viscosity or high inertia, thus keeping losses to a minimum.

- DO** use valves with a straight fluid path.
- DO** use slow sweeping bends with minimum radius equal to four to five times the tubing diameter.
- DO** keep the pumphead rollers and track clean.

The self-priming nature of peristaltic pumps means valves are not required. Any valves fitted must cause minimum restriction to flow in the pumping circuit.

When using Marprene tubing, after the first 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 about the compatibility of a tube material and the duty fluid, request a tube sample card for immersion trials.

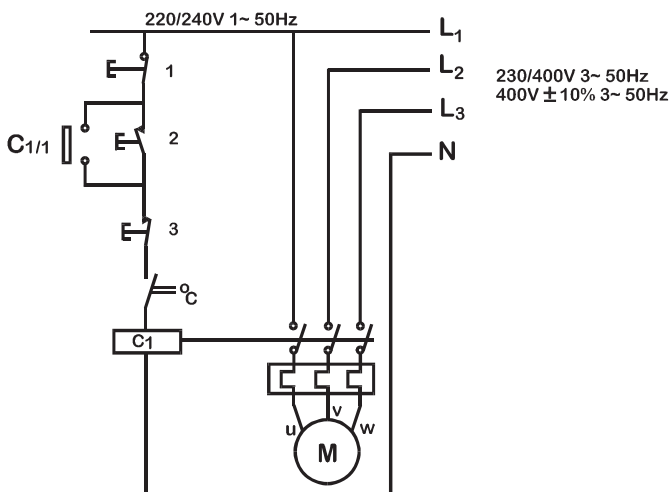
Installation

Pump

- Site the pump on a flat, horizontal, vibration-proof surface allowing a free flow of air around it. Ensure there is 0.5m of straight tubing before the pumphead inlet and after the pumphead outlets. Close coupled simplex pumps will require bolting down with four M8 bolts through the gearbox foot mounting holes.

AC Motor

- Ensure that mains voltage/frequency are in accordance with motor nameplate information.
- Secure protective conductor connections.
- If the motor is running in the wrong direction, interchange any two phases.
- Close unused cable entrance holes and the terminal box itself in a dust and watertight manner.
- A current overload relay should be fitted to a contact breaker. Connect the motor in accordance with the wiring diagram which will be found in the motor terminal box.
- When a thermal protection switch is fitted in the motor, the leads will be found in the motor terminal box. They should be connected to stop the pump if the switch operates. The switch will open circuit at an over temperature condition. See below for the connection of the drive motor showing possible ancillary switches and protections.



1 Emergency stop **2** Start **3** Stop

The ancillary switches are rated to 220/240V 1ph 50Hz. The Start contact should have a sprung return which will disengage following energisation of the coils C1 and C1/1.



Do not under any circumstances wire switches directly across any of the phases of a 3 phase supply. If in doubt disconnect the pump immediately!



Do not connect ancillary switches to the terminal box of a flame proof motor unless the switch has a suitable Exd rating for the zone area in which it is to be mounted.

Start up

Before starting and after prolonged storage of the gear units, remove the plug from the vent screw on top of the casing to avoid excessive pressure in the gearbox, which may cause leakage at the shaft seals.

Troubleshooting

Should the pump fail to operate, make the following checks to determine whether or not servicing is required.

- Check the electrical supply is available at the pump.
- Check that the pump is not stalled by incorrect fitting of tubing.



Always check to ensure that an Exd motor gearbox is suitably rated for the hazardous zone area in which it is to be mounted. Exd motors should only be installed by Exd qualified personnel.



Any deviation from normal operating conditions (increased power consumption, temperature, vibrations, noise) or warning signals by monitoring equipment suggest malfunction. Inform the responsible maintenance personnel at once to prevent the trouble from worsening. If in doubt disconnect the pump immediately.

AC Motor maintenance

- Remove any dust deposits from the fan cover to avoid overheating.
- Ensure that the bearing cage is packed to about 1/3 with evenly distributed lubricating grease.
- Select the correct lubricating grease from the table in the back of this operating instruction.

Gearbox maintenance - Simplex (single pumphead) units

- Change lubricant every 10,000 working hours or after 2 years.
- Combine a lubricant change with a thorough cleaning of the gear unit.
- Extreme working conditions (high air humidity, aggressive media and large temperature variations) will reduce the interval between lubricant changing intervals.
- Select the correct lubricating oil from the table in the back of this operating instruction.

Gearbox maintenance - Duplex (twin pumphead) units

The gearbox is filled for life with synthetic lubricant so no maintenance is required.

Belt variator maintenance

- Pulleys are supplied with a permanent grease packing. No refill is necessary. The variator should occasionally be run over its full range to apply a grease coating to the full track.
- The control spindle should be cleaned and greased occasionally.

Replacement of the V-belt

- Unscrew socket head screws and remove cover with the entire speed control mechanism.
- Remove V-belt
- Wrap new V-belt around open adjustable pulley and let it slip over the spring loaded pulley. The V-belt can be easily attached if the adjustable pulley is opened. Ensure that the adjustable pulley is opened carefully.
- Replace the removed cover with complete speed control mechanism and re-assemble.
- When positioning the top (adjustable pulley closed) speed limiting lock nut, ensure that the adjustable pulley has a gap of 0.5-1.0mm to prevent damage to the pulley and motor bearings.
- The V-belt should not be in contact with the bottom of the adjustable pulley.

Air Motors



The air motor is designed for air only. Do not allow corrosive, flammable or explosive gases or particulate material to enter the motor. Water vapour, oil-based contaminants, or other liquids must be filtered out. The recommended air pressure should not exceed 7 bar, 100 PSIG.



Always disconnect the air supply before servicing.

Installation

A muffler is supplied with the air motor, but not installed. Install a moisture trap and filter in the air line ahead of the motor. If condensates need to be flushed out of the motor, use clean, dry air at low pressure. For efficiency of output and speed control, use air lines of the same size or next pipe size larger than the intake port of the motor. A 4 way valve which can be connected by piping to both air ports of the motor will make reversing possible. Use a pressure regulator or a simple shut off valve to obtain desired power and conserve air to regulate speed and torque.

Lubrication

Use a detergent SAE #10 automotive engine oil. Lubrication is necessary for all moving parts and rust prevention. We recommend that an automatic air lubricator be installed in the air line just ahead of the motor. The lubricator should be adjusted to feed one drop of oil for every 25-35 l/sec, 50-75 CFM, of air going through the motor.

- Manual lubrication-Add 10-20 drops of oil every eight hours of operation through the inlet port while the pump is shut down.
- Automatic lubrication- An In-line oiler should be adjusted to feed one drop per minute for high speed or continuous duty use. Do not overfeed oil as contamination of the exhaust air may occur.

Troubleshooting

Reason	Low torque	Low speed	Won't run	Runs hot	Runs good then slows down
Dirt, Foreign material	x	x	x		
Internal rust	x	x	x		
Misalignment	x	x	x	x	x
Insufficient air pressure	x	x			
Air line too small		x			
Restricted exhaust		x			x
Poor lubrication	x	x	x	x	
Jammed machine	x	x	x		x
Compressor too small		x			x
Compressor too far from unit		x			x

Pump Specifications

Control range	See pump specification label
Voltage/frequency	See pump specification label
Power consumption	See pump specification label
Operating temperature range	5C to 40C
Storage temperature range	-40C to 70C
Noise	<75dB(A) at 1m
Standards	IEC 335-1, EN60529 (IP55)
Machinery Directive	98/37/EC EN60204-1
Low Voltage Directive	73/23/EEC EN61010-1
EMC Directive	89/336/EEC EN50081-1/EN50082-1

Specific drive performance details such as loaded drive speed variation against mains supply voltage fluctuation and drive stability from a cold start to normal operating temperature are available on request. For further information please contact Watson-Marlow Technical Support Centre.

501RLC Pumphead

The 501RLC pumphead has two spring-loaded working rollers, which automatically compensate for minor variations in tubing wall thickness, giving extended tube life. The 501RLC is set during manufacture to accept tubing with wall thicknesses of between 1.6mm and 2.0mm, and internal diameters of up to 8.0mm. It is equipped with a "tool lockable" guard for increased safety. This should be locked shut whilst the pump is in use.

The pumphead can be run clockwise for extended tube life, or anti-clockwise to operate against higher pressures.

501RLC Flow rates

Flow rates for the 501RLC were obtained using silicone tubing with the pumphead rotating clockwise, pumping water at 20C with zero suction and delivery pressures. For critical applications determine flow rates under operating conditions.

501RLC Installation. Simplex (single pumphead) units and duplex (twin pumphead) units

Isolate motor from mains supply.

Fit the track in any one of three orientations, over the drive shaft and locating boss. Secure the track with the four locating screws. Ensure the drive shaft is degreased before locating the rotor onto the shaft via the split collet. *Rotate the rotor until its guide rollers are aligned flush to the front edge of the track.* Tighten the rotor screw to a torque of 3Nm to prevent the collet slipping during operation. Swing in the crank handle.

To reposition the track, 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 four track locating screws, and pull the track clear. Rotate the track to its new position and tighten the track locating screws.



Photographs show duplex pumps

501RLC Tube loading simplex (single pumphead) units

Isolate pump from mains supply. 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 systems.

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. Note: For units with mechanical variators follow the Duplex tube loading procedure.



Fit the other end of the tubing into the second spring loaded clamp, ensuring that the tubing is not slack in the pumphead, since this can reduce tube life.

Close the crank handle and shut and lock the guard.

The 501RLC pumphead is fitted with four-position tube clamps, to accommodate various tube diameters, 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 the clamps so that the minimum necessary pressure is applied to the tubing.

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



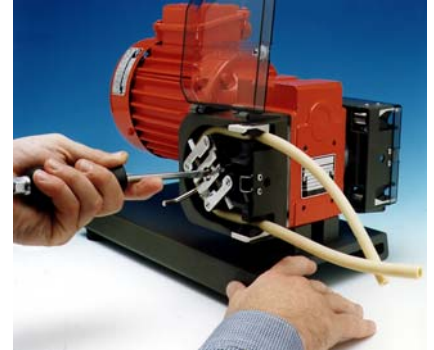
501RLC tube loading. Duplex (twin pumphead) units

Isolate the pump from mains supply. Unlock and open the hinged guard. Swing out the rotor crank handle until it locks into position. Loosen the rotor screw and give the rotor a sharp tap to release it. Pull the rotor slightly forward from its seated position on the drive shaft so that the pinned collet clears the drive shaft dog and it can rotate freely. Select the length of tubing required, noting that approximately 240mm is required for the track systems.



Due to the common gearbox, the two pump rotors run in opposite directions. This means that one rotor runs in a clockwise direction and the other runs in an anti-clockwise direction. Please consider this and the effect on the piping arrangements (suction and discharge) during installation.

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, since this can reduce tube life.

Rotate the rotor until it sits back slightly onto the shaft and guide rollers are aligned flush to the front edge of the track and the pinned collet is locked to the drive shaft dog. Tighten the rotor screw to a torque of 3Nm to prevent the collet slipping during operation. Clip the crank handle back into position. Lock the pumphead guard.

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

The 501RLC pumphead is fitted with four-position tube clamps, to accommodate various tube diameters, 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 the clamps so that the minimum necessary pressure is applied to the tubing.

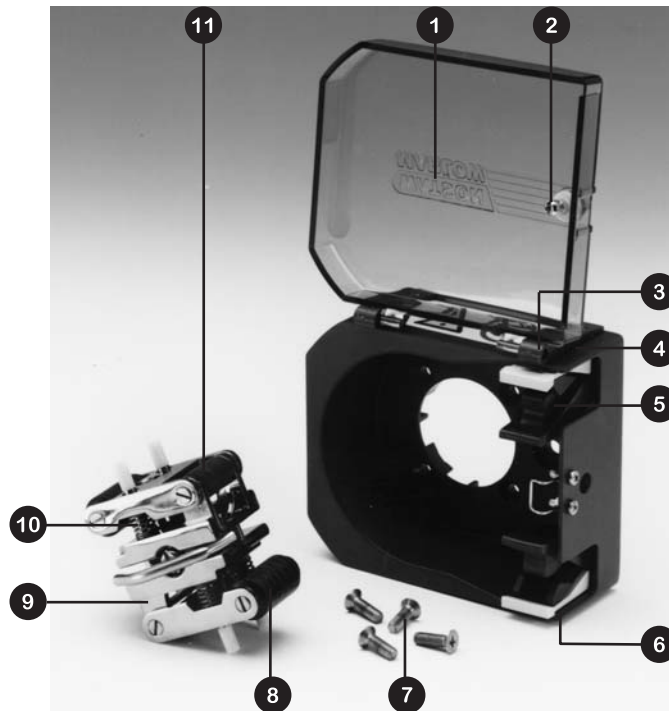
501RLC Roller adjustment

The 501RLC has a factory set gap of 2.6mm between the rollers and the track and is suitable for tubing having wall thicknesses of between 1.6 and 2.0mm. Adjustment of the gap will be required if tubing having a wall thickness of less than 1.6mm is required. 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. The 501RLC2 has a factory set gap of 3.8mm between the wall and the track and is suitable for tubing having wall thickness of between 2.1 and 2.5mm.


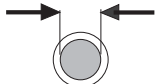

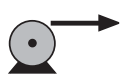

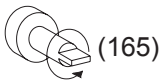
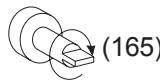
Check moving parts of the rotor from time to time for freedom of movement. Lubricate pivot points and rollers occasionally with Teflon lubricating oil. For rollers with oilite bushes, use a low viscosity mineral oil in low ambient temperature, or a high viscosity mineral oil for high ambient temperatures.

501RLC Pumphead spares



Number	Spare	Description
1	MN 1200M	Lockable guard
2	FN 4502	Lock
3	FN 2341	Hinge screw
4	MN 0266M	Hinge grey
5	MNA0114A	Tube clamp assembly
6	FN 2332	Screw
7	FN 0422	Screw (x 4)
8	MN 0011T	Main roller
9	MNA0143A	501RLC Rotor assembly
9	MNA0511A	501RL2C Rotor assembly
10	SG0001	Spring standard (1.6)
10	SG0002	Spring hard (2.4)
11	MN 0012T	Follower roller

Technical Data

							
English	Tube number	Tube bore	rpm	Pressure(+)	Suction	Counter-clockwise	Clockwise (rpm)

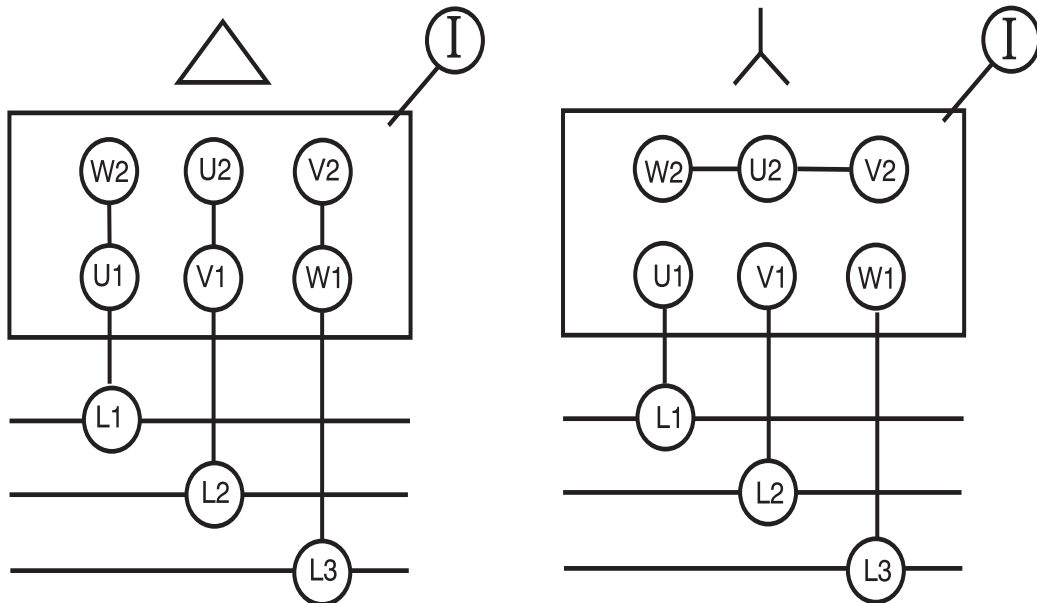
Gearbox lubricant

Mineral Oil	Energol GR-XP 220	Mobil-gear 630	Shell Omala Oel 220
	EnergolGR-XP 100	Mobil-gear 629	Shell Omala Oel 100
	Bartran HV15	Mobil DTE 11M	Shell Tellus Oel T 15

501F/RL, 501I/RL, 501TI/RL - 100ml

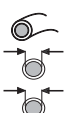
















601F/R, 601I/R, 601TI/R - 250ml

Motor wiring









501RLC, 501RLC2 (ml/min)







Flow rates

	#	112	13	14	16	25	17	18
	mm	0.5	0.8	1.6	3.2	4.8	6.4	8.0
	"	1/50	1/32	1/16	1/8	3/16	1/4	5/16
	60	2.5	7.4	26	110	240	380	600
	213	8.9	26	91	400	860	1400	2100
	291	12	36	120	540	1200	1900	2900
	62	2.6	7.6	26	120	250	390	620
	223	9.3	27	95	410	900	1400	2200
	281	12	34	120	520	1100	1800	2800
	6 - 60	0.25-2.5	0.74-7.4	2.6-26	11-110	24-240	38-380	60-600
	21 - 213	0.88-8.9	2.6-26	9.0-91	39-400	85-860	130-1400	210-2100
	29 - 291	1.2-12	3.6-36	12-120	54-540	120-1200	180-1900	290-2900
	6 - 62	0.25-2.6	0.74-7.6	2.6-26	11-120	24-250	38-390	60-620
	22 - 223	0.92-9.3	2.7-27	9.4-95	41-410	89-900	140-1400	220-2200
	28 - 281	1.2-12	3.4-34	12-120	52-520	110-1100	180-1800	280-2800
	12 - 60	0.50-2.5	1.5-7.4	5.1-26	22-110	48-240	76-380	120-600
	43 - 213	1.8-8.9	5.3-26	18-91	80-400	170-860	270-1400	430-2100
	13 - 64	0.54-2.7	1.6-7.9	5.6-27	24-120	53-260	83-410	130-640
	40 - 201	1.7-8.4	4.9-25	17-86	74-370	160-810	250-1300	400-2000

501RLC, 1.6mm

Product codes						
						
mm	"	#	Marprene	Bioprene	Pumpsil	
0.5	1/50	112	902.0005.016	903.0005.016	913.0005.016	
0.8	1/32	13	902.0008.016	903.0008.016	913.0008.016	
1.6	1/16	14	902.0016.016	903.0016.016	913.0016.016	
3.2	1/8	16	902.0032.016	903.0032.016	913.0032.016	
4.8	3/16	25	902.0048.016	903.0048.016	913.0048.016	
6.4	1/4	17	902.0064.016	903.0064.016	913.0064.016	
8.0	5/16	18	902.0080.016	903.0080.016	913.0080.016	
						
mm	"	#	Tygon	Fluorel	Neoprene	
0.8	1/32	13			920.0008.016	
1.6	1/16	14	950.0016.016	970.0016.016	920.0016.016	
3.2	1/8	16	950.0032.016	970.0032.016	920.0032.016	
4.8	3/16	25	950.0048.016	970.0048.016	920.0048.016	
6.4	1/4	17	950.0064.016	970.0064.016	920.0064.016	
8.0	5/16	18	950.0080.016	970.0080.016	920.0080.016	

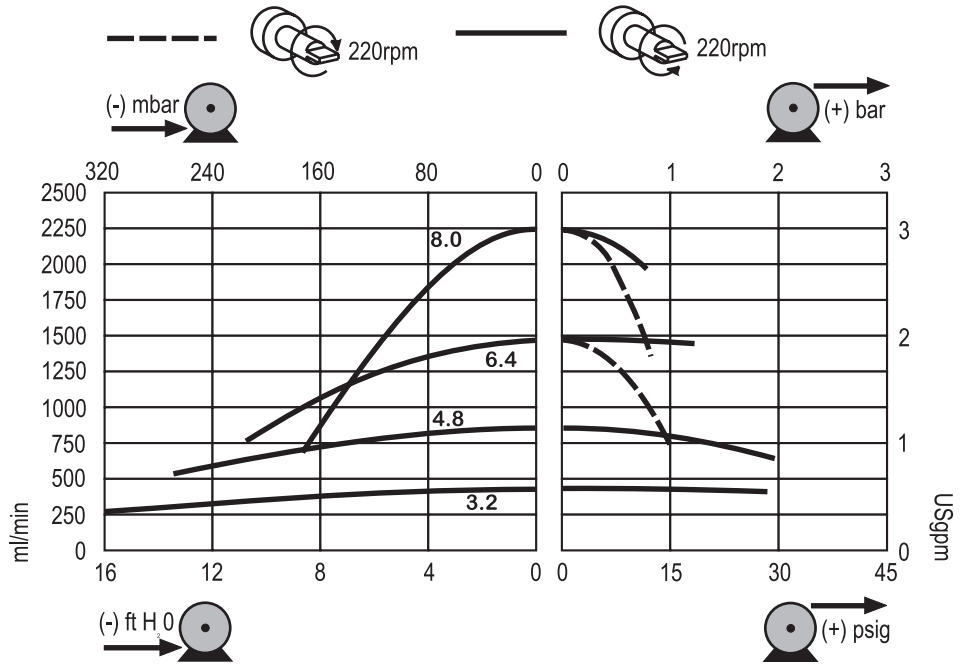
501RL2C, 2.4mm

Product codes						
						
mm	"	#	Marprene	Bioprene	Pumpsil	
0.5	1/50				913.A005.024	
0.8	1/32				913.A008.024	
1.6	1/16	119	902.0016.024	903.0016.024	913.A016.024	
3.2	1/8	120	902.0032.024	903.0032.024	913.A032.024	
4.8	3/16	15	902.0048.024	903.0048.024	913.A048.024	
6.4	1/4	24	902.0064.024	903.0064.024	913.A064.024	
8.0	5/16	121	902.0080.024	903.0080.024	913.A080.024	
						
mm	"	#	Chem-Sure	Sta-Pure		
1.6	1/16	119	965.0016.024	960.0016.024		
3.2	1/8	120	965.0032.024	960.0032.024		
4.8	3/16	15	965.0048.024	960.0048.024		
6.4	1/4	24	965.0064.024	960.0064.024		
8.0	5/16	121	965.0080.024	960.0080.024		

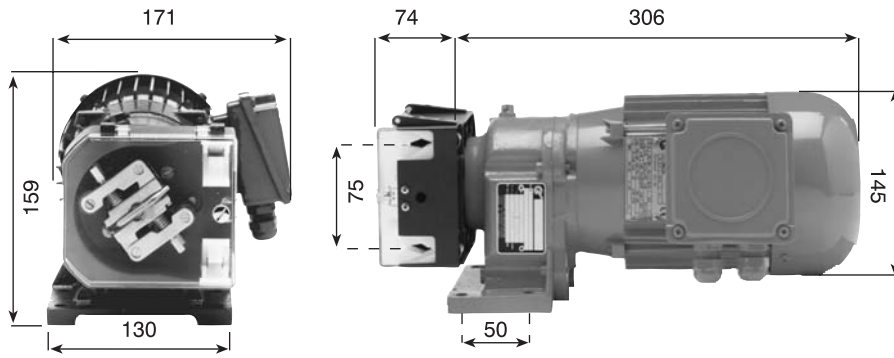
Note: 2.4mm wall Chem-Sure and Sta-Pure tubing are supplied in 355mm lengths

501RLC

Flow rates



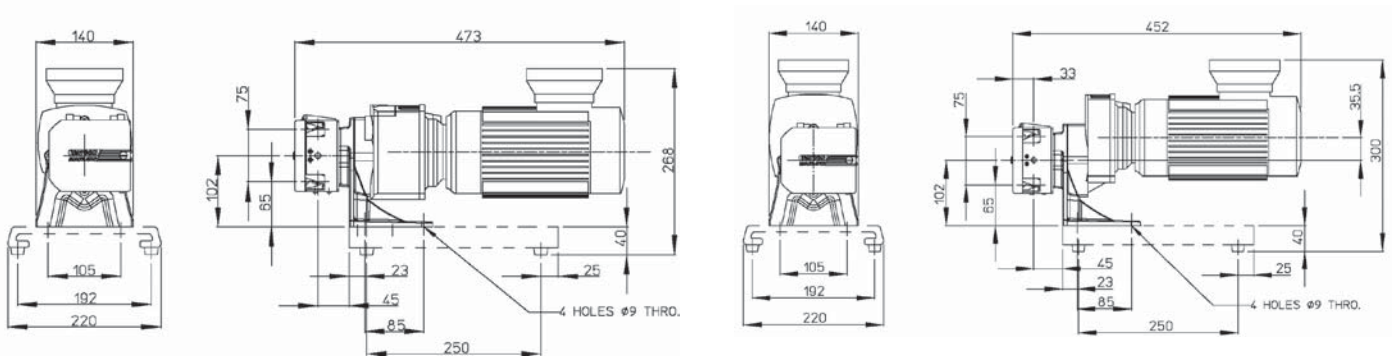
501F/R



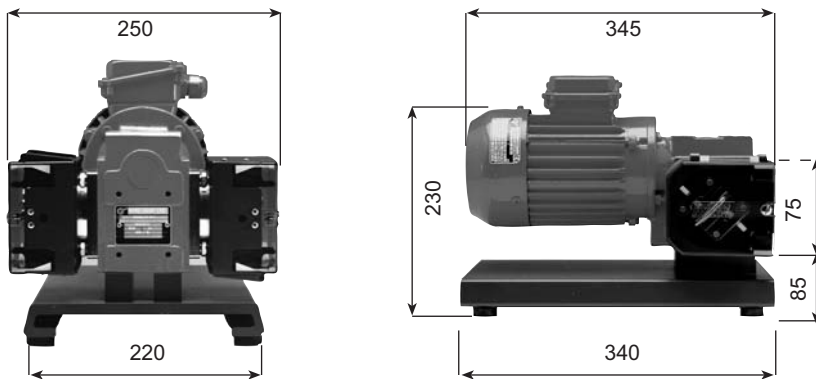
501DF/R

62rpm model

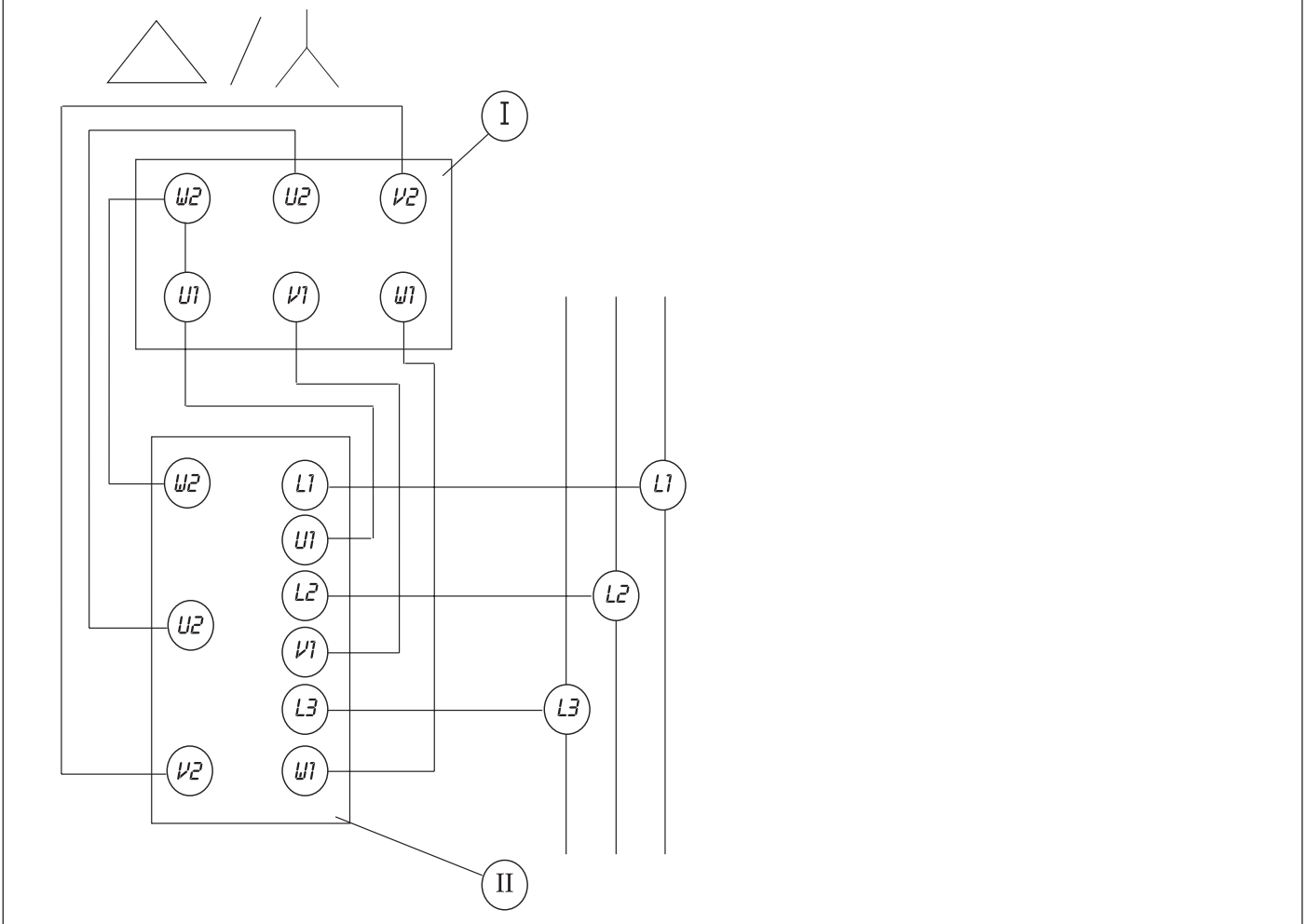
223 rpm model



501FX/RL



Switch



Watson-Marlow, Bioprene, Pumpsil and Marprene are trademarks of **Watson-Marlow Limited**.

Tygon is a trademark of the **Saint-Gobain Performance Plastics Company**. **Fluorel** is a trademark of **3M**.

Sta-Pure and **Chem-Sure** are trademarks of **W.L Gore and Associates**.


Warning, These products are not designed for use in, and should not be used for patient connected applications.

The information contained in this document is believed to be correct but Watson-Marlow Limited accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

Watson-Marlow Limited
Falmouth
Cornwall
TR11 4RU
England

Declaration of Conformity

- Description** 500 Series ATEX Compliant Configured Peristaltic Pumps
- Products** 501D, (F, V, X & P variant), ATEX close coupled pumps, configured with 501RLA, RL2A, or 313 or 314DA, XA, D2A, or X2A ATEX pump heads.
- Conformity** This document certifies that the above equipment complies with the requirements of Directive 94/9/EC (the "ATEX" directive).
- Rating** The pumps are rated as Group II, Category 2 equipment, with a T4 temperature classification, for use in gas based environments.


 II 2 G, c T4

- Standards** EN13463-1:2001
EN13463-5
- Manufacturer** Watson-Marlow Bredel Pumps, TR11 4RU, England.
- Notified body** Full details of the conformity assessment procedure can be found in the technical reference file, "ATEX-500-CP". In accordance with the requirements of Directive 94/9/EC a copy of this file has been archived with the following notified body:

Intertek (CE 0359), KT22 7SB, England.

Date 15th April 2004

Signature



Christopher Gadsden, Managing Director, Watson-Marlow Limited

Product use and decontamination declaration

In compliance with the **UK Health & Safety at Work Act** and the **Control of Substances Hazardous to Health Regulations** you, the user are required to declare the substances which have been in contact with the product(s) you are returning to Watson-Marlow or any of its subsidiaries or distributors. Failure to do so will cause delays in servicing the product. Therefore, **please complete this form** to ensure that we have the information **before** receipt of the product(s) being returned. **A FURTHER COPY MUST BE ATTACHED TO THE OUTSIDE OF THE PACKAGING CONTAINING THE PRODUCT(S).** You, the user, are responsible for cleaning and decontaminating the product(s) before returning them.

Please complete a separate Decontamination Certificate for each pump returned.

RGA No:

1 Company

Address

Postcode

Telephone

Fax Number

2 Product

3.4 Cleaning fluid to be used if residue of chemical is found during servicing;

2.1 Serial Number

(a)

2.2 Has the Product been used?

(b)

YES		NO	
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(c)

(d)

If yes, please complete all the following Sections

If no, please complete Section 5 only

3 Details of substances pumped

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

3.1 Chemical names:

(a) 5 Signed

(b) Name

(c) Position

(d) Date

3.2 Precautions to be taken in handling these substances:

(a)

(b) Note: To assist us in our servicing please describe any fault condition you have witnessed.

(c)

(d)

3.3 Action to be taken in the event of human contact:

(a)

(b)

(c)

(d)