WATSON MARLOW PUMPS

505S

Declarations

Declaration of conformity CE	***When this pump unit is used as a stand alone pump it complies with: Machinery Directive 98/37/EC EN60204-1, Low Voltage Directive 73/23/EEC EN61010-1, EMC Directive 89/336/EEC EN50081-1/EN50082-1.***

Declaration of Incorporation	***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 98/37/ EC EN60204-1.***

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

R. Woods

Three 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 three 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, rollers and motor brushes 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.

	***There are dangerous voltages (at mains potential) inside the pump. If access is required, isolate the pump from the mains before removing the cover.***

Recommended operating procedures

DO keep delivery and suction lines as short as possible using a minimum number of swept bends.

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

DO run at a slow speed when pumping viscous fluids. When using the 501RL pumphead, a 4.8 or 6.4mm bore tube with a 1.6mm wall will give best results. Tube smaller than this will generate a high-friction pressure loss, so reducing the flow. Tube

with a larger bore will not have sufficient strength to restitute. Flooded suction will enhance pumping performance in all cases, particularly for materials of a viscous nature. Silicone and Marprene tubing is available with a 2.4mm wall thickness for speeds up to 200rpm. (The rotor will require re-setting to a roller/track gap of 3.8mm.)

DO fit an extra length of pump tube in the system to enable tube transfer. This will extend tube life and minimise the downtime of the pumping circuit.

DO keep the track and rollers clean.

The self-priming nature of peristaltic pumps means valves are not required. Any valves fitted must cause no 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

The 505S/RL is suitable for single phase mains electricity supplies only.

To ensure correct lubrication of the gearbox the pump should be run only while its feet are standing on a horizontal surface. The pump should be positioned to allow a free flow of air around it.

- Set the voltage selector to either 120V for 100-120V 50/60Hz supplies or 240V for 220-240V 50/60Hz supplies.

A mains cable fitted with a moulded plug is supplied with the pump. The wires are colour coded in accordance with the following code:

- 220-240V: Live- Brown; Neutral - Blue; Earth - Green/Yellow.
- 100-120V: Live - Black; Neutral - White; Earth - Green.

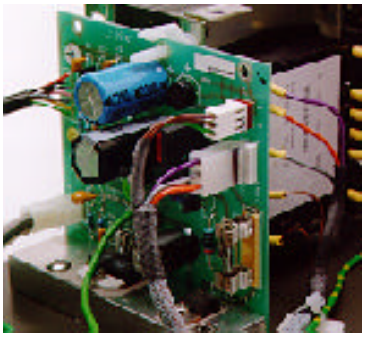
Reduced voltage operation

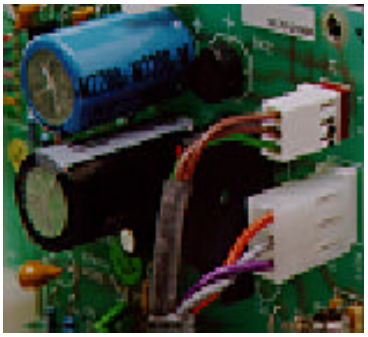
In areas where voltage is below that specified above, modifications can be made to the pump unit to allow operation under the following minimum voltage levels:

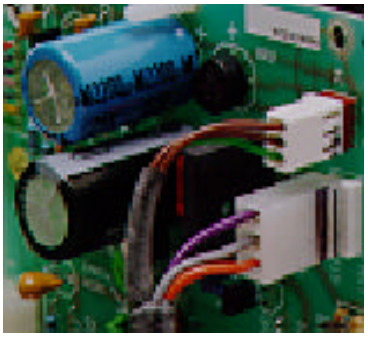
- **180V when using the 220-240V setting.**
- **90V when using the 100-120V setting.**

The modification requires the connector J18 on the **Control PCB** to be reversed. To locate the terminal, isolate the mains supply then remove the pump cover. **State A** shows the standard voltage setting, whilst **State B** shows the reduced voltage setting. Any damage caused to the pump in the process of carrying out this modification will not be covered by warranty.

Control PCB **State A** **State B**







Refer servicing to qualified personnel only.

Troubleshooting

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

- Check that the power switch is on.
- Check the mains supply is available at the pump.
- Check the voltage selector switch is in the correct position.
- Check the fuse in the mains socket.
- Check that the pump is not stalled by incorrect fitting of tubing.

Manual operation

- Switch power on (drive rear panel).
- Change the set speed by pressing the ⮝ or ⮟ key. The 505S speed control ratio is 110:1. This will give a minimum speed of 2rpm for the 220rpm drive and 0.5 rpm for the 55rpm drive.
- Change direction by pressing the ***CW/CCW*** key. Check the flashing ***CW/CCW*** symbol for actual direction setting. (***CW*** : clockwise ***CCW*** : counterclockwise).
- Select the maximum speed: press the ⮝ key and the ***Max*** key together. Select the minimum speed: press the ⮟ key and the ***Max*** key together.
- The keypad has a locking facility to avoid resetting or tampering. If the pump is stopped, press ***Stop*** until the padlock symbol illuminates. If the pump is running, press ***Start*** until the padlock symbol illuminates. All keys will be disabled except for ***Start*** and ***Stop***. Press these keys until the padlock symbol extinguishes to unlock the keypad.
- The pump can be set to automatically restart in its operating state set prior to interruption, or set so that after power is reconnected the pump will remain stopped. To invoke the Auto-restart facility switch off power to the pump at the mains supply. Press the ***Start*** key down when the mains supply is switched back on until the ***!*** symbol illuminates. Now press ***Start*** to start the pump. This facility can be cancelled by turning the mains supply off and then pressing the ***Stop*** key whilst turning the mains supply back on. The ***!*** symbol will not be illuminated.
- Press ***Start*** to start the pump. Press ***Stop*** to stop the pump.

Error messages

If a fault condition is detected in the drive unit it will stop, all keys will be disabled, and the display will flash:

ER1	Tachometer fault
ER2	Over temperature error
ER3	EEPROM error
ER4	EEPROM read error
ER5	EEPROM write error
ER6	EEPROM exhausted error. There is a maximum number of times the EEPROM can be written to. If ER6 is displayed, however, the EEPROM must be replaced.
ER9	RAM corruption error

Care and maintenance

The only scheduled maintenance of the 505S is to inspect the motor brushes and to replace them before their length is less than 6mm (1/4"). The life of the brushes will depend on the duty of the pump, which is expected to be at least 10,000 hours at maximum speed. When the pump needs cleaning, remove the pumphead and use a mild solution of detergent in water. Do not use strong solvents.

If the gearbox is rebuilt you should use 15 ml of the recommended lubricant, which is RD105, this is a SAE 30 mineral oil loaded with molybdenum disulphide to form a soft fluid grease.

Specification

Maximum rotor speed	55rpm, 220rpm
Voltage/frequency	100-120/220-240V 50/60Hz
Control range	110:1
Power consumption	100VA
Shaft Torque	2.2Nm
Operating temperature range	5 to 40C
Storage temperature range	-40C to 70C
Weight	7.7kg (17lb)
Noise	<70dBA at 1m
Standards	IEC 335-1, EN60529 (IP31)
	Machinery Directive 98/37/EC EN60204- 1
	Low Voltage Directive 73/23/EEC EN61010- 1
	EMC Directive:89/336/EEC EN50081-1 / EN50082-1

501RL Pumphead

The 501RL pumphead has two spring-loaded working rollers, which automatically compensate for minor variations in tubing wall thickness, giving extended tube life. The 501RL 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.

Flow rates

Flow rates for the 505S 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.

Installation

Fit the track in any one of three orientations, over the drive shaft and locating boss. Secure the track with the locating screw. Ensure the drive shaft is degreased before locating the rotor onto the shaft via the split collet. Tighten the rotor screw to a torque of 3Nm to prevent the collet slipping during operation.

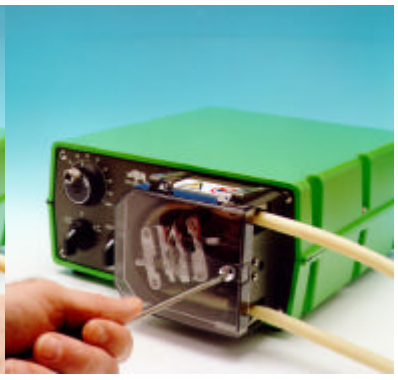
To reposition the track, swing out the crank handle to expose the rotor retaining screw. Turn the screw anticlockwise one turn to release the collet, and withdraw the rotor from the shaft. Loosen the track locating screw, and pull the track clear. Rotate the track to its new position and tighten the track locating screw. Use this method of removal and fitting in case cleaning is required.

Tube loading

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.





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.

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

The 501RL 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.


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 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.

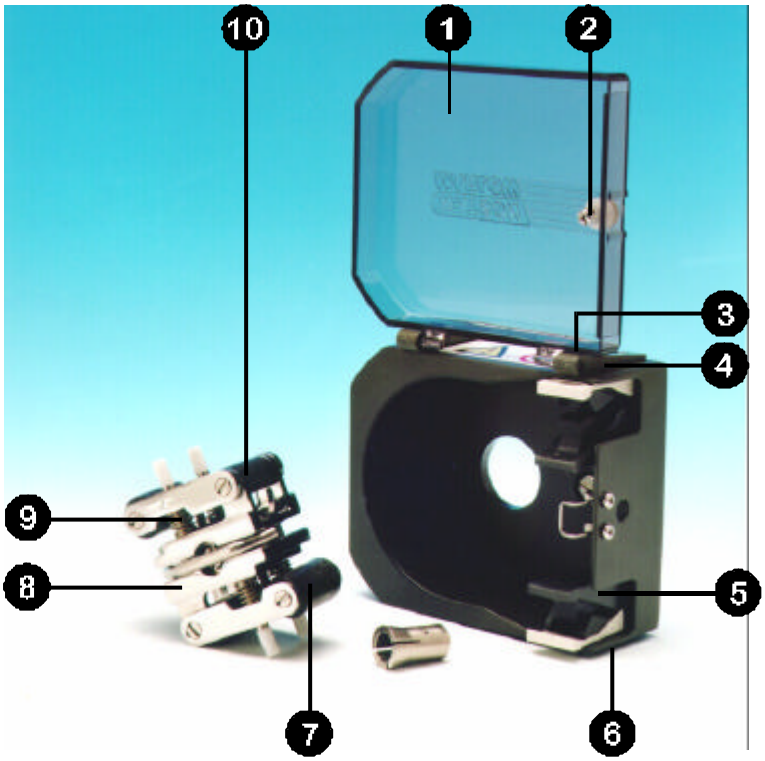
To change the gap setting, turn each adjusting screw clockwise to increase the gap, or anticlockwise to decrease the gap. A full turn changes the gap by 0.8mm.To restore the original settings of 2.6mm, turn the adjusting screws until both rollers are just

touching the track, then tighten each screw by three and a quarter turns. The 501RL2 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.

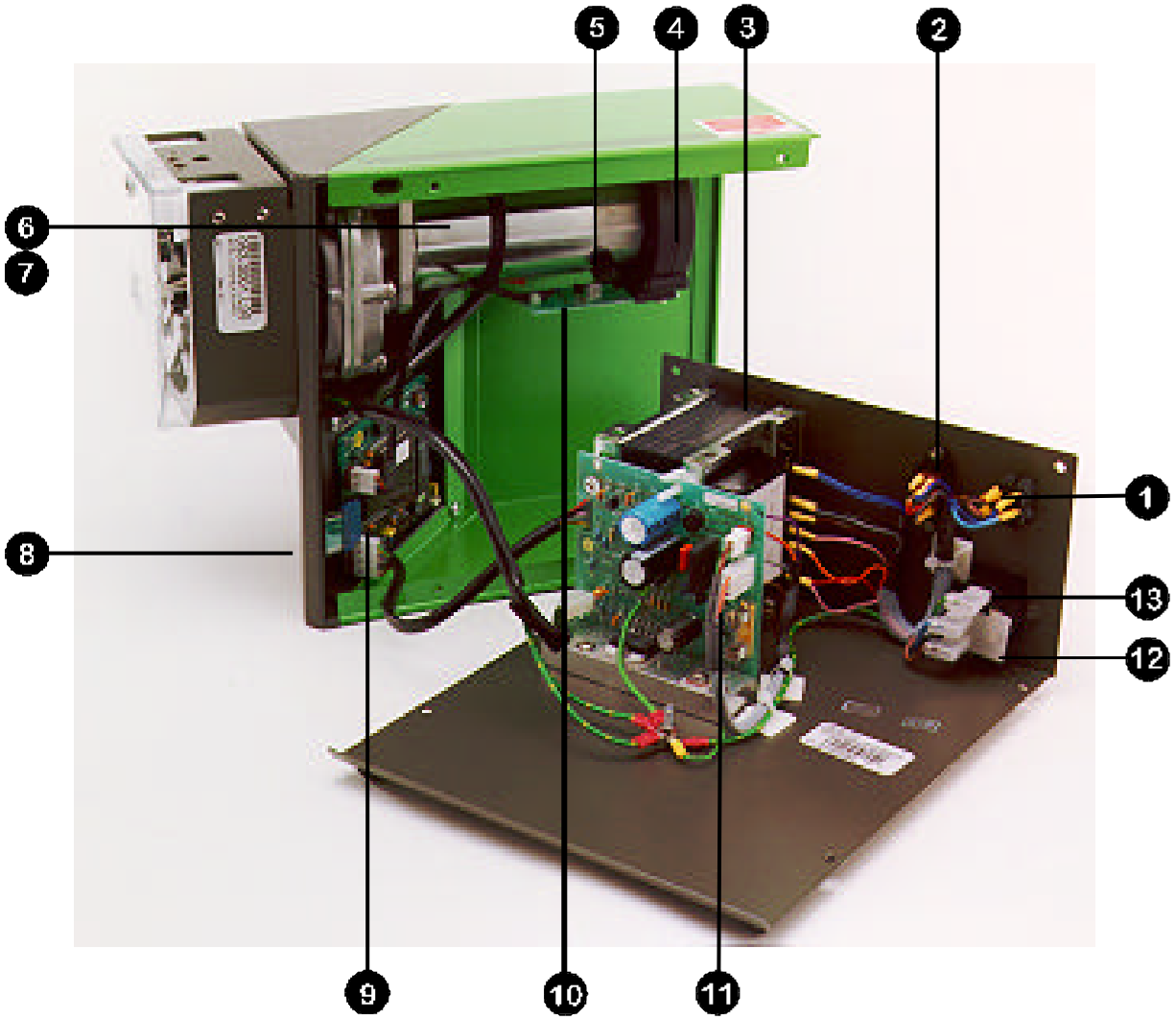
Specific drive performance details such as loaded drive speed variation against mains supply voltage fluctuation and drive stability from a cold start to normal operating temperature are available on request. For further information please contact Watson-Marlow Technical Support Centre.

Pumphead spares



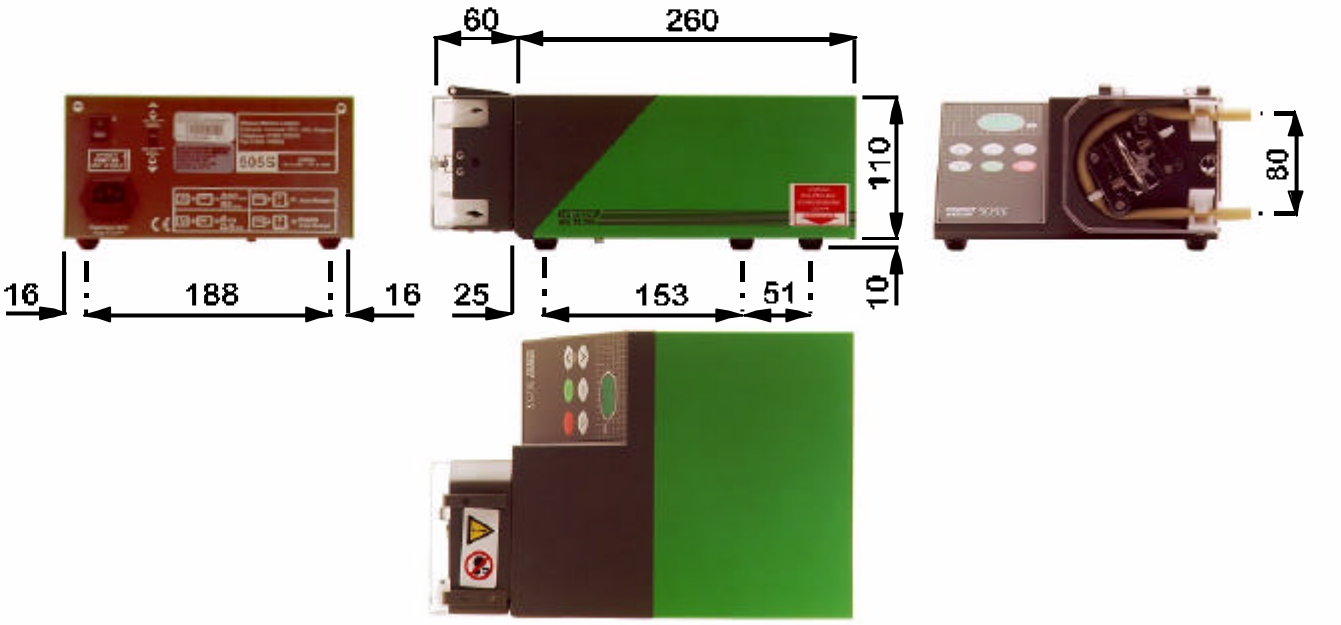
Number	Spare	Description
1	MN 1200M	Lockable guard
2	FN 4502	Lock
3	FN 2341	Hinge screw
4	MN 0266M	Hinge grey
5	MNA0623A	Tube clamp assembly
6	FN 2332	Screw
7	MN 0011T	Main roller
8	MNA0143A	501RL Rotor Assembly
9	SG0001/SG0002	Springs standard/hard
10	MN 0012T	Follower roller
	XX 0095	Teflon lubricant

Drive spares



Number	Spare	Description
1	SW 0147	On/Off switch
2	SW 0086	Voltage selector switch
3	TF 0032	Transformer
4	MNA0346A	Tachometer disc assembly
5	BM 0014	Motor brush
6	MNA0388A	Motor/gearbox 220rpm
7	MNA0396A	Motor/gearbox 55rpm
8	MN 0563B	Panel
9	MNA0423A	CPU and display PCB
10	MNA0420A	Tachometer PCB
11	MNA0422A	Speed control PCB
12	FS 0003	Mains fuse
13	US 0045	Mains connector

Outline dimensions



	#				
English	Tube number	Tube bore	Double-Y	Maximum cassettes	rpm

English	Pressure (+)	Suction	Clockwise (rpm)	Anticlockwise (rpm)	Stop

501RL, 501RL2 (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
	55	**2.4**	**6.2**	**25**	**98**	**215**	**345**	**540**
	220	**9.7**	**25**	**100**	**395**	**870**	**1400**	**2200**

505L (ml/min)

Flow rates							
	#	14	16	25	17	18	122
	mm	1.6	3.2	4.8	6.4	8.0	9.6
	"	1/16	1/8	3/16	1/4	5/16	3/8
	55	**39**	**125**	**230**	**385**	**495**	**690**
	220	**154**	**500**	**920**	**1540**	**1980**	**2750**

505BA (ml/min)

Flow rates									
	mm	0.13	0.19	0.25	0.38	0.50	0.63	0.76	
	"	0.005	0.007	0.01	0.015	0.02	0.025	0.03	
	55	**0.027**	**0.07**	**0.16**	**0.27**	**0.44**	**0.79**	**1.155**	
	170	**0.082**	**0.22**	**0.50**	**0.83**	**1.36**	**2.45**	**3.57**	48
	mm	0.88	1.02	1.14	1.29	1.42	1.47	1.52	
	"	0.035	0.04	0.045	0.05	0.055	0.058	0.06	
	55	**1.54**	**2.04**	**2.57**	**3.22**	**3.82**	**4.14**	**4.37**	
	170	**4.76**	**6.29**	**7.75**	**9.96**	**11.8**	**12.8**	**13.5**	48
	mm	1.65	1.85	2.05	2.38	2.54	2.79		
	"	0.065	0.07	0.08	0.09	0.1	0.11		
	55	**5.05**	**6.30**	**7.60**	**9.84**	**11.0**	**12.84**		
	170	**15.6**	**19.5**	**23.5**	**30.4**	**34.0**	**39.7**		48
⚠ : < 170									

313/314 (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
313							
55	**1.7**	**3.9**	**14**	**55**	**121**	**198**	**275**
220	**6.6**	**15**	**57**	**220**	**484**	**792**	**1100**
314							
55	**1.7**	**3.3**	**14**	**47**	**105**	**165**	**220**
220	**6.6**	**13**	**55**	**187**	**420**	**660**	**880**

313

Maximum number of pumpheads															
313/314 Peroxide/ Platinum Silicone															
	(0 ≤ bar ≤ 0.5)								(0.5 ≤ bar ≤ 2.0)						
#	112	13	14	16	25	17	18		112	13	14	16	25	17	18
mm	0.5	0.8	1.6	3.2	4.8	6.4	8.0		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		1/50	1/32	1/16	1/8	3/16	1/4	5/16
55	**6**	**6**	**6**	**6**	**6**	**4**	**3**		**6**	**6**	**6**	**6**	**5**	**3**	**3**
220	**6**	**6**	**6**	**6**	**6**	**4**	**3**		**6**	**6**	**6**	**6**	**5**	**3**	**3**
313/314 Marprene, Tygon, Neoprene, Fluorel															
	(0 ≤ bar ≤ 0.5)								(0.5 ≤ bar ≤ 2.0)						
#	112	13	14	16	25	17	18		112	13	14	16	25	17	18
mm	0.5	0.8	1.6	3.2	4.8	6.4	8.0		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		1/50	1/32	1/16	1/8	3/16	1/4	5/16
55	**6**	**6**	**6**	**6**	**5**	**3**	**3**		**6**	**6**	**6**	**6**	**4**	**3**	**3**
220	**6**	**6**	**6**	**6**	**5**	**3**	**3**		**6**	**6**	**6**	**5**	**4**	**3**	**3**

501RL, 501RLG, 313

Product codes

mm	"	#	Peroxide Silicone	Platinum Silicone	Marprene	Bioprene
0.5	1/50	112	910.0005.016	913.0005.016	902.0005.016	903.0005.016
0.8	1/32	13	910.0008.016	913.0008.016	902.0008.016	903.0008.016
1.6	1/16	14	910.0016.016	913.0016.016	902.0016.016	903.0016.016
3.2	1/8	16	910.0032.016	913.0032.016	902.0032.016	903.0032.016
4.8	3/16	25	910.0048.016	913.0048.016	902.0048.016	903.0048.016
6.4	1/4	17	910.0064.016	913.0064.016	902.0064.016	903.0064.016
8.0	5/16	18	910.0080.016	913.0080.016	902.0080.016	903.0080.016

mm	"	#	STA-PURE*	Gore flurooelastomer*	Neoprene	Tygon
0.8	1/32	13			920.0008.016	
1.6	1/16	14	960.0016.016	965.0016.016	920.0016.016	950.0016.016
3.2	1/8	16	960.0032.016	965.0032.016	920.0032.016	950.0032.016
4.8	3/16	25	960.0048.016	965.0048.016	920.0048.016	950.0048.016
6.4	1/4	17	960.0064.016	965.0064.016	920.0064.016	950.0064.016
8.0	5/16	18	960.0080.016	960.0080.016	920.0080.016	950.0080.016

mm	"	#	Fluorel	Butyl **
1.6	1/16	14	970.0016.016	930.0016.016
3.2	1/8	16	970.0032.016	930.0032.016
4.8	3/16	25	970.0048.016	930.0048.016
6.4	1/4	17	970.0064.016	930.0064.016
8.0	5/16	18	970.0080.016	930.0080.016

*** Use 501RLG**
*** *Not suitable for use with 313 pumpheads**

51RL2, 501RL2G

Product codes

mm	"	Peroxide Silicone	Platinum Silicone	Marprene	Bioprene	STA-PURE*
1.6	1/16	910.0016.024	913.0016.024	902.0016.024	903.0016.024	960.0016.024
3.2	1/8	910.0032.024	913.0032.024	902.0032.024	903.0032.024	960.0032.024
4.8	3/16	910.0048.024	913.0048.024	902.0048.024	903.0048.024	960.0048.024
6.4	¼	910.0064.024	913.0064.024	902.0064.024	903.0064.024	960.0064.024
8.0	5/16	910.0080.024	913.0080.024	902.0080.024	903.0080.024	960.0080.024
9.6	3/8	910.0096.024	913.0096.024	902.0096.024	903.0096.024	

mm	"	Gore fluoroelastomer*
1.6	1/16	965.0016.024
3.2	1/8	965.0032.024
4.8	3/16	965.0048.024
6.4	¼	965.0064.024
8.0	5/16	965.0080.024
9.6	3/8	

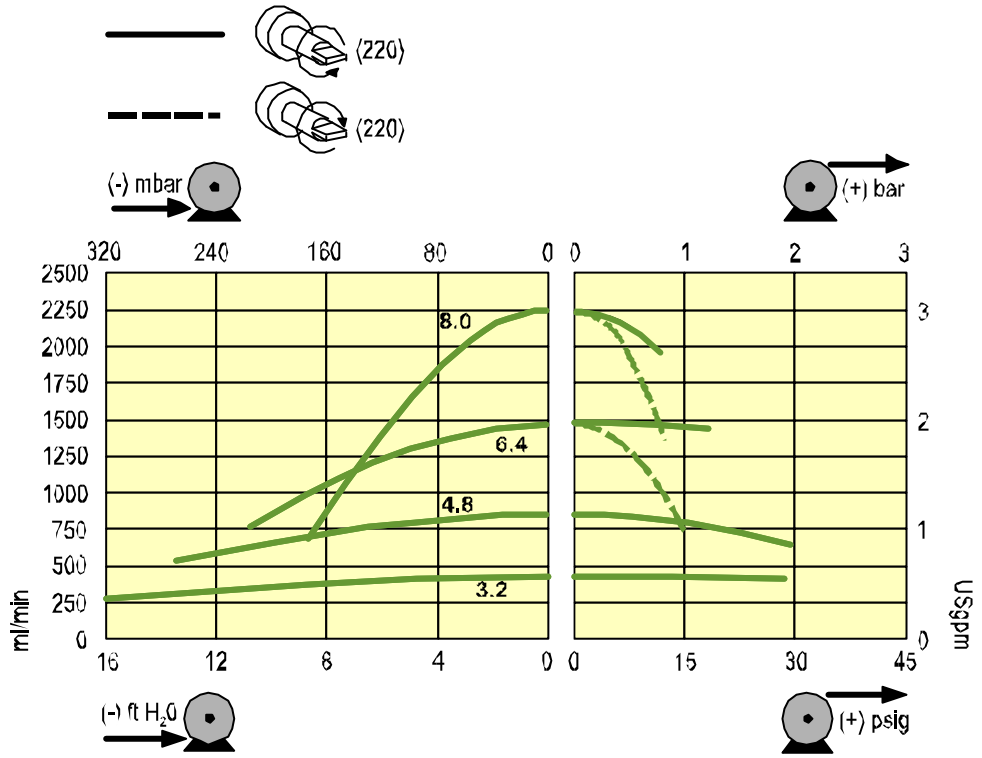
*** Use 501RL2G**

505L, 505LG

(2.4mm) Product codes							
mm	"	#	Peroxide Silicone	Platinum Silicone	Marprene	STA-PURE	Gore fluoroelastomer
1.6	1/16	119	**910.E016.024**	**913.E016.024**	**902.E016.024**	**960.E032.K24**	**965.E032.K24**
3.2	1/8	120	**910.E032.024**	**913.E032.024**	**902.E032.024**	**960.E032.K24**	**965.E032.K24**
4.8	3/16	15	**910.E048.024**	**913.E048.024**	**902.E048.024**	**960.E048.K24**	**965.E048.K24**
6.4	¼	24	**910.E064.024**	**913.E064.024**	**902.E064.024**	**960.E064.K24**	**965.E064.K24**
8.0	5/16	121	**910.E080.024**	**913.E080.024**	**902.E080.024**	**960.E080.K24**	**965.E080.K24**
9.6	3/8	122	**910.E096.024**	**913.E096.024**	**902.E096.024**		
9.6	3/8	122	**910.H096.024 (high flow element)**				

501RL

Flow rates



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Tygon is a trademark of the **Norton** Company.

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.

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 ……..

2.1 Serial Number … … … … … … … … … … … … … ..... (a)……

2.2 Has the Product been used? (b)……

YES		NO	

(c)……

(d)……

If yes, please complete all the following Sections. If no, please complete Section 5 only

3 Details of substances pumped

3.1 Chemical names:

(a)……

(b)……

(c)……

(d)……

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.

5 Signed ……

Name ……

Position ……

Date ……..

3.2 Precautions to be taken in handling these substances:

(a)…… .....

(b)…… .....

(c) ……

(d)……

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

(a)……

(b)……

(c)……

(d)……

3.4 Cleaning fluid to be used if residue of chemical is found:

(a)……

(b)……

(c)……

(d)……

To assist servicing, please describe any fault condition(s) you have witnessed

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Watson-Marlow Bredel Pumps . Falmouth . Cornwall TR11 4RU . England . Tel: 01326 370370 . Fax: 01326 376009