503S/RL

503S/RL variable speed pump
Installation and operating instructions

Publication PB 0121

i Quick start-up guide

1 The 503S operates on single phase supplies only. Ensure that the mains available matches that marked on the rear panel.

2 Fit tube into pumphead (refer Part 2 of this operating instruction for details). Only use tube supplied by Watson-Marlow Limited.

3 Select direction of rotation on the front panel.

4 Switch the power switch on (I).

5 Turn the speed control potentiometer to give the desired speed. Pump speed will be shown by the liquid crystal display.

6 The ten turn potentiometer features a locking knob. Pull out the knob to unlock and press in to re-lock.

7 For rapid priming depress the MAX switch (non latching) to give maximum speed.

8 The direction of rotation may be changed at any time.

ii 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 occured 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:

1 Consumable items such as rollers and tubing are excluded.

2 Products must be returned by pre-arrangement carriage paid to Watson-Marlow Limited or its authorised distributor.

3 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.

4 Products which have been abused, misused, or subjected to malicious or accidental damage 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 .

Thank you for buying this Watson-Marlow peristaltic pump which is designed and built to exceptionally high standards. This manual is for use with the 503S variable speed drive which is available in four maximum speeds of 10, 50, 100 and 170rpm, controllable over a speed range of 4 percent to 100 percent from the front panel ten turn potentiometer.

503S drives can be combined with any of six different pumpheads (303, 501M, 501RL, 502AA, 505L or Microcassette pumpheads) to give from one to forty-eight channels, and flow rates from microlitres per minute to 1700 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.

The manual is divided into three parts. Part 1 deals with the 503S drive, Part 2 with the 501RL pumphead and Part 3 contains relevant drawings.

Contamination by substances hazardous to health

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 for service. A certificate, or signed statement that the equipment has been decontaminated must be attached to the shipping carton.

Please use the certificate at the rear of these operating instructions.

1 Installation

Supplies

The 503S is suitable for single phase mains electricity supplies only. 503S drives are available for use with voltages from 100V-120V or 220-240V 50/60Hz. Please ensure that the voltage available matches that marked on the rear of the drive. A mains cable fitted with a moulded plug is supplied with the drive, but if another plug is to be fitted, the colour coding of the mains lead must be observed. The mains cable for UK and European supplies is coded so that the live lead is coloured brown, the neutral lead is coloured blue, and the earth lead is coloured green and yellow. The mains cable for American supplies is coded so that the live lead is coloured white, the neutral lead is coloured black, and the earth lead is coloured green

Please check

If the drive does not operate correctly, check that mains electricity is available at the unit, that the mains supply is within range, and that the fuse (located in the carrier beneath the mains connector) is intact.

WARNING

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

Operation

The 503S features a front panel, ten turn potentiometer, fitted with a locking knob. Pull the outer knob towards you to unlock, set the speed (as shown in "revolutions per minute" on the LCD display), and push in the outer knob to re-lock. For rapid priming depress the MAX switch (non latching) to give maximum speed; on release the drive will return to its original speed setting. Use the direction switch to change the direction of rotation at any time.

2 Flow rates

Standard operating conditions

The 503S can be fitted with any of six different pumpheads. For more information about the 501RL pumphead see Part 2 of this manual. For details of other pumpheads, please refer to the relevant operating instructions. Maximum numbers of pumpheads/channels permissible are also given.

The flow rates given below were obtained using silicone tubing (except for the 502AA where PVC 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.

501RL

501RL flow rates (ml/min)

	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"
10	0.4	1.3	4.2	19	39	64	100
50	2.1	6.1	22	92	200	315	1000
100	4.2	12	43	186	405	635	1000
170	7.1	21	73	320	700	1080	1700

303 flow rates (ml/min)							
	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"
10	0.3	0.7	2.7	10	22	36	50
50	1.5	3.5	14	50	110	180	250
100	3.0	7.0	27	100	220	360	500
170	5.1	12	46	170	374	612	850

Maximum number of 303 pumpheads							
	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"
10	6	6	6	6	6	5	5
50	6	6	6	6	6	6	5
100	6	6	6	5	4	3	2
170	6	6	4	3	2	2	1
	Marprene, Tygon, Neoprene and Viton 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"
10	6	6	6	5	3	3	3
50	6	6	6	6	4	3	3
100	6	6	5	3	3	2	1
170	4	3	2	1	1	1	1

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"	Channels
10	0.005	0.012	0.028	0.048	0.08	0.11	0.15	32
50	0.025	0.062	0.14	0.24	0.39	0.57	0.77	48
100	0.048	0.12	0.28	0.48	0.77	1.44	1.54	32
170	0.082	0.21	0.48	0.82	1.32	1.94	2.62	20
	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
10	0.22	0.29	0.37	0.45	0.58	0.63	0.68	32
50	1.09	1.44	1.85	2.25	2.89	3.16	3.42	48
100	2.18	2.88	3.70	4.50	5.78	6.32	6.84	32
170	3.71	4.90	6.29	7.65	9.83	10.7	11.6	20
	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
10	0.75	0.98	1.17	1.42	1.82	2.04		32
50	3.76	4.88	5.87	7.12	9.12	10.2		48
100	7.52	9.76	11.7	14.2	18.2	20.4		32
170	12.8	16.6	20.0	24.2	31.0	34.7		20

505L

505L low pulse pumphead flow rates						
	Silicone double tubing elements internal diameter					
	1.6mm 1/16"	3.2mm 1/8"	4.8mm 3/16"	6.4mm 1/4"	8.0mm 5/16"	9.6mm 3/8"
10	7.0	23	42	70	90	110
50	35	115	210	350	450	550
100	70	230	420	700	900	1100
170	120	390	715	1190	1530	1870

Microcassettes

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
10	0.01	0.03	0.05	0.08	0.15	0.28	0.42	15
50	0.04	0.14	0.24	0.42	0.75	1.40	2.10	15
100	0.08	0.27	0.47	0.84	1.50	2.80	4.20	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
10	0.58	0.74	0.90	1.20	1.50	1.60	1.70	15
50	2.90	3.70	4.50	6.00	7.50	8.00	8.50	15
100	5.80	7.40	9.00	12.0	15.0	16.0	17.0	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
10	2.00	2.50	3.00	3.60	4.30	4.80		15
50	10.0	13.0	15.0	18.0	22.0	24.0		15
100	20.0	25.0	30.0	36.0	43.0	48.0		12

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
10	0.01	0.03	0.04	0.08	0.13	0.24	0.35	14
50	0.04	0.13	0.21	0.38	0.65	1.20	1.80	15
100	0.08	0.25	0.43	0.75	1.30	2.40	3.50	9
	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
10	0.48	0.60	0.80	0.90	1.10	1.20	1.30	14
50	2.40	3.00	4.00	4.80	5.50	6.00	6.50	15
100	4.80	6.00	8.00	9.50	11.0	12.0	13.0	9
	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
10	1.50	1.80	2.20	2.60	3.00	3.30		14
50	7.50	9.00	11.0	13.0	15.0	16.0		15
100	15.0	18.0	22.0	26.0	30.0	33.0		9

Flow precision depends upon the accuracy and consistency of the tubing. Use only tubing obtained from Watson-Marlow Limited as this is formulated, manufactured and quality controlled to our own specification

501RL and 303 pumpheads

Tubing for 501RL and 303 pumpheads

Bore mm	Bore "	Wall mm	Wall "	Marprene	Silicone	Neoprene
0.5	1/50	1.6	1/16	900.0005.016	910.0005.016	
0.8	1/32	1.6	1/16	900.0008.016	910.0008.016	920.0008.016
1.6	1/16	1.6	1/16	900.0016.016	910.0016.016	920.0016.016
3.2	1/8	1.6	1/16	900.0032.016	910.0032.016	920.0032.016
4.8	3/16	1.6	1/16	900.0048.016	910.0048.016	920.0048.016
6.4	1/4	1.6	1/16	900.0064.016	910.0064.016	920.0064.016
8.0	5/16	1.6	1/16	900.0080.016	910.0080.016	920.0080.016
Bore mm	**Bore "**	**Wall mm**	**Wall "**	**Butyl ***	**Tygon**	**Viton**
1.6	1/16	1.6	1/16	930.0016.016	950.0016.016	970.0016.016
3.2	1/8	1.6	1/16	930.0032.016	950.0032.016	970.0032.016
4.8	3/16	1.6	1/16	930.0048.016	950.0048.016	970.0048.016
6.4	1/4	1.6	1/16	930.0064.016	950.0064.016	970.0064.016
8.0	5/16	1.6	1/16	930.0080.016		970.0080.016

* Butyl tubing is not suitable for use in 303 pumpheads

505L low pulse pumphead

Silicone double tubing elements

Bore mm	Bore "	Wall mm	Wall "	Product code
1.6	1/16	2.4	3/32	910.E016.024
3.2	1/8	2.4	3/32	910.E032.024
4.8	3/16	2.4	3/32	910.E048.024
6.4	1/4	2.4	3/32	910.E064.024
8.0	5/16	2.4	3/32	910.E080.024
9.6	3/8	2.4	3/32	910.E096.024

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

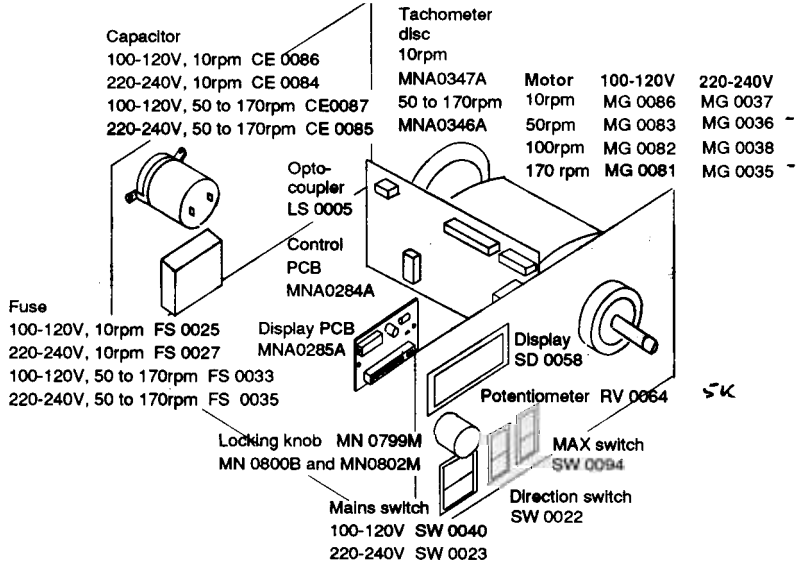
4 Specification

503S/RL nominal maximum rotor speeds	10, 50, 100 and 170rpm
503S/RL speed control range	5 to 100 percent
Voltage/frequency	100-120V and 220-240V 50/60Hz
Power consumption	**10rpm** 60VA
	50rpm 100-120V 235VA; 220-240V 150VA
	100rpm 100-120V 235VA; 220-240V 150VA
	170rpm 100-120V 235VA; 220-240V 150VA
Operating temperature range	0C to 37C 32F to 99F
Storage temperature range	-40C to 70C -40F to 150F
Weight	6.2kg 14lbs
Standards	IEC335-1/34-5 (IP31) ESCHLE

5 Care and maintenance

Scheduled maintenance of the 503S/RL is not required. When the pump needs cleaning, use a cloth dampened with water and mild detergent. Do not use strong solvents. If the gearbox is dismantled, it should be filled with a good quality grease such as Andersol 761.

6 Spares



7 Description

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, and is fitted with a "tool lockable" guard.

8 Positioning the pumphead

Any one of three tubing input/output 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, rotate the track to the new position and replace the screw.

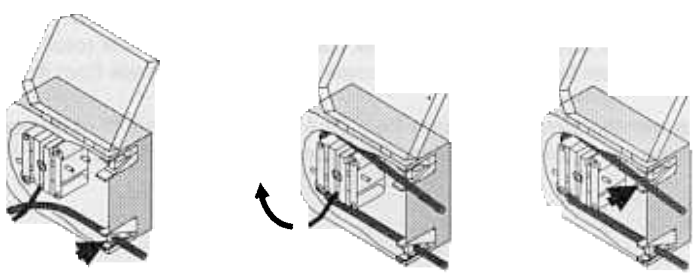
9 Tube loading

WARNING: Switch off the drive before loading the tube.

1 Open the hinged guard and swing out the rotor crank handle until it locks into position.

2 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).

3 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.



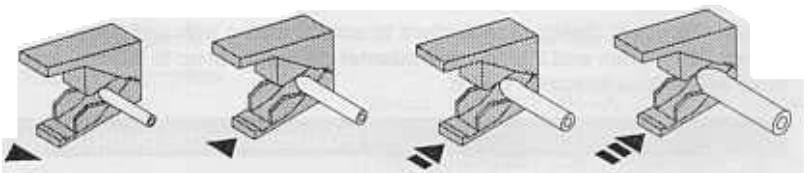
4 Fit the other end of the tubing into the second spring loaded clamp, ensuring that the tubing is not slack in the pumphead, as this can reduce tube life.

5 Close the crank handle and shut the guard.

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

Tube clamps

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.



10 Adjustment of the gap between the rollers and track

The factory set gap of 2.6mm between the rollers and the track 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 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.

Restore original settings

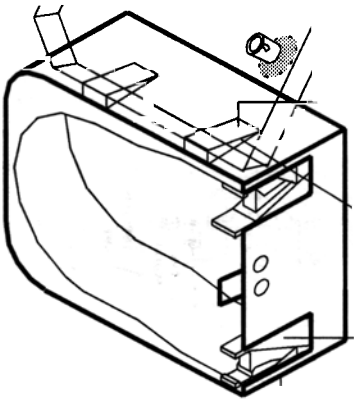
To restore the original setting of 2.6mm, turn the adjusting screws until both rollers are just touching the track, then tighten each screw by three and a quarter turns.

11 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.

Guard
MN 0377M



FN 2341
4 off

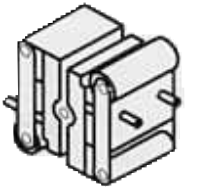
Hinge
MN0018M

Tube clamp assembly
MNA0114A

FN2332
2 off

Track assembly
MNA0311A

Rotor assembly

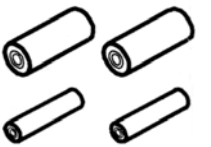


MNA0143A

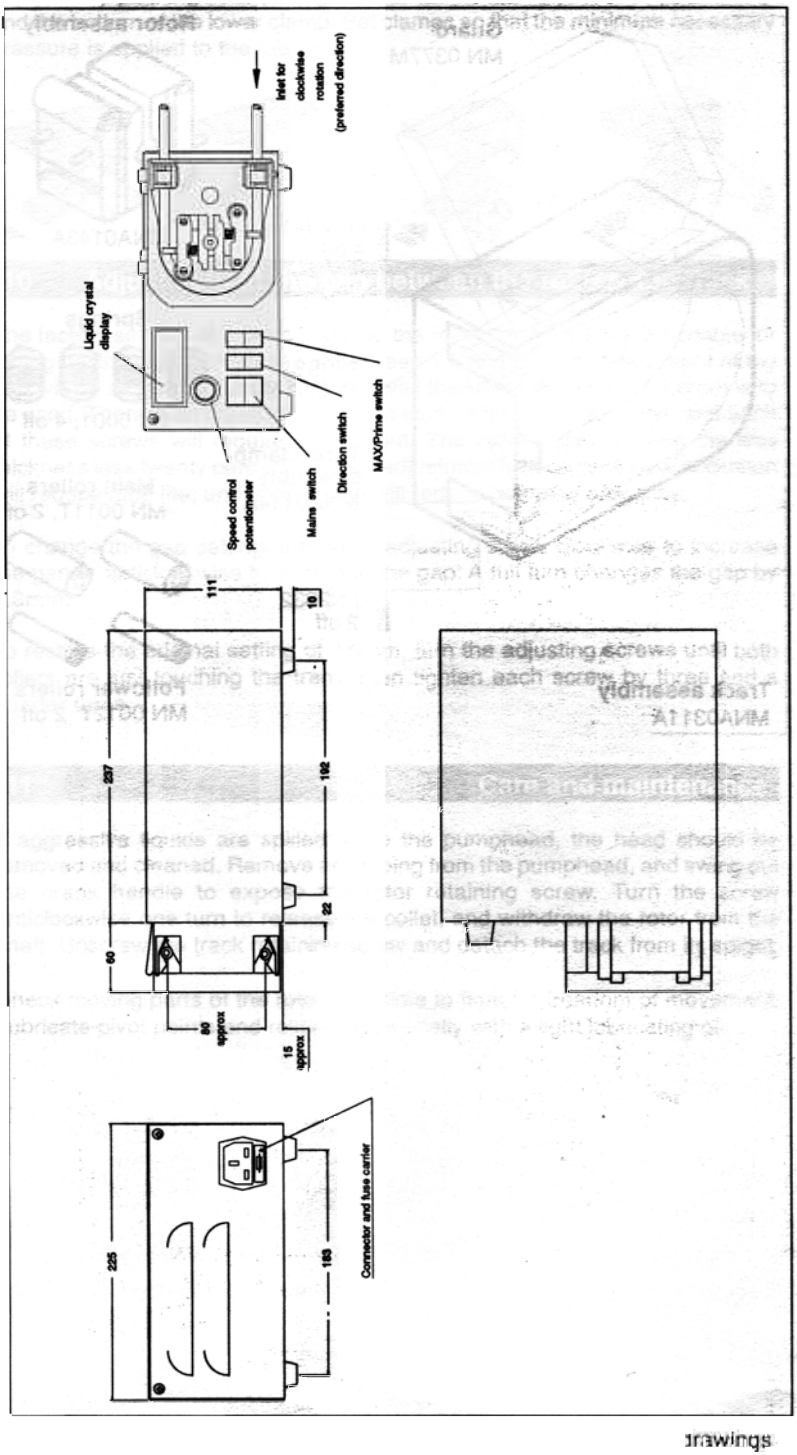
Springs

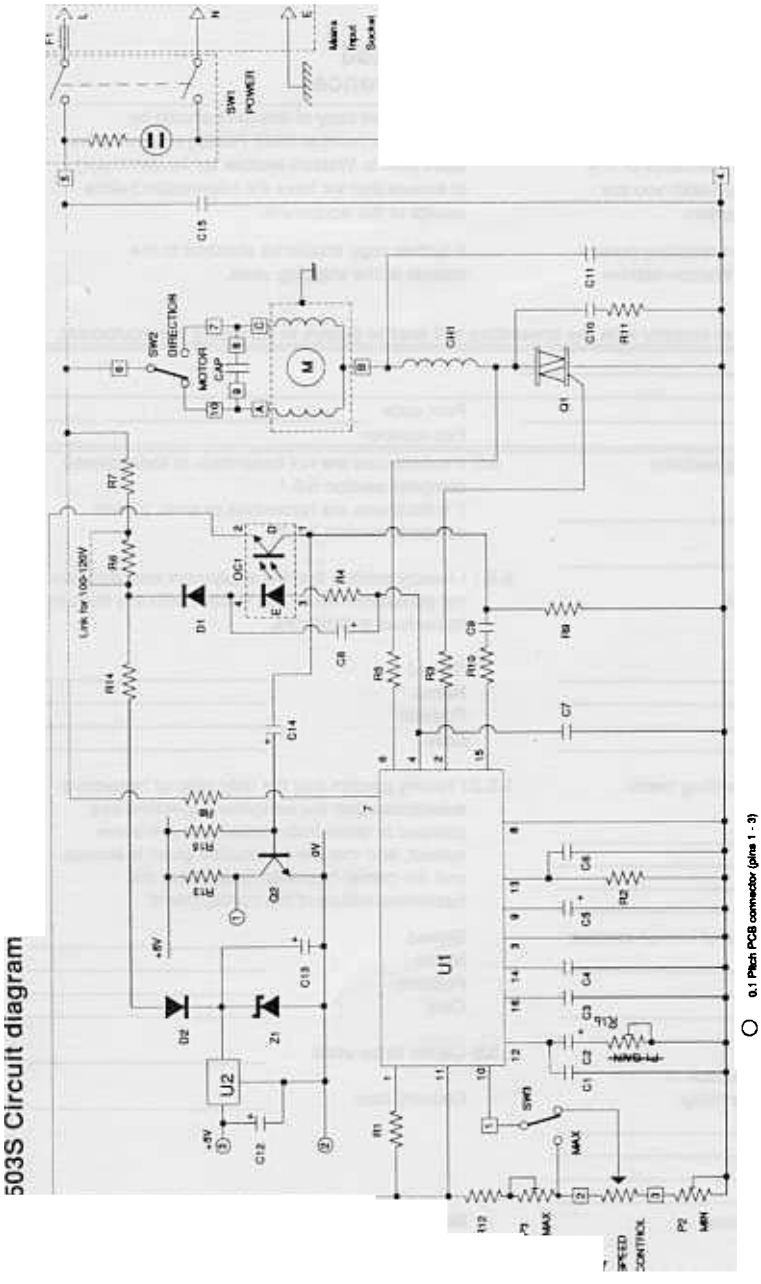
SG 0001, 4 off

Main rollers
MN 0011T, 2 off



Follower rollers
MN 0012T 2 off


Inlet for clockwise rotation (preferred direction)
Liquid crystal display
Speed control potentiometer
Mains switch
Direction switch
MAX/Prime switch
111
19
237
192
22
60
80 approx
15 approx
225
183
Connector and fuse carrier


503S Circuit diagram
Mains Input Socket
SW1 POWER
SW2 DIRECTION
MOTOR CAP
Link for 100-120V
U1
U2
SW3
MAX
SPEED CONTROL
0.1 Pitch PCB connector (pins 1 - 3)
0.3 Pitch PCB connector (pins 1 - 10 i C)

Watson-Marlow Limited
Health and Safety clearance

1.0 Pumps returned for service should be cleaned. If they have been contaminated with, or exposed to, body fluids, toxic chemicals or any other substance hazardous to health you are responsible for its decontamination.

2.0 This Form must be used when returning pumps and equipment for service at Watson-Marlow (or its distributor).

3.0 A completed copy of this form should be Faxed (Fax number 0326 76009) or sent 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 should be attached to the outside of the shipping case.

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

4.0 Company _____

Address _____

_____

Post code _____

Phone _____ Fax number _____

5.0 Please complete 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 Any further relevant information:

5.5 If substances are not hazardous or toxic, please complete section 5.5.1.
If substances are hazardous or toxic, please complete section 5.5.2.

5.5.1 I hereby confirm that the equipment specified has not pumped or come into contact with any toxic or hazardous substances.

Signed _____

Name _____

Position _____

Date _____

5.5.2 I hereby confirm that the only toxic or hazardous substances 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 of the hazardous nature of the consignment.

Signed _____

Name _____

Position _____

Date _____

5.6 Carrier to be used _____

Delivery date _____

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