



Watson-Marlow Pumps Group

WATSON-MARLOW BREDEL E-MANUALS

m-505l-gb-01

Watson-Marlow 505L pumphead**Contents**

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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 2006/42/EC.

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The information in this user guide is believed to be correct at the time of publication. However, Watson-Marlow Limited accepts no liability for errors or omissions. Watson-Marlow Bredel has a policy of continuous product improvement, and reserves the right to alter specifications without notice. This manual is intended for use only with the pump it was issued with. Earlier or later models may differ. The most up-to-date manuals appear on the Watson-Marlow website: <http://www.watson-marlow.com>

2 One 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, any part of this product which fails within one year 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:

- Tubing as a consumable item is 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.

3 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.

4 Peristaltic pumps - an overview

Peristaltic pumps are the simplest possible pump, with no valves, seals or glands to clog or corrode. The fluid contacts only the bore of a tube, eliminating the risk of the pump contaminating the fluid, or the fluid contaminating the pump. Peristaltic pumps can operate dry without risk.

How they work

A compressible tube is squeezed between a roller and a track on an arc of a circle, creating a seal at the point of contact. As the roller advances along the tube, the seal also advances. After the roller has passed, the tube returns to its original shape, creating a partial vacuum which is filled by fluid drawn from the inlet port.

Before the roller reaches the end of the track, a second roller compresses the tube at the start of the track, isolating a packet of fluid between the compression points. As the first roller leaves the track, the second continues to advance, expelling the packet of fluid through the pump's discharge port. At the same time, a new partial vacuum is created behind the second roller into which more fluid is drawn from the inlet port.

Backflow and siphoning do not occur, and the pump effectively seals the tube when it is inactive. No valves are needed.

The principle may be demonstrated by squeezing a soft tube between thumb and finger and sliding it along: fluid is expelled from one end of the tube while more is drawn in at the other.

Animal digestive tracts function in a similar way.

Suitable applications

Peristaltic pumping is ideal for most fluids, including viscous, shear-sensitive, corrosive and abrasive fluids, and those containing suspended solids. They are especially useful for pumping operations where hygiene is important.

Peristaltic pumps operate on the positive displacement principle. They are particularly suitable for metering, dosing and dispensing applications. Pumps are easy to install, simple to operate and inexpensive to maintain.

5 Safety notes

In the interests of safety, this pumphead 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. If the pump is used in a manner not specified by Watson-Marlow Ltd, the protection provided by the pump may be impaired.

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.



This symbol, used on the pump and in this manual, means: Caution, refer to accompanying documents.

There are moving parts inside the pumphead. Before opening the tool-unlockable pumphead guard, ensure that the following safety directions are followed.

- Ensure that the pump is isolated from the mains power.
- Ensure that there is no pressure in the pipeline.
- If a tube failure has occurred, ensure that any fluid in the pumphead has been allowed to drain to a suitable vessel, container or drain.
- Ensure that protective clothing and eye protection are worn if hazardous fluids are pumped.
- Primary operator protection from rotating parts of the pump is provided by the pumphead safeguard. Note that safeguards differ, depending on the type of pumphead.

This pump must be used only for its intended purpose.

If hazardous fluids are to be pumped, safety procedures specific to the particular fluid and application must be put in place to protect against injury to persons.



This product does not comply with the ATEX directive and must not be used in explosive atmospheres.

6 Good pump installation practice

6.1 General recommendations

A correctly engineered installation will promote long tube life. Site the pump on a flat, horizontal, rigid surface, free from excessive vibration, to ensure correct lubrication of the gearbox. Allow a free flow of air around the pump to ensure that heat can be dissipated. Ensure that the ambient temperature around the pump does not exceed 40C.

Do not stack pumps more than three high. When pumps are stacked, ensure that the ambient temperature around all the pumps in the stack does not exceed 40C.

The pump may be set up so that the direction of rotor rotation is clockwise or counter-clockwise, whichever is convenient. Please note, however, that tube life will be greater if the rotor rotates clockwise; and that performance against pressure will be maximised if the rotor rotates counter-clockwise.

Peristaltic pumps are self-priming and self-sealing against backflow. No valves are required in inlet or discharge lines, except as described below. Valves in the process flow must be opened before the pump operates. Users are advised to fit a pressure relief device between the pump and any valve on the discharge side of the pump to protect against damage caused by accidental operation with the discharge valve closed.

6.2 Do's and do not's

Do not build a pump into a tight location without adequate airflow around the pump.

Do ensure that proper connections are achieved between the pump tube and suction and discharge piping.

Do keep delivery and suction tubes as short and direct as possible - though ideally not shorter than 1m - and follow the straightest route. Use bends of large radius: at least four times the tubing diameter. Ensure that connecting pipework and fittings are suitably rated to handle the predicted pipeline pressure. Avoid pipe reducers and lengths of smaller bore tubing than the pumphead section, particularly in pipelines on the suction side. Any valves in the pipeline (not usually needed with a self-priming peristaltic pump) must not restrict the flow. Any valves in the flow line must be open when the pump is running.

Do use suction and delivery pipes equal to or larger than the bore of the tube in the pumphead. When pumping viscous fluids use pipe runs with a bore several times larger than the pump tube.

Do ensure that on longer tube runs at least 1m of smooth bore flexible tubing is connected to the inlet and discharge port of the pumphead to help to minimise impulse losses and pulsation in the pipeline. This is especially important with viscous fluids and when connecting to rigid pipework.

Do site the pump at or just below the level of the fluid to be pumped if possible. This will ensure flooded suction and maximum pumping efficiency.

Do keep the pumphead track and all moving parts clean and free from contamination and debris.

Do run at slow speed when pumping viscous fluids.

Do calibrate after changing pump tubes, fluid, or any connecting pipework. It is also recommended that the pump is calibrated periodically to maintain accuracy.

When using Marprene or Bioprene continuous tubing, **do** re-tension the tube after the first 30 minutes of running.

Tube selection: The chemical compatibility lists published in Watson-Marlow publications are guides. If in doubt about the compatibility of a tube material and the duty fluid, request a Watson-Marlow tube sample card for immersion trials.

7 The 505L pumphead

To overcome the pulsatile effect some peristaltic pumps exhibit, Watson-Marlow have developed the principle of twin offset tracks. This puts the two tubes out of phase, merging a pulse from one channel with a trough from the other.

The 505L is fitted with six stainless steel rollers and uses either silicone or Marprene tubing up to 9.6mm bore, 2.4mm wall thickness.

For most dispensing and low pulse applications, use Watson-Marlow double-Y tubing elements, which are pre-formed to the correct length to ensure accurate merging of flows to give the smoothest flow possible.

If you do not wish to use the special double-tube elements, a set of six tube clamps will allow the pumphead to be used with either twin inlet (suction) tubes or as a two channel (totally separate) precision pumphead.

7.1 505L Pumphead fitting and removal



Always isolate the pump from the mains power supply before removing the track or performing any positioning, removal or maintenance activity.

To fit and remove the pumphead



- Grease the drive shaft tongue. Position the pumphead centrally on the front face of the drive and manually turn the rotor until the slotted rotor shaft engages with the tongue of the drive shaft. Ensure that the two captive retaining bolts align with the top and bottom holes on the drive face.
- Use a 10ml spanner to tighten the retaining bolts to 3Nm.
- Position the adapter cover over the pumphead rear face plate and the captive retaining bolt heads. Click downwards into position.
- Reverse this procedure to remove the track.

To fit an extension pumphead

The front of the 505L pumphead is trimmed with a cover plate held in place with two screws. It must be removed before a second pumphead can be fitted.



- Lift the two levers at either side of the pumphead and remove the track.
- Remove the two screws securing the cover plate to the front of the fixed pumphead. A stubby crosspoint screwdriver may be convenient for this. Remove the cover plate.
- Grease the projecting shaft tongue at the rear of the extension pumphead and the slot at the front of the fixed pumphead. Position the extension pumphead so that the tongue and slot engage, and align the body of the extension pumphead with the body of the first, fixed, pumphead. Fit the two supplied extension pumphead fixing screws at each side of the extension pumphead and tighten. Secure the cover plate to the extension pumphead using the two screws which secured it to the fixed pumphead.
- Position the tracks and secure them by closing the levers.

8 505L tube loading



Always isolate the pump from the mains power supply before removing the track or performing any positioning, removal or maintenance activity.

Tube loading instructions are given for the three possible methods of using a 505L pumphead.

For most dispensing, and any application where there must be minimal pulsing, the use of Watson-Marlow double-Y silicone tubing elements is recommended. These are pre-formed to the correct length and merge two out-of-phase flows into a single smooth output. These elements fit on the bayonet-style retaining pegs supplied with the pumphead.

In certain circumstances it may be useful to run two separate inlet tubes from your source to the pumphead. It is advisable to do this if the fluid is particularly viscous and the single inlet tube is found to restrict the flow rate, or if the pump is situated a long distance from the source reservoir and is running at high speed. A tube clamp set is available from Watson-Marlow (see *505L Pumphead spares*) to securely fix twin inlet tubes.

The 505L may also be used as a two-channel, six-roller, precision pumphead, with two entirely separate tubes. The tube clamp set contains two clamps for each suitable size of tubing to enable both the inlet and the delivery side to be secured. It should be noted that, when used in this way, the flow does not benefit from the smoothing created by combining two out-of-phase flows, and slight channel-to-channel variation may be found in the flow rates. Keeping suction and discharge tubing lengths the same will minimise this variation.

8.1 505L: Fitting double-Y tubing elements

If using a standard element of any size:



- Lift the two levers at either side of the pumphead and remove the track.
- Stretch the tubing element slightly and locate it over the mushroom pegs either side of the pumphead.
- Replace the track and secure it by closing the two levers.

Note: When using Pumpsil 9.6mm elements, best results will be obtained from a High-flow element: part number 913.AH96.K24. Clamp MNA0345A is required to secure the element on the suction side of the pumphead.

If using a 9.6mm High-flow element:



- Lift the two levers at either side of the pumphead and remove the track.
- Remove the mushroom peg on the suction side of the pump by turning it counter-clockwise through one quarter turn and withdrawing it. Do not remove the peg on the delivery side.
- Lay the element across the rotor, with the smaller Y connector over the end peg on the delivery side.
- Tube clamps are marked with the nominal bore for their intended tubing. Pull the element taut and firmly secure it with a 9.6mm clamp on the suction side of the pumphead, using the bayonet-style fixing previously used for the mushroom peg.
- Replace the track and secure it by closing the two levers.

Transfer tubing may now be attached to the connectors. On the suction side, use 12.7mm bore tubing.

8.2 505L: Using twin inlet tubes

Improved flow rates may be obtained by fitting two inlet tubes and using a Y connector to obtain a smooth flow.



- Lift the two levers at either side of the pumphead and remove the track.
- Remove the mushroom peg on the suction side of the pump by turning it counter-clockwise through one quarter turn and withdrawing it. Do not remove the peg on the delivery side.
- Fit two lengths of tube to the top branches of a Y connector. Lay this assembly across the rotor, with the Y connector over the end peg on the delivery side.
- Tube clamps are available, marked with the nominal bore for their intended tubing. Pull the two lengths of tube taut and firmly secure them with a correctly-sized clamp on the suction side of the pumphead, using the bayonet-style fixing previously used for the mushroom peg. You may find it convenient to insert the tubes into the arches of the clamp before securing the clamp.
- Replace the track and secure it by closing the two levers.

Transfer tubing may now be attached to the connectors.

8.3 505L: Using two independent tubes

This option may be used to allow the 520L to function as a twin-channel pumphead.



- Lift the two levers at either side of the pumphead and remove the track.
- Remove the mushroom peg on both sides of the pump by turning it counter-clockwise through one quarter turn and withdrawing it.
- Mark a length of 145mm on two lengths of tube up to a bore size of 8.0mm; or mark a length of 150mm on two lengths of 9.6mm bore tubing.
- Tube clamps are marked with the nominal bore for their intended tubing. Secure the tubes to the suction side of the pumphead with a correctly-sized clamp, aligning one of the marks on each tube with the inner face of the clamp. Secure the clamp by inserting the fixing bayonet into the socket previously used for the mushroom peg and rotating it clockwise one-quarter turn.
- Stretch the tubes slightly and secure them with the second clamp in the same way, with the second pair of marks aligned with the inside of the second clamp. You may find it convenient to insert the tubes into the arches of the second clamp before securing the clamp.
- Replace the track and secure it by closing the two levers.

Note: After fitting new lengths of Marprene tubing, run the pump for about half an hour and then re-tension the tubing, making sure that the nominal lengths above are restored. If tubing lengths greater than those given are used, the tubing may move about within the pumphead and damage will occur.

9 505L maintenance



Always isolate the pump from the mains power supply before removing the track or performing any positioning, removal or maintenance activity.

The 505L pumphead is maintenance-free, although it is wise to check the moving parts of the rotor from time to time to ensure that the rotor and its rollers move freely.

If aggressive liquids are spilled on the pumphead, it should be removed and cleaned. Do not use strong solvents.

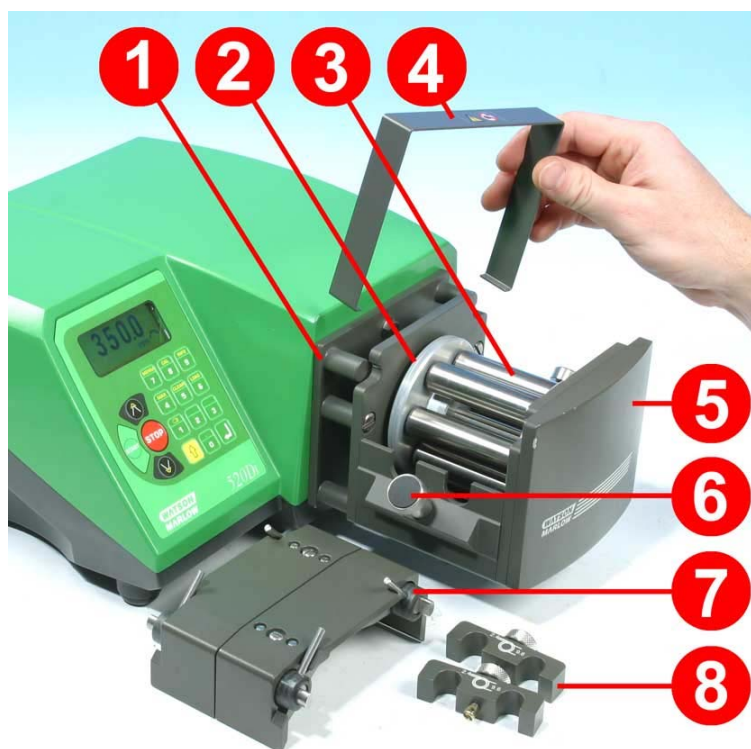
General guide to cleaning with solvents

Chemical	Cleaning precautions
Aliphatic hydrocarbons	Minimise bearing seals' exposure to less than one minute (risk of attack).
Aromatic hydrocarbons	Minimise bearing seals' exposure to less than one minute (risk of attack).
Ketone solvents	Minimise bearing seals' exposure to less than one minute (risk of attack).
Halogenated/chlorinated solvents	Minimise bearing seals' exposure to less than one minute (risk of attack).
Alcohols, general	No precaution necessary.
Glycols	No precaution necessary.
Ester solvents	Minimise bearing seals' exposure to less than one minute (risk of attack).
Ether solvents	Minimise bearing seals' exposure to less than one minute (risk of attack).

10 505L track adjustment

The track is set for use with 2.4mm wall tubing with bore sizes from 1.6mm to 9.6mm. Do not attempt to change the 14.3mm (0.56in) gap between the track and the top of the pumphead.

11 505L Pumphead spares



1	MNA0338A	Adaptor plate
2	BBO014	Drive shaft bearing
3	MNA0371A	Rotor assembly
4	MN0862S	Cover plate
5	MN1029C	End plate
6	MNA0339A	Tube-locating mushroom peg (two required)
7	MNA0333A	Track assembly
8	059.4001.000	Tube clamp set: includes two clamps for each of the six tube sizes

505L tube clamps

Full set: 059.4001.000

1.6mm bore: MNA0340A

3.2mm bore: MNA0341A

4.8mm bore: MNA0342A

6.4mm bore: MNA0343A

8.0mm bore: MNA0344A

9.6mm bore: MNA0345A

12 505L Flow rates

Pumping conditions

All performance figures in this operating instruction have been recorded against peak pipeline pressures.

Flow rates are normalised test values obtained using new tubing, pumping water at 20C with negligible inlet and discharge pressures. Actual flow rates achieved may vary because of changes in temperature, viscosity, inlet and discharge pressures, system configuration and tubing performance against time. Flow rates may also vary due to normal manufacturing tolerances of the tubing. These tolerances will make flow rate variance more pronounced at smaller bore sizes.

For precise and repeatable performance it is important to determine flow rates under operating conditions for each new piece of tubing.

505L pumpheads' flow rates are directly proportional to rotor speed. If you wish to run the pump at a speed not shown in the tables below, flow figures can be reached by dividing the maximum flow shown in the tables below by the maximum rpm figure, and multiplying the result by your required speed in rpm.

505L (ml/min)						
Speed range	1.6mm	3.2mm	4.8mm	6.4mm	8.0mm	9.6mm
0.1 to 350 rpm	0.04-150	0.23-800	0.42-1500	0.70-2500	0.90-3200	1.3-4400 *

* **Note:** Using 913.AH96.K24 High-flow element.

13 505L Tubing part numbers



2.4mm wall Double Y elements for 505L pumpheads

						
mm	inch	#	Marprene	Bioprene	Pumpsil	
1.6	1/16"	119	902.E016.K24	903.E016.K24	913.AE16.K24	
3.2	1/8"	120	902.E032.K24	903.E032.K24	913.AE32.K24	
4.8	3/16"	15	902.E048.K24	903.E048.K24	913.AE48.K24	
6.4	1/4"	24	902.E064.K24	903.E064.K24	913.AE64.K24	
8.0	5/16"	121	902.E080.K24	903.E080.K24	913.AE80.K24	
9.6	3/8"	122	902.E096.K24	903.E096.K24	913.AE96.K24	
9.6	3/8"	122			913.AH96.K24 (High flow)	
mm	inch	#	Chem-Sure	Sta-Pure		
1.6	1/16"	119	965.E016.K24	960.E016.K24		
3.2	1/8"	120	965.E032.K24	960.E032.K24		
4.8	3/16"	15	965.E048.K24	960.E048.K24		
6.4	1/4"	24	965.E064.K24	960.E064.K24		
8.0	5/16"	121	965.E080.K24	960.E080.K24		

Y connectors for 505L pumpheads

Description	Pack of 20
For 1.6mm bore	999.3016.K00
For 3.2mm bore	999.3032.K00
For 4.8mm bore	999.3048.K00
For 6.4mm bore	999.3064.K00
For 9.6mm bore	999.3096.K00

2.4mm wall tubing for 505L pumpheads operating as a twin-channel pump

					
mm	inch	#	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
9.6	3/8"	122	902.0096.024	903.0096.024	913.A096.024
mm	inch	#	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.

14 Trademarks

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

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

15 Warning not to use pumps in patient-connected applications

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

16 Publication history

m-505L-gb-01.pdf: Watson-Marlow 505L pumphead
First published 09 06. This edition 09 06.

17 Decontamination certificate

In compliance with the *UK Health and Safety at Work Act* and the *Control of Substances Hazardous to Health Regulations*, you are required to declare the substances which have been in contact with product(s) you return to Watson-Marlow or its subsidiaries or distributors. Failure to do so will cause delays. Please ensure that you fax us this form and receive an RGA (Returned Goods Authorisation) before you despatch the product(s). A copy of this form must be attached to the outside of the packaging containing the product(s). Please complete a separate decontamination certificate for each product. You are responsible for cleaning and decontaminating the product(s) before return.

Your name	<input type="text"/>	Company	<input type="text"/>
Address	<input type="text"/>		
Postcode/zip	<input type="text"/>	Country	<input type="text"/>
Telephone	<input type="text"/>	Fax	<input type="text"/>
Product type	<input type="text"/>	Serial number	<input type="text"/>
To speed the repair, please describe all known faults	<input type="text"/>		
The product has ...	<input type="radio"/> Been used <input type="radio"/> Not been used		
	<i>If the product has been used, please complete all the following sections. If the product has not been used, please just sign this form.</i>		
Names of chemicals handled with product(s)	<input type="text"/>		
Precautions to be taken in handling these chemicals	<input type="text"/>		
Action to be taken in the event of human contact	<input type="text"/>		
	<i>I understand that the personal data collected will be kept confidentially in accordance with the UK Data Protection Act 1998.</i>		
Signature	<input type="text"/>	RGA number	<input type="text"/>
		Your position	<input type="text"/>
		Date	<input type="text"/>

Please print out, sign and fax to Watson-Marlow Pumps at +44 1326 376009.