WATSON-MARLOW BREDEL MANUALS

m-520s-ip31-gb-05

# Watson-Marlow 520S IP31 pumps

## Contents

# 1 Declaration of conformity

This declaration was issued for Watson-Marlow 520S pumps on July 1, 2003. When this pump unit is used as a stand-alone pump it complies with: Machinery Directive 2006/42/EC, EMC Directive 2004/108/EC.

This pump is ETL listed: ETL control number 3050250. Cert to CAN/CSA std C22.2 No 1010-92. Conforms to UL std 61010A-1 April 30, 2002.

# 2 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. See 8 *Pump specifications.*

Responsible person: Christopher Gadsden, Managing Director, Watson-Marlow Limited, Falmouth, Cornwall TR11 4RU, England. Telephone +44 (0) 1326 370370 Fax +44 (0) 1326 376009.

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

# 3 Five year warranty

### 520 cased pumps, 620 cased pumps and 720 cased pumps

For any 520, 620 or 720 cased pump purchased after 1 January 2007, Watson-Marlow Limited ("Watson-Marlow") warrants, subject to the conditions and exceptions below, through either Watson-Marlow, its subsidiaries, or its authorised distributors, to repair or replace free of charge, any part of the product which fails within five years of the day of manufacture of the product. 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 normal operation as defined in this pump manual.

Watson-Marlow shall not be liable for any loss, damage, or expense directly or indirectly related to or arising out of the use of its products, including damage or injury caused to other products, machinery, buildings, or property, and Watson-Marlow shall not be liable for consequential damages, including, without limitation, lost profits, loss of time, inconvenience, loss of product being pumped, and loss of production. This warranty does not obligate Watson-Marlow to bear any costs of removal, installation, transportation, or other charges which may arise in connection with a warranty claim.

Conditions of and specific exceptions to the above warranty are:

### Conditions

- Products must be returned by pre-arrangement, carriage-paid, to Watson-Marlow, or a Watson-Marlow approved service centre.
- All repairs or modifications must have been made by Watson-Marlow Limited, or a Watson-Marlow approved service centre or with the express permission of Watson-Marlow.
- Warranties purporting to be on behalf of Watson-Marlow made by any person, including representatives of Watson-Marlow, its subsidiaries, or its distributors, which do not accord with the terms of this warranty shall not be binding upon Watson-Marlow unless expressly approved in writing by a Director or Manager of Watson-Marlow.

### Exceptions

- The warranty shall not apply to repairs or service necessitated by normal wear and tear or for lack of reasonable and proper maintenance.
- All tubing and pumping elements as consumable items are excluded.
- Products which, in the judgment of Watson-Marlow, have been abused, misused, or subjected to malicious or accidental damage or neglect are excluded.
- Electrical surge as a cause of failure is excluded.
- Chemical attack is excluded
- All pumphead rollers are excluded.
- The 620R family of pumpheads are excluded from all warranty when pumping above 2 bar while above 165rpm.
- Pumpheads from the 313/314 and the Microcassette ranges and any 701 extension pumpheads are excluded and retain their one-year standard pumphead warranty. The drive they are attached to is subject to the five-year warranty as set out here.
- Ancillaries such as leak detectors are excluded.

# 4 When you unpack your pump

Unpack all parts carefully, retaining the packaging until you are sure all components are present and in good order. Check against the components supplied lists, below.

### Packaging disposal

Dispose of packaging materials safely, and in accordance with regulations in your area. Pay particular attention to the expanded polystyrene shockproof shells. The outer carton is made of corrugated cardboard and can be recycled.

### Inspection

Check that all components are present. Inspect components for damage in transit. If anything is missing or damaged, contact your distributor immediately.

### Components supplied (520S pump, IP31, standard product)

- The 520S pump drive unit fitted with:
  - 520R or other pumphead (see 8 *Pump specifications*) if specified as a pump
  - The designated mains power lead for your pump
- PC-readable CDROM containing these operating instructions
- Quick Start manual

**Note**: Some versions of this product will include components different from those listed above. Check against your purchase order.

### Storage

This product has an extended shelf life. However, care should be taken after storage to ensure that all parts function correctly. Users should be aware that the pump contains a battery with an unused life of seven years. Long-term storage is not recommended for peristaltic pump tubing. Please observe the storage recommendations and use-by dates which apply to tubing you may wish to bring into service after storage.

# 5 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. See 31 *Decontamination certificate.*

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.

# 6 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.

# 7 Safety notes

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. 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.**

**This symbol, used on the pump and in this manual, means: Do not allow fingers to contact moving parts.**

**This symbol, used on the pump and in this manual, means: Recycle this product under the terms of the EU Waste Electrical and Electronic Equipment (WEEE) Directive.**

**Fundamental work with regard to lifting, transportation, installation, starting-up, maintenance and repair should be performed by qualified personnel only. The unit must be isolated from mains power while work is being carried out. The motor must be secured against accidental start-up.**

**There is a user-replaceable type T2,5A H 250V fuse in the fuseholder in the centre of the switchplate at the back of the pump. In some countries, the mains power plug contains an additional replaceable fuse. There is a fuse on the interface card which self-resets after five seconds. There are no user-serviceable fuses or parts inside this pump.**

**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.
- Protective clothing and eye protection must be 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. See the *pumphead* section of this manual.

This pump must be used only for its intended purpose.

The pump must be accessible at all times to facilitate operation and maintenance. Access points must not be obstructed or blocked. Do not fit any devices to the drive unit other than those tested and approved by Watson-Marlow. Doing so could lead to injury to persons or damage to property for which no liability can be accepted.

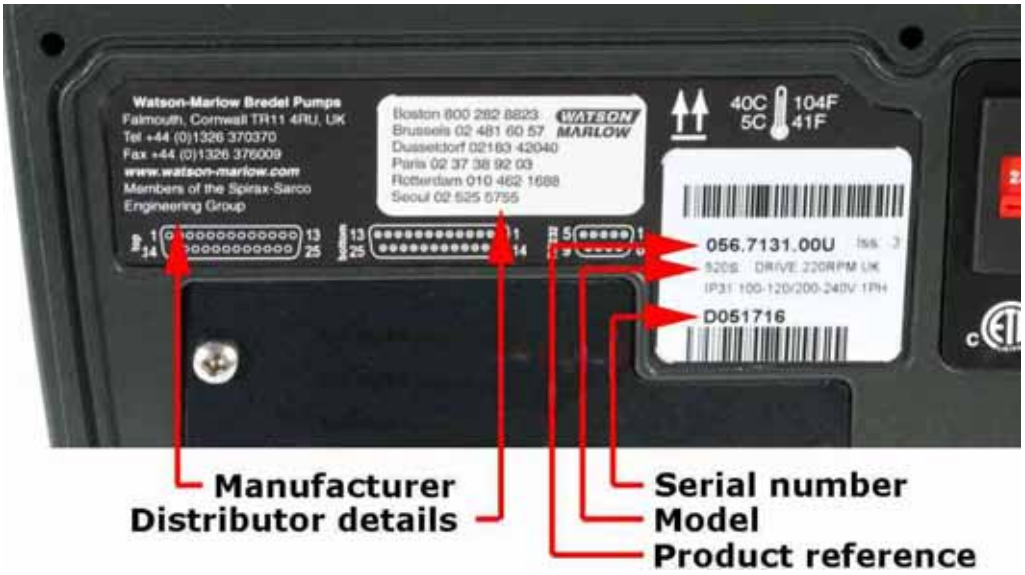
If hazardous fluids are to be pumped, safety procedures specific to the particular fluid and application must be put in place to protect against injury to persons.

The exterior surfaces of the pump may get hot during operation. Do not take hold of the pump while it is running. Let it cool after use before handling it. The drive unit must not be run without a pumphead fitted.

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

# 8 Pump specifications

A nameplate is fixed to the rear of the pump. It contains manufacturer and contact details, product reference number, serial number and model details.



## 520S, IP31 model

This pump operates by manual control only. There are no external control connections. All pump functions are controlled from the keypad. It features:

**Manual control**

Speed adjustment; run and stop; direction control; “max” key for rapid priming.

**MemoDose**

Allows precise repeat dosing. Stores in memory a pulse count from the motor. This count is repeated each time **START** is pressed to provide a single-shot dose.

**Calibration dose**

Uses the same pulse count as MemoDose. The corresponding pumped volume can be entered to calibrate the flow of the pump.

## IP (Ingress Protection) and NEMA definitions

| IP | | | | NEMA | |
|---|---|---|---|---|---|
| **1st Digit** | | **2nd Digit** | | | |
| **3** | Protected against ingress of solid objects with a diameter of more than 2.5mm. Tools, wires etc with a thickness of more than 2.5mm are prevented from approach | **1** | Protection against dripping water falling vertically. No harmful effect must be produced | **2** | Indoor use to provide a degree of protection against limited amounts of falling water and dirt |
| **5** | Protected against harmful dust deposits. Ingress of dust is not totally prevented but the dust must not enter in sufficient quantity to interfere with satisfactory operation of the equipment. Complete protection against contact | **5** | Protection against water projected from a nozzle against the equipment (enclosure) from any direction. There must be no harmful effect (water jet) | **12** | Indoor use to provide a degree of protection against dust, falling dirt and dripping, non-corrosive liquids |
| | | | | **13** | Indoor use to provide a degree of protection against dust and spraying water, oil and non-corrosive coolants |
| **6** | Protection against ingress of dust (dust-tight). Complete protection against contact | **6** | Protection against heavy seas or powerful water jets. Water must not enter the equipment (enclosure) in harmful quantities (splashing over) | **4X** | Indoor or outdoor* use to provide a degree of protection against splashing water, wind-blown dust and rain, hose-directed water; undamaged by the formation of ice on the enclosure. (Resist corrosion: 200-hour salt spray) |

* 520N cased pumps are rated to NEMA 4X (indoor use) only.

## Pump specifications

| | |
|---|---|
| **Control range (turndown ratio)** | 0.1-220rpm (2200:1) |
| **Supply voltage/frequency** | 100-120V/200-240V 50/60Hz 1ph |
| **Maximum voltage fluctuation** | ±10% of nominal voltage. A well regulated electrical mains supply is required along with cable connections to the best practice of noise immunity |
| **Installation category (overvoltage category)** | II |
| **Power consumption** | 135VA |
| **Full load current** | <0.6A at 230V; <1.25A at 115V |
| **Eprom version** | Accessible through pump software |
| **Enclosure rating** | IP31 to BS EN 60529. Equivalent to NEMA 2, suiable for indoor use. Protected against dripping water and falling dirt. May be wiped with a damp cloth, but should not be immersed |
| **Pumphead options** | 520R, 501RL, 313, 314, 505L, 505BA, 505CA, 314MC, 318MC |
| **Operating temperature range** | 5C to 40C, 41F to 104F |
| **Storage temperature range** | -40C to 70C, -40F to 158F |
| **Maximum altitude** | 2,000m, 6,560ft |
| **Humidity (non-condensing)** | 80% up to 31C, 88F, decreasing linearly to 50% at 40C, 104F |
| **Pollution degree** | 2 |
| **Noise** | <70dB(A) at 1m |

* Protect from prolonged UV exposure.

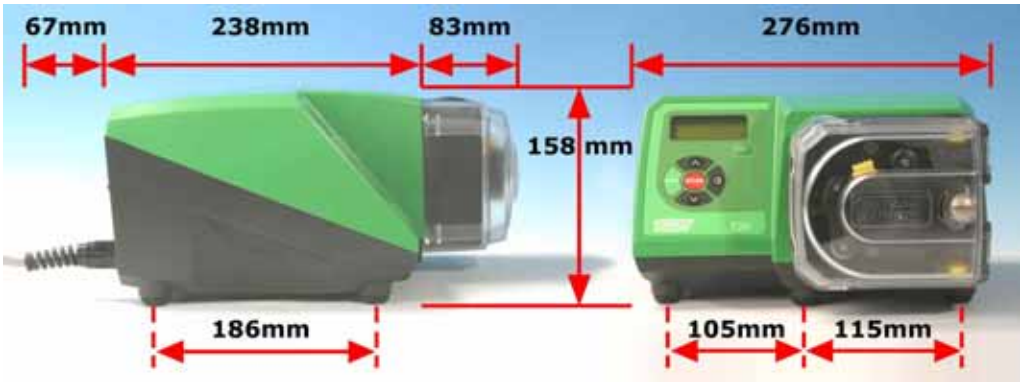
**Note**: 520 drive models are C ETL US listed. Cert to std CAN/CSA C22.2 No 1010-92. Conforms to std UL 61010A-1 April 30, 2002.
**Note**: 520 drive models have been tested in accordance with BS EN 61000-6-2:2001 (EN 61000-4-4) Fast Transient and Burst Tests to Industrial limits - ie: Level 3 : 2kV.

## Standards

| | |
|---|---|
| **EC harmonised standards** | Safety of machinery—electrical equipment of machines: BS EN 60204-1 |
| | Safety requirements for electrical equipment for measurement, control and laboratory use: BS EN 61010-1 incorporating A2 Category 2, Pollution degree 2 |
| | Degrees of protection provided by enclosures (IP code): BS EN 60529 amendments 1 and 2 |
| | Conducted emissions: BS EN 55011 A1 and A2 Class A, called by BS EN61000-6-4 |
| | Radiated emissions: BS EN 55011 A1 and A2 Class A, called by BS EN61000-6-4 |
| | Electrostatic discharge: BS EN 61000-4-2 |
| | Radiated RF immunity: BS EN 61000-4-3 A1 and A2, called by BS EN 61000-6-2 |
| | Fast transient burst: BS EN 61000-4-4 A1 and A2, Level 3 (2kV), called by BS EN 61000-6-2 |
| | Surge immunity: BS EN 61000-4-5 A1 and A2, called by BS EN 61000-6-2 |
| | Conducted RF immunity: BS EN 61000-4-6, called by BS EN 61000-6-2 |
| | Voltage dips and interruptions: BS EN 61000-4-11, called by BS EN 61000-6-2 |
| | Mains harmonics: BS EN 61000-3-2 A2 |
| | Pumps and pump units for liquids—common safety requirements: BS EN 809 |
| **Other standards** | UL 61010A-1 |
| | CAN/CSA-C22.2 No 61010-1 |
| | Conducted emissions FCC 47CFR, Part 15.107 |
| | Radiated emissions FCC 47CFR, Part 15 |
| | NEMA 4X to NEMA 250 (indoor use) for IP66 products only |

# 8.1 Dimensions

**520S IP31 model**




**Unit weights**

| | Drive only | + 520R, 520R2 | + 520REL, 520REM, 520REH | + 505L |
|---|---|---|---|---|
| **IP31** | 8.64kg<br>19lb | 9.54kg<br>21lb | 9.46kg<br>20lb 14oz | 11.12kg<br>24lb 8oz |

# 9 Good pump installation practice

## 9.1 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.

The **STOP** key on the keypad will always stop the pump. However, it is recommended that a suitable local emergency stop device is fitted into the mains supply to the pump.

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 for the 520R and 501RL pumpheads tube life will be greater if the rotor rotates clockwise; and that performance against pressure will be maximised if the rotor rotates counter-clockwise. To achieve 4 bar and 7 bar pressures using a 520RE pump and the appropriate rotor and element, the pump **must** rotate 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. Users of 520RE pumps at pressures up to 4 bar and 7 bar are advised to fit a non-return valve between the pump and the discharge pipework to avoid the sudden release of pressurised fluid in the unlikely event of element failure.

## 9.2 Do’s and do not’s

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

**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. When using the 520R pumphead, a 6.4mm or 4.8mm bore tube with a 2.4mm wall will give best results. Tube smaller than this will generate a high friction loss, so reducing the flow. Tube with a larger bore may not have sufficient strength to restitute fully. Flooded suction will enhance pumping performance in all cases, particularly for materials of a viscous nature.

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

**IP31** models may be wiped with a wet cloth, but should not be hosed or immersed. The front of IP31 models is further protected against light spillages onto the pump.

**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.

# 10 Connecting this product to a power supply

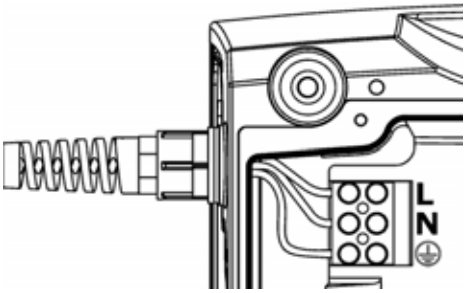

Set the voltage selector to 115V for 100-120V 50/60Hz supplies or 230V for 200-240V 50/60Hz supplies. Always check the voltage selector switch before connecting the mains supply.

Make suitable connection to an earthed, single-phase mains electricity supply.

**We recommend using commercially available supply voltage surge suppression where there is excessive electrical noise.**

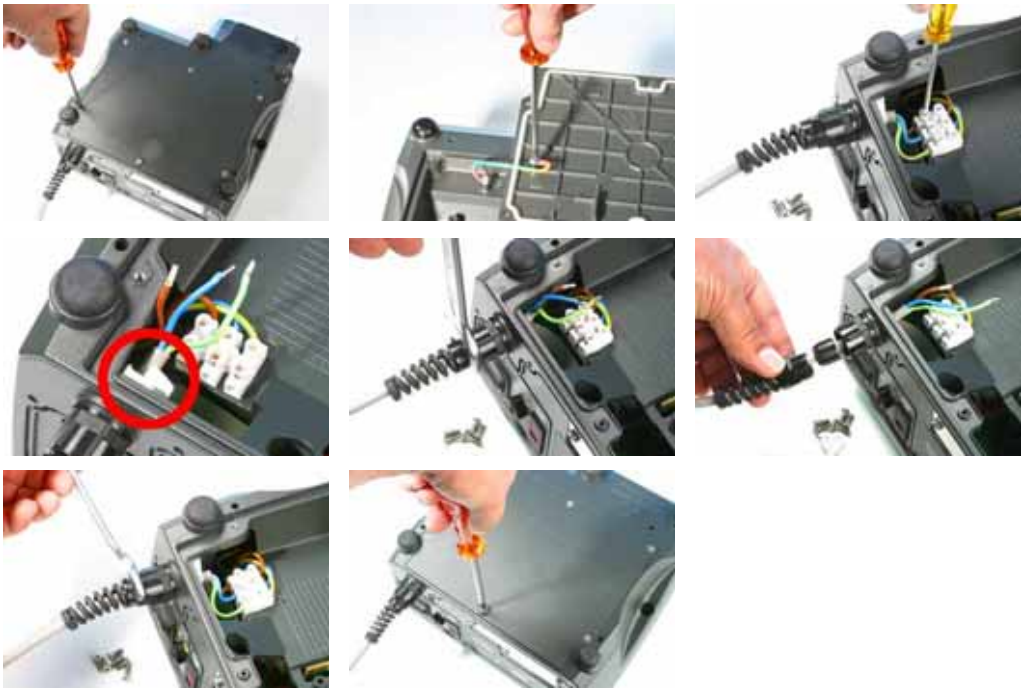
**Power cable**: The pump is supplied fitted with a cable gland and approximately 2.8m of power cable. Recommended cable: H05RN-F3G0.75; SJTW 105C 3-18AWG; max OD 8mm (5/16in).

This drawing shows the cable connections from below with the interface card cover removed.



If the mains power cable is inappropriate for your installation, it can be changed.

- Ensure that the pump is isolated from the mains power.



- Remove the six screws from the interface card cover underneath the pump. Lift off the interface card cover. You may find it convenient to remove the cover completely; if so, remove the cover earth lead.
- Undo the terminal block connectors. Remove the restraining clip by sliding its jaws sideways in opposite directions.
- Loosen the cable gland using a 19mm wrench and remove the gland and the cable.
- Thread a replacement cable through the three parts of the gland, the pump case and the restraining clip. Connect the new cable to the block connectors, following the drawing above.
- Tighten the restraining clip, and the gland to 2.5Nm. Check that the card cover earth link is secure. Replace the card cover, checking that the earth wire is not pinched beneath the cover lip. Take care that the sealing strip is properly seated to ensure a seal.


**Input line fusing**: type T2,5A H 250V 20mm time-delayed cartridge fuse, located in a fuseholder in the centre of the switchplate at the rear of the pump.

**Power interruption**: This pump has an auto-restart feature which, when active, will restore the pump to the operating state it was in when power was lost. See 14.7 *Auto-restart*.

**Stop / start power cycles**: Do not power up/power down for more than 100 starts per hour, whether manually or by means of the auto-restart facility. We recommend remote control where a high frequency of power cycles is required.

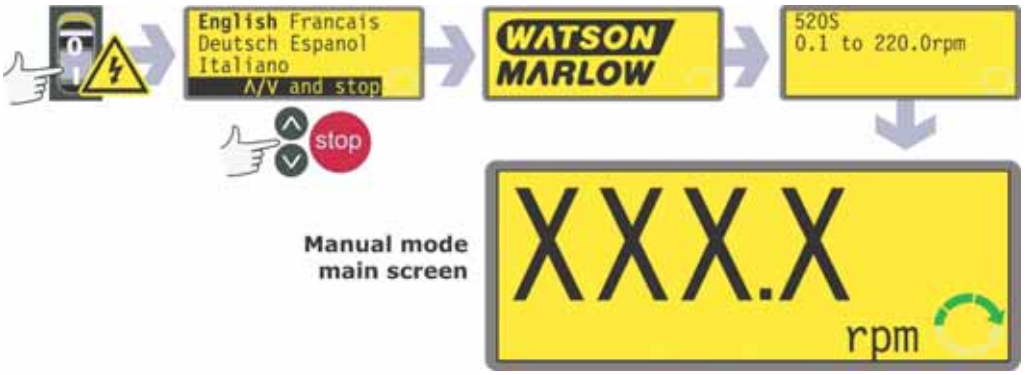
# 11 Start-up check list

**Note**: See also 21.2 *Tube loading*.

- Ensure that proper connections are achieved between the pump tube and suction and discharge piping.
- Ensure proper connection has been made to a suitable power supply.
- Ensure that the recommendations in the section 9 *Good pump installation practice* are followed.

# 12 Switching the pump on for the first time

**Note**: This manual uses **bold** type to highlight the active option in menu screens: "**English**" in the first screen represented here. The active option appears on the pump display in **inverse** text.




- Switch on the power supply at the rear of the pump. The pump runs a power-on test to confirm proper functioning of the memory and hardware. If a fault is found, an error code is displayed. See 17.1 *Error codes*.
- The pump displays a language menu. Use the **UP** and **DOWN** keys to select your language. Press the **STOP** key to confirm your choice.
  **The information which follows assumes that your choice was English**. When the language is chosen this menu will not appear again and all screens will appear in the language you chose. (Language can be reset as described later. See 14.5 *To reset language*.)

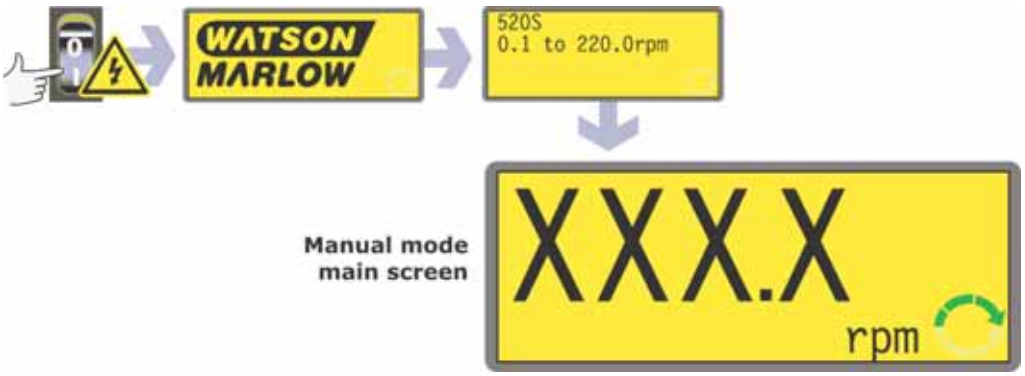
- The pump displays the Watson-Marlow start-up screen for four seconds, followed by the pump model identity screen for four seconds, and then the manual mode main screen.
- The rotation symbol on the display indicates clockwise rotation. The speed of rotation is the pump's maximum. Other initial start-up operational parameters are listed in the table below.

| **First-time start-up defaults** | | | |
|---|---|---|---|
| **Language** | Not set | **Keypad lock** | Off |
| **Speed** | Maximum | **Auto-restart** | Off |
| **Direction** | Clockwise | **Pump status** | Stopped |
| **Calibration** | 520R 9.6mm tube | **Beeper** | On |
| **Backlight** | On | **Manual screen** | rpm |

**The pump is now ready to operate according to the defaults listed above.**

All operating parameters may be changed by means of key-presses. See 14 *Operation*.

# 13 Switching the pump on in subsequent power cycles (if not in auto-restart mode)




- Switch on the power supply at the rear of the pump. The pump runs a power-on test to confirm proper functioning of the memory and hardware. If a fault is found, an error code is displayed. See 17.1 *Error codes*.
- The pump displays the Watson-Marlow start-up screen for four seconds followed by the pump model identity screen for four seconds, and then the manual mode main screen.
  - **Note**: If ANY key is pressed during the display of any of the preliminary screens, the display jumps to the next screen. Quickly pressing any two keys or any key twice immediately after switch-on causes the display to jump to the manual mode main screen. Once in the manual mode main screen, keys assume their normal functions - see 14.1 *Keypad functions* below. A subsequent press on **START** causes the pump to operate.
- Start-up defaults are those in place when the pump was switched off last. Check that the pump is set to operate as you require it.

**The pump is now ready to operate.**

All operating parameters may be changed by means of key-presses. See 14 *Operation*.

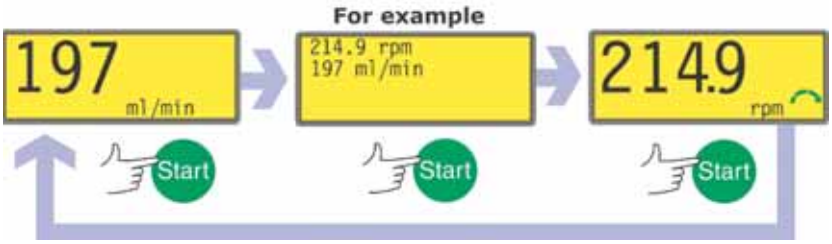
# 14 Operation

## 14.1 Keypad functions


All settings and functions of the pump in manual mode are set and controlled by means of key-presses. Immediately after the start-up display sequence detailed above, the manual mode main screen will be displayed. The currently selected rotation direction is indicated on the display by a clockwise or counter-clockwise segmented arrow. If an exclamation mark ( **!** ) shows, it indicates that Auto-restart is on (see 14.7 *Auto-restart*). If a padlock icon ( 🔒 ) shows, it indicates that Keypad lock is on (see 14.2 *Keypad lock*).

**A brief single press** on each key triggers a beep sound (if enabled - see 14.3 *Keypad beep*) and causes the pump to function as follows:

- **START**: starts the pump at the speed and in the direction shown on the display. The rotation symbol will become animated to confirm that the pump is operating. We recommend that the speed is reduced to a minimum (0.1 rpm) before starting the pump.




If the pump is running when **START** is pressed, it causes the information shown on the manual mode main screen to cycle from revolutions per minute, to flowrate in millilitres per minute (via a warning screen if flowrate has not been calibrated and if this is the first cycle since power-up) to both rpm and flowrate. See 16 *Calibration*.

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- **MAX**: while pressed, **MAX** operates the pump at the maximum allowed speed and in the direction shown on the display. When released, the pump returns to its previous status.
  **Note**: Priming can be achieved by pressing the **MAX** key until fluid flows through the pump and reaches the point of discharge, and then releasing the **MAX** key.
- **STOP**: has no effect if the pump is not running. If the pump is running, pressing **STOP** stops the pump. The display will continue to show the previous speed and direction. The pump will return to this speed and direction when the **START** key is pressed again.
  **STOP** is also used in the MemoDose facility, while calibrating the pump, setting the maximum speed and as an "enter" key - similar to the Return key on a personal computer.
- **UP**: increases the speed shown on the display in minimum steps of 0.1 rpm (unless the speed displayed is already the maximum allowed speed). If the pump is then started by pressing the **START** key, it will operate at the new speed. If the pump is running when **UP** in pressed, the change takes effect immediately.
  **Note**: After a speed change, a screen showing the new rpm figure **and** the new flowrate is displayed for four seconds before returning the user to the previously set manual mode main screen: rpm **or** flowrate.
- **DOWN**: decreases the speed shown on the display in minimum steps of 0.1 rpm. If the pump is then started by pressing the **START** key, it operates at the new speed. The minimum speed possible is 0.1 rpm. If the pump is running when **DOWN** is pressed, the change takes effect immediately.
  **Note**: After a speed change, a screen showing the new rpm figure **and** the new flowrate is displayed for four seconds before returning the user to the previously set manual mode main screen: rpm **or** flowrate.
  **Note**: You can reduce the pump speed from 0.1 rpm to 0 rpm by a further press on the **DOWN** key. The pump is still in the running state and the rotation symbol will continue to move. Press the **UP** key to return the pump to the minimum speed.
- **DIRECTION**: toggles the direction of rotation shown on the display. If the pump is then started by pressing the **START** key, it rotates in the new direction. If the pump is running when **DIRECTION** is pressed, the change takes effect immediately.

**Key-press combinations** cause the pump to function as follows:
- **DIRECTION** on power-up: resets defaults.
- **DIRECTION** and **UP** on power-up: toggles the keypad beep on and off.
- **START** on power-up: switches on the Auto-restart facility. See 14.7 *Auto-restart*.
- **STOP** on power-up: switches off the Auto-restart facility. See 14.7 *Auto-restart*.
- **STOP** and **UP** while the pump is stopped: turns the display backlight on.
- **STOP** and **DOWN** while the pump is stopped: turns the display backlight off.
- **STOP** and **DIRECTION**: set the maximum allowed speed.
- **DIRECTION** and **DOWN**: interrupts the display to show the pump's ROM version for four seconds.

- **MAX** and **UP**: sets the pump to maximum allowed speed.
- **MAX** and **DOWN**: sets the pump to minimum speed.
- **START** pressed and held for two seconds: toggles the keypad lock on and off. Only the **START** and **STOP** keys are active when keypad lock is on. The padlock icon is displayed.
- **STOP** pressed and held for two seconds: toggles the keypad lock on and off. Only the **START** and **STOP** keys are active when keypad lock is on. The padlock icon is displayed.
- **STOP STOP** within half a second: shortcut entry to the MemoDose menu; when in MemoDose, shortcut return to manual mode main screen. See 15 *MemoDose*.

**Note**: The maximum allowed speed of the drive defaults to 220 rpm. It is possible to set this limit at any speed up to this value. See 14.8 *Set maximum speed*.

**Note**: Confirmation screens are displayed for 4 seconds. While they are displayed, a single press on any key removes them.

## 14.2 Keypad lock

The keypad can be locked to prevent changes to pump speed or other settings, and make it possible only to start or stop the pump. The padlock symbol shows on the display.

- While the pump is running, hold down the **START** key for two seconds. The padlock symbol shows and only the **START** and **STOP** keys function.
- The keypad may also be locked while the pump is stopped. Hold down the **STOP** key for two seconds. The padlock symbol shows and only the **START** and **STOP** keys function.
- To unlock the keypad while the pump is running hold down the **START** key for two seconds. The padlock symbol is removed. If the pump is stopped hold down the **STOP** key until the padlock symbol is removed.

## 14.3 Keypad beep

The pump keypad can operate silently or indicate a positive key-press with a beep sound.

- To toggle the sound on and off, stop the pump. Turn off the mains power switch at the rear of the pump.
- Depress the **UP** and **DIRECTION** keys while switching on the mains power switch at the rear of the pump.

## 14.4 To reset defaults

All settings can be re-set to factory defaults.

- Turn off the mains power switch at the rear of the pump.
- Depress the **DIRECTION** key while switching on the mains power switch at the rear of the pump. A warning screen is displayed briefly, followed by a screen asking the user to confirm that factory defaults are to be reset.
- Select **Yes** or **No** using the **UP** and **DOWN** keys. Confirm by pressing **STOP**. If **Yes** was confirmed, the pump resets all user-settable data to default values and displays the manual mode main screen. If **No** was confirmed, no change is made and the manual mode main screen is displayed.

The language of display screens may be reset only by resetting defaults.

## 14.5 To reset language

The language of display screens is set on initial start-up. To reset language, reset all defaults (see 14.4 *To reset defaults*).

## 14.6 Backlight

To turn the display backlight on:

- Depress the **STOP** and **UP** keys together.

To turn the display backlight off:

- Depress the **STOP** and **DOWN** keys together.

## 14.7 Auto-restart

This pump offers an auto-restart feature. When active on power loss, it will restore the pump when power returns to the operating state it was in when power was lost. It does not operate when powering down in the middle of a dose; when the pump is restarted, it will await a press on the **START** key to begin the interrupted dose again. Auto-restart is retained while the pump is switched off. When the pump starts running look for the **!** symbol on the display. This **!** symbol indicates that the pump is set for auto-restart.

To turn the auto-restart facility on:

- Turn off the mains power switch at the rear of the pump.
- Depress the **START** key while switching on the mains power switch at the rear of the pump.

To turn the auto-restart facility off:

- Turn off the mains power switch at the rear of the pump.
- Depress the **STOP** key while switching on the mains power switch at the rear of the pump.

**Do not use auto-restart for more than 100 starts per hour. We recommend remote control where a high number of starts is required.**

## 14.8 Maximum allowed speed

To set the maximum allowed speed:


- Depress the **STOP** and **DIRECTION** keys together.
- The display shows the currently chosen maximum allowed speed.
- Use the **UP** and **DOWN** keys to change the maximum allowed speed.
- Press **STOP** to confirm.
- The pump redisplays the manual mode main screen showing the new maximum allowed speed.

## 14.9 Speed

To change the running speed:

- Use the **UP** and **DOWN** keys to change the pump's running speed within limits of 0.1 rpm and the maximum allowed speed.
  **Note**: You can reduce the pump speed from 0.1 rpm to 0 rpm by a further press on the **DOWN** key. The pump is still in the running state and the rotation symbol will continue to move. Press the **UP** key to return the pump to the minimum speed.

## 14.10 Direction

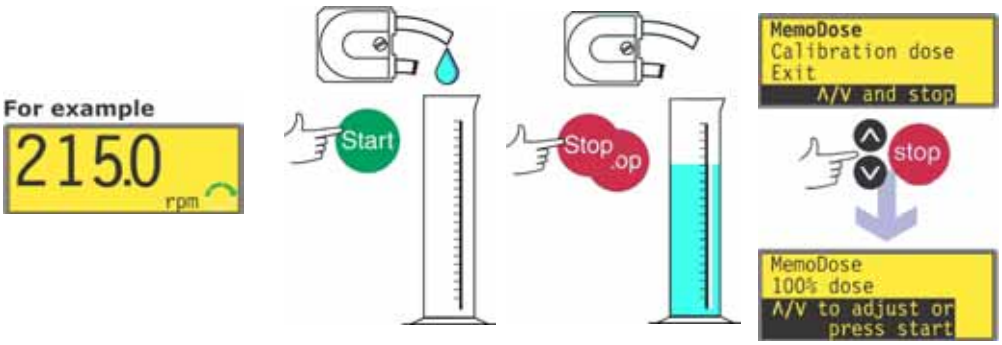
To toggle the pump's rotation sense:

- Press the **DIRECTION** key to toggle the pump between clockwise and counter-clockwise rotation.

# 15 MemoDose

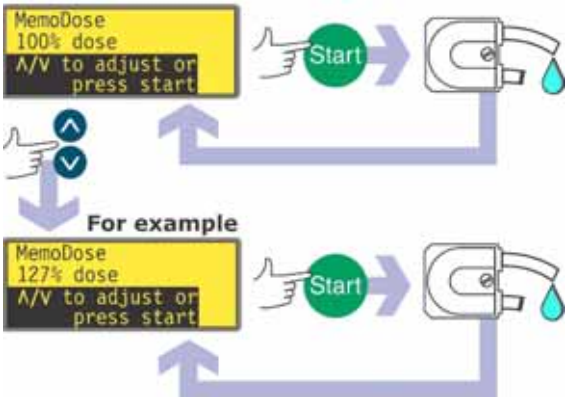
Each time the pump is started by pressing **START**, it records the number of pump-head revolutions which occur until **STOP** is pressed. The number of revolutions is proportional to the volume of fluid which has been dispensed: the dose. The MemoDose facility allows the user to repeat-dose a precise volume of fluid. To do so, a quantity of fluid must be dispensed as the master dose which the MemoDose facility can repeat exactly or proportionately.

### To dispense a master dose




- In the manual mode main screen, set the appropriate pump speed and direction using the **UP** or **DOWN** keys and the **DIRECTION** key. A slower speed may make it easier for the user to measure accurately (though a slower speed may not represent the duty condition).
- Place a suitable measuring vessel under the pump delivery tube.
- Press **START**. The pump runs and fluid is pumped into the vessel.
- When the required volume of fluid has been dispensed, it is necessary to stop the pump and display the MemoDose screen. This can be achieved in two ways.
  1. Press the **STOP** key twice within half a second. The pump stops and immediately displays the MemoDose/Calibration screen. Use the **UP** or **DOWN** keys to select **MemoDose**. Press **STOP** to confirm.
     OR...
  2. Press the **STOP** key once. The pump stops. (This may make it easier to ensure that the quantity of fluid that has been dispensed is sufficiently precise.) Then press the **STOP** key twice within half a second. The pump displays the MemoDose/Calibration screen. Use the **UP** or **DOWN** keys to select **MemoDose**. Press **STOP** to confirm.

### To repeat the dose

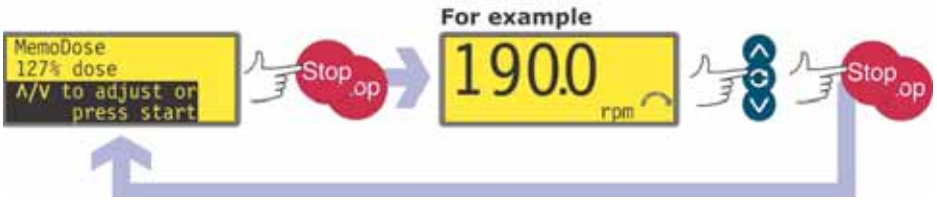



- The pump has recorded the number of pumphead revolutions required to dispense the master dose. If the volume of fluid in the measuring vessel is the volume required, press **START** to repeat the dose.
- If the volume in the measuring vessel differs from the volume required, the percentage setting may be adjusted within the limits 1% to 999% of the master dose. Use the **UP** or **DOWN** keys to alter the percentage. Press **START** to dispense the new dose.
- The display counts down as the dose proceeds and stops when the dose is complete.
- If **STOP** is pressed during dosing, the pump stops and returns the user to the MemoDose percentage screen.

Press the **STOP** key twice within half a second if you wish to exit MemoDose and return to manual operation.

## 15.1 Changing dosing speed

The user must exit MemoDose in order to change pump speed (and direction). After returning to MemoDose, the pump dispenses the previous dose size at the new speed.

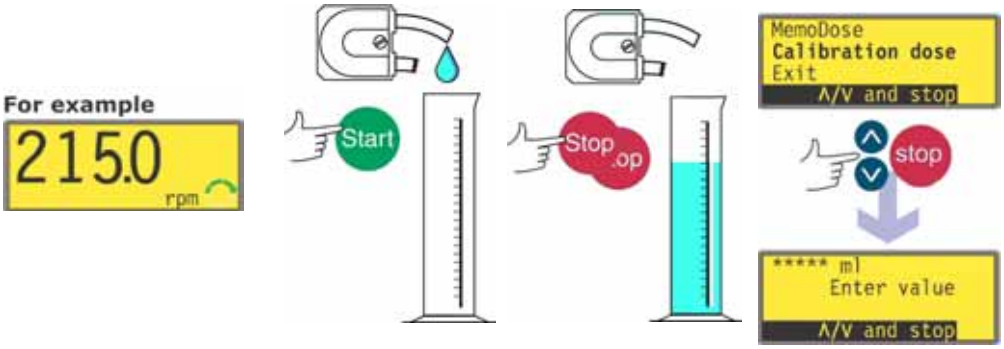



- Press the **STOP** key twice within half a second. The pump displays the manual mode main screen.
- **Do not start the pump. Doing so erases the previously recorded master dose and replaces it in the pump's memory with the current, unmeasured dose**. Adjust the speed showing on the display using the **UP** or **DOWN** keys.
- Press the **STOP** key twice within half a second to return to MemoDose. The display shows the previous percentage dose size. The pump will dose at the new speed.

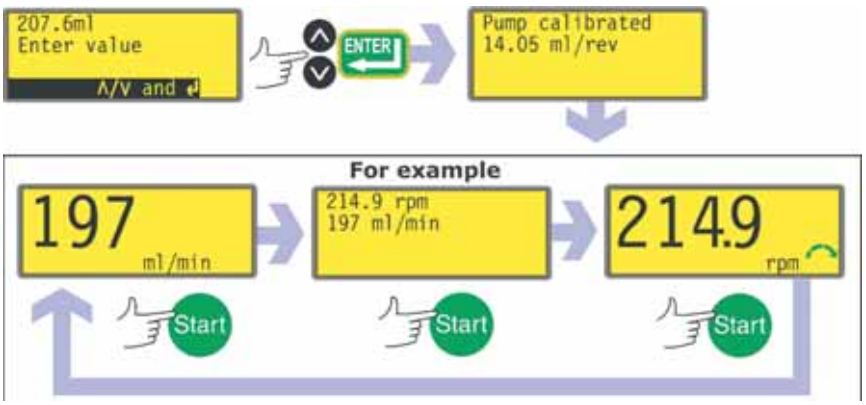
**Note**: To retain the MemoDose value through a power interruption the pump must be in auto-restart mode. The dosing cycle will resume at the start of a dose and wait for **START** to be pressed, with the MemoDose percentage screen displayed. See 14.7 *Auto-restart*.

# 16 Flow calibration

The pump can display flowrate in millilitres per minute as well as speed in revolutions per minute.




- In the manual mode main screen, set the appropriate pump speed and direction using the **UP** or **DOWN** keys and the **DIRECTION** key. A slower speed may make it easier for the user to measure accurately (though a slower speed may not represent the duty dondition).
- Place a suitable measuring vessel under the pump delivery tube.
- Press **START**. The pump runs and fluid is pumped into the vessel. The volume pumped is not important; but the greater the volume, the more accurate the flow-per-revolution calculation will be. We suggest that the pumphead be run for at least 10 revolutions, and at least 20 when small-bore pumping tube is used.
- When a volume of fluid has been dispensed, it is necessary to stop the pump and display the Calibration dose screen. This can be achieved in two ways.
  1. Press the **STOP** key twice within half a second. The pump stops and immediately displays the MemoDose/Calibration screen. Use the **UP** or **DOWN** keys to select **Calibration dose**. Press **STOP** to confirm.
     OR...
  2. Press the **STOP** key once. The pump stops. (This may make it easier to ensure that the quantity of fluid that has been dispensed is sufficiently precise.) Then press the **STOP** key twice within half a second. The pump displays the MemoDose/Calibration screen. Use the **UP** or **DOWN** keys to select **Calibration dose**. Press **STOP** to confirm.
- Measure the volume of fluid pumped. Make a note of the volume.
- The pump has recorded the number of pumphead revolutions required to pump the volume of fluid measured.
- The calibration dose screen is displayed. It shows a four-digit number of millilitres, and the instruction: “Enter dose value”. The number displayed is the number which was entered the previous time the pump was calibrated (or the default figure).




- Use the **UP** and **DOWN** keys to enter the measured volume of fluid pumped. Press **STOP** to confirm.
- The pump calculates the volume of fluid pumped for each pumphead revolution. The value from this calculation is saved for use in manual mode displays.
- The pump displays a confirmation screen for four seconds, and returns the user to the manual mode main screen, with millilitres per minute shown.
- The pump can now display millilitres per minute, revolutions per minute, or both. Press the **START** key while the pump is running to cycle though the three display options.

**Note**: Always recalibrate after changing pump tubes, fluid, or any connecting pipework. It is also recommended that the pump is recalibrated periodically to maintain accuracy.

**Note**: If the pump power is cycled while flow rate is displayed, calibration is lost and a warning is displayed.

## 16.1 Exit

To return to the manual mode main screen select **Exit** using the **UP** and **DOWN** keys. Confirm by pressing **STOP**.

# 17 Troubleshooting

If the pump display remains blank when the pump is switched on, make the following checks:

- Check the position of the voltage selector switch.
- Check the mains power switch at the rear of the pump.
- Check that mains power is available to the pump.
- Check the fuse in the fuseholder in the centre of the switchplate at the rear of the pump.
- Check the fuse in the wall plug if one is present.

If the pump runs but there is little or no flow, make the following checks:

- Check that the tube and rotor are in the pumphead.
- Check that fluid is supplied to the pump.
- Check that the tube is not split or burst.
- Check for any kinks or blockages in the lines.
- Check that any valves in the lines are open.
- Check that the correct wall-thickness tube is being used.
- Check direction of rotation.
- Check that the rotor is not slipping on the drive shaft.

## 17.1 Error codes

If an internal error occurs, a flashing error screen is displayed. **Note**: **Signal out of range**, **Over signal**, **No signal** and **Leak detected** error screens report the nature of an external signal. They do not flash.

| Error condition | Suggested action |
|---|---|
| RAM write error | Attempt to reset by switching power OFF / ON. Or seek support |
| RAM corruption | Attempt to reset by switching power OFF / ON. Or seek support |
| OTP ROM error / corruption | Attempt to reset by switching power OFF / ON. Or seek support |
| OTP ROM read error | Attempt to reset by switching power OFF / ON. Or seek support |
| Unknown pump type | Check the interface card and cables. Attempt to reset by switching power OFF / ON. Or seek support |
| Display failure | Seek support |
| Wrong key-press | Attempt key-press again. Attempt to reset by switching OFF / ON |
| Motor stalled | Stop pump immediately. Check pumphead and tube. Power OFF/ON may reset. Or seek support |
| Tacho fault | Stop pump immediately. Power OFF/ON may reset. Or seek support |
| Speed error | Stop pump immediately. Power OFF/ON may reset. Or seek support |
| Over current | Stop pump immediately. Check system. Power OFF/ON may reset. Or seek support |
| Over voltage | Stop pump immediately. Check mains voltage selector switch. Check supply. Power OFF/ON may reset. Or seek support |
| Under voltage | Stop pump immediately. Check mains voltage selector switch. Check supply. ON/OFF may reset. Or seek support |
| Watchdog error | Attempt to reset by switching power OFF / ON. Or seek support |
| Over temperature | Stop pump immediately. Turn OFF. Seek support |
| Unrecognised key-press | Attempt key-press again. Attempt to reset by switching power OFF/ON. Or seek support |
| Work overload | Turn OFF. Check power supply. Check pumphead and tubing. Wait 30 minutes. Power ON may reset. Or seek support |
| General error condition | Turn OFF. Seek support |

# 18 Drive maintenance

**There are no user serviceable parts inside the pump (except the power cable: see 10 *Connecting this product to a power supply*). The unit should be returned to Watson-Marlow or its appointed agents or distributors for service.**

# 19 Drive spares

| | |
|---|---|
| Replaceable main fuse, type T2,5A H 250V 20mm: FS0064 | Foot: MN2507M |

# 20 The 520R, 520R2 and 520RE pumpheads

### Identification of parts


| 520R/520R2 | | | | 520REL/520REM/520REH | |
|---|---|---|---|---|---|
| 1 | Guard latch | 5 | Rotor cap | 9 | Pumping roller |
| 2 | Guard (520R, 520R2) | 6 | Tube guide roller | 10 | Tube clamp slider (520R, 520R2) |
| 3 | Track | 7 | Rotor | 11 | Tube clamp (520R, 520R2) |
| 4 | Clutch button cover | 8 | Follower roller | 12 | Guard with seal (520RE) |
| | | | | 13 | Drain port (520RE) |

# 20.1 Pumphead position, removal and replacement

**Always isolate the pump from the mains power supply before opening the guard or performing any positioning, removal or maintenance activity.**

The pumphead track can be fitted in one of three orientations to provide right, up or down input/output port positions, whichever is convenient. Position the pumphead so that the tube ports face up or down only where the drive is placed on the bench edge - otherwise the pump tube or the hinged guard will impact the bench. Do not position the pumphead so that the tube ports face the keypad. Doing so may result in a safety risk.

The pump can be configured for clockwise or counter-clockwise rotor rotation. 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.

### To reposition the track

- Open the pumphead guard as described under 21.1 *Opening the pumphead guard*, below.
- Remove the rotor as described under *Rotor removal*, below.




- Undo and withdraw the four track-retaining screws using a slotted screwdriver.
- Remove the track.
- Relocate the track in the desired position. Replace and tighten the track-retaining screws.
- Replace the rotor as described under *Rotor replacement* below.
- Close the guard, pushing it fully home until the latch engages.

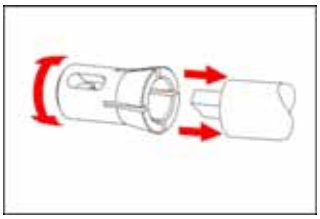
## Rotor removal

- Remove any tubing from the pumphead.




- Open the flexible rotor cap in the centre of the rotor.
- Undo and withdraw the central locating screw using a slotted screwdriver.
- Pull the rotor hub off its dogged shaft.
- Between the hub and the shaft is a split collet. If the collet is retained by the shaft, pull it off, loosening it if necessary by tapping it lightly. Avoid levering it off using a screwdriver or other tool. If the collet is retained within the hub, remove it, loosening it if necessary by reinserting the central locating screw a turn or two and tapping the screw head lightly.

## Rotor replacement


- Re-locate the split collet onto the drive shaft, rotating it until it fully engages the dog. Fit the rotor body over the drive shaft.
- Open the flexible rotor cap in the centre of the rotor. Use a slotted screwdriver to tighten the central locating screw to a torque of 3Nm (2.2 lb-ft) to prevent collet slip during operation. When fitted correctly, the tube guide rollers should align with the outer face of the track. Close the flexible rotor cap.
- Close the guard and ensure that the rotor is clear of the guard by observing the first few rotor rotations.

# 21 520R, 520R2 and 520RE installation

**Always isolate the pump from the mains power supply before opening the guard or performing any positioning, removal or maintenance activity.**

## 21.1 Opening the pumphead guard

- Unlock the pumphead guard by turning the guard fastener ¼ turn anticlockwise with a slotted screwdriver.
- Open the guard to its full extent to create maximum clearance for the tube ports.
- Ensure that the rollers rotate freely and that the tube clamps are clean.

## 21.2 520R and 520R2 Tube loading

520R continuous tubing pumpheads are factory-set to accept Watson-Marlow 1.6mm-wall tubing. 520R2 continuous tubing pumpheads are factory set to accept Watson-Marlow 2.4mm-wall tubing. Pumping performance may be adversely affected if Watson-Marlow tubing is not used.


- Mark a 225mm (8 ⅞ in) length onto the section of the tubing which is to be located into the pumphead.
- Open the lower spring-loaded tube clamp and locate the tubing, with the first 225mm (8 ⅞ in) length mark aligned to the inside face of the spring-loaded part of the tube clamp. Release the clamp.
- Disengage the rotor clutch by fully depressing the yellow clutch button on the side of the rotor hub and turning the hub a few degrees while the clutch button is still depressed. The rotor can now rotate independently of the gearbox and motor for one full revolution. If the clutch re-engages before tube fitting is complete, depress the clutch button again and turn the rotor a few degrees.
- Feed the tubing around the pumphead track, turning the rotor as necessary. Make sure the tubing is not twisted or pinched between the guide rollers and the track. Ensure that the second 225mm (8 ⅞ in) mark is adjacent to the inner edge of the upper tube clamp.
- Open the upper spring-loaded tube clamp and locate the tubing into it, making sure there is no residual twist in the tubing, and that the tube sits centrally between the tube guide rollers. Release the clamp.



- The spring-loaded tube clamps must grip the tubing tightly enough to stop it moving in and out of the pumphead but must not over-squeeze the tube and throttle fluid flow. The tubing clamps are fitted with yellow sliders which can be clicked into two positions while the clamps are held open: the outer position will allow the clamps to grip the tube tightly; the inner will grip the tube loosely. Adjust the sliders to prevent tube movement during a few trial rotations of the rotor.
- Close the guard, pushing it fully home until the latch engages.
- Connect suitable pipework to the pumphead tubing using appropriate connectors.
- Remember, when using Marprene or Bioprene tubing, re-tension the tubing after 30 minutes of running, as it may grow in length as it beds in. Re-tension so that 225mm (8 ⅞in) of tubing sits between the inside faces of the spring-loaded parts of the tube clamps.

## 21.3 520RE: fitting the drain port

The drain port is an optional extra, supplied with the pumphead. It is strongly recommended that users fit it before the pump is operated. It may be done with the rotor in position or removed.




- Remove the drain plug from the bottom of the pumphead. The drain plug is flexible. It may be removed using finger pressure from within the pumphead, or by accessing its flange from outside with a fingernail.
- Drop the port into position from inside the pumphead.
- Fit the supplied port retaining nut (⅜in BSP) and finger-tighten.
- Fit drainage pipework as required (not supplied).

## 21.4 520RE Element loading

520RE tubing element pumpheads are factory-set to accept Watson-Marlow 2.4mm-wall tubing elements. Elements fitted with either quick-release industrial connectors or Tri-clamp sanitary connectors may be used; however, **it is vital to match the pressure rating of the element with the pressure rating of the pumphead** so that the correct roller-spring rate and occlusion settings are used. The pressure rating of the pumphead appears on the flexible rotor cap in the centre of the rotor. The pressure rating of the element appears on the connector sleeve.

Note that the rotor cap and the element connector sleeve are colour-coded.

**Note**: To achieve 4 bar and 7 bar pressures using a 520RE pump and the appropriate rotor and element, the pump **must** rotate counter-clockwise.

| **Element and rotor pressure ratings** | | | | | |
|---|---|---|---|---|---|
| **Colour of flexible rotor cap and element connector sleeve** | | | | | |
| **Grey** | | **Beige** | | **Blue** | |
|  | |  | |  | |
| **520REL Pressures up to 2 bar (30 psi)** Bore sizes 3.2mm, 6.4mm and 9.6mm | | **520REM Pressures up to 4 bar (60 psi)** Bore sizes 3.2mm and 6.4mm | | **520REH Pressures up to 7 bar (100 psi)** Bore size 3.2mm | |
| **Industrial** | **Sanitary** | **Industrial** | **Sanitary** | **Industrial** | **Sanitary** |
| Marprene TL Pumpsil Neoprene Chem-Sure | Bioprene TL Pumpsil Sta-Pure Chem-Sure | Marprene TM Chem-Sure | Bioprene TM Sta-Pure | Marprene TH Sta-Pure | Bioprene TH Sta-Pure |

| **Element connectors for industrial and sanitary use** | |
|---|---|
| **Industrial** | **Sanitary** |
|  |  |

**Check that the conical connector sleeve of the element to be fitted is the same colour as the pumphead rotor cap**

## 520RE element loading procedure

**Note**: The element loading procedure is the same for industrial (pictured) and sanitary elements.





- Select an appropriate Watson-Marlow 520RE tubing element, paying attention to pressure capability, bore size, tubing material and type of connector. See the table above for pressure ratings. **Check that the connector sleeve of the element to be fitted is the same colour as the pumphead rotor cap**.
- Slide the connector D-flange at one end of the element into the lower connector D-slot.
- Disengage the rotor clutch by fully depressing the yellow clutch button on the side of the rotor hub and turning the hub a few degrees while the clutch button is still depressed. The rotor can now rotate independently of the gearbox and motor for one full revolution. If the clutch re-engages before tube fitting is complete, depress the clutch button again and turn the rotor a few degrees.
- Feed the tubing element around the pumphead track, turning the rotor as necessary. Make sure the tubing is not twisted or pinched between the guide rollers and the track.
- Slide the second connector D-flange into the upper connector D-slot.
- Check that the element lies in the middle of the track and that the connectior flanges are pushed fully home.
- Close the guard, pushing it fully home until the latch engages.
- Connect suitable pipework to the pumphead tubing using appropriate connectors. See below.

## 21.5 520RE Element connection

Select suitable tubing to connect to the tubing element supply and discharge connectors. Check that its pressure rating is appropriate to the application.

### Sanitary ¾ in mini-Tri-clamp connectors

Sanitary connectors are connected to a tubing system using mini-Tri-clamps and gaskets.



- Hold the connector end of the supply or discharge tube against the element connector, with a gasket between them.
- Use a Tri-clamp to engage both flanges squarely, close it and tighten.

### Industrial quick-release connectors

Industrial connectors are connected to a tubing system using quick-release fittings.



- Hold the pump securely and push the female fitting (available from Watson-Marlow Bredel) over the element until it clicks into place.

- To disconnect, hold the pump securely and pull the connector outer sleeve and twist counter-clockwise while pulling the female connector away.

# 22 520R, 520R2 and 520RE maintenance

**Always isolate the pump from the mains power supply before opening the guard or performing any positioning, removal or maintenance activity.**

- As part of regular cleaning and maintenance (and at least every three months), lubricate the pivot points, the follower rollers and the tube guide rollers with Ultra Lube (PA 1240), which is a non-toxic perfluoroether-based grease.
- The stainless steel pumping rollers run on externally-sealed bearings and are lubricated for life.
- Check that the pumphead track, rotor, rollers and spring-loaded tube clamps (if fitted) are clean and operating properly.
- If fluid is spilled inside the pumphead it should be cleaned as soon as possible, as reducing exposure time to contamination will prolong pumphead service life.
- To clean the pumphead, remove the rotor as described under *Rotor removal*, above. Flush the pumphead out with water and mild detergent, or suitable cleaning agent. Clean the rotor and rollers in the same way. If specific cleaning agents are required to clean the spillage, consult the general guide to cleaning with solvents below or Watson-Marlow after-sales office before proceeding, in order to confirm chemical compatibility. **Note:** the pumphead guard, rotor cap and clutch boot should be removed in advance of some cleaning regimes. See the table below. These components are available as spares if damaged.
- Replace the rotor as described under *Rotor replacement*, above.

### General guide to cleaning with solvents

| Chemical | Cleaning precautions |
|---|---|
| Aliphatic hydrocarbons | Remove guard. Minimize rotor cap and clutch boot exposure to less than one minute (risk of attack).<br>Re-lubricate follower and tube guide rollers. |
| Aromatic hydrocarbons | Remove guard. Minimize rotor cap and clutch boot exposure to less than one minute (risk of attack).<br>Re-lubricate follower and tube guide rollers. |
| Ketone solvents | Remove guard. Minimize rotor cap and clutch boot exposure to less than one minute (risk of attack).<br>Re-lubricate follower and tube guide rollers. |
| Halogenated/chlorinated solvents | Not recommended: possible risk to polycarbonate tube clamp adjusters and polypropylene tube clamp locators. |
| Alcohols, general | No precaution necessary.<br>Re-lubricate follower and tube guide rollers. |
| Glycols | Minimize rotor cap and clutch boot exposure to less than one minute (risk of attack).<br>Re-lubricate follower and tube guide rollers. |
| Ester solvents | Remove guard. Minimize rotor cap and tube clamp location cap exposure to less than one minute (risk of attack).<br>Re-lubricate follower and tube guide rollers. |
| Ether solvents | Not recommended: possible risk to polycarbonate tube clamp adjusters and polypropylene tube clamp locators. |

# 23 520R, 520R2 and 520RE rotor settings

520R, 520R2 and 520RE pumpheads are factory-set to give optimum tube life with Watson-Marlow tubing and elements. Radial roller positions should not be adjusted in any circumstances as this will adversely affect pumphead performance and invalidate warranty. Tamper-proof rotor arm occlusion setting screws are fitted to warn operators from occlusion adjustment. Tubing with a wall thickness other than 1.6mm or 2.4mm can be used only with a pumphead set up for that purpose during manufacture. Contact Watson-Marlow after-sales.

# 24 Pumphead spares


| | 520R/520R2 | 520REL/520REM/520REH |
|---|---|---|
| | 053.1011.100 | 520R |
| | 053.1011.2L0 | 520R2 |
| | 053.1011.EL0 | 520REL |
| | 053.1011.EM0 | 520REM |
| | 053.1011.EH0 | 520REH |
| 1 | MNA2050A (520R, 520R2) | Pumphead guard complete with tool-unlockable latch |
| 2 | MNA2045A (520R, 520R2) | Track assembly for cased pumps complete with spring-loaded tube clamps |
| 3 | MNA2076A (520R - 1.6mm wall tube)<br>MNA2077A (520R2 - 2.4mm wall tube)<br>MNA2148A (grey) (520REL)<br>MNA2149A (beige) (520REM)<br>MNA2150A (blue) (520REH) | Rotor cover, rotor cap and clutch button |
| 4 | MN2011M<br>S60022 | Clutch<br>Clutch spring |
| 5 | MNA2043A (520R - 1.6mm wall tube)<br>MNA2001A (520R2 - 2.4mm wall tube)<br>MNA2138A (520REL - 0-2 bar, 0-30 psi)<br>MNA2139A (520REM - 2-4 bar, 30-60 psi)<br>MNA2140A (520REH - 4-7 bar, 60-100 psi) | Rotor assembly complete with pumping rollers, follower rollers and tube guide rollers |
| 6 | MNA2006A (520R, 520R2)<br>MN2002M (520R, 520R2)<br>MN2131M (520RE) | Bottom (LH) tube clamp<br>Tube clamp location plug<br>Drain plug |
| 7 | MNA2005A (520R, 520R2)<br>MN2002M (520R, 520R2) | Top (RH) tube clamp<br>Tube clamp location plug |
| 8 | MN2034B<br>MN2005M | Guard latch spring<br>Guard latch spring cartridge |
| 9 | MNA2147A (520RE) | Pumphead guard complete with seal and tool-unlockable latch |
| 10 | MNA2144A (520RE) | Track assembly for cased pumps |
| 11 | MN2023T and MN2003T (520RE) | Drain port and nut |

Parts may be ordered individually.

# 25 Flow rates

## Pumping conditions

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

**When rotating counter-clockwise, 520R, 520R2 and 520RE pumpheads' flow rates are directly proportional to rotor speed. When rotating clockwise, 520R, 520R2 and 520RE pumpheads' flow rates are directly proportional to rotor speed up to 1.5 bar; their performance above 1.5 bar should be determined empirically.**

**Note: 520RE pumpheads should be used rotating counter-clockwise if pressures above 1.5 bar are required.**

**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.**

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.

## 520R and 520R2

All performance figures for the 520R and 520R2 pumpheads have been recorded against peak pipeline pressures.

Although rated to 2bar (30psi) peak pressure, this pump will generate in excess of 2bar (30psi) peak pressure if the pipeline is restricted. Where it is important that 2bar (30psi) is not exceeded, pressure relief valves should be installed in the pipeline.

Viscosity handling is maximised by using 2.4mm wall tubing with the 520R2 pumphead.

Flow rates are normalised test values obtained using 225mm (8 ⅞) of new tubing (measured from the inside faces of the tube clamps), and the pumphead rotating clockwise pumping water at 20C with negligible inlet and discharge pressures.

**Note**: Flow rates quoted are for 1.6mm and 2.4mm wall tubes. Tubes of 0.5mm and 0.8mm bore are only available in 1.6mm wall thickness except for platinum-cured silicone. Tubes of 9.6mm bore are only available in 2.4mm wall thickness.

## 520RE

Performance figures for the 520REL and 520REM have been recorded against 2bar peak pressure and 4bar peak pressure respectively.

Performance figures for the 520REH have been recorded against 7bar constant pressure.

Although the 520REL is rated to 2bar (30psi) peak pressure, the 520REM is rated to 4bar (60psi) peak pressure and the 520REH is rated to 7bar (100psi) constant pressure, the pumps will generate in excess of these pressures if the system pressures exceed this. Where it is important that these rated pressures are not exceeded, pressure relief valves should be installed in the pipeline.

Flow rates are normalised test values obtained using 520 elements and the pump-head rotating anticlockwise pumping water at 20C with negligible inlet and discharge pressures.

### Tube life

**Application factors that influence tube life in peristaltic pumps are pump speed and number of rollers (roller impacts/minute), chemical compatibility and viscosity of the duty fluid and suction and discharge pressure. Several tubing materials are available with different levels of life expectancy. In addition, tubing's dimensional tolerances from the manufacturing process affect its life.**

**In perfect conditions of no suction or discharge pressure, pumping water in a clean environment at normal room temperature, the following nominal tube life may be experienced:**

| | **520R and 520R2** |
|---|---|
| **Marprene, Bioprene, StaPure and Chem-Sure** | **less than 10,000 hours** |
| **Silicone** | **less than 250 hours** |
| **Others** | **less than 100 hours** |

**Note:** This is a guide only. It is not possible to make an accurate assessment of tube life except by trial of a real application.

## Continuous tubing

| 520R Neoprene, Sta-Pure, Chem-Sure, PVC, Pumpsil (ml/min) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Speed range** | **0.5mm** | **0.8mm** | **1.6mm** | **3.2mm** | **4.8mm** | **6.4mm** | **8.0mm** | **9.6mm** |
| **520S/R, 520S/R2** | | | | | | | | |
| **0.1-220rpm** | 0.004-9.5 | 0.01-24 | 0.04-97 | 0.18-390 | 0.40-870 | 0.70-1500 | 1.1-2400 | 1.6-3500 |

| 520R Marprene / Bioprene 64 shore tubing (ml/min) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Speed range** | **0.5mm** | **0.8mm** | **1.6mm** | **3.2mm** | **4.8mm** | **6.4mm** | **8.0mm** | **9.6mm** |
| **520S/R, 520S/R2** | | | | | | | | |
| **0.1-220rpm** | 0.004-9.0 | 0.01-23 | 0.04-92 | 0.17-370 | 0.38-830 | 0.67-1500 | 1.1-2300 | 1.5-3300 |

| 520R Fluorel (ml/min) | | | | | |
|---|---|---|---|---|---|
| **Speed range** | **1.6mm** | **3.2mm** | **4.8mm** | **6.4mm** | **8.0mm** |
| **520S/R, 520S/R2** | | | | | |
| **0.1-220rpm** | 0.03-70 | 0.13-280 | 0.29-630 | 0.51-1100 | 0.80-1800 |

| 520R Neoprene, Sta-Pure, Chem-Sure, PVC, Pumpsil (USGPH) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Speed range** | **0.5mm** | **0.8mm** | **1.6mm** | **3.2mm** | **4.8mm** | **6.4mm** | **8.0mm** | **9.6mm** |
| **520S/R, 520S/R2** | | | | | | | | |
| **0.1-220rpm** | 0.0001-0.14 | 0.0002-0.35 | 0.001-1.4 | 0.003-5.6 | 0.006-13 | 0.01-22 | 0.02-35 | 0.03-50 |

| 520R Marprene / Bioprene 64 shore tubing (USGPH) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Speed range** | **0.5mm** | **0.8mm** | **1.6mm** | **3.2mm** | **4.8mm** | **6.4mm** | **8.0mm** | **9.6mm** |
| **520S/R, 520S/R2** | | | | | | | | |
| **0.1-220rpm** | 0.0001-0.14 | 0.0002-0.37 | 0.001-1.5 | 0.003-5.9 | 0.01-13 | 0.01-23 | 0.02-37 | 0.02-53 |

| 520R Fluorel (USGPH) | | | | | |
|---|---|---|---|---|---|
| **Speed range** | **1.6mm** | **3.2mm** | **4.8mm** | **6.4mm** | **8.0mm** |
| **520S/R, 520S/R2** | | | | | |
| **0.1-220rpm** | 0.0005-1.1 | 0.002-4.5 | 0.005-10 | 0.01-18 | 0.01-28 |

## Elements

| | 520REL Neoprene, Sta-Pure, Chem-Sure, Pumpsil (ml/min) | | | 520REL Marprene / Bioprene TL (ml/min) | | |
|---|---|---|---|---|---|---|
| **Speed range** | **3.2mm** | **6.4mm** | **9.6mm** | **3.2mm** | **6.4mm** | **9.6mm** |
| **520S/REL** | | | | | | |
| **0.1-220rpm** | 0.18-390 | 0.70-1500 | 1.6-3500 | 0.17-370 | 0.67-1500 | 1.5-3300 |

| | 520REL Neoprene, Sta-Pure, Chem-Sure, Pumpsil (USGPH) | | | 520REL Marprene / Bioprene TL (USGPH) | | |
|---|---|---|---|---|---|---|
| **Speed range** | **3.2mm** | **6.4mm** | **9.6mm** | **3.2mm** | **6.4mm** | **9.6mm** |
| **520S/REL** | | | | | | |
| **0.1-220rpm** | 0.003-6.1 | 0.01-25 | 0.03-55 | 0.003-5.9 | 0.01-23 | 0.02-53 |

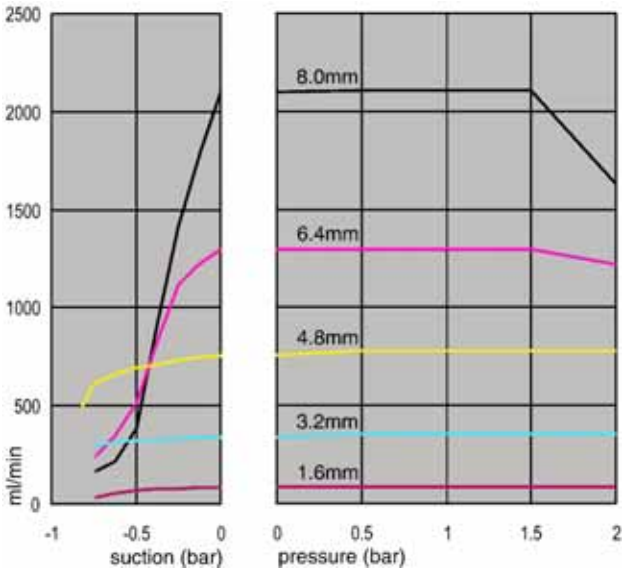
| | 520REM Sta-Pure, Chem-Sure (ml/min) | | 520REM Marprene / Bioprene TM (ml/min) | |
|---|---|---|---|---|
| **Speed range** | **3.2mm** | **6.4mm** | **3.2mm** | **6.4mm** |
| **520S/REM** | | | | |
| **0.1-220rpm** | 0.18-390 | 0.70-1500 | 0.17-370 | 0.67-1500 |

| | 520REM Sta-Pure, Chem-Sure (USGPH) | | 520REM Marprene / Bioprene TM (USGPH) | |
|---|---|---|---|---|
| **Speed range** | **3.2mm** | **6.4mm** | **3.2mm** | **6.4mm** |
| **520S/REM** | | | | |
| **0.1-220rpm** | 0.003-6.1 | 0.01-25 | 0.003-5.9 | 0.01-23 |

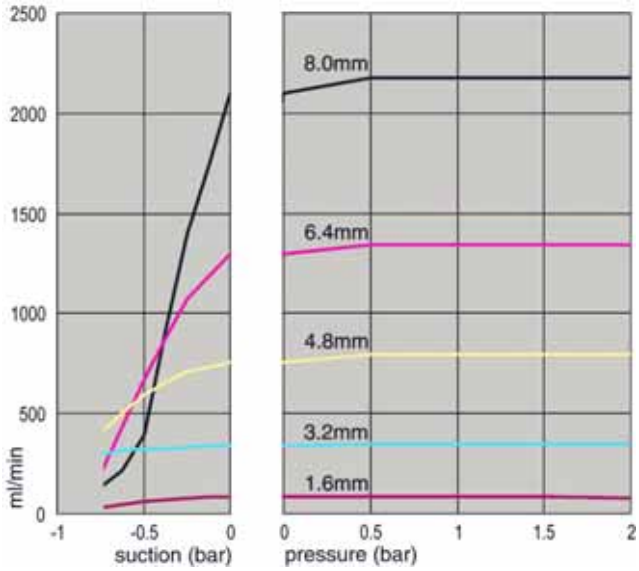
| | 520REH Marprene / Bioprene TH, Sta-Pure (ml/min) | 520REH Marprene / Bioprene TH, Sta-Pure (USGPH) |
|---|---|---|
| **Speed range** | **3.2mm** | **3.2mm** |
| **520S/REH** | | |
| **0.1-220rpm** | 0.20-450 | 0.003-7.1 |

## Performance curves

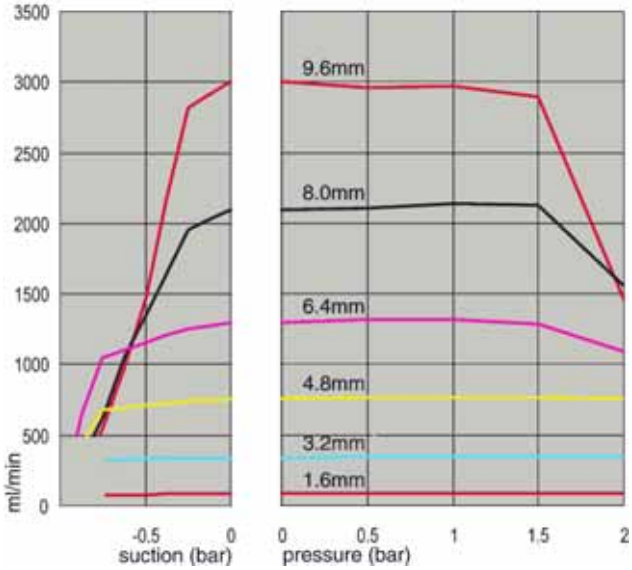
Marprene continuous tubing, 1.6mm wall, 200rpm, clockwise rotation



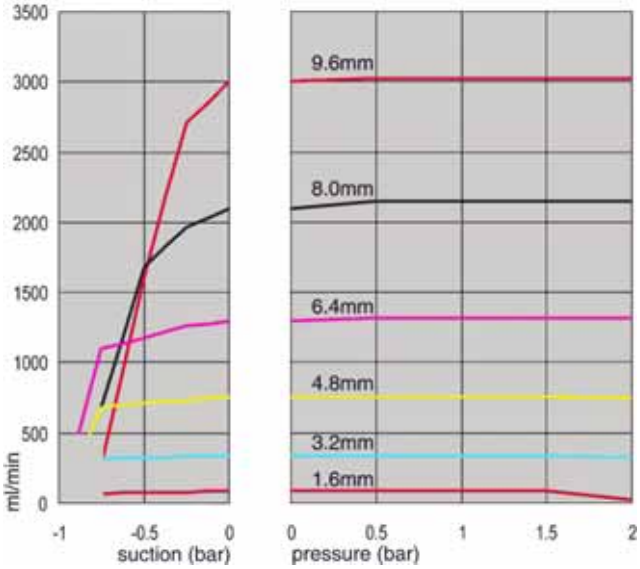

Marprene continuous tubing, 1.6mm wall, 200rpm, counter-clockwise rotation



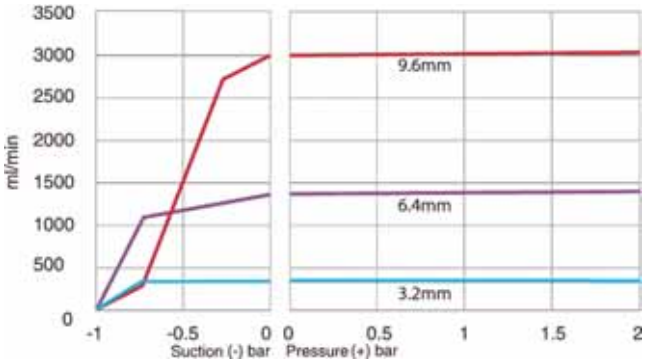
Marprene continuous tubing, 2.4mm wall, 200rpm, clockwise rotation



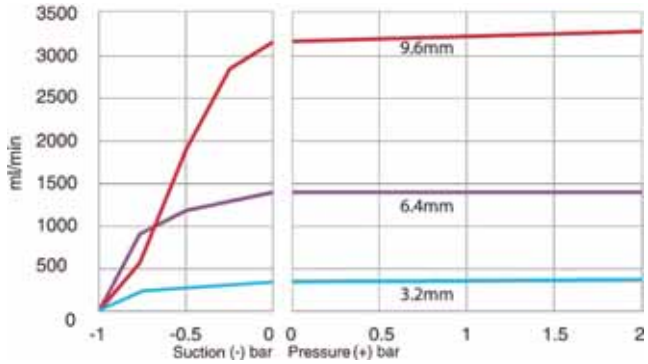

Marprene continuous tubing, 2.4mm wall, 200rpm, counter-clockwise rotation



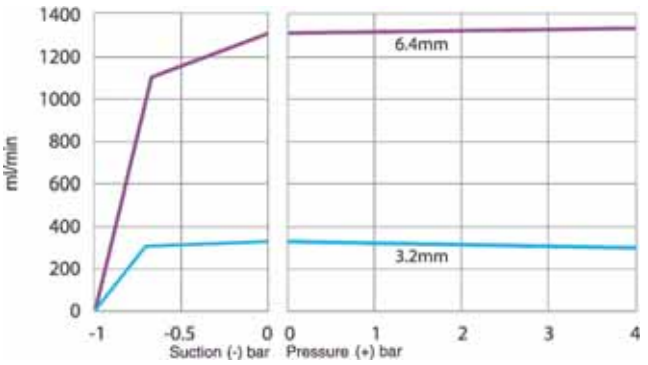
Marprene TL element, 0-2 bar (0-30psi), 200rpm, counter-clockwise rotation



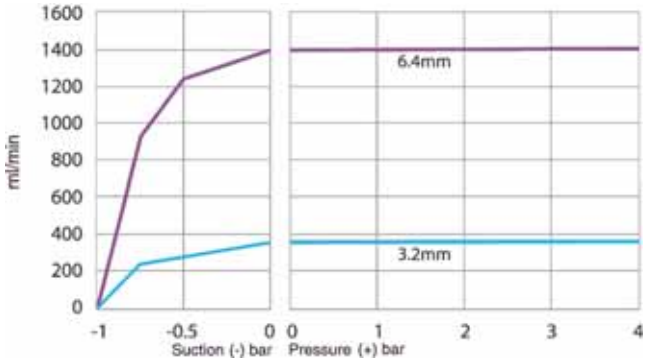

Sta-Pure element, 0-2 bar (0-30psi), 200rpm, counter-clockwise rotation



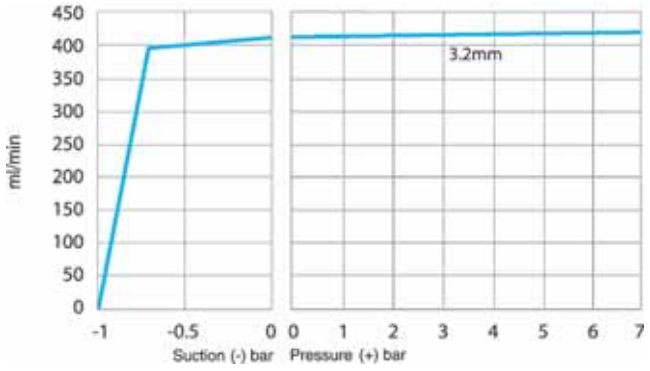

Marprene TM element, 2-4 bar (30-60psi), 200rpm, counter-clockwise rotation




Sta-Pure element, 2-4 bar (30-60psi), 200rpm, counter-clockwise rotation



Marprene TH element, 4-7 bar (60-100psi), 200rpm, counter-clockwise rotation



# 26 Tubing and element part numbers

**1.6mm wall tubing for 520R pumpheads**

| mm | inch | # | Marprene | Bioprene | Chem-Sure |
|---|---|---|---|---|---|
| **0.5** | 1/50 | **112** | 902.0005.016 | 903.0005.016 | |
| **0.8** | 1/32 | **13** | 902.0008.016 | 903.0008.016 | |
| **1.6** | 1/16 | **14** | 902.0016.016 | 903.0016.016 | 965.0016.016 |
| **3.2** | 1/8 | **16** | 902.0032.016 | 903.0032.016 | 965.0032.016 |
| **4.8** | 3/16 | **25** | 902.0048.016 | 903.0048.016 | 965.0048.016 |
| **6.4** | 1/4 | **17** | 902.0064.016 | 903.0064.016 | 965.0064.016 |
| **8.0** | 5/16 | **18** | 902.0080.016 | 903.0080.016 | 965.0080.016 |
| **mm** | **inch** | **#** | **PVC** | **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 |
| **mm** | **inch** | **#** | **Pumpsil** | **Sta-Pure** | |
| **0.5** | 1/50 | **112** | 913.A005.016 | | |
| **0.8** | 1/32 | **13** | 913.A008.016 | | |
| **1.6** | 1/16 | **14** | 913.A016.016 | 960.0016.016 | |
| **3.2** | 1/8 | **16** | 913.A032.016 | 960.0032.016 | |
| **4.8** | 3/16 | **25** | 913.A048.016 | 960.0048.016 | |
| **6.4** | 1/4 | **17** | 913.A064.016 | 960.0064.016 | |
| **8.0** | 5/16 | **18** | 913.A080.016 | 960.0080.016 | |

*Note: 1.6mm wall Chem-Sure and Sta-Pure tubing are supplied in 305mm lengths.*

## 2.4mm wall tubing for 520R2 pumpheads

| 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.*

## 2.4mm wall elements for 520RE pumpheads

| 0-2 bar (0-30 psi) pressure rated elements | | | | | | |
|---|---|---|---|---|---|---|
| **Industrial** | | | | | | |
| **mm** | **inch** | **#** | **Marprene TL** | **Pumpsil** | **Neoprene** | **Chem-Sure** |
| **3.2** | 1/8 | 16 | 902.0032.PFQ | 913.A032.PFQ | 920.0032.PFQ | 965.0032.PFQ |
| **6.4** | 1/4 | 17 | 902.0064.PFQ | 913.A064.PFQ | 920.0064.PFQ | 965.0064.PFQ |
| **9.6** | 3/8 | 122 | 902.0096.PFQ | 913.A096.PFQ | 920.0096.PFQ | 965.0096.PFQ |
| **Sanitary** | | | | | | |
| **mm** | **inch** | # | **Bioprene TL** | **Pumpsil** | **Sta-Pure** | **Chem-Sure** |
| **3.2** | 1/8 | 16 | 903.0032.PFT | 913.A032.PFT | 960.0032.PFT | 965.0032.PFT |
| **6.4** | 1/4 | 17 | 903.0064.PFT | 913.A064.PFT | 960.0064.PFT | 965.0064.PFT |
| **9.6** | 3/8 | 122 | 903.0096.PFT | 913.A096.PFT | 960.0096.PFT | 965.0096.PFT |

| 2-4 bar (30-60 psi) pressure rated elements | | | | |
|---|---|---|---|---|
| **Industrial** | | | | |
| **mm** | **inch** | **#** | **Marprene TM** | **Chem-Sure** |
| **3.2** | 1/8 | 16 | 902.P032.PFQ | 965.M032.PFQ |
| **6.4** | 1/4 | 17 | 902.P064.PFQ | 965.M064.PFQ |
| **Sanitary** | | | | |
| **mm** | **inch** | # | **Bioprene TM** | **Sta-Pure** |
| **3.2** | 1/8 | 16 | 903.P032.PFT | 960.M032.PFT |
| **6.4** | 1/4 | 17 | 903.P064.PFT | 960.M064.PFT |

| 4-7 bar (60-100 psi) pressure rated elements | | | | |
|---|---|---|---|---|
| **Industrial** | | | | |
| **mm** | **inch** | **#** | **Marprene TM** | **Sta-Pure** |
| **3.2** | 1/8 | 16 | 902.H032.PFQ | 960.H032.PFQ |
| **Sanitary** | | | | |
| **mm** | **inch** | # | **Bioprene TM** | **Sta-Pure** |
| **3.2** | 1/8 | 16 | 903.H032.PFT | 960.H032.PFT |

# 27 520 series pumping accessories

| Accessory | Description | Part code | Pump compatibility |
|---|---|---|---|
| 520ANC | Network cable, RS232, with 9-pin D-connectors | 059.3121.000 | 520Du, 520Di |
| 520ANX | Network extension cable with 9-pin D-connectors | 059.3122.000 | 520Du, 520Di |
| 520ANA | Network adaptor, 25-pin to 9-pin D-connectors | 059.3123.000 | |
| 520AB | Batch records cable with 9-pin D-connectors | 059.3125.000 | 520Di |
| 520AF | Footswitch with 25-pin D-connector | 059.3002.000 | 520U, 520Du, 520Di |
| 520AH | Handswitch with 25-pin D-connector | 059.3022.000 | 520U, 520Du, 520Di |
| 520AV | Proximity switch | 059.5072.000 | 520Di |
| 520AVN | Proximity switch | 059.507N.000 | 520DiN |
| 505LTC | Tube clamp set for 505L pumphead | 059.4001.000 | 520Di |
| 505AS | Filling stand | 059.5001.000 | All models |
| 520AL | Dispensing lance for use with 520AFN filling needles | 059.5052.000 | All models |
| 505AFN | Filling needle set | 059.5101.000 | All models |
| | Filling needle 1.6mm bore | 059.5100.016 | All models |
| | Filling needle 3.2mm bore | 059.5100.032 | All models |
| | Filling needle 4.8mm bore | 059.5100.048 | All models |
| | Filling needle 6.4mm bore | 059.5100.064 | All models |
| | Filling needle 8.0mm bore | 059.5100.080 | All models |
| | Tube monitor with 25-pin D-connector | 059.4501.520 | 520U, 520Du, 520Di |
| | Tube monitor, bare lead | 059.450N.520 | 520UN, 520DuN, 520DiN |
| 520AD | Leak detector kit | 059.8121.000 | 520U, 520Du, 520Di |
| 520AD | Leak detector kit | 059.8131.000 | 520UN, 520DuN, 520DiN |

# 28 Trademarks

**Watson-Marlow**, **Bioprene**, **Pumpsil**, **LoadSure** and **Marprene** are trademarks of Watson-Marlow Limited.
**Fluorel** is a trademark of 3M.
**Sta-Pure** and **Chem-Sure** are trademarks of W.L.Gore and Associates.

# 29 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.

# 30 Publication history

m-520s-ip31-gb-05.htm: Watson-Marlow 520S IP31
First published 10 03. Revised 03 06. Revised 01 08.

# 32 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** | | **Company** | |
| **Address** | | | |
| **Postcode/zip** | | **Country** | |
| **Telephone** | | **Fax** | |
| **Product type** | | **Serial number** | |
| **To speed the repair, please describe all known faults** | | | |
| **The product has ...** | ☐ Been used ☐ Not been used | | |
| | *If the product has been used, please complete all the following sections.*<br>*If the product has not been used, please just sign this form.* | | |
| **Names of chemicals handled with product(s)** | | | |
| **Precautions to be taken in handling these chemicals** | | | |
| **Action to be taken in the event of human contact** | | | |
| | *I understand that the personal data collected will be kept confidentially in accordance with the UK Data Protection Act 1998.* | | |
| **Signature** | | **RGA number** | |
| | | **Your position** | |
| | | **Date** | |
| | *Please print out, sign and fax to Watson-Marlow Pumps at +44 1326 376009.* | | |