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## WATSON-MARLOW BREDELE E-MANUALS

PB0339gb-03


### Watson-Marlow 521CC pumps



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## 1 Declaration of conformity

 When this pump unit is used as a stand alone pump it complies with: Machinery Directive 2006/42/EC, EMC Directive 2004/108/EC.

## 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.

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>

Product codes used in this manual	
<b>CC</b>	Close-coupled
<b>F</b>	Fixed speed
<b>DF, FD</b>	Hazardous atmosphere fixed speed
<b>P</b>	Pneumatic variable speed
<b>PD</b>	Pneumatic variable speed with duplex gearbox
<b>I, V</b>	Stand-alone inverter driven
<b>VI</b>	Varmeca IP55 integrated inverter driven
<b>DFX, DFD</b>	Hazardous atmosphere fixed speed with duplex gearbox
<b>FX, FD</b>	Fixed speed with duplex gearbox
<b>RC</b>	520RC 1.6mm wall tubing two-roller pumphead for close-coupled drives
<b>R2C</b>	520R2C 2.4mm wall tubing two-roller pumphead for close-coupled drives

## **3 Warranty**

### **3.1 One year warranty - 521P/RC and 521P/R2C models with air motors**

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.

### **3.2 Two year warranty - 521CC models with electric motors**

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 two years of delivery of the product to the end user. Such failure must have occurred because of defect in material or workmanship and not as a result of operation of the product other than in accordance with the instructions given in this manual.

Conditions of and specific exceptions to the above warranties 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.

## 4 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.

## 5 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.

## 6 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. 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, risk of electric shock.**



**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. No voltage must be applied while work is being carried out on the geared motor. The motor must be secured against accidental start-up.**

## 7 Dimensions

**521F/RC, 521F/R2C, 521DF/RLA, 521DF/RL2A**



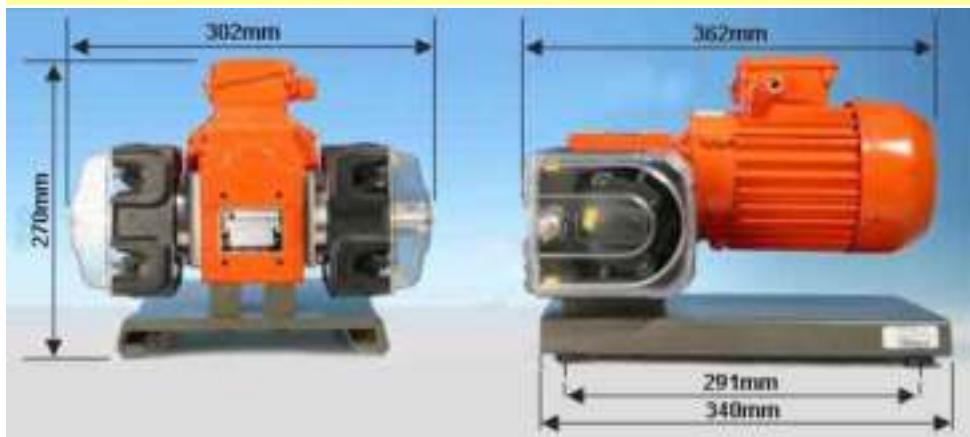
**521VI/RC, 521VI/R2C**



**521P/RC, 521P/R2C**



**521DFX/RLA, 521DFX/RL2A**



**Note:** The pumphead fitted to the 521DFX is the 501RLA, not the 520RC as shown here.

## 8 Unit installation

Site the pump on a flat, horizontal, vibration-proof surface, allowing a free flow of air around it. Ensure that there is 1m of straight, flexible tubing before the pumphead inlet and after the pumphead outlet. Close-coupled simplex pumps must be bolted down with four M8 bolts through the gearbox foot mounting holes. The pumphead will need to be removed before locating the bolts. See section 17: 520RC and 520R2C maintenance.

Duplex pumps are baseplate-mounted as standard.

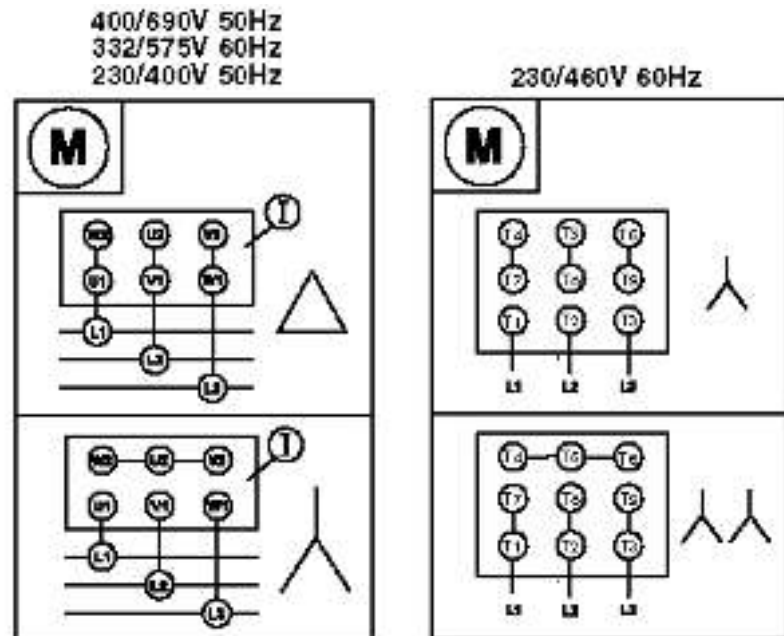
The pump may be set up so that the direction of rotor rotation is clockwise or anti-clockwise, whichever is convenient. Please note, however, that tube life will be greater if the rotor rotates clockwise; and that performance against pressure will be maximised if the rotor rotates anti-clockwise.

## 9 Standard AC three-phase motors (integrated)

### 9.1 AC (IEC) three-phase motors: motor wiring

For Nema C face motors or other options follow manufacturers' guidelines.

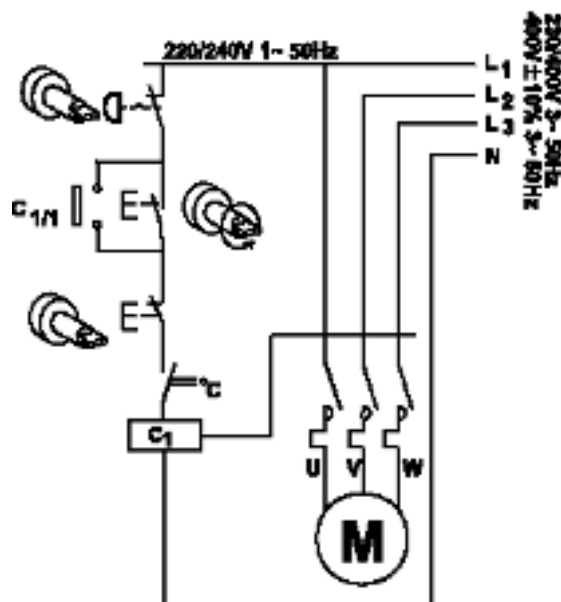
- Ensure that the mains voltage and frequency are in accordance with the motor nameplate information.
- Secure protective conductor connections.
- If the motor runs in the wrong direction for your needs, interchange any two phases.



- Close the terminal box and unused cable entrance holes in a dust-tight and watertight manner, ensuring that the IP55 protection is maintained.
- A current overload relay should be fitted to a contact-breaker appropriate to the current rating of the motor. Connect the motor in accordance with the wiring diagram in the motor terminal box.
- When a thermal protection switch is fitted in the motor, the leads will be found in the motor terminal box. They should be connected to open the circuit and stop the pump if an over-temperature condition occurs.



- See the drawing below for drive motor connections, showing possible ancillary switches and connections.



The ancillary switches should be rated to 220/240V 1ph 50Hz/60Hz. The *Start* contact should have a sprung return which will disengage following energisation of coils C1 and C1/1.



**Ensure that an emergency stop switch is fitted within reach of the pump.**



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



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



**AC three-phase motors must be connected to a suitable earth terminal. It is imperative that the equipment is powered via an isolating device and a circuit-breaking device (power contactor) which can be controlled by an external safety system (emergency stop, fault detector).**



**Correct installation and use of an AC three-phase motor with a suitably rated frequency inverter is the responsibility of the user and should be carried out by qualified personnel only.**

## 9.2 AC three-phase motors: troubleshooting

If the pump will not start make the following checks to determine whether servicing is required:

- Check that mains power is available to the pump.
- Check that the motor is connected in the correct Star/Delta configuration.
- Check that the pump is not stalled by incorrect fitting of tubing.



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



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

## 9.3 AC three-phase motors: maintenance

- Thoroughly clean and regrease the motor assembly every 10,000 working hours or after two years at the latest.
- Remove any dust deposits from the fan cover to avoid overheating.
- Dismount anti-friction bearings for cleaning and refill with a grease such as BP Energrease LS 2 or Mobil Mobilux 2.
- Ensure that the bearing cage is packed about 1/3 full with an evenly distributed lubricating grease such as BP Energrease LS 2 or Mobil Mobilux 2.

## 9.4 AC three-phase motors: gearbox maintenance - simplex (single pumphead) units

- Combine a lubricant change with a thorough cleaning of the gear unit every 10,000 working hours or after two years at the latest.
- Extreme working conditions (high air humidity, aggressive media and large temperature variations) will reduce the interval between lubricant changes.
- The first oil change should be carried out after approximately 1,000 working hours to compensate for run-in abrasion. Examples of suitable lubricating oils are BP Energol GR-XP 220 and Mobil Mobilgear 630.

## 9.5 AC three-phase motors: gearbox maintenance - duplex (twin pumphead) units

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

## 9.6 AC three-phase motors: gearbox maintenance - pump specifications

<b>Control range</b>	See motor nameplate
<b>Voltage/frequency</b>	See motor nameplate
<b>Power consumption</b>	See motor nameplate
<b>Full load current</b>	See motor nameplate
<b>Operating temperature range</b>	5C to 40C, 41F to 104F
<b>Storage temperature range</b>	-40C to 70C, -40F to 158F
<b>Noise</b>	<70dB(A) at 1m
<b>Standards</b>	BS EN60529 (IP55)
<b>Machinery directive</b>	2006/42/EC
<b>EMC directive</b>	2004/108/EC

## 10 Varmeca drives

The Varmeca drive is an IP65 integrated electronically-variable speed drive fitted to a standard enclosure IP55 motor gearbox. Standard Varmeca drives are single-phase but three-phase Varmecas are available.

Standard Varmeca drives are set up for manual control with the run command enabled. Current will be applied directly to the motor as soon as mains power is switched on. Subsequently, speed, direction of rotation and stop control can be achieved from the control knob and keypad.

**For information on how to set up the Varmeca for remote control, please refer to the Leroy Somer Varmeca-30 manual.**



**This Varmeca-30 must be connected to an approved earth terminal. It is imperative that the equipment is powered via an isolating device and a circuit-breaking device (power contactor) which can be controlled by an external safety system (emergency stop, fault detector).**

The Varmeca-30 is fitted with safety devices which stop the motor in the event of a fault. The motor can become jammed for mechanical reasons. Voltage fluctuations and power cuts may also stop the motor.

Removing the cause of a shutdown can lead to **restarting, which may be dangerous for certain installations**. It is essential that the user guards against the motor restarting after shutdown, if this is undesirable.

### 10.1 Varmeca drives: installation

- The standard Varmeca integrated drive requires no connection other than to the mains power supply.
- The Varmeca motor fan cools the whole unit. Make sure that the ventilation air inlet is free of obstruction.
- It is the responsibility of the owner or user to ensure that the installation, operation and maintenance of the inverter complies with health and safety regulations of the relevant country of use.



**Before carrying out any work, disconnect and lock the drive power supply. For single phase units, wait two minutes to make sure that the capacitors have fully discharged. After connection work, make sure that the seals are firmly in place, and the screws and cable glands are watertight to ensure IP65 protection. Clear any condensation from the drain holes at the bottom of the motor.**

### 10.2 Varmeca drives: connections

- The voltages on the power terminal blocks and the cables connected to them may cause fatal electric shocks. The drive stop function does not protect against these high voltages.
- The drive power supply must be protected against overloads and short circuits.
- It is vital to respect the rating of protection devices.
- Connections should be made with copper conductors only.

### 10.3 Varmeca drives: cables and protection devices

- Circuit breakers must be of the D-curve type suitable for a motor with an inverter.
- Comply with the size of protection (gl) fuses given in the table below.
- The cable size may vary according to legislation applicable in the country of use, which will take precedence over the values given in the table below without exception.

	Power	VMA rating	Current (A)	gl fuses or circuit breaker (A)	Cable (sq mm)
<b>230V/1/50/60Hz</b>	0.25kW 1/3HP	A or B 21M-025	3.5	8	1.5
<b>110V/1/50/60Hz</b>	0.25kW 1/3HP	A or B 21M-025	6.8	16	2.5

NB: The mains current value is a typical value which depends upon the source impedance. The higher the impedance, the lower the current. The fuses (UL approved) are intended for installations capable of delivering 5,000A maximum at 480V.

### 10.4 Varmeca drives: commissioning / start-up

- Remove the cover and connect a suitably rated mains cable via the cable gland to connection points L1, L2 and PE (earth) of the Varmeca terminal block.
- Secure the connection cover and cable gland into position, ensuring that the IP65 sealing is not compromised.



**The Varmeca must not be switched on with the connection cover removed.**



**The motor *Run* command has been enabled: the motor will start as soon as it is switched on.**

- Power-up at the mains: the green indicator lamp lights and remains on continuously.
- Start rotation by pressing a direction button for one second.
- Set the speed reference using the side control knob, adjusting speed between 10Hz and 80Hz. The speed control knob is calibrated in percentages of maximum speed.
- Press the *Stop* button to stop the unit.

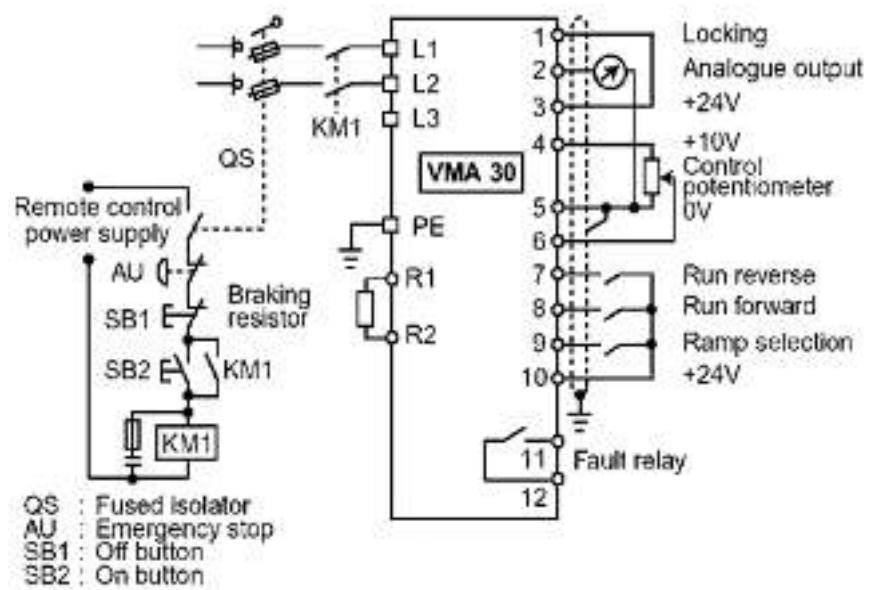
#### Varmeca drives fitted with electrical interlock pumpheads

Commissioning / start-up: as standard Varmeca units.

If the guard switch is activated:

- Press the *Stop* button twice to reset the unit after the pumphead guard has been closed
- Re-start rotation by pressing a direction button for one second

### 10.5 Varmeca drives: single phase connection diagram



**Before switching on the Varmeca-30 motor, check that electrical connections are correct and that any moving parts are mechanically protected. The Varmeca-30 must not be switched on with the protective cover removed.**

### 10.6 Varmeca drives: keypad indicator light display

Steady green light	Mains connected
Flashing green light	Motor current overload
Flashing green and red lights	Motor current limit
Flashing red light	Fault: under/over voltage
Steady red light	Fault: short circuit; locked motor rotor; faulty winding insulation; I <sup>2</sup> t overheating; or internal fault

## 10.7 Varmeca drives: Varmeca-30 specifications

<b>Power supply</b>	Single phase, 208V -10% to 240V +10%, 50/60Hz ±2% 110V -10% to 120V +10%, 50/60Hz ±2%
<b>Power range</b>	0.25kW, 1/3HP
<b>Maximum hourly mains stop/starts</b>	10
<b>Overload</b>	150% of nominal current for 60 seconds, 10 times per hour
<b>Efficiency</b>	97.5% motor efficiency
<b>Filter type</b>	Class B EMC filter (domestic and light industrial level)
<b>Motor frequency variation range</b>	10Hz-80Hz at constant torque
<b>Enclosure</b>	IP65: Varmeca drive; IP55: motor
<b>Storage temperature</b>	-40C to +70C (IEC 68.2.1), -40F to 158F
<b>Operating temperature</b>	-20C to 50C, -4F to 122F; power derated by 1% per degree C above 40C, 1% per 1.8 degrees F above 104F
<b>Altitude</b>	Up to 1000m without derating
<b>UL standard</b>	Conforming to UL508c (E211799)
<b>Weight</b>	21kg, 46lb

## 10.8 Varmeca inverter factory settings

The Watson-Marlow 521VI/RC and 521VI/R2C inverter default settings are listed in the table below. For more information on each parameter and its options, consult the Leroy-Somer Varmeca-30 operating instructions.

Parameter	Set value	Possible settings	Parameter	Set value	Possible settings
P01 F MIN	8	8Hz	P15 VP1-1		50Hz
P02 REF 0V - 4mA	8	8Hz	P16 VP2-1 VP1-2		60Hz
P03 F MAX	80	80Hz	P17 VP2		40Hz
P04 REF 10V - 20mA	80	80Hz	P18 VP3-2		70Hz
P05 ACCEL	3	3s	P19 ROTATION	FORWARD	FORWARD
P06 DECEL	3	3s	P20 SELECT 3		OUTPUT N
P07 STOP MODE	RAMP	RAMP	P21 PI K PRO		10
P08 Un MOT	400V	400V	P22 PI K INT		10
P09 FN MOT	50Hz	50Hz	P23 F MOT		-
P10 U / F	C	C: 0.25-1.1kW; D: 1.5-7.5kW	P24 I MOT		-
P11 BOOST	8%	Adapted to motor according to power	P25 FAULT		0
P12 OVERBOOST	20%	Adapted to motor according to power	P26 STOP F min		0
P13 F PWM	11	11: 0.25-2.2kW; 8: 3-4kW	P27 LOG CDC-VMA		-
P14 CONFIG	Standard	Standard	P28 CAL MOT	21M 025:520	Adapted according to motor power

## 10.9 Varmeca care and maintenance

- Temperature variations and excessive humidity encourage the formation of condensation. If this occurs, the condensation drain plugs at the bottom of the motor should be removed, even in a very humid atmosphere.
- No specific servicing is required for Varmeca-30 motors, apart from regularly removing dust from the fan grille and the cooling fins at the bottom of the unit.
- Dismantling the Varmeca-30 while it is under warranty will invalidate the warranty.



## 11 Air motors



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



Always disconnect the air supply before servicing.

### 11.1 Air motors: installation

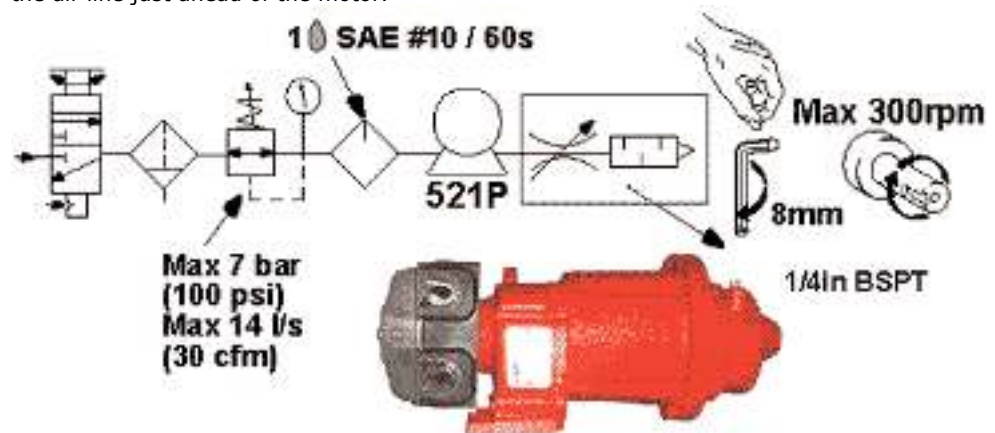
The air motor is supplied with a silencer installed. The silencer incorporates a speed limiter. Install a moisture trap and filter in the air line ahead of the motor. If condensates need to be flushed out of the motor, use clean, dry air at low pressure. For efficiency of output and speed control, use air lines of the same size or next pipe size larger than the intake port of the motor.

A four-way valve which can be connected by piping to both air ports of the motor will make reversing possible. Use a pressure regulator or a simple shut-off valve to obtain the desired power and conserve air to regulate speed and torque. **The motor should be regulated to run at no more than 3000rpm.**

The air motor should be mounted on a solid baseplate, preferably of metal, which in turn should be anchored to a shelf, floor or other machinery.

### 11.2 Air motors: lubrication

Use a detergent SAE#10 automotive engine oil. Lubrication is necessary for all moving parts and rust prevention. We recommend that an automatic air lubricator be installed in the air line just ahead of the motor.



- Automatic lubrication: An in-line oiler should be adjusted to feed one drop per minute for high speed or continuous duty use. Do not overfeed oil. Contamination of the exhaust air may occur.
- Manual lubrication: Shut the pump down after every eight hours of operation, and add 10-20 drops of oil through the inlet port.

### 11.3 Air motors: operation



**Do not drive an air motor with flammable or explosive gases nor operate the unit in an atmosphere containing them. Solid or liquid material leaving the motor can cause eye or skin damage. Keep away from the air stream. Do not drive an air motor in excess of the recommended speed, which is governed by a limiter on the outlet port. Do not allow an air motor to run at high speed with no load: excessive internal heat build-up, loss of internal clearances and rapid motor damage will result.**

### 11.4 Air motors: starting

Starting torque is less than running torque. It could vary depending on where the vanes stop in relation to the air intake port. To regulate speed and torque, use a pressure regulator or simple shut-off valve to obtain desired power and conserve air.

### 11.5 Air motors: shutdown procedure

- Turn off the air supply and remove the air lines from the motor.
- Use clean, dry air at low pressure to flush out condensates such as water.
- Re-lubricate the air motor with a squirt of oil in the chamber. Rotate the shaft by hand several times.
- Plug or cap each port.

### 11.6 Air motors: Air motor specifications

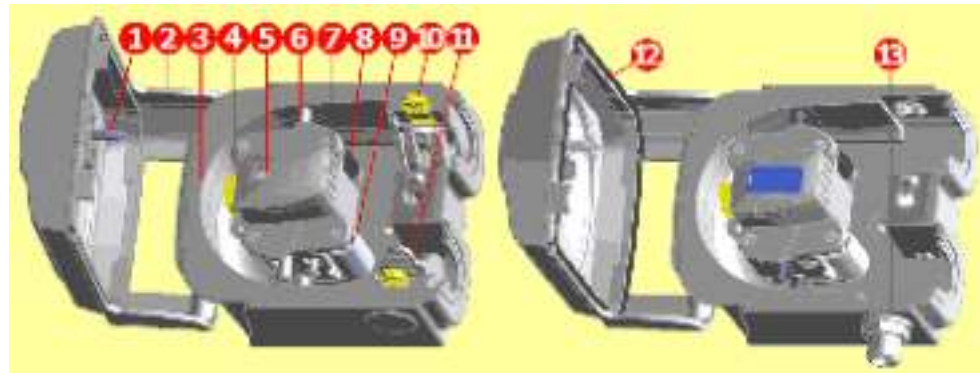
Maximum speed	Maximum pressure	Maximum torque	Maximum air consumption	Total internal end clearance	Total top clearance
3,000rpm	7.0bar, 100psig	26Nm, 19.2 lb-ft	14.15 l/s, 30cfm	0.0635mm, 0.0025in	0.0381mm, 0.0015in

### 11.7 Air motors: troubleshooting

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

## 12 520RC, 520R2C and 520REC pumpheads

### Identification of parts



1 Guard latch	5 Rotor cap	9 Pumping roller
2 Guard (520RC, 520R2C)	6 Tube guide roller	10 Tube clamp slider (520RC, 520R2C)
3 Track	7 Rotor	11 Tube clamp (520RC, 520R2C)
4 Clutch button cover	8 Follower roller	12 Guard with seal (520REC)
		13 Drain port (520REC)

### 12.1 520RC, 520R2C and 520REC key safety information



**Before opening the pumphead guard, ensure that the following safety directions are followed.**

- For close-coupled drives, ensure that the pump is isolated from the mains voltage.
- Ensure that there is no pressure in the pipeline.
- Primary operator protection from rotating parts of the pump is provided by the tool-unlockable safeguard.
- Secondary (backup) protection is available in the form of an electrical interlock which stops the pump if the pumphead guard is opened (and only for so long as the guard is opened). The electrical interlock on close-coupled pumps should never be used as primary protection. Always disconnect the mains power supply to the pump before opening the pumphead guard.
- 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 being pumped.

## 12.2 520RC, 520R2C and 520REC: good pump installation practice

### General recommendations

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.

**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. Any valves in the pipeline (not usually needed with a self-priming peristaltic pump) must not restrict the flow.

**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** 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 rollers clean and free from debris.

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

**Tube selection:** The chemical compatibility list published in the Watson-Marlow catalogue is only a guide. If in doubt about the compatibility of a tube material and the duty fluid, request a Watson-Marlow tube sample card for immersion trials.

A correctly engineered installation will promote long tube life. Please ensure that these guidelines are followed:

- Avoid tight pipeline bends, pipe reducers and lengths of smaller bore tubing than the pumphead section, particularly in pipelines on the suction side.
- Ensure that at least 1m of smooth bore flexible tubing is connected to the discharge port of the pumphead to help to minimise impulse losses and pulsation in the pipeline. This is specially important with viscous fluids and when connecting to rigid pipework.
- Ensure that connecting pipework and fittings are suitably rated to handle the predicted pipeline pressure. If rigid pipework must be used close to the pumphead, a drop-out section of pipe will simplify tube replacement.

### 12.3 520RC, 520R2C and 520REC: pumphead position, removal and replacement

The pumphead track can be fitted in one of two orientations to provide left or right input/output port positions, and clockwise or anti-clockwise rotor rotation, 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 anti-clockwise.

#### To reposition the track

- Isolate the pump from the mains power supply.
- Open the pumphead guard as described under **Opening the pumphead guard**, below.
- Remove the rotor as described under **Rotor removal**.



- 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.

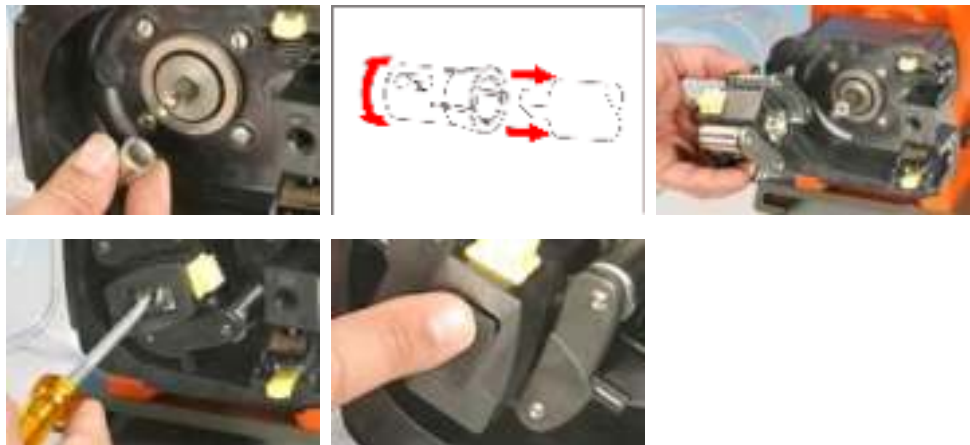


- Open the flexible rotor cap in the centre of the rotor.
- Undo and withdraw the central locating screw using a slotted screwdriver.
- Pull the rotor hub off its dogged shaft.

- 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 as one unit.
- 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.

## 13 520RC, 520R2C and 520REC installation

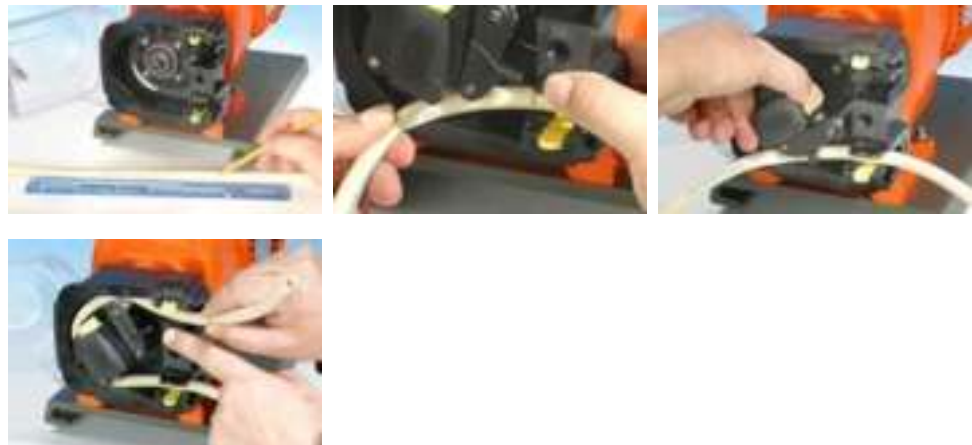
### 13.1 Opening the pumphead guard



- Isolate the pump from the mains power supply.
- Unlock the pumphead guard by turning the guard fastener ¼ turn anticlockwise with a flat-head 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.

### 13.2 520RC and 520R2C tube loading

520RC continuous tubing pumpheads are factory-set to accept Watson-Marlow 1.6mm-wall tubing. 520R2C continuous tubing pumpheads for close-coupled drives 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 length onto the section of the tubing which is to be located into the pumphead.
- Open the lower spring-loaded tube clamp and locate tubing, with the first 225mm 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. Ensure that the second 225mm 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 of tubing sits between the inside faces of the spring-loaded parts of the tube clamps.



### 13.3 520REC: 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. This 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 (3/8in BSP) and finger-tighten.
- Fit drainage pipework as required (not supplied).

### 13.4 520REC 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-springing 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	
					
<b>520REL</b> <b>Pressures</b> <b>up to 2 bar (30 psi)</b> Bore sizes 3.2mm, 6.4mm and 9.6mm		<b>520REM</b> <b>Pressures</b> <b>up to 4 bar (60 psi)</b> Bore sizes 3.2mm and 6.4mm		<b>520REH</b> <b>Pressures</b> <b>up to 7 bar (100 psi)</b> Bore size 3.2mm	
<b>Industrial</b> Marprene TL Pumpsil Neoprene ChemSure	<b>Sanitary</b> Bioprene TL Pumpsil Sta-Pure ChemSure	<b>Industrial</b> Marprene TM ChemSure	<b>Sanitary</b> Bioprene TM Sta-Pure	<b>Industrial</b> Marprene TH Sta-Pure	<b>Sanitary</b> 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

### 520REC 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 snugly in the middle of the track and that the connector 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.

### 13.5 520REC 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 3/4in Tri-clamp connectors

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

## 14 520RC, 520R2C and 520REC 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 are clean and operating properly.
- If fluid is spilled inside the pumphead it should be cleaned as soon as possible, as reducing pumphead exposure time to contamination will prolong service life.
- To clean the pumphead, remove the rotor as described under **Rotor removal**, below. 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 technical support 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 above.

### General guide to cleaning with solvents

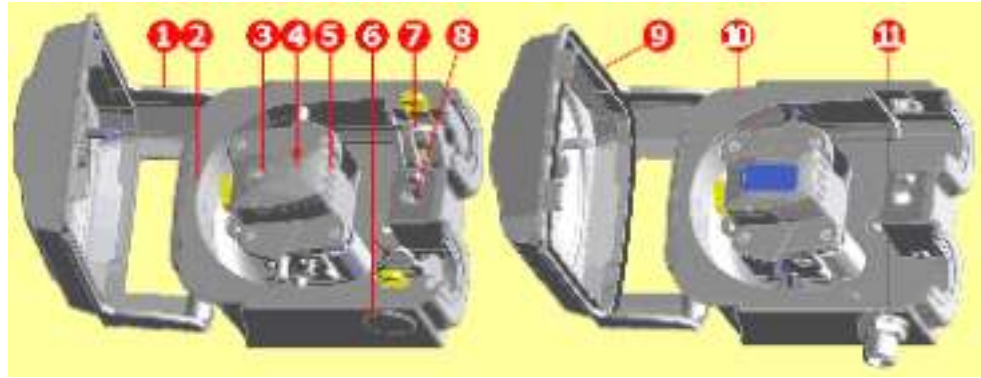
Chemical	Cleaning precautions
Aliphatic hydrocarbons	Remove guard. Minimise rotor cap and clutch boot exposure to less than one minute (risk of attack). Re-lubricate follower and tube guide rollers.
Aromatic hydrocarbons	Remove guard. Minimise rotor cap and clutch boot exposure to less than one minute (risk of attack). Re-lubricate follower and tube guide rollers.
Ketone solvents	Remove guard. Minimise rotor cap and clutch boot exposure to less than one minute (risk of attack). 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. Re-lubricate follower and tube guide rollers.
Glycols	Minimise rotor cap and clutch boot exposure to less than one minute (risk of attack). Re-lubricate follower and tube guide rollers.
Ester solvents	Remove guard. Minimise rotor cap and tube clamp location cap exposure to less than one minute (risk of attack). Re-lubricate follower and tube guide rollers.
Ether solvents	Not recommended: possible risk to polycarbonate tube clamp adjusters and polypropylene tube clamp locators.

## 15 520RC, 520R2C and 520REC rotor settings

520RC, 520R2C and 520REC pumpheads are factory-set to give optimum tube life with Watson-Marlow tubing. 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 technical support.

**Note:** 520RC, 520R2C, and 520REC pumpheads can not be adapted to use tube with walls thicker than 2.4mm.

## 16 Pumphead spares



520RC/520R2C		520RELC/520REMC/520REHC	
1	MNA2050A (520RC, 520R2C)		Pumphead guard complete with tool-unlockable latch
2	MNA2044A (520RC, 520R2C)		Track assembly for close-coupled pumps complete with spring-loaded tube clamps
3	MNA2076A (520RC - 1.6mm wall tube) MNA2077A (520R2C - 2.4mm wall tube) MNA2148A (grey) (520RELC) MNA2149A (beige) (520REMC) MNA2150A (blue) (520REHC)		Rotor cover, rotor cap and clutch button
4	MN2011M S60022		Clutch Clutch spring
5	MNA2043A (520RC - 1.6mm wall tube) MNA2001A (520R2C - 2.4mm wall tube) MNA2138A (520RELC - 0-2 bar, 0-30 psi) MNA2139A (520REMC - 2-4 bar, 30-60 psi) MNA2140A (520REHC - 4-7 bar, 60-100 psi)		Rotor assembly complete with pumping rollers, follower rollers and tube guide rollers
6	MNA2006A (520RC, 520R2C) MN2002M (520RC, 520R2C) MN2131M (520REC)		Bottom (LH) tube clamp Tube clamp location plug Drain plug
7	MNA2005A (520RC, 520R2C) MN2002M (520RC, 520R2C)		Top (RH) tube clamp Tube clamp location plug
8	MN2034B MN2005M		Guard latch spring Guard latch spring cartridge
9	MNA2147A (520REC)		Pumphead guard complete with seal and tool-unlockable latch
10	MNA2145A (520REC)		Track assembly for close-coupled pumps
11	MN2023T and MN2003T (520REC)		Drain port and nut

Parts may be ordered individually.

## 17 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 7/8) 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 of nominal bore. 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 pumphead rotating anticlockwise pumping water at 20C with negligible inlet and discharge pressures.



**Continuous tubing**

<b>520RC Neoprene, Sta-Pure, Chem-Sure, PVC, Pumpsil (ml/min)</b>								
<b>Speed range</b>	<b>0.5mm</b>	<b>0.8mm</b>	<b>1.6mm</b>	<b>3.2mm</b>	<b>4.8mm</b>	<b>6.4mm</b>	<b>8.0mm</b>	<b>9.6mm</b>
<b>521F/RC, 521F/R2C 521I/RC, 521I/R2C</b>								
<b>6-60rpm</b>	0.26-2.6	0.66-6.6	2.6-26	11-110	24-240	42-420	66-660	95-950
<b>21-213rpm</b>	0.9-9.2	2.3-23	9.2-94	37-370	83-840	150-1500	230-2300	330-3400
<b>29-291rpm</b>	1.2-132	3.2-32	13-130	51-510	110-1200	200-2000	320-3200	460-4600
<b>521P/RC, 521P/R2C</b>								
<b>26-257rpm</b>	1.1-11	2.9-28	11-110	46-4500	100-1000	180-1800	290-2800	410-4100
<b>521VI/RC, 521VI/R2C</b>								
<b>6-63rpm</b>	0.26-2.7	0.66-6.9	2.6-28	11-110	24-250	42-440	66-690	95-1000
<b>22-220rpm</b>	0.95-9.5	2.4-24	9.7-97	39-390	87-870	150-1500	240-2400	350-3500
<b>27-275rpm</b>	1.2-12	3.0-30	12-120	48-480	110-1100	190-1900	300-3000	430-4400
<b>521FX/RC, 521FX/R2C 521DFX/RC, 521DFX/R2C 521IX/RC, 521IX/R2C</b>								
<b>6-54rpm</b>	0.26-2.3	0.66-5.9	2.6-24	11-95	24-210	42-380	66-590	95-860
<b>21-206rpm</b>	0.9-8.9	2.3-23	9.2-91	37-360	83-820	150-1500	230-2300	330-3300
<b>520RC Marprene / Bioprene 64 shore tubing (ml/min)</b>								
<b>Speed range</b>	<b>0.5mm</b>	<b>0.8mm</b>	<b>1.6mm</b>	<b>3.2mm</b>	<b>4.8mm</b>	<b>6.4mm</b>	<b>8.0mm</b>	<b>9.6mm</b>
<b>521F/RC, 521F/R2C 521I/RC, 521I/R2C</b>								
<b>6-60rpm</b>	0.25-2.5	0.63-6.3	2.5-25	10-100	23-230	40-400	63-630	91-910
<b>21-213rpm</b>	0.86-8.7	2.2-22	8.8-89	35-360	79-810	140-1400	220-2200	320-3200
<b>29-291rpm</b>	1.2-12	3.0-31	12-120	49-490	110-1100	190-2000	300-3100	440-4400
<b>521P/RC, 521P/R2C</b>								
<b>26-257rpm</b>	1.1-11	2.7-27	11-110	44-430	98-970	170-1700	270-2700	390-3900
<b>521VI/RC, 521VI/R2C</b>								
<b>6-63rpm</b>	0.25-2.6	0.63-6.6	2.5-26	10-110	23-240	40-420	63-660	91-950
<b>22-220rpm</b>	0.90-9.0	2.3-23	9.2-92	37-370	83-830	150-1500	230-2300	330-3300
<b>27-275rpm</b>	1.1-11	2.8-29	11-120	45-460	100-1000	180-1800	280-2900	410-4200
<b>521FX/RC, 521FX/R2C 521DFX/RC, 521DFX/R2C 521IX/RC, 521IX/R2C</b>								
	0.25-	0.63-						

<b>6-54rpm</b>	2.2	5.7	2.5-23	10-91	23-200	40-360	63-570	91-820
<b>21-206rpm</b>	0.86-8.4	2.2-22	8.8-87	35-350	79-780	140-1400	220-2200	320-3100

<b>520RC Fluorel (ml/min)</b>					
<b>Speed range</b>	<b>1.6mm</b>	<b>3.2mm</b>	<b>4.8mm</b>	<b>6.4mm</b>	<b>8.0mm</b>
<b>521F/RC, 521F/R2C 521I/RC, 521I/R2C</b>					
<b>6-60rpm</b>	1.9-19	7.7-77	17-170	31-310	48-480
<b>21-213rpm</b>	6.7-68	27-270	60-610	110-1100	170-1700
<b>29-291rpm</b>	9.3-93	37-370	84-840	150-1500	230-2300
<b>521P/RC, 521P/R2C</b>					
<b>26-257rpm</b>	8.3-82	33-330	75-740	130-1300	210-2100
<b>521VI/RC, 521VI/R2C</b>					
<b>6-63rpm</b>	1.9-20	7.7-81	17-180	31-320	48-500
<b>22-220rpm</b>	7.0-70	28-280	63-630	110-1100	180-1800
<b>27-275rpm</b>	8.6-88	35-350	78-790	140-1400	220-2200
<b>521FX/RC, 521FX/R2C 521DFX/RC, 521DFX/R2C 521IX/RC, 521IX/R2C</b>					
<b>6-54rpm</b>	1.9-17	7.7-69	17-160	31-280	48-430
<b>21-206rpm</b>	6.7-66	27-260	60-590	110-1100	170-1600

<b>520RC Neoprene, Sta-Pure, Chem-Sure, PVC, Pumpsil (USGPH)</b>								
<b>Speed range</b>	<b>0.5mm</b>	<b>0.8mm</b>	<b>1.6mm</b>	<b>3.2mm</b>	<b>4.8mm</b>	<b>6.4mm</b>	<b>8.0mm</b>	<b>9.6mm</b>
<b>521F/RC, 521F/R2C 521DF/RLA, 521DF/RL2A 521P/RC, 521P/R2C 521V/RC, 521V/R2C</b>								
<b>5.7-57rpm</b>	0.004-0.04	0.01-0.1	0.04-0.4	0.16-1.6	0.36-3.6	0.64-6.4	0.99-9.9	1.4-14
<b>22.7-227rpm</b>	0.015-0.15	0.04-0.4	0.16-1.6	0.63-6.3	1.4-14	2.5-25	4.0-40	5.7-57
<b>521VI/RC, 521VI/R2C</b>								
<b>6.3-63rpm</b>	0.004-0.04	0.01-0.1	0.04-0.4	0.18-1.8	0.40-4.0	0.70-7.0	1.1-11	1.6-16
<b>22-220rpm</b>	0.015-0.15	0.04-0.4	0.15-1.5	0.61-6.1	1.4-14	2.5-25	3.8-38	5.5-55
<b>27.5-275rpm</b>	0.019-0.19	0.05-0.5	0.19-1.9	0.77-7.7	1.7-17	3.1-31	4.8-48	6.9-69
<b>521FD/RC, 521FD/R2C 521DFD/RC, 521DFD/R2C</b>								
<b>6.5-65rpm</b>	0.004-0.04	0.01-0.1	0.05-0.5	0.18-1.8	0.41-4.1	0.73-7.3	1.1-11	1.6-16
<b>24.7-247rpm</b>	0.017-0.17	0.04-0.4	0.17-1.7	0.69-6.9	1.6-16	2.8-28	4.3-43	6.2-62

<b>520RC Marprene / Bioprene 64 shore tubing (USGPH)</b>								
<b>Speed range</b>	<b>0.5mm</b>	<b>0.8mm</b>	<b>1.6mm</b>	<b>3.2mm</b>	<b>4.8mm</b>	<b>6.4mm</b>	<b>8.0mm</b>	<b>9.6mm</b>
<b>521F/RC, 521F/R2C 521DF/RLA, 521DF/RL2A 521P/RC, 521P/R2C 521V/RC, 521V/R2C</b>								
<b>5.7-57rpm</b>	0.004-0.04	0.01-0.1	0.04-0.4	0.15-1.5	0.34-3.4	0.61-6.1	0.95-9.5	1.4-14
<b>22.7-227rpm</b>	0.015-0.15	0.04-0.4	0.15-1.5	0.60-6.0	1.4-14	2.4-24	3.8-38	5.4-54
<b>521VI/RC, 521VI/R2C</b>								
<b>6.3-63rpm</b>	0.004-0.04	0.01-0.1	0.04-0.4	0.17-1.7	0.38-3.8	0.67-6.7	1.0-10	1.5-15
<b>22-220rpm</b>	0.014-0.14	0.04-0.4	0.15-1.5	0.59-5.9	1.3-13	2.3-23	3.7-37	5.3-53
<b>27.5-275rpm</b>	0.018-0.18	0.05-0.5	0.18-1.8	0.73-7.3	1.6-16	2.9-29	4.6-46	6.6-66
<b>521FD/RC, 521FD/R2C 521DFD/RC, 521DFD/R2C</b>								
<b>6.5-65rpm</b>	0.004-0.04	0.01-0.1	0.04-0.4	0.17-1.7	0.39-3.9	0.69-6.9	1.1-11	1.6-16
<b>24.7-247rpm</b>	0.016-0.16	0.04-0.4	0.16-1.6	0.66-6.6	1.5-15	2.6-26	4.1-41	5.9-59

<b>520RC Fluorel (USGPH)</b>					
<b>Speed range</b>	<b>1.6mm</b>	<b>3.2mm</b>	<b>4.8mm</b>	<b>6.4mm</b>	<b>8.0mm</b>
<b>521F/RC, 521F/R2C 521DF/RLA, 521DF/RL2A 521P/RC, 521P/R2C 521V/RC, 521V/R2C</b>					
<b>5.7-57rpm</b>	0.03-0.3	0.12-1.2	0.26-2.6	0.46-4.6	0.72-7.2
<b>22.7-227rpm</b>	0.12-1.2	0.46-4.6	1.0-10	1.8-18	2.9-29
<b>521VI/RC, 521VI/R2C</b>					
<b>6.3-63rpm</b>	0.03-0.3	0.13-1.3	0.29-2.9	0.51-5.1	0.80-8.0
<b>22-220rpm</b>	0.11-1.1	0.45-4.5	1.0-10	1.8-18	2.8-28
<b>27.5-275rpm</b>	0.14-1.4	0.56-5.6	1.3-13	2.2-22	3.5-35
<b>521FD/RC, 521FD/R2C 521DFD/RC, 521DFD/R2C</b>					
<b>6.5-65rpm</b>	0.03-0.3	0.13-1.3	0.30-3.0	0.53-5.3	0.82-8.2
<b>24.7-247rpm</b>	0.13-1.3	0.50-5.0	1.1-11	2.0-20	3.1-31

**Elements**

	<b>520RELC Neoprene, Sta-Pure, Chem-Sure, Pumpsil (ml/min)</b>			<b>520RELC Marprene / Bioprene TL (ml/min)</b>		
<b>Speed range</b>	<b>3.2mm</b>	<b>6.4mm</b>	<b>9.6mm</b>	<b>3.2mm</b>	<b>6.4mm</b>	<b>9.6mm</b>
<b>521F/RELC, 521I/RELC</b>						
<b>6-60rpm</b>	11-110	42-420	95-950	10-100	40-400	91-910
<b>21-213rpm</b>	37-370	150-1500	330-3400	35-360	140-1400	320-3200
<b>29-291rpm</b>	51-510	200-2000	460-4600	49-490	190-2000	440-4400
<b>521P/RELC</b>						
<b>26-257rpm</b>	46-450	180-1800	410-4100	44-430	170-1700	390-3900
<b>521VI/RELC</b>						
<b>6-63rpm</b>	11-110	42-440	95-1000	10-110	40-420	91-950
<b>22-220rpm</b>	39-390	150-1500	350-3500	37-370	150-1500	330-3300
<b>27-275rpm</b>	48-480	190-1900	430-4400	45-460	180-1800	410-4200
<b>521FX/RELC, 521IX/RELC</b>						
<b>5-54rpm</b>	8.8-95	35-380	79-860	8.4-91	34-360	76-820
<b>21-206rpm</b>	37-360	150-1500	330-3300	35-350	140-1400	320-3100

	<b>520RELC Neoprene, Sta-Pure, Chem-Sure, Pumpsil (USGPH)</b>			<b>520RELC Marprene / Bioprene TL (USGPH)</b>		
<b>Speed range</b>	<b>3.2mm</b>	<b>6.4mm</b>	<b>9.6mm</b>	<b>3.2mm</b>	<b>6.4mm</b>	<b>9.6mm</b>
<b>521F/RELC, 521I/RELC</b>						
<b>6-60rpm</b>	0.167-1.7	0.67-6.7	1.5-15	0.160-1.6	0.64-6.4	1.4-14
<b>21-213rpm</b>	0.586-5.9	2.3-24	5.3-53	0.559-5.7	2.2-23	5.0-51
<b>29-291rpm</b>	0.809-8.1	3.2-32	7.3-73	0.772-7.7	3.1-31	7.0-70
<b>521P/RELC</b>						
<b>26-257rpm</b>	0.725-7.2	2.9-29	6.5-65	0.692-6.8	2.8-27	6.2-62
<b>521VI/RELC</b>						
<b>6-63rpm</b>	0.167-1.8	0.67-7.0	1.5-16	0.160-1.7	0.64-6.7	1.4-15
<b>22-220rpm</b>	0.614-6.1	2.5-25	5.5-55	0.586-5.9	2.3-23	5.3-53
<b>27-275rpm</b>	0.753-7.7	3.0-31	6.8-69	0.719-7.3	2.9-29	6.5-66
<b>521FX/RELC, 521IX/RELC</b>						
<b>5-54rpm</b>	0.167-1.5	0.67-6.0	1.5-14	0.160-1.4	0.64-5.8	1.4-13
<b>21-206rpm</b>	0.586-5.7	2.3-23	5.3-52	0.559-5.5	2.2-22	5.0-49

	<b>520REMC Sta-Pure, Chem-Sure, (ml/min)</b>		<b>520REMC Marprene / Bioprene TM (ml/min)</b>	
<b>Speed range</b>	<b>3.2mm</b>	<b>6.4mm</b>	<b>3.2mm</b>	<b>6.4mm</b>
<b>521F/REMC, 521I/REMC</b>				
<b>6-60rpm</b>	11-110	42-420	10-100	40-400
<b>21-213rpm</b>	37-370	150-1500	35-360	140-1400
<b>29-291rpm</b>	51-510	200-2000	49-490	190-2000
<b>521P/REMC</b>				
<b>26-257rpm</b>	46-450	180-1800	44-430	170-1700
<b>521VI/REMC</b>				

<b>6-63rpm</b>	11-110	42-440	10-110	40-420
<b>22-220rpm</b>	39-390	150-1500	37-370	150-1500
<b>27-275rpm</b>	48-480	190-1900	45-460	180-1800
<b>521FX/REMC, 521IX/REMC</b>				
<b>5-54rpm</b>	8.8-95	35-380	8.4-91	34-360
<b>21-206rpm</b>	37-360	150-1500	35-350	140-1400



	<b>520REMC Sta-Pure, Chem-Sure, (USGPH)</b>		<b>520REMC Marprene / Bioprene TM (USGPH)</b>	
<b>Speed range</b>	<b>3.2mm</b>	<b>6.4mm</b>	<b>3.2mm</b>	<b>6.4mm</b>
<b>521F/REMC, 521I/REMC</b>				
<b>6-60rpm</b>	0.167-1.7	0.67-6.7	0.160-1.6	0.64-6.4
<b>21-213rpm</b>	0.586-5.9	2.3-24	0.559-5.7	2.2-23
<b>29-291rpm</b>	0.809-8.1	3.2-32	0.772-7.7	3.1-31
<b>521P/REMC</b>				
<b>26-257rpm</b>	0.725-7.2	2.9-29	0.692-6.8	2.8-27
<b>521VI/REMC</b>				
<b>6-63rpm</b>	0.167-1.8	0.67-7.0	0.160-1.7	0.64-6.7
<b>22-220rpm</b>	0.614-6.1	2.5-25	0.586-5.9	2.3-23
<b>27-275rpm</b>	0.753-7.7	3.0-31	0.719-7.3	2.9-29
<b>521FX/REMC, 521IX/REMC</b>				
<b>5-54rpm</b>	0.167-1.5	0.67-6.0	0.160-1.4	0.64-5.8
<b>21-206rpm</b>	0.586-5.7	2.3-23	0.559-5.5	2.2-22



	<b>520REHC Marprene, Bioprene TH, Sta-Pure (ml/min)</b>	<b>520REHC Marprene, Bioprene TH, Sta-Pure (USGPH)</b>
<b>Speed range</b>	<b>3.2mm</b>	<b>3.2mm</b>
<b>521F/REHC, 521I/REHC</b>		
<b>6-60rpm</b>	12-120	0.195-1.9
<b>21-213rpm</b>	43-440	0.681-6.9
<b>29-291rpm</b>	59-600	0.940-9.4
<b>521P/REHC</b>		
<b>26-257rpm</b>	53-530	0.843-8.3
<b>521VI/REHC</b>		
<b>6-63rpm</b>	12-130	0.195-2.0
<b>22-220rpm</b>	45-450	0.713-7.1
<b>27-275rpm</b>	55-560	0.875-8.9
<b>521FX/REHC, 521IX/REHC</b>		
<b>5-54rpm</b>	10-110	0.195-1.8
<b>21-206rpm</b>	43-420	0.681-6.7




## 18 Tubing and element part numbers

### 1.6mm wall tubing for 520R pumphheads

					
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 520R2C pumpheads**


					
<b>mm</b>	<b>inch</b>	<b>#</b>	<b>Marprene</b>	<b>Bioprene</b>	<b>Pumpsil</b>
<b>0.5</b>	<b>1/50"</b>				913.A005.024
<b>0.8</b>	<b>1/32"</b>				913.A008.024
<b>1.6</b>	<b>1/16"</b>	<b>119</b>	902.0016.024	903.0016.024	913.A016.024
<b>3.2</b>	<b>1/8"</b>	<b>120</b>	902.0032.024	903.0032.024	913.A032.024
<b>4.8</b>	<b>3/16"</b>	<b>15</b>	902.0048.024	903.0048.024	913.A048.024
<b>6.4</b>	<b>1/4"</b>	<b>24</b>	902.0064.024	903.0064.024	913.A064.024
<b>8.0</b>	<b>5/16"</b>	<b>121</b>	902.0080.024	903.0080.024	913.A080.024
<b>9.6</b>	<b>3/8"</b>	<b>122</b>	902.0096.024	903.0096.024	913.A096.024
<b>mm</b>	<b>inch</b>	<b>#</b>	<b>Chem-Sure</b>	<b>Sta-Pure</b>	
<b>1.6</b>	<b>1/16"</b>	<b>119</b>	965.0016.024	960.0016.024	
<b>3.2</b>	<b>1/8"</b>	<b>120</b>	965.0032.024	960.0032.024	
<b>4.8</b>	<b>3/16"</b>	<b>15</b>	965.0048.024	960.0048.024	
<b>6.4</b>	<b>1/4"</b>	<b>24</b>	965.0064.024	960.0064.024	
<b>8.0</b>	<b>5/16"</b>	<b>121</b>	965.0080.024	960.0080.024	

*Note: 2.4mm wall Chem-Sure and Sta-Pure tubing are supplied in 355mm lengths.  
9.6mm bore tubing is supplied in 610mm lengths.*

**2.4mm wall elements for 520RE pumpheads**

<b>0-2 bar (0-30 psi) pressure rated elements</b>						
						
<b>Industrial</b>						
mm	inch	#	Marpren 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
<b>Sanitary</b>						
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

<b>2-4 bar (30-60 psi) pressure rated elements</b>					
					
<b>Industrial</b>					
mm	inch	#	Marpren 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	
<b>Sanitary</b>					
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	

<b>4-7 bar (60-100 psi) pressure rated elements</b>					
					
<b>Industrial</b>					
mm	inch	#	Marpren TH	Sta-Pure	
3.2	1/8"	16	902.H032.PFQ	960.H032.PFQ	
<b>Sanitary</b>					
mm	inch	#	Bioprene TH	Sta-Pure	
3.2	1/8"	16	903.H032.PFT	960.H032.PFT	

## 19 520 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
620AL	Leak detector kit, bare lead	069.7131.000	520UN, 520DuN, 520DiN

## 20 Trademarks

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

**Fuorel** is a trademark of 3M.

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

## 21 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.

## 22 Publication history

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## 23 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.

<b>Your name</b>	<input type="text"/>	<b>Company</b>	<input type="text"/>
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**To speed the repair, please describe all known faults**

**The product has ...**  Been used  Not been used

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*I understand that the personal data collected will be kept confidentially in accordance with the UK Data Protection Act 1998.*

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