


# 604U

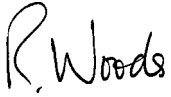


## Declarations

<b>Declaration of conformity</b> 	<b>When this pump unit is used as a stand alone pump it complies with: Machinery Directive 98/37/EC EN60204-1, Low Voltage Directive 73/23/EEC EN61010-1, EMC Directive 89/336/EEC, EN50081-1/EN50082-1.</b>
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<b>Declaration of Incorporation</b>	<b>When this pump unit is to be installed into a machine or is to be assembled with other machines for installations, it must not be put into service until the relevant machinery has been declared in conformity with the Machinery Directive 98/37/EC EN60204-1.</b>
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Responsible person: Dr R Woods, Managing Director, Watson-Marlow Limited, Falmouth, Cornwall TR11 4RU, England. Telephone 01326 370370 Fax 01326 376009.



## Two year warranty

Watson-Marlow Limited warrants, subject to the conditions below, through either Watson-Marlow Limited, its subsidiaries, or its authorised distributors, to repair or replace free of charge, including labour, any part of this product which fails within 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 warranty are:

- Consumable items such as tubing and rollers are excluded.
- Products must be returned by pre-arrangement carriage paid to Watson-Marlow Limited, its subsidiaries, or its authorised distributor.
- All repairs or modifications must have been made by Watson-Marlow Limited, its subsidiaries, or its authorised distributors or with the express permission of Watson-Marlow Limited, its subsidiaries, or its authorised distributors.
- Products which have been abused, misused, or subjected to malicious or accidental damage or electrical surge are excluded.

Warranties purporting to be on behalf of Watson-Marlow Limited made by any person, including representatives of Watson-Marlow Limited, its subsidiaries, or its distributors, which do not accord with the terms of this warranty shall not be binding upon Watson-Marlow Limited unless expressly approved in writing by a Director or Manager of Watson-Marlow Limited.

## Information for returning pumps

Equipment which has been contaminated with, or exposed to, body fluids, toxic chemicals or any other substance hazardous to health must be decontaminated before it is returned to Watson-Marlow or its distributor.



A certificate included at the rear of these operating instructions, or signed statement, must be attached to the outside of the shipping carton.

This certificate is required even if the pump is unused. If the pump has been used, the fluids that have been in contact with the pump and the cleaning procedure must be specified along with a statement that the equipment has been decontaminated.

## Safety

In the interests of safety, this pump and the tubing selected should only be used by competent, suitably trained personnel after they have read and understood this manual, and considered any hazard involved.

Any person who is involved in the installation or maintenance of this equipment should be fully competent to carry out the work. In the UK this person should also be familiar with the Health and Safety at Work Act 1974.

 	<b>There are dangerous voltages (at mains potential) inside the pump. If access is required, isolate the pump from the mains before removing the cover.</b>
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## Recommended operating procedures

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

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

**DO** run at a slow speed when pumping viscous fluids. 9.6 or 12.7mm bore tube with a 3.2mm wall will give best results. Tube smaller than this will generate a high friction pressure loss which reduces the flow. Tube with a larger bore will not have sufficient strength to resist. Flooded suction will enhance pumping performance. Some tube materials are available with a 4mm thickness for speeds up to 100rpm. (The rotor will require re-setting to a roller track gap of 6.6mm.)

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

**DO** keep the track and rollers clean.

The self-priming nature of peristaltic pumps means valves are not required. Any valves fitted must cause no restriction to flow in the pumping circuit.

**When using Marprene tubing**, after the first 30 minutes of running, re-tension the tube in the pumphead by releasing the tube clamp on the delivery side a little and pulling the tube tight. This is to counteract the normal stretching that occurs with Marprene which can go unnoticed and result in poor tube life.

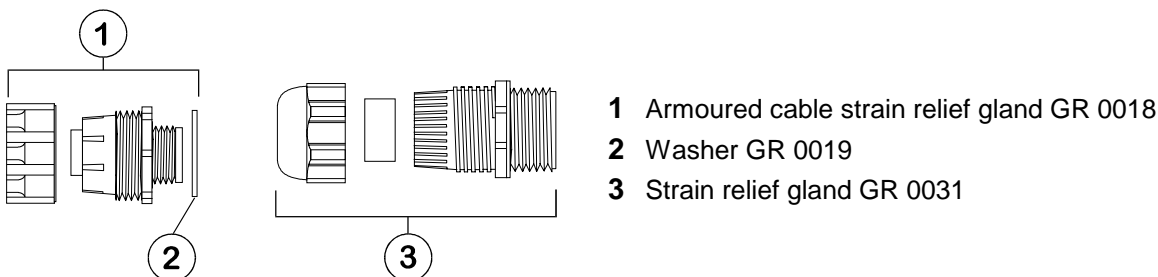
**Tube selection** The chemical compatibility list published in the Watson- Marlow catalogue is only a guide. If in doubt about the compatibility of a tube material and the duty fluid, request a tube sample card for immersion trials.

## Installation

The 604U is suitable for single phase mains electricity supplies only.

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

- Remove the small transparent plate on the rear panel to gain access to the voltage selector and terminal block.
- Set the voltage selector to either 120V for 100-120V 50/60Hz single phase AC supplies or 240V for 220-240V 50/60Hz single phase AC supplies.
- Route the mains supply cable through the entry point to the right of the recess, and couple the cable to the terminal block as shown on the rear panel.
- There are two alternative connectors. One accepts 20mm rigid or flexible conduit, and the other accepts three core 0.75 square millimetre PVC sheathed mains cable (via the screwed adapter supplied) so that a mains lead can be used.
- Ensure that the mains lead is securely retained in the strain relief gland so that IP55 ingress protection is maintained.
- Securely replace the transparent plate and the gasket over the recess.



- 1 Armoured cable strain relief gland GR 0018
- 2 Washer GR 0019
- 3 Strain relief gland GR 0031

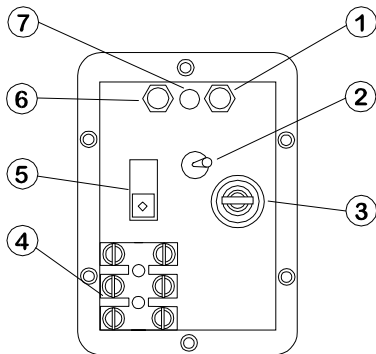


**Ingress protection standard will be compromised if the transparent plate is not replaced.**

## Rear panel recess

The pump rear panel recess houses the following:

1 Signal offset potentiometer 2 Tachometer switch 3 Fuse holder 4 Terminal block 5 Voltage selection switch 6 Signal range potentiometer 7 Signal overload LED.



## Troubleshooting

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

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

## Manual operation

Set the **Auto/Manual/Max** switch to **Manual**.

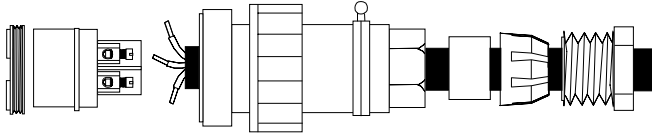
- **Start up direction** Start the pump by turning the **Forward/Off/Reverse** switch to the required direction of rotation. The preferred direction of rotation is clockwise (with fluid entering at the bottom of the pumphead), which will ensure the longest possible tube life. To operate against higher pressures use anticlockwise rotation.
- **Prime** To prime the pump at maximum speed turn the **Auto/Manual/Max** switch on the front panel to its **Max** position. When released the switch will return to its manual position.
- **Speed control** The speed setting dial is calibrated in percentage of maximum speed and has a locking knob to prevent accidental speed changes.
- **Stop** Stop the pump by turning the **Forward/Off/Reverse** switch to its central **Off** position. To change the direction of flow, turn the **Forward/Off/Reverse** switch to its central **Off** position until the pumphead rotor stops, and then turn it to the required direction of rotation.

If returning from auto control to manual control, it is not necessary to disconnect the process signal from the pump or adjust the calibration potentiometers.


**Automatic operation**

- Set the **Auto/Manual/Max** switch to **Auto**.

For all auto and remote control operations, the drive is supplied with a 6 pin waterproof connector.



Watson-Marlow part number UP0035

	<p><b>Correct assembly of the connector plug is essential or the ingress protection standard will be compromised. Never apply mains voltage across any pins on the 6 pin socket. Up to 30V may be applied across pins 2 and 3 but not across other pins. Permanent damage not covered by warranty may result in both instances.</b></p>
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The pump is controllable by an analogue process signal of up to 30V or 32mA. The pump will provide an increasing flow rate for rising control signal (*non-inverted response*) or an increasing flow rate for falling control signal (*inverted response*).

- **Signal offset** is the process signal level which has to be reached in order for the pump rotor to start rotating.
- **Signal range** is the change in process signal level necessary to produce the required change in pump rotor speed.

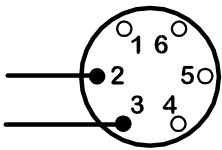
For example, when using a 4mA to 20mA process signal:

<b>Pump response</b>	<b>Signal offset</b>	<b>Signal range</b>
Non-Inverted	4mA	16mA
Inverted	20mA	16mA

For voltage modes, a stable variable DC voltage source can be used in conjunction with a DC voltmeter, (maximum 30V DC). Polarity set for a non-inverted response. Reverse polarity for an inverted response.

**Voltage signal**

Input impedance 220 kohms

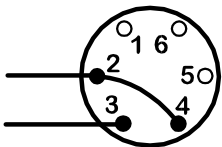


<b>Response</b>	<b>Range V</b>	<b>Offset V</b>	<b>Pin 2</b>	<b>Pin 3</b>
Non-inverted	5 to 30	0 to 30	-	+
inverted	5 to 24	0 to 24	+	-

For current modes, the same DC source can be used in conjunction with a DC milliamperemeter, (maximum 32mA). Polarity set for a non-inverted response. Reverse polarity for an inverted response.

**Current signal**

Input impedance 250 ohms



<b>Response</b>	<b>Range mA</b>	<b>Offset mA</b>	<b>Pin 2</b>	<b>Pin 3</b>
Non-inverted	12 to 30	0 to 30	-	+
inverted	12 to 30	0 to 24	+	-

## Calibration procedure

Ensure the correct wiring of the 6 pin plug and insert the plug into the socket at the rear of the pump.

- Remove the rear panel window.
- Turn the signal offset potentiometer clockwise until the slider traverse limit is reached and is signified by a clicking noise. Now turn the potentiometer ten turns anticlockwise. Repeat for the signal range potentiometer. This ensures correct potentiometer set-up for calibration.
- Set the process signal offset.
- Turn the signal offset potentiometer clockwise to set the drive shaft speed to the desired minimum.
- Set the process signal at its upper range limit (not exceeding 30V or 32mA).
- Turn the signal range potentiometer clockwise to set the drive shaft speed to the desired maximum.
- Repeat the procedure until pump response coincides exactly with the process signal.
- If the signal rises above its designated maximum, the action of the signal conditioner will be to hold the motor to maximum speed at the MAX setting indicated by the LED indicator flashing. If the signal rises above 30V, permanent damage, not covered by warranty, may result.

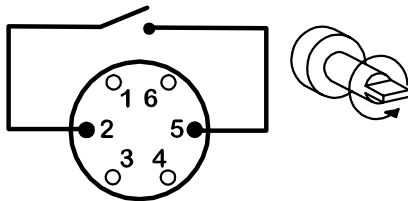


**Securely replace the rear panel recess cover on the back of the pump ensuring the gasket is in the correct position. This will avoid the ingress protection standard of the pump being compromised**

## Remote control

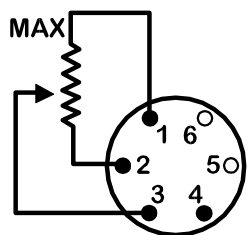
### Stop/Start

Connect remote switch between pins 2 and 5 of the 6 pin socket. Close contact to stop the pump, open to run.



### Speed

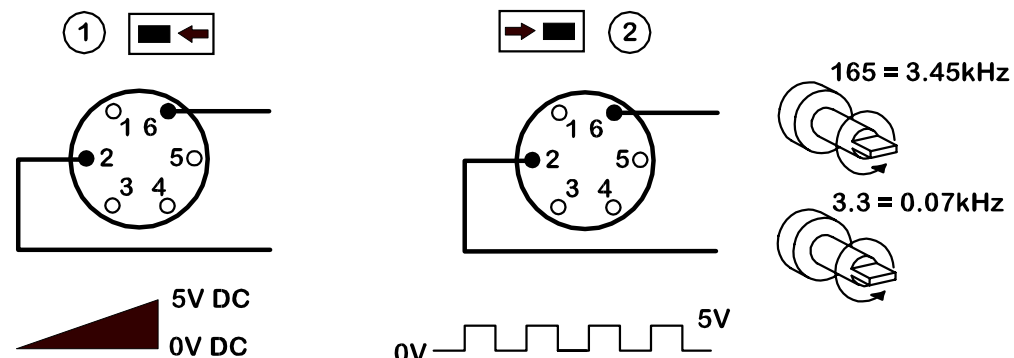
A remote potentiometer with a nominal value of between 4.7kohm and 5kohm should be wired as shown. When using a remote potentiometer do not connect a voltage/current signal at the same time. The speed control signal will require calibration relative to the minimum and maximum settings of the potentiometer. Use the offset and range potentiometers as described under calibration.



### Tachometer output

This facility can be used to indicate motor speed or total the number of motor revolutions. Select either 1) 0-5V DC or 2) 5V pulse train output using the tachometer output switch.

- 3.45kHz at 165rpm
- 0.07kHz at 3.3rpm



## Care and maintenance

The only scheduled maintenance required for the 604U/R is inspection of the motor brushes and their replacement before their length is less than 6mm. The life of the brushes will depend on the duty of the pump, but is expected to be a minimum of 4,000 hours at maximum speed.

If the pump requires cleaning, use a mild solution of detergent in water after removing the pumphead. Do not use strong solvents.

For gearbox rebuilds, use **Lubriplate GR-132** (Bodine reference LG-23) only. This is a lithium combination type thickener, NL GI No.1 grade, non-corrosive extreme pressure lubricant. This product is water resistant and resistant to a large degree to most other contaminants.

## Specification

Maximum rotor speed	165rpm
Voltage/frequency	100-120/220-240V 50/60Hz
Control range	50:1
Power consumption	250VA
Fuse rating	Type T (anti-surge) 5A
Operating temperature range	5 to 40C
Storage temperature range	-40C to 70C
Weight	21kg (46lbs)
Noise	<70dBA at 1m
Standards	IEC 335-1, EN60529 (IP55) Machinery Directive 98/37/EC EN60204- 1 Low Voltage Directive 73/23/EEC EN61010- 1 EMC Directive:89/336/EEC EN50081-1/EN50082-1

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

## 603R pumphead

The 603R has two spring loaded rollers, which automatically compensate for minor variations in tubing wall thickness, giving extended tube life.

The 603R is set during manufacture to accept a nominal tubing wall thickness of 3.2mm and bore sizes of between 4.8mm and 15.9mm.

The pumphead can be run clockwise for extended tube life or anti-clockwise to operate against higher pressures.

## Flow rates

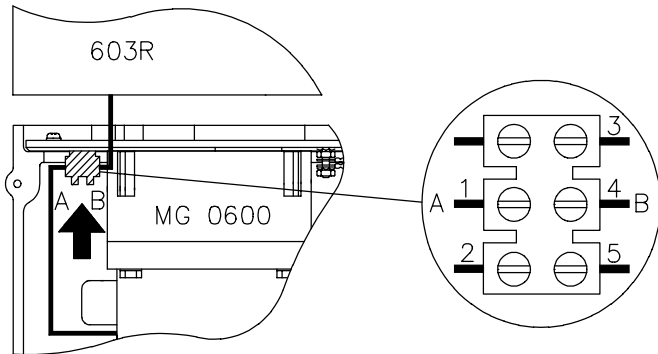
Flow rates for the 604U/R were obtained using Watson-Marlow 3.2mm wall thickness Marprene tubing pumping water at 20C with negligible suction and delivery pressures (unless otherwise stated) Where an application is critical, the flow rate should be determined under operating conditions. The important factors are suction and delivery pressures, temperature and fluid viscosity.



## Installation

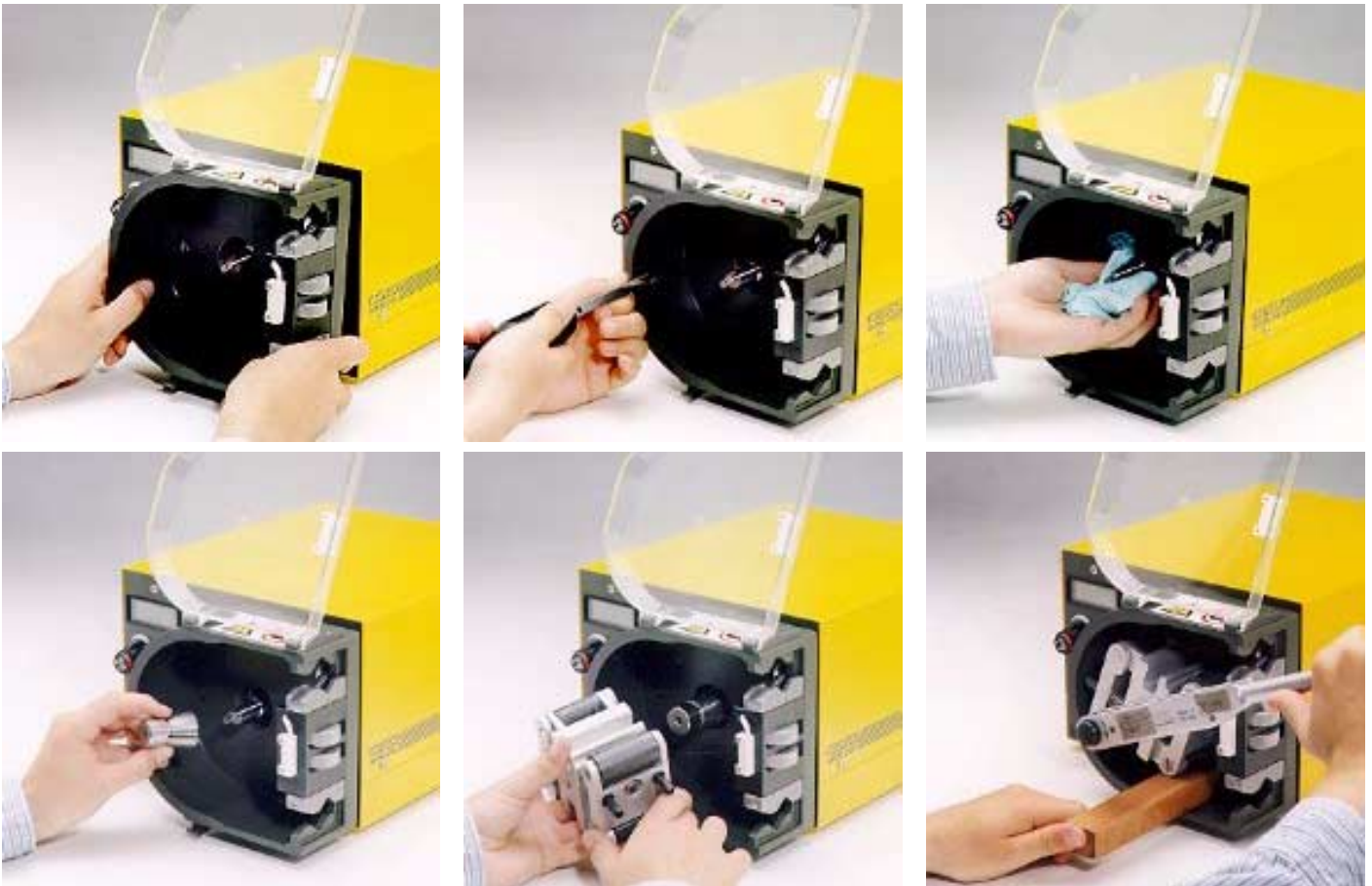
Remove the top half casing from the drive. Pass the switched guard wires on the track through the front panel of the drive and connect to the terminal blocks. Replace horizontal, front and back panel case gaskets to ensure the IP55 ingress protection standard is not compromised. Replace top half casing.

1 Red 2 Black 3 Red 4 Yellow 5 Black.



Fit the track over the drive shaft and locating boss. Secure the track with the retaining screws. Ensure the drive shaft has been completely degreased before locating the rotor onto the shaft via a split collet. Tighten the rotor bolt to a torque of 13Nm to prevent the collet slipping during operation.

• **Pump shown in track loading pictures is the 603S/R**



To remove the track, remove any tubing from the pumphead. Loosen the rotor securing bolt and give the rotor/bolt a sharp tap to free the collet. Release the collet, and withdraw the rotor from the shaft. Loosen the two track securing screws and pull the track clear. Use this method of removal and fitting in case cleaning is required.



## Tube loading



**Isolate drive from the mains supply. If the pump is not switched off before the pumphead guard is raised, a switch on the guard will cut off power to the motor. This switched guard is a safety back-up system and must not be used as the primary on/off switch for the pump.**

Open the pumphead guard and fit one end of the tube into the bottom adjustable clamp. Tighten the lower serrated adjustment wheel. Whilst rotating the rotor clockwise (a spanner is provided for this purpose), feed the tube between the rollers and the track, aligning it with the rotor tube guides. The tubing must lie naturally against the track and must not be twisted or stretched.

- **Pump shown in tube loading pictures is the 603S/R**



Fit the other end of the tube into the top adjustable clamp, ensuring that the tube is not slack in the pumphead since this can reduce tube life. Clamp the tube very firmly by turning the upper serrated adjustment wheel. Remove the spanner and close the guard.



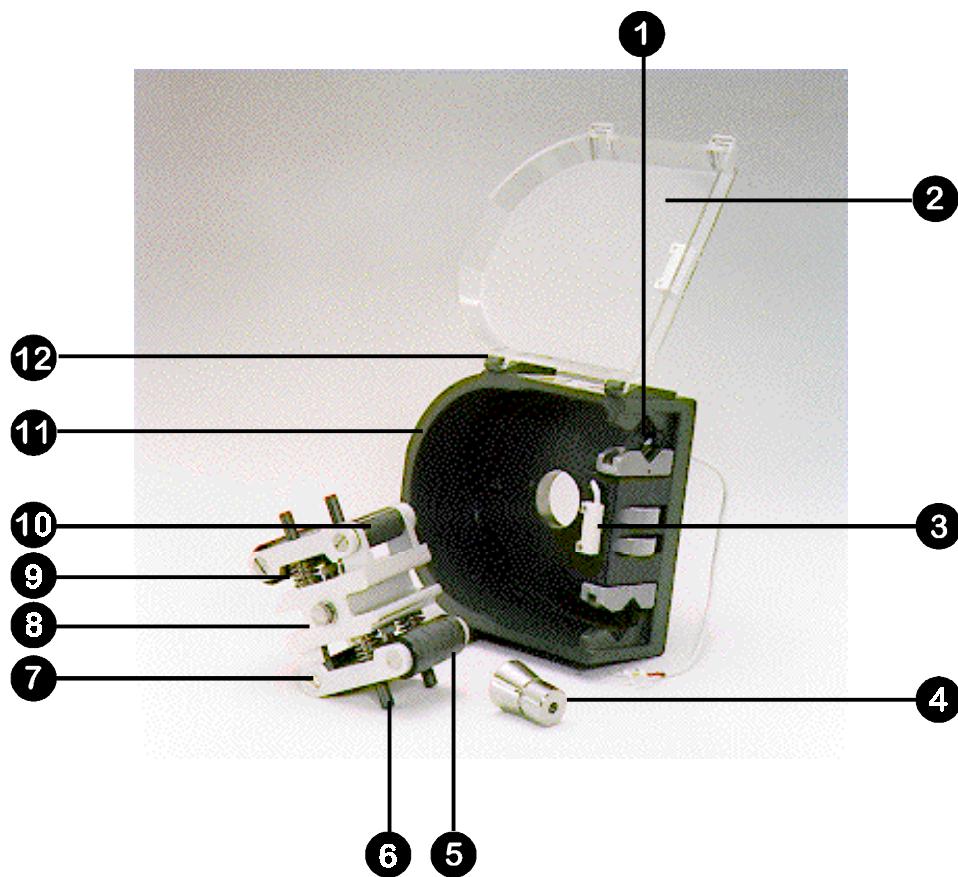
## Roller adjustment

Should it ever appear that the roller arms are not equally adjusted, the original factory setting of 5.2mm can easily be restored. Turn the adjustment screws on each roller arm anticlockwise until both rollers are just in contact with the track, and then turn each screw clockwise by five turns. Correct adjustment is important. For 4mm wall thickness tubing turn the screw clockwise by six and a half turns giving a roller/track clearance of 6.6mm.

Over-occlusion will reduce tube life. Under-occlusion will reduce pumping efficiency.

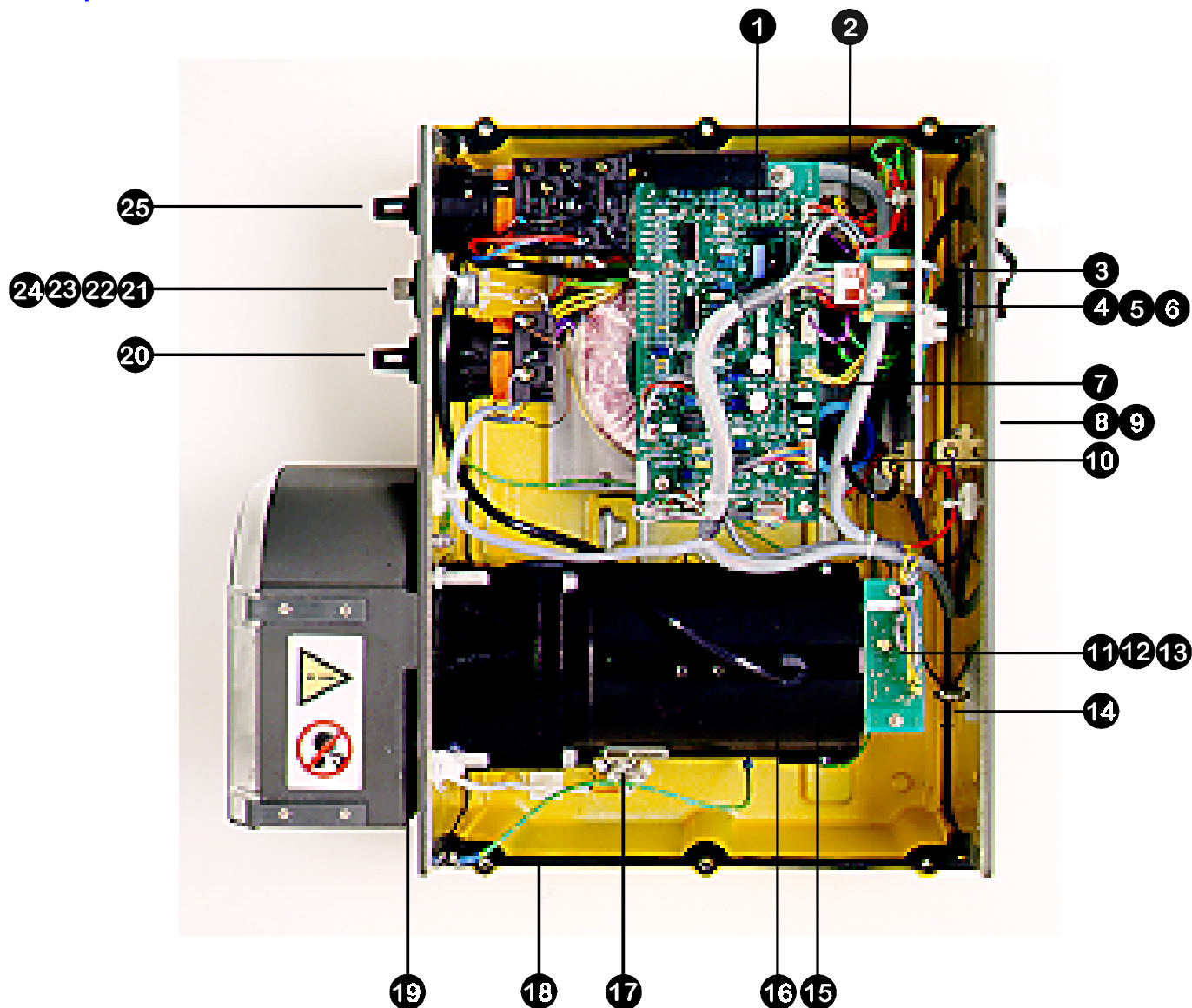
Check moving parts of the rotor from time to time for freedom of movement. Lubricate pivot points and rollers occasionally with a light machine oil. For scheduled maintenance, remove the rotor from the pumphead, clean thoroughly and apply Teflon lubricating oil to the roller spindles.

## Pumphead spares



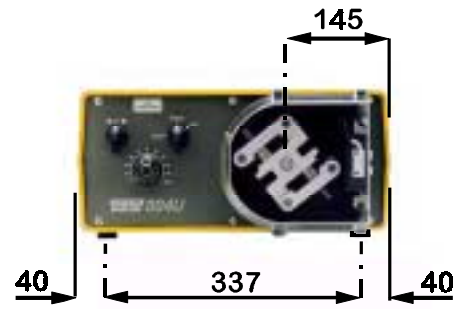
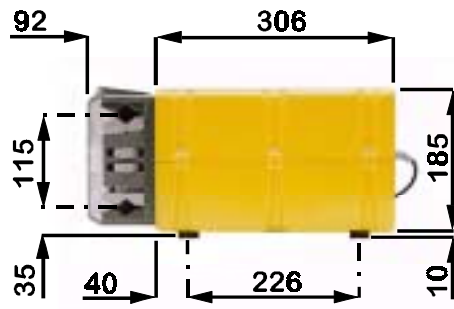
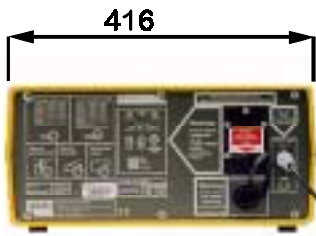
Number	Spare	Description
1	GR 0008	Grommet
2	MR 0258M	Guard
3	SW 0139	Guard Switch & magnet
4	MR 0601T	Collet
5	MR 0571T	Roller - tube
6	MR 0575T	Roller - tube guide
7	MR 0573T	Spindle
8	MRA0010A	Rotor assembly
9	SG 0003	Spring
10	MR 0572T	Roller - guide
11	MRA0161A	Track assembly
12	MR0283M	Hinge - guard Teflon lubricant

## Drive spares



Number	Spare	Description	Number	Spare	Description
1	MRA0177A	PCB Control	14	MR 0690S	Gasket
2	FA 0002	Mains filter	15	MG 0600	Motor/gearbox 165rpm
3	SW 0060	Tacho switch	16	BM 0015	Motor brush
4	SW 0086	Voltage switch	17	TM 0020	Terminal block
5	UP 0035	6 pin plug	18	MR 0691S	Gasket
6	US 0035	6 pin socket	19	OS 0042	Seal "O" ring
7	FA 0010	Earth filter	20	SW 0146	Auto/man/max
8	MR 0669S	Cover plate	21	MR 0769B	Potentiometer
9	MR 0771S	Gasket	22	MR 0716S	Knob
10	CE 0113	Capacitor 250V	23	MR 0715M	Locking knob
11	MR 0959H	Tacho harness	24	MD 0924T	Locking knob (machined)
12	MN 0787M	Tacho disc	25	SW 0141	Direction switch
13	MR 0525S	Tacho bracket		OG 0024	Gearbox lubricant

Outline dimensions



**Product use and decontamination declaration**

To comply with the *UK Health & Safety at Work Act* and the *Control of Substances Hazardous to Health Regulations* you, the user, are required to declare the substances which have been in contact with the product(s) you are returning to Watson-Marlow or any of its subsidiaries or distributors. Failure to do so will cause delays in servicing the product(s). Please complete this form to ensure that we have the information before we receive the product(s). A further copy *must* be attached to the outside of the packaging containing the product(s). The user is responsible for cleaning and decontaminating the product(s) before returning them.

Please complete a separate Decontamination Declaration for each pump returned. **RGA No:** .....

1 Company .....  
 Address .....  
 ..... Postcode .....  
 Telephone ..... Fax Number .....

2.1 Serial Number ..... (One product per declaration)

2.2 Has the Product been used?

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

3 Details of substances pumped

4 I confirm that the only substances(s) that the equipment specified has pumped or come into contact with are those named, that the information given is correct, and the carrier has been informed if the consignment is of a hazardous nature.

3.1 Chemical names:

5 Signed .....

- (a).....
- (b).....
- (c).....
- (d).....

Name .....

Position .....

Date .....

3.2 Precautions to be taken in handling these substances:

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

- (a) .....
- (b) .....
- (c) .....
- (d) .....

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

- (a).....
- (b).....
- (c).....
- (d).....

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

- (a).....
- (b).....
- (c).....
- (d).....

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