701S/R

Drive/s:	**Issue 4**
EPROM:	**N/A**
Pumphead/s:	**Issue1**

Watson-Marlow manual control high flow pump
Installation and operating instructions

Publication PB 0142
Issue 2

Contents

Declarations

Declaration of conformity

CE

When the 701S/R pump unit is used as stand alone pump it complies with:

Machinery Directive 89/392EEC and EN60204-1

Low Voltage Directive 73/23/EEC and EN61010-1

EMC Directive 89/336/EEC and EN50081-1/EN50082-1

Responsible person: Dr R Woods, Managing Director, Watson-Marlow Limited, Falmouth, Cornwall TR11 4RU, England.

Telephone 01326 370370 Fax 01326 376009

Declaration of incorporation

When the 701S/R pump 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 provisions of the Machinery Directive 89/392/EEC and EN60204-1.

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 glands 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.

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.

Ensure the drive is inoperative before opening the track cover

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

Information for returning pumps

In the current situation of heightened concern over the handling of hazardous materials, any equipment which has been contaminated with, or exposed to, body fluids, toxic chemicals or any other substance hazardous to health must be decontaminated before it is returned to Watson-Marlow or its distributor.

A certificate (a suitable blank form is 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.

Recommended operating procedures

DO keep delivery and suction lines as short as possible.

DO use the minimum number of bends in rigid pipe runs. If there must be a bend, use a swept bend and not a tight elbow

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 use the largest possible bore tube running at slow speed for the longest tube life.

DO fit an extra length of pump tube in the system so that you can move the tube through the pumphead occasionally, without needing to break the pumping circuit. This is particularly useful for extending tube life in long running sterile applications.

DO keep the track and rollers clean, and ensure that the rollers are free.

DO NOT fit valves in the suction or delivery line without considering that peristaltic pumps are self priming and will hold their prime up to several metres, so there may be no need for non-return or foot valves, nor for the loading valves required on many other kinds of pumps.

Any valves fitted must cause no restriction. If electrically actuated valves are fitted, they should be interlocked so that the pump will only run when the valves are open. Fit an automatic by-pass if manual valves are installed.

When using Marprene or Bioprene 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 and Bioprene, 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. Remember the sample will be fully immersed, but the fluid when in use will only be in contact with the inside of the tube. If the material swells but does not lose its strength it may be worth considering.

Viscous dispensing To overcome the common problems of reduced accuracy and dripping delivery pipes, the suction and delivery lines should be kept as short as possible. Use larger bore transmission tubing than that in the pumphead to keep the friction losses to a minimum. Improved accuracy will be noticed if rigid or semi-rigid pipe is used on the delivery side. The rigid tube is effective in reducing over-run because it does not expand during pumping.

Part 1: 701S/R Drive

Siting

The 701S/R can be operated at ambient temperatures from 5C to 40C. Storage temperatures from -40C to 70C are permissible, but allow time for acclimatisation before use. The pump should be positioned to allow a free flow of air around it.

Should the pump fail to operate, check that mains electricity is available at the unit, that the fuses are intact and that the pump is not stalled by incorrect fitting of tubing.

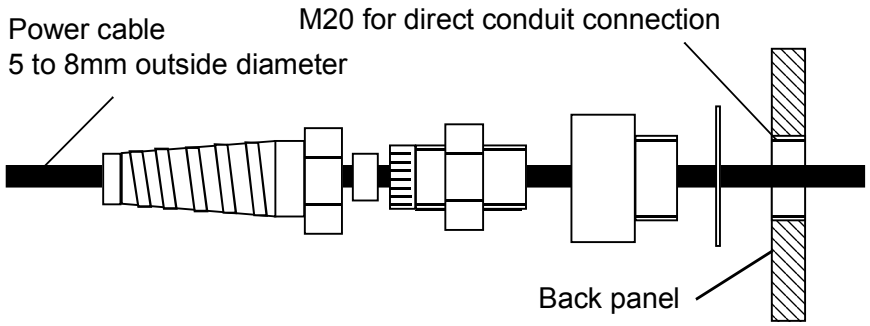
A drain hole (tapped 1/4" BSP) is provided at the left hand side of the pumphead base which is plugged during assembly. If required, the plug can be removed and a drain hose connected.

Installation

Supplies

The 701S/R is suitable for single phase mains electricity only. Ensure that the supply voltage and frequency correspond with those marked with a white dot on the rear panel, (220V 50/60Hz, 120V 50/60Hz or 100V 50/60Hz).

Remove the small plate on the rear panel to gain access to the terminal block. Route the mains cable through the entry point to the right of the recess and couple the cable to the terminal block in accordance with the instructions printed on the rear panel. Two alternative connectors are supplied to screw into the entry point gland. One accepts 20mm rigid or flexible conduit, and the other accepts a three core 0.75 square mm PVC sheathed mains cable (via the screwed adaptor provided) so that a flying lead can be used. Securely replace the transparent plate and gasket over the recess.



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

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

Part 2: Operation

Overview

Select the direction of rotation with the forward/off/reverse switch on the left hand side of the control panel and start the pump using the green start button. The preferred direction of rotation is clockwise (giving a flow direction of left to right when facing the pump), which will ensure the longest tube life. To stop the pump, turn the forward/off/reverse switch to its central off position. To change direction of flow, turn the forward/off/reverse switch through its central off position to the other direction and restart the pump with the green start button.

If at any time the pump fails to start, it is likely that the inbuilt protection circuitry is operating. Turn the forward/off/reverse switch to its central off position (you should hear the contactor drop out), and then to the required direction of rotation again. Wait 10 seconds and press the green start button.

The speed control range of the 701S/R is from 2% to 100% of the rated maximum speed (360rpm at the rotor). The speed setting dial has a locking knob to prevent accidental speed changes.

If the pump is to be used at low speed settings under manual control, and there is a risk that damage could be caused to the process if the pump is taken to higher speeds, then the speed limiting potentiometer in the rear panel recess can be brought into use. First, remove the panel covering the rear panel recess and turn the speed limiting potentiometer fully anti-clockwise. Next, turn the front panel speed potentiometer fully clockwise. Start the pump (which will run very slowly - if at all) and turn the rear panel speed limiting potentiometer clockwise until the pump reaches the desired maximum speed. Securely replace the panel with an intact gasket over the rear panel recess. It will now be found that the pump speed can be varied over a limited range from the front panel potentiometer.

Note that as the maximum speed is reduced using the speed limiting potentiometer, the speed control ratio is also reduced. The minimum speed at which the 701S/R will run is about 7rpm. If the speed limiting potentiometer is set to reduce the maximum speed to, say, 35rpm, then the speed control ratio will be 7rpm to 35rpm, which is a speed control ratio of 5:1.

Fitting a second pumphead

Tubing considerations

701S/R pump may be fitted with one 701RX extension pumphead to give two channels of flow. There is no restriction on the size of tube which can be used in each pumphead when two pumpheads are fitted, but if two tubes of 25.4mm bore are fitted, the maximum output pressure against which the pump can operate is 1.5 bar (22 psig).

1. Remove the plug from the slot in the centre shaft of the first pumphead, and remove the plug from the tapped hole on the top right hand corner of the first pumphead.
2. Remove the track securing bolt and the track from the first pumphead. Remove the M8 x 16 socket head cap screw from the bottom left (just above the left hand foot) of the first pumphead.
3. Remove the track securing bolt and the track from the extension pumphead.

Important

Grease the drive shaft tongue of the extension pumphead with the grease supplied. Turn the centre shaft of the extension pumphead until its drive shaft tongue is aligned with the slot in the drive shaft of the first pumphead.

Apply thread locking compound to the M8 x 16 socket head cap screw in the top right hand corner of the backplate of the extension pumphead. Fit the 701RX extension pumphead to the first pumphead, ensuring that the backplate of the extension pumphead is flat against the frontplate of the first pumphead.

4. Tighten the socket head cap screw in the top right hand corner of the extension pumphead with the modified Allen key supplied.
5. Apply thread locking compound to the M8 x 170 socket head cap screw in the bottom left of the extension pumphead frontplate, and tighten it with the Allen key supplied.

Follow the tube loading instructions in the next section for each pumphead, using the double length bolt to secure both tracks.

6. Tighten the track securing bolt with the Allen key provided to prevent removal by hand.

Tube loading

1. If the pump is running, stop it by turning the forward/off/reverse switch to its central position. The track acts as a guard to the rotor, and should not be removed until the pump has been stopped.
2. Turn the track compression spring knobs anti-clockwise about six turns. This raises the springs and aids both track removal and replacement.
3. Release the track by unscrewing the track securing bolt on the left hand side of the pumphead and withdrawing the bolt fully. Lift the track by its handle and slide out the right hand side of the track from under the springs.
4. Release in turn the two tube clamps by pulling on the release levers on either side of the front plate of the pumphead, and lift out both clamps.
5. Lay the tubing across the pumphead and secure the suction side by sliding in the first tube clamp (with its lip pointing outwards) and pressing it down firmly. Loosely fit the second tube clamp.
6. Slip the right hand end of the track under the springs and position the left hand end so that the track securing bolt can be inserted.
7. Tighten the track securing bolt with the Allen key provided to prevent removal by hand. The Allen key size is 6mm. Spare Allen keys are available from Watson-Marlow Limited or its distributors.

When the track has been fitted, screw down both the spring adjuster nuts fully.

Retensioning the tubing

Start the pump, allow any excess tubing to work through the pumphead, and press the delivery end clamp down firmly. Check the tube for movement when the pump is running.

If there is any sign of the tube working its way through the pumphead, the tube should be more firmly clamped at its suction end, the delivery end unclamped to release any excess tubing, pulled tight and then firmly reclamped again.

When using Marprene tubing, it is advised that the above procedure is carried out after approximately 30 minutes running time following initial tube loading. If the direction of flow is reversed, the tube should again be checked for movement.

Part 4: Appendices

Flow rates

These flow rates were obtained using Marprene tubing pumping water at 20C with zero suction and delivery pressures (unless otherwise stated). Where an application is critical, the flow rate should be determined under operating conditions. The important factors are suction and delivery pressures, temperature, fluid viscosity and tube material.

Flow rates 701S/R (litres/hr)	Minimum flows 2% of rates given				
Tube #	193	88	189	191	92
Tube bore	9.6mm 3/8"	12.7mm 1/2"	15.9mm 5/8"	19.0mm 3/4"	25.4mm 1"
360rpm	**420**	**780**	**1080**	**1500**	**2000**

Tubing range

Pump performance depends upon the accuracy and consistency of the tubing. Watson-Marlow tubing is specially formulated for peristaltic pumping and it is manufactured and quality controlled to our own specifications. We recommend Marprene tubing whenever it is chemically suitable.

701S/R Tubing range product codes				
Bore		Tube #	Marprene	Silicone
9.6 mm	3/8"	193	**902.0096.048**	**910.0096.048**
12.7mm	1/2”	88	**902.0127.048**	**910.0127.048**
15.9mm	5/8”	189	**902.0159.048**	**910.0159.048**
19.0mm	3/4”	191	**902.0190.048**	**910.0190.048**
25.4mm	1”	92	**902.0254.048**	**910.0254.048**
Bore		Tube #	Neoprene	Bioprene
9.6mm	3/8"	193	**920.0096.048**	**903.0096.048**
12.7mm	1/2”	88	**920.0127.048**	**903.0127.048**
15.9mm	5/8”	189	**920.0159.048**	**903.0159,048**
19.0mm	3/4”	191	**920.0190.048**	**903.0190.048**
25.4mm	1”	92	**920.0254.048**	**903.0254.048**
Bore		Tube #	Butyl*	Viton
19.0mm	3/4”	191	**930.0190.048**	**970.0190.048**
25.4mm	1”	92	**930.0254.048**	

* Butyl tubing should not be used at pumphead speeds greater than 200rpm.

Specification

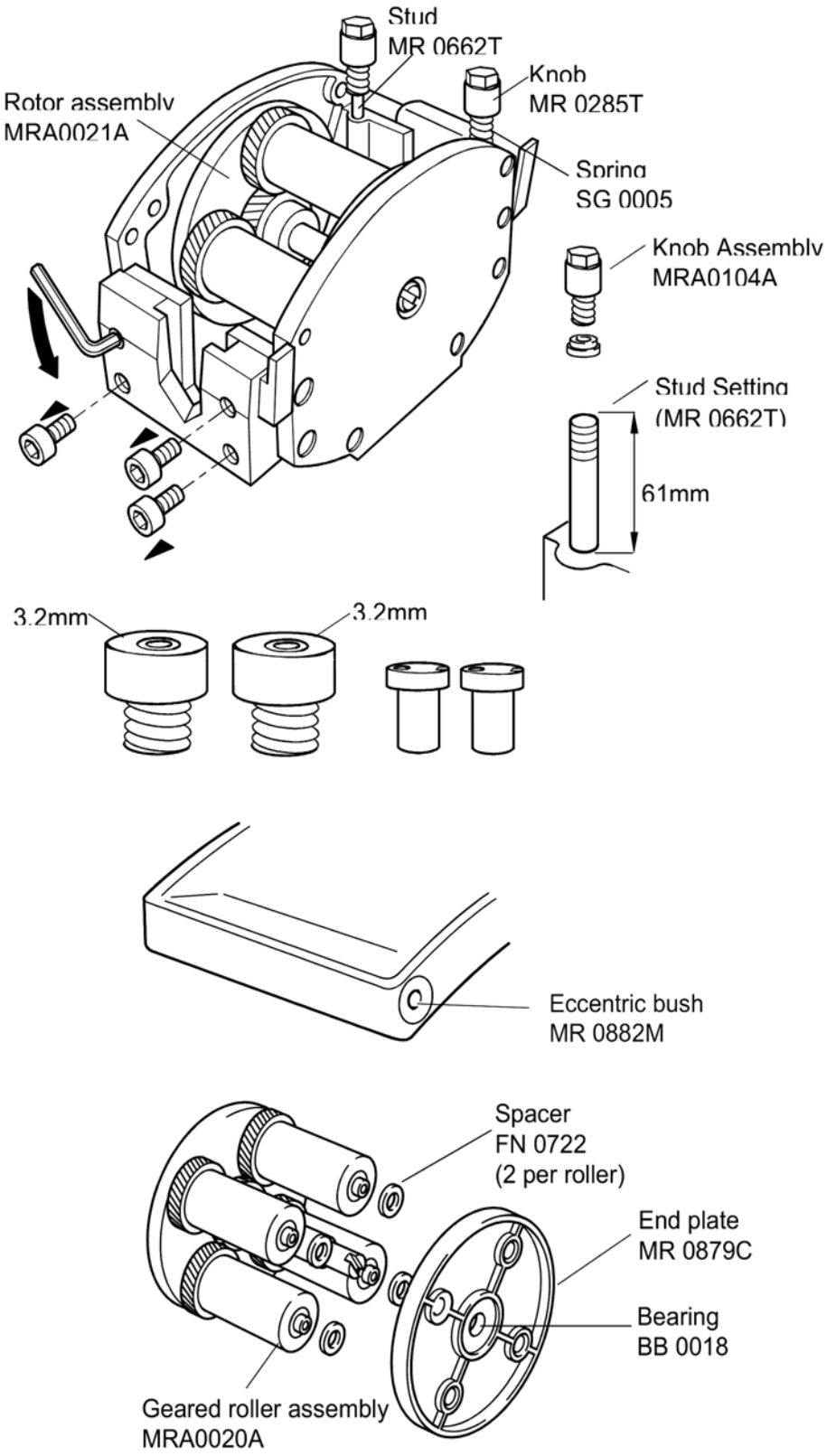
Nominal maximum rotor speed	360rpm
Speed control ratio	50:1
Maximum power consumption	750VA
Operating temperature range	5C to 40C
Storage temperature range	-40C to 70C
Weight	26kg
Noise (one pumphead)	<78dBA at 1m
Standards	IEC 335-1, EN60529 (IP55)
	Machinery Directive: 89/392EEC and EN602041 Low Voltage Directive: 73/23/EEC and EN61010-1 EMC Directive: 89/336/EEC and EN50081-1/EN50082-1

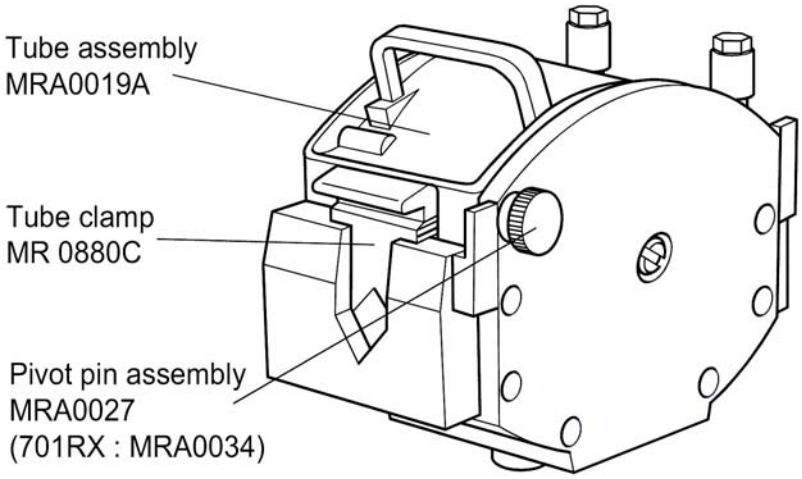
Care and maintenance

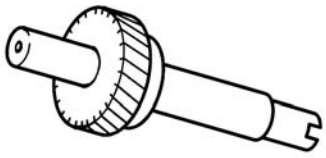
The 701S/R uses a permanent magnet direct current motor with a pulse-width-modulated speed controller which provides black commutation. The only scheduled maintenance required for the 701S/R is inspection of the motor brushes and their replacement before their length is less than 10mm. The life of the brushes will depend on the duty of the pump, but is expected to be at least 2000 hours at maximum speed.

The sun gear of the gearbox in the 701R and 701RX pumpheads should be lightly greased with a quality gear grease every one thousand hours. If harmful liquids are spilled on to the pump, the case and pumphead should be thoroughly cleaned with detergent and water. Strong solvents should not be used. The sun gear of the gearbox in the pumphead should be lightly greased with a quality gear grease after the pumphead has been cleaned.

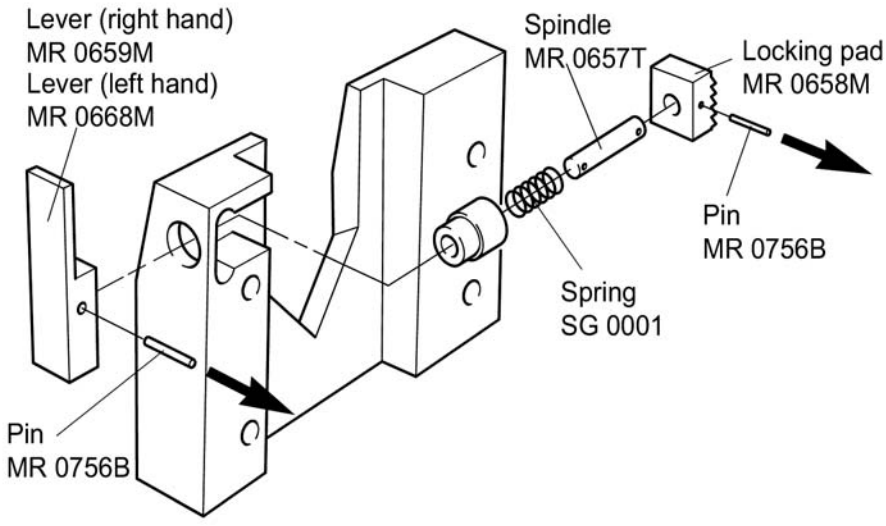
Pumphead spares



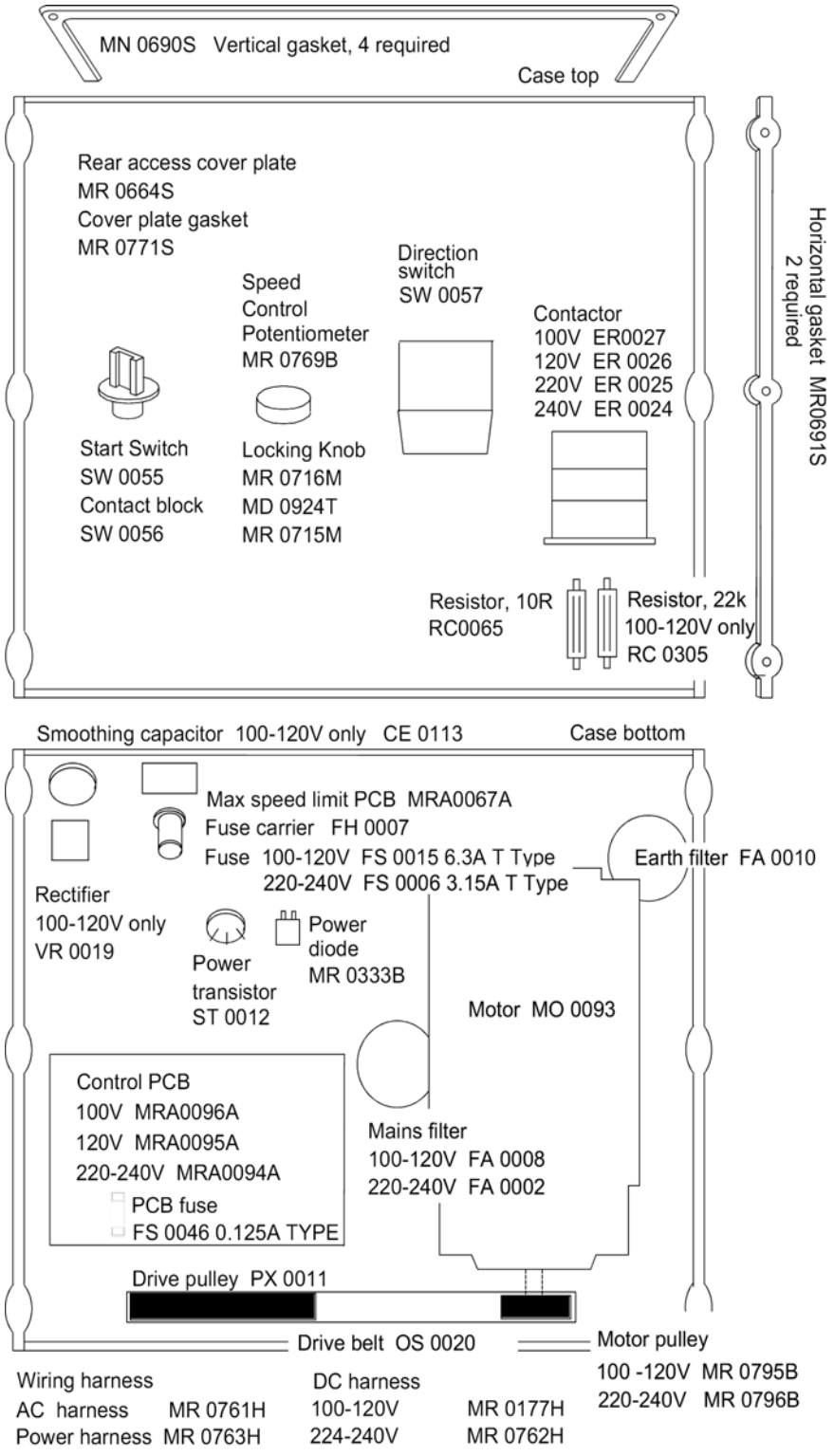




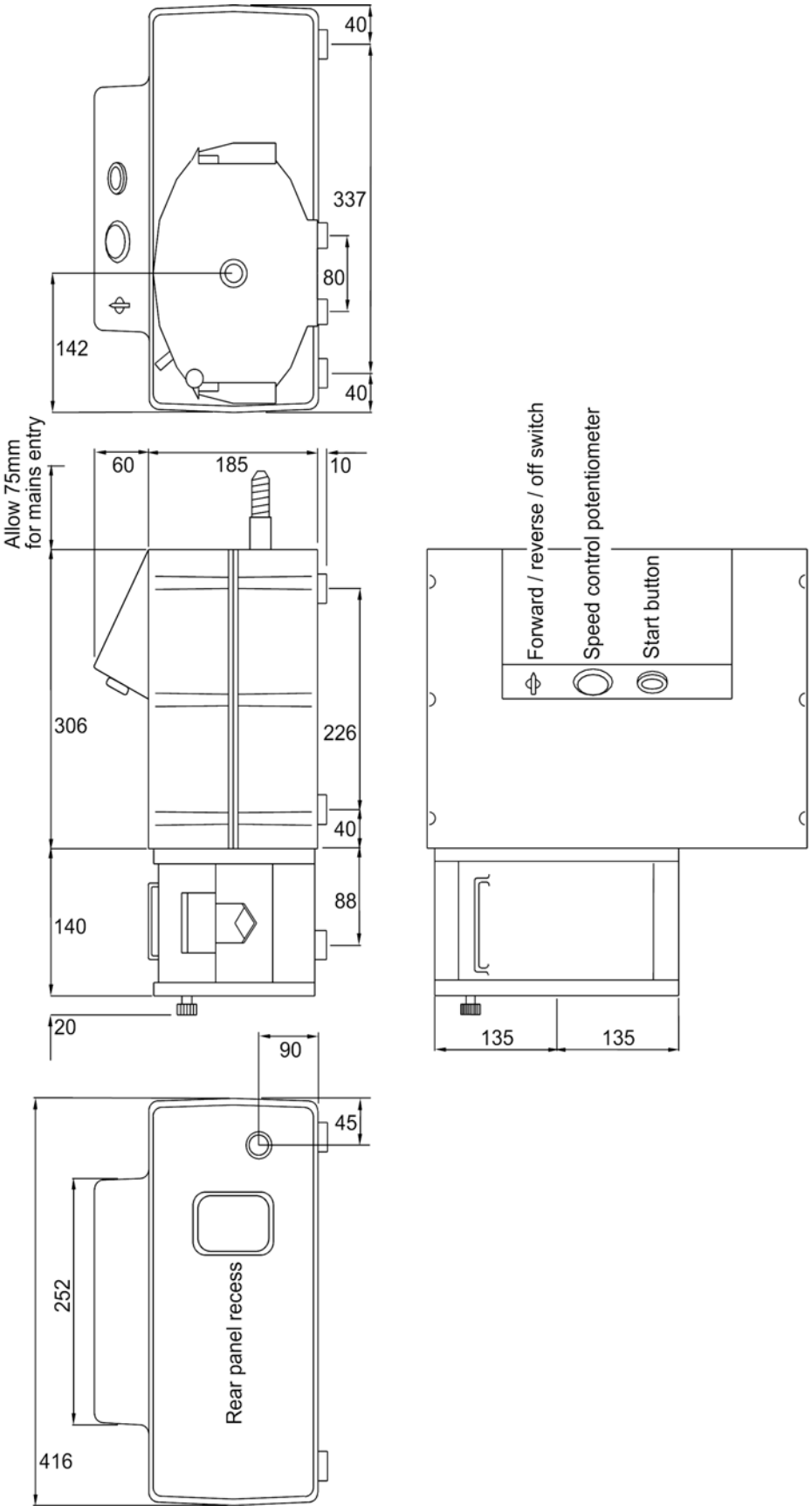
Shaft/Sungear assembly
MRA0039A
(701RX : MRA0040A)



Drive spares



Outline drawing



Decontamination certificate

Watson-Marlow Limited Health and Safety Declaration

1.0 This procedure is a legal requirement in the UK and **must** be used when returning pumps and equipment for service at Watson-Marlow (or its distributor).

2.0 **Pumps returned for service must be cleaned. You are responsible for their decontamination.**

3.0 Either fax this form or send by first class post to Watson-Marlow (or its distributor) to **ensure** that we have the information **before** receipt of the equipment.

A further copy must be attached to the **outside** of the shipping case.

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

4.0 Company .....
Address .....
..... Post Code.....
Telephone ..... Fax number.....

5.0 Please complete **all** the following sections

5.1 Pump Type.....

5.2 Serial number.....

5.3 Details of substances pumped

5.3.1 Chemical names:
(a) .....
(b) .....
(c) .....
(d) .....

5.3.2 Precautions to be taken in handling these substances:
(a) .....
(b) .....
(c) .....
(d) .....

5.3.3 Action to be taken in the event of human contact:
(a) .....
(b) .....
(c) .....
(d) .....

5.3.4 Cleaning fluid to be used if residue of chemicals is found during servicing:
(a) .....
(b) .....
(c) .....
(d) .....

5.4 If substances are not hazardous nor toxic, please complete section 5.4.1.
If substances are hazardous or toxic, please complete section 5.4.2.

5.4.1 I hereby confirm that the equipment specified has not pumped nor come into contact with any toxic or hazardous substances.

Signed.....
Name.....
Position.....
Date.....

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

Signed.....
Name.....
Position.....
Date.....

5.5 Carrier to be used
.....
Delivery date
.....

5.6 Fault description or any other information
.....
.....
.....
.....
.....

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

Watson-Marlow Limited, Falmouth, Cornwall TR11 4RU, England. Tel 01326 370370, Fax 01326 376009