

**WATSON-
MARLOW**

501H

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HEALTH AND SAFETY

Users are advised to familiarise themselves with these operating instructions before connecting or operating the pump. The sections listed below are of particular importance:

2:1	Electrical Supply
2:2	Fitting plug to mains lead
2:3	Fuse Protection
3:1	Suitable Tubing
3:6	Tube loading
4	Alarms

WARNING Do not use the 501H in the presence of flammable vapours.

WARNINGS AND CAUTIONS

Throughout this manual, these terms have the following specific meanings:

WARNING Indicates the possibility of hazard to self or others if the warning is not heeded.

CAUTION Indicates the possibility of damage to pump if the caution is not heeded.

Section 1: INTRODUCTION

WARNING The 501H is designed for haemodialysis applications. Other 501 pumps bearing different suffixes (501U, 501Z) are manufactured by Watson-Marlow but these are intended for laboratory and industrial use and do not incorporate certain of the fail-safe and audible alarm features of the 501H. Clinical users are therefore advised against using versions other than the 501H for patient connected applications.

The 501H is identified

- 1 The designation '501' on the left hand side of the cover.
A dark red line along the left hand side of the cover.
- 3 The words HIFLO BLOOD PUMP on the top surface of the cover.
- 4 The designation '501H 100' on the rear panel.
- 5 The designation '501H' on the front panel.

The Watson-Marlow 501H Hiflo blood pump incorporates many important new design advantages which will contribute to safety and patient care.

Compared to the Watson-Marlow MHRE blood pumps, the 501H has two large, rather than three small rollers. The 501H also has an increased track length enabling the speed of rotation to be halved. This means that for any given flow rate, the number of roller passes along the tubing is reduced by two thirds.

The large diameter rollers are spring-loaded and will adjust automatically to standard blood lines. The lower operating speed, large rollers and automatic tube-size compensation combine to greatly increase tubing life and reduce haemolysis.

The 501H also incorporates automatic protection against an internal tachometer failure which could allow the motor to substantially exceed its rated top speed. The pump will stop and an audible alarm will sound. This alarm will also function should the pump stall for any reason.

Further safety is provided by the switched pumphead guard. If the guard is raised while the pump is running, the pump will stop and alarm will sound. The pumphead may be rotated to three operating positions, and the complete pumphead assembly can be removed for cleaning and sterilisation.

These features make the 501H one of the worlds most advanced blood pumps. The Watson-Marlow name is your assurance of a product built to standards of reliability and durability which are becoming increasingly rare.

Section 2: INSTALLATION

2:1 Electrical supply

WARNING Ensure that the voltage marked on the rear of the unit corresponds to the local supply voltage.

2:2 Fitting Plug to Mains Lead

WARNING The wires in the mains cable are coloured in accordance with the following code:

Colour Code	Conductor	Plug marking
BROWN	LINE	L or coloured RED or BROWN
BLUE	NEUTRAL	N or coloured BLACK or BLUE
GREEN/YELLOW	EARTH	E or coloured GREEN or GREEN and YELLOW

WARNING Ensure that the rotor retaining screw is fully tightened.

Fuse Protection

The 501H is protected by two 0.8A type F fuses fitted in series with the line and neutral conductors of the mains cable. The fuses are of the cartridge type and are located at the rear of the unit.

A 0.04A type T fuse is fitted internally to protect the transformer.

WARNING Disconnect mains supply before removing the cover.

WARNING Never replace a fuse with one of a higher rating.

CAUTION Repeated fuse failure indicates a fault condition.

2:4 Ambient Temperature Limit

The 501H can be operated at ambient air temperatures from 10°C to 40°C.

The 501H can be stored at ambient air temperatures from -40°C to 70°C, but allow time for acclimatisation before operating the unit.

2:5 Ventilation

CAUTION The 501H needs a free passage of air around it. If units are stacked, the normal foot mountings will provide the necessary ventilation space.

2:6 To check operation

Ensure the guard is closed.

Press the power switch to the on position. The green indicator will light. Release knurled locking knob (turn anti-clockwise) and check response by turning speed control knob.

2:7 Failure to operate

If all of the above conditions have been observed check that

- 1 Mains electricity is available to the unit.
- 2 All fuses are intact.
- 3 That the rotor is not stalled by incorrect fitting of tubing.
- 4 The track guard is in the closed position.

If all these points are checked and the unit still fails to work satisfactorily, seek qualified advice.

Section 3: USING THE 501H

3:1 Suitable Tubing

The 501H is fitted with a new design of pumphead designed to operate without adjustment with silicone tubing having a wall thickness of 1.6mm, of between 3.2mm and 8.0mm internal diameter.

Should tubing be used which does not come within this range, the occluding force applied by the rollers will have to be adjusted - see section 5. If PVC tubing is to be used, harder springs will probably be needed in the pumphead rotor. These are available from Watson-Marlow.

The pumphead will accept and operate two lines, but in this arrangement each tube must have a maximum bore size of 4.8mm.

The spring-loaded tubing clamps are designed for tubing with a wall thickness of 1.6mm or greater and a hardness of 55° Shore A. If softer tubing is to be used then softer springs which may be more suitable are available from Watson-Marlow.

TUBING TYPE	CLAMP SPRINGS	ROTOR SPRINGS
Standard: 1.6mm wall thickness 55° Shore A hardness	Standard	Standard
Softer than standard	Softer	Standard
Harder than standard	Standard	Harder

3:2 Speed Control

The 501H has a speed control ratio of 10:1 which, on the speed control dial, equates to a range of 10% to 100% of maximum speed.

CAUTION The speed control dial has physical stops to prevent speeds below 10% being selected.

3:3 Flow Rates

The following flow rates were obtained with silicone tubing pumping water at 20°C, with nominal suction and delivery pressures.

They are for guidance only. Actual flow rates will depend on viscosity, suction and delivery pressures, and the type of tubing used.

WARNING Where very low flow rates are to be used, it is recommended that the smallest practical size tubing be selected. This will result in a relatively high speed setting, which provides inherent protection against potentially harmful effects, should an accidental increase in speed setting be made.

501H Flow Rates (ml/min)

Speed Setting	Tubing internal diameter (mm)			
	3.2mm	4.8mm	6.4mm	8.0mm
10%	19	39	64	100
20%	38	78	128	200
30%	55	120	189	300
40%	73	150	252	
50%	92	200	315	
60%	110	223	378	
70%	130	260		
80%	150	298		
90%	167	335		
100%	185			

Flow rates above 400 ml/min are not shown

3:4 Adjustment of Flow Rate Settings

From either the rates given above or the flow chart on the pump, determine the speed setting to be used for the required flow rate, bearing in mind the size of tubing to be used. This setting is given as a percentage of maximum speed and the speed control knob is calibrated accordingly.

Unlock the speed control knob by turning the small knurled knob anti-clockwise. Select the speed setting by turning the speed control knob until the required setting corresponds with the datum line. Lock the setting by firmly tightening the small locking knob.

3:5 Tube loading

- 1 Switch pump off.
- 2 Fully open hinged guard. Release crank handle and swing into its operating position.
- 3 Select length of tubing appropriate to the requirement, noting that a nominal length of 240mm is required for the track system (measured from the outside faces of the tube clamps).

- 4 Offer up that part of tubing to be housed in the pump-head. Firstly ease the tubing into one of the spring-loaded clamps and then, whilst rotating the rotor with the crank handle feed the tube between the rollers and the track, ensuring that it is aligned within the tube guides. Care should be exercised to ensure that the tube lies naturally against the track (ie is not twisted or stretched).
- 5 Locate the other end of the contained section of tube in the second spring-loaded tube clamp, ensuring that the tube is not slack in the pumphead, as this can reduce tube life.
- 6 Re-locate the crank handle into its closed position and close the guard.

3:6 Pumphead Orientation

The pumphead can be orientated to three alternative positions by removing the track securing screw, rotating the track to its new position and replacing the screw.



Section 4: ALARMS

Switched Guard Alarm

If the guard over the pumphead is lifted when the unit is running, the unit will be stopped automatically and an audible alarm will sound.

The unit cannot be re-started until the power switch has been turned to the off position and allowed to remain in this position for at least 5 seconds with the guard closed.

Stall Alarm

If the rotor should stall for more than 5 seconds, the unit will be stopped automatically and an audible alarm will sound. Check that oversize tubing is not being used and that the tubing is properly positioned.

The unit cannot be re-started until the power switch has been turned to the off position and allowed to remain in this position for at least 5 seconds with the guard closed.

3 Overspeed Alarm

Should a malfunction of the speed control system arise and result in an overspeed condition (ie the motor runs to full speed out of control), the pump will be stopped automatically and an audible alarm will sound.

Check that the alarm has not been caused by the switched guard being lifted.

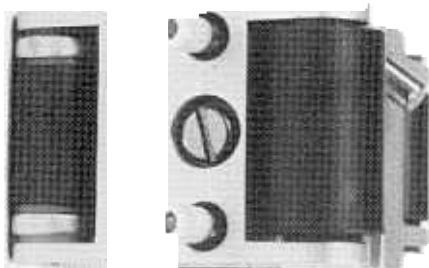
Section 5: ADJUSTMENT OF OCCLUDING FORCE APPLIED BY ROLLERS

The occluding force applied by the rollers, (as pre-set in manufacture), is suitable for tubing having a wall thickness of 1.6mm. This setting can, however, be altered for special cases. For instance, where larger bore tubing is used and the delivery pressure is low, tube life will be extended by reducing the occluding force. Re-adjustment of the normal pre-set gap of 2.8mm will also be required when tubing having wall thicknesses outside the range given above is used.

There is a separate adjusting screw on each of the two roller arms and both these screws will require adjusting. Correct adjustment is important. Over occlusion will reduce tube life and under-occlusion will affect pumping efficiency.

- 1 To increase the gap setting, turn the adjusting screw clockwise, 1/4 turn (note that one complete turn of the screw represents a change of 0.8mm of gap). Adjust the second screw by the same amount.

- 2 If this does not achieve the required setting, continue re-adjustment until satisfactory, ensuring that both screws are adjusted to the same extent.



Should it appear that the roller arms are not equally adjusted and it is desired that the original factory setting be restored, turn the adjusting screws until both rollers are just touching the track, then tighten each by 3 1/2 turns, thus restoring the gap to the original 2.8mm setting.

Section 6: CARE AND MAINTENANCE OF THE 501H

All moving parts of the rotor should be checked from time to time for freedom of movement.

Occasional lubrication of pivot points and rollers with a light lubricating oil will help to ensure trouble free operation.

WARNING Do not use silicone oil

Harsh abrasives and strong solvents must not be used to clean the 501H. Use a mild detergent solution and dry carefully.

Should spillage of harmful liquids occur during use, it is recommended that the pumphead be removed and cleaned. This must be carried out after first removing the tube.

The rotor is removed by swinging out the crank handle to expose the rotor retaining screw, which is then turned anti-clockwise one turn. This will release the collet allowing the rotor to be withdrawn from the shaft.

To remove the track, unscrew the track retaining screw and detach the track from its spigot.

When replacing the pumphead components, offer up the rotor to the drive spindle so that the extended crank handle is directly opposite the flat of the spindle and push the rotor fully on the spindle.

WARNING The rotor retaining screw must be adequately tightened to ensure that the tapered collet grips the drive spindle.

Check operation of the guard alarm. (See section 4:1)

Section 7: GENERAL SPECIFICATION

Rotor speed	100 rpm
Speed control ratio	10:1
Operating voltage/frequency	240V 50Hz
Maximum power consumption (stalled rotor)	150VA
Normal power consumption (maximum load)	75VA
Operating temperature	10°C to 40°C
Storage temperature	-40°C to 70°C
Relevant standard	BS5724
Audible noise	60 dBA maximum
Dimensions	140 x 200 x 390mm
Weight (inclusive of pumphead)	6.8Kg
