


313F, 313S, 313U, 313T



Declarations

Declaration of conformity 	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.
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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 98/37/EC EN60204-1.
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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.

R. Woods

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, rollers and brushes 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.

 	There are dangerous voltages (at mains potential) inside the pump. If access is required, isolate the pump from the mains before removing the cover.
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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 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 313F, 313S and 313U are 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.

Set the voltage selector to either 120V for 100-120V 50/60Hz supplies or 240V for 220-240V 50/60Hz supplies.

A mains cable fitted with a moulded plug is supplied with the pump. The wires are colour coded in accordance with the following code:

- 220-240V: Live - Brown; Neutral - Blue; Earth - Green/Yellow.
- 100-120V: Live - Black; Neutral - White; Earth - Green.

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.

313F/D manual operation

- 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.
- Set the pump to the desired high or low speed setting using the horizontal slider switch on the rear panel.
- **Stop** Stop the pump by turning the **Forward/Off/Reverse** switch to its central **Off** position.

313S/D, 313U/D manual operation

- 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.
- Set the pump to the desired speed output using the front panel potentiometer.
- Turn the pump on using the mains power switch on the rear panel.
- **Start up direction** Start the pump by turning the **Forward/Off/Reverse** switch to the required direction of rotation.
- **Stop** Stop the pump by turning the **Forward/Off/Reverse** switch to its central **Off** position.

Note: When the pump is running clockwise in manual operation and is switched to standby, it will come to a dead stop. When running counter clockwise it will freewheel to a stop. Any application requiring braking should have the pump set up for clockwise running.

313U automatic operation

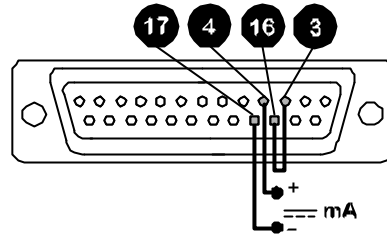
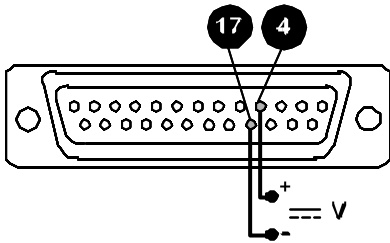
For the pump to be controlled by a process signal, the auto volts/manual/auto current (V M I) slider switch on the rear panel should be set to either auto volts or auto current depending upon the type of control signal to be used. Ensure that the mains switch on the rear panel is off. The process signal must be connected to the 25-way Dee plug provided, which must be inserted in the rear panel 25-way Dee connector. The pump is controllable by an analogue process signal of up to 0 to 10V or 4 to 20mA. The pump will provide an increasing flow rate for rising control signal (*non-inverted response*).


Voltage signal

Input impedance 220 kohms.
voltage signal 10V

Current signal

Maximum Input impedance 250 ohms



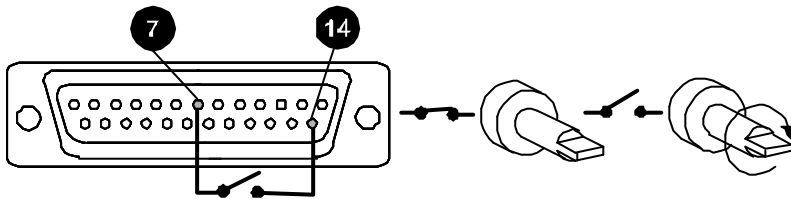
	<p>Never apply mains voltage across any pins on the 25D socket. Up to 10V may be applied across pins 4 and 17, but no voltage should be applied across other pins. Permanent damage, not covered by warranty may result in both instances. Do not use the mains power switch to control the pump for a high repetition of stop/starts. The auto-control facility should be used.</p> <p>When setting the drive control mode with the V M I switch ensure that power to the drive is switched off using the mains switch on the rear panel.</p>
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Remote control

Stop/Start

Connect remote switch between pins 7 and 14 of the 25 pin socket. Close contact to stop the pump, open to run. With no connection, the pump will default to running. A remote stop/start signal will control the pump whilst running under manual operation.

A TTL compatible logic input (Low 0V High 5V) may be applied to pin 7.



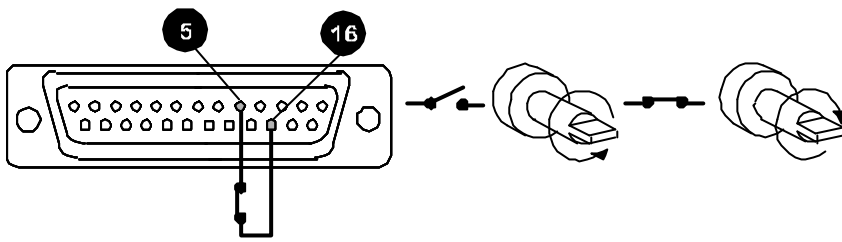
To invert the response to the signal input move the remote stop signal inverter link (see 313 "U" upgrade card, item 4, LK2) to the inverted pin positions on the signal inverter link block.



Note: When the pump is running in either direction and is stopped remotely, it will freewheel to a stop.

Direction

The remote direction facility operates with the front panel direction switch set in the anti-clockwise direction only. Connect remote switch between pins 5 and 16. Open switch for anti-clockwise rotation, close for clockwise rotation. With no connection, the pump will default to anti-clockwise



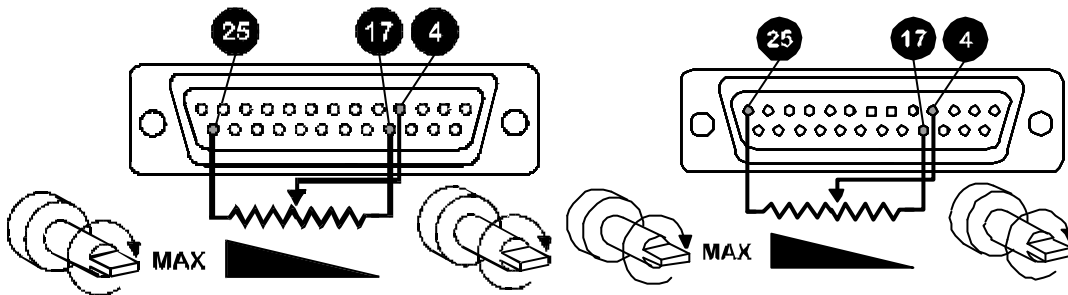
To invert the response to the signal input move the remote direction signal inverter link LK1 (see 313 "U" upgrade card, item 6, LK1) to the inverted pin positions on the signal inverter link block.



Note: When the front panel switch is set to CCW rotation, the drive rotates according to the remote switch direction set by LK1. When the front panel switch is set to CW rotation the remote switch is inhibited.

Speed

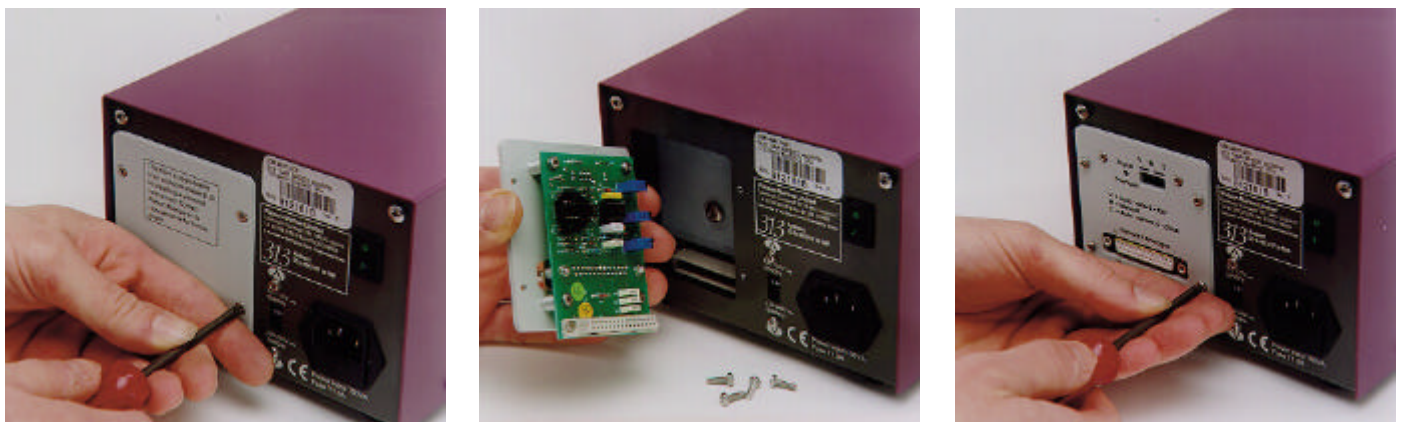
A remote potentiometer with a nominal value of between 1K and 2K with a minimum of 0.25W should be wired as shown. When using a remote potentiometer, do not apply a voltage/current control input signal at the same time. Set the drive control mode to auto volts (0-10V). Ensure that when changing the drive control mode, power to the drive is switched off using the rear panel mains switch.



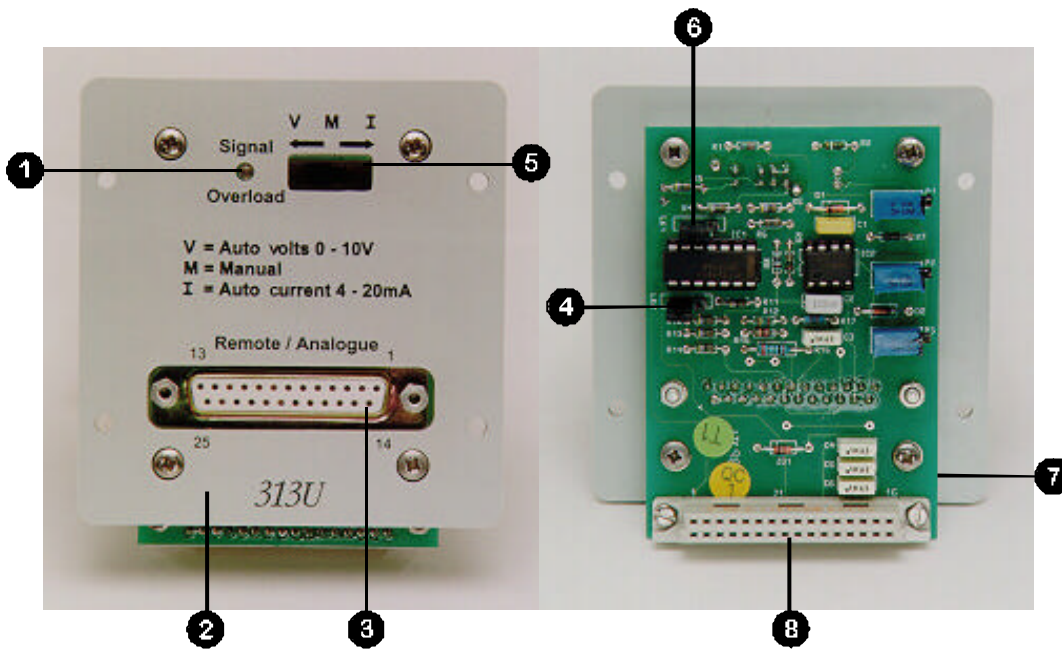
Note: As the remote potentiometer utilises the 0-10V range the speed response is only over $\frac{10}{12}$ ths of the potentiometer's electrical travel. The signal overload illuminates at this point and there is no further increase in speed.

313U upgrade card

To upgrade the manually controllable 313S/D into a remote or 0-10V/4-20mA analogue controllable 313U/D a 313U upgrade card will be required (part number 039.3001.U00). To install the "U" card, undo the four M3 screws on the drive rear panel "S" version cover plate and remove. Slot the 313U upgrade card into the rear panel recess, drop down to align the DIN edge connectors and push into position. Replace the four M3 screws on the card to secure it firmly to the rear panel.



313U upgrade card spares



Item	Part number	Description
1	SD 0087	Signal overload LED indicator
2	DE 1645S	Cover plate
3	US 0072	25-way Dee connector socket
4	US 0047	Remote stop signal inverter link
5	SW 0160	Auto voltage / manual / auto current switch 50V 2A
6	US 0047	Remote direction signal inverter link
7	PC 0147P	Analogue PCB
8	SL 0091	DIN edge connector

313T

The function of the 313T timer card is to convert 313S/D manually controlled drives into 313T/D drives allowing simple dosing operations to be performed.

The single/continuous/ repeat slider switch allows the user to select between single shot dosing, continuous manual pumping, or repeat dosing operations.

This publication should be used in conjunction with the manual provided with the pump.

Installation



Dosing

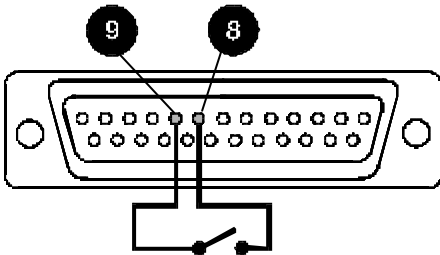
For the pump to be controlled as a simple dosing pump, the **Single/Continuous/Repeat** slider switch should be set to **Single** or **Repeat**. When set on continuous, the timing functions are over-ruled and the pump operates as a manual control variable speed unit, (front panel control).

The pump has a braking feature in the counter clockwise direction when viewed from the front of the pump, but not in the clockwise direction. The dosing operation will therefore be more accurate when run counter clockwise.

The dosing times are set by means of two manually adjusted potentiometers on the "T" card. The right hand knob adjusts the run time from zero to 10 seconds and the left hand one adjusts the off time from zero to 10 seconds.

Single dose set-up

- Set the slider switch to **Single**.
- Set the "on time" (dosing) knob on the rear of the pump as required and set pump speed to provide the required dose.
- Ensure the pump is set to run in the counter clockwise direction.
- The pump can be operated either from the **Start** button on the rear of the pump, or by closing a contact briefly across pins 8 and 9 on the 25 pin socket.



Repeat dose set-up

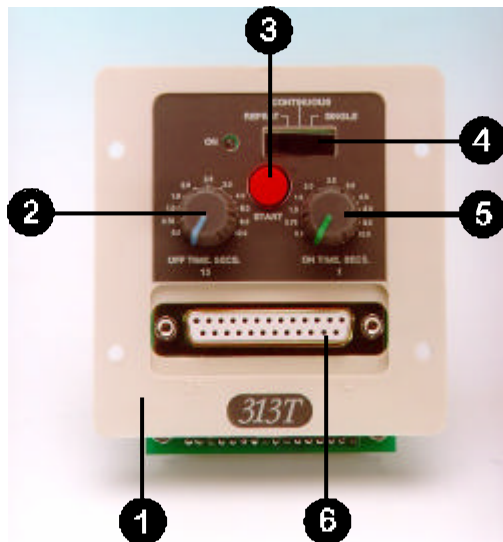
- Set the slider switch to **Repeat**.
- Set the "on time" (dosing) knob and the "off time" knob on the rear of the pump as required and set pump speed to provide the required dose.
- Ensure the pump is set to run in the counter clockwise direction.
- The pump can be operated either from the **Start** button on the rear of the pump, or by closing a contact briefly across pins 8 and 9 on the 25 pin socket.

To stop the dosing operation either:

- Turn the **CW/Standby/CCW** to standby
- Press the **Start** button for longer than the off time,
- Close the contacts on pins 8 and 9 for longer than the off time.

For monitoring purposes, there is an unbuffered strobe output on pin 10 where 0V is stop and +5V is run in the timing modes. For use with external instrumentation it must be buffered.

313T major components



- 1 PCB cover
- 2 "Off time" knob
- 3 Pushbutton switch
- 4 Slider switch
- 5 "On time" knob
- 6 25 Din socket

Care and maintenance

The only scheduled maintenance of the 313F, 313S and 313U is to inspect the motor brushes and to replace them before their length is less than 6mm 1/4". The life of the brushes will depend on the duty of the pump, which is expected to be at least 7,500 hours at maximum speed. When the pump needs cleaning, remove the pumphead and use a mild solution of detergent in water. Do not use strong solvents.

If the gearbox is dismantled, it should be filled with a good quality grease such as Castrol MS3.

Specification

313F/D nominal rotor speeds	5/50rpm, 200/400rpm
313U/D, 313S/D maximum rotor speeds	50rpm and 400rpm
Operating voltages and frequencies	110-240V 50/60Hz
313 S/D, 313U/D speed control ratio	20:1
Power rating	100VA
Operating temperature	5C to 40C
Storage temperature range	-40C to 70C
Weight	5.35kg, 12lb
Noise	<70dBA at 1m
Standards	IEC 335-1, EN60529 (IP31) Machinery Directive:98/37/EC EN60204-1 Low Voltage Directive:73/23/EEC EN61010-1 EMC Directive:89/336/EEC EN50081-1/ EN50082-1

313 and 314 pumpheads

The 313F/D, 313S/D and 313U/D can only be fitted with 313 three roller or 314 four roller pumpheads.

The 313 pumphead has three rollers and is designed to provide high flow rates, whilst with four rollers, the 314 pumphead provides the option of less pulsation and greater pumping precision.

Both pumpheads employ a "clamp and stretch" tube clamping motion which ensures that the tube is held correctly in position with no unwanted tube slackness.

The flip top track provides easy front end tube loading with no removal of components.

The simple bayonet mounting action for standard and extension pumphead fitting allows easy fast set up of ganged installations.

Installation

All 313 drives are provided with bayonet plate fittings attached. To fit a 313 or 314 pumphead, align the slot in the pumphead to the drive tang and using the bayonet fittings, turn the pumphead clockwise and snap into position.



To remove the pumphead push the bayonet plate locking lever back towards the rear of the drive and turn the pumphead anti-clockwise until it is freed from the bayonet plate fittings.

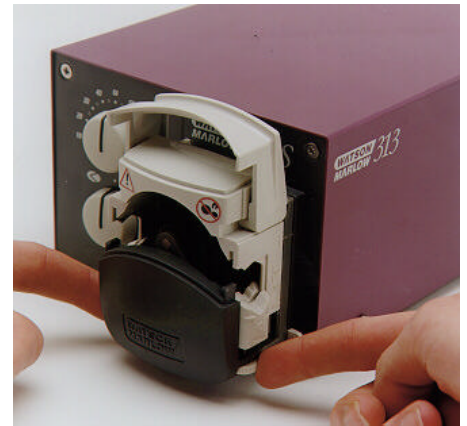


Flow rates

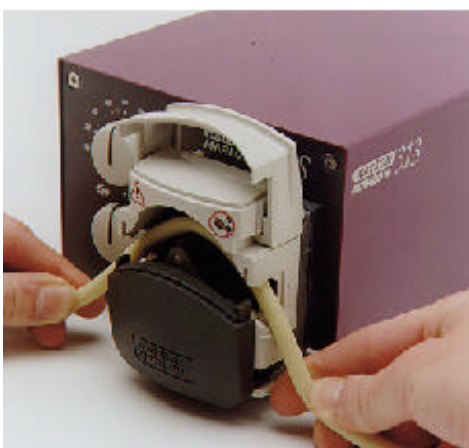
Flow rates for the 313F, 313S and 313U were obtained using silicone tubing, with the pumphead rotating clockwise at 100rpm, pumping water at 20C with zero suction and delivery pressures (unless otherwise stated). For critical applications determine flow rates under operating conditions.

Tube loading

- Switch off the pump before tube loading.
- Lift the "flip top" track until fully open.
- Set the pumphead tube clamps, with the track open to the required tube size, using the calibrations on each side of the pumphead.
- In some applications (where the outside of the tube is dirty or there is a high suction lift), the tube clamps may need to be adjusted to a smaller setting to give effective tube clamping



- Select the length and bore size of tube required, ensuring the tube is long enough to cover the source to delivery distance and the curvature of the track.
- Fit the tubing across the pumphead rotor and lower the track. Ensure the tubing is fitted correctly between the rollers and track, and that there is no pinching of the tubing by the tube clamps. The tubing must lie naturally against the track and must not be twisted or over stretched.



Fitting an extension pumphead

- Remove the first 313 or 314 pumphead by pushing the bayonet plate locking lever back towards the rear of the drive and turn the pumphead anti-clockwise until it is freed from the bayonet plate fittings. The extension pumphead can now be fitted.
- Align the slot in the extension pumphead to the drive tang and using the bayonet fittings turn the pumphead clockwise and snap into position.



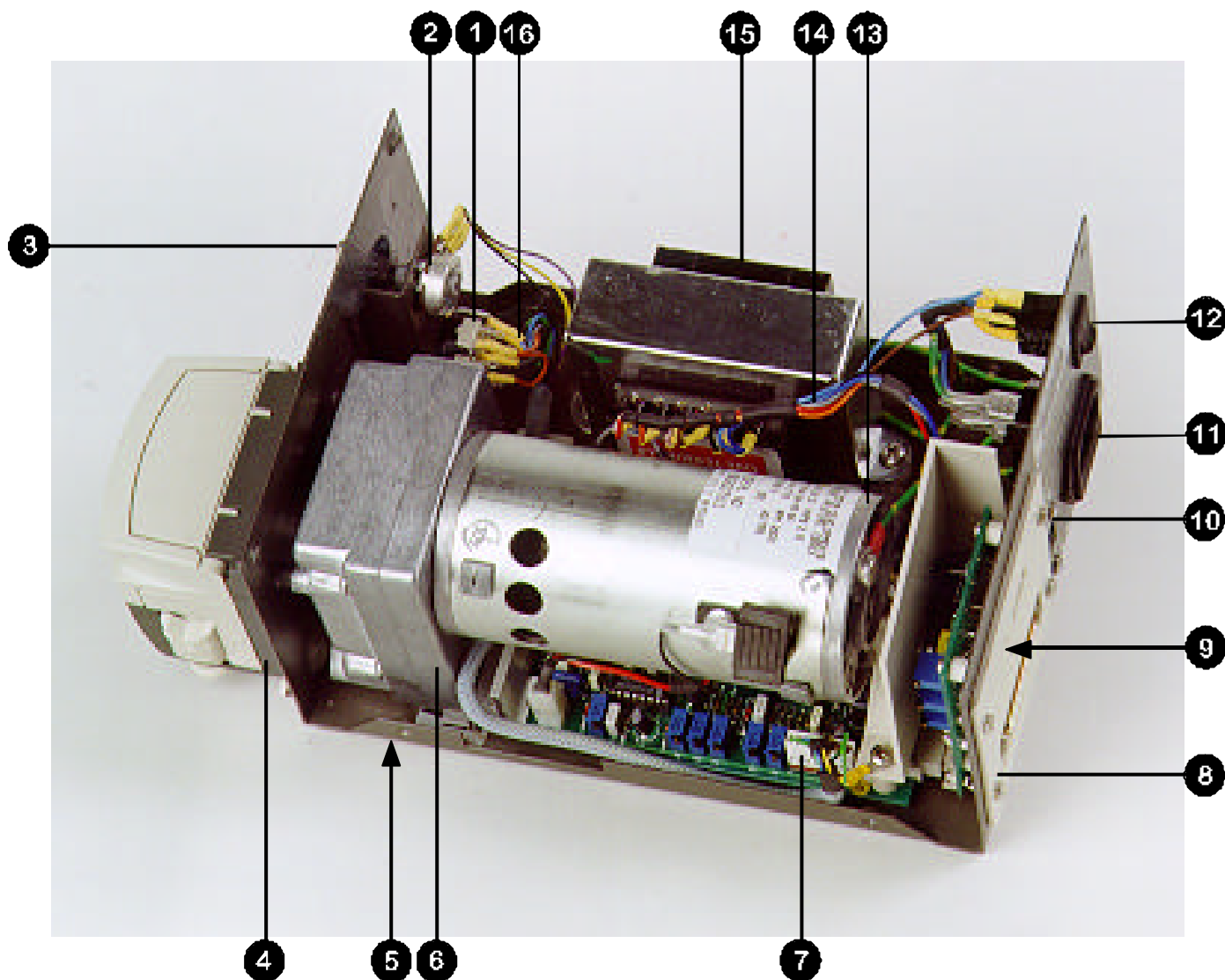
- Align the drive slot of the next pumphead to the drive tang of the extension pumphead, turn the next pumphead clockwise and snap into position.



If aggressive liquids are spilled onto the pumphead, it should be removed and cleaned using a mild solution of detergent and water. Remove any tubing from the pumphead, and wash thoroughly.

Check moving parts of the rotor from time to time for freedom of movement. Lubricate pivot points and rollers occasionally with Teflon lubricating oil.

Drive spares



Item	Part number	Description
1	DE 1654B	Rotary switch
2	DE 1663B	Potentiometer
3	DE 1647M	Soft touch knob
4	DEA1609A	Bayonet plate
5	FB 0009	Foot
6	DEA1616A	Motor gearbox 50rpm
	DEA1611A	Motor gearbox 400rpm
7	DEA1636A	313S Control PCB: calibrated at 400 rpm
	DEA1635A	313S Control PCB: calibrated at 50 rpm
	DEA1638A	313F Control PCB: calibrated at 400 rpm
	DEA1637A	313F Control PCB: calibrated at 50 rpm
8	DE 1666M	313S PCB cover
9	SW 0123	Speed selector switch (slider) 313F
10	SW 0167	Switch (slider) 250VAC
11	FS 0003	Fuse 1.0 amp T type
12	SW 0147	Switch (rocker) 250VAC
13	DE 1661H	Earth lead
14	DE 1649H	LT/AC harness
15	TF 0047	Transformer
16	DE 1650H/ DE 1632H	Control harness 313S/D, 313U/D/ 313F/D
	BM 0019	Motor brush

313 (ml/min) flow rates

Tube number	#	112	13	14	16	25	17	18
Tube bore	mm	0.5	0.8	1.6	3.2	4.8	6.4	8.0
Tube bore	"	1/50	1/32	1/16	1/8	3/16	1/4	5/16
Rpm	5	0.15	0.33	1.3	5	11	18	25
Rpm	50	1.5	3	13	50	110	180	250
Rpm	200	6	14	54	200	440	720	1000
Rpm	400	12	28	108	400	880	1440	2000
Rpm	2.5 - 50	0.07-1.5	0.15-3	0.65-13	2.5-50	5.5-110	9-180	12.5-250
Rpm	20 - 400	0.6-12	1.4-28	5.4-108	20-400	44-880	72-1440	100-2000

314 (ml/min) flow rates

Number	#	112	13	14	16	25	17	18
Bore	mm	0.5	0.8	1.6	3.2	4.8	6.4	8.0
Bore	"	1/50	1/32	1/16	1/8	3/16	1/4	5/16
Rpm	5	0.15	0.3	1.2	4.2	9.5	15	20
Rpm	50	1.5	3.0	12	42	95	150	200
Rpm	200	6	12	50	170	330	600	800
Rpm	400	12	24	100	340	760	1200	1600
Rpm	2.5-50	0.07-1.5	0.15-3.0	0.6-12	2.1-42	4.8-95	7.5-150	10-200
Rpm	20-400	0.6-12	1.2-24	5-100	17-340	38-760	60-1200	80-1600

313 and 314 maximum number of pumpheads

313 and 314 Peroxide/ Platinum Silicone															
		(0 = bar = 2)							(0.5 = bar = 2.0)						
Number	#	112	13	14	16	25	17	18	112	13	14	16	25	17	18
Bore	mm	0.5	0.8	1.6	3.2	4.8	6.4	8.0	0.5	0.8	1.6	3.2	4.8	6.4	8.0
Bore	"	1/50	1/32	1/16	1/8	3/16	1/4	5/16	1/50	1/32	1/16	1/8	3/16	1/4	5/16
Rpm	5	6	6	6	6	6	4	3	6	6	6	6	5	3	3
Rpm	50	6	6	6	6	6	4	3	6	6	6	6	5	3	3
Rpm	200	6	6	5	3	2	2	1	6	6	5	3	2	1	1
Rpm	400	6	6	5	3	2	2	1	6	6	5	3	2	1	1
313 and 314 Marprene, Tygon, Neoprene, Viton.															
		(0 = bar = 0.5)							(0.5 = bar = 2.0)						
Number	#	112	13	14	16	25	17	18	112	13	14	16	25	17	18
Bore	mm	0.5	0.8	1.6	3.2	4.8	6.4	8.0	0.5	0.8	1.6	3.2	4.8	6.4	8.0
Bore	"	1/50	1/32	1/16	1/8	3/16	1/4	5/16	1/50	1/32	1/16	1/8	3/16	1/4	5/16
Rpm	5	6	6	6	6	5	3	3	6	6	6	6	4	3	3
Rpm	50	6	6	6	6	5	3	3	6	6	6	6	4	3	3
Rpm	200	6	6	4	2	2	1	1	6	6	4	2	2	1	1
Rpm	400	6	6	4	2	2	1	1	6	6	4	2	2	1	1

Tubing for 313D, 314D, 313X and 314X pumpheads

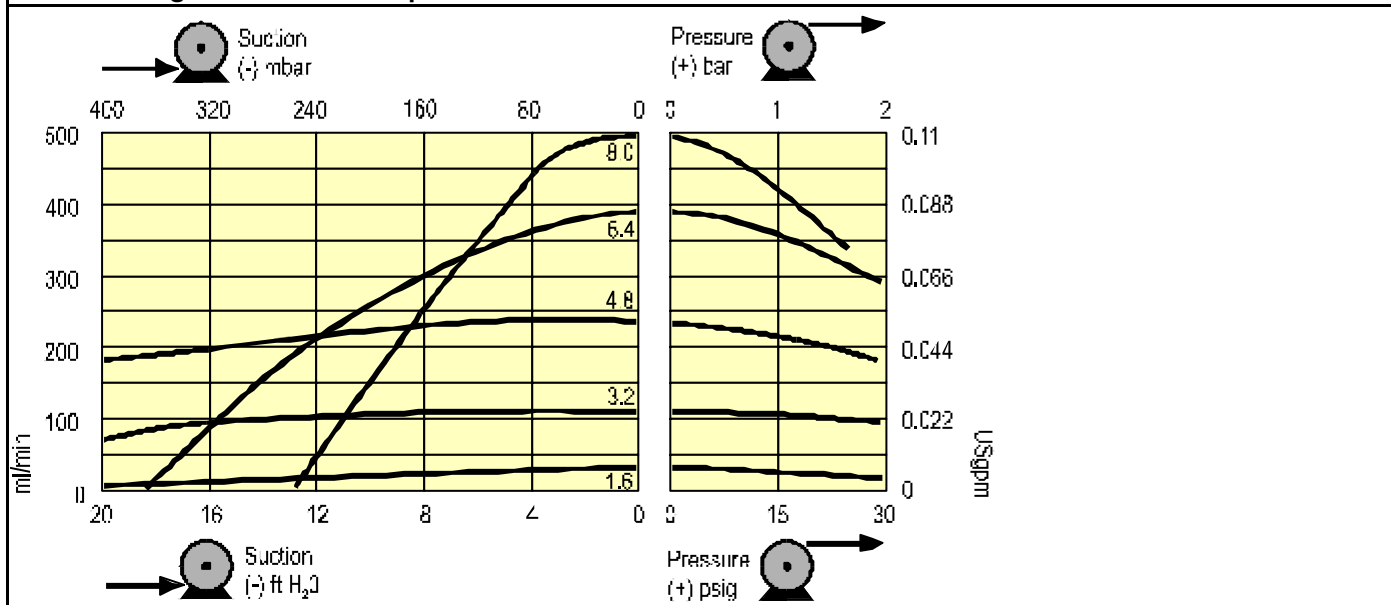
Product codes						
Bore Mm	Bore "	#	Marprene	Bioprene	Peroxide Silicone	Platinum Silicone
0.5	1/50	112	902.0005.016	903.0005.016	910.0005.016	913.0005.016
0.8	1/32	13	902.0008.016	903.0008.016	910.0008.016	913.0008.016
1.6	1/16	14	902.0016.016	903.0016.016	910.0016.016	913.0016.016
3.2	1/8	16	902.0032.016	903.0032.016	910.0032.016	913.0032.016
4.8	3/16	25	902.0048.016	903.0048.016	910.0048.016	913.0048.016
6.4	¼	17	902.0064.016	903.0064.016	910.0064.016	913.0064.016
8.0	5/16	18	902.0080.016	903.0080.016	910.0080.016	913.0080.016

Bore mm	Bore "	#	Tygon	Fluorel	Neoprene	STA-PURE
0.8	1/32	13			920.0008.016	
1.6	1/16	14	950.0016.016	970.0016.016	920.0016.016	960.0016.016
3.2	1/8	16	950.0032.016	970.0032.016	920.0032.016	960.0032.016
4.8	3/16	25	950.0048.016	970.0048.016	920.0048.016	960.0048.016
6.4	1/4	17	950.0064.016	970.0064.016	920.0064.016	960.0064.016
8.0	5/16	18	950.0080.016	970.0080.016	920.0080.016	960.0080.016

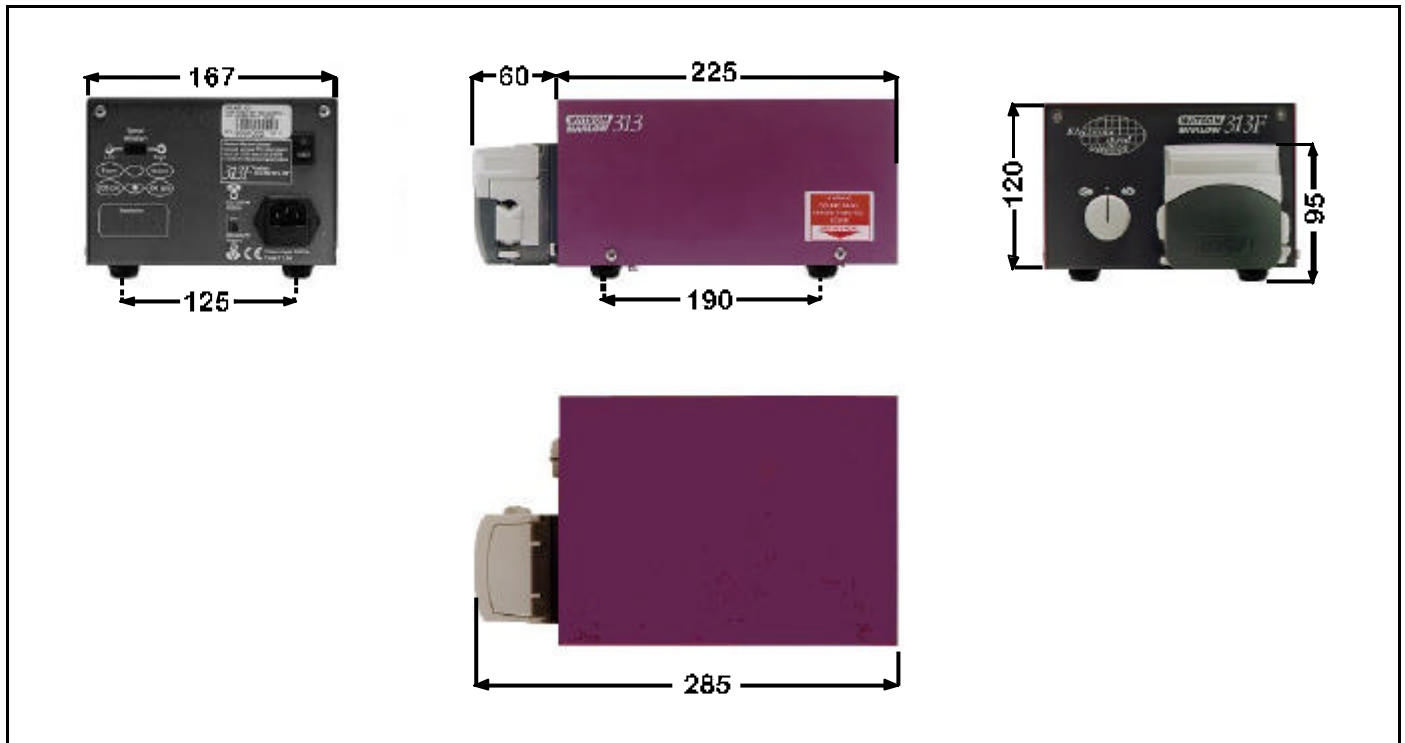
Tubing for 313D2, 314D2, 3132X and 3142X pumpheads

Product codes						
Bore mm	Bore "	#	STA-PURE	Marprene	Peroxide Silicone	Platinum Silicone
0.5	1/50	105		902.0005.024	910.0005.024	913.0005.024
0.8	1/32	108		902.0008.024	910.0008.024	913.0008.024
1.6	1/16	119	960.0016.024	902.0016.024	910.0016.024	913.0016.024
3.2	1/8	120	960.0032.024	902.0032.024	910.0032.024	913.0032.024
4.8	3/16	15	960.0048.024	902.0048.024	910.0048.024	913.0048.024
6.4	1/4	24	960.0064.024	902.0064.024	910.0064.024	913.0064.024
8.0	5/16	121	960.0080.024			

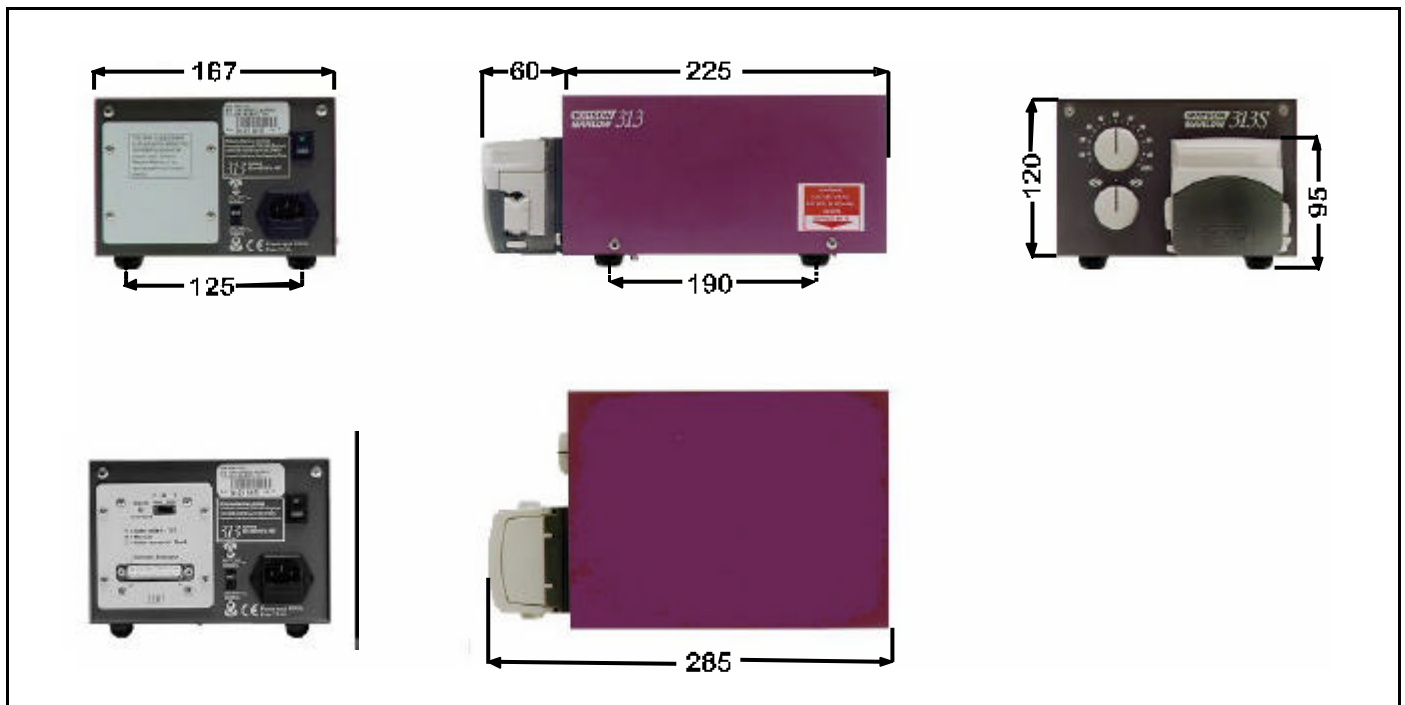
Flow rates against suction and pressure



313F outline dimensions



313S and 313U outline dimensions



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

Tygon is a trademark of the **Norton Company**.

Warning, These products are not designed for use in, and should not be used for patient connected applications.

The information contained in this document is believed to be correct but Watson-Marlow Limited accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

Product use and decontamination declaration

In compliance 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. Therefore, please complete this form to ensure that we have the information before receipt of the product(s) being returned. A FURTHER COPY *MUST* BE ATTACHED TO THE OUTSIDE OF THE PACKAGING CONTAINING THE PRODUCT(S). You, the user, are responsible for cleaning and decontaminating the product(s) before returning them.

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

1 Company
 Address Postcode
 Telephone Fax Number

2.1 Serial Number (a).....
 2.2 Has the Product been used? (b).....

YES		NO	
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 (c).....
 (d).....

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

3 Details of substances pumped 4 I hereby 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:
 (a).....
 (b).....
 (c).....
 (d).....

5 Signed
 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).....

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

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

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

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