Data Sheet

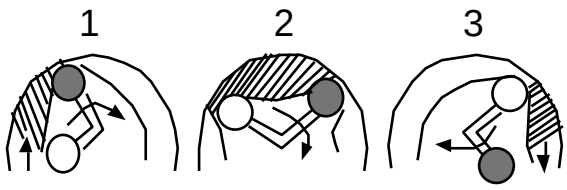
Peristaltic pump system

Peristaltic pump action

A typical peristaltic pump mechanism is shown in Figure 1. The advancing roller occludes the tube which, as it recovers to its normal size, draws in fluid which is trapped by the next roller (in the second part of the cycle) and expelled from the pump (in the third part of the cycle). This is the peristaltic flow-inducing action.

The flow-inducer (i.e. the roller) and tube together make the pump, and both are equally important.

Figure 1 **Peristaltic pump action**



The flow rate depends mainly on the internal diameter of the tube and the speed at which the rollers advance. Suction lift capability depends on the restitution power of the tube. If the tube does not restitute fully before the advance of the next roller, then the flow rate will be reduced.

For any particular flow rate, accuracy is maximised by using smaller bore tubing and a higher pump speed. For maximum tube life, however, it is best to use larger bore tubing and a slower pump speed.

The advantages of peristaltic pumping include:

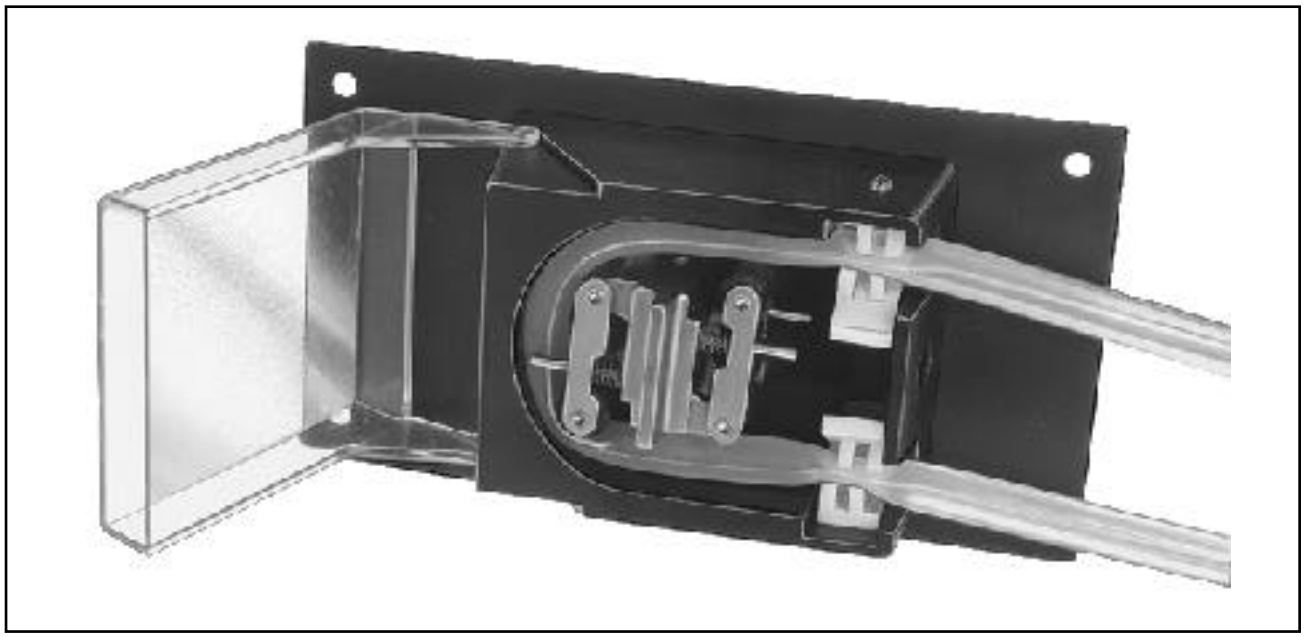
- The pump does not contaminate the fluid
- The fluid does not contaminate the pump
- The peristaltic pumping action is gentle
- Peristaltic pumps are self-priming, non-siphoning and can run dry.

Applications

There are many laboratory and industrial processes where the ability to confine the fluid to a tube is valuable. Instead of stripping and cleaning the pump, it is only necessary to fit a new tube which is very simple. A sterile tube creates a sterile pump.

Typical application areas include: pharmaceuticals, fermentation, food processing, beverage dispensing, inks and photographic solutions, as well as abrasive and aggressive fluids. Provided a fluid will pass through a tube, without causing a chemical reaction, then a peristaltic pump can speed its flow, control its flow rate, or dispense it in precise volumes.

System 101



Pump head (RS stock no. 330-812)

Comprising a panel mounting housing, with a hinged transparent cover, that contains the dual-roller rotating head. This head fits on to the shaft of the drive motor (RS stock no. 255-9598, etc available separately). The sprung roller construction ensures maximum tube life. The flow direction can be reversed by reversing the roller head rotation (i.e. direction of motor rotation). The head accepts tubing with bore sizes 0.5 to 4.8mm with a 1.6mm wall thickness.

Material specification

Rollers _____ MoS2 filled nylon 6
Roller head _____ Aluminium alloy
Hinged cover _____ Polycarbonate
Pump Housing _____ Acetal copolymer

Mounting plate (RS stock no. 330-828)

Matt black steel, pre-drilled 145 3 80 3 1.4mm, face plate required for fitting between the pump head and the drive motor to form a complete sub-assembly. If the drive motor and pump head are to be mounted on an existing panel (so as to become an integral part of a piece of equipment) this plate is not required.

Figure 2 **Mounting plate**

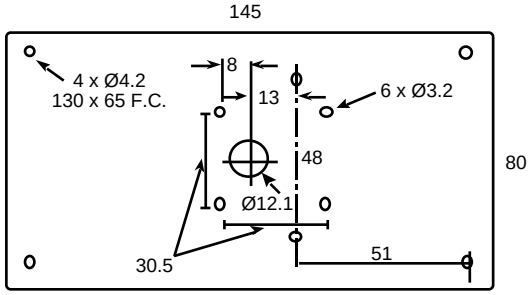


Figure 3 **Roller and tube assembly**

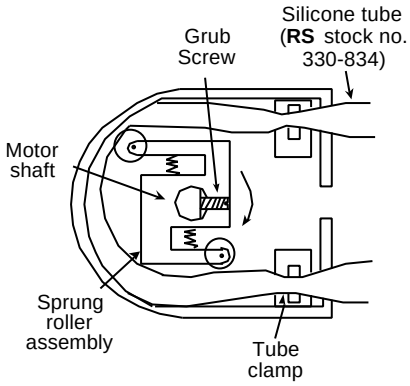
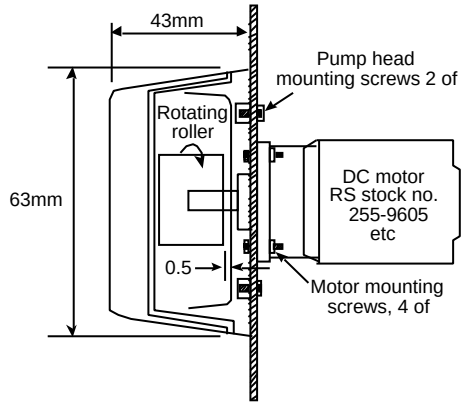


Figure 4 **Pump assembly - side view**



Tube life

Tube life depends on pumping speed, fluid temperature,= suction and deliver pressures and the chemical compatibility between the tube and the fluid (Table 1). Typically tube life when used with 101 pump head with 65rpm motor is in the region of 300 hours at zero delivery and suction pressure.

= This should be in the range -20°C to +100°C.

Flow rate

The flow rate for a given tube bore depends on the rotor speed and therefore on the d.c. motor drive voltage. The following flow rates are specified for pumping water at 20°C with zero suction and delivery heads.

Drive motor RS stock no.	Nom speed at 12Vdc	Flow rate ml/min. (L/hr) Bore (RS stock no.)				
		0.5	0.8	1.6	3.2	4.8
		184-5905	184-5911	184-5927	184-5933	330-834
*255-9598	130rpm	2.8 (0.2)	6.5 (0.4)	28.3 (1.7)	105.5 (6.33)	212.12.7
255-9605	65rpm	1.4 (0.08)	3.2 (0.2)	14.2 (0.8)	52.8 (3.2)	106 (6.4)
255-9611	40rpm	0.85 (0.05)	2.0 (0.12)	8.8 (0.5)	32.5 (1.9)	65 (3.9)
255-9627	20rpm	0.42 (0.03)	1.0 (0.06)	4.4 (0.3)	16.3 (1.0)	32.6 (2.0)
255-9649	8rpm	0.16 (0.01)	0.4 (0.02)	1.8 (0.1)	6.5 (0.4)	12.7 (0.8)

*This motor should only be used when higher flow rates are required. The operating life of the motor and tubing will be reduced to approximately half the values obtained when using other motors. This is due to increased loading on the motor and higher strain in the tubing.

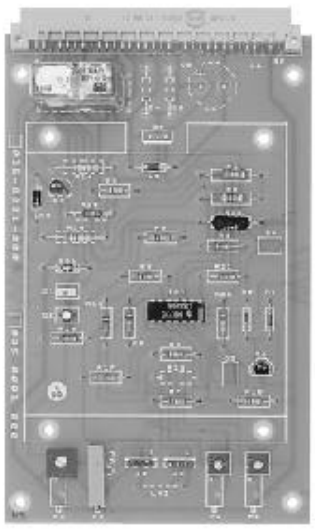
Speed control board (RS stock no. 320-584)

This Eurocard format board gives a speed control ratio better than 10 to 1 with all RS 12Vdc motors up to 20 Watts.

It is capable of manual speed control, remote stop and accepting a remote speed control signal input. With the addition of extra components to the standard board, options of direction reverse, power on LED, ac power supply input, board mounted speed control potentiometer and maximum speed (prime) switch are available.

The board may be powered from a 20V to 30Vdc supply (12W for a 101 system). The power output transistor for both series of drive motor (TIP 141) is mounted remote from the board. For all systems an adequate heatsink must be provided, suggested area 225cm2 (RS stock no. 401-497) for system 101.

Dimensions: W.100 L.167 D.15

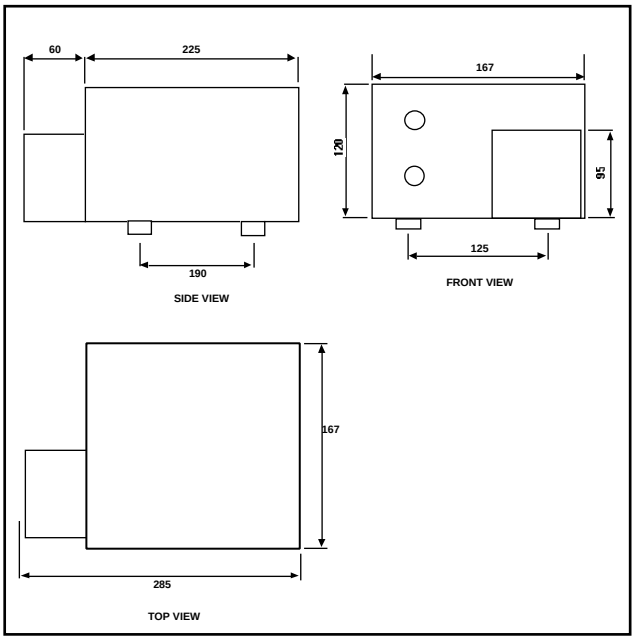


313S/D Peristaltic pump (RS stock no. 229-3440)

Technical information and features

- Flow rated from 0.07 ml/min to 2000 ml/min
- Reversible operation
- Front panel mounted manual speed control
- Selectable dual voltage operation 100-120V or 220-240V
- Rapid and simple tube loading flip-top pumphead
- Snap fit extension pumpheads
- Supplied fitted with a 313DW (229-3456|) three roller pumphead to suit 1.6mm wall thickness tube.
- Capable of driving up to 5 x 313 (**RS** stock no. 305-2363) Auxiliary pumpheads and 1 x 313DW pumphead flow rate ranges (ml/min)

		Tube bore and flow (ml/min)						
	rpm	0.5mm	0.8mm	1.6mm	3.2mm	4.8mm	6.4mm	8.0mm
313S/D	20-400	0.60-12	1.4-28	5.4-108	2.0-400	44-880	72-1440	10-2000



313S/D manual control pumps

Specification

Weight: 5.5kg
Operational temperature range: 5°C to 40°C
Noise: <70dBA at 1m
Control ratio: 20:1
Standards: CE, BS0800, IEC335-1, EN60529 (IP31)
Supply: 1ph, 100-120V, 220-240V, 50/60Hz, 100VA

Materials of construction

Drive: Painted steel casework
Body rear: Glass filled polypropylene
Body front, body front extension: IXEF
Mounting plate, track and lever: IXEF
Rotor, tube clamp: Glass filled Nylon
Mounting plate locking tab: Glass filled Nylon
Rollers: MoS2 filled Nylon 6 (Nylatron)
Spindles: Electroless nickel plated hardened steel
Fixings: Stainless steel
Sealed bearings: Carbon steel

The pump 229-3440 is supplied with 1 x 313 DW (RS 229-3456) pumphead. The total number of pumpheads can be increased by using the 313DW pumphead and the required number of auxiliary 313 x (RS 305-2363) pumpheads. Refer to table below for further details.

Maximum of heads								
Tube bore in mm								
Tube	Pressure	0.5	0.8	1.6	3.2	4.8	6.4	8.0
Silicone	0.5 bar	6	6	5	3	2	2	1
	2 bar	6	6	5	3	2	1	1
Marprene	0.5 bar	6	6	4	2	2	1	1
	2 bar	6	6	4	2	2	1	1

Tubing

Three metre lengths of Silicone and Marprene tubing with 1.6mm wall thickness are available in a range of Bore sizes. Both are capable of being steam sterilised and are suitable for transporting a wide range of chemicals. Please refer to tables below for compatible chemicals and for **RS** stock numbers.

Silicone

This food and medical quality material meets USP Class VI standards and is listed under the UK Water Fittings Bylaws Scheme. Colour - Translucent

Marprene®

Marprene is proven superior in applications where it is chemically compatible, it is the most often recommended tubing material. Marprene has a wide chemical compatibility and is highly resistant to oxidising agents such as ozone, peroxides and hypochlorite. Marprene is also opaque to both visible and ultra-violet light, and maintains low permeability to gases such as oxygen, carbon dioxide and nitrogen. Colour - Beige. Marprene meets USDA standards for food handling and complies with FDA 21 CFR 177.260.

How to choose the right tubing material

The best way to select a tube is to first decide which materials are chemically suitable, and then choose the one which best meets the physical demands of the application.

For maximum tube life, use a large bore tube at low speed. For maximum flow rate use the largest tube at maximum speed. For maximum accuracy, use a small bore tube at maximum speed. Suction lift depends on the tube restituting fully before the advance of the next roller. If it does not, the flow rate will be reduced. For maximum suction lift or pressure, use the smallest practicable bore size of tubing and run the pump at the slowest possible speed. Always make an immersion test before choosing a tube material for critical applications. Immerse a short length of the tubing in a closed container of the fluid for 48 hours, and then examine it for signs of attack, swelling, embrittlement or other deterioration.

	Silicone	Marprene
Bore Size	**RS** Stock Nos.	
0.5mm	184-5905	-
0.8mm	184-5911	-
1.6mm	184-5927	228-2046
3.2mm	184-5933	228-2052
4.8mm	330-834	228-2068
6.4mm	440-521	228-2074
8.0mm	320-578	228-2096

√ Suitable X Not suitable	Bioprene / Marprene	Silicone
Acetaldehyde	√	√
Acetamide	√	√
Acetic, acid, cold	√	√
Acetic, acid, hot	√	
Acetone	X	√
Acetylene	√	√
''Alamask''		√2
Aldehydes	√	
Aliphatic hydrocarbon solvents		√
Alum		√
Aluminium chloride	√	√
Aluminium salts	√	√
Aluminium sulphate		√
Ammonia gas, cold	√	√
Ammonia gas, hot	√	√
Ammonium hydroxide	√	√
Ammonium nitrate		√
Ammonium phosphate		√
Ammonium salts	√	√
Ammonium sulphate		√
Amyl alcohol	√	X
Aniline, cold	√	√
Aniline, hot	√	
Aromatic hydrocarbons		√
Arsenic salts	√	
Barium chloride	√	√
Barium hydroxide	√	√
Barium salts	√	√
Beer	√	√
Beer wort	√	√
Beet sugar liquors	√	√
Benzaldehyde	√	X
Benzoic acid	X	√
Benzyl alcohol	√	
Bleaching liquors	√	√
Blood	√	√
Borax	√	√
Boric acid	√	√
Brake fluid	√	
Brightners, electroplating	√	X
Butyl alcohol	√	√
Butraldehyde	√	X
Butyric acid	√	
Calcium bisulpide		√
Calcium chloride		√
Calcium hydroxide	√	√
Calcium hypochlorite	√	√
Calcium nitrate		√
Calcium salts	√	√
Cane sugar liquors	√	√
Carbitol		√
Carbon dioxide	√	√
Carbon monoxide	√	√
Carbonic acid	√	√
Castor oil	X	√
Caustic soda up to 50%	√6	√

√ Suitable X Not suitable	Bioprene / Marprene	Silicone
''Cellosolves''	√	
Chrome plating solutions	√	√
Chromic acid	√	X
Chromium salts	√	
Citric acid	√	√
Coconut oil	X	√
Cod liver oil	X	√
Coffee	√	
Copper salts	√	√
Corn oil	X	√
Detergent solutions	√	√
Dextrose	√	√
Diacetone alcohol		√
Diatomaceous slurry	√	√
Dibenzyl ether	√	
Dibutyl phthalate	X	√
Diethylamine		√
Diethylene glycol	√	√
Dimethyl formamide	X	√
Dioxane		√
''Dowtherm'' fluids		√
Essential oils	√	
Ethanolamine		√
Ethers	?	√
Ethyl acetate	X	√
Ethyl acetoacetate	X	√
Ethyl alcohol	√	√
Ethylene		√
Ethylene diamine		√
Ethylene glycol	√	√
Ethylene oxide	√	X
Ferric chloride	√	√
Ferric salts	√	√
Ferric sulphate	√	√
Ferrous chloride	√	
Ferrous salts	√	
Ferrous sulphate	√	
Fluoborates	√	
Fluboric acid	√	
Fluosilicic acid	√	
Formaldehyde	√	√
Formamide	√	
Formic acid	√	√
Fumaric acid	X	√
Furfural	√	
Gelatine	√	√
Glucose	√	√
Glycerine	√	√
Glycols	√	√
Gold plating solution	√	
Green sulphate liquor		√
Hexaldehyde		√
Hydraulic oil	√	X
Hydrobromic acid	√	X
Hydrochloric acid, cold	√	√
Hydrochloric acid, hot	√	X
Hydrocyanic acid	√	√

√ Suitable X Not suitable	Bioprene / Marprene	Silicone
Hydrofluoric acid, cold	√	X
Hydrogen gas	√	X
Hydrogen peroxide	X	√
Hydrogen sulphide, dry	√	X
Hydrogen sulphide, wet	√	X
Hyphochlorous acid	√	
Iodine	√	
Isobutyl alcohol	√	√
Isopropyl alcohol	√	√
Isopropyl chloride	√	
Kaolin	√	
Lactic acid, cold	√	√
Lard	√	√
Lead acetate		X
Lead nitrate	√	√
Linseed oil	X	√
Lithium grease	√	
Lye solution (KOH & Na0H)	√	√
Magnesium ammonium sulphate	√	
Magnesium chloride	√	√
Magnesium hydroxide	√	
Magnesium salts	√	√
Magnesium sulphate	√	√
Malic acid	√	
Manganese salts	√	√
Melamine		√
Mercuric chloride	√	
Mercuric sulphate	√	
Mercury	√	√
Methyl alcohol (methanol)	√	√
Methyl bromide		√
Methyl ethyl ketone	√	√
Methyl formate	√	
Methyl methacrylate	√	
Milk	√	√
Mineral oils	X	√
Molasses	√	
Mustard		√
Natural gas	√	√
Nickel chloride	√	√
Nickel salts	√	√
Nitric acid	√4	X
Nitrogen	√	√
Nitrogen oxides	√	X
Nitrous acid	√	
Oils, animal	√	√
Oils, vegetable	√	√
Oxalic acid	√	√
Oxygen, cold	√	√
Ozone	√	√
Palmitic acid	√	
Perchloric acid	√	X
Perchloroethylene	X	√
Phosphoric acid	√	X
Phthalic acid	√	√
Picric acid	√	X

√ Suitable X Not suitable	**Bioprene / Marprene**	**Silicone**
Piperidine		
Polyethylene glycol	√	
Potassium carbonate		√
Potassium chlorate	√	
Potassium cyanide	√	√
Potassium dichromate	√	√
Potassium hydroxide	√	X
Potassium iodide		√
Potassium nitrate		√
Potassium salts	√	√
Producer gas		√
Propyl alcohol	√	√
Pyrrole		√
Rubber latex		√
Salicylic acid	√	
Sea water	√	√
Sewage	√	√
Silver nitrate	√	√
Skydrol 500B4	√	
Soap solutions	√	√
Soda ash	√	√
Sodium aluminate	√	
Sodium bicarbonate	√	√
Sodium bisulphate	√	√
Sodium bisulphite	√	√
Sodium borate	√	√
Sodium carbonate	√	
Sodium chlorate	√	
Sodium chloride	√	√
Sodium cyanide	√	√
Sodium dichromate	√	√
Sodium hydroxide	√6	√
Sodium hyprochlorite	√	√
Sodium metaphosphate	√	
Sodium nitrate	√	X
Sodium nitrite	√	√
Sodium perborate	√	√
Sodium phosphates	√	X
Sodium silicate	√	√
Sodium sulphate	√	√
Sodium sulphide	√	√
Sodium sulphite	√	√
Sodium thiosulphate	√	√
Soyabean oil	X	√
Stannic chloride	√	√
Stannous chloride	√	√
Steam	√	X
Stearic acid	√	√
Sucrose solutions	√	
Sulphur	X	√
Sulphur chloride	X	X
Sulphur dioxide		√
Sulphur hexafluoride		√
Sulphur dioxide, dry	√	√
Sulphur trioxide, dry	√	√
Sulphuric acid 10% cold	√	X
Sulphuric acid 10% hot	√	X
Sulphuric acid 10-75% cold	√	X

√ Suitable X Not suitable	Bioprene / Marprene	Silicone
Sulphuric acid 10-75% hot	√	X
Sulphurous acid	√	X
Tannic acid	√	√
Tanning extracts	√	
Tar		√
Tartaric acid		√
Terpineol		X
Tertiary butyl catechol		√
Tin chlorides	√	√
Titanium dioxide	√	
Turpentine	√	X
Urea	√	√
Uric acid	√	
Vegetable oils		√
Vinegar	√	√
Water, fresh	√	√
Water, sea	√	√
Water, steam	√	√
Whiskey	√	√
Wine		√
Wort		√
Yeast		√
Zinc salts		√

1 Short periods only, 2 Swells, 3 Up to 20C only, 4 Up to 30C only, 5 Up to 100C only, 6 Up to medium concentration.