

***WATSON-
MARLOW***

HR & L

High flow peristaltic pumps

Installation and operating instructions

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PART 1: HR SERIES

Section 1: Flow rates

These flow rates were obtained pumping water at 20°C through neoprene tubing with nominal suction and delivery pressures. The flow rates are for guidance, and actual flow rates may vary due to viscosity, suction and delivery pressures and tubing material used. We will be pleased to advise on the flow rate likely to be obtained under specified conditions.

HRSR Flow Rates (litre/hr)

Model	rpm	Tubing internal diameter (mm)						
		3.2	6.4	9.6	12.7	15.9	19.0	25.4
HRSR	36	4	13	34	76	92	152	227
	76	8	31	78	156	190	311	467
	114	12	48	119	238	290	475	712
	176	19	74	185	370	452	740	1110
	214	23	90	225	450	550	900	1350

HRSV Flow Rates (litre/hr)

Minimum flows 16% of rates given

Model	rpm	Tubing internal diameter (mm)						
		3.2	6.4	9.6	12.7	15.9	19.0	25.4
HRSV	36	4	13	34	76	92	152	227
	96	10	40	101	202	249	404	606
	214	23	90	225	450	550	900	1350

Section 2: Guide to pump types

HR/BS	Shaft drive without motor or gearbox
HRSR	Fixed speed with forward/off/reverse switch
HRS	Fixed speed without switchgear
HRFR	Fixed speed, explosion-proof motor with forward/off/reverse switch
HRSF	Fixed speed, explosion-proof motor without switchgear
HRSV	Variable speed with forward/off/reverse switch
HRSV/S	Variable speed motor without switchgear
HRVF	Variable speed, explosion-proof motor with forward/off/reverse switch
HRVF/S	Variable speed, explosion-proof motor without switchgear

A number after the pump code denotes the maximum rpm of the unit.

Section 3: Tubing

A wide range of tubing is available in six different materials and eleven different sizes to handle almost any fluid.

We strongly recommend the use of Watson-Marlow tubing which is formulated, manufactured and quality controlled to our own specifications, designed to blend long tube life with accurate and consistent performance.

Tubing for HR Series

Bore mm	Material					
	Viton	Neoprene	Butyl	Silicone	PVC	Tygon
3.2 mm Wall Thickness						
3.2		TU027	TU075			
4.8				TU155		
6.4	TU055	TU028	TU076	TU097	TU110	TU165
8.0						TU166
9.6	TU057	TU029	TU077	TU098	TU111	TU167
12.7	TU056	TU030	TU078	TU099	TU112	TU168
15.9		TU031	TU079	TU156	TU113	TU169
19.0	TU058	TU032	TU080		TU114	TU170
25.4		TU033				TU171
4.8 mm Wall Thickness						
19.0		TU034	TU081	TU108		
25.4		TU035	TU082	TU154		

Section 4: Installation

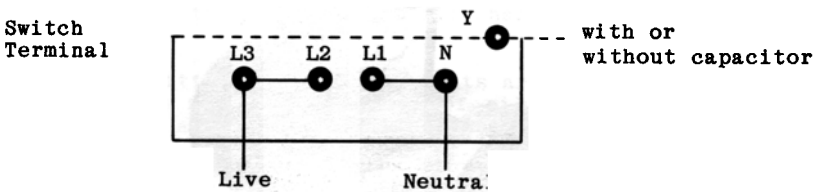
WARNING HR Series pumps must be earthed.

Check that the voltage stamped on the motor identity plate corresponds to the local supply. If when starting a three phase unit it rotates in the wrong direction, transpose any two lines. It is advisable to connect the motor to a current overload protection relay, ensuring that it is set to the correct current rating.

HRSR and HRSV

The terminals are exposed by removing the switch cover. This is accomplished by removing the switch handle, and the two screws adjacent to the switch shaft.

On three phase units connect the leads to terminals L1, L2 and L3. Should it be required to change star to delta, the connections are shown inside the switch cover.



HRS and HRSV/S

Connect as indicated inside the terminal box.

HRFR and HRVF

To expose the terminals, remove the back plate of the switch. For three phase units, connect the leads to terminals 1, 4 and 7. For single phase units, connect the leads to terminals 1 and 4. Connect the earthing stud inside the switch.

HRSF

For three phase units, connect the leads to all 3 terminals. For single phase units, connect the leads to both terminals and earth. Connections to the terminal box should be made according to BS4683 Part 2 specifications.

WARNING Units fitted with IP55 motors and standard Watson-Marlow switchgear are not hoseproof to IP55 standard. To achieve full IP55 protection, the Watson-Marlow switch must be removed and replaced with the original terminal box cover.

Section 5: Tube loading

WARNING Switch off the pump before removing the guard.

- 1 Check that the three rollers are positioned in the correct holes for the wall thickness of the tubing to be used. The rotor has two sets of holes, for 3.2mm and 4.8mm wall thicknesses. To change the position of the rollers, remove the nut at the back of the rotor, withdraw the complete roller assembly, locate it into the appropriate hole, then replace and tighten the retaining nut.
- 2 Slacken the thumb-nuts holding the clamps together and hinge down the tie rods. Remove the loose upper part of the clamp on each side of the track.

Remove the track by slackening both thumb-nuts and pulling it away from the tapered base.

Lay the tube on the track and then replace on one side the loose upper part of the clamp by sliding it into the grooves of the fixed section (making sure that the 'V' shaped notch faces towards the tube) and press down firmly by hand.

Hinge up the tie-bolts, locate the thumb nuts in the recesses on top of the clamp and tighten lightly one side, so as to grip the tube without crushing it. Lightly close the second clamp by replacing the upper part of the clamp and the thumb nuts but without tightening the thumb nuts.

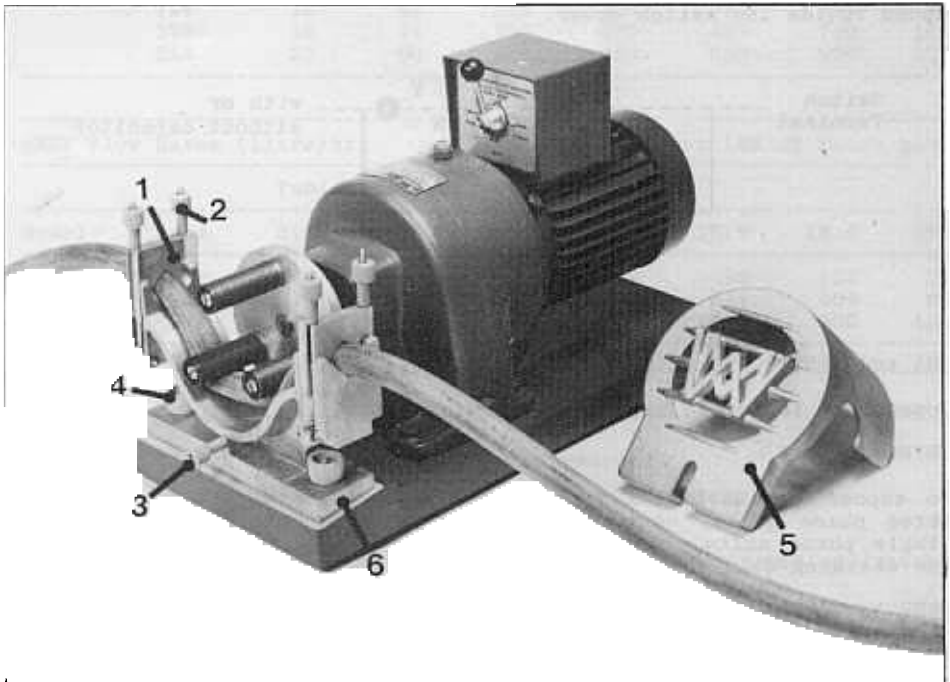
With one hand, hold the free end of the tube just outside the tube clamp and with the other thumb press down on the centre of the tube between the clamps. Allow the free end of the tube to slip through the hand under tension until the tube is stretched just sufficiently to make it touch the bottom of the track curve.

Secure the second clamp by tightening the thumb nuts, maintaining the tube position until it is firmly gripped.

Turn the rotor until one of the rollers is directly below the rotor centre. By tilting the track (with the top towards the pump) place the tube under the bottom roller.

- 8 Slide the track under the bottom roller, and push it until resistance is noticed, then tighten the thumb nuts holding the track to the base.
- 9 Replace the guard before switching the pump

NOTE When in position, the tube will be slightly stretched by the rollers. The purpose of this is to prevent the tube from moving sideways in the track when in action. Should movement occur, insufficient tension has been applied to the tube. In this case, the downstream clamp should be slackened, the tube tensioned and the clamp re-tightened.



1	Tube clamp	2	Clamp nut	3	Guard retaining thumb nut
4	Track retaining thumb nut	5	Guard	6	Track

Section 6: Starting and speed control

WARNING Ensure that the guard is fitted before starting the pump.

If it is desired to relieve the load on starting, the track may be withdrawn slightly down the incline of the tapered base (after checking that the guard is in position).

The pump is started by turning the switch handle to the position indicating the required flow direction.

WARNING The speed control of the variable speed gearbox fitted to the HRSV and HRVF must be adjusted only whilst the pump is running.

Section 7: Occlusion adjustment

The pressure applied by the rollers to the tube is adjusted by sliding the track either up or down its tapered base. With the track pushed up as far as possible, the tube will be completely occluded between the rollers and the track curve (providing the tubing is of the correct wall thickness), making the action one of positive displacement. This position is best for creating a vacuum or priming a dry tube.

After priming, re-adjustment of the track can be made after slackening the track thumb nuts. This should be done with both hands to keep the track parallel to its base. The re-adjustment can be done whilst the pump is running, but only with extreme care. In this position, backslip of the medium being pumped can occur and the pump can be operated against a restricted or closed outlet without building up excess pressure, whilst also prolonging tube life. Always remember to tighten the track thumb nuts before leaving the pump running.

Section 8: Lubrication

FIXED SPEED DRIVES

These units have final drive gearboxes which leave our works filled with Shell Macoma R220. This is normally sufficient for many years service. Grease the motor bearing nipples, where fitted, not more than once a year.

VARIABLE SPEED DRIVES

These units have both a variable speed gearbox and a fixed ratio final drive gearbox. The final drive gearbox is filled with Shell Macoma R220 and the variable speed gearbox is filled with Disco Long Life Oil which requires draining and refilling after every 6000 running hours. Disco long life oil is manufactured by the Imperial Oil and Grease Company, California, USA and is available worldwide under the trade name Molub-Alloy.

For higher ambient temperatures (30°C to 43°C), Shell Tellus Oil 46 is recommended, but with more frequent oil changes made every 700 running hours

The drain plugs fitted to the Disco units are of the magnetic type and should be cleaned after each refill of oil. The oil level should be checked regularly and topped up as necessary. Lack of oil will lead to premature wear

ALL MODELS

An occasional spot of light oil should be applied to the front and rear of the roller spindles. Apart from attention to the tubing, no further servicing is required.

Section 9: Getting the best from your pump

1 Do not over-squeeze the tube. A good guide to the right occlusion setting is to slide the track up the tapered base until the pump primes and no further.

Ensure that the rollers are in the correct set of holes for the wall thickness of the tube in use.

External lubrication of the tube is recommended. Silicone grease such as MS4 (available from Watson-Marlow) or similar, can be used on all materials except silicone rubber. Glycerine and other non-solvent based lubricants can be applied to silicone rubber and other elastomers.

Care should be taken to ensure that the area under the metal clamps is free from grease or lubricants.

- 5 Wherever possible, system tubing should be the same bore or larger than that in the pump.
- 6 Watson-Marlow offer an experienced advisory service. If you should have any doubt as to the best way to employ your pump, please contact us directly or through your local distributor.

Section 10: Spares list

Part No.	Description
SR 315	Roller (three required per pump)
SR 314	Spindle for roller (three required per pump)
SRA 01	Roller, spindle and circlip assembly (three required per pump)
SR 335	Tube clamp
SR 337	Pivot stud
SR 338	Knob for stud
SR 311	Track holding knob
SRA 02	Track and clamp assembly
SR 341	Guard
SR 338	Nut for guard
SW 007	Switch, rotary (HRSR, HRSV)
SRA 03	Switch and box assembly (HRSR, HRSV)
SR 318	Front cover knob
SR 303	Rotor - HRSR, HRSV
SR 323	Double pipe clip track
	Gearbox HRSV
	Gearbox HRSR
SR 316	Bronze rollers, each

Section 1: Flow rates

The flow rates given were obtained pumping water at 20°C through neoprene tubing with nominal suction and delivery pressures. The flow rates are for guidance, and actual flow rates may vary due to viscosity, suction and delivery pressures and the tubing material used. We will be pleased to advise on the flow rate likely to be obtained under specified conditions.

LHRS Flow Rates (litre/hr)

Model	rpm	Tubing internal diameter (mm)					
		9.6	12.7	19.0	25.4	38.1	44.5
LHRS	57	186	346	818	1363	2602	2974
	93	303	566	1334	2224	4245	4852
	138	450	840	1980	3300	6300	7200

LHRV Flow Rates (litre/hr)

Minimum flows 11% of rates given

Module	rpm	Tubing internal diameter (mm)					
		9.6	12.7	19.0	25.4	38.1	44.5
LHRV	57	186	346	818	1363	2602	2974
	93	303	566	1334	2224	4245	4852
	138	450	840	1980	3300	6300	7200

Section 2: Guide to pump types

- LH/bs Shaft drive without motor or gearbox
- LHRS Fixed speed with forward/off/reverse switch
- LHRS/S Fixed speed without switchgear
- LHRF/N Fixed speed, explosion proof motor without switchgear
- LHRV Variable speed with forward/off/reverse switch
- LHRV/S Variable speed without switchgear
- LHRV/FN Variable speed, explosion proof motor without switchgear

A number after the pump code denotes the maximum rpm of the unit.

Section 2: Tubing

A wide range of tubing is available in six different materials and ten different sizes to handle almost any fluid.

We strongly recommend the use of Watson-Marlow tubing which is formulated, manufactured and quality controlled to our own specifications, designed to blend long tube life with accurate and consistent performance.

Tubing for L Series

Bore mm	Material					
	Viton	Neoprene	Butyl	Silicone	PVC	Tygon
3.2 mm Wall Thickness						
9.6	TU057	TU029	TU077	TU098	TU111	TU167
12.7	TU056	TU030	TU078	TU099	TU112	TU168
15.9		TU031	TU079	TU156	TU113	TU169
19.0	TU058	TU032	TU080		TU114	TU170
25.4		TU033				TU171
4.8 mm Wall Thickness						
19.0		TU034	TU081	TU108		
25.4		TU035	TU082	TU154		TU172
38.1		TU036				
6.4 mm Wall Thickness						
38.1		TU037				
44.5		TU038				

Section 4: Installation

WARNING L Series pumps must be earthed.

Check that the voltage stamped on the identity plate corresponds to the local supply. If a 220/380V motor is fitted and used on 220V, check the relay starter coil rating and current overload setting.

Remove the starter box cover and connect the three phase supply to the terminals L1, L2 and L3, or as indicated inside the starter box. Connect earth to the correct terminal stud.

For units without switches, ie LHRS/S and LHRV/S, the terminals are located in the terminal box.

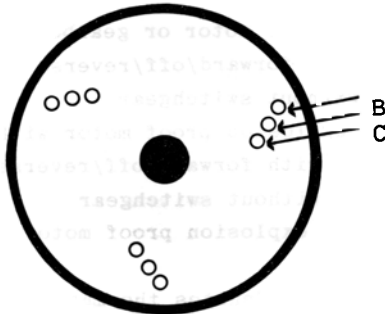
For explosion proof units, remove the rear motor cover to expose the terminals. Connections to the terminal box should be made in accordance with BS4683 Part 2.

Section 5: Tube loading

WARNING Switch off the pump before removing the guard.

Slacken the track retaining thumb nuts and slide the track down its tapered base until the front edge of the track is flush with the front edge of the base.

- 2 Remove the guard by unscrewing the three holding bolts. Lift the guard up and off.
- 3 Check that the three rollers are positioned in the appropriate holes for the wall thickness of the tube to be used. There are three holes at each roller station. The holes being for tubes 3.2mm (A), 4.8mm (B) and the inner holes for 6.4mm (C) wall thickness tubing, as shown in the diagram below.

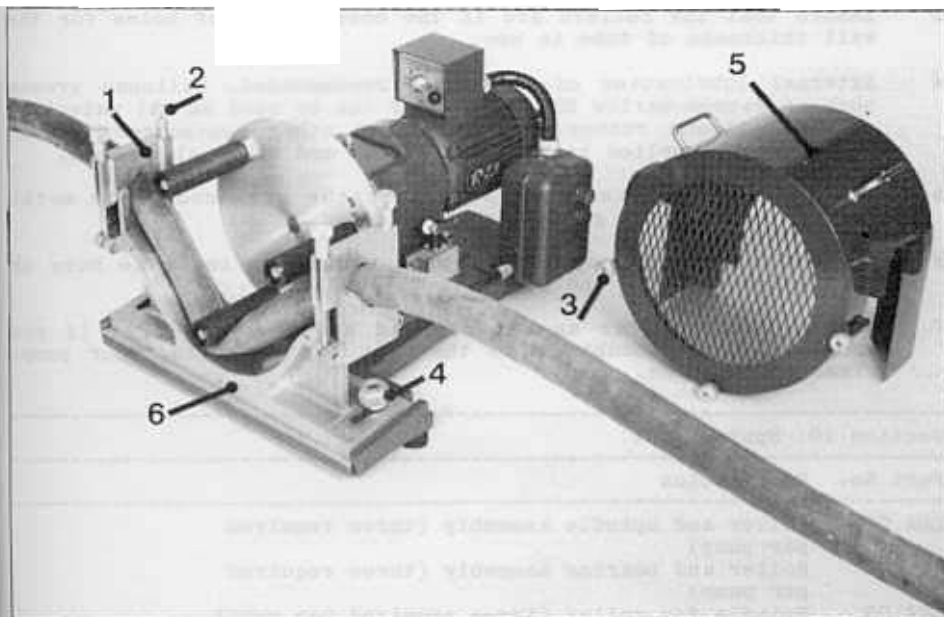


To change the position of the rollers, remove the nut at the back of the rotor, withdraw the complete roller assembly, locate it into the appropriate hole and then replace and tighten the retaining nut.

- 4 Slacken the thumb nuts holding the clamps together and hinge down the tie-rods.
- 5 Remove the loose upper part of the clamp on each side of the track.
- 6 Lay the tube in the clamp and feed it under the rollers to lie in the clamp at the other side of the track. (It is helpful to turn the rotor by hand whilst doing this, and in variable speed models this is easier at high speed settings).
- 7 Replace the loose upper part of one clamp by sliding it into the groove of the fixed section (after making sure that the 'V' shaped notch faces down towards the tube) and press down firmly by hand.
- 8 Hinge up the tie-rods, locate the thumb nuts in the recess on the top of the clamp and tighten lightly so as to grip the tube without crushing it.
- 9 Pull firmly on the other side of the tube so that the length in the track is under tension and replace the other clamp, maintaining the tension.

Tensioning the tube between the clamps keeps it central in the track during operation. If the tube moves forward over the edge of the track or backwards against the rotor when in operation, insufficient tension has been applied. In this event, the clamp on the discharge side should be slackened, the tube pulled through slightly and then the clamp re-tightened whilst the tube is being pulled through.

- 10 Replace the guard and the retaining bolts.



1	Tube clamp	2	Clamp nut	3	Guard retaining thumb nut
4	Track retaining thumb nut	5	Guard	6	Track

Section 6: Starting and speed control

The LHRS and LHRV will only start with the guard in position, when a projection operates the interlock. When fitted, set the forward/off/reverse switch to produce flow in the required direction, then press the green button to start.

LHRF/N and LHRV/FN explosion proof models are not fitted with an interlock switch. Care should be taken in starting these models.

WARNING The speed control of the variable speed gearbox fitted to the LHRV, LHRV/S and the LHRV/FN must only be adjusted whilst the pump is running.

Section 7: Occlusion adjustment

The pressure applied by the rollers to the tube is adjusted by sliding the track either up or down its tapered base. With the track pushed up as far as possible, the tube will be fully occluded between the rollers and the track (providing the tubing is of the correct wall thickness), making the action one of positive displacement. This position is best for creating a vacuum or priming a dry tube.

After priming, the track can be re-adjusted after slackening the thumb nuts. This should be done with both hands to keep the track parallel to its base. The re-adjustment can be done whilst the pump is running, but only with extreme care.

In this position, backslip can occur and the pump can be operated against a restricted or closed outlet without building up excess pressure, whilst also prolonging tube life. Always remember to tighten the track thumb nuts before leaving the pump running.

Section 8: Lubrication

Fixed speed drives have final drive fixed speed gearboxes which leave our works filled with Shell Macoma R220. This is normally sufficient for many years service. Grease the motor bearing nipples, where fitted, not more than once a year.

The variable speed gearbox requires lubrication in accordance with the Allspeed Instruction Manual, using the oil type supplied with the unit - Mobilfluid 62 or BP Hydraulic TF-C2.

Section 9: Getting the best from your pump

With variable speed models use as large a tube and run as slowly as practicable.

Do not over-squeeze the tube. A good guide to 'squeeze' is to slide the track up the tapered base until the pump just primes and no further.

3 Ensure that the rollers are in the correct set of holes for
wall thickness of tube in use.

4

5

6

7
