Model 806 Dilutor

Operator's Manual

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Intended Use

The Model 806 is an Automatic Sample Dilutor designed for use with the full range of Sherwood Flame Photometers; i.e. Models 410 (Single Channel), and Models 420, 420Cs and 425 (Dual/Multi Channel).

This operator's manual contains complete instructions for setting up and using the Model 806. It should be read in conjunction with the Flame Photometer Operator's Manual. Service information for use by appropriately qualified personnel is also available.

The Model 806 is intended for use by persons knowledgeable in safe laboratory practices. If the Model 806 is not used in accordance with these instructions for use, the protection provided by the equipment may be impaired.

CAUTION: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

There are no user replaceable parts within the instrument. Do not remove the rear cover from the Model 806 unless you are following the instructions from Sherwood Scientific.

Sherwood Scientific and its authorised Distributors and Agents consider themselves responsible for the effects of safety, reliability and performance of the Model 806 only if: -

- Assembly operations, extensions, re-adjustments, modifications or repairs are only carried out by persons authorised by them.
- The electrical installation of the relevant room complies with IEC requirements or the local regulatory code.
- The equipment is used in accordance with the instructions for use.

The information contained in this manual was correct at the time of going to print. However, Sherwood Scientific's policy is one of continuous product improvement and the right to change specifications, equipment and maintenance procedures at any time, without any notice, is reserved.

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Unpacking/Assembly

1.1 Unpacking

Remove the M806 Dilutor and Standard Accessories from the carton and check the instrument and all the items in the carton for signs of damage. Check items received against the following list and notify your Sherwood Scientific Distributor if any discrepancies or damaged items are discovered.

IMPORTANT Quantities shown in the following list are those supplied with a new instrument. Do not re-order from this list; instead refer to Section 9 of this manual.

Part No.	Description	Quantity
	M806 Dilutor	1
001 06 102	Tube clamp, for diluent supply tube	1
001 53 315	Universal mains Adaptor	1
001 72 001	Silicon rubber tubing, manifold block inlet/outlet	1 metre
001 72 107	Polythene diluent supply tubing	2 metres
449 06 001	Diluent filter, complete	1
449 99 001	Cleaning wire, pack of 3	1 pack
800 07 001	Manifold block	1
800 09 002	Diluent pump tube, pack of 3	1 pack
800 09 004	Roller, pack of 12	1 pack
800 09 005	Na/K sample pump tube, Orange, 1 in 200, pack of 3	1 pack
800 09 007	Constrictor, for Na/K sample tubes, pack of 10	1 pack
800 09 008	Li sample pump tube, Red, 1 in 50, pack of 3	1 pack
800 09 009	Constrictor, for Li sample tube, pack of 10	1 pack
800 15 000	Weir Holder Assy (Open) inc. Weir Assy	1
806 91 001	M806 Operators manual	1
001 56 603	Lithium Internal Reference Solution, 3 Molar, 6 x 100 ml	1 bottle
001 56 681	Diluent Concentrate, 6 x 100 ml	1 bottle
800 09 006	Lithium Internal Standard Tube, Orange, long, pack of 3	1 Pack

NOTE. The following two items are spares for the manifold block.

001 31 060	‘O’ ring, small, orifice seal	1
001 31 058	‘O’ ring, thumbscrew seal	1

Unpacking/Assembly continued

1.2 Assembly Instructions

The M806 operates at low voltage (12 Volts d.c.). The universal mains adapter supplied with the M806 comes with a range of plugs to suit most a.c. supplies around the world. The a.c. supply can be in the range 90 – 264V, 50 – 60Hz.

NB. Items 7and 8 below apply only when the Model 806 is used with the Model 420 Dual Channel Flame Photometer.

1. Connect the Universal Mains Adaptor to the dc socket on the rear panel.
2. Unlock the Platen Lock (item 2, figure 7.4) and raise the pump Platen, as shown in figure. 7.1, item 1. Remove the length of tubing from the roller assembly if fitted.
3. Using a clean tissue, fold it into a pad and hold it on the rollers. Do not close the platen as the pad might be forced down between the rollers and the housing.
4. Switch on the Dilutor. Wait one minute and then switch off. Inspect the pad of tissue. Repeat paragraphs 3 and 4 until the used pad is clean.
5. Identify the Na/K Sample Pump Tube, colour coded Orange (800 09 005), which gives a 1 in 200 dilution ratio. Insert the end that measures 70mm to the identifying clip, into the hole on the Platen Assembly, item 1, figure 7.2.
6. Fit the end of the Orange coded sample tube to the connector on the Manifold Block (800 07 001), refer to item 2, figure 7.1. Make sure that the Orange coded pump tubes are fitted to the shoulder on the connector.
7. Identify the Lithium Internal standard Tube, colour coded Orange (800 09 006), which is much longer than the Orange sample tube mentioned in 1.2.5 above. Pass the long end of this tube through the hole at the right-hand end of the instrument and into the bottle containing the Lithium Internal Reference Solution (001 56 603).
8. Feed the 70mm end of this tube through the hole in the Platen Assembly, item 2, figure 7.2, and fit the end to the connector on the Manifold Block, refer to item 3, figure 7.1.
9. Fit the Manifold Block on to the wire support by first locating it on the front wire and then clipping it on to the back wire.
10. Check that the four Pump Rollers are fitted to the Diluent Rotor. If not fitted follow points 11 and 12.
11. Hold the Rotor, to prevent it turning, and unscrew the Pump Roller Retainer, item 5, figure 7.1.

1.2 Assembly Instructions

12. Fit four Pump Rollers (800 09 004) (item 2, figure 7.3) on to the spindles and replace the Pump Roller Retainer.

NOTE Do not lubricate the Pump Rollers as the lubricant may react with the Diluent Pump Tube (800 09 002).

13. Fit the 2-metre length of polythene Diluent Supply Tubing (001 72 107) to the Diluent Pump Tube (800 09 002) and fit that end to the tension arm, item 1, figure 7.4. Fit the other end of the Diluent Pump Tube to the fixed arm as shown in figure 5.4, item 3.
14. Cut a 100mm length from the 1 metre length of Silicon Rubber Tubing (001 72 001).
15. Fit one end of the 100mm length of tubing to the Diluent Pump Tube and the other end to the plastic connector on top of the Manifold Block.
16. Feed the end of the Diluent Supply Tube through the hole in the Dilutor case, in the lower left hand corner.
17. Feed the Diluent Supply Tube through the Tube Clamp (001 06 102) (see figure A) so that the clamp is conveniently positioned adjacent to the Dilutor.

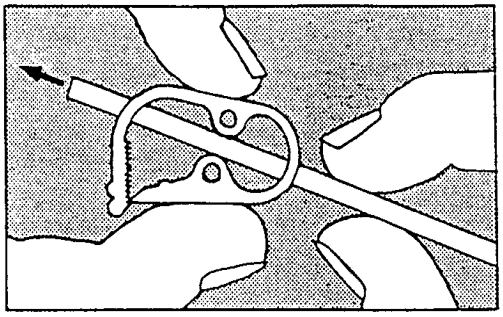


Figure A Diluent Supply Tube and Clamp

18. Remove the cap or plug, if fitted, on the inlet to the Diluent Filter (449 06 001).
19. Fit the Diluent Filter to the Diluent Supply Tube. Make sure that either the arrow is pointing in the direction of flow or that the outlet is connected to the tube that goes to the Dilutor. Insert the Filter into the diluent container (not supplied).

1.2 Assembly Instructions

20. If you have a new flame photometer (serial Number 29887 or later) remove the black cover plate from the Weir support holder mounting block.


If you have an older instrument (serial number 29886 or earlier please see the Retrofit Open Weir Assembly addendum on page 40.

Push the locating lugs of the combined Open Weir and Open Weir Holder Assembly (800 15 000) into the two holes in the mounting block and then turn the retaining screw to locate it in the central threaded bush and tighten to finger tight only to fix the weir assembly in place.


Unpacking/Assembly continued

1.2 Assembly Instructions continued

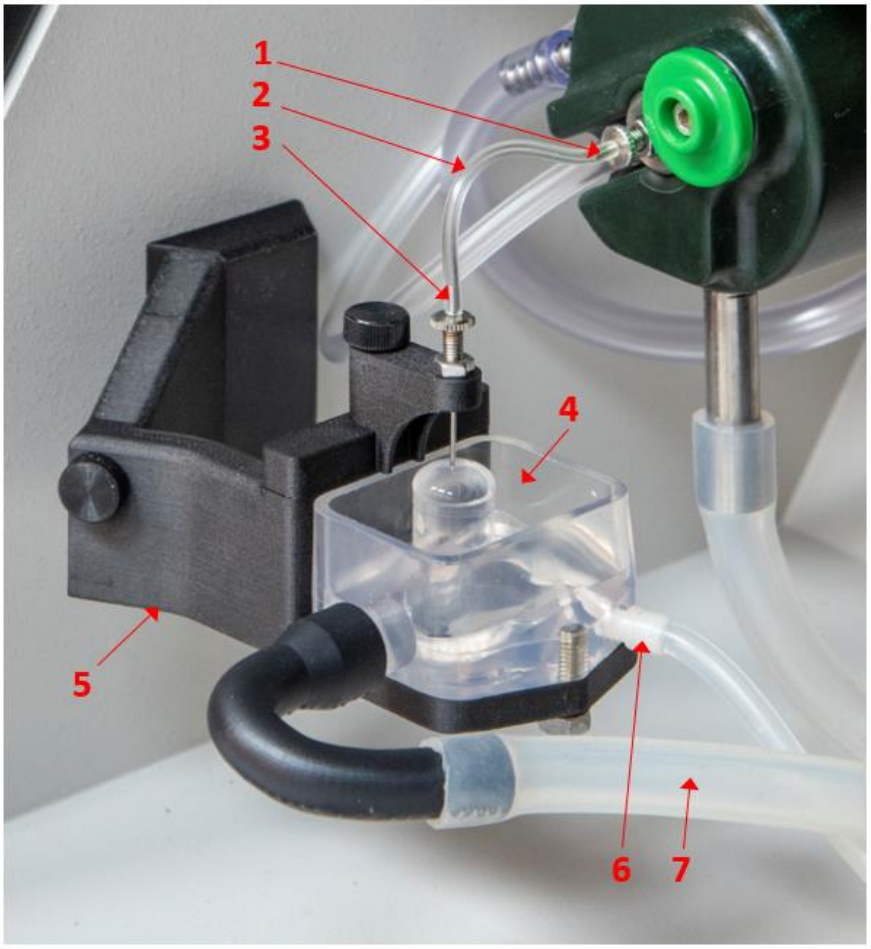


Figure C
1. Nebuliser tube, 2. Tubing, nebuliser to weir, 3. Stainless steel tube,
4. Open Weir assembly, 5. Weir Holder assembly, 6. Inlet tubing,
7. Waste tubing.

21. Connect the Nebuliser tube, item 1, figure C to the Open Weir Assembly (800 09 010) using the Small bore tubing, item 2, figure C supplied with the Weir Holder Assembly (800 15 000). Make sure the tubing is not kinked or creased.
22. Using the Silicone Rubber Tubing, (001 72 001) fit one end to the inlet connector on the Open Weir Assembly, item 6, figure C.
23. Position the M806 so that the distance between the Manifold Block outlet and the Open Weir Assembly is at a minimum, approximately 5cm to the right of the flame photometer. (Increasing the length of tubing between the Dilutor and the Weir assembly will increase the time between sampling and obtaining a stable readout on the Flame Photometer).
24. Cut the Tubing (001 72 001) to the required length and pass it through the Outlet Tube Guide, item 3, figure 7.3 on the front of the Dilutor.

1.2 Assembly Instructions continued

25. Connect the end of the tube to the outlet connector on the bottom of the Manifold Block.
26. Connect one end of the Open Weir Drain Tube, item 2, Figure D (800 72 002) to the black curved outlet arm of the open weir and push one of the barbed arms of the “Y”-piece item 3, Figure D (001 08 503) into the other end. Connect one end of the Silicone Tube, item 4, Figure D (400 72 002) to connect the ‘Y’-piece to the drain outlet of the constant-head and drain. Connect the flame photometer drain tube to the remaining arm of the “Y”-piece.

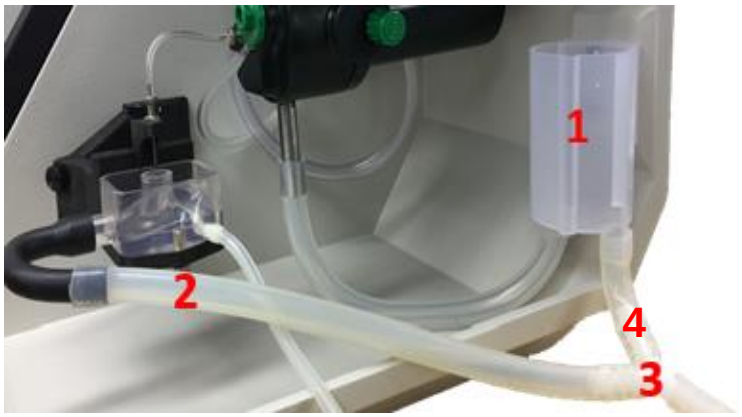


Figure D Waste Outlet Tube

1. Constant head & drain, 2. Waste outlet tube, 3 Drain “Y” piece, 4, Silicone Tube.

27. If necessary, reduce the length of the Sample Inlet Tube to accommodate the size of beaker to be used. Bear in mind that the length of Sample Inlet Tube plus the Constrictor is 90mm.

NOTE In the following paragraph, when fitting Constrictors to Sample Tubes, make sure that the correct size of Constrictor is used. The larger diameter Constrictor is used with the Red sample tube only.

28. Fit a Constrictor to the end of the Sample Inlet Tube by inserting the end that is cut at a 45° angle. Insert it approximately 3mm as shown in figure 5.3.
29. Refer to Section 5 of this manual for operating instructions.

2

Introduction

2.1 Introduction

The Model 806 Dilutor is an automatic sample dilutor designed for use with Sherwood Flame Photometers. It is a twin rotor peristaltic pump, the sample side consists of a positive action rotor and the diluent side consists of a peristaltic type rotor. The dilution ratios are 1 in 200 (for Na/K measurements) and 1 in 50 (for Li measurements). Standards and samples are presented to either sample pump tube, depending on the dilution ratio required. Other dilution ratios are available; contact your Sherwood Scientific distributor.

This manual covers the use of the Model 806 with a Model 410 Flame Photometer and should be read in conjunction with the instruction manual supplied with the Flame Photometer.

We also cover the use with the Models 420, 425 and 420Cs Dual Channel Flame Photometers when the Li* Internal Standard tube is used in place of the Lithium Sample Tube. This eliminates any dilution drift or error as the concentration of Internal Standard will also be affected by pump changes and the correction will be made by the 420 series Flame Photometers.

*Li Internal Standard used for M420 & M425; Li or Cs Internal Standard used with M420Cs.

2.2 Reagents

Sherwood Scientific supply a wide range of reagents, including standards, diluent and maintenance solutions for use with the M806 / Flame Photometer system. Please refer to Section 9.3 for a complete list of the reagents available.

The Lithium Internal Standard (001 56 603) is supplied specifically to be used with the Diluter when used in conjunction with the Model 420, M420Cs or M425 Flame Photometer.
A 10,000ppm Cs solution 001 56 601 is available for M420Cs Operators if required.

Dilutions

The diluent supply to the Model 806 **must** be made up with a minimum 1 part of Diluent Concentrate to 999 parts deionised or good quality distilled water. If bubbles are accumulating in your dilutor tubing, increase the diluent concentrate usage to 3ml per litre. If you know or suspect your samples may contain large macromolecules, e.g. Albumin then we recommend a minimum inclusion of 3ml Diluent Concentrate per litre of Diluent. This will need to be increased to 6 ml per litre if the Albumin concentration is high i.e. 20% or more.

Great care should be taken so that contamination does not occur when preparing the samples and standards, as the accuracy of the M806 / Flame Photometer system is dependent on the accuracy and purity of the standards used for calibration.

2.2 Regents continued

Storage

All solutions should be stored away from direct sunlight, in a cool place (below $+25^0C/+77^0F$), in an airtight container to prevent evaporation and discolouration. Glass containers should not be used, as they can affect Na concentration levels. Prolonged exposure to the atmosphere must be avoided to prevent evaporation of standard solutions, which could affect concentration.

Purification

No purification is required for Sherwood Scientific standard solutions.

3

Installation

3.1 Installation

Carry out the unpacking and assembly instructions. Check items received against the packing list and notify your Sherwood Scientific distributor if you have any problems.

3.2 Services Required

Electrical Supply

An a.c. supply at 90V to 264V, 50Hz or 60Hz

Diluent

A supply of diluent will be required, at approximately 2 litres per hour. The diluent should be made up of Diluent concentrate and deionised or good quality distilled water as suggested in section 2.2. The diluent container should be placed on the bench, alongside the Dilutor. *Do not* site the diluent container on the floor, as this will reduce the flow rate. If the system is to be run for 3 to 4 hours we recommend a minimum reservoir volume of 10 litres be used.

4

Performance Characteristics and Specification

4.1 Dilution Ratios

The following sample dilution ratios are available: -

Nominal	1 in 200	1 in 50
Pump tube	Orange	Red

The maximum and minimum dilution ratios for each tube are:

Maximum	1 in 300	1 in 100
Minimum	1 in 166	1 in 25

4.2 Stability

The stability of the dilution ratio between both the small bore pump tubes and the large bore pump tube will remain within the maximum and minimum ranges quoted in Section 3.1. Dilution ratio drift will be less than 0.5% per 10 minutes.

4.3 Warm Up

To meet the specification for the M806 / Flame Photometer system a 15-minute warm up period is required.

4.4 Environmental Conditions

Temperature

Operating +10^{0}C to +35^{0}C; Transportation -40^{0}C to +45^{0}C.

Humidity

Operating 85% at +35^{0}C; Transportation 95% at +45^{0}C, non-condensing.

This specification will be unaffected by an ambient temperature change of 4^{0}C (or less) per hour, within the range +10^{0}C to +35^{0}C, with a maximum of 7^{0}C shift during 8 hours.

Installation Category

Installation category 1.

4.5 Tube Life

At least 150 hours operation.

4.6 Roller Replacement (Diluent)

Change pump rollers at every other tube change, equivalent to 300 hours operation.

4.7 Nominal Pump Rates

Diluent	33 ml/minute
Orange	0.15 ml/minute
Red	0.6 ml/minute

NOTE Only nominal pump rates can be quoted because of the variations in line voltage and frequency. This will not affect performance provided the dilution ratios are within the limits quoted in Section 4.1.

4.8 Minimum Sample Volume

Na serum/urine	50 µl
K SERUM	50 µl
K Urine	50 µl (for Flame Photometer only pre-diluted 1 in 5)
Li serum	200 µl

4.9 Power Requirements

Voltage

90V to 264V, 50 / 60Hz.

Power

25VA.

4.10 Diluent Supply

A supply of diluent at 2 litres/hour will be required. The diluent supply must be made up from 1 part Diluent Concentrate to 999 parts deionised or good quality distilled water. See note in section 2.2 for more guidance on Diluent concentrate inclusion rates.

4.11 Size

Width	237 mm
Depth	206 mm
Height	156 mm

Space must also be provided to the right of the flame photometer for the diluent container and dilutor, on the same level. Clear access to the mains supply switch must be provided.

4.12 Weight

2.2 kg.

5

Operating Instructions

5.1 Controls and Indicators

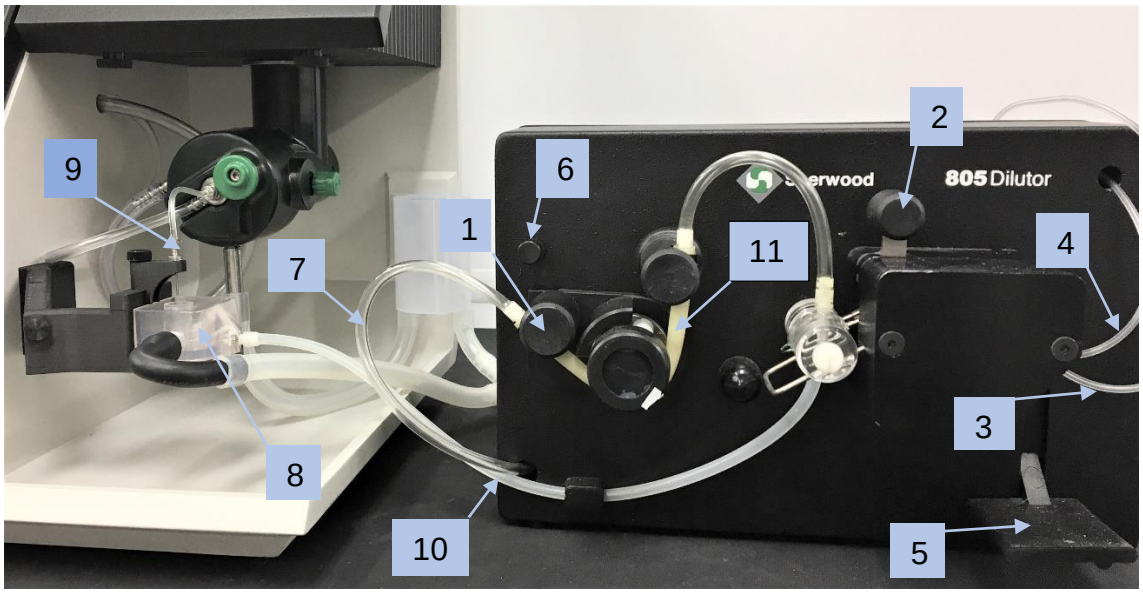


Figure 5.1 Model 806 Dilutor Operating

1. Diluent tube tension arm, 2. Platen lock,
3. Sample pump front tube; short if no autosampler, long with autosampler, with orange tab for 1:200 dilution or red tab for 1:50 dilution,
4. Li or Cs Internal reference (long tube, orange tab) rear pump tube,
5. Sample lift, 6. Tension arm release button, 7. Diluent supply tubing,
8. Weir assembly, 9. Height adjustment for sample intake capillary,
10. Dilutor outlet tube to weir assembly. 11. Diluent tube.

Diluent Tube Tension Arm

The diluent tube tension arm pulls the diluent tube around the pump rotor (shown in the tensioned position, Figure 5.1). Diluent is pumped by the peristaltic action of the rollers passing in succession over the pump tube.

CAUTION Do not leave the diluent pump tube tensioned when the dilutor is switched off, as the life of the pump tube will be drastically reduced.

5.1 Controls and Indicators continued

Platen Lock

The platen lock, (shown locked in Figure 5.1) holds the pump platen in contact with the sample pump tubes. This results in positive action pumping of sample solution via the two sample pump tubes. Variation of dilution ratios is achieved by changing the bore size of the pump tubes. Nominal dilution ratios are 1 in 50 using Red pump tubes and 1 in 200 using Orange pump tubes.

CAUTION Do not leave the platen locked down when the dilutor is switched off, as the life of the pump tubes will be drastically reduced.

Sample Pump Tube Identifiers

The colour identifies the dilution ratio of the sample pump tubes. Red is 1 in 50 and Orange is 1 in 200.

Lithium/Caesium Internal Standard Pump Tube

Carries the Lithium/Caesium internal Standard Solution from its container through the body of the M806 into the manifold via the sample pump in parallel to the sample tube.

Sample Lift

Platform for holding sample cups, which can be raised and lowered.

Tension Arm Release Button

Button that, when depressed, releases the diluent tube tension arm; which releases the tension on the diluent pump tube.

Diluent Supply Tubing

The diluent supply tubing carries diluent from the diluent container to the diluent pump tube.

Power

The *power* on/off button switches the dc supply from the mains adaptor to the instrument.

5.2 Controls and Indicators

Power

Dc socket for the dc supply lead from the mains adaptor.

Serial Plate ⎓ symbol denotes equipment suitable for direct current only.

5.3 Operation

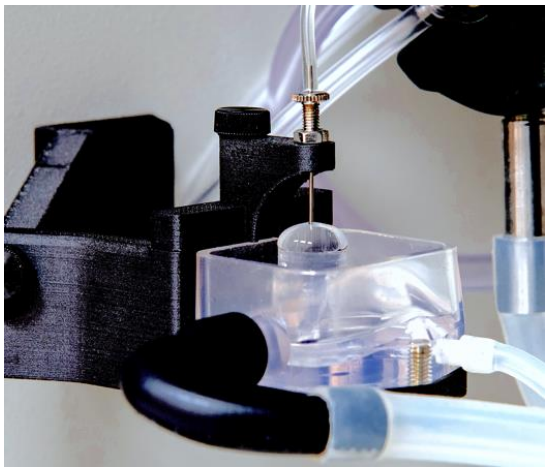
1. Switch on the Flame Photometer and light the flame, as detailed in the flame photometer instruction manual, Section 5.4, and connect the dilutor to the PSU. (For the Model 420, 420Cs or 425 in Peak and Reference mode, set a delay of 30 seconds).
2. Swing the diluent tube tension arm clockwise until it engages with the catch, Item 1, Figure 5.1, and set the platen lock to the locked position, as shown in Figure 5.1, Item 2.
3. Release the clamp fitted to the diluent supply tubing and switch on the dilutor by pressing the *power* on/off push-button.

Calibration

4. Check that sufficient diluent is available in the diluent container (and that the Internal Standard Tubing is immersed in the Lithium or Caesium Standard solution if one of the M420 series flame photometers is being used).
5. Place a beaker of deionised water on the sample lift (Item 5, Figure 5.1), and raise it so that the correct sample constrictor is immersed.
6. If possible, allow 15 minutes for the Flame Photometer to stabilise.

   Whilst waiting for the Flame Photometer to stabilise, observe the position of the capillary tube in the diluent meniscus at the top of the open weir central inlet tube.

   The end of the capillary tube should be adjusted if necessary to be just below the surface, preferably by no more than approximately 1 mm. If the height of the capillary tube needs to be adjusted, slacken the locking nut and turned the knurled adjustment screw to raise or lower the end of the capillary as necessary. Once at the correct height, re-tighten the locking nut.



7. Allow the reading to stabilise then adjust the *blank* control so that the display reads 0.0. (On the Model 420, 420Cs or 425 the blank procedure is automatic).

Operating Instructions continued

5.3 Operation continued

8. Replace the deionised water with a standard solution. Make sure the standard is presented to the correct sample constrictor. Na/K standards should be presented to a tube with and orange tab and Li standards to a tube with a red tab. Use a standard with a concentration level similar to that expected in the samples.

9. Allow the reading to stabilise, then adjust the *coarse* and *fine* controls for a convenient reading e.g. if a 140mmol/l Na standard is aspirated, set the display to read 140. (For the Model 420 or 425 follow the method from the Operator Manual).

10. Carefully adjust the *fuel* control, on the Model 410, for a maximum reading on the display, ensuring that only small adjustments are made, with a pause of several seconds between adjustments. (Flame Optimisation is automatic on the Model 360, 420, 420Cs or 425 and this procedure is not required).

NOTE If you have any difficulty obtaining a maximum Sodium reading proceed as follows: - Open the inspection flap and adjust the *fuel* control until the flame just starts to lift off the burner. Then turn the *fuel* control back, counter clockwise, until the cones of the flame are on the burner. Close the flap and proceed with paragraph 11.

11. Remove the standard solution, then aspirate deionised water. Adjust the *blank* control for a 0.0 reading.

12. Repeat paragraphs 8, 9 and 11 until the blank reading is 0.0 (within ±0.2) and the calibration reading is within ±1%. If a chart recorder is being used set zero on the blank solution and set span while aspirating the calibration standard.

Operating Instructions continued

5.3 Operation continued

Determinations

13. Place a beaker containing a sample on the sample lift and raise it so that the correct sample constrictor is immersed in the sample. Na/K samples should be presented to the front and Li samples to the rear sample constrictor. When the display reading stabilises, note the result. Repeat with other samples. (For the Model 420, 420Cs or 425 press 'Measure' when the sample just reaches the inlet to the sample pump).

NOTE For K, urine with greater than 100mmol/K, samples must be manually pre-diluted 1 in 5 with diluent before presentation to the dilutor.

14. If a constrictor is blocked by fibrin debris, use a scalpel to cut off the end. Make sure that the tube is cut squarely, not at an angle, see Figure 5.3. If necessary, fit the correct new constrictor to the sample tube, refer to Section 8.2.

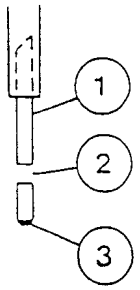


Figure 5.3 Sample Constrictor

1. Constrictor, 2. Cut, 3. Fibrin debris.

15. Recalibrate by presenting the standard solution to the correct sample inlet constrictor and repeating paragraph 9. Experience in use will determine how frequently the calibration needs to be checked.

16. When all sample determinations are completed, shutdown the Model 806, as detailed in paragraphs 17 to 21.

5.3 Operation continued

Shutdown

CAUTION To remove any protein that has built up, at least once a week place both sample constrictors in Enzymatic Cleaning Solution for 10 minutes, while running the dilutor.

17. Place the sample constrictors and/or internal reference tubing in deionised water for two minutes.
18. Remove the sample constrictors/ internal reference tube from the deionised water. Remove the diluent supply tube for the diluent reservoir and allow the dilutor to pump the liquid from all of the tubes.
19. Switch off the Dilutor.
20. Depress the tension arm release button, Item 6, Figure 5.1 and release the platen lock, as shown in Figure 5.4.

CAUTION If the diluent tube tension arm is not released and the pump platen unlocked, the life of the tubes will be drastically reduced.

21. Shutdown the flame photometer as detailed in the relevant instruction manual.

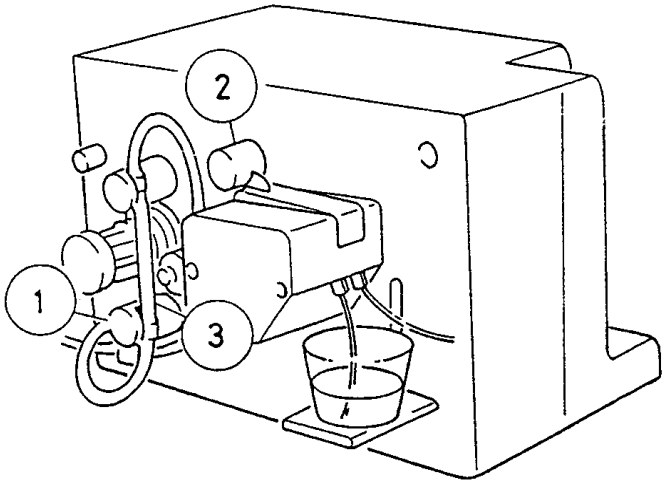


Figure 5.4 Model 806 Dilutor Shutdown

1. Diluent tube tension arm (released), 2. Platen lock (released),
3. Diluent pump tube.

6
Operational Precautions and Hazards

6.1 Operational Precautions

1. Solutions aspirated into the Flame Photometers should contain a non-ionic wetting agent. To achieve this add a minimum of 1 part Diluent Concentrate to 999 parts deionised or good quality distilled water and store in the diluent container. (See section 2.2 for more on this).
2. When used with minimum volume samples, it is imperative that fibrous or solid substances are not present. If samples containing fibrous or solid substances are routinely processed, use a large sample volume and adjust the sample lift height so that the sample constrictor does not reach the bottom of the beaker. This will help to prevent blockages in the constrictor.
3. To prevent the build-up of protein it is recommended that Enzymatic Cleaning Solution is used each week. Cloudy or partially opaque samples can be an indication of protein precipitation.
4. Make sure that genuine Sherwood Scientific reagents and supplies are used.
5. Do not leave the diluent pump tube tensioned or the platen locked down unless the Model 806 is on. If the platen is inadvertently left locked down for more than 20 minutes, with the Model 806 switched off, Sherwood Scientific recommends that that the pump tubes are replaced to maintain performance.
6. Make sure that the routine maintenance procedures are carried out at the intervals stated in Section 7.
7. Do not leave standard solutions exposed to the atmosphere, as losses due to evaporation will affect the concentration of the solution and the accuracy of results.

6.2 Hazards

1. All electrical equipment is potentially hazardous. Do not remove the cover from the Model 806, unless it is disconnected from the power supply.
2. When used in a Pathology Laboratory, all samples should be treated with the caution accorded to those known to contain pathogenic organisms. Gloves should be worn, and cleaning of component parts of the Model 806 such as the tubing, beakers, manifold block, weir and drain tubing should all be carried out using Tubing Disinfectant. Refer to procedure detailed in Section 7.4.
3. Do not move the Model 806 while a beaker is in position on the sample lift.

7

Maintenance

7.1 General

This maintenance schedule covers the Model 806 Dilutor only. Flame Photometer manuals should be referred to for their maintenance instructions, which must be carried out in addition to those listed in this section.

The Weekly and Monthly Maintenance sections are summaries of the work and the equipment required. The tasks are detailed in Section 7.4 onwards, together with tasks that are part of the six monthly routine service. These procedures have been included as they might be required when using the Troubleshooting Guide.

Refer to Section 9 for ordering information and Catalogue Numbers of parts used for maintenance. These parts are listed, for each operation, under Equipment Required.

WARNING When used in a Pathology Laboratory, cleaning of component parts of the Model 806 such as tubing, beakers, manifold block, weir and drain tubing should be carried out using Tubing Disinfectant. Refer to procedure detailed in Section 7.4.

NOTE The Daily maintenance is detailed in the Shutdown procedure.

7.2 Weekly

EQUIPMENT REQUIRED: - Enzymatic Cleaner.

1. Deproteinise the system, Section 7.4.

7.3 Monthly

EQUIPMENT REQUIRED: - As for Weekly maintenance,
plus dilutor pump tubes (and pump rollers for alternate tube changes); diluent filter and ‘O’ ring seal, if required.

1. Deproteinise the system.
2. Change pump tubes, (and pump rollers for alternate tube changes), Section 7.5.
3. Clean manifold block, Section 7.7.
4. Clean diluent container.
5. Check diluent filter, and ‘O’ ring seal. Clean or replace as necessary, Section 7.8.
6. Clean pump platen and rollers, Section 7.9.

7.4 Deproteinising or Disinfecting Procedure

NOTE To Deproteinise the system use Enzymatic Cleaner; to disinfect the system, use Tubing Disinfectant.

EQUIPMENT REQUIRED:- Enzymatic Cleaner or Tubing Disinfectant.

1. Switch on the flame photometer and compressor, and light the flame, as detailed in the flame photometer manuals.
2. Swing the diluent tube tension arm clockwise until it engages with the catch, Item 1, Figure 5.1, and set the platen lock to the locked position, as shown in Figure 5.1, Item 2.
3. Release the tube clamp on the diluent supply tube and remove the tube from the diluent container.
4. Switch on the dilutor, and allow the diluent tube to empty. Switch off the dilutor.
5. Close the clamp on the diluent supply tube and depress the tension arm release button.
6. Fill a beaker with Enzymatic Cleaning Solution or Tubing Disinfectant, and place it on the sample lift.
7. Raise the sample lift so that both sample constrictors are immersed to a depth that will give 10 minutes supply of solution.
8. Switch on the dilutor and allow 10 minutes for the solution to completely Deproteinise or disinfect the system.
9. After 10 minutes lower the sample lift and remove the beaker.
10. Release the tube clamp on the diluent supply tube and replace the tube in the diluent container. Swing the diluent tube tension arm clockwise until it engages with the catch.
11. Flush both sample pump tubes with deionised water for 2 minutes.

7.5 Changing Pump Tubes and Rollers

EQUIPMENT REQUIRED: - Tubing Disinfectant; diluent pump tube; sample pump tubes; pump rollers (alternate pump tube changes).

1. Using Tubing Disinfectant, disinfect the system as detailed in Section 7.4.
2. Switch off the dilutor.
3. Close the clamp on the diluent supply tube. Raise the pump platen, as shown in Figure 7.1.
4. Disconnect the tube from the steel connector at the bottom of the manifold block, Item 4, Figure 7.1.
5. Unclip the manifold block from the rear wire and remove it from the front wire. Disconnect the two manifold pump tubes and remove them from the dilutor.
6. Take the Orange coded sample pump tube and insert the end that measures 70 mm to the identifying clip, into the hole on the platen assembly, Item 1, Figure 7.2.
7. Fit the end to the connector on the manifold block, so that the pump tube is across the front of the rollers. Make sure that Orange coded pump tubes are fitted up to the shoulder on the connector.

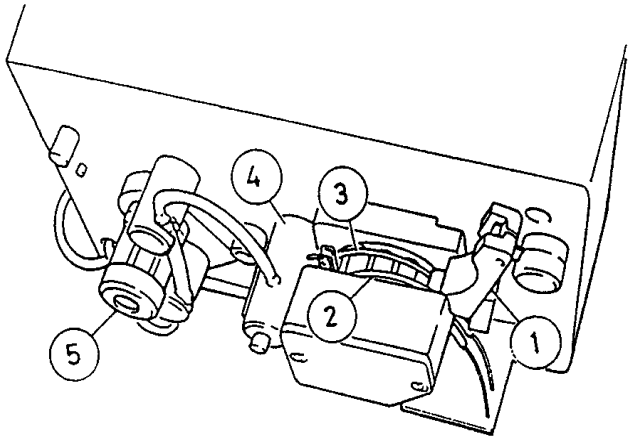


Figure 7.1 Changing Pump Tubes

1. Pump platen raised, 2. Orange coded (Na/K) sample pump tube, 3. Red coded (Li) sample pump tube, 4. Manifold block, 5. Pump roller retainer.

Maintenance continued

7.5 Changing Pump Tubes and Rollers continued

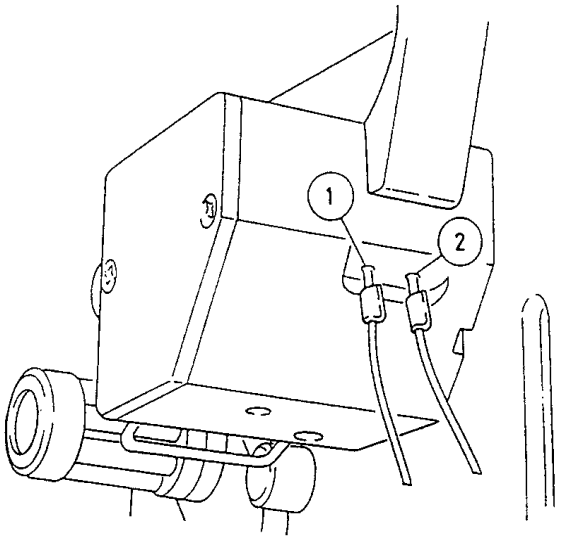


Figure 7.2 Inserting Pump Tubes

1. Orange coded (Na/K) sample pump tube, 2. Red coded (Li) sample pump tube.

8. Feed the 70 mm end of the Red coded sample pump tube through the hole in the platen assembly, Item 2, Figure 7.2, and fit it to the connector on the manifold block, refer to Item 3, Figure 7.1. Make sure that Red coded pump tubes are fitted up to the manifold block i.e. on the shoulder.
9. Cut the ends off the sample pump tubes, if necessary. Fit the appropriate constrictor 3 mm into the end of each sample pump tube by inserting the end that is cut at a 45^0C angle.
10. Fit the manifold block on to the wire support by first locating it on the front wire and then clipping it on to the back wire.
11. Unclip the diluent pump tube from the fixed arm and tension arm.
12. Disconnect the two tubes from the ends of the diluent pump tube.

NOTE If the pump rollers are to be replaced (every other tube change) continue with paragraph 13. If not, continue with paragraph 16.

13. Hold the rotor, to prevent it turning, and unscrew the pump roller retainer, Item 5, Figure 7.1.
14. Remove the four pump rollers, Item 2, Figure 7.3.
15. Fit four new pump rollers and refit the pump roller retainer.

NOTE Do not lubricate the pump rollers as they are impregnated with special oil that will not react with the diluent pump tube.

16. Fit the diluent supply tubing to the new diluent pump tube and fit that end to the tension arm. Fit the other end to the fixed arm and connect the tubing to the manifold block.

7.5 Changing Pump Tubes and Rollers continued

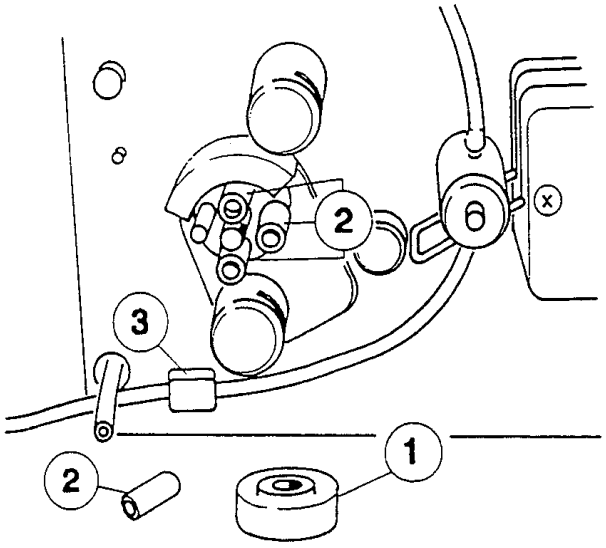


Figure 7.3 Fitting Pump Rollers

1. Pump roller retainer. 2, Pump rollers. 3, Outlet tube guide.

7.6 Checking Pump Flow Rates

EQUIPMENT REQUIRED: - Measuring cylinders, (2 ml capacity for an Orange coded pump tube and 50 ml capacity for the diluent pump tube); beaker, 10 ml capacity for a Red coded pump tube; beaker, 500 ml; sample beaker.

The following procedure details a method for measuring the flow rates of the three pump tubes. The small bore sample tubes are measured over 10 minutes to give a more accurate result, while the diluent pump tube is measured over one minute.

1. Using Tubing Disinfectant, disinfect the system as detailed in Section 7.4.
2. Switch off the dilutor.
3. Disconnect the dilutor outlet tube (Item 12, Figure 7.4) from the weir assembly and place the end in a 500 ml beaker.

Maintenance continued

7.6 Checking Pump Flow Rates continued

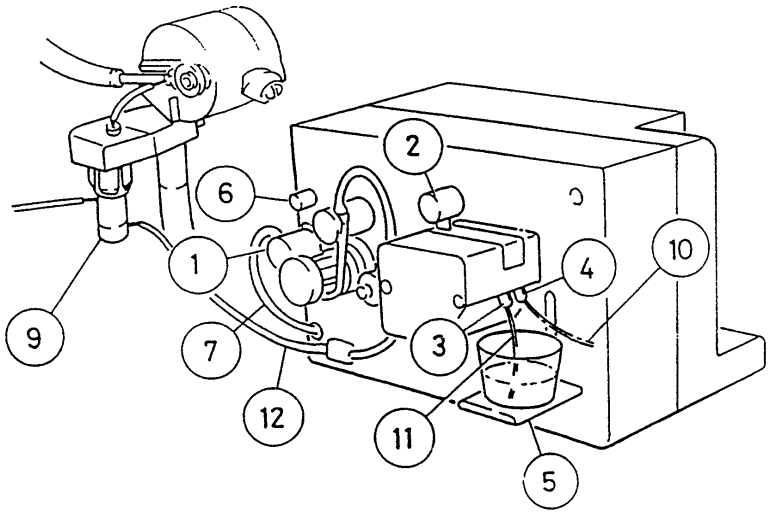


Figure 7.4 Model 806 Dilutor Operating (shown with closed weir assembly).

1. Diluent tube tension arm, 2. Platen lock,
3. Orange (Na/K) sample pump tube identifier,
4. Red (Li) sample pump tube identifier, 5. Sample lift,
6. Tension arm release button, 7. Diluent supply tubing,
9. Weir assembly, 10. Li constrictor or internal reference tube,
11. Na/K constrictor, 12. Dilutor outlet tube to weir assembly.

4. Place both sample constrictors in a beaker containing deionised water.
5. Fill the 2 ml measuring cylinder to the mark with deionised water. Fill the 10 ml beaker with deionised water and weigh it.
6. Release the clamp fitted to the diluent supply tubing.
7. If necessary, swing the diluent tube tension arm clockwise until it engages with the catch, Item 1, Figure 7.4 and set the platen lock to the locked position, as shown in Figure 7.4, Item 2.
8. Switch on the dilutor.
9. Run the dilutor for one minute so that the pump tubes and manifold block are primed.
10. Switch off the dilutor.
11. Place the Orange tube sample constrictor into the 2 ml measuring cylinder and the Red tube sample constrictor into the 10 ml beaker.
12. Switch on the dilutor and run it for an accurately timed 10 minutes. Make sure that both constrictors remain immersed in water during the 10 minute measurement period.

7.6 Checking Pump Flow Rates continued

13. During the 10 minutes, fill the 50 ml measuring cylinder to the mark with deionised water.
14. Remove the end of the diluent supply tube from the diluent container and place in the 50 ml measuring cylinder. Measure the decrease in volume over a period of one minute. Note the result.
15. At the end of 10 minutes, switch off the dilutor and carefully withdraw the sample constrictors so that any droplets are left in the beakers.
16. Note the amount of water pumped by the Orange pump tube from the measuring cylinder. Reweigh the 10 ml beaker and calculate the flow rate of the Red pump tube.
17. Release the platen lock, Item 2, and depress the tension arm release button, Item 6, Figure 7.4.
18. Divide the diluent tube flow rate by 1/10 of the Orange coded sample tube flow rate (equivalent to the flow rate for one minute), note the result.
19. Divide the diluent tube flow rate by 1/10 of the Red coded sample tube flow rate and note the result.
20. Check that the results are within specification for the appropriate colour coded tube, Orange: - 166 to 300; Red: - 25 to 100.
21. If any result is outside the stated limits, replace all pump tubes as detailed in Section 7.5. If new pump tubes have been fitted check that:-

    - the diluent filter is clean, Section 7.8.
    - the manifold block is not obstructed, Section 7.7.
    - the orifice is not damaged. Check by replacing the orifice.

22. Refit the dilutor outlet tube to the weir assembly.

7.7 Cleaning the Manifold Block

EQUIPMENT REQUIRED: - Dilutor cleaning wire; Enzymatic Cleaner; Tubing Disinfectant; wash bottle; brush.

1. Using Tubing Disinfectant, disinfect the system as detailed in Section 7.4.
2. Switch off the dilutor.
3. Raise the pump platen. Unclip the manifold block from the rear wire and remove it from the font wire, Item 4, Figure 7.1.
4. Disconnect both pump tubes and the inlet and outlet tubes from the manifold block.

CAUTION In the following paragraph; note that the knurled screw retains a spring, which is under compression.

5. Unscrew the knurled screw in the end of the manifold block.

Maintenance continued

7.7 Cleaning the Manifold Block continued

6. Remove the spring, (Item 3, Figure 7.5) and tap out the Orifice (Item 4, Figure 7.5). Be careful that it does not roll away and that the small ‘O’ ring, (Item 5, Figure 7.5) beyond it is not lost, although it will probably remain in the manifold block.

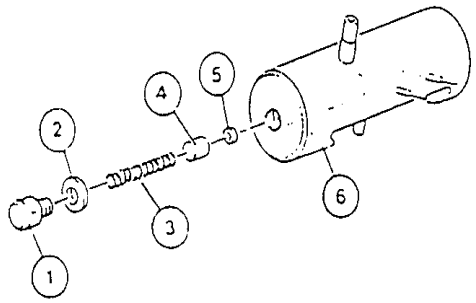


Figure 7.5 Manifold block

1. Knurled screw, 2. ‘O’ ring, 3. Spring, 4. Orifice, 5. Small ‘O’ ring, 6. Manifold block.

7. Check that the orifice is clear of debris. Pass a cleaning wire (Cat. No. 100 99 010) through it and rinse in a jet of water from a wash bottle. Do not use larger wire or the jewel may be chipped.
8. Clean the spring with a brush, if necessary.
9. Pass a dilutor cleaning wire through all channels in the block. To remove stubborn protein deposits soak the block in Enzymatic Cleaning Solution. Then rinse thoroughly in deionised water.
10. Check if ‘O’ rings are worn and replace as necessary.
11. When reassembling, check that the small ‘O’ ring is lying flat in the end of the diluent channel.
12. Insert the orifice into the channel so that the orifice end (the smaller hole) rests on the ‘O’ ring.
13. Insert the spring and hold it in place by tightening the knurled screw in the end of the block. The screw must be fitted with an ‘O’ ring seal, Item 2, Figure 7.5.
14. Replace the tubes on the manifold block and reassemble to the dilutor.
15. Check the pump flow rates as detailed in Section 7.6.

7.8 Cleaning or Replacing the Diluent Filter

Metal Filter Type

EQUIPMENT REQUIRED: - Diluent filter ‘O’ ring seal, if required.

1. Swing the diluent tube tension arm clockwise, Item 1, figure 7.4, until it engages with the catch. Release the tube clamp on the diluent supply tube.
2. Switch on the Dilutor.
3. Remove the tube from the diluent container and allow the dilutor to empty the diluent tube.
4. Switch off the dilutor.
5. Remove the diluent filter from the diluent supply tubing.
6. Use a syringe to force Enzymatic Cleaning Solution through the filter and soak the filter in the solution overnight, if required.
7. Rinse the Enzymatic Cleaning Solution from the filter with deionised water before re-fitting.
10. Place the diluent supply tube in the diluent container and switch on the dilutor.

Plastic Filter Type

EQUIPMENT REQUIRED: - Diluent filter ‘O’ ring seal, if required.

1. Swing the diluent tube tension arm clockwise, Item 1, figure 7.4, until it engages with the catch. Release the tube clamp on the diluent supply tube.
2. Switch on the Dilutor.
3. Remove the tube from the diluent container and allow the dilutor to empty the diluent tube.
4. Switch off the dilutor.
5. Remove the diluent filter from the diluent supply tubing.
6. Unscrew the two parts of the filter. Remove the gauze and the ‘O’ ring seal.
7. Scrub the gauze, to remove any particulate matter.
8. Inspect the ‘O’ ring seal and replace if necessary.
9. Reassemble the diluent filter and refit to the diluent supply tubing. Make sure that either the arrow is pointing in the direction of flow or that the *outlet* is connected to the tube that goes to the dilutor.
10. Place the diluent supply tube in the diluent container and switch on the dilutor.
11. Check that air is not entering the filter by examining the tube for air bubbles. If necessary, tighten the end of the filter or replace the ‘O’ ring.

7.9 Cleaning the Pump Platen and Rollers

EQUIPMENT REQUIRED: - Soft, lint-free cloth; iso-propanol; Tubing Disinfectant; Tissues.

1. Using Tubing Disinfectant, disinfect the system as detailed in Section 7.4.
2. Switch off the dilutor.
3. Raise the pump platen, as shown in Figure 7.1.
4. Disconnect the two sample pump tubes, Items 2 and 3, Figure 7.1, from the manifold block and withdraw them from the pump assembly.

IMPORTANT If oil is present on the rollers, use tissues and carry out paragraph 5. If dirt and plasticiser are present, *moisten* the cloth with iso-propanol and carry out paragraph 5. *Do not* use an excessive amount of iso-propanol on the cloth, as it could remove the grease from the roller bearings and cause them to fail.

5. Switch on the dilutor and clean the pump rollers and platen.
6. Switch off the dilutor.
7. Clean the underside of the pump platen using the cloth moistened with iso-propanol.
8. Refit the two pump tubes to the manifold block, as detailed in Section 7.5, paragraphs 6, 7 and 8.

8

Troubleshooting

8.1 Troubleshooting Guide

The Troubleshooting Guide is intended to help customer's clear specific faults on the Model 806 dilutor as quickly as possible.

The charts are arranged as a series of questions with only two possible answers, Yes or No. If the answer is Yes, you move down the chart to the next question. If the answer is No, you move to the right, across the chart, to the next question. References are given to other sections of this manual for setting up and supplementary information. The charts are not exhaustive, but in the majority of cases will save you time, especially if your experience of the Model 806 Dilutor is limited.

There are three charts; the first deals with general problems, while the other two relate to specific faults.

The following is a list of the charts:-

CHART NO.	TITLE
1	General problems.
2	Pump flow rates incorrect.
3	Unstable readings.

CHART No.1

General Problems

IF FAULT PERSISTS, CONTACT YOUR SHERWOOD SCIENTIFIC DISTRIBUTOR

NOTE If fault is present when dilutor is not in use, refer to Flame Photometer Instruction Manual.

Are pump flow Rates correct? NO → Refer to Chart 2.

YES

Are the readings On the flame Photometer Stable? NO → Refer to Chart 3.

YES

Is diluent Container Contaminated? NO → Is sample constrictor clear? NO → Refer to Section 5.3 paragraph 14.

YES → YES

Rinse with fresh Deionised water Before refilling.

Do samples contain debris? NO → Are any tubes pinched or crushed? NO → Check flame photometer with prediluted samples.

YES → YES

Check for blockages In manifold block and pump tubes and refer to Section 6.1 paragraph 2.

Change all suspect tubing.

CHART No.2.

Pump Flow Rates Incorrect

IF FAULT PERSISTS, CONTACT YOUR SHERWOOD SCIENTIFIC DISTRIBUTOR

NOTE If fault is present when dilutor is not in use, refer to Model 410 Instruction Manual.

Are pump flow rates correct? (Section 7.6)	Is pump platen locked down? Figure 5.1, Item 2.	NO	The pump platen must be locked down, refer Section 5.3.
YES	YES		
Refer Chart 1.	Are the correct colour coded pump tubes fitted? (Orange 1 in 200 or Red 1 in 50).	NO	Fit the correct colour coded tubes, Section 7.5.
	YES		
	Is the manifold block free to slide on the wire support?	NO	Fit correctly to wire support, Section 7.5, paragraph 10.
	YES		
	Is the diluent filter blocked or allowing air to leak into the diluent supply?	NO	Clean manifold block (Section 7.7).
	YES		
	Refer Section 7.8.		

CHART No.3.

Unstable Reading

IF FAULT PERSISTS, CONTACT YOUR SHERWOOD SCIENTIFIC DISTRIBUTOR

NOTE If fault is present when dilutor is not in use, refer to Model 410 Instruction Manual.

Are the readings on the flame photometer stable? NO

YES

Refer Chart 1

Is the manifold block free to slide on the wire support? NO

YES

Is the diluent filter blocked or allowing air to leak into the diluent supply. NO

YES

Refer Section 7.8.

Fit correctly to wire support, Section 7.5, paragraph 10.

Are the pump tubes fitted correctly to the manifold block connectors? NO

Refer to Section 7.5 paragraphs 7 and 8.

YES

Are the manifold pump rollers free of oil? NO

Replace both sample pump tubes (Section 7.5) and clean pump rollers (Section 7.9)

YES

Has the routine maintenance been carried out? NO

Carry out monthly maintenance, refer Section 7.3.

YES

Is Diluent Concentrate present In diluent supply? NO

Add 1 part Diluent Concentrate to 999 parts deionised water. Refer Section 6.1, Paragraph 1.

YES

Check flame photometer with prediluted samples.

9

Spares and Accessories

9.1 Ordering Information

When ordering spares or accessories for the Model 806, please give the following information to your Sherwood Scientific distributor: -

Model 806 Serial No.
Catalogue No. of part required (Cat. No.)
Description Quantity required.

This will help us to deal quickly and efficiently with your order.

The number shown in the third column (Quantity) is the quantity of items that are supplied against the stated catalogue No. If the quantity is greater than 1, then only multiples of that quantity can be supplied.

9.2 Spares and Accessories

Cat. No.	Description	Quantity
449 06 001	Diluent filter, complete	1
001 31 063	'O' ring seal, for diluent filter	1
800 09 010	Open Weir Assembly	1
800 15 006	Open Weir Holder Assembly	1
800 15 001	Retrofit Kit, Open Weir & Holder Assembly for Flames upto #20584 & from #28016 to #29886	1
800 15 007	Retrofit Kit, Open Weir, Holder Assembly & Constant Head & Drain for Flames #20585 to #28015	1
001 08 503	"Y"-Piece for Drain Tube	1
800 72 002	Open Weir Drain Tube	1
400 72 002	Drain Tube – CH&D to 'Y'	1
001 72 107	Diluent supply tubing	per metre
001 72 001	Tubing, for manifold block inlet and outlet	per metre
100 99 010	Cleaning wire, pack of 3	1 pack
800 09 004	Roller, for diluent pump tube rotor, pack of 12	1 pack
800 09 002	Diluent pump tube, pack of 3	1 pack
800 09 005	Na/K sample tube, Orange, 1 in 200, pack of 3	1 pack
800 09 006	Lithium Internal Reference tubing, pack of 3	1 pack
800 09 007	Constrictor, for Na/K sample tube, pack of 10	1 pack
800 09 008	Li sample tube, Red, 1 in 50, pack of 3	1 pack
800 09 009	Constrictor, for Li sample tube, pack of 10	1 pack
800 07 001	Manifold block	1
001 06 102	Tube clamp, for diluent supply tubing	1
001 53 315	Universal Mains Adaptor	1

9.2 Spares and Accessories

Cat. No.	Description	Quantity
001 26 074	Disposable sample cups, 1ml, pack of 1000	1 pack
001 26 033	Disposable sample cups, 20ml, pack of 50	1 pack

NOTE The following items are spares for the manifold block.

001 03 011	Thumbscrew	1
001 21 054	Spring	1
449 04 008	Orifice	1
001 31 060	‘O’ ring, small, orifice seal	1
001 31 058	‘O’ ring, thumbscrew seal	1

9.3 Solutions

Cat. No.	Description	Quantity
001 56 100	Standard Solution, 140.0mmol/l Na, 5.00mmol/l, 1.5mmol/l Li, 100 ml	1 bottle
001 56 184	Cleaning Solution, 500 ml	1 bottle
001 56 182	Enzymatic Cleaner, pack of 6 x 5g sachet	1 pack
001 56 603	Solution 3 Molar Lithium , pack of 6 x 100 ml	1 pack
001 56 681	Diluent Concentrate, 6 x 100 ml	1 pack
001 56 682	Tubing Disinfectant, 6 x 100 ml	1 pack
001 56 601	Solution, 10,000ppm Cs, 6 x 100 ml	1 Pack
001 56 160	Solution, 160.0 mmol/l Na, 8.00 mmol/l K, 100 ml	1 bottle

Addendum:
Retrofit Open Weir Assembly

If you have an older flame photometer (serial number 29886 or earlier) that you wish to add a new Dilutor to, you will require an Open Weir Retrofit Support Bracket (800 15 002), Fig..A1, in addition to the Open Weir Support Assembly 800 15 000 included with the new Dilutor.

If you have an old Flame Photometer and Old Dilutor and you have decided to replace your Closed Weir Cup assembly with the Open Weir Assembly you will require 800 15 001.

Fig. A1

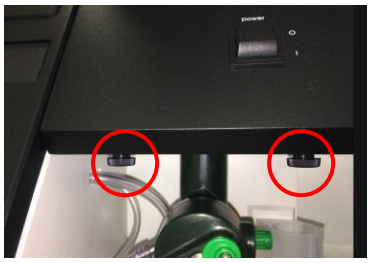


Fig. A2

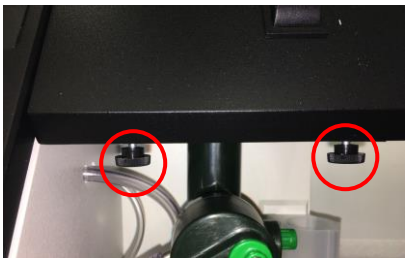
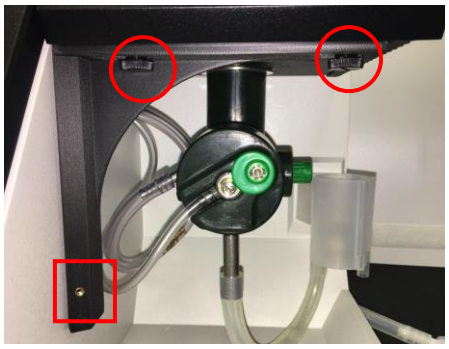
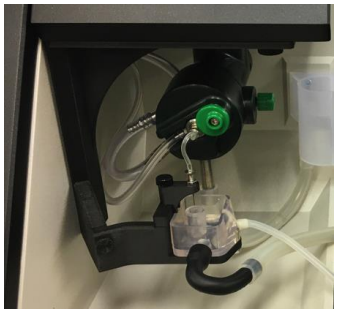


Fig. A3

Locate the two chimney retaining thumbscrews at the front of the flame photometer Fig. A2 and unscrew them but not completely Fig. A3.



Offer up the Retrofit Support Bracket (800 15 002) so the holes go over the thumbscrew heads and then push to the left so the slots move around the thumbscrew threads and the left side of the bracket sits against the left sidewall of the sample area moulding. Gently tighten the thumbscrews to hold the bracket securely in place. Push the locating lugs of the combined Open Weir and Open Weir Holder Assembly (800 15 000) into the two holes in the mounting block and then turn the retaining screw to locate it in the central threaded bush (red square above) and tighten to finger tight only to fix the weir assembly in place. The assembly will look as per the picture below once finished.



Sherwood Scientific Limited
Product Warranty Statement

Warranty Term: 12 Months

Sherwood Scientific Ltd (Sherwood) warrants, subject to the conditions itemised within this document, through either Sherwood personnel or personnel of its authorised distributors, to repair or replace free of all charges, including labour, any part of this product which fails within the warranty time specified above, appertaining to this particular product. Such failure must have occurred because of a defect in material or workmanship and not have occurred as a result of operation of the product other than in accordance with procedures described in the instructions furnished with this product.

Conditions and specific exceptions that apply to the above statement are as follows:

1. End-user warranty time commences on the date of the delivery of product to end-user premises.

2. 'Free of all charges' statement applies only in areas recognised by Sherwood as being serviced either directly by its own personnel, or indirectly through personnel of an authorised distributor. Products purchased outside these areas requiring service during the warranty period will incur charges relative to the travel/transit costs involved. However, products purchased in such areas will be serviced during the warranty period free of all charges providing they are returned, carriage paid, to either Sherwood or by pre-arrangement to an authorised Sherwood distributor.

3. All maintenance (other than operator maintenance as described in the instructions), repairs or modifications have been made by Sherwood or Sherwood authorised personnel.

4. This product has where applicable been operated using Sherwood specified supplies and reagents.

5. Sherwood reserves the right to make any changes in the design or construction of future products of this type at any time, without incurring any obligation to make any changes whatsoever to this particular product.

6. Reagents, supplies, consumables, accessories and user maintenance items are not included in this warranty.

7. Repairs or replacement of any part failing due to abnormal conditions including the following, are excluded from this warranty:
   a) Flood, lightning, earthquake, tornado, hurricane, or any other natural or man-made disaster.
   b) Fire, bombing, armed conflict, malicious mischief or sprinkler damage.
   c) Physical abuse, misuse, sabotage or electrical surge.
   d) Damage incurred in moving the product to another location.

Product Warranty Statement (continued)

8. User agrees to permit Sherwood personnel or personnel of its authorised distributor to make changes in the product which do not affect results obtained, but do improve product reliability.

Representations and warranties purporting to be on behalf of Sherwood made by any person, including distributors and representatives of Sherwood, which are inconsistent or in conflict with the terms of this warranty (including but not limited to the limitations of the liability of Sherwood as set forth above), shall not be binding upon Sherwood unless reduced to writing and approved by an officer of Sherwood Scientific Ltd.

Except for the obligations specifically set forth in this warranty statement, in no event shall Sherwood be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort or any other legal theory and whether advised of the possibility of such damages.

Neither Sherwood nor any of its third party suppliers makes any other warranty of any kind, whether expressed or implied, with respect to Sherwood Products.

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