

# **POOL OPERATING MANUAL**

**June 28, 2012**

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## POOL OPERATING MANUAL

### 1. Pool Water Levels

The water level in the pool must be maintained at or above the mid-height of the highest of the two pool skimmer inlets. If the water level drops below a skimmer inlet, air will enter the pump and damage the pump. If necessary stop the pump and put extra freshwater in the pool.

### 2. Start of Pump and Filters after Pool Filling

*Note:* This section of the manual is to be read in conjunction with Attachment A Pool Pipework Diagrams.

Check that all isolating valves (A, B, C, D and E as shown in Attachment A) are correctly set to allow flow from the skimmers to the trailer, through the pump, through the filters, through the heat pump and then 50/50 split through the on-line chlorinator and then to the pool return nozzles.

Check whether the basket on the trailer is filled with water by viewing through the clear plastic lid. If it is not filled with water, remove the basket lid and this should allow some water to flow through the pipes into the basket. Otherwise, pour some water into the basket so there will be water available to prime the pump and then reclose the basket.

Start the pump. The water flow will surge several times initially until all air has been purged from the system. An incorrectly seated basket in a pool skimmer can cause air to enter the pumping system. Removing and then reseating these may assist if the system is having some trouble expelling all of the air.

### 3. Start of Heat Pump after Pool Filling

Ensure that the water pump is running and that air is purged from the system.

Switch on the heat pump at the large switch on the trailer power board. A green light will appear on the heat pump control panel.

Do not touch the “SET” button on the heat pump panel. This is for technician use only. If the “SET” button has been inadvertently pushed, do not touch it again. After a delay it will automatically reset to the original settings for this pool.

After a delay of 2 minutes, the heat pump fan will start.

The temperature indicated on the heat pump panel normally displays the actual pool water temperature. Use the buttons with the up or down arrows on the heat pump panel to adjust the temperature to the required 28 degrees C. The panel will temporarily show the desired temperature that you have entered and then revert to showing the actual water temperature. However, the heat pump controls will remember the temperature that you have entered. If you wish to see the temperature that you have entered, press an up or down arrow button and the entered temperature will be displayed temporarily again. (The Ultra Model heat pump requires both arrow buttons to be pressed simultaneously before the temperature can be altered)

After a few minutes the heat pump compressor will start and a red light will appear on the control panel indicating that the heating has started.

#### **4. Subsequent Stopping and Starting of Pump**

The pump can usually be stopped and started without any need for further air purging from the system. The heat pump should always be turned off when the water pump is off.

#### **5. Subsequent Stopping, Starting and Operation of Heat Pump**

Restarting is as for 3. above.

#### **6. Electricity Conservation Measures**

The electricity used in the heat pump is the largest operating cost item for the pool.

The most effective cost saving measure is to always put the pool cover on the pool when it is not in use.

The school may elect to minimise electricity consumption by keeping the pool setting to the minimum recommended internationally, which is 28 degrees C.

Other measures could include switching off the heat pump overnight or at weekends. The timing of the restart of the heat pump must take account of the time needed to return the pool to the desired temperature for swimming lessons. The school would have to determine the best regime by experimentation.

See section B2 for details on setting the timer for the Heat Pump.

#### **7. Pool Chemical Treatment**

The School is responsible for ensuring the health of the pool users by correctly maintaining the pool treatment. Written records of the pool water testing must be kept to demonstrate that the treatment has been maintained correctly.

The pool water is treated by:

- In line chlorinator on the pool trailer and,
- Manually testing and adding additional chemicals to supplement the treatment.

The in line chlorinator requires the addition of chlorine tablets from time to time. Up to 5 tablets may be placed in the chlorinator at a time. Twice per week, open the chlorinator and add more tablets. To open the chlorinator, the water pump and the heat pump must be stopped and valves A and B must be operated to isolate the chlorinator as shown on the 3<sup>rd</sup> page of Attachment A. Make sure the tablets do not press down on the internal tube when screwing back the chlorinator top. After restocking the chlorinator with chlorine pills, return the valves A and B to their original positions as shown on the first page of Attachment A and restart the water pump and heat pump.

For the instructions on manually testing and adding additional chemicals refer to the water testing and treatment instructions included in Attachment C.

#### **8. Faecal Incident**

In the event of a known faecal discharge into the pool, all pupils must leave the pool immediately and shower if shower facilities are available.

All of the visible faecal material must be scooped out of the pool immediately.

Instructions regarding the remaining action to be taken are given in Attachment D

## 9. Microbiological Testing

Microbiological testing of the pool water must be carried out twice per school term. The first test should be after 4 weeks of use and the second test after 8 weeks of use.

For schools in the Auckland region– Watercare Services Laboratory will take the samples and carry out the tests.

For schools outside Auckland – samples are taken by the schools in accordance with a prescribed procedure, packed with ice in a disposable chilly bin and couriered to Watercare Services Laboratory for testing.

The tests will be per Table 4 of NZS 5826:2010 (pg 22).

The school must contact Watercare Services Laboratory (N (Neb) Svrzikapa)), Ph (09) 538 7600 to arrange this.

The results are to be sent to PoolsiNSchoolZ and the school.

Please contact either David Brown Ph 021 594715 or Ian Calhaem (09) 579 0512, 021 936785 if you require any further information.

## 10. Backwash of Filters

To ensure that the water in the pool is treated correctly and ensure the maximum life of the filter media, it is necessary to backwash the filters regularly.

It is recommended to back water the filters once per week to keep the filters clean and thus minimise the use of chemicals – it only takes a few minutes.

To carry out a backwash do the following:

- Connect the flexible hose that is provided on the trailer to the waste connection on the side of the trailer. Direct the hose to a grassed area or to a sewer sump. The backwash water should not go into a stormwater sump.
- Stop the heat pump and then the water pump.
- Change the valve settings that are on top of the filter bodies from “Filter” position to “Backwash” position (Refer to page A-6 of Attachment A for the diagram that shows the valves correctly set to the backwash position).
- It is recommended to clean one filter at a time. i.e. change the left hand valve to :Backwash” leaving the other set to “Filter”.
- Start the pump and water will pump out of the waste pipe. Continue the backwash until waste water runs clear. While backwashing, check that the water level in the pool does not drop below either of the skimmer inlets. If necessary, stop the pump and add freshwater to the pool.
- When the backwash has reduced the filter pressure gauge readings to the start-up readings (about 90kPa), stop the pump and change the right hand filter to “Backwash” and return the left filter to “Filter”. Restart the pump and clean the second filter. Finally return the right hand valve on top of the filter body to the original setting for filter operation and restart the pump and the heat pump.
- Add fresh water to the pool to bring the water level to about mid-height on the highest of the two pool skimmer inlets.

## 11. Units fitted with Cyclone Filters

Some trailers are fitted with a cyclone filter between the water pump and the sand filters. This is to remove the larger particles before they enter the sand filter, so

minimising the need to backwash. When the sight glass shows a build up of dirt, place a bucket under the outlet and open the tap till approximately 1 bucket full is removed. Leave the water pump running.

## **12. Cleaning Pool Baskets**

There are baskets in each pool skimmer box (pool outlet) and a basket in the pool trailer to collect hair and debris. These must be checked daily and cleaned sufficiently frequently to have a minimal accumulation of hair. The hair affects the chemical content of the pool water passing through it and increases the amount of chlorine dosing that is required for the pool.

The pump and heat pump should be stopped before cleaning these baskets. To clean the basket on the trailer valve C must also be closed as shown on 4<sup>th</sup> page of Attachment A. Remember to reopen this valve before restarting the pump.

## **13. Pool Gates**

To comply with pool safety regulations, the pool gates are equipped with self-closing springs on the hinges. The gates must self-close when released at an opening of 100 mm. When not in use gates must be kept closed and should never be tied open.

It is suggested that the gates are not locked, because it is suspected that unauthorised individuals may try to gain access to the pool by slashing the cover when they find that the gates are locked.

## **14. Steps to Access Pool Platform**

The lower set of steps is part of a pool-safety compliant fence giving a second barrier to small children entering the pool (the first barrier is the pool marquee and gates). These are hinged so that they can be raised and locked in the up position to act as a gate. The steps should be put in the raised position when each class finishes in the pool to guard against unsupervised entry to the pool by small children. It is particularly important to leave the steps in the raised position when the last class of the day leaves the pool.

## **15. Mat under Feet of Pool Steps**

A black rubber mat is provided to go on the bottom of the pool under the feet of the pool entry steps. It is important to have this in place to prevent the feet of the steps damaging the pool liner. Check frequently to ensure that this mat is in place.

## **16. Vacuum Cleaning of the Pool Floor**

The pool floor should be cleaned from time to time to remove build-up of dirt that settles to the pool floor. An automatic pool vacuum cleaner is provided by Pools iN SchoolZ for sharing amongst a group of schools. Arrangements should be made to ensure that one of these vacuum cleaners is brought to your school for use. Contact Pools iN SchoolZ to arrange to borrow a vacuum.

Inside the vacuum cleaner is a dirt collection bag, similar to that found on ordinary household vacuum cleaners. Remove this bag from the unit and clean it. Then reinstall the bag.

The pool vacuum cleaner is electrically driven. The power supply cable should be plugged into the power outlet on the pool trailer switchboard. It is best to feed the electric cable into the pool from the end furthest from the pool entry steps, otherwise the cleaner may tangle the slack cable around the steps. Feed the electric cable into

the pool without tangles. Tie the electric cable to a pool upright at a length which just allows the vacuum cleaner to reach the far end of the pool and not go under the steps.

Before switching on the power, hold the vacuum cleaner head underwater in the inverted position to allow air to escape. If the air is retained, the head will not sink to the bottom of the pool. Lower the vacuum cleaner head to the bottom and switch on the power. The cleaner head should then automatically rove around the pool.

Three hours operation should be sufficient to clean the pool bottom. If left running the vacuum cleaner will automatically stop after 3 hours.

## **17. Marquee Cover Tension**

Ensure that the marquee top cover tension is maintained. A loose cover will flap excessively in the wind and chaff and develop holes where it rubs against the marquee frames.

When looseness in the top cover is detected, tighten in the following order:

First, untie and tighten the four choke ropes (perimeter tapes) that are in the ends of both coves to pull the cover down between the butted end frames and over the outer end frames and retie. These must be very tight. If necessary place a foot on choke rope and pump the foot to gain extra tension.

Second, check and tighten all ratchet straps at the bottom edges of the cover.

## **18. Security Camera Operation**

The security camera inside the trailer will operate continuously provided that it is connected to the electrical socket on the trailer switchboard.

When the camera detects movement, it will turn to the area of movement and follow the movement. At night the light on the camera will also operate.

In the event of wanting to view the recording made by the camera, contact Pools iN SchoolZ

## **19. Safety Horn**

An air-powered safety horn is supplied to be kept in the pool marquee. It is recharged after use with the supplied air pump.

This is to provide a means for a teacher to summon extra help in the event of an incident occurring in the pool which prevents the teacher from leaving the pool, for example while assisting a pupil in difficulties.

The school must arrange a signalling procedure for use of the horn and instruct school staff in the agreed procedure.

## **20. Cleaning Pool Carpets**

If it is desired to clean the carpets, they may be cleaned in-situ when they are on asphalt or concrete surfaces. The cleaning may be carried out by distributing detergent or shampoo on the carpet and hosing with a low pressure waterblast or with a handheld hose and broom. Excess water can be removed from these with a wet vacuum cleaner or squeegee.

## **21. Care of Life Vests**

At the end of each swimming day, the life vests should be washed in fresh water (not pool water) and hung to dry. This is required to obtain maximum life from the vests and minimise the build-up of chlorine in them.



## 22. Common Problems and Solutions

- Air bubbles on pool surface in vicinity of eye balls
  - This is usually caused by one of the baskets in the pool skimmers becoming dislodged and allowing air to be sucked in.

Solution:

  - Reseat the skimmer basket and the bubbles will disappear in about 1 min.
  - If the problem reoccurs then the baskets can be held down with a rounded pebble. Make sure the pebble is larger than the hole in the bottom of the skimmer.
- Chlorine level drops quickly
  - This is usually caused by hair in the baskets.

Solution:

Remove hair from baskets per Section 11 and the plumbing diagram on page A-5.

  - Chlorine is normally maintained by the TriChlor tablets in the inline chlorinator. If the tablets have been used up the chlorine will drop throughout the day.

Solution:

  - Add more TriChlor tablets to the inline chlorinator. Refer to Section 7 and the plumbing diagram on page A 4.
- Heat Pump has a thick layer of ice on the back and sides
  - A light frosting of ice is normal. The Heat Pump periodically switches to defrost mode to blow hot air onto the ice to melt it.

A thick layer of ice is abnormal.

To remove the ice, switch off the Heat Pump and hose the ice with water at normal temperature. When the ice has melted turn on the Heat Pump again. If the problem persists call PoolsiNSchoolZ for advice.
- Heat Pump shows an error code and shuts down
  - The Heat Pump is intelligent and has a number of built in features to shut the pump down in the event of a problem. The most likely problem is a lack of water which will result in a low flow error.

Solution:

  - Refer to the plumbing diagram on page A2.
  - Check ALL the valves as any one will cause a low flow error.
  - Each valve should be pointing in the direction shown in diagram A1.
- Pressure on Filters higher than normal > 100pa

Solution:

  - Check all valves as above.
  - Check water is flowing out of the skimmers and is being returned through the eyeballs
  - If the first 2 checks are OK then you will need to backwash as discussed in section 10.

### **23. Contact Details for Help**

In the event of help with understanding the operating instructions for the pool or rectifying any malfunction of the pool, please contact:

In the first instance:

Ian Calhaem  
[Ian.Calhaem@Hunterville.org](mailto:Ian.Calhaem@Hunterville.org)  
Ph: 09 579-0512  
Mob: 021 936-785  
Fax: 099 579-0510

If Ian Calhaem is not available please contact:

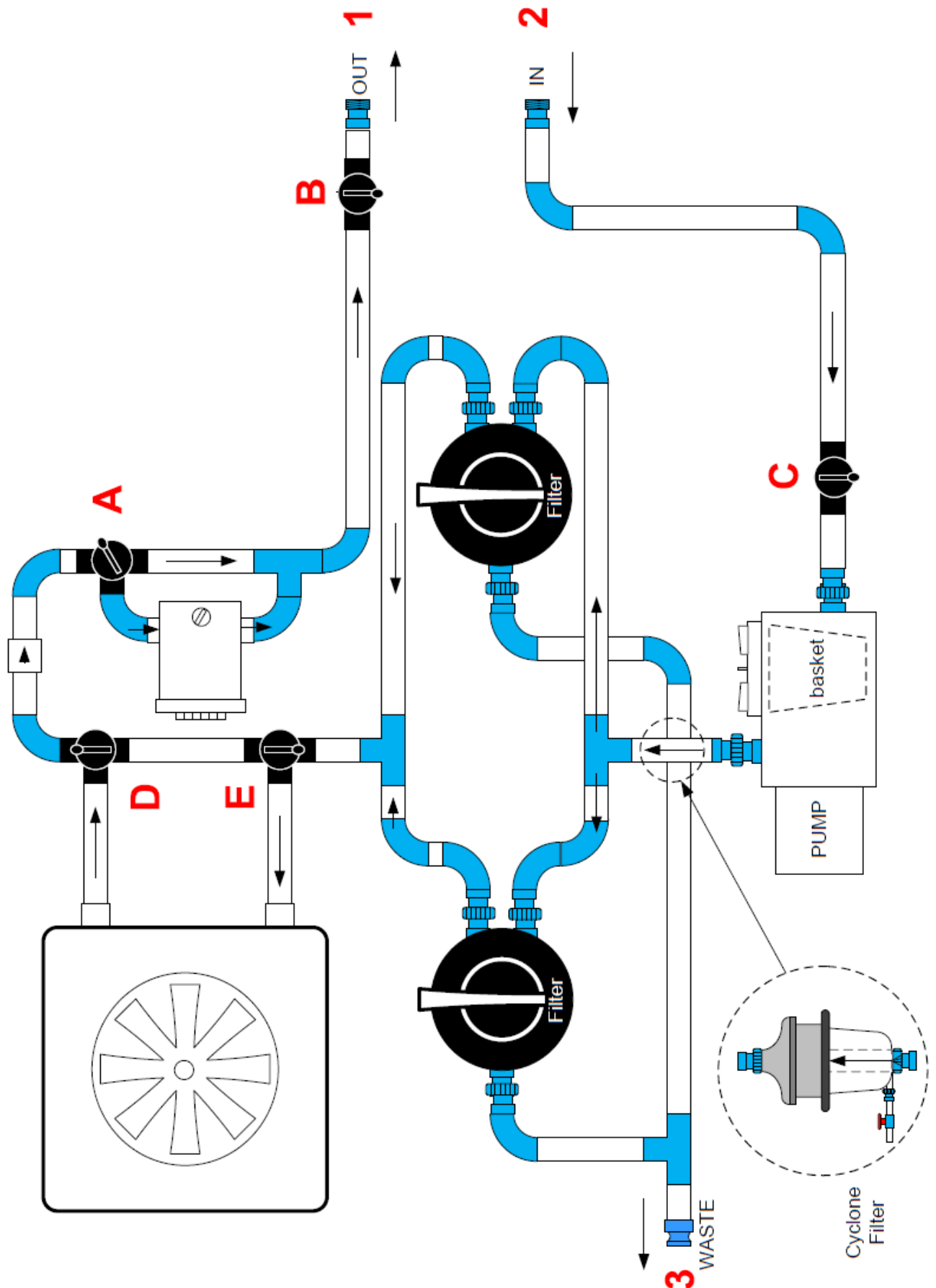
David Brown  
[david.brown@poolsinschoolz.com](mailto:david.brown@poolsinschoolz.com)  
Mob: 021 594715

Or

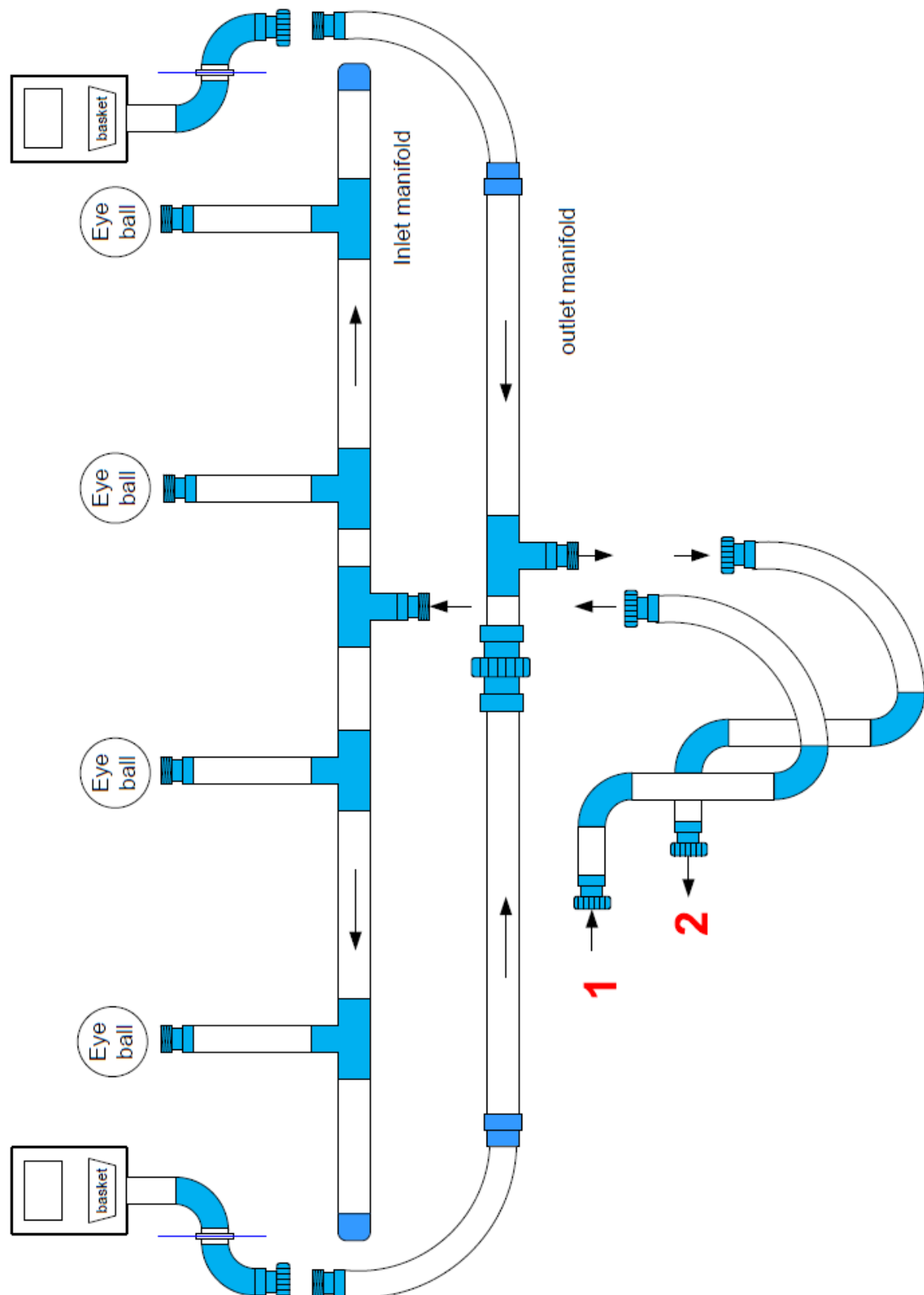
Graham Barker  
[graham@PoolsiNSchoolZ.com](mailto:graham@PoolsiNSchoolZ.com)  
Ph: 09 528 3634  
Mob: 021 528364

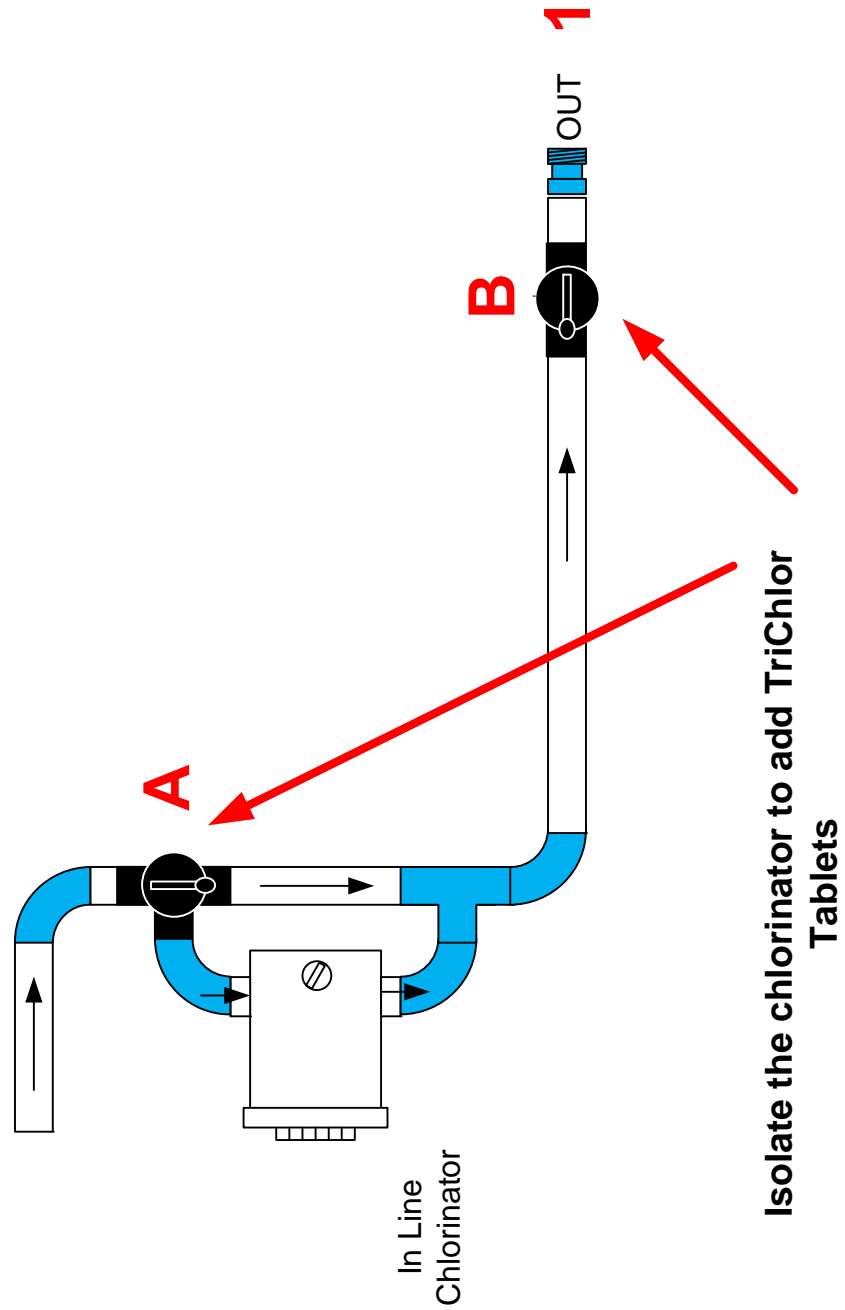
**Attachment A**

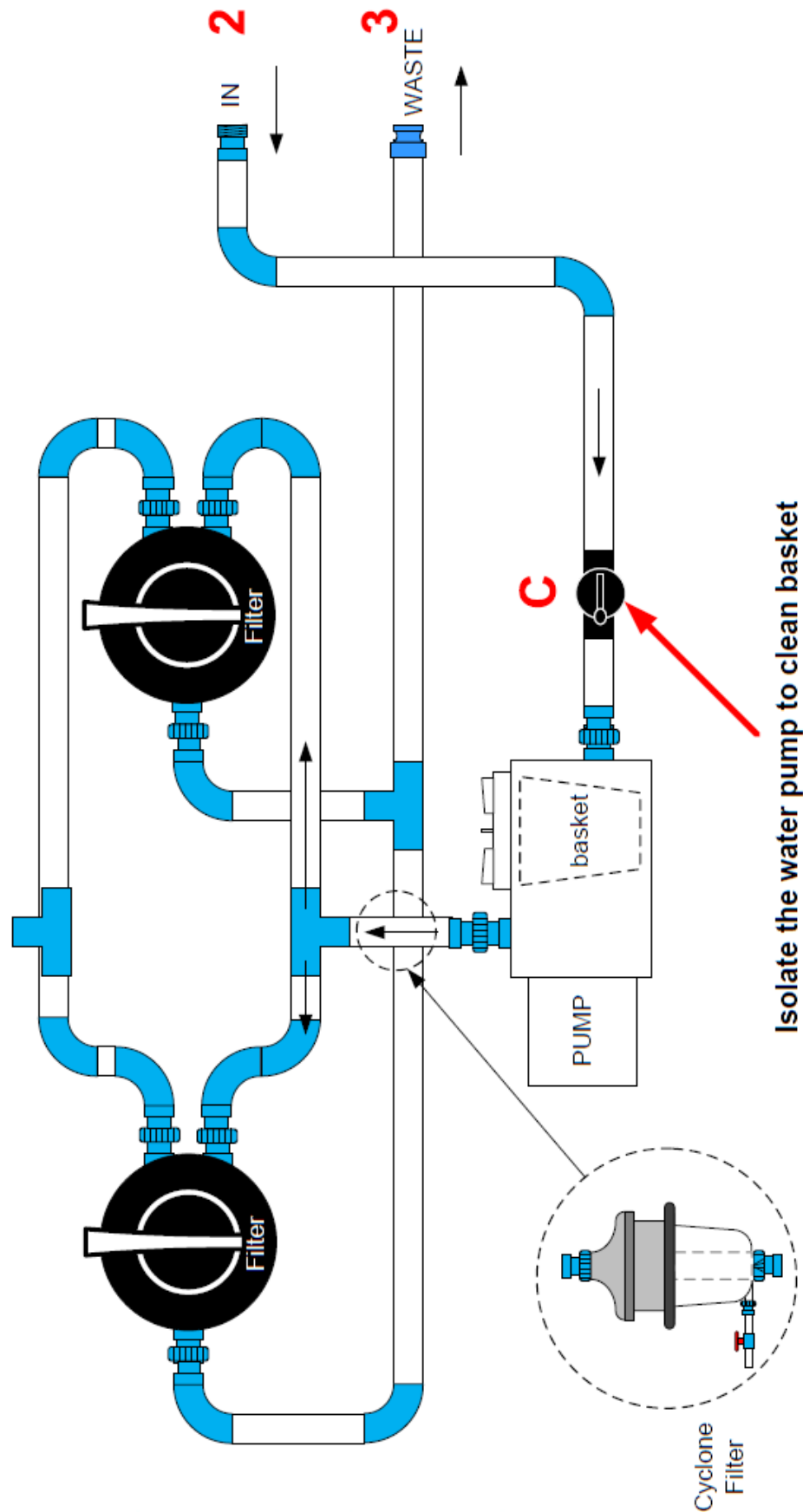
**POOL PIPEWORK DIAGRAMS**

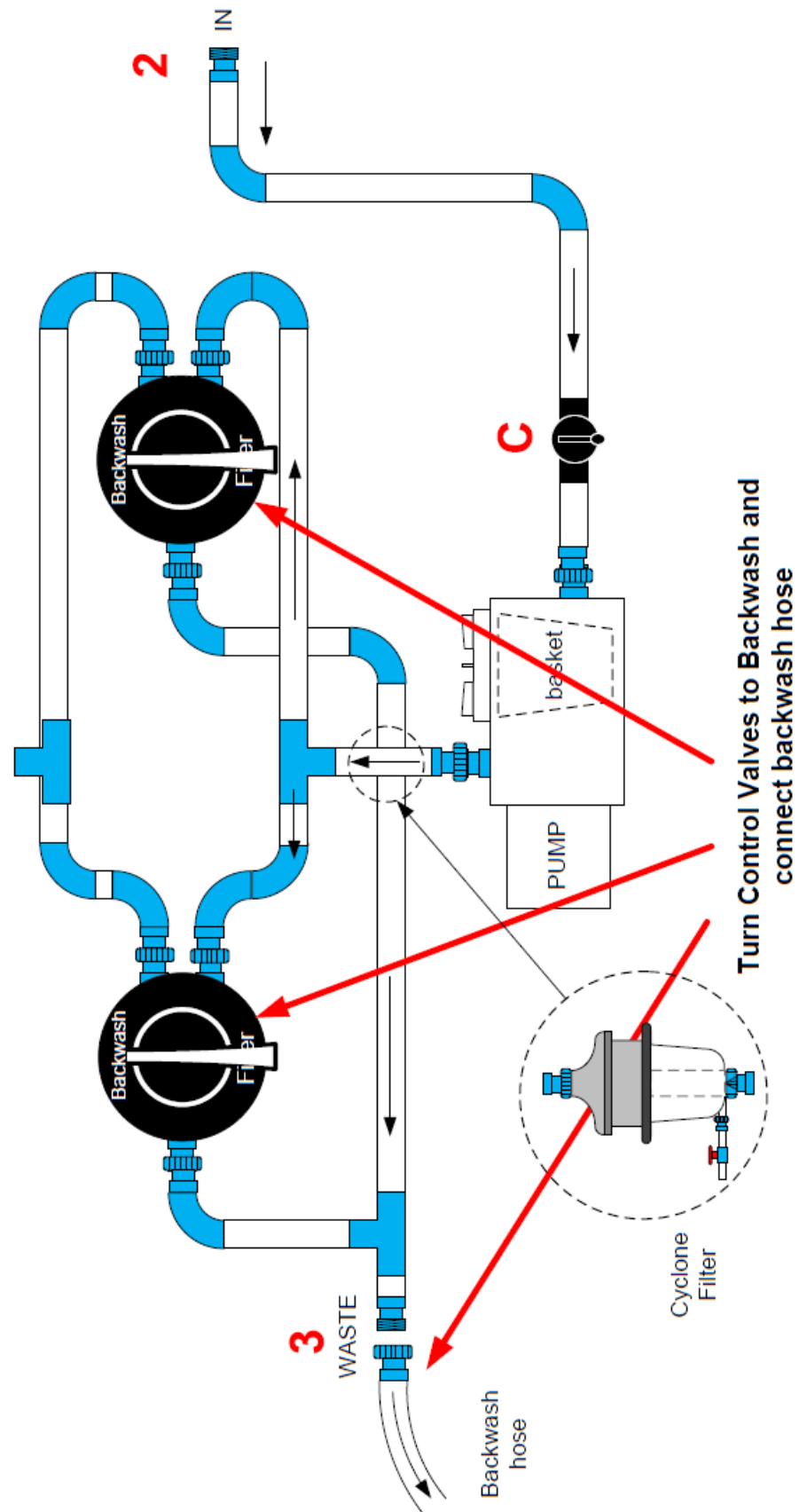


# Pools iN SchoolZ











## Attachment B

### POWER SUPPLIES

Most PoolsiNSchoolZ Pools are powered by a single phase 32 amps supply which is the same as used by the Dental and Life Education vans.

PoolsiNSchoolZ pools installed in the South Island are fitted with a larger capacity heat pump which requires a 3 phase 32 amp supply. These are identified by a 5 pin socket instead of the 3 pin socket used for the single phase.

It is very important that the outlet is protected with a Residual Current Device (RCD) and this is a legal requirement as the output is in a “damp” environment. i.e. is outside. We have discovered some installations that do not have this RCD fitted on the School power board but it can and **must** be retrofitted before the Pool is plugged in.

The trailer power supply has its own RCD protection fitted, and MK II single phase and all three phase trailers are also fitted with an Energy meter and a timer which will allow the heat pump to be turned off during the night to save power.

Each PoolsiNSchoolZ trailer is supplied with a Certificate of Compliance.

- B2 Operation of the timer
- B3 Single Phase electrical board layout MK I
- B4 Single Phase electrical board layout MK II
- B5 Three Phase electrical Board layout

## TIMER

The timing unit is a simple mechanical design. It consists of a rotating disc with a series of tabs that can be moved sideways to cover the red markers. When the red markers are covered the power to the heat pump is off. At the bottom of the timer is a vertical switch to override the timing tabs.

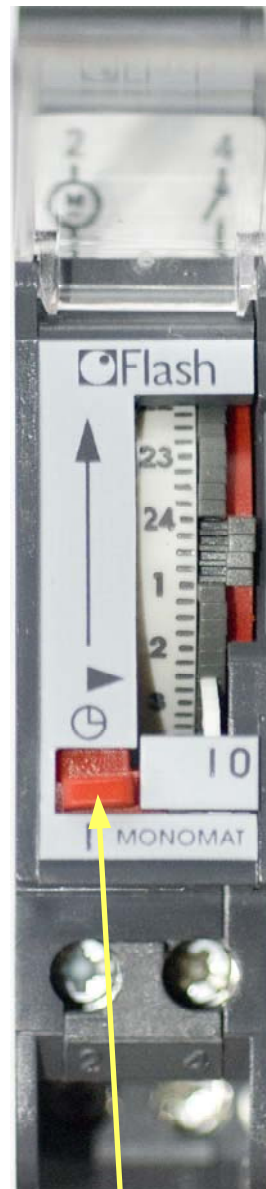
The water pump runs continuously to maintain the chemical balance of the pool water.



Red zone  
indicates ON

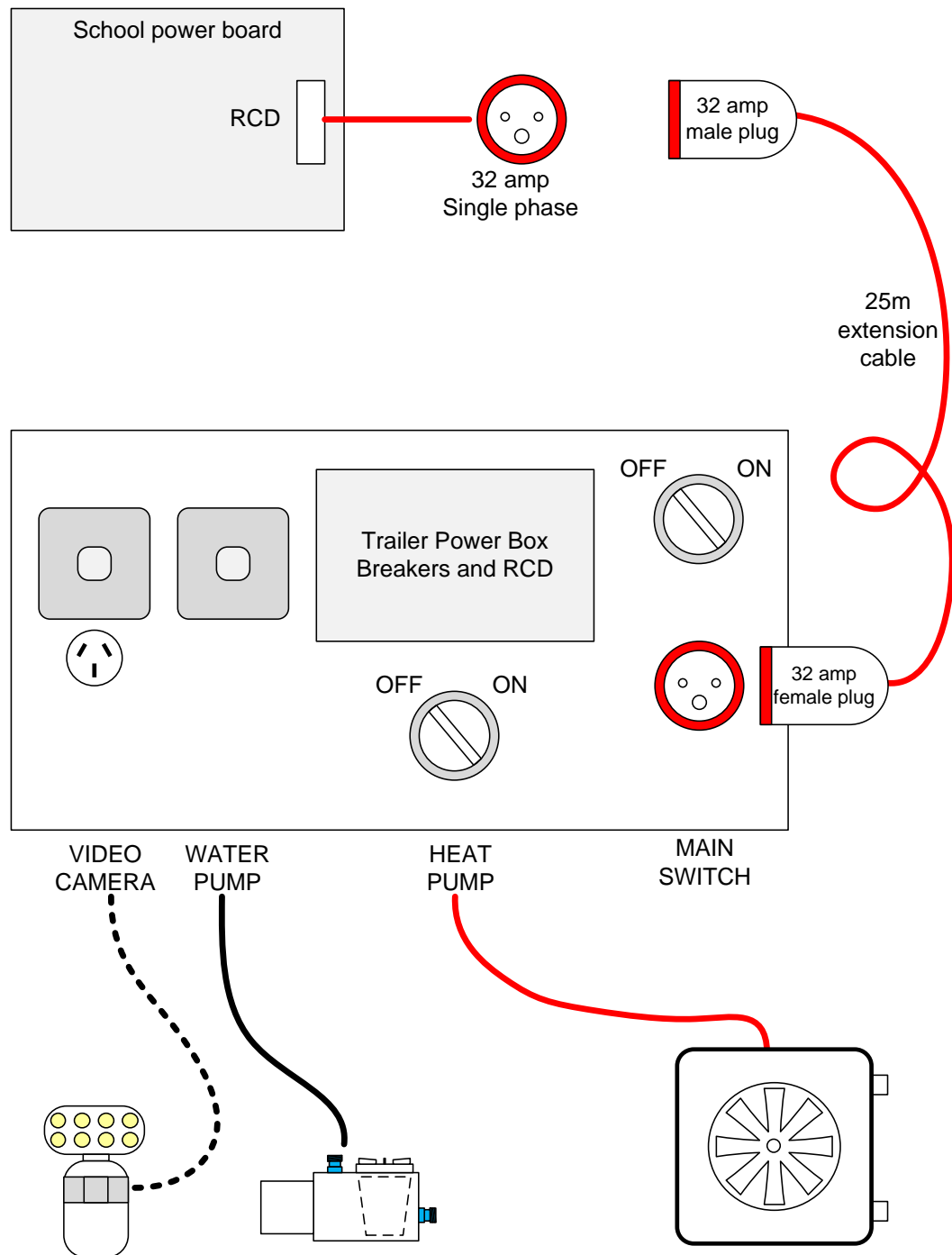


OFF from  
midnight until  
1:00am

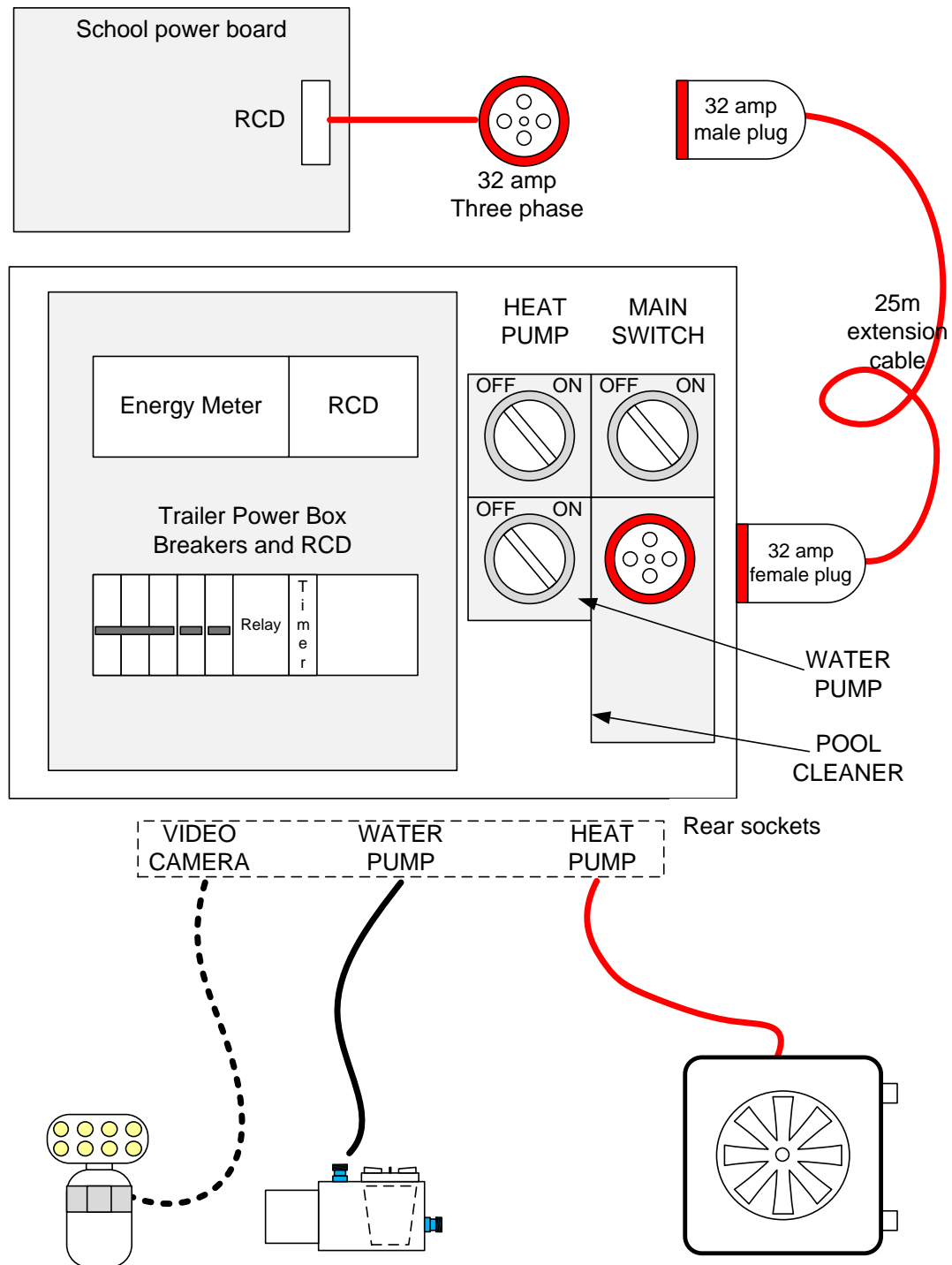


Override switch  
ON

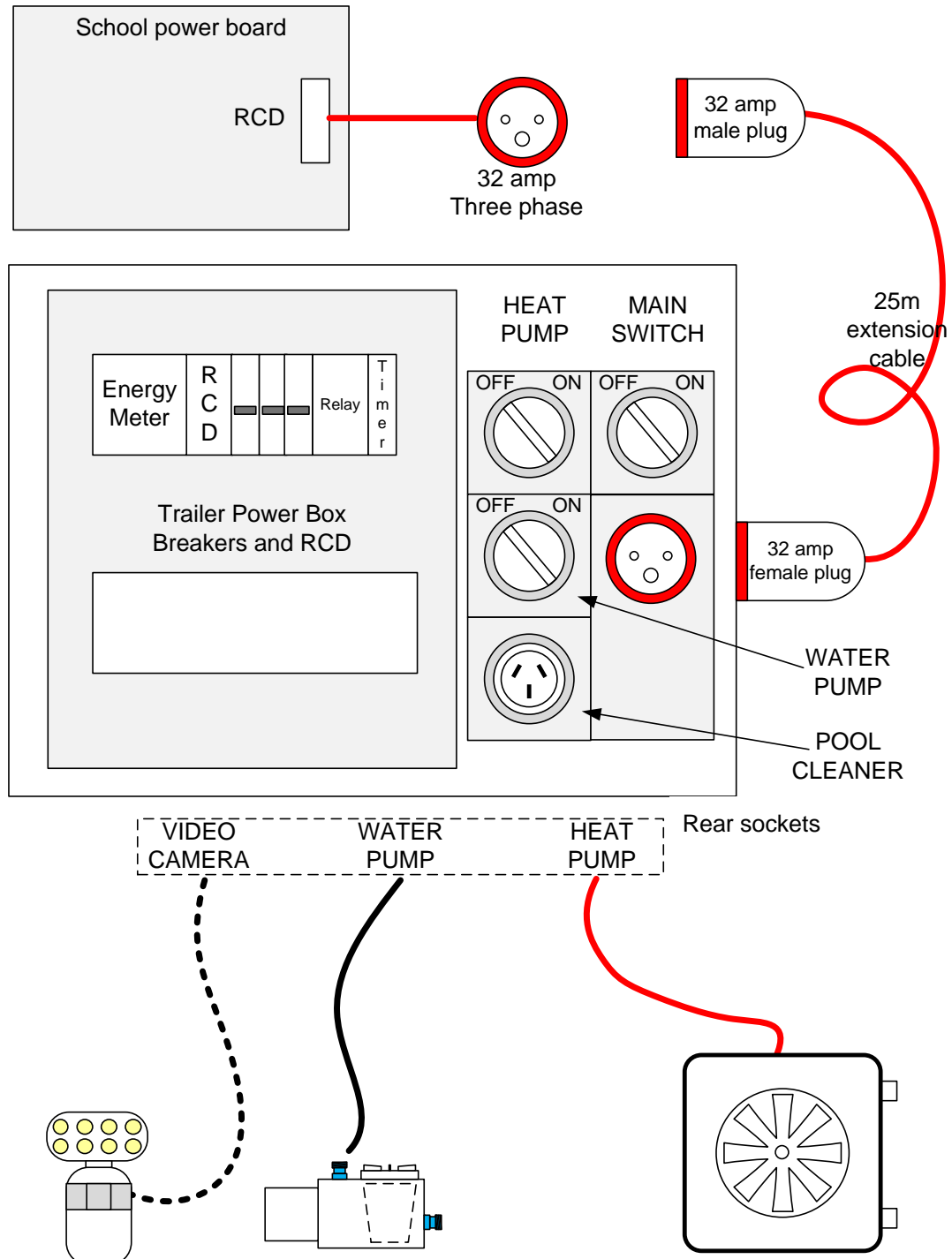
## Single Phase Mk I



## Single Phase Mk II



## Three Phase



## Attachment C

### CHEMISTRY

Refer to the following Discussion, Calculation Tables, and Measuring instructions.

The cost of pool chemicals is the responsibility of the School, but PoolsiNSchoolZ has negotiated very competitive rates for pools chemicals.

This has enabled us to bulk supply each school with a starter chemical kit that should last for the term, apart from the liquid chlorine which has a limited shelf life and needs to be replenished when required.

You can obtain additional chemicals by filling in the order form and emailing it to [Info@poolsinschools.com](mailto:Info@poolsinschools.com)

List A chemicals can be delivered anywhere in the country (additional freight charge), but chlorine products in List B have to be collected as they are classified as hazardous goods. (In Auckland TriChlor Tablets can be delivered with List A chemicals)

You may download<sup>1</sup> the Purchase Order Form from:

<http://www.poolsinschoolz.com/docs/PurchaseOrder.pdf>

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<sup>1</sup> Users of Mac Lion OS will need to download the file before they can view it as Lion browsers are not compatible with Acrobat forms.

## PURCHASE ORDER

P.O. Number

P.O. Date

Ordered By

Delivered

Address

Address

City

Zip Code

City

Zip Code

Country

Country

Phone Number

Phone Number

Fax number

Fax number

Contact Name

Contact Name

Email

Email

Description	Size	Quantity	Unit Price	Amount
<b>List A</b>				
Alkalinity Increase (Sodium Bicarbonate)	25 Kg	0	\$42.48	\$0.00
Hardness Increase (Calcium Chloride)	25 Kg	0	\$61.80	\$0.00
Ph Decrease (Sodium bisulphate)	25 Kg	0	\$78.60	\$0.00
Water Clarifier	1 litre	0	\$28.80	\$0.00
<b>List B</b>				
Liquid Chlorine *	20 litre	0	\$32.83	\$0.00
TriChlor Tablets **	50 x 200g	0	\$103.20	\$0.00
AquaChlor Granules** (equiv to 10l liquid chlorine)	2 Kg	0	\$15.00	\$0.00

\* Liquid Chlorine is supplied in a refillable container  
This may be swapped for a full container at:-

Pool Quip Limited    Pool Quip Limited    Pool Quip Limited  
282 Neilson St,        75 Apollo Drive        75 Blenheim Road  
Onehunga               North Shore             Christchurch

TOTAL	\$0.00
GST	
<b>GRAND TOTAL</b>	<b>\$0.00</b>

Pools iN SchoolZ will give you an order number to quote when we receive your order form

\*\* TriChlor tablets can be delivered in Auckland with List A chemicals. Outside Auckland please contact Pools iN SchoolZ

## Maintaining the chemistry in your PoolsiNSchoolZ pool

Your pool is 9.15 metres long, 5.2 metres wide, and 1 metre deep giving a volume of 47580 litres.

The temperature is maintained at 28 deg C by the heat pump.

When the pool is first filled it is important to adjust the hardness and total alkalinity of the water as this greatly assists in stabilising the chemistry and avoids large changes in pH and free Chlorine levels. Also when first filled it is important to shock dose the pool with chlorine to remove any initial bacteria.

When a pool has been balanced it is maintained by measuring and adjusting the free Chlorine and the pH levels on a daily basis (it is recommended to measure these 3 times a day if the pool is in heavy use as it is much easier to maintain a pool that is not too far away from the balance condition).

### **WARNING**

All chemicals should be treated with respect. They should be stored in a safe place away from other substances such as hydrocarbons (petrol, diesel, etc).

Dry chemicals should always be dissolved in water before being added to the pool, and liquids added to water to dilute them.

Acid must always be added to water NOT the other way round as it generates heat and could splash up into your face or on clothing.

### **Hardness**

The hardness of the pool is important as it also assists in maintaining the correct pH and Chlorine balance. Hardness is controlled by the addition of Calcium Chloride granules, which must be dissolved in water before use. The target hardness is **150 – 200 ppm**.

Adding calcium chloride which has a pH of 8.5 will also raise the pH of the pool.

Calcium chloride does not get used up in normal pool operation so once it is set should remain for the term and requires measuring say once a month. The only reason the hardness level will decrease is if there is a significant loss of water and the pool is topped up with soft tap water.

### **Alkalinity**

The alkalinity of the pool is important as it controls how quickly the pH of the pool changes when other chemicals are added. Is it controlled by adding Sodium Bicarbonate which is sometimes referred to as “pH Buffer” . The target alkalinity is **100-150 ppm**.

Adding Sodium bicarbonate (pH 9) will also raise the pH of the pool.



## pH

The pH is a measure of the acidity of the pool. A pH of 7.0 is neutral. Less than 7.0 is acidic and greater than 7.0 is alkaline. The target for the pH in the pool is slightly alkaline **7.2 to 7.6** is ideal.

The pH of the pool water is maintained by adding sodium bicarbonate (See note on alkalinity) which increases the pH.

Correcting the hardness by adding Calcium Chloride (see note on hardness) will also increase the pH value.

Both alkalinity and hardness should be changed gradually so that the pH can be monitored to ensure that it stays within the target range of 7.2 to 7.6. If it does exceed 7.6 then the pH can be reduced by the addition of Sodium bisulphate.

## Chlorine

Two measurements of chlorine are important.

- The free chlorine level (FCl) is a measure of the amount of chlorine available to sanitise the pool.
- The total Chlorine level (tCl) is a measure of both the free chlorine and the chlorine that has been used up in the sanitising process.

The used chlorine is chlorine that has been converted into Chloramines. It is the Chloramines that gives a pool a strong Chlorine smell and must be removed. Chloramines are removed by ADDING more chlorine to the pool.

As this pool is being heavily used the free chlorine levels should be kept high. Free chlorine is rapidly decreased by natural causes such as sunlight, and by the bather load.

The target free chlorine level is **4.0 – 6.0 ppm** with the total chlorine being the same indicating that there are no chloramines present. The total chlorine level should be maintained within 0.2 of the free chlorine level. i.e. if the free chlorine level is 5.0 the total chlorine level should be no more than 5.2.

In the **PoolsiNSchoolZ** pool the normal free chlorine level is maintained by the inline chlorinator mounted on the trailer. This has a dial which can be set to control the amount of chlorine added automatically to the pool. Once set it should maintain the free chlorine level at the correct value for the daily bather load. The inline chlorinator contains TriChlor tablets which dissolve very slowly. These tablets also contain another chemical – Cyanuric Acid which is added to stabilise the free chlorine and inhibit the depletion of the chlorine by sunlight.

Cyanuric acid gradually builds up in the pool over time and should be less than a maximum of 100ppm. This will not be a problem in the **PoolsiNSchoolZ** pool as it is refilled at the start of each term.

When the Chloramine level is high the chloramines must be removed. This is done by shock dosing the pool with a high level of free chlorine. When shock dosed the pool should not be used until the free chlorine level has returned to normal values (4 – 6 ppm). Shock dose by adding 2 litres of liquid chlorine and waiting at least an hour.

## Tables

The following tables have been calculated based on the volume of your pool (47580 litres). The tables tell you what to add to the pool to bring the pool back to a perfect condition. E.g. if the free chlorine level is measured as 2.0 ppm then from the tables below you must add either 621 cc of liquid chlorine or 105 gm of Aquachlor (dissolved in water) to bring the free chlorine level up to the minimum target of 4.0 ppm.

Raise Free  
Chlorine

Remove  
Chloramines

liquid chlorine [pH 13]			Aquachlor [pH 11]		(Total Chlorine higher than free Chlorine)		
fCl	liquid	volume	fCl	liquid	wt	liquid chlorine [pH 13]	
0.5	1090	cc	0.5	184	gm	tCl - fCl	Aquachlor [pH 11]
1.0	932	cc	1.0	158	gm	0.1	53 gm
1.5	776	cc	1.5	132	gm	0.2	105 gm
2.0	621	cc	2.0	105	gm	0.3	158 gm
2.5	466	cc	2.5	79	gm	0.4	211 gm
3.0	311	cc	3.0	53	gm	0.5	263 gm
3.5	155	cc	3.5	26	gm		

Target range ->

4.0 to 6.0 ppm

Less than free chlorine plus 0.2

## Tables

The following tables have been calculated based on the volume of your pool (47580 litres). The tables tell you what to add to the pool to bring the pool back to a perfect condition. E.g. if the free chlorine level is measured as 2.0 ppm then from the tables below you must add either 621 cc of liquid chlorine or 105 gm of Aquachlor (dissolved in water) to bring the free chlorine level up to the minimum target of 4.0 ppm.

Lowering  
Alkalinity

Raising  
Alkalinity

Raising  
Hardness

Lowering  
pH

Sodium bi Sulphate [pH 1.4]			Sodium Bicarbonate [pH 9]			Calcium Chloride [pH 8.5]			Sodium bisulphate [pH 1.4]		
Akl	quantity	wt	ppm	quantity	wt	ppm	quantity	Wt	pH	Acid	quantity
160	0.9	kg	50	3.4	kg	25	6.4	kg	7.7	93	gm
165	1.4	kg	60	2.7	kg	50	5.5	kg	7.8	185	gm
170	1.8	kg	70	2.0	kg	75	4.6	kg	7.9	278	gm
175	2.3	kg	80	1.4	kg	100	3.7	kg	8.0	371	gm
180	2.7	kg	90	0.7	kg	125	2.7	kg	8.1	463	gm
						150	1.8	kg	8.2	556	gm
						175	0.9	kg	8.3	649	gm

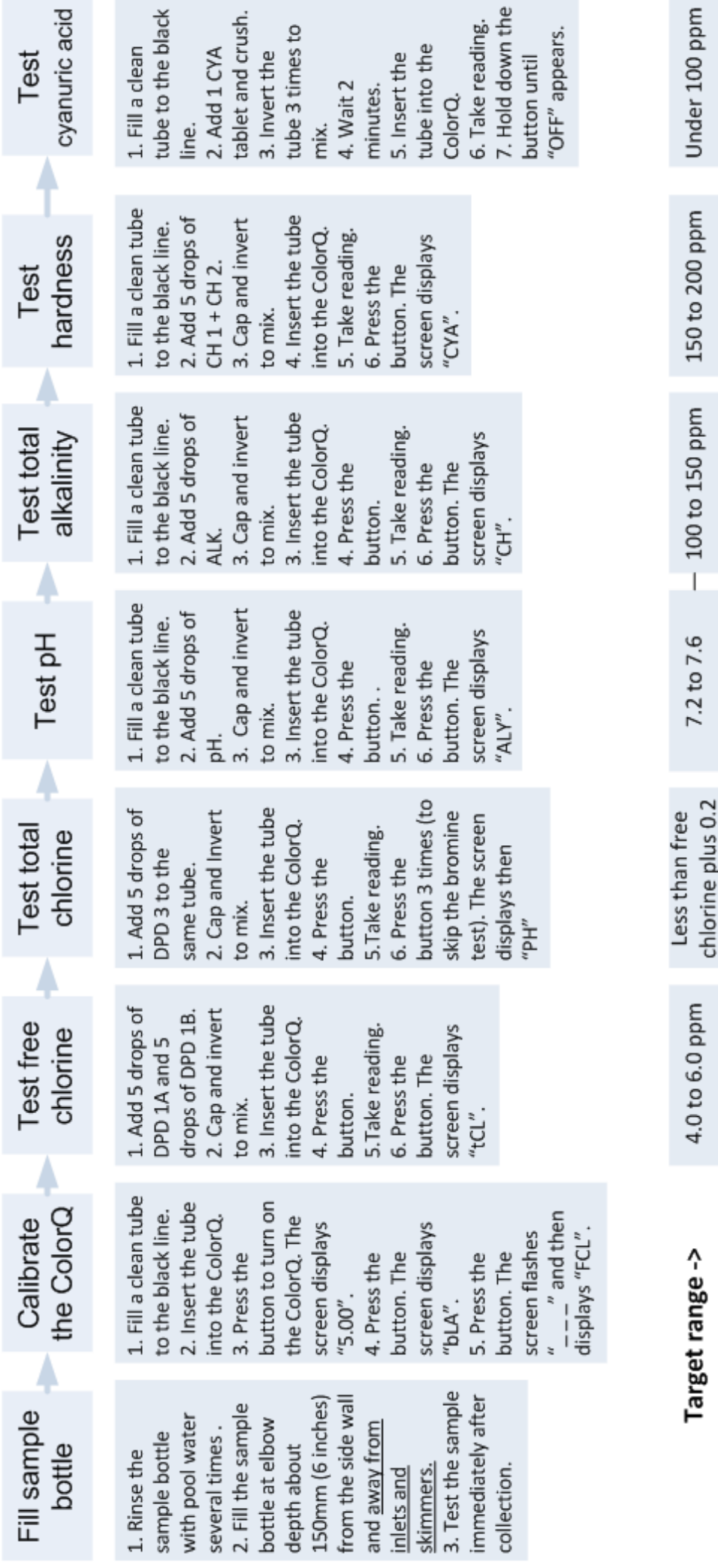
Target range ->

100 to 150 ppm

150 to 200 ppm

7.2 to 7.6

## ColorQ full test (once per week)



## ColorQ Quick test (3 times per day)

### Fill sample bottle

1. Rinse the sample bottle with pool water several times .
2. Fill the sample bottle at elbow depth about 150mm (6 inches) from the side wall and away from inlets and skimmers.
3. Test the sample immediately after collection.

### Calibrate the ColorQ

1. Fill a clean tube to the black line.
2. Insert the tube into the ColorQ.
3. Press the button to turn on the ColorQ. The screen displays "5.00".
4. Press the button. The screen displays "bLA".
5. Press the button. The screen flashes " --- " and then displays "FCL".

### Test free chlorine

1. Add 5 drops of DPD 1A and 5 drops of DPD 1B.
2. Cap and invert to mix.
3. Insert the tube into the ColorQ.
4. Press the button.
5. Take reading.
6. Press the button. The screen displays "tCL".

### Test total chlorine

1. Add 5 drops of DPD 3 to the same tube.
2. Cap and invert to mix.
3. Insert the tube into the ColorQ.
4. Press the button.
5. Take reading.
6. Press the button 3 times (to skip the bromine test). The screen displays then "PH".

### Test pH

1. Fill a clean tube to the black line.
2. Add 5 drops of pH.
3. Cap and invert to mix.
3. Insert the tube into the ColorQ.
4. Press the button. .
5. Take reading.
6. Press the button. The screen displays "ALY".

### Test total alkalinity

1. Fill a clean tube to the black line.
2. Add 5 drops of ALK.
3. Cap and invert to mix.
3. Insert the tube into the ColorQ.
4. Press the button.
5. Take reading.
6. Press the button. The screen displays "CH".

### Target range ->

4.0 to 6.0 ppm

Less than free chlorine plus 0.2

7.2 to 7.6

100 to 150 ppm

### Tips

- Use the attached tables to calculate the required chemicals.
- Make frequent small adjustments to the water chemistry, rather than infrequent large changes.
- With heavy bather loads, keep the free chlorine closer to 6 ppm.
- Do the full test on the last day of the week, so that shock dosing if needed (e.g. to remove chloramines) can be done before the weekend.
- Never test immediately after shock dosing.
- Hold the reagent bottles vertically upside down, not at an angle, to ensure uniform drop size.
- Keep the reagent bottles tightly sealed.
- A reading of "Lo" means that the value is too low for the ColorQ to measure.
- Invert the tubes to mix, do not shake as this can introduce air bubbles which will affect the reading.
- After completing the test, rinse the tubes and caps with pool water. Once a day clean the tubes using the bottle brush.

## **Attachment D**

### **FAECAL INCIDENT INSTRUCTIONS**

Refer to the following CDC Healthy Swimming instructions.



*Healthy Swimming*

# Fecal Incident Response Recommendations for Pool Staff\*

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**What do you do when you  
find poop in the pool?**



\*Check for existing guidelines from your local or state regulatory agency before use.  
CDC recommendations do not replace existing state or local regulations or guidelines.

- These recommendations are for responding to fecal incidents in chlorinated recreational water venues.
- Improper handling of chlorine-based disinfectants can cause injury. Follow proper occupational safety and health requirements when following these recommendations.
- **Pool Closures:** Fecal incidents are a concern and an inconvenience to both pool operators and patrons. Pool operators should carefully explain to patrons why the pool needs to be closed in response to a fecal incident. Understanding that pool closure is necessary for proper disinfection and protection of the health and safety of swimmers is likely to promote support rather than frustration. Pool closures allow chlorine to do its job — to kill germs and help prevent recreational water illnesses (RWIs).

[www.cdc.gov/healthyswimming](http://www.cdc.gov/healthyswimming)

Last updated November 15, 2010



## Important background info...

### WHAT ARE RECREATIONAL WATER ILLNESSES (RWIs)?

What is the first thing that pops into your head when you think about water safety? Drowning? Slipping? Lightning? All good answers, and all are very important. But, did you know that germs can contaminate swimming water? These germs cause RWIs that have made many people sick.

RWIs are caused by germs such as "Crypto" (KRIP-toe), short for *Cryptosporidium*, *Giardia* (gee-ARE-dee-uh), *E. coli* 0157:H7, and *Shigella* (Shi-GEL-uh).

### HOW ARE RWIs SPREAD?

RWIs are spread by swallowing pool water that has been contaminated with fecal matter. How? If someone has diarrhea, that person can easily contaminate the pool. Think about it. Pool water is shared by every swimmer. Really, it's communal bathing water. It's not sterile. It's not drinking water.

The good news is that germs causing RWIs are killed by chlorine. However, chlorine doesn't work right away. It takes time to kill germs and some germs like Crypto can live in pools for days. Even the best maintained pools can spread illness.

### SHOULD ALL FECAL INCIDENTS BE TREATED THE SAME?

No. A diarrheal fecal incident is a higher-risk event than a formed-stool incident. With most diarrheal illnesses, the number of infectious germs found in each bowel movement decreases as the diarrhea stops and the person's bowel movements return to normal. Therefore, a formed stool is probably less of a risk than a diarrheal incident that you may not see.

A formed stool may contain no germs, a few, or many that can cause illness. You won't know. The germs that may be present are less likely to be released into the pool because they are mostly contained within the stool. However, formed stool also protects germs inside from being exposed to the chlorine in the pool, so prompt removal is necessary.

### **Germ Inactivation Time for Chlorinated Water\***

Germ	Time
<i>E. coli</i> O157:H7 Bacterium	Less than 1 minute
Hepatitis A Virus	About 16 minutes
<i>Giardia</i> Parasite	About 45 minutes
Crypto Parasite	About 15,300 minutes or 10.6 days <sup>†</sup>

### SHOULD YOU TREAT A FORMED FECAL INCIDENT AS IF IT CONTAINS CRYPTO?

No. In 1999, pool staff volunteers from across the country collected almost 300 samples from fecal incidents that occurred at water parks and pools.<sup>¶</sup> CDC then tested these samples for Crypto and *Giardia*. None of the sampled feces tested positive for Crypto, but *Giardia* was found in 4.4% of the samples collected. These results suggest that formed fecal incidents pose only a very small Crypto threat but should be treated as a risk for spreading other germs (such as *Giardia*). Remember a diarrheal fecal incident is considered to be a higher-risk event than a formed-stool fecal incident.

\* 1 parts per million (ppm) or mg/L free chlorine at pH 7.5 or less and a temperature of 77°F (25°C) or higher.

<sup>†</sup> Shields JM, Hill VR, Arrowood MJ, Beach MJ. Inactivation of *Cryptosporidium parvum* under chlorinated recreational water conditions. J Water Health 2008;6(4):513–20.

<sup>¶</sup> CDC. Prevalence of Parasites in Fecal Material from Chlorinated Swimming Pools — United States, 1999. MMWR 2001;50(20):410–2.



## What do I do about...

### formed stool in the pool?

Formed stools can act as a container for germs. If the fecal matter is solid, removing the feces from the pool without breaking it apart will limit the degree of pool contamination. In addition, RWIs are more likely to be spread when someone who is ill with diarrhea has a fecal incident in the pool.

### diarrhea in the pool?

Those who swim when ill with diarrhea place other swimmers at significant risk for getting sick. Diarrheal incidents are much more likely than formed stool to contain germs. Therefore, it is important that all pool managers stress to patrons that swimming when ill with diarrhea is an unhealthy swimming behavior.

1. **For both formed-stool and diarrheal fecal incidents,** close the pool to swimmers. If you have multiple pools that use the same filtration system — all pools will have to be closed to swimmers. Do not allow anyone to enter the pool(s) until the disinfection process is completed.
2. **For both formed-stool and diarrheal fecal incidents,** remove as much of the fecal material as possible (for example, using a net or bucket) and dispose of it in a sanitary manner. Clean and disinfect the item used to remove the fecal material (for example, after cleaning, leave the net or bucket immersed in the pool during disinfection).

VACUUMING STOOL FROM THE POOL IS NOT RECOMMENDED.

3. Raise the free chlorine to 2 parts per million (ppm), if less than 2 ppm, and ensure pH 7.5 or less and a temperature of 77°F (25°C) or higher. This chlorine concentration was selected to keep the pool closure time to approximately 30 minutes. Other concentrations or closure times can be used as long as the contact time (CT) inactivation value\* is achieved (see next page).
4. Maintain free chlorine concentration at 2 ppm and pH 7.5 or less for at least 25 minutes before reopening the pool. State or local regulators may require higher free chlorine levels in the presence of chlorine stabilizers,<sup>†</sup> which are known to slow disinfection. Ensure that the filtration system is operating while the pool reaches and maintains the proper free chlorine concentration during the disinfection process.
5. If necessary, before attempting the hyperchlorination of any pool, consult an aquatics professional to determine the feasibility, the most optimal and practical methods, and needed safety considerations.
6. Raise the free chlorine concentration to 20 ppm<sup>‡§</sup> and maintain pH 7.5 or less and a temperature at 77°F (25°C) or higher. The free chlorine and pH should remain at these levels for at least 12.75 hours to achieve the CT inactivation value of 15,300.\*\* **Crypto CT inactivation values are based on killing 99.9% of Crypto. This level of Crypto inactivation cannot be reached in the presence of 50 ppm chlorine stabilizer, even after 24 hours at 40 ppm free chlorine, pH 6.5, and a temperature of 77°F (25°C).††** Extrapolation of these data suggest it would take approximately 30 hours to kill 99.9% of Crypto in the presence of 50 ppm or less cyanuric acid, 40 ppm free chlorine, pH 6.5, and a temperature of 77°F (25°C) or higher.
7. Confirm that the filtration system is operating while the water reaches, and is maintained, at the proper chlorine level for disinfection.
8. Backwash the filter after reaching the CT inactivation value. Be sure the effluent is discharged directly to waste and in accordance with state or local regulations. Do not return the backwash through the filter. Where appropriate, replace the filter media.
9. Allow swimmers back into the water only after the required CT inactivation value has been achieved and the free chlorine and pH levels have been returned to the normal operating range allowed by the state or local regulatory authority.



Establish a fecal incident log. Document each fecal incident by recording date and time of the event, whether it involved formed stool or diarrhea, and the free chlorine and pH levels at the time of observation of the event. Before reopening the pool, record the free chlorine and pH levels, the procedures followed in response to the fecal incident (including the process used to increase chlorine levels if necessary), and the contact time.

\* CT inactivation value refers to concentration (C) of free chlorine in ppm (or mg/L) multiplied by time (T) in minutes at a specific pH and temperature.

† Chlorine stabilizers include compounds such as cyanuric acid, dichlor, and trichlor.

‡ Many conventional test kits cannot measure free chlorine levels this high. Use chlorine test strips that can measure free chlorine in a range that includes 20–40 ppm (such as those used in the food industry) or make dilutions with chlorine-free water when using a standard DPD test kit.

§ If pool operators want to use a different free chlorine concentration or inactivation time, they need to ensure that CT inactivation values always remain the same (see next page for examples of how to accomplish this).

\*\* Shields JM, Hill VR, Arrowood MJ, Beach MJ. Inactivation of *Cryptosporidium parvum* under chlorinated recreational water conditions. J Water Health 2008;6(4):513–20.

†† Shields JM, Arrowood MJ, Hill VR, Beach MJ. The effect of cyanuric acid on the chlorine inactivation of *Cryptosporidium parvum*. J Water Health 2008; 7(1): 109–114.

## Pool disinfection time...

How long does it take to disinfect the pool after a fecal incident? This depends on what type of fecal incident has occurred and at which free chlorine levels you choose to disinfect the pool. If the fecal incident is formed stool, follow Figure 1, which displays the specific time and free chlorine levels needed to inactivate *Giardia*. If the fecal incident is diarrhea, follow Figure 2, which displays the specific time and free chlorine levels needed to inactivate Crypto.

**Figure 1 *Giardia* Inactivation Time for a Formed-Stool Fecal Incident**

Free Chlorine Level (ppm)	Disinfection Time*
1.0	45 minutes
2.0	25 minutes
3.0	19 minutes

\* These closure times are based on 99.9% inactivation of *Giardia* cysts by chlorine at pH 7.5 or less and a temperature of 77°F (25°C) or higher. The closure times were derived from the U.S. Environmental Protection Agency (EPA) Disinfection Profiling and Benchmarking Guidance Manual. These closure times do not take into account "dead spots" and other areas of poor pool water mixing.

**Figure 2 Crypto Inactivation Time for a Diarrheal Fecal Incident**

Free Chlorine Level (ppm)	Disinfection Time*†
10	1,530 minutes (25.5 hours)
20	765 minutes (12.75 hours)
40	383 minutes (6.5 hours)

\* Shields JM, Hill VR, Arrowood MJ, Beach MJ. Inactivation of *Cryptosporidium parvum* under chlorinated recreational water conditions. J Water Health 2008;8(4):513–20.

† At pH 7.5 or less and a temperature of 77°F (25°C) or higher.



The **CT inactivation value** is the concentration (C) of free chlorine in ppm multiplied by time (T) in minutes (CT inactivation value = C x T). The CT inactivation value for *Giardia* is 45 and the CT inactivation value for Crypto is 15,300 (pH 7.5 or less and a temperature of 77°F [25°C] or higher). If you choose to use a different free chlorine concentration or inactivation time, you must ensure that the CT inactivation values remain the same.

**In a PoolsiNSchoolZ pool operating at normal free chlorine level of 4.0 and pH 7.5, treatment consists of :-**

1. shock dosing the pool with 2.0 litres of liquid chlorine and
2. closing the pool for 26 hours.