



**Count on it.**

Micro-Irrigation Business

# **Aqua-Clear™**

## **Fiberglass Sand Filters**



*Addendum to the Installation & Users Guide*

## **Automatic Backwash Filter Assembly**

See Installation & User's Guide for important Safety  
Instructions

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# Automatic Backwash Filter Operating Manual Addendum

## System Contents

Please check immediately to see that you have received all the parts for the system. For two filter systems, reference Table 1. For one filter expansion systems, reference Table 2. Systems may contain kits, the detailed contents of which appear in Table 3.

**Table 1**

	System Part Numbers	ACS-218-12VDCL	ACS-224-12VDCL	ACS-230-12VDCL	ACS-236-12VDCL
		ACS-218-24VAC	ACS-224-24VAC	ACS-230-24VAC	ACS-236-24VAC
<b>Aqua-Clear Automatic Filter System</b>	<b>Qty</b>	<b>2 x 18"</b>	<b>2 x 24"</b>	<b>2 x 30"</b>	<b>2 x 36"</b>
Filter Body	2	AC-40	AC-60	AC-100	AC-140
Aqua-Clear Hydraulic Kit	1	ACK-HYD1		ACK-HYD1	
Backwash Controller - 12v DCL	1 either AC or DC	B-EXFP111002DP		B-EXFP111002DP	
Backwash Controller - 24v AC		B-EXFP211002DP		B-EXFP211002DP	
Backwash Valve (12v DCL)	2 either AC or DC	B2x2350S551DSPBZVI		B3x3350S551DSPBZVI	
Backwash Valve (24v AC)		B2x2350S554RCPBZVI		B3x3350S554RCPBZVI	
3" Fitting Kit	2	n/a		ACK-3F	
Operations Manual Addendum	1	ALT227		ALT227	

**Table 2**

	System Part Numbers	ACX-118-12VDCL	ACX-124-12VDCL	ACX-130-12VDCL	ACX-136-12VDCL
		ACX-118-24VAC	ACX-124-24VAC	ACX-130-24VAC	ACX-136-24VAC
<b>Aqua-Clear - Expansion Filter</b>	<b>Qty</b>	<b>1 x 18"</b>	<b>1 x 24"</b>	<b>1 x 30"</b>	<b>1 x 36"</b>
Filter Body	1	AC-40	AC-60	AC-100	AC-140
Bulkhead Adapters (2")	1	AC-BHA-2		AC-BHA-2	
3" Fitting Kit		n/a		ACK-3F	
Air release valve	1	ARV-BBK1		ARV-BBK1	
Tee, Plastic [8mm Compression]	1	B-FT98-T		B-FT98-T	
8MM Hydraulic Tube - 10' Coil	1	B-8MMHYD-10		B-8MMHYD-10	
Operations Manual	1	ALT227		ALT227	
Backwash Valve (12v DCL)	1 either AC or DC	B2x2350S551DSPBZVI		B3x3350S551DSPBZVI	
Backwash Valve (24v AC)		B2x2350S554RCPBZVI		B3x3350S554RCPBZVI	
Controller Expansion board (12v DCL)	1 either AC or DC	B-S-TG-0208		B-S-TG-0208	
Controller Expansion board (24v AC)		B-S-TG-0215		B-S-TG-0215	

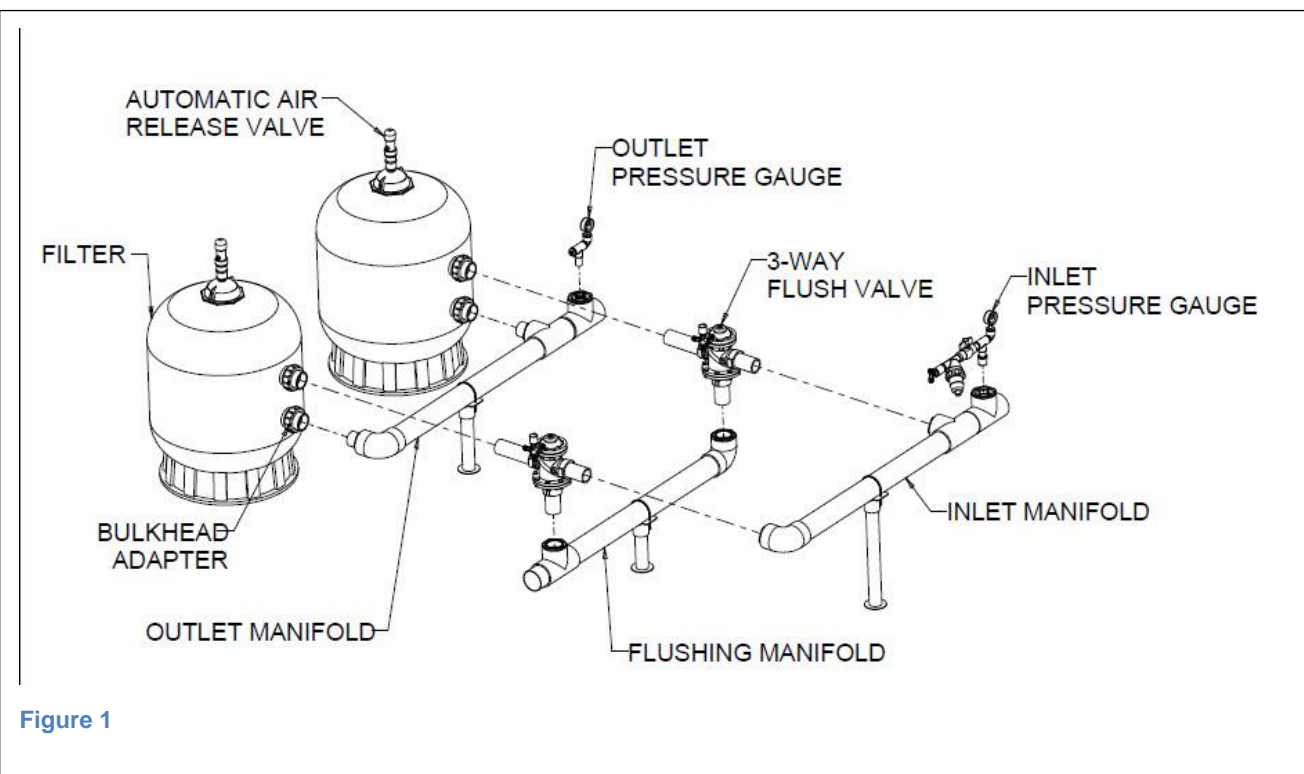
## System Contents (cont.)

**Table 3**

<b>Hydraulic Kit Contains:</b>	The Aqua Clear Hydraulic Kit is included with the Filter station; Part numbers are provided here for parts reference.	
<b>Description</b>	<b>Qty</b>	<b>SKU</b>
Pressure gauge (0-100 psi)	2	GPM0100
8MM Hydraulic Tube - 10' Coil	2	B-8MMHYD-10
3/4" disc filter	1	ALFD75150-L
Air release valve	2	ARV-BBK1
Reducing Bushing 1/4" x 1/8", Brass	2	28-102
Tee, Plastic [8mm Compression X 1/8" NPT]	1	B-FT98-1T
Elbow, Plastic [8mm Compression X 1/8" NPT]	1	B-FT28-EL
Tee, Plastic [8mm Compression]	1	B-FT98-T
Bulkhead Adapters (2")	2	AC-BHA2
<b>3" Fitting Kit</b>	The Aqua Clear Hydraulic Kit is included with the Filter station; Part numbers are provided here for parts reference.	
Grooved Couplings (3")	3	B-DS-V2030
Grooved Nipples	3	VG03PE
Air Vent Cover Adapter	1	T-60403

## Overview

Construct the manifold system shown below, using only schedule 40 PVC pipe and fittings. VERY IMPORTANT to always support the PVC manifolds or any long runs to prevent any added stress on the filter bulkheads and glue joints. In general, use as short a length of PVC pipe as practical, and do not add unnecessary fittings and elbows; this will prevent unnecessary pressure losses and improve efficiency.



## Assembly of the Automatic Backwash valves

1. The 2" backwash valve model has grooved adapters threaded into the valve body. It is assumed that these adapters will be removed, and threaded adapters used to build the kit. **Be sure to use plenty of Teflon tape on the male fittings used to connect to these valves to prevent leakage.**
2. The 3" backwash valve model has grooved fittings. The valve will need to be assembled to PVC grooved adapters (included). Basic assembly instructions for grooved fittings follow (See Figure 2):
  - Use a light coating of non-petroleum based lubricant, and slide the rubber gasket all the way onto the valve body.

- Position the valve connection to the PVC grooved adapter.
- Slide the gasket toward the PVC fitting so that it equally straddles the grooved fitting on the valve, and the grooved fitting on the adapter.
- Clamp the Grooved fitting over the rubber gasket, tightening the two bolts equally.
- Some flexibility of this joint when complete is normal; it is one of the advantages of a grooved fitting connection.

## Hydraulic Control Filter Assembly

See Figure 3 for detail on construction of Hydraulic Control Filter Assembly

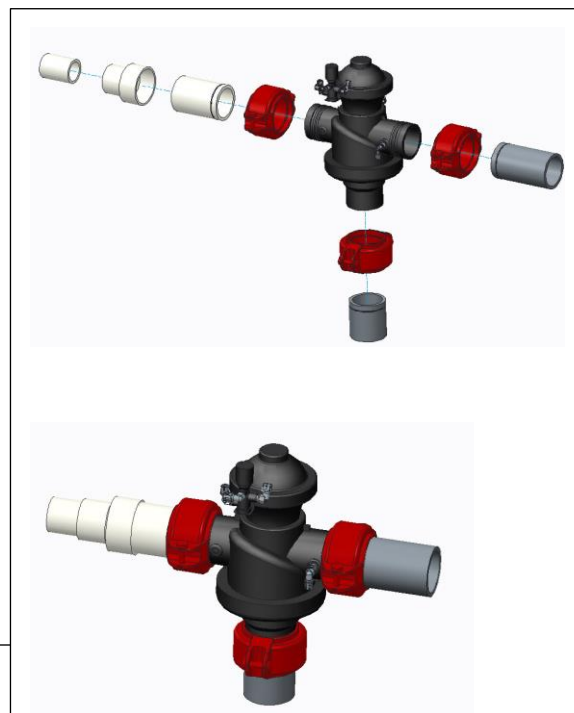


Figure 2 Grooved Fitting Assembly

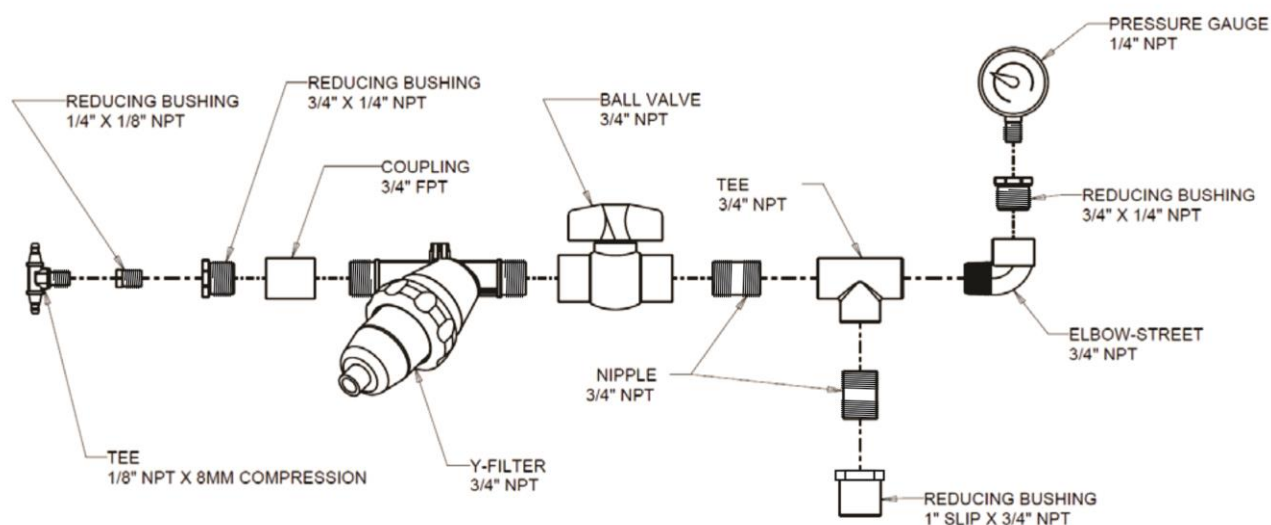
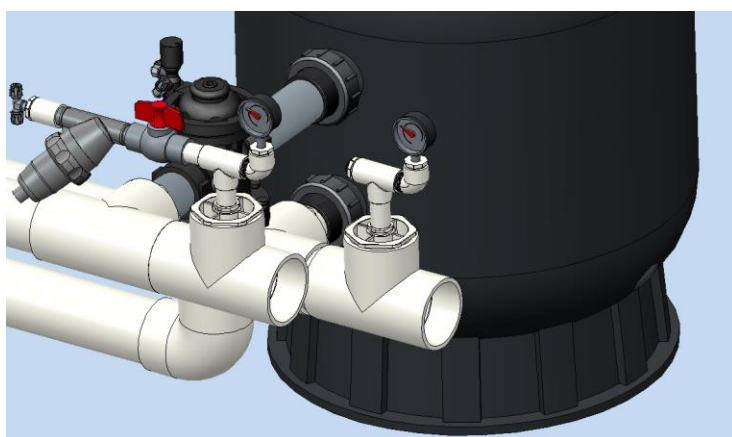


Figure 3 Hydraulic Control Filter Assembly

## Manifold Assembly

Be certain to allow sufficient clearance to allow the installation of all three manifolds (see Figure 4)

**It is Very Important to support manifolds** to prevent stresses to bulkhead fittings on filters. Excessive stress can lead to failure of the filter.

A chart showing the basic recommended fittings and pipe lengths is in Table 4.

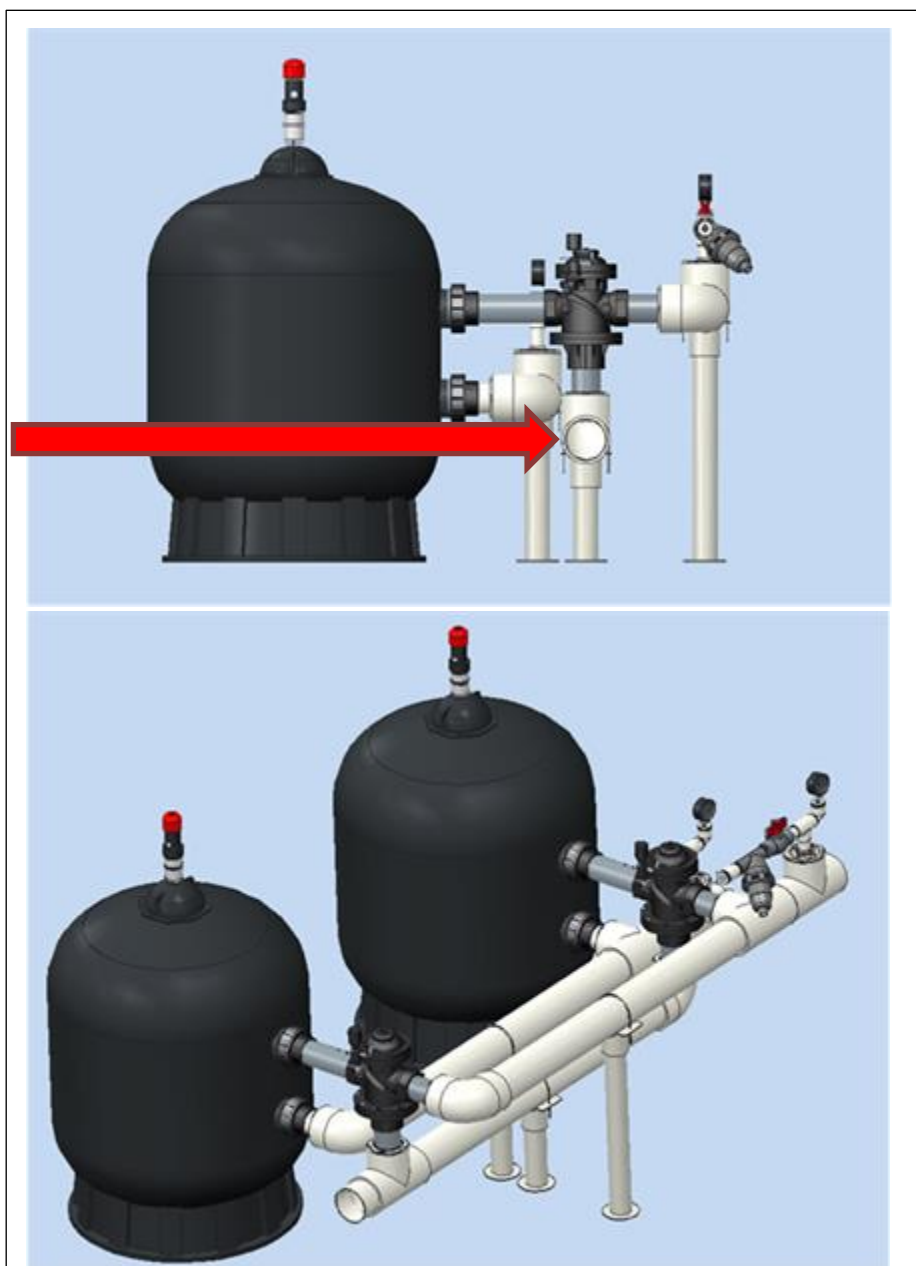


Figure 4 Manifold Clearance Recommendation

A detailed assembly diagram for these parts is in the appendix.

Parts to Source Locally						
DESCRIPTION All Parts Schedule 40 PVC unless noted		Fitting Code	2 x 18" & 2 x 24"	2 x 30" & 2 x 36"	1 x 18" & 1 x 24" *	1 x 30" & 1 x 36" **
2" PVC Pipe (Schedule 40)			Approx. 5 ft + Backwash line length			
3" PVC Pipe (Schedule 40)			Approx. 10 ft	Approx. 5 ft + Backwash line length		
4" PVC Pipe (Schedule 40)				Approx. 15 ft		
1	Coupling (3/4" NPT)	430-007	1	1		
2	Coupling (1" NPT)	430-010	2		1	
3	Reducing Coupling (3" Socket x 2" Socket)	429-338		2		1
4	Elbow, Street, (3/4" MPT x FPT)	412-007	2	2		
5	Elbow (2" Socket)	406-020	1			
6	Elbow (3" Socket)	406-030	2	1		
7	Elbow (4" Socket)	406-040		2		
8	Male Adapter (2" Socket x MPT)	436-020	2			
9	Male Adapter (3" Socket x MPT)	436-030		2		
10	Nipple, 3/4" x 3" length, MPT	883-030	2	2		
11	Nipple, 2" x 4.5" length, SCH 80 PVC (MPT x Slip)	1887-045	4		2	
12	Nipple, 2" x 8" length, SCH 80 PVC, (MPT x Slip)	1887-080	2		1	
13	Nipple, Close (3/4" NPT)	883-005	1	1		
14	Reducing Bushing (1" MPT x 1/4" FPT)	439-128	2		1	
15	Reducing Bushing (1.25" MPT x 1" FPT)	439-168		2		1
16	Reducing Bushing (1" Spigot x 3/4" FPT)	438-131	2	2		
17	Reducing Bushing (2" Spigot x 3/4" FPT)	438-248		2		
18	Reducing Bushing, (3" Spigot x 1" Socket)	437-335	2			
19	Reducing Bushing, (3" Spigot x 2" Socket)	437-338	4		2	
20	Reducing Bushing, (4" Spigot x 2" Socket)	437-420		4		
21	Reducing Bushing, (4" Spigot x 3" Socket)	437-422		2		1
22	Reducing Bushing (3/4" MPT x 1/4" FPT)	439-098	4	4		
23	Gate Valve (2" FPT)		1			
24	Gate Valve (3" FPT)			1		
25	Ball Valve (3/4" FPT)	2621-007	1	1		
26	Tee (2" Socket)	401-020	1		1	
27	Tee (3" Socket)	431-030	4	1	2	1
28	Tee (4" Socket)	401-040		4		2
29	Tee, Threaded (3/4" FPT)	405-007	2	2		

\* if running max flows on a 3x24", consider upsizing manifold to 4"

\*\* if running max flows on a 3x36", consider upsizing manifold to 6"

**Table 4 Parts toSource Locally**



## Assembly of the Air Vents

See Figure 5.

For the 18" and 24" models, the air vent is attached to the 1/4" threaded nipple which comes attached to the manual air bleed assembly. The rest of the manual air bleed assembly is not needed. This 1/4" threaded nipple is then installed onto the 6" closure on top of the filter.

For the 30" and 36" models, the air vent adapter should first be installed on the 8" closure on top of the filter. The Air Vent can then be threaded onto this adapter. *Note: This fitting is reverse thread, so to tighten, twist the nut counterclockwise.*

There is a plastic air relief tube (item #9 on the Replacement Parts diagram of the Filter Manual) inside the filter attached to the Lower Piping Assembly; it has a small screen filter on the upper end. This tube is not attached to any part of the external Air Vent structure. The tube with the screen filter should be placed inside the dome of the top cover during final assembly.

**NOTE:** For all threaded connections, be certain to use adequate amount of Teflon tape or paste to create a good seal.

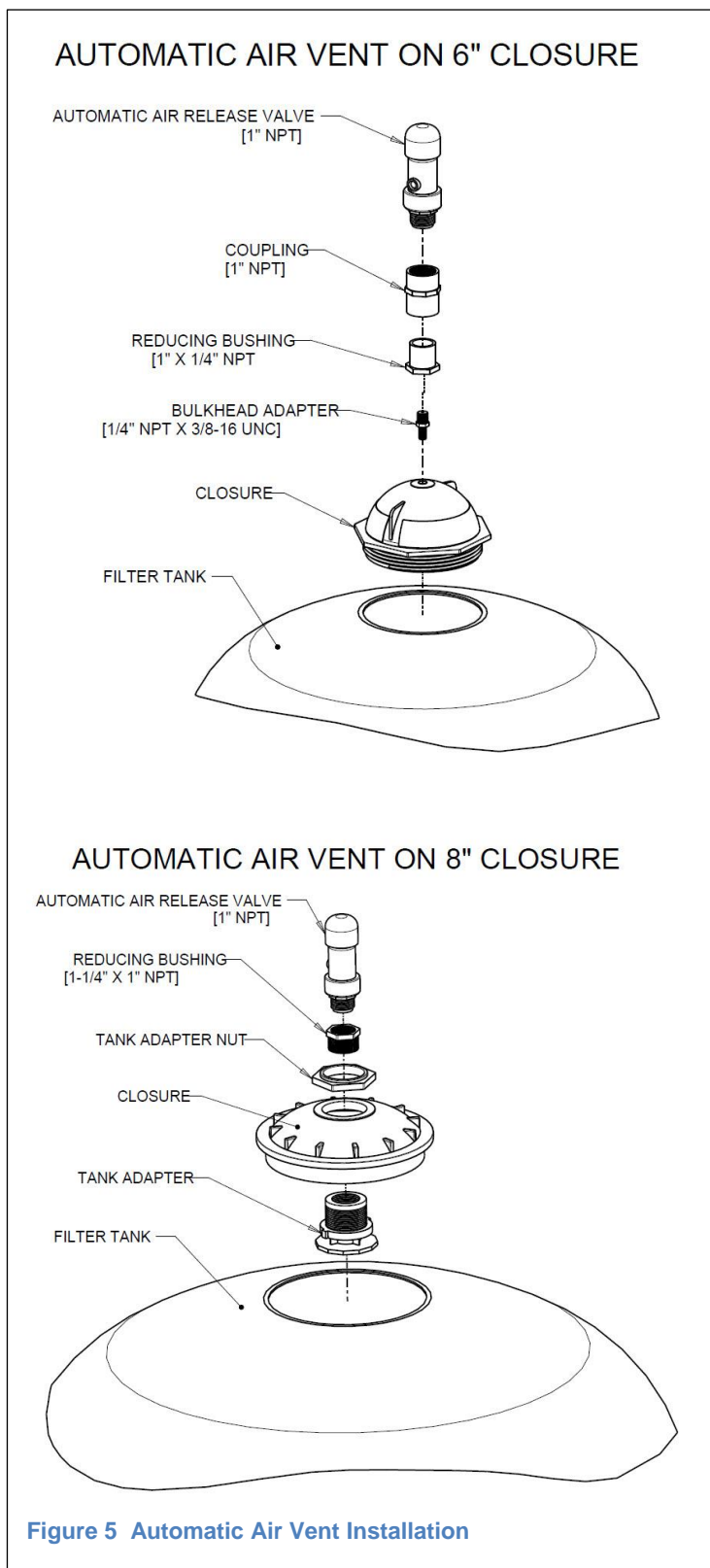
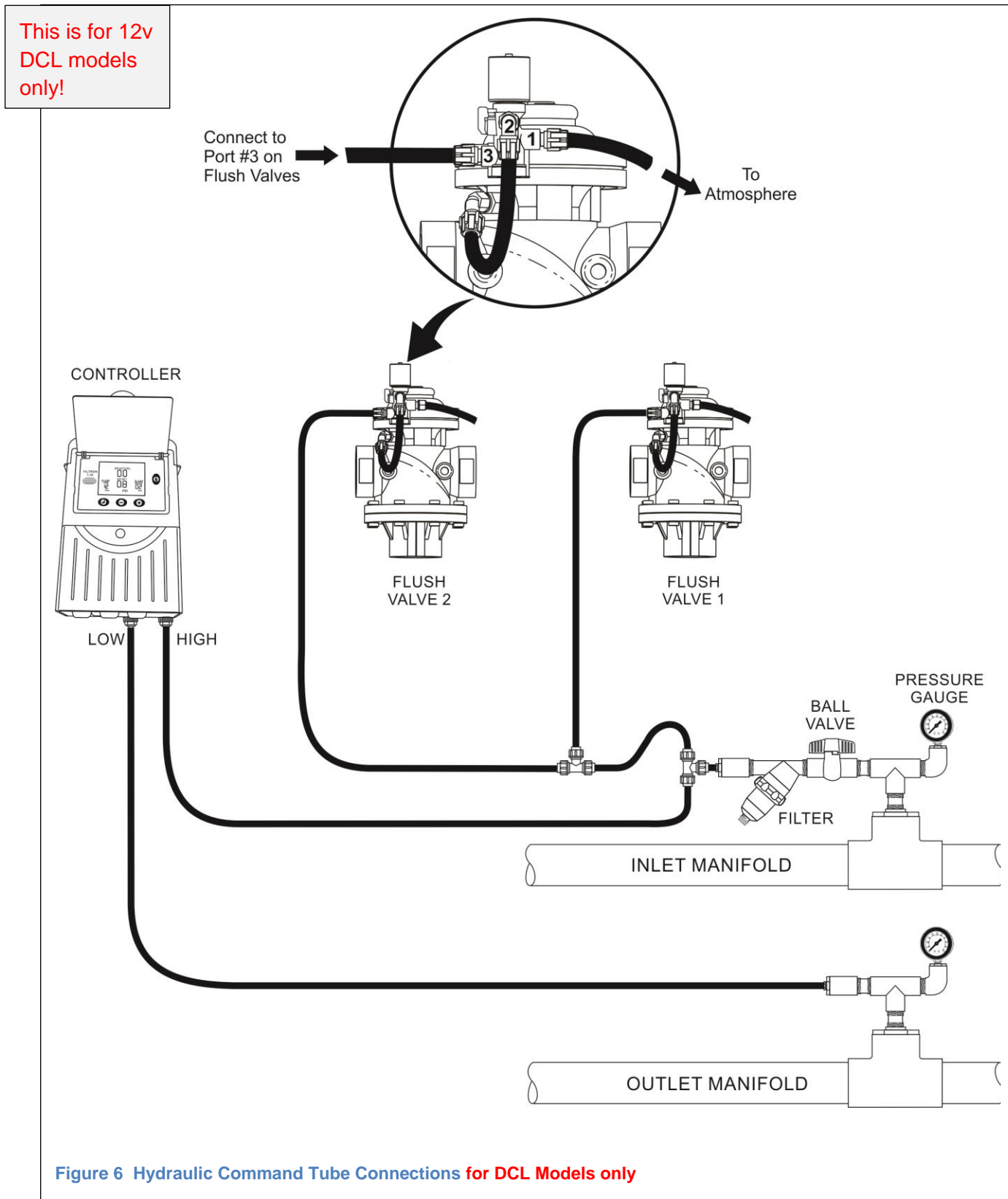


Figure 5 Automatic Air Vent Installation

## Connection of the Hydraulic Command Tubing



This is for 24v  
AC models  
only!

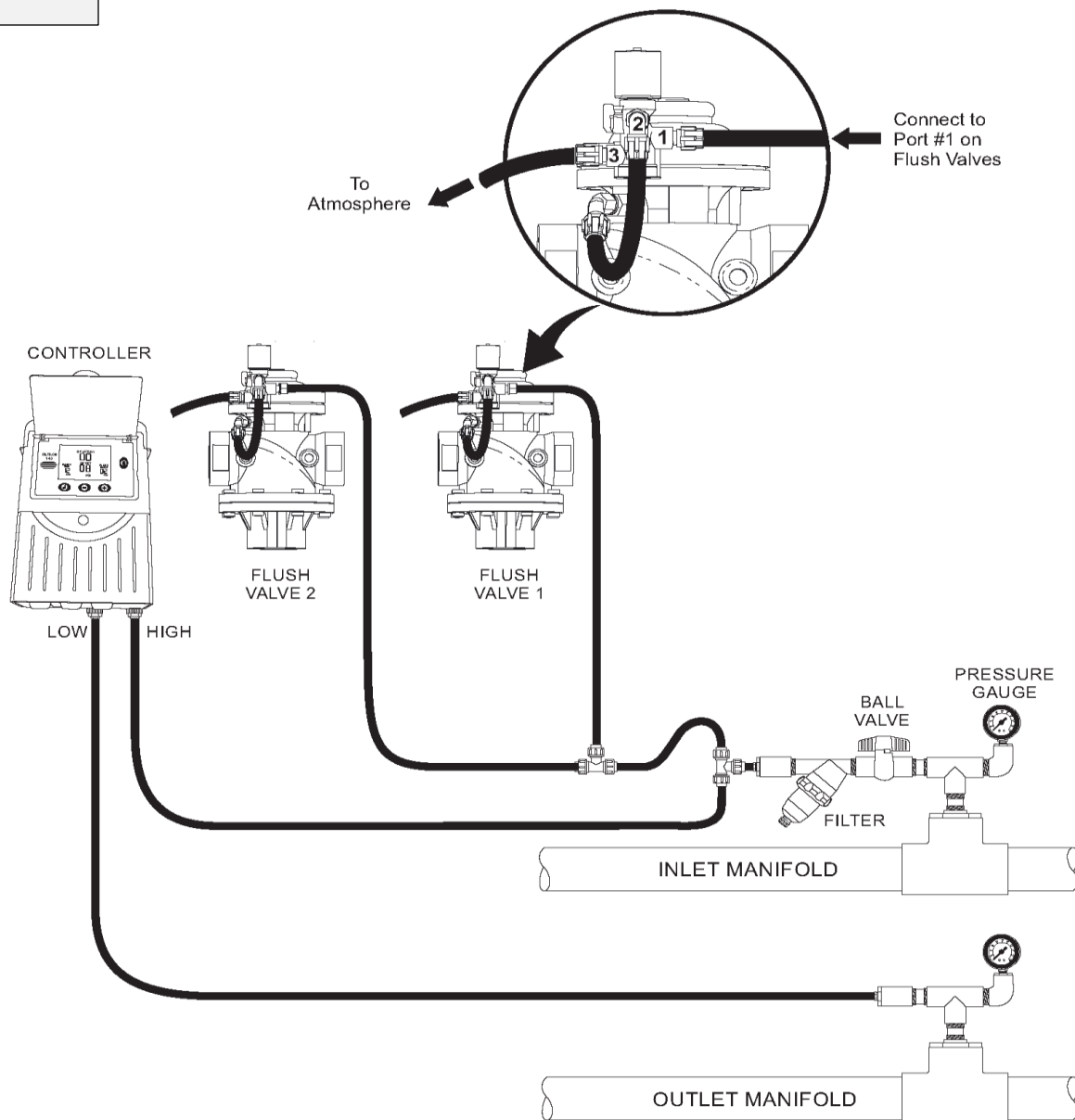


Figure 7 Hydraulic Command Tube Connections for AC Models only

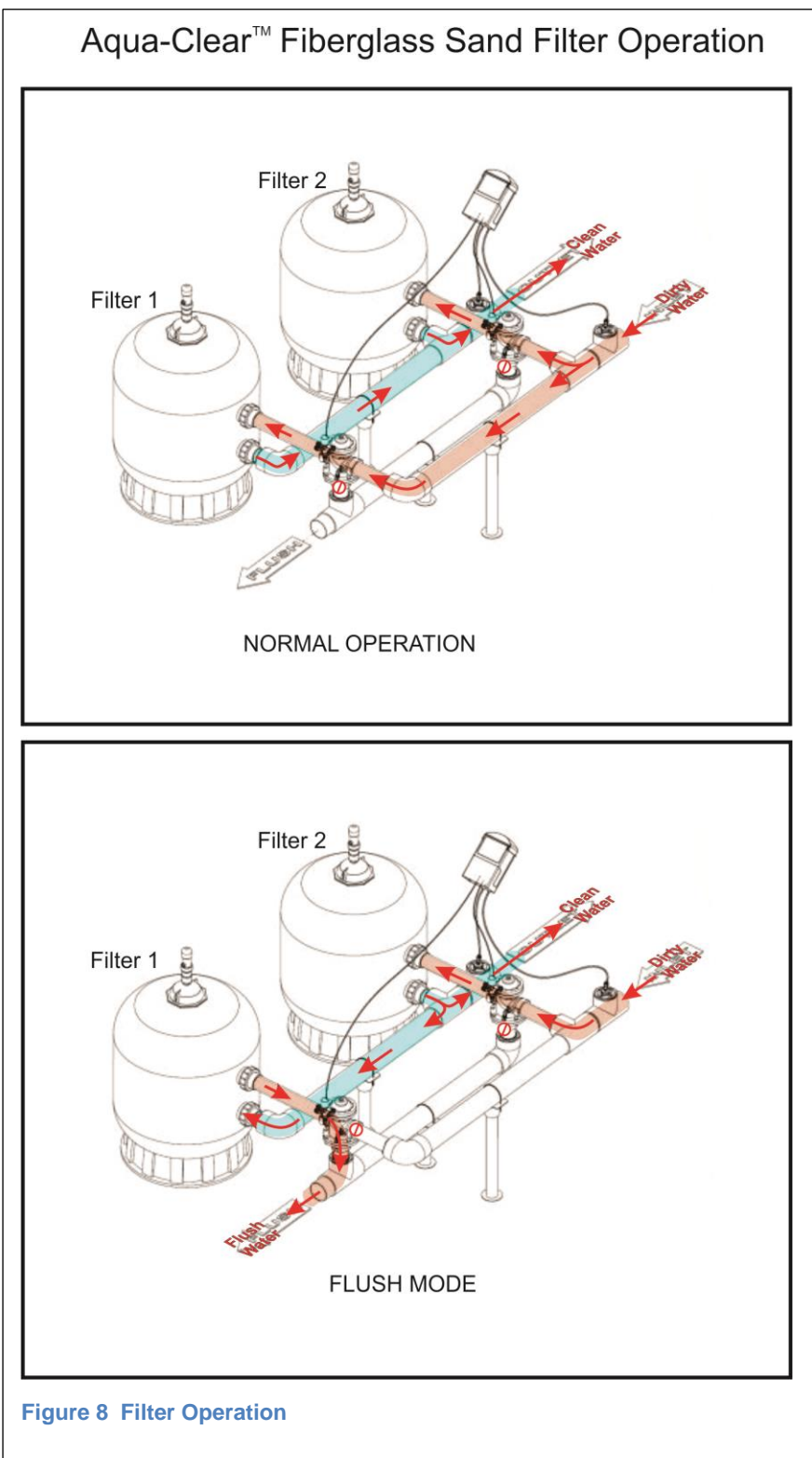
Hydraulic command tube serves two purposes in an automatic backwash system:

1. It communicates the pressure levels to the controller, which manages the backwash
2. It provides the pressure to open and close the backwash valves. Follow the circuit diagram in Figures 6,7 to connect the Hydraulic Command Tubing.

The filter on the Hydraulic Command assembly assures that the water used to control the valves is clean of debris. This filter will become clogged over time, and should be cleaned. Closing the ball valve upstream of the filter will allow you to clean the filter even when the system is in operation. Cleaning this filter should be a routine maintenance check, and a troubleshooting step any time the backwash is not occurring as it should.

## Operation of the Automatic Filters

The top illustration in Figure 8 shows the filters operating in “filtration” mode. The lower illustration shows the water flow when Filter #1 is in “backwash” mode. After Filter #1 has been backwashed, the controller will backwash Filter #2.



## Programming the Automatic Backwash Controller

### General Information

The controller comes with its own manual which provides good detail. The information below is abbreviated, and explains some terms found in the controller manual.

The general function of the backwash controller is to sense the need for the filters to be backwashed, and to manage a backwash cycle in which each filter is individually flushed.

As the filters become dirty and need to be flushed, the pressure loss through filters increases. The controller senses the need for the filters to be backwashed by tracking the pressure of the system both upstream, and downstream of the filters. The controller is physically connected by hydraulic tube to a point upstream of the filters, and also downstream of the filters. This difference in the upstream and downstream pressure is called the pressure differential (sometimes abbreviated PD, or DP). The controller can be instructed to initiate a backwash sequence when the PD hits a specified limit (typically 5-7 psi).

The controller will also initiate a backwash sequence after a specified period of time has elapsed, whether the PD sensor has called for a backwash or not. This is typically operated as a backup trigger to the PD actuation, in case of a sensor failure.

The controller also keeps track of the number of backwashes that have occurred between resets, enabling the operator to evaluate the operation of the system over time.

### Getting Started

There are two stages to programming. Steps 1-4 of this section assign values to commonly manipulated settings: how long, when, and how frequently to backwash, as well as some readouts from the controller on how many times the filter has backwashed.

Steps 5-13 of this section are sometimes referred to as 'configuration'. You will be instructing the controller what values to use for the various functions it can perform, and some information about the system being controlled. Typically the system is configured once at the initial assembly stage, however, it can be re-configured at any time.

### Basic Program

To perform steps 1-4, briefly press the ENTER key. After entering the desired value for a function, press the ENTER key to move to the next function to be programmed. For each function, the + and – keys will scroll through the available selections for that function. See the steps which follow for explanation of function and typical settings.



**Figure 9 Enter Key**

### Initial Configuration

After performing the Basic Program entry, press and hold the enter key for 3 seconds, and you will enter the configuration stage, steps 5-13. After entering the desired value for a function, press the ENTER key to move to the next function to be programmed. For each function, the + and – keys will scroll through the available selections for that function. See the steps which follow for explanation of function and typical settings.

If you decide during the initial programming to change a variable which you have already passed, you can reach it by cycling all the way through the remaining functions to be programmed, and loop back to the function to be changed.

Any time changes to the configuration settings are desired, this stage can be entered by pressing and holding the ENTER key.

## Program Settings

Following is the sequence of controller functions that will appear after entering the programming cycle:

### 1. Flush Time

Defines the duration of the flushing time per station. The following options are selectable:

- 5-20 seconds in steps of 1 second
- 20-55 seconds in steps of 5 seconds
- 1-6 minutes in steps of 0.5 minutes

*A typical flush time setting is 1 to 2 minutes.* The proper flush time can vary with the contaminant load of the water, season, and several other factors. See the general filter instruction manual for guidance on how to fine tune the flush time based on observation of the flush water.

### 2. The PD Set Point

This sets the value of the pressure differential that will initiate a flushing cycle.

*Typical setting is 5-7 psi.*

### 3. The Flush Mode

This sets the method by which the controller will trigger a backwash cycle.

*The typical setting is "By Time".* In this setting, both the time and the pressure differential can trigger a backwash cycle; if the PD sensor calls for a backwash before the timer does, a backwash will occur (and the timer will be re-set). If the PD sensor has not called for a backwash within the timer cycle, the timer will trigger a backwash, and the timer will re-set.

The length of time to set in this field varies widely with how dirty the water is, how much the filters are used, and several other factors. To optimize this setting, growers often check how frequently the filters are backwashing by the PD trigger, and set the timer for a period of time 20% longer than the frequency called for by the PD sensor. *A typical initial setting is 4-8 hours.*

### 4. Accumulations Readout

There is nothing to set at this point – it is an informational readout on the amount of backwashing that has been occurring. There are three consecutive readouts: DP, time, and manual. Each step indicates the # of backwash cycles triggered by either DP, time, or manual. Cycle through these using the ENTER key.

## 5. Main Valve

The standard controller is not equipped for this function; an expansion board can be added which enables the controller to command a master valve when a backwash cycle is triggered. Please speak with your Toro dealer if you wish to add this functionality. *The standard setting should be “No” to indicate no main valve function.*

## 6. Dwell Time

The controller backwashes the filters one at a time. The Dwell time is the pause between the filters in a backwashing cycle. This Dwell Time allows the system to come back to full pressure for the next backwash. *A typical dwell time setting is 30 seconds.*

## 7. DP Delay

This is the delay during which the PD sensor reading is expected to remain stable before the controller triggers a backwash. This delay prevents the filter from backwashing due to a short spike in the pressure differential; if the pressure differential exceeds the value of the set point for the length of time set here, then a backwash will trigger. *A typical setting is 10-15 seconds.*

## 8. Looping Limit

Sometimes a fault in the PD sensor, or another problem occurs in the system, and the filter can enter an ‘endless loop’ of consecutive backwashing cycles. This could create flooding or washout conditions where the backwash water exits, and so a limit to the number of consecutive backwash cycles commanded by the PD sensor is set in this field. If the filter enters into an ‘endless loop’ of consecutive backwash cycles called for by the PD sensor, when the limit set in this field is reached, the PD sensor will be ignored, and the filter will be triggered only by the timer. When the PD sensor returns once again to a reading below its trigger setpoint, the looping limit will re-set, and the PD sensor will now be available to trigger backwash cycles again. *Typical setting is 5.*

## 9. Alarm

The standard controller is not equipped for this function; an expansion board can be added which enables the controller to close a switch and trigger an alarm. Please speak with your Toro dealer if you wish to add this functionality. *The standard setting should be “No” to indicate no alarm function.*

## 10. Delay Valve

The standard controller is not equipped for this function; an expansion board can be added which enables the controller to command a master valve when a backwash cycle is triggered, and this setting would manage the delay between actuating the main valve and the backwash cycle. Please speak with your Toro dealer if you wish to add this functionality. *The standard setting should be “No” to indicate no delay valve function.*

## 11. View Outputs

This function is not used on the standard controller; press ENTER to pass by it.



## 12. Pressure Units

Select PSI for US units, or Bar for metric units.

## 13. Calibration

This will calibrate the PD sensor. While the controller sensor ports are disconnected from the hydraulic tubing, select the Calibration = Yes. The calibration occurs very quickly, and the sensor ports on the controller should be reconnected after passing through this program step.

This will conclude the programming of the controller, and it is ready to use. If you want to revisit any of the settings, simply cycle through them at this point. If you wish to change setting 1-4, briefly press the ENTER key. If you wish to re-visit steps 5-13, press and hold the ENTER key for at least 3 seconds.

## Manual Backwashing

A flushing sequence can be manually triggered by the MANUAL key (hand icon, or M). By pressing the MANUAL key again the cycle will be terminated.



Figure 10  
Manual Key  
symbols

Each backwash valve can also be manually backwashed using the small green lever on the side of the solenoid. See figures below



Figure 12 - Filtration Position



Figure 11 - Manual Backwash Position



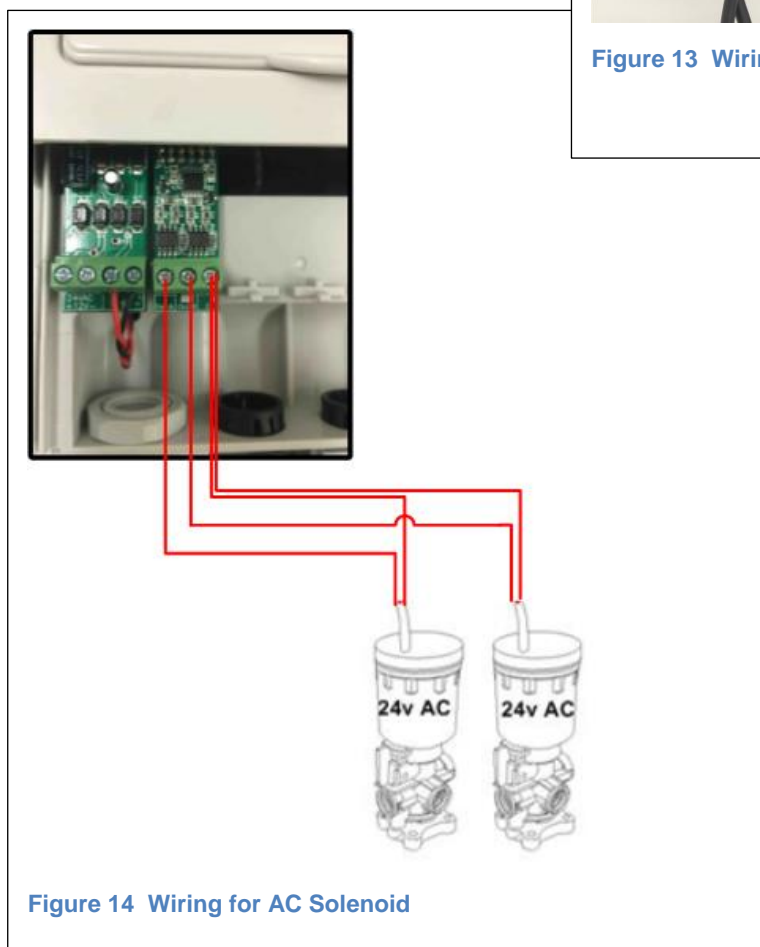
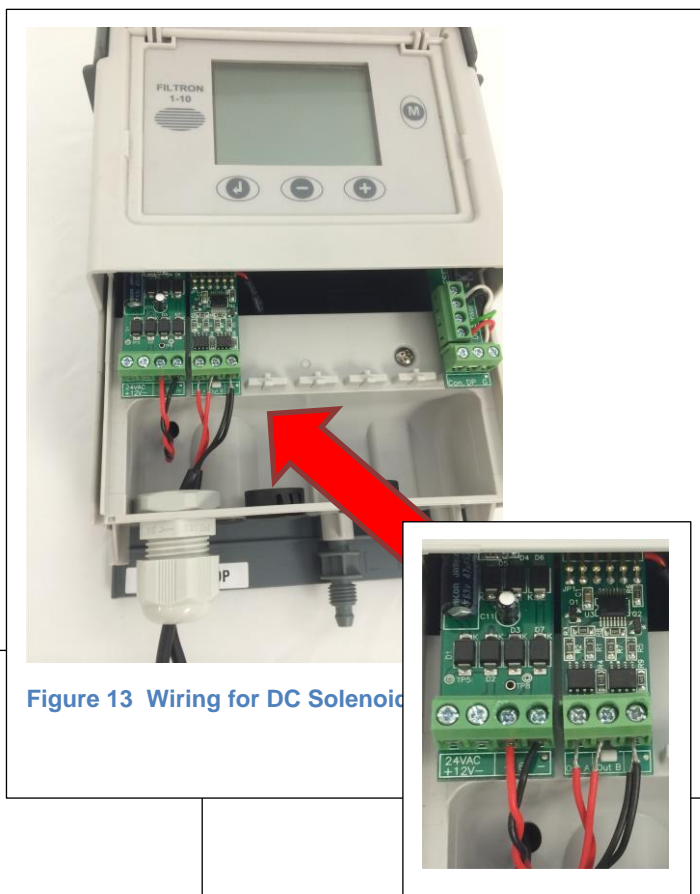
## Wiring the Controller

### Solenoids

Each of the solenoids must be connected to the board inside the controller, as shown in Figures 11, 12.

**DC models:** The black wire from each solenoid should be attached to the common terminal (C) as shown in Figure 11. The red wires should be attached as shown to terminals Out A and Out B respectively.

**AC models:** The solenoid wires will be the same color. One wire from each solenoid should be attached to the common terminal (C), and the other wires from each solenoid connected to terminals Out A and Out B see Figure 12.



## Powering the Controller

### DC Model

The DC model requires four D Cell batteries, which should power the controller for a year. Install the batteries by removing the top of the controller, and installing four D size batteries as shown in Figure 13.



The unit has two levels of low battery indication. When the battery voltage drops to the first level, the low battery sign will appear on the screen.

When the battery voltage drops further to the second level, all outputs will shut down, and the screen will be cleared leaving only the low battery icon.

**The DC model must always be used with 12v DC Latching solenoid valves.**



**Figure 15** Add batteries to top of Controller

### AC Model

The AC model is connected by a transformer to an external power source. **The AC model must always be used with 24v AC solenoid valves.**

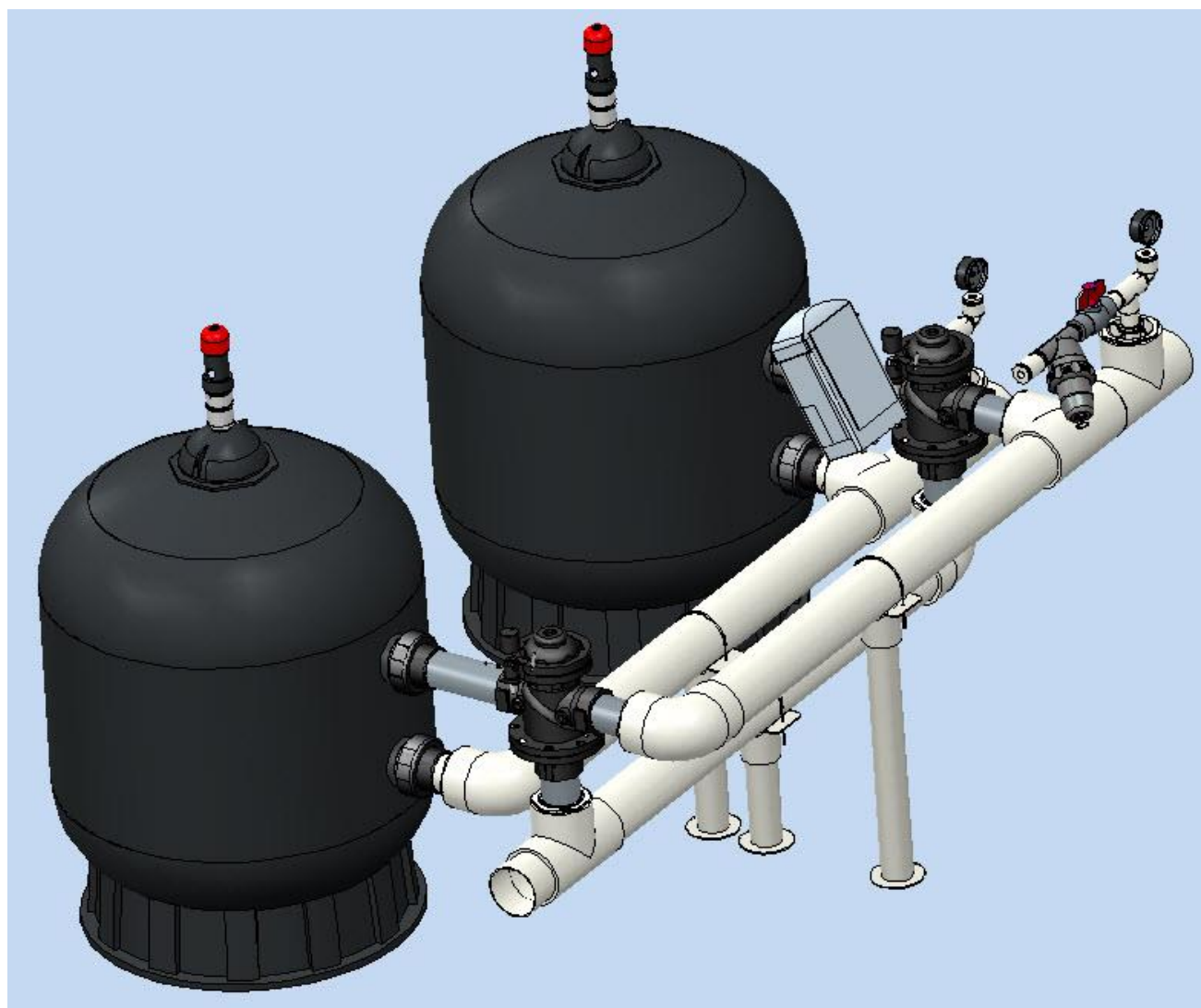
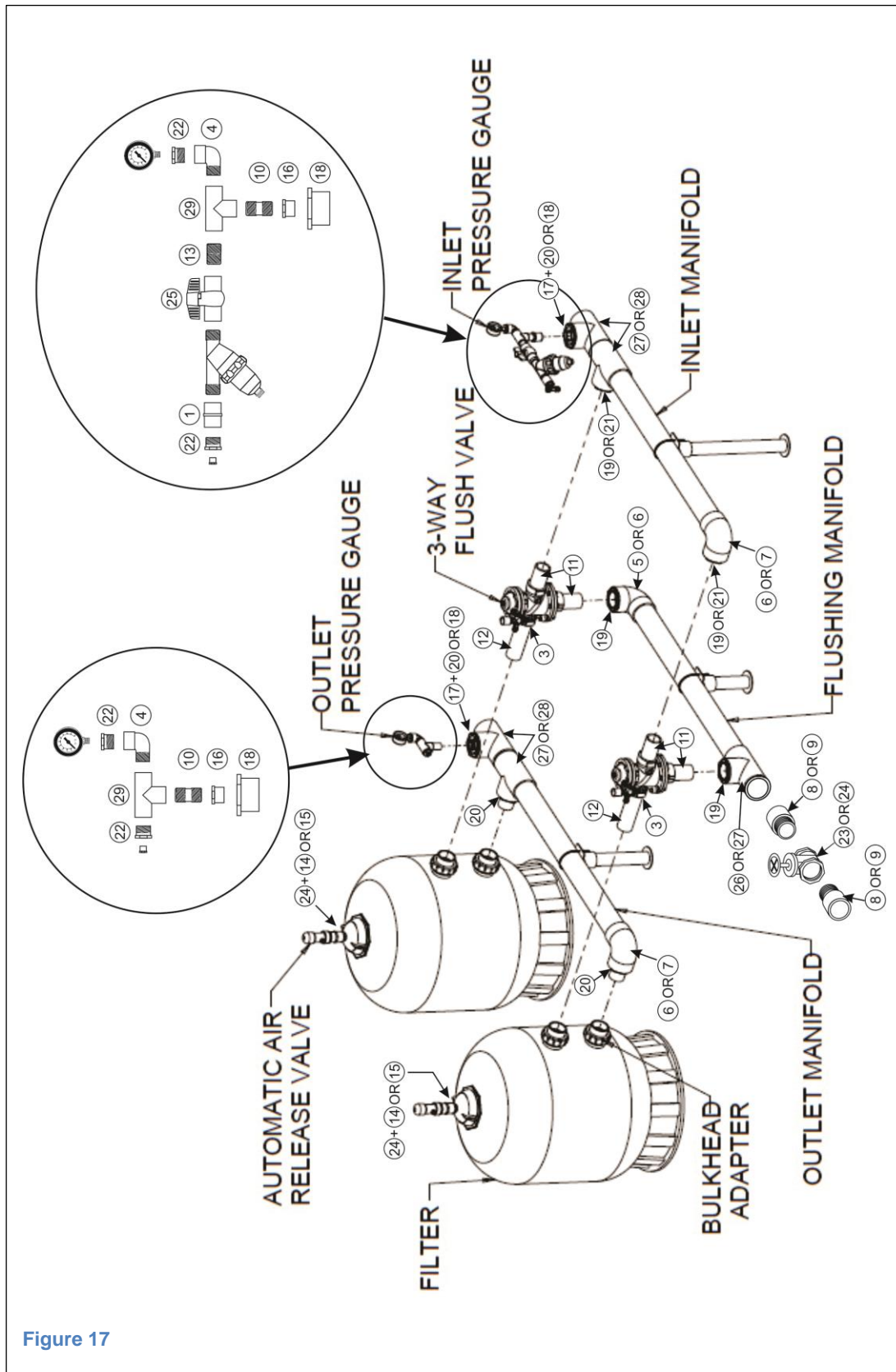


Figure 16 Finished Assembly

## Appendix 1: Manifold Construction Detail



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ALT227 v3.0



**Count on it.**