yardney
WATER FILTRATION SYSTEMS

# Installation And Operation Instruction Manual

INSMAN-204

# Industrial Granular Activated Carbon Multi Tank

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## GENERAL SAFETY GUIDELINES

Please read the entire manual before beginning any procedure.

1. Only properly trained personnel should operate and service the equipment.

2. Always wear proper safety gear when servicing equipment.

3. Before installing the system, ensure that the system falls within the designed operating parameters.

4. Know the safety operating limits of the system and any equipment directly connected to or affected by it.

5. Be sure that the system is depressurized before any maintenance work, removing components or opening of the vessels.

6. Be sure to re-examine the system before putting it back into service.

7. Be sure to maintain all equipment and to continuously check the system for leaks and or damage. Fixing problems as they occur will prolong the life of the system.

**GENERAL:** The Yardney GAC Filtration Systems are designed to utilize granular activated carbon for the removal of dissolved organic pollutants from water by a process called absorption over the carbon. As the water passes through the porous granules of carbon, organic pollutants are attracted to the surface of the pores and are held by weak physical forces. This process continues until the carbon becomes saturated and its capability to absorb organic impurities is consumed.

The Yardney GAC Filtration Systems also have the ability to filter out suspended solid particles that can be removed during the backwash process. The minimum suggested operating pressure is 30 PSI.

## 1. RECEIVING INSTRUCTIONS

Upon receipt of the filter system, inspect for any visible damage, missing parts, etc. If any damage is noted, advise the freight carrier and Yardney Water Management Systems at once. A damage claim should be filed with the freight company as soon as possible to avoid any unnecessary delays in settlement of the damage claim or installation of the filter system.

## 2. INSTALLATION

With a few exceptions, Yardney GAC Filter Systems are shipped completely assembled and mounted on structural steel skids. The larger systems, 5472-4, 5 & 6, are shipped on two (2) separate skids and assembly is required.

All filter systems must be installed on a level surface that will support the equipment. It is recommended that 1/4" tolerance be the maximum allowed. A concrete base with grouting and/or shims under the structural members is generally the best method to obtain the levelness required. The grouting and/or shims should be kept to a minimum for best results.

A minimum of 48" should be maintained around the filter system to allow for media loading and servicing.

The inlet and outlet manifolds are supplied with either a flange or groove for use with groove type couplings. In either case, line connections to the filter system should be the same size as those supplied with the system.

The inlet and outlet manifolds are supplied as standard with fusion epoxy lining and modifications to the manifolds that require welding. Cutting, excessive heat, etc., should be avoided.

The backwash line piping is connected to the backwash restrictor valve on the backwash manifold. The backwash line piping should discharge into a floor drain or sump and should not be connected directly to a pressurized drain line.

If it is necessary to run the backwash piping a long distance to a drain, allowance should be made in the size and drainage of pipe to handle total backwash flow without any restriction.

Specific sizes for backwash piping are shown in the table below.

| | Backwash Flow (Per Filter) | Minimum Pipe Size |
|---|---|---|
| **GAC-1872** | 18 GPM | 2” |
| **GAC-2472** | 32 GPM | 2” |
| **GAC-3072** | 49 GPM | 2” |
| **GAC-3672** | 71 GPM | 4” |
| **GAC-4872** | 126 GPM | 4” |
| **GAC-5472** | 159 GPM | 4” |

*TABLE 1: BACKWASH FLOW AND PIPE SIZE.*

Restriction of backwash flow from filters to the drain will have an adverse effect on the overall backflushing capability and could lead to inadequate cleaning of the filter during the backwash cycle.

**CAUTION:** In certain carbon system applications, high voltage electrical charges may accumulate to levels of shock or ignition hazard. As a precaution against possible ignition or shock, all carbon treatment systems should be adequately grounded!!!

**NOTE:** **Yardney GAC Filter Systems that are supplied on two separate skids require the installation of the inlet and outlet tee and connecting the backwash line prior to connecting to your process. Refer to the illustration below.**

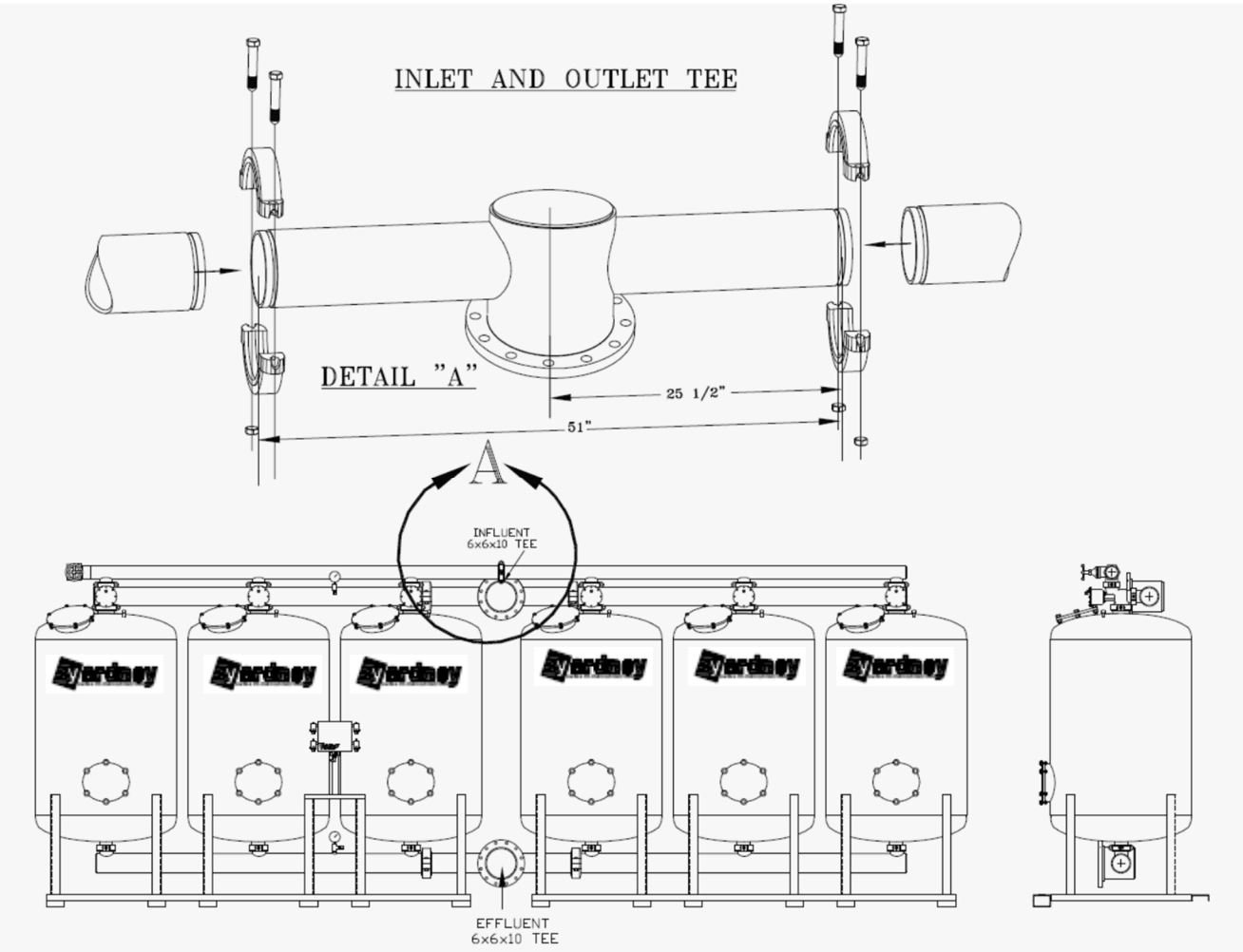



*FIGURE 1: GAC SYSTEM WITH TWO SKIDS.*

## 3. GRANULAR ACTIVATED CARBON

The multiple tank GAC filtration system consists of one grade of crushed rock and one grade of granular activated carbon. Gravel is used for supporting the carbon while the activated carbon is used for filtering and absorption. Refer to the media requirement table and illustration on page 7.

NOTE: THE CRUSHED ROCK MUST BE THOROUGHLY WASHED PRIOR TO LOADING INTO THE FILTER. FAILURE TO WASH THE CRUSHED ROCK COULD LEAD TO COMPROMISED FILTER PERFORMANCE.

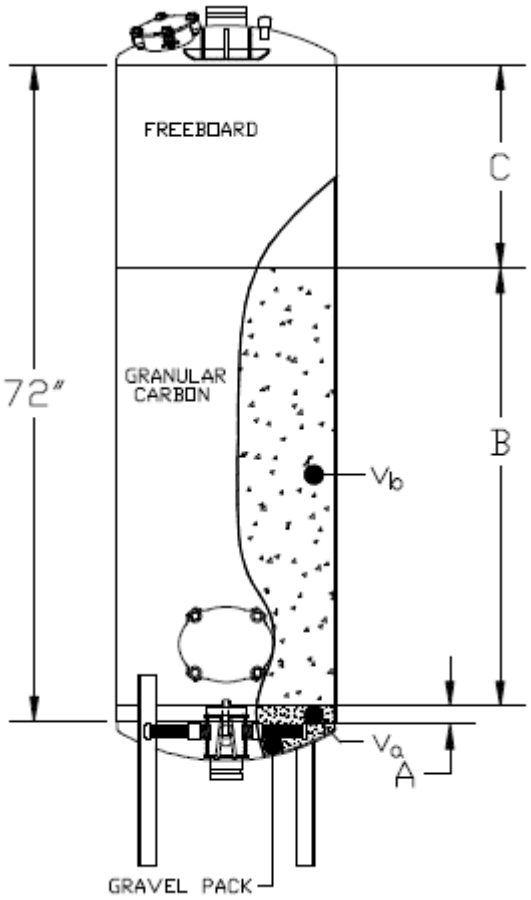
**CAUTION: Wet granular activated carbon in closed vessels creates an oxygen depletion condition, which is hazardous to human health, unless proper precautions are observed. Lack of oxygen due to depletion can be fatal! Take caution and DO NOT enter a tank loaded with carbon.**

Once the crushed rock has been installed and packed around the collection laterals, it should be raked moderately level. The succeeding layer of carbon should now be installed.

Remove all foreign material (i.e. pieces of media bagging material) from the filter vessel. Clean all sealing surfaces of the manway. Chipping of the vessel lining may occur unless the sealing surfaces are free of sand, grit, etc. Close the manway.

## 4. INITIAL BACKWASHING

After completion of the loading process, the filters should be filled with clean, fresh water and allowed to soak for a minimum of 24 hours. After the soaking period the filters should be backwashed following the sequence designed for the filter system. It is recommended that the backwash operation be performed using the manual mode of operation. By the manual mode the operator will familiarize himself with the filter system and will also be available to spot any potential operational problems prior to actual operation of the filter system. The filter should be cleaned until such time as the backwash water becomes clear. A quick check of the backwash water may be made filling a glass container with the water as it exits the filter. The container should not have any sedimentation at the bottom after the water has settled. Granular activated carbon can have significant amounts of black dust associated with it and should be backwashed until the backwash water runs clear. **Refer to Page 9 & 10 for backwash instructions.**




| FILTER DIAMETER (INCHES) | ½" TO ¾" CRUSHED ROCK A (INCHES) | Va (ft³) | GRANULAR ACTIVATED CARBON B (INCHES) | Vb (ft³) | C (INCHES) |
|---|---|---|---|---|---|
| 18 | 2 | 1.0 | 48 | 7.0 | 22.5 |
| 24 | 2 | 1.5 | 48 | 12.5 | 22.5 |
| 30 | 2 | 2.5 | 48 | 19.5 | 22.5 |
| 36 | 2 | 4.0 | 48 | 28.0 | 22.0 |
| 48 | 2 | 7.0 | 48 | 50.0 | 25.0 |
| 54 | 2 | 9.5 | 48 | 63.5 | 24.5 |

*TABLE 2: MEDIA LOADING TABLE; ALL DIMENSIONS AND VOLUMES ARE APPROXIMATE.*

## 5. ROUTINE MEDIA CLEANING

The filter media should be cleaned on a routine basis. The length of the filtering cycle between cleaning sequence is dependent upon the application. Typical filtering cycles are in the 12-24 hour range, however, some applications allow for a much longer cycle; or in some cases, shorter cycles.

The condition, which determines the length of the filtering cycle, is the media bed differential pressure. The differential pressure may be determined by reading the influent and effluent pressure gauges. Subtract the effluent pressure gauge reading from the influent pressure gauge reading. The difference is the media bed differential pressure. The filter system should be cleaned when the differential pressure reaches approximately 10 PSID -- more than the clean filter pressure differential.

It is recommended that a filter be cleaned at least once a day regardless of the application or differential pressure. The cleaning sequence of a filter system varies from one step (for simple systems) to as many twenty steps (for more complex systems). If the filter system were comprised of several filters, the cleaning sequence steps would be multiplied by the number of filters. However, regardless of the complexity of the cleaning sequence, all filters are cleaned by reversing the water flow inside the filter.

In a simple cleaning sequence, valve manipulation will occur simultaneously while in a complex cleaning sequence the valve manipulation will occur over a period of several minutes. In the case of the multiple unit filter system, a delay between stations is recommended to minimize water surges within the filter system.

## 6. OPERATION SEQUENCE

Regardless of the number of filter tanks, the operational sequence for each unit is identical. Therefore, only one sequence example is shown (3-way valve sequence).

**On Line** - Influent/backwash valve open to influent position, on-line timer controls duration (Time between flushes is set as required)

**Backwash** - Influent is closed, backwash is open to backwash position. Backwash timer controls the duration. (Time: 3 min.)

## 7. CLEANING CYCLE TIMER SETTINGS

**Refer to separate manual for operation of backwash controller.**

Various timers are supplied with filter systems to control the duration of the various steps in the cleaning cycle sequence. As a general rule, timer settings are recommendations only. The settings, which should be observed for proper filter system operations, are as follows:

| | |
|---|---|
| Backwash | 180 seconds |
| Delay | 0 |
| D/P Delay | 30 seconds |

**All other timer settings should be determined on site - based upon dirt load, etc.**

## 8. INITIATION OF THE CLEANING SEQUENCE

The cleaning sequence may be initiated by one of the following initiation events: The filter cycle timer, the pressure differential override or the manual override. Generally, the filter cycle timer is the primary initiation source, while the pressure and manual override are secondary initiation sources. In all cases, the automatic controls will accept the first initiation signal. Any subsequent signals will not have any effect on the controls until such time as the cleaning sequence has been completed. Each of the cleaning initiation sources are explained individually below.

## 9. FILTER CYCLE TIMER

The filter cycle timer is generally referred to as the periodic start timer, when the timer reaches its set time a signal is sent to the controlling component to begin a cleaning sequence.

As stated above, this timer is generally the primary initiation source and its set time should be adjusted as required such that it remains the primary source.

## 10. AUTOMATED MODE

The filter system may be cleaned in either of two modes, automated or manual. With the automatic controls in the automated mode, the filter system is capable of completely unattended operation. However, if the case arises, the system may be operated manually.

## 11. FILTER CYCLE LENGTH

The filter cycle time is the period of time between cleaning of the filter(s). This period of time is controlled by the periodic start timer. The optimum cycle length is critical to the proper and efficient operation of the filter system. If the cycle length is too long, the filter media will become excessively dirty, which will result in increasingly shorter filter cycle time. On the other hand, an insufficient cycle length will result in too frequent backwashes and inefficient use of the filter. Due to these factors, the cycle length must be determined on site under actual operating conditions.

The filter cycle controlled by the periodic start timer should be adjusted as stated above until the optimum cycle length has been determined. In some applications, the cycle length will vary depending upon actual operating conditions, such as the time of year, the amounts of solids in the influent water, etc.

## 12. BACKWASH VALVE AIR SUPPLY

The filters are designed to use air pressure for backflush valve actuation. A pressure regulator and gauge assembly should be used prior to connecting the air supply to the solenoid valves. Once the system has been put on-line the air supply can be regulated for proper backflush valve opening. The backwash valves should open into the backflush position with minimal noise and hammer.

The air supply requirement varies with the size of the filters and the pressure at which the filters will operate. The GAC-36", 48" and 54" require the air supply to the backwash valves be at least 75% of the system operation pressure.

The air supply required to operate the valves on the GAC-18, GAC-24 and GAC-30 is approximately one-half of the system operating pressure. In all cases, the air supply to the regulator should exceed the air supply requirements for the backwash valves.

The air supply is routed through a 24VAC normally closed solenoid valve. One solenoid valve is supplied for each backwash valve.

The solenoids are mounted on the backwash control box and pre-wired at the factory.

On the larger systems, GAC-5472-4 through GAC-5472-6, it will be necessary to install the supply tubing from the solenoid valves to the backwash valves. The tubing is pre-cut and numbered to correspond with the respective backwash valve.

The solenoid valves are supplied with a manual override. In the event the electrical supply to the backwash controller is interrupted, the filters can be backwashed by using the manual operator. Turning the thumb screw located on the base of the solenoid valve to the "ON" position will change the position of the solenoid plunger allowing air pressure to open the backwash valve. The filter can now be backwashed.

To terminate the backwash, the manual operator should be turned to the “OFF” position.

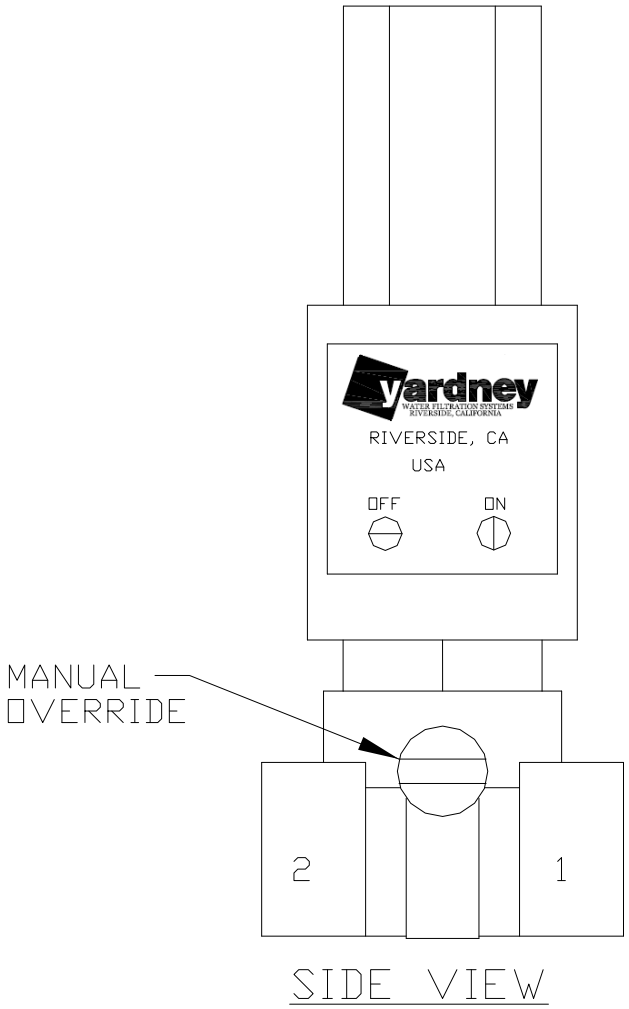
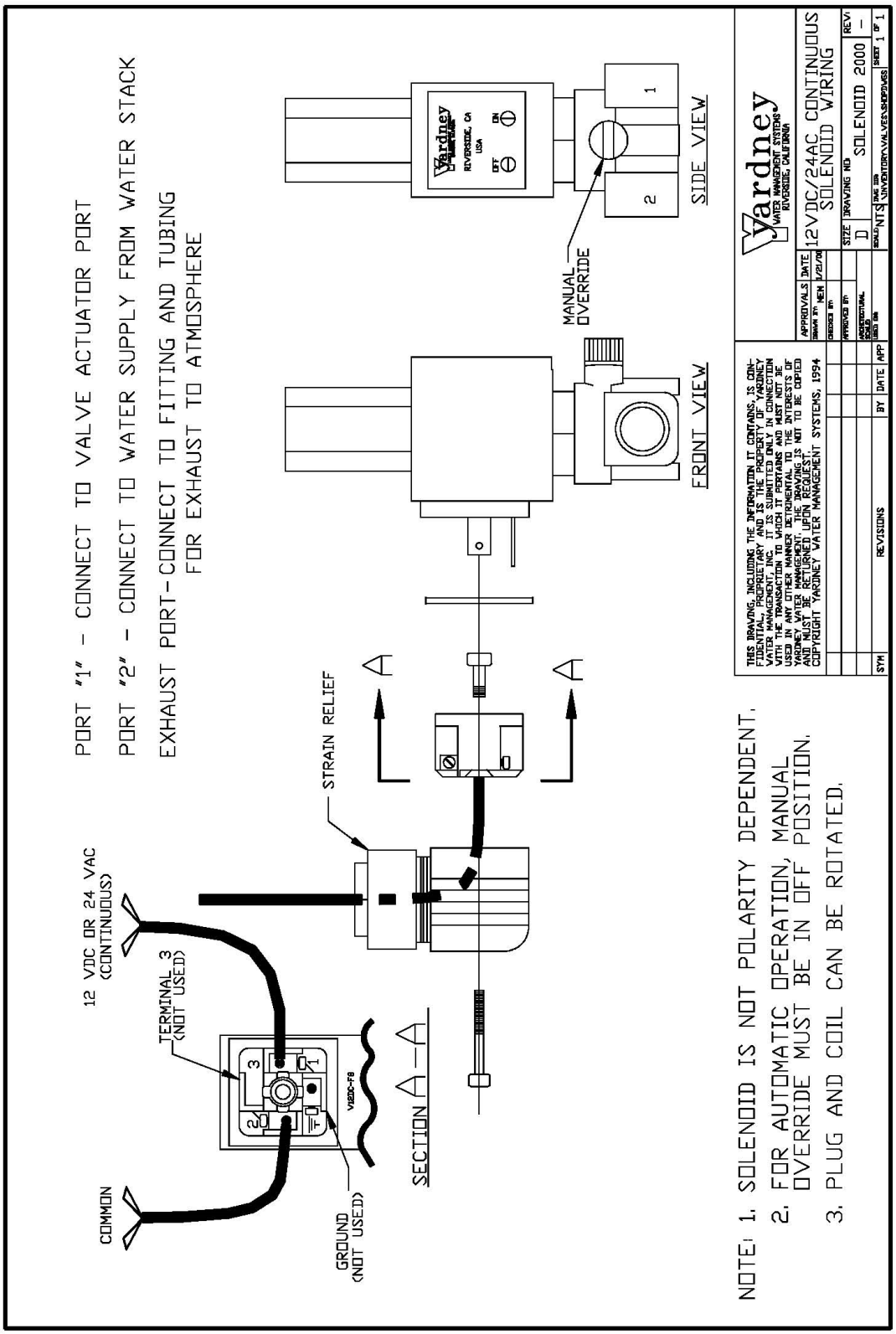
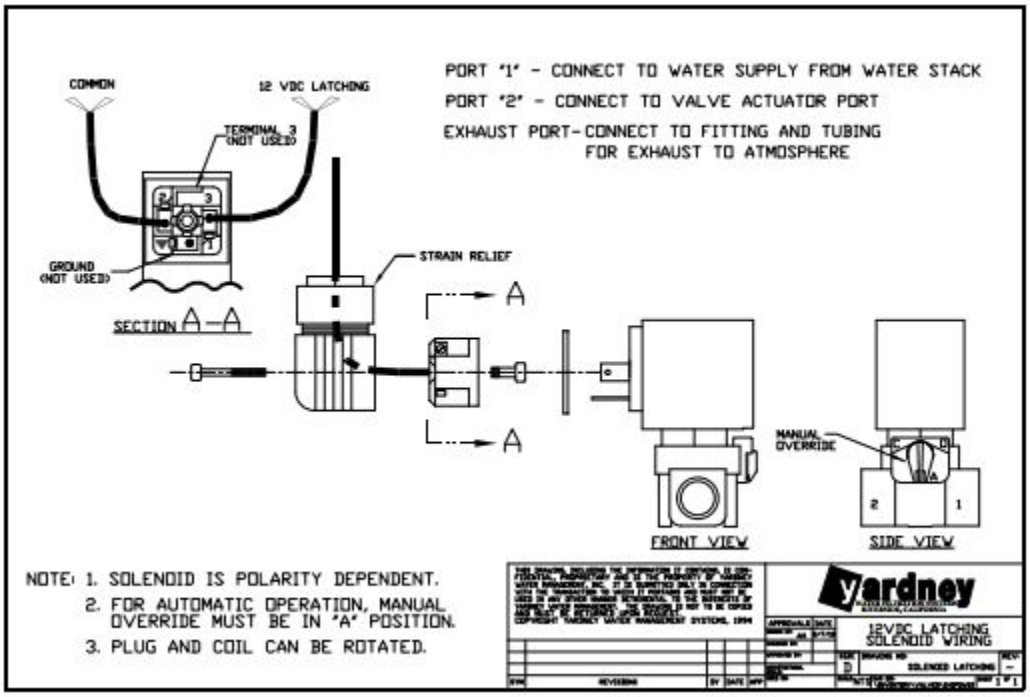
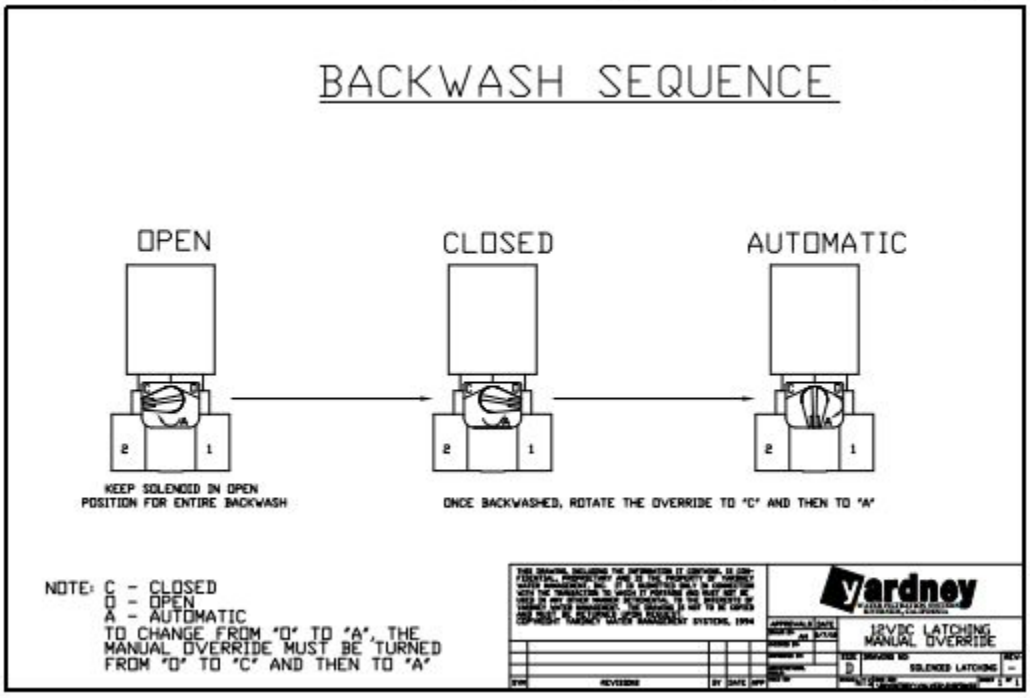



*FIGURE 2: SOLENOID WITH MANUAL OVERRIDE THUMB SCREW.*




*12VDC/24VAC CONTINUOUS SOLENOID WIRING.*




*12VDC/24VAC CONTINUOUS SOLENOID WIRING.*

## 13. SYSTEM START-UP

The following start-up sequence can be used for the starting up of both automatic and manual backwash filter system. In the event that the filter system is supplied with manual backwash valves, then the manual backwash valve operator supplied with the system must be used for opening and closing the backwash valves.

> **NOTE:** First time start-up should be done with caution. All air must be purged out of all lines and filters. Valves and pumps must be opened slowly to prevent damage to filters and related components.

13.1 Start the system in the manual mode with the controller in the "OFF" position, with the backwash restrictor valve in the 1/4 open position. Introduce the water into the filter system, filling lines and tanks slowly.

13.2 When approximately 10 PSI is obtained, turn manual override knob on solenoid on Tank #1 to "ON" position for 1 to 2 minutes. Turn Tank #1 "OFF" and repeat on Tank #2, etc. (This is done to purge entrapped air from the tanks.)

13.3 When 50% of the system pressure is attained, repeat the manual flush cycle to again purge the entrapped air.

13.4 When 100% of the system pressure is reached or after 15 minutes of operation, repeat the flush cycle allowing 3 minutes flush per tank.

13.5 With manual override knob in the "OFF" position, turn the flush controller on. Set 180 seconds on flush time and 10 seconds on delay time. Push manual start button and system should go through an automatic flush cycle.

13.6 Set the pressure differential switch to 10 psi over the clean filter pressure differential. (Example: Clean filter pressure differential of 5 PSI + 10 PSI = 15 PSI pressure differential switch setting.)

13.7 The automatic controller should be set so that the frequency of filter backwashing corresponds with the buildup of pressure drop to the established dirty filter pressure differential set point. Establishing the time frequency of flush may require several days of monitoring to determine the proper setting. (Example: If it takes 6 hours of operation to reach the dirty filter pressure switch setting of 15 PSI, the backwash frequency should be set at 6 hours on the controller.)

13.8 The backwash restrictor valve adjustment - A critical factor to successful carbon filtration operation!!!

a. Open the backwash restrictor control valve approximately 25%. (1 to 1-1/2 turns depending upon valve brand.)
b. Be sure all air is purged from each tank by partially opening and closing each tank flush valve.
c. Before proceeding with backwash adjustments, the pump must be run long enough to fill the entire system at the designed pressure and flow.
d. Using the manual override on the solenoid valve, manually open the flush valve on one tank. This changes that tank from the filtering mode to backwash (see Fig. 2).
e. By the use of a screen, your hand, or a sampling device, monitor the contents of the backwash water.
f. Gradually open the backwash restrictor valve until a small amount of the filter media from the backwash water appears.
g. When media begins to show in the backwash water, close the backwash flow control valve until the water is essentially clear of media. A trace of media is acceptable since it is desirable that the lighter granules (fines) in the bed be allowed to wash out. After completing the above adjustments, all tanks should be backwashed extensively (3 to 5 minutes each) to remove contaminants and fine material usually found in newly installed media.

**IMPORTANT NOTES**:

1. If, at a later time, you make any significant changes in pressure or flow, the above adjustments should be checked.
2. We recommend backwashing at 10 PSI above clean filter pressure differential.

## 14. OPERATION OF THE AUTOMATIC CONTROLS

Yardney GAC filters are normally supplied with solid-state electronic controls (see Yardney Synergy controller instructions contained within the control box.) the control box operation is detailed in a separate instruction manual.

14.1 Periodic – Sets the time between the backwash processes.

14.2 Flush Time – Sets the duration of the backwash.

14.3 Delay – Set to “5” seconds for air actuated valves. Set to allow for a slight valve overlap on hydraulically actuated valves.

14.4 Pressure Differential – The system is designed for use with the supplied pressure differential switch gauge that senses a differential in pressure across the filter bed as the contaminant accumulates in the filter bed. When a pressure drop through the filter reaches the setting on the gauge, the switch will initiate a backwash after sensing the sustained pressure loss for more than 30 seconds.

## 15. INITIAL SETTINGS FOR THE AUTOMATIC CONTROLS

15.1 Periodic: During start-up, the filters should be backflushed every two hours. After observing how rapidly the filters load up, the interval between backflush can be increased to as long as once every 24 hours depending on the amount of contaminant accumulation. We recommend backflushing when the filter shows a 10 PSI (net of clean filter differential pressure) between the gauges.

15.2 Flush Duration: During start-up and initial operation, the backflush duration should be set for 2-1/2 - 3 minutes. The minimum backwash duration should be set at 2 minutes.

15.3 Delay: The delay time should be adjusted to allow an overlapping of the backwash valves. The next valve in sequence should start to open a few seconds before the proceeding valve closes. If the valve shuts off completely, prior to the opening of the next valve, water hammer may occur.

## 16. PRESSURE DIFFERENTIAL

A pressure differential switch connected electrically to the controller terminals marked "P.D." When the pressure drop reaches the setting set on the gauge, the switch will override the "periodic hour" setting and initiate a flush cycle. This is to protect the system from loading up with particulate prior to setting for backwash, set on the controller. A flush cycle initiated by the pressure differential switch is treated like a regular flush cycle and will zero the interval time elapsed so that the correct interval setting will initiate the next flush cycle.

> **EXAMPLE:** If the interval setting is for 12 hours and the P.D. switch initiates a flush cycle 6 hours into this setting, the next scheduled flush cycle will be 12 hours later. This eliminates doubling up of backflush events.

## RECOMMENDED SPARE PARTS

| Number | | Part |
|---|---|---|
| 1. | **Electrical** | |
| | Solenoid valve 24 VAC | 166002460 |
| | Pressure differential switch 0 – 20 PSI | 166070020 |
| 2. | **Gauges** | |
| | 0-100 PSI glycerin filled, SS body | 144025100 |
| 3. | **Valves** | |
| | Urethane seal | |
| | For 1 ½" D series valve | 136070150 |
| | Urethane seal D series valve | 136070300 |
| | For filter size GAC-24, 30 | |
| | Urethane seal 454D series valve | 136070400 |
| | For filter size GAC-36, 48, 54 | |
| | O-rings (1 per valve) 1 ½" D series valve | 141000037 |
| | O-rings (2 per valve) 342D and 454D series valves | 141006087 |
| | Back-up rings (2 per valve) 1 ½" D series valve | 141090037 |
| | Back-up rings (4 per valve) 342D & 454D series valves | 141090063 |
| | Bushing O-rings (2 per valve) 342D & 454D series valves | 141008100 |
| | Diaphragm (1 per valve) 1 ½" D series valve | 136090251 |
| | Diaphragm (1 per valve) 342D series valve | 136090454 |
| | Diaphragm (1 per valve) 454D series valve | 136090454 |
| 4. | **Gaskets for Grooved Couplings** | |
| | 1" for filter size GAC-24, 30 | 108560150 |
| | 2" for filter size GAC-24 | 108560200 |
| | 3" for filter size GAC-24, 30 | 108560300 |
| | 4" for filter size GAC-24, 30, 36, 48, 54 | 108560400 |
| | 5" for filter size GAC-36, 48, 54 | 108560500 |
| | 6" for filter size GAC-48, 54 | 108560600 |
| 5. | **Lid Gaskets** | |
| | Side Manway -- 9-3/4" x 7-3/4" | 142023036 |
| | For filter size GAC-24, 30 | |
| | Side Manway -- 14-1/4"OD | 140031114 |
| | For filter size GAC-36, 48, 54 | |
| | Top Manway -- 7-5/16" x 5-1/8" | 142022400 |
| | For filter size GAC-24 | |
| | Top Manway -- 9-3/4" x 7-3/4" | 142023036 |
| | For filter size GAC-30, 36 | |
| | Top Manway -- 14-1/4" OD | 140031114 |
| | For filter size GAC-48, 54 | |
| 6. | **Filtration Media** | |
| | ½" – ¾" crushed rock | 148055075 |
| | Activated Carbon | 148041240 |