WHITEMAN, OSTERMAN AND HANNA
99 Washington Avenue
Albany, New York

CONTINGENCY PLAN FOR TREATMENT OF RESIDENTIAL SUPPLIES AT BRAULT LAGOON SITE WEST CHAZY, NEW YORK

May 1985

LMSE-85/0171&442/019

LAWLER, MATUSKY & SKELLY ENGINEERS
Environmental Science & Engineering Consultants
One Blue Hill Plaza
Pearl River, New York 10965

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1.0

INTRODUCTION

The purpose of this report is to summarize the results of an investigation to find the safest and most practical means to reduce levels of volatile organic compounds (VOCs) in the water supplied by individual residential wells in the vicinity of the Brault Lagoon site, West Chazy (Clinton County), New York. A system has been specified that will bring water found to be in excess of applicable standards to acceptable levels.

At this time (April 1985), none of the local residents are receiving water with unacceptable amounts of VOCs.

CHAPTER 2.0

IDENTIFICATION AND EVALUATION OF ALTERNATIVES

2.1 TECHNOLOGIES

Several alternative mechanisms are available for purifying water contaminated by VOCs. For point-of-use application (that is, not for centralized public supplies) they are boiling, aeration, reverse osmosis, and activated carbon adsorption.

Boiling water to drive off the VOCs is acceptable only as a short-term solution and has not been evaluated for further application. Aeration, because of the size of the equipment involved and air flow requirements, is not satisfactory for residential use. Reverse osmosis appeared to be a promising technology at one time; however, its use is not widespread, and the one company known to have manufactured units suitable for residences is no longer marketing them.

Activated carbon adsorption (ACA) is in widespread use for treating organic compounds. In New York State there are over 2000 operating units installed on private wells. Though the literature on their use is scanty, enough information is available to make an assessment of their performance in the Brault lagoon area.

2.2 TYPES OF UNITS

There are five basic types of activated carbon point-of-use devices.

1. Pour-through units. These are not attached to any portion of the plumbing system. Water is poured

through the top of the unit and collected in a reservoir. These units are considered unacceptable for use in West Chazy because of their limited capacities and cumbersome operation.

2. Faucet-mounted units. These attach to the end of a faucet and are typically used to remove objectionable taste and color. Treatment capabilities are limited both in terms of carbon quantity and contact time (discussed below). They are not considered a satisfactory solution for the removal of VOCs.

3. Line bypass unit. These units are usually installed to treat only the kitchen sink cold water line. They can be installed under the sink if room is available. Otherwise, more extensive replumbing is required. A bypass line is installed so that untreated water can be used for other than drinking and cooking purposes, thereby conserving on carbon utilization and allowing the use of small cartridges. The advantage of this type of unit over a whole-house unit (discussed below) is that less costly cartridges can be used. However, if additional treatment of the water is required to allow the ACA units to operate properly (disinfection, iron removal, manganese removal, backwashing - discussed later), the line bypass units lose much of their cost advantages. Additionally, such installations do not permit water to be drunk from the bathroom tap, nor do they address inhalation of VOCs from showers.

4. In-line single tap units. These are similar to the above, except that no bypass is available.

5. In-line whole-house units. These units provide treatment for the entire water supply for in-house uses. Outside taps are supplied with untreated water derived from a bypass line installed upstream of the carbon units. This bypass is needed to keep the carbon units of a practical size and conserve on carbon utilization. The outside taps need to be marked to indicate that the water is untreated.

The in-line whole-house ACA unit is the most practical method for addressing the problems at the Brault lagoon site.

CHAPTER 3.0

DESIGN CONSIDERATIONS

3.1 GENERAL

The basic point-of-use ACA system consists of the following five elements (see Figure 3.0-1):

1. Two ACA cartridges. These are situated in series so that the effluent from one cartridge is polished by the second cartridge. When (or before) the carbon in the first canister has been exhausted and the contaminants are "breaking through," the first canister is removed and replaced by the polishing canister, which then becomes the first filter. A new polishing filter filled with virgin carbon is then installed. This replacement process is referred to as rebedding. Activated carbon is corrosive and special materials need to be used for construction of the cartridges, i.e., for home units, black iron (Culligan equipment) or resin coated (Bruner equipment).

2. Backwash system. Because the local waters are high in iron and manganese, backwashing of the first (upstream) cartridge will be required.

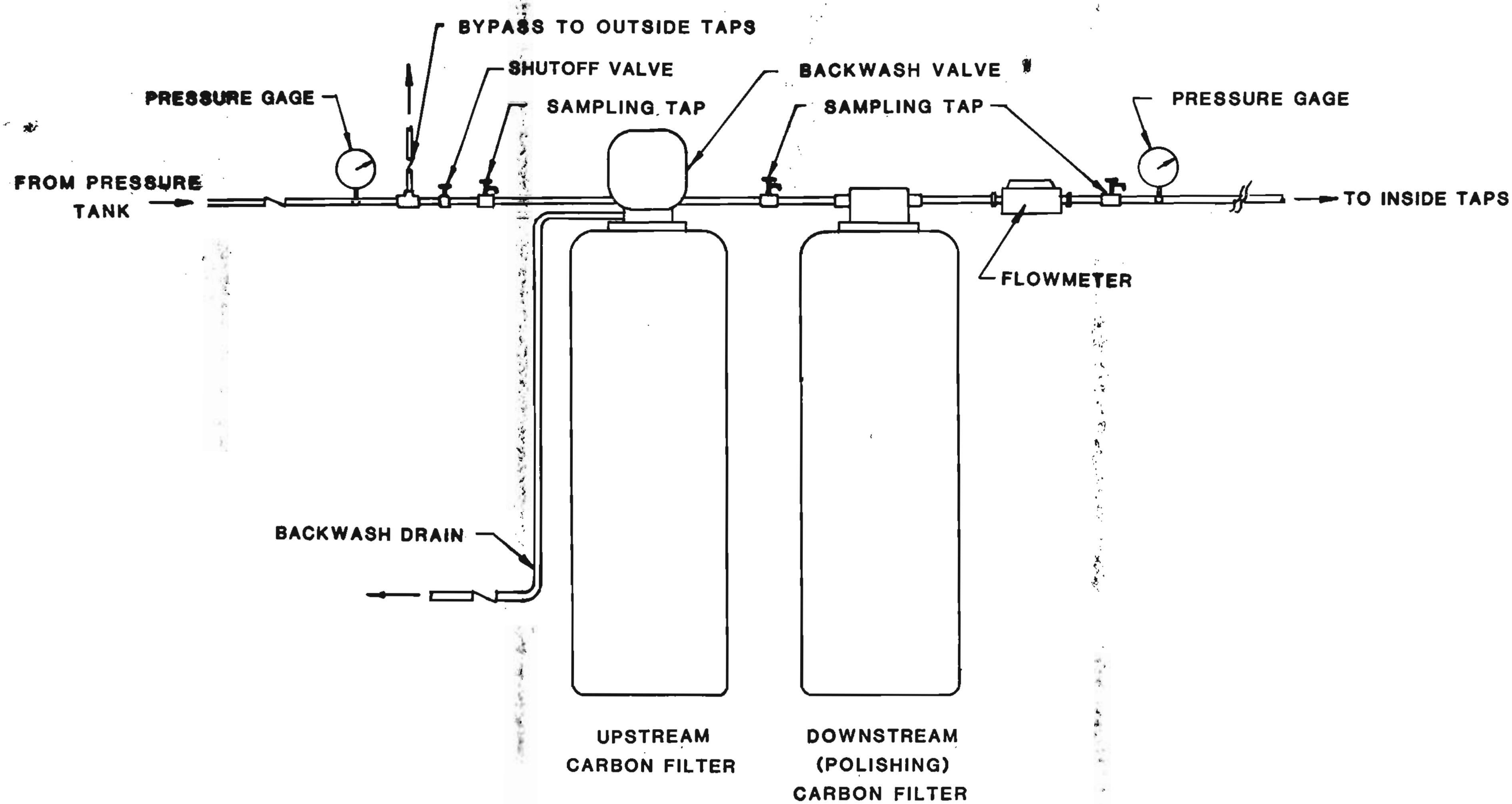
3. Sampling taps. Three should be provided to sample in front of, between, and following the two cartridges.

4. Pressure gages. At a minimum, one gage should be installed upstream of the cartridges. A second downstream gage is recommended to monitor for unacceptable loss of pressure through the treatment system.

5. Flowmeter. This is required to monitor water consumption and evaluate the performance of the system.

FIGURE 3.0-1

BASIC ACA SYSTEM



3.2 CARBON UTILIZATION

The ability of an ACA system to remove VOCs is dependent on the mix and concentrations of contaminants, the required effluent values, the type of carbon, hydraulic loading (both instantaneous and average), and size of the carbon bed in terms of depth and cross-sectional area. Temperature and pH also affect the performance of the system. Several literature sources were reviewed to ascertain the adsorption rates expected in home units. A summary of the useful sources is given below:

	LB 1,1,1-TCE REMOVED PER LB CARBON			
SOURCE	INFLUENT LOADING:	100 ppb	1000 ppb	CARBON TYPE
Cohen & Dobbs		0.0016	0.0053	?
Love et al.		0.0010	0.0020	Filtrasorb 300
		0.0027	0.0041	Witcarb 950
Calgon		0.0025	0.0041	GW 12 x 40

Cohen and Dobbs developed activated carbon isotherms for a number of organic substances, including 1,1,1-TCE. Isotherms present a relationship between the amount of a substance adsorbed and its concentration in the surrounding solution. The above figures were calculated from the graphics of that report. Love summarized investigations of others. Values from isotherms of two different carbons are given above. The Calgon isotherms are taken from a company fact sheet. As the above tabulation indicates, all of the above values compare reasonably well.

The above tabulated capacities should be interpreted as theoretical maximums because the isotherms are based on higher water-to-carbon contact times than occur in operating ACA systems. With pilot-scale ACA systems (rather than the apparatus for determining isotherms), Love reported that carbon capacities could range widely from 0.00002 to 0.0075 lb 1,1,1-TCE removed per pound of carbon, depending on the influent concentration (237 to 1000 ppb). However, breakthrough (the point at which the carbon was determined to be exhausted) was set at only 0.1 ppb. If higher breakthrough values were specified, the carbon capacities would increase appreciably.

A preliminary estimate of carbon requirements for a typical household can be made with the following calculation:

ITEM	INFLUENT (ppb 1,1,1-TCE) 100	1000
Influent mass	1 lb 1,1,1-TCE per 1.4 MG	1 lb 1,1,1-TCE per 0.14 MG
Carbon capacity (from Calgon isotherms, above)	0.0025 lb/lb	0.0041 lb/lb
Carbon utilization (weight)	1 lb carbon per 350 gal	1 lb carbon per 600 gal
Carbon density	29 lb/ft^3	29 lb/ft^3
Carbon utilization (volume)	100,000 gal/ft^3 carbon	17,000 gal/ft^3 carbon
Household consumption	300 gpd	300 gpd
Carbon exhaustion rate	300 $days/ft^3$ carbon	60 $days/ft^3$ carbon
Safety factor	1.5	1.5
Expected rebed interval	200 day/ft^3 carbon	40 $days/ft^3$ carbon

As detailed below, practical sizes for ACA cartridges are 1 ft^3 and 2 ft^3. For the 2 ft^3 unit, replacement intervals should be expected to range from four to less than once per year, depending on the quality of the water.

Studies on operating ACA systems for the purpose of evaluating carbon bed depth and cross-sectional area are somewhat contradictory.

In general, greater bed depth will result in greater water-carbon contact time and thereby offer greater removal efficiency for a given flow. Greater water usage will necessitate greater bed depth. The bed cross-sectional area affects both contact time and pressure loss through the system. For industrial applications, loading rate design values typically range from 2 to 10 gpm/ft^2.

The New York State Department of Health has developed advisory guidelines for sizing point-of-use ACA systems:

1. The system should be sized to handle at least 5 gpm. When running individually, most in-house domestic uses require less than 5 gpm. However, when water is being used for more than one purpose, e.g., shower and toilet, this rate can be exceeded, depending on the characteristics of the plumbing. This high flow does not necessarily result in poor quality water being delivered to the household, but it will result in greater pressure losses through the ACA system. Depending on the capabilities of the pressure tanks, some inconvenience and/or a need to change the resident's use of water will result.

2. The maximum application rate should be 10 gpm/ft^2. For a standard 10-in. OD tank (9.5-in. ID), the allowable loading would be 4.9 gpm (say 5 gpm), just meeting Guideline 1 (above).

3. The empty bed contact time should be at least 3 min. With the above-referenced loading of 5 gpm, 2 ft^3 of carbon would be required. Thus, the minimally acceptable arrangement would be two 1-ft^3 units in series. There is a safety factor built into this specification because water initially drawn from the cartridges after a period of non-use would achieve much higher contact time.

With these specifications as a basis, a preliminary analysis of alternatives for sizing the cartridges was performed. Cartridge capacities of 1 ft^3, 2 ft^3, and 3 ft^3 were investigated. Several manufacturers known to market point-of-use systems were contacted regarding the availability of units in these size ranges:

- Sears, Roebuck & Co.
- Lindsay
- Bruner
- Culligan

Sears markets a 1-ft^3 unit, but could not make available to LMS a technical specialist to discuss details of their equipment. Lindsay, the supplier for Sears, subsequently indicated that their equipment was not adequate for the needs of this program.

The Bruner equipment for home use is marketed in 1- and 2-ft^3 sizes. A 3-ft^3 cartridge is available, but Bruner considers this size impractical for home use for the following reasons:

1. A larger, nonstandard backwash valve is required.
2. The size and weight of the canister makes handling unwieldy, particularly when it is filled with wet carbon.
3. Whereas the replacements for the 1-ft^3 and 2-ft^3 systems are prefilled cartridges, the 3-ft^3 unit has to be emptied and refilled on location. Carbon dust poses a significant nuisance problem.

Culligan also markets various size units. However, as of this writing, little specific information was made available to LMS.

The cost of the basic 2-ft^3 cartridge for the Bruner equipment is $165 more than it is for the 1-ft^3 system for installation and $55 more for each rebed ($340 vs $285). As explained below, the 1-ft^3 cartridge system will need to be replaced at least three times per year, whereas the 2-ft^3 system, with twice the capacity, will need rebedding only 1.5 times per year. After one year, the savings in rebeds for the 2-ft^3 system will more than offset its higher initial costs.

There are other advantages of the larger unit. First, a longer canister life will require less frequent monitoring for breakthrough. Second, the 3-min connect time Health Department guideline can be met in flow rates up to 10 gpm (however, there will be pressure loss through the system at this rate).

3.3 OTHER CONSIDERATIONS

3.3.1 General

Specific adjustments must be made to reflect the need for disinfection, pretreatment, and location vis-a-vis the water pressure tank.

3.3.2 Disinfection

The need to provide disinfection is a result of two concerns:

1. Bacteria may interfere with the operation of the system bed. This would be a particular problem with filamentous bacteria.
2. Pathogens may grow in the carbon bed and pose a health hazard in the drinking water.

There is little agreement in the literature concerning pathogen buildup on carbon beds. Some researchers have found considerable bacteria growth in ACA systems. Others have found that some growth does occur during times when the system is not in use but not at any significantly greater level than would be expected in other components of residential plumbing systems, and that a minor amount of flushing after a period of non-use will eliminate any nuisance condition.

Likewise, there is little agreement about the treatment needed to eliminate the problem, if one exists. Culligan, one ACA unit supplier, recommends that postultraviolet (UV) disinfection be provided. Bruner, another supplier, recommends that prechlorination with a hypochlorite solution be used if bacteria problems are anticipated. This requires that an 80-gal retention tank (smaller, if credit is taken for the retention in the pressure tank) be installed to provide sufficient contact time.

The state health department recommends that postdisinfection be provided, preferably by UV equipped with self-wipers and dosimeters. A recommended alternative to UV is post-hypochlorite injection and detention. The department did not specifically address the possible impact of prechlorination in their document.

A reasonable approach is to follow the manufacturer's recommendations. In the case of Bruner, this will entail prechlorination to reduce clogging if bacteria are present in the influent. If no bacteria are present, then chlorination (either pre- or post-) will not be provided, though the plumbing fittings to allow this installation will be provided. However, the system will be monitored to determine whether bacteria multiply in excess of applicable standards. In this event the system will be corrected by the addition of the necessary disinfection equipment. Basing the need for disinfection upon actual system performance is considered the most practical approach as the literature on this topic is so contradictory. (It should be recognized that, as detailed below, chlorination will be needed for most of the local wells so as to oxidize iron/manganese, thus eliminating most of the concern over possible pathogen growth.)

3.3.3 Iron and Manganese Removal

With iron and manganese concentrations below .3 and 0.05 mg/l, respectively, backwashing alone will eliminate any clogging. At higher concentrations, either a backwashing iron prefilter or a prechlorination system for oxidizing and settling the metals must be installed. If disinfection is needed in any event, then the iron/manganese would be reduced at the same time.

At concentrations of 0.3 to 3 mg/l, iron would not interfere with the ACA system, but would still be a household nuisance. Food-grade polyphosphate could be added if the retention tank were installed. Otherwise, the backwashing iron filter would be available for use.

3.3.4 Location

The ACA system can be installed either upstream or downstream of the pressure tank. Both Bruner and Culligan recommend that their equipment be installed downstream so as to keep the carbon system under constant pressure to allow proper backwashing. Unacceptable pressure loss through the ACA system could be remedied by increasing the rating of the pressuring system. Also, capacities of well pumps are typically unknown. A large pump could overload the carbon beds hydraulically, with inadequate treatment the result. Furthermore, any desorption of contaminants from the pressure tank would be treated.

3.4 SPECIFICATION AND SPACE REQUIREMENTS

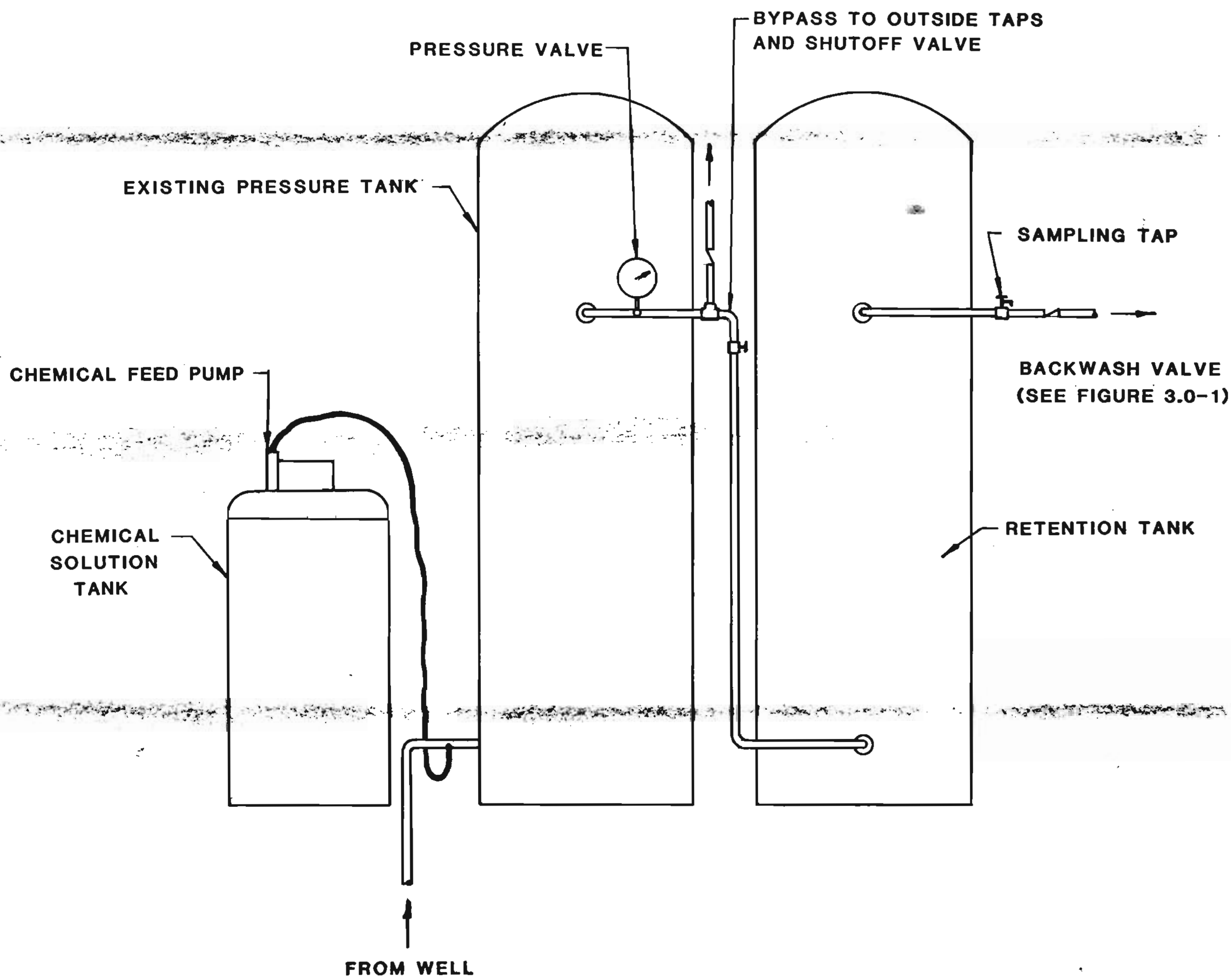
As explained in Chapter 4.0, Bruner equipment filled with Calgon carbon should be specified for the Brault Lagoon area. Appendix A contains a brochure illustrating the AF 10 automatic backwashing filter with a polishing unit. Each unit is 10 in. in diameter and 60 in. high. Inlet and outlet connections are 1 in. NPT female and the drain connections to the valve are 1/2-in. NPT female. The required water pressure range is 25-125 psi. Electrical requirements are 115/120 V, 60 Hz (3 watt continuous) for the chemical feed pump(s) and the automatic backwash. Without electricity the filter will still operate but will have to be backwashed manually. Each filter contains 58 lb of Calgon GW 12 x 40 virgin carbon. A 3/4-in. Ista flowmeter is also specified. A bypass assembly with associated valves is included as well as miscellaneous fittings such as sample taps. The tanks are of fiberglass construction, and all piping and fittings are plastic or noncorrosive stainless steel.

The optional pretreatment system contains an 80-gal retention tank 20 in. in diameter and 5 ft tall. A chemical solution tank that contains approximately 30 gal and is 18 in. in diameter and 30 in. tall is included. A chemical feed pump sits on top of the chemical solution tank. Figure 3.0-2 is a plumbing layout showing the configuration, including the optional chemical feed system.

The basic system requires space for the 10-in. diameter cartridge plus room for fittings. Side by side, a minimum of 24 in. is required. A 6-in. space is required from a back wall and 18 in. must be maintained in front. Proportionally more space will be required if any pretreatment is needed.

FIGURE 3.0-2

CHLORINATION CONFIGURATION



CHAPTER 4.0

OPERATIONAL CONSIDERATIONS

4.1 CARBON DISPOSAL

The spent carbon must be properly disposed of when exhausted. Because this material is generated by the household, it is not a RCRA hazardous waste.

A system has been set up for Long Island, New York, whereby the used canisters containing the spent carbon are transported (without manifesting) to the licensed TSD facility owned by the vendor. From there the carbon is accumulated until there is sufficient quantity to justify a bulk shipment of the material to Calgon, the carbon manufacturer. The manufacturer then regenerates the carbon for subsequent use in industrial applications. (Only virgin carbon is used for the domestic systems.)

4.2 MONITORING

The state health department recommends that samples be collected at quarterly intervals of the theoretical bed life. Samples should be collected upstream, between, and downstream of the two canisters and analyzed for VOCs. Downstream samples should also be collected and analyzed for standard plate count to ascertain the need for disinfection, if none is provided.

Once the performance of the system has been fully documented, the sampling frequency can be reduced. At a minimum, samples should be collected when the carbon beds are replaced.

4.3 MAINTENANCE

As previously indicated, several suppliers were contacted to ascertain the availability of equipment and maintenance contracts. Only Bruner's local representative, King Marketing/Design Engineers, indicated that an installation/maintenance package is available. Design Engineers installed and is servicing the previously noted 2000 units on Long Island. LMS has reviewed their price quotes and found them competitive with prices of other suppliers. Given their experience in New York, competitive price, and willingness to operate and maintain a turnkey installation, LMS recommends that this company be relied on for the ACA systems.

Design Engineers will subcontract to and train a local plumber to install and maintain the system. LMS recommends that Harris issue a purchase order directly to Design Engineers to this end. Major cost elements of the P.O. should be: (1) an initial lump sum charge for setting up the administrative program at Design Engineers and subcontracting with a local plumber, (2) a per installation charge depending on equipment needed, and (3) a per rebed charge.

APPENDIX A

EQUIPMENT SPECIFICATIONS

CALGON CORPORATION

GW 12X40

GRANULAR ACTIVATED CARBON

ACTIVATED CARBON PRODUCT BULLETIN

Highly Effective and Economical Filter Medium For Dechlorination and Trace Dissolved Organic Removal Used in Water Treatment Equipment Where High Quality Water is Desired

Calgon® GW 12X40 Granular Activated Carbon is a filter medium designed for efficient dechlorination and removal of trace dissolved organics from water supplies, including those causing tastes and odors. It is distributed through manufacturers of water conditioning equipment.

The effectiveness and economy of water treatment equipment using GW 12X40 Carbon have resulted in wide acceptance in food processing and beverage industries, where dechlorination and dissolved organic removal are of prime importance. This carbon is also used in steam generating plants to produce high quality make-up water.

advantages and benefits

- **Economical to use** — Particle size, high surface area and high density of GW 12X40 Carbon result in long filter life, providing maximum assurance against chlorine breakthrough and an extended service period for removing dissolved organics from water.
- **Provides long-lasting protection** — The high surface area of this product, approximately 900 square meters per gram (N_2-BET method), effectively removes a wide range of dissolved organics over a long period of time. Produced under rigidly controlled conditions by high temperature steam activation, GW 12X40 Carbon provides a pore structure with optimum characteristics for removing dissolved organics to produce high quality potable water.
- **Superior hardness** — GW 12X40 Carbon is made from selected grades of bituminous coal combined with suitable binders to give superior hardness for long life.
- **Suitable for backwashing** — The high density and hardness of GW 12X40 Carbon allows rapid wetting and makes it suitable for effective backwashing with minimum losses. For the purpose of estimating the volume of GW 12X40 Carbon in systems utilizing backwash procedures, GW 12X40 Carbon has a backwashed and settled bulk density of 29 pounds per cubic foot.

dechlorination of water

The properties of GW 12X40 Granular Carbon offer superior dechlorination efficiency. In most water treatment applications, a bed of GW 12X40 will provide dechlorination of the water for periods varying between one and three years.

Dechlorination efficiencies are significantly improved at higher water temperatures and lower pH values. The presence of some organic impurities does not affect dechlorination performance, while other impurities can lower efficiency significantly.

The performance of GW 12X40 for dechlorination will depend on the conditions of treatment and the water supply treated. As a manufacturer of water conditioning equipment, you can assist your customer in estimating dechlorination efficiency based on his operation and the water supply being treated.

specifications

Mesh Size, U.S. Sieve Series	12X40
Larger than 12 Mesh, Max. %	5
Smaller than 40 Mesh, Max. %	5
Mean Particle Diameter, mm	0.9-1.1
Iodine Number, Minimum	850
Methylene Blue Number, Minimum	180
Abrasion Number, Minimum	75
Ash, Maximum, %	11.0
Moisture as Packed, Maximum, %	2.0

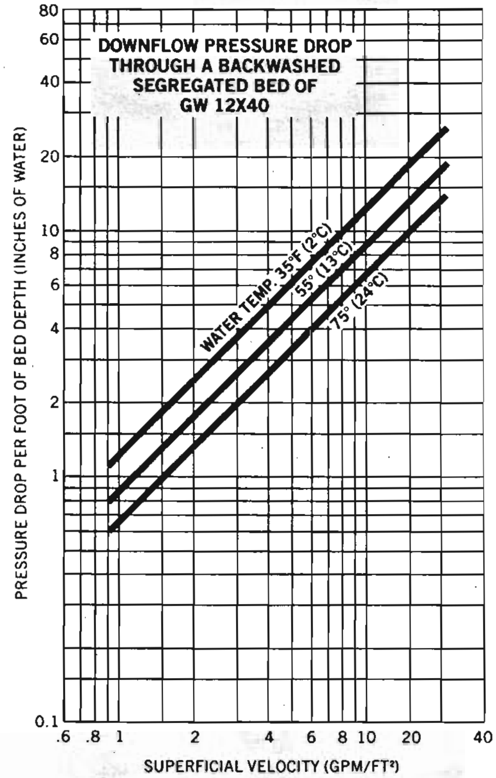
packaging

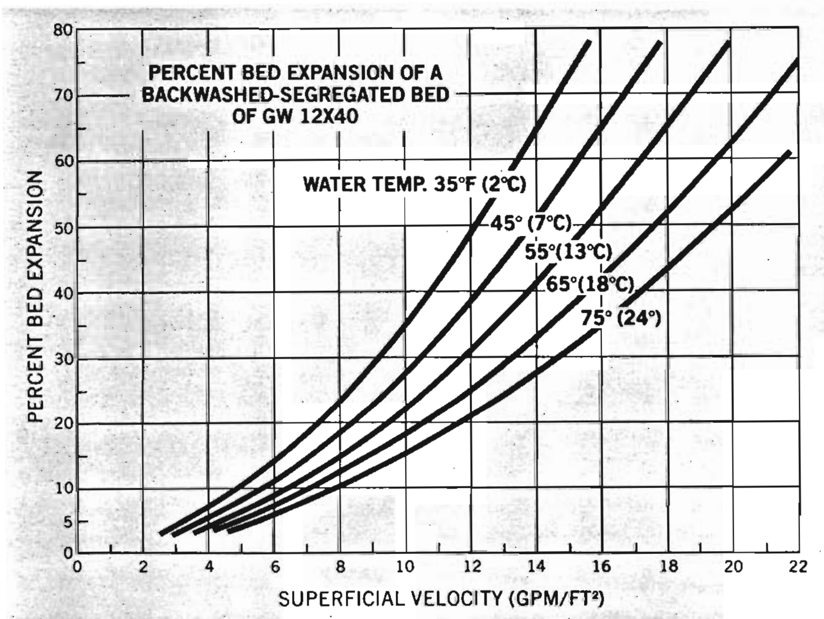
Packed in 5 cu. ft. fiber drums, 145 lbs. net; 2 cu. ft. drums, 58 lbs. net; and 2 cu. ft. bags, 58 lbs. net. Shipping point, Catlettsburg, Kentucky.

precaution

Wet activated carbon preferentially removes oxygen from air. In closed or partially closed containers and vessels, oxygen depletion may reach hazardous levels. If workers are to enter a vessel containing carbon, appropriate sampling and work procedures for potentially low-oxygen spaces should be followed, including all applicable Federal and State requirements.

For information regarding incidents involving human and environmental exposure, call (412) 777-8000 and ask for the Regulatory and Trade Affairs Department.





For additional information, contact your nearest regional office listed here or write to the Activated Carbon Division, Calgon Corporation, P.O. Box 1346, Pittsburgh, Pa. 15230.

Calgon Corporation
P.O. Box 1346
PITTSBURGH, PENNSYLVANIA 15230
(412) 777-8000

Calgon Corporation
120 E. Ogden Avenue
HINSDALE, ILLINOIS 60521
(312) 325-9090

Calgon Corporation
7405 Page Avenue
ST. LOUIS, MISSOURI 63133
(314) 863-3200

Calgon Corporation
4800 West 34th Street
Suite B-8
HOUSTON, TEXAS 77092
(713) 682-1301

Calgon Corporation
1081 Route 22
P.O. Box 6768
BRIDGEWATER, NEW JERSEY
(201) 526-4646

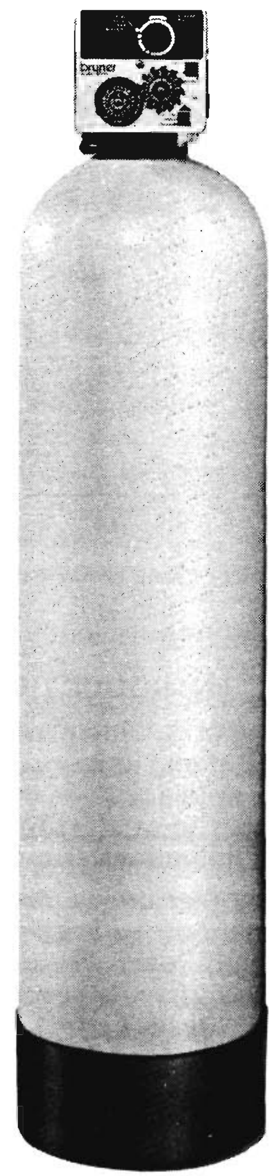
Calgon Corporation
2121 El Camino Real S
SAN MATEO, CALIFORNIA 94403
(415) 572-9111

CALGON CORPORATION
SUBSIDIARY OF MERCK & CO., INC.

Printed in U.S.A.

SERIES AF10-AC AUTOMATIC BACKWASHING FILTER

w/BRUNER 350 VALVE



bruner® CORPORATION WATER TREATMENT EQUIPMENT

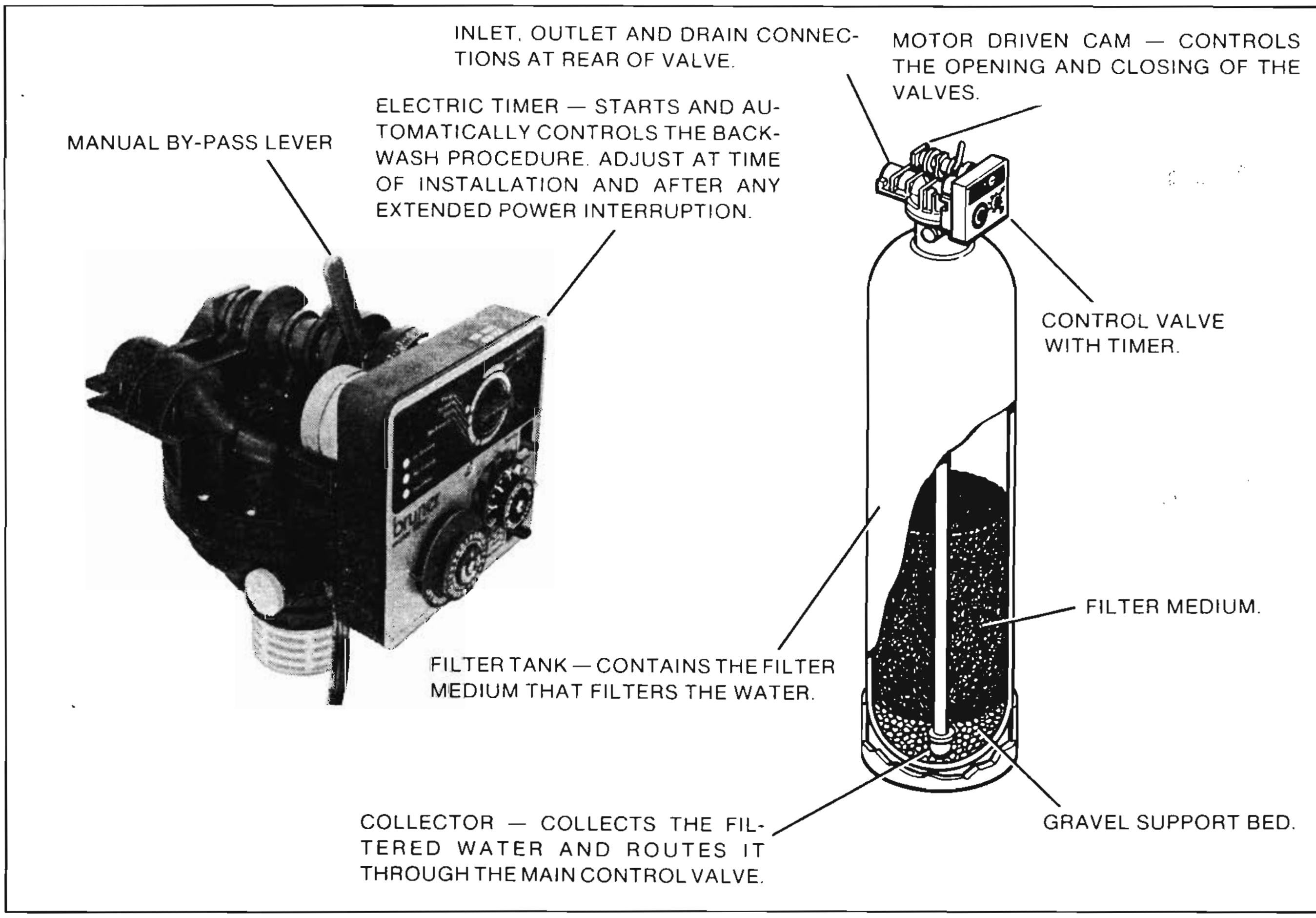


Figure 1. Filter Tank and Control Valve

INTRODUCTION

Your new Bruner automatic water filter will contribute to better and longer service from all the water using appliances in your home. You'll soon appreciate the many savings and personal benefits that filtered water brings.

Your filter requires only a minimum amount of care and attention to keep it operating efficiently for many years. The entire unit, including the control valve, is constructed from rust and corrosion resistant materials. The automatic timer operates on a 12-day time cycle, allowing backwash frequencies of 2, 3, 4, 6 or 12 times during each 12 day cycle.

Special features allow for an extra manually initiated backwash, a vacation setting, and an optional second backwash period if the unit is used on difficult waters.

This manual contains specifications, instructions for installation and operation, a maintenance guide and repair parts list.

REGISTER YOUR WARRANTY

To validate the warranty on this equipment, the warranty card must be completed and mailed within 10 days of installation (or purchase date if you install it yourself). Any claims or correspondence concerning equipment in warranty must include warranty/serial number, model number, and date of installation (or purchase if you install the equipment). For your convenience, enter this information in this manual for future reference.

Model No. ______________________

Warranty/Serial No. ______________________

Date Installed (Purchased) ______________________

Dealer ______________________

UNPACKING THE WATER FILTER

This unit has been shipped partially assembled. Loading of the filter medium and mounting the control valve and timer must be done at the time of installation.

Verify that all of the following items are present before proceeding. Refer to Figure 1 to identify parts.

- Filter tank with control valve
- Manifold tube with stopper at upper end
- Gravel support bed

LOCATING THE WATER FILTER

Location of the water filter is usually determined by the water supply piping in the building. Keep in mind however that a continuous supply of electrical power is required as well as a drain for the disposal of backwash flow. A dry level floor is preferred.

NOTE: If it is necessary to shim the unit when leveling, do not shim the tank directly. Cut a platform of 1/2" plywood and shim under the platform.

LOADING THE FILTER TANK

1. Remove the control valve by turning it counterclockwise. Set it carefully aside for later use.
2. Place the manifold tube with the collector end inserted first into the filter vessel. See Figure 2.
3. Plug the upper end of the manifold tube with the stopper provided.
4. Pour contents of the bag tagged "GRAVEL" into the filter tank to form a bed around the collector.
5. Pour contents of the bag tagged "FILTER MEDIUM" into the filter tank.
6. Thoroughly clean the threads and sealing surface on top of the filter tank. Remove the stopper from the end of the manifold tube.

ATTACHING THE CONTROL VALVE

1. Thoroughly clean the threads on the control valve.
2. Check that both the large, tank-sealing O-ring and the small manifold tube O-ring are in place in the valve. See Figure 3.
3. With the top end of the manifold tube centered in the tank opening, thread the control valve onto the tank making sure that the manifold tube is inserted in the center opening of the control valve.

NOTE: *Do not* pull the manifold tube up during step 3 as this will disturb the filter medium.

Turn the control valve clockwise until it is seated firmly on the filter tank. *Do not* exceed 20 ft.-lbs. of tightening torque.

CONNECTING THE FILTER

Connect the filter to the water system as shown in Figure 4. Refer also to the following specifications.

SPECIFICATIONS

Service flow rate @15 lb. pressure loss: 8.0 gpm

Backwash rate: 5.0 gpm

Filter tank loading: 1.0 cu. ft.

Filter tank size (dia x hgt): 10 x 40 in.

Inlet and outlet pipe size: 1" NPT female

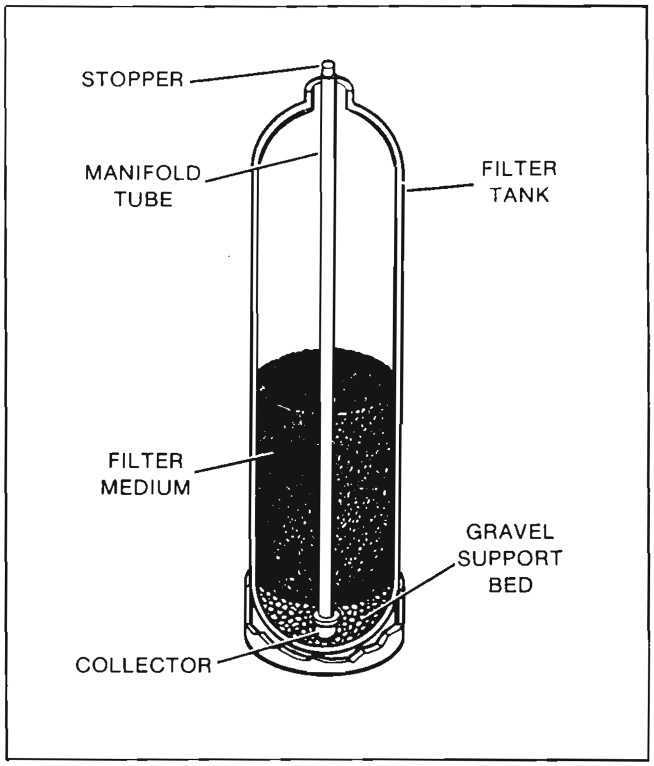


Figure 2. Loading the Filter Tank

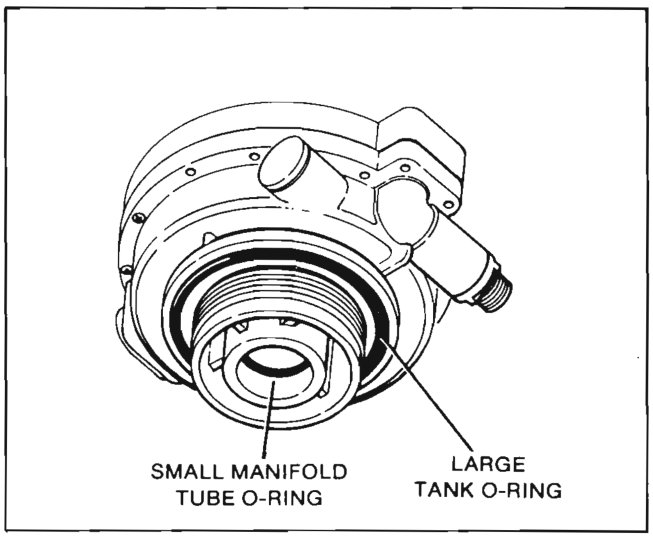


Figure 3. Location of O-rings in Control Valve

Drain Connections

To valve: 1/2" NPT female

Pipe, tube or hose I.D. — 25 ft. or less: 1/2" — over 25 ft.: 3/4"

Overhead drain line maximum ht.: 5 ft. above top of filter

Water pressure range, psi.: 25 min. - 125 max.

Water temperature: 120° F max.

Electrical requirements: 115/120V. 60 Hz (3 watts continuous)

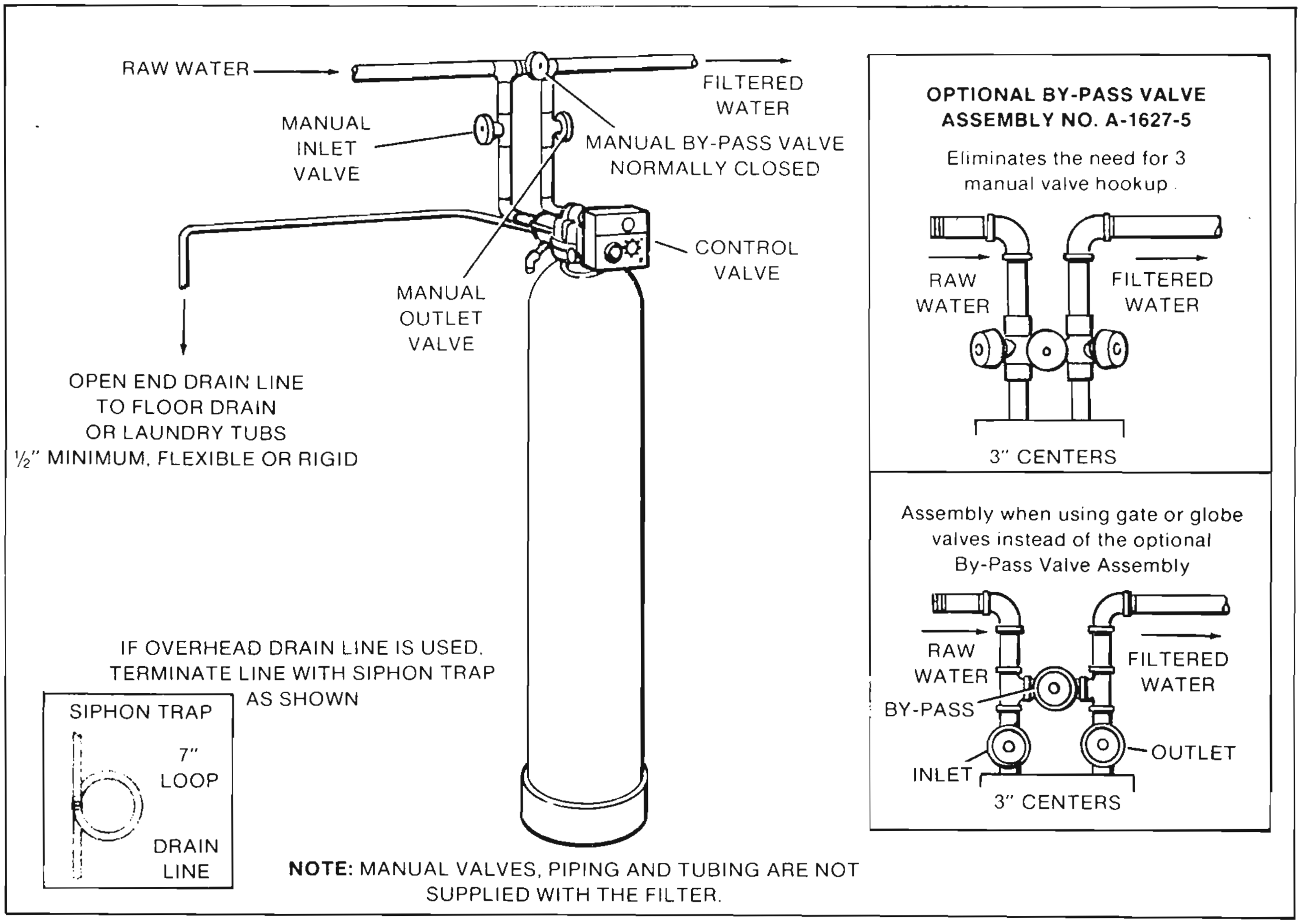


Figure 4. Connecting the Filter to the Water System

CHECKING WATER PRESSURE

If the filter is installed on a private well system, check the water pressure with an accurate gauge. If the pressure is less than 25 psi, it must be increased or incomplete backwashing will occur.

START UP

Before putting the filter into service, it is important to saturate the filter bed with water and remove the trapped air from the tank. To do this, proceed as follows:

1. Be sure the manual inlet, outlet and by-pass valves are closed.
2. Be sure the electrical cord is *not* plugged into the outlet.
3. Turn the position indicator (see Figure 5) to SERVICE. To do this use a crescent wrench or the optional wrench, part no. A-1872-1, to rotate the position indicator counterclockwise until the arrow on the indicator points to SERVICE.
4. Open a convenient water faucet on a treated water line. Open the manual inlet and outlet valves. By-pass the softener (if there is one).
5. Let the water flow at least ten minutes to saturate the filter bed and expel air from the tank.
6. Close the manual outlet valve. Close the manual inlet valve. Turn position indicator to BACKWASH. This allows the entrapped air to vent from the tank to the drain.

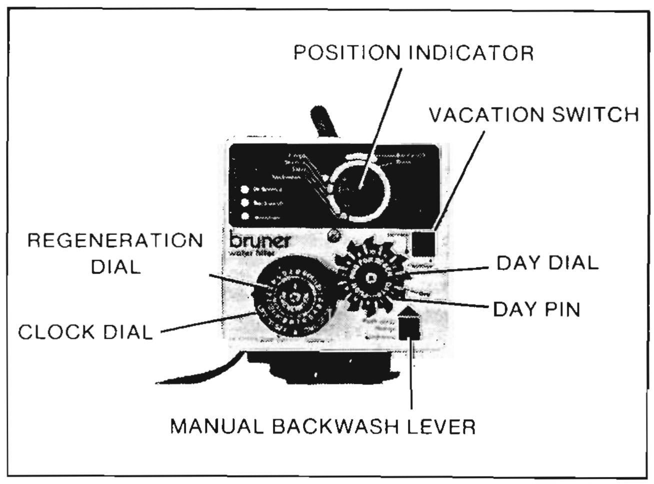


Figure 5. Control Valve

7. With indicator set at BACKWASH, slowly open the manual inlet valve. Let the unit fill until a steady stream of water runs out of the drain line. If water does not flow from drain line, some air is still trapped in the tank. Repeat steps 6 and 7 until water does flow.
8. Turn indicator to SERVICE. Open the outlet valve. Open a faucet and allow the water to flow until it is clear.
9. Reverse the softener by-pass procedure of step 4 (if it was done) to return the softener to on-stream.

CONTROL VALVE ADJUSTMENTS

Your filter requires periodic backwashing, a process whereby water flows upward through the filter bed to cleanse and loosen the filter medium. Backwash water flows to the drain.

The control valve automatically cycles the filter on a predetermined schedule and regulates the duration of the various backwash steps. To adjust the control valve refer to Figure 5 and proceed as follows:

1. Rotate the day dial until No. 1 is opposite the day arrow.
2. PRESS IN the day pin on all days the filter is to backwash. On days the filter is not to backwash, day pins must not be pressed in. A minimum backwash frequency is once every six days. If water pressure drops excessively between backwashes, increase the backwash frequency as necessary by pushing in additional day pins.
3. Set the time by pulling the clock dial outward and rotating it until the arrow is opposite the current time of day.
4. Check that the arrow on the REGENERATION dial is set at an acceptable time for backwashing. If the time of backwashing is to be changed, loosen the Phillips head screw on the REGENERATION dial and rotate the dial to the desired time. Tighten the Phillips head screw.
5. Plug the electrical power cord into a circuit which has a constant source of power and is not controlled by a switch.

MANUALLY INITIATED BACKWASH

If an extra automatic backwash is desired **press upward once** on the manual backwash lever located at the lower right corner of the timer. This will not change the normal schedule.

NOTE: It may be 1-1/2 hrs. before backwash begins.

MANUAL BY-PASS LEVER

If a temporary supply of unfiltered water is desired the MANUAL BY-PASS LEVER located at the front of the camshaft assembly (Figure 1) may be used instead of external by-pass valves. Moving the lever to the right (BY-PASS) position supplies unfiltered water to the service lines. Should you forget to return the lever to INSERVICE position, it will return automatically at the next regular backwash.

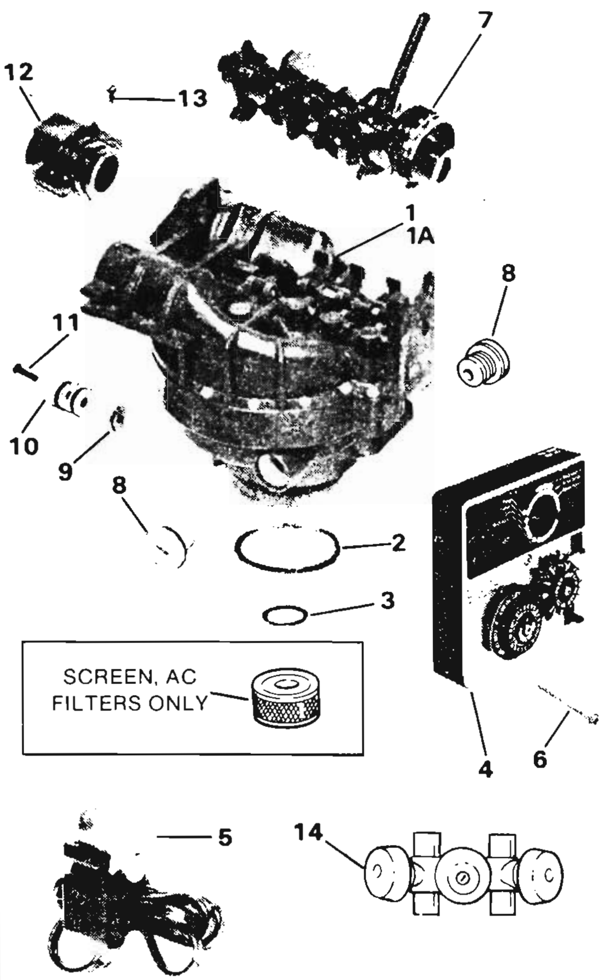
VACATION SWITCH

Normally in SERVICE position, this switch is used to disengage the backwash system when you are away on vacation or when conditioned water will not be used for any extended period.

OWNER CARE AND MAINTENANCE

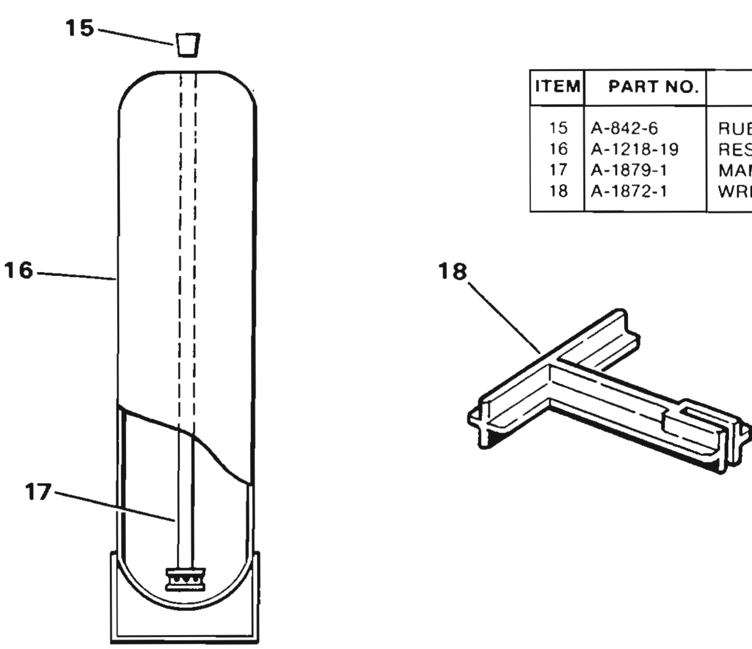
1. Periodically check to determine that the unit is delivering enough filtered water for family needs and adjust the backwash controls if necessary.
2. Check and reset the time clock setting after any power interruption the same as you would any other electric clock in the home.
3. If no water will be used for any extended period of time, the control may be set to VACATION, thus avoiding needless backwashing.
4. If the unit may be subjected to freezing temperatures, it must be completely drained of water to prevent damage. For proper draining procedure, write to the manufacturer, Technical Service Department. Ask for Bulletin 10-175.

CONTROL VALVE AND TIMER PARTS



ITEM	PART NO.	DESCRIPTION
1		CONTROL VALVE COMPLETE
	C-1076-2	120/60
	-5	240/50
	-6	120/50
1A	B-967-3	CONTROL VALVE W/SCREEN (LESS TIMER, CAM UNIT, & PIPE ADAPTERS)
2	A-604-72	"O" RING, Tank Adapter
3	A-604-19	"O" RING, Manifold Tube
4	A-1866-7	TIMER — COMPLETE, 120/60
	-8	TIMER — COMPLETE, 240/50
	-9	TIMER — COMPLETE, 120/50
5	A-1867-1	TIMER MOTOR w/Cord & Mounting Bracket, 120/60
	A-1867-2	TIMER MOTOR w/Cord & Mounting Bracket, 240/50
	A-1867-3	TIMER MOTOR w/Cord & Mounting Bracket, 120/50
	A-1870-2	SCREW, Mounting Bracket, Two Required
5A	A-709-29	TIMER MOTOR, 120/60
	A-709-30	TIMER MOTOR, 240/50
	A-709-31	TIMER MOTOR, 120/50
	A-1870-1	SCREW, Timer Motor, Two Required
6	A-1869-2	SCREW, Timer, One Required
7	A-725-9	CAM UNIT ASSEMBLY
8	A-1016-7	CAP w/"O" Ring
9	A-708-5	BACKWASH FLOW WASHER, 5.0 GPM
10	A-1054-5	COVER w/"O" Ring, Backwash
11	A-1869-1	SCREW, Cover, One Required
12	A-1054-6	ADAPTER w/"O" Rings, Inlet-Outlet, 1" NPT
12A	A-604-73	"O" RING, Adapter
13	A-1870-3	SCREW, Adapter, Two per Adapter Required
14	A-1627-5	BY-PASS VALVE ASSEMBLY (Optional)

TANK PARTS



ITEM	PART NO.	DESCRIPTION
15	A-842-6	RUBBER STOPPER
16	A-1218-19	RESIN TANK W/BASE, 10 x 40
17	A-1879-1	MANIFOLD TUBE ASSEMBLY
18	A-1872-1	WRENCH, Position Indicator (Optional)

Figure 7. Spare Parts

TROUBLESHOOTING GUIDE

The following chart is presented to offer suggestions for correcting simple problems which may occur with any installation. It presents some problems which are easily corrected by following the instructions and referring to other material contained in this manual.

PROBLEM	POSSIBLE CAUSE	REMEDY
1. Control will not backwash automatically.	a. Electric cord unplugged.	a. Connect power.
	b. Control set to VACATION.	b. Reset switch to SERVICE.
	c. Defective timer motor.	c. Replace motor.
	d. Day pins not down on Regeneration Dial.	d. Depress pins for days backwash required.
	e. Binding gear train of timer.	e. Replace timer.
2. Control backwashes every day.	a. Timer set incorrectly.	a. Make correct setting according to instructions.
3. Control backwashes at excessively low or high rate.	a. Damaged or restricted backwash flow control washer.	a. Remove and clean or replace washer.
4. Flowing or dripping water at drain line after backwash.	a. Foreign matter preventing a drain valve (5 or 6 Figure 8) from seating.	a. Manually depress the drain valve to flush away obstruction.
5. Unfiltered water leakage during service.	a. Defective external bypass valve.	a. Repair or replace valve.
	b. O-ring around riser tube damaged.	b. Replace O-ring.
	c. Bypass lever not in SERVICE position.	c. Reposition lever.

VALVE IDENTIFICATION

1—BRINE	5—BRINE & FLUSH DRAIN
2—BY-PASS	6—BACKWASH DRAIN
3—BACKWASH	7—CHECK VALVE (INTERNAL AUTOMATIC)
4—INLET	

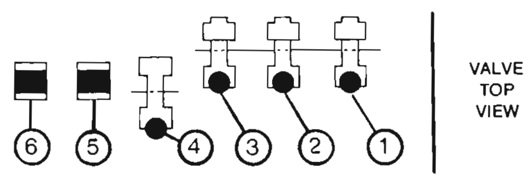


Figure 8. Valve Identification