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A Division of GZA

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October 20, 2017
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Mr. Rodney Weber
MI Operations Team Leader
Kaat's Water Conditioning, Inc.
3470 3 Mile Rd, NW
Grand Rapids, MI 49534

Re: Point of Entry (POE) Whole House Treatment System - Private Residential Wells, Belmont, Michigan - Wolverine World Wide, Rockford, MI

Dear Mr. Weber:

Rose & Westra, a Division of GZA GeoEnvironmental, Inc. (R&W/GZA) is pleased to submit the following letter related to the POE treatment systems to be installed for the treatment of perfluorinated compounds (PFCs).

Provide and install XXX POE treatment systems as generally quoted in your October 12, 2017 letter and generally in compliance and conformity with the document entitled, *"New York State Department of Environmental Conservation (Department) Point of Entry Treatment (POET) System Specification."* Deviations to the specification are summarized on the attached table dated 10-19-17. A general schematic of the system is attached.

Description	Units	Unit Cost	Subtotal
POE Treatment System 8 gpm	XXX	$X,XXX	$XXXXXX

In general, the POE systems will include the following components:

- Pre-filter (Dual Gradient 50 -5 micron)
- Lead GAC Canister (2 ft3 Culligan Cullar F600AW)
- Lag GAC Canister (2 ft3 Culligan Cullar F600AW)
- Post-Filter (Dual Gradient 50 -5 micron)
- UV Lamp (VIQUA S8Q-PA)
- Flow Meter (total gallons)
- Influent, Midpoint and Effluent Water Sampling Ports

The activated carbon media will be Filtrasorb F600AW, manufactured by Calgon Carbon Corporation.

A flow restrictor will be installed on the discharge of the UV disinfection system to restrict the flow to 8 gpm the flow restrictor.

New York State Department of Environmental Conservation (Department) Point of Entry Treatment (POET) System Specification

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New York State Department of Environmental Conservation (Department) Point of Entry Treatment (POET) System Specification

I. POET System General Requirements

a. The POET system, described herein, is for use in residential properties, individual single family homes to four unit apartment buildings, and certain commercial establishments. Providing similar water treatment for a facility determined to be a public water supply, regulated by the New York State Department of Health (NYSDOH), may include additional requirements.

b. The Contractor shall comply with the NYSDOH Environmental Health Manual CSFP 530, dated November 6, 2000, entitled "Individual Water Supplies – Activated Carbon Treatment Systems" or the most recent version. Additionally, the Contractor shall comply with attachment 1, 10 NYCRR Appendix 75-B, effective December 1, 1990, entitled "(IWS Treatment Devices)" or the most recent version.

c. The Contractor shall furnish all labor, tools, and equipment necessary to provide a complete operating water treatment system as described below, and if directed by the Department, shall provide continuous operation and maintenance of the installed systems, including all required water sampling.

d. The POET system must be installed by a qualified person based on their training and experience and/or based on any specific qualifications as may be required per applicable regulation, code, etc. of the municipality where the POET is installed.

e. The majority of systems to be installed will be utilized for the removal of organic chemicals such as chlorinated solvents and petroleum hydrocarbons from drinking water wells. The systems will be referred to herein as the "Standard System", and shall include, at a minimum, the equipment and appurtenances indicated on the schematic diagram.

f. Greensand filters, water softeners, flow restrictors and chlorinators will not be required in all systems and shall be installed on an as-needed basis as determined by the Department. When required, these units are subject to the same installation criteria as the Standard System. The Department will notify the Contractor when installation of other than a Standard System is required and the additional or modified equipment will be subject to the Department's approval.

g. The Contractor shall contact owners and conduct pre-installation inspections to verify well capacity, system information and proper orientation, and notify the Department of any constraints for a Standard System. The Contractor shall also contact the owners to arrange for installation of the treatment systems and to perform system maintenance and water sampling as required. The Contractor shall obtain any and all required permits, licenses, and inspections. The Contractor shall perform any and all sampling and analyses required prior to installation of the system. The Contractor shall install, monitor, and service the treatment system as required by the Contract.

h. All tanks and treatment equipment installed under this specification shall use non-toxic materials. All coatings must comply with the NSF and American National Standards Institute (NSF/ANSI) Standard 61 for use in potable water systems, where appropriate.

In general, this work will include, but is not limited to:

i. Contacting the individual installation customers to arrange for a time when the necessary installation may be made and/or maintenance and sampling events may be performed.

ii. Informing the individual installation customers of the space requirements for the necessary equipment.

iii. Arranging for and obtaining any and all required permits, licenses, and inspections.

iv. Furnishing and installing the POET system, along with any supports, fittings, copper pipe, etc. required for the installation.

v. Performing maintenance as detailed under "Scheduled Maintenance" (Section I.i) for the duration of the work.

vi. Clean up after installation and/or after any maintenance/sampling activities have been completed.

vii. Completing any electrical wiring, per local code, required to provide a source of power for the Ultraviolet Disinfection Units.

viii. Making repairs and/or changes following any inspection of individual installations, to provide for an acceptable (code-compliant) system. Repair/Changes of this nature are to be performed at no additional cost.

ix. Collecting required water samples from the completed system and shipping or transporting the samples to an approved laboratory. All samples shall be collected following the sampling procedures in DER's Spill Guidance Manual and DER-10 and/or the Contractor shall provide a written Standard Operating Procedures (SOP) for sampling for the Department's approval.

x. Providing for a twenty-four (24) hour, seven (7) day per week answering service, such that the Contractor can receive notice to install, monitor, replace, or maintain a water system at any time, and then provide the required services within twenty-four (24) hours of such notification.

xi. Proper disposal and/or regeneration of spent activated carbon.

xii. Providing for unscheduled maintenance or other services within twenty-four (24) hours of notification as provided for in part x. above.

xiii. The Contractor shall undertake every effort to ensure that the manufacturer's warranties are maintained in full force through the manufacturer's warranty period. Any repairs to the system during the warranty period shall be made at no cost to the Department.

i. The Contractor shall supply and install piping, valving, sampling taps, fittings, hangers, and all other components not listed herein but required to provide a functioning installation. Nothing in this section shall be construed as indicating that anything other than a completed, fully functioning installation is required.

II. POET System General Specifications

a. The water treatment system shall be installed as shown on the schematic diagram (Figure 1). Adjustments may be allowed to: a) provide easy access for sampling and/or periodic replacement of appropriate units, b) account for space limitations, c) address resident's requests, and/or provide for proper operation of the system. It shall be the responsibility of the Contractor to visit the project area to become familiar with the type of construction employed and possible obstacles which may be encountered in completing the installation. The Department shall not be held responsible for claims made by the Contractor as a result of its failure to do so. The Standard Water Treatment System installed and supplied is illustrated as on the schematic diagram and consists of:

All components, tools, and accessories used in this process must be known to be Teflon-free (including free from substances that may contain perfluorooctanoic acid or perfluorooctane sulfonic acid) and must be rated for use in potable water systems.

No Teflon tape or pipe joint compound containing Teflon is to be used on any system installs. All system piping and fittings shall be ¾' copper and consists of:

- 5/8" by ¾" water meter
- ½" ball valves
- ¾" gate valves or ¾" ball valve
- ¾" check valves
- ½" sampling ports
- Pressure gauges
- Water pre –filtration unit with cartridge (5 micron), 12 replacement cartridges are to be left at the residence
- Activated carbon vessels with a minimum capacity of 2 cubic feet each.
- GAC must be Calgon FILTRASORB 600 AR Plus or equivalent GAC that meets the NSF/ANSI specification as approved by the Department.
- Ultraviolet light with a minimum dosage of 40,000 microwatts sec/cm2, and that is designed to operate with 120V-60Hz AC current. The unit should include a manufacturer-installed 6-8 foot grounded plug. The unit must be equipped with an audio and visual alarm to indicate if light intensity drops below minimum.

- Ground Fault Interrupt circuit. The UV unit must be powered through a GFI receptacle.
- Miscellaneous piping, fittings and appurtenances necessary to complete the installation.

b. All materials furnished by the Contractor shall be subject to approval by the Department, and must be approved for use in potable water supplies, and meet all local building codes/ordinances governing plumbing. The Contractor shall provide properly trained personnel for the installation and maintenance of the system who meet the appropriate health and safety requirements of all applicable local, State, and Federal rules, laws and regulations.

   i. Restrictions on use of Lead-Containing Materials: Currently, all products certified by NSF as compliant with Annex G are also compliant with NSF/ANSI 372. No additional testing is required beyond the normal routine monitoring of certified products. Additional information can be found at the NSF website at www.nsf.org. The listings of products currently certified by NSF to Annex G will continue to bear the [G] certification footnote:

   [Current Footnote]
   [G] Product complies with NSF/ANSI 372 and conforms with lead content requirements for "lead-free" plumbing as defined by California, Vermont, Maryland, and Louisiana state laws and the U.S. Safe Drinking Water Act in effect January 4, 2014]

c. All pipe fittings furnished by the Contractor shall be ¾"copper, appropriate for potable water systems, unless otherwise approved. All electrical wiring and fixtures shall be Underwriters Laboratories (UL) approved. No leaded solder may be used for pipe fitting installation work and all solder must be approved for use in potable water systems. All tanks and treatment equipment installed under these specifications shall use non-toxic materials and all material coatings must be approved by the NSF for use in potable water systems, where appropriate.

d. The Contractor shall be required to remove the POET system when and as directed by the Department. The treatment system shall be removed from the premises and properly salvaged or disposed of by the Contractor.

e. After the installation, each system is to be thoroughly flushed and inspected for leakage under normal house pressure by the Contractor prior to acceptance. The Contractor shall notify the Department upon completion of each installation and provide a completed Installation Checklist and arrange for inspection of the units and subsequent approval.

III. POET System Detailed Specifications

a. Granular Activated Carbon (GAC) – The Contractor shall supply and install GAC vessels meeting the specifications. Only virgin GAC may be used. Upon notification by the Department, the Contractor shall remove and dispose of spent GAC. Such removal shall be performed consistent with applicable local, State and Federal requirements as specified.

b. Granular Activated Carbon Vessels – GAC vessels are to be supplied and installed as part of the treatment system and shall be construed to meet the following requirements:

i. Units shall be downflow design and constructed of stainless steel, nylon, or fiberglass wound ABS plastic approved for use for potable water supply purposes.

ii. Each vessel is to be supplied with manually operated pressure venting, as well as inlet and outlet shut-off valves which permit the removal and replacement of the vessel without the need for auxiliary valves.

iii. Vessels shall be supported in an upright position with a stand of approved construction firmly fixed to the bottom of the vessels.

iv. All vessels are to be equipped with an inlet distribution and an outlet collection device.

v. Vessels should be sized to allow for 100% removal of contaminants by the lead vessel.

vi. All vessels shall have a normal inside diameter of no less than nine (9) inches and an effective height of no less than thirty-six (36) inches. For purposes of this part the height will be measured from the bottom of the bottom-most outlet of the distribution device to the top of the uppermost outlet on the collection device. Only that depth having a corresponding nominal cross-sectional dimension of nine (9) inches maximum may be included in the effective depth calculation. For locations where there is insufficient head room (e.g., basement crawl space), a solution will developed by the Contractor and approved by the Department before installation.

vii. The flow rate through the carbon treatment unit shall not exceed ten (10) gallons per minute per square foot of cross-sectional surface area (in one vessel), or as dictated by the GAC provider. Flow rates will be controlled by a flow limiting device, if necessary, to maintain the proper hydraulic loading rate. The flow limiting device should be installed as shown on Figure 1.

viii. All GAC vessels are to be approved by the NSF for potable water use, as appropriate.

ix. T he clear water head loss through each GAC vessel, with no carbon installed, shall be certified by the vessel supplier to not exceed two (2) psi at flow rate of five (5) gpm.

x. GAC vessels are to have a minimum working pressure of one hundred (100) psi and a minimum operating temperature rating of not less than one hundred degrees Fahrenheit (100°F).

xi. Contractors must furnish detailed specifications for the GAC vessels and associated equipment.

xii. GAC vessels equipped with an integral threaded distribution/collection cap shall have the cap secured to the vessel with a minimum of six (6) No. 8 threads and O-ring rubber gasket to form a tight seal.

xiii. Inlet and outlet connections on the vessels shall be National Pipe Thread (NPT) with a diameter at least equal to that of the system piping, and in no case less than ¾".

xiv. Regardless of the type, the minimum accessible clear opening on the GAC vessels shall not be less than 2 ½" in diameter.

xv. Bolted caps shall be firmly affixed to the GAC vessels with a minimum of eight (8) bolts spaced at equal intervals and sealed with a ¼" form-fitting robber gasket or equivalent.

xvi. Strainers supplied with the vessels shall have a maximum clear opening of 0.40 millimeters and must be manufactured of high impact plastic or stainless steel.

xvii. Drop pipes extending from the head of the vessel to the collection strainer must be manufactured of high impact plastic or stainless steel.

c. Particulate Filters: Particulate filter units to be installed to remove dirt, sediment or other particulate matter from the well water before processing in the POET system. The particulate filtration units shall conform to the following specifications:

i. The filtration units shall use replaceable filter media consisting of either bags or cartridges. Specifications for the media are included in part iv of these specifications.

ii. Each filtration unit shall be equipped with a manually operated pressure relief valve and required O-rings and shall be installed so as to permit the normal removal and replacement of the filter media by hand without auxiliary valves.

iii. The filtration housing shall be plastic or stainless unless otherwise approved by the Department.

iv. The filter units shall be approved by the NSF for potable water supply use.

v. The maximum allowable head loss through the unit at a filtration rate of five (5) gallons per minute, and with a clean filtration cartridge installed, shall be three (3) psi.

vi. Each filtration unit shall have a minimum operating pressure rating of one hundred (100) psi and a minimum operating temperature rating of not less than one hundred degrees Fahrenheit (100°).

vii. The filtration unit shall be furnished with ¾", or greater, NPT inlet and outlet connections.

viii. Each unit shall be supplied with an installed filtration cartridge satisfying the requirements of Section iii of these specifications.

d. Particulate Filter Media: Cartridges are to be compatible with the filtration unit supplied under Section ii of these specifications. For the duration of the Call Out, twelve (12) replacement cartridges are to be left with each installed unit on an annual or as needed

basis. The filter cartridge is to be replaced monthly or upon a noticeable drop in water pressure. Particulate filter cartridges shall satisfy the following requirements:

i. Cartridges shall be constructed of cellulose or glass-cellulose matrix.

ii. Cartridges shall have a progressive density structure to provide for maximum solid retention.

iii. Cartridges shall be supplied with all required O-rings or gasket seals.

iv. Clean filter cartridges, when installed in a filter housing satisfying the requirements of Section ii of these specifications, shall be capable of processing design flow with a maximum pressure drop of three (3) psi.

v. Cartridges shall have a minimum operating pressure of one hundred (100) psi and a minimum operating temperature of 100 degrees Fahrenheit (100°F).

vi. All cartridges shall be designed to remove suspended matter with a size of 5.0 microns or greater.

vii. In some cases, cartridges shall also be impregnated with an oxidizing agent to enable the filtration units to remove both dissolved and colloidal iron and manganese.

vii. Contractors are expected to supply the pressure curves, relating flow to head loss through the cartridge and the estimated removal efficiencies and cartridge life expectancy for the removal of dissolved iron and manganese, for the cartridge to be furnished.

e. UV Disinfection Units:

i. An ultraviolet disinfection unit shall be installed in the treatment system as indicated on the schematic diagram figure 1. The installation shall include all appurtenant wiring, controls, and piping necessary to provide a functional unit.

ii. UV disinfection units and their maintenance may be considered optional items at the discretion of the Department. (For public water supplies with external distribution systems, post treatment disinfection with sodium hypochlorite should be provided to maintain a chlorine residual in the system)

iii. The following requirements shall apply to the UV disinfection units:
   - The UV disinfection unit shall consist of a UV lamp mounted in a totally enclosed steel housing
   - The unit shall come equipped with NPT inlet and outlet connections at least equal to the diameter of the system piping and in no case less than ¾"
   - With new lamp installed, the unit shall have a minimum dosage of forty thousand (40,000) microwatts sec/cm^2 at a flow rate of five (5) gpm
   - Units shall be designed with a maximum operating pressure rating of at least one hundred twenty-five (125) psi and an operating temperature range of forty (40) to one hundred (100) degrees Fahrenheit

- Units shall be capable of processing with a head loss of no greater than two (2.0) psi at five (5) gpm
- Each unit shall be designed to operate with 120V – 60 Hz AC current and come equipped with a manufacturer-installed six (6) to eight (8) foot grounded electrical cord and plug. All electrical components shall be approved by the Underwriters Laboratory or equivalent reviewing agency
- A ground fault circuit interrupter protected outlet should be supplied to plug the UV light into
- Lamp casings shall be stainless steel, unless otherwise approved by the Department
- Each unit shall come equipped with mounting brackets for mounting onto a fixed surface
- Units with a view lens shall be equipped with a filtered lens that allows for the safe inspection of the lamp operation emission by eliminating the exposure of ultraviolet radiation to the inspector.
- Each UV disinfection unit shall have a sending device equipped with both a visual and an audio warming alarm which shall be activated when the ultraviolet light source intensity falls below (for public water suppliers, an automatic shut-off or a flow diversion valve shall be provided to prevent inadequately disinfected water from entering into the water system, if the ultraviolet light source falls below a minimum intensity level)
- Each sending unit shall have an adjustable calibration control for manually adjusting the intensity below which the devise shall activate the alarm
- Prior to installation of the ultraviolet disinfection unit, a raw water sample should also be collected and analyzed for the parameters listed below to determine the need for and type of supplemental pretreatment in addition to particulate removal. Any proposed pretreatment must be authorized by the Department.

f. Water Flow Meter:

   i. Water meters shall conform to the American Water Works Association, Standard C 710-95 and:
      - Shall be 5/8" X ¾"
      - Shall be frost free type
      - Shall be furnished with coupling nuts and tail pieces
      - Shall read in United States Gallons
      - Shall be remote, sealed register
      - Coupled drive shall be provided
      - The main meter casing may be of a polycarbonate (fiberglass reinforced) synthetic polymer

g. Gate Valves: Gate valves shall be ¾", on hundred twenty-five (125) pound bronze. They shall be rated for two hundred (200) psi non-shock cold water. Valves shall be non-rising stems.

h. Ball Valves: Ball valves shall be ½", one hundred twenty-five (125) pound bronze, rated for two hundred (200) psi non-shock cold water. Valves shall have an operating lever.

i. Check Valves: Check valves shall be ¾", horizontal swing, Y-type one hundred twenty-five (125) pound bronze with renewable discs. They shall be rated for two hundred fifty (250) psi non-shock cold water.

j. Sampling Taps: Sampling taps shall be installed as shown in figure 1 in order to sample raw water, water between carbon filters, and treated water. The taps shall consist of the following sweat/solder fittings, a ¾" x ¾" x ½" copper 90° ell (long radius). All fittings are to have a minimum pressure rating of one hundred twenty-five (125) psi non-shock cold water. If hose bibs are used, they must include a backflow preventer.

k. Pressure Gauges: Pressure gauges shall be installed as shown in figure 1 (i.e., before the prefilter and before and after the activated carbon unit). The gauges shall have a single faced 1 ½" dial with a scale range of zero (0) to one hundred (100) psi. The gauges shall be constructed with a drawn steel casing, phosphor bronze Bourbon tube, brass movement and ¼" NPT male bottom connection. Pressure gauges should fit into a ¾" x ¾" x ½" copper tee with a ½" sleeve tapped for a ¼" NPT. Accuracy shall be two percent (2%) total scale range.

l. Granular Activated Carbon

Parameter	Requirement(s)
Parent Material (virgin)	Bituminous Coal, Coconut Shell, or Lignite
Approved Product(s)	Calgon Filtrasorb 600 AR Plus or equivalent
Nominal Mesh Size (U.S. Sieve Series)	12 x 40
Apparent Density (lb/ft^3)	31

The contractor shall ensure that the carbon has been prepared and analytical data demonstrates that the carbon will have no backwash characteristics that result in an exceedance of NYS or federal drinking water standards.

m. Ultraviolet Disinfection Unit – Pre-Installation Water Quality Analysis

Parameter	Upper Guidance Levels
Iron	0.3 mg/l
Manganese	0.05 mg/l
Hardness (calcium)	300 mg/l[1]
Hydrogen Sulfide	1 mg/l
Turbidity	1 NTU

[1] Hardness equivalent of 17.5gpg (300 mg CaCO3/l) or greater would need softening

Raw water quality data, for existing sources only, is necessary to determine the need for supplemental pre-treatment, in addition to particulate removal, prior to installation of ultraviolet disinfection unit. All testing is to be performed using field test kits acceptable to the Department. In some instances it may be necessary to send confirmatory samples to be analyzed by an ELAP certified laboratory.

IV. POET GAC Vessel Preparation and Assembly Procedures

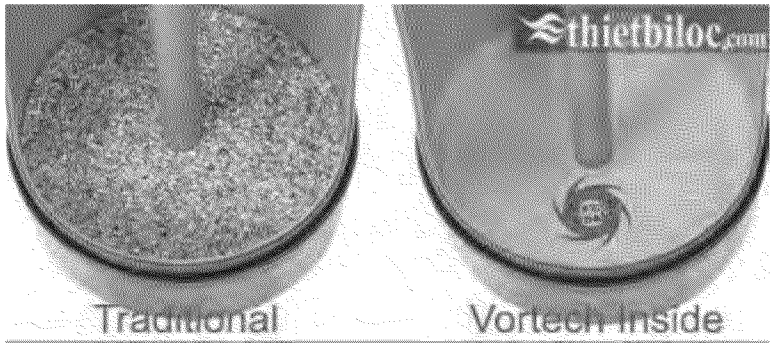
This section defines the procedures used to assemble, hydrate, backwash, and otherwise prepare Granular Activated Carbon (GAC) vessels for use in Point of Entry Treatment (POET) systems. These procedures have been developed to aid Department staff and contractors assigned to complete these tasks, and must be completed in accordance with the requirements and guidance provided herein, unless otherwise approved by the Department.

a. Assembly Instructions

For ENPRESS vessels equipped with Vortech diffusers, which do not need a gravel pack, skip Step 1 and go directly to Step 2.

ENPRESS vessels with Vortech diffusers are readily identified by the Vortech decal located near the bottom of the vessels. These vessels have a plastic "flower" diffuser permanently affixed across the entire vessel bottom with a fixed riser and do not need any gravel pack. Look inside the vessel with a flashlight to see the "flower" if there is any question.

Example: vessel with gravel pack (left), ENPRESS vessel with Vortech diffuser (right)



Vessel with gravel pack ENPRESS vessel with Vortech

Preparation Steps

i. Adding Gravel to non-Vortech vessel (e.g. Clank, Structural, Canature, etc.):

- Un-screw, by hand, the manifold from top of vessel (if so supplied).
- Insert the removable basket diffuser and riser pipe into the notch at the bottom-center of the vessel.

NOTE: The top of riser pipe, when properly seated in the bottom of the vessel, should be flush with the top of the vessel. If the top of the riser pipe is above or below the top of the vessel, the riser should not be used unless it can be confirmed that the riser will reach and seat in the O-ring of the manifold being used, or not be so tall as to prevent complete installation of the manifold.

- Place a plastic cap on, or otherwise plug, the top of the removable riser pipe to prevent gravel from entering the riser pipe during the fill process.
- Place the manufacturer-supplied funnel (blue) in the top of the vessel.
- Add 1.5 gallons (by volume) of No. 3 gravel to the vessel bottom (10" or 12" diameter vessel) using a 5-quart plastic bucket to pour gravel through funnel. This volume of gravel will just cover or be slightly above the basket diffuser.

ii. Adding GAC Media to the Vessel:

NOTE: THIS STEP MUST BE CONDUCTED IN A WELL VENTILATED AREA WITH RESPIRATORY PROTECTION.

- Place a plastic cap on, or otherwise plug, the top of the riser pipe to prevent GAC from entering the riser pipe during the fill process.
- Place the manufacturer-supplied funnel (blue) in the top of the vessel.
- Pour GAC media into the vessel until approximately 2/3 full. Do not completely fill the vessel with GAC, or there will be no room for bed expansion during backwashing. Gently shake vessel periodically to ensure that the GAC media settles without voids or bridging.
- Remove the plastic cap or other plug from the top of the riser pipe.
- Place the appropriate manifold on the vessel until GAC hydration is performed.
- The non-Vortech gravel-packed vessels may pose a problem with the riser "floating" out of the vessel when not confined by the manifold, or when exchanging manifolds. Application of NSF approved, safe for potable water lubricant on the O-ring where it contacts the riser pipe may help when exchanging manifolds.
- Write the initials of the vessel assembler and date of assembly on the top of the vessel, or otherwise label as directed.

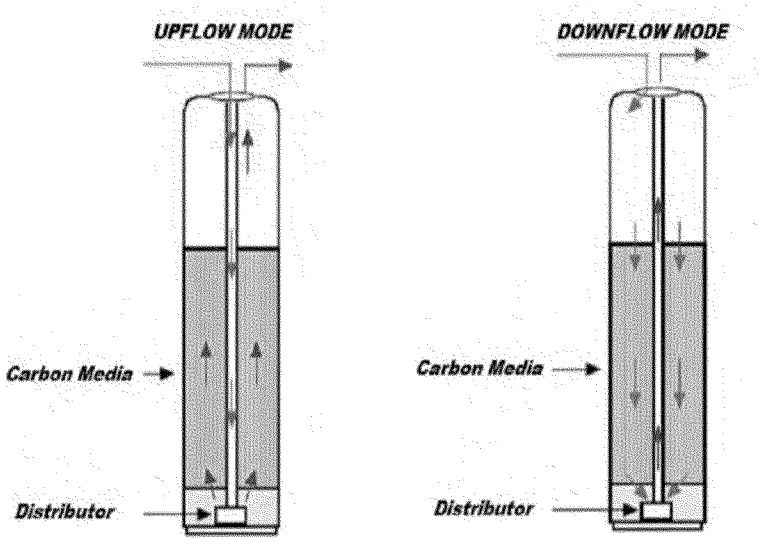
NOTE: There is an O-ring in the manifold that may be hard to reach with the filter basket in place. In this case, the top of the riser pipe can be lubricated with NSF-approved lubricant.

NOTE: When attaching the filter basket to the manifold, twist the basket until it clicks into the locked position (this may require considerable strength). Once locked, it cannot be removed by twisting in the opposite direction. Be sure the basket is secure before installing the manifold.

b. GAC Hydration - UPFLOW MODE:

BEFORE CONTINUING, THE FOLLOWING INFORMATION SHOULD BE REVIEWED AND UNDERSTOOD.

There are two possible flow configurations for the POET GAC vessels:



UPFLOW – water enters through the riser pipe and travels up through the GAC bed
DOWNFLOW – water travels down through the GAC bed and exits through the riser pipe

NOTE: Hydrate and Backwash the filters in the UPFLOW configuration. Settle the GAC media, install and operate the filter in the DOWNFLOW configuration.

NOTE: The following steps assume a clean, clear and potable source of water has been established and can be delivered at a flow rate of between five (5) and eight (8) gallons per minute (gpm). A potable water supply manifold (Figure 1) with flow meters and appropriate valves for control and throttling of flow is needed for backwashing more than one cylinder at a time.

NOTE: GAC must be properly hydrated before use. Otherwise, air trapped in the GAC grains can cause GAC loss during backwashing (due to buoyancy) and interfere with contaminant uptake. For gravel-diffused vessels, hydration must be done carefully to prevent the riser from "floating," or rising out of the gravel. For this reason, GAC hydration should be performed with the vessel manifold in place.

- Plumb the vessel manifold to the potable water supply and waste lines in the UPFLOW configuration.
- Slowly add clean potable water until the vessel is completely filled.
- The GAC grains will take up water during the hydration phase. Periodically check the water level in the vessel and ensure that the GAC is completely immersed in water.
- Leave the downflow inlet valve open so air can be released.

NOTE: Due to the bubbling that occurs during the GAC hydration process, some water may be discharged from the vessels.

- Allow the GAC to soak in water for a minimum of 24 hours.
- Record the date and start/end time of the hydration period on the outside of vessel

NOTE: DO NOT ALLOW VESSEL TO SIT FOR MORE THAN 3-4 DAYS PRIOR TO BACKWASHING.

c. Backwashing – UPFLOW MODE:

- Plumb the vessel manifold to the potable water supply and waste lines in the UPFLOW configuration.
  - Manifold Type A (Figure 2 - left): Connect the clean water supply line to the UPFLOW fitting and the waste line to the DOWNFLOW fitting.
  - Manifold Type B (Figure 2 - right): Connect the clean water supply line to the side labeled "IN" and the waste line to the side labeled "OUT".
- The backwash curve from the GAC manufacturer is in units of gpm/sq.ft. The 10" and 12" diameter vessels have a cross-sectional area of approximately 0.5 and 0.8 sq.ft., respectively. According to the backwash curve attached (Figure 3), the manufacturer's recommended bed expansion of 20-30% corresponds to **6 gpm for the 10" vessels and 7-8 gpm for the 12" vessels**. DO NOT FLUSH AT A HIGHER FLOW RATE as bed expansion can force GAC grains against the top screen and out of the vessels.
- Slowly open the water supply valve at each of the flowmeters and increase the flow rate to 6 gpm or 8 gpm depending upon vessel size. Backwash each vessels for a total of 75 gallons or until the water flowing from the waste line is clear (i.e., it contains no visible GAC particles/fines).
- The flowmeters cannot be zeroed, as they measure total accumulative flow to the hundredth of a gallon. Therefore, the initial number indicated on each flowmeter must be recorded and 75 gallons ADDED to this number to determine the final target total for each tank.
- Upon completing the high volume backwash to remove GAC fines, collect a small sample of water from each waste line and check for floating particles. If present, continue to backwash until no particles are present.
- After the fines have been removed, reduce the flow rate to achieve a 10 minute Expanded Bed Contact Time (i.e., volume of carbon bed (gallons) divided by 10 minutes) as required by the size of the tank and carbon bed volume (e.g., 1.7 gpm for a 10 inch diameter, 54 inch tall cylinder with 1.6 ft^3 of GAC). Flush a total of 20 bed volumes through the vessel at the reduced flow rate (e.g., 239 gallons for a vessel with 1.6 ft^3 of GAC).
- If flow diminishes in the waste line of a given vessel, pulsing the inlet valve may help clear a blockage.
- If pulsing the flow does not restore flowrate, then briefly change to DOWNFLOW mode by temporarily switching hose configuration. Once the required backwash flowrate is re-established, return to UPFLOW mode, and continue the backwash.
- Watch all tanks that are discharging carbon at a high rate, and use a clear or white container to capture a discharge sample for observation. It is quite obvious if dust or carbon granules (solid media) are being flushed. An internal tank problem is rare,

but a failure can allow the carbon media to flush out. Be on the look-out for any major discharge of tank media.

d. GAC Settling and Final Inspection – DOWNFLOW MODE:

- Once backwash is complete, reverse the potable water supply hoses and flush for approximately five minutes at five gpm, or 30 gallons, in the DOWNFLOW mode to settle the GAC media in vessel.
- If the vessel manifold is removed after settling, a flashlight should be used to inspect the GAC level in the vessel. If necessary, a shop-vac with a pipe fitting can be used to remove water from the riser pipe and expose the GAC surface. Refill the vessel with water after inspection.
- Attach a tag to top of vessel with the initials of who performed the work, as well as the backwash date and time (or some alternate tracking information).

e. Final assembly:

- If not already in place, screw the manifold onto the top of the vessel and tighten (be sure the white filter basket is attached to bottom of manifold).

NOTE: Check for missing or damaged O-rings. There is an O-ring that contacts the riser pipe and an O-ring that contacts the top of the vessel. BOTH must be present.

NOTE: put a small film of NSF-approved lubricant on all O-rings before assembly, including valve assemblies.

- Create and print VESSEL ID label using the attached naming convention (Figure 4) and attach to the top of vessel just below manifold.
- Attach a sticker indicating the type of GAC (e.g. F 600 AR+ 12X40).

NOTE: If Manifold Type B is used, the in and out arrows can be reversed by removing the four crosshead screws and rotating the head 180 degrees for either DOWNFLOW or UPFLOW mode and replacing the screws. Verify that the “in” arrow is the DOWNFLOW mode. Connect paper tag to the side of the manifold labeled “in” to ensure the vessels are installed in the DOWNFLOW configuration.

NOTE: DO NOT ALLOW VESSEL TO SIT FOR MORE THAN 3-4 DAYS PRIOR TO INSTALLATION IN THE RESIDENCE.

NOTE: If the holding time on a backwashed vessel expires, the vessel can be “freshened” with a 10-15 minute backwash (1-2 bed volumes), followed by a brief period of DOWNFLOW settlement as described in Step 5 above. A new holding time is then established.

Installation Notes:

1. An experienced GAC installer must conduct a pre-installation evaluation to identify complicating matters (low headroom, unique well system). Good documentation is necessary for this step; get the information to the installer, if different.

2. After installation, have the user run water to remove entrapped air in the entire system and identify other concerns while you're still there to allow for questions, problem identification.

3. The first half-dozen or so GAC installations for a plumber will take significantly longer than planned.

4. Don't begin an installation too late in the day (after 3pm) to allow adequate time to procure unexpected supplies.

5. If there is a need for a large number of installations, use a standardized manifold and GAC system (GAC vessels, particulate filters, UV unit). This improves long term operation & maintenance efficiency.

NOTE: PRIOR TO CONNECTING THE SECOND GAC VESSEL TO HOMEOWNER'S PLUMBING SYSTEM, A FLUSH OF THE SYSTEM SHOULD BE CONDUCTED TO ENSURE THAT NO GAC FINES ARE PRESENT.

V. POET Sampling Plan and Procedures

a. Sampling Plan: After the POET system has been installed, at least three times the POET system empty volume (typically approximately 50 gallons for a total of 150 gallons) must be run through the system prior to sampling to ensure that the water sampled is representative of treated well water.

Requirements for sampling of the POET system will be established by the Department on a case-by-case basis. Typically, sampling after installation will consist of drinking water volatile organic compounds (VOCs, to determine if there are any organic compounds in the well water that could load the GAC with compounds other than the target compound) and total coliforms to determine if there is bacterial contamination in the well water (other site-specific requirements may be included by the Department):

Analytes	Pre-Carbon	Mid-Carbon	Post-Carbon
Drinking Water VOCs[1]	Yes	Yes	Yes
Total Coliforms[2]	Yes	No	Yes

Notes:
1. Using EPA Test Method 524.
2. Using EPA Test Method 9221 B.1/B.2, 9222 B/C, 9223 B, or 1604.

Laboratory analysis turnaround time shall be three days unless otherwise specified by the Department.

All analyses shall be completed by a laboratory currently approved under the New York State Environmental Laboratory Accreditation Program (ELAP).

b. Sampling Procedures

Samples and sampling equipment must not come in contact with aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFC materials must be avoided. Many food and drink packaging materials and "plumbers thread seal tape" contain PFCs. All clothing worn by sampling personnel must have been laundered multiple times. The sampler must wash hands before sampling and wear nitrile gloves while filling and sealing the sample bottles. Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

There are three sampling port locations on each system: influent (raw, pre-carbon), intermediate (mid-carbon) and effluent (post-carbon). Check the water meter to see that the system has been in use and the water in the system is representative of the incoming water. Purge at least one gallon from each sampling port. Sample each port separately in the following order: effluent, intermediate, influent (raw).

Fill two pre-cleaned 250 mL HDPE or polypropylene bottle with the sample.
Cap the bottles with an acceptable cap and liner closure system.
Label the sample bottles.
Fill out the chain of custody.
Place in a cooler maintained at 4 ± 2° Celsius.

Collect one field duplicate for every sample batch, not to exceed 20 samples.
Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, not to exceed 20 samples. The MS/MSD is to be collected at the first sampling location.

VI. POET System Maintenance

a. The Contractor shall supply all labor, equipment, cartridge filters, GAC media, treatment chemicals, replacement ultraviolet lamps, and miscellaneous supplies needed to complete, operate and properly maintain the treatment systems over the term of the Contract until directed otherwise by the Department.

b. A log book shall be kept for each system. The log book shall be used to record relevant information such as sampling dates, GAC replacement dates, water meter readings, UV light changes and prefilter changes. This information shall also be submitted semi-annually to the Department for each installation.

c. For the Contractor's information, typical maintenance activities are expected to include:

   i. Periodic replacement of the particulate prefilter will normally be performed by the occupant (once per month). Contractor shall provide occupant with instructions on

proper change-out and supply twelve (12) prefilters. The Contractor shall perform all other maintenance activities listed herein. If the occupant is unable to change-out the prefilter, the Contractor shall complete the task on a monthly or as needed basis.

ii. Periodic replacement of GAC media as directed by the Department.

iii. Cleaning of UV light quartz sleeve as needed (minimum every six months) and other service as recommended by the manufacturer.

iv. Replacement of UV bulbs (minimum of once per year or as needed).

v. Complete system inspection during each maintenance visit.

vi. Collection of water samples, from the appropriate system sampling taps, during scheduled and unscheduled maintenance visits, or as directed by the Department.

vii. Inspection of the homeowner's well and pressure tank system, to confirm that these are operating properly, before installing the POET system. As part of the inspection, the Contractor must also complete the Pre-installation Checklist, which must then be submitted to the Department.

viii. Complete system inspection during each maintenance visit, including a check for leaks, proper valve settings and proper pressure, and completion of the POET System Maintenance Checklist and submission of this checklist to the Department.

d. Unscheduled Maintenance and Special Sampling Visits:

i. The Contractor shall perform within four (4) hours or the next work day after notification, all repairs, maintenance, removal of existing systems, or other services required to resolve problems with the system, including any emergency situation. An emergency situation shall be construed as a major leak in the system or the lack of adequate water pressure.

ii. The Department may also request that the Contractor conduct special sampling visits. Notification for unscheduled maintenance or special sampling visits may be authorized only by the Department. If emergency service is requested by the resident, the Department Representative should be contacted and notified of the need as soon as possible, but the temporary unavailability of the Department Representative is not to preclude the performance of any required immediate corrective action.

c. Removal, Replacement, and Disposal of Spent GAC Media:

When the analysis of the water samples indicate that the contaminant has broken through the first GAC vessel or at the discretion of the Department, the Contractor will be directed by the Department to replace the spent GAC. The following procedure should be followed:

i. The first (lead) GAC vessel shall be removed.

ii. The second (lag) GAC vessel shall be moved to the lead position.

iii. A freshly charged and backwashed GAC vessel shall be installed in the lag position.

iv. The former lead vessel shall be removed from the site by the Contractor. The GAC media shall then be removed from the former lead vessel, drained to the extent possible, and appropriately disposed of by the Contractor.

v. The former lead vessel, once emptied of GAC media, will be triple rinsed and stored, in an inverted position to allow drainage, in an appropriate location that minimizes the risk of the unit becoming contaminated. Within twenty-four (24) hours of reuse, the GAC vessel should again be triple rinsed to remove any debris accumulated during storage, and then filled with the appropriate volume of virgin GAC media. The GAC vessel shall be backwashed as described below to remove all fines and dust from the GAC media and properly stored by the Contractor prior to reuse of the vessel. Hydrated and backwashed vessels must not be stored longer than three days prior to field installation to prevent significant bacteriological growth while the hydrated vessel is in storage.

vi. The Contractor is responsible for appropriate disposal, including any potential testing or manifesting requirements if the waste may be considered hazardous.

VII. POET System Record Keeping

a. The Contractor shall, at a minimum, maintain a list of information on all POET systems, including:

   i. The resident's name, street address, mailing address, telephone number, and email address.

   ii. The property owner's name, street address, mailing address, telephone number, and email address.

   iii. The name of the person to be contacted to arrange for the scheduling of maintenance or sampling, their street address, mailing address, telephone number, and email address.

b. A copy of this list shall be provided to the Department semiannually.

c. Additionally, the following reports and checklists shall be performed and provided to the Department:

   i. Complete inspection of the homeowner's well and pressure tank system, prior to installation of each GAC system, with completion of the Pre-installation Checklist. This checklist will be utilized to establish the condition of the existing household plumbing

and provide the justification for the installation of any equipment not specified in the Standard System.

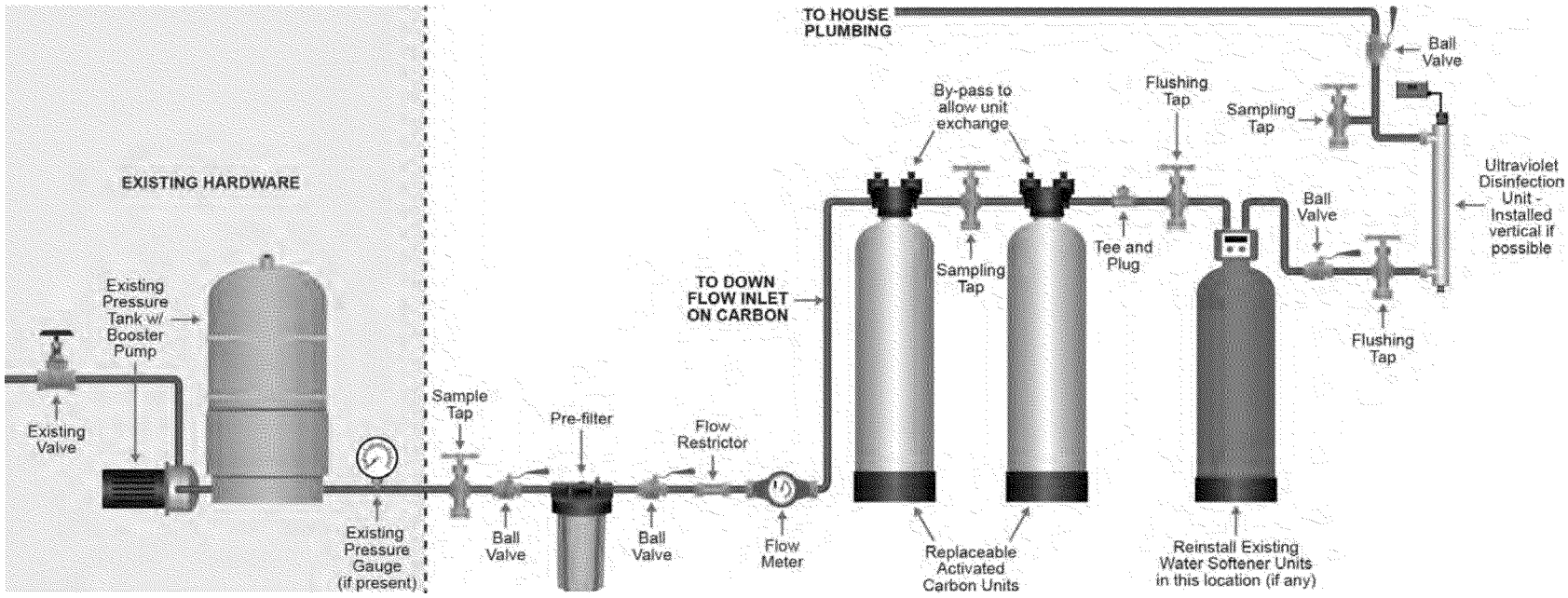
ii. Upon completion of the installation, the POET System Installation Checklist must be completed and signed by either the resident or property owner and the installer.

iii. Complete system inspection during maintenance visits, including a check for leaks, proper valve settings and proper pressure, completion of the POET System Maintenance Checklist.

iv. A semiannual report shall be submitted to the Department which shall include a summary of the analytical data from sampling rounds, water meter readings, a summary of all routine and emergency service provided during the reporting period, and a statement of the system condition based on any inspections that were performed.

d. Items requested by the Department and deemed necessary for a properly operating system, but not included in this specification, or the Standard System such as a water softener or heated enclosure for the Standard System where sufficient space is unavailable in the residence) shall be paid by submission of actual receipted costs based upon the lowest of a minimum of three (3) quotes and purchasing from the lowest quote. Minor modifications to an existing treatment system, unscheduled maintenance work or special sampling visits may be paid at rates in the Contract or be subcontracted out.

Figure 1: Schematic Diagram for Point of Entry Treatment System



Date 10-19-17

The Culligan proposed system has proven itself, the technology will work. The system meets the NYSDEC specifications in most part. Below is a spreadsheet showing some of the differences.

APPENDIX A NYSDEC POET System Specification		Culligan Proposal (dated 10-12-17) Proven System Designed for Culligan Water Technologies, Colchester, VT	
Items	**Description**	**Included**	**Not Included**
I,c	All required water sampling	Test water on site for Hardness & Iron	Water sampling for contaminants
I,g	All sampling and analyses required	Test water on site for Hardness & Iron	Water sampling for contaminants
I,h,vii	Electrical source of power	Not included	Electrician
I,h,ix	Collecting required water samples	Test water on site for Hardness & Iron	Water sampling for contaminants
II,a	Install as shown on NYSDEC Schematic Drawing	Install as shown on Culligan Drawing	x
II,a	Teflon free	Thread x Pex adapters using Teflon tape	Teflon Free Tape or Paste
II,a	3/4" Copper	1" Pex	x
II,a	3/4" Gate and or Ball Valves	1" Ball Valves	x
II,a	12 replacement cartridges left at residence	We replace two every 4 months	x
II,a	UV must be powered through a GFI receptacle	Not Included	Electrician
II,c	3/4 Copper	1" Pex	x
II,d	Remove system when directed to do so	If Culligan's fault no charge	If other reason's we charge $195.
III,b,ii	Vessels with manually operated pressure vent	Use sampling valves to bleed air	x
III,b,vi	Insufficient head room and or crawl space	Not Included	Additional cost, each home is different
III,b,xv	Vessels with a minimum of eight (8) bolts	Not Included	x
III,d	12 replacement cartridges left at residence	We replace two every 4 months	x
III,d,i	Cartridges made of cellulose or glass-cellulose	Not Included	x
III,d,iii	Cartridges supplied with O-rings or gasket seals	Culligan replaces as needed	When we replace an O-ring $ 6.85 ea.
III,e,iii	Ground fault circuit interrupter protected outlet	Not Included	Electrician
III,e,iii	UV adjustable calibration control	Not Included	These are used on large Industrial UV's
III,h	Ball valves 1/2"	1"	x
III,,J	Sampling Taps 3/4" x 3/4" x 1/2"	1" x 1" x ? (no hose bibs)	x
III,m	UV pre-installation water quality analysis	Test water on site for Hardness & Iron	Send water sample to lab for Turbidity, Hydrogen Sulfide and Manganese Total Cost $ 215

APPENDIX A NYSDEC POET System Specification		Culligan Proposal Proven System from Culligan Water Technologies, Colchester, VT	
Items	**Description**	**Included**	**Not Included**
V,a	Sampling Water	Not Included	Water sampling for contaminants
V,b	Sampling Water	Not Included	Water sampling for contaminants
VI,b	Semi Annual reports submitted	Log Book with each system to record cartridge, GAC Vessel and UV bulb and sleeve replacement. Water Meter readings.	Water sampling dates and information submitted semi-annually
VI,c,i	Cartridge replaced by occupant 1 time per month	We replace two every 4 months	x
VI,c,iii	Cleaning quartz sleeve every 6 months	Will check quartz sleeve every 4 months	
VI,c,vii	Per installation check list submitted to ?	Not Included	Is this required?

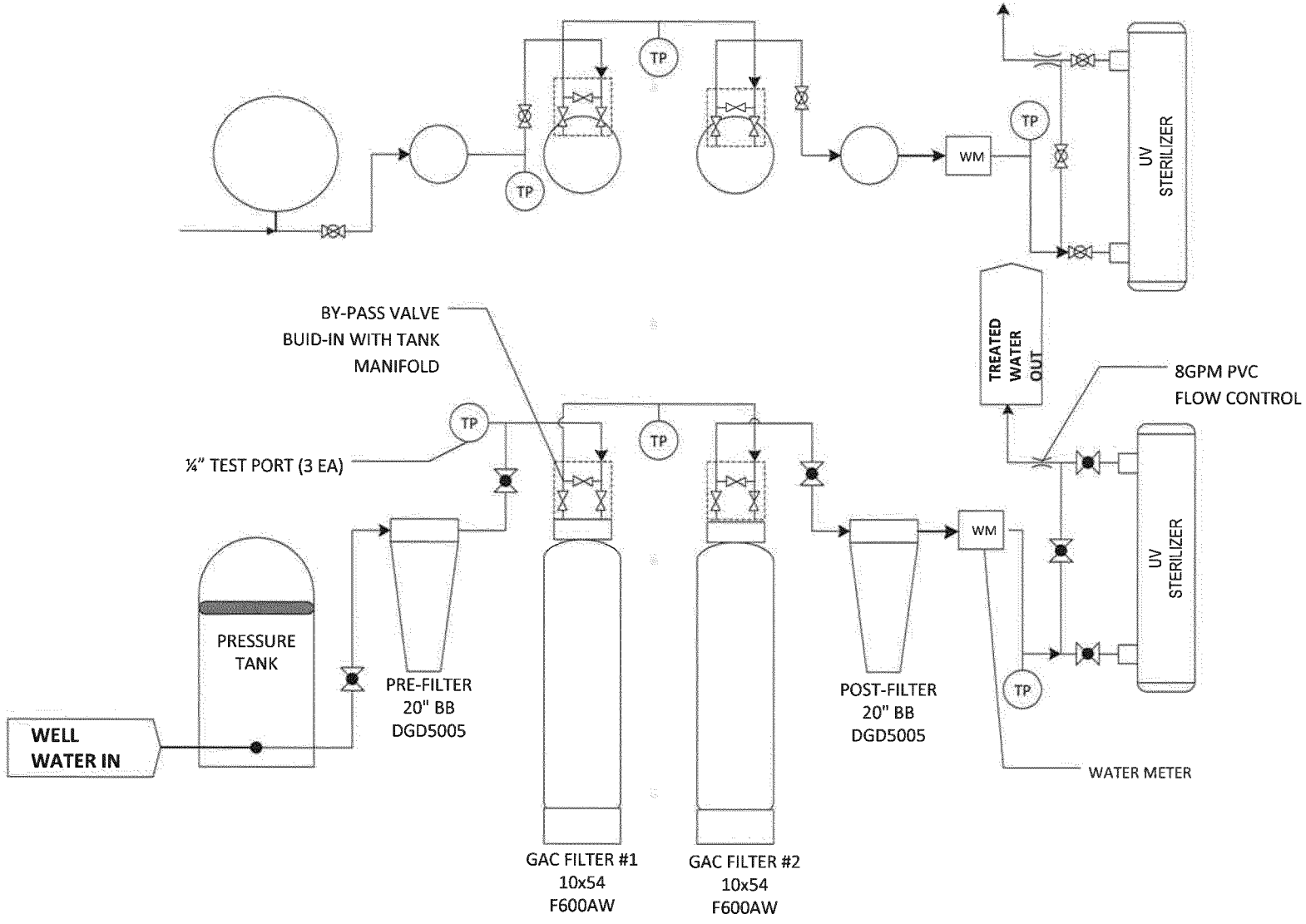
Please note the following:

Culligan System Warranty - 1 Year Parts and Labor

If Customer has an automatic sprinkler system, the Culligan Treatment System will not treat this water.

The GAC Vessels for the 10 GPM System are 14" x 47"

Kaats Culligan agrees to complete all Installations in the period of time detailed on your purchase order. Kaat's Culligan is not responsible for an act of God or war that would prevent us from meeting this time line.



Culligan

ENGINEERED SYSTEM
ROSEMONT, IL USA

PFOA REDUCTION POE SYSTEM

CULLIGAN PORTABLE EXCHANGE CARBON FILTER SYSTEM

SIZE	DATE	DWG NO	REV
	03-13-2016		

SCALE	NTS	BY: GPI	SHEET	1 OF 1