Eko3 systems

Eko3 FILTRATION SYSTEMS

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FILTRATION FOR POOLS AND SPAS

All swimming pools and spas are subject to constant contamination from particulate matter brought in by swimmers, wind and articles used in and about the water. This type of contamination includes particles of dirt, cosmetics, suntan lotion and body oils, leaves, mineral residue, partially oxidized organic matter and other debris.

Filtration is the mechanical means for removing this insoluble matter from swimming pool and spa water. Pool and spa water carrying particulate matter, solids and debris is passed through a filtration media that produces clear water returning to the pool or spa basin. Water clarity is important for appearance, hygiene and safety.

For centuries filtration technology has been developed for production of clean drinking water, industrial applications and more recently, pool and spa applications. Most government codes and regulations were developed from this research and they provide for a range of efficiency levels depending on the type of application. To properly design and build a pool and/or spa, one must have a strong understanding of the mechanics pertaining to filtration and the intent of this article is to provide a basic guide to swimming pool and spa filtration systems.

Water Clarity

Water clarity is measured in Nephelometer Turbidity Units (NTU). On commercial pools and spas, most codes require turbidity units to not exceed 0.5 NTU during low usage times and to not exceed 1.0 NTU during peak bather loads. NTU's are not easily measured at the poolside. This is the reason most pool operators (both residential and commercial) look at clarity in terms of being able to see the main drains clearly from the pool deck or a 2 inch disk with black and red quadrants through fifteen feet of water. These water clarity requirements are only a bare minimum and in all cases we should design and size for clear water that allows for complete visibility of the entire pool.

Three factors affect water clarity: turnover rate; filter media selected for the application; and total available filter area.

Filter Media

Generally, there are five types of filter media used in swimming pool and spa granular media filtration and they are as follows:

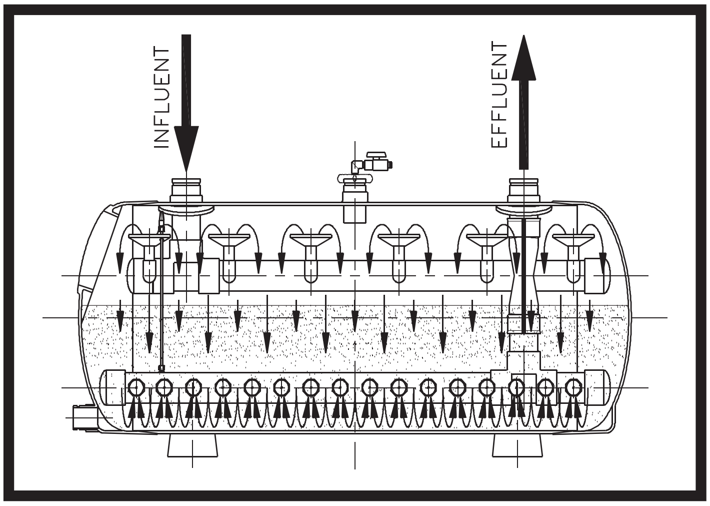
1) Silica Sand
2) Anthracite
3) Garnite
4) Zeolites
5) Gravel

Basic Principles of Operation

Filtration

Unfiltered water enters the filter tank through the influent port. When utilizing end piped options, either influent port of the tank can be utilized. Once entering the distribution header, the water flows through a hydraulically balanced system of diverters strategically placed over the filter bed in sets of two (2). Even distribution of the water is achieved throughout the filter tank, which results in low levels of turbulence and minimal differential pressure losses. Water flow paths are parallel and vertical at the surface of the filter media bed resulting in flow capacities of up to 20 USGPM per sq. ft. (13.6 liters/sec per sq.m.) of filter area without creating channeling within the filter bed (see Figure A).

Figure A: Path of Flow During Filtration



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Under high flow rates, suspended solids within the water are exposed to unbalanced forces while flowing through the filter bed. These unbalanced forces cause the suspended particles to travel in an irregular path around and toward the grains of filter media. Upon contact the suspended solids are trapped on the jagged edges of the filter media grains. This filtration process is also aided through straining at the surface of the filter bed and electrostatic attraction of the suspended solids and filter media. Through this process of filtration, solids are collected and contained throughout the media bed thus providing long filter cycles between backwashes.

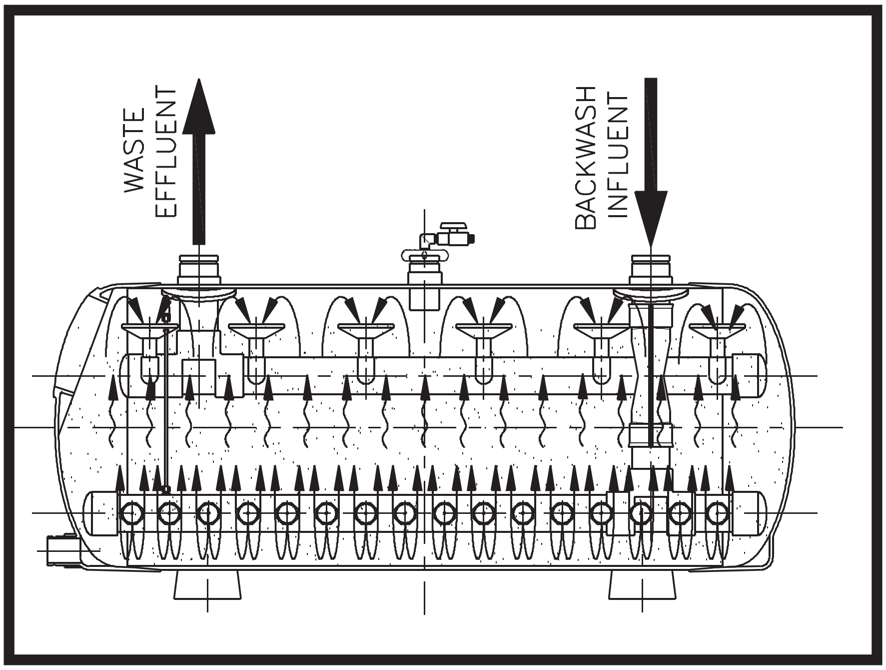
The filtered water is then collected through the use of "V" slotted laterals designed to retain the small filter media particles.

After entering the collection header, the filtered water exits the tank through the effluent port.

Backwash (Reverse Flow)

Backwashing is the reversal of water flow through the filter bed. Backwashing is normally initiated when the pressure drop from the influent port to the effluent port reaches 15 to 17 psi during normal operation. Backwashing is achieved by routing the water flow into the collection header and laterals through the filter bed then exiting by the diverters and distribution header. This reversal of flow direction will cause the filter bed to lift and expand, which is called fluidization. The fluidization of the media bed causes a release of the collected solids (see Figure B).

Figure B: Path of Flow During Backwash



During backwash, circulation patterns are established within the media bed, which facilitates even and thorough cleansing of the filter media particles. The hydraulic balance created through the distribution and collection system design reduces water velocities to below that of the media-settling rate, preventing loss of filter media during backwash. The solids that have been released during fluidization are collected and discharged to waste by the diverters.

For multiple filter tank applications, each filter tank is backwashed independent of the other filters tanks. Filtered water from the adjacent tank(s) is directed in reverse through the tank being backwashed.

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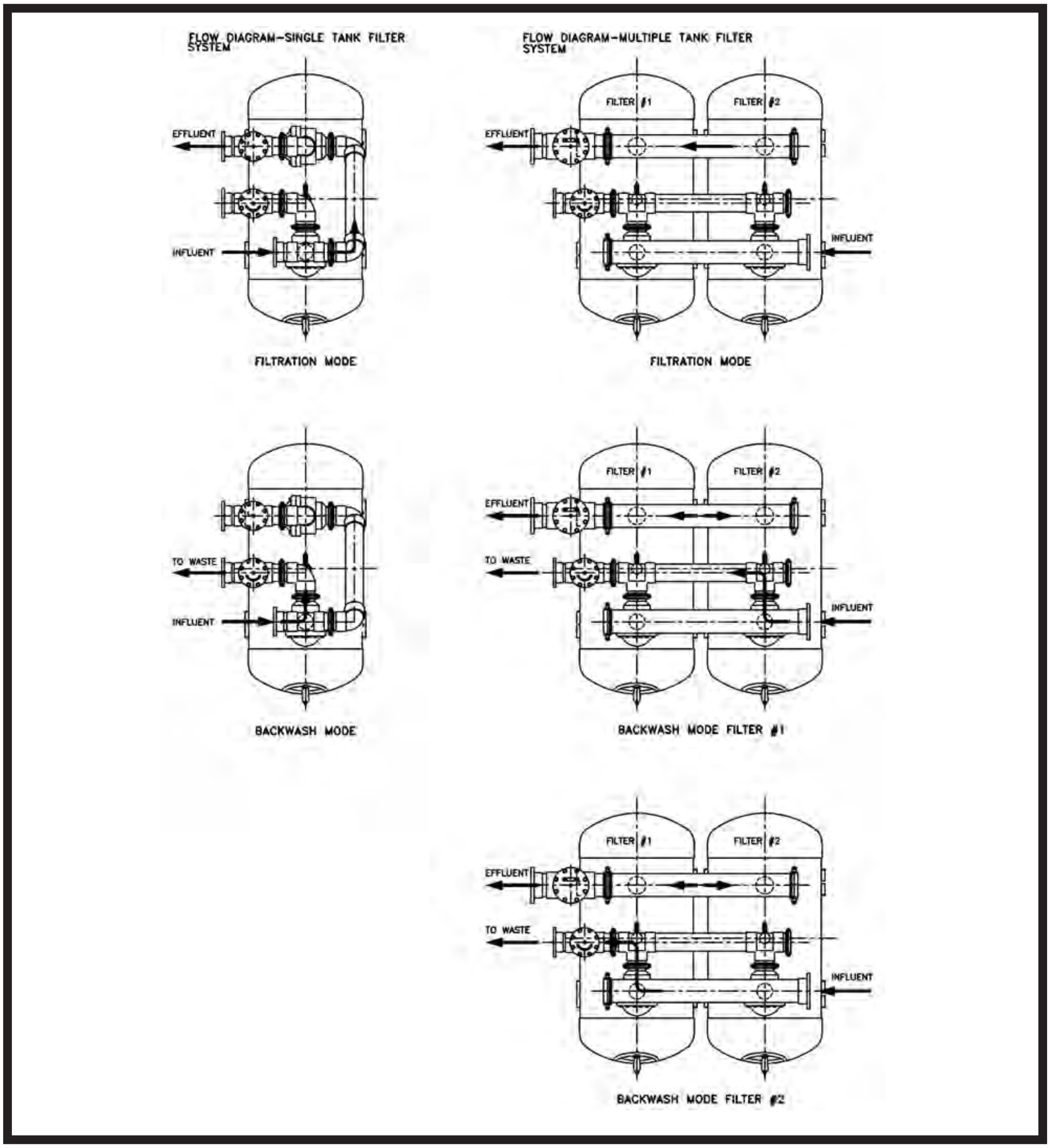
Flow Diagrams Single and Dual Tank.

Filter Systems with three through eight tanks allow a portion of the filtered water to return to the source during the backwash cycle.



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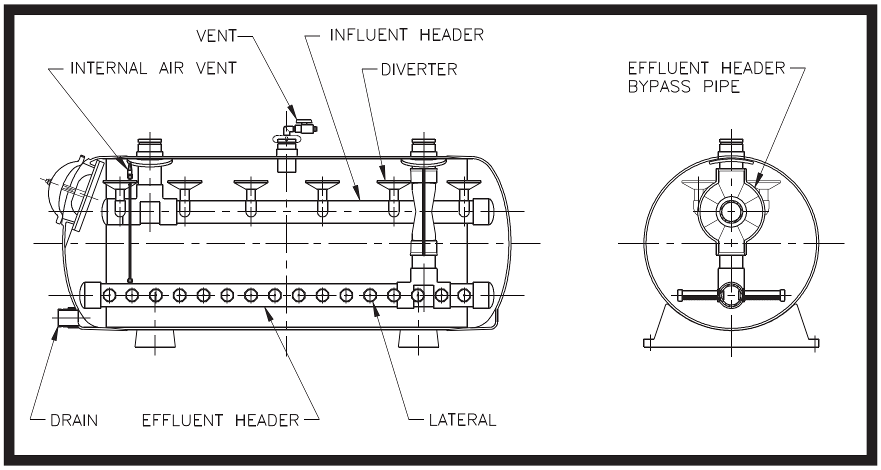
Design Features & Engineering Specifications for Eko3 Top Piped Filter(s)

Design Features

Each Nemato filter system has been designed to stringent engineering performance specifications and manufactured by composite craftsman committed to a high level of quality. All Nemato products are subjected to rigorous quality control and material standards to assure dependability. We at Nemato are pleased to provide you with a filter system that will be reliable and trouble-free for many years to come.

All our filter tanks are manufactured in-house of isophthalic fiberglass reinforced polymers with a maximum working pressure of 100 psi (690kPa). The following is a sectional view of Nemato's Eko3's top piped filter tank and internal components (see Figure C):

Figure C: Eko3 Filter Tank Components



Engineering Specifications

Nemato filtration systems come in three (3) tank diameters and various lengths to provide a wide range of filter areas. The following are dimensional drawings (see Figure D) and dimensional data (see Figure E):

Figure D: Dimensional Drawing

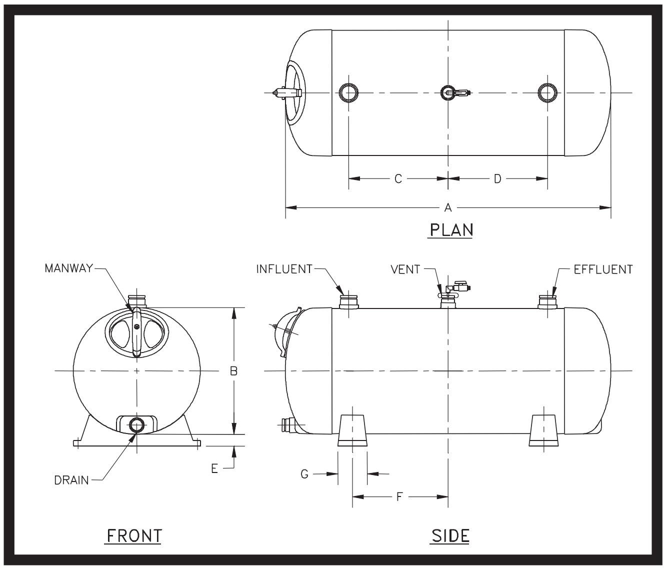


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Figure E: Dimensional Table

Model No.	A	B	C &D	E	F	G
EKO-34-100	48.5”	36”	8.75”	3.5”	6”	8”
EKO-34126	60”	36”	8.75”	3.5”	12”	8”
EKO-34-153	72”	36”	16.75”	3.5”	18”	8”
EKO-34-193	88.5”	36”	25.25”	3.5”	25”	8”
EKO-34-237	108”	36”	34”	3.5”	32.5”	8”
EKO-42-145	57”	42.5”	8.75”	3.5”	5.25”	10”
EKO-42-200	76.5”	42.5”	16.75”	3.5”	15”	10”
EKO-42-225	86”	42.5”	16.75”	3.5”	19.5”	10”
EKO-42-250	94”	42.5”	21”	3.5”	23”	10”
EKO-42-275	102”	42.5”	25.25”	3.5”	25”	10”
EKO-42-310	115”	42.5”	31.5”	3.5”	31”	10”
EKO-42-360	129”	42.5”	39.5”	3.5”	36.5”	10”
EKO-42-410	150”	42.5”	48”	3.5”	37”	10”
EKO-42-460	166”	42.5”	56”	3.5”	41”	10”
EKO-60-300	81”	60”	8.75”	3.5”	9.5”	12”
EKO-60-350	93”	60”	16.75”	3.5”	15.5”	12”
EKO-60-400	105”	60”	21”	3.5”	21.5”	12”
EKO-60-450	117”	60”	28”	3.5”	27.5”	12”
EKO-60-500	129”	60”	34.25”	3.5”	31.75”	12”
EKO-60-550	141”	60”	39.5”	3.5”	34.75”	12”
EKO-60-600	153”	60”	45”	3.5”	38”	12”
EKO-60-650	165”	60”	51”	3.5”	41”	12”
EKO-60-700	177”	60”	57”	3.5”	45”	12”
EKO-60-750	189”	60”	63”	3.5”	48”	12”
EKO-60-800	201”	60”	69”	3.5”	51”	12”

Granular Media Filter Sizing

The rate per square foot of filter surface area will vary for each type of filter system. In most commercial installations these rates are regulated by government requirements and legislation. Most government codes also require all filters to be tested to ANSI/ NSF Standard 50 by a certified testing agency. When looking at certification of filters, you need to be aware of the two types of approvals within the standard. The first approval would be for pool only applications and the second approval would be for pool & spa applications. One must ensure that all spa applications carry the necessary approval by the testing agency in order to maintain appropriate product certifications.

In general however, filtration effectiveness improves by increasing the filter area for a given volume of water (see Figure G):

Figure G: Clarification Attained in Swimming Pools through Consecutive Dilution

No. of Times Pool Volume Displaced by Filtered Water 24hr period (turnovers per day)	Hours Required to Filter Pool Volume (turnover period)	% Clarification of Pool Water after Equilibrium is Obtained	No. of Days Required to Attain Equilibrium
1	24	42	9
2	12	84	4
3	8	95	3
4	6	98	2
5	4.8	99	1

Many government regulations limit flow rates to 15 US GPM / Sq. Ft. for commercial installations. For high use pools or spas, this may need to be further reduced. Nemato's ***Eko***[3] Model of filtration products has many options for top piped, end piped and stacked filtration options. The following table lists the various sizes, operating flow ranges and end use application for the top piped configurations (see Figure H).

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Figure H: *Eko*[3] Line Top Piped Filter Selection Table

Model No.	Filter Area Ft.^{2}	Influent/ Effluent Size	Design Filtration Rate GPM Per Ft.^{2}	Flow Rate USGPM @ 15 USGPM/ FT.^{2}	Operating Weight Lbs	NSF Certified End Use Application
EKO-34-100	10.0	4"	5 to 20	150	2550	Pool or Spa/Hot Tub
EKO-34-126	12.6	4"	5 to 20	189	3250	Pool or Spa/Hot Tub
EKO-34-153	15.3	4"	5 to 20	230	3950	Pool or Spa/Hot Tub
EKO-34-193	19.3	4"	5 to 20	290	4900	Pool or Spa/Hot Tub
EKO-34-237	23.7	4"	5 to 20	355	6000	Pool or Spa/Hot Tub
EKO-42-145	14.5	6"	5 to 20	218	4590	Pool or Spa/Hot Tub
EKO-42-200	20.0	6"	5 to 20	300	6075	Pool or Spa/Hot Tub
EKO-42-225	22.5	6"	5 to 20	338	6750	Pool or Spa/Hot Tub
EKO-42-250	25.0	6"	5 to 20	375	7425	Pool or Spa/Hot Tub
EKO-42-275	27.5	6"	5 to 20	412	8100	Pool or Spa/Hot Tub
EKO-42-310	31.0	6"	5 to 20	465	9150	Pool or Spa/Hot Tub
EKO-42-360	36.0	6"	5 to 20	540	10500	Pool or Spa/Hot Tub
EKO-42-410	**41.0**	**6"**	**5 to 20**	**615**	**11850**	**Pool or Spa/Hot Tub**
EKO-42-460	**46.0**	**6"**	**5 to 20**	**690**	**13200**	**Pool or Spa/Hot Tub**
EKO-60-300	**30.0**	**6"**	**5 to 20**	**450**	**12700**	**Pool or Spa/Hot Tub**
EKO-60-350	**35.0**	**6"**	**5 to 20**	**525**	**14850**	Pool or Spa/Hot Tub
EKO-60-400	**40.0**	**6"**	**5 to 20**	**600**	**17000**	**Pool or Spa/Hot Tub**
EKO-60-450	**45.0**	**8"**	**5 to 20**	**675**	**19150**	**Pool or Spa/Hot Tub**
EKO-60-500	**50.0**	**8"**	**5 to 20**	**750**	**21300**	**Pool or Spa/Hot Tub**
EKO-60-550	**55.0**	**8"**	**5 to 20**	**825**	**23450**	**Pool or Spa/Hot Tub**
EKO-60-600	**60.0**	**8"**	**5 to 20**	**900**	**25600**	**Pool or Spa/Hot Tub**
EKO-60-650	**65.0**	**8"**	**5 to 20**	**975**	**27750**	**Pool or Spa/Hot Tub**
EKO-60-700	**70.0**	**8"**	**5 to 20**	**1050**	**29900**	**Pool or Spa/Hot Tub**
EKO-60-750	**75.0**	**8"**	**5 to 20**	**1125**	**32050**	**Pool or Spa/Hot Tub**
EKO-60-800	**75.0**	**10"**	**5 to 20**	**1200**	**34200**	**Pool or Spa/Hot Tub**

[1] NSF Certification for horizontal filters includes isophthalic and vinyl ester resins.
[2] All filters have top mount influent/ effluent connections.
[3] Maximum operating pressure of 100 psi.
[4] Certification includes use of clear acrylic/ FRP manway cover.

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Conclusion

Many variables come into play when selecting and sizing appropriate filtration systems for pools or spas. Some of these would be as follows:

* **Pool Volume**
* **Turnover Rate Required**
* **Bather Load**
* **Technical Capability of Operator**
* **Wastewater Handling Capability**
* **Primary Source Water Chemistry**

When selecting and sizing filtration systems, one must consider these variables, as well as potential technological or regulatory changes. Beyond this, a harmonious relationship must be sought with the rest of the recirculation system. When designed and applied properly, filters should provide reasonable payback through good water clarity and reliable performance for a lengthy period of time.

Since the late 1960's, the Hi-Rate principle has proven to be the stable provider of excellent water quality at an affordable cost per gallon. Nemato Corp. offers Hi-Rate Permanent Media Filtration Systems for all levels of sophistication, recreational, life support, decorative/display, and industrial processes. Nemato ***Eko³*** Model Filtration Systems are available for manual or fully automatic operation.

Eko³ Series Filter Systems

Nemato ***Eko³*** Model filter tanks are constructed of Fiberglass Reinforced Isophthalic or Vinylester Resin (F.R.P.) and manufactured to ASTM and ASME tank standards using molded surfaces for all critical dimensions. The tanks are totally non-corrosive and have a gel-coat finish with UV protection. The filter systems are designed for working pressures of 100 PSIG with a 4 to 1 safety factor.

The filter systems are shipped with all internal components and media dump port in a fully assembled state. All ***Eko³*** filter designs come with uniquely placed integrally molded influent/ effluent connections (both top piped & end piped), 12" x 16" integrally molded manhole seat with internally mounted F.R.P. or F.R.P./ Clear Acrylic cover, integrally molded F.R.P. saddle supports.

Eko³ Series Diaphragm Valve Kits

Backwash Valves are of the diaphragm type and all components are injection-molded in ABS. Strength, minimal head losses (requires less pump horsepower), and materials that will not corrode are the hallmark of these commercial/ industrial-duty valves.

Eko³ Series Connecting Piping Kits

Eko³ Series filtration systems connecting piping kits are quick and easy to install for both floor mounted and filtration systems. With operational flow rates up to 11,200 U.S.G.P.M. and flow velocities of 8 ft./ sec or less, the connecting piping ensures minimal head loss and balanced flow in single to eight tank systems. Designed for operating pressures of 100 P.S.I.G., the connecting piping kits are ideally suited for both 50 and 100 P.S.I.G. ***Eko³*** Series filtration systems up to 560 sq. ft. of total filter area or less.

The connecting piping is constructed of Sch. 80 PVC and Fiberglass Reinforced Vinylester Resin (F.R.P.) and is totally non-corrosive. For outdoor applications the connecting piping can be painted PVC gray to provide a high quality finish with UV protection.

The connecting piping kit is modular in design eliminating dimensional stack-up during installation while providing complete access to all filter components. Minimal floor space is required which can easily accommodate future expansion of the filter system. The influent/ effluent connecting headers range in sizes from 3" to 24" while all waste piping is sized for single filter backwash requirements in each system. The connecting piping is available with either grooved or flanged connections to simplify

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Manual Flow Control Valves
Eko[3] Series MFC (Manual Flow Control) valves ensure tamper proof adjustment of filter system flows during both filter and backwash operation. The MFC valves are constructed of non-corrosive (PVC, UHMW-PE, and EPDM) material, which will provide years of trouble free service. The MFC valve is designed for working pressures up to 100 P.S.I.G and is available in sizes ranging from 3" to 20". The MFC valves are a gate design that allows manual adjustment of effluent flow during the backwash cycle to ensure the designed backwash flow rate is achieved.

Priority Flow Control Valves
Eko[3] Series PFC (Priority Flow Control) valves ensure automatic tamper proof adjustment of filter system flows during both filter and backwash operation. The AFC valves are constructed of non-corrosive (PVC, UHMW-PE, and EPDM) material, which will provide years of trouble free service. The AFC valve is designed for working pressures up to 100 P.S.I.G and is available in sizes ranging from 3" to 12". The PFC valves are a gate design that allows hydraulically operated adjustment of effluent flow during the backwash cycle to ensure the designed backwash flow rate is achieved.

EKO3 Series Isolation & Flow Control Valves

Butterfly Valves *Eko*[3] Series butterfly valves are constructed of non-corrosive (PVC, EPDM and Viton) material, which will provide years of trouble free service. The butterfly valves are designed for working pressures up to 150 P.S.I.G. and are available in sizes ranging from 3" to 8". The butterfly valves are dynamically sealed for bubble-tight shut-off with excellent isolation characteristics.

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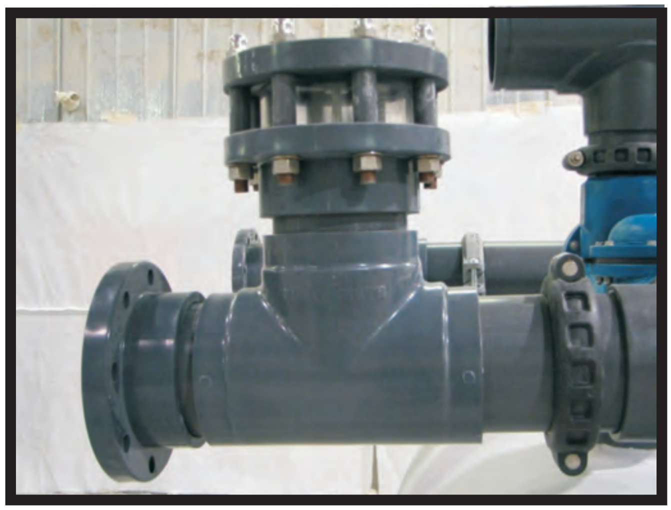
Primary Flow Control Valves

Eko^{3} Series PrFC (Primary Flow Control) valves ensure automatic tamper proof adjustment of filter system flows during both filter and backwash operation. The PrFC valves are constructed of non-corrosive (PVC, EPDM and Viton) material, which will provide years of trouble free service. The PFC valve is designed for working pressures up to 150 P.S.I.G and is available in sizes ranging from 3" to 20". The PrFC valves are a butterfly design that allows electrically operated adjustment of effluent flow during the backwash cycle to ensure the designed backwash flow rate is achieved.

Backwash Flow Control Valves

Eko^{3} Series BFC (Backwash Flow Control) valves ensure tamper proof adjustment of filter system backwash flows during backwash operation. The BFC valves are constructed of non-corrosive (PVC, UHMW-PE, EPDM and Acrylic) material, which will provide years of trouble free service. The BFC valve is designed for working pressures up to 60 P.S.I.G and is available in sizes ranging from 3" to 8" and comes with a sightglass for viewing of wastewater during the backwash cycle. The BFC valves are a gate design that allows manual adjustment of the backwash flow rate during backwash operation to ensure reliable filter operation.



Pressure Modification System

The **Eko^{3}** Series Pressure Modification System (PMS) provides constant and adequate water pressure through the Pilot Valve Assembly for operation of the filter systems when dual diaphragm valves are chosen for the operation system. Pressure Modification System eliminates the need to utilize unreliable and unpredictable city water as the diaphragm valves' pressure source. Water passing through the Pressure Modification System is clean, filtered water, assuring problem-free valve operation. The pump for the Pressure Modification System is in operation only during the backwash mode of operation and is initiated either by hand (manual systems) or by Hi/ Lo pressure cutout switch. A bladder type pressure tank is incorporated to prevent frequent motor-cycling and unnecessary component wear by providing a draw down source of pressurized water.

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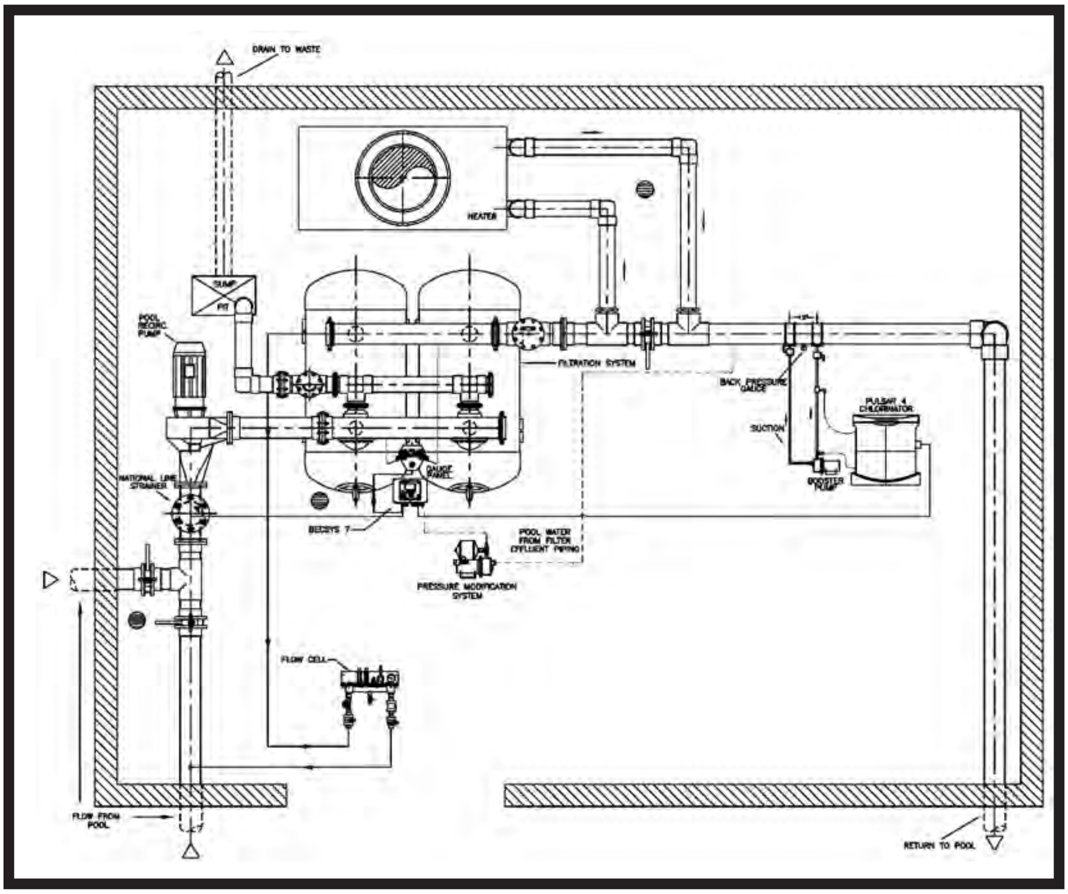
Typical Installation and Notes

The following is a typical plan view illustration of a typical mechanical room layout. The drawing illustrates accessory items such as filtration equipment, chemical treatment equipment, heater, recirculating pump, etc.

Mechanical room equipment requirements will vary with every site. Always consult an architect and/or engineer for proper installation recommendations.



Notes:

- Filter systems may be installed with the back and sides of the tank(s) against walls because operation and/or maintenance is performed at the front of the system
- Influent, effluent, and waste manifolds are reversible for right or left side installation.
- Diaphragm Valves, Face Piping, Manual Flow Control Valves, Priority Flow Control Valves and Backwash Flow Control Valves, are not factory installed onto manifolds, allowing for maximum installation flexibility.
- Provide a minimum clearance of 36" in front of the filter tanks and all electrical control panels. Refer to local code requirements.
- Always provide isolation valves in both influent & effluent connecting piping to the filter system. Lack of isolation valves may impede ability to perform service and maintenance, and could contribute to potential flooding problems
- Waste lines and/ or backwash sump must be of sufficient size to accommodate uninterrupted backwash flow rate for duration of backwash cycle for the installed filter system.
- A floor drain must be installed in the filter room
- DO NOT store corrosive chemicals such as chlorine, acid, etc. in the mechanical room as they will corrode equipment.
- DO NOT inject chemicals used for the correction of pH and/or the oxidation of organics before the recirculation pump, filter and heater.

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Shipping and Packaging

Our Quality Assurance Specialists have inspected all of Nemato's ***Eko³*** Model filtration systems at multiple points throughout the manufacturing process. Components are also performance tested, allowing for a trouble-free installation, ease of start up and years of dependable service.

The system is packaged in heavy-duty shipping crates and cartons to protect the finish surfaces and components against freight handling damage. Should freight damage occur, claims for equipment damage in shipment or shortages must be made with the carrier and noted on the bill of lading before accepting merchandise.

Should any question arise regarding the shipment of the Nemato's ***Eko³*** Line filtration system, or its components, please feel free to contact our Customer Service Department:

Nemato Corp.
1605 McEwen Drive
Whitby, Ontario, Canada L1N 7L4
Phone: 800-361-5025
e-mail: sales@nemato.com

Instructions for Receiving Filter Shipments

When a filter shipment arrives, carefully inspect the shipment for freight damage and verify that the appropriate quantity of crates and cartons have arrived on the jobsite. Inspection of the shipment should include verification that the crates and cartons were received undamaged and confirmation that filter tank(s) and system components are not damaged inside and/or outside. Remember that there are two types of freight damage:

Visible damage: Obvious damage to the crating or the filter itself must be noted on the Bill of Lading upon receipt; such as "Crating shattered, tank has gouge in its side." If you fail to make such a notation, the Freight Company can and will maintain that the shipment arrived free of damage and may deny any future damage claims.

Hidden damage: Since our filter crates and cartons are built to take abuse, the crate(s) and cartons may be undamaged and yet there still may be damage to the filter tank(s) and system components that is not obvious until the items are completely unpacked. If no obvious damage is discovered, note on the Bill of Lading that you "Reserve the right to re-inspect the shipment for damage after unpacking".

If Damage is Discovered

If you find either type of damage, keep all crating and packaging materials and call the Freight Company as soon as possible to file a report and have the filter tank crate(s) and/or system component cartons inspected. **Do not attempt to use the filter system until advised by the Freight Company to do so!** It is also advisable that photos be taken of the packaging and the damage to the filter, components, etc.

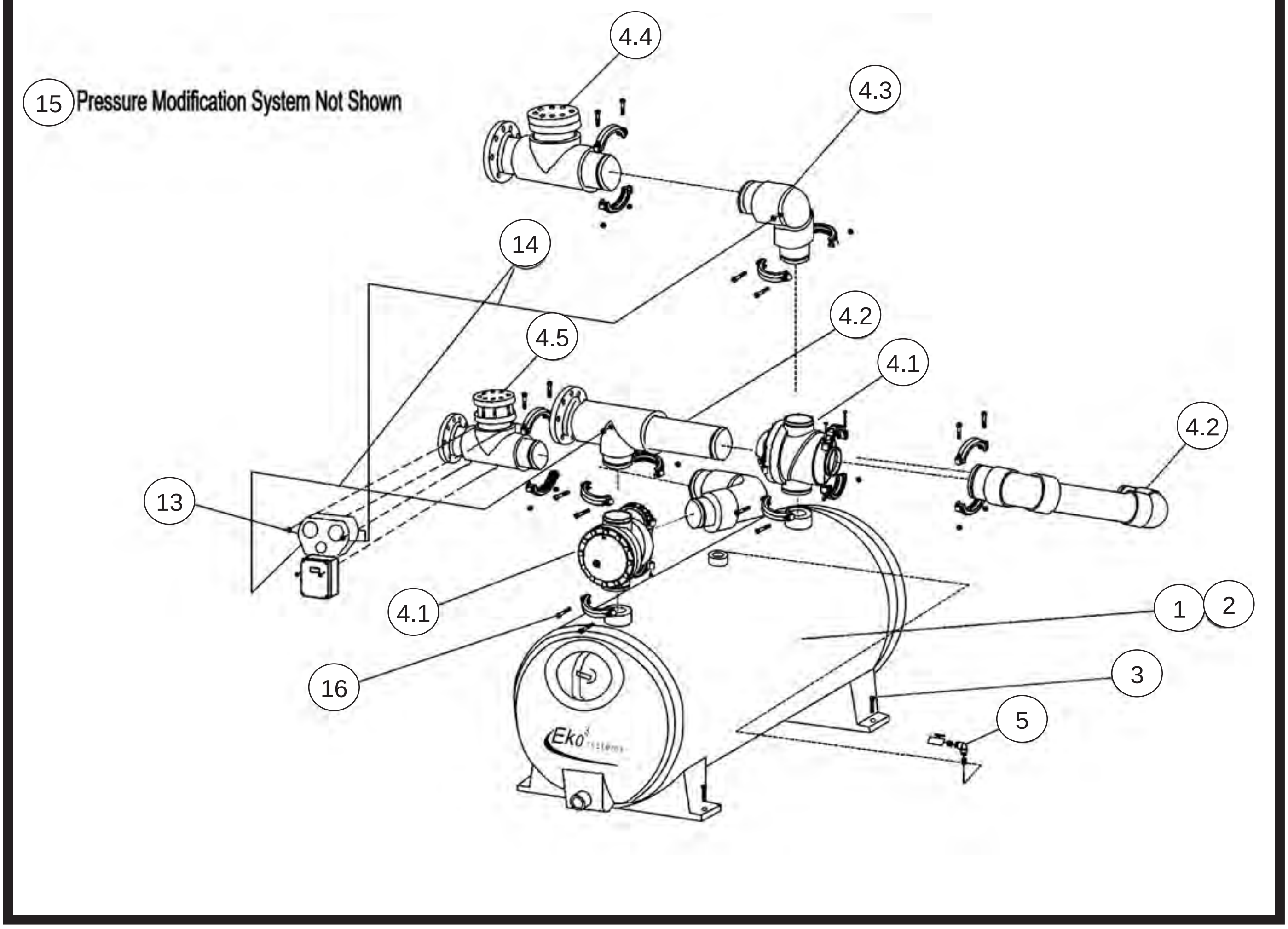
After you have reported the damage to the Freight Company, please call our Customer Service Department and inform them of what has happened. At that time, we can determine what corrective action is needed to repair or replace the damaged parts and make the appropriate arrangements. Any parts and/or related expenses needed to repair the damage will be billed to your account. **Nemato Corp. is neither responsible for filing the damage claim with the Freight Company nor responsible for the costs of the repair of the damage, if the situation is not properly handled.**

Assembly Instructions

Quick Reference Assembly Guide

For Single Tank Systems

Refer to detailed assembly procedures for each step of assembly corresponding to the quick reference assembly guide.



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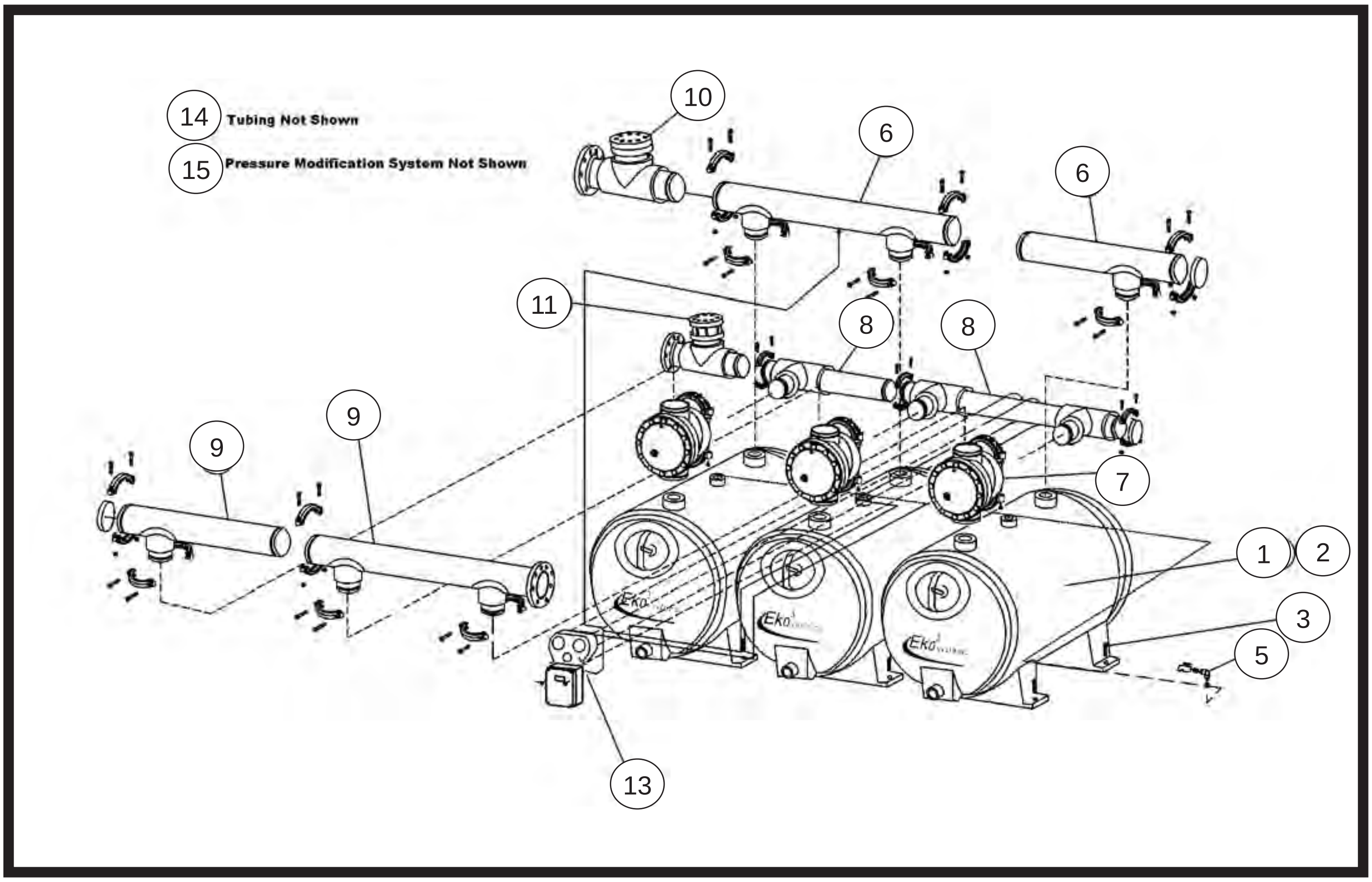
Quick Reference Assembly Guide

For Multiple Tank Systems

Refer to detailed assembly procedures for each step of assembly corresponding to the quick reference assembly guide



Assembly Methods and Procedures
These instructions will cover the installation and assembly of single (1) through eight (8) tank Nemato Corp. ***Eko***[3] Line filtration systems.

Many of the assembly methods and procedures are common to all ***Eko***[3] Line filtration systems. These methods are being addressed at the beginning of the assembly instructions so that they may be covered one time.

Positioning Filtration System and Configuration of Components
Consult architectural and/or engineering installation drawing for proper plumbing and electrical component installation configuration. It is recommended that all codes and regulations related to plumbing and electrical equipment installation be observed.

NOTE: Model EKO-34-100, EKO-34-126, EKO-42-145 and EKO-60-300 filtration systems require the Three Port Diaphragm Valve to be installed with the waste port facing the front of the filter tank. All other systems require the waste port to be installed facing the rear of the tank.

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Grooved Coupling Assembly

The system employs grooved coupling assemblies that are used to attach Three Port Diaphragm Valve and piping to the filtration system.

The assembly procedure is as follows:

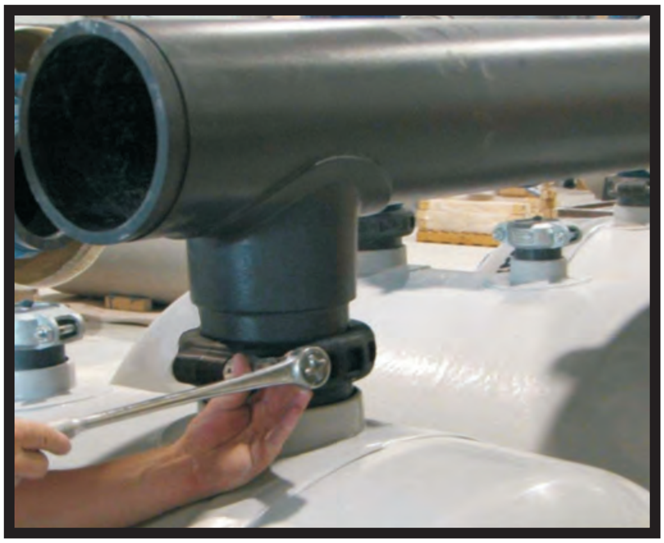
- Lightly lubricate the outside surface and sealing flanges of the coupling seals with silicone lubricant provided,
- Position the lubricated coupling seals on a grooved nipple,
- Position the item to be attached against the nipple,
- Adjust the coupling seals on the two nipples being joined so that they are touching and the seal is half on each nipple,
- Install the coupling halves over the seal – place the coupling halves so that the bolts are facing out and/or on topside of assembled coupling. If utilizing 6" ABS couplings, nuts or bolts may be placed in the recess of the coupling, however the bolt in the recess will facilitate the spinning of the nut onto bolt. This will allow for a clean looking installation,
- Squeeze the coupling halves together and insert the coupling bolts, attaching the nuts,
- Square the coupling ears for neat appearance and tighten firmly.

Solvent Welding PVC Pipe and Fittings

Prior to solvent welding, clean all pipe to be glued. Coat the inside of the PVC fitting that is to receive the piping spool. Coat one end of the pipe spool or fitting to glued with solvent cement. Quickly push the pipe spool or fitting into the receiving fitting or pipe until bottoming out – followed by a 1/8 to 1/4 turning motion.

- Make sure the pipe or fitting is in the desired location. DO NOT hesitate while installing the pipe or fitting as it may seize prior to bottoming out. Wipe off any excess solvent cement.

Note: Refer to solvent cement manufacturer's recommendation for use of their product in solvent welding PVC pipe and fittings.



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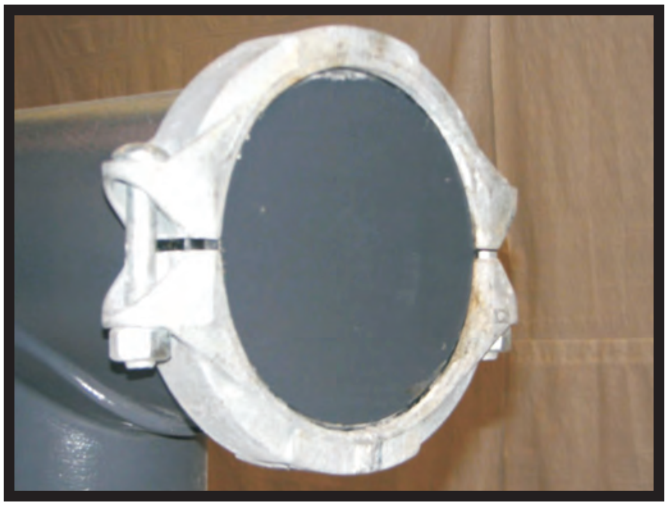

Flange Assembly

When mating field piping to the flanges supplied with the system, the gasket between flange faces should be elastomeric full-faced with a hardness of 50 to 70 durometer. Ensure proper alignment of the boltholes in the mating flanges and there is not an excessive gap between the mating flange faces prior to tightening of bolts. Pulling down the nuts diametrically opposite each other using a torque wrench should tighten the bolts.

Face Piping Manifolds

Piping manifolds are prefabricated and pressure tested prior to shipment. Manifold sections are provided in two-tank configurations and single-tank configurations. Manifolds are provided with grooved ends to allow for assembly with grooved couplings and gaskets and flanges for influent connections. There are two types of two-tank manifolds; the first is fitted with a flanged influent connection and the second has grooved ends to allow for assembly to flow control valve assemblies and other branch manifolds. The two-tank configurations are referred to as a two-branch manifolds and the single tank configuration is referred to as a single-branch manifold. These manifolds are supplied in pipe sizes 4” thru 24”. For ease during shipping and installation, manifold sections are joined together at the site. Refer to installation guideline or consult architectural and/or engineering installation drawings for manifold sizes.

Typical two-branch manifold

Typical single-branch manifold

Priority Flow Control Valve into a two-branch manifold

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Manifold end caps are provided and are to be installed on the plain grooved end of each manifold installed. Install an end cap on the manifold using the appropriate size grooved coupling and seal.

End cap being installed

NOTE: The end of the manifold with the groove connection will be the discharge for the filtered or backwash water. Discharge or backwash may be positioned for either left or right plumbing configurations. Consult architectural and/or engineering installation drawings for this flow direction information.

Piping Support

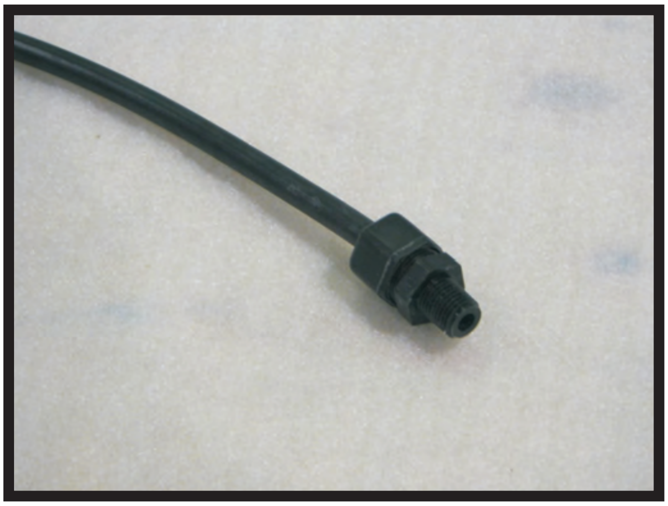
Since the piping and valves of the system are held together with flexible grooved couplings, the piping and valve may require external support to keep these items plumb and level. During assembly, 2" x 4"s may be utilized for temporary support. If permanent plumbing support is required, the use of rigid strut fastener and hanger support systems, such as Unistrut or Aickinstrut, are recommended.

Threaded Pipe Fitting Connections

Threaded pipe fitting connections made in the field are to employ standard practices, i.e., 3 to 5 wraps of Teflon tape and Teflon paste, hand-tighten, followed by 1 to 1½ turns with a wrench.

Tubing Connections

Fasten-tight tubing connectors are employed, allowing for positive seal without the need for tightening with tools. When installing tubing into fittings, make sure tubing extends at least 1/8" beyond o-ring. Care should be taken in handling the stainless steel retainer; it is razor sharp and can cut your skin very easily.



Filter Component Terminology

- Filter Tank – Filter pressure vessel
  - Front of filter tank – The end of the tank with tank end head containing the manhole and winterizing and filter media dump port
  - Rear of filter tank – The end of the tank opposite the end containing the manhole
  - Manhole – the opening in the front of the filter tank (also a viewing window)
  - Influent Port (In) – Front of filter tank, water enters filter at this port in filter mode, also influent manifold (inlet or dirty water)
  - Effluent Port (Out) – Rear of filter tank, water exits filter at this point in filter mode, also effluent manifold (return or clean water)
- Diaphragm Valve – Diaphragm valve (molded of black ABS) that when activated allows for backwash of filter tank
  - Waste Port (Out) – Diaphragm valve or face piping connection, water exiting to waste sump, also waste manifold (dirty water to waste)
- Connecting Piping – Manifolds and valves that attach to the filter tank
  - Grooved Coupling – Fittings that are used to join two pipes or pipes and fittings that have grooved ends – consisting of two halves, a gasket and two nuts and bolts
    - Manual Flow Control Valve – The valve used on the effluent piping of all single and three through eight tank filter systems for the control of filter flow rate
    - Priority Flow Control Valve – The valve used on the effluent piping of all two-tank filter systems and any

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multiple tank system operating at flow velocities less than 8 ft./second. It controls filter flow rate and closes during backwash to ensure sufficient water to backwash adjacent filter tank

- Backwash Flow Control Valve – The valve used on the waste line of all filter systems for the control of the backwash rate of flow
- Filter Gauge Panel – The unit consists of influent/effluent & differential gauges. Used for monitoring system pressures and initiating backwash for automatic systems.
- Pressure Modification System is a fractional horsepower pump that is used to generate pressure – the pressure must be a minimum of 20 psi higher than filter system operating pressure. This pressure is used to actuate the filter system's operating valves

Step 1: Remove Components From Shipping Crates/Cartons

(All Filter systems)

Remove the filter tanks from their crates. DO NOT REMOVE THE PROTECTIVE WRAPPING FROM THE TANKS AT THIS TIME. The wrapping is intended to protect the finish surface of the tank during transit and installation. It will protect the finish from solvent drips, over-spray, dust, dirt, and other construction contaminants. Remove the wrapping after completing the entire installation procedure.

Mounted in the filter tank crate is a "tank positioning template." Remove template and set aside for future use.

Remove the pipe manifolds from shipping crates. Exercise care when handling components, as abuse will cause damage to the manifold and fittings.

Position all hookup materials so they will be accessible during the entire assembly operation, but away from the assembler's foot traffic.

Step 2: Tank Positioning

Chalk lines are recommended for multiple tank installations and should be laid for positioning the two support legs for each tank. Positioning and anchor bolt hole templates are provided to aid in setting the filter tanks.

Attention must be paid to the location and routing of the influent, effluent and waste line plumbing when planning the proper location of the filter system. The tanks must be level and parallel to each other or damage may occur to filter tanks, operating valves or connecting piping. When establishing tank position the following tolerances must be maintained (see Figure M):

Figure M: Tank Positioning Dimensional Tolerances

TANK to TANK EQUIDISTANCE VARIANCE	INFLUENT to INFLUENT or EFFLUENT TO EFFLUENT CONNECTION HEIGHT LEVEL VARIANCE FOR MULTIPLE TANK INSTALLATIONS	INFLUENT/ EFFLUENT PLUM VARIABILITY FROM 90	ALLOWABLE GAP BETWEEN CONNECTING PIPE UTILIZING GROOVED COUPLINGS
0.125"	0.25"	1.5	0.125"

Step 3: Position Tanks and Install Anchor Bolts

Anchor bolts, nuts and flat washers are provided. Anchor bolts must be installed and secured to comply with the requirement of specific seismic zones. If the filter room floor is not level, non-metallic shims must be used to level the tanks or the face piping plumbing connections may break or leak.

Select one of the following appropriate assembly steps for your filter system:

Step 3A: Positioning Single Tank

Position the tank in the desired location, drill four anchor bolt holes, and install anchor bolts, washers and nuts. Tighten nuts to secure filter system.

Step 3B: Positioning Multiple Tanks

Position the "tank positioning templates" (removed from the shipping crate earlier) along the chalk line. The templates, when butted together side by side, will ensure the proper alignment of filter tank to filter tank and tanks to face piping (see Figure N).

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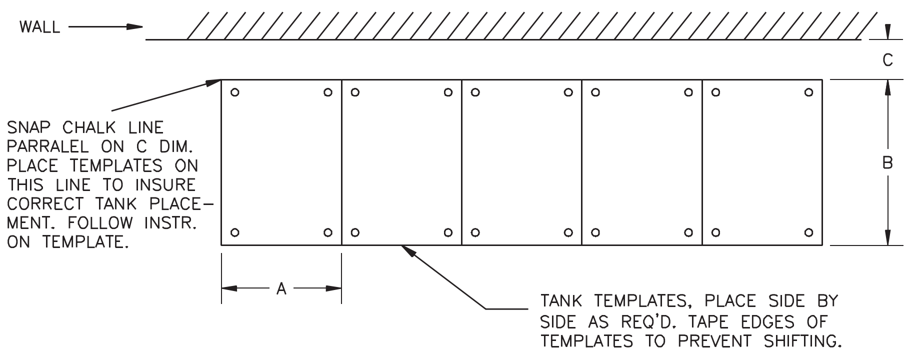
Figure N: Template Dimensional Table

Model No.	A	B	C
EKO-34-100	39”	18”	15.25”
EKO-34-126	39”	30”	15”
EKO-34-153	39”	42”	15”
EKO-34-193	39”	56”	16.25”
EKO-34-237	39”	71”	18.5”
EKO-42-145	48”	16.5”	20.25”
EKO-42-200	48”	36”	20.25”
EKO-42-225	48”	45”	20.5”
EKO-42-250	48”	52”	21”
EKO-42-275	48”	56”	23”
EKO-42-310	48”	68”	23.5”
EKO-42-360	48”	79”	25”
EKO-42-410	48”	80”	35”
EKO-42-460	48”	88”	39”
EKO-60-300	66”	25”	28”
EKO-60-350	66”	37”	28”
EKO-60-400	66”	49”	28”
EKO-60-450	66”	61”	28”
EKO-60-500	66”	69.5”	29.75”
EKO-60-550	66”	75.5”	32.75”
EKO-60-600	66”	82”	35.5”
EKO-60-650	66”	88”	38.5”
EKO-60-700	66”	96”	40.5”
EKO-60-750	66”	102”	43.5”
EKO-60-800	66”	108”	46.5”



The positioning template footprint is smaller than the filter tank with the rear of the filter tank is longer than the template. If you are positioning the rear of the filter tank two (2”) inches away from the mechanical room wall, you must set the template at the “C” dimension plus 2” for proper anchor/tank location.

Position the first tank, installing all anchor bolts, and secure before positioning the next tank. Repeat this procedure until all of the tanks are installed.

Four anchor bolt kits are supplied for each tank. Each kit consists of stainless steel threaded rod stock; bolts, washers and an anchor bolt epoxy set kit. Kits are as follows (see Figure O):

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Figure O: Anchor Kit Specifications

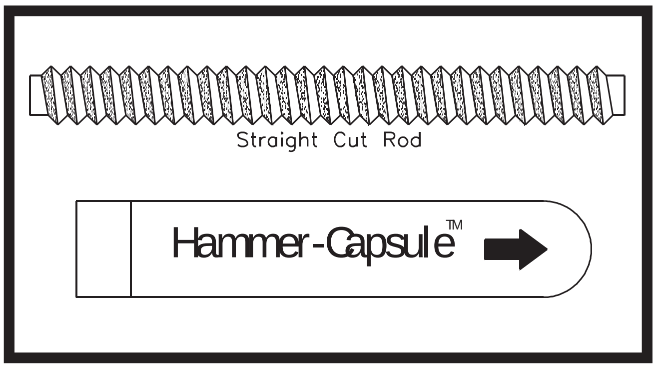
Anchor Kit Model No.	Tank Diameter	Stainless Steel Threaded Rod Dimensions	Anchor Bolt Hole Drilling Requirements
375-08558	34”	1/2” x 6"	9/16” hole x 4” deep
375-08560	42”	5/8” x 6 1/2"	3/4” hole x 5" deep
375-08570	60”	3/4" x 7 1/2"	7/8” hole x 5 1/2" deep

Anchor bolts must be installed and secured to comply with the requirements of seismic zone installations.

Hammer-Capsule epoxy bolt sets are provided for the setting of the tank anchor bolts. The capsule system consists of a self-contained, single-use, two-part glass capsule into which a threaded anchor rod is directly driven without the need for a chisel point or spinning action. It is designed for use in the installation of the stainless steel threaded rods provided into solid concrete.

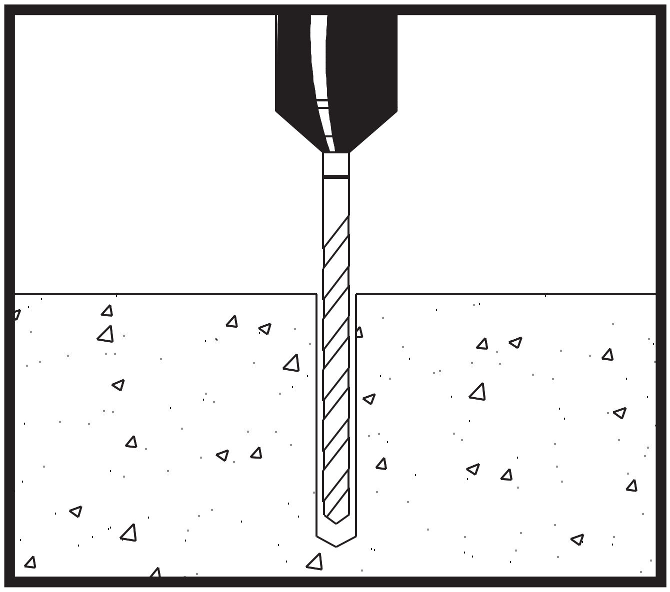
The epoxy adhesive is packaged in a single-use glass capsule having pre-measured components. A mixture of hardener and quartz aggregate is contained in the upper portion of the capsule while the lower portion contains an epoxy acrylate resin.

CAUTION: Store in a cool, dry, well-ventilated area between 50F - 100F. Keep containers tightly closed and sealed.

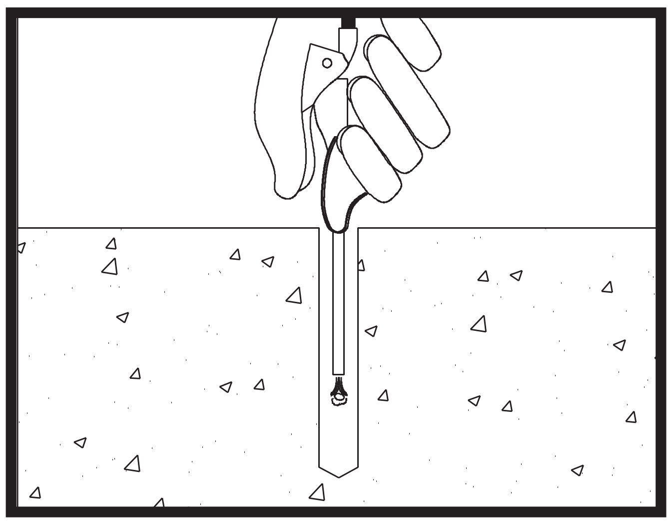


Installation Procedure for Anchor Bolts

Drill a hole using a carbide-tipped bit meeting the diameter requirements of ANSI B212.15 to the minimum depth required as shown in Figure O.



Clean the hole thoroughly with compressed air or blowout bulb and nylon brush. Mark the threaded rod with the embedment required. The threaded rod should be free of dirt, grease, oil or any other foreign material.



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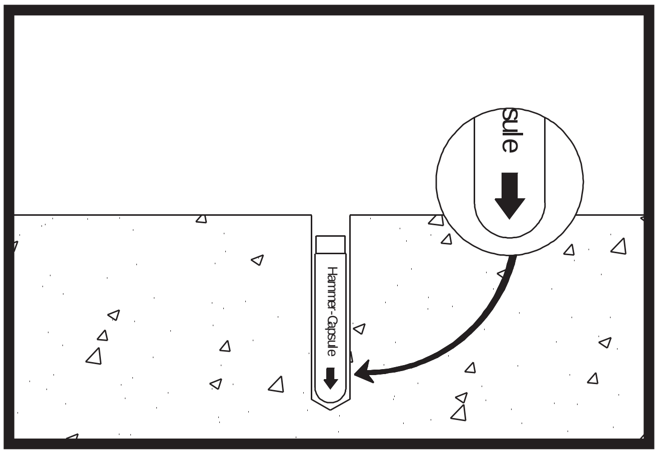
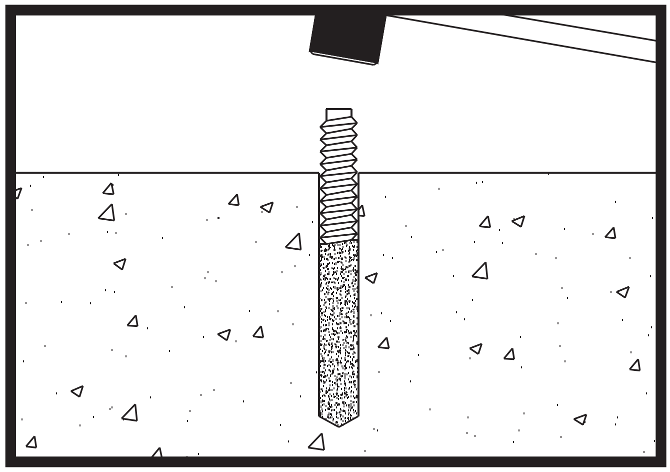
Check the capsule to ensure it is not damaged and invert several times to confirm that all of the resin is in a liquid state, and flowing easily within the capsule. Insert the capsule into the cleaned anchor hole. Be careful to observe the direction of insertion. The arrow on the capsule should point toward the bottom of the hole.



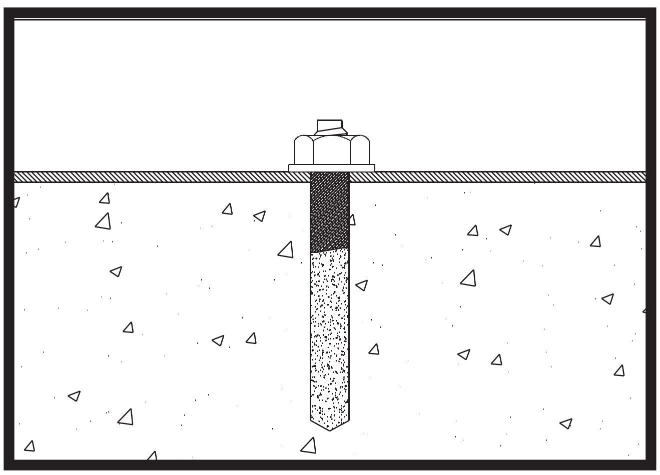
Drive the threaded rod into the anchor hole through the capsule until it is fully embedded. A 2-pound hammer is recommended. Stop driving immediately upon reaching the bottom of the anchor hole.



Allow the Hammer-Capsule to cure for the prescribed times listed in Figure P.

Figure P: Anchor Kit Curing Times

Temperature	Dry Hole Installation	Damp Hole Installation
Over 68 F (20 C)	10 Minutes	30 Minutes
50 - 68 F (10 - 20 C)	20 Minutes	1 Hour
32 - 50 F (0 - 10 C)	1 Hour	3 Hours
23 - 32 F (-5 - 0 C)	5 Hours	N/A



Step 4: Install Diaphragm Valves and Piping (Single Tank Systems Only)

(For Multiple Tank Systems, Proceed to Step 5)

Various plumbing configurations may be employed when assembling the filter valves and face piping to the filter tank: influent to left or right, effluent to left or right, waste to left or right, or in any combination therein.

4.1 – Position Backwash Valve

Position the lubricated grooved coupling seals on the front and rear top port nipples of the filter tank. Install the Diaphragm Valves – two per tank.

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Important: Diaphragm Valves must be installed noting the directional flow arrow on side of valve.

Valves Positioned for Bridge Manifold Right

Valves Positioned for Bridge Manifold Left

Position all grooved coupling ears to the sides of the Diaphragm Valves; this will allow access for tightening the securing nuts.

Tighten the grooved coupling assemblies sufficiently to support the Diaphragm Valve and piping to be added.

4.2 – Install Influent Tee and Bridge Manifold

Locate influent tee assembly. Attach to front Diaphragm Valve Influent port. Attach using grooved coupling. Position as required.

Locate the bridge manifold and grooved couplings for assembly. Position the manifold for proper orientation, right or left side connection. Connection will be made between the front Diaphragm Valve tee assembly and the rear Diaphragm Valve Bridge Manifold port.

Influent tee and flange adapter nipple installed

Tighten the grooved coupling assemblies sufficiently to support the bridge manifold.

Bridge Manifold installed Left side

4.3 – Install Effluent Elbow and Backwash Elbow Assemblies

Locate the two elbow assemblies. The connections will be made using grooved couplings. Attach one elbow assembly to the Backwash port of the front Diaphragm Valve – exiting either left or right. Attach the second elbow assembly to the Effluent port of the rear Diaphragm Valve – exiting either left or right.

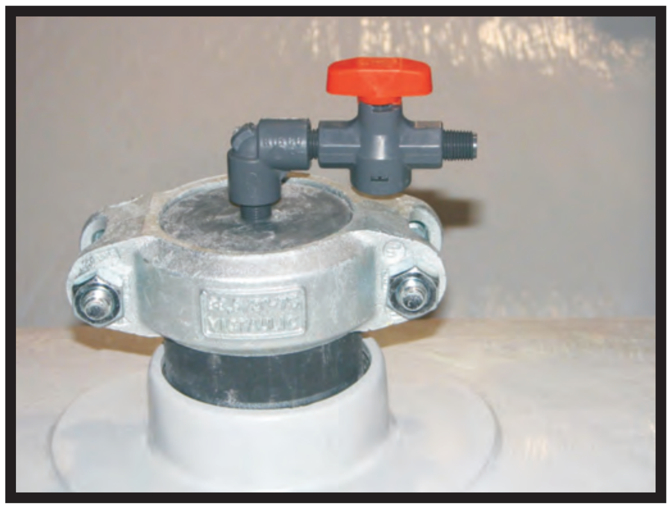
Effluent Elbow Assembly installed left

Backwash Elbow Assembly installed exiting left

4.4 – Install the Manual Flow Control Valve
Install the Manual Flow Control Valve into the Effluent Elbow assembly on the rear Diaphragm Valve. The connection will be made using a grooved coupling.

4.5 – Install the Backwash Flow Control Valve
Install the Backwash Flow Control Valve assembly into the Backwash Elbow assembly on the front Diaphragm Valve. The connection will be made using a grooved coupling.

Step 5: Install Manual Air Relief Valve(s)
All filter systems are provided with automatic and manual air relief systems. The automatic air relief system is internally mounted and the manual air relief system is externally mounted.



Each tank is provided with two (2) 1/4" PVC pipe nipples, a 1/4" PVC elbow and a 1/4" manual air relief valve. Apply five (5) wraps of Teflon tape to both ends of the 1/4" PVC pipe nipples provided. Thread one nipple into the tank's 3" air relief port. Thread a 1/4" PVC elbow onto this nipple. Thread a 1/4" nipple into the elbow. Thread the 1/4" manual air relief valve onto this nipple – hand tighten. Do not use a wrench

If desired – install a 1/4" NPT T 3/8" tubing fitting into each external air relief valve. Install 3/8" tubing (not provided), directing to a floor drain or waste sump. DO NOT connect into a pressurized line – allow sufficient air gap to allow for visual observation of air being expelled.

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Step 6: Install Effluent Manifold
(Two through eight-tank systems; single-tank systems proceed to STEP 12)
The effluent or filtered water manifold must be installed at this time – failure to do so will result in a very difficult installation.

Locate the components of the effluent manifold – manifold pipes, grooved couplings, seals and end plugs. Influent and effluent manifolds Are NOT Identical and Are NOT Interchangeable.

Position the lubricated grooved coupling seals on the tanks' rear port nipples. Position a two-tank branch manifold onto the tanks' rear port nipples.

Photo depicts system effluent manifold, positioned in left configuration

The grooved end of the two-tank branch manifold is the point of flow termination and/or the flow end of the manifold or the point at which a single-branch manifold would be connected.

Position all grooved coupling seals allowing access for tightening the securing nuts. Tighten the grooved coupling assemblies sufficiently to support and seal the effluent manifold to the system.

If more than two tanks are employed – attach single-branch manifolds using appropriate grooved couplings to obtain the desired manifold length. Branch connections are always attached to the tank's ports with grooved couplings.

Install the manifold end cap with a grooved coupling as required.

Step 7: Install Diaphragm Valves
Position the lubricated grooved coupling seals on the front top port nipples of the filter tanks. Install the Diaphragm Valves – one per tank. The Diaphragm Valve will be attached to the tank's front port.

Important: Diaphragm Valves must be installed noting the directional flow arrow on side of valve.

Note the orientation of the Backwash Valve and clamp being installed to the filter tank

Position all grooved coupling ears to the sides of the Diaphragm Valves; this will allow access for tightening the securing nuts.

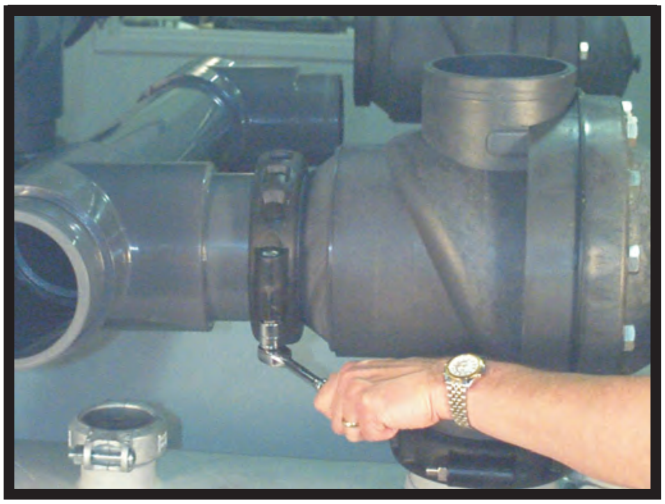
Tighten the grooved coupling assemblies sufficiently to support the Diaphragm Valve and piping to be added.

Step 8: Install Waste Manifold
The waste manifold is sized for single tank backwash of all systems. Position a two-tank branch manifold onto the Diaphragm Valves' Backwash port. Grooved coupling seals are used to attach these manifolds to the Diaphragm Valves.

Position all grooved coupling ears to the sides of the Diaphragm Valves; this will allow access for tightening the securing nuts.

Tighten the clamp assemblies sufficiently to support the Diaphragm Valve and piping to be added.

One end of the waste line manifold may be secured with a grooved coupling allowing the opposite manifold end to be moved into position and secured. If more than two tanks are employed – attach single branch manifolds together to obtain the desired manifold length. Waste line branch and manifold components all utilize grooved couplings at their connection points.



Install the manifold end cap as required.

Step 9: Install Influent Manifold
The influent or raw water manifold will now be installed. Locate the components for this influent manifold – manifolds, grooved couplings, seals and end plugs. Influent and effluent manifolds **Are NOT Identical and Are NOT Interchangeable.**

Position the lubricated coupling seals on the Diaphragm Valve Influent port nipples. Position a two-tank branch manifold onto the influent port of the Diaphragm Valves.

Position grooved coupling seals and install coupling halves – securing nuts.

Influent Manifold is installed on top of Backwash Valves

If more than two tanks are employed, attach single-branch manifolds together using appropriate couplings to obtain the desired manifold length. Branch connections are always attached to the Diaphragm Valves using grooved couplings.

The grooved end of the two-tank branch manifold is the point of flow termination and/or the point at which a single-branch manifold would be connected – the flanged end of the two-tank branch manifold is to be the influent connection of the manifold.
Install the manifold end cap as required.

Step 10: Install Priority Flow Control Valve
All of the valves needed for the operation of the filter are provided and they have been pre-assembled and tested. Valves have not been attached to manifold piping, as installation options have been allowed. If fittings such as 90 elbows or 45 elbows are needed, they should be installed now.

Filter systems employing two filter tanks or multiple filter systems with low circulation pipe flow velocities of less than 8 ft/ sec, require the installation of an Priority Flow Control Valve on the effluent manifold (return line). All others systems (single or multiple tank systems with pipe flow velocities greater than 8 ft/ sec) require the installation of a Manual Flow Control Valve on the effluent manifold. Install the appropriate valve at this time. The connection will be made using a grooved coupling.

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Flow direction for these valves is not important however, the grooved connection is intended for factory supplied piping and the flanged connection is for field-supplied piping. The valves may be installed in vertical or horizontal configurations.

Step 11: Install Backwash Flow Control Valve

Install the Backwash Flow Control Valve assembly onto the waste manifold. The Sightglass valve assembly has been factory-assembled, but not installed, as installation options have been allowed. The connection will be made using a grooved coupling.

Flow direction for this valve is not important however, the grooved connection is intended for factory supplied piping and the flanged connection is for field-supplied piping. The valve may be installed in vertical or horizontal configurations.

Step 12: Install Optional Backwash Check Valve

Install the optional Backwash Check Valve after the Backwash Flow Control Valve. The check valve has been factory assembled but not installed. The valve can be installed in either the vertical or horizontal position -- taking note of the flow arrow. The valve will be solvent welded in place.

Step 13: Filter Control Console Installation

Locate the Filter Control Console and its installation hardware. Three Filter Control Consoles are offered:

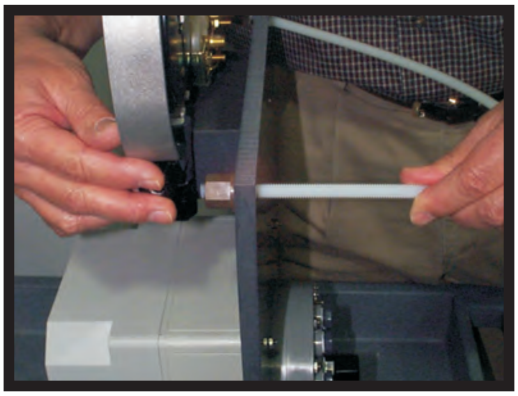
- Manual Control Console consisting of gauge panel assembly, filter control enclosure with Multiport Valve all attached to a PVC mounting plate.
- Automatic Filter Control consisting of a gauge panel, differential pressure gauge/switch and filter control enclosure with motorized Multiport Valve all attached to a PVC mounting plate.
- Fully Automatic Filter Control consisting of a gauge panel assembly, filter control enclosure with staging motor driver for Multiport Valve all attached to a PVC mounting plate.

Before installing the Filter Control Console, install the necessary ips to tubing fittings into the Multiport Valve.

Note: A more detailed separate installation Installation & Operation Manual is provided with the filter control console.

Use Teflon tape for the installation of ips to tubing fittings and/or 3/8" pipe plugs. Apply 5 to 8 wraps of Teflon to tube fitting and install into the Multiport Valve. Tighten all ips fittings by hand into Multiport Valve body – plus a 1/4" turn by wrench.

- Single-tank systems
  Multiport Valve is provided with all necessary fittings.
- Two-tank systems
  Remove 3/8" ips pipe plug and install the 3/8" ips x 1/2" tubing fitting (provided).
- Three through eight-tank systems 3/8" ips x ½" tubing fittings are provided to accommodate the total number of tanks in the system. Remove the appropriate number of 3/8" ips plugs and replace with straight 3/8" ips x 1/2" tubing fittings.



- Locate the two Nylon all-thread rods that are covered with 3/8" Polyethylene tubing
- Locate the four3/8" Fiber Nuts
- Attach the two 3/8" Nylon all-thread rods to the mounting plate uppermost holes - attach one end of each threaded rod to the console mounting plate, using the Fiber Nuts provided
- Allow two threads to protrude beyond nut
- Make sure threaded stock protective polyethylene tubing is in place.

(Single tank systems)
Install the Filter Control Console. The Filter Control Console will be attached to the filter system's Backwash Flow Control Valve assembly.

- Slip one threaded rod (covered with protective tubing) over each side of the Backwash Sightglass Valve assembly - wrapping over and around the tee
- The threaded rod will then be pushed through the lower hole of the mounting plate
- Attach and secure the 3/8" Fiber Nuts
- Tighten the assembly so that no movement occurs
- Cut off excess threaded rod - remove any sharp edges

Note: The gauge panel will slightly obscure the sightglass.

(Multiple tank systems)
Install the Filter Control Console. The Filter Control Console will be attached to the filter system's backwash-piping manifold – between two tanks. If the filter is to be controlled automatically, then locate the Filter Control Console as near to the automatic backwash control device as possible - either right or left side of the system between the first and second filter tanks.

- Slip one threaded rod (covered with protective tubing) over each side of the backwash piping manifold - wrapping over and around the manifold
- The threaded rod will then be pushed through the lower hole of the mounting plate
- Attach and secure the 3/8" Fiber Nuts
- Tighten the assembly so that no movement occurs
- Cut off excess threaded rod - remove any sharp edges

Step 14: Install Tubing
(All Filter Systems – Single and Multiple Tanks)
Two tubing sizes are used with the filter system - 3/8" and 1/2". All tubing is black and features UV protection. The pressure gauges are connected to the filter system using 3/8" tubing. The Multiport Valve is connected to the operating valves of the system using1/2" tubing.

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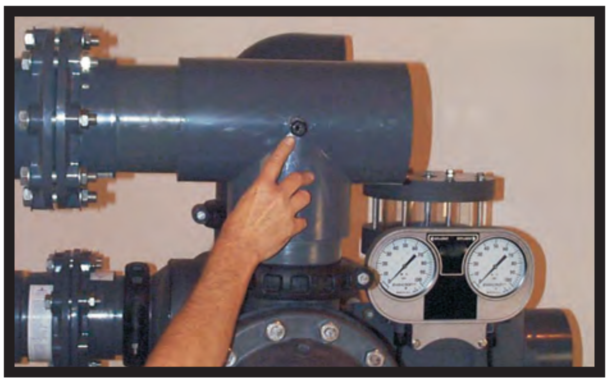
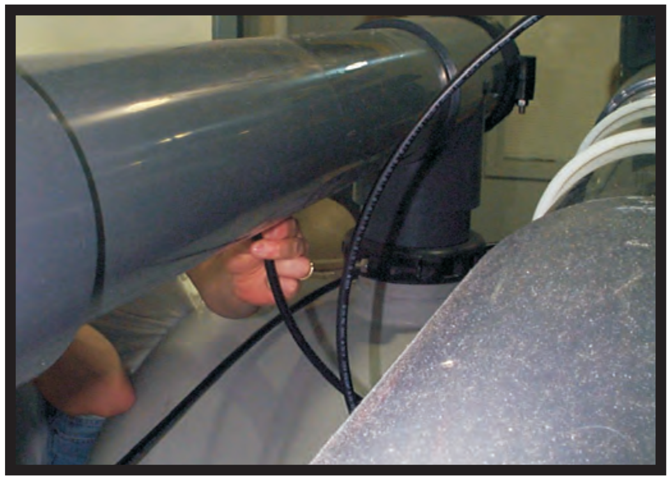
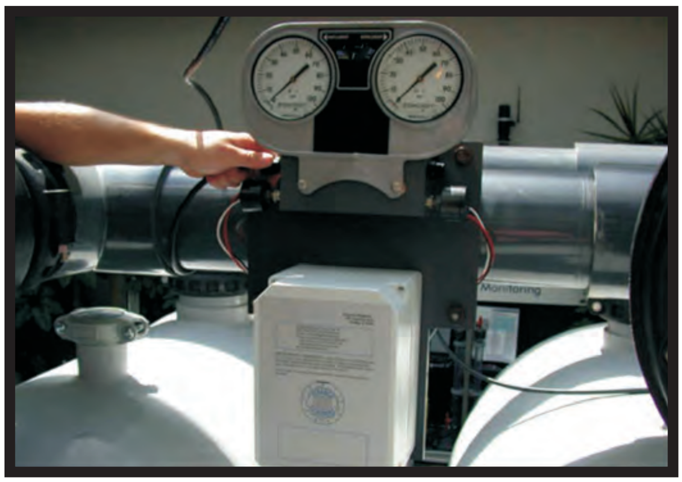
Gauge Panel
Quarter-inch male NPT x3/8 “ Fasten Tight tubing fittings are provided for connection to the pressure gauges. Install the two fittings provided into their respective manifolds. All influent and effluent manifolds/assemblies have been pre-tapped for your convenience - just remove the desired pipe plugs and install the tubing fittings (one in the influent and one in the effluent manifold). Fitting locations should be immediately adjacent to the Filter Control Console to facilitate ease of connection.







Connect the tubing from the effluent manifold to the effluent connection of the gauge panel and connect the tubing from the influent manifold to the influent connection of the gauge panel.

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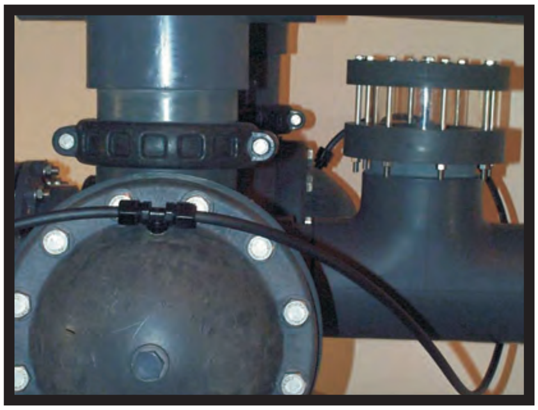
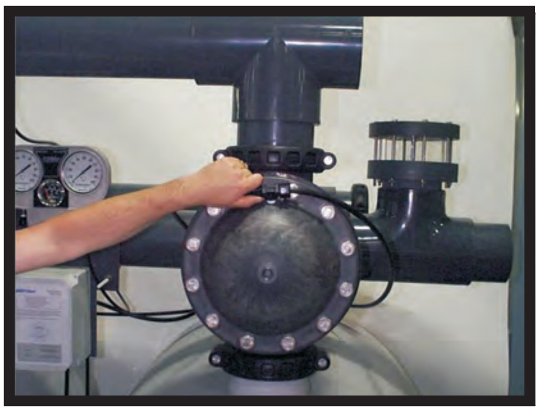
Tube Fittings to Operating Valves
Install3/8" male NPT x 1/2" tubing fitting into Backwash Valve(s) cover (front upper quadrant of valve).

- Single-Tank Systems
  The influent or front Backwash Valve will receive a 3/8" male NPT x 1/2" tubing branch tee fitting and the effluent or rear Backwash Valve will receive a straight 3/8" male NPT x 1/2" tubing fitting.
- Two-Tank Systems
  Both Backwash Valves will receive a 3/8" male NPT x1/2 " tubing branch tee fitting.
- Three through Eight-Tank Systems
  All Backwash Valves will receive a 3/8" male NPT x 1/2" tubing straight fitting.





Two tank systems - the Backwash Valves all receive 3/8" male NPT x ½" tubing branch tees.

Tubing to Operating Valve
Using the 1/2" tubing provided, connect the Multiport Valve to the operating valves.

- Single-Tank Systems
  Connect port number one (1) of the Multiport Valve to the 1/2" tubing tee located on the front, or influent, Backwash Valve. Connect the front Backwash to the rear, or effluent, Backwash Valve.
- Two-Tank Systems
  Connect port number one (1) of the Multiport Valve to the 1/2" tubing tee located on the first (1st) filter tank's Backwash Valve. Connect port number two (2) of the Multiport Valve to the ½" tubing tee located on the second (2nd) filter tank's Backwash Valve.

  Connect the 1/2" tubing tee located on the first (1st) filter tank's Backwash Valve to the Priority Valve (either port). Connect the1/2" tubing tee located on the second (2nd) filter tank's Back-wash Valve to the Priority Valve (either port).

  Note: The rectangular block that houses the tubing fittings contains a check ball - do not remove the tube fittings from this assembly, as check ball may be lost.
- Three through Eight-Tank Systems
  Connect port number one (1) of the Multiport Valve to the1/2" straight tubing located on the first (1st) filter tank's Backwash Valve. Connect port number two (2) of the Multiport Valve to the 1/2" straight tubing fitting located on the second (2nd) filter tank's Backwash Valve. Connect port number three (3) of the Multiport Valve to the 1/2" straight tubing fitting located on the third (3rd) filter tank's Backwash Valve. And so on, and so on.

Multiport Valve

- To vent connection
  Connect the Multiport Valve vent port to a floor drain or waste sump. Due to varying site locations of floor drain or waste sumps, vent tubing is not supplied with the filter system. Tubing is to be ½" black Polyethylene with UV inhibitors. DO NOT connects this line to a pressure or non-venting line. If this line is not allowing venting to atmosphere, the system's operating valves will not function

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- Operating pressure connection
The discharge of the Pressure Amplification System will be connected to the center or pressure port of the Multiport Valve, use the ½" tubing provided.

Step 15: Install Pressure Amplification System (All Filter Systems – Single and Multiple Tanks)
Locate the Pressure Modification System (booster pump with pressure sustaining tank and pressure switch). Install the Pressure Modification System in a desirable location with all-electrical interface and connections. The Pressure Modification System may be installed by mounting to the mechanical room floor – between two filter tanks or mechanical room wall (with volute down). A housekeeping slab is recommended to elevate the motor above the floor by at least 4 inches. Connect the suction of the Pressure Amplification pump to the effluent manifold of the filter system – this connection must be between the filter and the Manual and/or Priority Flow Control Valve. Note: On single tank systems connect pump suction to the influent manifold. Manifold tapings are provided for this connection. To help identify the suction of the system, the suction line of the booster pump is equipped with a spring-loaded check valve. Connect the discharge tubing of the Pressure Modification System to the supply port on the Pilot Valve Assembly.

Step 16: Tighten All Hardware
At this time, make sure all grooved couplings are seated in their respective grooves; tighten grooved coupling nuts on all tanks, valves and manifold port connections. The influent, effluent and backwash flange bolts should be tightened in incremental stages in a diametrically opposite pattern that will produce a uniform stress across the mating flange faces (see Figure Q).

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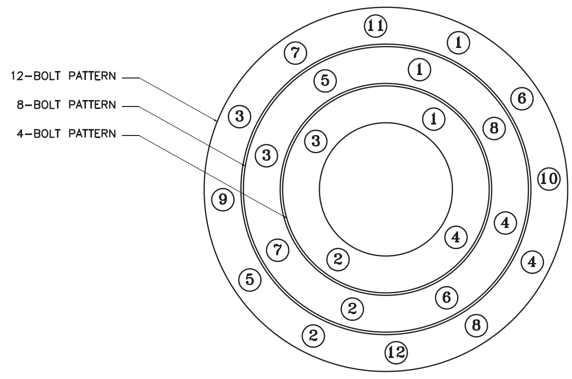
Figure Q: Flange Bolt Torque and Tightening Pattern

Tightening Pattern	Flange Size (inches)	Incremental Torque (ft. lbs}	Recommended Torque (ft. lbs.)*
	3- 4	5	30
	6- 8	5	50
	10	5	70
	12- 24	5	100

*Based on using flat-faced PVC flanges, a full-faced neoprene gasket, well lubricated hardware, tightened in the proper pattern and applying torque in small increments. For raised-face flange assemblies and PVC-to-metal flange (or other materials), the above torque recommendations may vary.

Caution: When thermoplastic flanges are used with butterfly valves or other equipment where a full-faced continuous support does not exist, a back-up ring or fiberglass reinforcement should be used to prevent cracking of the flange face.

Step 17: Install Pipe Supports (not supplied with filtration system or piping kit)
Adequate support for the Diaphragm Valves, Manual or Priority Flow Control Valves, Backwash Flow Control Valves and Manifold Assemblies is a matter of great importance. Support spacing is a function of pipe size, operating temperatures, location of valves or fittings and the mechanical properties of the pipe material (see Figure R).

To ensure satisfactory operation of a PVC piping system, the location and type of hangers should be carefully considered. Some notable areas of concern where special consideration should be exercised are as follows:

- Concentrated loads such as Diaphragm Valves, Manual or Priority Flow Control valves and Backwash Flow Control Valves should be supported directly to eliminate high stress concentrations. Should this prove to be impractical, the pipe must then be supported immediately adjacent to the load.
- In systems where large fluctuations in temperature occur, allowance must be made for expansion and contraction of the piping system. Since changes in direction in the system are usually sufficient to allow expansion and contraction, hangers must be placed so this movement is not restricted. Thermal expansion must not exceed .0625" per joint when using grooved couplings.
- Changes in direction such as 90 elbows, should be supported as close as possible to the fitting to avoid introducing excessive torsional stresses into the system.
- When using grooved couplings, thrust reaction must be restrained at the points of deflection or dead ends by external supports or harnesses and not transferred to the joints.

- Straight alignment of the pipe must be maintained at all joints through the use of suitable support systems.
- Since PVC expands or contracts approximately three times that of steel, hangers should not be of the type that will restrict this movement. However, it may be desirable in some instances to use a clamp-type hanger to direct thermal expansion or contraction in a specific direction. When using a clamp-type hanger, the hanger should not deform the pipe when it has been tightened.
- PVC and FRP is somewhat notch sensitive and require hangers that provide as much bearing surface as possible. Sharp supports or sharp edges on supports should not be used with PVC or FRP since these will cause mechanical damage if the pipe moves.
- Valves should be braced against operating torque.
- PVC and FRP lines should not be placed along side steam or high temperature pipelines.

Figure R: Schedule 80 PVC & FRP Pipe Maximum Support Spacing In Feet

Temp.	Schedule 80 PVC & FRP Nominal Pipe Size									
F (C)	3”	4”	6”	8”	10”	12”	14”	16”	18”	20”	24”
60 (15)	9	10.25	12.75	14.75	17	19	20	22	23.25	25.25	28.5
100 (38)	8	9	11.25	13.25	15	16.75	17.75	19.5	21	22.5	25.25
140 (60)	6.75	7.75	9.75	11.33	13	14.33	15.25	16.5	18	19.25	21.5

Step 18: Filter Media Specification and Installation Media Requirements

All ***EKO***[3] Model Filter Systems can be used with one (1) single grade of # 20 silica sand or in Filter Systems up to 46 sq. ft., with Zeoclere-30 or Zeobrite zeolite. When using Zeoclere-30 or Zeobrite in an ***EKO***[3] Filter System, the zeolite must be installed with a ¼” x 1/8” washed gravel under bed. The following chart indicates the quantities of filter media required for each filter tank

Figure S: Media Requirements

Model No.	# 20 Grade Silica Sand			Zeoclere-30 or Zeobrite & ¼" x 1/8" Gravel Underbed	
	Bed Depth (inches)	Lbs	Cu. Ft.	Cu. Ft. Zeoclere-30	Cu. Ft. Underbed
EKO-34-100	16.5	1250	12.5	10	2.5
EKO-34-126	16.5	1600	16	13	3
EKO-34-153	16.5	2000	20	16	4
EKO-34-193	16.5	2550	25.5	20.5	5
EKO-34-237	16.5	3200	32	25.5	6.5
EKO-42-145	16.5	2310	23.1	14.85	8.25
EKO-42-200	16.5	3155	31.55	20	11.55
EKO-42-225	16.5	3550	35.5	22.5	13
EKO-42-250	16.5	3925	39.25	24.75	14.5
EKO-42-275	16.5	4300	43	27	16
EKO-42-310	16.5	4900	49	30	19
EKO-42-360	16.5	5600	56	34	22
EKO-42-410	16.5	6400	64	39	25
EKO-42-460	16.5	7200	72	44	28
EKO-60-300	30	7100	71	57	14
EKO-60-350	30	8350	83.5	67.5	16
EKO-60-400	30	9600	96	78	18
EKO-60-450	30	10850	108.5	88.5	20
EKO-60-500	30	12100	121	N/A	N/A
EKO-60-550	30	13350	133.5	N/A	N/A
EKO-60-600	30	14600	146	N/A	N/A
EKO-60-650	30	15850	158.5	N/A	N/A
EKO-60-700	30	17100	171	N/A	N/A
EKO-60-750	30	18350	183.5	N/A	N/A
EKO-60-800	30	19600	196	N/A	N/A

Caution: Poor water quality may be the result of incorrect media selection. It is important that the media selected conforms to Nemato Corp. specifications. Filter media depth shall be as indicated on the drawings; measurements will be taken at the site and will be from centerline of the collection laterals to the top of the media. Silica filter media shall be a carefully selected grade of hard, uniformly graded silica with a minimum combined mean percent of silica by weight of 90%, which shall be free of limestone or clay. Media shall be angularly shaped particles of silica with a particle size between .45mm and .55 mm with a roundness value between 0.0 and 0.15. Round or Sub-rounded particle shapes are not acceptable as suitable media. Uniformity coefficient shall not exceed 1.50. The specific gravity of the media shall not be less than 2.5 with a minimum hardness of 7 mhos.

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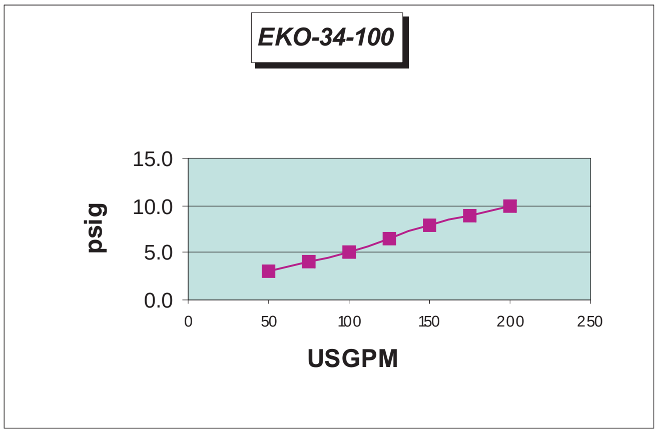
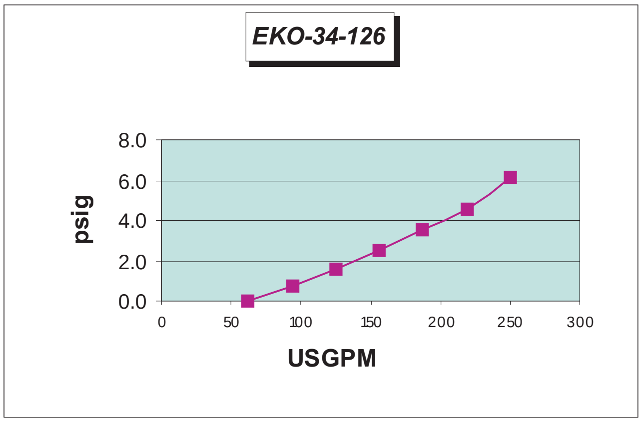
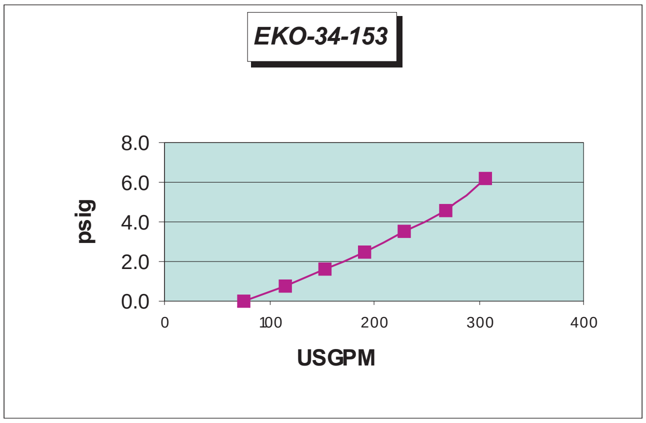
Head Loss Curves For #20 Silica Sand and Zeoclere-30 or Zeobrite Zeolite

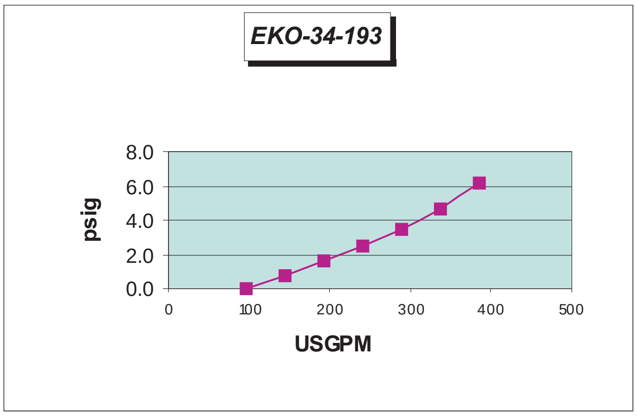
EKO[3] Filter Systems are certified by NSF International to ANSI / NSF Standard 50 for both pool and spa applications at filtration rates of 5 to 20 U.S. GPM / sq. ft. when installed with #20 silica sand. ***EKO***[3] Filter Systems are certified by NSF International to ANSI / NSF Standard 50 for both pool and spa applications at filtration rates of 5 to 15 U.S. GPM / sq. ft when installed with Zeoclere-30 or zeobrite zeolite. The following are design head loss curves for each of the filters:

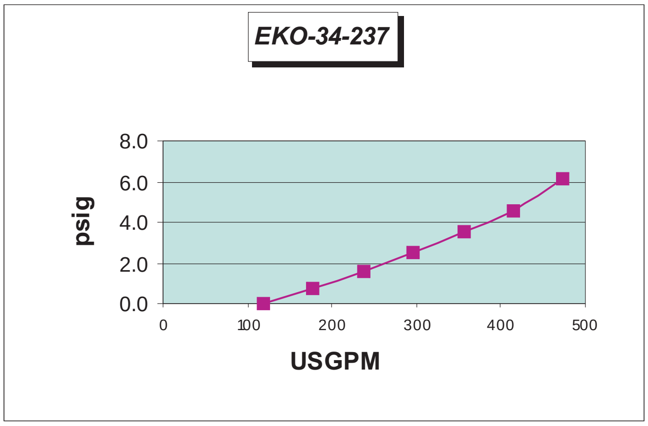
EKO-34-Series Head Loss Curves w/ #20 Silica Sand











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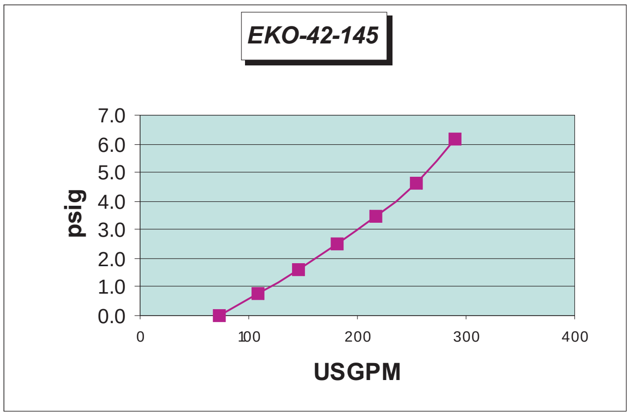
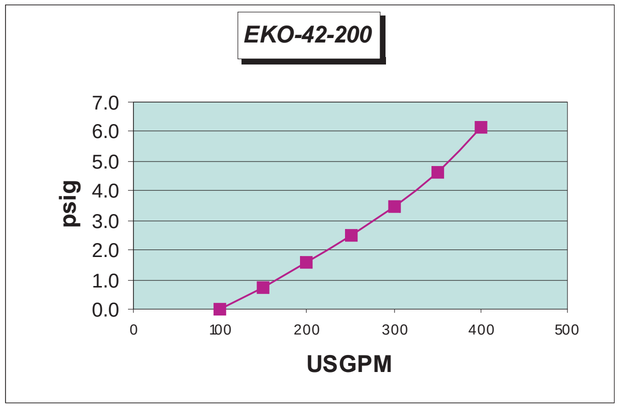
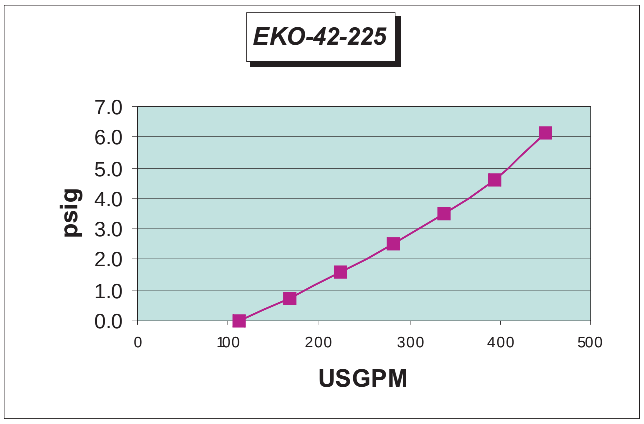
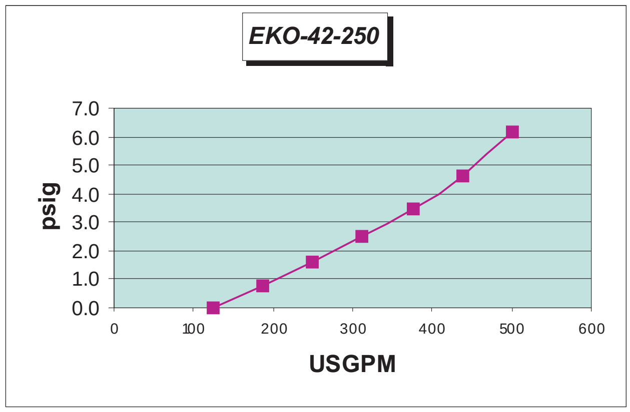
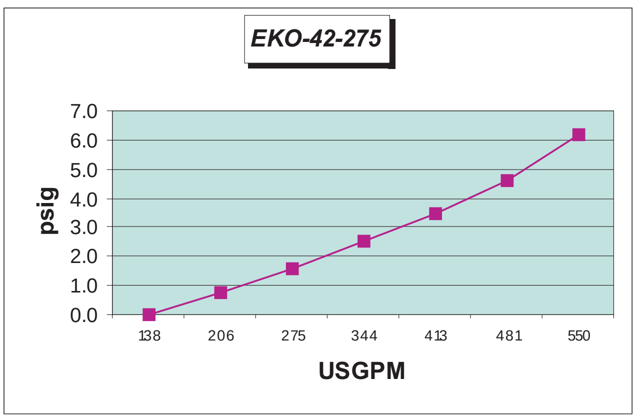
EKO-42-Series Head Loss Curves w/ #20 Silica Sand

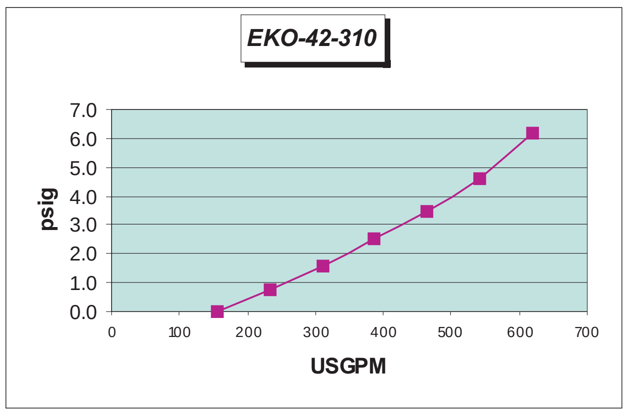












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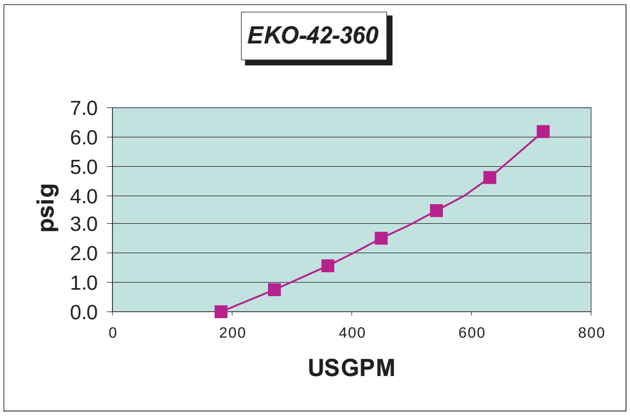
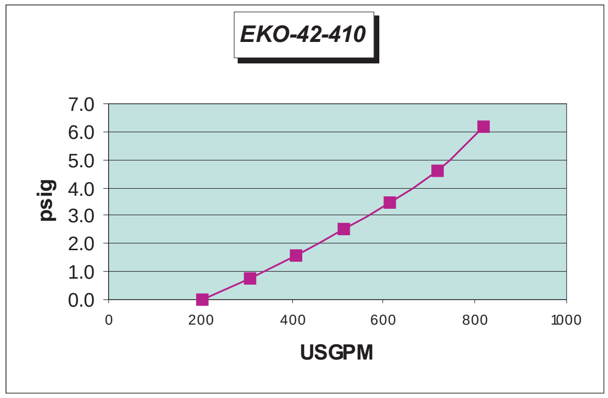
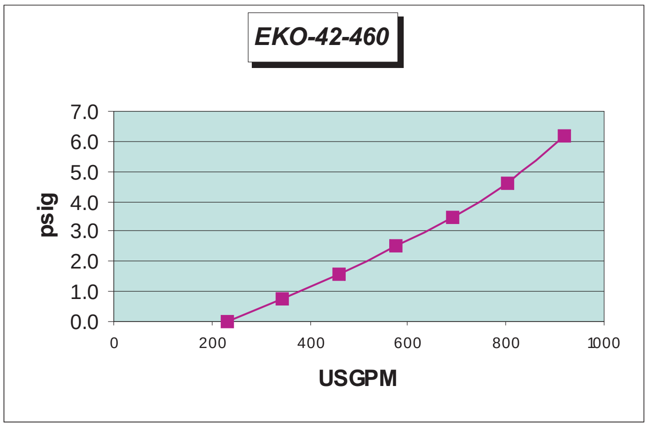
EKO-42-Series Head Loss Curves w/ #20 Silica Sand







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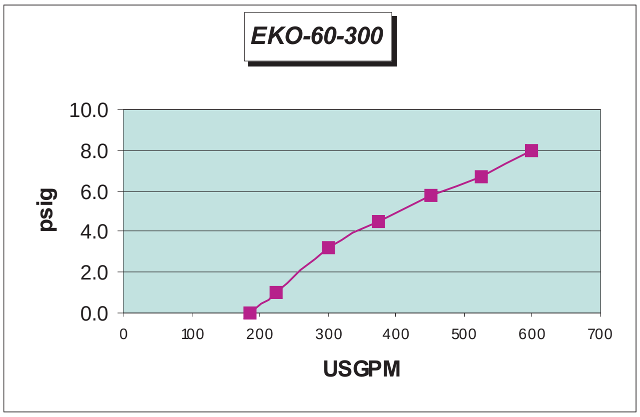
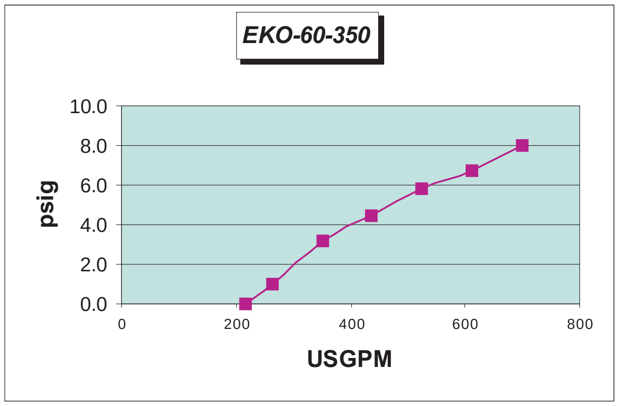
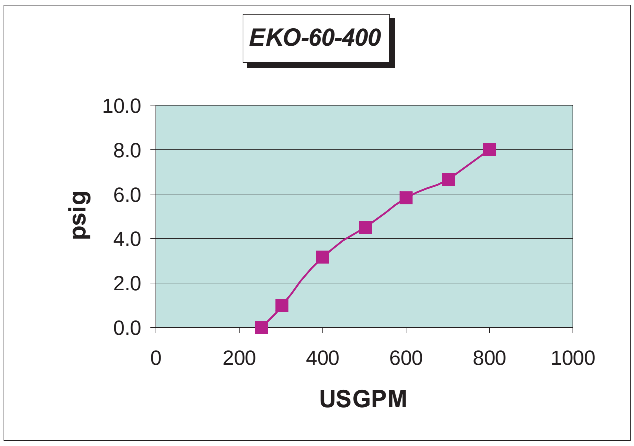
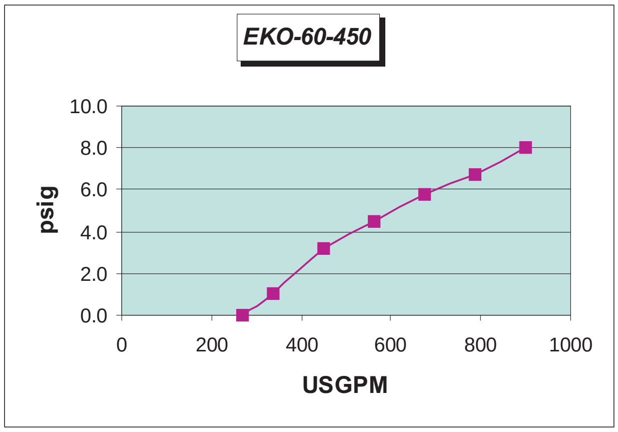
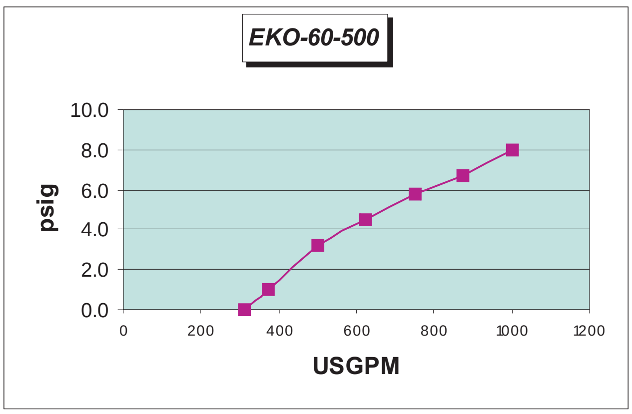
EKO-60-Series Head Loss Curves w/ #20 Silica Sand

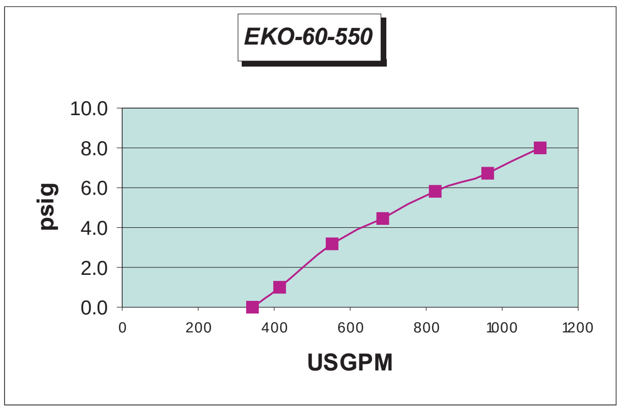




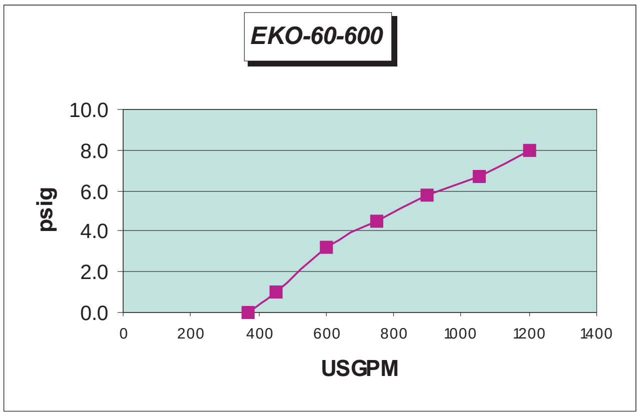


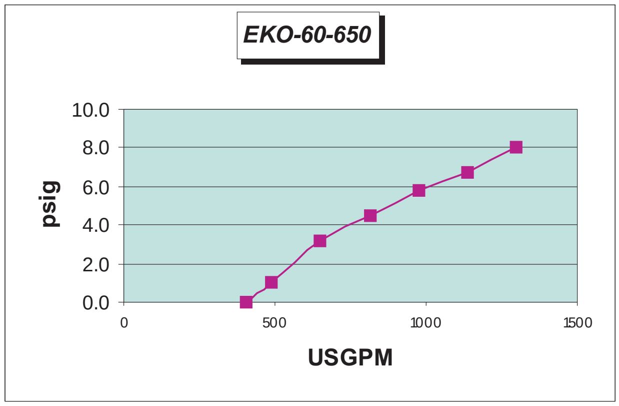


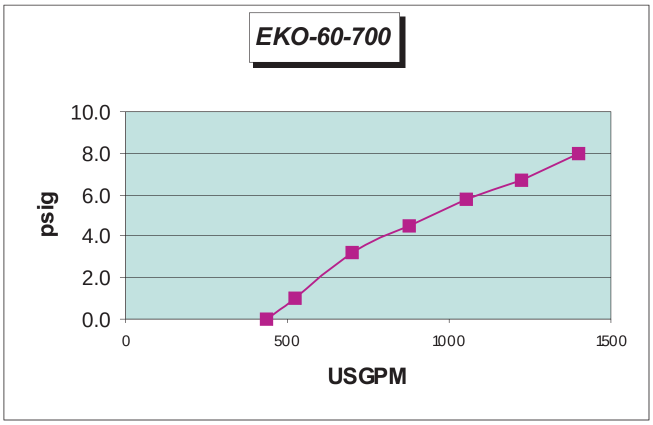


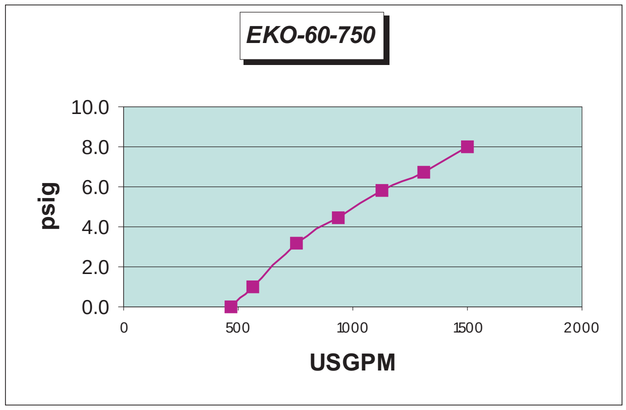


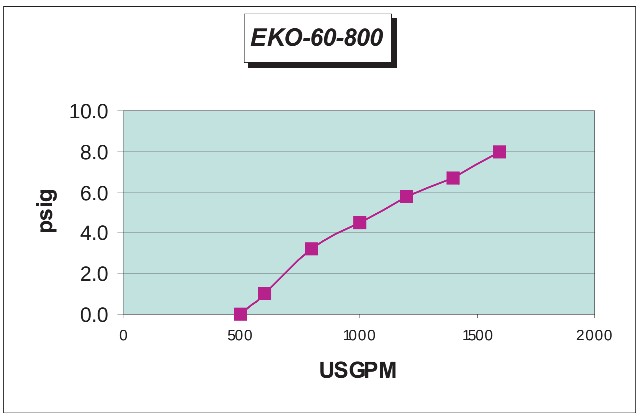
EKO-60-Series Head Loss Curves w/ #20 Silica Sand











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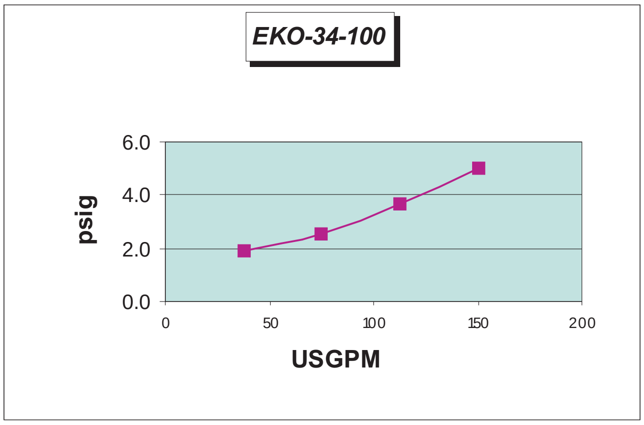
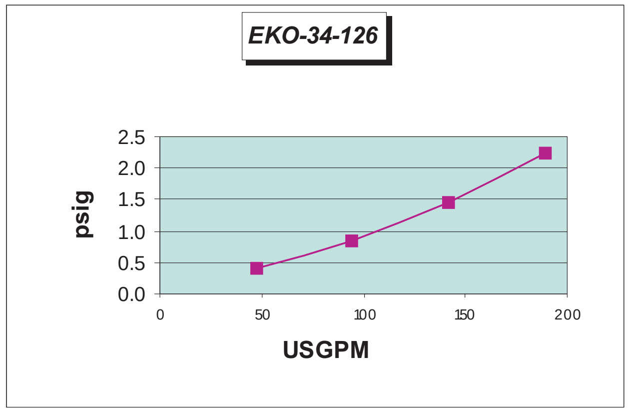
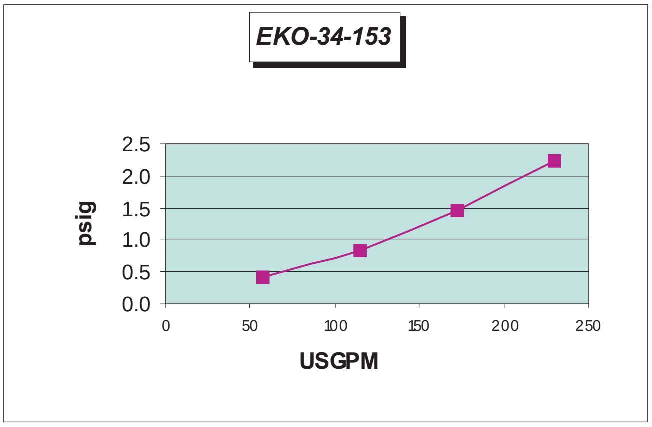
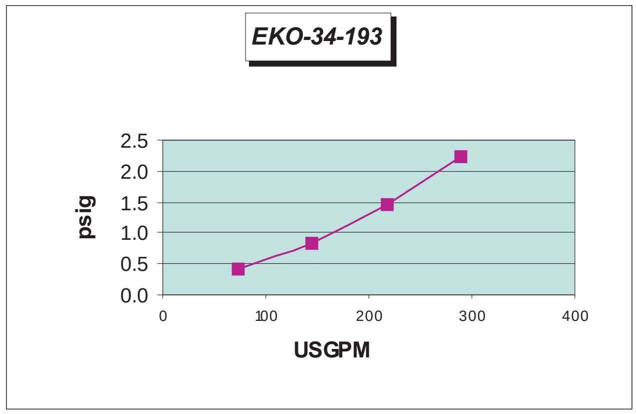
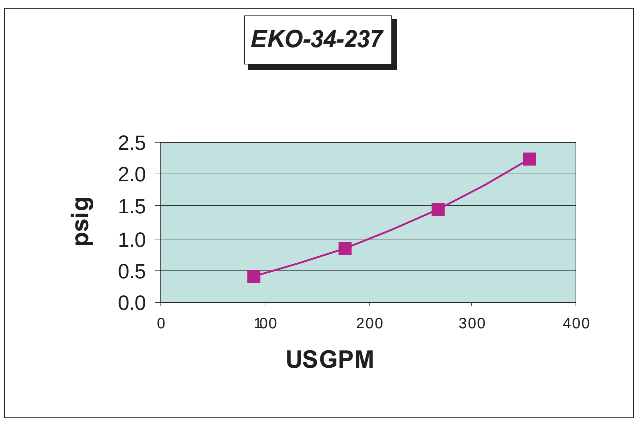
EKO-34-Series Head Loss Curves w/ Zeoclere-30 or Zeobrite











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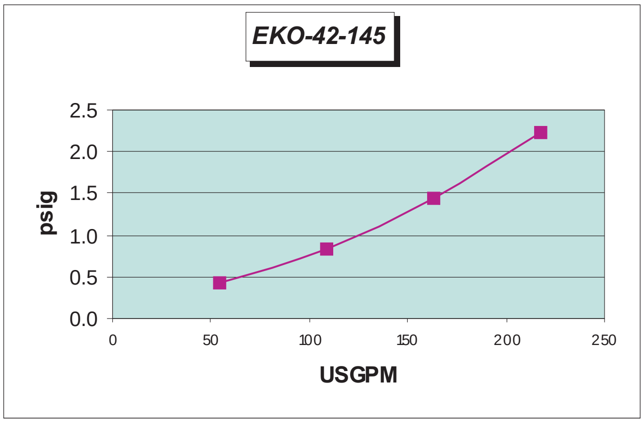
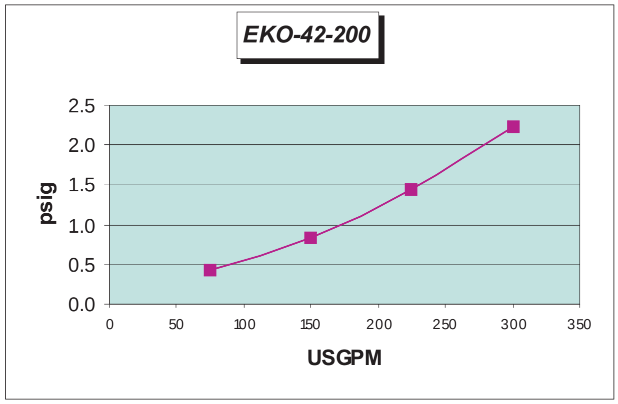
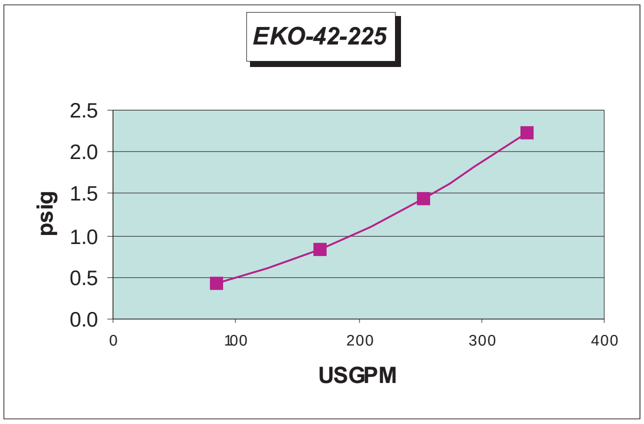
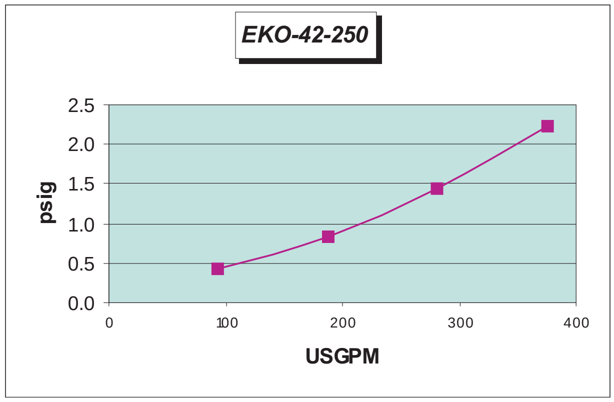
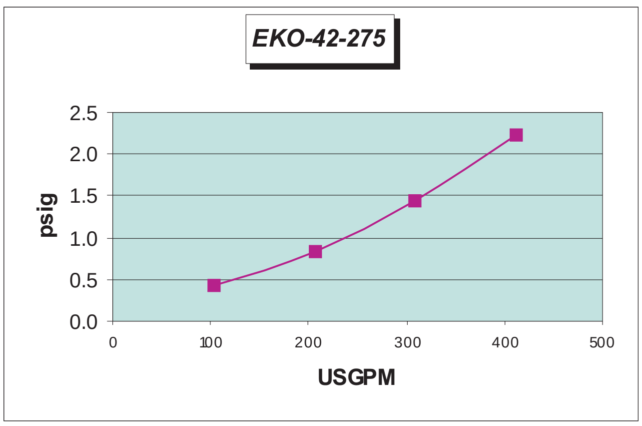
EKO-42-Series Head Loss Curves w/ Zeoclere-30 or Zeobrite

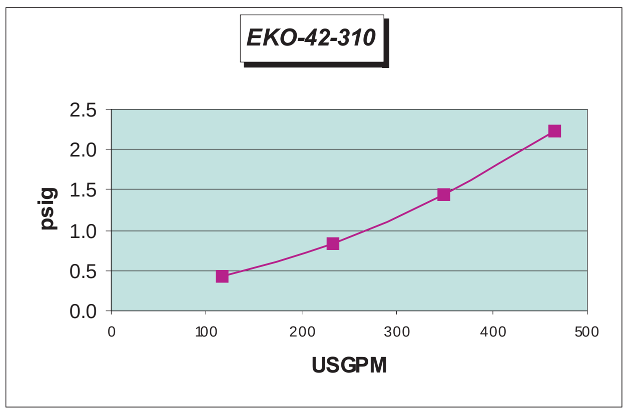












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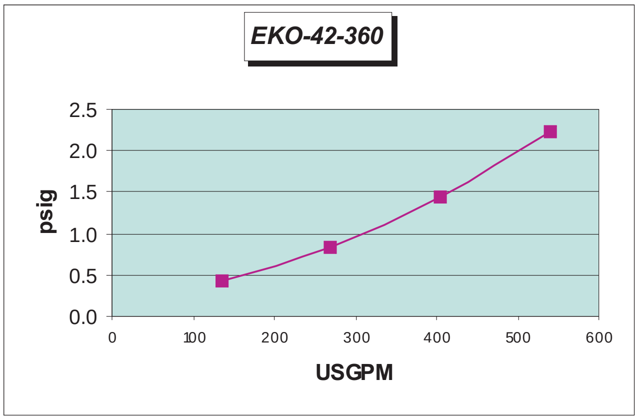

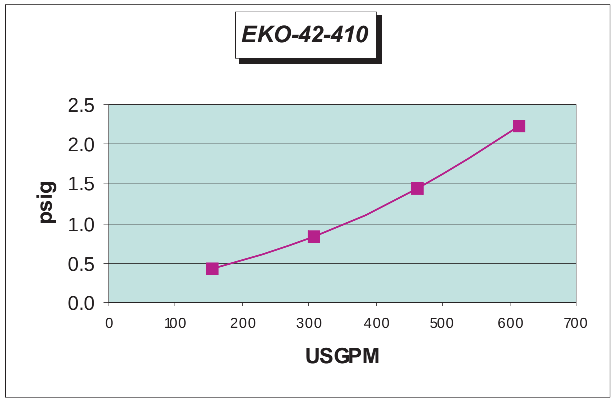

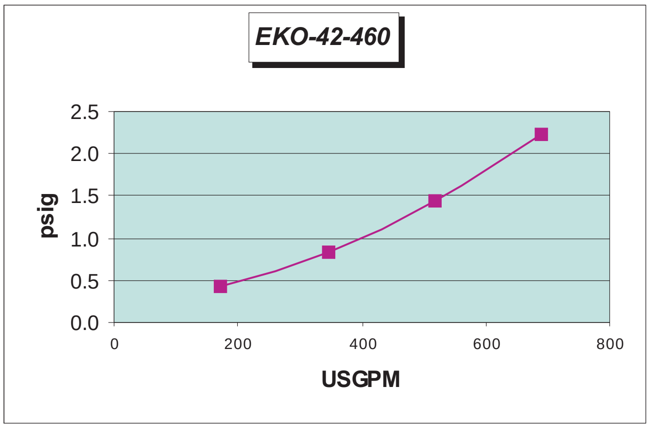

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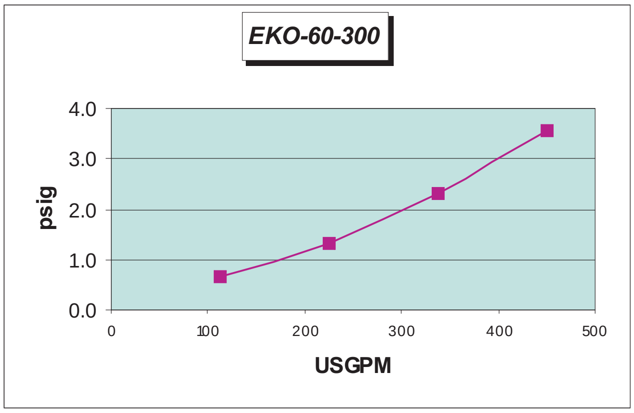
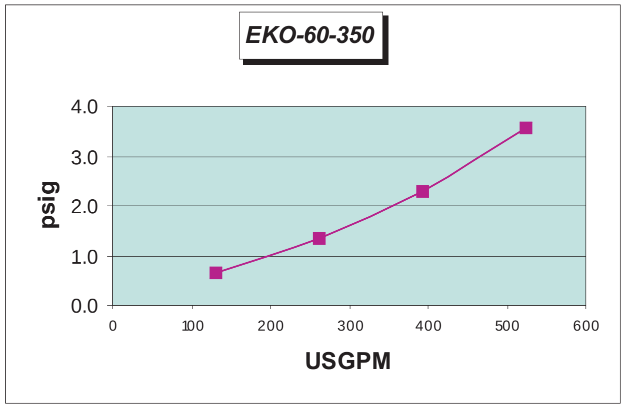
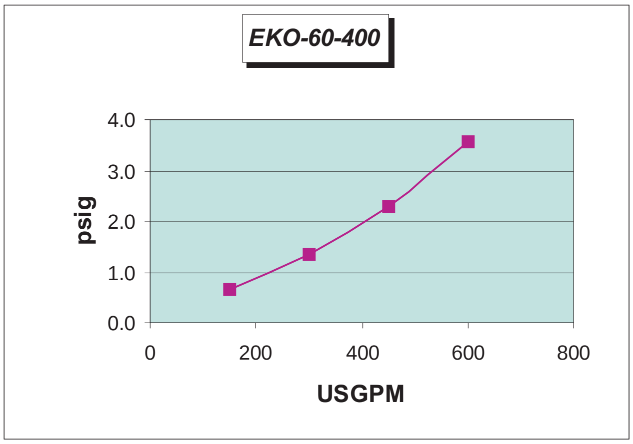
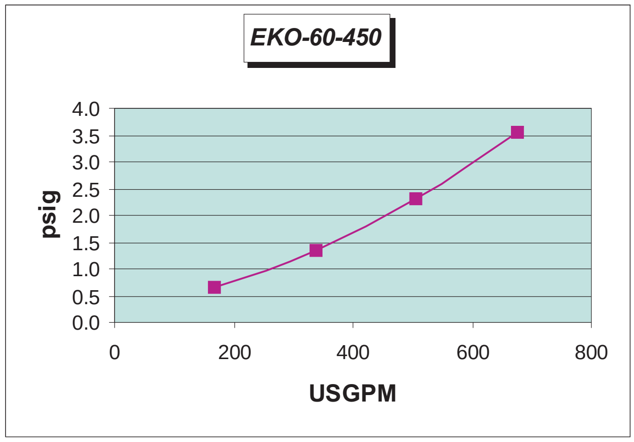
EKO-60-Series Head Loss Curves w/ Zeoclere-30 or Zeobrite









Step 18.2 – Installation of Media
When removing manhole cover, installing media and replacing manhole cover, care should be taken not to damage tank internal components and manhole cover gasket. Damaged laterals may result in media being discharged from the filter tank and damage to manhole cover gasket may result in water leakage. Inspect internals for freight damage before installing media. See Figure T for freeboard from top of media bed to the top of the diverter assembly in each filter.

Figure T: Filter Tank Freeboard

Model No.	Freeboard From Top of Media Bed to Top of Diverter Assembly
EKO-34-Series Filter	8.7”
EKO-42-Series Filter	9.81”
EKO-60-Series Filter	9.81”

Caution: After installing filters, pressure testing should be completed before the filters are loaded with sand.

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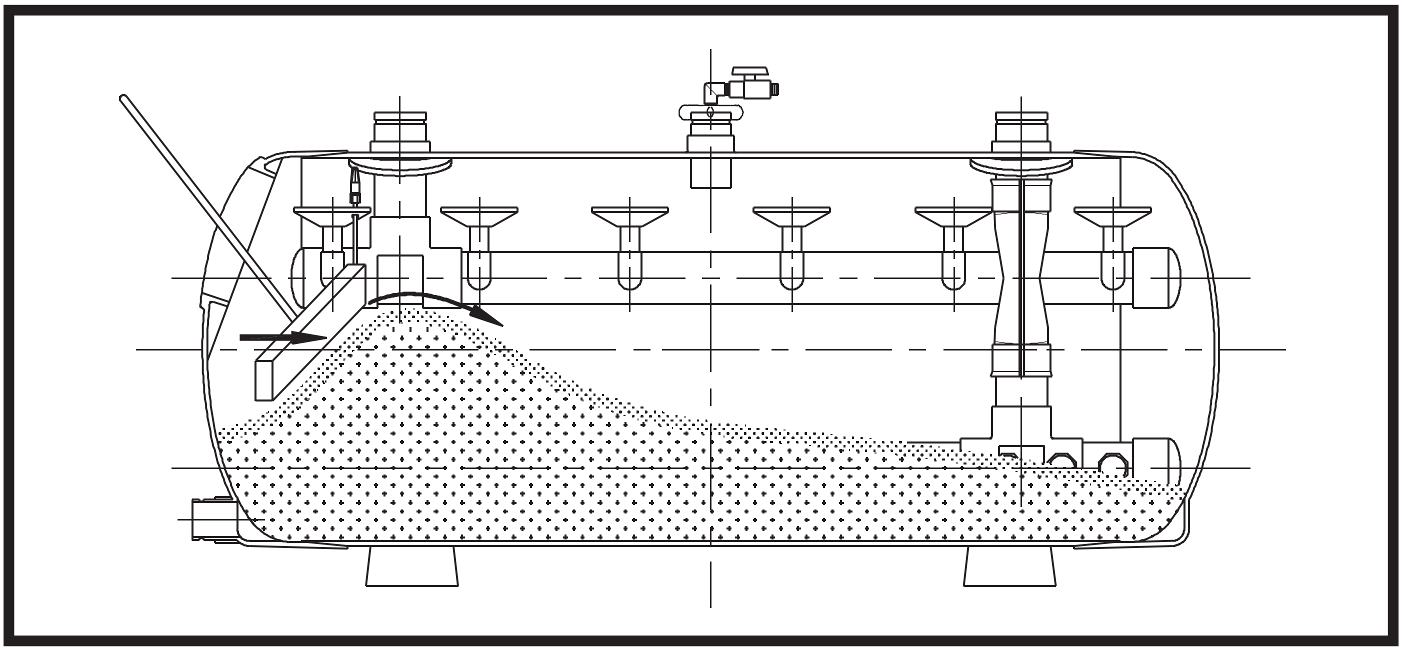
Step 18.3 – Media Installation Tool
Make a media installation tool using scrap lumber – a 2" x 4" as the pushing handle long enough to extend three quarters of the length of the filter tank with a 1" x 6" x 10" piece of lumber nailed to the pushing handle's end to act as the media pusher. The tool will allow for media to be pushed back to the rear of the tank during the loading process. DO NOT use a metal tool, such as a hoe or rake, as it may damage internal components.



Step 18.4 – Manhole Cover Removal
Using a wrench, remove the bolt that secures the manhole clamp.

If necessary, to allow easier loading of the filter media, remove the distribution header extension - remove the self-tapping

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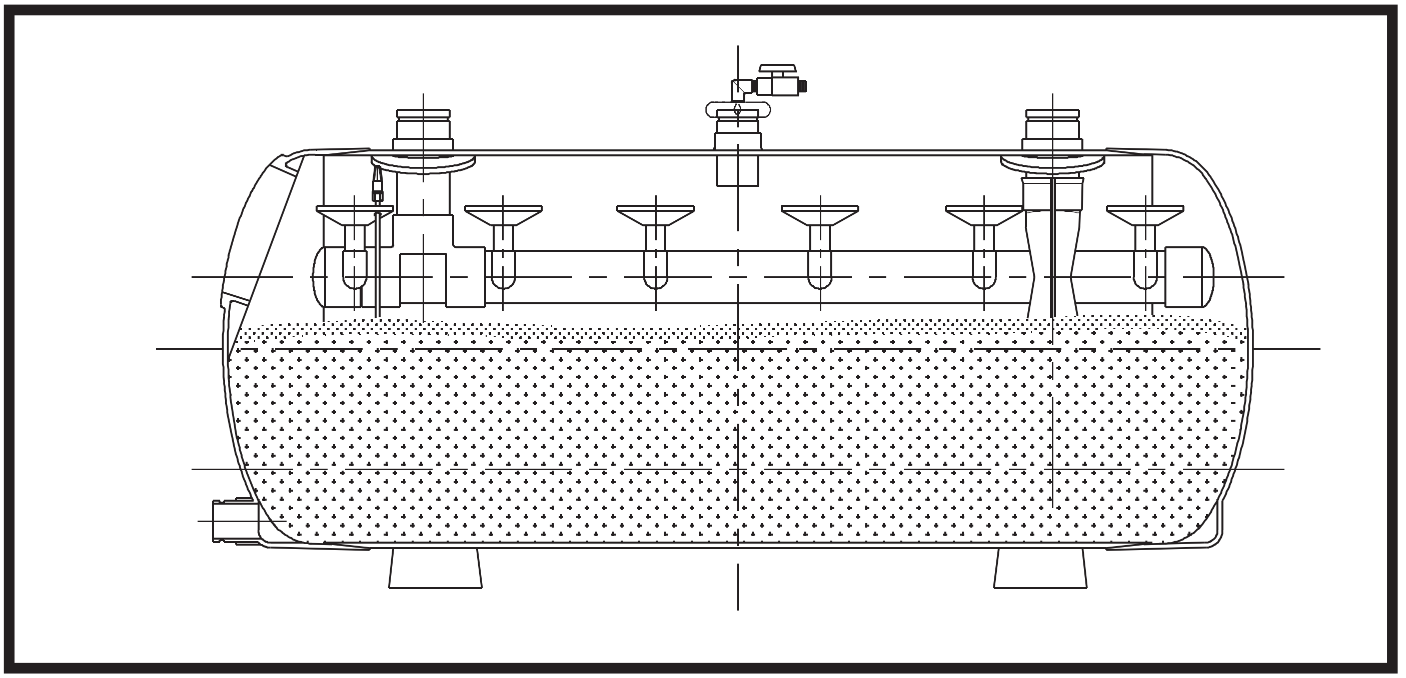
Push the cover into the tank-rotate the cover and remove from the tank opening..

Set the manhole cover aside-ensuring the cover and sealing gasket are not damaged..

Step 18.5 – Fill Tank with Media

Fill the tank approximately half full of water. This will protect the under drain lateral system from excessive strain when the sand is loaded. Cover the open end of the distribution header assembly to prevent plugging with media during the loading process. Rest a media bag in the access opening of the filter tank with one end cut open. Pour the media into the tank and, as the media piles inside the tank under the access opening, push the media to end of the tank. Take care to not damage the laterals, diverters, and internal vent assembly or drain assembly. The filter media should be level and touch the bottom of the distribution header when loading is complete.



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Step 18.6 – Reinstall Manhole Cover

Locate distribution header extensions and reinstall aligning the boltholes and secure in place with the stainless steel bolts provided.

Ensure the tank manhole cover seat is clean and free of any and all media grains. Clean the manhole cover gasket seal and install in a reverse order to removal.

Position the clamp ensuring proper seating in the molded clamp seats on the top and bottom of the manhole opening in the tank. Make sure the gasket is set equally top and bottom before securing with a 30-foot pound torque.

Initial Start-Up

Read the following instructions carefully before attempting to operate the filter. Prior to actual startup, it is recommended that the operator or installer go through several dry runs familiarizing them selves with the mechanics of the particular system. Once familiar with the operation, proceed with the actual initial start-up.

Initial Start-up Methods and Procedures:

Filter Control Console

For initial start-up of the filter system, remove the cover from the Multiport Valve enclosure. Using a screwdriver, loosen the four vandal-proof screws, remove the enclosure cover, re-attach the cover, remounting it to the bottom, left or right side of the enclosure, re-attaching cover using two of the four vandal-proof screws. See photo below.

It is recommended that the Multiport Valve enclosure cover be kept in place at all times, removing only when authorized operator is in attendance. The cover provides protection from vandals, keeping unwanted individuals from backwashing the filter in a manual mode.

Recirculating Pump Requirements

Undersized pumps or existing worn pumps will often not generate sufficient flow and/or pressure to meet the facility's design flow rate or the required filter system backwash flow rate. If adequate flow is not available from the recirculation pump, the filter system will not function properly in either the filtration or backwash modes of operation. Typically, recirculation pumps must generate the designed/required flow rate in gallons per minute at a discharge head of 60 feet minimum.

Initial Backwash Requirement

As the recirculating pump picks up prime, the filters' influent gauge will indicate a high reading and the effluent gauge a low reading. This is because the new media (sand) in the filter may contain very fine sand particles restricting flow. These fines must be thoroughly backwashed to waste before the gauges will settle down to their normal operating pressures. The filter system will exhibit between 3.5 and 8.0 (depending on the model of filter selected) psi differential or head loss when employing #20 sand and operating at 15 gallons per minute (gpm) per square foot of filter area. The system will always require an effluent pressure gauge reading of four (4) psi or greater to ensure proper operation.

Differential Pressure of Filter System

All ***EKO***^{3} Filter Systems will have varying head loss, which is dependent upon filter media and operational flow rates. Filters should be backwashed when 15 to 17 PSIG differential is indicated on the influent and effluent pressure gauges. When sizing the main circulation pump, calculate maximum head loss at 15 to 20 PSIG through the filter and face piping.

Example:

Influent gauge reading-	25 psi
Effluent gauge reading-	-17 psi
Differential Pressure-	8 psi

Several components will contribute to Total Filter System Head Loss and need to be considered during initial design, trouble-shooting and/ or service. The key critical components are the filter tank (including type of filter media), control valves and piping kits.

Filter Tank Pressure Loss

The following charts provide filter tank differential pressures when operating at various USGPM/ Sq. Ft. filtration rates-employing #20 silica sand or Zeoclere- 30/Zeobrite respectively:

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Filter Tank Presssure Lossw/ #20 SilicaSand

Model No.	5 GPM/ Sq. Ft.	10 GPM/ Sq. Ft.	15 GPM/ Sq. Ft.	20 GPM/ Sq. Ft.
EKO-34-100T	3.0 psi	5.0 psi	8.0 psi	10.0 psi
EKO-34 & 42 Series	0.6 psi	1.6 psi	3.5 psi	6.15 psi
EKO-60 Series	0.75 psi	3.2 psi	5.8 psi	8.0 psi

Filter Tank Pressure Loss w/ Zeoclere- 30 or Zeobrite

Model No.	5 GPM/ Sq. Ft.	10 GPM/ Sq. Ft.	15 GPM/ Sq. Ft.
EKO-34-100T	2.0 psi	3.3 psi	5.0 psi
EKO-34 & 42 Series	0.6 psi	1.25 psi	2.23 psi
EKO-60 Series	0.75 psi	2.0 psi	3.5 psi

Note: The listed head losses are approximate and are for filters with clean filter media.

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Eko³ systems

Diaphragm Valve Head Loss

The following are design head loss for the Diaphragm Valves operating at various flow rates:

Diaphragm Valve Head Loss Table

300 USGPM	400 USGPM	500 USGPM	600 USGPM
2.0 psi	3.0 psi	4.0 psi	5.0 psi

PVC Pipe Flow Velocity

The following chart provides flow velocities measured in Ft./ Second for standard Sch. 80 PVC pipe operating at various flow rates measured in USGPM:

PVC Pipe Flow Rate (USGPM) @ Various Velocity

Pipe Dia. (")	Sch 80 I.D.	Radius (Ft)	Area (Sq. Ft.)	US Gal/ Ft.	1 Ft./ Sec	2 Ft./ Sec	3 Ft./ Sec	4 Ft./ Sec	5 Ft./ Sec	6 Ft./ Sec	7 Ft./ Sec	8 Ft./ Sec	9 Ft./ Sec	10 Ft./ Sec
1.5	1.476	0.0615	0.01188	0.0888	5	11	16	21	27	32	37	43	48	53
2	1.913	0.079708	0.01995	0.1492	9	18	27	36	45	54	63	72	81	90
2.5	2.29	0.095417	0.02859	0.2138	13	26	38	51	64	77	90	103	115	128
3	2.864	0.119333	0.04471	0.3345	20	40	60	80	100	120	140	161	181	201
4	3.786	0.15775	0.07814	0.5845	35	70	105	140	175	210	245	281	316	351
5	4.768	0.198667	0.12393	0.9270	56	111	167	222	278	334	389	445	501	556
6	5.709	0.237875	0.17768	1.3290	80	159	239	319	399	478	558	638	718	797
8	7.565	0.315208	0.31198	2.3336	140	280	420	560	700	840	980	1120	1260	1400
10	9.493	0.395542	0.49126	3.6746	220	441	661	882	1102	1323	1543	1764	1984	2205
12	11.294	0.470583	0.69535	5.2012	312	624	936	1248	1560	1872	2185	2497	2809	3121
14	12.412	0.517167	0.83983	6.2819	377	754	1131	1508	1885	2261	2638	3015	3392	3769
16	14.224	0.592667	1.10294	8.2500	495	990	1485	1980	2475	2970	3465	3960	4455	4950
18	16.014	0.66725	1.398	10.4570	627	1255	1882	2510	3137	3765	4392	5019	5647	6274
20	17.814	0.74225	1.72994	12.9399	776	1553	2329	3106	3882	4658	5435	6211	6988	7764
24	21.418	0.892417	2.50072	18.7054	1122	2245	3367	4489	5612	6734	7856	8979	10101	11223

Note: When designing new filter system installations or renovations, we recommend the maximum flow velocity for connecting piping to be 8 Ft./ Second for discharge piping and 5 Ft./ Second for suction piping.

Connecting Piping Pressure Loss

The following chart provides average connecting pipe pressure losses when operating at various flow velocities measured in Ft./ Second:

Connecting Piping Pressure Loss

No. of Tanks	2 Ft./ Sec.	5 Ft./ Sec.	8 Ft./ Sec.	10 Ft./ Sec.
Single	0.3 psi	1.2 psi	2.6 psi	4.5 psi
Multiple (2 thru 8)	0.35 psi	1.4 psi	3.0 psi	5.0 psi

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Total Filter System Head Loss

Calculating Total Filter System Head Loss will vary slightly from single tank to multiple tank systems. Total Filter System Head Loss calculations should be based on the total operating flow of the system, USGPM/ Sq. Ft. flow rate for the filter tank, operating flow rate for the control valves, operating flow velocity (measured in Ft./ Sec.) for the connecting piping and any functional back pressure requirements.

Example
Single Tank:

- Total System Flow Rate: 250 USGPM
- Filter Selection: 1- 34" Filter Tank @ 19.3 Sq. Ft. of Filter Area/ Filter Tank
- Filter Media Selection: #20 Silica Sand
- Filtration Rate: 250 19.3 = 12.95 USGPM/ Sq. Ft. of Filter Area
- Backwash Valve Selection: 6" Influent, 6" Tank, 6" Backwash
- Backwash Valve Flow Rate: 250 USGPM
- Connecting Pipe Size: 4" (Maximum Flow Rate @ 8 Ft./ Second Velocity, 281 USGPM)
- Functional Backpressure: 4 psi

- Filter Head Loss =	3.5 psi
- Influent Backwash Valve Head Loss =	2.0 psi
- Effluent Backwash Valve Head Loss =	2.0 psi
- Connecting Piping Head Loss =	2.6 psi
- Functional Backpressure =	4.0 psi
- Total Head Loss =	14.1 psi

Example
Multiple Tanks:

- Total System Flow Rate: 600 USGPM
- Filter Selection: 2- 42" Filter Tanks @ 20 Sq. Ft. of Filter Area/ Filter Tank
- Filter Media Selection: #20 Silica Sand
- Filtration Rate: 600 (2x20) = 15 USGPM/ Sq. Ft. of Filter Area
- Backwash Valve Selection: 6" Influent, 6" Tank, 6" Backwash
- Backwash Valve Flow Rate: 600 2 (one valve/ tank) = 300 USGPM
- Connecting Pipe Size: 6" (Maximum Flow Rate @ 8 Ft./ Second Velocity, 638 USGPM)
- Functional Backpressure: 4 psi

- Filter Head Loss =	3.5 psi
- Backwash Valve Head Loss =	2.0 psi
- Backwash Piping Head Loss =	3.0 psi
- Functional Backpressure =	4.0 psi
- Total Head Loss =	12.5 psi

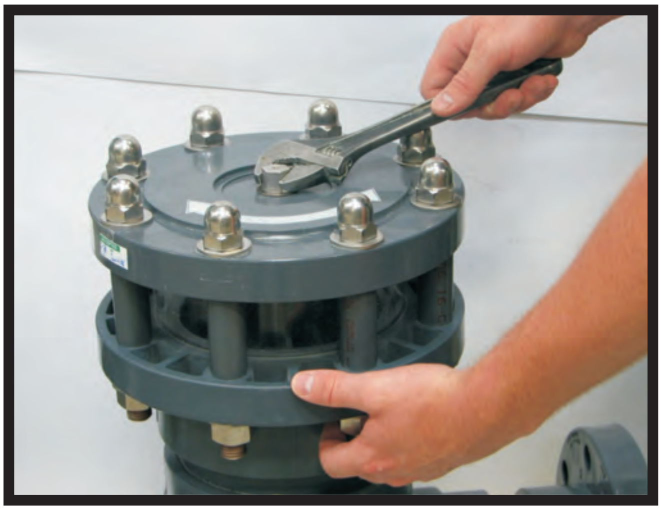
Operating Valve Flow Adjustment

The Filter System Operating Valves are as follows:

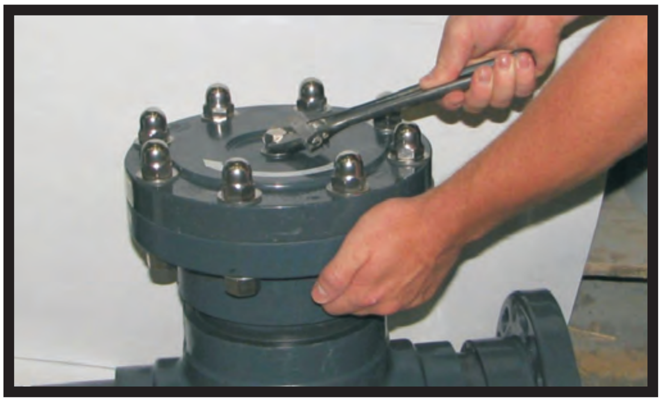
- Diaphragm Valve
- Backwash Flow Control Valve
- Manual Flow Control Valve
- Priority Flow Control Valve – (Priority Flow Control Valves are used on all two tank systems or three tank systems which operating at flow velocities less than 8 ft./ second)

No adjustment is required for the Diaphragm Valve. All other operating valves require rate of flow and backpressure adjustment. Each valve has a flow/pressure adjustment bolt located on the top cover. Each has an adjustment arrow, indicating the direction of bolt rotation for flow/pressure increase and decrease. These valves are vandal-proof, requiring a wrench to alter flow rate/back-pressure settings.

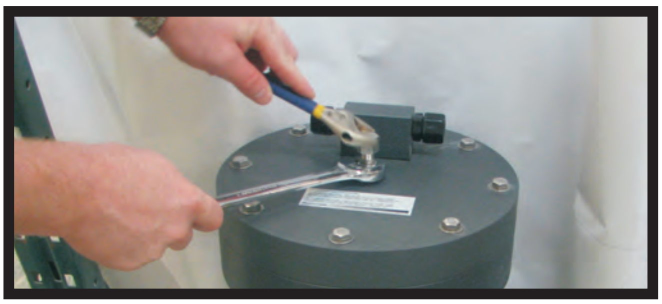
The photographs below show the adjustment procedures:



Backwash Flow Control Valve - rotate the adjustment bolt to increase or decrease flow/back-pressure



Manual Flow Control Valve-rotate the adjustment bolt to increase or decrease flow/back-pressure



Priority Flow Control Valve - loosen the jam nut - rotate the adjustment bolt to increase or decrease flow/back-pressure - tighten the jam nut

Step 1: Initial Start-up Procedure

- Open all valves in the mechanical room piping system that allow the flow of water to the recirculation pump, filter system and back to the pool/ spa.
- Partially close the Manual Flow Control Valve/ Priority Flow Control Valve and the Backwash Flow Control Valve. Loosen Jam Nuts, if present and rotate flow adjustment both to the closed position (see adjustment arrow on valve).

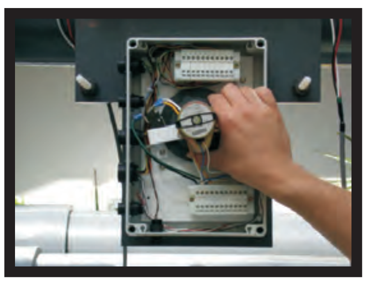
The operating valves (Manual Flow Control Valve, Priority Flow Control Valve and Backwash Flow Control Valve), other than Diaphragm Valve, of this system require slight flow restriction to produce backpressure (3 to 4 pounds of backpressure) to assure proper operation of Diaphragm Valve(s). Partial closure of the operating valves will aid in the initial startup and the set up of the filter system. Following the initial start-up procedure, the valves will be adjusted to ensure proper flow, slight backpressure and operation.
Three preliminary procedures are required before the filtration system is set in operation:

Step 2: Backwash of System

The initial start-up of the filter will require a thorough backwash of the new filter media, adjustment and setting of the backwash flow rate followed by the adjustment and setting of the filtration flow rate.
The Multiport Valve indicator dial controls the Multiport Valve, which in turn governs the operation of the Backwash Valves that are installed on the filter tank(s).

- Remove the cover from the Filter Control Console - Multiport Valve
- Rotate Multiport Valve indicator dial to the "H" (HOME) position. Align "H" to the pointer.
- Operate the pump until each filter is purged of air and water is flowing from the backwash port of each Dual Diaphragm Valve.

CAUTION: Automatic Filter Control Systems (AFC and MRCs only) Multiport Valve indicator dial must be rotated in a counter-clockwise direction. Failure to rotate in the proper direction will result in damage to the drive motor.



Note: Open the external air vent of each filter during cleaning of the system to ensure proper air purging of each filter tank.

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Step 3: Pumping Water:

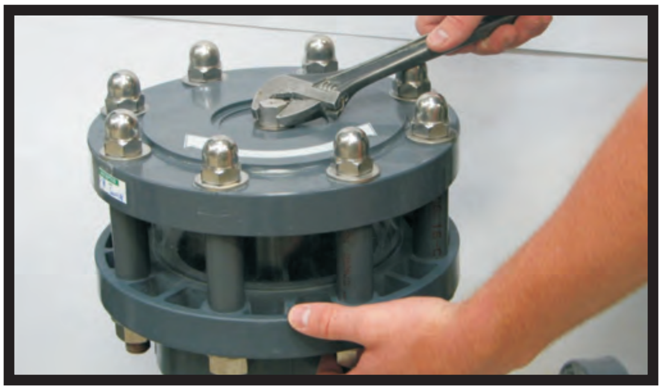
Turn ON the main electrical power supply. Switch the circuit breakers to the ON position for both the motor starter of the recirculation pump and the Pressure Modification System ONLY. DO NOT power any automatic control equipment at this time. The filter system will be manually operated during the initial start-up procedure.

- Manually activate magnetic motor starter (HOA) for the main recirculating pump.
- Confirm that the recirculation pump is in operation and that pressure appears on the Filter Gauge Panel Assembly
- Close manual external air vent of each filter once all air has been expelled from the filter tank(s).

Step 4: Backwash Flow Control Valve Adjustment

After the filtration system is in operation, allow the system to operate for 5 to 10 minutes in the filtration mode before adjustment of the operating valves. Filtration system installations where multiple filter tanks are utilized and sequencing of single filter tank backwash is required – a Backwash Flow Control Valve should be installed in the backwash line. This valve must be set, during "INITIAL START-UP", to the single filter tank backwash flow rate requirement as specified in Figure U.

- Manually activate the magnetic motor starter (HOA) for the Pressure Amplification System - supplying operating pressure to the Multiport Valve.
- Rotate Sequencing Valve indicator dial to the number one (1) position. Align number one (1) to the pointer. Rotate dial in counterclockwise direction for motorized Multiport Valve, or any direction for manually operated Sequencing Valve.
- Isolate the filtered water return line down stream of the filtration system.
- Manually activate the magnetic motor starter (HOA) for the Pressure Modification System– supplying operating pressure to the Pilot Valve Assembly.
- Start the recirculating pump and ensure it is still throttled to the backwash flow rate requirement for one of the filters being utilized.
- Water will begin to flow out of the filter's backwash line (to waste) at this time.
- Adjust the Backwash Sightglass Valve as follows:
  - o Begin to close the Backwash Flow Control Valve until you begin to see a slight pressure rise at the discharge of the pump or a slight reduction in the flow rate. Ensure the Backwash Flow Control Valve positioned for proper throttling of backwash flow rates. See Figure U for recommended Backwash Flow Rates/ Size Chart. A flow meter may be installed in the backwash line to assure designed backwash flow rates.



- An acceptable alterative method to ensure desired backwash flow rate:
  - o Put your hand in the backwash water flow stream.
  - o Open the Backwash Flow Control Valve until you feel filter media fines being released.
  - o Close Backwash Flow Control Valve just until media is not present in flow stream.
- Backwash water must appear in the Sightglass during this operation. If after backwash flow rate adjustment has been made no water is present in the Sightglass, turn the adjustment bolt counterclockwise to decrease flow, until water flow is seen in the Sightglass viewing area.
- While the filter system is backwashing and following he adjustment of the Backwash Flow Control Valve – the influent pressure gauge, mounted in the Gauge Panel Assembly, must be reading at least four (4) PSIG. If not decrease flow further through the Backwash Flow Control Valve until the desired backpressure is achieved.

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Figure U: Recommended Backwash Flow Rates

Model No.	Minimum Backwash Flow Rate- US GPM	Maximum Backwash Flow Rate- US GPM
EKO-34-100	150	200
EKO-34-126	189	252
EKO-34-153	230	306
EKO-34-193	290	386
EKO-34-237	355	474
EKO-42-145	218	290
EKO-42-225	338	450
EKO-42-250	375	500
EKO-42-275	412	550
EKO-42-310	465	620
EKO-42-360	540	720
EKO-42-410	615	820
EKO-42-460	690	920
EKO-60-300	450	600
EKO-60-350	525	700
EKO-60-400	600	800
EKO-60-450	675	900
EKO-60-500	750	1000
EKO-60-550	825	1100
EKO-60-600	900	1200
EKO-60-650	975	1300
EKO-60-700	1050	1400
EKO-60-750	1125	1500
EKO-60-800	1200	1600

* For inquiries related to other types and grades of filter media, contact Nemato Corp.
** Refer to Step 18: Filter Media Specification and Installation in the installation section of this manual for filter media specifications – effective size and uniformity coefficient

Note: Open the external air vent of each filter during cleaning of the system to ensure proper air purging of each filter tank.

Step 5.1 – Initial Filter System Backwash & Setting the Filter Bed for Filters Installed w/ #20 Silica Sand

When a filter is first started, the sand bed will automatically adjust to its natural operating level. Allow each tank in a single or multiple tank filter system to backwash for a minimum of 10 minutes, uninterrupted. This will allow for the removal of contaminants and fines from the new filter media.

- Single Tank Filter System - rotate the Multiport Valve from Home (H) to the number one (1) position. Rotate dial in counterclockwise direction for motorized Multiport Valves. Leave in the number one (1) position for 10 minutes.
- Multiple Tank Filter System - rotate the Multiport Valve from Home (H) to the number one (1) position. Leave in the number one (1) position for 10 minutes. Rotate to the number two (2) position. Leave in the number two (2) position for 10 minutes. Rotate to the number three (3) position and so on.
- Following the completion of initial backwash of the last filter tank in the system, rotate the Multiport Valve to the Home (H) position. The filter is now filtering water.
- Following completion of filter system backwash, turn off the Pressure Amplification System.

Note: Open external air vent of each filter during setting of sand to ensure removal of entrapped air.

Step 5.2 – Initial Filter System Backwash & Setting the Filter Bed for Filters Installed w/ Zeoclere-30 or Zeobrite

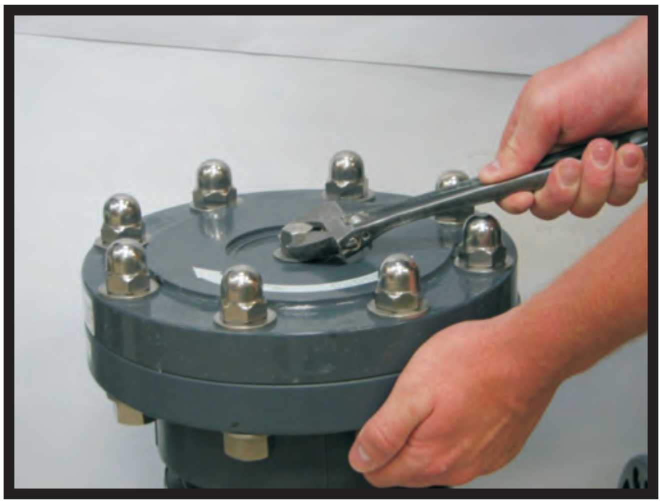
When a filter is first started, the sand bed will automatically adjust to its natural operating level. Allow each tank in a single or multiple tank filter system to backwash for a minimum of 2 to 3 minutes, uninterrupted. This will allow for the removal of contaminants and fines from the new filter media.

- Single Tank Filter System - rotate the Multiport Valve from Home (H) to the number one (1) position. Rotate dial in counterclockwise direction for motorized Multiport Valves. Leave in the number one (1) position for 10 minutes.
- Multiple Tank Filter System - rotate the Multiport Valve from Home (H) to the number one (1) position. Leave in the number one (1) position for 10 minutes. Rotate to the number two (2) position. Leave in the number two (2) position for 10 minutes. Rotate to the number three (3) position and so on.
- Ensure the Manual or Automatic Flow Control Valve is totally closed during this procedure.
- Start the recirculating pump and backwash until the backwash water is totally clear in the Backwash Flow Control Valve Sight glass.
- Ensure a drain valve has been installed between the Automatic Flow Control Valve and filter tank on single tank systems. The valve must be connected to the backwash line and opened with the Diaphragm Valves in the filter position, until water clears in the Backwash Flow Control Valve Sight glass.
- After backwashing, and rinsing for single tank systems, allow the media to settle for 3 to 5 minutes. After media settling is complete, repeat the backwash, and rinse procedure for single tanks systems, at least two more times ensuring the media settles between each cycle.
- Following completion of filter system backwash, turn off the Pressure Amplification System.

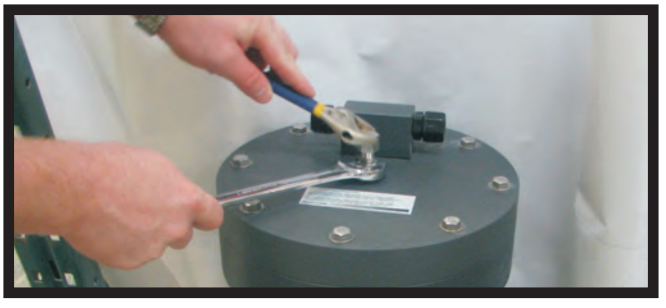
Note: Open external air vent of each filter during setting of sand to ensure removal of entrapped air.

Step 6 - Filter System Flow Control Valve Adjustment
The rate of flow for the filter must now be set. Refer to architect/engineer drawings for the design flow rate. Either the Manual or Automatic Flow Control Valve governs the filter's flow rate. Filter systems employing two tanks, or multiple tank systems operating at flow velocities less than 8 ft./ second, should utilize an Automatic Flow Control Valve. All other systems employ the Manual Flow Control Valve.

- **Manual Flow Control Valve Adjustment**
  - o The Manual Flow Control Valve is set at its closed position. Observe the flow rate on the flow meter (gpm). Rotate the adjustment bolt on top of the Rate of Flow Valve – turn in the direction of “increasing the flow”. Rotate the adjustment bolt until desired flow rate is achieved.
  - o Observe the effluent pressure of the filter system on the Filter Gauge Panel Assembly. The effluent pressure must be four (4) pounds per square inch or greater. If the pressure is not indicated, decrease or close the Rate of Flow Valve until this pressure is indicated on the effluent pressure gauge.



- **Priority Flow Control Valve Adjustment**
  - o Loosen the lock nut on the adjustment bolt located on top of the Automatic Flow Control Valve – this valve is set at its closed position. Observe the flow rate on the flow meter (gpm). Rotate the adjustment bolt on top of the Automatic Flow Control Valve – turn in the direction of “increasing the flow”. Rotate the adjustment bolt until desired flow rate is achieved. Tighten the lock nut on the adjustment bolt.
  - o Observe the effluent pressure of the filter system on the Filter Gauge Panel Assembly. The effluent pressure must be four (4) pounds per square inch or greater. If the pressure is not indicated, decrease or close the Automatic Flow Control Valve until this pressure is indicated on the effluent pressure gauge.



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Step 7 – Filtration

The filter system is now ready for filtering water. Check the filter system's pressure gauges (Filter Gauge Panel Assembly).

- Ensure all diaphragm valve ports are connected to the appropriate location.
- Ensure the Pressure Modification System is wired correctly, plumbed to appropriate locations (i.e. suction to effluent port of filter system and discharge connection to supply connection of control assembly) and operational.
- Manually activate the magnetic motor starter (HOA) for the Pressure Modification System– supplying operating pressure to the Pilot Valve Assembly.
- Manually activate magnetic motor starter (HOA) for the main recirculating pump.
- Confirm that the recirculation pump is in operation and that pressure appears at the Filter Gauge Panel Assembly.
- Make note of the Influent pressure and the Effluent pressure gauge readings. Once there is a difference between these pressure gauge readings of 15 to 25 psi, the system will require backwash.

Once the initial start-up is completed, for automatic systems refer to the Installation and Operating Manual for the respective Backwash Control System supplied for the filters.

Note: Periodically open external air vent of each filter to ensure removal of entrapped air.

Maintenance/ Service

The following maintenance/service procedures are for the filter systems and their components. For maintenance/service on filter controllers, see their respective owner's manuals. Refer to the parts lists in the back of this manual for replacement parts.

WARNING: Before performing any maintenance on the filter system, shut OFF all electrical power and close all valves between the source water and the filter system.

COMPONENT INSPECTION AND SERVICE

The following items (if applicable to system installed) should be inspected and/or serviced only if the performance of the system is reduced below normal levels. Refer to the troubleshooting section of this manual to identify the cause before attempting to service these components.

Item 1 – Filter Tank, Internal Components and Media

Item 2 – Multiport Valve

Item 3 – Backwash Flow Control Valve

Item 4 – Priority Flow Control Valve

Item 1 – Filter Tank, Internal Components and Media

Step 1: Backwash the filter system thoroughly

Step 2: Turn "OFF" Electrical Power

Step 3: Drain Filter Tank

Drain Filter tank by removing the drain plug, located in the lower front quadrant of the tank. Allow 30 to 60 minutes for complete drainage, dependent upon size of filter tank. Open manual air relief valve(s) on top of tank(s) to accommodate the draining process. To accelerate the process, remove the manway and push upper cover into tank. Be careful not to remove sand in this process.

Step 4: Remove Manhole Cover

After tanks have drained, using a wrench, remove the bolt that secures the manhole clamp. Remove the clamp, securely holding the manhole cover in place. Push the cover into the tank – rotate the cover and remove from the tank opening. Set the manhole cover aside – making sure it and its sealing square "O"-Ring are not damaged. If necessary, to allow ease of access to tank interior and media, remove the distribution header extension – remove the screws from the sides of the tee and pull the extension forward with a rotating motion.

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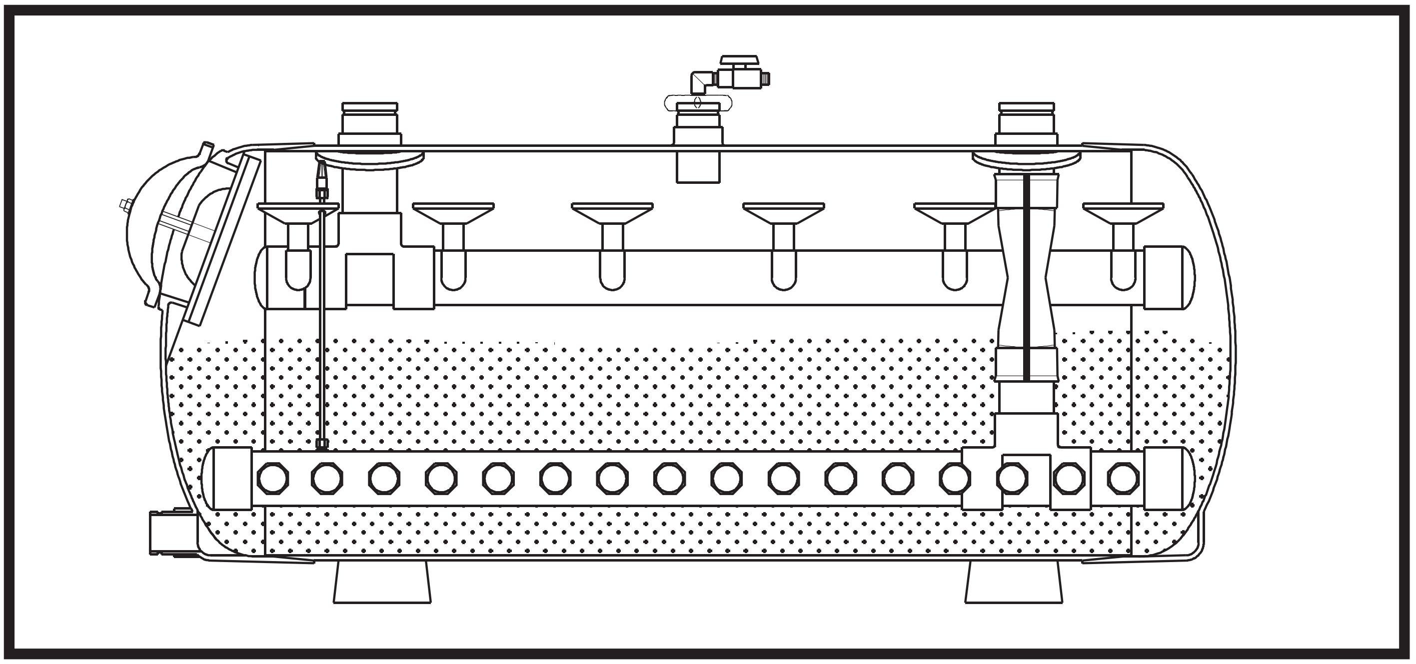
Step 5: Inspect Tank Internal Components
Inspect internal components exposed above the media bed. Make sure all headers are in place and diverters are properly attached to headers.



Step 6: Inspect Media Bed for Flatness
Observe media bed for flatness. Channeling (holes) or media migration (piles or hills) indicate a problem exists.

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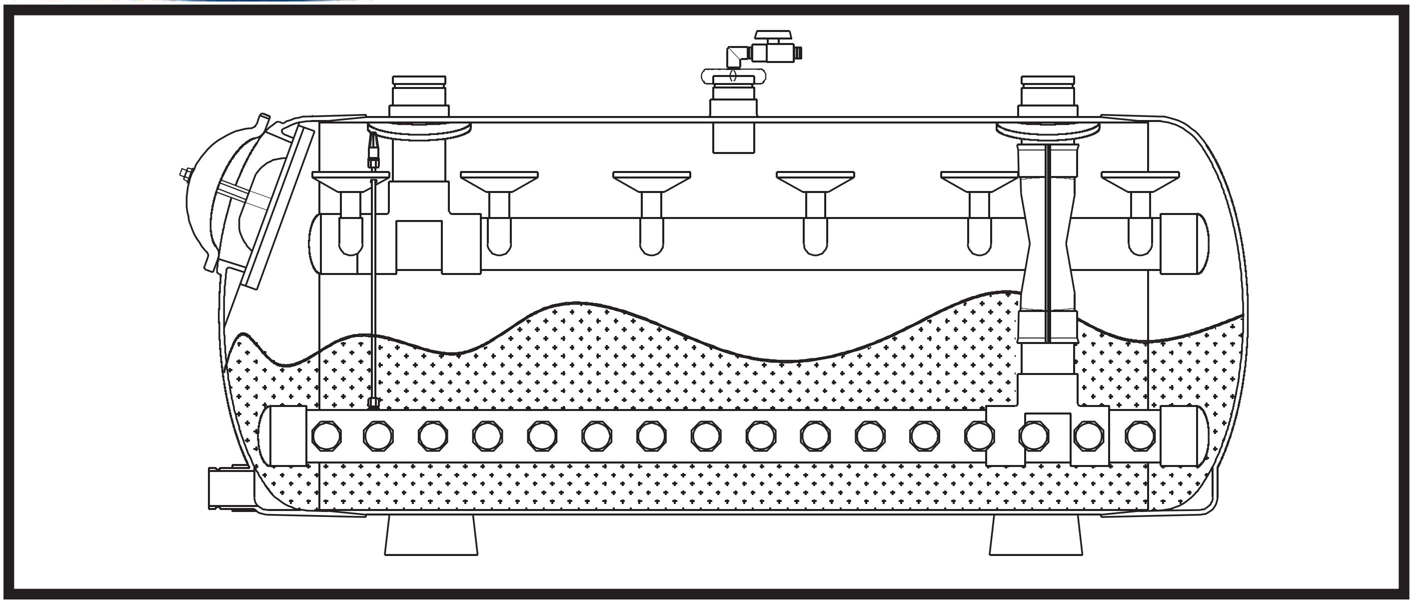
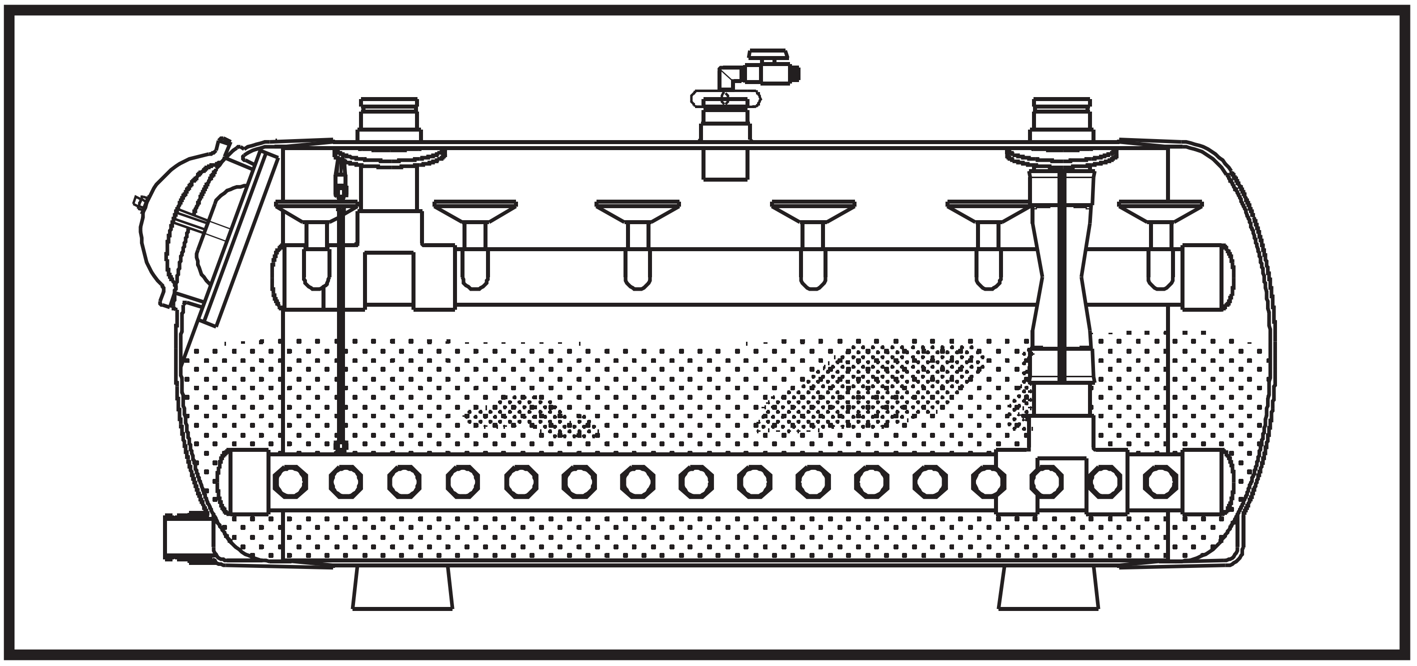


Step 7: Inspect Filter Media for Contamination
Remove media samples from 2 areas, the tank center and along either sidewall. When removing samples use only your hands and take sample 4 to 6" below the surface- inspect for contamination. Contamination can be dirt and other debris that has not backwashed out of the media bed, or calcium deposits, or hair and/or other matted material accumulated in the media bed. The media must be loose without the presence of calcium or contaminant binding. After visual inspection, rinse samples with water. Risne water should be relatively clear, if not media may be contaminated. If media is contaminated, replace with new filter media approved by Nemato. Improper backwash and/or improper water chemical balance may be causing these conditions. Take corrective action to remedy the problem.



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Step 8: Inspect and Service the Automatic Internal Air Relief

Remove the slotted screen assembly from the internal air relief tubing and remove any trapped debris. Inspect the tubing and compression fittings attached to the screen assembly and header. Replace any components that appear to be worn, cracked, suffering from any erosion or chemical attack. Reinstall all the components whether new or original in the reverse order of removal.

Step 9: Inspect the Fiberglass Tank for Visual Acceptance Levels

The fiberglass tank should be inspected for any blisters (rounded surface elevations resembling a human skin blister), chips (small pieces broken off an edge or surface of the tank), cracks (material separation or fracture), crazing (fine cracks at or under the surface of the tank), delamination (separation of the layers of material in the tank) and pitting (small craters in the surface of the tank).

Following the inspection of internal components, reinstall the manway cover.

Step 10: Reinstall Manway Cover

Insert the distribution header extension into the tee ensuring alignment with the screw holes. Secure in place with stainless steel screws.

Remove any and all media sand grains from inside manhole flange. Clean the cover and the square "O"-Ring gasket. Install the manhole cover in reverse order of removal.

Position the clamp at 90 to horizontal and tighten the bolt to a torque spec of 30-foot pounds.

Item 2 – Multiport Valve Lubrication & Inspection (All Systems)

Step 1: Disconnect Tubing

Disconnect all tubing from the Multiport Valve assembly. Make a note of the tubing connections for assistance in reassembly.

Step 2: Removal of Multiport Valve

Open the enclosure and remove the motor and motor mounting bracket (if automatic system), and then remove indicator dial (pull off). Remove the four screws that secure the Multiport Valve to the backplate.

Step 3: Disassemble the Multiport Valve

Remove the nuts and bolt that hold the assembly together. Gently pull the two parts away from one another, being careful not to lose components.

Step 4: Remove Internal Components

Remove rotor, springs, cup seals, O-Ring, etc.

Step 5: Lubricate Seals and O-Rings

Replace any rubber components that appear worn or have hardened.

Step 6: Reinstall all components

Step 7: Reassemble

In reverse order of disassembly, reassemble the Multiport Valve and attach to the backplate. Reattach motor bracket and motor.

Item 3 – Backwash Flow Control Valve

Step 1: Remove Cover

Remove nuts, washers and bolts. Pull the cover assembly along with the gate up and out of the valve body. Remove Sightglass and O-Ring from valve body and cover. Remove any debris from adjustment bolt.

Set cover, O-Ring and Sightglass aside.

Step 2: Clean Sightglass Tube

Clean the Sightglass lens with a soapy water solution. Avoid abrasive cleansers that may scratch the clear plastic lens. Clean the "O"-Ring and grooves with a clean cloth. Replace worn or hardened "O"-Rings.

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Step 3: Reinstall Sightglass Lens
Lubricate O-Rings with silicone lubricant. Position the Sight glass and center it on the "O"-Ring. Replace

Step 4: Reinstall Cover and Gate Assembly
Lubricate the "O"-Ring with silicone lubricant. Install the cover and gate assembly, guiding the gate down into the slot opening inside valve body. Center the cover O-Ring on the Sightglass lens.

Reinstall bolts, washers and nuts, securing firmly to a torque spec of 20-inch pounds with a torque wrench.

Step 5: Setting Backwash Flow Rate
Refer to Initial Start-up procedure Step 4 for setting the Backwash Flow Control Valve.

Item 4 – Priority Flow Control Valve

Step 1: Remove Cover
Remove the tubing from the valve by pulling up on the compression ring on the fitting while pulling the tubing out of the fitting. Remove the nuts, washers and bolts and put the cover aside.

Step 2: Push Piston Down
Using one hand, push the piston all the way down inside of cylinder

Step 3: Clean Cylinder
Clean the cylinder with a clean cloth and lubricate the inside wall with silicone lubricant

Step 4: Re-assemble
Re-assemble the valve in reverse order of disassembly. Apply 20-inch pounds with a torque wrench to the bolts and nuts.

Troubleshooting

POTENTIAL PROBLEMS:

Filter Media Being Discharged Out of Filter
Cause:
1. Underdrain system or laterals damaged or installed incorrectly
2. Incorrect media (excessive fines)

Correction:
1. Remove remaining media (via media dump port), repair Underdrain system or lateral and reinstall media
2. Check media size and type, if incorrect, replace with the proper grade and type

Cloudy Water Returning to Pool Immediately Following Backwash
Cause:
1. Media contamination
2. Internal automatic air relief missing

Correction:
1. Media inspection will determine course of action
2. Open tank to confirm automatic air relief is installed properly.

Filtered Water Not Clearing Up
Cause:
1. Water chemistry not in balance
2. Incorrect media
3. Rate of flow in excess of 20 gpm per sq ft of filter area
4. Mud balls have formed in media
5. Filter system is not being backwashed
6. Original water source

Correction:
1. Consult your Nemato Distributor
2. Remove media and install correct media
3. Reduce flow rate
4. Remove media to a depth that mud balls are no longer present; degrease and descale the media, ensure media is degreased before descaling or setting of oils could occur; add recommended media to appropriate level
5. Backwash filter manually
6. Consult local water chemist

CAUTION: Incorrect media selection may result in poor filtered water quality and/or short filter cycles

Frequent Backwash Intervals:
Cause:
1. Excessive solids loading and insufficient backwashing
2. Media bed was not backwashed thoroughly in the initial start-up to rid the media of fine media particles
3. Media is too fine
4. Laterals inside tank are plugged with finer media grains or algae growth
5. Backwash flow rate is below 15 gpm per sq ft of filter area
6. Improper backwash duration

Correction:
1. Manually backwash each tank thoroughly
2. Manually backwash the system for approximately five minutes
3. Degrease and Descale the media, ensure media is degreased before descaling or setting of oils could occur
4. Replace with proper media as recommended

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5. Remove media, clean out slots in laterals with razor blade and replace with new media
6. Increase backwash flow rate
7. Increase backwash cycle time

Clean Media, High Influent Pressure, Low Effluent Pressure, Little or no Outlet Flow

Cause:

1. Media too fine
2. Media not backwashed sufficiently in initial start-up causing compaction of media bed
3. Media bed compacted due to high differential pressure between the inlet and outlet

Correction

1. Replace filter media with proper size media
2. Manually backwash each tank thoroughly for several minutes
3. Restrict the Rate of Flow or Priority Valve to create backpressure across media bed, thus relaxing media bed, allowing flow to pass through bed. Also rate of flow may be exceeding design flow rate.

High Influent and Low Effluent Pressure Gauge Readings – System Will Not Backwash

Cause:

1. Water pressure supply to Sequencing valve is below designed pressure, automatic backwash valves are not actuating
2. Media bed plugged with heavy dirt loading
3. Laterals inside tank are plugged with fine media grains or algae growth
4. Media too fine
5. Media not backwashed sufficiently during initial start-up to remove the media fines
6. Multiple tank systems only – adjacent filter tank(s) not being backwashed often enough
7. Two tank or three tank systems employing Manual Flow Control Valves – system will not backwash
8. Supply control water to multiport valve 25 psi higher than influent pressure

Correction

1. Provide system operating pressure plus 15 psi to Sequencing valve.
2. Manually backwash each tank or remove upper 3" of media bed
3. Remove media, clean out slots in laterals with razor blade and replace with new media
4. Replace with proper media
5. Backwash the system thoroughly for several minutes
6. Increase backwash frequency
7. Priority Valve check valve ball is missing, install check valve ball

Backwash Valve Stays in Backwash Position

Cause:

1. Valve needs back-pressure to reverse flow from backwash to filter operation mode
2. Multiport valve doesn't vent
3. Backwash valve failure

Correction:

1. Restrict flow at Manual or Automatic Flow Control Valve and Backwash Sightglass Valve. Filter System pressure gauges should indicate a minimum of 4 psi on the effluent pressure gauge.
2. Confirm mulitport valve operation
3. Remove tubing from front of backwash valve to determine if pool water is partially energizing valve. If so, disassemble valve for inspection/ repair

Note: Backwash valve rebuilding is recommended every 4 years as preventative maintenance.

Winterizing

If the filter system is not to be operated during months in which it may encounter freezing temperatures, winterizing is recommended.

The procedure for winterizing the filter is as follows:

· Backwash the filter system
· Shut "OFF" all electrical power to the filter's automatic controllers
· Disconnect and drain all control and sensor tubing; reattach after completing void of water
· Remove tank drain plugs and open manual air relief valves
· Replace drain plugs after tanks have completely drained
· Loosen all bolts on backwash valve covers – allowing them to drain – tighten to 20 foot pounds following drainage

This procedure covers the filter system only – see other component equipment manufacturers' winterizing recommendations for their procedures.