



GRAVER TECHNOLOGIES

Targeted Applications

WHERE CAN WE WIN

Targeted Applications

- **Food and Beverage:** Beer, Wine, Bottled water, Flavorings/extracts, CBD Oil
- **High Purity:** Electronic devices (chips, LED, solar power cells, battery packs for EV), CMP, Cosmetics, Active Pharmaceutical Intermediates, Ophthalmics, Nutraceuticals
- **Water:** Pre RO, Community systems, Process water (rinse, dilution, CIP).
- **General Industrial:** Inks, Bulk Chemicals, Nozzle protection, Deep well injection, Catalyst recover. Amine sweetening, Plating, Lubricating/Cutting Fluids



WHERE CAN WE WIN

How Filters are Used

- Optical Clarification
- Tank Vents/Fermentation Feed Air
- DE or Carbon Removal/Polishing
- Protect pump seals
- Classification – remove agglomerates while leaving pigments
- Pre RO
- Process Steam
- Microbial Control

Critical Considerations

- Standards
 - USP Class VI Plastic Testing
 - EU 1935
 - FDA
- Validation information for sterilizing /bioburden reduction filters
- Chemical Compatibility with solvents
- Operating temperatures
- Solids Loading/Contaminant loading levels
- NSF Requirements
 - Standard 61 – Leaching/Migration of Chemical Components



WET BENCH

What is the Filter Issue

A wet bench is a fully-automated process tool used for wet cleaning and etching in semiconductor manufacturing to produce wafers/chips. The process will use a variety of aggressive chemicals in the etchers and cleaners including sulfuric acid, nitric acid, hydrofluoric acid, hydrochloric acid and ammonium hydroxide. Some operations may occur at temperatures up to 180° C.

Graver Options

ZTEC E can be used for many of the buffered etches (BOE) and dilute acids that are at ambient temperatures. The more aggressive (concentrated) acids may work with TefTEC, but best suited with an all-fluoropolymer filter such as Citadel.

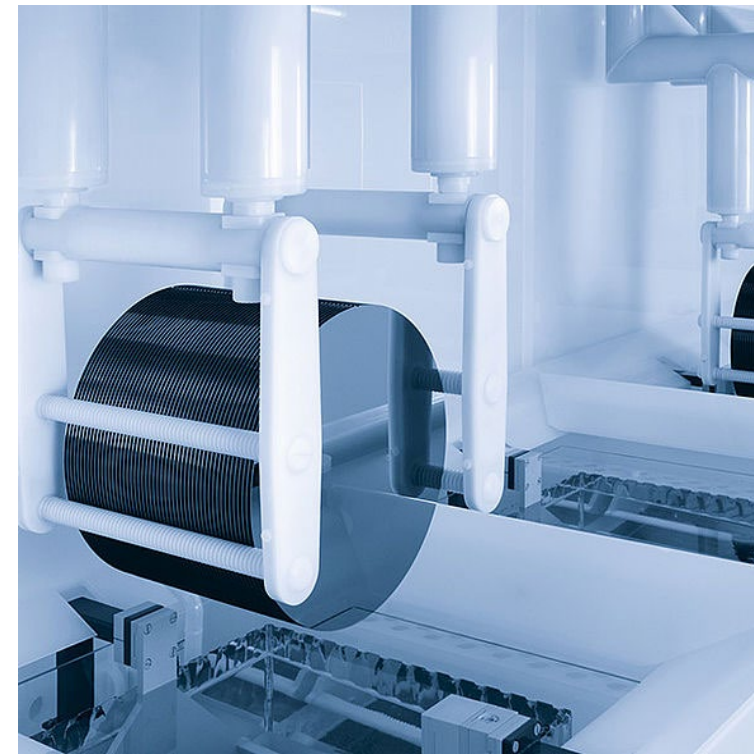
ZTEC E 0.1 – 0.6

TefTEC 0.05 – 0.2

Citadel 0.05 – 0.2

Additional Considerations

The acids and etches are aqueous based and as such, PTFE must be pre-wet. Both TefTEC and Citadel are offered in a wet pack form which eliminates the need to pre-wet on site.



CMP SLURRY

What is the Filter Issue

Chemical mechanical polishing/planarization is a process of smoothing surfaces with a slurry which is a combination of etch chemicals and abrasive particles that polish or flatten the surface of a wafer. The slurry particles can agglomerate, forming larger particles which result in scratches to the surface of the wafer. The slurry is recirculated from mix tanks/day tank, and thus passed multiple times through the filter bank.

Graver Options

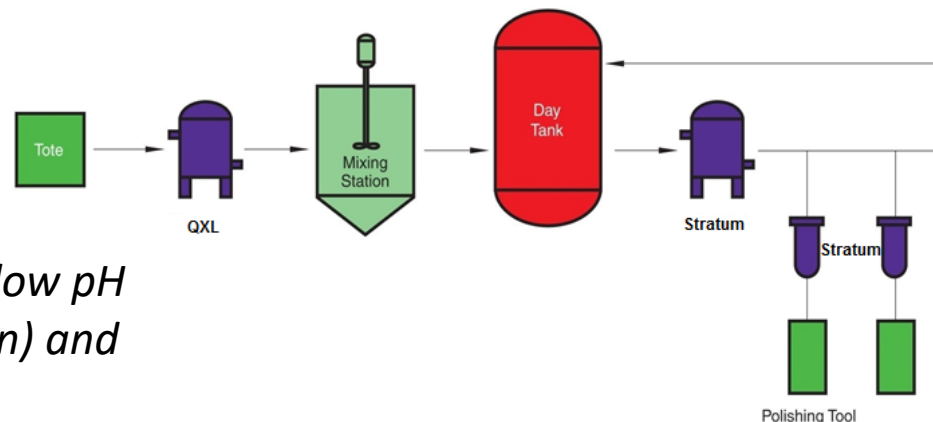
High performance melt blown filters like Stratum A are commonly utilized on slurry tanks. Pleated filters are seldom used as they have been shown to experience short life, but QXL offers and innovative media that can work with some slurry types.

Stratum A/C 0.3 – 10 micron

QXL 0.45 - 5 micron

Additional Considerations

There are two major categories of slurries: low pH metallic slurries (alumina, copper, tungsten) and high pH oxide slurries (silica).



COMPRESSED AIR & GAS

What is the Filter Issue

Compressed gas is used throughout facilities to move products (as opposed to pumps), operate equipment (air driven pumps) or as a part of the production process (inflate bags, blow off dust & debris).

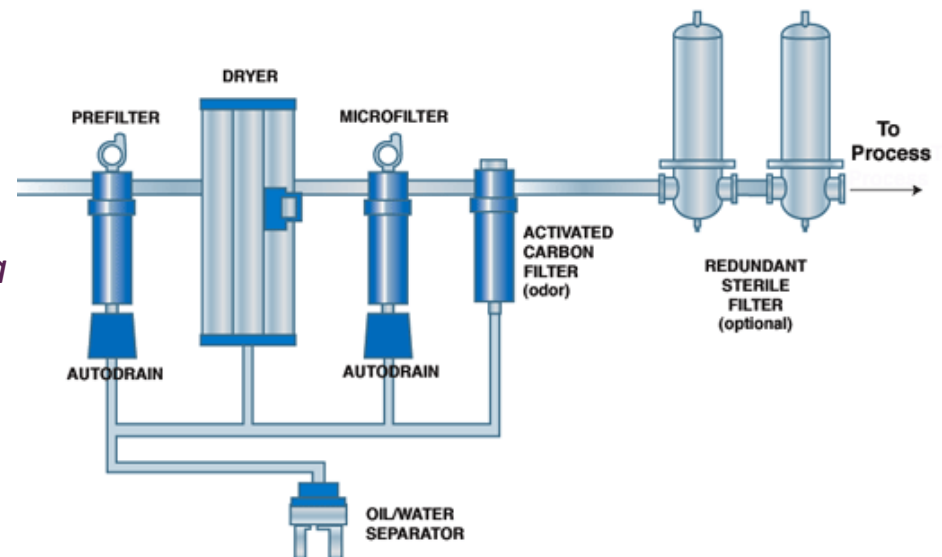
Graver Options

The best option is to utilize a PTFE membrane due to the hydrophobic nature. However, since the systems are under higher pressure, a polypropylene media is also suitable. In instances where a bacterial claim is required, a membrane is necessary.

- TefTEC V 0.2 micron
- TefTEC 1 micron
- QMA 1 micron.

Additional Considerations

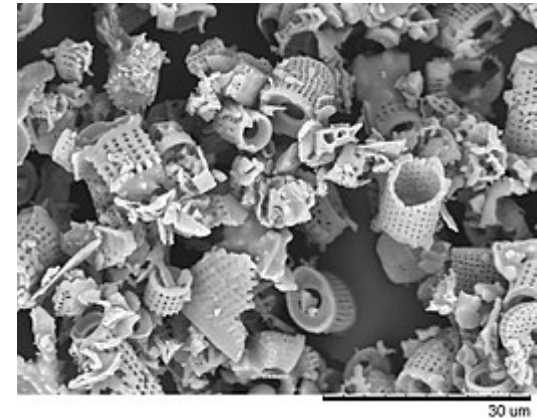
The filters are typically changed out on a PM basis (preventative maintenance) between 3 months and 1 year.



TRAP FILTERS

What is the Filter Issue

Diatomaceous Earth (DE) or other filter aids may be used in beer/wine processes after fermentation to improve the effectiveness (efficiency, capacity) of filter presses. The filter aid may leak from the filter with the process fluid and a filter is required to capture fermentation material.



Graver Options

The goal is to remove particles typically greater than 5 micron. A range of products can be used to include:

- QXL 5 micron
- QMC 1 micron
- PMC 1 micron
- Stratum C 1 or 5 micron

Additional Considerations

The filters may be backwashed, thus pleated are more suitable in those situations. Single layer media such as PMC may be best as QXL and QMC are multi-layered.



BIOBURDEN/MICROBIAL CONTROL

What is the Filter Issue

Healthcare applications, which include cosmetics, pharmaceuticals and diagnostics, require a high level of bacterial control as many are ingested or injected. This can be anything from bioburden reduction to sterile packaging. Addressing some of the most critical applications (SVP) is difficult due to validation with governmental agencies.

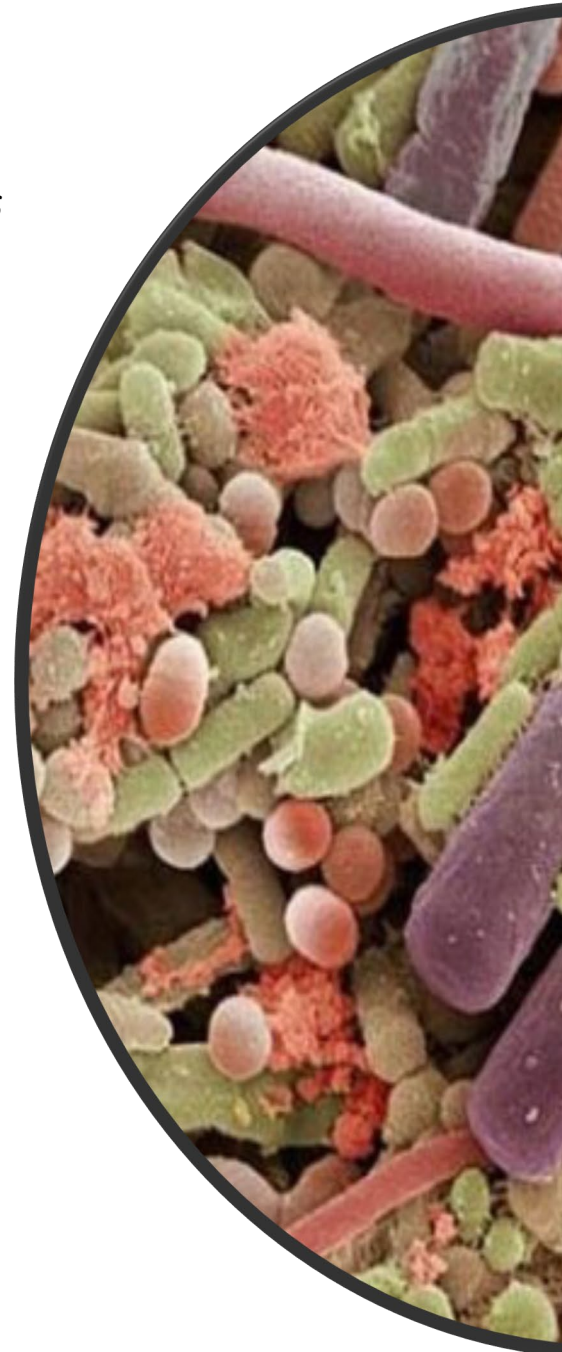
Graver Options

The goal is to remove microbes typically that are in the sub-micron range. Membranes with bacterial claims and appropriate prefilters are required. Single layer membrane products are considered bioburden reduction while the double layer is considered sterilizing grade.

- QSL 0.2 & 0.5 micron
- ZTEC WB 0.2/0.45/0.65
- ZTEC B 0.2 micron
- ZTEC P 0.2 micron

Additional Considerations

Integrity testing is standard for these applications. Support documents are required/requested which document the integrity/bacterial retention correlation as well as other product claims.



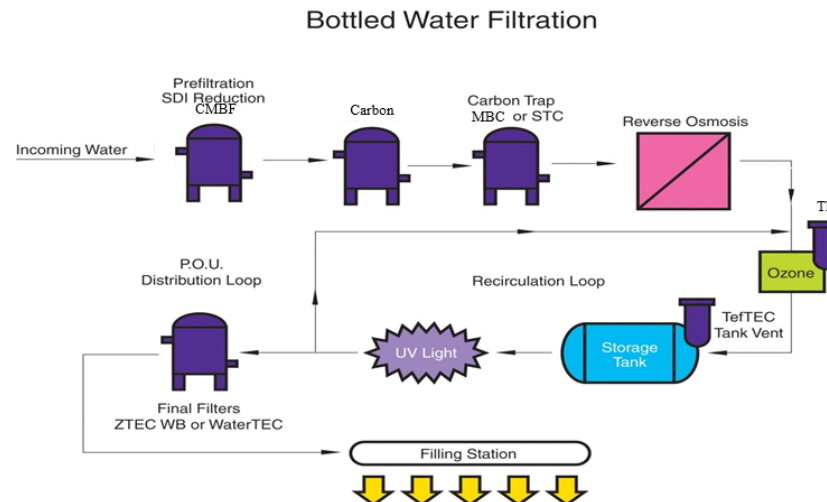
BOTTLED WATER

What is the Filter Issue

Requirements will depend on whether the water is considered purified (Reverse Osmosis) spring water. Purified is produced by reverse osmosis, so filter requirements are those typical of an RO system. Spring water will often require membrane filtration for bottling, or the use of ozone with particle control.

Graver Options

- CMBF™, PMC™, STC™ 1 to 10 micron rated cylindrical melt blown filters provide effective SDI reduction and particulate removal to protect the RO membrane. QCR™ may be utilized where Giardia and Cryptosporidium Cyst reduction is necessary. ZTEC™ WB 0.2 membrane filters effectively remove microbial contamination in the final filtration stage.
- Hydrophobic PTFE membrane for tank vent applications.
- TPE™ Titanium sintered metal powder media can be used following ozonation.



WINE & BEER

What is the Filter Issue

High solids post-fermentation requires technology other than cartridge filters. Once removed, the capture of diatomaceous earth is required where filter press is utilized. The bottling process requires membrane filtration with a suitable prefilter to reduce the risk of microbial contamination which results in spoilage.

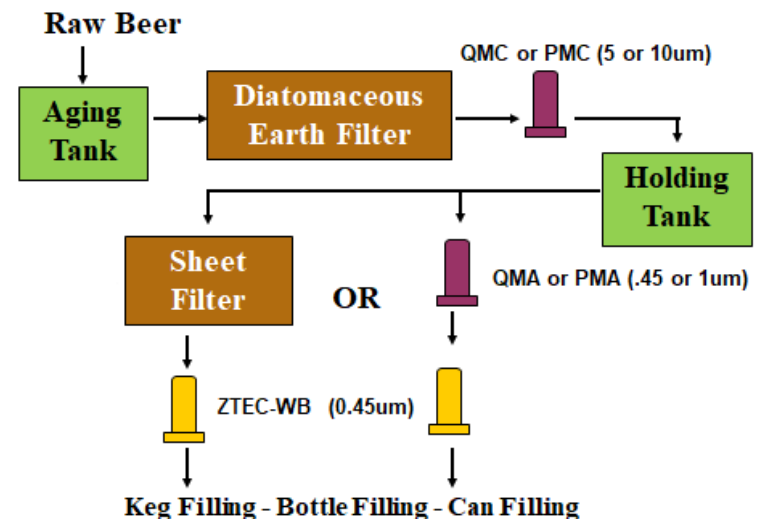
Graver Options

- For trap filtration, Stratum C can be used, but where backwash may be done, products such as QXL or PMC are more suitable.
- Bottling requires a bacterial rated membrane such as ZTEC WB 0.45 (most common) or 0.65. A 1 micron filter is generally recommended, either QMC or PMC/PMA. QSL is also an ideal option due to the 2-in-1 serial construction.

Additional Considerations

Integrity testing is standard for these applications as is cleaning and reuse of the bottling filters. Users will often seek help on integrity test values and testing process as well as recommendation on cleaning.

Beer Filtration



WATER JET

What is the Filter Issue

Companies like Flow International manufacture Water Jets which produce small streams of water under very high pressure to cut fabrics, metals and concrete. The water is pressurized through very small nozzles and must have a high degree of particle control to minimize abrasion and plugging of the nozzle, typically from 1 – 5 micron.

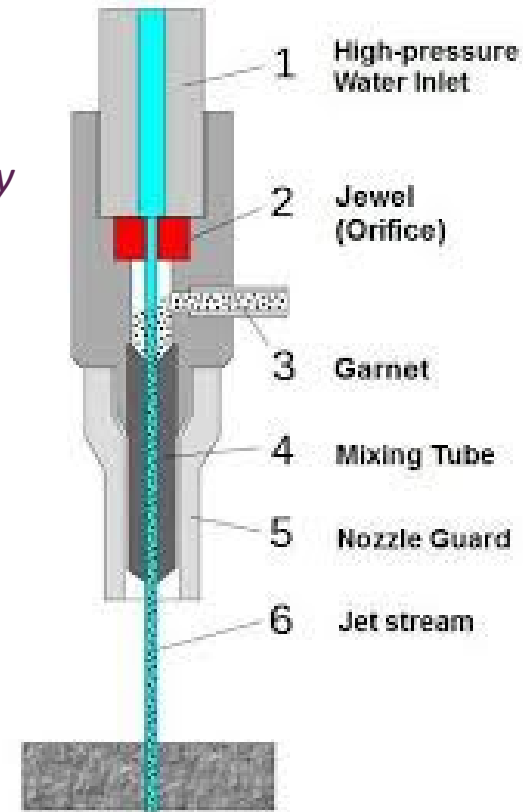
Graver Options

Evaluation of the two OEM filters (prefilter, final filter) from Flow International show that they are very similar in performance at around 3- 4 micron, despite being labeled as a 1 and 0.45 micron.

- PMC 0.45 - 5 micron
- PME 1- 5 micron
- MBC 1 - 10

Additional Considerations

Improvement can easily occur by providing a more practical filter scheme, using a 5 micron/1 micron or a 2 micron/0.45 micron.



INJECTION WELL

What is the Filter Issue

Injection wells are intended as a waste disposal method for potentially hazardous waste. The wells may be thousands of feet underground, typically below a rock base to prevent upward intrusion. The wells must be protected from particle loading into the strata, otherwise it requires costly repair or replacement.

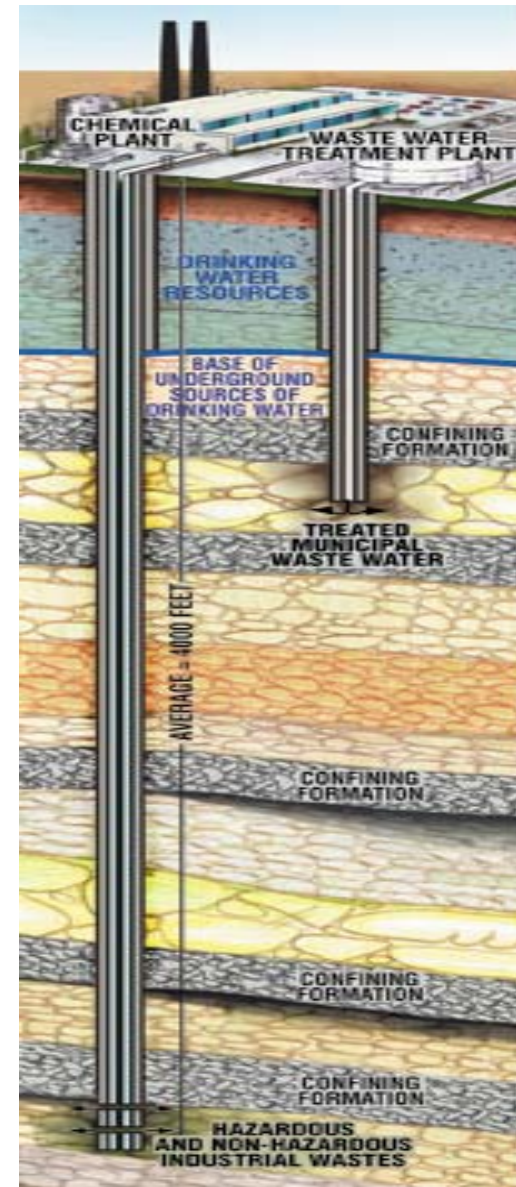
Graver Options

The options are determined by the character of the well. The strata may require sub-micron filtration or as open as 60 – 100 micron depending on the character of the soils. This application has high flow rates, so High Flow is well suited. If sub-micron filtration is required, WaterTEC may be used, but will require adequate prefiltration.

- PMC 1 - 5 micron
- PME 1- 5 micron
- High Flow 1 - 100

Additional Considerations

Each well application is unique and will require some testing/analysis to determine the character of the particles in the wastewater.



TANK VENTS

What is the Filter Issue

Tank Vents are often found on high purity water system storage tanks as well as fermentation tanks. They may serve two purposes: reduce/eliminate unwanted particles from entering the process; reduce/eliminate microbial contamination which can destroy a fermentation process. Since venting occurs at very low pressure, the use of a hydrophobic PTFE media is critical to reduce the risk of wetting out the membrane which will reduce air flow.

Graver Options

Three PTFE options are available:

- TefTEC - 0.2 micron is suited to general particle control and microbial reduction in non-critical applications where a microbial claim is not required
- TefTEC V - 0.2 micron is a lower cost option, but it has an aerosol bacterial removal rating making it suitable for more critical applications - not a liquid sterile claim
- TefTEC P – 0.2 utilized in the most critical applications where sterility is mandated. Rated for absolute retention in liquid.

Additional Considerations

Will need to qualify the microbial requirements in the application to determine the suitability of the TefTEC product. Sizing vent application is critical to prevent damage to a vessel.



INKS

What is the Filter Issue

High performance inks such as those used for ink jet applications require suitable filtration to prevent particle from plugging up nozzles during the printing process. Both dye based and pigment based chemistries are in use, with dye based inks typically being filtered at sub-micron levels. Inks may be solvent based, although more are trending to water based.

Graver Options

QXL is an innovate multi-layer media that is well suited to capturing deformable particle which would be found in pigment based inks. GFC offers an inherit charge that works well with biological contaminants which may be found in dye based inks. WaterTEC is also well suited to dye based inks where a fine level of particle removal is necessary.

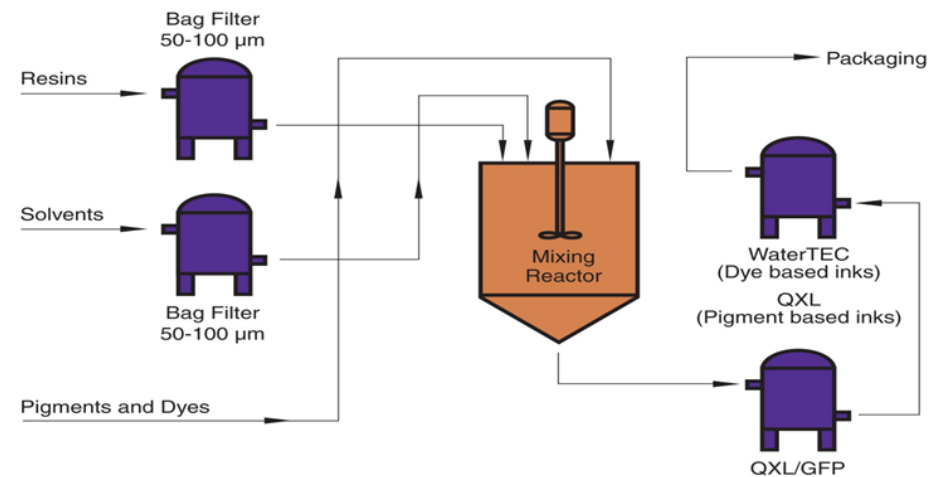
QXL 0.45 - 10 micron

GFC 0.2 – 10 micron

WaterTEC 0.1 – 0.2

Additional Considerations

Multi-stage filtration is typically required. In pigment based inks, agglomerates may form while dye based inks tend to have biological materials, both of which rapidly plug filters.



SEAL FLUSH

What is the Filter Issue

Filtration is employed in heavy industrial applications such as Pulp/Paper mills or oil/gas to protect the seals of rotating equipment (pumps, valves) to ensure that particulate in the flush water, typically sand or silt, is removed. This particulate can become embedded in the packing, cause wearing of the packing sleeve, and lead to pre-mature failure. Such a failure can cause significant upset to the operations of the plant, including downtime, reduced output, thousands of dollars in lost revenue, and a costly repair.

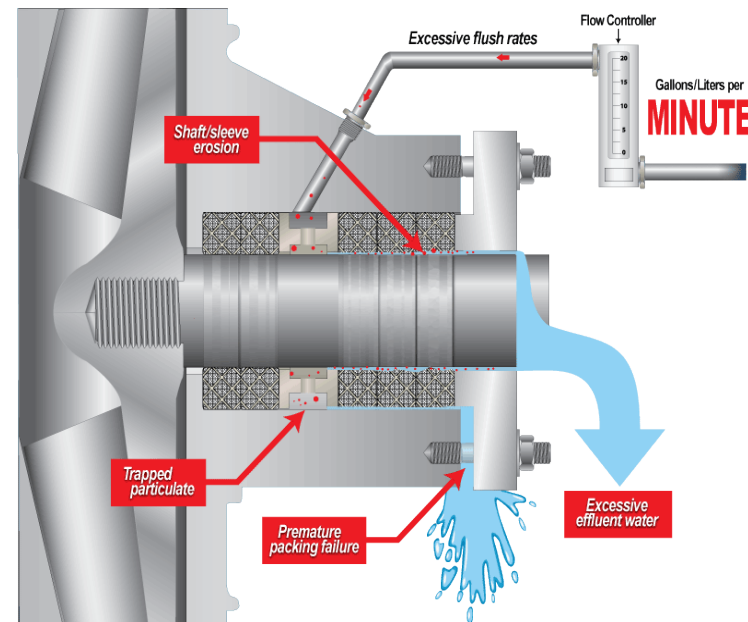
Graver Options

Historically resin bonded filters such as RTEC G have been used for industrial and commercial seal flush applications. High performance melt blown such as Stratum C provide more precise filtration, less fiber migration and longer on-stream life. In high flow applications, the High Flow designs offer a smaller footprint and simpler change-out.

- Stratum A/C 1- 20 micron
- High Flow 1- 20 micron
- RTEC G 1- 20 micron

Additional Considerations

Depending on the source water, multi-stage filtration may be required.



OIL AND GAS

This market has not been actively pursued with the LPF product lines. There are a number of well-established applications for the Air & Gas products where we can work on the synergies of the two segments.

Upstream Processes - Production

Produced Water – High Flow non-soluble organics, suspended solids, used in the production process.

Midstream Processes - Processing, storing, transporting

Natural Gas – LG Coalescer

Downstream Processes- Converting oil and gas into the finished product.

Gasoline, Diesel, Jet Fuel - Particle control in tank farm – GFP, HFGF

Boiler Feed Water – RO Protection with CMBF

Amine Unit – Particle Control for heat exchangers, pumps seals, – Stratum A/C

Instrument Protection – Stratum, LG Coalescer



COOLING TOWERS

What is the Filter Issue

Cooling towers operate at very high flow rates and tend to build up significant levels of contaminant, picking up materials from the air towers (open looped system) and/or developing high level of biofilm over time. Typically the entire flow is not filtered, but rather a side stream of 5 – 10% is used to maintain the solids at an acceptable level.

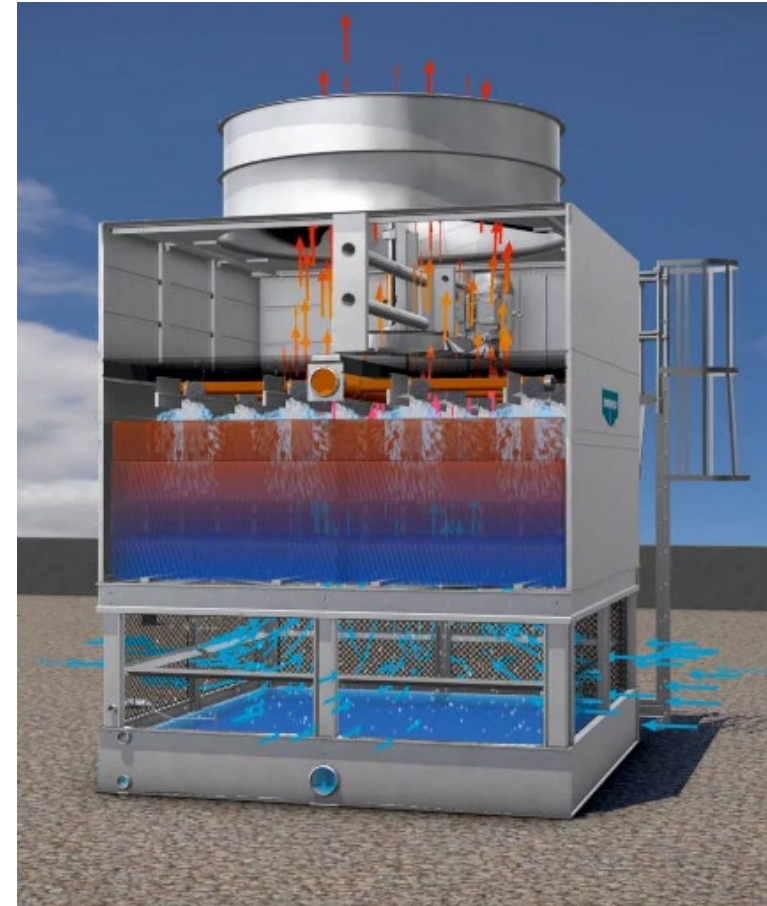
Graver Options

Traditionally, cooling tower filtration was accomplished using a melt blown such as MBC. High Flow is now the primary option due to the flow demand and the need to minimize the footprint of the process.

- High Flow 5 – 20 micron
- MBC 5 - 10

Additional Considerations

Due to the potential for high solids, when replacing or adding filtration into a loop, it is recommended to start more open and over time move to a tighter rating until the filtration goal is reached.



PRODUCT SPOTLIGHT: HIGH FLOW



HF 1 x 60"



8"



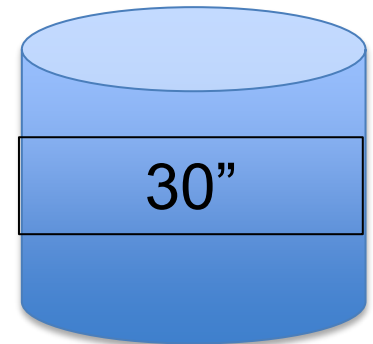
26 x 40" PLT



27"



36 x 40" Depth



30"

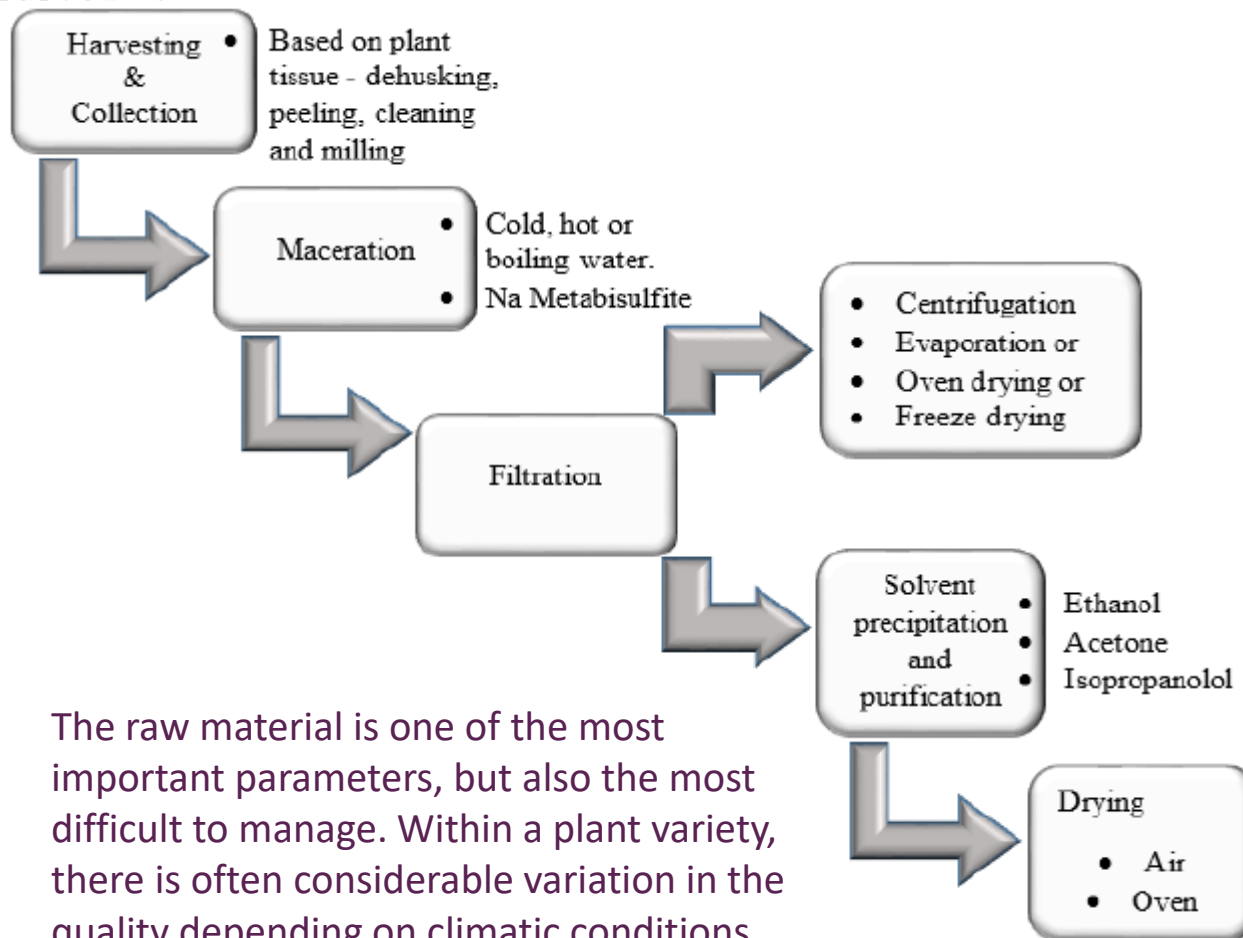
- Smaller housing footprint
- Lower capital investment
- Handles flows up to 375 GPM (60" element)



Certified to
NSF/ANSI Standard 61 for
materials requirements only.
COMPONENT



EMERGING TREND: PLANT EXTRACTS



The specificity and yield of the extractions also depend on their intrinsic parameters (quality of the solvent, choice of equipment and properties pertaining to the procedures).

The raw material is one of the most important parameters, but also the most difficult to manage. Within a plant variety, there is often considerable variation in the quality depending on climatic conditions, cultivation practices, geographical origin, etc.

EMERGING TREND: EV BATTERIES

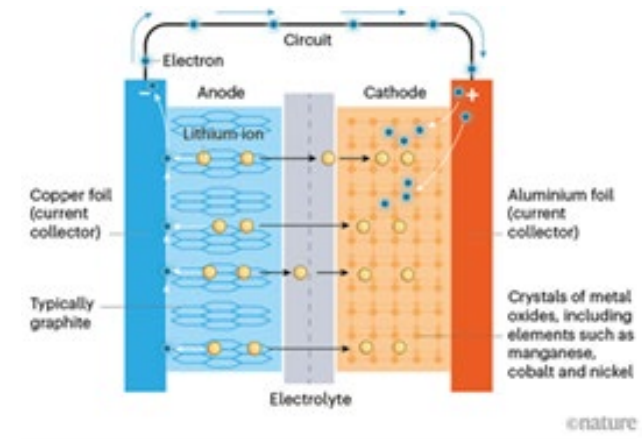
What is the Trend

Most electric vehicles in the market today utilize essentially the same battery technology. The underlying chemistry is not any different than the battery technology used in your smart phone or other mobile device, except it is utilized at a much larger scale. Battery packs are built from individual cells, assembled into modules and incorporated into packs. There are three main technologies used: cylindrical, prismatic, pouch.

Filtration Opportunity

Two key processes with battery manufacturing where high-quality particle control is required:

- *Electrolyte Solution - lithium salt solution such as lithium hexafluorophosphate that allows an electrical charge to pass between the anode and the cathode;*
 - 0.5 – 1 micron QMA or PMA
- *Anode/Cathode Slurry - solvents and water are used to create the slurry which is must further be managed during coating*
 - WaterTEC 0.2 or TefTEC 0.2 (compatibility)
 - 1 micron QXL or Stratum A - agglomerate filtration



REVERSE OSMOSIS – PRE RO

What is the Filter Issue

Reverse Osmosis membrane filters are used to produce high purity water either as bottled water or as a municipal source (desalinization) and require a prefilter to assure that the incoming water meets an SDI (silt density index) specification of less than 5 .

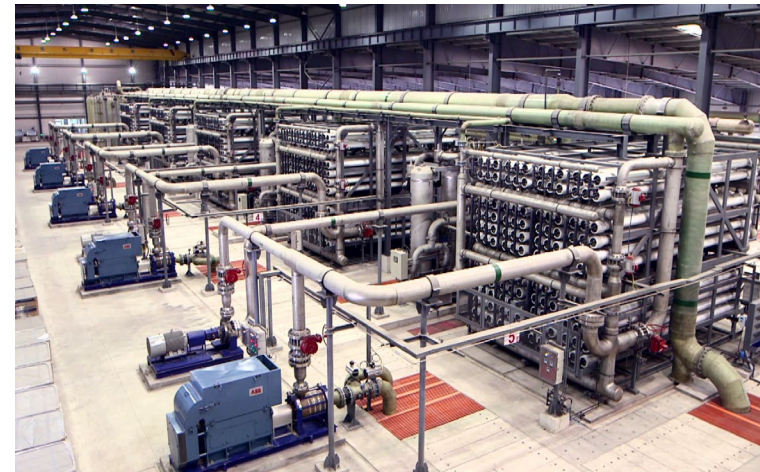
Graver Options

Generally the pre RO filter for the food and beverage industry is a nominally rated melt blown. Large diameter filters are starting to gain ground where space, flow and change-out is an issue.

- MBC 1 or 5 micron
- CMBF 1 or 5 micron
- High Flow 1 or 5 micron.

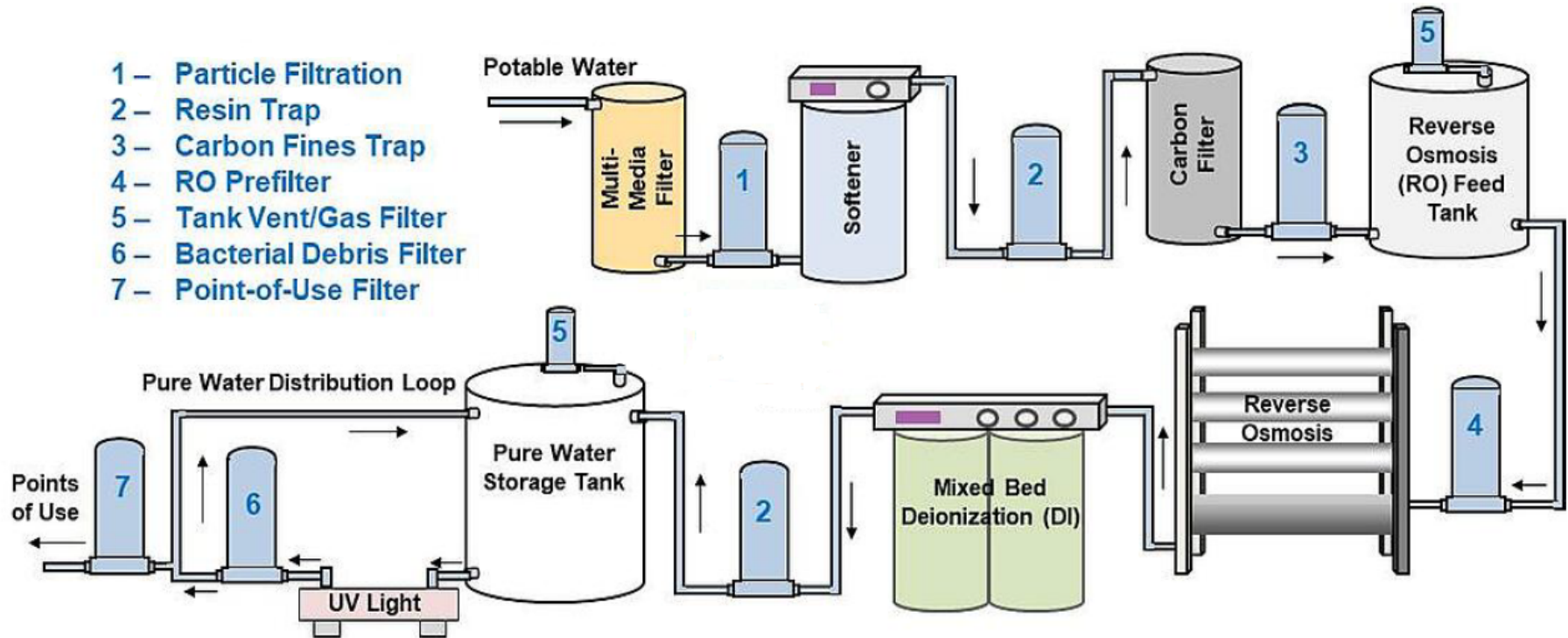
Additional Considerations

Highly competitive application area with numerous manufacturers. The multi-zone construction, product consistency and NSF 61 are the key points for Graver melt blown. High Flow option is driven by need for longer on-stream life, better retention, ease of use and smaller footprint.



SCHEMATIC: PRE RO

RO/DI System for High Purity Industrial Process Water



DID YOU KNOW.....

Silt Density Index

What is It?

Silt Density Index or SDI (ASTM standard test method D 4189-82), is the empirical test developed for measuring the potential rate of fouling of nano filtration (NF) or RO membranes. It represents the potential fouling of the membranes by finely suspended particles (silt), bacteria, and organics that may be present in the feed water.

How is it Performed?

Measure the time required to filter a fixed volume of water through a standard 0.45µm pore size microfiltration membrane at a constant pressure of 30 psi (2.07 bar), normally initially and after 5, 10 and 15 minutes (after silt build up). The SDI value is calculated a ratio of percent plugged at each point, with the 15 minute value typically reported.

What does it Mean?

Membrane manufacturers and system designers insist that the 15 minute SDI value of the feed water should be as low as possible, and in any case, should not exceed 5.0, to minimize fouling of membranes.



HIGH PURITY WATER SYSTEMS

What is the Filter Issue

The healthcare and microelectronics industry consume significant amounts of water with high purity standards. For microelectronics, particle control below 0.1 micron, metal extractables, TOC recovery are some key aspects. For healthcare, the quality will depend upon the purpose, with standards from Purified Water to Water for Injection (WFI), but will have aspects of microbial or endotoxin control dictated depending on how it is being used.

Graver Options

In addition to the requirement for pre RO filters, membrane filters are essential to achieve the required levels of particle and microbial control. Generally the pre RO filter for the food and beverage industry is a nominally rated melt blown. Large diameter filters are starting to gain ground where space, flow and change-out is an issue.

- CMBF/MBC 1 or 5 micron
- QMA/PMA 1 micron
- ZTEC E/ZTEC B/ZTEC P 0.03- 0.2 micron

Additional Considerations

High Purity Water system filters are installed for extended periods of time from several months to several years, so having a presence is essential to getting the opportunity to secure the business. Due to the price point of membranes, the sales, while infrequent, can be significant.

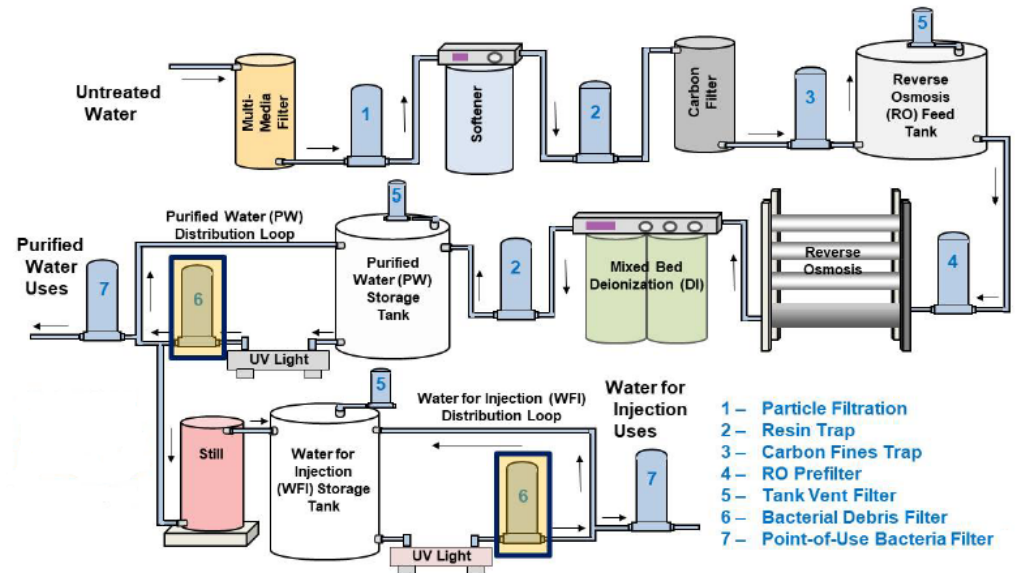


SCHEMATIC : HIGH PURITY WATER

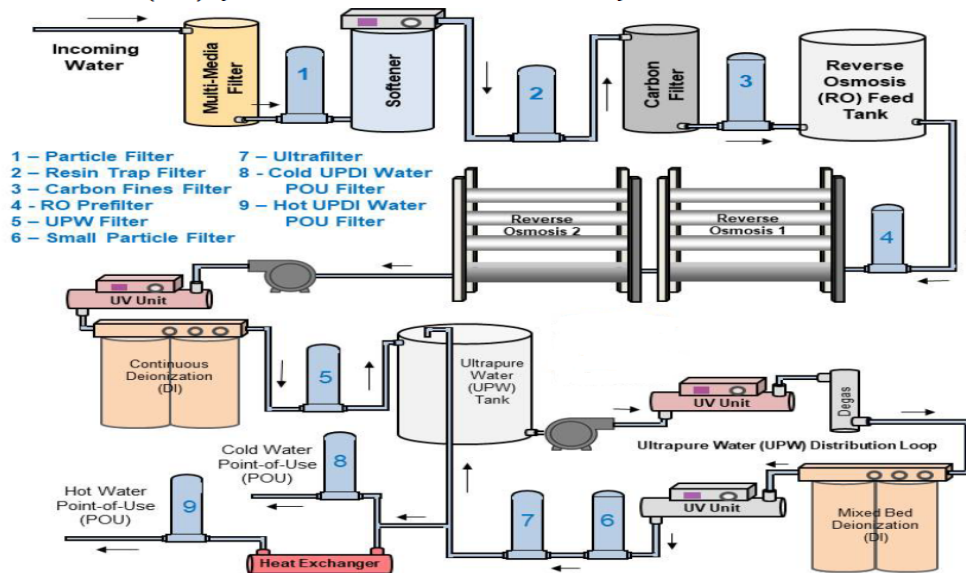
Bacteria Reduction in Pharmaceutical Water Systems

THE 8 TYPES OF WATER ARE:

- Non-potable
- Potable (drinkable) water
- USP purified water
- USP water for injection (WFI)
- USP sterile water for injection
- LUSP sterile water for inhalation
- USP bacteriostatic water for injection
- USP sterile water for irrigation



Ultra-Pure Water (UPW) System for Electronics/Semiconductor Industry



Type 1 Ultrapure -18.2MΩ-cm

Molecular biology
Electrochemistry
Critical cell and tissue culture
(GF)AAS, HPLC, IC, ICPMS, GC, MS
DNA sequencing
Genomics
Proteomics
Immunology
Pharmacology



DIALYSIS RINSE WATER

What is the Filter Issue

While the water used in dialysis clinic does not come in direct contact with the patient, it has both bacterial and endotoxin requirements. The filter typically used is hollow fiber which makes endotoxin reduction claims. While PES membrane filters will not remove endotoxin, the thermally bonded PES filters are resistant to many sanitization chemicals which degrade the potting used in hollow fiber filters.

Graver Options

Due to the rating of the hollow fiber filters originally used, ZTEC 0.03 is the choice. The filters are used in a recirculating loop after the storage tank. Super-chlorination (1 – 3%) is possible with PES, thus eliminating the bacteria that are associated with endotoxin, so endotoxin removal is not necessary. Water is produced using RO, so Pre RO filters such as Crystal MBF are used.

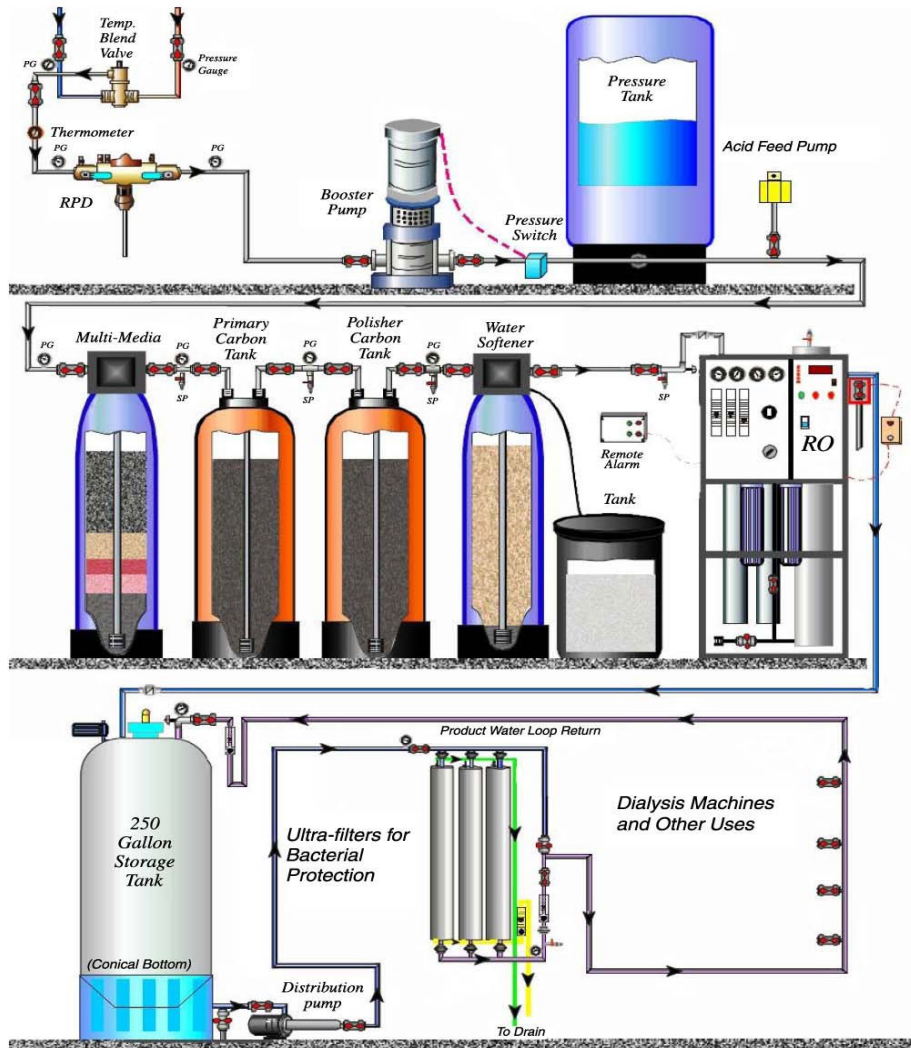
- ZTEC E 0.03 micron
- CMBF

Additional Considerations

Regular sanitization using bleach is common practice. Some systems may use ozone, which has very limited compatibility with most polymeric filters.



SCHEMATIC: DIALYSIS RINSE WATER



Art Work Courtesy of Byron Roshto and Renal Care Group Northwest

Association for the Advancement of Medical Instrumentation (AAMI)

Contaminant	Maximum Concentration mg/L (Unless otherwise noted)	Test Methodology
Calcium	2 (0.1 mEq/L)	EDTA Titrimetric Method, or Atomic Absorption (direct aspiration), or Ion Specific Electrode
Magnesium	4 (0.3 mEq/L)	Atomic Absorption (direct aspiration)
Potassium	8 (0.2 mEq/L)	Atomic Absorption (direct aspiration), or Flame Photometric Method, or Ion Specific Electrode
Sodium	70 (3.0 mEq/L)	Atomic Absorption (direct aspiration), or Flame Photometric Method, or Ion Specific Electrode
Antimony	0.006	Atomic Absorption (platform)
Arsenic	0.005	Atomic Absorption (gaseous hydride)
Barium	0.10	Atomic Absorption (electrothermal)
Beryllium	0.0004	Atomic Absorption (platform)
Cadmium	0.001	Atomic Absorption (electrothermal)
Chromium	0.014	Atomic Absorption (electrothermal)
Lead	0.005	Atomic Absorption (electrothermal)
Mercury	0.0002	Flameless Cold Vapor Technique (Atomic Absorption)
Selenium	0.09	Atomic Absorption (gaseous hydride), or Atomic Absorption (electrothermal)
Silver	0.005	Atomic Absorption (electrothermal)
Aluminum	0.01	Atomic Absorption (electrothermal)
Chloramines	0.10	DPD Ferrous Titrimetric Method, or DPD Colorimetric Method
Total chlorine	0.50	DPD Ferrous Titrimetric Method, or DPD Colorimetric Method
Copper	0.10	Atomic Absorption (direct aspiration), or Neocuproine Method
Fluoride	0.20	Ion Selective Electrode Method, or SPADNS Method
Nitrate (as N)	2.00	Cadmium Reduction Method
Sulfate	100.00	Turbidimetric Method
Thallium	0.002	Atomic Absorption (platform)
Zinc	0.10	Atomic Absorption (direct aspiration), or Dithizone Method

DID YOU KNOW.....

Endotoxins

What is It?

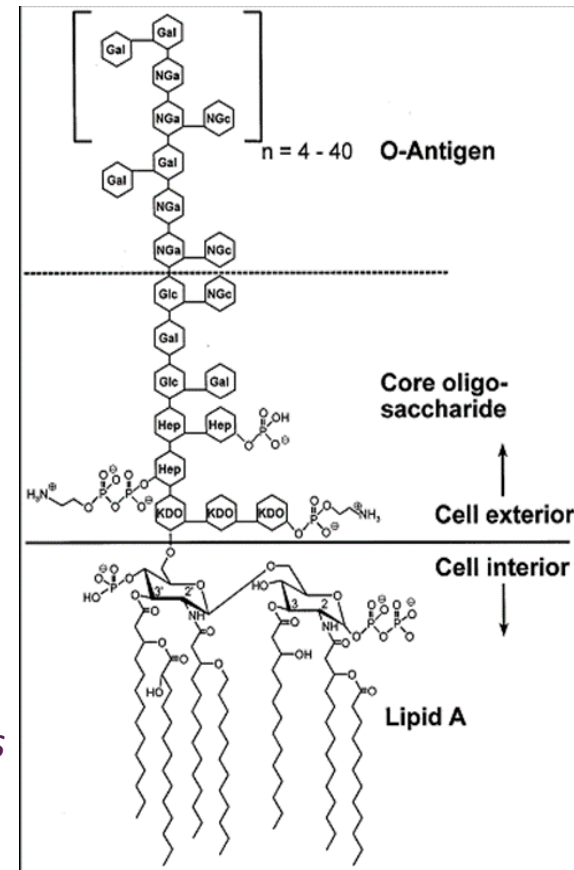
Part of the outer membrane of the cell wall of Gram-negative bacteria. In bacteriology it is used to refer to the **lipopolysaccharide** complex associated with the outer membrane of Gram-negative pathogens such as *Escherichia coli*, *Salmonella*, *Shigella*, *Pseudomonas*, *Neisseria*, *Haemophilus*, *Bordetella* and *Vibrio*. Endotoxin, also referred to as **pyrogen**, is continuously shed from the outer membrane of viable gram-negative bacteria and is released when the bacterial cell dies.

Why is it a Concern?

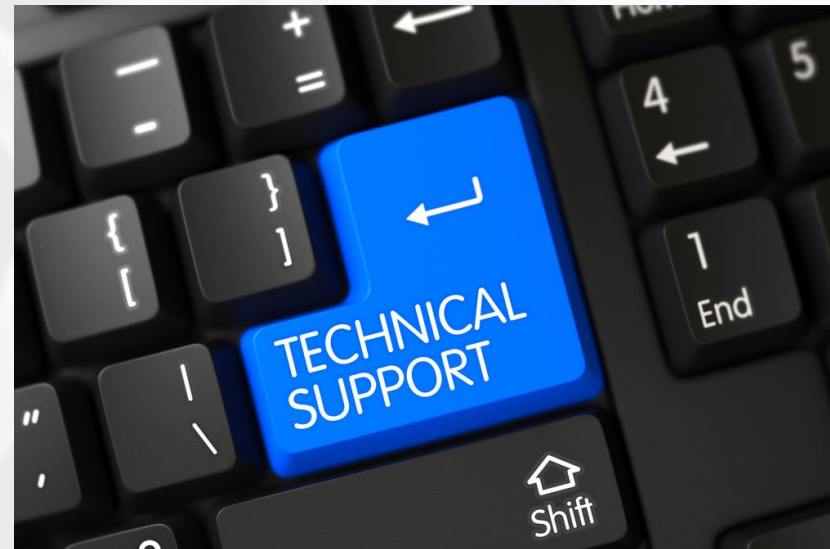
Endotoxins are heat and pH stable, meaning they are difficult to eliminate by typical sanitization methods. They produce fever, tissue injury and death in mammals, and is an even higher risk for immuno-compromised individuals (sick, elderly).

What does it Mean?

Water systems, medical devices, pharmaceutical components and critical filters such as ZTEC will have LAL claims, which is a measure of endotoxin levels that extracts from a product. The best control is to reduce or eliminate contaminating bacterial in a system.



SUPPORT



WEB SITE: WWW.GRAVERTECH.COM

- Great source for downloading support documents.
- Distributor protected page with additional documents
 - Pricing
 - Training Modules
 - COC
 - Housing Drawings

The screenshot shows the Graver Technologies website homepage. The header features the Graver Technologies logo on the left, a search bar with a 'SEARCH' button in the center, and links for 'MetSorb® Calculator Login', 'Distributor Login', and a language selector set to 'EN' on the right. A dark purple navigation bar contains links for 'Products', 'Industries We Serve', 'Company Contacts', 'About Us', 'Product Finder', 'Downloadable Resources', 'Request Quote', and a 'Contact' button with a phone icon. The main content area has a background image of industrial piping and tanks. It features the headline 'Engineered Solutions For Your Next Challenge. And The One After That.' followed by the text 'Graver Technologies delivers solutions to the toughest challenges in industrial filtration, separation, and purification for companies around the world.' Below this is a white button with a phone icon and the text 'CONSULT WITH AN EXPERT'. A dark purple section titled 'Industries We Serve' lists 'Air Purification/OEM', 'Food & Beverage', 'Healthcare', 'Industrial', 'Microelectronics', 'Power Generation', and 'Water Treatment'. A 'Custom/OEM Applications' link is highlighted in white, and a 'VIEW ALL' link is on the right. A 'Get Help' button with a question mark icon is in the bottom right corner. A small accessibility icon (a person in a wheelchair) is in the bottom left corner.

Graver Technologies

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Application Brief

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www.gravertech.com

AB-002

Vent Filtration Basics Elements of System Sizing

Tanks are commonly used for storing a variety of liquids. To protect the liquid contents from microbial or particulate contamination, it is customary to install a vent filter on the tank. When liquid is added or removed from a tank, air must move in or out of the tank to fill the changing airspace above the liquid. A tank vent filter allows air to flow in both directions and prevents possible damage to the tank that could result if air is compressed during tank filling or a vacuum is created during tank emptying. It is critical, therefore, to size for proper air flow under both normal operating conditions as well as potential CIP or steam conditions, taking into consideration the pressure and vacuum ratings of the vessel.

Factors Affecting Life

Vent filters tend to have significant life spans, often being in service from 3 months to 1 year. The life will depend upon a number of factors including environmental conditions, the operating temperature of the system as well as the choice of media.

- Like any other filtration application, filter life will depend upon the volume of particles the filter is exposed to. Because the filter operates in both directions, there is some natural cleaning of the filter that occurs as the tank fills and forces air in the reverse direction. Obviously life span will be shorter in a dusty environment compared to the life span in a pharmaceutical clean room.
- In general, high temperatures will have a negative impact on filter life. In critical applications, steam cycles are common to prevent microbial contamination. Steam will cause expansion and contraction of the filter (as it heats and cools) which may ultimately damage the structural integrity of the filter. In those operations that use a steam jacketed filter housings or heat tracing on the filter housing, the constant high temperature, which may range from 65°C to 120°C, results in oxidation of the polypropylene components and may lead to failure.
- For a vent filter to function properly, the media must remain dry, so avoid contact with either the contents in the tank or environmental conditions. A wetted filter is impermeable to the bulk flow of air until the pressure reaches a point where the liquid in the pores is displaced (bubble point). Since tank venting is done at essentially atmospheric pressure, this pressure is not achieved and may be higher than the vacuum or pressure rating on the tank. As such, it is best practice to choose a hydrophobic material for the application, with PTFE membrane being the optimal choice.



Application Case Study

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ACS-006

High Flow Filters Clean up Chilled Water Loop

Application:	Chilled Water Loop for Industrial Engine Manufacturing Plant
Current Product Used:	New application, but also considered depth filters and bags
Graver Product:	Graver Technologies High Flow Series (100, 40 and 20 micron)

Discussion:

A major industrial engine manufacturer was experiencing contamination from pipe rust and biofilm in a closed loop water systems that was causing abrasive wear, fouling heat exchangers, cooling pipe work, and affecting the operation of valves and mechanical pump seals.

It was decided that a 500 GPM side stream filtration loop was needed to gradually remove this contamination from the 500,000 GPM system. The engineer in charge of this project considered use of multi-stage depth filters as well as bag filters, although he preferred the higher efficiency of depth filters. Graver met with the engineer and recommended two 60" HF housings manifolded together with 2-60" High Flow filters. While the 60" HF filter can handle 500GPM, the inlet/outlet requirement for the housing was not feasible for the customer, so 4" flanged connections were specified that allowed for 250GPM per housing.



Graver High Flow Housing installed on chilled water loop

Results:

- The High Flow system was much smaller than the proposed depth or bag filter systems
 - Each High Flow Housing is 12" in diameter and the sloped design fit easily against the wall under pipework, with no hinge or davit arm to contend with.
 - A depth filter cartridge housing would have been approximately 25" in diameter and need to be located away from wall to allow for head removal and filter changeout.
 - Bags were ruled out as the system would have been too large to fit the available space.
- Filter changeout cost was reduced by 30-60% compared to bags or depth filters
 - A single High Flow 20 micron, 60" element has a list price of \$425.
 - 25 40" Absolute rated depth filter would cost \$800-1100 per change out for a 20um.
 - Bag filter changeout was estimated at \$600+ for absolute rated bags.
- Changeout time was significantly reduced with a single High flow element (10-15 minutes) instead of 25 40" depth filters with tube guides and springs.
- Customer achieved system cleanup by stepping down microns over an extended period of time, progressing from 100 micron to 20 micron.
- System cleanup was accomplished with use of a single 60" High Flow run at 250 GPM.

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SELECT CARTRIDGE FILTRATION TOPICS

Selected topics to address commonly asked question for the application of cartridge filters in industrial processes

LAB SERVICES



- Submit AWR (Application Work Request) to your RSM.

- Must be approved before sending in samples.

- Some limits on samples types

- Compatibility with equipment
- Hazardous materials
- Disposal issue.



AWR20-

Graver Technologies

Application Work Request

Please complete this form as thoroughly as possible; application detail must be included. Submit to your Regional Sales Manager: RSM@gravertech.com. Your request will be reviewed within 2 days and, if approved, you will be provided an AWR number. Include a hardcopy of this form with the sample(s) as well as MSDS (if required). Samples should be sent to Doug Knigge, Graver Technologies, 200 Lake Drive, Glasgow, DE 19702.

Requestor Information

Distributor:	Location (City, State, Country):
Distributor Rep:	Phone Number:

Customer Information

User:	Location (City, State, Country):
User Contact:	Phone Number:
Estimated Annual Sales for This Opportunity:	

Application Information

Fluid:	Temperature:
Total Flow Rate:	Flow Rate:
Viscosity:	Process Volume:
Filtration Objective:	

Sample Description (identify what is being sent - qty, part number, type of sample, etc)

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Test Objective (purpose of the test - i.e. identify Graver equivalent, recommended prefilter, etc.)

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Safety Certification

In general, Graver will not accept hazardous samples for analysis. You must certify, by signing below, that the sample(s) included in this shipment is(are) microbiologically safe and non-toxic.

Signature, Sample(s) Provider _____ Date _____

RSM Approval

_____ Date: _____

QUESTIONS

The most exciting phrase to hear in science, the one that heralds new discoveries, is not 'Eureka!' (I found it!) but 'That's funny ...'

Isaac Asimov



how planes fly

