Clean & Safe Drinking Water Workshop
Gander, NL

PRESSURE FILTER
OPERATION AND MAINTENANCE

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By: Robert Gillis, P.Eng.
Atlantic Purification Systems
PRESENTATION AGENDA

• Media Types
• Filter Types
  – Filters versus Conditioners
• Valve Types
  – Time Clock, Meter Initiated, Pressure Differential, Manual
• Installation Procedures
• Operation Procedures
  – Filter and Conditioner Sequences
• Maintenance
  – Backwashing, Regeneration, Chemical Cleaning, Media Replacement
MEDIA TYPES
MEDIA TYPES

• Media Types
  – Determined by raw water quality
  – Varies from application to application
  – May use one or more medias in the same tank
  – May use one or more filters in series for complete treatment
  – Variety of products out there on the market
  – Some regulations require media with NSF Certification
MEDIA TYPES

• Activated Carbon (Various Types and Grades)
  – Reduction of chlorine, taste and odors

• Anthracite
  – Medium density filtration – used in single, dual or multi-media filtration

• Birm
  – Reduction of iron and manganese
  – Passive or active air injection prior as an oxidizing agent

• Calcite
  – White marble media
  – Neutralizes acidic or low pH waters to neutral or less corrosive
MEDIA TYPES

• Corosex
  – Neutralizes acidic or low pH waters to neutral or less corrosive
  – Very fast reaction which sometimes over corrects to high pH
• Filter Sand and Gravel
  – Low density filtration – used as base material or single media filtration
• Filter-AG or Filter-AG-Plus
  – Highly efficient media for reduction of suspended matter
• Greensand FMH or Manganese Greensand or Greensand Plus
  – Reduction of soluble iron, manganese and hydrogen sulfide
  – Requires conditioning with chlorine or potassium permanganate
MEDIA TYPES

- Garnet
  - Final filtration of a multi-media down flow filtration bed
- Micro-Z
  - Highly efficient media for reduction of suspended matter
- MTM or Pyroluz
  - Reduction of iron, manganese and hydrogen sulfide
- Multi-Media
  - Efficient media for reduction of suspended matter
  - Mixture of anthracite, garnet, sand and gravel
MEDIA TYPES

• Bayoxide E33
  – Reduction of arsenic

• Organic Reduction
  – Strong base anion exchange resins
  – Reduction of organics – TOCs and Tannins
  – Regeneration using salt water brine

• Softeners
  – Strong acid cation exchange resins
  – Reduction of hardness (as CaCO₃) in water
  – Increases chloride (Cl) and sodium (Na) levels
MEDIA TYPES

• Deionization
  – Various anion and cation resins
  – Regeneration required either in-situ or off site
  – Some medias specific to reduction of one parameter
  – Others will reduce group of parameters
MEDIA TYPES

Softener

Chem Free Iron Filter / Neutralizer

Greensand Filter

Multi-Media Filter

MEDIA

Resin
(Amber to Blonde)

Support Bed
(when supplied)
Fine, Medium and/or Coarse Gravel

MEDIA
Calcium Carbonate & Magnesium Oxide
Mixed
(Grey / White)

Support Bed
(when supplied)
Fine, Medium and/or Coarse Gravel

MEDIA
Greensand (Black)

Support Bed
(when supplied)
Fine, Medium and/or Coarse Gravel

MEDIA
Anthrafilt / Anthracite (Black)
Fine Sand
Fine Garnet (Purple)
Coarse Garnet (Purple)

Support Bed
(when supplied)
Fine, Medium and/or Coarse Gravel

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MEDIA TYPES

Organic Color Removal
- OCR Resin (White)
- Support Bed (when supplied) Fine, Medium and/or Coarse Gravel

Chem Free Birm Filter
- Birm (Grey)
- Support Bed (when supplied) Fine, Medium and/or Coarse Gravel

Iron Softener
- Resin (Amber to Blonde) & Garnet Fine (Purple) Mixed
- Support Bed (when supplied) Fine, Medium and/or Coarse Gravel

Carbon Filter
- Carbon (Black)
- Support Bed (when supplied) Fine, Medium and/or Coarse Gravel

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FILTER TYPES
FILTER TYPES

• Filters
  – Consists of:
    • Pressure Vessel – Fiberglass, PVC or Stainless Steel
    • Valve
    • Distributor / Hub & Lateral
    • Retention or Upper Screen – not always
    • Drain line flow control – internal or external
    • Riser / Distribution Tube
    • Media
    • Under bed support gravel/sand
FILTER TYPES - PICTURES
FILTER TYPES

- Conditioners
  - Consists of:
    - Same components as Filters
    - Brine/Regenerative material storage tank
    - Brine well
    - Brine tubing for suction & fill
    - Brine control valve
  - Some conditioners can accept continuous regeneration with a feed of chlorine or potassium permanganate injection prior to filter
CONDITIONER TYPES - PICTURES
VALVE TYPES
VALVE TYPES

• Autotrol, Fleck, Clack, or Kinetico
  – Control Available in
    • Time Clock Regeneration/Backwash
    • Metered Initiated Regeneration/Backwash
    • Differential Pressure Regeneration/Backwash
    • Manual

• Manual Valves
  – Open and close valves to direct flow to perform different filter functions

• Others
  – Pneumatic or hydraulically actuated valves with a controller
VALVE PICTURES
INSTALLATION PROCEDURES
INSTALLATION PROCEDURES

• READ INSTALLATION INSTRUCTIONS PROVIDED BY MANUFACTURER

• Filter Location
  – Position near a floor drain with adequate carrying capacity to handle the water filter backwash rate
  – Suitable flooring required

• Piping Installation
  – Install piping as shown on General Arrangement Drawings
  – Include unions on inlet, outlet and drain lines for easy disconnection
  – Install isolation valves on inlet and outlet
  – Install by-pass piping
INSTALLATION PROCEDURES

- Hub, Lateral & Riser Installation
  - Temporarily install valve on tank to ensure proper alignment of the inlet and the outlet piping
  - Once media is installed, it will be difficult to move the tank.
  - Temporarily attach riser tube to hub in order to determine correct riser tube height. Cut riser to height indicated in manual
  - Permanently attach riser to hub
  - Install hub portion of riser/hub assembly into top mount access port
  - Inspect all laterals for damage
  - Attach laterals to hub per manufacturers instructions
  - Place hub and laterals at the bottom of the filter. Cover riser tube to prevent media and water intrusion
INSTALLATION PROCEDURES

• Filter Media Loading
  – Ensure tank alignment is correct
  – Verify all media is on site
  – Fill filter vessel with ¼ to 1/3 water
  – Refer to O&M Manual for media sequencing and quantities
  – With bottom media first, using a funnel, slowly and gently poor media into the unit – usually gravel is added first
  – Continue adding media layers as required
INSTALLATION PROCEDURES

• Final Assembly
  – Attach valve to top of filter
  – Connect to inlet, outlet & drain piping
  – Put filter into backwash mode
  – Slowly open inlet valve and allow filter to fill and all the air to escape
  – Allow unit to stay in backwash mode to thoroughly remove fines and clean media. Some medias may require a soak-in period. Consult manufacturer
  – If electronically actuated valve, unplug valve to allow filter to stay in Backwash mode until drain line water is clear.
  – Power valve and allow valve to return to Service operation
  – Alternatively backwash filter several times to remove the fines and clean the media
  – Ensure all leaks are eliminated
INSTALLATION PROCEDURES

• Brine Tank
  – Install Air Check Valve on Valve
  – Connect brine draw line between valve and brine tank
  – Adjust float assembly in brine tank for proper water level
  – Ensure overflow line is free and piped to drain
  – Ensure regenerant support base is properly installed
  – Fill tank with regenerant (salt, potassium permanganate or other)
FILTER OPERATIONS
FILTER OPERATIONS

- **Service**
  - Untreated water is directed down through the media and up the dist. tube to outlet

- **Backwash**
  - Flow is reversed
  - Down the distribution tube and up through the media.
  - Lifts media and causes scouring
  - Debris is flushed to the drain

- **Slow Rinse**
  - Directed down through the media bed and up the distribution tube to drain
FILTER OPERATIONS

• Re-pressure
  – Position in valve head to allow air and water pressures to hydraulically balance

• Fast Rinse
  – Water is directed down through the media and up through the riser tube to drain to rinse off any remaining brine or debris
CONDITIONER OPERATIONS

• Service
  – Untreated water is directed down through the media and up the distribution tube to outlet

• Backwash
  – Flow is reversed
  – Down the distribution tube and up through the media.
  – Lifts media and causes scouring
  – Debris is flushed to the drain

• Brine /Slow Rinse
  – Water flow is directed to brine injector and brine is drawn from the regeneration tank
  – Directed down through the media bed and up the distribution tube to drain
CONDITIONER OPERATIONS

• Re-pressurize
  – Position in valve head to allow air and water pressures to hydraulically balance

• Fast Rinse
  – Water is directed down through the media and up through the riser tube to drain to rinse off any remaining brine or debris

• Brine Refill
  – Water is directed at a controlled rate to the regenerant tank to create brine for the next cycle
  – Maintain salt above water level
CONDITIONER OPERATIONS

- Service Position
CONDITIONER OPERATIONS

• Preliminary Rinse Position
CONDITIONER OPERATIONS

• Backwash Position
CONDITIONER OPERATIONS

• Brine Position
CONDITIONER OPERATIONS

• Slow Rinse Position
CONDITIONER OPERATIONS

• Second Backwash Position
CONDITIONER OPERATIONS

- Settling Rinse Position
CONDITIONER OPERATIONS

- Brine Tank Fill Position
MAINTENANCE PROCEDURES
MAINTENANCE PROCEDURES

• Backwashing
  – Utilized to lift and scour the filter bed
  – Redistribute media to avoid channeling or packed bed
  – Use raw or treated water
  – Optional conditions
    • Time Clock
      – Backwashes on a schedule
    • Meter Initiated
      – Measures water volume and backwashes when filter has treated pre-determined volume
    • Differential Pressure
      – Measures pressure differential across filter and backwashes filters when DP exceeds pre-determined maximum DP
    • Manual
      – Either via the opening and closing of a single valve or multiple valves
MAINTENANCE PROCEDURES

• Regeneration
  – Some medias require regeneration
  – Purpose is to recharge the bed with elements that either exchange or act as a catalyst for removal action
  – Common Solutions
    • Brine – Salt
    • Potassium Permanganate
    • Hydrochloric Acid (HCl)
    • Others – depending on media and application
  – Continuous or Intermittent (during backwash cycle)
  – Can add cleaning agents on periodic basis
CHEMICAL CLEANING OPTIONS

• Ironeater/Res-up
  – Removes iron and rust build up on resin beds that foul the softener or other medias

• Citric Acid
  – Removes iron and other contaminants from fouled water softeners

• Mineral Reactivator
  – Clean a fouled resin bed and restore exchange capacity
**CHEMICAL ADDITION OPTIONS**

- Potassium Permanganate / Fer-Sul
  - Strong oxidizing agent
  - Oxides dissolved iron and manganese to insoluble oxides
  - Injected continuously prior to filter or during regeneration/backwashing only
CHEMICAL ADDITION OPTIONS

• Soda Ash, Caustic Soda or Sodium Bicarbonate
  – Highly alkaline
  – Neutralizes acid found in some waters
  – Helps to eliminate corrosion
• Polyphosphate
  – Sequesters iron and manganese to reduce or eliminate iron staining
  – Holds iron in solution
  – Helps prevent or retard corrosion
MAINTENANCE PROCEDURES

• Injector Cleaning
  – Injector on valve will clog due to sediment, salt and silt
    • Treated water for backwashing will prevent this
      – AKA – Separate Source Backwashing
  – Procedure
    • Shut off water supply
    • Open faucet downstream to relieve pressure or put valve into backwash mode
    • Carefully remove injector assembly and disassemble per manufacturers instructions
    • Flush all parts with water
    • Use one of the mentioned cleaning agents or vinegar to clean the small holes in the orifice and throat
    • Reassemble in reverse order
MAINTENANCE PROCEDURES

• Media Replacement
  – Depressurization
    • Place the unit into the backwash position for several minutes to loosen the bed – unplug valve if necessary
    • Shut off the main water supply to the filter or place the filter in by-pass to depressurize the filter
    • Disconnect the plumbing on the inlet, outlet and drain
  – Valve Removal
    • Unscrew the control valve from the filter tank
    • Separate the valve from the distributor tube. Place valve to one side
MAINTENANCE PROCEDURES

• Media Replacement
  – Removal of Old Media
    • If tank is small and light enough, the filter can be simply picked up and turned upside down into a large drum or bin to remove the media. Be careful to not break the distribution tube/riser or hub assembly
    • For heavier tank, insert a piece of ½” flexible hose into the distributor and siphon the water into the drain
    • Remove distributor tube from the tank
    • Flush out all the contents into a large pail or garbage can by elevating the tank as required
    • Lay tank on its side and insert a garden hose into the tank
    • Make sure tank is completely empty before proceeding
MAINTENANCE PROCEDURES

• Media Replacement
  – Removal of Old Media
  • Alternatively, can use a wet shop vac or a media extractor
MAINTENANCE PROCEDURES

- Media Replacement
  - Loading the New Media
    - Inspect distribution tube and laterals/hub
    - Place distributor tube into tank
    - Plug end of distributor tube to prevent media from entering it
    - Fill filter ¼ to 1/3 full of water
    - Place media into the tank in the order indicated by the manufacturer
      - An empty 1 gallon or 4 liter container with the bottom cut out makes a good funnel
      - Similarly, a 18 liter bottled water bottle is good too
MAINTENANCE PROCEDURES

- Media Replacement
  - Loading the New Media
    - Ensure distributor tube stays on the bottom of the tank, reasonably centered
    - Whenever possible, fill the tank outdoors to avoid problems with dust. If inside, wear dust mask.
    - Wear appropriate safety gear, goggles, mask, gloves, etc.
MAINTENANCE PROCEDURES

• Media Replacement
  – Placing the Unit in Service
    • Once media is loaded, remove the cover from the distributor and clean the top of the tank
    • Place control valve on the tank, ensuring the distributor fits into the valve properly
    • Tighten the valve onto the tank using moderate force
    • Apply household liquid soap to the main seal O-ring
MAINTENANCE PROCEDURES

• Media Replacement
  – Placing the Unit in Service
    • Connect inlet, outlet and drain connections
    • Change valve to backwash position
    • Slowly open inlet valve to allow air to escape and fines to be removed
    • Once filled, some resins require a soak in period. Consult manufacturer
    • Allow to backwash until drain runs clear – disconnect power
    • Allow valve to continue through cycle to service mode.
    • Open inlet valve fully.
    • Check for leaks
SUMMARY

• Media Types
• Filter Types
• Valve Types
• Installation Procedure
• Operation Sequences
• Maintenance Procedures
QUESTIONS?

Robert Gillis, P.Eng.
Atlantic Purification Systems Ltd.
10 Ferguson Rd, Dartmouth, NS
Ph: 902-469-2806 x 103
Email: robert@aps.ns.ca

Steve Frizzell
APS Local Office
PO Box 1115, Goulds, NL
Ph: 709-697-2457
Email: steve@aps.ns.ca