Clean & Safe Drinking Water Workshop
Gander, NL

PRESSURE FILTER OPERATION AND MAINTENANCE

March 25th, 2010

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Atlantic Purification Systems

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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**

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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

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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

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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

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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 $CaCO_3$) in water
  - Increases chloride (Cl) and sodium (Na) levels

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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

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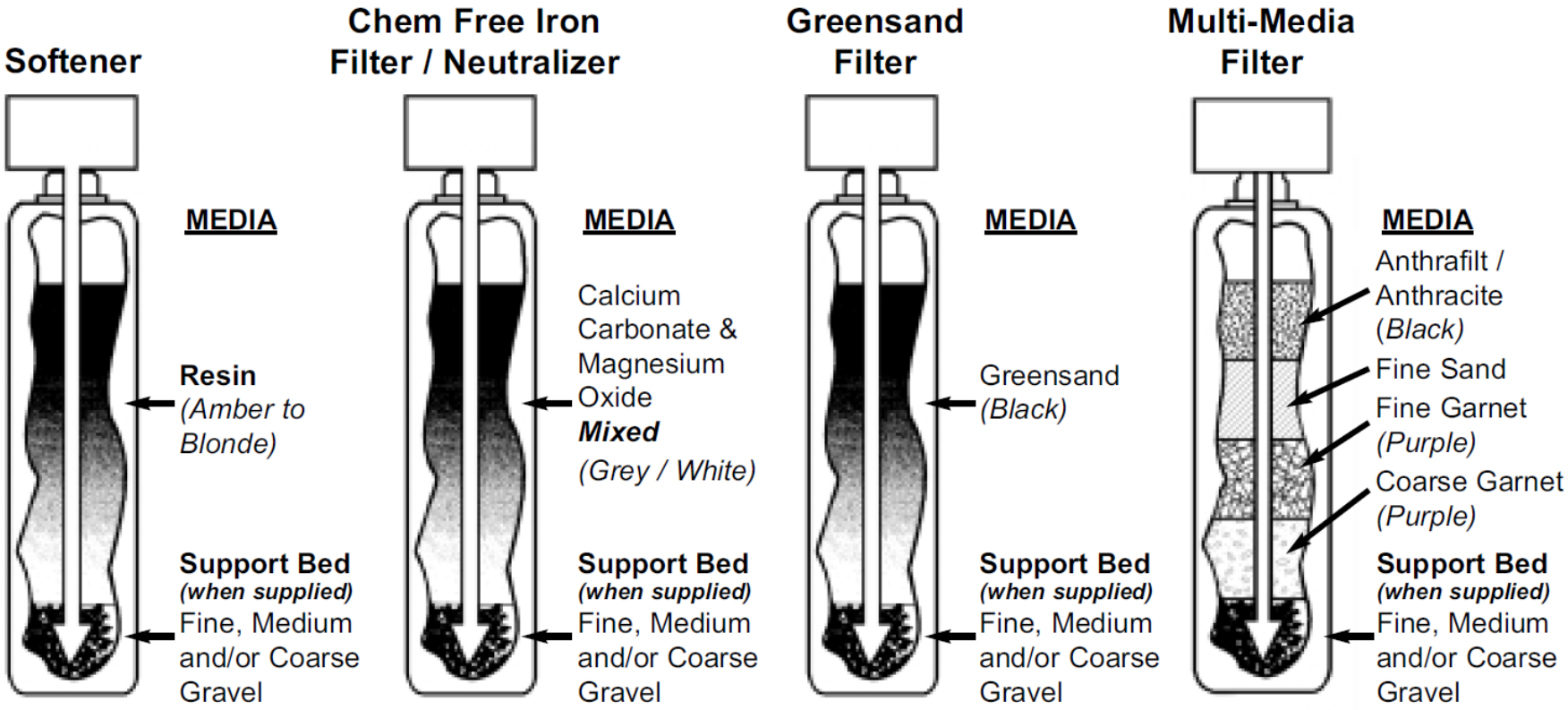
MEDIA TYPES



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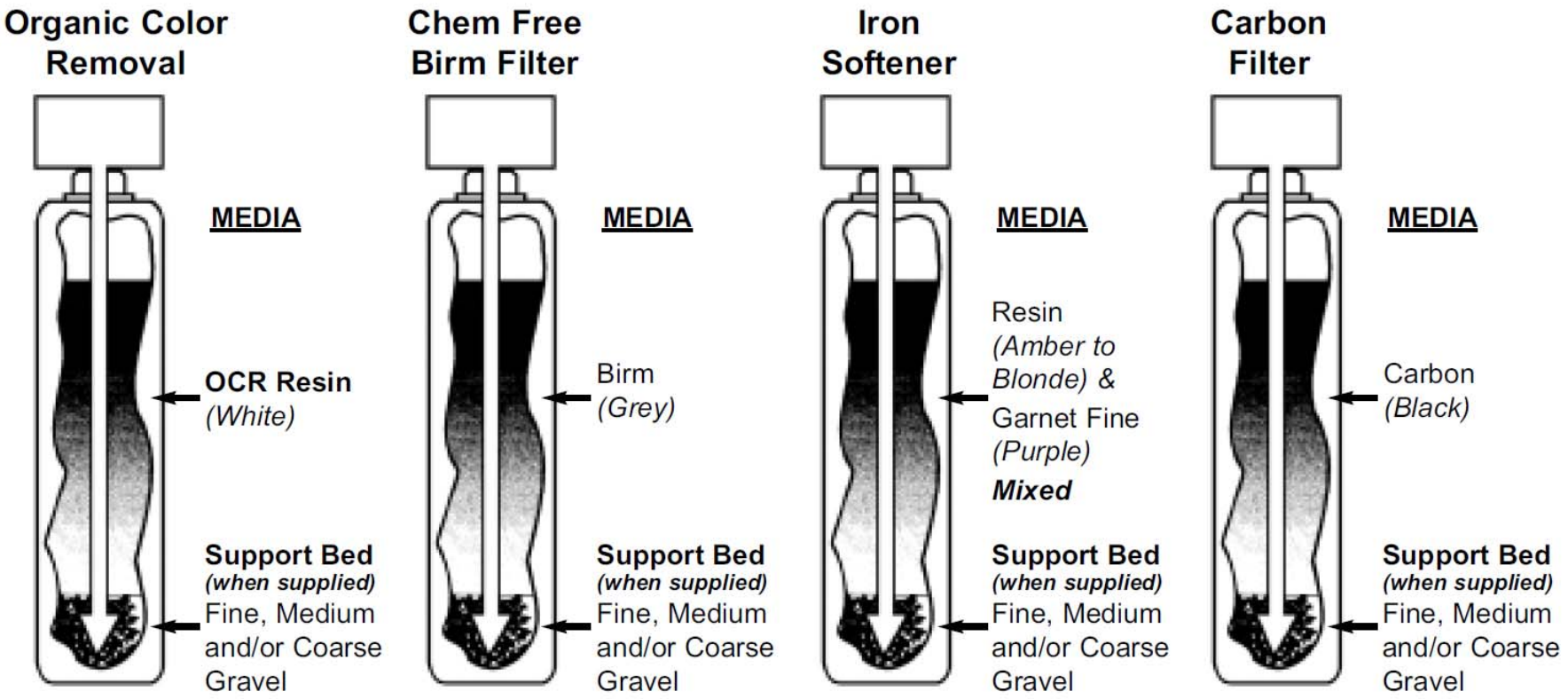
MEDIA TYPES



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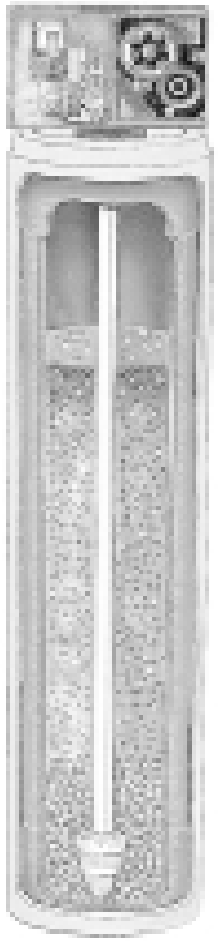
FILTER TYPES

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



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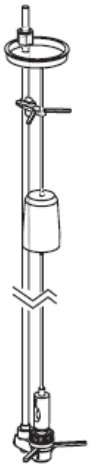
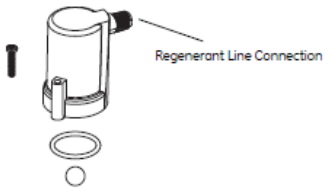
FILTER TYPES



- 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

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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

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VALVE PICTURES

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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

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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

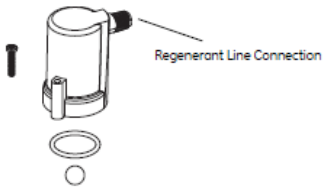
INSTALLATION PROCEDURES

- 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

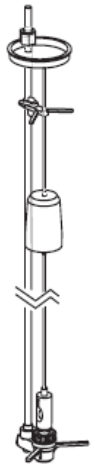
INSTALLATION PROCEDURES

- 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)



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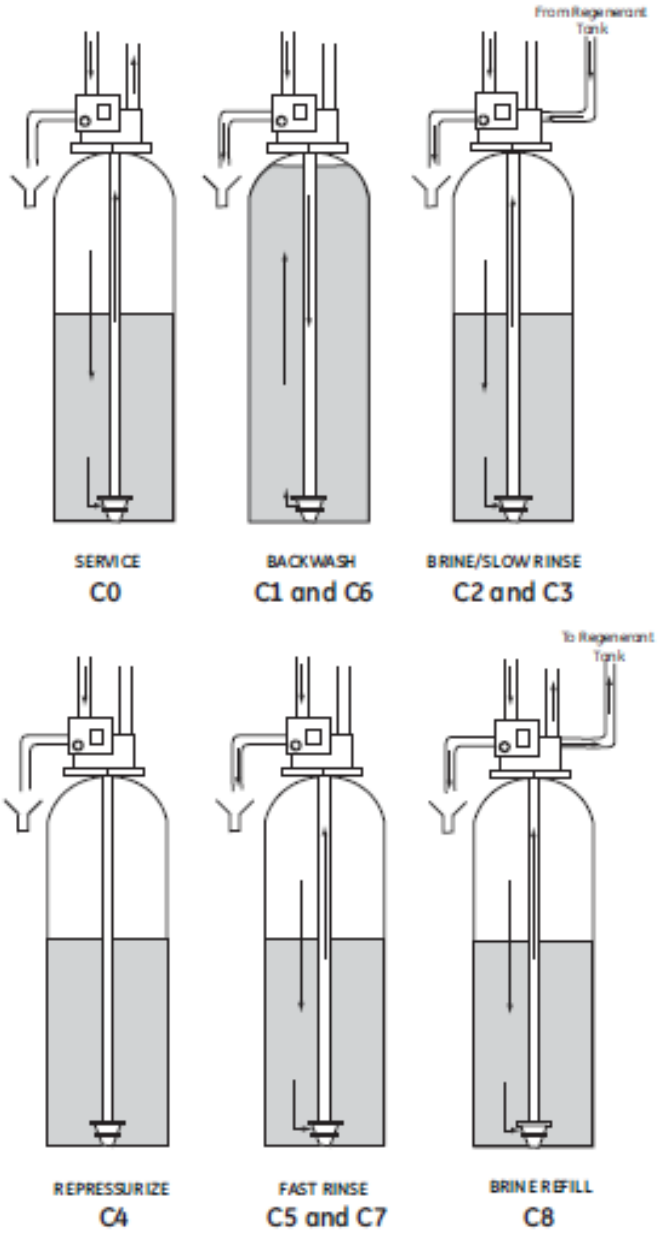
FILTER OPERATIONS

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



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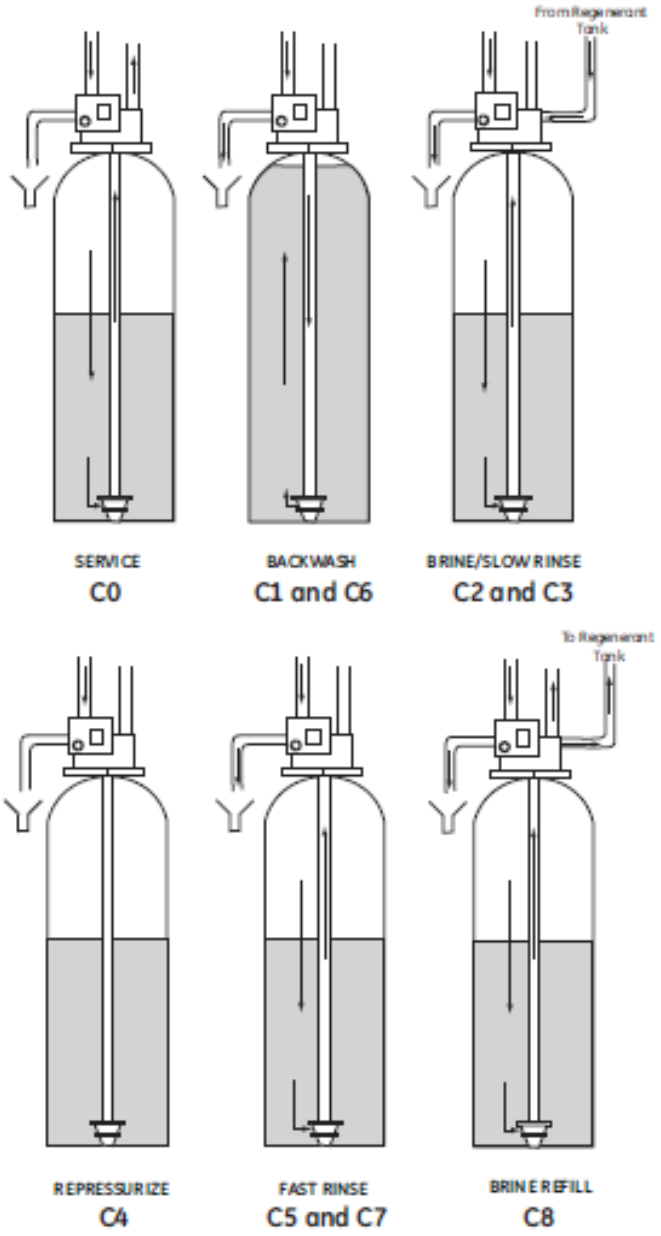
FILTER OPERATIONS

- 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



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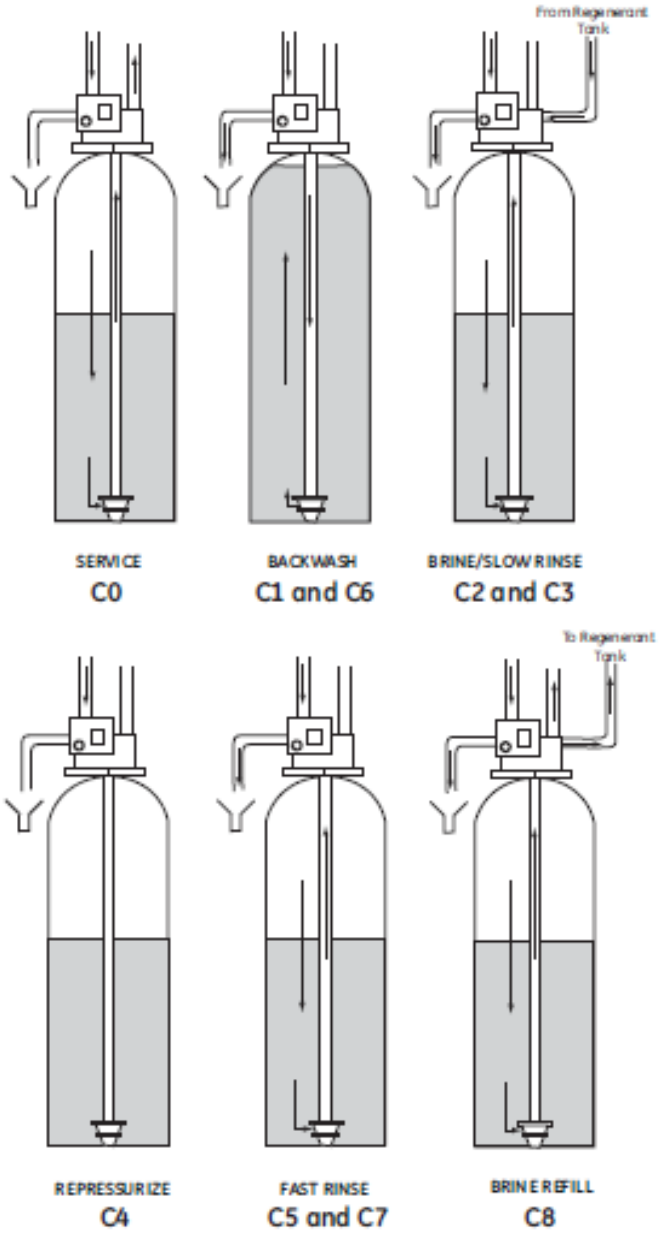
CONDITIONER OPERATIONS

- 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



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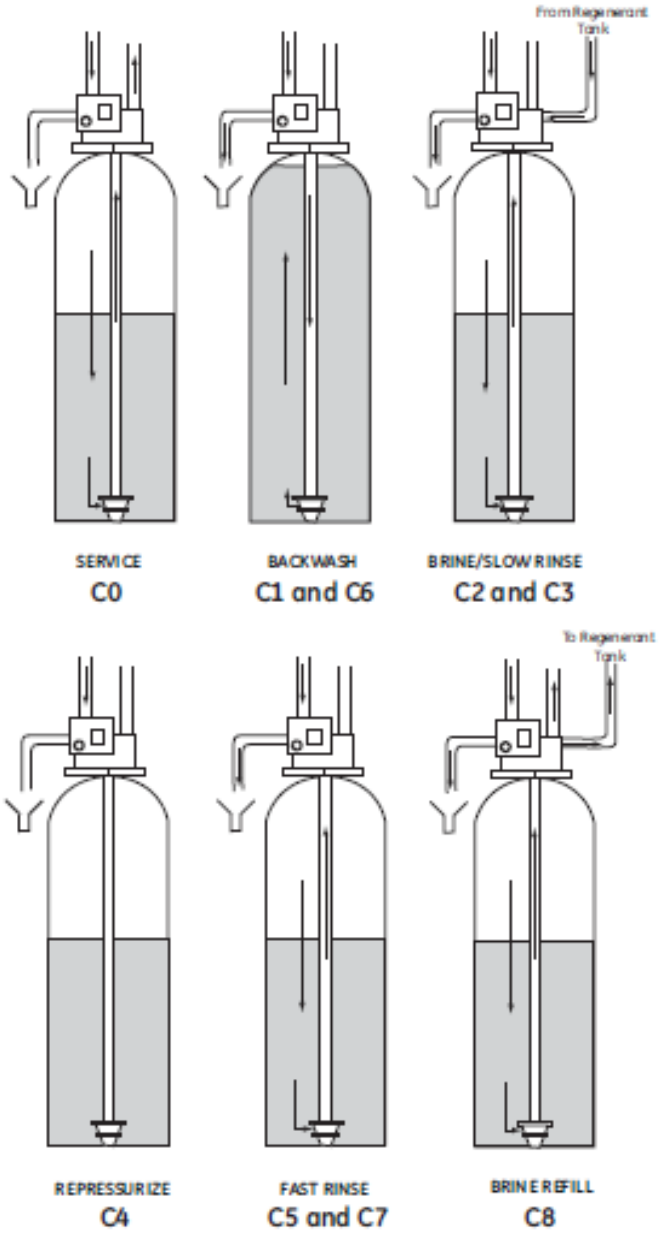
CONDITIONER OPERATIONS

- 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



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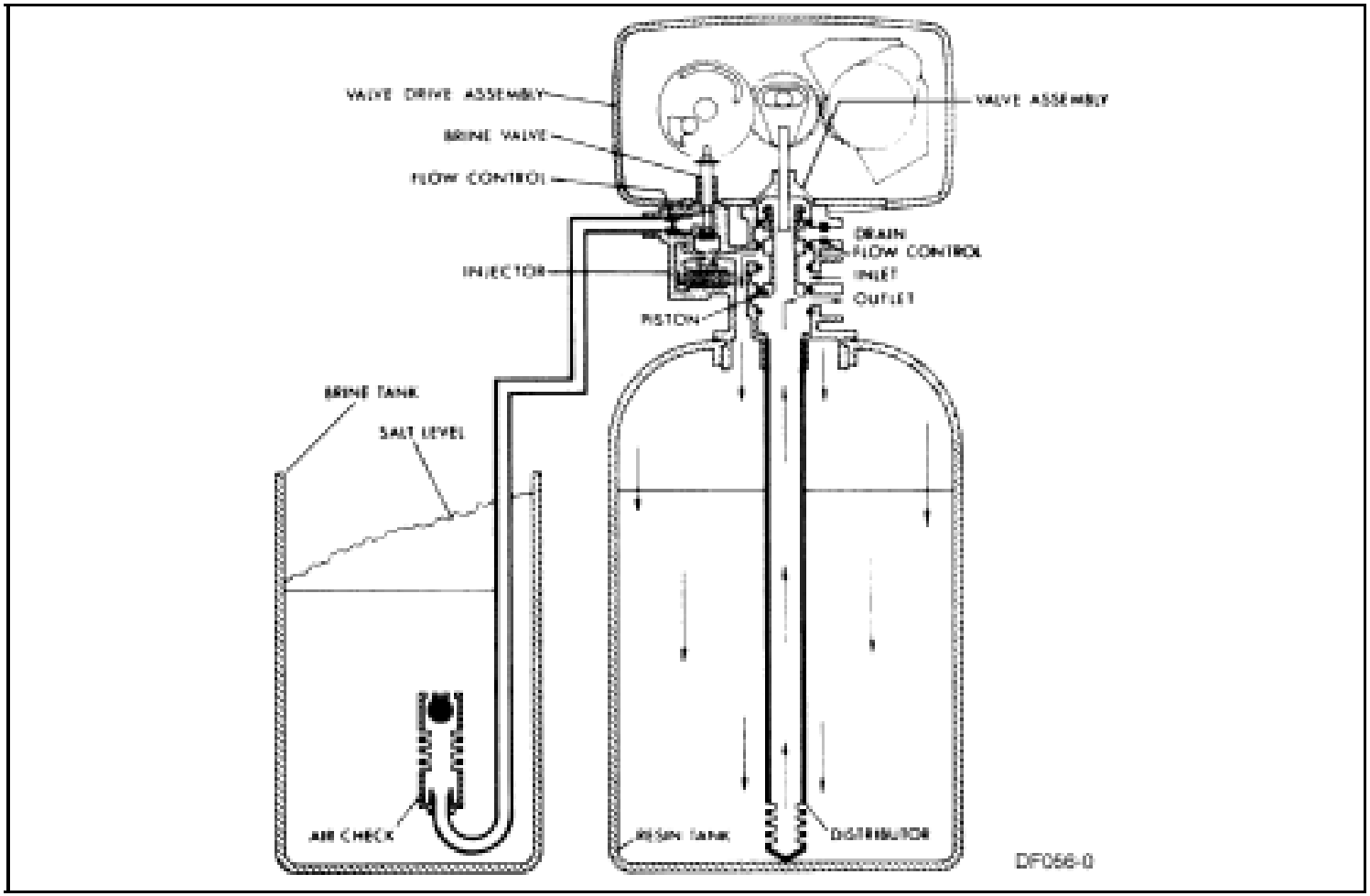
CONDITIONER OPERATIONS

- Service Position



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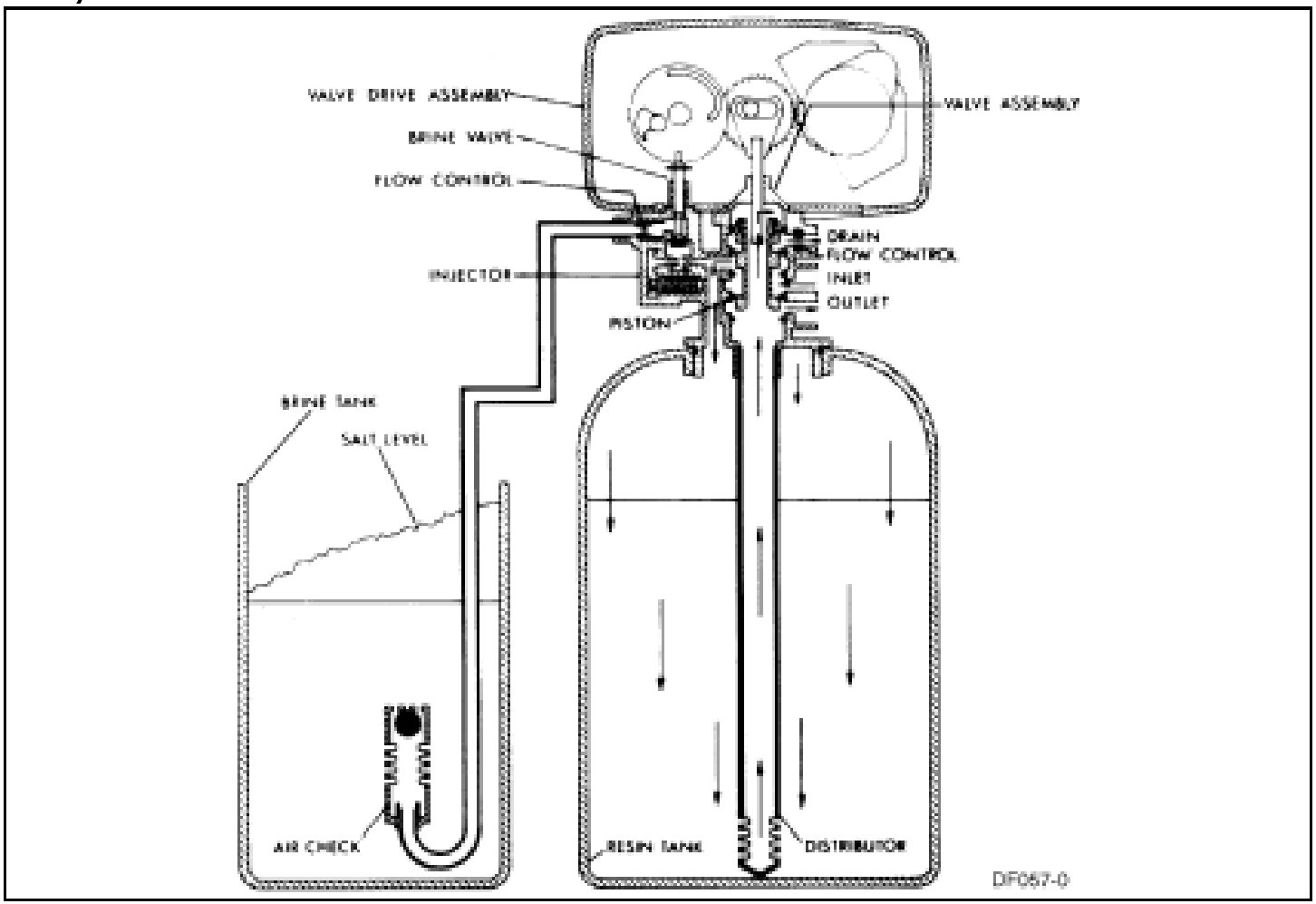
CONDITIONER OPERATIONS

- Preliminary Rinse Position



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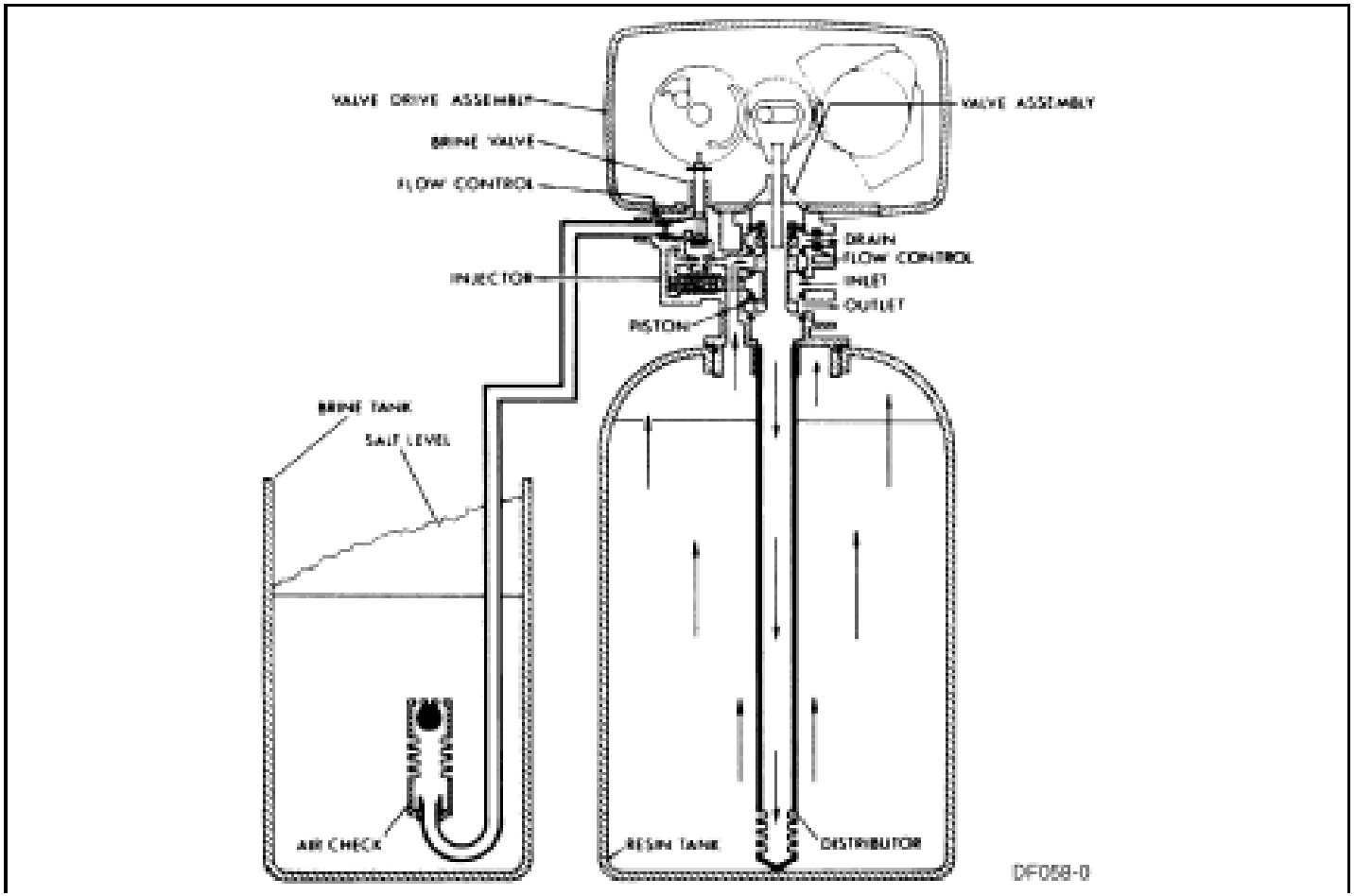
CONDITIONER OPERATIONS

- Backwash Position



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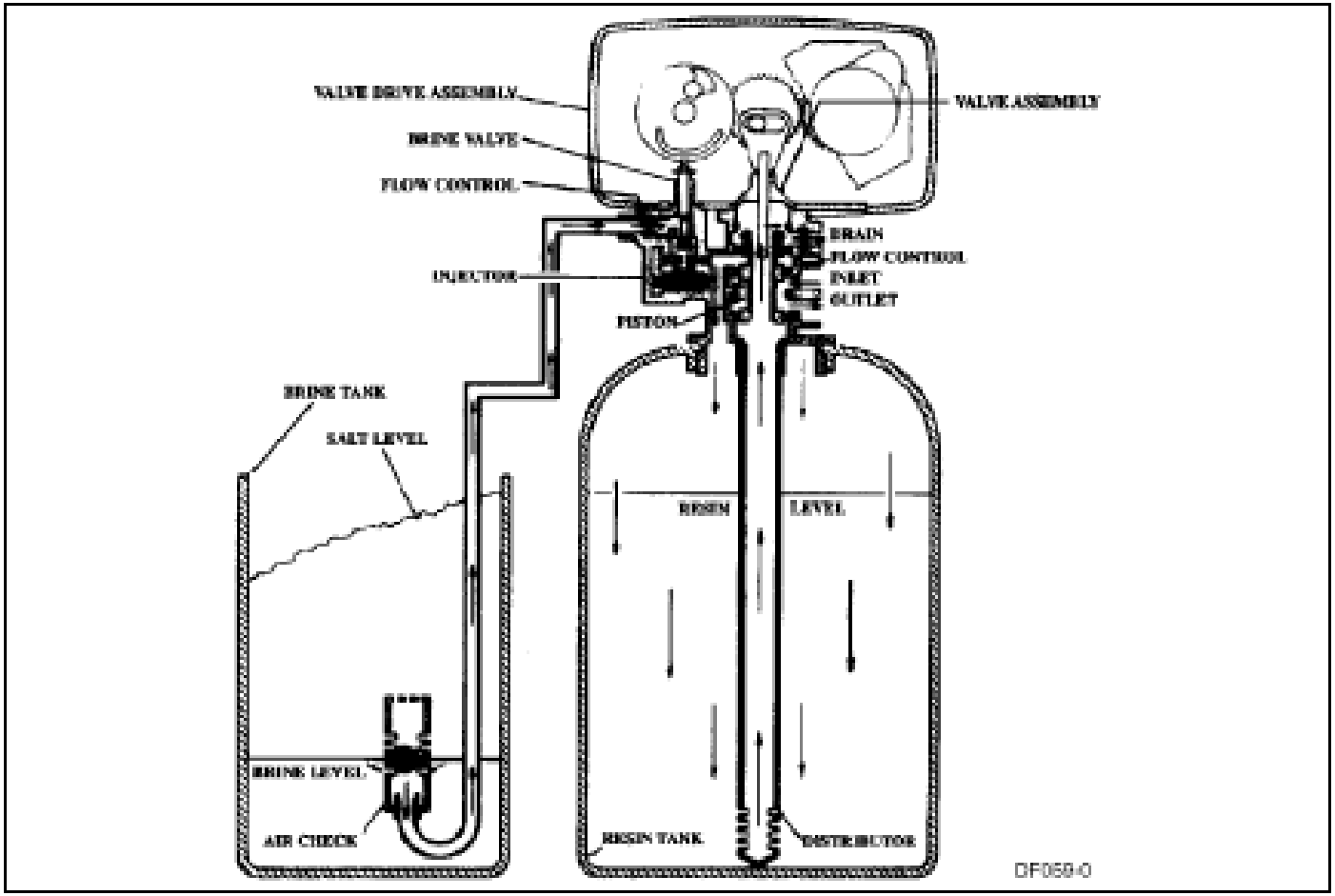
CONDITIONER OPERATIONS

- Brine Position



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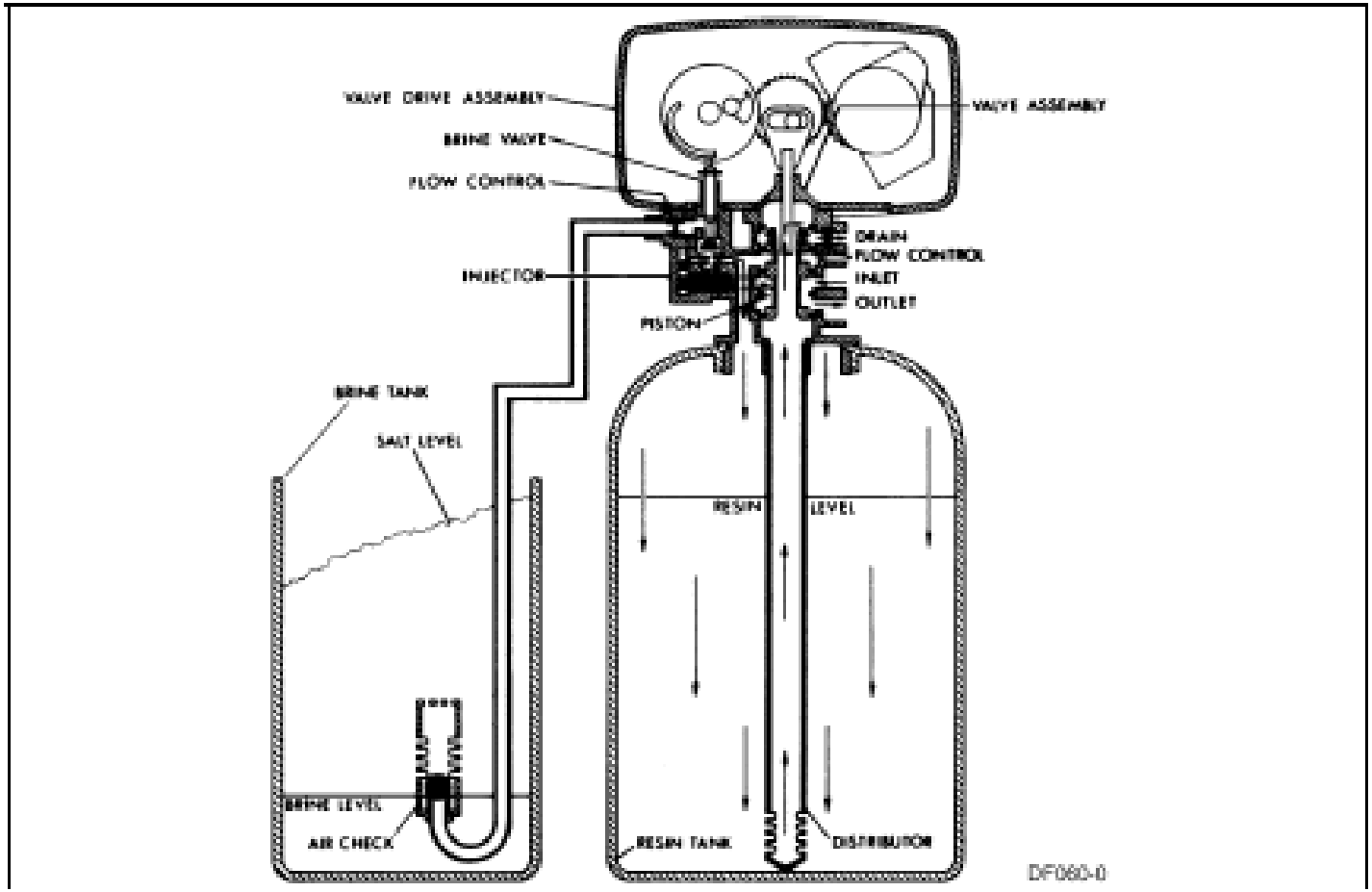
CONDITIONER OPERATIONS

- Slow Rinse Position



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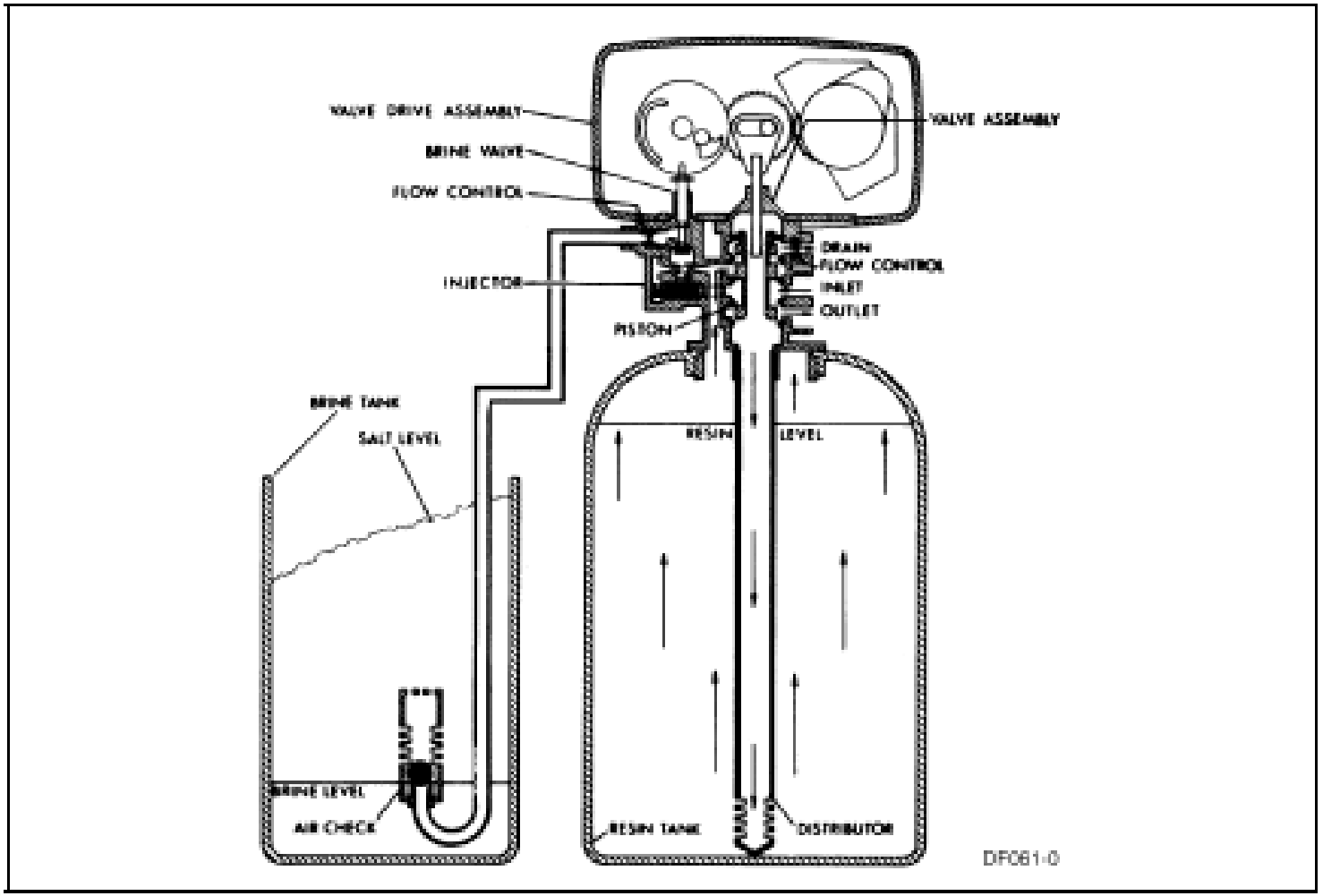
CONDITIONER OPERATIONS

- Second Backwash Position



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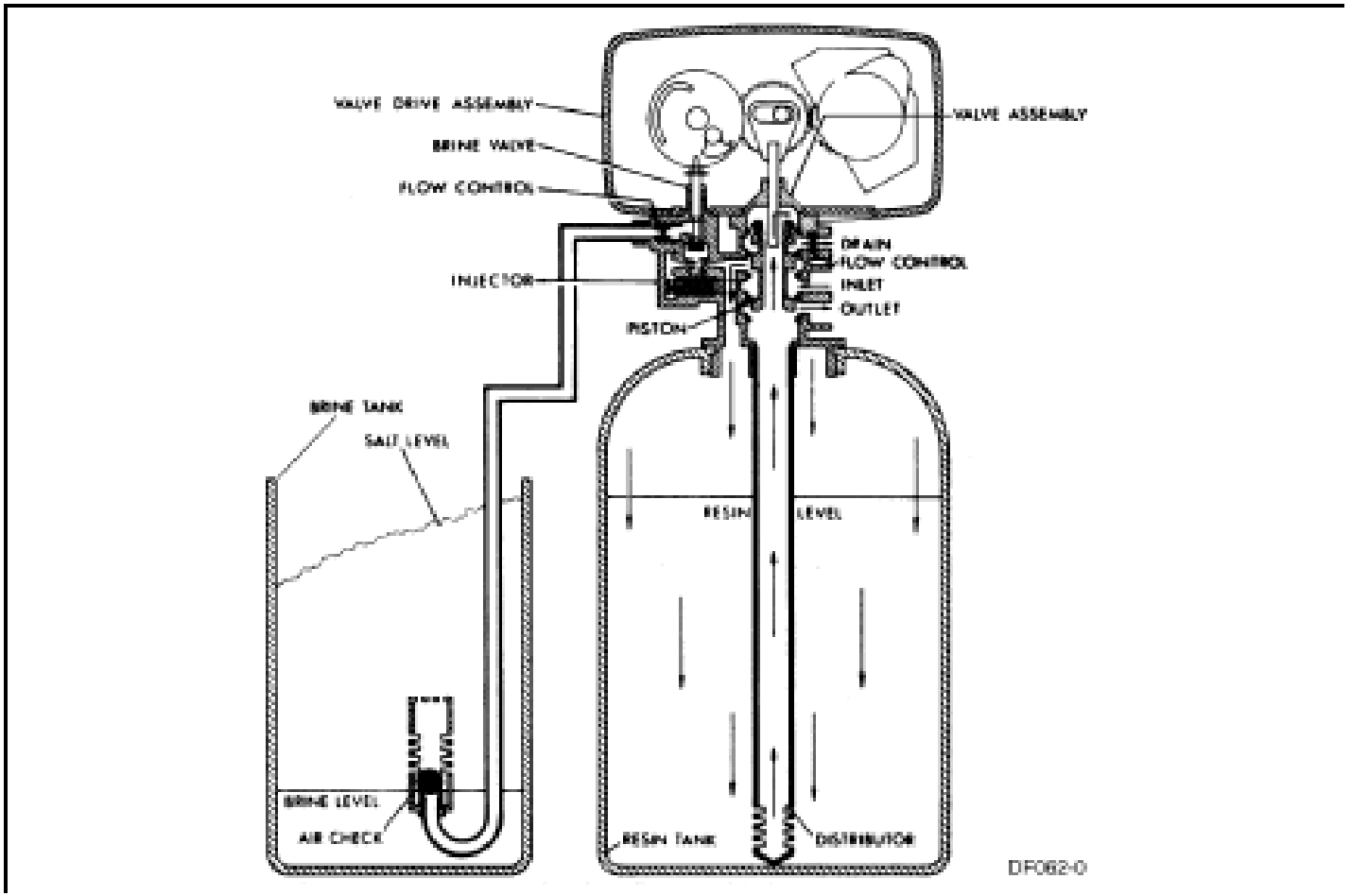
CONDITIONER OPERATIONS

- Settling Rinse Position



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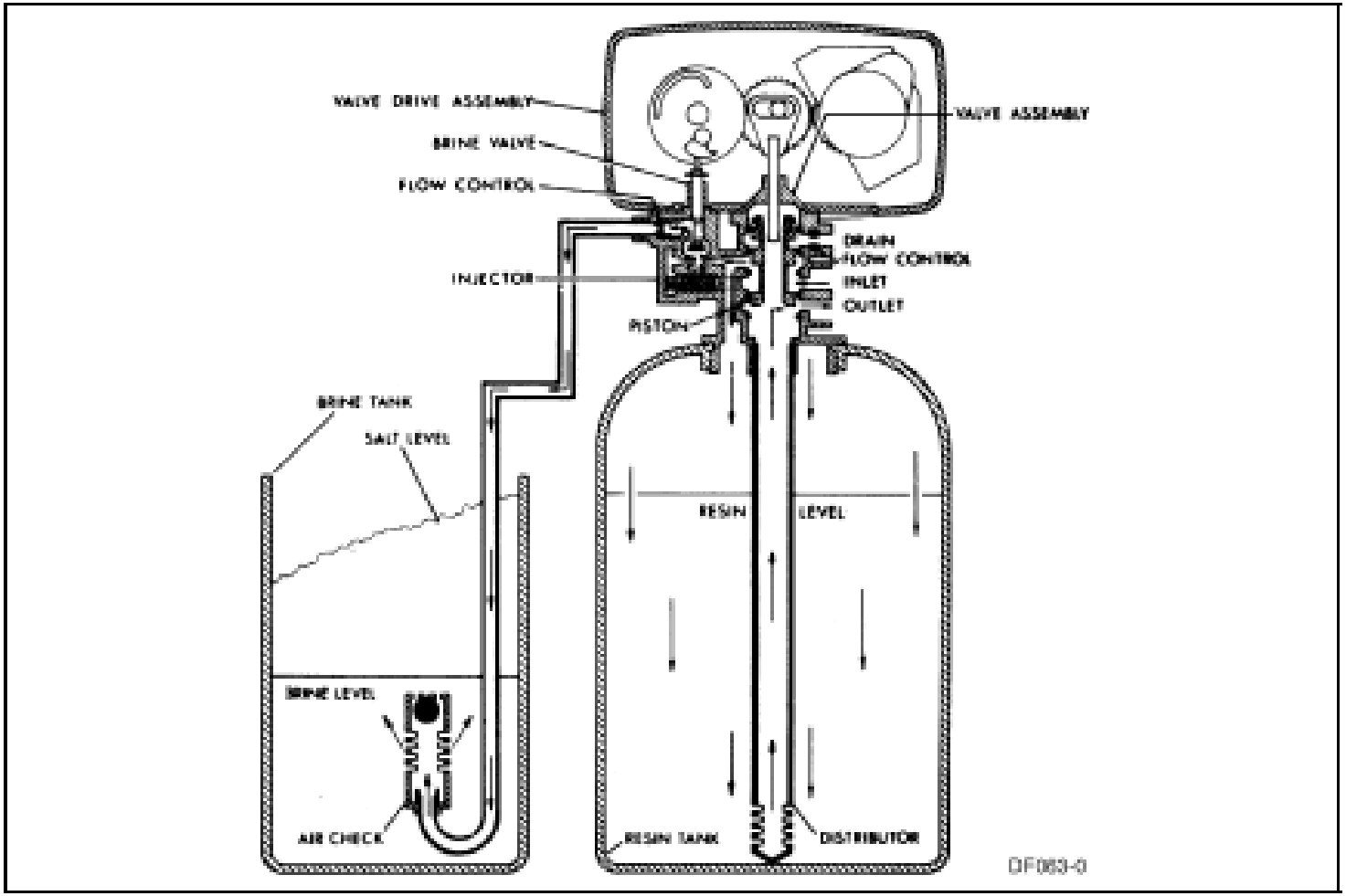
CONDITIONER OPERATIONS

- Brine Tank Fill Position



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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

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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

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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

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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

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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

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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 ?

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