Corrosion Control Basics

Produced by

AIR & WATER QUALITY INC.
"Maine's Water Experts"

Treatment Options

- Fixture change out
- pH, alkalinity and DIC control
  - Solution feed with soda ash/potash/ caustic soda
  - Calcite contactors
- Aeration- limited applications
- Orthophosphate – usually lead only

Fixture Change Out

- Confirm with DWP that this is an acceptable option for your system.
- Confirm fixtures are the problem with split samples.
- Change identified fixtures.

Split Sample Calculations

- If you collect a100 ml + 900 ml sample, calculate the composite (combined) concentration -

0.1(100 ml conc.) + 0.9(900 ml conc.)= conc.

- Example

  100 ml sample 150 ppb

  900 ml sample is 10 ppb

Split Sample Calculations

0.1(150 ppb)+ 0.9(10 ppb) = conc. ppb

15 ppb + 9 ppb = 24 ppb

Solution Feed

Sizing and installation of solution feed pump

Sizing the solution feed pump

- Chemical demand
- Delivery flow (in most cases well pump flow)
- Pump voltage

Chemical Demand

- pH is a ratio of acidity to alkalinity.
- pH is a log (power of 10) relationship

Example- to go from a pH of 7.0 to a pH of 7.3 the ratio of alkalinity to acidity has to double.

Chemical Demand

10^7 = 10,000,000

$10^{7.3}$ = 19,952,623

19,952,623 / 10,000,000 = 1.995

Determining the Demand

- Mix stock solutions (10 g/L).
- Field titrate 50 ml sample with pH meter to desired end point pH.
- Calculate demand in mg/L for desired end point pH.

3/27/2004

Tools for Determining Demand

- pH meter
- Graduated cylinder
- Stock Solution with in dropper bottle
- Container for sample

3/27/2004

Water Proof pH Meter

3/27/2004

Calculating Demand

$C_{stock} \times V_{stock} = C_{final} \times V_{final}$

C_{final} = Conc. of chemical in finished water

Delivery Flow (pump capacity)

There are three ways to determine well pump capacity-

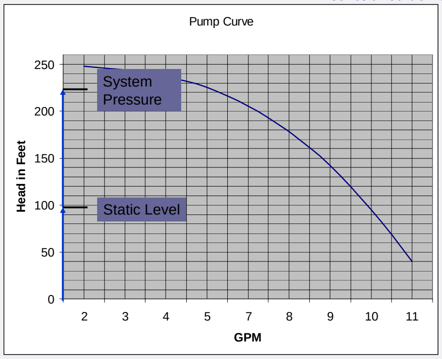
1. From pump curves
2. Onsite flow test
3. Water meter readings

Pump Curve

- You can check with the pump supplier to get a pump curve if you don’t have it. He can also help you use the curve to determine the pump’s performance in your system.

Pump Curve

Corrosion Control Basics



3/27/2004

Corrosion Control Basics

Onsite Flow Test for Pressurized Systems

- Turn off the water to the distribution system.
- Activate pressure switch to fill pressure tank.
- Draw off a known quantity of water without having the pump start.
- Start the pump to refill the pressure tank and record the refill time. (continued)

3/27/2004

Corrosion Control Basics

Onsite Flow Test for Pressurized Systems (continued)

- Calculate the pump flow by -

$$\frac{\underline{2}\text{ gallons drawn off}}{\underline{15}\text{ seconds to refill tank}} \times 60 = \underline{8}\text{ GPM}$$

3/27/2004

Corrosion Control Basics

Using a Water Meter

- Record the starting value of the water meter.
- Start the well pump and run it for a minute.
- Note the ending value on the water meter. (continued)

3/27/2004

Corrosion Control Basics

Using a Water Meter
(continued)

- The difference between the starting value and ending value on the meter will be the delivery rate on the well pump in gallons/min.
- Remember for meters that cubic feet -7.48 gallons/c.f.

3/27/2004

Corrosion Control Basics

Calculating pump size and solution concentration

__ mg/L (dose) X __ gal/min (well pump) =

__oz /5 gallons sol. X __ gal/day (feed pump)

3/27/2004

Sizing Solution Pump

30 mg/L(dose) X **20** gal/min (well pump) = **600**

50 oz /5 gallons sol. X **12** gal/day(feed pump)
or
30 oz /5 gallons sol. X **20** gal/day(feed pump)

Solubility

Compound	Solubility lbs / gallon
Potash	~ 8
Soda Ash	~ 1
Sodium Hydroxide	~ 3.5

Choosing Feed Pump Capacity

If the pump can only vary the stroke, choose the pump to have approximately twice the capacity in GPD than is required to do the job.

Choosing Feed Pump Capacity

If the pump has both a stroke and frequency control, use 25% of the pump's maximum output for deciding the size pump you need.

Choosing Feed Pump Capacity

Example- If the pump's max. output is 30 GPD, what is the output with the stroke and frequency set at 50%.

Solution: 30 X.5 X .5 = 7.5 GPD
30 X .25 = 7.5 GPD

Solution Tanks

- Polyethylene construction
- Flooded suction
- Place to mount pump
- Bulkhead fitting for suction and bleed return
- Large enough to hold at least one weeks supply
- Childproof lid

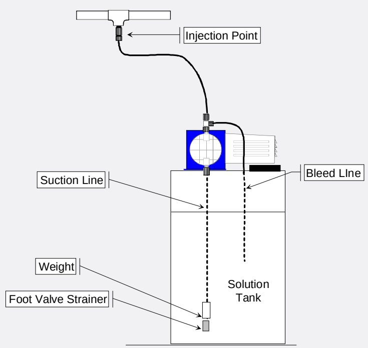
Solution Tanks and Pumps

Corrosion Control Basics

3/27/2004

Solution Feed Pump Tank Mount

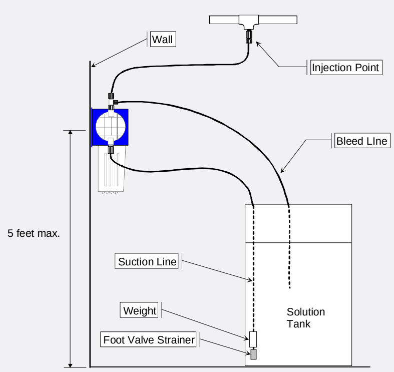
Corrosion Control Basics



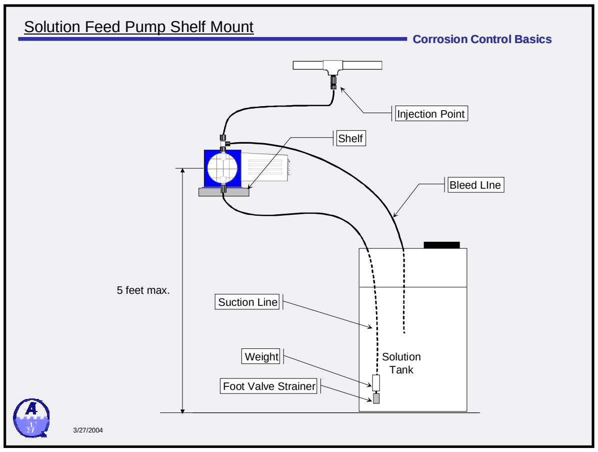
3/27/2004

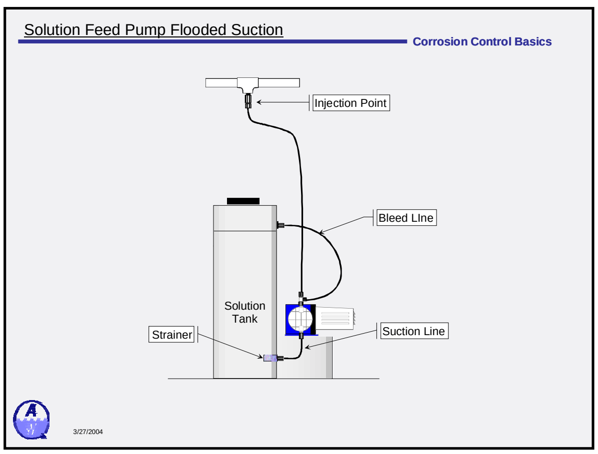
Solution Feed Pump Wall Mount

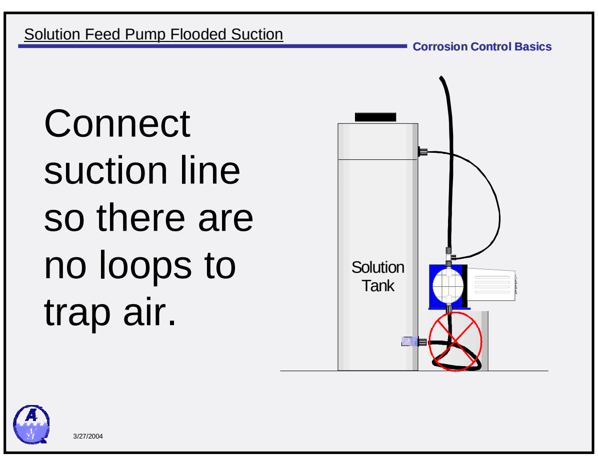
Corrosion Control Basics



3/27/2004


Solution Feed Pump Shelf Mount
Corrosion Control Basics
Injection Point
Shelf
Bleed LIne
5 feet max.
Suction Line
Weight
Foot Valve Strainer
Solution
Tank
3/27/2004


Solution Feed Pump Flooded Suction
Corrosion Control Basics
Injection Point
Bleed LIne
Solution
Tank
Strainer
Suction Line
3/27/2004


Solution Feed Pump Flooded Suction
Corrosion Control Basics
Connect suction line so there are no loops to trap air.
Solution
Tank
3/27/2004

Injector and Injection Point

- The Injector tip should be placed in the center of the pipe receiving the injector.
- The injector should be installed from under the pipe to allow the check valve in the injector to seal.

Injector and Injection Point

- The injector should be installed in the delivery pump (well pump) discharge line and before any distribution – including the pressure tank.

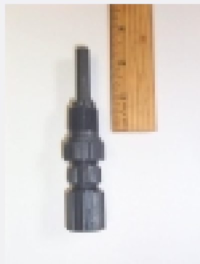
Injector Check Valve

- The check valve allows the solution pump to be primed without back pressure
- The check valve also provides for the removal of the discharge line during servicing.

Corrosion Control Basics

Injector

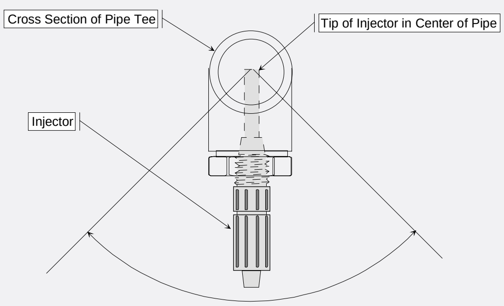
- Most injector tips can be trimmed to fit a wide range of pipe sizes



3/27/2004

Injector

Corrosion Control Basics



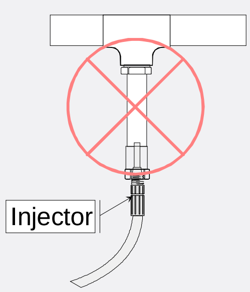
Place Injector within 45 Degree Angle of Vetical

3/27/2004

Injector Location

Corrosion Control Basics

The injector should not be placed in a stub of pipe. This will allow the build up of chemical and cause either scaling or corrosion in the stub.



3/27/2004

Scaling

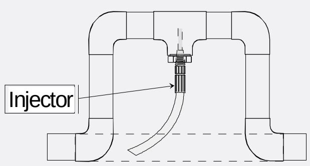
Corrosion Control Basics

3/27/2004

Corrosion Control Basics

Injector

- If the injection point must be located so the injector can not be installed from under the pipe, a loop can be installed to provide for the proper orientation of the injector.



3/27/2004

Corrosion Control Basics

Control Valves

- Bleed valve
- Multi-function valves

3/27/2004

Bleed Valves

Corrosion Control Basics

3/27/2004

Corrosion Control Basics

Bleed Valves

- At a minimum, all diaphragm pumps should have a bleed valve.
- The bleed valve provides for easy priming by bleeding off air and removing back pressure
- The bleed valve also relieves pressure in the discharge to provide for easy service.

3/27/2004

Multi-function Valves

Corrosion Control Basics

3/27/2004

Corrosion Control Basics

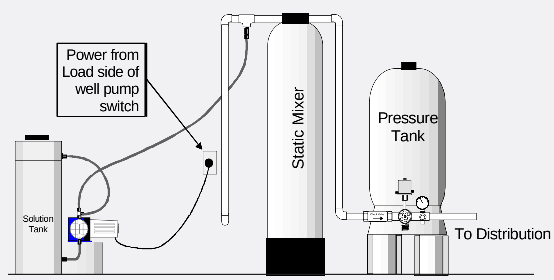
Multi-Function Valves

- Anti-siphon protection
- Back pressure
- Priming aid/line drain
- Pressure Relief
- Degassing

3/27/2004

Solution Feed with Submersible Pump

Corrosion Control Basics



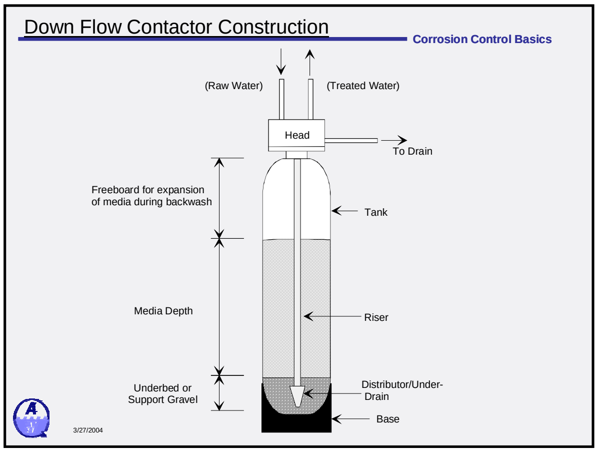
3/27/2004

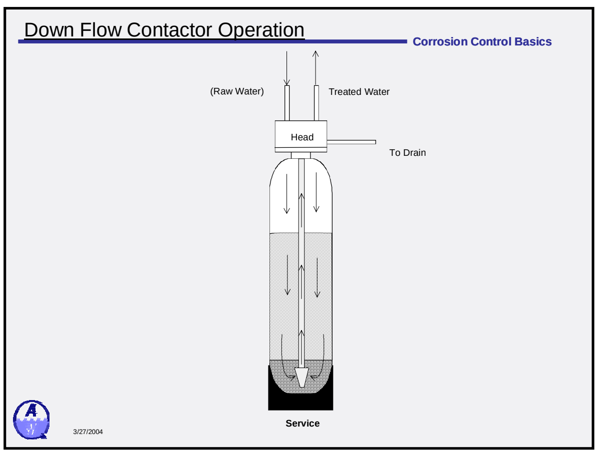
Corrosion Control Basics

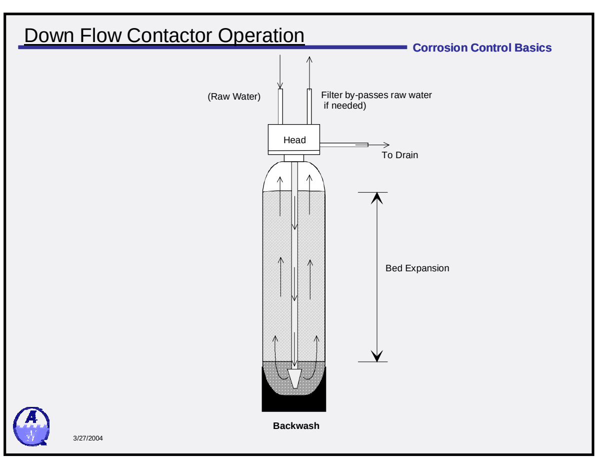
Calcite Contactors

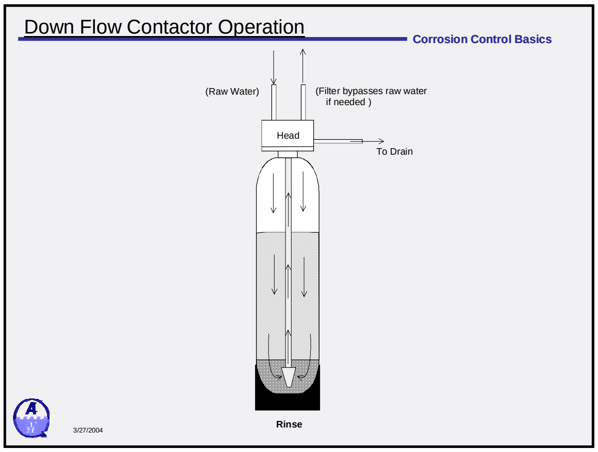
Down flow or Up flow

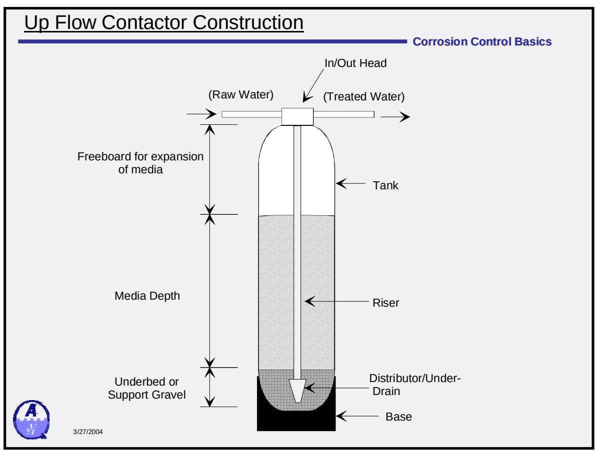
3/27/2004

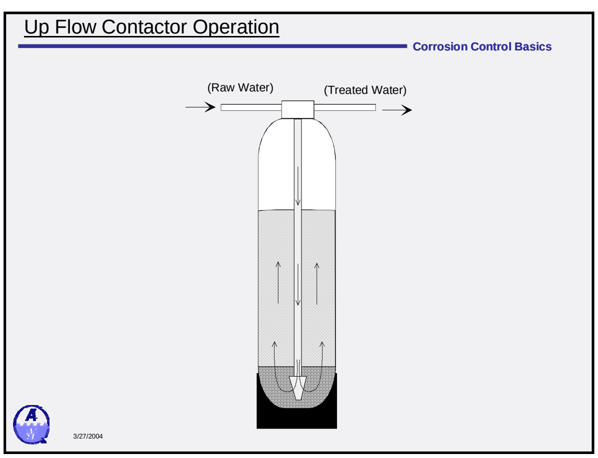

Down Flow Contactor Construction
Corrosion Control Basics
(Raw Water)
(Treated Water)
Head
To Drain
Freeboard for expansion
of media during backwash
Tank
Media Depth
Riser
Underbed or
Support Gravel
Distributor/Under-
Drain
Base
3/27/2004


Down Flow Contactor Operation
Corrosion Control Basics
(Raw Water)
Treated Water
Head
To Drain
Service
3/27/2004


Down Flow Contactor Operation
Corrosion Control Basics
(Raw Water)
Filter by-passes raw water
if needed)
Head
To Drain
Bed Expansion
Backwash
3/27/2004


Down Flow Contactor Operation
Corrosion Control Basics
(Raw Water)
(Filter bypasses raw water
if needed)
Head
To Drain
Rinse
3/27/2004


Up Flow Contactor Construction
Corrosion Control Basics
In/Out Head
(Raw Water)
(Treated Water)
Freeboard for expansion
of media
Tank
Media Depth
Riser
Underbed or
Support Gravel
Distributor/Under-
Drain
Base
3/27/2004


Up Flow Contactor Operation
Corrosion Control Basics
(Raw Water)
(Treated Water)
3/27/2004

Contactor Sizing

- Calcite contactor flows should not exceed 5 gpm per square foot.
- Minimum bed depth should be approximately 30”.

Contactor Sizing

- Each contactor that requires back-washing should be sized to handle no more than half the highest continuous flow to allow for back-washing.

Calculating Tank Diameter

$$24\sqrt{\frac{\text{GPM}}{15.7}}$$

Example: 20 gpm max. flow available

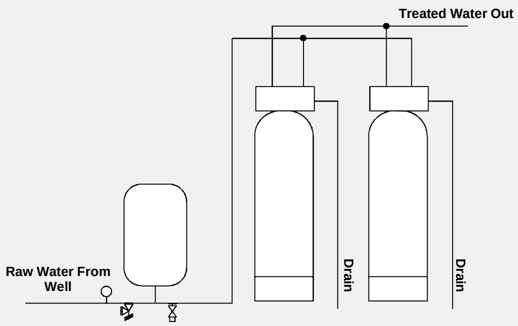
$$24\sqrt{\frac{10\ \text{GPM}}{15.7}} = 20''$$

Installation Layout

Pressurized system

Pressurized System Layout

Corrosion Control Basics



3/27/2004

Corrosion Control Basics

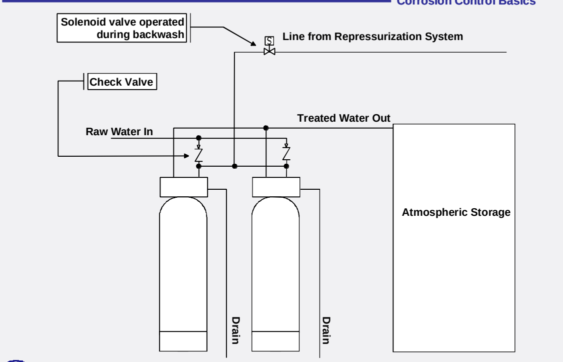
Installation Layout

Atmospheric Systems

3/27/2004

Atmospheric System Layout

Corrosion Control Basics

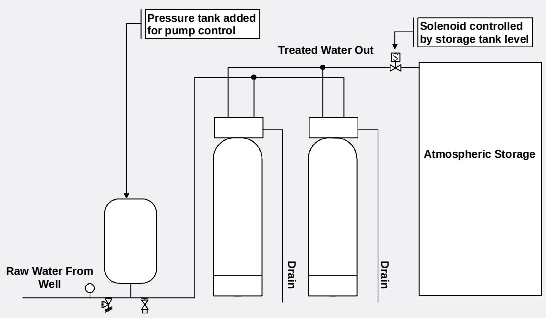


Calcite contactors with no raw water by-pass valves

3/27/2004

Atmospheric System Layout

Corrosion Control Basics



3/27/2004

Corrosion Control Basics

Chemical/Media Consumption

3/27/2004

Chemical/Media Consumption

Corrosion Control Basics

$$\frac{\_\_ \text{ mg/L} \times \_\_ \text{ gal/day} \times 365 \times 8.34}{1{,}000{,}000}$$

= ___ pounds

3/27/2004

Corrosion Control Basics

Chemical/Media Consumption

Example:

$$\frac{25 \text{ mg/L} \times 1200 \text{ gal/day} \times 365 \times 8.34}{1{,}000{,}000}$$

= 91 pounds

3/27/2004