The Handbook on
Field Chlorination
&
Dechlorination
Using the

H_2O Neutralizer®

Operation
&
Maintenance
Manual

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1.0 Foreword

1.1 Introduction

This Operation and Maintenance Manual is intended to be used as a guide for chlorinating and dechlorinating your water systems.

The H_2O Neutralizer® is designed to allow the user to comply with all field chlorination procedures and all current and future dechlorination procedures.

Water system chlorination can be accomplished using chemicals that meet the current AWWA B300 standard and allow the user to meet AWWA C651-05 Disinfecting Water Mains standard.

Water system dechlorination can be accomplished using any of the common dechlorination chemicals that are on the market today however, Measurement Technologies only endorses the use of *No-Chlor*™ dechlorination grade Ascorbic Acid or Calcium Thiosulfate Solution. All other chemicals that are commonly used in neutralization of chlorine have bad side effects on the discharge water and the receiving waters. These side effects can be the lowering of pH, the removal of dissolved oxygen from the water and all other chemicals have a slow reaction time. A slow reaction time requires the use of additional chemicals to complete the reaction when you are flushing water. *No-Chlor*™ features immediate reaction to dechlorinization with no effect on dissolved oxygen. Depending on the amount of ascorbic acid being used, can affect the pH, however calcium thiosulfate solution is pH neutral. Water that has a high pH requires the use of additional chemicals to complete the neutralizing of chlorine when you are using chemicals other then *No-Chlor*™ dechlorination grade ascorbic acid.

1.2 BACKGROUND

Measurement Technologies began producing the H_2O Neutralizer® in 1999. The first model was 3” in size and only designed for dechlorination. The 5” device was later introduced in the fall of 2000. It did not take long to realize that the device could also be used for chlorination, which made the device dual purpose and answered the problems of field chlorination. Both utilities and contractors have faced the problem of super chlorinating lines unevenly, causing failed purity tests. The H_2O Neutralizer® injects chlorine into every gallon of water that is entering the new system. For dechlorination, the H_2O Neutralizer® design allows the operator complete control of the feed solution entering the venturi, allowing the proper balance between the chlorine residual level and the amount of dechlorination solution required.

The quest for environmentally sound means of dechlorination started in the 1990’s. First, a local kidney dialysis doctor in Mount Vernon, Washington, enlightened Public Utility District No. 1 of Skagit County as to the benefits of ascorbic acid, Vitamin C, to remove chlorine from our drinking water. Ascorbic acid has been recommended as the dechlorinating agent of choice for VOC’s (EPA QA Newsletter, January, 1988), as well as being the choice of many

owners of exotic fish to dechlorinate their tank water. Ascorbic acid is an additive in fish food to improve their immune systems. It is also an additive in food production for human consumption. When weighing the benefits of ascorbic acid to the conventional sulfur-based dechlorination chemicals, Skagit County quickly made the change to ascorbic acid. It made good environmental sense.
The first few years the utility used the ascorbic acid for dechlorination with conventional methods that had been used over the years with sulfur-based chemicals. The methods that were being used were different configurations of drip systems as well as simply broadcasting the ascorbic over open water. Results were not impressive, especially with the higher cost of ascorbic acid. Tony Smith, then Water Superintendent for the P.U.D., decided that it was time to design a device that would work under all field conditions and make the most economical use of ascorbic acid. The H_2O Neutralizer® was born out of two principles. It has a mainline orifice with additional (easy to install) orifice inserts to control flow rates and differential pressure, and a lateral by-pass venturi to create a full vacuum at low flows that will maintain throughout the entire performance range of the device. The design allows the device to reach 29 inches of vacuum with as little as 5 psi and approximately 6-8 gpm of flow. The H_2O Neutralizer® is available in two different models. The 3M is designed to be used on connections up to 3" in size, and the 5M is designed to be used on connections up to 6". We offer units that are designed for both DeChlorination AND Chlorination.

2.0 General Operational Procedures

2.0 Principal of Operation

The H_2O Neutralizer® works on differential pressure, which directs part of the water though the eductor block. When the water travels through the eductor cylinder a vacuum is created in the Feed Solution line. This vacuum will reach 29 inches after you have 20 psi of by-pass pressure in the eductor block. The vacuum allows you to introduce either a dechlorination reagent or hypo-chlorite solution into the waterway through the eductor cylinder. The charged water then re-enters the main water flow to either dechlorinate or chlorinate your water. The vacuum stays consistent through the flow range, allowing you to control the feed solution by means of the control valve. When dechlorinating you mix your reagent solution based on your chlorine level. Then you can fine-tune the amount of reagent to the chlorine level by means of the Feed Solution Control Valve. This allows you to make up your solution as strong as you need, and still allowing you to only introduce what is necessary to do the dechlorinating. This can be achieved by starting at the full open position on the control valve, then lower the control valve opening; test your water; and when you get a reading of chlorine, open back up the control valve just a small amount until you can test with no chlorine in the water. You have now balanced the reagent to the chlorine level in the water; if you are using sodium-based reagents you can minimize the side effects by only adding what is needed to remove the chlorine.

The H_2O Neutralizer® can be installed either at the hydrant or blow-off point with a maximum hose length of twenty feet on the discharge side of the unit or if the

point of discharge is farther than twenty feet from the hydrant, any length of hose can be put on the inlet side of the H_2O Neutralizer®. This holds true for either DeChlorinating or Chlorinating of your system.

2.1 Orifice Rings and how to use them

The 3M and 5M H_2O Neutralizer® comes with a factory installed main orifice ring and three additional rings. The insert rings are designed to control the discharge rate of flow or to build differential pressure within the device to allow the eductor to produce a full vacuum.

If you do get a vacuum on the feed solution line and you are pushing water out of the line instead of pulling a vacuum, what this means is that you have not created differential pressure at the orifice ring.

- Check to make sure that you have all valves in the full open position.
- Make sure that your orifice is the smallest opening in the system. If not install a smaller orifice.
- Increase water pressure. If you can not increase water pressure install a smaller orifice.
- Make sure that you do not have more then twenty feet (6.096 m) of discharge hose. If needed re-locate hose in front of device.

2.2 Connections

2.2.1 The 3M H_2O Neutralizer® comes with two special adapters. Each adapter has female hydrant threads BY Type ‘A’ or ‘D’ Cam Loc connections. The device comes with Cam Loc connections, this allows for a combination of connection possibilities.

2.2.1.1 For connecting to service lines smaller then the hydrant threads.

- Use a bushing that has the proper male hydrant thread BY the properly sized FNPT.
- Measurement Technologies has a special chlorinating adapter, see the sales catalog for information.

2.2.1.2 Connecting to service lines larger then the hydrant threads.

- Use a standard Cam Loc fitting with NPT connections BY Cam Loc.

2.2.2 The 5M H_2O Neutralizer® comes standard with a 4.5” swivel inlet connection and a 5” Type ‘A’ Cam Loc outlet connection. Standard inlet thread is National Standard Thread, special threads connections can be ordered. 5M devices requiring a 4” inlet must be made up using Cam Loc fittings. This will allow the inserting of orifice rings.

2.2.2.1 Connecting to service lines smaller then 4” is not recommended.

2.2.2.2 Connecting to service lines larger then 4.5”.

- Inlet and outlet connections can be changed out to other piping configurations. Remember that you need to be able to insert orifice rings. Main orifice tube has 5” MNPT on each end.

3.0 Calculations

3.1 Total amount of water

Weather you are chlorinating or dechlorinating all formula's are based on knowing the amount of water. Using the Feed Solution Spreadsheet program allows you to enter the footage of pipe by size that you are working with, or just entering the total gallons into the *'Grand Total'* box.

3.1.1 Manually calculating the total gallons within a pipe.

Pipe Size	Gal/Ft	Ltr/Ft
4"	0.7	2.65
10"	4.5	17.03
16"	11.3	42.77
24"	25.4	96.15
42"	77.0	291.47
60"	148.3	561.36

Pipe Size	Gal/Ft	Ltr/Ft
6"	1.6	6.06
12"	6.4	24.23
18"	14.3	54.13
30"	39.4	149.14
48"	100.5	380.43
64"	168.7	638.59

Pipe Size	Gal/Ft	Ltr/Ft
8"	2.9	10.98
14"	8.6	32.55
20"	17.6	66.63
36"	56.7	214.63
54"	129.3	489.44

Multiply total footage of pipe by size ***by*** the gallon per foot amount.

3.2 Chlorine residual level (CRL)

Monitoring for "free residual chlorine" and "total residual chlorine" (free available plus combined available chlorine) is a requirement during dechlorination. The concentration of residual chlorine in the discharge water will determine the dosing rate of the dechlorination chemical. Monitoring for residual chlorine level is required for chlorination as well.

Field test kits should be used to determine chlorine residual levels. The detection limit needs to read at 0.01 mg/l level for dechlorination.

Palintest Duo 1000 test kit reads to 0.01 mg/l and also has high range detection to 200 ppm. This device is idea for both chlorinating and dechlorinating.

3.3 Chlorinating

The H_2O Neutralizer® allows you to comply with all the requirements of AWWA C-651-05 'Disinfecting Water Mains' standard, for pipeline chlorination.

The following equation was used for determining the below chart.

$$\text{Pounds of Chlorine} = \frac{V \times C}{119{,}000}$$

V= total volume of water in gallons
C= concentration of chlorine in mg/l or ppm

Pounds of Chlorine based on ppm

Gallons	10 ppm	20 ppm	30 ppm	40 ppm	50 ppm	75 ppm	100 ppm	150 ppm	200 ppm
100	0.01	0.02	0.03	0.04	0.05	0.07	0.09	0.13	0.17
500	0.04	0.08	0.13	0.17	0.21	0.32	0.42	0.63	0.84
1,000	0.08	0.16	0.25	0.34	0.42	0.63	0.84	1.26	1.68
5,000	0.42	0.84	1.26	1.68	2.10	3.15	4.20	6.30	8.40
10,000	0.84	1.68	2.52	3.36	4.20	6.30	8.40	12.61	16.81
50,000	4.20	8.40	12.61	16.81	21.01	31.51	42.02	63.03	84.03
100,000	8.40	16.80	25.21	33.61	42.02	63.03	84.03	126.05	168.07

3.3.1 12.5% Sodium Hypochlorite

3.3.1.1 Sodium Hypochlorite conforming to ANSI/AWWA B300 is available in liquid form in container sizes from 1 gallon to 50 gallon. In concentrations of 5% to 15% with 12.5% being the typical strength.

3.3.1.2 The H_2O Neutralizer® allows you to chlorinate with two different methods.

3.3.1.2.1 Straight from the container.
All adjusting of the chlorine residual level will be done with the feed solution control valve.

3.3.1.2.2 *No-Brainer* method of chlorination.
This is based on controlling the flow rate in filling the system, then mixing water with 12.5% sodium hypochlorite and having the feed solution control valve in the full open position.

3.3.2 Granular Calcium Hypochlorite

3.3.2.1 Calcium hypochlorite conforming to ANSI/AWWA B300 is available in granular form or tablets (tablets can not be used with the H_2O Neutralizer® and must contain approximately 65 percent available chlorine by weight.

3.3.2.2 Using the Feed Solution spreadsheet program determine the total amount of chlorine require. Then divide the total pounds of chlorine ***BY*** .65, this will give you the required amount of granular calcium hypochlorite.

3.4 DeChlorinating

The H_2O Neutralizer® is able to use any of the dechlorination chemicals that are available. However, due to manufacturing differences the H_2O Neutralizer® is

only guaranteed to neutralize chlorine when using *No-Chlor*™ dechlorination grade Ascorbic Acid or Calcium Thiosulfate Solution.

3.4.1 *No Chlor*™ DeChlorination Grade Ascorbic Acid.

3.4.1.1 Determine the required amount of ascorbic acid.
Multiply your chlorine residual level ***BY*** 0.0000084. Multiply your answer ***BY*** the total gallons of water to be dechlorinated. Now, multiply that answer ***BY*** 2.5. Your answer is total amount of *No-Chlor*™ that is required.

EXAMPLE:
0.0000084 (1ppm per gallon of water)
X 43 (Chlorine residual level)
0.0003612
X 10,000 (Total gallons of water to be neutralized)
3.62 (Pounds of Chlorine)
X 2.5 (Dechlorination chemical factor)
9.03 (Pounds of *No-Chlor*™ required)

3.4.2 *No-Chlor*™ DeChlorination Grade Calcium Thiosulfate Solution.

3.4.2.1 Determine the required amount of Calcium Thiosulfate Solution
Multiply your chlorine residual level ***BY*** 0.0000084. Multiply your answer ***BY*** the total gallons of water to be dechlorinated. Now, multiply that answer ***BY*** 0.4. Your answer is total amount of *No-Chlor*™ that is required.

EXAMPLE:
0.0000084 (1ppm per gallon of water)
X 43 (Chlorine residual level)
0.0003612
X 10,000 (Total gallons of water to be neutralized)
3.62 (Pounds of Chlorine)
X 0.4 (Dechlorination chemical factor)
1.45 (Gallons of *No-Chlor*™ required)

Or, the easy method is to register your device and get the feed solution spreadsheet program on CD-Rom.

4 Chlorinating

4.1 General Operation

Using the H_2O Neutralizer® for Chlorinating is just as easy as DeChlorinating. When using this device in a closed system (not to open discharge), all you have to maintain is greater incoming pressure then discharge pressure. We recommend having 15-20 psi of differential pressure. Check with the local controlling agencies as to the requirement of Backflow protection devices in your connection to the existing system. Your filling point should be at the high end of

the system. You should be discharging your weakened water at the low point of the new system. If this is not possible, you will have to have additional pressure to overcome the additional force required to push the water uphill. You may be required to use two H_2O Neutralizer®; one on the intake (this is for chlorinating), and one on the discharge point of the new system (this is for DeChlorinating weakened super chlorinated water). When you are chlorinating your new system, your specifications will call out how hot your water should be (target ppm at filling time) and what your ppm should be after twenty-four hours of contact time. When you start to fill your system, the first main slug of water should be at a high level of chlorine residual, then start to reduce the residual level as you fill the rest of the system.

If you consider the entering water as individual water molecules issued "**X**" number of chlorine bullets, these bullets will be used as the water travels down the pipeline purifying the line. You want to make sure that the water first entering the system has plenty of chlorine bullets. This way the water will be purifying the line as far as possible in the system before that water becomes too weak to do the job. You must have sample points selected throughout the system to get accurate readings on your chlorine residual level. As your chlorine residual level starts to stay at the target level of super chlorinated water, you may turn down the control valve to lower the number of chlorine bullets being issued to the water molecules. When your discharge point has reached the proper chlorine residual level, you may shut down your filling operation.

It is recommended that you follow the ANSI/AWWA C651-05 or current standard for Disinfecting Water Mains.

4.2 Set-Up

- Attach 2½" FNST x Type 'D' adapter to blow-off or fire hydrant. If you are connecting to a filling point which is not 2½" in size, you will need a bushing to down size to your line size. Make sure that you have installed the next size smaller orifice. If you are using a line size of 1" (minimum) you must install a bolt nut and fender washer into the ¾" orifice to block the entire flow, which will force the water thought the by-pass allowing the device to function properly.
- The H_2O Neutralizer® must be located at the entry point of the new system. All meters, backflow preventors and any length of hose must be located in front of the device. Check with local regulations.
- Your point of entry must be within the first ten feet of your piping system
- Install a control valve. If desired.
- Determine the line pressure from the source. Then compare the flow chart to the desired fill rate to determine what size orifice would be needed. It is always better to start with the smallest orifice, get everything working and then increase the orifice opening after everything is working.
- Install the required orifice to the unit. Always remember that you need to have the orifice smaller then the smallest ID of your filling line.
- You must have a 15-20 psi differential pressure at the main line orifice for the modified venturi to properly work.
- Attach the H_2O Neutralizer®.

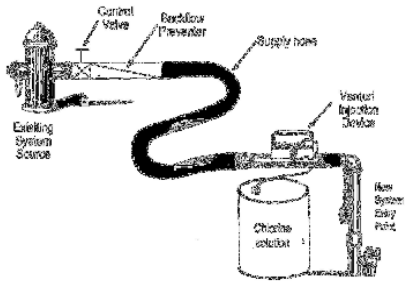
- Attach 3” Discharge hose to the H_2O Neutralizer®, and then attach to the source connection assembly. If you are using a 2½” hose, use 2½” FNST x Male Cam adapter, attached directly to the H_2O Neutralizer®, then run your hose to your source connection.
- Select various sample points throughout the system, making sure that your first sample point is in close proximity to the entry point.
- Prepare chlorine feed solution according to charts. Note, the device will give you 60 GPH of feed solution; you should dilute your chlorine to avoid overloading your system with too high of a chlorine residual level.
- You will be chlorinating your system by means of a modified slug method. When using this method make sure that your feed solution is of the proper strength and have a nearby sample point.
- It is recommended to have a higher chlorine residual level at first, (minimum of 100 ppm) and then lower your residual level as you fill the pipeline. The reason for this is that the water that enters your pipeline at first must travel the full length of your system.
- As you test from your sample points you will notice that the chlorine residual level will start to maintain the high level that you have at the entry point. At this time you can start to turn down the amount of chlorine that you are putting into the device by turning down the feed solution control valve or by diluting your feed solution.
- Once you test for the desired chlorine residual level at your discharge point, you have finished your super chlorinating.

  Follow the specifiers’ requirement for contact time and discharge water in the proper manner.

4.3 Chlorination procedures

- Prevent contaminating materials from entering the water main during installation.
- Flush water main to remove those materials that may have entered the water main during construction.
- Pressure test the water main at this time, this way if you have a leak you are not discharging super chlorinated water into the environment.
- Determine the proper amount of chlorine that will be required. Remember that if your water main is dirty it will use more chlorine then if clean.
- Multiply your target CRL ***by*** 0.0000084; this will give you the amount of chlorine in each gallon of water. Now, multiply this answer ***by*** the total gallons of water to be chlorinated. This answer will be the total pounds of chlorine, now you will have to convert this answer into the proper amount of chlorine for disinfection i.e. 65% Calcium Hypochlorite, 12.5% Sodium Hypochlorite.
- **OR, JUST DOWNLOAD YOUR COPY OF THE EXCEL SPREADSHEET PROGRAM FOR CALUATING ALL YOUR REQUIRED MATERIALS.** This done by registering your device with Measurement Technologies.
- Protect the existing distribution system from backflow.
- Have the proper chlorine test equipment.

- Pre-determine the test port locations for chlorine testing. The first test port should be located either just after the device using the 2” chlorine adapter or within the first ten feet from the entry point.
- The number of additional test port will be determine by the number of lateral lines and length of pipeline. Each dead-end or lateral line should have a test port at the end.
- It is always better to start with the ¾” orifice installed in the device. After you have everything working you can always install a larger orifice ring to increase flow rate. If you have to connect to a 1” service line, remember to install the ¾” orifice with fender washers.



4.3.1 Adjusting CRL

- **C**hlorine **R**esidual **L**evel means the PPM or **P**arts **P**er **M**illion of chlorine is in the water. Your project specifications will call out the level they want you to chlorinate your pipeline. Most specifications will state the CRL when you finish chlorinating the pipeline; remember it will require more chlorine to chlorinate the pipeline to the CRL specified because of contaminated material that is still in the pipeline when you start to fill the pipeline.
- The first third of the required water needed to fill the line should contain a higher CRL then the last 2/3’s. This water must travel the complete system so if you do not have high CRL, the chlorine will be used purifying the pipeline before you get to the end of the pipeline. You will then have to discharge water that does not meet the specifications for CRL exposure time of 24 hours.
- Start filling the new system with the control valve in the full open position, as soon as the vacuum is started, draw a water sample and determine CRL.
- As you fill the system check your CRL at the next test port location. Test points should at regular intervals along the pipeline.
- As the chlorine residual level increases adjust the control valve to lower the CRL that is entering the system, never go below the final CRL specified.
- Test points can be taken from service line connections, fire hydrants blow-off hydrants or dedicated testing ports.

4.3.2 Order of chlorination

- If your pipeline has a main trunk line with lateral lines coming off in different directions. Start with the entry point on the trunk line then by

opening and closing of valve direct the water into the first lateral line fill that section to the specified CRL, change valves and direct the water to the next section. Continue this until the system is filled with super chlorinated water.

- If you have a series of hills on the project relocate the device to high points and chlorinate in sections.

4.3.3 Are we done yet?

- When each section and all test points read the proper CRL you are finished.
- If you have to discharge water that does not meet the minimum CRL you must dechlorinate before this water can be released into the environment.

4.4 Getting ready to dechlorinate

After you have finished chlorinating your system and all valves have been shut down. Disconnect the H_2O Neutralizer® and flush device with clean water. Follow the specifications for the project on the length of contact time that the chlorine must remain in the pipeline. You should never let the super chlorinated water remain in the pipeline longer then the required amount of time because the chlorine can harm gaskets and linings. At times it can be more difficult to reduce CRL when you flush the line and dechlorinate.

After the contact time has been met. Take CRL test at various locations in the system to determine that you still have the required amount of CRL.

Prepare your discharge site area.

- Depending on the size of the system you may have to have multiply discharge locations, if this is the case plan you're flushing so that you end at the farthest point from the filling location.
- Make sure that your receiving area will handle the planned rate of flow and the amount of water that is being planned in the discharge.
- Beware of soil erosion in discharge area, if this is a possibility make arrangements to control.

5 DeChlorinating

5.1 General Operation

EPA is mandating that the discharge of chlorinated water to the Storm Sewer Systems be eliminated; this is to protect aquatic life. Utilities, contractors, fire departments and all others that must discharge potable water into the storm sewer system must remove the chlorine and at the same time control the pH levels and dissolved oxygen.

The H_2O Neutralizer® is a device that will allow you to dechlorinate potable water (to over 300+ ppm of chlorinated water) for discharge directly into the environment by use of various DeChlorinating reagents. The device was designed primarily for use with *No Chlor*™ DeChlorination Grade Calcium Thiosulfate Solution or Ascorbic Acid; however, it will work with sodium-based reagents as well. The H_2O Neutralizer® will allow you to control the amount of reagent entering the potable water to properly balance the amount of reagent to the chlorine. An additional benefit of this device is that you may also chlorinate your systems by using the same method and just replacing your reagent with chlorine solution.

5.2 Set-Up

- Add proper amount of *No-Chlor*™ DeChlorination Grade Ascorbic acid to the feed solution water. Make sure that all ascorbic is diluted in water before flushing starts.
- Sprinkle *No-Chlor*™ DeChlorination Grade Ascorbic acid in the discharge pathway.
- Turn Feed solution control valve to the ***Full Open*** position.
- Open water valve on blow-off or hydrant to start the flushing. Make sure that you have 20 psi of by-pass pressure and vacuum.
- Check chlorine residual level with proper test equipment. (By using a DPD or OTO based chlorine test kit, you are able to quickly tell if you have removed the chlorine). If you still have chlorine in your test water, your feed solution is not made to the correct strength. Add more *No-Chlor*™ DeChlorination Grade Ascorbic acid to the feed solution batch. Also, put one cup of *No-Chlor*™ DeChlorination Grade Ascorbic acid into the discharged water path. RECHECK WATER.
- IF YOU STILL HAVE CHLORINE IN THE WATER SHUT DOWN THE FLUSH AND DETERMINE WHAT IS CAUSING THE PROBLEM. Test source water for chlorine residual level.
- If you have no chlorine with the control valve in the *full open* position, turn down the valve until you get a trace of chlorine back into your test water. Then, SLIGHTLY OPEN the valve to once again remove the chlorine.
- Once you have tested for zero chlorine with a DPD or OTO based chlorine test kit, ***RETEST*** with the proper testing equipment to verify that you have completely removed the chlorine from your discharge.
- Record the time of your test and the discharge information. This should be done every time you start a new batch of feed solution.
- When discharging super chlorinated water, you need to be concerned with the rate of discharge flow. Ideally discharge should not exceed 300 gpm. However, there are times when the flow can be increased beyond that rate, as well as times when your discharge rate should be at lower levels. This is true when you are reaching levels in the 200 ppm range. Also, check with governing bodies for higher discharge rate approval.
- You may change orifices to increase discharge flow rate if all tests indicate no chlorine residual in discharge water. The higher the chlorine residual level to be DeChlorinated, the slower the discharge rate.

- When mixing your next batch of feed solution, check the incoming chlorine residual by drawing a sample from the make-up water valve and testing. As the level decreases you adjust your formula for the next batch.
- When switching your feed solution suction hose to your new batch of feed solution, ALWAYS VERIFY THAT YOU HAVE ZERO CHLORINE IN YOUR DISCHARGE.
- Once your incoming water matches the source waters chlorine residual level you have finished your flush.

5.3 DeChlorination Procedures

The H_2O Neutralizer® is a device that will allow you to dechlorinate potable water for discharge directly into the environment or Storm Sewer System by use of various dechlorinating reagents. The device was designed primarily for use with *No-Chlor*™ DeChlorination Grade Ascorbic Acid; however, it will work with sodium-based reagents as well. The H_2O Neutralizer® allows you to control the amount of reagent entering the water and properly balance the amount of reagent to the chlorine

The H_2O Neutralizer® works on differential pressure, which directs part of the water through the eductor block. When the water travels through the modified venturi assembly a vacuum is created on the feed solution line. This vacuum will reach 29 inches after you have 20 psi of by-pass pressure in the eductor block. The vacuum allows you to introduce either a dechlorination reagent into the waterway through the modified venturi. The charged water then re-enters the main water flow to dechlorinate your water. The vacuum stays consistent through the flow range allowing you to control the feed solution by means of the control valve. When DeChlorinating, mix the reagent solution based on the chlorine level. Then fine-tune the amount of reagent to the chlorine level by means of the feed solution control valve. This allows you to make up your solution as strong as you need, and still allowing you to only introduce what is needed to do the DeChlorinating. This can be achieved by starting at the full open position on the control valve, and then gradually close the valve until a trace of chlorine is detected in the discharge. The valve should then be opened slightly until the detectable trace of chlorine disappears. You have now balanced the reagent to the chlorine level in the water. If you are using sodium-based reagents you have minimized the side effects by only adding what is needed to remove the chlorine. Testing should be performed frequently to assure proper operation of the unit throughout the flushing process.

The H_2O Neutralizer® can be installed either at the hydrant or blow-off point with a maximum hose length of twenty feet on the discharge side of the unit, or if the point of discharge is farther than twenty feet from the hydrant, any length of hose can be put on the front side of the H_2O Neutralizer®.

5.3.1 Test CRL

- When you are ready to discharge your water test for CRL.
- Either manually calculate your required amount of *No-Chlor*™ Dechlorination Grade Calcium Thiosulfate Solution or Ascorbic Acid or use the spreadsheet program to determine.

- Always have extra dechlorination material on hand to be able to handle any unforeseen problems.

5.3.2 Starting the discharge to dechlorinate using Calcium Thiosulfate Solution.

In preparing to dechlorinate chlorinated water, you must first determine the approximate amount of chlorine that needs to be dechlorinated. When using *No-Chlor*™ DeChlorination Grade Calcium Thiosulfate Solution we have found that 0.4 gallons of *No-Chlor*™ will neutralize one pound of chlorine. The formula for making up a feed solution is based on the chlorine level to be dechlorinated. The H_2O Neutralizer® delivers 60 gallons per hour of feed solution through the eductor. You control the rate of flow of the neutralizing reagent by the control valve in the feed solution line. This allows you to balance the amount of reagent entering the water therefore conserving on the reagent. If you find that you have the control valve down in the lower numbers of the scale, adjust by adding water to the CTS feed solution. This will help in conserving on reagent and allow more control in neutralizing of the water.

- CTS comes in liquid form, you will only need additional container if you dilute the CTS with water. Thirty-Two gallon plastic container work well for this.
- If the connection is different then a 2 ½" Male NST, make up the required connection, using a 3" Type "A" Cam lock adapter with a bushing installed to the proper connection.
- Proper testing equipment. Chlorine indicator and a DPD type-testing unit are recommended.
- Notify proper authorities of your discharge, if required.
- Determine if you will require an additional discharge hose to locate between the discharge outlet and the device.

- Make connection to pipeline discharge point. Install additional hose if the discharge point is farther than twenty feet from this connection. Attach special 2 ½" F x Type 'A' adapter to either the hydrant, blow-off or discharge outlet, and then attach the H_2O Neutralizer®.

- Attach optional 3" Dust Cap, and then pressurize the device. Fill your feed solution container (if needed); make note of the pressure gauge reading at this time. Shut down the pressure, remove dust cap.

- Determine discharge rate by comparing the pressure gauge reading to the Flow Chart. If required, insert one of the three orifices into the H_2O Neutralizer®.

- Attach discharge hose and Full Flow Diffuser to the H_2O Neutralizer®. See diagrams.

- Open Feed Solution Control valve to the full open position and place feed solution tube into the CTS container.

- Pour a small amount of ***No-Chlor***™ CTS in the open discharge pathway. This will prevent any chlorinated water from being discharged into the environment.

- Open discharge valve to start the flow of discharge water. Check for vacuum. If you do not have vacuum, check by-pass pressure gauge for pressure. If there is not enough pressure insert a smaller orifice.

- Verify that you have removed chlorine from the water by using OTO solution or acceptable method. If you still have not removed the chlorine from the discharge water decrease the discharge flow. Once you have tested for no chlorine in your discharge, you may turn down the feed solution control valve until you test for chlorine again. What you are doing is balancing the strength of your feed solution to the residual level of the chlorine in your discharge. ***NOW***, TEST YOUR DISCHARGE WITH THE ***proper testing equipment*** and record the information in a record book.

- Exchange feed solution tube when the first container is finished into the next container of CTS.

5.3.3 Starting the discharge to dechlorinate using ascorbic acid.

In preparing to dechlorinate super chlorinated water, you must first determine the approximate amount of chlorine that needs to be dechlorinated. When using *No-Chlor*™ DeChlorination Grade ascorbic acid we have found that 2 1/2 pounds of *No-Chlor*™ will neutralize one pound of chlorine. The formula for making up a feed solution is based on the chlorine level to be dechlorinated. For every five gallons of feed solution and every 10 ppm of chlorine, you add one cup of *No-Chlor*™ ascorbic acid. So if you have 40 ppm of chlorine to be neutralized, you would make up your solution with four (4) cups of *No-Chlor*™ to every five (5) gallons of solution. If you are using a thirty (30) gallon feed solution container (this would then give you 30 minutes of flushing time per batch of feed solution) you would add 24 cups of *No-Chlor*™ into the container. The H_2O Neutralizer® delivers 65 gallons per hour of feed solution through the eductor. You control the rate of flow of the neutralizing reagent by the control valve in the feed solution line. This allows you to balance the amount of reagent entering the water therefore conserving on the reagent. If you find that you have the control valve down in the lower numbers of the scale, adjust the next batch of feed solution. Do not put in as much *No-Chlor*™. This will help in conserving on reagent and allow more control in neutralizing of the water.

- Determine the size of feed solution containers required for the project. Two containers are required. The size can be determined by estimating the amount of water that will be discharged. The feed solution at full vacuum has a 1-gallon per minute suction rate, so 5-gallon buckets will only last 5 minutes and 32-gallon barrels will last 30 minutes. Use the proper feed solution bucket for the project.

- If the connection is different then a 2 ½" Male NST, make up the required connection, using a 3" Type "A" Cam lock adapter with a bushing installed to the proper connection.
- Proper testing equipment. Chlorine indicator and a DPD type-testing unit are recommended.
- Notify proper authorities of your discharge, if required.
- Determine if you will require an additional discharge hose to locate between the discharge outlet to the device.

- Make connection to pipe line discharge point. Install additional hose if the discharge point is farther than twenty feet from this connection. Attach special 2 ½" F x Type 'A' adapter to either the hydrant, blow-off or discharge outlet, and then attach the H_2O Neutralizer®.

- Attach optional 3" Dust Cap, and then pressurize the device. Fill your feed solution container; make note of the pressure gauge reading at this time. Shut down the pressure, remove dust cap.

- Determine discharge rate by comparing the pressure gauge reading to the Flow Chart. If required, insert one of the three orifices into the H_2O Neutralizer®.

- Attach discharge hose and Full Flow Diffuser to the H_2O Neutralizer®. See diagrams.

- Mix ***No-Chlor***™ ascorbic acid dechlorination grade with make-up water to create the feed solution water. Follow the feed solution formulas.

- Open Feed Solution Control valve to the full open position and place feed solution tube into the container.

- Spread a small amount of ***No-Chlor***™ ascorbic acid in the open discharge pathway. This will prevent any chlorinated water from being discharged into the environment.

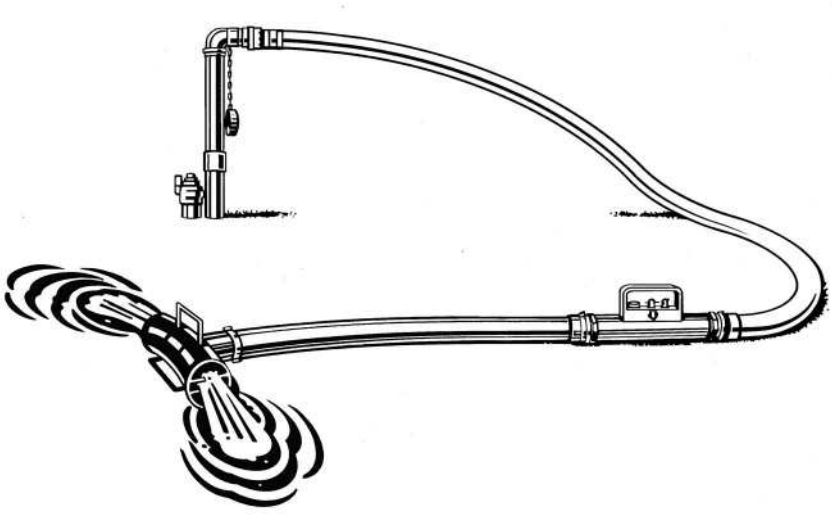
- Open discharge valve to start the flow of discharge water. Check for vacuum. If you do not have vacuum, check by-pass pressure gauge for pressure. If there is not enough pressure insert a smaller orifice.

- Verify that you have removed chlorine from the water by using OTO solution or acceptable method. If you still have not removed the chlorine from the discharge water increase the amount of ***No-Chlor***™ ascorbic acid in the feed solution container. Once you have tested for no chlorine in your discharge, you may turn down the feed solution control valve until you test for chlorine again. What you are doing is balancing the strength of your feed solution to the residual level of the chlorine in your discharge. ***NOW***, TEST YOUR DISCHARGE WITH THE ***proper testing equipment*** and record the information in a record book.

- Fill the second feed solution container from the make-up water. At this time, check the incoming chlorine residual level of the discharge water by pulling test water from the make-up water valve. Mix your batch of solution based on the residual level of the test. Exchange feed solution tube when the first container is finished.

5.3.4 Are we done yet?

When the CRL being discharged matches the CRL from the source system that the new water is coming from, you are finished flushing the super chlorinated water from the newly installed pipeline.



Feed Solution Tables

Feed solution formulas are based upon using the 3M H_2O Neutralizer® with *No-Chlor*™ DeChlorination Grade Ascorbic acid. Measurement Technologies, Inc. will only guarantee the neutralizing of up to 300 ppm chlorine, when using No-*Chlor*™ DeChlorination Grade Ascorbic acid and following the procedures set below with the H_2O Neutralizer®.

No-Brainer Method:

- Potable drinking water, up to 2 ppm of chlorine or chloramines:
  ½ cup (3 cups for 5M H_2O Neutralizer®) *No-Chlor*™ into every 5 gallons of make up water.
- Super chlorinated water:
  1 cup *No-Chlor*™ for every 10 ppm of chlorine into every 5 gallons of make up water.
  5M H_2O Neutralizer® should not be used to dechlorinate ***Super Chlorinated Water***.

FEED SOLUTION CHART:

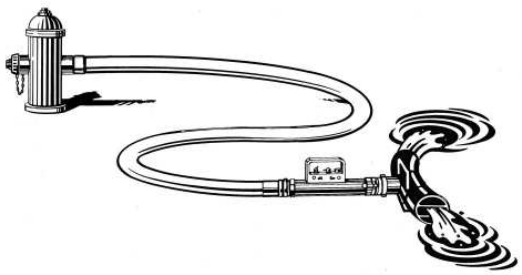
Calculate your feed solution by flow rate vs. chlorine residual level

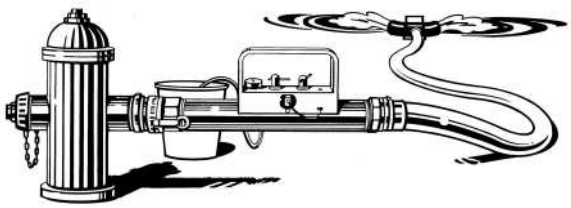
- Determine the rate of flow of your discharge.
- Determine the chlorine residual level of the water.
- Multiply the flow rate ***BY*** the ppm of chlorine residual level. Use the chart to determine the proper amount of *No-Chlor*™ per every five gallons of feed solution.

Feed Solution Chart

Factor			Cups / 5 Gals.
>	-	1100	1/3 cup
1101	-	2200	2/3 cup
2201	-	3300	1 cup
3301	-	6600	2 cups
6601	-	9900	3 cups
9901	-	13,200	4 cups
13,201	-	16,500	5 cups

Factor	Cups / 5 Gals.
16,501 – 19,800	6 cups
19,801 – 23,100	7 cups
23,101 – 26400	8cups
26,401 – 29,700	9 cups
29,701 – 33,000	10 cups
33,001 – 36,300	11 cups
36,301 – 39,600	12 cups





H_2O Neutralizer®

Flow Chart

Model: 3M (3”)

Flow Characteristics

Orifice Size	Flow Rate
0.75”	25 – 100 gpm
1.00”	100 – 200 gpm
1.50”	200 – 450 gpm
2.00”	450 – 750+ gpm

Flow Table

By Pass Pressure:	5 psi	10 psi	15 psi	20 psi	30 psi	40 psi	50 psi	60 psi	70 psi	80 psi
Orifice Size	Flow Rate GPM (approximate)									
0.75”	20	45	75	90	100	110				
1.00”	100	120	130	140	150	180	190	200		
1.50”		200	240	275	300	350	375	425	450	
2.00”				400	500	600	670	710	750	790

Model: 5M (5”)

Flow Characteristics

Orifice Size	Flow Rate
2.50”	600 - 1250 gpm
3.00”	1250 - 1600 gpm
3.50”	1600 - 2000 gpm
4.00”	2000 - 2700 gpm

Flow Table

By Pass Pressure:	10 psi	20 psi	30 psi	40 psi	50 psi	60 psi	70 psi	80 psi
Orifice Size	Flow Rate GPM (approximate)							
2.50”	600	765	835	970	1040	1180	1250	1285
3.00”		435	1110	1320	1450	1575	1665	1752
3.50”		1110	1390	1665	1860	1970	2085	2194
4.00”		1590	1735	2025	2170	2455	2600	2675

Note:

1. Flow rates rounded to nearest 10 gallons.
2. If the unit is attached directly to the fire hydrant instead of the diffuser assembly, care must be taken to minimize friction losses on the discharge side of the unit. Only twenty feet of discharge hose may be attached to the unit.
3. The orifice selection and flow tables are based on utilizing a maximum twenty-foot section of 3” diameter fire hose on the discharge side of the unit.
4. High-end flow rates are available under ideal conditions with high inlet pressure.

6 Troubleshooting

No vacuum.

- Eductor (modified venturi) has debris in throat opening. Slightly turn Eductor valve to create a backwash, to clean the throat opening or shut down the flushing and inspect the eductor.

Water comes out of the feed solution hose, no vacuum.

- No differential pressure. Increase flow rate or insert a smaller orifice. Check by-pass pressure gauge.

Still have chlorine in discharge water.

- Increase strength of feed solution. Add more *No-Chlor*™ DeChlorination Grade Ascorbic acid.
- Slow down discharge rate.
- Verify that your test equipment is working properly or retest with different testing equipment.
- Allow adequate time for ascorbic acid to completely dissolve into solution. Cold water will slow down dilution rate. At times it will help to use warm water, as this will allow you to make extremely high strengths of solution.

7 Maintenance

7.1 General

It is recommended that the following maintenance be performed after each use:

- Thoroughly flush the unit and eductor block assembly with clean water.

- Remove the venturi assembly for cleaning and lubricate the cylinder and o-rings with a light coating of mineral oil.

Periodic maintenance may need to be performed on the follow components:

- Regularly inspect the valves for proper operation and seepage.

- Remove eductor block assembly for cleaning and lubricate the block and o-rings with a light coating of mineral oil.

8 Warranty

H_2O NEUTRALIZER®

LIMITED WARRANTY

Measurement Technologies, Inc. warrants the H_2O Neutralizer® against defects in materials and manufacture for one year from date of shipment. Measurement Technologies will, at its sole option repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor. The customer is, however, responsible for any transportation cost. This warranty does not cover failures due to abuse, misuse, improper installation, accident or unauthorized alteration or repairs.

THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLLIED OR STATUARY, INCLUDING ANY LIABILITY ARISING UNDER ANY WARRANTIY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, WHICH MAY VARY FROM STATE TO STATE.

Measurement Technologies, Inc. is not liable or responsible for any loss, damage or injury to any person or property directly or indirectly rising from the use or inability to use the product. User shall determine the suitability of the product for its intended use before using. User assumes all risk in connection with the use of the product. No claims for labor or damage will be allowed. The foregoing warranties and remedies are exclusive and in lieu of all others, whether written, oral or implied. There is no warranty on merchandise or fitness for a specific use of any product.

9 Contact Information

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