



OPERATING INSTRUCTION MANUAL

Mark 2 Silver Recovery Unit



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Statement of Warranty and Liability

All equipment manufactured by Hallmark Refining Corporation is guaranteed against defects in materials and workmanship for a period of six months from the date of shipment from our factory. Any claimed defects must be reported, and the materials and/or equipment must be returned freight prepaid, to our plant within the guarantee period. Our liability for defects in material and/or workmanship shall be limited to the replacing or repairing, at our option, such defective materials and/or equipment at no cost to the purchaser. Warranty replacement items will be shipped regular surface freight at Hallmark Refining Corporation's expense. Any damages or loss occurring during shipment are not covered by this warranty but are the responsibility of the carrier(s). Please report all shipping damage to the carrier(s) immediately.

All materials and/or equipment furnished by other suppliers carry no warranty except said supplier's warranty as to materials and workmanship. Transportation, handling damage, wear and tear, and other causes of damage outside the control of the manufacturer are not covered by this warranty. Under no circumstances will Hallmark Refining Corporation be responsible for any damage, loss or liability of any nature arising out of the installation and/or use of the materials and or use of equipment furnished.

There are no other warranties, expressed or implied, except as stated above. The warranty becomes null and void if any devices or accessories other than those distributed or officially recommended by Hallmark Refining Corporation, are installed, or attached to this equipment.

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An Introduction to Silver Recovery

Silver recovery has become an increasingly important concern for photo labs as the local discharge limits for silver have become stricter. Properly maintained silver recovery systems can achieve most of these strict requirements and may even be a source of income. Proper operation and maintenance are vital to achieving both environmental and economic goals.

The images created on photographic films and papers are captured by exposure to silver halide. When these films and papers pass through their respective chemical processes, most of the silver is dissolved into one or more chemical solutions. These solutions are called Fixer for film and Bleach-Fix for paper, and in some processes a Stabilizer Rinse may be used that will contain silver. As the Fixer or Bleach-Fix removes silver, active ingredients are used up. Automated processing machines replenish these chemicals automatically. Excess chemistry, containing silver, overflows into waste holding tanks, which should be transferred to the Silver Recovery Unit or they may overflow directly into the Silver Recovery Unit.

As films and papers travel through these solutions, they carry chemicals from one step to the next. This means that any chemical step downstream from the Fixer or Bleach-Fix may also contain silver in its overflow. These will need to be treated if they contain silver above the local limit.

With today's heightened environmental concerns, most sewage agencies regard silver as a hazardous material. Silver bearing chemicals must be treated to remove the silver before the chemicals may be disposed. There are several ways to treat waste chemicals. The Mark 2 Silver Recovery System is designed to de-silver silver bearing waste solutions on site. The level of silver that can remain in the disposed chemicals varies from location to location, but generally must fall below 5 parts per million (5 ppm). Many agencies however, require an even lower level of silver in a waste destined for sewer disposal.

The Mark 2 Silver Recovery System will reduce the level of silver consistently to below 5 ppm when maintained and operated properly.

Hallmark Refining recommends that all photofinishing labs comply with the laws governing the disposal of hazardous materials for their operation.

Installation of the Mark 2 Silver Recovery Unit

- Pump Station
- Containment Cart
- Plumbing Kit containing:
 - (1) Pre-assembled ¾" Exit Hose Assembly with Sample Valve and Grey Quick Disconnect Elbow
 - (1) Pre-assembled Quick Disconnect Bridge Assembly with Sample Valve and Quick Disconnect Elbows
 - (1) #12 Clamp
 - (4) Swivel Casters with Phillips Head Screws
 - (1) Operations Manual
- Two Mark 3X Quick Disconnect Silver Recovery Columns with Shipping Information

Tools Required:

- Phillips Screwdriver
1. Remove the pump station from its box. Open the small box containing the plumbing kit and locate the casters and screws. Install the casters on the bottom of the containment tray using the pilot holes provided. Place the pump station inside the tray, on the left.
 2. Remove the columns from their boxes and the quick disconnect cap covers from the top of the columns. Leave the caps tethered to the quick disconnect inserts. These caps will be needed to return the column to Hallmark Refining when it is exhausted. Some air may escape when the caps are removed. This is normal, as the columns are pressure checked at Hallmark Refining before shipping. Place the columns inside the containment tray, on the right.
 3. Connect the pump station to the "in" of the first column using the pre-assembled section of tubing provided. The red elbow should snap onto the red quick disconnect nipple fitting on the column.
 4. Connect the two columns together using the pre-assembled bridge assembly. The GREY "out" of the first column should lead into the RED "in" of the second column. The elbows are color-coded and should correspond to the color of the nipple fittings. RED is IN and GREY is OUT.
 5. Attach the pre-assembled GREY quick disconnect elbow with a 10 foot length of ¾" tubing from the outlet of the secondary column to the drain. This tubing needs to be long enough to reach the drain with a loop in it between the drain and the second column. (See Illustration 1) The loop creates a P-Trap effect and reduces rust formation.

6. From inside the tank, remove the section of tubing used to immobilize the float switches during shipping.
If the float switch covers are not removed, the alarm will sound and the system will run continuously!
7. Check to be sure that all hose fittings and elbows have been securely attached. Plug the system into an uninterrupted source of power, preferably with a GFI Outlet. A 9 Volt battery is supplied with the unit and shipped inverted to prevent the SRU from alarming in transit. Slide the battery from its cover and install it.
8. Fill the pump station with water to test the system for leaks. **Both columns must be filled with water prior to the introduction of silver bearing waste.** A complete holding tank of water will have to be pumped through the unit before water will begin to exit the columns to the drain.
9. The system is now ready to process silver bearing waste. If the system is to be direct plumbed from the processor, remove one of the plugs from the rear of the system tank and install a polyethylene elbow. The most common connection would be to 5/8" tubing and would utilize a large barbed elbow and a large stainless steel hose clamp.



The Hallmark Mark 2 Silver Recovery Unit should be located near an outlet and be easily accessible. The use of extension cords is not recommended.



Illustration 1: Configuration of the Mark 2 Silver Recovery Unit

Operation of the Mark 2 Silver Recovery Unit

The Mark 2 Unit was developed specifically for low volume users. The system is designed to operate optimally with the Mark 3X Hallmark Silver Recovery Columns. The pump station has been designed to pump at a flow rate of 42 mL/min.

Pressure Relief Valve (PRV)

Located between the Mark 2 Silver Recovery pump and the primary silver recovery column, the Pressure Relief Valve (PRV) protects the pump and columns from damage from excessive pressure. Blockages in the tubing or dishwasher fitting obstruct the flow of liquid through the system. If a blockage occurs, the PRV diverts the flow of solution back into the holding tank.

Silver Testing

For optimum performance of the Mark 2 Silver Recovery Unit, a silver dip test must be performed weekly. **For the most accurate reading, silver testing should be performed after the unit has been operating for at least two hours.** When **ANY** color change is detected between the columns, the first column is exhausted. Call Hallmark Refining Corporation at 800-255-1895 to order a new column.

Silver Testing Procedure

Materials:

- Silver test paper (Part Number 112-001)
This is supplied with your system. To reorder, contact Hallmark Refining Corporation. *This item is light sensitive and should be kept in the packaging in a dry drawer when not in use.*
- Standard personal protective equipment (Goggles, gloves and apron)
- Container to collect sample (Film canisters work well)

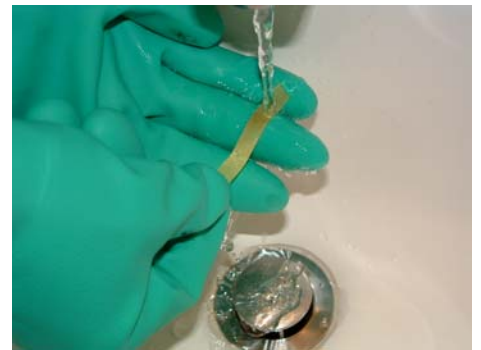
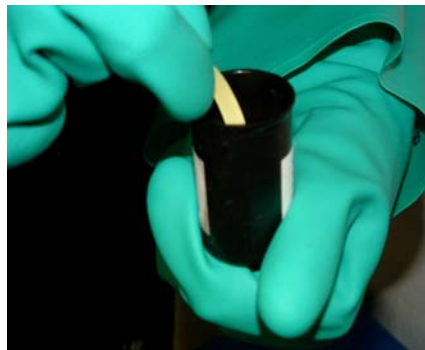
1. Put on your **Gloves, Apron and Goggles.**
2. **Turn off the silver recovery unit.**
3. Remove the plug on the second sample valve, closest to the drain. Place a graduated cylinder under the second sample valve and turn the lever to release any liquid and pressure in the line. **Opening the sample valve should only produce a dribble of liquid. If solution sprays out, this indicates the unit is pressurized. Refer to the troubleshooting guide for assistance.** Repeat this three times, pouring the chemistry back into the holding tank each time until the third sample. The first two will not give an accurate reading, so it is necessary to use the third collection. All solutions filling the graduate should be disposed of back in the Hallmark Mark 2 Silver Recovery Unit Holding Tank.



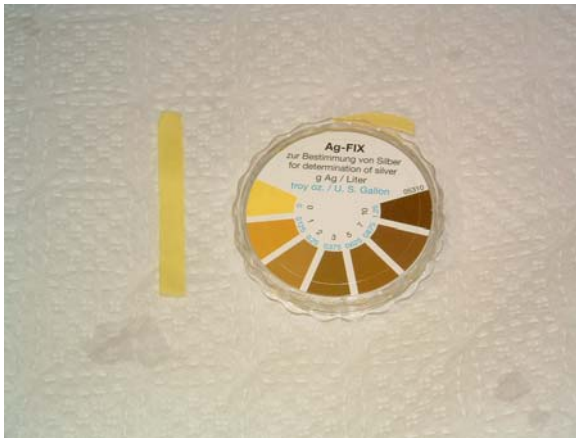
4. Transfer some of the solution from the graduate sample taken at the drain line into a film canister. Secure the cap tightly on the canister and shake vigorously, but carefully for 3 minutes. Take off the lid and allow the canister to sit until the foam dissipates.
5. Repeat this procedure at the sample valve between the two columns.



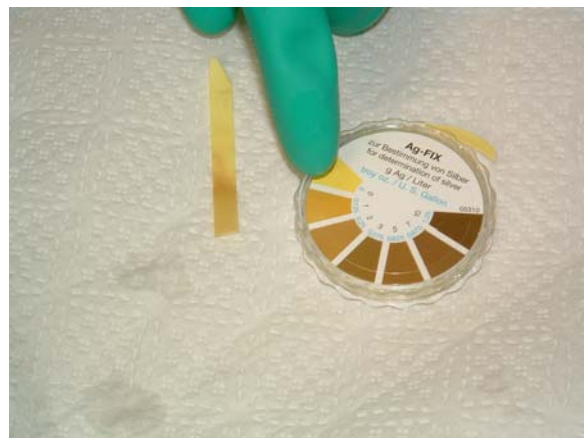
6. Transfer some of this solution from the graduate sample taken between the columns into a film canister. Secure the cap tightly on the canister and shake vigorously, but carefully for 3 minutes. Take off the lid and allow the canister to sit until the foam dissipates.
7. Tear off about 2 inches of silver test paper. Each sample will require its own test strip. Put the test strip halfway in the solution for 5 seconds. Rinse the strip under slowly running water for 30 seconds. The silver will not rinse off. The color of the chemistry must be removed to get an accurate reading.



If the silver test strip is not yellow, it is time to change the primary column. **ANY** brown color is an indicator that it is time to change the primary silver recovery column. If the strip from the drain sample is darker than the sample between the columns, verify the columns were changed properly and are in the correct positions and retest. Rust is brown and can give a false positive reading. Following these procedures and allowing the rust to settle to the bottom of the container should give the most accurate results. Unless the columns were changed improperly, it is not possible for silver to be at the drain if silver is not coming out of the primary column. To order a new Hallmark Column, call Hallmark Refining Corporation at 800-255-1895.



Silver test paper indicates column is performing optimally.



Silver test paper indicates primary column is exhausted.

Silver Recovery Log

Month:		Year:	
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Silver Test Paper Results

	(Attach test strip here)	(Date and Initial)
WEEK 1		
WEEK 2		
WEEK 3		
WEEK 4		
WEEK 5		

Column Information

	Serial Number	Date Installed	Initials
Primary			
Secondary			
2nd Primary			
2nd Secondary			

- ◆ *Transfer column information from last month's log sheet. At month end, transfer current column information to next month's Silver Recovery Log.*

Washing and Shipping a Chemical Recovery Column

1. When it is time to change a column on the silver recovery unit, the column being removed will need to be rinsed with clean water before removal to comply with EPA (Environmental Protection Agency) and DOT (Department of Transportation) laws. Failure to rinse the column prior to removal could result in a fine for the improper shipment of “hazardous waste”.
2. Fill the holding tank of the Mark 2 Silver Recovery Unit with cold tap water and allow it to be pumped through the system. The EPA requires that the column be triple rinsed prior to shipping. **It will take 2 holding tanks of water to equal three times the volume of the Mark 3X Column.** Washing can stop when no color change is detected in silver estimating paper used to sample the effluent from the column. To be certain that no soluble silver is present, allow the cartridge to stand overnight and then test a sample of the solution. If silver is present, repeat the washing step until no visible silver is present when tested. The silver test paper should remain yellow.
3. After completing the rinse step, remove the primary column and slide the secondary column into the primary position (connected to the pump). Install a new column in the secondary position (closest to the drain) and reinstall the quick disconnect elbows and tubing. Be certain all connections are secure before turning on the Silver Recovery Unit. The RED Quick Disconnect fitting is the inlet and the GREY Quick Disconnect fitting is the outlet of the column.
4. The rinsed column can now be capped and packaged for shipment.
5. Fill the holding tank with water and allow the water to pump through the system before filling the tank with additional silver bearing waste. Alternatively, the new column being installed into the secondary position may be manually filled with 3 gallons (12 Liters) of water. The columns work most effectively when they are filled with water before processing silver.

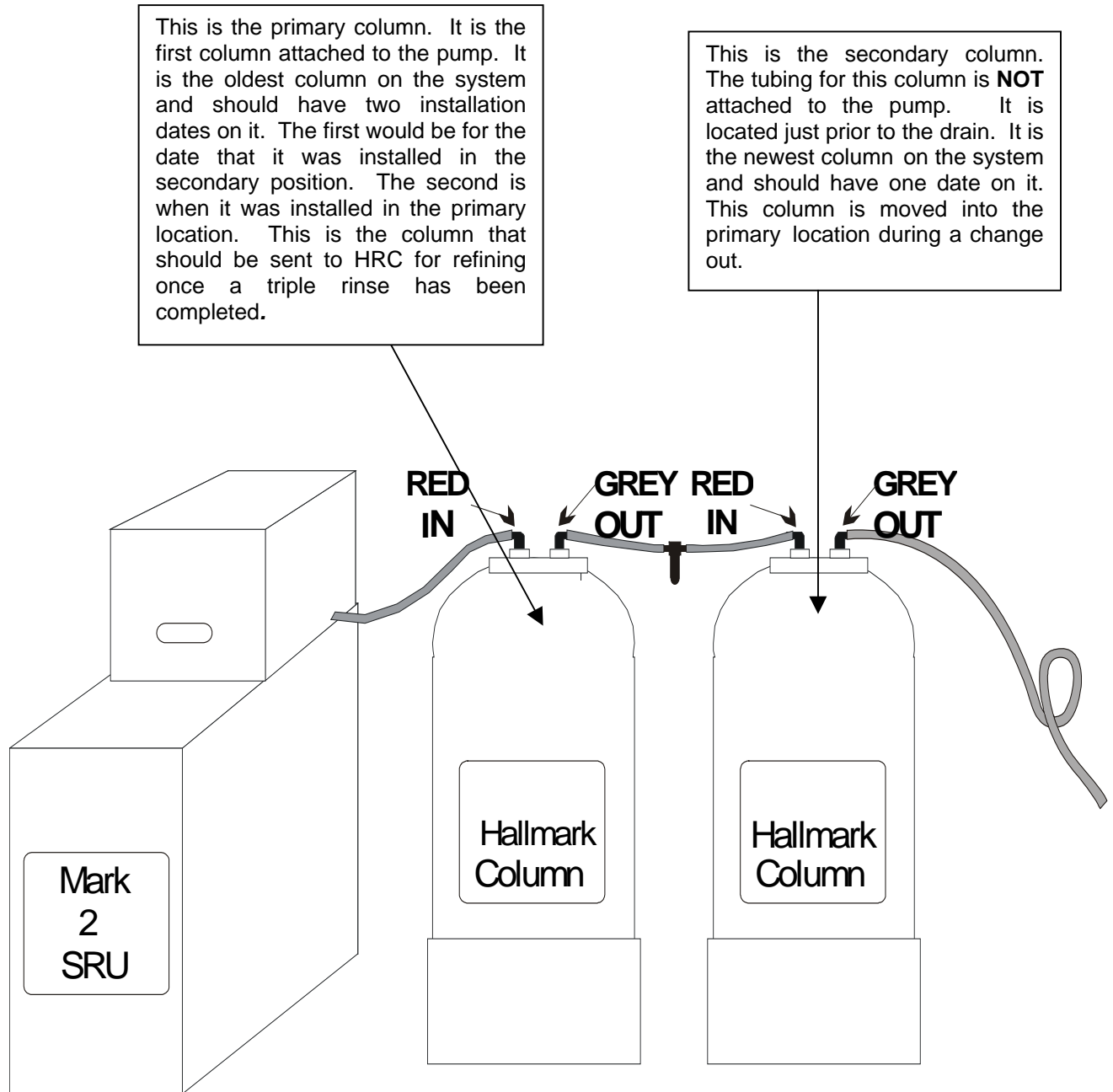
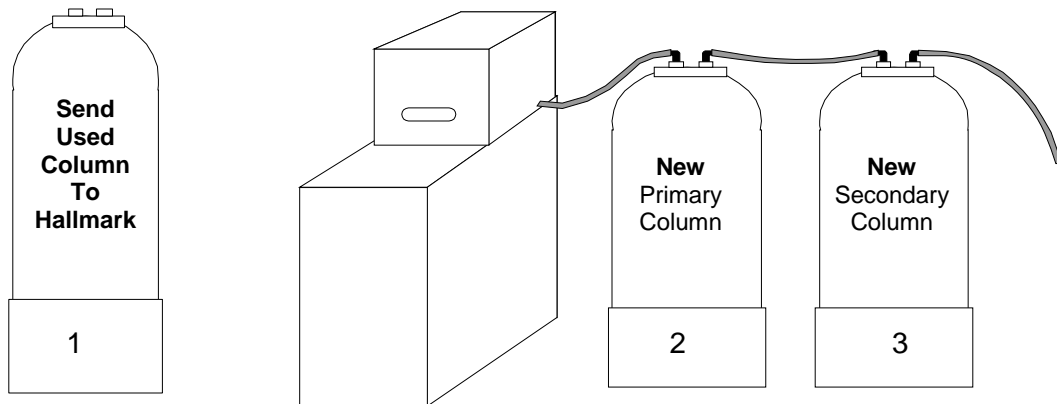
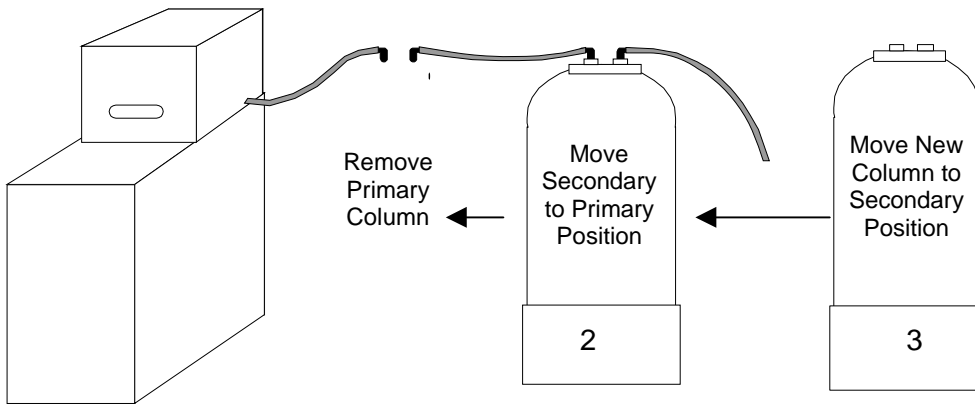
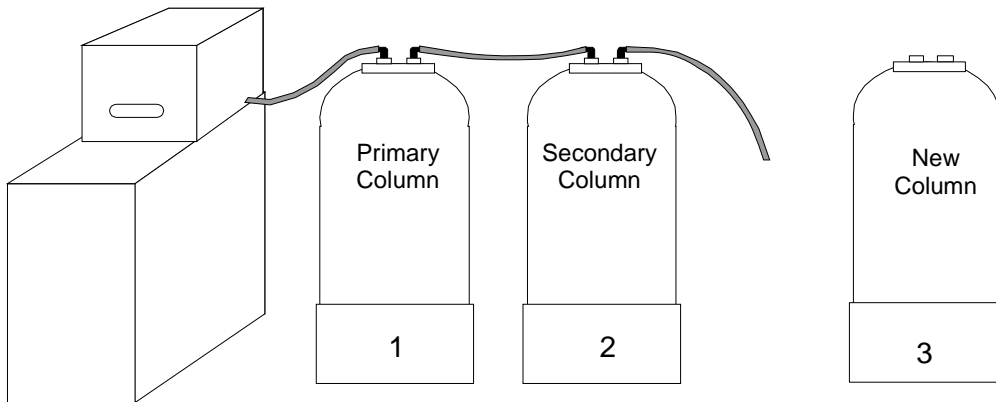


Illustration 2: Changing a Column on the Mark 2 System

Changing a Column is as easy as 1 – 2 – 3 !



Troubleshooting the Mark 2 Silver Recovery Unit

<p>The pump has no power.</p>	<ul style="list-style-type: none"> • Check the power source. Is it plugged in? If not, plug it in and/or turn the rocker switch to the on position. • Is the fuse burnt out? Inspect for cause. The fuse is a 1½ Amp Slo Blo. • Check the float switch in the holding tank. Does the bottom one turn the pump on when it is lifted? If not, new electronics may be needed. • Was it whining or humming when it stopped? If so, the motor may be burned out. <p>Please call Hallmark Refining @ 1-800-255-1895 to order parts.</p>
<p>The pump is running, but the solution is moving very slow.</p>	<ul style="list-style-type: none"> • Is the PRV (Pressure Relief Valve) activated? • Is there pressure at the sample valves? Wearing PPE, begin checking at the LAST sample valve for pressure and work your way backward. If high pressure exists at the last sample valve, follow the instructions for cleaning the dishwasher fitting. • Has a pump output test been done? Disconnect the tube from the in valve of the first column. Place the tube in a graduated cylinder. When the first drop of liquid enters the cylinder, start timing the output for one minute. Turn off the unit after one minute. The output should be between 34 - 50 milliliters. • If the pump output is less than recommended, do the following: Check and clean the hose strainer in the holding tank. Inspect the poppet valves and follow the instructions for priming the pump.
<p>The pump is running, but the chemistry level in the holding tank is not dropping.</p>	<ul style="list-style-type: none"> • Is the PRV (Pressure Relief Valve) activated? • Is there pressure at the sample valves? Wearing PPE, begin checking at the LAST sample valve for pressure and work your way backward. If high pressure exists at the last sample valve, follow the instructions for cleaning the dishwasher fitting. • Has a pump output test been done? Disconnect the tube from the in valve of the first column. Place the tube in a graduated cylinder. When the first drop of liquid enters the cylinder, start timing the output for one minute. Turn off the unit after one minute. The output should be between 34 -50 milliliters. • If the pump output is less than recommended, do the following: Check and clean the hose strainer in the holding tank. Inspect the poppet valves and follow the instructions for priming the pump. • Is the bellows (plastic accordion part) warped or leaking? The bellows tends to warp when pumping against a blockage. ALWAYS relieve pressure at the sample valves before disconnecting the QD fittings. The PRV is intended to prevent this from happening. Make sure the blockage is removed before the new bellows is installed. Please call Hallmark Refining @ 1-800-255-1895 to order this part.

<p>The Mark 2 System is leaking.</p>	<ul style="list-style-type: none"> • Is the PRV (Pressure Relief Valve) activated? • Is there pressure at the sample valves? Wearing PPE, begin checking at the LAST sample valve for pressure and work your way backwards. If high pressure exists at the last sample valve, follow the instructions for cleaning the dishwasher fitting. • Is there liquid on top of the column near the elbows? If so, check to be sure the QD fittings are clicked into place. ALWAYS relieve pressure at the sample valves before disconnecting the QD fittings. • Is there a hole in the bellows (plastic accordion)? See section above. • Are any clamps loose? • Are the sample valves closed with the lever parallel to the ground? • Is the O-ring on the QD nipple present? This can be greased with Vaseline to create a better seal if the O-ring is worn out. • Are the columns exhausted?
<p>The system is full to the top and doesn't appear to be draining.</p>	<ul style="list-style-type: none"> • Was the holding tank over filled? • Was the unit shut off? Overfilling may occur if power to the unit is turned off. • Did the liquid enter the tank faster than the pump could remove it?
<p>The system runs 24 hours and never turns off.</p>	<ul style="list-style-type: none"> • Was the float switch cover removed from the float switch when the unit was installed? • There may be something under the bottom float switch that won't allow the system to shut off. • Check the float switch for sediment build up. Gently unhinge and clean the float switch. • Has the float switch toggle been hinged upside down? The float must hang down so that it will rise horizontally to activate when liquid raises it.

Poppet Valve Schematic

Poppet valves open and close to allow liquid to flow in and stay in the hoses. For this reason, the point of the poppet valve **must** point into the flow of the liquid. The O-Ring associated with the poppet valve **must** be on the outside of the poppet valve to seal it properly – it will **ALWAYS** be installed last.

If the gaskets of the poppet valves are not properly seated or the cone is twisted and not able to open and close freely, slow pumping or even no liquid movement will be experienced. If this is a continuous problem, check the rest of the system for blockage.

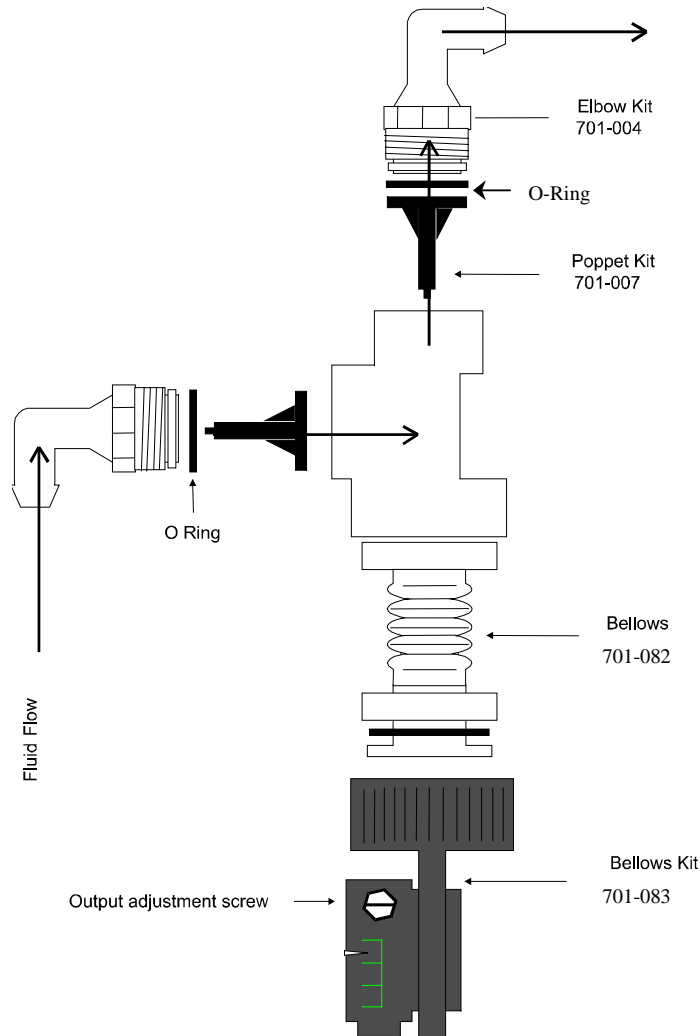


Illustration 3: Orientation of the GRI Pump Poppet Valves and O-Rings

Parts List for the Mark 2 Silver Recovery Unit

Part Number	Part Description
915-066	Drop In Assembly with PRV and Red QD
906-137	Holding Tank
906-138	Containment Tray with Casters
915-006	3/4" Sample Valve Assembly
511-002	1/2" Threaded Plug for Sample Valve
510-065	5/8" Poly MPT Elbow
511-005	Threaded Plug for Hallmark Column
917-026	3/4" QD Bridge Assembly with Sample Valve
917-027	3/4" QD Exit Hose Assembly with Sample Valve
520-004	1/4" Hose Strainer Assembly
520-005	Replacement Hose Strainer
520-025	Complete Hose Strainer Assembly with 1/4" Tubing
106-007	3/4" Clear Tubing
106-003	3/8" Clear Tubing
106-002	1/4" Clear Tubing
522-042	3/4" Plastic Hose Clamp
522-036	3/8" Plastic Hose Clamp
917-048	Pressure Relief Valve Assembly
514-036	3/8" x 3/4" Hose Adapter
916-003	Parts Kit with QD Fittings
701-080	GRI Pocket Bellows Pump
701-007	GRI Poppets with O-Rings (set of two)
701-082	GRI 3/4" Bellows
701-083	GRI 3/4" Bellows Kit
701-004	GRI 3/8" Elbow Connectors (set of two)
112-001	Silver Estimating Paper

Maintenance Procedures for the Mark 2 Silver Recovery Unit

Cleaning the Filter in the Mark 2 Holding Tank

For optimum performance of the Mark 2 Silver Recovery Unit, the filter in the holding tank should be checked and cleaned periodically.

To clean the filter:

1. Put on your **Gloves**, **Apron** and **Goggles**.
2. **Turn off the silver recovery unit.**
3. Open the lid of the holding tank. Pull up the holding tank filter located at the end of the flexible tubing.



4. Unscrew the filter.



5. Rinse the filter under running water. Use a brush if necessary.
6. Reattach the filter to the fitting by screwing it back in place and submerge the filter into the liquid in the holding tank.
7. Turn on the Silver Recovery Unit and resume normal operation.

Priming the GRI Pump

1. Put on your **Gloves, Apron and Goggles.**
2. **Turn off the silver recovery unit.**
3. With a container handy to catch any liquid, slowly open the sample valve on the exit tubing to relieve any pressure. Repeat this procedure at the sample valve between the columns. If pressure exists, follow the instructions to clean the dishwasher fitting before proceeding.
3. Remove the clear elbow on the side of the pump so that the side poppet valve and O-Ring are accessible. The tubing does not need to be removed. The elbow is held on by a swivel connector. Twist the swivel connector counter clockwise. Remove the O-Ring and poppet valve.
4. Remove the clear elbow on the top of the pump so that the top poppet valve is accessible. The tubing does not need to be removed. The elbow is held on by a swivel connector. Twist the swivel connector counter clockwise. Remove the O-Ring and poppet valve. This is best achieved by pushing the poppet valve up from inside the pump.
5. Clean both poppet valves with warm soapy water. Inspect the poppets and O-Rings to ensure they are in good working order.
6. Grasp the point of the poppet valve with two fingers and place the flat end of the poppet valve into the side of the pump head so that the point of the poppet valve is facing out of the pump head. Place the O-Ring over the point of the poppet valve. Twist on the side elbow hand tight over the point of the poppet valve and O-Ring. **O-Rings ALWAYS go in last. The O-Ring creates a seal between the poppet valve and elbow.**
7. Using a squirt bottle of water, fill the reservoir (bellows) with water until it slightly spills over.
8. Install the top poppet into the pump point down. Place the O-Ring onto the flat part of the poppet valve. **O-Rings ALWAYS go in last. The O-Ring creates a seal between the poppet valve and elbow.** Twist the clear plastic top elbow on hand tight. Refer to Illustration 3 for a diagram of the orientation of the poppet valves.

9. Be certain there are enough chemicals in the holding tank to cover the bottom float switch.
10. Have a container ready to catch the liquid that will come out of the pump and tubing still detached from the column.
11. Turn the power on to the Silver Recovery Unit. As the bellows begins to move up and down, it will pull the liquid up into the pump and push the liquid out as the bellows compresses together. If air bubbles are present or the liquid appears to hesitate coming up, air is getting into the pump and the elbows should be tightened or the poppet valves need to be replaced.
12. After 20-30 seconds, liquid should begin to flow through the pump.

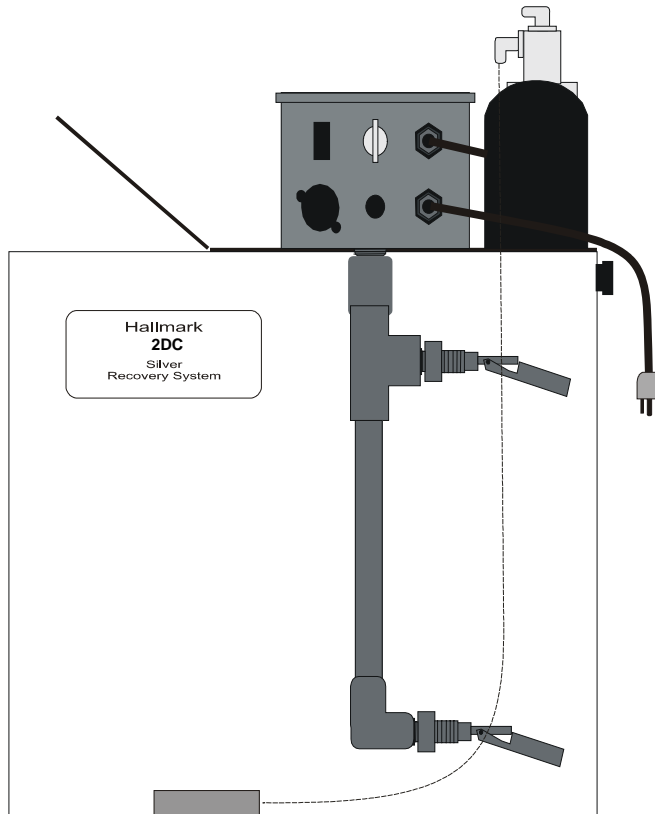


Illustration 4: Operational Schematic of the Mark 2 System

Calibration of the GRI Pump

The flow rate of the bellows can be verified by the following procedure:



During the following steps, silver bearing waste may have to be handled, use proper personal protective gear, including approved safety goggles and gloves.

1. Put on your **G**loves, **A**pron and **G**oggles.
2. **Turn off the silver recovery unit.**
3. With a container handy to catch any liquid, slowly open the sample valve on the exit tubing to relieve any pressure. Repeat this procedure at the sample valve between the columns. If pressure exists, follow the instructions to clean the dishwasher fitting before proceeding.
4. Press the large grey CPC button on the red elbow connected to the primary column and remove the red QD IN elbow on the first column.
5. Place a 100 mL graduated cylinder under the disconnected tubing and red elbow. Turn on the power to the Silver Recovery Unit.
6. Turn the pump on and begin counting 60 seconds when the first drop of liquid enters the cylinder.
7. Read the amount of liquid collected in the graduate.
8. Pour the collected liquid back into the Mark 2 Holding Tank.
9. Repeat this procedure at least three times to verify it is an accurate reading. Ideally, the pump should discharge 42 mL/min. Any reading within 20% of this is adequate.

Instructions for Cleaning the Dishwasher Fitting on the Drain Line

For optimum performance of the Mark 2 Silver Recovery Unit, the dishwasher fitting where the hose attaches from the last column to the sink should be checked and cleaned periodically.

To clean the dishwasher fitting:

1. Put on your **Gloves**, **Apron** and **Goggles**.
2. **Turn off the silver recovery unit.**
3. With a container handy to catch any liquid, slowly open the sample valve on the exit tubing to relieve any pressure.
4. Remove the exit tubing from the dishwasher fitting by loosening the hose clamp. Pull the tubing off the dishwasher fitting.
5. Insert a long screwdriver into the dishwasher fitting pipe and pull the debris out of the fitting. Try not to allow the debris to go down the pipes as it could cause a clog further down stream.
6. Once the debris has been removed to the best of your ability, squirt water into the dishwasher fitting. If the water drains, the fitting is clear. If the water does not drain, the clog is beyond the reach of the screwdriver and will require a plumber to snake the pipes.
7. Once the fitting is clear and water can drain freely, reattach the exit hose to the dishwasher fitting and tighten the hose clamp.
8. Turn on the Silver Recovery Unit and resume normal operation.
9. If pressure builds up again at the last sample valve, the clog has not been removed. Repeat this procedure or contact a plumber to clear the drain professionally.

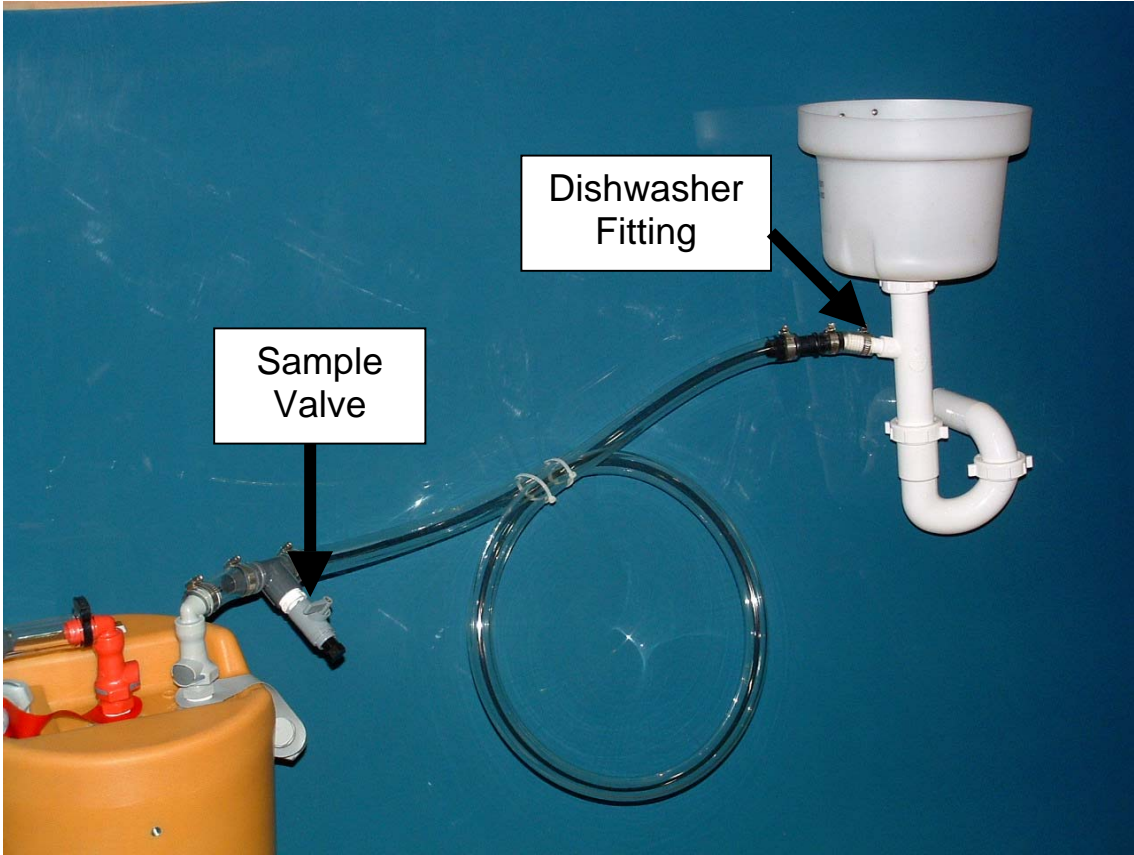
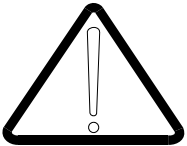


Illustration 5: Operational Picture of the Silver Recovery Drain



If the clog requires a plumber to fix it, this does not mean that all photo operations have to cease. The hose that would normally be attached to the dishwasher fitting can be put into a bucket. When the bucket is full, this container can be carried to another sink in the store and dumped down the drain.

Instructions for Using Iron Out in Photo Lab Applications

Iron Out should be used as a preventative measure to reduce iron build up in photo labs that use steel wool type silver recovery units. Photo labs that operate a liquid transfer station are at the most risk of damage from iron build up. Excessive iron buildup will cause liquid transfer station malfunction and clogged pipes. It is recommended that Iron Out be used weekly for best results.

Use Iron Out as follows:

1. Once a week, mix 1 cup Iron Out with 1 gallon warm water in a container. Be sure the Iron Out dissolves completely. Pour it down the drain, preferably after the lab has closed. This allows the Iron Out sufficient time to sit in the liquid transfer station's holding tank or pipes and dissolve iron buildup.

DO NOT pour the powdered Iron Out down the drain first, and then flush the sink with water. Undissolved Iron Out tends to crystallize and contributes to the buildup problem.

2. Iron Out will not solve current drainage problems. It is intended as a preventative measure only. Current problems need to be addressed and resolved before Iron Out can be effective.



Suggested Maintenance Checklist

As with any piece of equipment, the Mark 2 Silver Recovery Unit has maintenance requirements. The following suggestions are intended to keep the Silver Recovery Unit working optimally and efficiently with minimal down time.

Weekly Checklist:

- Flush holding tank with five Liters of warm water.
- Clean holding tank filter as required using instructions provided.
- Perform and log silver testing to determine if column should be changed. If at any time high pressure is present at the sample valves, follow the instructions provided for cleaning the dishwasher fitting.
- Flush drain with Iron Out using instructions provided.

Biannual Checklist:

- Clean poppet valves and replace if necessary.
- Clean and/or change soiled/clogged tubing.
- Clean and/or replace dishwasher fitting.
- Order spare parts as necessary to prevent expensive emergency overnight shipments.

Mark 2 Silver Recovery Unit Available Options

There are two options available for the Mark 2 Silver Recovery Unit. Both of these enable the user to optimize performance and chemical handling for the Mark 2 Silver Recovery Unit. The unit is fully operable without the use of either of these options, but the following is available.

External Float Switch Alarm for Drain Monitor

If the user does not have a direct drain for the waste exiting the silver recovery unit, a 2.5-gallon container with a drain monitor is available. The alarm is battery operated and could be used in a drum or waste container. When the container is full, the sensor will alarm.

Stand Alone Water iNjector for Flushing the Drain

The Stand Alone Water iNjector can be installed after the exit line of the Mark 2 Silver Recovery Unit. A solenoid valve injects liquid at timed intervals into the drain. The solenoid must be attached to a tee connector on the cold water connection of the water supply. The amount of time the water is injected as well as the amount of water can be adjusted. Refer to Illustration 6 for further details.

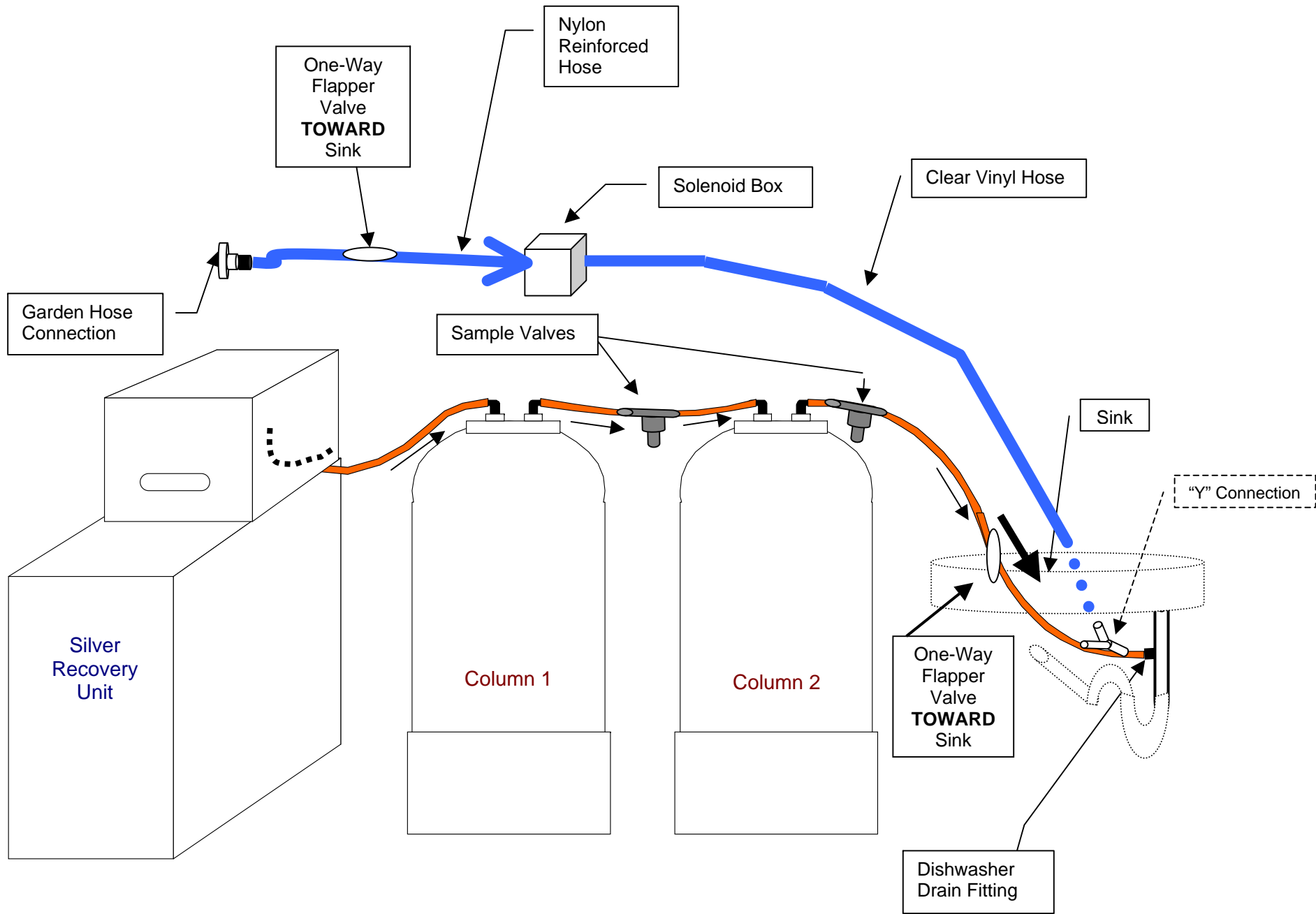


Illustration 6: Configuration of the Stand Alone iNjector System

Installation of the Mark 2 Water iNjector

Before installing the iNjector, the site should be prepared in advance with the following:

- Standard 110 VAC Electrical outlet
- Dishwasher drain fitting or fitting on Liquid Transfer Station
- Garden Hose Bib
- Operational Mark 2 Silver Recovery Unit manufactured by Hallmark Refining Corporation with Two One-Way Flapper Valves

Installation Instructions:

1. Open the box containing the solenoid and tubing. Remove all components. The box should contain:
 - Gray box containing solenoid with 2DC hoses and a low voltage lead attached as follows:
 - ◇ 6' braided tubing with garden hose fitting, attached to the IN side of the solenoid box.
 - ◇ 6' - 1/2" clear vinyl tubing attached to the OUT side of the solenoid box.
 - ◇ Low voltage electrical connection with 2DC male plugs, attached to solenoid box.
 - ◇ "Y" connector attached to clear tubing and 2DC hose clamps.
 - ◇ One-way flapper valve for exit line of the Silver Recovery Unit.
 - ◇ 4 self-tapping screws.
2. Locate the gray solenoid box in a place convenient to the hose bib and the drain. Attach the box to the wall or sink cabinet with the screws provided.
3. Connect the garden hose fitting on the braided hose to the hose bib. Tighten completely. The fitting has a screen/washer that must be in place before attaching it.
4. Attach the "Y" in the line so that the bottom leg of the "Y" is attached to the line going directly to the drain. **This should be positioned as close to the drain as possible.** The solenoid and the line from the column attach to the upper legs of the "Y". Secure with hose clamps provided.
5. Plug the Stand Alone iNjector into a 110V outlet.

6. Between the last sample valve and the “Y” connection fitting for the iNjector, install the one-way flapper valve in the line, clamping it firmly onto the tubing on either side. **The FLOW must be pointed towards the sink.** This valve prevents liquid from backflowing into the silver recovery columns.
7. Open the valve on the garden hose bib. Check for leaks and tighten connections if necessary.
8. Program the Stand Alone iNjector for the desired flush intervals and time frames.

FLOW CHART FOR SETTING INJECTOR DELAY AND FLUSH TIME

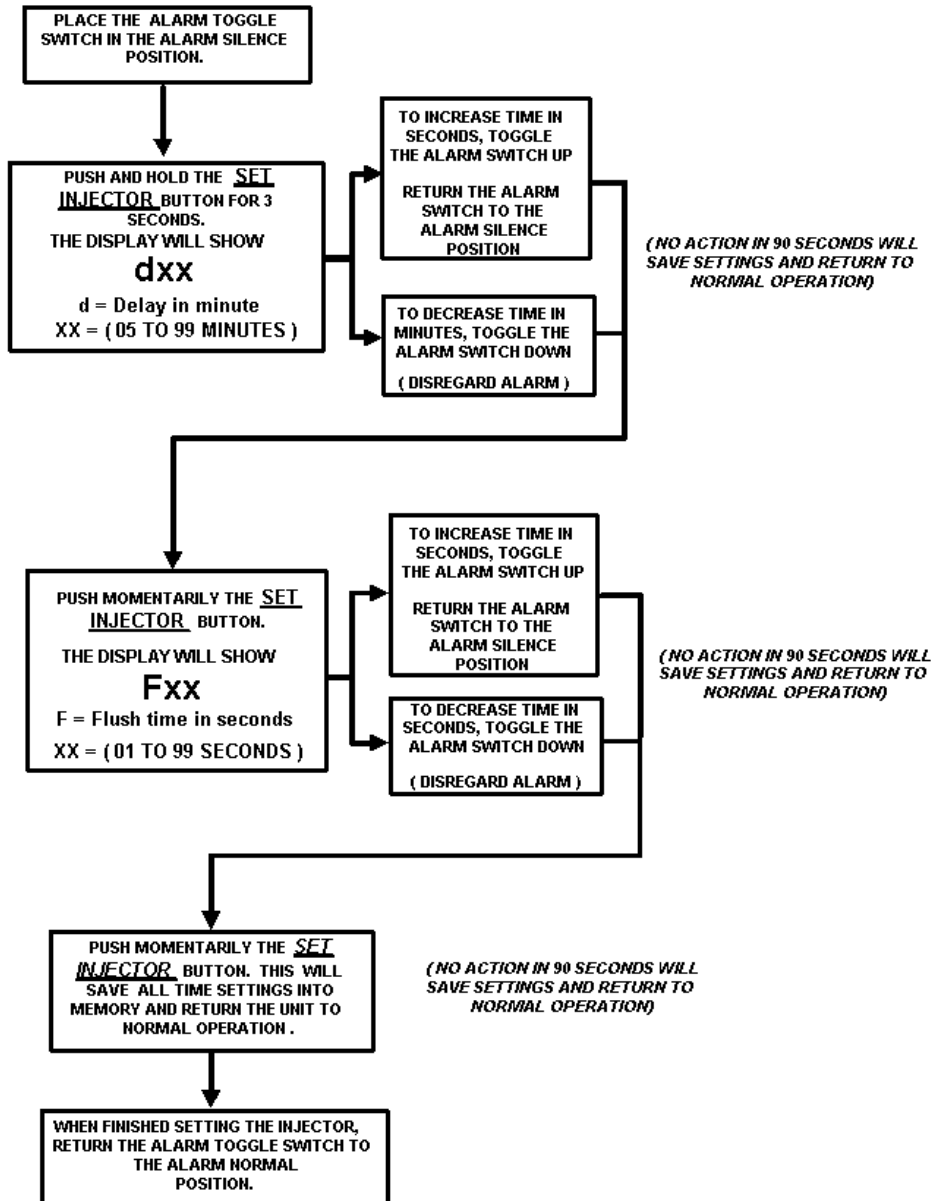


Illustration 7: Flow Chart for Setting iNjector Delay and Flush Time

Specifications for the Mark 2 Silver Recovery Unit

Pump Station Size.....	18" W x 18"L x 24" H
Containment Dimensions.....	18" W x 18"L x 10" H
Column Weight (Dry).....	18 lbs.
Column Weight (Wet).....	35 lbs.
Power Requirements.....	115 VAC, 150 Watts
Collection Tank Capacity.....	5 Gallons/19 Liters
Processing Speed.....	.65 gal/hr
Pump Flow Rate.....	42 mL/min
Column Potential (Primary).....	400 Gallons
Column Potential (Tailing).....	800 Gallons
Column Efficiency.....	1.0 ppm or less
Silver Return in Primary Application.....	Up to 50 Troy Ounces