

SPRAY SILVERING INSTRUCTIONS

INTRODUCTION

Spray Silvering uses an air compressor and specially designed spray guns to apply silvering chemicals to glass and other substrates. The reflective silver coating is not paint. It is created at the moment when the chemicals meet and mix on the surface. Each step in the process creates the conditions needed for this chemical reaction to occur. The process is not difficult but each step is important for success.

TABLE OF CONTENTS

INTRODUCTION.....	1
GLASS TRAY AND RACK.....	2
COMPRESSED-AIR EQUIPMENT	2
FILLING THE SILVER BOTTLES	5
MIXING THE SENSITIZER.....	5
CLEANING THE GLASS	5
STEPS FOR CLEANING THE GLASS.....	6
SENSITIZING THE GLASS.....	6
SILVERING THE GLASS	7
RINSING THE SILVER	7
GALVANIC COPPER	7
AIR DRYING THE MIRROR.....	8
PAINTING THE MIRROR.....	8
CLEANING THE FRONT OF THE MIRROR.....	8
ONE-TIME SETUP CHECKLIST.....	9
SILVERING SETUP CHECKLIST	10
SILVERING PROCESS CHECKLIST	11

GLASS TRAY AND RACK

The silvering reaction occurs whether the glass is vertical or horizontal. We think that you get a more uniform result and use silver more efficiently when the glass is horizontal.

Spray silvering is a wet process. You will need a tray to catch the run-off and a rack to hold the glass above the level of the waste water in the tray.

Spraying produces a chemical mist. Use adequate, active ventilation and a respirator designed for organic vapors. We include a respirator in our Spray Silver Kit.

- Your work area must be large enough to let you maneuver the glass safely
- The tray and rack must be strong, level and waterproof. We have instructions for Building a Large Mirroring Bench on our website.
- The rack must hold the glass at least 2" above the waste water to avoid splash back.
- The tray must drain into a separate container to capture and treat the run-off. See our Waste Treatment Instructions for details.

COMPRESSED-AIR EQUIPMENT

AIR COMPRESSOR

Your compressor should be able to deliver 6 to 8 CFM (cubic feet per minute) at 40 to 60 PSI (pounds per square inch). The HP (horse power) of the compressor is less important than its delivery rate. The larger the tank (measured in gallons), the less often the compressor will cycle off and on.

REGULATOR

You need a regulator to monitor and control the air pressure from your compressor. Some compressors have a built-in regulator. If your compressor does not include a regulator, you need to install one between the air compressor and the manifold.

AIR HOSES

The length of the hose and the size of the connections depend on your compressor and your regulator. You will need to connect the regulator to the Spray Silver Manifold. We recommend 'quick-connect' connectors. All hoses must be designed to withstand the *maximum pressure your compressor can supply*. Our hoses can withstand 150 PSI.

MANIFOLD

The manifold allows the compressor to drive multiple devices at once. Our manifold has ¼" NPT connectors.

SPRAY GUNS

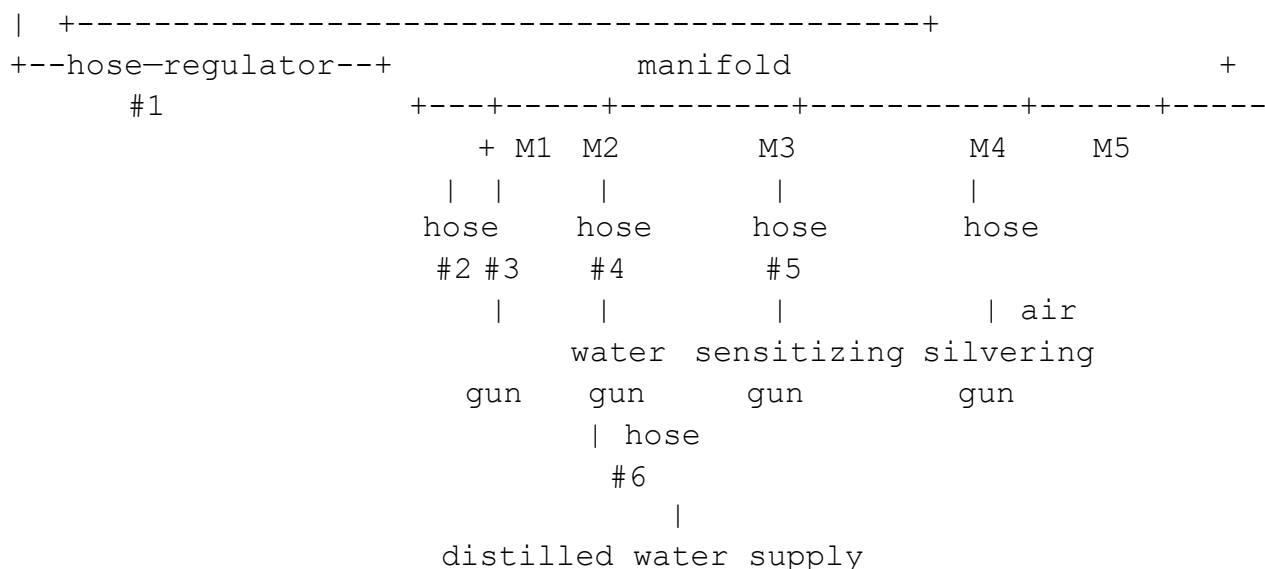
Spray guns for silvering must be made of stainless steel or plastic. Other metals such as brass, zinc or pot metal will contaminate and ruin the silvering chemicals. Guns that have previously been used for paint will also contaminate the chemicals. For spray silvering, you need four (4) separate guns:

- Silvering gun (dual-nozzle) for the silvering chemicals
- Sensitizer gun for the Sensitizer
- Distilled water gun for rinsing
- Air gun to force dry the finished mirror

COMPRESSED AIR TRAIN

The following schematic shows how to connect all these components together.

Compressor



WATER GUN

The water gun is used to rinse the glass with distilled water between each step in the process. You must use distilled, de-ionized or reverse osmosis water for mirroring. Any other type of bottled water or tap water will contaminate the silver. Our water gun has a barbed connector and a plastic hose that feeds into a distilled water container. The container must allow air to flow into the bottle as the gun draws out the distilled water.

SENSITIZING GUN

This is used to deliver the sensitizer (also known as the tinning solution). You must sensitize the glass before you silver it. Diluted Sensitizer is held in a one quart (1 liter) bottle underneath the gun. The gun and the metal parts of the HDPE bottle are made of stainless steel to resist attack from the sensitizing chemicals. The angle of the bottle relative to the gun can be adjusted when you attach the bottle.

SILVERING GUN

The silvering gun is basically two guns joined together with one handle and one trigger. This keeps the silver solution and the silver reducer separate until you mix them together on the glass.

Our silvering gun has a stainless-steel body to resist attack from the silver chemicals. It has a ¼" NPT male inlet to attach to the female-ended hose. Each side has a screw head and feed tube that attaches to a 1-quart HDPE bottle.

The jets from the two guns come together at a point about 1 foot in front of the gun. To get a smooth layer of silver, hold the gun 2 to 3 feet away from the glass so that they merge before they hit the glass. You should not "force" the silver onto the glass.

ADJUSTING THE SILVERING GUN

Before using the gun, check that each side is delivering the same rate of flow. Use distilled water for this test. Do not use silvering chemicals or tap water. Measure 500 mL of distilled water into each bottle and attach the bottles to the gun. Point the gun into a sink or tub, squeeze the trigger and hold for about 30 seconds. Remove the bottles from the guns and set them flat on your bench. The bottles should have lost the same amount of water. If the level is not the same, adjust the knobs on the end of each gun and repeat the test until the guns are spraying equally. The silvering process will not work if the guns are more than 10% out of balance.

AIR GUN

The air gun is used to blow-dry the mirror after you silver it and before you paint it. Having an air filter on your compressor will ensure that your mirror does not get ruined by oil in the air line.

FILLING THE SILVER BOTTLES

Use the same bottle for silver and reducer each time. Use a felt-tip permanent marker to label one side of the gun R for Reducer and the other S for Silver. Label one quart bottle Reducer and the other one Silver. Dilute the chemicals as follows.

1. Wash the bottle labeled Reducer with distilled water and empty it.
2. Measure **30 ml** of Concentrated Spray Silver Reducer into the bottle. Add **970 ml** of distilled water. Attach it to the right-side gun.
3. Wash the bottle labeled Silver with distilled water and empty it.
4. Measure **30 ml** of Concentrated Spray Silver Solution into this bottle. Add **970 ml** of distilled water. Attach it to the left-side of the gun.
5. The diluted solutions have a shelf life of 3 to 5 days but freshly mixed chemicals work best.

MIXING THE SENSITIZER

Sensitizer for 2-Part Silver has a dilution ratio of 500:1. The concentrated chemical has a shelf life of 9 to 12 months. We recommend that you store it in a refrigerator. Do not freeze.

Diluted Sensitizer has a shelf life of 6 to 8 hours. Mix up fresh every day.

1. Label the bottle as Sensitizer. Wash it with distilled water and empty it.
2. Use the syringe included with the Sensitizer for 2-Part Silver to measure out 1 ml and add it to the bottle for the Sensitizer gun. Replace the cap on the syringe to keep it clean.
3. Measure out 500 mL of distilled water and add it to the bottle for the Sensitizer gun.

CLEANING THE GLASS

The mirroring chemicals attach directly to the glass. The glass must be perfectly (chemically) clean before you mirror it. Windex® glass cleaner, Dawn® dishwashing detergent and many other glass cleaners leave a film on the glass that prevents the mirroring chemicals from attaching. Our optical grade Concentrated Glass Cleaners (liquid and powder) rinse cleanly without leaving a film.

Cerium oxide is an abrasive (not a detergent) that is used to polish the glass. Clean the glass before using cerium oxide so that you do not force dirt into the glass.

STEPS FOR CLEANING THE GLASS

1. Wearing rubber gloves to keep your fingerprints off the glass, wash the glass with diluted Glass Cleaner, very warm tap water and a clean, dedicated sponge or paper towel. Pay special attention to the edges which are often dirtier than the center of the glass.
2. Rinse off the Glass Cleaner with very warm tap water.
3. Sprinkle the wet glass with Cerium Oxide. Add more warm tap water to make a thin pink slurry. Polish the glass with cerium oxide using our pure wool Maple Felt Polisher. Scrub in circles as if you were polishing your car. Again, pay special attention to the edges of the glass.
4. Rinse the glass well with warm tap water and *wipe the glass* thoroughly with your very wet clean sponge. Cerium oxide adheres firmly to the glass surface and must be removed by wiping. Wiping and rinsing at the same time works best.
5. Once the cerium oxide has been removed, rinse the glass thoroughly with distilled water to remove all traces of tap water.

SENSITIZING THE GLASS

Sensitizer (tinning solution or Tin for Silver) is the chemical that attaches the silver to the glass. You must have a good coating of sensitizer. You must allow it time to attach to the surface and then you must *rinse it all off*. The sensitizer that you need will stick to the surface. Any excess sensitizer left on the surface will prevent the silver from forming a bright adherent coating on the glass.

1. Rinse the glass well with distilled water.
2. Spray on a generous layer of diluted Sensitizer.
3. Allow the Sensitizer to sit on the glass for at least 30 seconds. The timing is not critical. Allowing the Sensitizer to sit for more than about 30 seconds does not help or hurt the process.
4. Rinse off ALL of the Sensitizer with distilled water from the Spray Water gun. Be sure the glass is very well rinsed. You will not be able to rinse off the Sensitizer that has attached to the glass.

SILVERING THE GLASS

Spray Silver chemicals react fast but not instantly. For the best results, stand about 2 feet from the glass and spray the tinned, rinsed surface by 'wafting' the spray across the glass and then giving the chemicals about 10 seconds to react before spraying again.

Take care that you do not spray into the waste water below the glass and cause the waste to splash back onto the surface.

We strongly recommend wearing a respirator.

1. Cover the glass with one even spray of silvering chemicals and wait about 10 seconds for the silver to form.
2. Spray and wait again. If one area of the glass seems dark, spray more silver in that area. The spent silver waste water that covers the glass will be yellow brown.
3. If you are unsure about the coating, rinse the glass with distilled water to remove the waste chemicals and check the thickness of the silver. A good silver surface is almost opaque.
4. You can spray more silver onto the rinsed surface – the silver will adhere to itself so do not re-sensitize the surface.
5. A heavy coating of silver does not make the surface more reflective and it can actually weaken the bond between the silver and the glass.

RINSING THE SILVER

After you have silvered the glass, use the distilled water spray gun to rinse the silver thoroughly pushing all of the spent silver waste over the edge of the glass. Continue until no colored or cloudy liquid remains on the surface and the runoff is clear.

GALVANIC COPPER

After your glass is silvered and while it is still wet, you can add a layer of copper to protect the silver. The copper is a sacrificial layer that traps and neutralizes any contaminants, such as sulfur in the air, which might get through the backing paint and attack the silver. A perfect silver mirror with a copper backing will last many years longer than one that does not.

If you are making an antiqued or distressed mirror, be aware that the copper layer might show through the distressed silver.

We have separate instructions for applying the galvanic copper.

AIR DRYING THE MIRROR

To dry the mirror, use the air gun to push the water off the coppered surface. Take care not flick waste water from the mirroring tray back onto the glass. If you do, rinse it off with distilled water and dry again.

You can speed the drying process with a hair-dryer. Do not use a heat gun and do not concentrate heat in one spot or the glass may crack.

PAINTING THE MIRROR

When the glass is perfectly dry on both sides, apply the backing paint with a disposable foam roller. Instructions for thinning the backing paint for spraying are on our website. Allow the paint to cure 12 to 24 hours before packing or hanging the mirror.

CLEANING THE FRONT OF THE MIRROR

Paint spots and silvering chemicals often flow over the edge onto the front face of the mirror. When the backing paint is completely dry, you can remove it with a **new** single edge razor blade or a little Pumice on a wet paper towel. Be careful not to scratch the glass.

Silver drips or spots can be removed with a paste of Pumice and Silver Remover. Be careful not to let the Silver Remover attack the mirror back. Give the glass a final polish with dry Pumice and a clean, dry cloth.

ONE-TIME SETUP CHECKLIST

Do this before using the equipment for the first time

1. Refer to the schematic "Compressed Air Train" above.
2. Set the regulator on your compressor to deliver **40 psi** (pounds per square inch).
3. Attach the compressor hose to the manifold.
4. Attach four (4) air hoses to the manifold.
5. Attach the four (4) guns – air gun, water gun, sensitizer gun and silvering gun.
6. Confirm that the blue water tube is attached to the barbed connection on the water gun.
7. Insert the other end of the blue water tube into a bottle of steam distilled or de-ionized water.
8. Turn on the compressor and let the tank fill with air.
9. Test the guns with air to be sure they are connected properly.
10. Use a permanent felt tipped marker to label one quart bottle "Sensitizer".
11. Fill the bottle half way with distilled water.
12. Attach the bottle to the sensitizer gun.
13. Spray water from the sensitizer gun to test all the connections and clean the bottle and the gun.
14. Empty the quart bottle and blow all remaining water out of the gun.
15. Label one quart bottle "Silver" and the other quart bottle "Reducer".
16. Fill the bottles equally with distilled water.
17. Attach the bottles to the correct sides of the silvering gun.
18. Spray water from the gun to test all the connections and to clean the bottles and the guns.
19. Adjust the guns to deliver equal amounts of liquid (see above).
20. Empty the quart bottles and blow all remaining water out of the gun.

SILVERING SETUP CHECKLIST

Do this before every silvering session

1. Measure out 500 mL of distilled water.
2. Pour it into the "Sensitizer" bottle.
3. Measure out 1 ml of Concentrated Sensitizer for 2-Part Silver.
4. Pour it into the "Sensitizer" bottle.
5. Rock the bottle to mix.
6. Re-attach the Sensitizer bottle to the sensitizer gun.
7. Measure out 970 ml distilled water and pour it into the "Silver" bottle.
8. Measure out 30 ml Concentrated 2-Part Spray Silver Solution.
9. Pour it into the "Silver" bottle.
10. Rock the bottle to mix the solution.
11. Attach the "Silver" bottle to the "S" side of the gun.
12. Measure out 970 ml distilled water and pour it into the "Reducer" bottle.
13. Measure out 30 ml Concentrated 2-Part Spray Silver Reducer.
14. Pour it into the "Reducer" bottle.
15. Rock the bottle to mix the solution.
16. Attach the bottle to the "R" side of the gun.

SILVERING PROCESS CHECKLIST

CLEAN AND POLISH THE GLASS

1. Wear gloves at all times to keep finger prints off the glass and the chemicals off your fingers.
2. Clean the glass thoroughly with Glass Cleaner, hot tap water and a clean sponge.
3. Rinse the glass with hot tap water.
4. Sprinkle a little cerium oxide on the glass.
5. Use our Felt Polisher and hot tap water to polish the glass.
6. Use the sponge and hot tap water to wipe off all of the cerium oxide.
7. Inspect the glass to be sure that the water does not bead up anywhere.
8. Place the glass on the rack in your mirroring tray.
9. Spray-rinse the glass with distilled water to remove all traces of tap water.
10. Do not touch the glass until the silvering is complete.

SENSITIZE THE GLASS

11. Spray the glass all over with diluted Sensitizer for 2-Part Silver.
12. Wait about 30 seconds for the Sensitizer to attach to the glass.
13. Spray-rinse the glass very thoroughly with the water gun (you will not be able to rinse off the sensitizer that has attached to the glass).

MIRROR THE GLASS

14. Spray the glass evenly with the silvering chemicals.
15. Wait about 10 seconds for the silver to develop.
16. Repeat until the glass is almost opaque.
17. Spray-rinse the finished silver with distilled water.

BACK THE SILVER WITH GALVANIC COPPER

18. Sprinkle a light even layer of iron powder all over the wet silver.
19. Spray the silver with diluted Galvanic Copper solution.
20. Use the spray to move the iron powder to areas where the copper is not fully developed.
21. Remove all of the iron powder with distilled water.

AIR-DRY THE COPPERED SURFACE

22. Use the air hose to dry the coppered silvered glass.
23. Stand the mirror on edge to dry completely.

PAINT THE COPPER WITH BACKING PAINT

24. Paint the dry coppered silver with mirror backing paint using a foam roller or a paint spray gun.
25. Allow the paint to cure for *at least* 12 hours before installing the mirror.

CLEAN OFF SPILLS FROM THE FRONT FACE OF THE GLASS

26. It is normal for some silvering chemicals to deposit on the face (the reflective side) of the mirror.
27. Use a paste of Silver Remover and pumice to clean off any silver.
28. Use a sharp new razor blade or a paste of pumice and water to clean off any paint.
29. Finish cleaning the face with dry pumice and a soft cloth.
30. Stand back and admire your handiwork!