

WÜRTH USA **WINDSHIELD REPAIR PROGRAM**



TRAINING GUIDE

Needs Analysis

- There are over 250 million vehicles on the road logging in billions of road miles. The potential for windshield damage from debris in roadway is very high
- The ability to repair a windshield quickly allows for the vehicle to maintain factory strength, OEM specifications and removes potential for further damage due to potential spreading or cracking and defect due to poor aftermarket replacement
- Learning the proper procedures for chip and crack repair can maintain the OEM specifications of the vehicle and enable the operator to drive much earlier than a complete windshield replacement

Objectives:

The objective of this class is to familiarize participants with the types of glass that can be repaired, when glass is beyond repair and the proper procedures of WSR.

The participants will learn through practical application, the execution of the various types of glass repair.

The participants will be proficient in all of the tools used in the WSR procedures.

What you will learn:

The participants will learn all of the following subject matters in order:

- Benefits of WSR
- Types of Breaks:
- Repair Limitations:
- Equipment Introduction
- Safety
- Preparation for repairing
- Completing a Repair
- Drilling Laminated Glass
- Repair of cracks (Review)
- Capping a pit

Know the Benefits of WSR:

- **Windshield Repair (WSR):** WSR is the process of removing air from a break by either vacuum or displacement and filling the break with resin.
- Restores the structural integrity of glass
 - A damaged windshield is unstable and can fail completely at any time
- Success rate of over 99% against damage
- **WSR:** The original factory seal is retained (glue that holds the windshield i.e. (bond and seal))
- Windshield is an integral part of the airbag deployment system and the structural integrity of the roof (another significant safety benefit)

Know the Benefits of WSR:

- A news report investigation into windshield replacement found that **80% of windshield replacements are not done correctly!**
- **WSR** dramatically improves vision and appearance of the windshield
- **WSR DOES NOT MAKE DAMAGE DISAPPEAR**, a small scar will always be visible
- **WSR** is much more cost effective than windshield replacement



Know the Benefits of WSR:

- Most repairs are between \$50-100. Replacement glass alone can be several hundred to several thousand dollars before labor fees
- Meets the need for convenience, average repair time is 15 minutes vs. several hours for a replacement (*Installation is approx. 30 minutes to 1 hour and then you have to let the urethane cure*)

Types of Breaks:



- **Bulls-eye Break:** separated cone in the outer layer of glass that results in a dark circle with an impact point
- **Star Break:** a series of legs that emanate from the break, giving it the appearance of a star. It has multiple variations and is sometimes referred to as "Bat Wings"
- **Combination Break:** possesses multiple characteristics, this could be a star within a bull's-eye or a short or long crack emanating from the damage
- **Surface pit:** a nick in the glass and is associated with normal wear and tear
Surface pits do not penetrate to the polyvinyl buteral layer (plastic laminate layer)
- **Short crack:** is anything that is under 6" in length
- **Long crack:** is anything over 6" in length
- **Edge crack:** extends to edge of the windshield
- **Stress Crack:** extends to any edge, but lacks an impact point

Types of Breaks:

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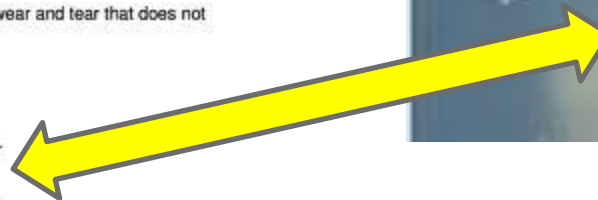
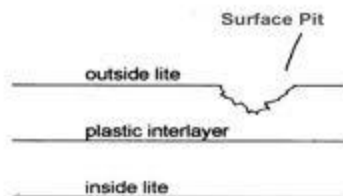


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4.16 Surface Pit: A nick in the glass associated with normal wear and tear that does not penetrate to the plastic interlayer



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How Damage Occurs:

2 ways that windshield damage occurs

- By impact with an object (bulls-eyes, stars, and combinations)
- Stress: this occurs when the windshield has been forced into an unnatural position due to improper installation, or when the frame in which the window sits has been damaged. Poor body work from roof damage

Repair Limitations:

- Not all damage is repairable
- Cited on ROLAGS www.rolags.com

Repair Limitations:

Most common Limitations:

- Damage that penetrates both the inside and outside layer of the windshield should not be repaired
- DPVA(Driver Primary Viewing Area- 2 damages with in 4" of each other in the DPVA it can interfere with safe operation of a vehicle



Repair Limitations:

Most common Limitations:

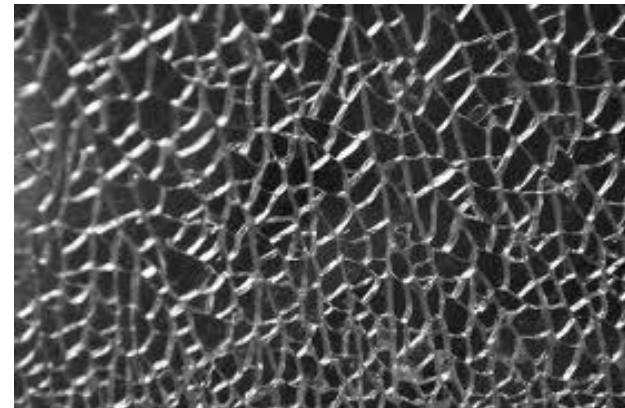
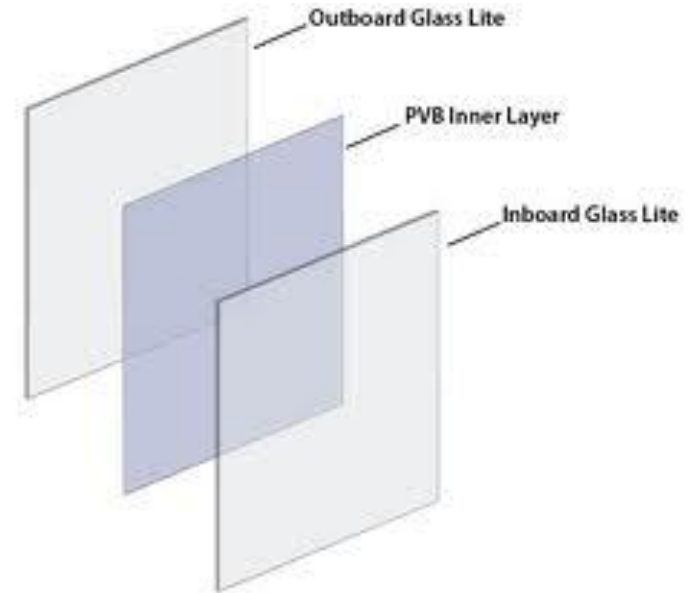
- Checking the windshield bug (Stamp at the bottom corner) will tell you the type of glass, its manufacturer, and any special features of the glass



Repair Limitations:

Most common Limitations:

- Know What Kind of glass can be repaired:
Laminated glass can be repaired
- Tempered glass can not.
Most cars still use tempered glass on the side and other parts of the car



Equipment Introduction

- **The Scribe:** is a tool that is used to dislodge loose pieces of glass from the impact point. The steel tip is replaceable, and will not scratch the windshield
- **Blower:** used to remove remaining loose glass from the damage

Equipment Introduction (cont.)

- **The Complete Bridge Assembly art# 0891634450:** attaches to the windshield and holds the injector assembly in place. It consists of A vacuum cup and 2 leveling screws. The leveling screws are used to level the bridge and ensure an even seal between the injector and windshield. The Bridge Assembly (Wurth USA) uses a stainless steel flip lever to anchor the bridge to the windshield surface. To make a small adjustment to the bridge position, loosen the adjusting nut, move the bridge, then retighten the nut

Equipment Introduction

- **The Injector Assembly:** is a sturdy stainless steel Instrument that consists of 3 pieces:
 - the barrel,
 - the plunger
 - and the end seal (which is installed in the barrel and **MUST BE INSTALLED** correctly, be sure that the text and the larger end of the hold are placed into the barrel to achieve adequate vacuum and pressure
- The Injector Assembly has a spring loaded plunger that applies and maintains correct amounts of pressure during the repair which is great for working on more than one repair at a time and it can be locked back during vacuum cycles

Equipment Introduction (cont..)

- **The mirror** : is placed on the windshield directly behind the damage to be repaired, which gives you the benefit of seeing both sides of the repair at the same time
- **Resin**: cures due to exposure to ultraviolet light, it is important to protect the repair from ultraviolet light until it is completed to your satisfaction. Place it over the bridge before starting the repair
- **Wurth Repair Resin One Shot, art. # 0891634420**: comes in a syringe and is optically matched to provide high strength, clear repairs
- **Premium Pit Resin art.# 0891634422**: are a high viscosity resin used to fill the impact pit after it has been filled with **Wurth Repair Resin, One Shot**

Equipment Introduction (cont..)

- **Curing tabs:** are used to hold the pit resin in place during the curing process and allow UV light to pass through
- **The UV light :** is made in the USA and emits a specific frequency of UV light to cure windshield repair resins. It runs off of a 12 volt power source
- **Razor blade:** used to remove the excess resin and make the repair flush with the windshield preventing interference with the windshield wipers
- **Pit polish:** is used in the final step to remove small scratches and shine the filled pit

Equipment Introduction (cont..)

- **Dremel Drill and carbide burrs:** (Techniques for drilling glass are covered in the chapter on repair cracks)

Safety

- Personal protection is important because resin contains acrylic acid and other chemicals
- System includes MSDS which outlines precautions and first aid for all included chemicals
- Always wear eye and hand protection
- **DO NOT USE LATEX GLOVES** - the resin will eat right through them
- If you spill resin, clean it up **IMMEDIATELY** with warm soapy water before it has a chance to cure and dry
- Resin will etch the paint of the vehicle
- Denatured alcohol may be used to clean resin from paint equipment and on spills that are not on a vehicle's paint

Preparation for Repairing (cont..)

- Assess the damage so that you know what you are dealing with prior to starting
- Use the ROLAGS standard to determine if it can be repaired or if a replacement is necessary; it is ultimately your decision on what you will or will not repair, and be sure to explain this to the customer
- It is important to know what the DPVA (it is the diameter of the steering wheel boxed with the wiper sweep)

Preparation for Repairing (cont..)

- Damage is not invisible after the repair and a small scar will be visible
- Customers can expect at least an 80% improvement in the cosmetic appearance
- Hydrophobic coatings (rained, sealant from a car wash) cause water to bead up and run off the windshield, if the windshield has a coating, the pit resin will not adhere to the glass and will pop out when you scrape the repair flush
- To test for coatings, spray away from the damage and see if the water beads up
- The coating can be removed with steel wool. DO NOT USE A LIQUID CHEMICAL OR OTHER SUBSTANCE TO CLEAN THE REPAIR AREA AS IT CAN CAUSE MOISTURE TO ENTER THE BREAK
- RECOMMENDED GLASS TEMPERATURE RANGE FOR THE BEST REPAIR RESULTS IS 70-100 DEGREES f OR 21-38 c

Preparation for Repairing (cont..)

- If the windshield is too hot, the risk of it cracking out is increased
- The easiest way to cool the glass is to get it indoors, you can also run the A/C through the defrost vents. Watch the break during this process and stop immediately if you notice the damage spreading. A windshield that is too cold will cause the resin to thicken and can make it difficult to completely fill the damage.
- To warm, bring into a heated building, turn on the heat in the car, or a blow dryer but be sure to not over heat the glass
- The last thing to check for is for moisture in the break because moisture will prevent the repair from filling with resin and will create a void which is visible as a black spot and will increase the chances of the repair failing down the road

Completing a Repair

- After the expectation and preparation are complete, it is now time to complete the repair
 - Begin by taking your scribe and gently clean the pit of loose glass and use the blower to remove any debris that remains
 - Put the inspection mirror in behind the damage
 - Take the bridge assembly and retract the adjusting screws and injector barrel so it does not extend past the vacuum cup. Make sure that the adjusting slow is centered so that you have the maximum range if any adjustments are necessary once that bridge has been attached to the windshield
 - Orient the bridge so that the vacuum cup of the bridge is above or to the side of the damage to prevent resins from coming into contact with the rubber and damaging it, also make sure that the injector is facing you for easy access

Completing a Repair (cont..)

- Lock the bridge via the vacuum cup, Center the injector's end seal hole directly over the pit using our centering pin. Check the position of the bridge by using the centering tool to ensure injector is directly over the pit and if it is not installed correctly it could cause improper repair
- When the bridge is properly positioned screw the injector barrel down until the end seal just touches the glass and then advance it another half turn
- Then, screw the leveling screws down so that they just touch the glass. Then, advance the leveling screws 2 full turns (pushing the injector seal tighter against the glass)

Completing a Repair (cont..)

- At this point the bridge should be level to the glass unless the glass has significant curves to it, if so it may need additional turns.
 - This is to have a universal seal against the glass and the injector, the amount of the end seal connected to the glass and the injector should be invisible.
 - You can also check with a ruler and should be within 1/8 of an inch of each other. This all may vary depending on the curvature of the glass and be careful to not over-tighten the injector or leveling screws. Doing so will compress the glass, prevent it from filling with resin, or crack the glass further

Completing a Repair (cont..)

- Now we are ready to fill the injector with resins, one syringe will fill most voids of damage. Insert the syringe directly to the bottom of the injector tube, and release the resin, totally covering the end seal so as not to inject air or and air bubble into the repair and so that you have sufficient fluid pressure
- Take the I-100 injector, set it into the vacuum position and install into the injector barrel. Screw the plunger down until it stops, and avoid over-tightening
- Pull back on the plunger and rotate $\frac{1}{4}$ turn clockwise to lower into the first pressure cycle
- Apply a slight amount of thumb pressure at this point to force the resin into the damage
- Leave the plunger in the first pressure cycle for 5 minutes. If you leave it longer it will not be an issue

Completing a Repair (cont..)

- After the first pressure cycle is complete, hold the injector barrel still with one hand, pull back on the plunger and rotate $\frac{1}{4}$ turn clockwise to lock it back into position. This is called a vacuum cycle and started to remove the air from the break. Leave the injector like this for at least 30 seconds
- Using the same techniques, complete an additional pressure cycle of 2 minutes, followed by a second vacuum cycle of 30 seconds. Always end on a pressure cycle. 2 to 4 cycles are required. The end result should be that all the air is removed from the break

Completing a Repair (cont..)

- Closely inspect the break before removing the bridge. You may rotate the bridge for better visibility by loosening the adjusting nut. Check the break for air pockets from multiple angles. Once the resin cures you will not be able to extract any more air or inject any more resin
- When you are sure the resin has completely filled the damage, remove the bridge by placing the locking lever in the vertical position and lifting an edge of the vacuum cup. Set it down on a towel and make sure that it is away from any UV light
- Place one drop of pit resin directly below the pit, squeezing slowly to minimize air bubbles
- Carefully apply the curing tab, bottom up and do not push on the curing tab as it will force the resin out of the pit. If there is an air bubble in the pit, you can use a straight pin to pop any air bubble even if the curing tab has been applied **BEFORE CURING THE RESIN**

Completing a Repair (cont..)

- The goal is to leave a small hump in the resin to ensure a flat surface at finish
- Place your UV lamp over the repair and turn it on before leaving it to set for 5 minutes. Make sure the resin does not get on the cups.
- After 5 minutes, remove the lamp by breaking the suction of each cup.
- Remove the curing tab
- At a 90 degree angel, use a new razor blade and scrape the resin flush with the surface of the glass
- When all excess resin is removed from the glass, use a drop of pit polish to polish the surface of the repair

Drilling Laminated Glass

- Choose the Proper burr type
- The 3 situations where drilling is necessary: before beginning, plan where you will drill the hole and what type of burr is best for the application. NEVER DRILL THROUGH THE GLASS AND INTO THE LAMINATE. Glass thickness can vary across manufacturers and products
- Hold drill tight with 2 hands. Hold the drill approximately 45 degrees to the glass and gently touch it to the surface to begin. Do not use much pressure
- Slowly rotate the base clockwise to allow shavings to exit the hole
- Check depth often and be sure to clear of all debris before proceeding
 - **Note:** When terminating a crack. It allows the crack to be anchored and prevents it from spreading across the windshield

Repair of Cracks (Review)

- Repair of cracks (Review)
- Note: copy info from crack previously typed
- There is a higher risk of repair failure in stress cracks as there is no way to determine the extent of glass damage
- If the crack is on the inner layer, a repair is not recommended
- Locate the end of the glass by gently flexing the glass to see where the break stops
- Drill a hole about 1/32" past where you saw the crack stop
- a bull's-eye can also be created by inserting a probe tip into the drilled hole and lightly tapping the end of the probe, it does not take a lot of force

Capping a Pit

- Capping a pit. After curing a resin cap over a large pit, a hole must be drilled to allow the damage to be filled with resin. Use a burr that makes the smallest diameter hold for cosmetic reasons. The larger the hole, the more visible to finished repair will be
- When there is an air pocket, drill a hole, reset the bridge, and fill the area
- Apply a light pressure to the glass so the crack runs into the bull's-eye you have created. This prevents the crack from spreading after you have finished the repair
- Hot glass is more prone to cracking than cold, ideally doing the repair at the lower end of the temperature gauge is better
- Attach the Bridge assembly the same way as if fixing a chip at the impact point or the drill hole, whichever is lower on the glass

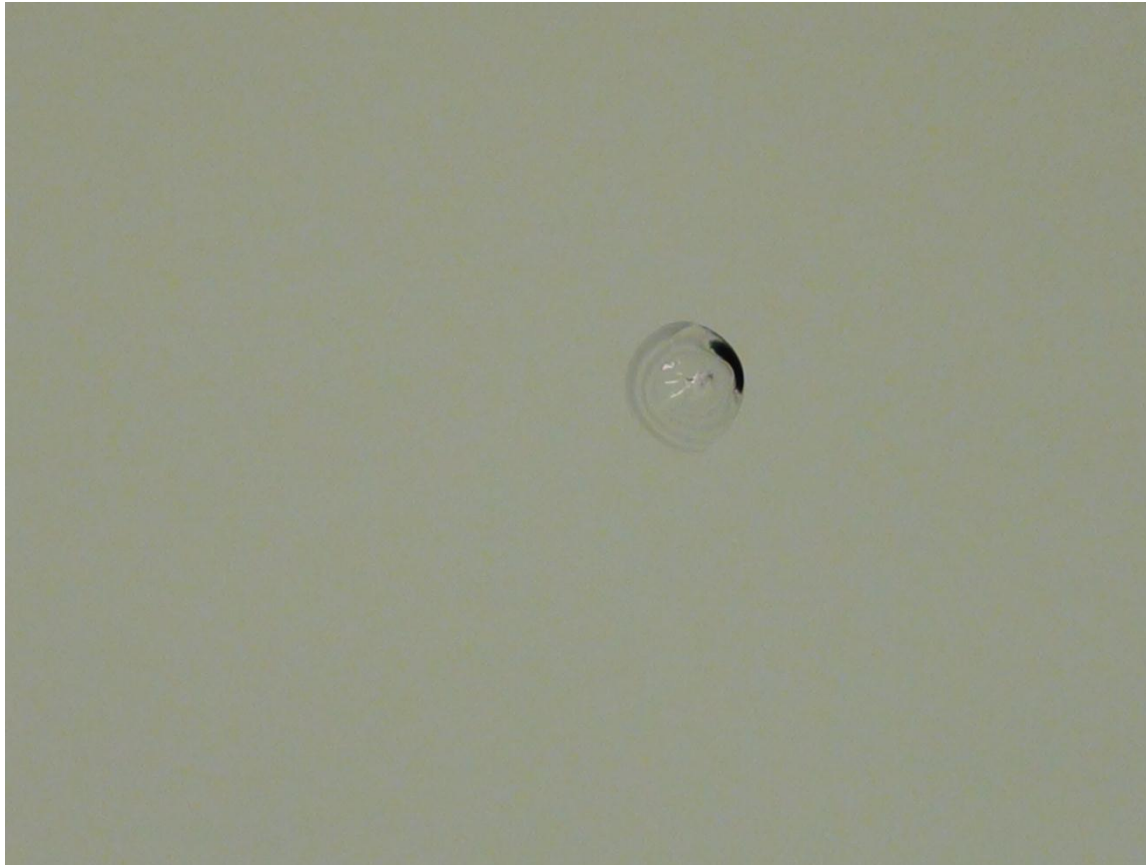
Capping a Pit (cont..)

- Load the injector with 1 syringe, place injector into pressure cycle. The same way as chip repair
- Leave the injector in the pressure cycle until the crack has been filled with resin and cured. **DO NOT SWITCH TO VACUUM CYCLE.** Switching to a vacuum cycle will cause air to be drawn into the break
- When the resin progress has stopped, apply small amounts of resin directly to the crack just behind where the resin has progressed. The resin will draw into the crack, and fill it seamlessly. Do not introduce resin ahead of where it has naturally progressed as this will trap air in the break
- As the crack cures, cover with the curing tab
- When the entire crack is filled, protect the bridge and injector from UV light with a thick towel or other barrier. You can then cure the length of the crack using your UV light

- Once the crack has been cured, finish filling the bull's-eye you made or impact point as you would a standard repair(**note: crack repair requires the deluxe kit, with 2 bridges**)
- If necessary, repeat the process at the other end of the crack. It is important not to rush the process to avoid trapping air bubbles in the finished crack
- REMEMBER: Cracks will always be visible at certain angles and lighting conditions even after successfully filled and cured
- Success rate of a crack is only 55%. Make the customer aware of this

Pictorial Flow of a Common WSR: (Premium Kit Shown art# 19645006)

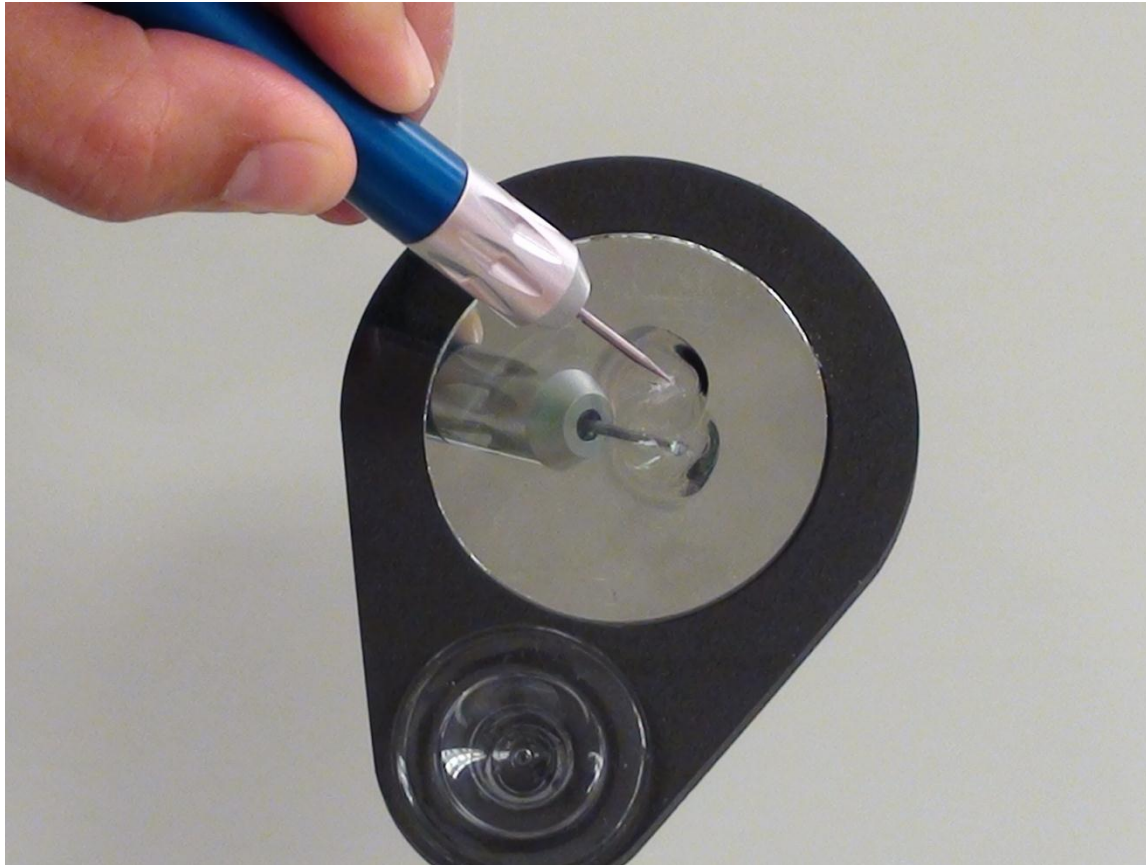




Step 1: Inspect the Break

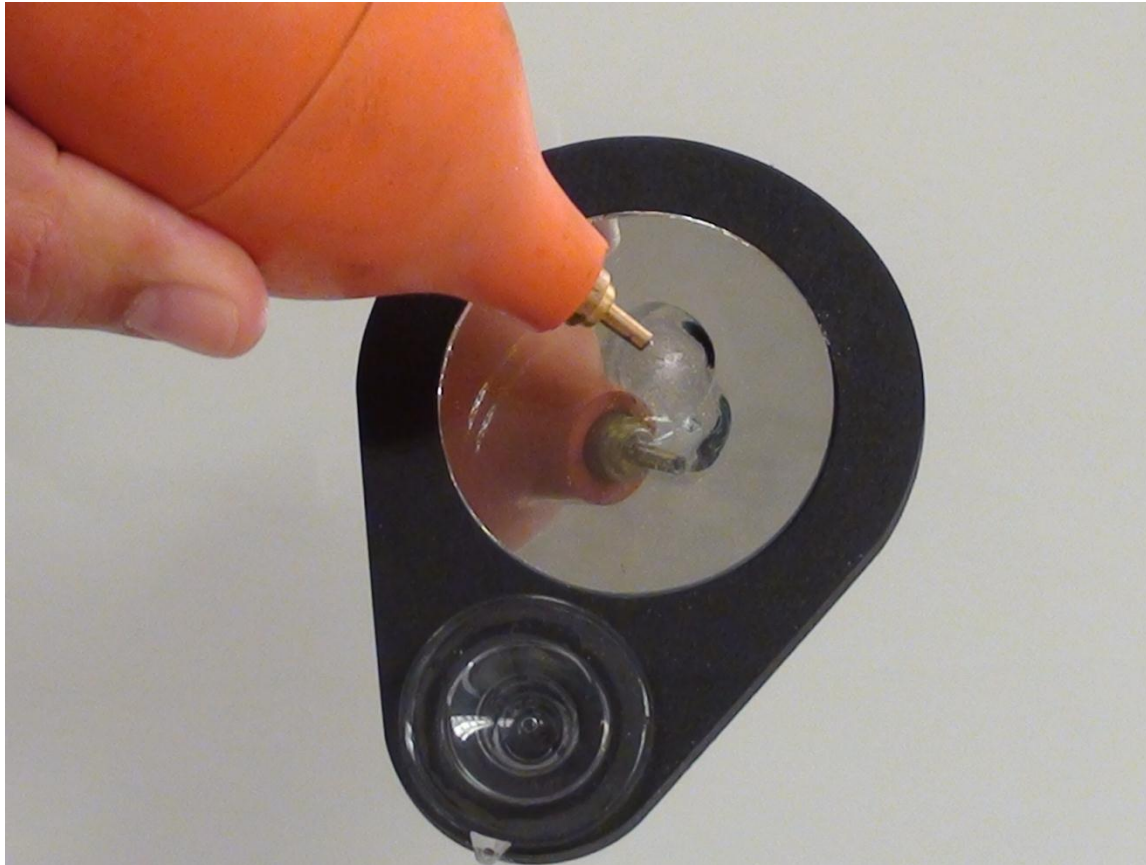


The inspection mirror magnifies the break by 3x

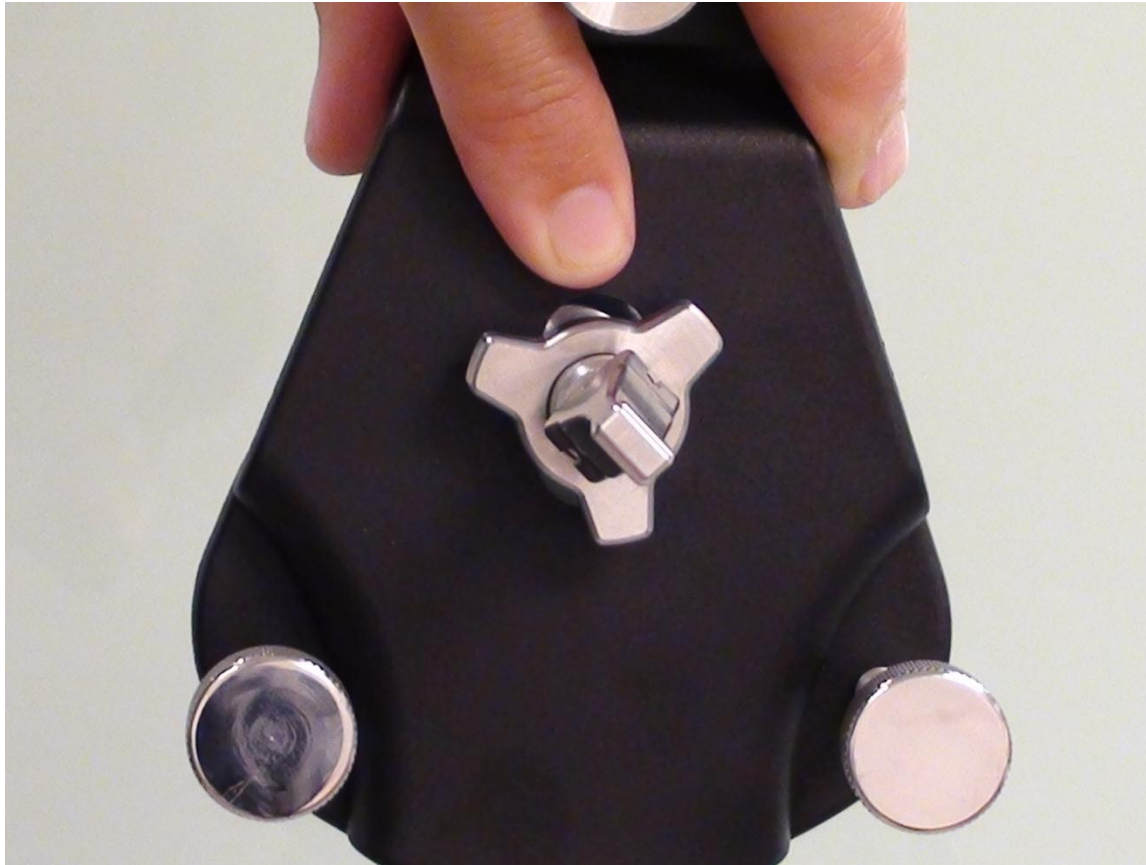


Clean the impact point, or pit, with a steel probe

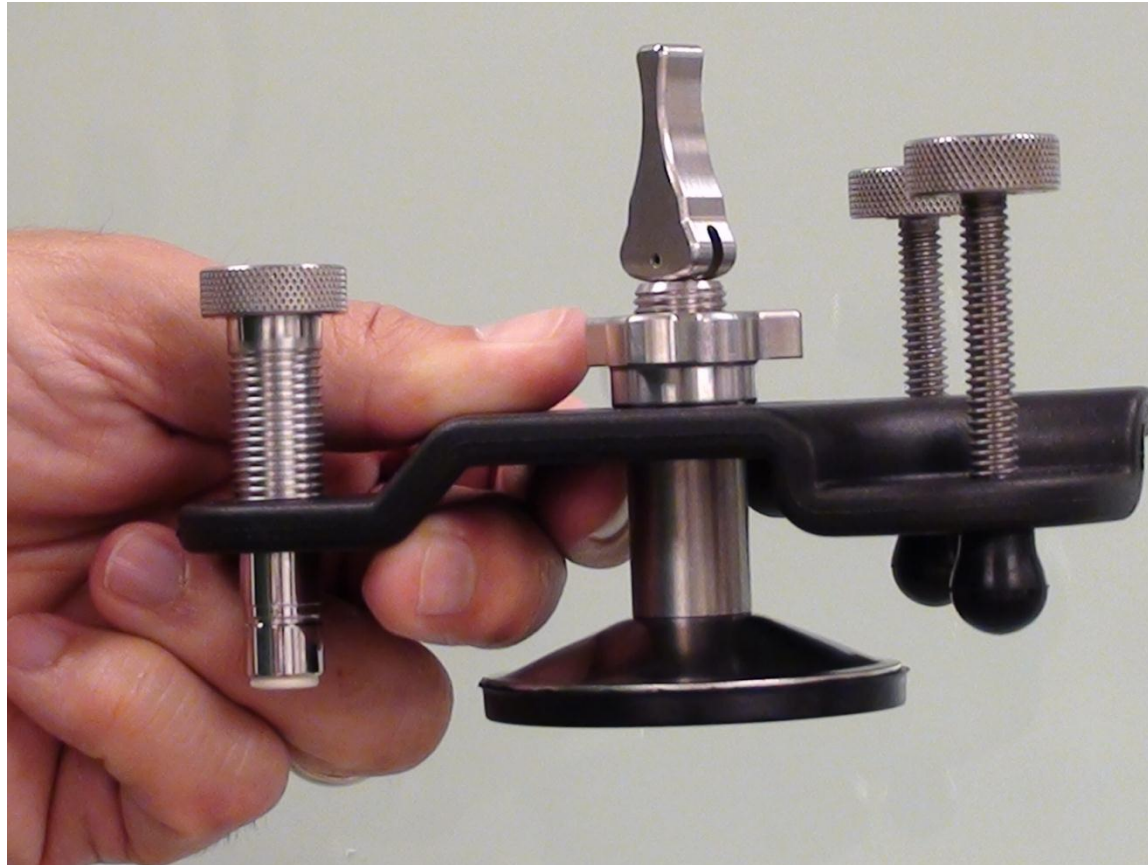
This dislodges any loose glass particles.



Blow the dust particles free to insure the pit is clean



Insure that the bridge is centered in the adjusting slot.



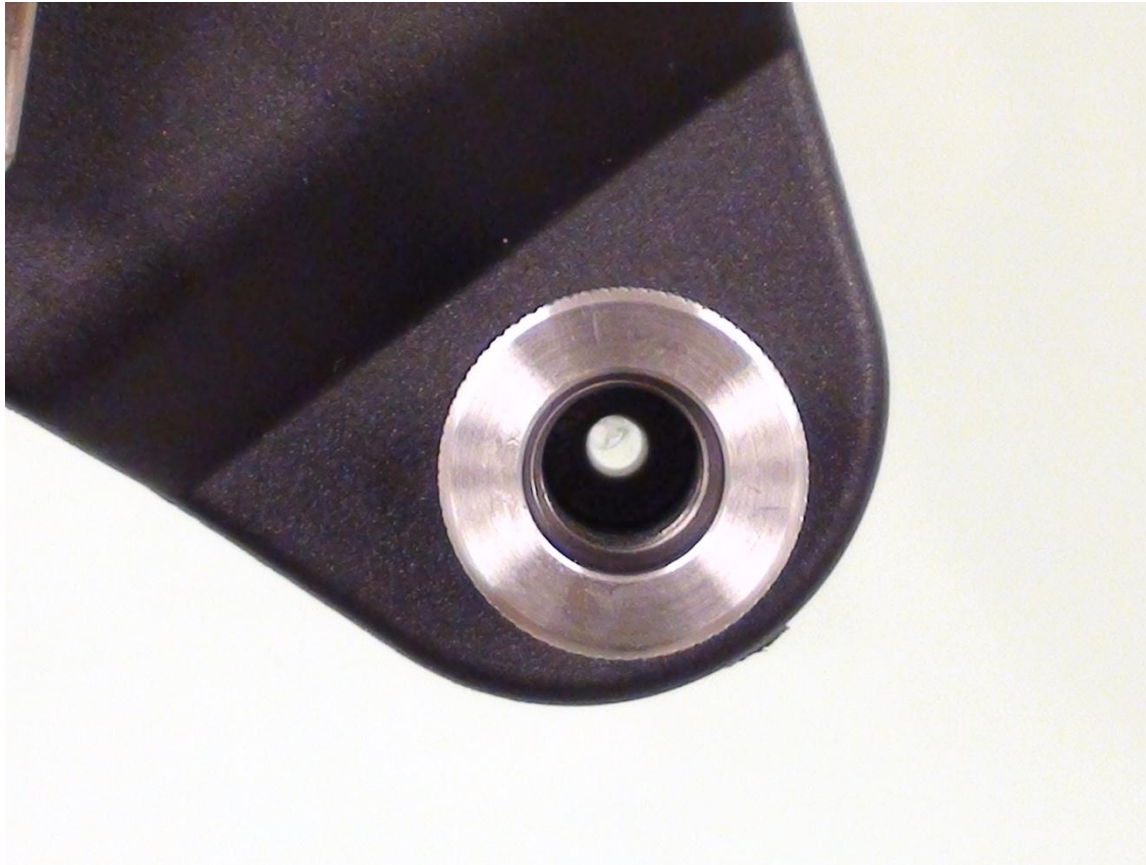
Back off the leveling screws and injector barrel

This allows the bridge to firmly affix to the windshield without interference from the leveling screws or injector.



Push the flip lever down to lock the bridge in place.

Center the injector barrel over the pit. Make any adjustments necessary by loosening the adjusting nut.



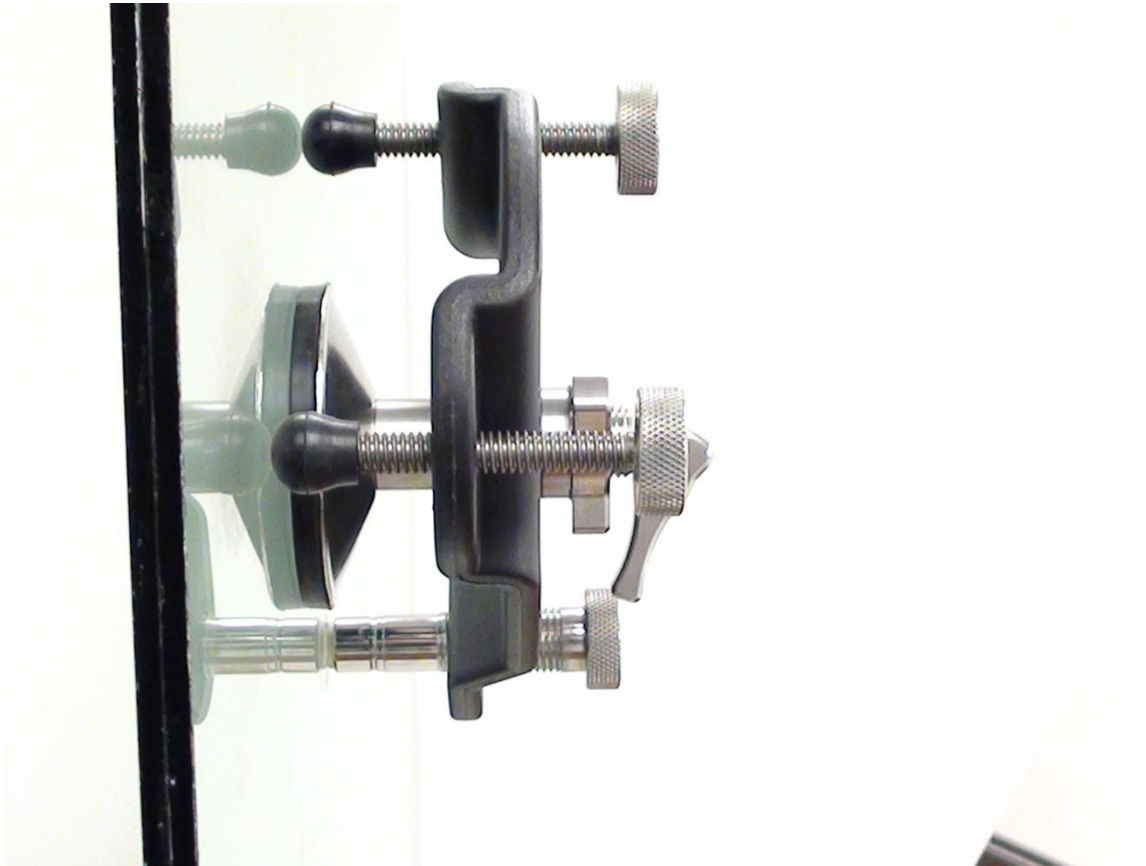
You can see the pit at the center of the injector barrel.



Screw down the leveling screws until they just touch the glass.

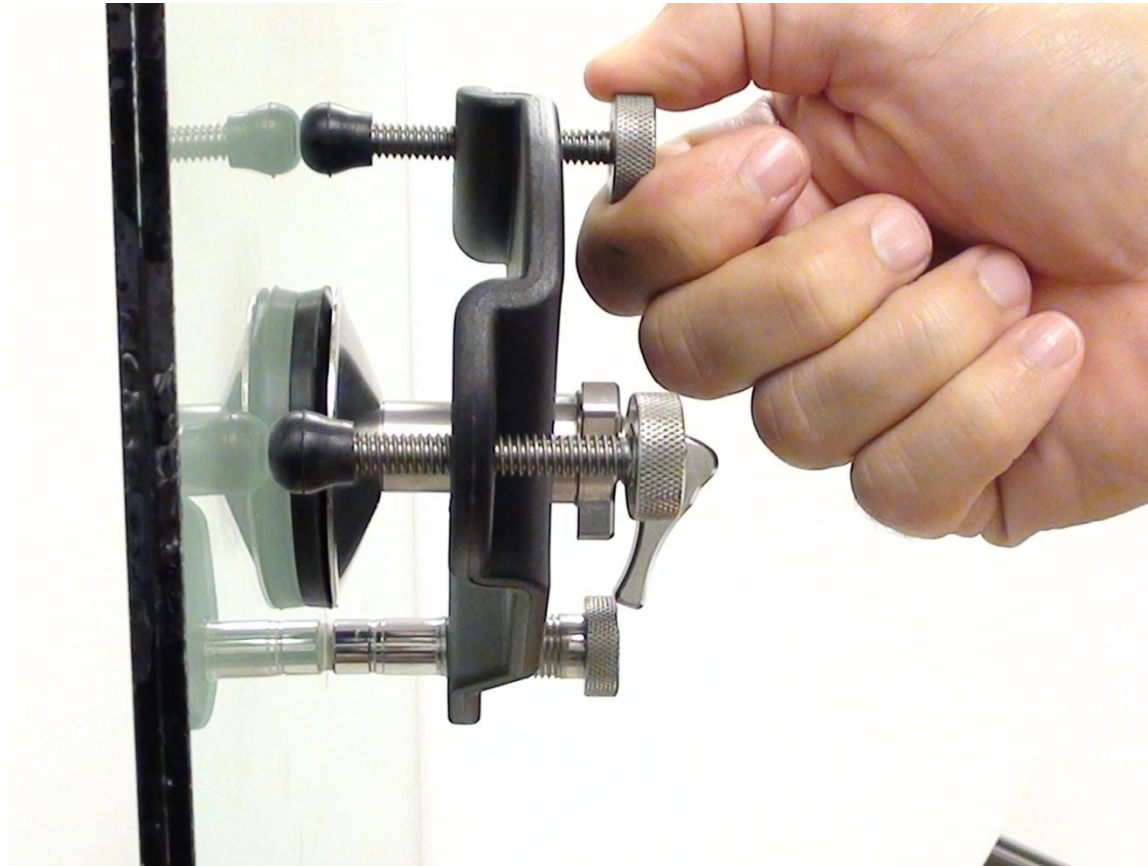


Screw down the injector barrel until it just touches the glass.

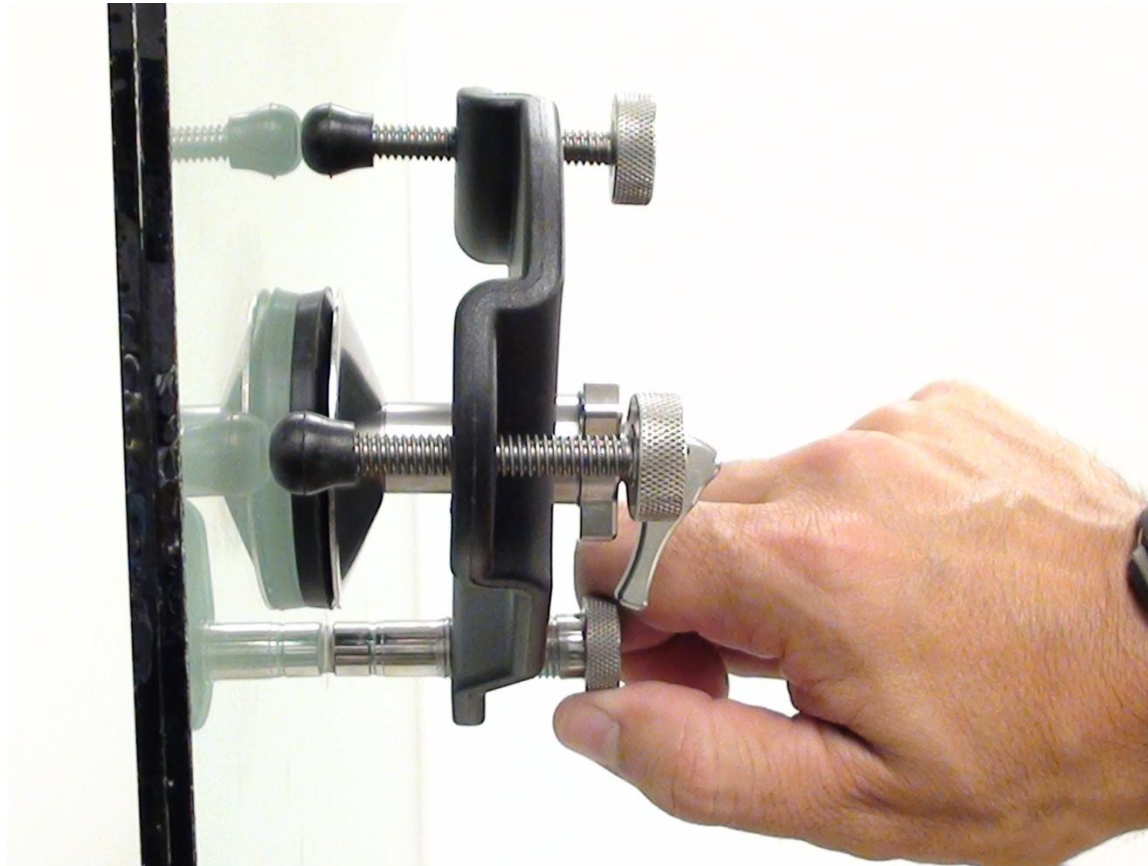


A side view with the leveling screws and injector barrel just touching the glass.

DO NOT over tighten.



Advance the leveling screws 2 full turns.



Advance the injector barrel 1/2 turn more.



Load the injector with about 1 Syringe of fill resin.



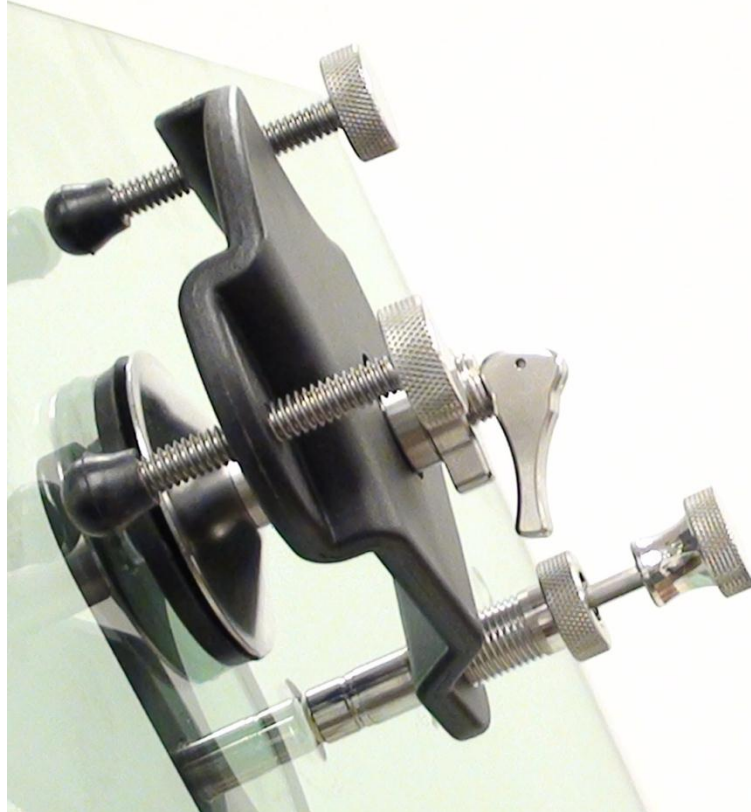
Make sure you get the resin to the bottom of the injector barrel.

The white end seal must be filled with resin for a successful repair.



The injector plunger in the vacuum position.

Pull back on the knob, rotate $\frac{1}{4}$ turn clockwise, and lock in place. Note that the piston is retracted.

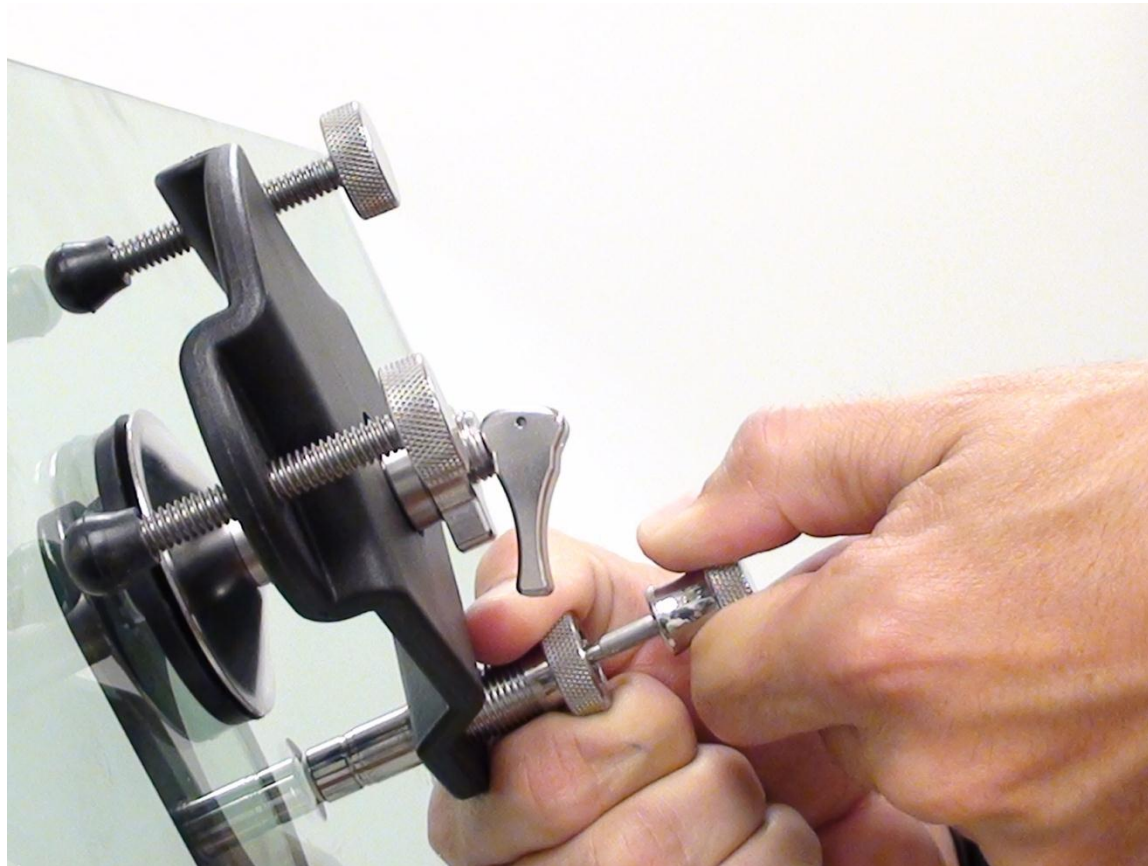


Screw injector plunger until it stops. DO NOT over tighten.

This shows the injector plunger in vacuum position and properly installed.

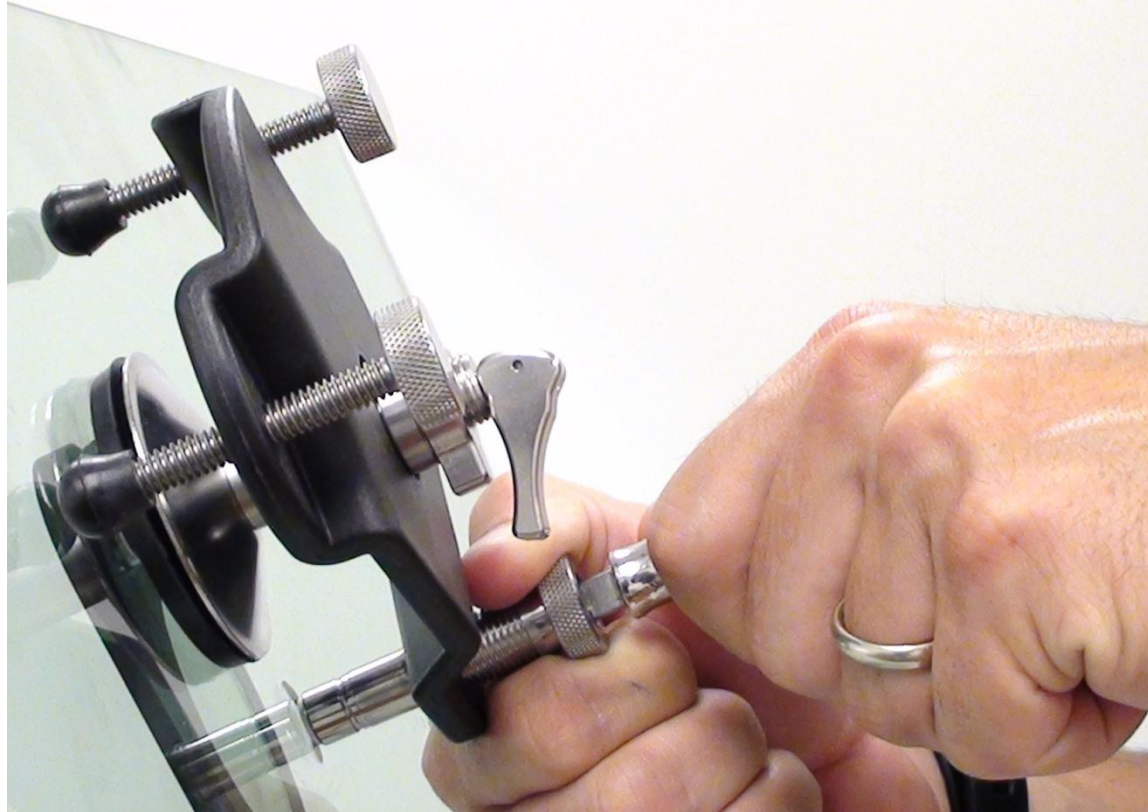
Basic cycles to complete a repair.

1. First pressure cycle: 5 minutes
 2. First vacuum cycle: 30 seconds
 3. Second pressure cycle: 2 minutes
 4. Second vacuum cycle: 30 seconds
 5. Third pressure cycle: 2 minutes
- Always end on a pressure cycle
 - Most repairs will require between 2 and 4 total cycles to remove all air
 - The process is completed when no air remains in the break

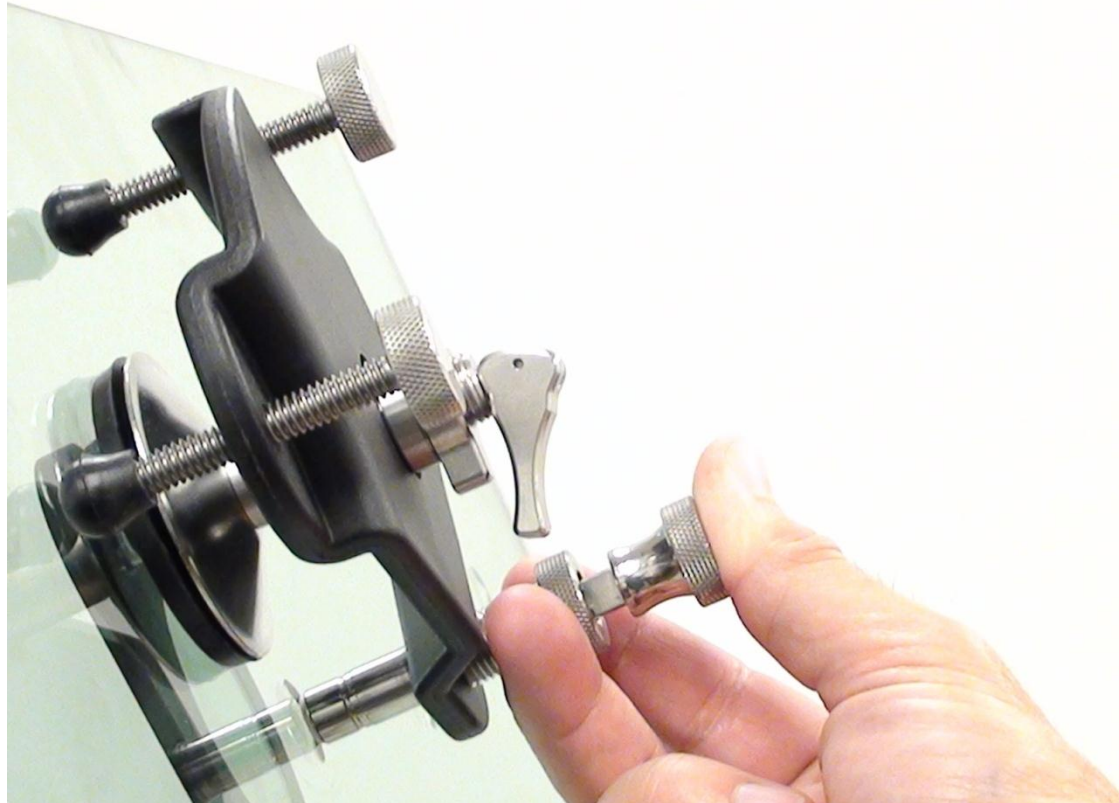


Begin your first pressure cycle.

Hold barrel with off hand, pull back on plunger with other hand, rotate $\frac{1}{4}$ turn clockwise, and gently lower into place.

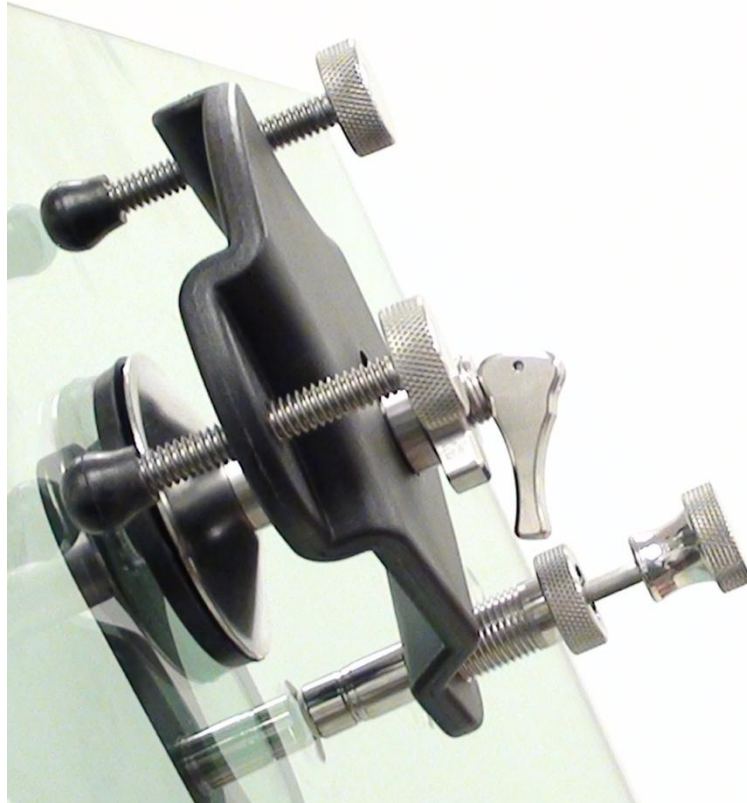


Rotating ¼ turn to start pressure cycle.



Apply a slight amount of pressure to injector plunger.

The plunger should not move more than 1/16 of an inch down. DO NOT bottom out plunger as this could crack the windshield. Leave in 1st pressure cycle for 5 minutes.



First 30 second vacuum cycle.

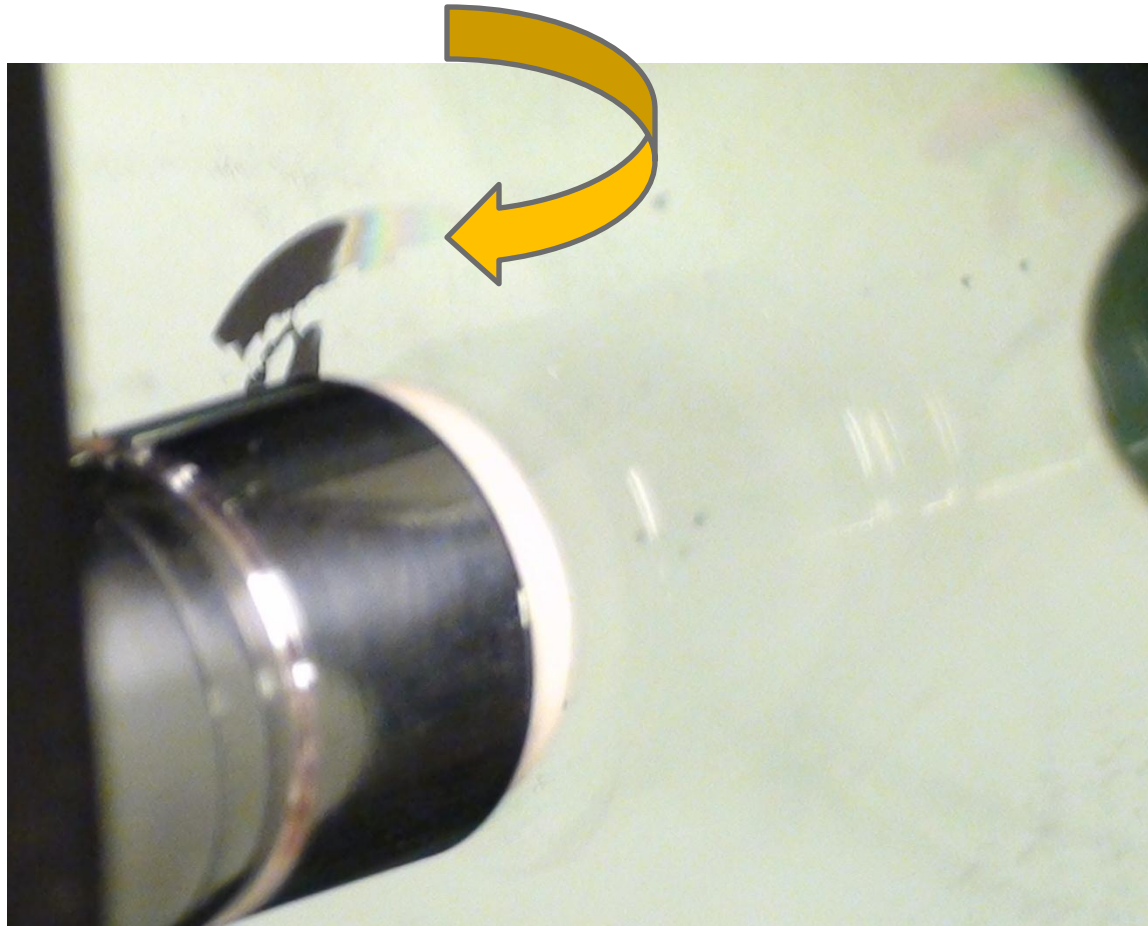
Hold barrel with off hand, pull back with other hand, rotate $\frac{1}{4}$ turn clockwise and lock into place.



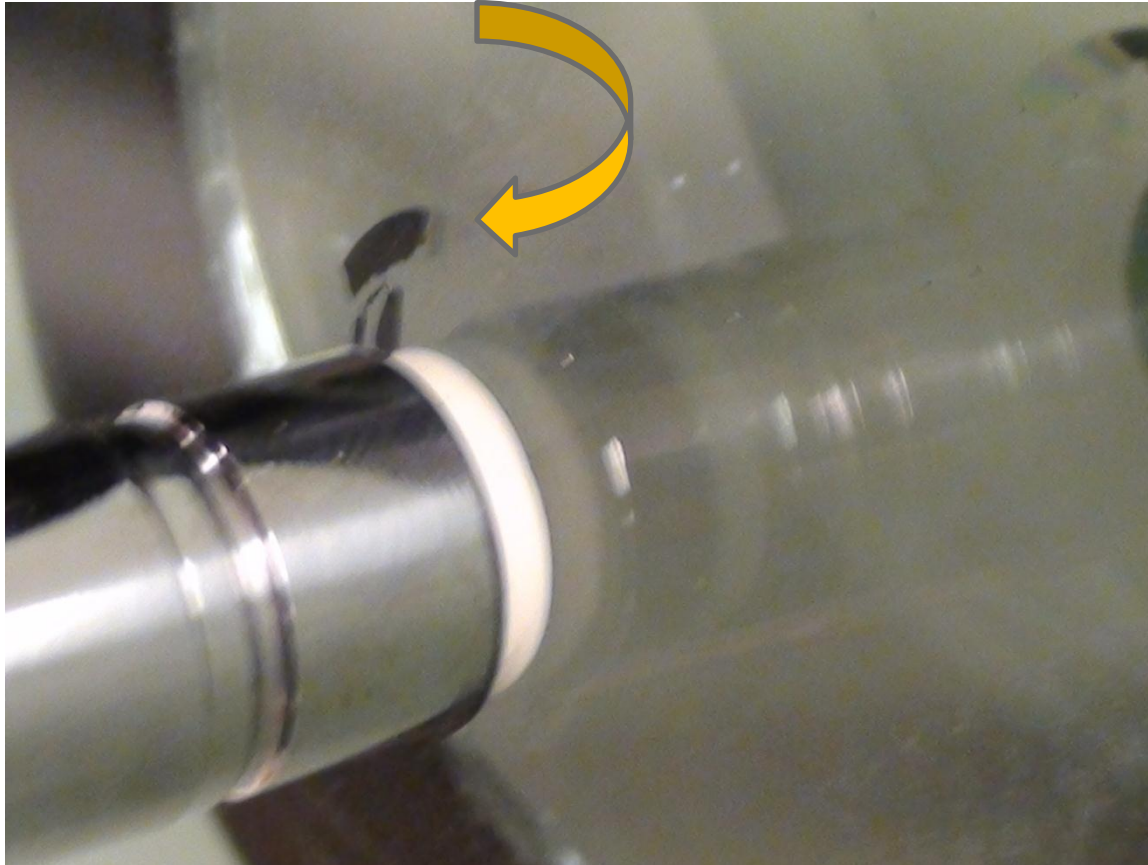
Resin being forced into break by hydraulic pressure.

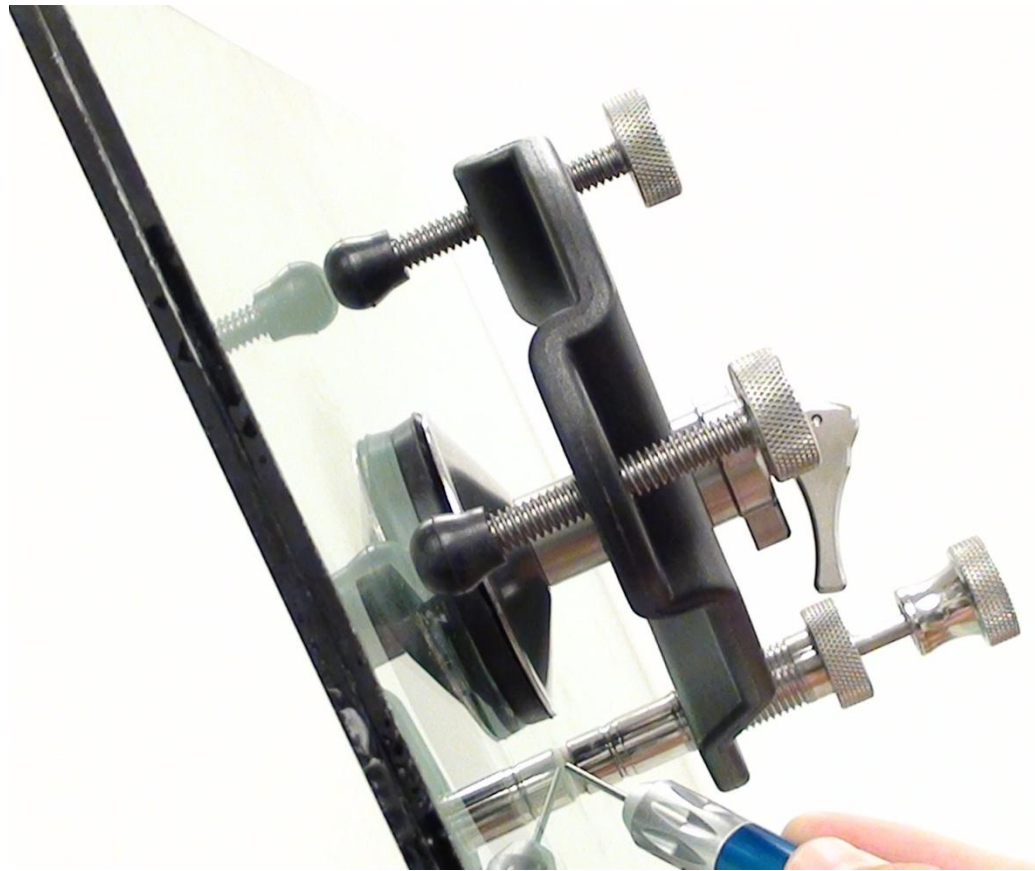


Note the air (black crescent on right) still in the break.

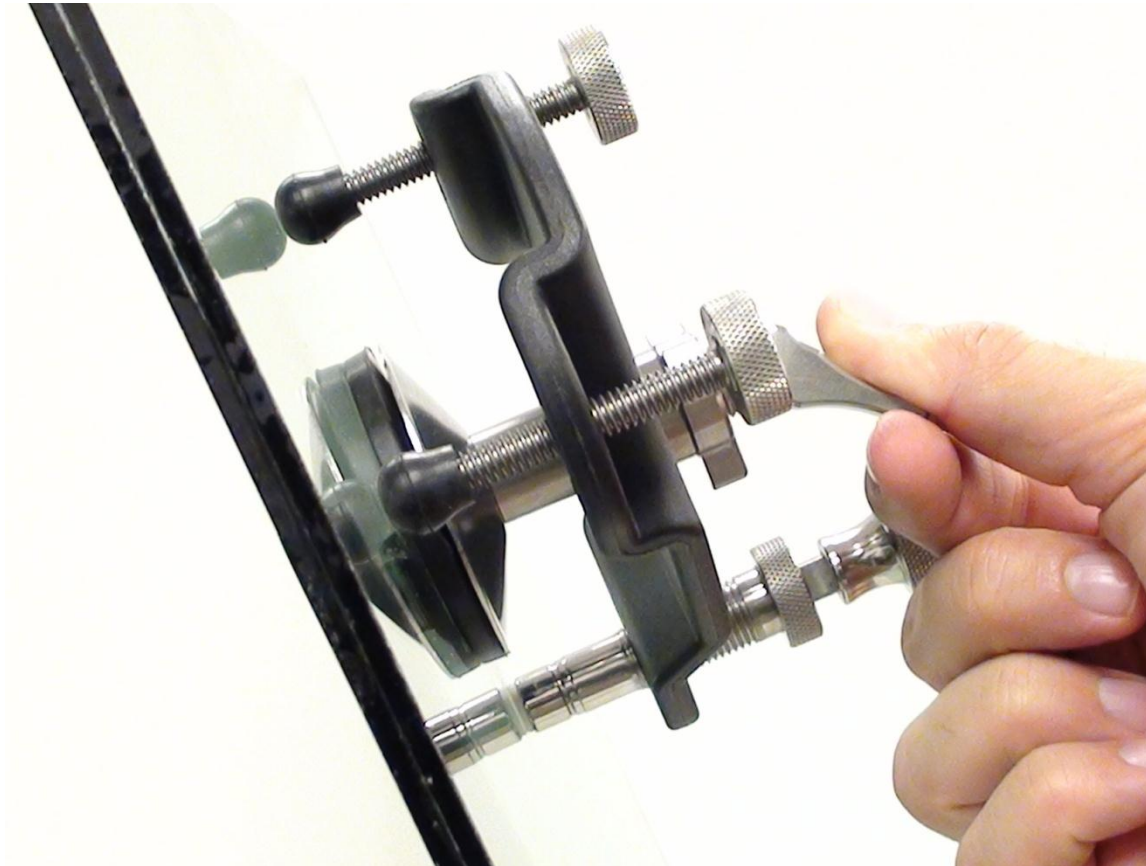


Another view of air (black pocket at 11 o'clock position)

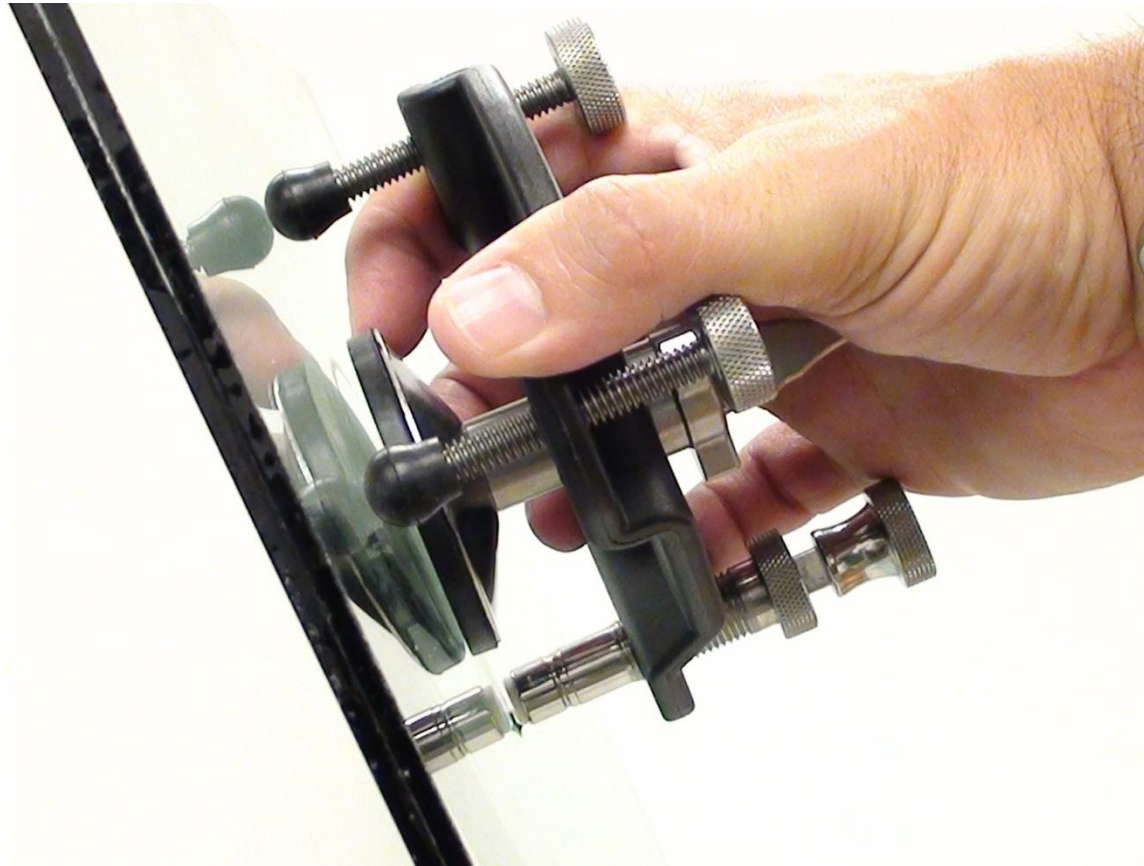




Flexing glass with probe to help air evacuate break.



Flip locking lever up to release vacuum cup.



Gently pry vacuum cup from glass to break suction.

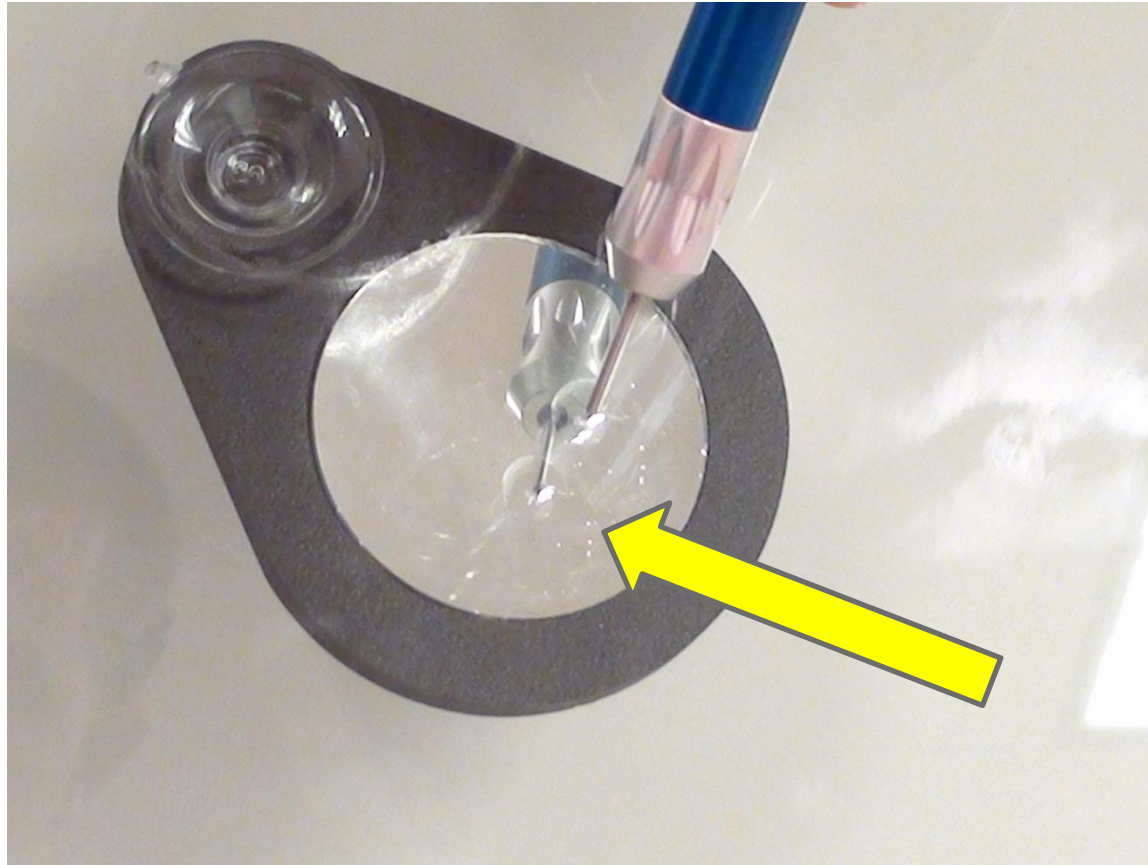
DO NOT pull on bridge as this may damage the vacuum cup and/or the windshield.



Keep bridge in upright position and place out of sun.

This prevents resin from flowing back into injector plunger and curing in place.

Resin can cure inside the injector in as little as 30 seconds and render it unusable.



Filled repair being pointed out with probe.

Note that there are no black, green, or shiny pockets of air left in the break.



Apply on drop of pit resin just below the pit.

Squeeze the resin out slowly and make sure there are no air bubbles. Use a straight pin to pop any air bubbles.



Gently lay the curing tab in place.

Do not push on the tab as this can force resin out of the pit. The goal is to have a dome of resin over the pit which will be scraped flush.



Properly laid curing tab.



UV lamp – off.



UV lamp – on.

UV light can be hard to see in bright condition.

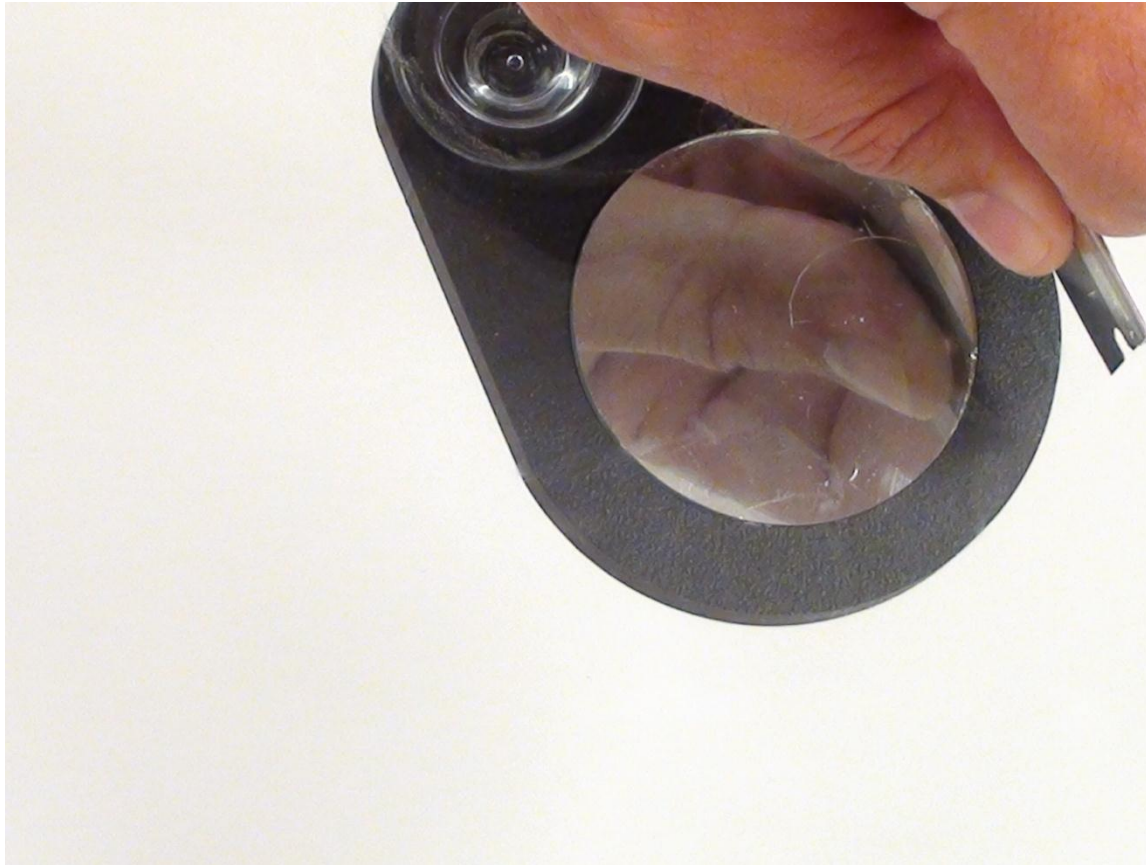


Place UV light over break and leave for 5 minutes.



Break suction by gently lifting edges of suction cups.

There are small tabs on each suction cup for this purpose.

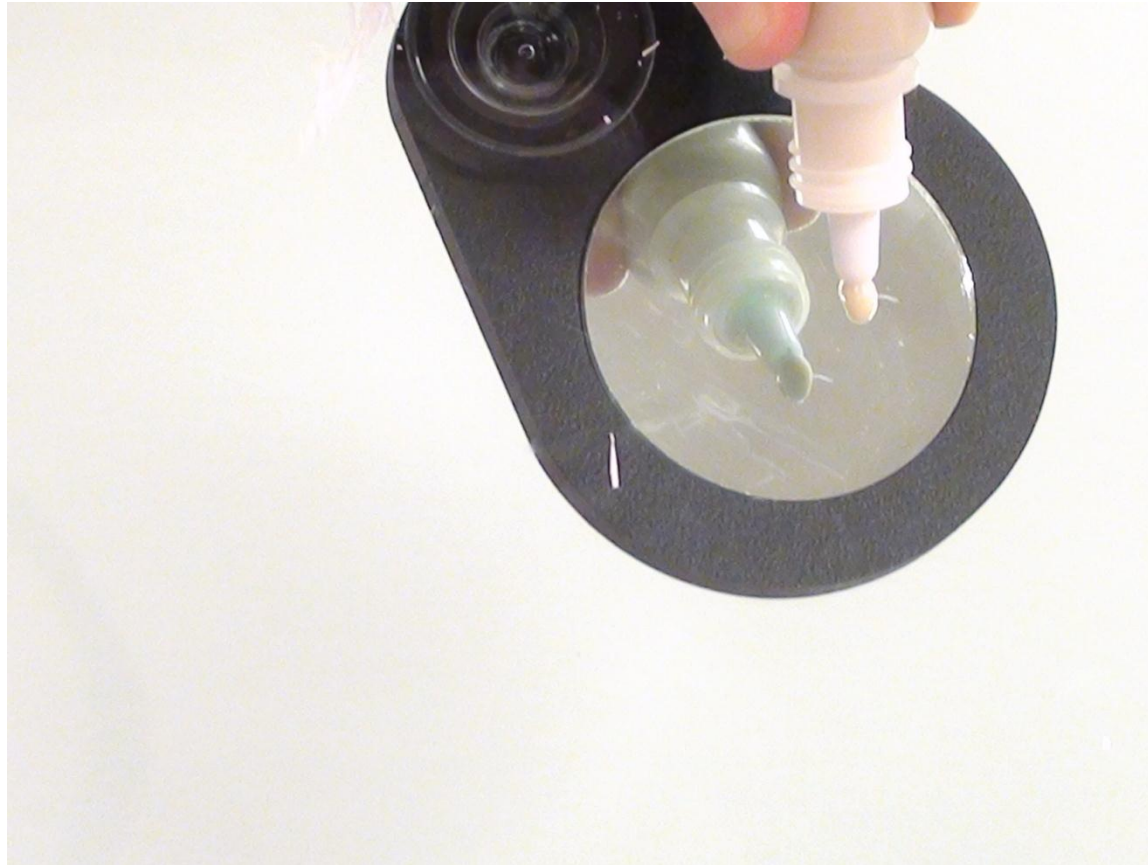


Hold new razor at 90° angle and scrape resin flush.

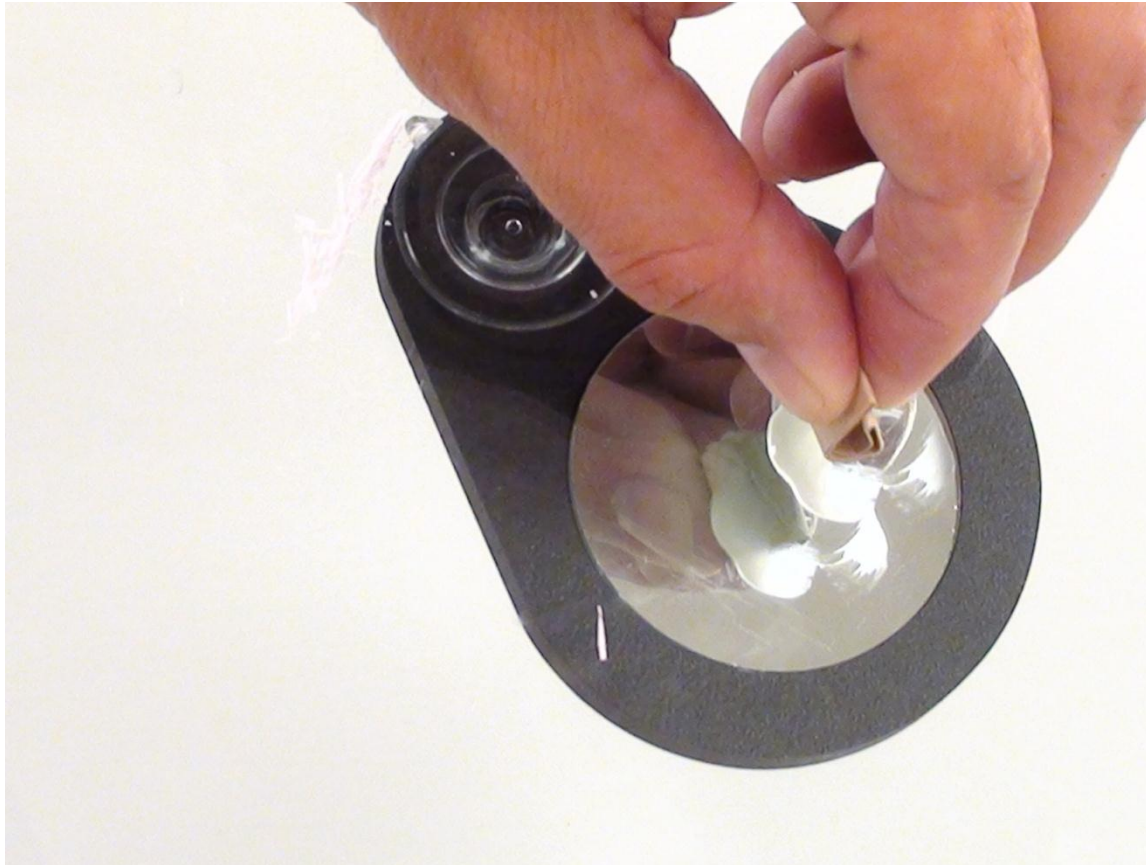


Use firm, long, fast strokes.

Don't stop over the pit area as this can pop the resin cap from the filled pit.



Apply a drop of pit polish to shine the finished pit.

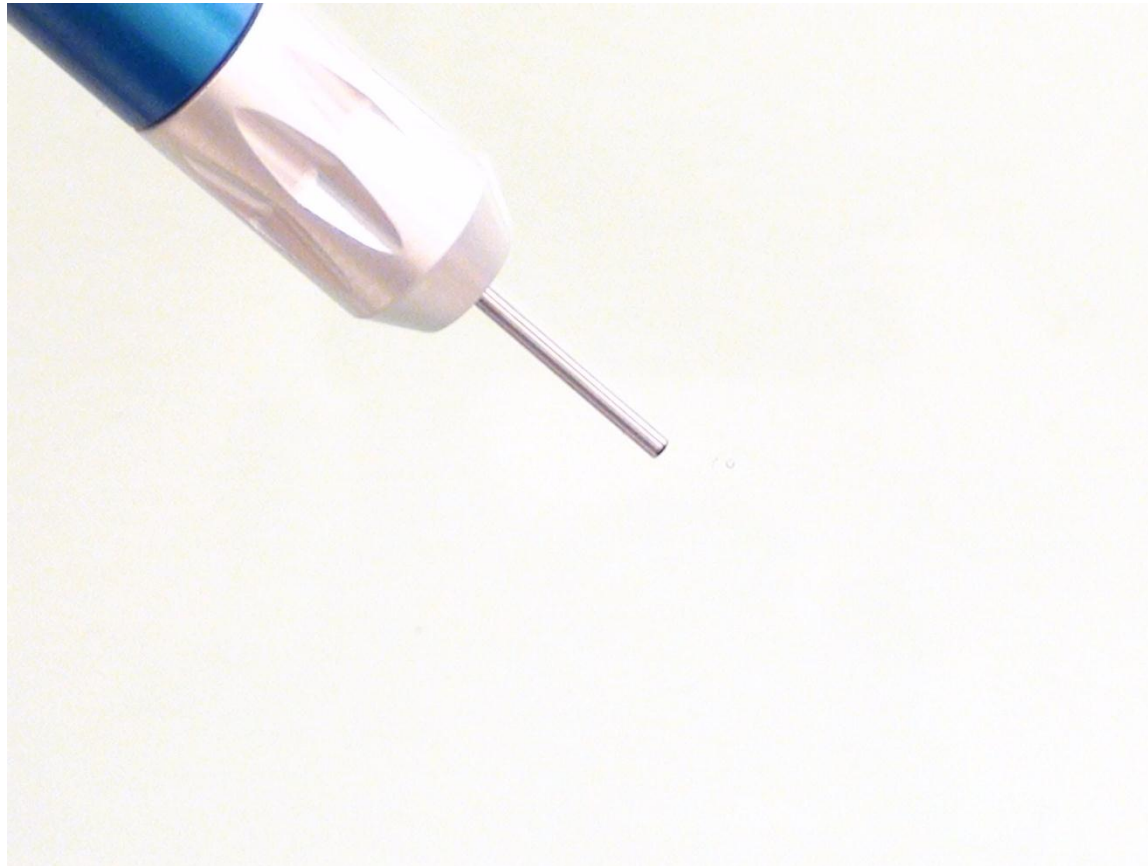


Using razor cover to polish pit.

You may also use a rag, towel, or cork to polish the pit.



Wipe the glass clean for your customer.



The finished repair is flush and has no air remaining in the break.

A repaired chip will not disappear but leave a small scar.

**THANK YOU FOR YOUR
ATTENTION**