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Welcome to the windshield and rock chip repair industry. This manual is designed to give you basic information to begin a windshield repair business and technical training by answering basic questions about windshield repair and running a windshield repair business.

We recommend that you inform each customer before beginning a repair that it will not disappear. The main purpose of the repair is to keep the damaged area from becoming a long crack. The repair will look much better than before but no matter what kit or resin you use, you will never make any rock chip completely disappear. This especially applies to the pit where the rock hit the windshield.

In the early 1970’s windshield repair was introduced to the auto glass industry. As the industry grew, newer equipment and resins began making it economical and profitable to repair windshields. Windshield repair, when done properly offers the following:

- Improvement of the windshield’s strength and integrity.
- Keeps the windshield from further damage, cracking, or splitting.
- It will in most cases look much better after the repair.
- Saves the original seal by avoiding replacement.

What is Windshield Repair?

Windshield repair is the simple process of injecting a liquid resin into the damaged area of laminated glass and allowing it to cure, thereby restoring the integrity of the windshield and preventing further damage from occurring. Most people are unaware that a windshield is made of two separate pieces of glass with a layer of lamination in the middle. This is a soft clear, rubbery type material. Lamination is a required safety feature in the manufacturing process, designed to prevent the glass from shattering in the event of a crack or break, as well as preventing flying road debris from impacting the windshield and reaching the driver. When a windshield is “chipped or dinged” in general only the outer layer of glass is damaged and this is the layer of glass the repair technician will be working with. Some impacts that hit near the edge of a windshield, will crack the inside layer of glass. That is not repairable.

Windshield Repair System

The following are the key basic components you will need in order to do quality repairs for your customers.

- **Windshield Repair Bridge** - This device is used to inject the resin into the damaged area of the windshield.
- **High Speed Drill with dental bur** - This is used to create an avenue for the resin to flow more freely into star breaks or small cracks.
- **Repair Resin** – Repair resin is the first step of liquid injection and is a thinner resin than pit filler.
- **Pit filler Resin**- Pit filler is designed for the final touch. It seals off the repair with a hard finish.
- **Curing Film** – Curing film is used to hold the pit filler in place, flatten it, and accelerate the curing process.
- **Ultra Violet Light** - Windshield repair and pit filler resin, are **UV sensitive**. When exposed to UV rays, whether from sunlight or a UV light, the resin will harden and bond the damaged glass together.
- **Nitrile Gloves** - Used to protect hands from repair resins that can cause irritation to the skin.
- **Probe** – Used to place pressure on the cracks to allow the resin to flow.
- **Heating Element** – (lighter) Used to heat the glass during the repair process.
- **Razor blade** - Used to scrape off the excess resin from around the pit.
- **Pit Polish** – This step is optional. By polishing the pit you can remove some of the dull appearance of the finished repair. Many companies do not do this because from the driver’s perspective it will look no different. From outside the vehicle there is a small benefit in terms of appearance. Every technician or business owner will have his/her own preference in regards to polishing the pit.
- **Curing Film**- This comes in strips. Cut the film into squares. You can re-use it several times.
**Note:** In directions for all the types of repairs you are taught to place the chip under pressure. You are also taught to pivot the bridge away from the injector to check your progress. NEVER PIVOT THE BRIDGE AWAY FROM THE PIT UNLESS YOU HAVE FIRST REMOVED THE PRESSURE ON THE RESIN, BY REVERSING THE PISTON. IGNORING THIS STEP CAN CAUSE RESIN TO SQUIRT DIRECTLY IN YOUR EYES. WEAR SAFETY GLASSES. IF YOUR KIT DOES NOT HAVE SAFETY GLASSES, GET A PAIR BEFORE YOU BEGIN. IF YOU GET RESIN IN YOUR EYES FLUSH WITH WATER AND SEEK MEDICAL ATTENTION. KEEP ALL RESINS OUT OF THE REACH OF CHILDREN.

**Product Care and Precaution Information**

**Repair Bridge:** For nightly storage wipe all parts with a clean soft cloth. Once a week, during times of heavy use, you can soak the injector and piston in a small amount of acetone overnight. Remove all seals before soaking. End seals and inner O-rings should be replaced as needed.

**High Speed Drill Motor:** We recommend a four hour charge time. Remove the bur (dental drill bit) from the collet at the end of the day and store.

**Repair and Pit Filler:** Repair resins are UV sensitive. *Always replace the cap after use.* Be sure to tighten the cap, and store in the carrying case when not in use. Keep resin bottles out of direct sunlight. If you are working in the sun keep the repair covered with your hand while working. If you walk away place a rag over the bridge to block UV rays. You do not want your resin to cure until you are done with the repair.

When using repair resin it is important that you wear nitrile or chemical resistant gloves to protect your skin from harmful chemicals. We recommend nitrile dipped gloves. They allow you to grip the cylinder and piston better than thin disposable gloves. Safety glasses must be worn to protect the eyes from possible resin splashes. If resin gets on your skin wash immediately with soap and water or glass cleaner. If resin enters the eyes flush with water and immediately seek medical attention. Keep out of reach of children.

**Razor Blades:** Razor blades should always be stored in a safe place.

**Single Point Probe:** The probe should be handled and stored with care. The pointed end can cause injury or damage if handled carelessly.
Different types of chips

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**Bull’s Eye Repair**

**Important note before you begin!**

A Bull’s Eye is actually a small cone shaped break inside the first layer of glass. *(Figure 2.1)* As you can see in *Figure 2.1*, the top of the cone is where the pit (impact point) is located. The bottom of the cone lays on the lamination of the windshield. When you repair a Bull's Eye, you are forcing resin from the top to the bottom or border area of the cone. Because the bottom of the cone lays on the lamination, this circular area is a place where damage can occur to the windshield. The lamination can become soft from too much heat or age. *(older vehicles)* When repairing a bull or combo bull star break, watch closely and if you see the border expanding or changing in anyway, immediately reverse the piston to avoid damage to the lamination. A slight expansion beyond the border is not a problem. A small amount of air will dissipate to the outer edges of the bull. This will not be very visible.

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**Step 1: Mount the bridge and Heating the Glass**
Before you place the repair bridge on the windshield, make sure the injector and rear set screw are backed out high enough so that they are above the bottom of the suction cup. (Figure 2.2), otherwise the cup will not adhere to the windshield properly.

![Figure 2.2](image)

![Figure 2.3](image)

Next, with the piston removed from the cylinder, mount the repair bridge so that you can see the center of the pit through the cylinder. (Figure 2.3) If you are unable to get up high enough to look through the cylinder, you can estimate the cylinder being over the pit. You will become better at this as you get more hands on experience.

Unless the windshield is already hot from the sun, before you begin the repair, go inside the vehicle and heat the Bull’s Eye with a lighter or match, until it is nearly too hot to touch with the back of your finger. Take care to not overheat the glass as you could over soften the lamination. Now exit the vehicle, bring the cylinder down until it makes contact with the pit. Then turn it in a bit farther to firm it up on the glass. Next bring the rear set screw down and do the same. This will create a tight seal between the windshield and the repair bridge. You may need to tighten or adjust the cylinder and rear set screw slightly as you proceed with the repair. (Never over tighten these parts of the bridge. You can crack the windshield by doing so.)

**Step 2: Drop resin into the cylinder**

Most Bull’s Eyes take between 6 to 8 drops of repair resin in the cylinder (Figure 2.4). When you perform your first repair of the day the cylinder is dry, therefore some of the resin is absorbed into the threads, you may need to use a bit more resin for the first repair of the day. (8-10 drops)

A larger Bull may take a bit more resin. **IF YOU DO NOT USE ENOUGH RESIN ON ANY TYPE OF REPAIR, YOU WILL NOT GET A PROPER SEAL.** Too much resin and you will not be able to get into the vacuum cycle.

![Figure 2.4](image)

![Figure 2.5](image)
**Step 3: Forcing the Resin into the Pit and Vacuuming Air Out:**

First, make sure you have secured the top external portion of the cylinder with your thumb and index finger as above in Figure 2.5. With your other hand, place the piston in the cylinder and begin to *slowly* screw it in clockwise. This will force resin down into the Bull’s Eye. It is important to use small slow turns. Small turns will allow you to have better control over the resin flow. Watch closely as the resin flows to the outward edges of the bull. Once the resin reaches the border of the Bull’s Eye, reverse the direction of the piston with 3 or 4 turns. This action will produce suction, creating a vacuum cycle. You may or may not be able to see air leaving the Bull’s Eye and flowing into the injector. Allow 10-15 seconds before moving to the next step. *(Any air in the chip will look like small black lines or bubbles moving in the direction of the injector. Areas within the rock chip that contain air are generally dark or black.)*

**Step 4: Bring the pressure down a second time:**

Again slowly screw the piston clockwise to force the resin into the bull. As soon as the resin reaches the border of the Bull’s Eye, reverse the piston again just as before. Leave the injector in the vacuum cycle for another 10-15 seconds.

Bring the pressure down on the bull for a third time. *Watch the border of the bull closely. If you see resin moving beyond the border, reverse the direction of the piston immediately. A small amount of air will dissipate into the edges and slightly increase the size of the border. That is fine. You are making the air go away. That is what you want. Provided you do not see a problem such as the border changing too much in appearance, leave it in the pressure cycle for about 10 or 15 seconds. Relieve the pressure and it should be done. If you still see air you will need to cure it under pressure. See below...*

**Step 5: Viewing the Repair: CAUTION: NEVER TURN THE BRIDGE WHILE UNDER PRESSURE**

Reverse the piston slowly to relieve the pressure. Now, slightly unscrew the cylinder and rear set screw by turning them counter-clockwise until they are both loosely touching the glass. You can now pivot the bridge away from the Bull’s Eye and view the repair. If all the air has been removed from the Bull’s Eye, it should look much less visible. *(Not the pit. It will never disappear)* and you may then skip the next step and go directly to **Step 7 - Curing the Pit.** If you do still see air in the Bull’s Eye you will need to follow the instructions in Step 6.

**Step 6: Curing the Bull’s Eye While Under Pressure:**

If you still see dark areas (*air pockets*) in the Bull’s Eye, you will notice that when you put pressure down with the piston, the air or black areas disappear. Curing under pressure is simply ‘freezing’ resin in that condition by using UV rays.

To cure under pressure, pivot the bridge back over the pit so that you have the pit in the center of the end seal. When you begin to pressurize the repair again as discussed in Step 3, you should see the air in the Bull’s Eye disappear. If not, or if the end seal leaks excessively when you bring the pressure down, you may not be directly over the pit. You may wish to go back to Step 1 and remount the bridge. At this point, the Bull’s Eye should only need 2-4 drops more of resin. Bring the pressure down gently by turning it in clockwise. The Bull’s Eye should now be clear, and the air dark areas should be completely gone.

Leaving the Bull’s Eye under pressure, place the UV light over the repair. *(figure 2.6)* You will want to allow 5-10 minutes to cure, remove the light. If the sun is shining you won’t need to use the UV light. Simply leave the Bull’s Eye under pressure for about 5 minutes in the sunlight. Next, begin taking the pressure off of the Bull’s Eye by slowly reversing the piston.
Step 7: Cure the Pit and Scrape the Resin:

Once you are satisfied release the pressure by reversing the piston. You can then release the lever and remove the bridge from the windshield. Do not wipe away the repair resin but place pit filler directly over the repair resin. (1 or 2 drops) Then place a piece of curing film over the pit. You can then secure the UV Light over the repair site and cure the pit filler resin (Figure 2.7). It will take between 5.10 minutes to cure the pit filler. Once the pit filler is hard to the touch you can remove the U.V. Light. If it is still soft, let it cure a bit longer.

You can now remove the curing film and with a razor blade, shave the excess resin away from the pit in a circular motion (Figure 2.8). This helps not to pull the pit resin out of pit.

Step 8: Buffing the Pit:

This step is optional. If you chose you can buff the pit with buffing polish. It will look a bit better from outside the vehicle.

Star Break or Small Crack

Important note before you begin!

If you have never repaired a windshield, it is important that you understand how to identify a small crack with resin, versus one without. You need to be able to determine whether the chip or crack has previously been filled by another technician. It is common for a technician to be asked to repair a chip that someone else has already filled! Follow this simple rule: If the crack is visible from any angle, it does not have resin in it. If a crack is only visible from certain angles, it has resin in it. This rule is extremely important for those just starting in windshield repair. You don’t want to find yourself trying to fill a break someone else has already filled! Or filling your own crack again and again! Try to view any cracks from every angle while you are injecting it with resin. This practice will help you become familiar with seeing resin as it flows into the small cracks. The legs or cracks will not disappear. Your eye will become trained to see legs or small cracks that are filled with resin vs not filled.
Step 1: Drilling the pit area:

The purpose of drilling is to create an avenue for the resin to flow out to the ends of the cracks or “legs”. While repairing Star Breaks or Small Cracks, you will notice that some are formed at an angle. When you drill into a pit with a crack that is angled, it is important to do your best to drill at that same angle so as to provide the correct avenue for resin to flow. This only applies to small cracks (one crack with a pit in the middle) Not star breaks.

Before you begin drilling make sure you have a tight grip on the drill and that your palm is on the glass while holding the drill. This will prevent it from skipping on the glass. Start by drilling a hole in the center of the pit (Figure 3.1). You do not need to drill all the way to the lamination but if you are a beginner it is fine to do so at first. That is how you will learn how deep the lam is. We recommend you drill all the way into the lam on your first few repairs. You will learn to judge the correct depth with experience. Some technicians prefer to drill all the way to the lamination. This is optional. The repair Will look slightly better if you do not drill into the lam. (learn to stop just before reaching the lam)

Step 2: Mount the bridge:

Again, before you place the Bridge on the windshield, make sure the injector and rear set screw are unscrewed until they are higher then the cup on the bridge assembly (Figure 3.3). Otherwise the cup will not adhere to the windshield.

Next mount the bridge in the exact same way you mounted it for the bull’s eye.
**Step 3: Drop resin into the cylinder**

Most all chips will require between 6 to 8 drops of resin in the injector (Figure 3.3). Again use extra resin if it is the first repair of the day. If you do not use enough resin you will not get a proper seal. If you use too much you will not be able to get the piston into the vacuum cycle. You will learn how much resin to use as you go. These are just starting points to get you going. Some like to use as little resin as possible so as to avoid waste. This is a good practice to do as you gain more experience.

**Step 4: Forcing the Resin into the Pit:**

Place the piston into the cylinder and begin driving resin into the break, by turning the piston slowly clockwise. Use small fractions of a turn. As the resin begins to enter the damaged area of the windshield you will start to feel resistance. Watch closely and you should see the resin begin to flow into the legs of the Star Break. (The “Legs” are the small cracks) At this time turn the insert approximately one eighth of a turn more, or until it feels fairly firm. It may even leak a bit. That is okay. Let the injector stay in that position, and begin to probe the legs.

**Step 5: Probing the Cracks or “Legs”**

With the Star Break or small crack under pressure, you need to help the resin flow to the outer end of each crack. With your probe at an angle, put pressure directly on the leg that you are trying to fill (Figure 3.4). Hold the pressure down on the leg for 3 or 4 seconds. This pressure opens the crack, and you will see the resin flowing outward. Lift the probe and apply gentle pressure again 2 or 3 times for each leg. You need to find every leg within a star break and probe each one of them. Be careful not to apply too much pressure so you do not cause a longer leg or crack. (If this happens just let the resin flow into the longer leg and move onto the next leg of the star break) It’s very important that you watch closely and find the angle needed to view each leg as the resin flows. Remember, small cracks look different when they have resin in them and you will learn to find the angle at which to view the flow of resin. You must also learn to know when the leg is full. You do not want to be trying to fill a leg that is full! It will still be visible from certain angles even when full.
Step 6: Vacuum

Reverse the pressure from the injector by turning the piston counter-clockwise. This will create suction, placing the injector in the vacuum cycle. Leave it this way for 10-20 seconds. It takes a certain amount of turns to get into this cycle. A good start is about 3-5 (what we call flick or half turns) You may or may not see air slowly moving out of the legs. You cannot always see the air moving. (The video may say something different about turns of the piston. These are just starting points. You will learn the techniques by hands on experience.)

Step 7: Bring the Pressure Down and Probe the Legs a Second Time:

Slowly turn the piston in again and until you feel reasonable pressure. Then probe each of the legs a second time. As before, probe each leg two or three times. By probing the legs each time you will help resin to flow outward to the end of each crack within the star break.

Step 8: Vacuum a Second Time:

Reverse the pressure from the injector by turning the piston counter clockwise until you again reach the vacuum cycle. Leave the injector in the vacuum cycle for about 10-15 seconds.

Step 9: Heating the Windshield:

Increase the pressure again by turning piston clockwise one last time. Firm it up as before so that there is pressure on the resin. While the break is under pressure, go inside the vehicle and heat the outer edges of the legs. This will draw the resin outward. (Do not be deceived. Heat can make legs disappear when they have not. Step out of the vehicle and remove the pressure by reversing the piston. Now wait a few minutes for the star break to cool. If you still see air in the legs bring the pressure down again and probe whatever cracks may need probing, If you still have air at the end of a leg, you can take your drill, while you have the break under pressure, and drill at the end of the leg. Do this at an angle toward the center of the break. Releasing the air will allow the leg to fill. You do not need to drill deep. Just until you get results. We do not recommend drilling each leg. This is only for stubborn legs that may come up from time to time.

Step 10: Inspect the Repair:

Inspect the repair by taking the pressure off and pivoting the bridge as described above. All of the legs should be filled with resin. Certain facts may keep you from filling every star break perfectly. How long it has been there, how much oil, road debris, grease, dirt, rainex, etc. may have penetrated the break. Just do your best. Do not go around drilling holes everywhere or you will make it look much worse than before. A finished star break will still be visible from inside the vehicle. The pit will always be visible from inside and out. Remember what you tell your customer before each repair. (It will not disappear. The main purpose of the repair is to keep it from spreading to a long crack and you guarantee your work)

Step 11: Cure the Pit:

With a curing tab in hand, take the pressure off the resin, unscrew the cylinder, and remove the bridge. Now place a drop or two of pit filler directly over the repair resin. Place the curing film over the pit. Cure the pit filler resin and scrape it off as described above (Bull's Eye Repair)
Combination Bull’s Eye-Star Break

Step 1: Mount the Injector

Just as before make sure the cylinder and rear set screw are screwed up higher than the cup. (Figure 4.1)

Next mount the bridge so that you can see the pit through the center of the cylinder. (Figure 4.2) Drop in your resin as with any other chip and bring the pressure down with the piston. Fill the bull area of the combo and watch the resin flow beyond the bull and into the legs. Probe the legs just as you would a star break. Take the pressure off and get into the vacuum cycle as you did with the bull and star break (10-15 seconds). Bring the pressure down a second time and probe the cracks again the same as you did the star break. Get in the vacuum cycle one last time and wait 10-15 seconds. Now bring the pressure down for the third time and probe the cracks or (legs) again. This time go inside and carefully heat the outer edges of the legs of the combo break. Be careful not to heat the bull portion of the combo while under pressure as it could cause a daisy. The repair should be done. Go outside the vehicle, take off the pressure, pivot the bridge and view the repair. If it looks good, place your pit filler on the pit, cure it, and scrap it as with the other chip repairs. If you see areas that still need attention pivot the bridge back over the pit and bring the pressure down again repeating steps to fill the cracks. You may need to cure the bull portion of the combo under pressure. Simply follow the steps for curing a bull under pressure.
Crack Stop Repair

Occasionally, you may have a customer who has a 2-6 inch crack that they would prefer to have repaired instead of replacing the whole windshield. In these cases the customer usually will have a high deductible, liability coverage only, or no insurance and prefer to have you stop the crack from getting any worse.

You will begin by drilling a small hole at one or both ends of the crack, depending on the location of the crack. Do your best to drill a hole directly over the end of the crack. Drill all the way to the lamination. To prevent the crack from going around the hole, hone the hole out to about 1/8th of an inch in diameter. Do this by gently pushing outward in a circular motion (at this point you are using your drill as a router and may need to use a higher speed). Do not use any downward pressure or you may drill all the way through the windshield!

Next, blow the dust out and inject the hole you created just as you would a star break. Watch the resin flow. If it stops, simply relieve the pressure from the resin by turning the piston outward until you are out of the pressure cycle, then move your bridge over and inject directly over the crack. Keep doing this until you reach the other end of the crack. It may also be necessary to repair the area where the crack began. Any chip close to the edge of the windshield is considered a high stress area and can crack out if a repair is attempted. You must be careful and use very little pressure in mounting and injecting. All repairs done near the edge of the windshield must be done carefully. It is also necessary to let the customer know that you will do your best not to crack the windshield, but that you cannot be responsible if it does crack. If the customer does not agree, do not attempt to do the repair. You should even go so far as to have the customer sign a written agreement that you have made for these cases.

Frequently Asked Questions

These pages contain important information that will be useful for you when you are in the field. We suggest you read the Frequently Asked Questions before you begin performing rock chip repairs.

1. What is “the pit”?

The pit is the center of the damage on the windshield, where the rock hit. This is the area where resin is injected into the chip.

2. Will I encounter different types of chips besides those discussed in this training manual?

Yes. However, nearly every chip you will ever find will have some characteristics of the chips found in your manual and you can always simply follow the same steps to repair them.

3. What is the “lamination” in a windshield?

Lamination is the thin layer of clear soft plastic between the two layers of glass. Lamination is a required safety feature that keeps the glass in a windshield from shattering. It is what keeps a rock from flying through the windshield when you are driving down the road. Most people do not know that a windshield is really made up of two pieces of glass. When a windshield is chipped, it is usually the outside layer of glass that is damaged.

4. Is it okay to drill all the way through the first layer of glass?

Yes. However, repairs will look slightly better if you learn to stop drilling just before you reach the lam. Some technicians find it easier to fill small cracks and Star Breaks by drilling through the first layer of glass. If you choose to drill all the way through the first layer, remember to remove the laminate from the bur with a small piece of steel wool or your fingernail.
5. Is it possible to damage the lamination during a windshield repair?

Yes, the laminate can be damaged by pressure. All repairs require heat either from your lighter or the sun. When you pressurize the resin to the lamination by turning the piston inward, you have to be careful. Heat softens the lamination in a windshield. Always watch closely when putting down pressure on any chip that is heated, or hot from the sun.

6. What is a “Daisy?”

A daisy is damage to the lamination usually caused by a combination of too much heat and pressure on the chip. It looks a lot like a real daisy, but is transparent. The size of a daisy will usually depend on the length of time the chip is left under pressure. A daisy cannot be repaired or reversed. It is unlikely you will cause a daisy in chips other then a Bull or Combination Bull-Star Break. This is because of the large opening to the lamination in these types of chips.

7. How do you avoid causing a “Daisy?”

Use tiny fractions of a turn while driving the resin down, and pay close attention to the border of the Bull or Combo. If you see the resin going beyond the border, quickly reverse the piston to relieve the pressure.

8. Why does my drill sometimes stop cutting?

Most importantly, you should be drilling at the slowest speed possible. Overheating your bur can keep it from cutting. Drilling too slow will obviously not cut as well so find the sweet spot for drilling the glass. Whenever you are drilling, you may need to stop and let the bur cool. If that doesn’t work, the bur may be too dull and you may need to change it. Keep in mind that you should be seeing a ‘powder’ accumulating around the pit while you are drilling. If not, you probably are not cutting through the glass. Changing speed, pressure, and angles can also help.

9. When do you drill a hole at an angle?

Many small cracks or partial Bulls are formed at an angle. When you drill into the center or pit of a small crack, you need to follow the angle of the crack. You may need to lean the drill at an angle to match the angle of the crack. This opens an avenue that is congruent, or in line, with the crack you are trying to fill.

10. I keep breaking drill bits. Why is that?

Most likely you are drilling a hole, backing off and drilling again at a different angle. Drilling at a different angle the second time can not only break the bit, but also it can fracture the glass. It’s very important to keep the drill at the same angle when are drilling.

11. Why won’t my bridge cup adhere to the windshield?

First, make sure the windshield isn’t dirty. Use a small amount of cleaner to ready the area. (Never spray glass cleaner into the pit) Next, hold up the bridge assembly and make sure the cup is positioned lower than the cylinder and rear set screw. If not, adjust the bridge accordingly. Finally, before you press the lever down to secure the cup to the glass make sure you are also applying a downward pressure on the whole bridge assembly. This will make sure the cup is pressed flat before you press the lever down.

12. Why not heat a combination Bull Star Break before injecting?

Heating cracks can actually cause them to temporarily disappear or close. We do not recommend heating a Combo first because of the cracks. We do recommend heating cracks under pressure, but only after the cracks have been probed.
13. If it's a hot sunny day should I take any extra precautions in repairing windshields?

Yes! If the windshield is extra hot, we recommend cooling it before you begin. If you reside in a hot environment it is a good idea to either have an awning that you can set up to shade the windshield or keep a golf umbrella in your vehicle. The other option is to let the customer know ahead of time to have the vehicle parked under a tree or somewhere in the shade. This is only a recommendation, not a requirement. Anytime you are working on a warm windshield it is very important to pay special close attention to the effect the pressure will have on the cracks and lamination. A warm windshield is also a good thing. You will find it easy to fill Bulls, Combinations, and small cracks, so don’t be discouraged if it is a hot day, just remember to careful in all you do. Use less pressure in every way. This includes how tight you mount the bridge and how much pressure you place on the resin. (NEVER TRY TO COOL A CHIP WITH ICE OR ANYTHING SIMILAR. YOU WILL CRACK THE GLASS)

14. Is it possible to drive air into the lamination?

Yes, it most often occurs on older windshields or extra hot windshields. The lamination in an older car can actually become liquefied on a hot day! If it’s really hot outside or you are working on an older car, be extra careful and shade the glass before you begin working! Older cars are generally considered those that are 15-20 years old. Cars kept in extreme weather conditions – such as very hot areas, may have windshield laminates that liquefy more easily than the average vehicle. Either do not attempt a repair on an old vehicle or warn the customer ahead of time absolving you of any responsibility.

15. How can I stop my end seal from leaking resin?

It isn’t anything to worry about if your end seal leaks a small amount of resin. If the end seal is new, the problem will subside after a few repairs. If the problem persists, simply remove the end seal and turn it around. If you still have a problem you may not be tightening the injector and rear set screw hard enough. Don’t be afraid to tighten these knobs more during the repair process. These guidelines are a starting point. You will learn what works best as you gain experience. (Never ream the cylinder or rear set screw down hard. It is not necessary. Firm it up as you go and that is all you should need)

16. How do you decide if a windshield is too old to repair?

If the vehicle is older you may still be able to repair the windshield. You do need to take extra care if the windshield looks to be aged. Older cars are generally considered those that are 15-20 years old.

17. What is the high stress area of the windshield and how do you do repairs in this area?

About 3-4 inches from the edge of the windshield is considered a high stress location. This area is close where the windshield is glued to the vehicle. Be extra careful when repairing chips in this area. It's a good idea to let the customer know of the risk before you do a repair in this area of the windshield. This is a policy you will need to set for yourself. Never use heat when repairing a chip near the edge of the glass. The customer will understand why the repair may not look as good as it could when you explain to him/her the extra caution you are taking.

(Before you do any repairs in this area, let your customer know that if the windshield cracks while doing the repair, you will not be held liable for a replacement. Also inform the customer that you will be extra careful while injecting the resin into the chip. Of course if the chip is not repaired, the chances of it spreading are even greater. After explaining this to the customer, let him/her decide. The customer will usually allow you to do the repair.)

18. How will I know when to change the o-ring or end seal on my injector set?

The end seal will begin to expand and/or leak excessively. You can then flip it and keep using if for a while longer. As for the O-ring, it will become loose on the piston or start to shred. Remember to wipe off any resin from your O-ring and end seal after every appointment. This will extend the life of these parts. Do not store the piston inside the cylinder. You do not want the O-rings soaking in resin.
19. **How can you do a motor home or a bus windshield when the glass is nearly vertical?**

The difficulty here is getting resin into the injector. Use an extra amount of resin and quickly insert the piston.

20. **What is a ½ or ¼ Bull?**

A ½ Bull is when the cone of the Bull is only half formed. The same goes for a ¼ bull. It's only ¼ formed or maybe ½ formed. Treat these types of partial Buls as you would a full Bull. You can make these types of damage nearly disappear, especially if you heat them first. We highly recommend the heat method for any Bull, unless of course it's a hot day. It is actually better to get a partial Bull a bit hotter than a full Bull before injecting.

21. **I have a Bull's Eye that won't take resin. What should I do?**

This is rare, but sometimes a Bull won't accept resin. Take your probe and put direct pressure on the center of the Bull. This is the top of the cone of the Bull. As you put pressure down on the cone you will see the Bull flexing. After doing this a few times, use your drill to clean around the top of the cone and inject it. It should now take resin. Another consideration is the Bull may have already been repaired. The resin that was injected and cured will keep you from doing it again.

22. **A small area of the Bull will not take resin. What can I do to complete the repair?**

This is also rare, but sometimes a small area of the Bull is stubborn and won't allow you to pressurize it with resin. A good remedy is as follows. While the Bull is under pressure, drill a hole into the part of the Bull that you are seeing the air. This will almost always solve the problem.

23. **I did a Bull repair and when I was finished, I could see small cracks in the cone. Why?**

Sometimes the cone of a Bull will contain fractures inside it. These small cracks in the cone pose no threat and there is nothing you can do to make them disappear. You may wish to explain this to your customer before you begin.

24. **I am doing a star break and one or more of the legs won't fill with resin. What now?**

First, be sure that you have probed the cracks by putting direct pressure on the legs, while the star break is under pressure with resin. If necessary repeat this for at least 3 or 4 cycles. If there are still one or more cracks that are not taking any resin, simply go inside the vehicle and heat the cracks while under pressure with resin. A last resort is, while in the pressure cycle, drill the stubborn leg, at an angle, pointed to the center of the star break. This will release the air that is trapped in the leg.

25. **How much pressure can I put on a crack when probing?**

There is no exact way to determine how much pressure to put on a crack with your probe. It is possible to enlarge a crack when probing. If you see the crack enlarge remove the pressure immediately. This does not happen very often and when it does, the crack will usually not go far. The resin will usually fill out to the end of the now longer crack, making it nearly invisible. You will learn by experience how to determine how much pressure is needed for probing cracks.

26. **My injector does not seem to be vacuuming out any air. Why is that?**

If you are not seeing air being removed from a chip it is most likely because you are using too much resin. Too much resin in the injector will fill the injector and not allow for the vacuum cycle. Try using a few less drops of resin when doing a repair. Also, just because you do not see air coming out does not mean that it is not coming out. Follow the steps and you should be fine.
27. Heating cracks under pressure makes the resin flow so why not do that from the start?

You could do that. The problem is you wouldn’t be getting any air out of the cracks. This is a very important part of the process. Air in a chip is always visible. Where there is air, there is no resin! With Star Breaks and small cracks, it’s always best for heat to be the very last part of the process.

28. Should I repair a windshield in the rain?

We do not recommend repairing windshields in the rain. If a windshield is wet, it needs to be dry before repairing. Just as a chip will absorb resin, it will also absorb water. Water does not mix with repair resin. You must dry the chip out before repairing it. A good way to do this is to have the customer run his or her vehicle with defrost on full hot for about 15 minutes before doing the repair. Check to make sure the chip is dry. A Bull is dry when it has a dark “marble-like” look to it. With your probe, put pressure on the bull and flex the cone inside. If the appearance changes as you do this, it has water in it. With a small crack or Star Break, remember the rule? If a crack is visible from any angle, it does not have resin in it. If a crack is only visible from certain angles, it has resin in it. The same holds true with water. Water in a small crack will make the crack visible from certain angles only. If a small crack is completely dry, it will be visible from any angle. Just be sure to give small cracks and Star Breaks plenty time to dry before repairing. Please note: We do not recommend leaving a vehicle running unattended while drying out a chip in a windshield.

29. What happens if I crack the customer’s windshield?

This is a policy that you will need to set for yourself when you start your business. There is always a small possibility this may happen whenever you do a windshield repair. If you do a lot of windshield repairs, and that is obviously your goal, it is likely that at some point in time you will accidentally crack a windshield and it may not even be your fault. You might be following the instructions of your manual exactly and still crack out a windshield. It is important to know that it is a rare occasion and most customers are very understanding about it when it happens. They realize that the windshield was damaged before you began the repair anyway. Some technicians and business owners will pay for a replacement or refer customers to someone they know to replace the windshield for them at a special rate. While others technicians will let the customer know ahead of time that there is a slight possibility of the windshield cracking during the repair and because of the fact that the windshield is already damaged; they will not be held responsible. But do remember if you follow the directions of your manual closely, cracking a windshield will be extremely rare. It is a good idea to have the customer sign an agreement that you create, that does not hold you responsible for further damage to the windshield.

30. How do I know if a windshield has a rock chip that has already been repaired?

Anyone who enters the windshield repair business will soon learn how to spot a chip that’s already been repaired. The problem is customers will sometimes insist a chip needs to be fixed and has never been repaired. One way of determining if a repair has been done is looking at the pit. If there is some yellowing in the center, you know its aged resin. You can also take your probe to the pit and if it feels soft, it probably has resin in it. In most cases, you cannot repair a chip a second time.

31. My customer has a surface chip. Is that something that would need to be repaired?

We do not recommend repairing surface chips. There is little or no benefit to the customer and we would certainly not recommend billing an insurance company for it.

32. I have followed all the steps and I am not satisfied with the appearance. What now?

Leave it alone! Remember what you told the customer before you began? The chip won’t disappear. It will look better but the main reason for the repair is to keep the chip from spreading to a long crack. We do not recommend going over a chip repair a second time after the resin has been cured. If a chip has just happened it will fill easily. If it has been there a while it may not. They absorb dirt, grease, wax, etc. Just do your best and when it is done it is done.
33. What kind of guarantee should I give to my customers?

This will be up to you. A good guarantee is this; “Mrs. Johnson, if the repair ever fails, the money is refunded back to your insurance company.” Of course if Mrs. Johnson paid for the chip she would get her money back. This is a good guarantee and may insurance companies expect it.

34. If I get resin on the paint of a vehicle, will it remove the paint?

If you do spill resin on a painted area you must clean it right away. You don't want the resin to cure on the paint, so it is best to spray the area with glass cleaner and wipe it as soon as possible.

35. I am new at windshield repair and wearing gloves makes it difficult to do repairs?

If your kit did not come with nitrile dipped gloves, you should purchase a pair. You can get them at Home depot or other hardware stores. Buy extra gloves so you can change them as they wear down. We do not recommend ever doing repairs with no gloves. Nitrile dipped is best. Thin nitrile gloves are slippery.

36. My potential customer has a huge chip. Can I help this person?

Yes, you can inject at least some resin into almost any damage on a windshield. Just let the customer know that it certainly will not disappear. It should keep the windshield from becoming worse. Heating a big chip before injecting will actually cause the chip to absorb resin without much pressure. In the case of a huge chip, you might heat it first, even if it is a Combination. Mount your bridge and inject it. Even if it leaks because it is so big it should take some resin. You don’t have much to lose. Most likely your customer will be amazed at your work!