WORKING WITH ALUMINUM

5 THINGS TO REMEMBER

Repairing aluminum panels presents special challenges for auto repair facilities. At Dent Fix, we've identified five critical areas of concern to keep in mind when performing aluminum panel repairs. These include

1. Galvanic Corrosion
2. Softness of aluminum
3. Work Hardening
4. Heat and Conductivity
5. Oxidation.

1. GALVANIC CORROSION

Galvanic corrosion is an electrochemical process in which one metal corrodes preferentially to another when both metals are in contact in the presence of an electrolyte like moisture. This is an accelerated corrosion due to the electric charge created in the process.

In the automotive repair center, galvanic corrosion occurs when an aluminum panel is exposed to the shop environment containing steel shavings, dust, and particulates carried over from steel panel and frame repairs. All shops have a degree of humidity in the air, and this moisture is the electrolyte which accelerates the corrosion between the steel dust and the aluminum panel. The technician can also bring dust particles on gloves and clothing which can end up on an aluminum panel. Steel contaminants will be present on tools, and certainly contained in grinding discs or sanding abrasives. These particles can be transferred to and potentially embedded in the aluminum panel.

The result is corrosion on the aluminum panel which negatively impacts the refinish process. This contamination is often invisible but is present nonetheless. It can manifest itself through primers, fillers, and paint not adhering to the panel, causing lifting and other paint related issues incurring costly redoes and repairs.

In an ideal situation, all aluminum repairs are conducted in an isolated environment where there are no steel operations present and are performed with a separate and dedicated set of tools and abrasives.

An exposed aluminum panel can be protected with mask paper when not in use to prevent dust from settling on the panel. The minimum OEM requirements are to isolate the work area with a vinyl curtain wall to divide areas where aluminum and steel may cross contaminate. In addition, it necessary to obtain a specified set of specialty tools and maintain an isolated common tool set. Keep in mind that aluminum dust can also migrate back to steel panels to corrode in the same manner, causing similar corrosion and finish issues.

The Aluspot Dent Repair System provides a solution with a specifically designed set of tools for aluminum repair, contained in an isolated storage tool box, intended to prevent contamination and thus insure the integrity of the repair process.

2. SOFTNESS

Consideration must be given when working with aluminum due to the softness of the material itself. Aluminum is too soft to be used on it's own, so it is alloyed with magnesium or silicon for added strength in body panels. Structural and cast pieces are alloyed with zinc. The 7000 series alloy contains zinc, the 6000 series contains silicon, and the 5000 series alloy contains magnesium. The Aluspot system features magnesium and silicon studs for use on panels corresponding to the alloyed material to ensure a proper weld and bond to the panel.

The softness of aluminum dictates that no sandpaper coarser than 80 grit be used to avoid gouging. The Aluspot system is equipped with a special low tooth per inch body file to prevent caking. Keeping hammers and dollies free of nicks and sharp edges is also critical, as these can damage soft aluminum panels and effect finish time.

Always use a hammer-off technique when working aluminum panels to prevent pinching and over-stretching of the material.

3. WORK HARDENING

Aluminum is work-hardened, meaning it becomes harder with each forming process applied to it. It is first hardened when the panel is originally stamped, but the process occurs again when the panel is damaged. Reshaping the panel will cause the panel to over harden and then crack and break. Aluminum has a work hardened memory that makes it want to stay in its current state. Steel on the other hand has return memory. Steel wants to spring back, while aluminum will fight to stay in its current shape. Heat must be applied to erase this memory and then the work of panel repair can take place to reset the memory into a new shape.

4. HEAT & CONDUCTIVITY

Traditional transformer based steel stud welders, do not create enough heat fast enough to weld on aluminum due to its high heat flow characteristics. The Aluspot system includes a Capacitor Discharge stud welder, which is designed to release far more electrical energy much quicker than a steel stud welder.

Attempting to pull the panel back into shape without applying heat will over-harden the panel and it will crack and break. Technically, aluminum will be workable in the 400-570°F range. We do see movement in temperatures below 400°F and over 570°F will anneal or permanently soften the aluminum.

Manufacturers have specific temperature ranges that they recommend. For example, Ford advises heating panels to no more than 400°F to protect any bonding agents, glues, or sound deadener on the back side of the panels from debonding or failure. Aluminum will melt at 1200°F with no color change indication. It is critical to maintain temperature control. The Dent Fix Aluspot system includes a heat gun featuring controllable temperature output. Keeping in mind that aluminum has excellent heat conductivity, it will rapidly flow the heat away from the target work area you are heating. This requires applying heat at a higher temperature than the desired range because of the rapid cooling properties of aluminum. For this reason, the system includes an emissivity-specific infra-red thermometer, which works on reflective surfaces, to accurately monitor the temperature of the work area and keep the temperature of the work in the desired range.

HINTS: The stud should be welded at a perpendicular or vertical position to the panel to ensure a complete fusion of the pin to the aluminum. Voltage adjustment allows for variations in the thickness of the aluminum sheet and needed pull strength.

5. OXIDE

Oxide is basically how aluminum rusts. It forms a protective coating on the aluminum that can be seen when the aluminum changes from the shiny surface to the slightly dull silver color. Again, aluminum melts at 1200°F and does not change color as it melts. The oxide, however, melts at 3600°F. The Capacitive Discharge welder is powerful enough to power through the oxide. The problem is the oxide layer contaminates the stud weld and causes a larger spark. This greater spark removes critical molten aluminum that the pin will need to fuse with. The problem is easily solved with simple but essential stainless steel brushes - a shoe handle brush for general cleaning and a toothbrush for more intensive cleaning of the oxide. The technique to remove oxide before stud welding is to brush the area vigorously in a back-and-forth motion, and in the same direction for the final strokes to keep the oxide out of the weld area.

HINTS: The 3 keys to a proper stud weld are:

- Perpendicular Stud Pin
- Contaminant Free Weld
- Start Weld at Level 3 or 85 volt