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WARNING ON ALUMINUM REPAIR: DON'T BELIEVE THE HYPE! – PART 1

Over the past few years, we've had to listen to the outcries over PartsTrader, suppressed Labor Rates, refusal to pay for necessary procedures, database provider mistakes, increasing Direct Repair Program intrusion and complaints over a lack of profit. Although those issues are important and worthy of attention, they are not the focus of this article. This month, we will address the misconceptions and misinformation about aluminum repair, something which all repairers need further understanding of.

Last month, we wrote about the poor quality of welds that we, and other consultants and industry experts, have been seeing performed on collision-damaged vehicles. We mentioned that the main reason we are seeing these extremely poor-quality welds is due to bad habits, absence of pride in one's work and a lack of education. Well, let us state that an overwhelming amount of collision repair facilities *CANNOT* repair steel vehicles correctly. We have proof, and if you are willing to have your repairs inspected, we can arrange that if you like. All challenges (good and bad) will be printed. With that said, attempting to repair aluminum-intensive vehicles without the proper training and equipment constitutes negligence on your part. This article will hopefully explain the truth about aluminum repair from the perspective of someone who is not making a profit from it. If you are not one to read the blurb about the authors, please note that Jeff is a Licensed Professional Engineer and has been involved in the automotive field for over 35 years and is, among other things, an ASE Certified Master Tech. Larry has been an industry trainer and speaker and is a Certified Collision Repair Tech and Certified Aluminum Welder for multiple OEMs. And he *STILL* works at a shop two to three days a week.

Cosmetic Repairs

Unlike steel, aluminum has no memory and *DOES NOT* want to go back to its original shape. This is the main issue with repairing aluminum panels. Cosmetic repairs are generally performed on sheet aluminum and rarely performed on extruded or cast aluminum; the only repairs would be dressing of welded or riveted areas and no applications of filler. Due to aluminum's memory characteristics, heat must be applied to the deformed area, but caution must be used to keep below the annealing temperature of aluminum. As the use of aluminum in the manufacturing of vehicles has increased (and we now find aluminum used as structural parts), technicians must learn new repair processes for them as well. Aluminum is extremely sensitive to heat, and the way that aluminum responds to applied pulling force is also different than steel. Precautions must be used when repairing it.

Alloyed aluminum is grouped into two categories: Heat-treatable and non-heat-treatable. Both can be heated for repair. The heat-treatable group includes: 2000 series (alloyed with copper) used often for body panels; 6000 series (alloyed with magnesium), also used for body panels; and 7000 series (alloyed with both zinc and magnesium, making it very strong), used for applications such as bumper reinforcements. These types of aluminum alloys gain strength from being heat-treated at the factory during the baking process.

Non-heat-treatable aluminum includes: 1000 series (nearly 99-percent pure), which is very soft and used for electrical wiring; 3000 series (alloyed with magnesium), used for interior structures; 4000 series (alloyed with silicon), often used for electrode welding wire; and 5000 series (alloyed with magnesium), often used for inner structural parts. These types of aluminum alloys gain their strength from work hardening during the stamping process. Let's look at what happens when heat is applied to aluminum:

- Aluminum melts at 660°C/1220°F. Remember, aluminum does not turn a different color before melting; it just disappears. Caution must be used when using heat.
- Aluminum repair heating temperatures: 204°C - 299°C/400°F - 570°F (sheet aluminum outer panels *only*, not structural members). We recommend that you keep the temperature as close to 400°F as possible.
- Aluminum has high thermal conductivity and therefore heats rapidly. Unlike steel, it can be heated and cooled multiple times during the repair process.
- Aluminum anneals at 300°C - 410°C/572°F - 770°F. This range is dependent on the alloy(s), but for general purposes, never go

Please note that this is not a "how-to" article. ***WE WILL NOT DISCUSS OR EXPLAIN ALUMINUM WELDING PROCEDURES AND PROCESSES. ALTHOUGH LARRY MONTANEZ IS A CERTIFIED ALUMINUM WELDER AND TECHNICIAN WITH MULTIPLE OEMs, WE WILL NOT DISCUSS THE PROCESS. THIS IS DUE TO THE FACT THAT, WHEN REQUIRED TO WELD ALUMINUM, THE REPAIR FACILITY MUST BE ON AN OEM REPAIR PROGRAM. EACH OEM PROGRAM THAT ALLOWS ALUMINUM WELDING HAS ITS OWN PROPRIETARY WELDING CERTIFICATION TEST - ALTHOUGH ONE OEM HAS BROKEN THAT RULE, AND WE WILL DISCUSS THIS ISSUE IN THIS ARTICLE. ADDITIONALLY, THIS ARTICLE IS NOT A TRAINING GUIDE OR HOW-TO MANUAL; IT IS FOR INFORMATIONAL PURPOSES ONLY. IT IS A GENERALIZATION OF MULTIPLE DISCIPLINES OF OEM REPAIR PROCEDURES AND REQUIREMENTS.***

above 570°F when attempting to repair an aluminum panel. If you anneal the panel, it will never hold its shape again and will be permanently ductile. Heat crayons or non-contact thermometers *MUST* be used when heating aluminum. Remember, it does not change color or give any indication of overheating that can be judged by the eye.

Repairing aluminum outer panels can be difficult. Deformities to aluminum outer panels can be classified into two basic categories of repair: Repairable and unrepairable. (We know, this is pretty obvious, but let us explain.) The repairability of the panel is dependent on the accessibility and inaccessibility of the damage.

Accessible: Access to both sides/backside of the panel. This will allow for hammer-off-dolly techniques to be utilized.
Inaccessible: No access to the backside of the panel. Hammer-off-dolly techniques cannot be performed.

Generally, accessible damage may be repairable and inaccessible damage may not be repairable. This is a general statement, and repairability would depend on the location of the damage, the size and type of damage sustained. Unrepairable damage is generally, but not limited to: Visible cracks, tears or breaches of the outer panel, deformities through feature lines, multiple deformities and damaged areas with little or no backside accessibility. Although there are many companies that make aluminum weld-on dent removal equipment for inaccessible areas, there are limitations to the repairability based on the severity. Most of the damage should be removed with heat applications and hammer-off-dolly techniques. Once this is done, weld-on dent removal equipment can be used to remove any small deformities to the panel. Another option is to weld the pins on, heat the area to proper temperature range and then apply pressure to the pins to gently remove the material. Aggressive pulling will cause micro-cracking or visible fracturing. In general, most of the damage to the outer body panels will require replacement.

Structural Repairs

Structural components include, but are not limited to: Unirails, inner reinforcements, rear body panels, rocker assemblies, quarter panels, apron assemblies and generally anything that is affixed to the vehicle other than by bolts. These components are generally affixed to the vehicle by rivet-bonding, rivets, welding, EJOT screws, friction-stir welding or clinches. These components are generally not repairable and require replacement if damaged in a collision event. The types of aluminum alloys these components are formed from are extremely strong and get work-hardened when deformed; they will crack, fracture or separate during repair attempts. One of the most important steps in the damage analysis process of a vehicle is to measure the vehicle for structural misalignment. This is true for steel-intensive vehicles, but it is paramount for aluminum-intensive vehicles, as there is no structural realignment to these vehicles.

We hope this article has helped the industry to better understand the issues surrounding aluminum cosmetically and structurally and the commitment with getting involved with an OEM aluminum repair program. Stay tuned for next month's installment, when we delve into equipment and training requirements shops must adhere to in order to be on any of the many aluminum collision repair programs. As always, please feel free to contact us if you have any questions.

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