

Repair Considerations for Exhaust Parts

In the past, automotive exhaust systems were only expected to last a few years at best. Then in the mid-1970s, U.S. Federal environmental mandates for catalytic converters with five-year or 50,000-mile warranties forced vehicle makers to switch from mild steel to stainless steel as the material of choice for these parts. The advent of extended length warranties and increased consumer expectations has led to the factory exhaust of today's vehicles typically having all of its parts made from some alloy of stainless steel.

Stainless steels have high chromium content compared to other steels. By far the most widely used stainless steel alloy for factory exhaust parts is 409 ferritic stainless steel, which has the lowest chromium percentage of any stainless steel at 11.2% and a carbon content of only 0.010%. This makes it an economical choice for exhaust parts, while offering improved corrosion resistance over mild steel. For longer-term durability requirements, some exhaust parts may be aluminized or coated by hot dipping in a molten aluminum solution.

These advanced metals add some new considerations when replacing exhaust system parts. Many OEM exhaust systems are a one-piece welded design from the catalytic converter back (see Figure 1). These one-piece units are typically made by GMA (MIG) welding individual parts with a special metal-cored tubular 409 series stainless steel

electrode wire using a shielding gas of 98% argon and 2% oxygen. The metal-cored welding electrode wire is similar in design to flux-cored electrode wire. The electrode wire is a hollow tube that has a solid metal core made up of different metal alloys with other ingredients and deoxidizers added to help stabilize the welding arc. Nearly all of the welding current is carried by the outer tube, which creates a wider, shallower path of penetration than that of the solid 409 series electrode wire. This allows the weld to be made with less heat and filler material.

There are challenges to welding exhaust system parts in a repair facility. One challenge is obtaining the proper consumables to set up a GMA (MIG) welder to weld stainless steel exhaust parts. Using ER70S-6 steel electrode wire to weld stainless steel exhaust parts may lead to a corrosion problem at the weld zone. At least one OEM service manual recommends any welding done to the exhaust system be done with AISI 409 electrode wire. Many welding equipment suppliers do not stock 409 series electrode wire, as its main application is in the manufacturing sector. The electrode wire is also typically only available in large spool sizes of 16 kg (35 lb) or more. Solid 409 electrode wire is typically not found in diameters less than .035" and tubular metal-cored electrode wire diameters start at .045", meaning a liner change will be required before using it. The tubular electrode wires are



Figure 1— This is an example of a welded, one-piece exhaust system.

also not designed for welding in the overhead position - a disadvantage when welding exhaust parts on the vehicle. The argon-oxygen shielding gas mixture is also typically not available in the smaller bottle sizes. This reduces the practicality of having the correct consumables on hand for the occasional job that requires exhaust welding.

Another challenge is that when aluminized exhaust parts are welded, the heat in the weld zone will burn off the aluminized coating creating a corrosion hot spot. This will lead to premature failure of the part from corrosion through and around the weld. In Figure 2, you can see the corrosion starting on a new aluminized exhaust pipe where a hanger bracket was welded to it. These exhaust parts are new enough that the paper sticker, with the part number, is still on the tailpipe, yet there is already significant corrosion around the weld zone where the bracket was attached.

There are also some additional health concerns when welding stainless

steel. The nickel in stainless steel can cause asthma and cancer. The chromium can cause cancer, sinus problems, and "holes" between the nostrils. A welding respirator is required when welding stainless steel.

Because of these issues, most service parts supplied to replace parts on a one-piece welded exhaust system are designed to be attached with slip-fits and clamps (see Figure 3). When exhaust parts require removal for access to other vehicle parts, removal of the entire part in one piece may be a better option than cutting a section off and re-welding it later. If welding is the only option on a stainless steel exhaust system, use the correct consumables and equipment to maintain the corrosion resistance of the exhaust system. Also be sure to use the proper safety equipment.

Additional information on exhaust system service is contained in the new I-CAR Enhanced Delivery course "Fuel And Exhaust Program 1." Watch for it this spring in your area.

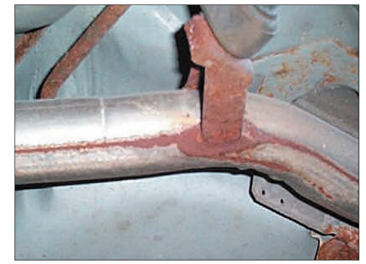


Figure 2- This corrosion hot spot was caused by welding a hanger bracket onto an aluminized exhaust pipe.

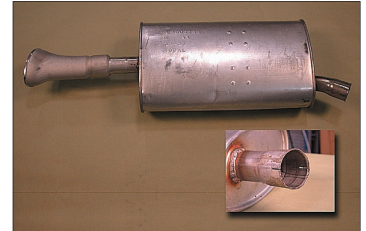


Figure 3- This factory replacement muffler, for a vehicle with a welded one-piece exhaust system, is designed to attach with a slip-fit and clamp.