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Unibody Weld Quality Testing

**SAE Recommended Practice
Revised May 1987**

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UNIBODY WELD QUALITY TESTING

1. PURPOSE: The most important aspect of structural unibody repair is the correct application of Gas Metal Arc Welding, or G.M.A.W. (formerly called Metallic Inert Gas, M.I.G.) welding. It is the intent of this SAE Recommended Practice to inform the body repairman on how to evaluate his welds and check if the welder is properly adjusted. By doing this, he can improve the quality of his structural repairs and develop consistent welds.

2. INTRODUCTION: The recommended welding procedure for unibody vehicles is G.M.A.W. This procedure utilizes a wire which meets the American Welding Society Standard AWS-E-70S-6. A minimum of 5/16 in (7.94 mm) diameter hole should be used to form G.M.A.W. plug welds in all structural areas. The quality of a weld can be determined by both a good visual inspection and physical testing of the weld itself. Testing weld quality can be done in a typical body repair shop, utilizing available equipment. Other welding methods may also be acceptable, but remain to be tested for comparison to factory spot weld strength levels.

NOTE: The need for testing weld quality is essential when welding high strength steel. The sensitivity to excessive heat makes it imperative to control dwell time and sequencing of multiple welds, where the potential overlap of heat affected zones from adjacent welds could adversely affect both weld and base metal strength.

Due to the limitations associated with the identification of high strength steel, it is recommended that all components to be welded be treated as high strength steel.

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Comments on this Recommended Practice are invited from interested parties and can be submitted in writing to SAE Headquarters.

3. DEFINITIONS:

a. Gas Metal Arc Welding

G.M.A.W. welding is described as follows:

An electric arc is struck between the work piece and a continuous solid bare electrode which is automatically fed through a gun at a constant rate. Shielding gas is fed simultaneously through the gun nozzle and into the weld zone. This gas surrounds the wire to protect the molten weld metal from the contaminating effects of the atmosphere. A 75% Argon and 25% Carbon Dioxide gas mixture is typically used for the shielding gas.

b. Plug Weld

A plug weld is a welded joint that can be produced by Gas Metal Arc Welding. In the body repair trade, it is commonly used to replace resistance spot welds. A plug weld is formed by drilling or punching a 5/16 in (7.94 mm) minimum diameter hole in the outer panel to be joined. If more than one outer panel is to be joined, each successive outer panel must have a larger hole (by at least 10%) than each succeeding inner panel. Then, the G.M.A.W. electrode is directed into the corner of the hole, then the technician welds the outer panel(s) to the base material. This can be done by welding around the bottom inner edge of the hole.

The technician should not merely direct the welding electrode into the hole and allow the molten weld metal to fill the hole. The filler metal will be too cold to penetrate the base metal if the hole is just filled. Instead, the arc should be struck against the bottom inner edge of the hole then welded around the inner edge of the hole completing the plug weld. This procedure will assure that the molten weld metal ties together the metal layers. (See Fig. 1A)

c. Continuous Weld, Butt Joint

A butt joint is formed when two pieces of metal meet edge to edge. When performing this type of weld, the technician will produce a continuous joint utilizing 1/2 - 3/4 in (13-19 mm) welded segments. The welding location sequence must be alternated to minimize heat build up in the welding zone. This technique will also help to limit the level of metal distortion and fatigue by allowing the metal to cool between the welding of each segment (See Fig. 2A). A "root gap" (gap between two panels) should also be left between the pieces of metal. The root gap should be equal to 1 - 1 1/2 times the thickness of the metal being welded. (See Fig. 2B)