



Aluminum Arc Welding

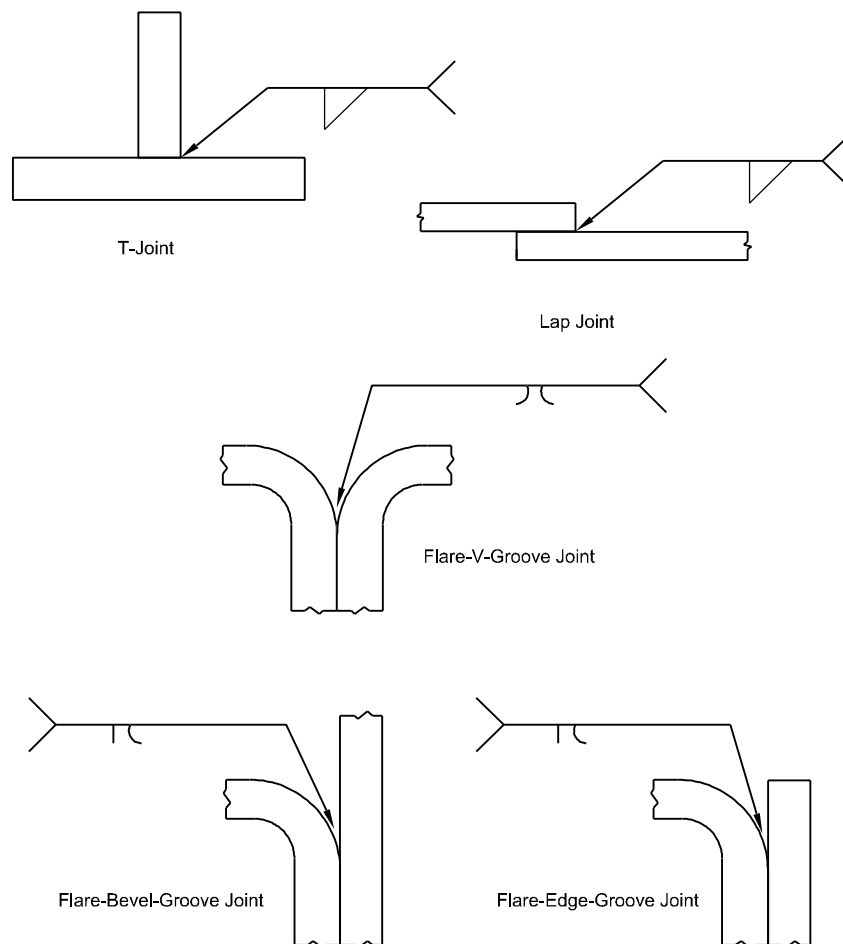
1 Scope

This specification addresses Gas Metal Arc Welding (GMAW) and Gas Tungsten Arc Welding (GTAW) of aluminum alloys.

1.1 Purpose. This specification provides the acceptance criteria for aluminum arc welds in automotive products for which GM is responsible for establishing or approving the product design.

1.2 Application. This specification applies to the following types of joints: T-joint, Lap joint, Flare-V-Groove, Flare-Bevel-Groove and Flare-Edge-Groove. See Figure 1. When referenced on a weld drawing the criteria established in this specification becomes mandatory. Deviations from any weld criteria provided in this specification must be identified on a weld drawing or other product design document.

Figure 1: Weld Joints



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1.3 Usage. Welds are considered satisfactory when they carry the intended or expected service loads and satisfy functional performance requirements. Service loads on weldments in a vehicle are varied in both type and magnitude and cannot be addressed by this specification. Therefore, while weld acceptance criteria of this specification are consistent with service loading requirements, they have been established based on the use of process and product monitoring. Furthermore, welds identified as discrepant often retain a percentage of their mechanical properties and may contribute to the integrity of the welded product. Any attempted use of this specification for other uses, such as post-crash weld quality assessment, may lead to an erroneous result or conclusion.

1.4 Clarification. For clarification of this specification or editorial comments, contact the GM Weld Council at WeldCouncil.CRW@gm.com.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 Normative.

AWS A5.10/5.10M ANSI/AWS A2.4
ANSI/AWS A3.0

2.2 GM.

GM9683P EP-1

3 Requirements

3.1 General.

3.1.1 Categories of Arc Welds.

3.1.1.1 Structural Arc Welds. Structural arc welds are required for performance of the welded product. All arc welds are structural unless specifically noted as process welds on the weld drawing.

3.1.1.2 Process Arc Welds. Process arc welds (tack welds) are to facilitate in-process assembly but are not required for structural performance of the product. Process welds must be approved and identified by Product Engineering.

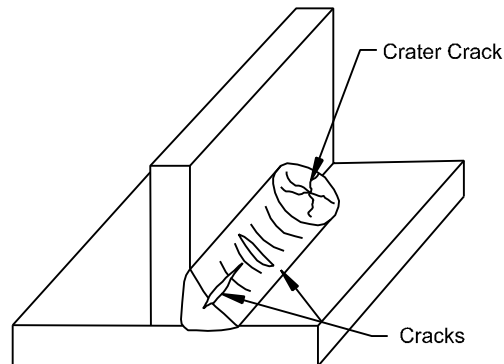
3.1.2 Filler Metals. Filler metals used must conform to the requirements of AWS A5.10/5.10M, **Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods.**

3.2 Visual Acceptance Criteria.

3.2.1 Weld Quantity and Location. The number of welds and location of welds installed on the product must agree with the weld drawing. Welds are properly located when installed within 10mm from the location indicated on the weld drawing. Welds will not start or end at any edge of a material, where the edge of metal is transverse to the nominal weld length. Welds required to be wrapped around a corner shall be detailed on the weld drawing.

3.2.2 Cracks. The weld bead must not have any crevices or cracks characterized by a sharp tip, which are visible without the aid of magnification. Crater cracks are not acceptable. See Figure 2.

Figure 2: Example of Cracks in Weld Bead

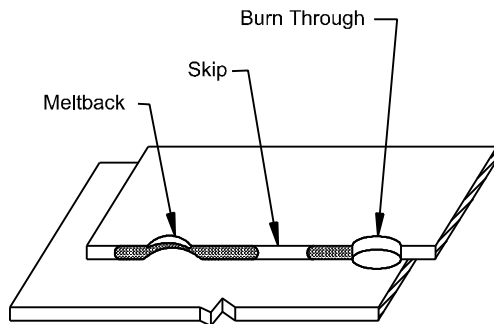


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3.2.3 Crater. A crater is a depression in the weld bead at the termination of the arc. Craters equal to or less than 1 mm in depth are acceptable provided they are not within 10 mm of the end of the weld bead.

3.2.4 Burn Through. The weld bead and the areas around the weld bead shall be free of holes caused by melting through the materials. See Figure 3.

Figure 3: Example of Burn Through, Meltback, and Skip in Weld Bead



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3.2.5 Meltback. The weld bead shall not cause the original material to melt back from the edge. This occurs where the base metal melts back from an edge, but does not become part of the weld. The portion of the weld bead exhibiting meltback is not considered part of the effective weld length. See Figure 3.

3.2.6 Length of Undercut. Undercut is a groove melted into the base metal adjacent to the weld toe and left unfilled by weld metal. Undercut is acceptable only when the total undercut length is less than or equal to 25 % of the specified weld length and provided undercutting is not within 10 mm of the ends of the weld.

3.3 Measurable Acceptance Criteria.

3.3.1 Effective Weld Length. The effective weld length must be greater than or equal to the specified weld length shown on the weld drawing less any short allowance shown in Table 1. Any portions of the weld that do not ensure fusion of the parts being joined (i.e., skips, off joint, meltbacks), are not to be included in the effective weld length.

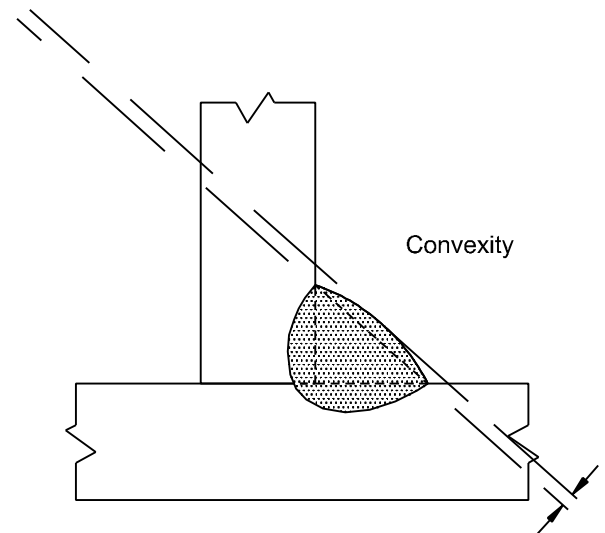
Table 1: Short Allowances

Specified Length Millimeters (mm)	Short Allowance Millimeters (mm)
25 or less	3.0
Over 25 – 150	6.0
Over 150	13.0

3.3.2 Surface Porosity. Individual pores less than 1.6 mm inch diameter, separated by at least their own diameter, and other scattered surface porosity is acceptable. The total amount of surface porosity (sum of diameters) shall not exceed 6.4 mm in any 25 mm of weld.

3.3.3 Convexity. There are no limits on amount of convexity, provided the part remains functional, and does not interfere with mating components. See Figure 4.

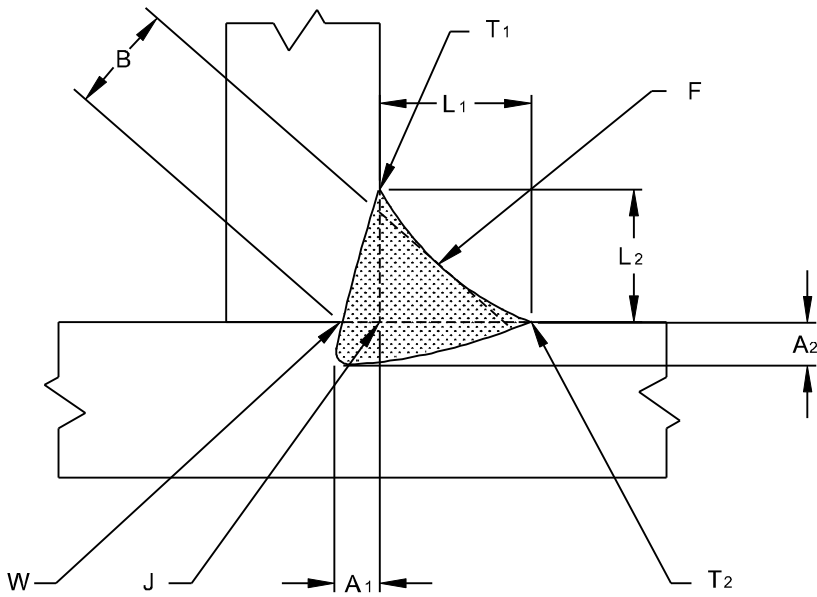
Figure 4: Example of Convexity in Weld Bead



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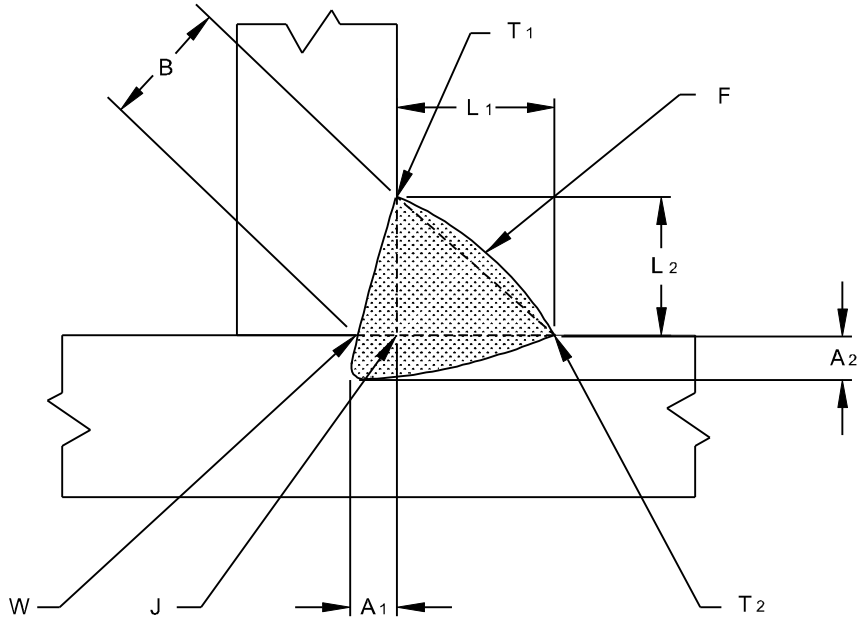
3.3.4 Weld Cross-Section in a Lap or T Joint (referred to as a fillet weld). The weld is acceptable when the criteria for fillet weld leg, throat, depth of fusion, undercut, internal porosity, and cracks are met. See Figure 5.

Figure 5A: Fillet Weld (Concave)



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Figure 5B: Fillet Weld (Convex)



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The following table applies to Figures 5A and 5B:

A = Depth of Fusion
B = Throat
F = Weld Face
J = Joint Root
L = Fillet Weld Leg
T = Weld Toe
W = Weld Root