



Aluminum Resistance Spot Welding

1 Scope

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

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

1.2 Applicability. The criteria established in this specification become mandatory when referenced on a product release document or Statement of Requirements (SOR). Deviation from any weld criteria provided in this specification must be approved by Product Engineering.

1.3 Usage. Welds are considered satisfactory when they meet the expected design service loads and satisfy functional performance requirements. The evaluation criteria contained in this document has been established as a basis for the manufacturing acceptance of welded products and are the same for all welds regardless of service load. Furthermore, welds identified as discrepant often retain a percentage of their mechanical properties and may contribute to the integrity of the welded product. Application of this specification for other uses, such as post-crash weld quality assessment, may lead to erroneous results or conclusions.

1.4 Clarification. For clarification of this specification or editorial comments, email the GM Weld Council at weld.council@gm.com.

2 References

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

2.1 External Standards/Specifications.

ISO 4063

ISO 17677-1

2.2 GM Standards/Specifications.

GM4491M

GMW15563

GMN3903

3 Requirements

3.1 General Acceptance Criteria.

3.1.1 Categories of Spot Welds.

3.1.1.1 Structural spot welds are required for performance of the welded product. All spot welds are structural unless specifically noted as process welds on the weld design document.

3.1.1.2 Process spot welds are to facilitate in-process assembly but are not required for structural performance of the product. Process welds are exempt from the measurable acceptance criteria contained in this standard.

3.1.2 Process Adjustment Criteria.

3.1.2.1 Extra Welds. Any assembly having more welds than specified on the weld design document shall have the welding process adjusted.

3.1.2.2 Distortion. Spot welds in which the surfaces are distorted more than 15 degrees from the normal plane shall have the welding process adjusted to original qualified procedure reduce or eliminate the distortion. See Figure 1.

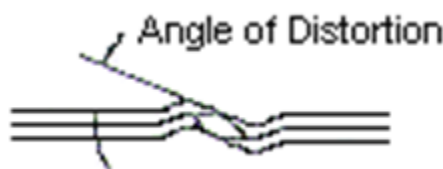


Figure 1: Weld Distortion

3.1.2.3 Indentation. Spot welds in which the depth of the depression on the surface (caused by the welding electrode) results in the reduction of the metal thickness of any individual layer that exceeds 20% shall have the welding process adjusted to the original qualified procedure to reduce the amount of indentation.

3.1.2.4 Internal Porosity. Different types of pores or voids may be observed during macro cross section examination. Internal porosity that is greater than 30% of the fusion zone area shall have the process adjusted to the original qualified procedure.

3.1.2.5 Penetration. Penetration is the percent of the layer thickness that is fused. Welds with penetration less than 20% shall have the welding process adjusted to the original qualified procedure.

3.1.2.6 Weld Surface Appearance. Weld surface appearance requirements are not part of this standard. Weld surface appearance criteria are to be addressed through the appropriate use of Product Quality Standards (PQS).

3.2 Visual Acceptance Criteria.

3.2.1 Weld Quantity. The number of welds installed on the product must agree with the quantity specified on the weld design document. The pattern is nonconforming if the number of welds installed on the product is less than the specified.

3.2.2 Cracks. Spot welds with visible cracks on the surface are discrepant. See Figure 2.

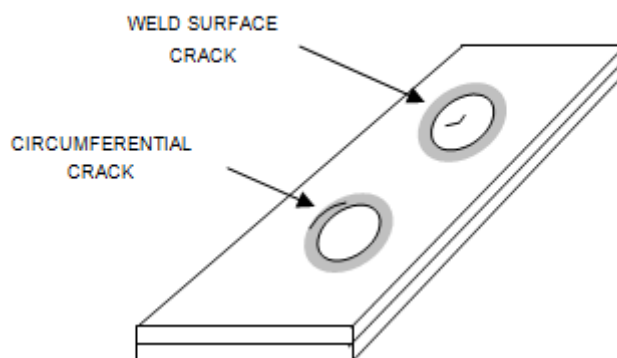


Figure 2: Surface Cracks

3.2.3 Holes. Spot welds shall be free of hole(s) extending through the weld. Spot welds with holes extending through the weld are discrepant.

3.2.4 Location/Edge Weld. A spot weld, as defined by the impression left by the electrodes, is to be located as shown on the weld design document. Welds with imprints that break or deform the original edge of the weld flange are discrepant. See Figure 3. Welds with imprints that overlap each other are discrepant.

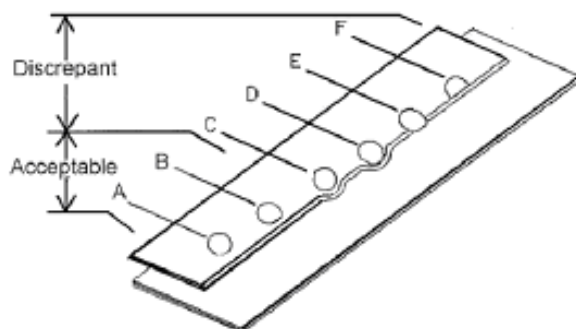


Figure 3: Edge Weld

3.3 Measurable Acceptance Criteria.

3.3.1 Location/Spacing for Welds. Welds installed on the product must be within 10 mm from a location specified by a template (provided by Engineering) to be acceptable. When a template is not provided by Engineering, welds are acceptable provided the weld is within 20 mm of the location indicated on the weld design document.

3.3.2 Weld Size.

3.3.2.1 Two (2) Thickness Welds. To determine the acceptable weld size for a two thickness weld (two loose pieces or one loose to two previously welded), use the metal thickness (t) of the thinner of the two layers being welded to determine the weld size as listed in Table 1. A spot weld whose measured plug diameter or nugget width is equal to or larger than the appropriate value in Table 1 is an acceptable weld.

3.3.2.2 Three (3) Thickness Welds. Three thickness welds in aluminum will potentially have a different weld size requirement at each interface. To determine the acceptable weld size for a three thickness weld (three loose pieces) use the metal thickness (t) of the thinner of the two layers at any interface to determine the acceptable weld size. However, in the case where the thinnest layer is stacked between two heavier layers use the second thickest piece (t) to determine the acceptable weld size for both welds. A spot weld whose measured plug diameter or nugget width is equal to or larger than the appropriate value in Table 1 is an acceptable weld.

Table 1: Minimum Acceptable Weld Size ^{Note 1}

Metal Thickness (t) (mm)	Weld Size (mm)
0.60 to 0.70	3.0
0.71 to 0.90	3.5
0.91 to 1.10	4.0
1.11 to 1.40	4.5
1.41 to 1.70	5.0
1.71 to 2.00	5.5
2.01 to 2.40	6.0
2.41 to 2.80	6.5
2.81 to 3.20	7.0
3.21 to 3.60	7.5

Note 1: More than three thickness welding is not covered by this table.