



Weld Acceptance Criteria and Repair Procedures for Resistance Projection Welding - Steel

1 Introduction

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 standard provides the acceptance criteria and repair procedures for Resistance Projection Welding.

1.2 Applicability. This standard applies to the resistance projection welding of embossed projections. Criteria for welding of coined projections are specified in GMW16215 "Welding Acceptance Criteria and Repair Procedures: Resistance Projection Welded Steel Nuts, Studs, Cages and Other Parts with Solid Coined Projections". The criteria established in this standard become mandatory when referenced on a product drawing or Statement of Requirements. Deviation from any acceptance criteria provided in this standard shall be identified on the product drawing or Statement of Requirements.

1.3 Remarks. Welded structures are considered satisfactory when they carry the intended service loads for a required period. Service loads on weldments in a vehicle are varied in both type and magnitude and cannot be addressed by this standard. Therefore, while the weld quality criteria of this standard are consistent with service loading requirements, they have been established specifically for use in process and product monitoring. Any attempted application of this document to other uses, such as post-crash weld quality assessment, may lead to an erroneous result or conclusion. Discrepant welds by retaining a portion of their engineering properties may still contribute to the integrity of the assembly.

1.4 Clarification. For clarification of this standard or editorial comments, email the GM Global 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.

None

2.2 GM Standards/Specifications.

GM4491M	GMW14058
GMW14057	GMW15563

2.3 Additional References.

- Body Opening Appearance Perceptual Quality Best Practices
(The supplier shall work with the GM responsible engineer to comprehend this requirement.)

3 Requirements

3.1 General Acceptance Criteria.

3.1.1 Individual Projection Weld Criteria. There are multiple visual and measurable attributes that describe projection weld quality. These attributes are divided into two categories, criteria that cause the weld to be discrepant, and criteria that is undesirable for appearance or processing and require the process to be adjusted to the qualified setup.

3.1.2 Categories of Projection Welds. There are two categories of projection welds: structural and process.

3.1.2.1 Structural Projection Welds. Structural projection welds are installed for performance of the welded product. All projection welds are structural unless specifically noted as process welds on the weld design document.

3.1.2.2 Process Projection Welds. Process projection welds are installed to facilitate in-process assembly, but are not required for structural performance of the product. Process projection welds must be approved by Product and Manufacturing Engineering and shown on the weld design document. Process welds containing holes or cracks should be repaired.

3.2 Visual Acceptance Criteria.

3.2.1 Cracks. Projection welds having surface cracks that are visible without the aid of magnification whether in or around the weld cause the weld to be discrepant.

3.2.2 Holes. A hole is a perforation in the weld that allows light to travel through the material from one exterior surface to the opposing exterior surface. Projection welds that contain holes extending through the weld are discrepant and cause the product to be nonconforming regardless of the pattern tolerance.

3.2.3 Missing Welds. Whenever fewer welds exist in the product than are specified on the weld design document, the omitted welds are discrepant.

3.2.4 Perceptual Quality Requirements. Projection welds visible to the customer in strategic areas of the body are to be considered Perceptual Quality (PQ) welds (reference the Body Opening Appearance Perceptual Quality Best Practices – Weld Appearance Zone Diagrams). Product Quality Standards are to be utilized to document the appearance acceptance standards addressing the desired weld precision (alignment, spacing, concentricity) and prominence (surface marking, indentation, distortion, pits, spatter and whiskers). Projection welds not meeting appearance standards shall have the process adjusted to the original qualified setup to eliminate the undesirable condition.

3.3 Measurable Acceptance Criteria.

3.3.1 Quantity of Welds. The number of welds installed shall agree with welds specified on the weld design document. Missing or welds not installed are discrepant.

3.3.2 Location. A projection weld whose center point is installed further than 10 mm from the design nominal location or whose edge distance “d” or “e” is located closer than 1.0 mm and 2.5 mm respectively from the trim edge of the embossed part (as shown in Figure 1) is discrepant.

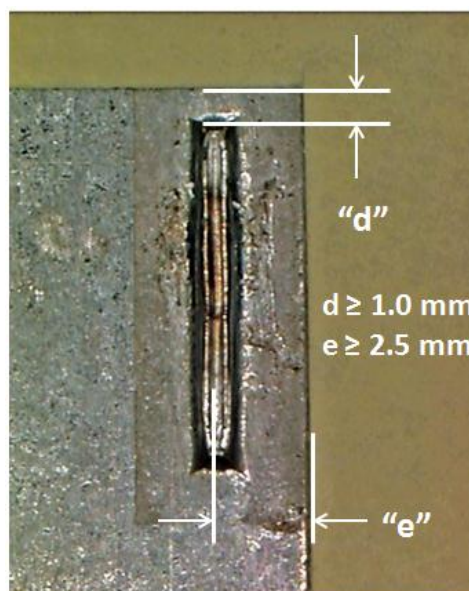
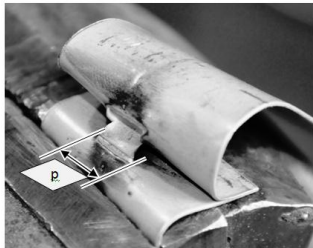


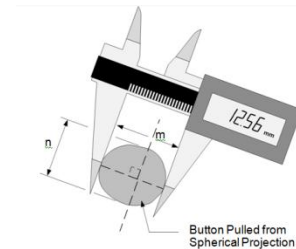
Figure 1: Edge Location Example

3.3.3 Weld Size. Weld size may be determined by either measuring the weld button or weld nugget.

The weld button size for a linear projection weld is the length of the button. The weld button size for a spherical projection is determined by adding the measurement of the major axis to the measurement of the minor axis and dividing by 2 (see Figure 2). Measurements are to be taken at the faying surface.



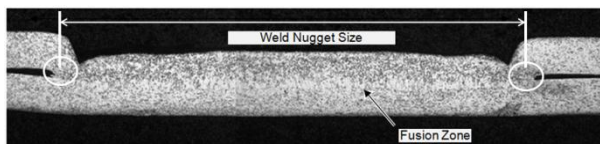
Linear Projection Button Measurement



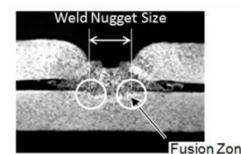
Spherical Projection Button Measurement

Figure 2: Projection Weld Button Measurement Examples

The weld nugget size is the weld size measurement achieved by examining the macro section of a weld cross section and measuring the dimensions of the fusion zone. The weld nugget size for a linear projection weld is the length of the fusion zone taken from a longitudinal cross section. The weld nugget size for a spherical projection weld is the width of the fusion zone at the base of the projection (see Figure 3).



Longitudinal Cross Section of Linear Projection Weld



Cross Section of a Spherical Projection Weld

Figure 3: Projection Weld Nugget Size Measurement Examples

Projection welds whose weld button or nugget size is smaller than shown in Table 1 are discrepant.

Table 1: Minimum Weld Size

Projection Shape	Required Weld Size
Linear Projection	80% of the embossed projection weldable length
Spherical Projection	65% of the of the embossed projection diameter

3.3.4 Non-fused Welds. Weld locations that do not show evidence of welding (measureable button or plug) after destruct test are classified as non-fused. Non-fused welds are discrepant.

3.4 Disposition/Repair Procedure.

3.4.1 Disposition. Manufacturing product acceptance is based on all resistance projection weld patterns conforming. A weld pattern conforms to this standard when the number of non-discrepant welds (see 3.1, 3.2, and 3.3) within the pattern meets or exceeds the weld pattern tolerance, and there are no welds with holes, and no adjacent welds in the pattern that are known or suspected to be missing or non-fused.

3.4.2 Repair Procedures. When repair is required, projection welds shall be repaired according to the procedures specifically authorized by the Product Release Engineer. In the absence of an engineering approved repair procedure, the following repair methods shall be used in the listed order of preference as shown in Table A1 of Appendix A.

3.4.2.1 Repair by Resistance Spot Welding (RSW). Spot weld with a weld gun that is qualified for the metal types and thicknesses to be welded. One repair spot weld shall be added for each projection weld being repaired.