



Welding Acceptance Criteria and Repair Procedures: Resistance Projection Welded Steel Nuts, Studs, Cages and Other Parts with Solid Coined Projections

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 specification provides acceptance criteria for steel nuts, studs, cages and other parts with solid projections that are resistance projection welded in automotive products that GM is responsible for establishing or approving the product design. This specification does not cover the welding of projections that are embossed into sheet metal.

1.2 Applicability. This specification applies to resistance projection welded steel nuts, studs, cages, and other parts with solid coined projections.

The criteria established in this specification become mandatory when referenced on a weld drawing. Deviation from any weld criteria provided in this specification must be identified on a weld drawing or other product engineering design document.

1.3 Remarks. Welded fasteners 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.

None

2.2 GM Standards/Specifications.

GMW14058

GMW15563

3 Requirements

3.1 General Acceptance Criteria.

3.1.1 Presence and Location. A projection welded fastener that is missing or located outside the position tolerance indicated on the assembly documentation is discrepant.

3.1.2 Set-down. Weld fasteners and cages (except fasters with ring projections) shall be set down so that the gap between the base of the fastener and the mating part is no more than 0.3 mm or 30% of the pre-weld projection height – whichever is lesser. The welding process shall be adjusted whenever a gap is detected that exceeds this value. Set-down is not a criterion for welds to be discrepant.

3.1.3 Parallelism. The post-weld side-to-side gap between the head of a welded fastener and the mating part shall not differ by more than 0.2 mm. The welding process shall be adjusted whenever this gap difference is exceeded. Parallelism is not a criterion for welds to be discrepant.

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3.1.4 Surface Eruptions. Welding shall not leave eruptions that are more than 0.2 mm high to the back side of the sheet being welded. The welding process shall be adjusted (e.g., replace electrodes) whenever eruption is detected that exceeds this value. Flatness is not a criterion for welds to be discrepant.

3.2 Visual Acceptance Criteria.

3.2.1 Cracks. A welded assembly that has a crack that is visible without magnification and located in or around the welds is discrepant.

3.2.2 Holes. A welded assembly that has a hole that extends through any of the welds or sheets is discrepant.

3.2.3 Spatter. A welded fastener shall not have spatter on its threaded section. A fastener that has spatter on its threaded section shall have its process adjusted to eliminate the condition. When spatter impedes subsequent assembly, threads with spatter should be repaired.

3.3 Measurable Acceptance Criteria.

3.3.1 Nuts and Studs with Multiple Projections. The quality of a projection welded nut or stud with multiple projections is acceptable when either the quantity of projections welded or push-out strength criteria are met. A projection welded nut or stud having multiple projections that does not meet either of these criteria is discrepant.

3.3.1.1 Quantity of Projections Welded. The quality of a projection welded nut or stud with multiple projections is acceptable when the quantity of projections that show evidence of welding is equal to or greater than the number specified in Table 1. (Push-out Load Strength is an alternative criterion.)

Table 1: Acceptable Quality Based on Projections with Evidence of Welding

Number of Projections on the Part	Number of Projections with Evidence of Welding
2	1
3	2
4	3
6	4

3.3.1.2 Push-out Load Strength Criteria. The quality of a projection welded nut or stud with multiple projections is acceptable when the tested part exceeds the push-out loads contained in Table 2. (Quantity of projections welded is an alternative criterion.)

Table 2: Acceptable Quality Based on Push-Off Force

Weld Fastener Size	Minimum Push-Out Load (kN)
4 mm	4.0
5 mm	4.5
6 mm	5.0
8 mm	5.5
10 mm	7.0
3/8 in	7.0
7/16 in	7.8
≥12 mm	9.0

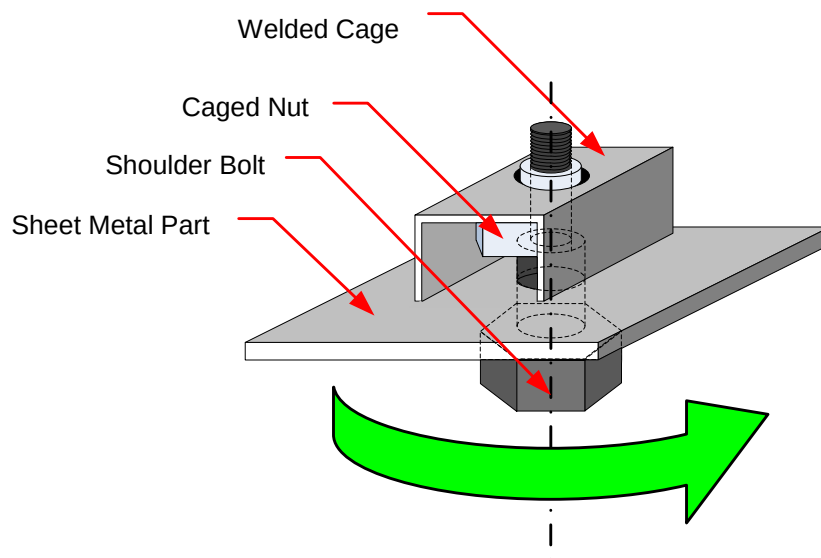
3.3.2 Projection Welded Fastener with Single Ring Projection. The quality of a projection welded fastener with a single ring projection is acceptable when Evidence of Welding exists over at least 80% of the weldable length (projection circumference).

3.3.3 Parts with Long Projections. The quality of a projection welded part with one or two (non-ring) projections - each of which is longer than 10 mm is acceptable when evidence of welding exists over or at least 80% of the weldable length of each projection.

3.3.4 Welded Cages. The quality of a projection welded cage is acceptable when either all projections show evidence of welding or the cage withstands the torque shown in Table 3. An example of torque testing welded cages is shown in Figure 1.

Table 3: Torque for Testing Welded Cages

Weld Fastener Size	Minimum Torque (N·m)
8 mm	40
10 mm	60
7/16 in	85
12 mm	100
14 mm	100



Note: Shoulder Bolt is bottomed against Nut; Torque is applied in Tightening Direction. (Torque is not applied to outside walls of the cage.)

Figure 1: Example of Torque Testing Welded Cages

3.4 Disposition/Repair Procedure.

3.4.1. Disposition. Products supplied to the requirements of this standard are conforming provided the parts as welded meet the General, Visible and Measurable Acceptance Criteria of this standard. Assemblies not conforming to these criteria must be repaired or scrapped. The identified process adjustment criteria of this standard do not cause the product to be nonconforming, and repair is not required.

3.4.2 Repair Procedures. Weld repair methods are shown in Table A1, Appendix A. Arc welds or arc brazes must meet applicable GMW14058 acceptance criteria. Arc welding should not be used for repair if the mating part is thinner than 1.2 mm (arc brazing should be used instead.) Either arc brazing or arc welding may be used for repairs when the mating part is 1.2 mm or thicker.