



Material and Process Testing Requirements for Hot Stamped Aluminum and Stamping Suppliers

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/Material Description. This document describes the minimum process and internal testing requirements for producers of hot stamped parts. Aluminum Hot Stamping, or Hot Stamped Aluminum (HSA), utilizes a heat treatable aluminum such as 7075 that is heated to homogenize (solution treat) microstructure, followed by stamping in a water cooled die to produce the proper part shape and to simultaneously quench the aluminum to create a W-temper. This is followed by natural or artificial aging of formed parts. Parts may also be specified to contain soft zones, which are lower strength than the surrounding metal and may not be the fully strengthened structure. Parts may also be produced in an “intermediate” condition in order to accommodate subsequent processing such as a paint bake, which will affect properties in order to obtain specified final properties in the finished vehicle.

1.2 Symbols.

W: Solution Treated Aluminum

T54: Solution Treated following the shaping process and artificially underaged to a stable condition.

T6: Solution Treated and artificially aged to maximum strength condition.

T61: Solution Treated and artificially aged. No surface passivation, curing, or paint cure process applied.

T64: Solution Treated, artificially aged and subsequently processed to the stable in-service condition, i.e., finished.

1.3 Applicability. Typical parts covered by this specification are those that require extremely high strength and are generally critical to passenger safety. These parts are found throughout the body structure and closures, with typical applications including but not limited to door beams, center pillar reinforcements, floor reinforcements, and upper body roof rails.

2 References

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

2.1 External Standards/Specifications.

AIAG CQI-9	IATF 16949	ISO 4287
ASTM B487	ISO 1463	ISO 6892

2.2 GM Standards/Specifications.

GMW3059	GMW3335	GMW18378
---------	---------	----------

2.3 Additional References.

- GM1927 03 Supplier Quality Statement of Requirements
- GM1927 03a Detection Levels for Heat Treated Components SOR Appendix F
- GM1927 03a Heat Treat Requirements and Approved Supplier List
- GM 1927-16b Press Process Audits
- Statement of Requirements (SOR) Appendix N

3 Requirements

3.1 Requirements on Test Specimens. Not applicable.

3.2 Marking. All parts shall be marked as shown in the Statement of Requirements (SOR) Appendix N.

3.3 General Requirements. All sheet metals shall be produced at supplier facilities approved by GM and will be shown as approved to GMW18378 (Material). All hot stampings shall be produced at hot stamping supplier facilities approved by GM and will be shown as approved to GM1927 03a Detection Levels for Heat Treated Components SOR Appendix F, reflected on GM1927 03a Heat Treat Requirements and Approved Supplier List. Approved suppliers are listed in the GM Approved Materials Source List and can be provided by your GM Global Purchasing Supply Chain (GPSC) buyer.

3.3.1 Suppliers of hot stamped parts to GM are required to verify that incoming aluminum meet all specified material requirements. This shall include, but not be limited to; thickness, chemistry, coating weight and coating type (for coated products) and any other requirements determined by GM and/or the released part drawing/math data. The supplier is responsible to ensure that the aluminum, heat treatment, stamping process, die cooling, post form trimming, etc., are capable of producing parts meeting all specified requirements.

3.4 Supplier Audits. Suppliers shall develop a Heat Treatment Assessment Plan consistent with the requirements of Automotive Industry Action Group (AIAG) standard CQI-9 Heat Treat System Assessment Process Table I "Hot Stamping" and Process table C "Aluminum Heat Treating." General Motors shall perform assessment audits to ensure suppliers are in conformance to these requirements. Successful completion of the CQI-9 audit and the GM 1927-16b Press Process Audits is required before a hot stamper can be placed on the GM Approved Source List and supply parts to General Motors. Failure to be in compliance with the CQI-9 audit standards shall result in removal from the opportunity to bid on future business and may result in the loss of current business.

3.5 Supplier On-Site Testing Requirements. Suppliers providing Hot Stamped parts to General Motors are required to have on-site testing capability to perform part evaluations to ensure conformance to specification requirements and to monitor quality of parts as they are produced. The laboratory shall have operator(s) that have adequate training to perform such tests and operators shall be available to perform testing consistent with their quality plans during all shifts when parts are being produced. At a minimum, suppliers are required to be able to perform tests 3.5.1 through 3.5.5.

3.5.1 Microstructural Evaluation. Suppliers shall have the proper equipment to section, mount, polish, etch, microscopically examine and photograph samples at a minimum magnification of 500x and resolution > 1 μ m with a metallurgical microscope to determine the phases present in test samples.

3.5.2 Hardness Testing. Suppliers shall have the capability to perform Rockwell B and BHN hardness testing. Suppliers shall also have the capability to perform Vickers or Knoop micro-hardness testing and provide representative photographs.

3.5.3 Mechanical Properties. Suppliers shall have the capability to perform mechanical property testing with full size and subsize tensile bars following GMW3335 tensile testing requirements.

3.5.4 Thickness Testing. Suppliers shall have the capability to perform thickness testing, including part thickness, oxide thickness, coating thickness and thickness of each alloy coating layer (coated parts). Thickness testing shall be performed using a suitable layer thickness gauge, online x-ray gauge, or from a specimen sectioned perpendicular to the panel surface per ASTM B487 or ISO 1463.

3.5.5 Surface Texture. Suppliers producing product with controlled surface quality shall have the capability to measure surface roughness using a profilometer per ISO 4287.

3.6 Part Verification Requirements. Suppliers shall ensure and verify part conformance to all applicable specification requirements. Testing prior to Non-Saleable, Saleable, and Fully-Approved Production Part Approval Process (PPAP) shall be conducted on the first part of each production run and on a part from approximately the 20th sequential die hit (i.e., steady state part) of every production run until the process is determined to be in control as measured by successful completion of full PPAP. For the purpose of this requirement, a production run shall be defined as a product run, e.g., Mule, Integration Vehicle Engineering Release (IVER), Material Required Date (MRD)1, MRD2, etc., or plant work shift, e.g., 8 h. The supplier shall cut at least six (6) samples from a part, unless otherwise agreed with GM Supplier Quality and Product Engineering, to evaluate all requirements listed in subsequent sections for each sample. The specific test locations shall be established prior to first shipment to GM and chosen from the areas of interest, e.g., hot and cold areas of the part exiting the die as shown through thermal imaging, critical areas identified by Computer