



Exhaust Casting Variation Acceptance Standard

1 Scope

1.1 Material Description. The objective of this specification is to define the acceptance limits of several types of surface anomalies on exhaust castings. Also, described herein, are internal casting discontinuity limits.

1.2 Symbols. Not applicable.

1.3 Applicability. This specification applies to surface and internal casting anomalies of any exhaust manifold casting, the cast portion of a maniverter, or any other exhaust casting, regardless of the process or material, including, but not exclusively, GMW13, GMW3164, and ASTM A439.

1.4 Remarks. Various areas of an exhaust casting are subject to different stresses. During the visual inspection phase of process monitoring, particular attention shall be paid to casting anomalies such as shrink porosity, inclusions, blows, excess metal resulting from core or mold chip-out that could affect flow or clearance, flash, porosity, and machining defects – all of which may have a deleterious effect on the exhaust casting strength if permitted to exceed a certain size in specific locations.

2 References

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

2.1 External Standards/Specifications.

ASTM E446 ASTM A439

2.2 GM Standards/Specifications.

GMW13 GMW3059 GMW3164 GMW14270

3 Requirements

3.1 Part Condition. These visual standards are applicable for the final machined product. The casting must be clean, and free from any core sand, machining chips, debris, or burrs. Cosmetic imperfections in the casting surface resulting from normal processing operations are allowed in hidden areas. Oxidation/rust on the exhaust manifold machined surfaces is allowable as long as it conforms to the surface finish specification and must not flake or chip off. Red/brown oxide, whether spotty or covering up to 50% of the manifold including machined surfaces, is acceptable. See Figure A1 in Appendix A.

3.2 Inspection Process. Visual inspection is to be performed with the naked eye as natural vision or corrected vision to 20/20. No magnification is to be used. X-ray is used to determine internal void type and limits.

3.3 Total Discontinuities Allowed. No more than 6 total casting surface anomalies allowed per casting in any combination using this specification. The limit does not apply to casting discontinuities that are 1.0 mm or less. See Figure A2 and Table A1 thru Table A3 in Appendix A.

3.4 All materials supplied to this standard must comply with GMW3059, Restricted and Reportable Substances, including the requirement to submit a full material composition disclosure to GM via the International Material Data System (IMDS) or via a completed GMW3059 report form.

4 Manufacturing Process

Applies to castings utilized as exhaust components.

5 Rules and Regulations

5.1 Legal Regulations. All materials must satisfy applicable laws, rules, regulations and recommendations valid in the country of usage.

5.2 Language. In the event of conflict between the English and domestic language, the English language shall take precedence.

5.3 Inspection and Rejection. Samples of components or materials released to a GM material specification shall be tested for conformity with the requirements of this material specification and approved by the responsible Engineering department prior to commencement of delivery of bulk supplies.

A new approval must be received for any changes, e.g., properties, manufacturing process, location of manufacture, etc. If not otherwise agreed, all testing and documentation normally required for initial release must be completed.

It is the responsibility of the supplier to inform the customer in a timely manner, without solicitation, and to include documentation of all modifications of materials and/or processes and to apply for a new release.

5.4 Material Safety Data Sheets/Safety Data Sheets (MSDS/SDS). For new product submissions, or when a change in chemical composition of an existing product has occurred, a complete copy of the Material Safety Data Sheet/Safety Data Sheet must be submitted in compliance with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) requirements or other country-specific MSDS/SDS requirements.

6 Approved Sources

Materials supplied to this specification must be approved by General Motors.

A list of approved materials can be found in the GM Materials Approved Source List. This GM Material File is provided to third parties to reduce redundant testing of materials. If approved material already listed is used, the part supplier can use GM Material File reference for Production Part Approval Process (PPAP) material approval. If the decision is made to use a not yet approved material, contact Materials Engineering (Nonferrous and Casting Global Subsystem Leadership Team) for details on the approval process. The material approval process must be completed prior to PPAP start date of the part supplied to General Motors.

Engineering qualifications of an approved source are required for this standard. Only sources listed in the GM Materials File (i.e., GM SupplyPower) under this standard number have been qualified by engineering as meeting the requirements of this standard. To access this list, reference GMW14270 for latest location.

For other GM locations, the responsible engineering group should be contacted to obtain the approved source in that individual country.

7 Notes

7.1 Glossary.

Blows: Gas entrapments in castings, causing voids in the metal.

Dings/Dents: A small bump or depression in metal leaving an impression, sometimes caused by handling damage.

Core Fin: Core has a fin that creates a void in casting.

Flash/Metal Fin: A thin section or fin of metal formed at the mold, core or in parting of a casting due to the cope and drag not matching completely or where core and core print do not match.

Gate: The portion of a runner in a mold through which molten metal enters the mold cavity.

Inclusions: Particles of foreign material in a metallic matrix. The particles are usually compounds (such as oxides, sulfides, or silicates) but may be of any substance that is foreign to the matrix.

Maniverter: A combination of exhaust manifold and exhaust converter.

Oxide: The result of a metalloid or metal, or a combination thereof, combining with oxygen. There is usually a color change.

Porosity: Voids or pores resulting from trapped air or other gases or from shrinkage during the cooling phase of casting.

Rust: A series of iron oxides formed by the reaction of iron with oxygen in the presence of water or air moisture.