GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW3161

Stainless Steel for Exhaust Applications

1 Scope

This specification defines corrosion resistant stainless steels primarily used in automotive exhaust applications. It covers cold and hot rolled, uncoated and coated stainless steel sheets and tapes (strips) for exhaust systems, used at GM units worldwide. The specification includes chemical composition, physical and mechanical properties, heat treatment and characteristic properties. Parameters for surface treatment, welding and filler materials are not covered with this specification.

1.1 Material Description. This specification describes stainless steels typically used in automotive exhaust systems. Stainless steels are iron base alloys containing sufficient chromium to form a passive film of surface associated oxygen. Stainless steels are specified for applications which require corrosion, high temperature oxidation resistance or high temperature strength.

These materials are suitable for cold forming and bending. The stabilized and low carbon stainless steels can be readily welded with minimal risk of sensitization. Both heat treatable and non-heat treatable stainless steels are described in this specification.

Additional requirements or agreements may be specified by local business units.

1.1.1 Material Identification. The material designation is defined by the GMW base metal specification number, steel grade and coating (if required).

Example: GMW3161M-ST-S-X2CrTi12-AL30

1.2 Symbols. Not applicable.

1.3 Applicability. These materials are typically used in exhaust components such as take down pipes, hangers, flanges, gaskets, catalytic converters, muffler internals, and are specified based on the expected part metal temperature and environmental exposure. Cross reference specifications are listed in Appendix C, Table C1. Additional details regarding typical use are described in Appendix D.

1.4 Remarks. Not applicable.

2 References

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

2.1 External Standards/Specifications.

ASTM A240	ASTM A428	ASTM E112	EN 10095
ASTM A262-15	ASTM A751	DIN 17470	
ASTM A370	ASTM E8	EN 10088-2	

2.2 GM Standards/Specifications.

GMW3059

3 Requirements

3.1 Requirements on Delivery.

3.1.1 Chemical Requirements.

3.1.1.1 Base Metal. The chemical composition of the alloys covered by this specification is listed in Appendix A, Table A1 and Table A2. The compositions are based on product analysis as determined per ASTM A751 (Test Methods, Practices and Terminology for Chemical Analysis of Steel Products).

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Other reference documents may be specified by the purchaser. These documents include EN 10088-2 Technical Delivery Conditions for Sheet/Plate and Strip for General Purposes and ASTM A262-15 Standard Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels. Chemical analysis supplied on certifications can be obtained on product during continuous casting operation.

Aluminum may be intentionally added, 0.20 wt% to 0.40 wt% as a deoxidizer or for grain refinement.

3.1.1.2 Surface Treatment. All products except the aluminized are supplied in the uncoated condition. If surface protection or lubricants are required, the applicable specification shall be defined on the purchase order.

Aluminized stainless steels shall be hot dip coated on both sides to a minimum coating requirement of 30 g/m^2 per side, reference ASTM A428. Type 1 coating is a hot dip aluminum-silicon alloy containing 5% to 11% silicon to promote adhesion. The coated product shall be capable of 180 degree mandrel bend at room temperature over a diameter of 2x the material thickness. The coating shall show no evidence of flaking on the outside bend surface excluding 6 mm from each edge. Bend test samples shall be 50 mm in width and cut not less than 50 mm from the side and 100 mm from the end of the sheet or coil.

3.1.2 Mechanical Requirements. The tensile strength, yield strength and elongation shall meet the requirements as specified in Appendix A, Table A3. Mechanical properties shall be determined per ASTM A370 or per EN 10088-2 Technical Delivery Conditions for Sheet/Plate and Strip for General Purposes.

Material elongation may be determined by the manual method described by ASTM E8 or the calculated method described by ASTM E8. The elongation result will be reported according to ASTM E8.

3.1.3 Physical Requirements. Not specified. Typical physical properties for reference are listed in Appendix B, Table B1.

3.1.3.1 Material Thickness. Thickness shall be defined on the detail part drawing. For flat roll material the preferred material thickness and tolerance for new designs are listed in Appendix A, Table A4.

3.1.3.2 Surface Requirements.

3.1.3.2.1 Surface Finish. For cold roll anneal and pickled sheet and strip, the surface finish shall be < 5 μm Ra.

3.1.3.2.2 Surface Quality. For uncoated sheet and strip, surface scratches shall be < 0.13 mm deep. For bar form, surface seams shall be < 0.15 mm.

3.1.3.3 Marking. Marking shall be agreed upon between the purchaser and user.

3.1.4 Additional Requirements. Requirements such as tolerances on product shape and dimensions, inspections units, number of tests, sampling, test conditions, retests, inspection documents, packing, and handling of disputes shall be agreed upon between supplier and the local business unit.

3.2 Processing Requirements.

3.2.1 Chemical Requirements. Not applicable.

3.2.2 Mechanical Requirements. Not applicable.

3.2.3 Physical Requirements. Not applicable.

3.2.4 Additional Requirements.

3.2.4.1 Welding. The stabilized stainless steels, which are generally alloyed with Titanium or Niobium are readily weldable using stabilized stainless steel filler metals and resistant to chromium carbide sensitization under normal weld schedules. The low carbon stainless steels, with carbon content < 0.03% show improved resistance to sensitization when welded.

For non-stabilized stainless steels with carbon contents over 0.03% a post weld heat treatment is recommended to restore optimum corrosion performance.

3.2.4.2 Post Mill or Additional Processing. Bar products may be peeled or ground as defined on the purchase order. Alternatively, if peeling or grinding is a product performance requirement it will be specified by the detailed engineering part drawing.

3.3 Performance Requirements. Not applicable.

3.4 Requirements on other Stages during Life Cycle.

3.4.1 Chemical Requirements. Provisions must be made to prevent the addition of such elements (see 5.3) from scrap or other materials used in the manufacturing process which would impair the recyclability of the finished components.

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3.5 All materials supplied to this standard must comply with GMW3059, **Restricted and Reportable Substances**, including the requirement to obtain a GM-approved International Material Data System (IMDS) submission.

4 Manufacturing Process

Not applicable.

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 (Materials Engineering).

The appropriate GM Materials Engineering department(s) must confirm material as meeting the requirements of this specification. Any test data sheets of material submitted to General Motors for such confirmation (e.g., during Production Part Approval Process (PPAP)) under this material specification must list all properties and must apply corresponding test methods of this material specification.

7 Notes

7.1 Glossary. Not applicable.

7.2 Acronyms, Abbreviations, and Symbols.

GHS	Globally Harmonized System of Classification and Labeling of Chemicals
GSSLT	Global Subsystem Leadership Team
IMDS	International Material Data System
MSDS	Material Safety Data Sheet
PPAP	Production Part Approval Process
SDS	Safety Data Sheet

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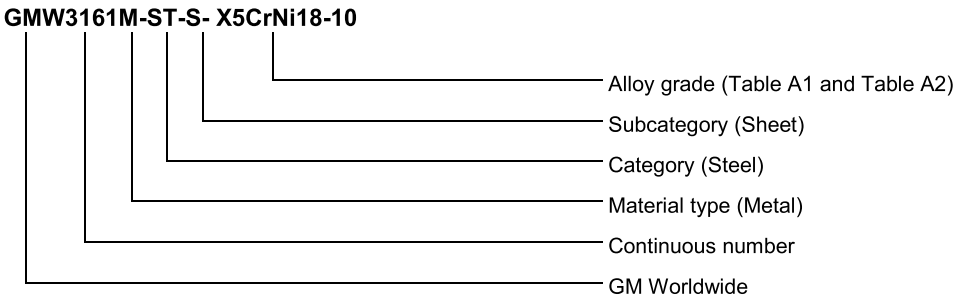
8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

Example: GMW3161M-ST-S-X5CrNi18-10

Where:



9 Release and Revisions

This standard was originated in August 1998. It was first published in June 2002.

Issue	Publication Date	Description (Organization)
1	JUN 2002	Initial publication.
2	MAY 2005	Revised section 3.1.1.1, 3.1.2, 3.1.3.2.1, Table A2 and Table A3; Content changes made to 3.1.2 (Mechanical Requirements)
3	JAN 2011	Update template and standards references. (Non-ferrous Metals GSSLT)
4	JUN 2011	Added new grades and revised coating requirements. (Non ferrous Metals GSSLT)
5	NOV 2016	Revised to 2016 template. (Materials – Nonferrous Materials and Castings GSSLT)
6	MAY 2019	Updates to Table A1, Table A3, Table B1, Table C1, Appendix D. (Materials – Nonferrous Materials and Castings Global Subsystem Leadership Team (GSSLT))

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