



Variable Thickness Rolled Blanks (VTRB) and Tubes (VTRT) Fabricated from Sheet Steel

1 Scope

This standard defines the requirements for variable thickness rolled blanks (VTRB) and tubes (VTRT) used in the manufacture of automotive steel parts. Variable thickness rolled blanks shall be produced from continuous cast hot or cold rolled coils/strip that are cold rolled to specific multiple thicknesses, annealed or as-rolled, and galvanized (if applicable), and then leveled and cut to specified blank sizes. Variable thickness rolled blank products shall be used for cold formed stampings and hot formed stampings. Variable thickness rolled tubes shall be manufactured from variable thickness rolled blanks that are formed into circular tubes along the longitudinal direction and joined by a laser-welded seam.

1.1 Material Description. The material designation is specifically used for variable thickness material defined by the thickness values, GMW base metal specification number, steel product type, minimum yield and/or tensile strength, coating (if applicable) and finish type. The steel product type is designated by either Cold Rolled (CR) minimum yield strength for High Strength Low Alloy (HSLA) grades from GMW3032M-ST-S or minimum tensile strength/yield strength for Hot Stamped (HS) (or Hot Stamped Tube (HT)) grades from GMW14400M-ST-S. Applications of variable thickness rolled blanks shall be limited to unexposed parts.

1.1.1 Material Call-Outs. The list of material and coating designations shown in Table 1 are the only approved material call-outs that can be released unless Materials Engineering and the appropriate Global Sub-System Leadership Team approves.

Table 1: Approved Material Call-Outs

GMW Base Metal Specification	Grade	Material Call-Out	Description
GMW3032M-ST-S	270LA	GMW15619M-ST-S-270LA-UNCOATED-U	Variable thickness rolled HSLA steel with 270 MPa minimum yield strength
GMW3032M-ST-S	300LA	GMW15619M-ST-S-300LA-UNCOATED-U	Variable thickness rolled HSLA steel with 300 MPa minimum yield strength
GMW3032M-ST-S	340LA	GMW15619M-ST-S-340LA-UNCOATED-U	Variable thickness rolled HSLA steel with 340 MPa minimum yield strength
GMW3032M-ST-S	420LA	GMW15619M-ST-S-420LA-UNCOATED-U	Variable thickness rolled HSLA steel with 420 MPa minimum yield strength
GMW3032M-ST-S	270LA	GMW15619M-ST-S-270LA-EG60G60G-U	Hot dip galvanized, variable thickness rolled HSLA steel with 270 MPa minimum yield strength
GMW3032M-ST-S	300LA	GMW15619M-ST-S-300LA-EG60G60G-U	Hot dip galvanized, variable thickness rolled HSLA steel with 300 MPa minimum yield strength
GMW3032M-ST-S	340LA	GMW15619M-ST-S-340LA-EG60G60G-U	Variable thickness rolled HSLA steel with 340 MPa minimum yield strength with 60 g/m ² of zinc on both sides of the sheet
GMW3032M-ST-S	380LA	GMW15619M-ST-S-380LA-EG60G60G-U	Variable thickness rolled HSLA steel with 380 MPa minimum yield strength with 60 g/m ² of zinc on both sides of the sheet

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GMW Base Metal Specification	Grade	Material Call-Out	Description
GMW3032M-ST-S	420LA	GMW15619M-ST-S-420LA-EG60G60G-U	Variable thickness rolled HSLA steel with 420 MPa minimum yield strength with 60 g/m ² of zinc on both sides of the sheet
GMW14400M-ST-S-HS	HS1300T/950Y-MS	GMW15619M-ST-S-HS-1300T/950Y-MS-UNCOATED-U	Variable thickness rolled hot stamped steel, uncoated
GMW14400M-ST-S-HS	HS1300T/950Y-MS	GMW15619M-ST-S-HS-1300T/950Y-MS-AS60G60G-U	Variable thickness rolled hot stamped steel, AISi coated
GMW14400M-ST-T-HT	HT1475T/1170Y-MS	GMW15619M-ST-T-HT-1475T/1170Y-MS-UNCOATED-U	Variable thickness rolled tube, uncoated
GMW14400M-ST-T-HT	HT1475T/1170Y-MS	GMW15619M-ST-T-HT-1475T/1170Y-MS-AS60G60G-U	Variable thickness rolled tube, uncoated

1.2 Symbols. Not applicable.

1.3 Applicability. Typical applications for variable thickness rolled blanks include (but not limited to) body structure panels such as roof bows, cross sills, rocker panels, cross members, tunnel reinforcements, radiator support assembly tie bars, and B-pillars. Tubular applications include instrument panel cross car beams.

2 References

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

2.1 External Standards/Specifications.

ASTM E8	ASTM E646	ISO 10275	ISO/TS 16949
ASTM E517	ISO 10113	ISO 13919-1	

2.2 GM Standards/Specifications.

GMW11	GMW3059	GMW14400	GMW16823
GMW3032	GMW14019	GMW14699	

2.3 Additional References.

- Material Parts Specification (MPS) sheets.
- TMC003 Material Safety Data Sheet guidance documents (available at www.gmsupplypower.com).

3 Requirements

3.1 Blank Requirements on Delivery.

3.1.1 Chemical Requirements. Steel grades for variable thickness rolled blanks are selected by desired properties referenced in GMW base metal specifications, GMW3032 and GMW14400. Exact chemical composition of variable thickness rolled blanks and tubes may vary from those listed in the referenced base metal specification. Supplier shall submit a deviation with chemistry variation.

3.1.2 Mechanical Requirements. Steel grades selected for variable thickness rolled blank applications are targeted to meet minimum mechanical property requirements. Actual mechanical properties for each section will vary, but shall meet the minimum requirements as specified. Tensile properties for variable thickness rolled blanks shall be measured in the transverse direction to allow the use of standard size tensile specimens. For blanks which are further used for tube production longitudinal values are preferred. The supplier must be able to provide the mechanical values in both directions on request, e.g., by rolling a validation sample.

The VTRB supplier shall submit final mechanical property minimums for each thickness segment to be included in the product math data and updated on the MPS sheet prior to MPS Release 3. These properties will override the material grade call-out in the case of a conflict.

3.1.3 Blank Thickness and Dimensional Requirements. The variable thickness rolled segments of variable thickness rolled blanks shall conform to thickness tolerance of ± 0.05 mm for all thickness segments for blanks and tubes. Thickness and thickness tolerances shall be specified by the detailed engineering math data. In most cases, this information can also be found on the detailed MPS sheets issued by General Motors North America (GMNA) – Body Manufacturing Engineering. Minimum constant section lengths must measure at least 50 mm. Minimum thickness change between two adjoining sections is 0.2 mm.

3.1.4 Maximum Thickness Reduction. Variable thickness rolled blanks may vary in thickness from 0.65 mm to 3.5 mm. Variation from one constant thickness section to the next must not exceed 50% to 55% maximum reduction from the thick to the thin section depending upon the exact grade of the starting material.

3.1.5 Maximum Widths. The current maximum width capability of variable thickness rolled blank suppliers is 750 mm.

3.1.6 Blank Length and Width Tolerances. Unless otherwise specified by the Geometric Dimensioning and Tolerancing (GD&T) datum locating scheme, the permissible tolerances for blank length is ± 2.0 mm. Blank width tolerance is ± 1.0 mm.

3.1.7 Minimum and Maximum Thickness to Length Change (Slope) of Transition Areas. The typical maximum thickness to length change (slope) within transition areas shall not be more than 1 mm/100 mm of length. Location of transition areas can vary by ± 5 mm, thus shortening or lengthening the adjoining constant thickness section.

3.1.8 Hot Stamped AlSi-Coating. Applications of AlSi-coated VTRB for hot stamping are restricted to non-corrosion critical areas only. Exceptions must be approved by Materials Engineering.

Defects of the AlSi-coating caused by the rolling operation such as inversions as shown in Figure 1 and large area break-offs (over 1mm in maximum dimension) shown in Figure 2 are not allowed.



Figure 1: Example of Inversion in AlSi Coated Hot Stamped Steel



Figure 2: Example of Large Break-off Areas in AlSi Coated Hot Stamped Steel

3.1.8 Blank Edge Preparation. Maximum allowable burr on any edge shall be no greater than 10% metal thickness.

3.1.9 Surface Quality. Processing shall be controlled such that the surface quality of the variable thickness rolled blank meets the requirements of GMW16823 for the specified surface type.

3.1.10 Dimensions and Tolerances of the Blank Stack. The blanks shall be stacked so that each stack is identical in shape with the edges flush. The dimensions and tolerances for the stacks are as follows:

3.1.11 Stack Shift, Blank Stagger and Stack Lean Tolerances. Permissible tolerances for these requirements are 26 mm (Figure A1, Figure A2, and Figure A3).

3.1.12 Flatness of a Stack. Unless otherwise noted, the allowable variation in distance from the top of the stack to the ground at any point in the plan view of the stack will be agreed upon by the supplier and GM Global Purchasing and Supply Chain (GP&SC) Steel Supplier Quality. If necessary, dimples may be added to the stack to maintain the flatness of the stack. Recommended dimensions for the dimples are shown in Figure A4, Figure A5, Figure A6, and Figure A7. The location of the dimples will be found on the MPS sheet. Dimples should either be staggered, or put on every other blank in a stack. The parallelism shall not be obtained by additional devices (e.g., wooden wedges or blocks).

3.2 Variable thickness Rolled Tube Requirements on Delivery.

3.2.1 Manufacturing Description. Variable thickness rolled tubes shall be manufactured from variable thickness rolled blanks that are formed into circular tubes along the longitudinal direction and joined by laser weld seam to create a butt joint. The laser weld butt joint shall meet the requirements of ISO 13919-1 Quality Level C (Medium).

3.2.2 Tube Thickness and Dimensional Requirements. Wall thickness tolerances for variable thickness rolled tubes shall be ± 0.1 mm. Tube dimensional requirements such as length, squareness of cut, straightness, and ovality shall be shown in the electronic math data file or engineering part drawing. Wall thickness tolerances of ± 0.2 mm is allowed ± 20 mm either side from laser weld seam.

3.3 Additional Requirements.

3.3.1 Lubrication. Variable thickness rolled blanks and tubes shall be lubricated as specified on the MPS sheet to conform to GMW14019 for mill oils and pre-lubes, to prevent rust. The variable thickness rolled blanks shall have a sufficient amount of oil coverage in the finished state to provide rust protection and the needed lubricity for forming the part.

3.3.2 Process Control. The supplier shall develop quality process control procedures compliant with ISO/TS 16949 demonstrating that the product will conform to all specification requirements listed in this document. This shall include a statistical sampling plan based upon product quality performance. The data required to be submitted for this specification for each shipment will be determined by the manufacturing location.

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. In addition, product MSDS/SDS submissions must be in compliance with specific country General Motors TMC003 Material Safety Data Sheet/Safety Data Sheet guidance documents where available.