



Automotive Steel Tubing For Fluid Handling GM124M

1 Scope

These specifications cover two types of steel tubing suitable for automotive uses. There are requirements for the base metal, the optional coating materials, and the coated tubing. These requirements are applicable to the product coming out of the tube mills and the coating application lines, which are sometimes separate facilities. This tubing is used in the production of customized parts and assemblies. It is recommended that those parts and assemblies be validated for corrosion performance, conductivity and continuity, strength, appearance, and other critical properties unique to the particular application.

1.1 GM123M. Covers double wall construction tubing wherein the two walls and the joints are copper brazed in a reducing atmosphere to produce tubing satisfactory for hydraulic lines. It

should not be used for fuel lines because residual copper can contribute to the formation of sour gas. See Figure 1.

1.2 GM124M. Covers single wall construction tubing wherein the joint is electric resistance welded. It is recommended for fuel lines, power steering lines, transmission oil cooler lines, lubricating oil lines, vacuum lines, etc. See Figure 1.

1.3 Tubing Designation Code. It is recommended that the codes in paragraph 3.1 be used on drawings and purchase orders to designate tubing type, outside diameter, wall thickness, manufactured condition finish and the internal diameter (ID) coating.

1.4 Typical Application. GM123M is typically used for hydraulic brake lines whereas GM124M is typically used for fuel lines, power steering lines, transmission oil cooler lines, lubricating oil lines, vacuum lines, etc.

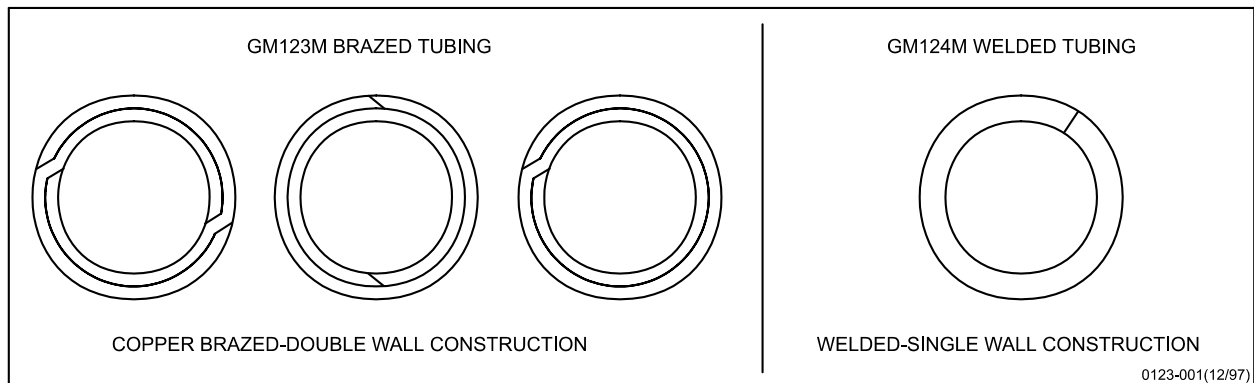


Figure 1: Tubing Construction

2 References

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

2.1 External Standards/Specifications.

ASTM A254	SAE J463
ASTM A875	SAE J526
ASTM B117	SAE J527
ASTM B750	SAE J533

ASTM E8	SAE J1290
SAE J403	

2.2 GM Standards/Specifications.

9985670	GM9505P
GM4298P	GM9508P
GM4465P	GM9509P
GM4653M	GM9540P
GM6277M	GMW3001

GM9071P GMW3059
GM9102P

2.3 Additional References.

Information regarding GMPT fuels can be obtained by contacting GM Powertrain Materials Engineering.

- GMPT-6-006 TF2 gasoline
- GMPT-5-005 Bio-Diesel
- GMPT-5-001 #2 Diesel
- GMPT-6-019 Oxidized Gasoline
- GMPT-6-023 E85 Low pH

3 Requirements

3.1 General Requirements. Basic tubing material shall be cold rolled 1006, 1008 or 1010 steel per SAE J403. Brazing material should be copper or copper alloy as designated in SAE J463, Copper Alloy UNS C51000.

GM123M (I/II/III/IV/V)

GM124M (I/II/III/IV/V/VI)

- 'I' = First item in parenthesis, a B or a W.
- B = Brazed, W = Welded
- 'II' = Outside diameter of as-brazed or as-welded tubing (mm)
- 'III' = Wall thickness (mm)
- 'IV' = Manufacturing Process (*)
- 'V' = Automotive
- 'VI' = Internal Diameter Coating(**)

(*) Process Abbreviations:

- A = Annealed
- P = Plain
- U = Unannealed (as welded)
- G = Zinc-aluminum-alloy Metal Coating
- F = Copper Fused
- E = Extended Corrosion Protection Paint Coating
- N = Extruded Nylon 11 or 12
- C = Copper Plate – Standard copper plate thickness is 0.009 mm minimum. If other than standard thickness is required, numeral(s) should be used immediately following the letter C, e.g., C13 indicates 0.013 mm minimum.
- (**) Internal Diameter Abbreviations
- Blank = Plain
- P = Plain
- Ni = Ni Plating

Example:

GM124M (W/6.00/0.7/AGE/V/Ni) – indicates welded single walled tubing, 6 mm O.D., 0.7 mm wall thickness, annealed tubing, protected from corrosion with a base coating of a zinc-aluminum-alloy metal followed with a topcoat paint layer, approved for automotive application, with a Nickel plated ID.

3.2 Mechanical Properties. The following requirements shall apply only to the more common types of steel tubing; that is, welded-annealed and brazed-as manufactured. Properties of other classes of tubing, such as welded mechanical tubing or work hardened tubing, shall be as specified through special agreement between supplier and purchaser.

3.2.1 Tensile tests shall be conducted on finished tube in accordance with methods of testing tubes outlined in ASTM E8. Tensile properties shall be per SAE J526 for welded tubing and per SAE J527 for brazed tubing.

3.2.2 Tubing shall be capable of being expanded over a tapered mandrel having a slope of 1 in 10 until the outside diameter at expanded end is increased 20% without cracking or showing flaws (ASTM A254, Paragraph 6.3). Prior to expansion test, tubing shall be cut off square, edge crowned, and deburred. It shall be held firmly and squarely in the die, and punch must be guided on the axis of the tubing.

3.2.3 Unless otherwise specified, tubing shall be capable of withstanding the following internal static hydraulic pressure:

- Through 10.0 mm OD.....35 MPa
- Over 10.0 through 16.0 mm OD.....15 MPa

Note: Subsequent cold working of the tube (coiling, straightening, bending, drawing, etc.) will increase the strength and hardness of the tube. Considerably higher strength and hardness for specific applications can be obtained by cold working or case hardening of the tube.

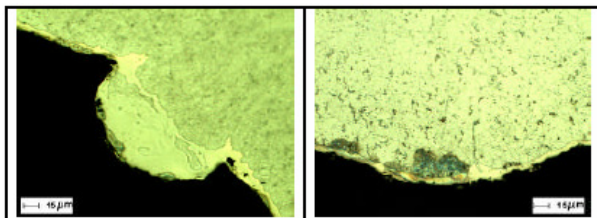
3.3 Dimensions. Tubing shall conform to the dimensions and tolerances listed by the purchaser.

3.3.1 Welded Tubing. Nominal diameter and wall thickness shall conform to those listed in SAE J526. Maximum OD for the Zinc-aluminum alloy plus Nylon 11 or 12 topcoat, GN, can be found in Table 2.

3.3.1.1 Nickel Coated ID Weld Bead. In order to ensure good re-flow of the nickel at the weld, it is important that the weld bead have a smooth

cross-sectional profile and minimum bead dimensions. Report the bead height dimension (The typical bead height shall be 0.15mm or less. Continue monitoring the bead height until a maximum bead height requirement has been established).

Typical examples of good versus undesirable bead profiles are shown below in Figure 2.



Left Photo: Typical internal weld bead with undesirable cross-sectional profile.

Right Photo: Typical internal weld bead with good and smooth cross-sectional profile.

Figure 2: Weld Bead Profile Examples

3.3.2 Brazed Tubing. Nominal diameter and wall thickness shall conform to those listed in SAE J527. Maximum OD for the Zinc-aluminum alloy plus Nylon 11 or 12 topcoat, GN, can be found in Table 2.

3.3.3 Flare Ends.

3.3.3.1 SAE-type flares shall conform to the dimensions and tolerances shown in SAE J533.

3.3.3.2 ISO-type flares shall conform to the dimensions and tolerances shown in SAE J1290.

3.3.3.3 FLARED ENDS. In the case of GM123M (inverted flare), pipe flare ends shall conform to the Supplementary Requirements in ASTM A254 section S1.

3.4 Finishes. Finish on the inside and outside of the tubes shall conform to the specified finish as shown in Table 1.

3.5 Environmental Resistance (GE, GN and Ni).

3.5.1 Salt Spray Testing (GM4298P). Coated tubing shall be subjected to the following corrosion tests and evaluation methods. All corrosion tests shall be conducted on fabricated parts or on the test sample in Figure 3. Test samples as described in Figure 3 shall be aligned in the test chamber with the formed elbow facing down but not contacting the test fixture, except as noted. Fabricated parts shall be aligned in the test chamber as agreed upon between the testing facility and reviewing authority. The frequency for running all of the

corrosion tests shall be documented in the control plan.

Note: Surface contaminants can cause staining in a corrosion test. Stains in the absence of corrosion should not be recorded as a corrosion failure.

3.5.1.1 Zinc-Aluminum Alloy – Extended Corrosion Protection (GE). The GE extended corrosion protection tubing must withstand 1000 h of salt spray exposure per GM4298P with no more than 1.5 mm of creepback (See GM9102P) from longitudinally placed scribes and no other loss of adhesion after GM4298P exposure and air blow-off.

3.5.1.2 Zinc-Aluminum Alloy – Extruded Nylon 11 or 12 (GN) Low Temperature Chip Resistance plus Salt Spray (GM9508P, GM4298P). Subject formed tubing samples (see Figure 3) to the chip resistance test, GM9508P, Method B, five times each. The tubing shall be placed in the gravelometer such that the plane created by the bend is parallel to the panel. Within 24 h of gravelometer exposure, place the specimens into salt spray per ASTM B117 or GM4298P.

The tubing shall show no base metal corrosion extending more than 1 mm from gravel impacted area after 2000 h. Non gravel impacted areas shall be free from rust after 2000 h.

3.5.2 Humidity Testing (GM4465P, GM9071P). Extended corrosion protected tubing (GE) shall be subjected to 96 h of humidity testing per GM4465P. Immediately after the humidity test, the tubing shall be wiped dry and tape adhesion tested per GM9071P, except a linear scribe should be made longitudinally on the tube. There shall be at least 99% adhesion.

3.5.3 Nickel Plated (Ni) Humidity Testing (GM4465P, GM9071P). The nickel plated ID coating shall be exposed to the following humidity test using 100 mm straight samples and on test samples as shown in Figure 4. Three test samples of each configuration shall be sectioned longitudinally, exposing the inside surfaces of the tube. The cut edges of the test samples shall be sufficiently protected to prevent rust bleed out. The samples shall be placed in the test chamber with the inside surfaces facing upward. The straight samples shall be placed approximately at a 30° angle from the vertical in order to allow for moisture run off. The nickel coating must withstand 168 h of humidity exposure per GM4465P with no red rust outside the weld (heat affected) zone. Any corrosion