



Smooth Hoses for Wiring Harness

1 Introduction

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. This standard defines the test and validation requirements for smooth hoses use in the passenger and engine compartment.

1.2 Applicability. All passenger car and light duty truck wire harnesses.

1.3 Remarks. Smooth hoses are closed hoses used on harness branches that require compact packaging environment and more flexibility. They are typically made of Polyvinyl Chloride (PVC) or Polyurethane (PUR). See Figure 1 for a seat belt reactor bundle example.



Figure 1: Seat Belt Reactor Bundle Smooth Hose Example

1.4 Temperature Classes. Eight (8) smooth hose classes have been defined in Table 1 to respond to the various temperatures encountered on vehicles.

Table 1: Temperature Class Rating

International Organization for Standardization (ISO) Temperature Class	Operating Temperature	Equivalent to Temperature Class
A	-40 °C to 85 °C	T1
B	-40 °C to 100 °C	T2
C	-40 °C to 125 °C	T3
D	-40 °C to 150 °C	T4
E	-40 °C to 175 °C	T5
F	-40 °C to 200 °C	T6
G	-40 °C to 225 °C	T7
H	-40 °C to 250 °C	T8

2 References

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

2.1 External Standards/Specifications.

ASTM D5374	ISO 1817	ISO 6722-1	SAE J1703
ASTM D5423	ISO 4926		

2.2 GM Standards/Specifications.

GMW3059	GMW3232	GMW3235	GMW15626
---------	---------	---------	----------

3 Test Preparation and Evaluation

3.1 Resources.

3.1.1 Facilities.

3.1.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.1.1.3 Ovens. Unless otherwise specified, when an oven is required, it shall be a hot air oven. The oven type shall either be a forced air or mechanical convection. See Figure 2 and Figure 3. The air shall enter the oven in such a way that it flows over the surface of the test pieces and exits near the top of the oven. The oven shall have not less than eight (8) and not more than 20 complete air changes per hour at the specified ageing temperature. Reference ASTM D5423 and ASTM D5374 for temperature uniformity and air exchange measurements.

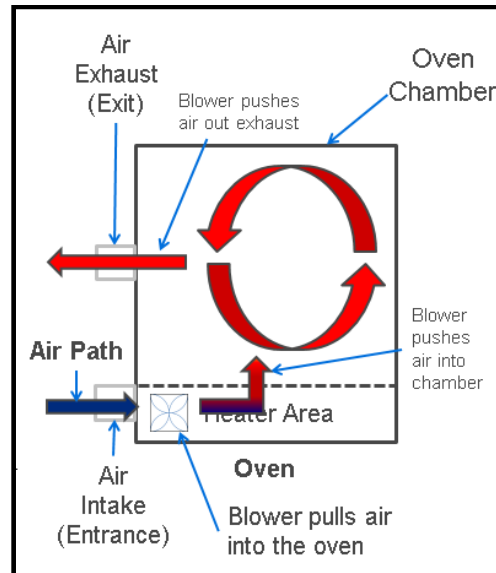


Figure 2: Forced Air Oven

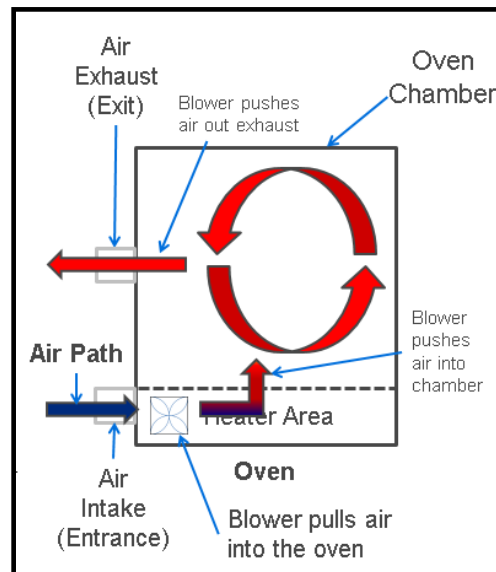


Figure 3: Mechanical Convection Oven

3.1.2 Equipment. See each individual test in Section 4.

3.1.3 Test Vehicle/Test Piece. The number of test samples is specified in each test. The test sequence is defined in Appendix A. The hoses to be tested shall be manufactured under full production conditions. No parts out of prototype tools shall be used. If not stated otherwise, for testing smooth hoses with different diameters but equal material, three (3) representative diameters (small, medium, large) shall be tested.

3.1.4 Test Time. See each individual test in Section 4.

3.1.5 Test Required Information. Not applicable.

3.1.6 Personnel/Skills. Not applicable.

3.2 Preparation. See each individual test in Section 4.

3.3 Conditions.

3.3.1 Environmental Conditions. Test samples for all tests shall be preconditioned $+23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ and a relative humidity of $50\% \pm 6\%$ for $\geq 16\text{ h}$. Unless otherwise specified, all tests other than "in process" tests shall be conducted at this temperature. Where no tolerance is specified, all values shall be considered approximately.

3.3.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

3.4 Instructions. See each individual test in Section 4.

3.5 Data. See 3.7.1.

3.6 Safety. This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

3.7 Documentation. Samples of components or material released to this standard shall be tested for conformity with the requirements of this standard and approved by the responsible GM Department prior to the start of delivery of production level components or materials.

Any change to the component or material, e.g., design, function, properties, manufacturing process and/or location of manufacture requires a new release of the product. It is the sole responsibility of the supplier to provide the customer, unsolicited, with documentation of any change or modification to the product/process, and to apply for a new release.

If not otherwise agreed to, the entire verification test shall be repeated and documented by the supplier prior to start of delivery of the modified or changed product. In some cases, a shorter test can be agreed to between the responsible GM department and the supplier.

3.7.1 Test Results. Test results shall be reported in a test report (see example in GMW15626). The test report shall include as minimum:

- Name of the supplier
- Date
- Designation
- International Material Data System Identification (IMDS_ID) and information. If the International Material Data System (IMDS) datasheet has been approved by the customer
- The result and interpretation of test result

4 Requirements and Procedure

4.1 Identification. As part of the work of type testing, material identification shall be performed by means of determination of various chemical and physical properties and characteristics in order to determine the properties and characteristics of type-tested hose.

This is done in order to obtain reference values that would be needed in the event of any claims. Departures from these reference values exceeding normal tolerances shall initiate more extensive inspection in accordance with this standard.

4.1.1 IR-spectrum. This method is used for identification of organic compounds and takes place on the basis of the position and intensity through molecular movement provoked absorption.

The analysis of the insulation shall be performed in delivery condition, after short-term ageing (240 h) and after long-term ageing (3000 h).

4.2 Dimensions. Measurements according to 4.2.1 and to 4.2.2 shall be performed at the same time.

Test sample: Prepare three test samples each with a length of 500 mm.

4.2.1 Outer Diameter (D_o).

4.2.1.1 Procedure. The outer diameter shall be measured at two points along the length of the hose separated by a distance of > 100 mm. The diameter shall be taken to be the mean value of three measurements at each point. The measurement shall be made peripherally with a mutual displacement of 120 degrees.

Measurement accuracy: 0.01 mm.

4.2.1.2 Interpretation of Results. The values for outer diameter and thickness can be agreed upon. A data-sheet of the hose, including the dimensions, shall be presented together with the test report.

4.2.2 Inner diameter (D_i).

4.2.2.1 Procedure. The inner diameter shall be measured by a series of mandrels with an increasing diameter of 0.1 mm being passed through a test section of the smooth hose. The mandrel shall be inserted ≈ 50 mm into the hose. The inner diameter is equal to the diameter of the mandrel that can be easily inserted.

4.2.2.2 Interpretation of Results. No single value shall exceed the value given in Appendix B. A data-sheet of the hose, including the dimensions, shall be presented together with the test report.

4.2.3 Thickness (t).

4.2.3.1 Procedure. The thickness shall be measured at two points along the hose separated by a distance of > 100 mm. The thickness shall be taken to be the mean value of three measurements at each point. The measurement shall be made peripherally with a mutual displacement of 120 degrees.

4.2.3.2 Interpretation of Results. The values for outer diameter and thickness can be agreed upon. A data-sheet of the hose, including the dimensions, shall be presented together with the test report.

4.3 Impact.

Test sample: Prepare three test samples each with a length of 150 mm.

Procedure: Perform the test (see 4.3.1 to 4.3.2 in the middle of the test sample using the apparatus shown in Figure 4).

Once the hose has attained $+23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$, it shall be visually examined for cracks.