



Shielded and Unshielded Sheathed ISO Cables

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 Scope. This standard specifies the test methods and requirements for round shielded and unshielded sheathed International Organization for Standardization (ISO) cables. The standard is based on the ISO 14572.

1.2 Mission/Theme. Shielded and unshielded sheathed cables can have one or more insulated conductors. The shielded cable is composed of foil/braided strands of copper/aluminum or other conductive materials. This shield is covered with a jacket. The shield reduces electrical noise from affecting the signals, and reduces electromagnetic radiation that may interfere with other devices. The purpose of the cable is to supply power and signals to components.

1.3 Classification. Shielded and unshielded sheathed cables are classified by the nominal voltage of the system, by the dimensions and by the operating temperature. See Figure C1 in Appendix C and Figure D1 in Appendix D. The inner cores shall be tested and fulfill the requirements according to GMW15626.

1.3.1 Nominal System Voltage Classes.

- 60 V cables intended for use in road vehicle applications where the nominal system voltage is ≤ 60 Volts Direct Current (V_{DC}) and ≤ 30 Volts Alternating Current (V_{AC}).
- 600 V cables intended for use in road vehicle applications where the nominal system voltage is in the range of 60 V_{DC} to 900 V_{DC} and 30 V_{AC} to 600 V_{AC} .

Note: For 600 V applications, the cable shall meet the 600 V performance requirement of ISO 6722-1 regardless of wall thickness construction and, 60 V and 600 V cables shall not be mixed in the same sheathed or shielded multi-core cable.

1.3.2 Temperature Classes. Eight cable classes have been defined in Table 1 to respond to the various temperatures encountered on vehicles.

Table 1: Temperature Class Rating

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	IEC 60811-501	ISO 6722-1	SAE RM-66-06
ASTM D5423	ISO 1817	ISO 14572	

2.2 GM Standards/Specifications.

GMW3059	GMW15626
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3 Test Preparation and Evaluation

3.1 Resources.

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

3.1.2 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.

3.1.3 Facilities. Laboratory with sufficient resources and equipment to execute the tests in Section 5.

3.1.4 Equipment. See each individual test in Section 5.

3.1.4.1 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 Figures 1 and 2. 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.

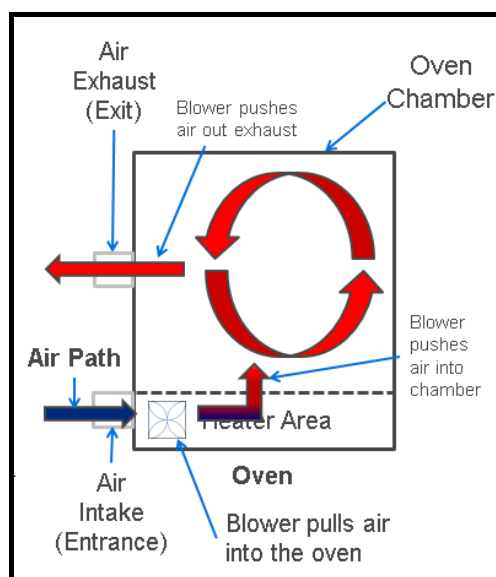


Figure 1: Forced Air Oven

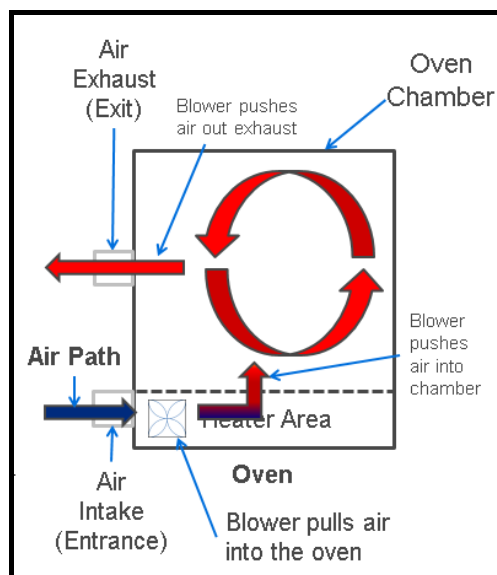


Figure 2: Mechanical Convection Oven

3.1.5 Test Vehicle/Test Piece. The number of test samples is specified in each individual test of Section 5. The cables to be tested shall be manufactured under full production conditions. No parts out of prototype tools shall be used.

3.1.6 Test Time. See each individual test in Section 5.

3.1.7 Test Required Information. See 3.7.1.

3.1.8 Personnel/Skills. General familiarity with wire and wire testing.

3.1.9 Test Required for Certification. The cables shall be submitted to the tests specified in Table A1 in Appendix A. Initial qualification tests shall be performed by a certified, independent laboratory, unless otherwise agreed to by the appropriate GM department.

3.2 Preparation. See each individual test in Section 5.

3.3 Conditions.

3.3.1 Environmental Conditions. See ISO 14572.

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 5.

3.5 Data. See 3.7.1.

3.6 Safety. This standard may involve hazardous materials, operations, and equipment. This standard does not propose to address all the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

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. The results shall be reported in the test report. See the Test Report example in Appendix B. The test report shall include as minimum:

- Name of the supplier
- Date
- Supplier Product Designation
- GM Wire Code Designation
- Production Location
- Designation of Compound
- International Material Data System (IMDS) Identification (ID) and information, if the IMDS datasheet has been approved by the customer
- Test result and interpretation of test result

4 Requirements and Procedure

4.1 General.

4.1.1 Caution. See ISO 6722-1.

4.2 Materials.

4.2.1 Conductors. See GMW15626.

4.2.2 Insulation. All single cores must pass the tests as defined in GMW15626.

4.2.3 Material of the Sheath. The sheath (jacket) shall be smooth and free from cracks, pitting, and other defects visible to the naked eye.

4.2.4 Screen. Screening of cables may be done by using aluminum foil with drain wire, spiral screen, or braid of tinned copper strands. Any foil used for screen has to be overlapped by 5% minimum. The design of the cable must be approved by the GM Materials Engineering Department. For high voltage (600 V cables) only, the tinned copper screen coverage shall be $\geq 90\%$. Depending on the application requirements, a higher level shield coverage percentage may be requested by GM for a specific cable type.

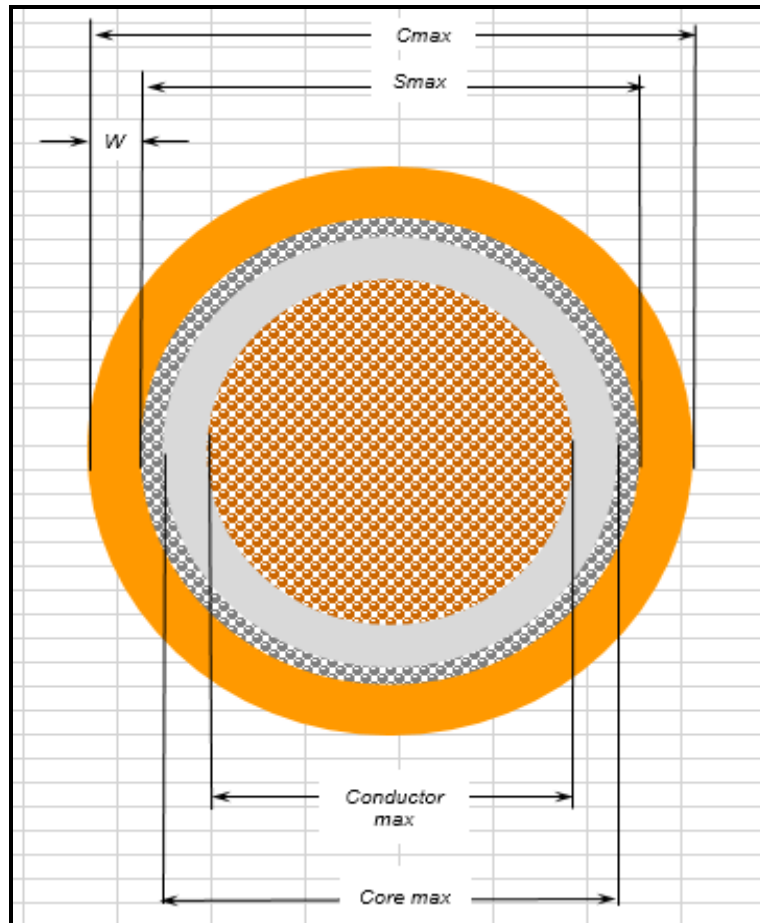
4.2.5 Drain Wire. The drain wire is normally a tinned copper conductor. See GMW15626 for drain wire sizes and properties.

4.2.6 Colors. Colors of the inner cores shall be according to GMW15626. The colors of the sheath shall be black if nothing else is stated. In some applications; e.g., high voltage cables, a colored orange sheath is required. Contact the GM Materials Engineering Department for more information.

4.2.7 Marking. The usage of marking is to be established between customer and supplier.

5 Test and Performance Requirements

5.1 Outside Cable Diameter. The measurement is carried out according to ISO 6722-1. All measurements (inner core and outer jacket) shall be within the limits of the appropriate maximum and minimum outside cable diameter. See Figure 3 for Shielded Cable Construction. The dimensions for Shielded Cable are shown in Table 2, Thin Wall Shielded Cable, and Table 3, Thick Wall Shielded Cable. Multi-core cables dimensions are specific to the required applications, therefore, the cable constructions must be agreed between supplier and General Motors.

**Where:**

Cmax is the maximum cable diameter of sheath (outer jacket).

Conductor max is the dimension of the core conductor.

Core max is the outer diameter dimension of the core insulation.

Smax is the maximum screen diameter.

W is the wall thickness of sheath (outer jacket).

Wmax is the maximum wall thickness of sheath (outer jacket).

Wmin is the minimum wall thickness of sheath (outer jacket).

Wnom is the nominal wall thickness of sheath (outer jacket).

Figure 3: Shielded Cable Construction

Table 2: Thin (Reduced) Wall Shielded Cable Dimensions

ISO Conductor		Core				Screen		Outer Jacket			
Size (mm ²)	Diameter (mm)	Outside Diameter (OD) (mm)		Insulation Thickness (mm)		Conductor (mm)	Maximum (Max) (mm)	Nominal (Nom) Wall Thickness	Minimum (Min) Wall Thickness	Minimum Cable Outside Diameter	Maximum Cable Outside Diameter
	Max	Min	Max	Nom	Min	Max	Smax	Wnom ^{Note 1}	Wmin	Cmin	Cmax
1.5	1.80	2.20	2.40	0.30	0.24	0.13	2.9	0.40	0.32	3.3	3.7
2.0	2.00	2.50	2.80	0.35	0.28	0.13	3.3	0.40	0.32	3.7	4.1
2.5	2.20	2.70	3.00	0.35	0.28	0.13	3.5	0.40	0.32	3.9	4.3
3.0	2.40	3.10	3.40	0.40	0.32	0.16	4.0	0.40	0.32	4.2	4.8
4.0	2.80	3.40	3.70	0.40	0.32	0.16	4.3	0.40	0.32	4.5	5.1
5.0	3.10	3.90	4.20	0.40	0.32	0.16	4.8	0.60	0.48	5.4	6.0
6.0	3.40	4.00	4.30	0.40	0.32	0.16	4.9	0.60	0.48	5.5	6.1
8.0	4.30	4.60	5.00	0.40	0.32	0.19	5.8	0.65	0.52	6.5	7.1
10.0	4.50	5.30	6.00	0.60	0.48	0.19	6.8	0.65	0.52	7.5	8.1
12.0	5.40	5.80	6.50	0.60	0.48	0.19	7.3	0.65	0.52	8.0	8.6
16.0	6.30	6.40	7.20	0.65	0.52	0.19	8.0	0.80	0.64	9.0	9.6
20.0	6.90	7.00	7.80	0.65	0.52	0.19	8.6	0.80	0.64	9.6	10.2
25.0	7.80	7.90	8.70	0.65	0.52	0.21	9.5	0.90	0.72	10.7	11.3
30.0	8.30	8.70	9.60	0.80	0.64	0.21	10.4	0.90	0.72	11.6	12.2
35.0	9.00	9.40	10.40	0.80	0.64	0.21	11.2	1.00	0.80	12.6	13.2
40.0	9.60	10.0	11.10	0.90	0.71	0.21	11.9	1.00	0.80	13.3	13.9

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