



General Specification for Vehicular Horns

Contents

1 Introduction.....	6
1.1 Purpose.....	6
1.2 Applicability.....	6
1.3 Remarks.....	6
2 References.....	6
2.1 External Standards/Specifications.....	6
2.2 GM Standards/Specifications.....	7
2.3 Additional References.....	7
3 Test Preparation and Evaluation.....	7
3.1 Resources.....	7
3.1.1 Facilities.....	7
3.1.2 Equipment.....	7
3.1.3 Test Vehicle/Test Piece.....	7
3.1.4 Test Time.....	7
3.1.5 Test Required Information.....	7
3.1.6 Personnel/Skills.....	8
3.2 Preparation.....	8
3.3 Conditions.....	8
3.3.1 Environmental Conditions.....	8
3.3.2 Test Conditions.....	8
3.4 Instructions.....	8
3.5 Data.....	8
3.6 Safety.....	8
3.7 Documentation.....	8
3.7.1 Test Results.....	8
4 Requirements and Procedure.....	8
4.1 Regulatory Requirements.....	8
4.1.1 Argentina; Argentine Republic.....	9
4.1.2 Australia.....	9
4.1.3 Brazil; Federative Republic of.....	9

4.1.4 Canada.	9
4.1.5 China; People's Republic of.	9
4.1.6 Customs Union of Belarus, Kazakhstan and Russia.	9
4.1.7 Egypt; Arab Republic of.	9
4.1.8 Gulf Cooperation Council (GCC).	9
4.1.9 India; Republic of.	10
4.1.10 Indonesia; Republic of.	10
4.1.11 Israel; State of.	10
4.1.12 Japan.	10
4.1.13 Korea; Republic of.	10
4.1.14 Malaysia.	10
4.1.15 Morocco; Kingdom of.	10
4.1.16 New Zealand.	10
4.1.17 Peru; Republic of.	10
4.1.18 South Africa; Republic of.	11
4.1.19 Taiwan.	11
4.1.20 Thailand; Kingdom of.	11
4.1.21 Tunisia; Republic of.	11
4.1.22 United Nations (UN R28 Audible Warning Devices).	11
4.1.23 United States of America\States.	11
4.1.24 Venezuela; Republic of.	11
4.2 Part Drawing Requirements.	11
4.3 Pre-Release Requirements.	11
4.3.1 Design Failure Mode and Effects Analysis (DFMEA).	11
4.3.2 Process Failure Mode and Effects Analysis (PFMEA).	11
4.3.3 Process Control Plan.	12
4.3.4 Internal Part Approval.	12
4.3.5 Mandatory Detailed Test Plan.	12
4.4 Test Sample Performance and Failure Determination.	12
4.5 Test Sample Size, Selection, Allocation, Identification and Disposition.	12
4.5.1 Test Sample Size.	12
4.5.2 Test Sample Selection.	12
4.5.3 Test Sample Allocation.	12
4.5.4 Test Sample Identification.	12
4.5.5 Test Sample Disposition.	12
4.6 Functionality.	12
4.7 Life Expectancy.	12
4.8 Appearance.	13
4.9 Mechanical Requirements.	13

4.9.1 Mounting Orientation.....	13
4.9.2 Mounting Torque.....	13
4.9.3 Materials.	13
4.9.4 Bracket Attachment to Horn.....	13
4.9.5 Identification.....	13
4.9.6 Recyclability/Recoverability.	13
4.10 Electrical and Audible Requirements.	13
4.10.1 Polarity.	13
4.10.2 Voltage Range.	13
4.10.3 Recommended Fusing and Wiring.	13
4.10.4 Terminations.	13
4.10.5 Current Draw.....	14
4.10.6 Readiness.....	14
4.10.7 Parasitic Load.	14
4.10.8 Connection Sequence.	14
4.10.9 Insulation Resistance.....	14
4.10.10 Electromagnetic Compatibility.	14
4.10.11 Fundamental Frequency.....	14
4.10.12 Sound Pressure Level and Harmonic Frequency Content.	14
4.10.13 Variability.	15
4.10.14 Adjustments.	15
4.11 Mechanical Validation Test Requirements.....	15
4.11.1 Noise and Rattles.....	15
4.11.2 Vibration.....	15
4.11.3 Shock.....	18
4.11.4 Drop.	18
4.11.5 Free Fall.....	18
4.12 Climatic.....	18
4.12.1 Temperature.	18
4.12.2 Low Temperature Wakeup.	19
4.12.3 Seven (7) Point Functional Check.	20
4.12.4 High Temperature Degradation Electronic Horn Only.....	20
4.12.5 Thermal Shock.....	21
4.12.6 Humidity.....	22
4.12.7 Corrosion.	24
4.12.8 Dust.....	24
4.12.9 Frost.....	24
4.12.10 Water Impingement.....	25
4.12.11 Water Immersion.....	26

4.12.12 Altitude	26
4.12.13 Dimensional.	26
4.13 Additional Electrical Tests Electronic Horn.....	26
4.13.1 Battery Voltage Dropout Test.	26
4.13.2 Sinusoidal and Pulse Superimposed Test.....	27
4.13.3 Reverse Polarity.....	27
4.13.4 Overvoltage.....	27
4.14 Horn Connector Test Requirements.....	28
4.14.1 Terminal Push-out Force.	28
4.14.2 Connector Engagement Force.....	28
4.14.3 Locked Connector Disengage Force.	28
4.14.4 Unlocked Connector Disengagement Force.....	28
4.14.5 Connector Installation Abuse, Side Force.	28
4.15 Contaminants.	28
4.16 Reliability/Durability Requirements.....	29
4.16.1 Combined Environmental Reliability Test (CERT).....	29
4.16.2 Durability Requirements.	30
4.16.3 Continuous Blow Requirements.	30
4.17 Serviceability and Service Parts Requirements.	30
4.18 Quality Assurance.	30
4.18.1 Quality Assurance Requirements.	30
4.18.2 Process Control.	30
4.18.3 Reliability Re-Certification.....	30
4.18.4 Quality Control Audits.	30
4.18.5 Audit Test Failures.....	31
4.18.6 Audit Documentation.	31
5 Provisions for Shipping	31
5.1 Shipping.....	31
5.2 Packaging.....	31
5.3 Lot Control.	31
6 Notes	31
6.1 Glossary.....	31
6.2 Acronyms, Abbreviations, and Symbols.....	32
7 Additional Paragraphs	33
8 Coding System	33
9 Release and Revisions	34
Appendix A.....	35
A1.1 Severe Usage Regions.	35
A1.1.1 Background.	35

A1.1.2 Observations.	35
A1.1.3 Electrical, Mechanical and Audible Requirements.	35
Appendix B.....	36
Appendix C.....	38
Appendix D.....	40
D1 GMW15575 Horn Test Plan Report.	40
D1.1 Instructions.....	41
D1.2 Report Outline.....	41

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 specification covers the requirements for horns for installation in General Motors Company (GM) vehicles. This document should be referenced on, and is thus an extension of engineering parts drawings covering these products.

1.2 Applicability. The horn subsystem is required on all vehicles. Its purpose includes one or more of the following:

- An alerting device to be used by the operator of the vehicle to alert persons outside the vehicle to the vehicle's position or motion.
- An annunciating device to inform the operator of the vehicle to some condition, or change of condition of the vehicle, e.g., alarm enabled.
- An alerting device for the purpose of warning away intruders, or for providing an audible vehicle locator.
- Although not a primary mission of the horn, it is recognized that it is also used as a celebratory noise maker, e.g., parades, wedding processions, and should be capable of not being damaged by a reasonable amount of such usage.
- An alarm device for an anti-theft system.

1.3 Remarks. Electrical-Mechanical and Electronic classes of horns are covered by this specification. Acoustic amplification may be provided by a trumpet-type projector, whether straight or curved. Unless otherwise specified, the requirements of this specification apply equally to horns of both classes. This specification does not cover horn or horn assemblies that use air, or compressed air, to generate the sound, except by specific reference from another document. See 6.1 Glossary for horn definitions.

Note: The horn is not a safety device. It is not so classified in any known regulation, world-wide. The horn is a sound signaling device. It is often referred to as a "warning" device, but in the context alerting people around the vehicle, as described in 1.2 Applicability.

2 References

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

2.1 External Standards/Specifications.

779/95 Article 30/E Decree 32/2018 Annex B	DLT B.E. 2559	IEC 60068-2-30	PP.55 2012
32017/6	Document Listing (Rule 4)	IEC 60068-2-38	SAE J377
ADR 94/00	DS 58/03 (Supreme Decree)	IEC 60068-2-64	SANS 10169:2004
AIAG DFMEA	FMVSS 302	IS-1884:1993, Amend 2	Section 2.7.9
AIAG PFMEA	GB 15742-2019	ISO 16750-2	TR CU 018/2011
AIAG PPAP	General Traffic Code (COVENIN 2855/92 and 2859/92)	ISO 16750-4	USCAR 150-S-002-1-A01
Article 43-2	GSO 99	ISO/IEC 17025	USCAR 150-S-003-1-C01
CONTRAN 764/2018	IATF 16949	Item 3.1	UN R28
Decree 540/2014	IEC 60068-2-1	Item 3.3.23 (CY2013)	
Decree No. 2000/147	IEC 60068-2-27	KMVSS 53 (and NVCA 38)	

2.2 GM Standards/Specifications.

GMW3059	GMW3103	GMW3431	GMW15357
GMW3091	GMW3116	GMW14872	GMW15725
GMW3097	GMW3191	GMW15272	

2.3 Additional References.

- Part Drawings
- Release Drawings

3 Test Preparation and Evaluation

3.1 Resources.

3.1.1 Facilities. All data based on laboratory testing shall be from an ISO/IEC 17025 accredited laboratory. Documents verifying accreditation shall be available for inspection.

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.

3.1.2 Equipment. When not otherwise specified, the test equipment requirements of SAE J377 4.1.1 On-Vehicle Test Equipment Defaults and 4.2.1 Component Level Test Equipment Defaults shall be used.

3.1.3 Test Vehicle/Test Piece.

3.1.3.1 Production Part Approval. The Production Part Approval Process (PPAP) shall be completed in accordance with and in the format prescribed by the joint industry standard, PPAP, published by Automotive Industry Action Group (AIAG), or its successor document. The default submission level shall be used unless otherwise specified by the purchasing documents.

3.1.3.1.1 Part Approval Submission. Where sample submission is required for appearance or dimensional verification, GM sample submission procedures as outlined in the AIAG PPAP or subsequent publications shall be followed.

3.1.3.1.2 Visual Inspection and Dissection. The part shall be visually inspected for defects in appearance, manufacture, or assembly. Rattles, tightness of attachments, smoothness of operation, and workmanship shall be included in the inspection. Dimensions, mass, and finishes as specified in this specification and the applicable GM drawings are to be checked. Refer to 4.12.13 Dimensional.

3.1.4 Test Time.

3.1.4.1 Electrical Mechanical Horn

Calendar time:	67 days
Test time:	1150 h
Coordination time:	24 h

3.1.4.2 Electronic Horn

Calendar time:	86 days
Test time:	1466 h
Coordination time:	24 h

3.1.5 Test Required Information.

3.1.5.1 Development Tests. Development tests are tests used to evaluate specific areas of design. Development tests are a tool for evaluating original designs, design alternatives, proposed improvements, cost reduction proposals, or for field problem analysis. Development tests may be severe. Development tests often accelerate testing by exaggerating specific environments. Failures under a development test are expected. Such failure does not necessarily indicate inadequacy of design. Any failures must, however, be evaluated and the results and any actions documented.

3.1.5.2 Validation Tests. All horns must be validated at the component and system levels prior to their release for vehicle level testing. Validation tests are those tests required to demonstrate that the horn or horn system can meet the requirements of Section 4 for the life of the horn. These component validation, or design release tests, must be satisfactorily completed before authorization for start of production and before quantities are made exhibiting a GM logo or part number.

3.1.5.3 Reliability/Durability Tests. Sample sizes, specification parameters to be monitored, and test sequence shall be determined by the test plan developed under 4.3.5 Mandatory Detailed Test Plan. Where new parts differ from parts previously tested and fully qualified under this specification, by details that affect only styling, re-testing may be waived by the purchase agreements.

3.1.5.4 Test Content and Sequence. Figure B1 Test Matrix for Electrical-Mechanical Horn and Figure B2 Test Matrix for Electronic Horn, in Appendix B, gives the sample size and test sequence to be used for validation. Where basic horns are validated as separate items, the test schedule for assemblies consisting of those validated basic horns together with brackets and/or jumper harnesses may be abbreviated by the GM Development/Validation Engineer to include only those parameters related to the added bracket(s) and/or harness(es).

3.1.6 Personnel/Skills. General familiarity with laboratory equipment, e.g., electrical measurement equipment, like voltage and resistance meters, hot/cold chambers, etc. Familiarity with sound pressure measuring equipment.

3.2 Preparation. As specified by the required tests.

3.3 Conditions.

3.3.1 Environmental Conditions. When not otherwise specified, the test environment of SAE J377 4.1.2 On-Vehicle Test Environment Defaults, and 4.2.2 Component Level Test Environment Defaults shall be used.

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. All tests must be accomplished in accordance with the procedures and methods outlined in this or referenced documents unless otherwise specified. Specific forms shall be used where required.

3.5 Data. All original data shall be retained with the master file copy of any final laboratory or test report. Comments, if included, are to be based on fact, and should not include opinions.

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. As specified in Section 4.

4 Requirements and Procedure

4.1 Regulatory Requirements. The horn shall comply with the regulatory requirements of 4.1.1 thru 4.1.24. The responsibility is with the supplier of the horn or horn system. Requirements of national governments shall apply even if not explicitly stated in this standard. Specific national requirements may be waived under specific

purchase orders or engineering part drawings. Vehicles not destined for sale outside a specific geographical area, e.g., North America or Korea, may be exempted from meeting sound level requirements outside that area, and from the related sound level requirements of SAE J377.

4.1.1 Argentina; Argentine Republic. Executive Order 779/95 Article 30/E Decree 32/2018 Annex B (Instituto Argentino de Normalización y Certificación (IRAM) Centro de Enseñanza de Tecnología Informatica Argentino (CETIA) 13D1 and 13D2) amended per Resolution 838/99 Audible Warning Devices. Argentina accepts compliance to United Nations (UN) UN R28 or 70/388/EC. All motor vehicles shall have an audible signaling device compliant with admissible sound levels according to the vehicle category. The maximum sound level admissible emitted by audible signaling devices installed in motor vehicles shall be 104 dB(A). Minimum sound levels and test procedures are as noted in UN R28 or 70/388/EC.

4.1.2 Australia. Australian Design Rule (ADR) ADR 94/00 Audible Warning. The technical requirements of ADR 94/00 are as follows:

- a. Each vehicle must be fitted with at least one audible warning device which:
 1. Provides an acoustic signal having constant amplitude and frequency characteristics; and
 2. is capable of providing sufficient audible warning of the presence of the vehicle.
- b. The audible warning device(s) may be powered by any energy source, including compressed air.

Note: The technical requirements of UN R28 are considered equivalent to ADR 94/00.

4.1.3 Brazil; Federative Republic of. Conselho Nacional de Transito (CONTRAN) Resolution 764/2018 Audible Warning Device (Horn). The horn, or similar equipment, sound level was harmonized UN R28 limits, M and N categories being:

- Lower limit: 87 dB(A).
- Higher limit: 112 dB(A).

4.1.4 Canada. Individual provincial regulations require a horn on every vehicle audible from a distance of 60 m (196.8 ft).

4.1.5 China; People's Republic of. Guobiao (GB) GB 15742-2019 Performance Requirements and Test Methods of Horn for Motor Vehicles. This standard specifies the performance requirements for and test methods of electro-pneumatic horns, as well as the installation performance requirements and test methods of horns onto motor vehicles. This standard replaces GB 15742-2001 with main differences as follows:

- In the "Normative References" section, IEC 651 was substituted with GB/T 3785 and IEC 225 was substituted with GB/T 3241.
- Chinese language modifications were made to the literal descriptions concerning the frequency spectrum and the lower limit of sound pressure level.
- The test method for durability was amended from "allow adjustment of the horn one time in the test" to "not allow adjustment of the horn in the test".
- The minimum sound pressure level of the whole vehicle is adjusted from 93 dB(A) to 87 dB(A), for vehicles of categories of M and N and motorcycles with power more than 7 kW, per UN R28.

4.1.6 Customs Union of Belarus, Kazakhstan and Russia. Technical Regulation (TR) TR CU 018/2011 On the Safety of Wheeled Vehicles. For horns, the Customs Union requires compliance to UN R28.

4.1.7 Egypt; Arab Republic of. Decree 540/2014 E-mark Certificate and Certification of Environmental Conformity. The audible warning device (horn) shall comply with UN R28.

4.1.8 Gulf Cooperation Council (GCC). GCC Standardization Organization (GSO) GSO 99 Sound Signaling Devices. GSO 99 consists of a component bench test with the required minimum sound level, under the following conditions, of 105 dB(A) and the required maximum sound level of 125 dB(A):

- The microphone mounting height is required to be between 1.15 m and 1.25 m with a distance to the microphone of 2 m.
- The frequency range, within which the total sound level must be higher than that of any frequency component above 3550 Hz, is 900 Hz to 3550 Hz.

4.1.9 India; Republic of. Indian Standard (IS) IS-1884:1993, Amend 2 (reaffirmed in 2014) Specifications for Electric Horns. For the horn fitted on all other motor vehicles, the maximum sound pressure level shall be between 93 dB(A) to 112 dB(A) measured as follows:

- The sound signaling device shall be operated at test voltages of 13 V with tolerance of ± 0.5 V, measured at the terminals of the source and corresponding respectively to rated voltage of 12 V. A calibrated power supply may be used for operating the sound signaling device.
- The horn fitted on the vehicle shall be measured at a distance of 7 m in front of the vehicle, the latter being placed on an open site on ground as smooth as possible, and in the case of devices supplied with direct current, with its engine stopped.
- The sound pressure level of the background noise and wind noise must be at least 10 dB(A) below the sound level to be measured.
- The maximum sound pressure level shall be measured within the range of 0.5 m and 1.5 m above the ground.

4.1.10 Indonesia; Republic of. Peraturan Pemerintah (PP) PP.55 2012 General Technical Requirement. Article 69 requires the sound of the horn be the lowest of 83 dB(A) and the highest of 118 dB(A).

4.1.11 Israel; State of.

4.1.11.1 Item 3.1 (2007/46/EC ((EC) Reg. 1060/2008 up to (EU) No. 540/2014)) Type Approval of Motor Vehicles and Their Trailers (CY2015). Audible warning devices shall comply with EC No. 661/2009 (mandatory equipment) and UN R28 (horn).

4.1.11.2 Item 3.3.23 (CY2013) (74/61/EEC (95/56/EC)) Devices to Prevent Unauthorized Use (Anti-Theft, Immobilizer and Alarm System). In compliance with the Israeli regulations on the "prevention of noise", published in Israel's Official Gazette "Reshumot" on January 27, 2011, the installation of audible alarm devices in new vehicles is prohibited. New vehicle types introduced into the Israeli market on or after January 1, 2012, certified under EC-WVTA, equipped with either a standard or optional Vehicle Alarm System (VAS), using the vehicle's existing horn and/or a power sounder, are prohibited. Only an "optical" function of the alarm system is permitted.

4.1.12 Japan. Article 43 (Attachment 74 and Attachment 75, TRIAS 43-J074R028-01, TRIAS 43-J075R028-01) Horn. The sound level shall be at least 93 dB(A) but not exceed 112 dB(A) for the horns when measured as follows:

- The maximum sound pressure level shall be measured with the microphone set within the range of 0.5 m to 1.5 m above ground.
- The microphone shall be placed 7 m in front of the vehicle.

Note: The Japanese Ministry of Land, Infrastructure and Transport (JMLIT) has adopted UN R28 Audible Warning Devices January 1, 2004 as equivalent to the Japanese Technical Standards.

4.1.13 Korea; Republic of. Korea Motor Vehicle Safety Standard (KMVSS) KMVSS 53 and Noise and Vibration Control Act (NVCA) NVCA 38. Vehicle sound pressure level must be ≥ 90 dB(A) and ≤ 110 dB(A) measured at a $2 \text{ m} \pm 0.05 \text{ m}$ ($6.6 \text{ ft} \pm 0.16 \text{ ft}$) distance from the front end of the vehicle and $1.2 \text{ m} \pm 0.05 \text{ m}$ ($3.9 \text{ ft} \pm 0.16 \text{ ft}$) in height with engine off. Test conditions and test procedures are based on UN R28.

4.1.14 Malaysia. Document Listing Rule 4 Certification. Audible warning devices shall comply UN R28 (NT:2012:01:01, NR:2014:01:01).

4.1.15 Morocco; Kingdom of. Comité National de l'Environnement des Affaires (CNEH) requires that 2015 new homologation vehicles audible warning devices comply with UN R28 (70/388/CEE, 93/30/CEE).

4.1.16 New Zealand. 32017/6 Land Transport Rule: Vehicle Equipment 2004. Audible warning devices shall be capable of giving a warning that is audible under normal traffic conditions from a distance of not $< 100 \text{ m}$.

4.1.17 Peru; Republic of. Decreto Supremo (DS) DS 58/03, DS 17/2009 (Bus, Microbus, Taxi Regulation). A bus, microbus, and taxi shall be equipped with a horn with a uniform and continuous sound, audible from at least a distance of 50 m for Category L and 100 m for Category M and Category N vehicles, whose intensity is within the established maximum permissible limits.

Note: The maximum permissible limit was not defined for horn or audible devices in the regulation.

4.1.18 South Africa; Republic of. South African National Standard (SANS) SANS 10169:2004 (South African Bureau of Standards (SABS) SABS 0169) Audible Warning Devices. A vehicle shall be fitted with one or more audible warning devices such that, when operated, a continuous sound is emitted at a level of at least 93 dB.

Note: UN R28 and 70/388/EEC are acceptable equivalent standards.

4.1.19 Taiwan. Section 2.7.9 Acoustic Vehicle Alerting System (AVAS). The A-weighted sound pressure level emitted by the device(s) fitted on the vehicle shall be measured at a distance of 7 m in front of the vehicle, the latter being placed on an open site, on ground as smooth as possible, and in case of devices supplied with direct current, with its engine stopped. In front of the vehicle body and within the range of 0.5 m and 1.5 m above the ground, the maximum sound-pressure level emitted by the device(s) fitted on the vehicle shall be at least equal to 87 dB(A) and not more than 112 dB(A). The sound pressure level of the background noise and wind noise must be at least 10 dB(A) below the sound to be measured.

4.1.20 Thailand; Kingdom of. Department of Land Transport (DLT) Buddhist Era (B.E.) B.E. 2559 Horn Installation. Applicable to all vehicles sold in Thailand, the requirements are equivalent to UN R28 or TIS771-2550.

4.1.21 Tunisia; Republic of. Decree Number (No.) No. 2000/147 Article 66 Vehicle General Requirement. Every motor vehicle shall be equipped with a horn which approved according to UN R28 (78/316/CE Version 1993).

4.1.22 United Nations (UN R28 Audible Warning Devices). The audible warning device fitted on a vehicle shall be of a type approved under the UN R28 regulation and shall bear an approval mark. Application for approval shall be submitted by the holder of the trade name or mark or by his duly accredited representative.

The device shall be tested as fitted on the vehicle. The sound pressure level shall be measured 7 m in front of the vehicle with engine not running on an open site on ground as smooth as possible. The ambient noise level shall be at least 10 dB lower than the sound pressure to be measured. The microphone (type as described in the UN R28 regulation) shall be placed approximately in the mean longitudinal plane of the vehicle in a height between 0.5 m and 1.5 m. Test voltage for devices supplied with direct current shall be 6.5 V, 13 V or 26 V respectively to the rated voltage.

The label shall be per UN R28 Component (Device) Marking (Section 4, Paragraph 5.5 to Paragraph 5.7 and Annex 2 Part I)

4.1.23 United States of America\States. Every motor vehicle when operated upon a highway shall be equipped with a horn in good working order and capable of emitting sound audible under normal conditions from a distance of not < 61 m (200 ft), but no horn or other warning device shall emit an unreasonably loud or harsh sound or a whistle.

4.1.24 Venezuela; Republic of. National Traffic Code 98 General Traffic Code Comision Venezolana de Norma Industriales (COVENIN) COVENIN 2855/92 and COVENIN 2859/92. One electrical or pneumatic horn whose sound is heard at 100 m of distance.

4.2 Part Drawing Requirements. The part drawing shall show all views to clearly define dimensions not contained herein, the device part number and labeling requirements, and any parameters necessary to fully define the product on a purchased part level.

4.3 Pre-Release Requirements. Prior to validation testing, i.e., design release, the component supplier shall comply with the following requirements.

4.3.1 Design Failure Mode and Effects Analysis (DFMEA). A DFMEA at the piece part level shall be completed and made available for inspection. The DFMEA shall identify critical characteristics that should be controlled during processing. The DFMEA shall be completed in accordance with and in the format prescribed by the joint industry standard, Potential Failure Mode and Effects Analysis, published by the AIAG, or its successor document.

4.3.2 Process Failure Mode and Effects Analysis (PFMEA). A PFMEA shall be completed and made available for inspection. The PFMEA shall identify critical processing that could produce non-conforming material, and must address critical characteristics identified during the DFMEA. The PFMEA shall be completed in accordance with and in the format prescribed by the joint industry standard, Potential Failure Mode and Effects Analysis, published by AIAG, or its successor document.

4.3.3 Process Control Plan. A process control plan including control characteristics shall be completed and made available for inspection. This process control plan will identify Key Product Characteristics (KPC), the Key Control Characteristics (KCC) necessary to address KPCs, and the method of controlling the KCCs.

4.3.4 Internal Part Approval. The supplier will have an established part approval plan for all component parts. This will include, as applicable, dimensional checking reports, certifications or inspection reports for all process control characteristics for all internal parts, and machine/shift setup checks.

4.3.5 Mandatory Detailed Test Plan. The supplier shall provide a test plan that describes:

- How the horn is setup and mounted in the test equipment.
- What operational mode the horn was in during the test.
- How the functions of the horn are monitored during and after the test.

The supplier, GM Lead Engineer, and GM Development/Validation Engineer need to review the completed test plan to assure the content is acceptable. A cover page template and instructions are found under Section D1 GMW15575 Horn Test Plan Report in Appendix D.

4.4 Test Sample Performance and Failure Determination. Unless otherwise specified, all samples shall be checked for proper performance before and after each test segment and after the complete test sequence. Performance shall be determined by a minimum of one (1) actuation of 15 s On and 15 s Off and a minimum of three (3) actuations of 1 s On and 1 s Off at an input voltage of 13 V. Sound Pressure Level (SPL) shall be measured during any of the 1 s actuations. Failure shall be defined as one of the following:

- A reduction in SPL from the initial value > 5 dB(A), or
- A change in fundamental frequency which results in the unit being outside its manufacturing tolerance of ± 20 Hz, or
- A significant change in tone quality with a Signal to Noise Ratio (SNR) value below 18 dB. Paragraph 6.1 Glossary contains an SNR definition.

A vehicle level test failure will be determined should the vehicle fail to produce a sound level in the specified range. Regarding performance degradation, tone stability is required, but some loss of tone clarity or amplitude may be accepted by the GM Lead Engineer and GM Development/Validation Engineer.

4.5 Test Sample Size, Selection, Allocation, Identification and Disposition.

4.5.1 Test Sample Size. Unless otherwise specified by purchasing documents, sample sizes are as specified by the required tests.

4.5.2 Test Sample Selection. Production samples shall be selected at random from pieces that have been subjected to all normal processing and handling including final packing, excluding final sealing of the shipping container.

4.5.3 Test Sample Allocation. Samples shall be allocated as shown in the test matrix in Figure B1: Test Matrix for Electrical-Mechanical Horn and Figure B2: Test Matrix for Electronic Horn, in Appendix B. Each lot of samples must successfully complete each test in the order shown unless otherwise noted.

4.5.4 Test Sample Identification. All samples used for any type of testing, with exception of production audit samples, shall be permanently marked with a serial number for identification, either at the point of manufacture or at the testing location.

4.5.5 Test Sample Disposition. When samples are no longer needed for test, whether having been actually subjected to testing or not, shall be scrapped. The only exception shall be for production audit samples that are not subjected to any intrusive examination or testing, that have been subjected to < 10 cycles of actuation, and that have been returned to the output stream within one day of the shift of manufacture.

4.6 Functionality. At normal voltage the horn shall be capable of producing an audible output lasting a minimum of four (4) minutes, i.e., continuous duty.

4.7 Life Expectancy. For the purposes of this specification, the life shall be as defined by the following Intended Usage and Life Expectation. For reference purposes this life consists of at least the following:

- Nominal Duty Cycles for Electrical-Mechanical Horn: 100 000 cycles of 1.0 s On, 4.0 s Off.
- Nominal Duty Cycles for Electronic Horn: 1 000 000 cycles of 1.0 s On, 4.0 s Off (High Usage Applications).

4.8 Appearance. Appearance shall be in accordance with the applicable release drawings. As a guideline, it is recommended that the horn be mounted in such a position that it does not need to be painted or otherwise aesthetically treated.

4.9 Mechanical Requirements. Unless otherwise stated, failure or degradation of performance is defined in Section 4.4 Test Sample Performance and Failure Determination.

4.9.1 Mounting Orientation. These devices shall be fully functional at all orientations. However, actual mounting orientation shall be determined to minimize the possibility of water or debris damage to the horn, i.e., high and protected from direct splash (High P/DS).

4.9.2 Mounting Torque. The bracket shall be designed to withstand a mounting bolt or nut torque of 25 Nm without damage or deformation. When an anti-rotation key is incorporated, applying this torque to the bracket shall not cause the key to deform and allow the bracket to turn.

4.9.3 Materials. Materials shall conform to the requirements of GMW3059. When intended for use inside the passenger compartment, the material used in the construction of any parts covered by this specification shall meet the flammability requirements of United States Federal Motor Vehicle Safety Standard (FMVSS) FMVSS 302.

4.9.4 Bracket Attachment to Horn. The assembly shall meet the requirements of SAE J377 6.2 Mounting.

4.9.5 Identification. The horn or assembly will be labeled in accordance with SAE J377 6.7 Identification.

4.9.6 Recyclability/Recoverability. The horn shall be made to the maximum extent possible with materials that can be disassembled to identifiable recyclable or recoverable components. Ease of disassembly shall be considered in the design. Recyclability/Recoverability shall be in accordance with GMW3116.

4.10 Electrical and Audible Requirements. Unless otherwise stated, failure or degradation of performance is defined in Section 4.4 Test Sample Performance and Failure Determination.

4.10.1 Polarity. The horn shall be designed to have the polarity as specified by Paragraph 4.10.4 Terminations. The mounting and metallic pieces of the horn shall not be connected to the electrical circuits. In all devices, any exposed metallic case, shell, or bracket is to be at vehicle ground potential.

4.10.2 Voltage Range. The horn shall be designed to work with voltages in the range of 9 V to 16 V, as measured at the horn terminals as specified by SAE J377 7.2 Operating Voltage Range. Refer to Section 4.10.4 Terminations. For reference this range is generally described in Table 1 Voltage Range.

Table 1: Voltage Range

9.0 V to 11.4 V	Some performance degradation allowed but no damage or permanent degradation may occur.
11.5 V to 15.5 V	Must meet all requirements.
15.6 V to 16.0 V	Some performance degradation allowed but no damage or permanent degradation may occur.

4.10.3 Recommended Fusing and Wiring. The horn is intended to be wired with a maximum total direct current resistance of 0.1 Ω . It is recommended that the horn be on an isolated circuit fused at 10 A for one horn, 15 A for two (2) horns, and 25 A for four (4) horns.

Note: Recommended wiring resistance is based on the stall current required to start an electromechanical horn. The circuit must provide at least 9 V at the horn terminals when the battery voltage is at 11 V, under a 30 A starting transient.

4.10.4 Terminations. Unless otherwise specified by the assembly drawing, the following applies.

4.10.4.1 Two (2) Terminal Horn. For a two (2) terminal horn, the standard horn connector is defined by USCAR 150-S-002-1-A01. For this connection, terminal one (1) is ground and terminal two (2) is battery positive terminal (B+). Terminal one (1) is the terminal closest to the connector latch.

4.10.4.2 Three (3) Terminal Horn. For a three (3) terminal horn, the standard horn connector is defined by USCAR 150-S-003-1-C01. For this connection, terminal one (1) is ground, terminal two (2) is control, and terminal three (3) is B+.